The Magazine of the British Naturalists' Association

Country-Side

Volume 36 No. 2 Summer 2023
The Magazine of the British Naturalists' Association

Queen of Spain Fritillaries – Caddisfly – Slow Worms – Guillemots – Thoughts on New Woods – Exoplanets – Gair Wood – Living with Nature – Greater Horseshoe Bats

Country-*Side*

SUMMER 2023
Vol. 36 No 2
ISSN No. 0011-023X

Founded by E. Kay Robinson in 1905
Editor: Pauline Rutherford
Printing: Hot Metal Press, Barnsley

Country-side is published by:
British Naturalists' Association ©2021
Registered Charity No. 296551
A Company Limited by Guarantee.
Registered No: (02119195) in England & Wales
Registered Office: 27 old Gloucester Street, London WC1N 3AX

British Naturalists' Association
Contact Details:
Email: info@bna-naturalists.org
Website: www.bna-naturalists.org

Editors Contact:
Email: country-side@bna-naturalists.org

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Photo: Harry Scott
Back cover: Greater Horseshoe bat emerging from a mine
Photo: Daniel Hargreaves

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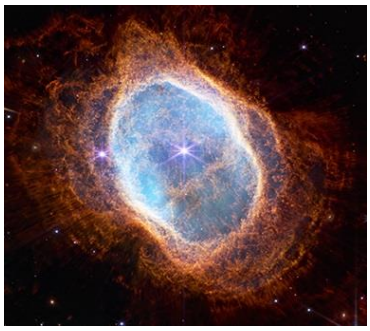
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Notes for Contributors

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Deadline for next issue: September 15th 2023

Editorial

Pauline Rutherford

Another year seeming to whiz by! This has been a difficult one for many with the cost of living increasing for most of us. The one thing that doesn't cost extra is nature. How refreshing it is to get away from problems and visit some part of our natural world; to get out to search and find wonderful things. In July the BNA will be hosting a Weekend Workshop at Brandon Marsh, a wildlife trust reserve near Coventry. On this weekend everyone will be given the opportunity to take part in field activities led by some of the BNA experts. Details are on the website; I hope you will come along and join in what promises to be a weekend of nature.
This issue of Country-*Side* has once again produced an excellent array of articles and my thanks go to everyone who submitted them.

Natural History Observations

In search for the Queen of Spain Fritillary (*Issoria lathonia*)

Harry West

On 9th October I decided to head out in search of a butterfly called the Queen of Spain Fritillary *Issoria lathonia*. The weather was superb bright blue skies, sun beaming out, not a cloud in sight; the wind was low and the temperature was warm with a high of 18°C.

After doing some failed research in where to go out looking for this butterfly (not much information was found on where it could be apart from the southeast coasts of Britain), I decided to speak to some contacts I have and after a few phone calls and messages I had a location. I left Canterbury around 11:00am heading down to Walmer, Deal. The drive took around 30-40 mins as I had taken some wrong turns (oops). I managed to find a parking spot near the location where I had to go, it was about a 15-minute walk.

The sun was beating down on me by the time I arrived and the day was warming up nicely with very little wind and still no sign of clouds in the sky. I arrived at the location around 12:05pm. Now for the hard part in finding the Queen of Spain, that's if they're even still there! I took the bridle path north east from the road and slowly walked the path, there was a lot of bird chatter and a sight of a Kestrel *Falco tinnunculus* hovering over the field beside me. As I got to the end of the field edge, I had to turn right into another field margin and walk down along an old corn field.

Queen of Spain Fritillary female (left) and male. *Photos: H. West*

A Damselfly *Zygoptera* sp. was hovering over the old corn field and as I was tracking the damselfly, I noticed a little fluttering happen on the edge of the field so I crept up slowly making sure my shadow wasn't going to cover the subject. As I got closer, I noticed it was just a Small White butterfly *Pieris rapae*, and I'd got my hopes up for a false alarm. After getting a photo of the Small White I kept following the field edge round scanning for any hover movement across the field and around the margin edge.

Another 200m and I spotted something hovering around the field edge, I followed carefully, making sure I had not spooked it and watched it land on the ground. I got my camera ready to zoom into the subject and took the photo. When I quickly reviewed the image I had captured I realised I had found a male Queen of Spain Fritillary. I decided to try and get a few more shots of this male before he eventually left. After waiting around for a while to see if any more would come out I decided to move on further down the field margin, as I was walking down, I noticed the same male gliding around the field edge but quickly followed by a second butterfly. I hurried over to find that there were two Queen of Spain Fritillaries. I then managed to get a shot of the second butterfly and after reviewing the image, I could see I had found a female Queen of Spain!

The Queen of Spain is a common species in Europe but only seen in Britain as an extremely rare migrant. There have been less than 400 records of this species of butterfly since the first recording 300 years ago! They can be identified by the very distinctive large silver spots on the underside of the hindwings. Both male and female are very similar in appearance, although the female is slightly larger, with a shorter abdomen and a more greenish hue around the base of the upper-side wings. Early summer flyers can be mistaken for Pearl-bordered *Boloria euphrosyne* or Small Pearl-bordered Fritillary *Boloria selene* when in flight. In late summer/early autumn they can be confused with Wall Brown *Lasiommata megera* when in flight but once the Queen of Spain settles you can see the differences between the two: the Wall Brown has black spots with white central dots, and the wings are edged with a brown band. The Queen of Spain has regular rows of rounded spots, the wings have a fine white edging to them.

It breeds in diverse ranges of habitats in Europe from hay meadows to heaths and woodlands, their preferred breeding habitat is mainly in lowland areas. They can migrate to higher altitudes if the summer has been warm and dry. In Britain there have been rare occurrences of breeding but only during very warm, dry summers.

Strange Jelly Discovered!

Mark Dudley MBNA

Strange jelly blob. *Photo: M. Dudley*

Sometimes when you go for a nature walk you go with a specific subject matter in mind. It could be birds in spring, whilst awaiting the first sightings of returning summer migrants; or insects on a warm summer day, particularly Hoverflies *Syrphidae* sp; or as the autumn draws closer Leaf Miners (spp) before the trees shed their leaves, the nights draw-in and the first frosts appear. During such a ramble I always keep a look out for anything unusual - a natural history curiosity, something either observed behaviourally or on this occasion a new species to add to my list.

This was one such day - on the apex of a leaf just dangling down about head height, on the edge of a path close to a stream was this translucent blob. It looked on closer inspection to a be like a translucent woodlouse as it had a speckled appearance with ridges. The Common Woodlouse *Oniscus asellus* has a smooth shiny exoskeleton made up of plates with yellow patches and so I wondered if this might be the exuviae shed as the woodlouse grows and develops. However, it seemed a long distance from a stone, which is where one would usually find such critters.

When I started going out on nature walks and in particular joined the BNA, my interests in all facets of the natural world widened from birds to mosses to moths and on to other insects; and so did the quantity of identification books I would carry with me. Add in some pots, a pair of binoculars and a net and every walk became an expedition - which over time was not good for my back. So I moved into using digital apps, which I downloaded onto my iPad, as my books. These iPads, are a bit like a laptop, and can be large and quite a weight. So eventually I got an iPhone and transferred the apps and books over. This allows me to keep hundreds of identification guides in my pocket, as well as it being much kinder to my back. These digital downloads of identification guides normally get me to species level on most flora and fauna, I even have apps that can identify bird sounds and bats (with a little technological gadget for the latter), but none were much help when it came to this blob, now where does one go?

Someone, I can't quite remember whom, showed me a little technological identification gem called 'Google Lens' (1), which is available on the search menu of any camera phone. Clicking on this app allows you to take a picture of the object before you, and as long as it's in focus and zoomed in to remove any other surrounding details, the app then searches its vast databases of pictures and comes back with a closest match of what it believes you are looking at. Now this process of identification is a bit hit-and-miss even on very obvious fauna and flora - it can come back with several incorrect choices - and it is non-geographic so after pointing the lens at an ant in a British woodland for example don't expect too much; and as I said previously it does rely very much on you getting a good, well-focused picture of the subject matter however, on this occasion it offered a suggestion as first choice that seemed pretty plausible, as it returned a photo of what looked like the same gelatinous specimen that was before me. How excited was I? On returning home I flicked through several books, but not one gave a similar illustration and very few even mentioned this curiosity.

The identification that Google Lens presented as its top suggestion was the egg mass of a caddisfly called the Mottled Sedge *Glyphotaelius pellucidus*. Further research (2 & 3) mainly through the internet, showed this to be one of only a few Caddisflies to lay its eggs in such a way. As a larva the Mottled Sedge is one of those fascinating critters found in still, slow-running water that builds its home out of leaves. There are 199 UK species of caddisflies of which most build a protective home out of small stones or leaves or a combination of the two, as well as there being a few case-less forms. Mottled Sedge larvae builds its protective home out of leaves and is able to live and feed camouflaged from much bigger organisms that potentially could eat it. Here it lives from October to April (pupating between June and July) before floating to the surface to transform into a flying adult. It is very vulnerable as its mottled brown and cream wings dry, reminding me of why fake caddisflies are used as fishing bait. As an adult it mates, and the female will lay its eggs in these gelatinous masses on the surface of leaves hanging over a water body. One female may lay up to six egg masses, each getting smaller. The yellow eggs hatch and the larvae fall into the water to begin the cycle again. The gelatinous mass I saw was rather large, so I presume it may have been one of the females earlier-laid masses.

But what a find! I thought so. Has anybody else seen anything like this? So next time you wander out, have a look to see if you can find egg masses as evidence of Caddisfly larvae living in a water body close by. And try Google Lens on a sighting and see if it helps identify something in the natural world.

References

(1) https://play.google.com/store/apps/details?id=com.google.ar.lens&hl=en_US&gl=US&pli=1

(2) https://www.naturespot.org.uk/species/glyphotaelius-pellucidus

(3) https://www.bioimages.org.uk/html/Glyphotaelius_pellucidus.htm

Further reading

A comprehensive guide to Insects of Britain & Ireland. Paul D. Brock 2015

Breeding Habits of Slow Worms *Anguis fragilis*

Steven Rutherford FBNA

Our largest reptile with adults measuring up to, and sometimes exceeding, 40 cm, the Slow Worm can be thought of by some non-Naturalists' as a snake; however, this is a legless lizard with traits of smooth scales, the ability to blink and a blunt tail. The tongue is short and broad and is notched in a shallow fork with a slower tongue movement than that of the Grass Snake *Natrix natrix* or Adder *Vipera berus*. Though widespread throughout mainland England, Wales and Scotland, it is missing from the island of Ireland, the Isle of Man and most of the islands of Scotland, and can be sparce or local in large parts of their northerly range. The strong-holds tends to be south of a line between the towns of Colchester and Hereford as well as the counties of Norfolk, Suffolk and Essex. Where common, the Slow Worm tends to be readily encountered because of its liking for gardens, especially with compost heaps where impressive numbers can be found living together. They are also a great ally to the gardener because of their liking for slugs. This article is the result of eight years of personal recording and observations on their breeding behaviour.

Fig. 1. Male Slow Worm

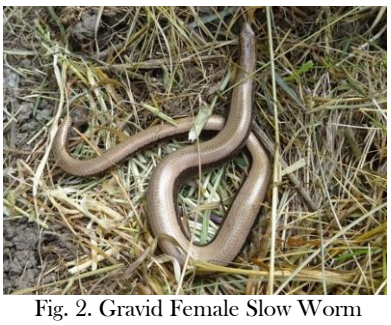


Fig. 2. Gravid Female Slow Worm

As part of the Long Grass Area (LGA) project at Wentworth Garden Centre near Rotherham, management by the local BNA members of the area has been to introduce habitats that would be of use for Common Frogs *Rana temporaria*, Common Toads *Bufo bufo* and newts with the placement of mats, logs and grass piles for refuges and feeding areas and siting two compost bins within the managed grass area that can be used as hibernacula. Slow Worms were first recorded under the refuges in 2016 and has given an opportunity for me to observe their breeding. The sexes are obviously distinguished as the males are uniformly brown with tiny light blue flecks and have a broad head without an obvious neck, there is a melanistic colour form, however, this is quite rare. The female is a pale silvery brown on the back and has a contrasting dark chocolate colour on the flanks. Females also have a unique dark mark at the back of the head that can continue down the back to the tail in some individuals. Young Slow Worms look like miniature females but lighter in colour with a definite dark stripe down their backs.

