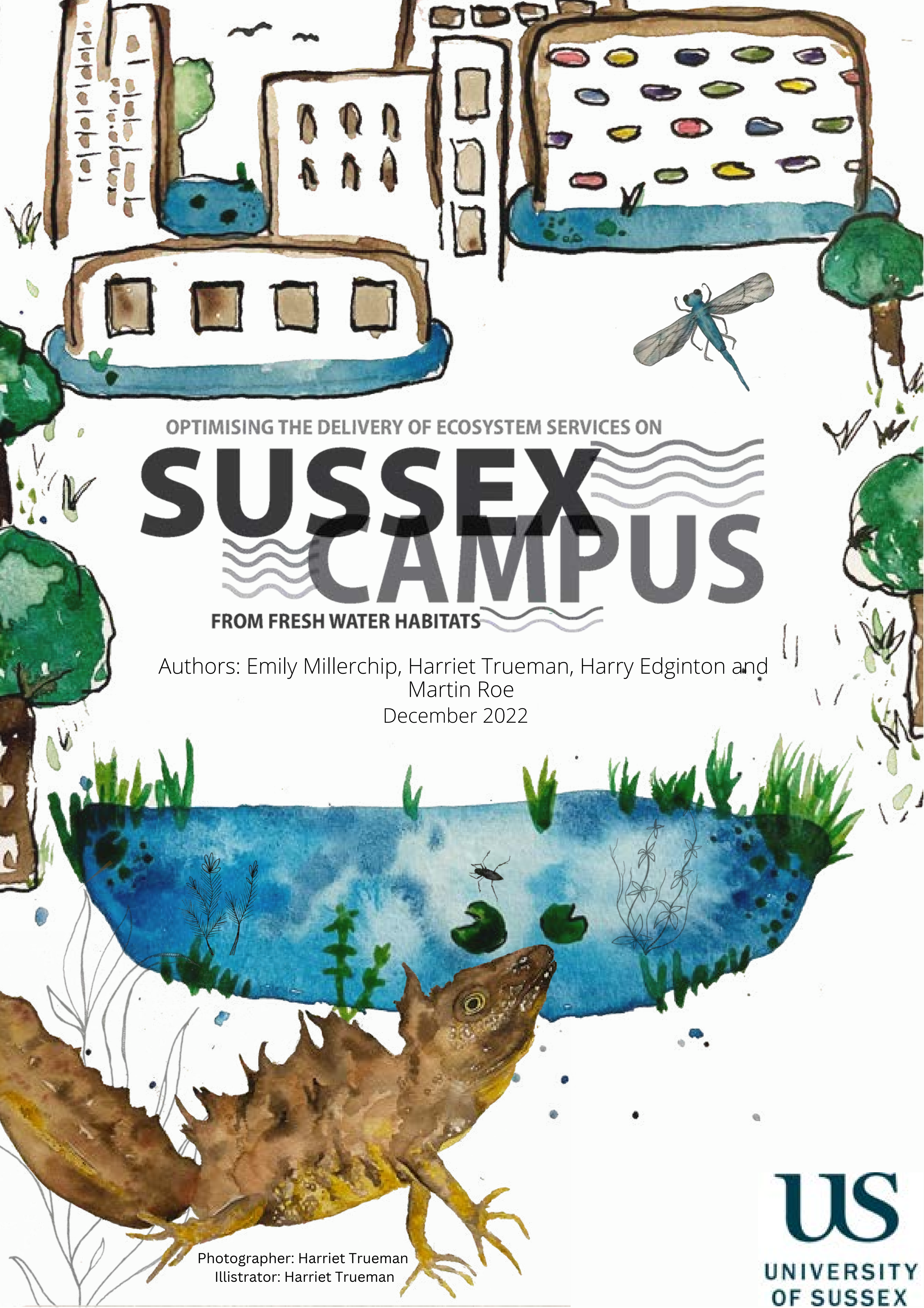

OPTIMISING THE DELIVERY OF ECOSYSTEM SERVICES ON

SUSSEX CAMPUS

FROM FRESH WATER HABITATS

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UNIVERSITY OF SUSSEX

EXECUTIVE SUMMARY

An analysis of freshwater habitats across Sussex University Campus, with potential interventions to optimise the biodiversity and ecosystem service delivery of these sites.