Fig. 3. Young Slow Worms

We have observed that the Slow worms start to disperse from the refuge mats at the end of September and have all moved to their winter hibernacula by the second or third week of October. They will burrow into the grass pile or move into the compost bins where they are left undisturbed. We start to find the males as they emerge towards the end of March, followed very soon by the females. Males and females can be found in the late morning under the refuge mats on warm days either singly or in groups of mixed sex. The refuge mats are also used by Black Garden Ants *Lasius niger* that use the bare ground under the mats when nesting. As the temperature rises under the mats the ants carry their eggs to the surface to regulate their temperature; these eggs are another food for the Slow Worms, so, an easy way to find the Slow Worms is to know where the ant nests are. Breeding takes place through April and May but is rarely observed. After quite a vigorous meeting, the male holds the female by the head with his mouth and they coil together in a concentric form (Fig. 5) and lie still together as the act takes place. From the beginning of July, the gravid (pregnant) females are notably swollen from just below the neck down to the start of the tail, and the young are born live form the start of September.

Fig. 4. Slow Worm next to ant eggs

Fig. 5. Breeding Slow Worms
All photos: S. Rutherford

Further reading

The Reptiles and Amphibians of Dorset – David C. Wareham
Britain's Reptiles and Amphibians – Howard Inns

Home with a Sea View: How a Guillemot gets a breeding site

Sarah Wanless HonFBNA and Mike Harris

A visit to a seabird colony at the height of the breeding season is always an exhilarating experience and assault on the senses - a constant procession of parents bringing in food for their chicks, a vast cacophony of sound and especially on warm still days, an overwhelming aroma of guano. Depending on the colony, it will potentially be possible to see Gannets (*Morus bassanus*) with their dagger-like bills and fluffy white chicks, Puffins (*Fratercula arctica*) standing in serried ranks in front of their burrows or Kittiwakes (*Rissa tridactyla)* on their neatly built nests cemented onto the cliff face. However, the commonest, and thus one of the most easily seen, seabird species around British coasts is the Guillemot (*Uria aalge*) with its smart black and white plumage, inhabiting densely packed breeding ledges. To human eyes establishing a site and finding a mate amidst the chaos of a Guillemot 'city' seems a very daunting prospect. Over the last forty years, our studies on the Isle of May, a National Nature Reserve off the coast of southeast Scotland I have helped reveal how Guillemots do it and the many challenges that immature birds face before they start to breed.

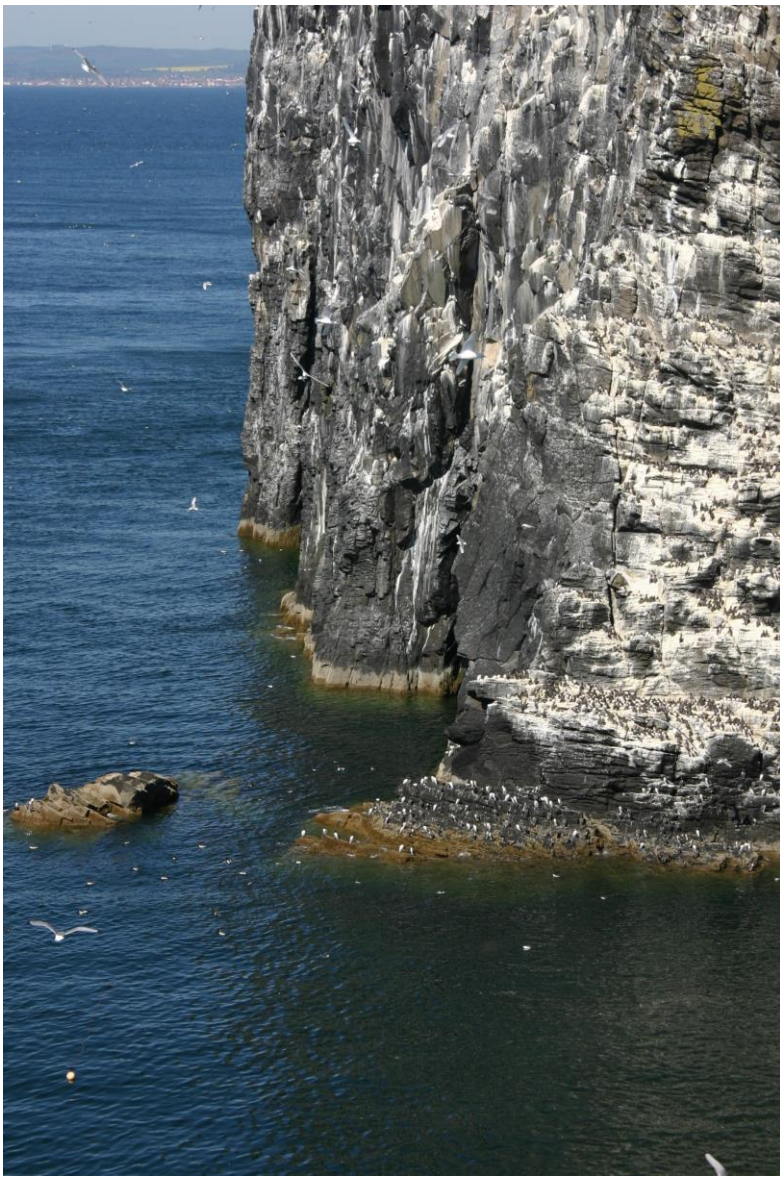


Figure 1. Part of the Guillemot colony on the Isle of May showing the guano-covered breeding ledges and the sea rocks where the two-year-old birds first come ashore.

Guillemots have an unusual breeding strategy in that they do not build a nest; instead the female lays the single egg directly onto a rocky ledge. Even more unusually chicks leave the colony when they are about 3 weeks old, still only about a third the size of their parents and with partially grown wings, meaning that they are unable to fly. Most departures occur when the weather is calm and dry. Given that it is often windy, sometimes very windy, on the coast, chicks may have to wait several days before conditions are suitable and thus fledging is often highly synchronised with thousands of chicks leaving simultaneously. However, because fledging occurs in the late evening and during the night, very few people ever get to see this amazing spectacle and it is rarely captured on film. The chick is taken to sea by the male parent.

Ideally the two stay close together either as the chick makes its way down the cliffs jumping and tumbling from ledge to ledge (which can take more than an hour), or as the chick leaps off the breeding ledge and plunges into the sea far below. If they do get separated the chick immediately

starts giving an insistent, individually recognizable, piercing contact call which the male responds to, so that in most, though sadly not all, cases the two are soon reunited. If all goes well the male and chick meet up on the sea and swim off together into the fading light. The next morning many females can be seen standing on their sites holding fish and wondering where their chicks have gone. The female then continues to periodically occupy her breeding site for up to two weeks. The immediate period after the chick leaves the colony is shrouded in mystery, but by the following morning the chicks and their dads are out of sight of land and relatively safe from predators like large gulls. Initially the chick is totally dependent on its father for food and protection but it gradually learns how to dive and catch fish for itself and after 4-6 weeks it has grown to nearly adult size, can fly and is able to survive independently.

Every field season just before the first chicks leave, our team goes into some of the most accessible parts of the colony to ring several hundred chicks. Each chick is fitted with a long-lasting stainless-steel ring (needed because Guillemots can live for more than 20 years), and a colour ring engraved with a unique alpha-numeric code which allows us to follow the birds for the rest of their lives without disturbing them. Each year we spend many hours walking along the cliffs with a telescope patiently observing hundreds of Guillemots on the sea rocks and cliffs, trying to see a colour ring and read its inscription to discover which birds have survived.

Although in the Baltic a few Guillemots return briefly to the colony in their first summer, elsewhere in the breeding range birds remain at sea until they are

Figure 2. A momentous event in the Guillemot calendar. A chick leaps off the ledge into the sea below with the male parent about to follow.

Figure 3. Dad and junior meet up successfully on the sea and immediately start to swim away from the colony.

at least two years old. The young birds first come ashore on the sea rocks at the base of the breeding cliffs, but they are very wary and the slightest disturbance causes them to jump back in the water. Sightings of colour-ringed birds reveal that not only do immature Guillemots return to the colony where they were born but they also visit other colonies. Thus, over the years Guillemot chicks from the Isle of May have been seen at colonies on Skomer in southwest Wales, the Farne Islands off Northumberland, Heligoland off the coast of Germany and in the Baltic. We assume that this prospecting behaviour helps birds decide which colony they will eventually recruit to. In the fullness of time advances in bio-logging will hopefully provide us with detailed data about where Guillemots go and what they do during this important but still largely unknown period of their lives.

By the time they are three years old Guillemots have become more confident on land. They

Figure 4. Catching Guillemot chicks to ring on the Isle of May.
Photo: Akinori Takahashi.

Figure 5. A Guillemot chick aged about 10-14 days old with a stainless-steel ring on one leg and orange colour-ring 950 on the other.

return to the colony earlier in the season than two-year olds, and spend most of their time on ledges above the breeding areas, apparently watching what is going on in the colony and building up a detailed picture of the configuration of sites and identity of breeding birds. Many four-year olds show similar behaviour to three-year olds, but a few progress to occupying, though not actually breeding at, a site within the breeding area and may bring in a display fish as a signal of site ownership. Only after at least five

years of learning about the colony and the surrounding feeding areas does a Guillemot finally get a breeding site and a mate; sometimes another inexperienced bird but often a bird whose mate has died during the winter.

Figure 6. This may be the first time these Guillemots have set foot on land since they left the colony two years ago.

Figure 7. Sightings of colour-ringed birds indicate that immature Guillemots from the Isle of May visit multiple colonies around the North Sea and west coast of Britain. This bird was photographed flying in front of the colony on Heligoland, Germany. *Photo: Norbert Uhlhaas*

The evidence suggests that breeding sites are very hard to acquire and once a bird gets a site, it keeps it for many years. If it does change site, it rarely moves more than a couple of metres. Despite the fact that immature Guillemots from the Isle of May visit many breeding colonies, most return home to breed, often close to, but not normally on, the ledge where they were reared. Estimating how many Guillemots move to another colony is very difficult because the chances of seeing (and crucially reading) a colour ring on a densely packed breeding ledge is equivalent to finding a needle in a haystack. Currently our best estimate is that about 20% of Isle of May Guillemots emigrate.

Recording which colour-ringed birds we see also allows us to estimate how many chicks survive to recruit into the breeding population. On average, 52% of Guillemot chicks that fledge from the Isle of May survive their first winter. However, values vary greatly from year to year. For example, in the mid-2000s very few chicks survived whereas in the best years the rate is over 90%. In general, chicks that fledge early in the season are much more likely to survive than late fledging chicks. The advantage of being early is critical in years when survival after leaving the colony is low. In the worst years, only the very earliest chicks survive. Intuitively, heavier chicks might be expected to survive better than lighter ones but this appears not to be the case, at least within a season, so perhaps a potentially poor start in the colony can be offset by favourable conditions when the chick has gone to sea. Survival of two-, three- and four-year-old Guillemots is higher than first-years with less variation between years. Once a bird reaches breeding age, it has a very high chance of survival with, on average, over 90% surviving between breeding seasons. Many Guillemots in the Isle of May population are older than the research students studying them. Our oldest bird was last seen 36 years after it was ringed as a breeding adult so it must have been at least 40 years old. Like humans, Guillemots grow old. However, unlike us there are no obvious physical changes – Guillemots do not get grey feathers or wrinkles, and the occasional white feather present in the otherwise dark head and neck is left over from the winter plumage. Rather, the changes are physiological and birds are less likely to breed (though some still continue to occupy a site), and increasingly likely to die.

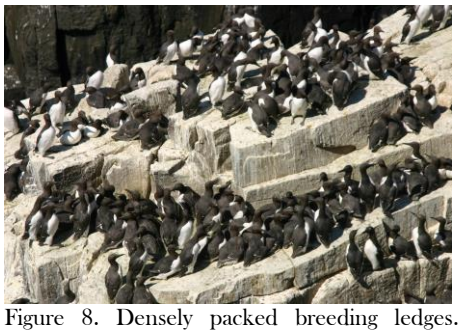


Figure 8. Densely packed breeding ledges. Guillemots do not visit such areas until they are at least three years old.

We hope that this article will encourage readers of Country-*Side* to visit a Guillemot colony this summer and not only enjoy watching the breeding birds but also the immatures on the sea rocks and cliff top ledges as they work out how to get their home with a sea view.

Acknowledgements

The Isle of May Guillemot study has only been possible because of the skill and commitment of many people over the years, in particular Francis Daunt and Mark Newell. NatureScot and its predecessors allowed us to work on the island and major funding has been provided by the Joint Nature Conservation Committee (JNCC), Natural Environment Research Council (NERC) and European Union (EU). We thank Akinori Takahashi, Harry Scott and Norbert Uhlhaas for letting us use their images and Pauline Rutherford for encouraging us to write this article.

Sarah Wanless and Mike Harris are Fellows at the UK Centre for Ecology & Hydrology and started the Guillemot study on the Isle of May in 1980. Sarah became a BNA Honorary Fellow and was given the BNA Peter Scott Memorial Award in 2019, and then in 2020, became BNA Honorary Vice-President.

All photos: Mike Harris unless indicated.

See front cover for additional photo by Harry Scott caption: "Most four-year-old Guillemots have yet to find a breeding site and spend their time at the edge of the colony often interacting with other birds".

Thoughts on a new wood with the possible changes of biodiversity over time

Steven Rutherford FBNA

"Seventy years ago, the natural succession of farmland into woodland was a hot theme of ecology: research was done, and books were written, and students examined how this happened."
Trees and Woodlands in the British Landscape – Oliver Rackham 1976

Within this article I discuss the beginning of a secondary woodland that covers a small fragment of a former arable field, along with a larger area of a brownfield site that was part of a long-gone coal mine in the South Yorkshire village of Thorpe Hesley. I go on to look to the future to how, if left, its potential natural development could change, by looking at examples of established woods from around the UK at various stages of non-intervention. This self-seeded woodland, along with some older linked hedges that have become overgrown, as well as some enveloped within the edges of the new wood, are linking the study area into a single habitat with pockets of various changing woodland. We will see how this is causing changes, both positive and negative, to the local biodiversity while increasing the area's ability to sequester carbon. The discussion will cover the need to look after soil health that will also drawdown and hold carbon as well as increase biodiversity.

A new wood

These new woods cover 10.4 hectares and lead onto arable fields. They hold a range of pioneering species including Silver Birch *Betula pendula*, Ash *Fraxinus excelsior*, Field Rose *Rosa arvensis* and Common Hawthorn *Crataegus monogyna*; however, three species of willows - Grey Willow *Salix cinerea ssp. Oleifolia*, Goat Willow *S. caprea* and Crack Willow *S. fragilis* cover the greatest area and are becoming dominant to exclusive in large parts of the new woodland. These young willows can become important to the local biodiversity as they can support over 750 species of insects including more than 200 that depend entirely on willows. Crack Willows and other trees standing in the wet areas of the wood are susceptible to damage by wind throw and wet rot in large branches that get damaged, and so, it will become a very important site for one of Britain's rarest breeding birds, the Willow Tit *Poecile montanus*, that is still tenuously holding on in the mature trees and hedgerows in this wet woodland. Sycamore *Acer pseudoplantanus*, Oaks *Quercus spp*, Ash, Elder *Sambucus nigra* and Field Maple *Acer campestre* are abundant along the woodland edge and in the old Hawthorn hedges, along with a few thickets of Blackthorn *Prunus spinosa* and interlinked with Bramble *Rubus fruticossus agg.*, while on the wetter sites Common Alder *Alnus glutinosa* and Willows dominate. The growth, spread and subsequent dominance of the trees in this area means that the area is developing into a patchwork of wooded habitats that are linked with the mature hedges, will be discussed later. The new woods have been brought about by the ending of the coal mining and a withdrawal of agricultural management followed by unintentional natural management through human recreational acts. Some of the hedges have become engulfed within the woodland edge or fragmented around the field boundaries but are still giving connections and acting as corridors.

The changing face of biodiversity from grass to scrub to woodland

The area has been changing gradually since I started to take interest in 1998. The fields have always been a popular site for dogwalkers while the children of the village use some of the old pit remains as a natural adventure bike track. The action of the dogwalkers and the children has kept open some areas and maintained paths that crisscross this part of Thorpe Hesley. Within this short space of time the habitat has already started the transformation from a grass- and low herbage- dominated area with a scattering of a few saplings, and is now becoming a closed canopy wood on the largest part of the site. The new habitats are turning into a variety of compartmental wooded areas, including an established wet woodland, a brownfield site and the old hedgerows as well as scrub and footpaths; and as these new wooded areas develop and expand, they are encouraging a change in the local biodiversity. The wild- sown and unmanaged new woodland is quickly developing into an area of competing saplings that have little or no competition or shading from older established trees. As the canopy closes, the light reaching the ground is becoming less, and is becoming restricted to

the winter months, allowing very few species of ground flora to be able to thrive. These deciduous trees produce quantities of leaf litter that will be broken down by the actions of bacteria, fungi and small invertebrates. The leaf litter is also food for the grubs of larger adult beetles and flies that could help in its breakdown, however, few of these larger insects will be venturing into this area, as without abundant flowers growing there will be not enough pollen and nectar to draw them in. The invertebrates that can live in this environment such as springtails, pseudo-scorpions, millipedes and centipedes will thrive and be part of the recycling of the fallen leaves, while the actions of worms will take the resourced energy from the decomposing litter back into the soil to complete the nutrient cycle and increase the long-term soil health and carbon storage.

So many trees standing close together might seem problematic for most of the dependant species. However, the woodland rides made by the dogwalkers and the open places that will in time develop and create lines and edges of trees in this case Willows; and these willows, as we saw earlier, can support a large number of dependant insects and are also host to a good number of galls on the leaves and twigs. The early pollinators associated with this spring bounty are mainly Honey Bees *Apis mellifera* and larger Hoverflies along with the overwintering, early emerging adult butterflies and a selection of other flies.

The avian fauna within this area has been changing as the habitat started to become unsuitable for the ground-nesting birds. These had included red data listed Lapwings *Vanellus vanellus* and Skylarks *Alauda arvensis* that used the grassland that preceded the woodland. The birds that then relied on the next stage of conversion to still open, but more scrubby grassland with some small saplings (such as Yellowhammer *Emberiza citronella* and Reed Bunting *E. schoeniclus*, both also red data listed), have also been displaced now by the trees. Kestrels *Falco tinnunculus* were using the open short grassland to find food such as small mammals, grasshoppers and worms, and are now having to look for new open feeding places as the spread and growth of the trees encroaches on this former grassy terrain. Buzzards *Buteo buteo* are also adapting to these landscape changes and are starting to be seen displaying over the new woods as the trees reach a height that is acceptable to them for nest-building. Unfortunately for the hunting Buzzards, their favoured prey items of local Hares *Lepus europaeus* and Rabbits *Oryctolagus cuniculus*, which used to use the open areas for feeding and breeding, have all but disappeared and will limit the Buzzards abilities to breed. Also, tracks made by the Field Voles *Microtus agrestis* that were regularly seen in the open areas as the snow cleared at the end of the winter months are now restricted to the path edges and the rides, and this is starting to affect the nocturnal avian hunters. Barn Owls *Tyto alba* were regularly observed over the open grassland while Tawny Owls *Strix aluco* were common in the small wooded areas surrounding our target area. Little Owls *Athene noctua* used the large Oak and Ash trees in the hedgerows, avoiding conflict with the larger owls by hunting in the field margins, taking mainly worms and beetles, supplemented with the occasional hedgerow bird. Wood Mice *Apodemus sylvaticus*, Bank Voles *Myodes glareolus* and Field Voles can still be found in the small remaining scrub areas and woodland edges especially in and around the Bramble. Their effort in making burrows creates opportunities for ground-nesting bumblebees to take over these burrows in the spring. The Little Owls have become the only member of the owl family now hunting in this area, suggesting that their prey


Children's adventure bike track


Dog walking path


Colonisation of Willows


The older, wetter woodland that is part of the Willow Tit breeding area

items are still to be found in the hedgerows and field margins. I would expect that Tawny Owls will recolonise the wood as it becomes mature and more open, allowing the birds to find prey on the larger exposed sections that develop.

Within the ground flora, large areas of Common Spotted Orchids *Dactylorhiza fuchsia* used to be found among the swathes of typical grassland floral species, but are now only to be found in a couple of locations. There are still some patches in the open sections that are dominated by dandelions and hawkweeds along with stands of tall grasses and umbellifers, infilled with various species of cranesbills and vetches. These flowers are still attracting pollinating bees, beetles, wasps and flies along with butterflies on warm days. The butterflies, Large White *Pieris brassicae* and Small White *P. rapae*, Green-veined White *P. napi*, Large Skipper *Ochlodes sylvanus* and Small Skippers *Thymelicus sylvestris*, Meadow Browns *Maniola jurtina*, Gatekeepers *Pyronia Tithonus* and Common Blues *Polyommatus icarus*, are all classed as common, however, the local abundance and diversity are being challenged because the expansion of the tree population has either squeezed them out of the area, or restricted their range and population size locally.

As the trees start to out-compete each other, space will open to allow flowers to return and different species of tree to invade. Fungi populations associated with the invading trees and plants will also extend their range. The relationships between fungi and other species groups are many, including passing water and nutrients between the plant and the soil while gaining food in return in a symbiotic partnership, recycling dead wood and other organic materials while opening trees to saproxylic insects, and allowing communication between trees. Some fungi are predators on insects while other insects rely on fungi for food in a complicated and important food web. The action of fungi greatly improves soil health by returning organic material back into the ground. Light coming into the open spaces will encourage the proliferation and spread of the ground flora, although competition between the species groups will benefit the most robust and light dominant. This competition will be controlled over time as the surrounding trees grow and close out light and then dieback in a successional rotation. However, some specialised woodland flowers, especially ones associated with ancient woodlands, will probably never colonise this new wood because of their inability to spread and disperse seeds over a great distance.

Carbon capture and the Government's promise to plant trees to counter the carbon crises.

The UK Government has committed to increasing tree planting rates across the UK to 30,000 hectares per year by the end of this Parliament. To achieve this, they are intending to spend over £500 million of the £640 million Nature for Climate Fund on trees and woodlands in England between 2020 and 2025.

It will be interesting to see how this plan has worked by the end of the project and what long-term strategy will be in place after the project has finished; equally important will be to hear were the 30,000 trees per year are being sauced and what biosecurity is being placed on the movement of so many trees.

The need to encourage carbon capture in the face of the climate crises and how that will impact on biodiversity is the next question to be asked. there are no silver bullets to solve these complex problems and strategies such as planting of new trees will need to be carefully considered and only thought of as part of the solution by Benjamin Hodgson as seen on his project in Leeds (Hodgson 2023). Questions are also being posed about the long-term safety of the environment, not only because of the world's declining biodiversity but also because of the growth of the world population of humans bringing with it problems of food security, water quality and availability as well as the health of the soil are all the questions that need to be urgently addressed.

There is also a need to manage trees on some of our nature reserves, as trees can become a problem if they are allowed to grow and out compete important sites of ground flora, heathlands or peat. Managing this problem by controlling the spread of the trees with clear fell removal needs to be explained carefully to the public who may see trees as the only answer to the problem of carbon capture.

Trees are also an important crop and it can be argued that younger trees will take up a greater amount of carbon per year than mature trees, so, a crop rotation of thirty years of trees would be a good way of producing a low carbon product from a poor-quality soil. The timber thus produced will also hold part of the carbon from the trees for many more years. However, the calculations of the benefits will need to include the carbon produced in the transfer of the saplings to the site, the maintenance of the trees, felling, removal and production of the end product as well as how the brash that is left behind is dealt

with after the felling has been completed.

The rush to plant non-native trees as a crop needs to be balanced against the need to look after our mature and ancient trees and woodlands with the wealth of diversity that they hold, the long-term storage of carbon and the biodiversity within the individual trees and the long undisturbed soil and established associated flowers.

Time - the unknown factor.

Apart from closing the canopy, the stands of small trees in our new wood in Thorpe Hesley should be able to grow quite well while being forced to grow vertically with only the top branches and outer trees producing much in the way of flowers and leaf. As the trees grow, crowding will become a problem, with the ensuing conflicts bringing damage to limbs and trunks. The damaged areas will then be susceptible to infections and infiltration of fungi causing dieback and death to some of the trees producing openings for sunlight to penetrate and regeneration opportunities for light dependant trees, such as Oak, Ash and Holly *Ilex aquifolium*. The gaps in the trees will also allow more light to reach the woodland floor and so will enable the ground flora to re-invade and encourage a more diverse range of dependant invertebrates to return. Woodlands at this stage can be seen at locations across the UK as woods and some plantations are being left to mature.

Storm damage is more destructive when these openings occur and produces great volumes of deadwood. this encourages an increase in biodiversity of the saproxylic community. Standing deadwood is also a good substrate for various mosses and lichens giving nice hide-a-ways for small species as well as new food reserves for various dependent groups.

The changes in woodland density to fewer trees with greater space and variety of species, as well as local damage to branches and trunks, will bring about a change to the avian fauna. By taking advantage of new nesting and feeding opportunities that become available woodland birds such as the Wren *Troglodytes troglodytes*, the Robin *Erithacus rubecula* and the Blackbird *Turdus merula* will be found in the developing woodland clearings. Members of the tit family, some of the warblers, the Nuthatch *Sitta europaea* and woodpeckers are closely associated with a more open woodscape, and with an increase in small birds, the wood will again become the hunting area for the Sparrowhawk *Accipter nisus*. This lower density of trees will also suit the local population of small and medium sized mammals from Pigmy Shrews *Sorex minutus* to Badgers *Meles meles*. Woodland bats also prefer a more open space and will be able to use the small openings in damaged bark and branches for roosting and nesting, and the new glades will become their hunting ground.