Ecosystems Services:

Supporting: Ponds support a range of ecological interactions, if designed correctly and maintained to a high ecological standard.

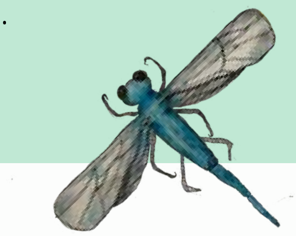
Regulating: Ponds have the potential to mitigate the urban heat island effect and store carbon in sediment, though these are dependent on a range of abiotic and biotic factors. Ponds can also increase flood resilience in urban spaces by storing large volumes of water.

Provisioning: Ponds provide habitat, food and water for a range of species. Water provision can be particularly useful during times of drought.

Cultural: Blue-green spaces are important for people's mental health and well being. There are many opportunities to utilise ponds for educational or recreational purposes. For example, Information boards and workshops can be used to raise biophilic attitudes.

Methods to quantify/monitor:

- Measures for biodiversity could be achieved using observational studies through citizen science, or pond sampling. Novel methods such as Eco-acoustics may also be utilised.
- Local air temperatures can be measured, using thermometers, in areas adjacent to ponds and compared to those in built-up areas around campus.
- Recordings can be taken of the number of benches and the accessibility of each pond.
- Water quality metrics can be measured on site, as well as in the laboratory.
- Calculations of water depth and the potential for water storage.
- Using public surveys to quantify the aesthetic value of ponds.



Recommendations and Conclusions:

- Creation of a habitat corridor between the 'Good' Dew pond and 'Poor' Attenborough Pond, to increase available habitat for amphibians and other species.
- Plant wildflowers or place potted plants next to ponds to increase biodiversity.
- Remove fish from ponds, as these can dominate small aquatic ecosystems
- Ensure ponds are actively monitored and cleaned/restored, if necessary.
- Install stormwater management systems, particularly on the zebra crossing on Gardeners Centre Road.

Contents

Word count: 4000

GLOSSARY

Biodiversity: The variability among all living organisms, spanning from an individual genetic scale to complex ecosystems [1].

Biogeochemical Cycles: The systems by which chemical compounds cycle through the earth's biotic and abiotic elements [2].

Charismatic Species: Animals which are deemed 'attractive' by humans. These are often colourful or patterned species which are easily recognisable [3] .

Ecosystem: A dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit [4].

Ecosystem services: The benefit provided by ecosystems that contribute to making human life both possible and worth living [4].

Eutrophication: The increase in the rate of supply of minerals and organic matter (often Nitrogen and Phosphorous) to an ecosystem [5].

Fluvial Flooding: Is the flooding which occurs when rivers can no longer contain the volume of water entering them.

Methanogenesis: The production of methane as a byproduct of metabolism due to anaerobic respiration [6].

Nitrification: The production of nitrate by microbes through the oxidation of nitrogen compounds [7].

Pluvial Flooding: Is the flooding of surface waters, often in urban areas, caused by high levels of precipitation.

Pond: Small freshwater sites which are either permanent or temporary. They can be either natural or manmade [8].

Turbidity: the measure of the opacity of a solution due to its suspended sediment.

Urban Heat Island Effect: Urban areas accumulate heat and so have higher relative temperatures than surrounding natural areas [9].

INTRODUCTION

Freshwater habitats cover less than 1% percent of Earth's surface, but support 10% of our planet's species [10]. Research has shown that ponds support particularly high levels of biodiversity, including rare and charismatic species, in comparison to other freshwater sources [11]. In the UK, ponds support a staggering two-thirds of our native freshwater species, whilst providing a multitude of ecosystem services [12].

Ecosystem services are defined as the benefits provided by the natural world that contribute to successful human life [1]. They can be divided into four categories; supporting, regulating, provisioning and cultural services. Supporting services are the fundamental and essential roles played by ecosystems. Ponds provide this role through fulfilling niche requirements of species. They also support essential biological processes, for example nutrient cycling and photosynthesis [13]. Second, ecosystems provide us with ‘regulating’ services; those that moderate natural phenomena. Examples of regulating services offered by ponds include their role as carbon sinks and their mitigation of the urban heat island effect [14]. Similarly, they can aid in flood alleviation [15]. There are benefits to an ecosystem’s extractable goods, also known as its ‘provisioning’ services. The most obvious extractable resource provided by ponds is freshwater, and this provides an important source of drinking water which is particularly beneficial to species during periods of drought [16]. Finally, ponds provide a range of culturally enriching services, due to their high aesthetic, recreational, and educational value [17]. Studies have highlighted that spending time in blue spaces improves our mood and wellbeing [18] [19].