How our woodland could change

In our wood, it is unlikely that management will be used to change the woodland structure, unless the area is used for new building in the future. This seems unlikely, as building on top of an old pit head would come with engineering complications, and there are other sites within the village that could be easier to build on. Changes will probably, therefore, be brought about from natural causes such as high winds and heavy snow, but my feeling is that natural competition and infections will have a greater effect in opening up areas, allowing the changes to occur that I mentioned above.

Evidence of how some more established secondary woodlands are developing can be seen in the photos showing different examples of neglected and managed events that are opening the canopy in these woodlands, and making space for new species to encroach.

Dell Woods in the Abernethy National Nature Reserve near Nethy Bridge is a fine example of a former plantation. Figure 1 shows a Scots Pine *Pinus sylvestris* that died and has been left standing; I first noticed and photographed this tree in the summer of 1998. In the spring of 2018, it was noted that the small Pine showing to the right of the dead tree had snapped, probably due to heavy snow. In 2019 a Great Spotted Woodpecker *Dendrocopos major* had made a nest near the top of the large tree, and this was used by Swifts *Apus apus* as a nest hole a year later. The smaller tree is a good size for Crested Tits *Lophophanes cristatus* to excavate a nest as the heart wood deteriorates. Sunlight is reaching more of the woodland floor and is allowing the ground flora to regenerate, as the Heather *Calluna vulgaris* and Blaeberry *Vaccinium myrtillus* form ever larger mounds, bare patches of soil between them are being colonised by Common Cow-Wheat *Melampyrum pratense* and Chickweed Wintergreen *Trientalis europaea*. Missing in this part of the wood, however, are the flowers of the ancient Caledonian Woods such as Twin Flower *Linnaea borealis*, One Flower Wintergreen *Moneses uniflor*, Lesser Twayblade *Listera cordata* and Creeping Lady's Tresses *Goodyera repens*. Saplings of Birch, Aspen *Populus tremula* and Scots Pine are also

beginning to grow, protected from deer by the new patches of Juniper *Juniperus communis*, acting as maidens in a nursery with their spiny branches deterring the deer from eating the delicate leaves of the small deciduous trees. Figure 2 shows a stump from a nearby Scots Pine that was snapped due to high winds and shows the actions of a Great Spotted Woodpecker and the burrowing effects of saproxylic invertebrates.

The second example is Knettishall Heath in the Brecklands which had been neglected and was turning into a secondary wood following the demise of the local rabbit population. A small non-native plantation on the site has also been removed, and is now being managed as a nature reserve. Figure 3 shows how the trees were forming a closed canopy. Part of the management has been to fell large parts of these areas only leaving some of the native species that survived on the fringes. The actions of ponies as part of the management has prevented tree regeneration and has thus encouraged a wood pasture landscape, with standard Scots Pines, Silver Birch, Oaks and Hawthorn seen in Figure 4. As this reserve had been a heath before the trees became dominant, patches of many of the specialist plants and insects associated with this habitat survived and it will be interesting to see how the recovery and expansion of biodiversity progresses over time. On another part of the reserve, an old stand of Beech *Fagus sylvatica* is starting to show its age and is dropping branches which are either dead or overly heavy. Figure 5 shows a particularly large branch that has dropped where the site management has tidied, but not removed the fallen wood. Figure 6 shows the pioneering qualities of an Aspen stand at the RSPB reserve at Inch Marshes. The suckers quickly produce a closed canopy which restricts the ability of other species of trees to seed successfully. Aspen can reach the age of one hundred years; however, they are vulnerable to wind throw as seen in a mature

Figure 1. Scots Pine

Figure 2. Dead stump of Scots Pine

Figure 3. Knettishall Heath Plantation

Figure 4. Knettishall Heath wood pasture


Figure 5. Dropped branch on Beech

section of the wood in Figure 7, with the tree uprooted. Already this part of the wood has a more open look with the sunlight reaching the floor.

Figure 8 is another windthrown tree. This time an Oak has been uprooted and damaged some of the surrounding saplings.

Final thoughts

The small woodland in Thorpe Hesley that I have described will only take up a small amount of carbon, and will provide only a small refuge to help increase the local biodiversity and maintain the health of the soil. The process has cost nothing to plant and maintain in terms of finance and carbon release, and will change naturally in character and biodiversity over the years without any artificial management. The hedges will assist the distribution and movement of some species and there is the benefit of the nearby wet woodland that holds some unique species. Time and monitoring will be important in the continuation and protection of this and the surrounding habitats.

Reference:

B Hodgson. Gair Wood: a woodland creation project in peri-urban Leeds. Country-*Side* Summer 2023.


Figure 6. Aspen Wood


Figure 7. Aspen windthrow


Figure 8. Oak windthrow showing damage to other trees

Steven Rutherford is Honorary Chairman of the BNA. He received the Richard Fitter Memorial Medal as an MBNA in 2015 and became FBNA in 2-17. He has had an interest in woodland ecology from a young age.
All photos: S. Rutherford

Five Thousand Plus and Counting

Roy Stewart MSc FIBMS FLS FRSB FBNA

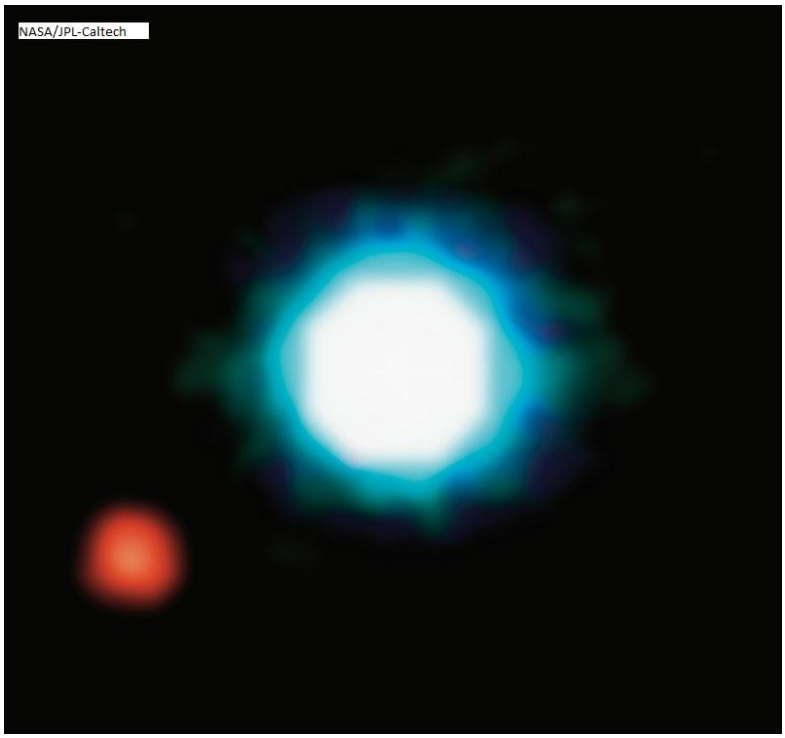
You may be wondering what an article on astronomy is doing in the Country-Side magazine. Well, the magazine editor requested an article and when you realize that astronomy is probably the oldest of all the natural sciences and we have been looking up at the sky trying to make sense of it from the dawn of civilization, then it makes perfect sense. We have created stories and myths involving gods and monsters to explain the movements of stars and planets and shapes of the constellations and other celestial events but science can now provide a much more beautiful, fascinating and above all accurate story. Observations of the universe can now take place across the whole of the electromagnetic spectrum using both land-based and space-based systems and has yielded not only incredible images but also a phenomenal amount of data; much still to be analysed. It's impossible to do justice to the whole of astronomy in a single article, so one of the most exciting and current areas of research was chosen and this is the study of exoplanets. In the early days of research, the term extra solar planet was used but they are essentially the same terms.

There are many complicated definitions of what an exoplanet is but the simplest one is by NASA; *"An exoplanet is any planet beyond our solar system. Most orbit other stars, but free-floating exoplanets, called rogue planets, orbit the galactic centre and are untethered to any star".* The idea of exoplanets is not new and can be traced back to this statement by Epicurus in a letter to Herodotus (~ 300 BC) *"There are an infinite number of worlds, some like this world, others unlike it."* The first detection of an exoplanet occurred in 1992 when the astrophysicists Aleksander Wolszczan and Dale Frail discovered three exoplanets. They were found in an unexpected environment, orbiting the pulsar PSR1257+12. In 1995, the Geneva-based astronomers Michel Mayor and Didier Queloz detected the first exoplanet around a "normal" (main sequence) star, 51 Pegasi. The planet, named 51 Pegasi b, has around half the mass of Jupiter and orbits around its parent star in just over four Earth days, lying almost eight times closer to it than Mercury is to the Sun. Mayor and Queloz were awarded the 2019 Nobel Prize for Physics for the discovery of the first known extrasolar planet orbiting a Sun-like star. For some reason the first exoplanet discovered in a system is called 'b' and not 'a'. Apparently A is reserved for the parent star. Since 1995, this area of astronomy has become a very dynamic research field and as of 1 February 2023, there are 5,307 confirmed exoplanets in 3,910 planetary systems, with 853 systems having more than one planet and these were discovered using a host of different techniques. Many candidate exoplanets are still waiting to be confirmed and, no doubt there are many more to be discovered. The actual numbers could be staggering. Assuming there are 200 to 250 billion stars in the Milky Way, it's estimated that there could be 11 billion potentially habitable Earth-sized planets in the Milky Way, rising to 40-billion if planets orbiting the numerous red dwarfs are included. Note this is just our galaxy. If we include all the other galaxy systems in the universe then the numbers just become incredibly high and will run into many, many trillions.

Searching for exoplanets is like looking for the proverbial needle in a haystack. Planets emit little or no light of their own often just reflecting the radiation from their brightly-shining host star. An analogy often used; is that it's like seeing the light from a dim candle in front of a raging forest fire. Currently there are six main investigative tools used to spot hidden exoplanets: Direct detection which involves the direct imaging of a system or Indirect detection, which involves the following – Radial velocity tracking – Astrometry –- Transits – Pulsar timing - Gravitational microlensing (these last two will not be discussed especially as microlensing relies on a one-off event).

Direct Imaging. This is the hardest way to detect an exoplanet due to the extreme contrast between the light emitted by the parent star and by the companion planet. This can be overcome by using infrared radiation, rather than visible light. The visible light output of a Jupiter-like planet is one billionth of that of its host star, while in the infrared the contrast is just a factor of a few thousandths. Another method is to physically block out the starlight, using a coronagraph that masks the bright central core of the star, leaving only the corona, the outer plasma region of the star's atmosphere; this is very similar to an eclipse of the sun by the moon. Using this method, the adaptive optics instrument

NACO, on ESO's (European Southern Observatory). Very Large Telescope (VLT) obtained the first image of an exoplanet in 2004. The exoplanet designated 2M1207b, is a Jupiter-like planet but 5 times more massive than our Jupiter. It orbits its parent brown dwarf star at a distance 55 times larger than the Earth to the Sun, nearly twice as far as Neptune is from the Sun. The system 2M1207 lies at a distance of 230 light-years, in the constellation of Hydra. In November 2008, a group of astronomers using the Keck telescopes announced the imaging of 4 planets orbiting the star HR 8799. HR 8799 is a young star, and the planets around it still retain some of the heat of their formation which is how the exoplanets were detected by using infrared radiation. With repeat observations, astronomers were able to observe the planets move in their orbits The HR 8799 system hosts 4 super-Jupiter planets with orbital periods ranging from 40 to more than 400 years. *There is an animation of this system on YouTube. As of April 2020, 50 exoplanets had been discovered with direct imaging.

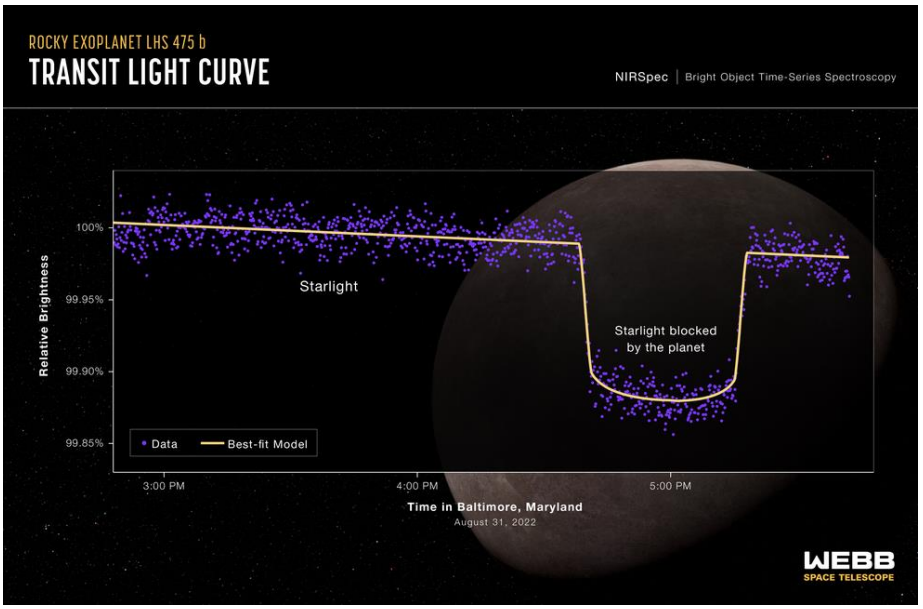


2M1207b is the first exoplanet directly imaged

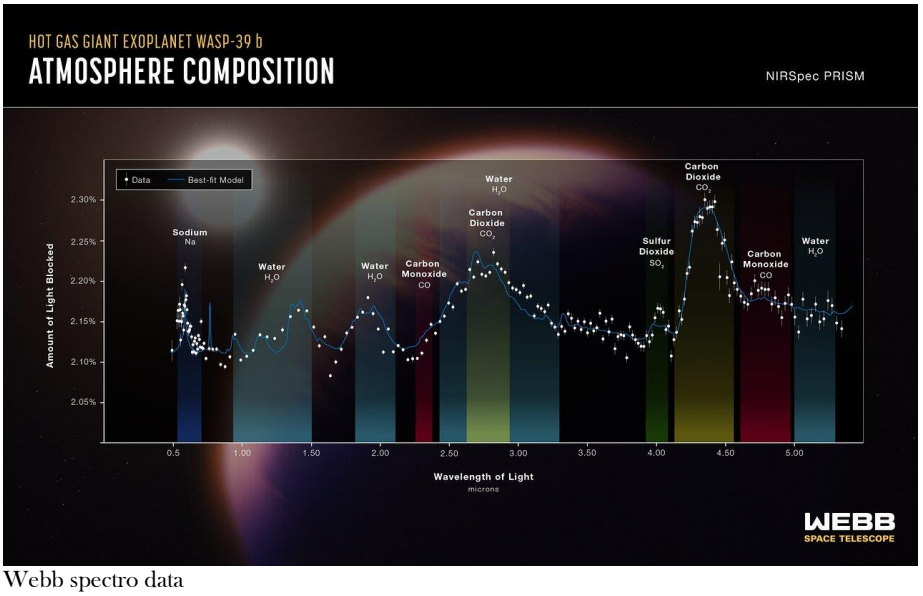
Radial Velocity. One of the main ways of detecting new exoplanets is by measuring radial velocity. It's commonly assumed that a planet orbits the star but in reality, they both orbit around a common centre of gravity called the barycentre. As the exoplanet moves around the star it exerts a slight gravitational attraction on the star which causes it to wobble which then has an effect on the light reaching the observer on earth. The velocity of the star along the line of sight of an observer on Earth is its radial velocity. Changes in the radial velocity of the star cause the lines in the star's spectrum to shift towards redder wavelengths when the star is moving away from us and towards bluer wavelengths when the planet is approaching us; this is the Doppler effect. The periodic changes in the star's radial velocity depend on the planet's mass and the inclination of its orbit to our line of sight. As the inclination of the planetary orbit is unknown, the measurement of this regular variation gives a minimum value for the mass of the planet. At present, the most successful low-mass exoplanets hunter is HARPS (High Accuracy Radial Velocity for Planetary Searcher), which is mounted on ESO's 3.6-metre telescope at La Silla, Chile. Many of the planets that have been discovered by this method are very large and very close to their stars. These planets, are much larger than our Jupiter, and orbit their stars in a matter of days or even hours. Such a large planet causes a large wobble, and this, as well as the short orbit time, makes these planets much easier to detect than ones that are smaller or farther from their stars. As of November 2022. Over 1000 planets have been discovered by this method.

Transit Photometry. The next technique, which involves studying a transit - the passage of a planet between a star and Earth, is called the 'transit photometry' method. These transits cause a dimming of the light received and if the dimming is detected at regular intervals and lasts a fixed, repeated length of time, then it is very likely that another, dimmer object is orbiting the star and this is highly likely to be an exoplanet. Transit photometry is currently the most effective and sensitive method for detecting exoplanets. It is a particularly advantageous method for space-based observatories that can stare continuously at stars over a long period of time, although it also can be performed from the ground with quite small telescopes. How much a star dims during a transit directly relates to the relative sizes of the star and the planet. A small planet transiting a large star will create only a slight dimming, while a large planet

transiting a small star will have a more noticeable effect. The size of the host star can be known with considerable accuracy from its spectrum, and photometry therefore gives astronomers a good estimate of the orbiting planet's diameter, but not its mass. This makes photometry an excellent complement to the radial-velocity method, which allows an estimate (a lower limit) of a planet's mass, but provides no information on the planet's diameter. Using both methods, and combining mass and diameter, scientists can calculate the planet's density. Density, in turn, can suggest whether a planet is rocky, gassy, or in between. The most successful telescope used so far for detecting exoplanets was the Kepler orbiting telescope. The observatory was in commission for just under nine years, from its launch in March 2009 to its decommission on November 15th 2018. The data that Kepler collected is still being analysed but so far has detected 2,600 planets by observing more than half a million stars mainly in the region of Cygnus. The Kepler mission is now followed by the TESS mission. (Transiting Exoplanet Survey Satellite). This will study 200,000 of the brightest stars in an area of the sky 400 times larger than the area covered by Kepler. In addition to "primary" transits, which occur when a planet passes in front of its star, scientists are also interested in "secondary" transits, which occur when a planet completely disappears behind the star as seen from Earth. By deducting the star's light spectrum when the planet is hidden from the spectrum when it is visible, scientists can arrive at the planet's spectrum. The spectrum of the light emitted by a planet is a clue to its temperature and can also hint at the composition of its atmosphere and therefore one can look for bio signatures which could also indicate possible life.



Webb transit data



Webb spectro data

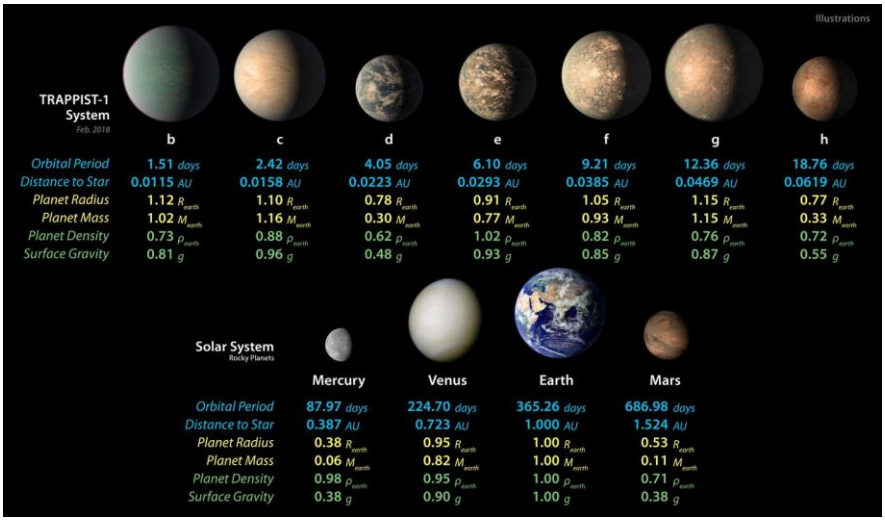
Astrometry. The last method to discuss is astrometry. This term relates to the ability to precisely measure the position and movement of a star. In 2013 the Gaia satellite mission was launched with the initial aim of creating a very detailed catalogue of over one billion astronomical objects and concentrating especially on the exact position of stars. So far, it has exceeded all expectations by cataloguing 1.8 billion stars. By monitoring minute changes in a star's position over time the existence of an exoplanet can be inferred. This can then be followed up by more specific measurements using dedicated instruments such as the James Webb Space Telescope (JWST). It is expected that Gaia will detect some tens of thousands of exoplanets out to 500 parsec (around 1600 light-years).

In this article you will have seen the term 'hot Jupiter's' used. This was the first type of exoplanet discovered and currently approximately 1% of all planetary systems studied have these planets. Ranging in size

from about one-third the size of Jupiter to ten Jupiter masses, all hot Jupiter's orbit their host stars at an extremely close range, usually much closer than the orbit of. A "year" on a typical hot Jupiter lasts hours or at most a few days. For comparison, Mercury takes almost three months to complete a trip around the sun. Because of their close orbits, most, if not all, hot Jupiters are thought to be tidally locked to their stars with one side continually exposed to the star's radiation and the other shrouded in perpetual darkness. This is very similar to the tidal locking of the Earth and Moon. The surface of a typical hot Jupiter can get as hot as almost 5,000 degrees Fahrenheit, with "cooler" specimens reaching 1,400 degrees but still hot enough to melt aluminium. As with most discoveries in science this has raised more questions than answers; how did they form, how can they survive, why is Jupiter in our system different and so on. There are two main ways these hot Jupiters can form either in situ from the protoplanetary accretion disc or by migration. We now know that our Jupiter actually migrated in towards the sun early on in the formation of the solar system but along with influence from Saturn migrated back out to its current position. This is known as the Grand Tack Hypothesis. In doing so it created the late heavy bombardment of the earth, possibly also disturbing the orbits of Neptune and Uranus at the same time and causing the highly eccentric orbits of comets and trans Neptunian objects. These hot Jupiters could have migrated inwards and just stayed there because there was no outward pull. It's also been shown that there is no reason they can't form in situ. A proposal has been put forward that the cores of hot Jupiters could be from about 1% of super earths with a critical mass of about ten Earth masses, which then could pull in huge amounts of hydrogen and helium by accelerated accretion from the protoplanetary disc to form these gas giants.

The next question is how the hot Jupiters survive as gas giants when they are so close to their sun; surely all the gas would be blown away or radiated off. Although less massive exoplanets have been found with their atmospheres boiling away, hot Jupiters are so incredibly massive that over the lifetime of the sun only approximately 1% of their atmosphere will be lost to photo evaporation. It therefore looks like Jupiter type planets can actually form under two different mechanisms. In discussing hot Jupiter's, the next type of exoplanet that was mentioned were super earths. This refers to planets that have masses between 1.2 and 10 times the mass of our Earth. The name is a bit of a misnomer as even though they contain the word Earth these planets can also vary enormously in composition and planets up to ten times the mass of Earth begin to resemble Neptune are often referred to as 'little' or 'mini-Neptunes'. Extraordinarily since the launch of the Kepler telescope these super earths/mini-Neptune's have been discovered to be the most dominant type of planet in all exoplanet systems found so far but they are not found in our own solar system.

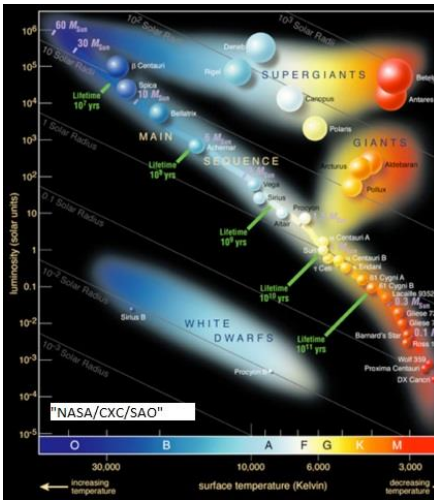
One of the most interesting studies of extra solar systems is the Trappist system. Forty light-years away, seven Earth-size planets closely orbit a faint star called TRAPPIST-1 but all these exoplanets orbit within the orbit size of Mercury and are all tidally locked so experience dramatic temperature differences depending on whether a given hemisphere is facing towards or away from the star. It has even been suggested that the innermost planets could be so hot that they are just a seething mass of molten rock and actually rain down magma and have been called lava worlds The planets were discovered in 2016 with a telescope called TRAPPIST – the Transiting Planets and Planetesimals Small Telescope thus giving the system its name. The sun they orbit is not like our sun. It's called a red dwarf and is actually the most dominant type of star in the universe. This brings us the question, are these planets habitable or capable of supporting life? Life on a planet depends on its parent star and are all classed differently. Red dwarfs are very small stars about a tenth of the size of our sun, and have a much lower temperature of about



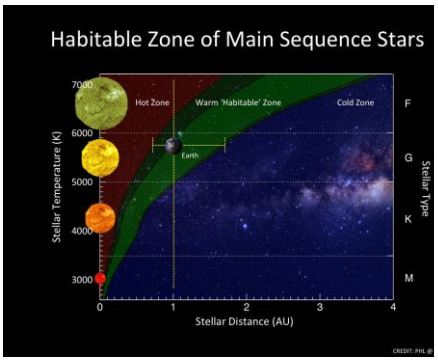
Trappist system comparison

3000 Kelvin as opposed to our sun at about 5500 Kelvin. They are classified as an M TYPE star on the main sequence as shown on a Hertzsprung–Russell diagram.