Sussex university is located on the south downs (a range of chalk hills) on the dip slope side. There are also some clay deposits, especially surrounding Falmer village, next to the university [20] (Figure 1). Chalk is highly porous, so it naturally drains surface water very quickly, making natural freshwater sources less abundant. To combat this, farmers historically built dew ponds, with clay bottoms, to water livestock. Today, they provide substantial wetland habitat on the south downs [21]. There are currently eight ponds on Sussex campus, including one dew pond (Figure 2). We explored these habitats to assess the extent to which they fulfil supporting, regulating, provisioning and cultural ecosystem services, and generated solutions to improve and maximise their delivery. Within this, we have created a list of methods for assessing these key factors, which can be used again in future pond evaluations.

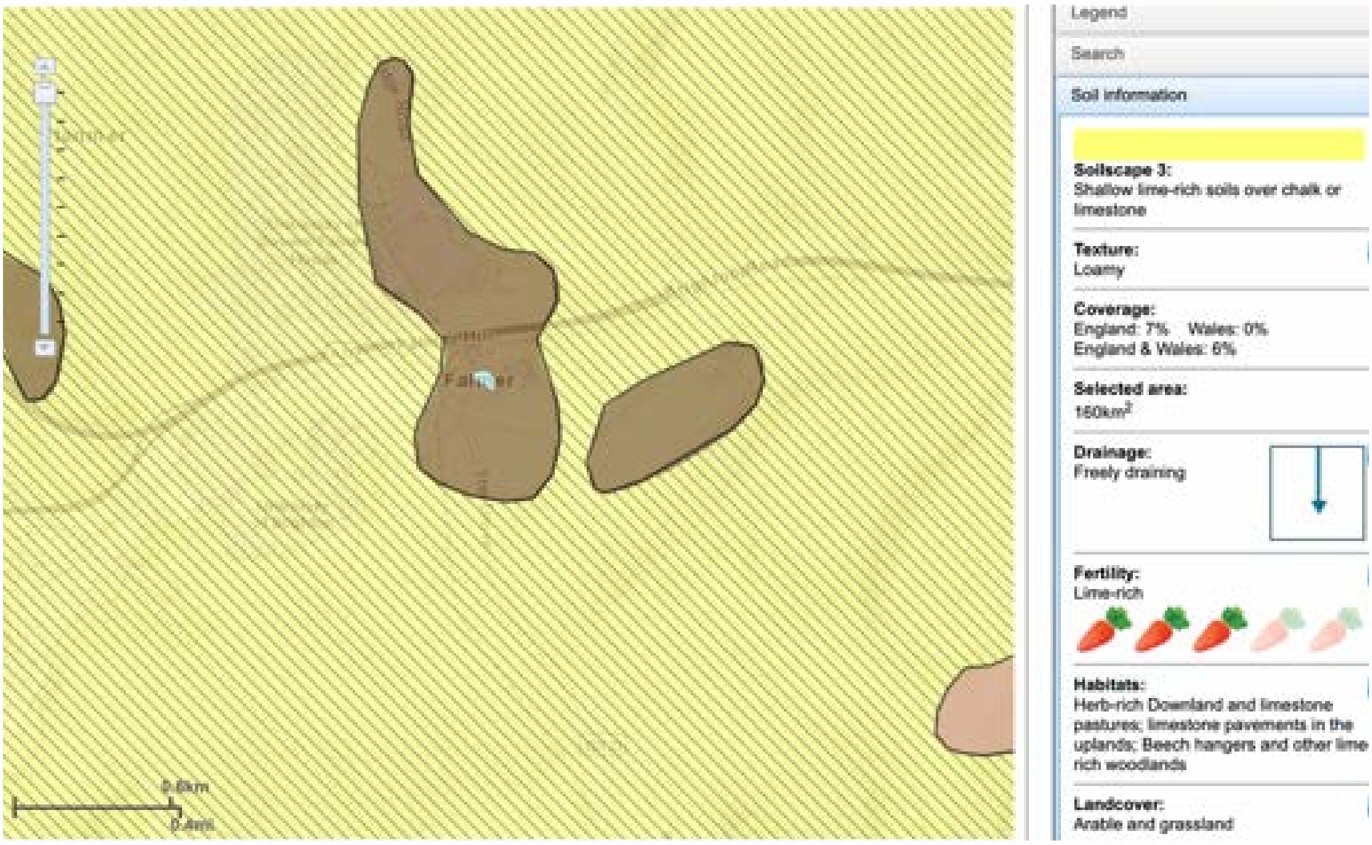


Figure 1: *Soilscape map showing dominant soil type of campus area, including chalk soil statistics* [20].

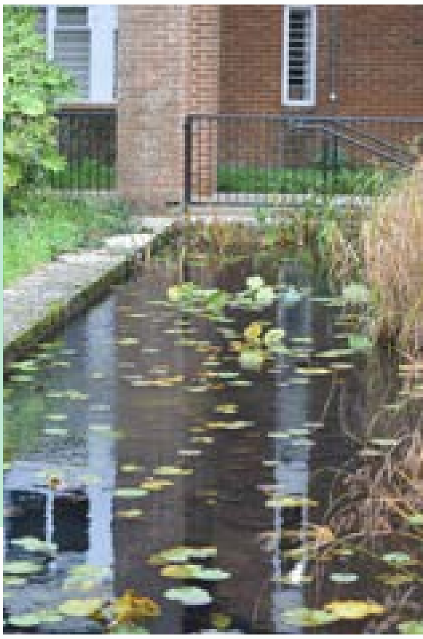
UNIVERSITY OF SUSSEX

POND LOCATIONS ON CAMPUS

Figure 2: *pond locations on Sussex Campus*

PONDS ON CAMPUS

Arts A
Arts A Pond is a small, circular pond built for aesthetic purposes. It is surrounded by impermeable tiles and has a steep drop into the pond, limiting accessibility for wildlife. It has four benches and is located near the Arts Piazza cafe. Goldfish and Cattails dominate the pond's **biodiversity.**



Arts C
A rectangular pond for aesthetic purposes between the Arts C and Arts B building. It has a steep grass slope on one side and is fenced off on the other three. It has a cement border and steep banks, limiting wildlife accessibility. Grasses and goldfish dominate this pond.

Chichester
The pond outside the Chichester building has a rectangular border filled with pea gravel. When our survey was carried out (November 2022) the pond was filled with leaf litter. Its cement slopes are steep and the area surrounding the pond is impermeable and gravelled.