Because of this, these planets can orbit much closer and still be in what's known as the 'habitable zone', 'circumstellar zone' or more commonly the 'Goldilocks zone'. Most planetary systems have been discovered around red dwarfs (and the nearest planetary system to us orbits our closest neighbour Proxima Cenatauri, which also happens to be a red dwarf). Red dwarfs burn their fuel very slowly and therefore could potentially exist for much longer than our sun. Our sun is half-way through its life so potentially has another 5 billion years to exist, but red dwarfs potentially could exist for trillions of years. However, with regard to habitability, the big problem with this class of star, especially when young, is they are very temperamental and prone to very violent coronal-mass ejections and flares. Given how close their planetary siblings orbit, then any or all potential life will effectively be eradicated. No planetary searches so far have revealed a solar system similar to ours, or even a star which closely resembles the Sun. The nearest star that matches our own with a corresponding planet is the star Kepler-452 located about 1,800 light-years away in the Cygnus constellation, and although not a G2 star it is a G-type main-sequence star. Although similar in temperature to the Sun, it is 20% brighter, 3.7% more massive and 11% larger. Alongside this, the star is approximately six billion years old and possesses a high metallicity. Thus, Kepler-452 cannot be considered a solar twin, although it could be considered a solar analogue due to its age. The only known planet in orbit around this



Hertzsprung–Russell reference



Habitable zone

so just slightly further from its host star than earth and with a similar orbital period of roughly 384 days. Unfortunately, it has a mass at least five times that of Earth, and has a radius of around 1.5 times that of Earth therefore pushing it into the super Earth category. Nevertheless, it is the first potentially rocky super Earth planet discovered orbiting within the habitable zone of a very sun like star. Unfortunately, because it is receiving more radiation from its sun and also has increased gravitation due to increased mass it is highly likely it may have developed a runaway greenhouse effect.

In conclusion, we can see that exoplanetary systems are very common but currently we have not seen anything comparable to our solar system. This could just be a bias in our observations due to limited technical capability but if so, it could all change with new data from JWST and new satellite platforms that are due to launch plus the building of three new thirty-metre ground-based telescopes with adaptive optics. The alternative is that we are unique, and to paraphrase a famous book series by Lemony Snicket; we may just be as we are because of "A Series of Fortunate Events".

*NACO - This is Paranal Observatory's NAOS+CONICA instrument, better known as NACO

** YouTube link: https://www.youtube.com/watch?v=x9EG3gbQ5P0&t=3s

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Roy Stewart is a BNA Trustee and the Chairman and Science Officer with South Yorkshire branch. He received MBNA in 2015, and was upgraded to FBNA in 2023.

Gair Wood: A woodland creation project in peri-urban Leeds

Benjamin Hodgson ABNA

The site of Gair Wood before planting began Photo: Dr Robin Hayward

Woodland in the United Kingdom

The UK currently has around 3.24 million hectares of woodland – approximately 13% of the total land cover. This distribution is not uniform, with woodland covering 19% of Scotland but only 10% of England (Forest Research, 2022). Whilst woodland cover in the UK has more than doubled over the past century, the UK still has one of the lowest levels in Europe.

Approximately half of UK woodland is also comprised of non-native plantations and many woodland species are thought to be in decline (Reid, 2021). Native woodlands are excellent for sequestering carbon, providing habitats for biodiversity, mitigating flood risks, and improving the health and well-being of people; however, The Woodland Trust argues that the UK is not creating native woodlands fast enough to reach its climate goals.

The White Rose Forest project

The White Rose Forest is the community forest for North and West Yorkshire. This ambitious project aims to increase woodland cover across the region To mitigate climate change and flooding, and to create a healthier environment for people. Their proposal states that by 2050, the region can increase tree cover from 11% to 19% by planting around 160 million trees. To achieve this goal, the current action plan (2021 – 2025) aims to plant over 7 million trees in the area, with 2 million of the trees in urban areas and 2,500 hectares of tree cover in priority river catchments. One project contributing towards the White Rose Forest is Gair Wood, a new woodland created by the University of Leeds, United Bank of Carbon and the White Rose Forest.

Gair Wood

Gair Wood is a 36-hectare site just north of Leeds, in between Golden Acre Park and Eccup Whin Local Nature Reserve. The site is surrounded by roads and until recently was composed of multiple pastoral fields with a hedgerow and a small patch of pre-existing woodland. Previously, the site was used by tenant farmers for grazing livestock and hay production. Baseline ecological surveys showed the fields to be species-poor neutral grasslands.

An artist's impression showing the mosaic of habitat envisioned for Gair Wood Image: James McKay

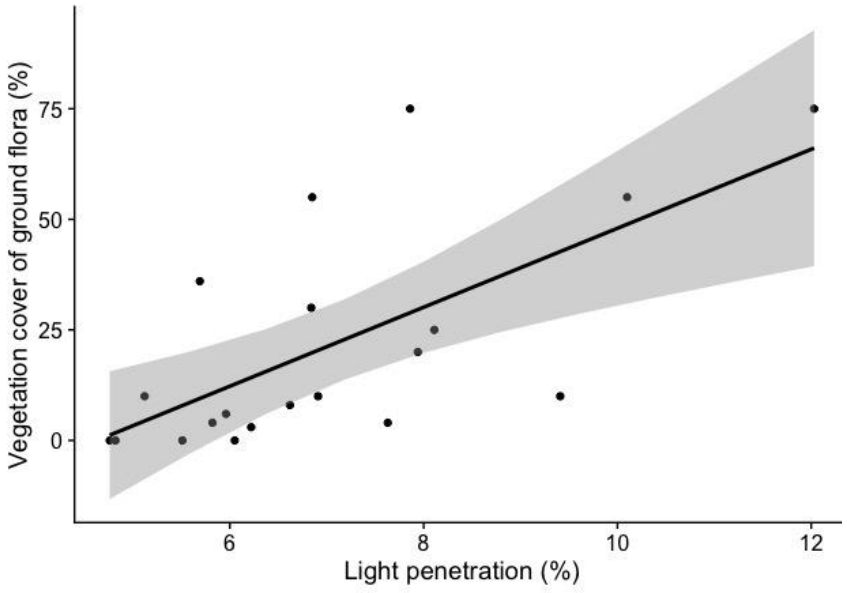
As an ecology student at the University of Leeds I visited the site last summer and observed that the grasslands had thick and uniform swards and were heavily dominated by grasses such as Perennial Ryegrass *Lolium perenne*, Yorkshire fog *Holcus lanatus* and Cock's Foot *Dactylis glomerata*. The grasslands were in poor to moderate condition and the patch of deciduous woodland, line of trees and hedgerow all showed damage from livestock. Himalayan Balsam *Impatiens glandulifera* and Japanese Knotweed *Reynoutria japonica* were also present on site however there are plans to eradicate these invasive species as part of the Gair Wood project.

In December 2022, the first tree of Gair Wood was planted by Roger Gair, who had worked at the University of Leeds for over 40 years. This tree, an Oak, was the first of over 65,000 native trees and shrubs to be planted across 20 hectares of the site. Species planted include English and Sessile Oak *Quercus sp.*, Silver Birch *Betula pendula*, Hornbeam *Carpinus betulus*, Elder *Sambucus nigra*, Common Alder *Alnus glutinosa* and Small Leaved Lime *Tilia cordata*. Among them, the two Oaks, Alder, and Small Leaved Lime are the most abundant. In addition to the carbon sequestration potential of the woodland, the site's biodiversity value has been a key focus throughout the project. Gair Wood was designed to create a mosaic of different habitats – patches of woodland will be interspersed with scrub and open areas, and trees will be planted in a non-uniform pattern. Further heterogeneity in the structure of the woodland will be created through the coppicing of some trees once they have established. Gair Wood will help to connect the surrounding woodlands and over time will provide a new place for the local community to benefit from nature.

Gair Wood is also intended to act as a 'Living Lab' where researchers and students from a variety of disciplines can study the impact of the woodland on air pollution, biodiversity, and soil. A section of the site has been left unplanted and will be allowed to naturally regenerate into woodland, providing an important research opportunity into the difference between natural regeneration and planting in woodland creation schemes.

Roger Gair (Left) planting the first tree at Gair Wood.

The team planting on the first day. Both photos: Dr Robin Hayward



The effect of light penetration on the percentage cover of ground flora in the small area of woodland that was already present at Gair Wood. Graph created by B. Hodgson.

My project on the site

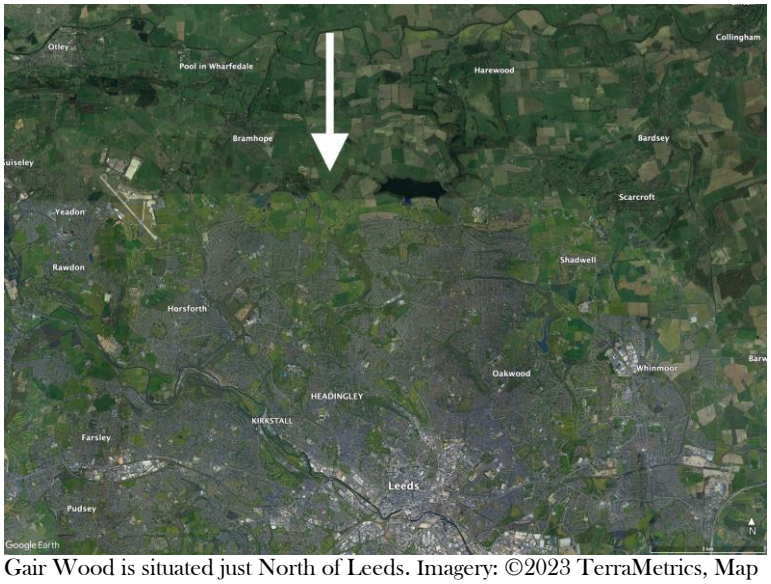
Last August I was lucky enough to complete a Research Experience Placement on the Gair Wood project funded by the Natural Environment Research Council (NERC). Alongside assisting with baseline invertebrate And bird surveys, I completed my own small research project on the existing area of woodland. I aimed to examine how a variety of environmental variables such as soil characteristics, light intensity

1 m² bramble quadrat Photo: B. Hodgson

and tree spacing affected the abundance and species diversity of the ground flora. The pre-existing woodland was around 4 hectares in size and was primarily dominated by Oak and Beech *Fagus sylvatica* with Sycamore *Acer pseudoplatanus* and Silver Birch also present. Most of the trees were similar in size and spacing and created a very thick closed canopy, which I believe is the reason for the woodland's very poor ground flora. One-quarter of my data collection points (0.25m² quadrats*) had no plant species present and none of the data collection points contained more than a single species. Given this low species richness, I looked at the percentage cover of the ground flora to get a sense of the primary productivity. By examining the effect of environmental variables on productivity, I aimed to see what may be limiting biodiversity, given that species richness is often constrained by low productivity.

Out of the variables that I recorded, the only one that had a significant impact on ground flora percentage cover was the amount of light penetration through the woodland canopy, which showed a weak positive correlation. The non-uniform pattern of tree planting, combined with ongoing woodland management such as coppicing, may allow the new and existing woodland at Gair Wood to have a more developed and diverse ground flora, at great benefit to diversity.

The boundary of Gair Wood. Imagery: ©2023 Infoterra Ltd & Bluesky, Maxar Technologies, The GeoInformation Group, Map data ©2023



Gair Wood is situated just North of Leeds. Imagery: ©2023 TerraMetrics, Map data ©2023

*Quadrat – usually 1 m² frame, sometimes marked with smaller, wire areas.

Acknowledgements:
I would like to thank my supervisors Dr Cat Scott and Dr Thomas Sloan for allowing me to be a part of this project and Dr Robin Hayward for kindly allowing me to use their photos and for their thoughtful feedback during the writing of this piece.

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Benjamin Hodgson is an undergraduate part-way through a 4-year integrated master's degree (MBiol) in ecology and conservation at Leeds University. He was awarded ABNA in 2022.

Living with Nature *or* What happened when the Council didn't mow the grass in our small Essex town

Mark Halladay, Dr Chris Gibson FBNA, Councillor Glyn Evans

For urban authorities to contribute to targets of 30% land use for nature and the halt of species' decline by 2030 requires changes in the management of urban green spaces*. This in turn demands engagement with and understanding of public expectations of that management. This report gives an account of one attempt to change that management and the public reaction it received.

King George V playing fields (an original site) in July 2022

Background

Wivenhoe was originally a small fishing village on the banks of the estuarine River Colne, 3 miles downstream from Colchester. Today the larger part of its 11000 population lives on mid-century estates supplied with generous public green spaces on a landscape of south-facing sand and gravel substrate.

Since 2010, two of the co-authors have led attempts to raise awareness and appreciation of the town's biodiversity. This has included canvassing for improved habitat management of the town's closed cemetery, creation of a wildlife garden and, most pertinently, creation of a cultivated verge (as a very effective part of a local school's car parking controls) and the experimental "no mow" of an area of the town's main recreation ground.

Encouraged by the public support for these initiatives, in 2020 a team of resident volunteers set out to see what happened if more of the public spaces in the town were left unmown for the summer months.

Now entering its third year as a systematically evaluated project, the objectives of Wivenhoe's Green Spaces initiative are:

1) to improve biodiversity in public spaces,

2) to gauge public reaction to the "no sow/no mow" approach, and

3) to check the technical feasibility of the regime.

This report presents results to date with emphasis on the second element, that of public reaction.

What we did

Three different Councils – two parish councils, (Wivenhoe Town and Elmstead Market), and the Borough (now City) of Colchester council - are responsible for the town's public spaces. All were wary of public reaction from the start. When the project was first mooted, one Town Councillor wanted an assurance that there was demonstrable majority that there was demonstrable majority support for support for the changes among the local population in advance of approval. Meanwhile, the Borough made clear its expectation that the Town Council would handle the complaints that would inevitably follow.

It took a year (2020) to negotiate the project, after which all three Councils agreed to leave areas of fourteen public sites unmown from March to October. The sites ranged from football pitch-sized areas of open space to one small residential frontage verge. These areas were chosen to minimise negative impact in the first year.

A conservation approach was adopted with the only management being a single cut and collect mowing in October.

The approach became known as "no sow/no mow".

Public messaging was carefully planned, ranging from letters to neighbouring households to repeated articles in, and posts on, local traditional and social media. Explicit "style notes" for public communications were adopted so that all messaging was:

explanatory – making clear the reasons for action and its urgency,

committed – making it clear that we were taking action,

engaging – positively seeking and facilitating feedback from people,

responsive and positive – responding to comments constructively.

To test the objectives, structured surveys of floral biodiversity were undertaken. These comprised monthly identification of flowering plants in all the project areas and bi-monthly quadrant counts of flower heads in comparable mown and unmown areas. Records were checked by BNA Fellow and co-author, Dr Chris Gibson.

Public comment was systematically captured for later analysis. Technical feasibility was tested by direct discussion with contractors and grounds staff.

What happened in 2021 – the botany

Surveys ran from April to August. The results were that:

1136 individual observations were made;

141 species were identified across all sites;

the number of species per site ranged from 24 to 64;

an average 5 times more flower heads were found on project sites than on equivalent mown sites (range: x3 to x29).

Perhaps the most significant finding was the increase in the number of flower heads in the unmown sites. Diversity of species is eye-catching - which in itself is no small matter in the context of urban nature recovery and the management of public expectations - but on ordinary recreational spaces and roadside verges, abundance is arguably more important for biodiversity.

What happened in 2021 – initial public reaction

We started telling people about the project on the town's Facebook posts in March 2021. The first three responses to the first post read:

Great stuff. One of the local farms in our village is returning some of its land back to its original state too.

Couldn't people also be encouraged to make some changes to their gardens to encourage wildlife and reduce the carbon footprint?

I'd love to help.

Immediately evident were the three responses that were to become most typical: applause for doing something, ideas for extending the principle and offers of help.

At the same time, 72 explanatory letters were hand-delivered to immediate neighbours to the sites from a named lead Councillor (the third co-author, Glyn Evans). These invited comments even before the project began. One response was received: a note of appreciation for the initiative.

An article in the local *"WivNews"* magazine and a public Zoom talk about the project (we were still in deepest Covid lock-down) completed the launch. All three – the Facebook post, the media article and the zoom talk – generated offers of help and in April 2021, 12 volunteers met to practice and refine the survey process.

Regular posts were made throughout the summer. Continuing to explain what was going on paid dividends with continued feedback being mainly positive. The final post of the year[1] gave prompt feedback to residents about the project and received a typical range and tone of responses. Five members of the public posted their own spontaneous and appreciative photo posts of the flowers that

The team trying out the survey process in April 2021

they encountered[2]. One member of the public raised concerns about the impact on hay fever sufferers. No response was made by the project team while other members of the public firmly rejected the idea[3] that there was an adverse impact.

A range of other issues were raised including the need for on-site signage (signs subsequently supplied), requests for advice about wildlife gardening, difficulties of dog poo pick-up in longer grass and sowing wildflower seed/"bee-bombing" (discouraged in favour of wild plants).

Perhaps the most pertinent comments were those regarding road safety. Extra cuts were introduced for one site (a large junction verge emerging from a residential estate on to a busy road) following concerns expressed by local residents.

Over the growing season, seven traditional media articles were published and ten Facebook posts made by the project. Surveyors noted any discussions with site users on-site. These combined interactions generated 229 comments from the public.

In 111 of these comments, the respondent's attitude to the project was unambiguous (the balance was assessed as off subject or not carrying a sufficiently clear indication of attitude). Of those 111, 105 were clearly in favour and six opposed. This represents a ratio of more than 17:1 or 94% public acceptability. No complaints were received by any of the Councils.

The second year - 2022

All three Councils agreed to repeat the project with the addition of 15 new sites. These comprised sections of ordinary residential streets and their frontage verges. This represented quite new and different territory.

Millfield an original site just mown in May 2021

General view of Henrietta Close (another original site) 2021

The original sites were chosen to give least likelihood of complaint. These new sites were chosen as a more challenging test of public attitude. They encroached directly into residents' private space on relatively affluent streets of overwhelmingly owner-occupied households. The approach firmly challenged the orthodox appearance of this very lived-in environment. This was a deliberate policy to see how far support and acceptance of the no sow/no mow approach would extend.

Planned management remained one cut and collect mowing in October. The public communications were repeated with 189 letters delivered to the households whose frontage verges now joined the project. Surveys on residential sites were reduced to two in the season, in May and July, and undertaken by the first author.

The new management regime and surveys were repeated unchanged on the 14 original sites.

Comparative results for the two years are presented in Table 1 split between those for the original 14 sites and those for the new residential sites.

The botanical results were consistent with the weather conditions, exacerbated by the lack of regrowth after an unplanned July cut to the residential verges (see note to Table 1). The record high

temperatures and lack of rain suppressed both flower abundance and number of species. It also kept grass length down (which itself may have had an effect on public response).

What happened in 2022 – public reaction

The number of comments relating to the original sites dropped dramatically from 111 in 2021 to 27. This may have been because the project messaging tended to focus on the residential sites as the novel element to the project. It may also be that social media thrives on novelty and by 2022 the original sites were "old news". At the same time, approval ratings remained at 93% for those open spaces' sites. The fall in the number of comments but their continued positivity suggests that some degree of public habituation has already occurred to their new regime.

On the residential sites results were more mixed. Table 2 separates comments received from direct neighbours of the sites from those made on social media, the latter presumed to be from the wider community.

Social media comments from the general public are both more numerous and proportionately very much more in favour of the approach on the residential streets than are the direct comments received from neighbours.

Direct feedback was gleaned from a mid-season "meet the neighbours" event held on the two most populous streets on an evening in early July. Notes announcing the sessions were posted to all the relevant households a few days previous.

Five people from four households attended from one street (of the 24 households in the project there). No one attended from the second street of 26 households. Key issues raised included litter, dog mess, spread of "weeds" into gardens, the appearance of general untidiness and lack of consultation. These were similar issues to those raised in the 16 direct comments, which mainly came in the form of emails to the lead Councillor.

From the balance of the written comments and the tone of the face-to-face feedback, it would seem reasonable to speculate that the approach might be more popular in theory than in practice.

On the other hand, 173 (92%) of the 189 households receiving a letter made no comment, while no householders attended the meeting in the second street. No safe conjecture can be made as to the attitudes of this silent majority. But if we consider that the initial response of experienced Council staff was the confident anticipation of widespread complaints, this widespread non-response points to something different happening.

While for a few the issue of unmown verges remains a concern (and for a very few, a highly emotive issue) one interpretation of this 'silent majority effect' is that the measures are regarded as commensurate with the much-publicised biodiversity crisis.

Feature	Orig. sites 2021	Orig. sites 2022	Res verges*
Number and type of sites	14 mainly open spaces	14 mainly open spaces	15 sections of residential streets
No. of observations	1134	720	268
Flowering species	141	113	80
Abundance ratio	x5 (range = x3 - x29)	x1.3 (x1 – x12)	x1.3
Height of grass (cm) (2 sample sites)	Millfield = 112 Bobbits = 87	Millfield = 63 Bobbits = 58	n/a
Comments rec'd	111	27	45
Public approval rates	95%	93%	71%
Formal complaints	0	0	3
Letters to neighbours	72	37 (feedback of 2021 results)	189
No. of replies from neighbours	1	0	16 (8%)
Costs	£300 signage CBC	£650 cut & collect WTC	£340 signage CBC

Table 1 Green Spaces results 2021/2022

*Note: the drought and high temperatures of 2022 led to concerns about fire risk on the residential verges. An unplanned precautionary mowing was made to most of those sites in July to reassure residents.

Table 2 Comments by source and by attitude to the changes

Residential verges	No. of comments	For	Against
Direct comment	16	5 (31%)	11 (69%)
Social media	29	27 (93%)	2 (7%)

This sense was implicit in many of the concerns raised. These would frequently begin with phrases such as "I realise we need to do something, but...". Extrapolated to a silent majority, this might be taken as an indication of widespread tolerance of the measures and of their being perceived as proportionate to the problem. Indifference is, of course, an equally available interpretation. From the point of view of nature recovery, either will do!

On balance, we have resisted the temptation to take the view that silence means assent, just as we have rejected the complaints of a small minority objecting to the new regime in its entirety.

On the residential roads the most frequent complaint was about untidiness. And in a hot, dry summer of a type predicted to become more frequent, concerns of fire risk were very genuinely felt. In response to both concerns, a planned "harvest cut" in late July is being introduced in 2023, consistent with published best practice (see Plantlife's Managing Grassland Road Verges, 2019)[4].

Conclusions to date

Results to date confirm what was expected in terms of biodiversity impact: if mowing is reduced, floral (and insectivorous) diversity becomes apparent and abundance increases, even on the most depleted of roadside verges and in the harshest of weather conditions.

It is public reaction that is more variable, and our engagement with the Councils concerned makes it clear that public acceptance is the critical success factor for any urban nature recovery regime.

Ernest Road mown (2021) and unmown (2022)

That reaction over two years indicates that, for the original sites– areas of recreational spaces and out of the way verges - no sow/no mow on a once a year, cut and collect basis is not only acceptable but popular. It can be safely adopted on a permanent basis.

Our project suggests the same approach on high density residential streets brings a more mixed response. Small numbers of highly dissatisfied neighbours can give cause for hesitation. However, the very small number of households responding to the issue at all does not reveal the attitudes of those remaining silent.

Overall, we point to positive public support for nature friendly management of public green spaces in general, and acknowledge the specific problems that this management leads to in residential areas. At the same time, the biodiversity benefits are as well evidenced as they were expected.

Plans for 2023 are to adopt the 'no sow/no mow' as standard in the original open-spaces' sites, introduce a mid-season cut in residential areas and repeat surveys of both botanical impact and public reaction.

We hope to be able to report on the third and final year of the project in a year's time.

Notes

*Source is from the Environmental Improvement Plan (UK Govt. Feb 2023); and (species decline) is legislated for in the Environment Act 2021.

Links

[1] Wivenhoe Community Notice Board | Update on the Green Spaces Project | Facebook

[2] Wivenhoe Community Notice Board | When I went for a walk in King George V playing fields with my son, Kit Lindsley on Saturday, I was delighted to see that areas of grass had been lef... | Facebook

[3] Wivenhoe Community Notice Board | Much as I support our new leaders attempts to increase him diversity by not mowing etc, I really feel that they should have considered the misery of a... | Facebook

[3]https://www.plantlife.org.uk/application/files/6316/5168/1521/Managing_grassland_road_verges_2020.pdf

This article is an adaptation by Mark Halladay from a Zoom PowerPoint presentation, given to the BNA in November 2022.

Thanks to the volunteer surveyors, contractors and ground staff and to the site neighbours who have made this project so interesting and successful.

All photos: M. Halladay

A significant steppingstone for Greater Horseshoe bats *Rhinolophus ferrumequinum* in southern Britain

Julia Bracewell

Once, the dusk and dark summer skies of southern Britain were filled with the sound of hundreds of Greater Horseshoe bat wings sweeping through the air, as they hunted the myriad insects that shared those warm evenings — but now, those same summer skies are largely devoid of this rare bat and its wing song. The Greater Horseshoe bat suffered a catastrophic crash in population during the last century when population numbers fell by as much as 98% in Britain, leaving around 2,200 individuals* in isolated pockets and confined to parts of Wales and southwest England (Ref. 1). The causes of this crash are varied and cumulative — the loss of suitable summer and winter roosts, together with a drastic reduction in the abundance and variety of their insect prey caused by changes in land use, agricultural practices, and the increased use of pesticides. It doesn't help that this species has some peculiarities that make it quite fussy in its needs and wants.

Greater Horseshoe bats in flight. Photo: Andrew McCarthy

The Greater Horseshoe bat is one of our largest and rarest bat species, weighing in between 18-24g. The other horseshoe bat in Britain, the Lesser Horseshoe bat *Rhinolophus hipposiderus*, is a much smaller bat weighing between just 4-9g.

The body shape and physiology of the Greater Horseshoe make it difficult for the creature to crawl and squeeze into cracks and crevices to shelter and rest. Instead, these bats need large openings into sheltered spaces and buildings where they can fly in directly to roost and raise their young. Traditionally a cave dweller, these bats now rely on abandoned mines, ice houses and old barns with large openings, all of which are in short supply. In particular old barns have often either become too derelict to provide sufficient shelter or are being converted to human dwelling spaces.

Their roosting habits also distinguish horseshoe bats from other species by hanging from their feet and wrapping their wings around their body while asleep. Infra-red cameras linked to external monitors have allowed for privileged peeks into the usually hidden world of a Greater Horseshoe bat maternity roost and have treated viewers to the choreography of cleaning to the collective and rhythmic resting and to the raising of young pups — all done while hanging from the tiniest of toes. These acrobatic feats are possible thanks to a specialised tendon-locking mechanism that locks the feet into a grip with minimal muscular effort enabling the muscles to be in a 'relaxed' state while hanging on.

Hibernating Greater Horseshoe bat. Photo: Daniel Hargreaves

The physiology of the horseshoe's face determines its echolocation method too, which is different to the echolocation of other bat species. The distinctive nose-leaf which gave rise to the bats common name, focuses the echolocation calls into a very directional beam which, along with the very high frequency of the calls, makes it difficult for prey to be aware of the bat's approach.

Since that catastrophic population crash last century, numbers of the Greater Horseshoe bat are slowly rising, though they are still low at around 13,000 — for comparison the Common Pipistrelle *Pipistrellus pipistrellus* numbers around 3 million. The change in fortune of the Greater Horseshoe species has happened in a number of ways, including legislation to protect bats. In addition, in the early 1980s, the **Honourable Vincent Weir, founder of Vincent Wildlife Trust (VWT),** became concerned about the plight of Britain's bats and started several VWT research projects to identify the needs of rare bat species. It became clear that the widespread loss of roosting and breeding sites across the south and west of Britain was driving the dramatic decline in both horseshoe bats. So, from the 1980s through to the 2000s Vincent purchased several important breeding and hibernation sites for rare bats, including a farm building in Devon that is now home to the largest known maternity colony of Greater Horseshoe bats in western Europe. Today, VWT's bat reserves in Britain are home to around 50% of the British Greater Horseshoe bat population. Despite its slow reproduction rates, the Greater Horseshoe is increasing faster than any other British bat species being monitored, but it still remains one of our rarest bats with a core range limited to the southwest and parts of Wales.

Female Greater Horseshoe bats with pups. Photo: Martyn Phillis

While small colonies of a few Greater Horseshoe bats have been found outside the core range, including in North Wales, the West Midlands and Sussex, there haven't been any significant records of the species breeding in the south for at least 100 years.

Until now.

On 14 February 2019, during a routine bat survey at an old, derelict stable block in West Sussex, ecologist Scotty Dodd of the Sussex Bat Group came across a small group of what he thought were Greater Horseshoe bats. Wanting to be sure before becoming too excited, he sent photographs of the bats to fellow

Derelict stable before renovation. Photo: Julia Bracewell

Sussex Bat Group members, Martyn Phillis and the late Tony Hutson who both confirmed that they were the rare Greater Horseshoe bat. The excitement reached new levels when in the summer of that year, Scotty recorded Greater Horseshoe pups — the first record for more than 100 years of multiple breeding Greater Horseshoe bats 100km east of a known stronghold in Dorset.

Recognising the huge significance of this find and learning that the derelict stable was to be put on the market for development, Sussex Bat Group contacted Vincent Wildlife Trust and the two organisations joined forces to try to save the site. The team launched an appeal to raise £350,000 in total — £200,000 of which was the purchase price of the stable block, with a deadline of six months in which to raise it before the building would be put onto the open market. The rest was to cover renovation costs to make the building safe and secure and enhance the building to meet the specific needs of the species.

And now, just 18 months later, we have saved the building and with a new roof and secure walls, it is ready for the return of the Greater Horseshoes later in the year. This has been a positive good news story of how routine wildlife monitoring, collaboration and partnership and the huge generosity of donors and supporters of bat and wildlife conservation have all worked together to create one more steppingstone to help a species return to its former ranges in the southeast of England.

Julia Bracewell is Senior Design and Communications Officer with Vincent Wildlife Trust

Greater horseshoe bat in the Swan Mine.

Greater Horseshoe bat entering a hibernation site.
Photos: Daniel Hargreaves

Further Information

1 -To learn more about the acrobatic choreography during cleaning visit a privileged peek into the hidden world of Greater Horseshoe bats

2 -To find out more about the Sussex Bat Appeal visit vwt.org.uk or Sussex Bat Group's JustGiving page

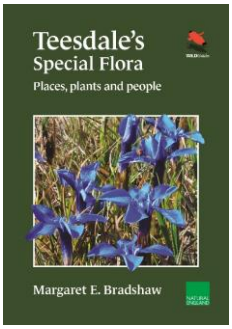
3 -To listen to a podcast on BatChat of Scotty's significant find, listen here.

Ref. 1

'Distribution and Status of Bats in Europe' R. E. Stebbings and Francesca Griffith (1986) *publ Institute of Terrestrial Ecology,* Natural Environment Research Council.

Book Reviews

Editor: Roy Stewart MSc, FIBMS, FLS, FRSB, FBNA



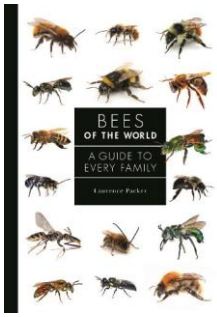
Teesdale's Special Flora: *Places, Plants and People* by Margaret E. Bradshaw. Published June 2023 by Princeton University Press. ISBN: 9780691251332. £14.99

25% discount for BNA members Visit Princeton University Press's website https://press.princeton.edu/ Use the code BNA20 to redeem your offer.

Reviewed by Steven Rutherford

There are some spectacular places to see wildlife around these isles, and Teesdale must rank amongst the best – but also one of the least well known. Many botanists amongst us will be aware of the unique assemblage of plants that this area holds, and yet, situated between Durham and the Lake District, this gem of an area on the catchment of the river Tees will be new, I would think, to most. Margaret Bradshaw's book from Wild Guides has the usual floral identification you would expect in a good guide with the added information of IUCN Red List, First Record in Teesdale, Altitude and Life-Cycle, along with sections on Distribution, Habitat, Status and Conservation, with an added Further Information website at the end of each account. All extremally useful. The book starts, however, with detailed information of why this area holds such a unique assemblage in such a small space by explaining the geology and soils and how that works with the weather and climate. The history of the discoveries and the people who made them is given a chapter, with another on the plant Communities and Habitats.

I hope that this book encourages more naturalists to visit and enjoy the delight of such a rare place for plants, as long as we all tread carefully and lightly.



Bees of the World by Laurence Packer. Published February 2023 by Princeton University Press. ISBN: 978-0-691-22662-0. £25

25% discount for BNA members Visit Princeton University Press's website https://press.princeton.edu/ Use the code BNA20 to redeem your offer

Reviewed by Professor Ted Benton

The 'blurb' of the back cover reads: 'A beautifully illustrated introduction to the incredible variety of bees from around the world'. For once, this is a completely justified description and assessment of the book. The reviewer's job is merely to elaborate.

Laurence Packer is one of the leading global experts on wild bees, and heads a lab at York University Toronto which is a hub for international bee research and holds one of, if not the, largest collections of bee specimens. Though Packer has written powerfully on the significance of bees and the need for conservation, his central research interests are in classification (taxonomy) and the closely related discipline of evolutionary history (phylogeny). This makes for instructive insights, scattered throughout the book, into the on-going discussions and continuing uncertainties in the finer-level relationships between different groups of bees, as new species are discovered, and DNA analysis increasingly informs these issues.

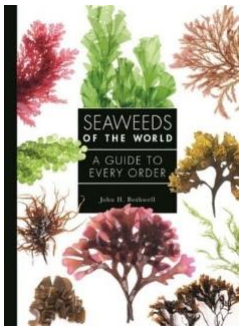
The introduction is clear, comprehensive and impressively concise, covering the details of bee anatomy, life histories, nesting behaviour, relationships to flowers, habitats and conservation in a few short pages. The writing is enlivened by some striking analogies, such as his comparison of the bee practice of 'mass provisioning' to an imaginary human parent collecting 18 years of groceries, putting them into a room, giving birth, and then leaving the child to look after itself.

The core of the book is devoted to a series of introductions to the main families of bees (in order of their successive branching from ancestral stock). For each family Packer introduces the sub-families and over 100 genera (out of the world's 500-plus genera). Each genus is illustrated by one or more large photographs, almost all of which are of superb quality, and which frequently display the distinctive features of the genus. Usually, the text includes interesting information about the nesting habits, floral preferences, etc. of selected species, as well as providing a distribution map, habitat preferences, and detailed anatomical differentia for the genus.

(Bees of the World cont.)

For the British bee enthusiast, the book allows us to situate our fauna within the global diversity. Interestingly, although Britain has less than 300 species, out of a global total of (so-far described) species of 20,000 (under 1.5%), at the highest level of classification (families) we have six out of a global seven. The seventh family (Stenotritidae) is confined to Australasia. The distribution maps themselves tell an interesting story, with many taxa widespread through Europe and Asia but absent from Australasia, and others confined to that biogeographical zone. In terms of habitat, groups of bees specialising in arid, hot conditions are absent from Britain, but we have representatives adapted to a very wide range of other habitats. Packer provides accounts of nesting and mating behaviour even more outlandish than those we encounter here – such as the Orchid bees, whose males collect scents from orchids (or other plants and even animals) to use in courtship 'displays', or the American ground nesting bees that dig burrows as deep as five metres.

In short, this is a book full of visual delights and information for the more general reader, and still has plenty to offer for the more obsessed 'melittologist'.



Seaweeds of the World: *a guide to every order.* By John Bothwell

Published January 2023 by Princeton University Press. ISBN: 9780691228549.
£25
25% discount for BNA members Visit Princeton University Press's website https://press.princeton.edu/ Use the code BNA20 to redeem your offer.

Reviewed by Mark Dudley

Seaweeds of the World belongs to a family of books which is new to me, but is already a collection of six books which the publishers Princeton University Press are marketing as a guide to every family - others include spiders, lizards and turtles with bees and snakes probably available at the time of reading this review and I am sure there will be more. After reading this book and seeing the quality, it makes me want to delve into some of the other publications of the series. It is easy to pick-up and read and should appeal to all those that have an interest in the study of Phycology or an interest in plants of a rocky shore. If you know absolutely nothing about seaweeds then this could be a great book to begin with.

The book is full of excellent pictures and for the first quarter of the book, covers everything you need to know about their properties, biochemistry, life cycles, evolution, distribution and finally their uses in various cultures around the world. The other three quarters of the book presents a double page spread of 75 of the 200 known genera of seaweed - green, red or brown. These were chosen on the basis of being the first described by Linnaeus because they were common and distinctive, of cultural or economic importance worldwide, or as the author refers to them for their scientific interest or particular beauty. Don't expect this to be a comprehensive field guide to all species around UK coastal waters because it isn't and does not try to be.

The introduction sets the tone of the book nicely referencing what is often an under represented organism, that not only links the life of land and water, but our developed cultures and sets the stage inspiring me to read more. I particularly like the evolutionary side of my ecology so the first few sections of the book most appealed but if you are unfamiliar with the fact red and green seaweeds are unrelated to brown seaweeds as a human is to a potato, then you might be lost in the science, particularly the difference in life cycles and how and why they came into existence through endosymbiosis and secondary endosymbiosis. Alongside this the author delves into the photochemical processes in converting carbon dioxide and water into sugars, a process called photosynthesis, and briefly explains how each seaweed colour uses different pigments to absorb light before explaining how it absorbs carbon dioxide using an organelle called a pyrenoid. But don't be put off by this as it is fascinating and as the natural history chapter evolves the author brings us around to where humans have used seaweed as food, fodder and fertiliser before taking us into the industries that have evolved from farming this product.

The main body of the book covers the chosen 75 genera from all three colours of seaweeds (and most get a double page spread), a couple of pictures, etymology, diversity (number of species belonging to this genus), distribution maps, habitat, and life cycle along with shape and size. The author then explains what is typical of the genus, along with some points of interest linking it back to its importance to humanity. What becomes apparently clear is that there is so much diversity in shape and form amongst seawards as there is within flowering plants, which makes this book overall a fascinating read.

Volume 36 Number 2 Summer 2023

British Naturalists' Association the National Body for Naturalists ISSN No. 0011-023X