Wildlife Pond
The pond on the campus wildlife walk is found behind the Arundel building. It is in a forested area, but is not directly under canopy cover. It has gradual slopes and is surrounded by natural vegetation. At the time of survey, it was covered in leaf litter and pondweed.

PONDS ON CAMPUS

Dew pond

A passive rewilding project which has been previously restored [22]. It has gradual slopes, good surrounding vegetation and is away from the main campus. It has a bench and an information board for students to learn about the wildlife that utilises this space.

Attenborough Pond

This Pond is situated around a section of the Attenborough centre. It is mostly used for rainwater storage. It has steep cement slopes, little aquatic vegetation and is surrounded by mown grass. It is populated with goldfish.

Falmer Moat

The Falmer courtyard has a concrete moat which holds excess water in times of high rainfall. In periods of little precipitation, it dries up. The Moat supports no flora or fauna and is surrounded on all sides by impermeable surfaces.

Meeting House Pond

This pond surrounds most of the Meeting House Building and its purpose is to store excess water. It has steep concrete edges and supports no fauna or flora. It is surrounded by mown grass and is adjacent to a section marked for Wildflower planting.

Greenhouse Gas emissions

Ponds have multiple impacts on **biogeochemical cycles**, which affect climate change, ecosystem health and hydrological characteristics of the landscape. A range of carbon fluxes have been recorded in ponds, from carbon storage in sediment, to methane releases due to **methanogenesis**. These fluxes are influenced by a range of factors, especially if ponds dry out, exposing sediment to air which releases carbon, while limiting methanogenesis processes [23]. Methanogenesis is affected by aquatic ecosystem structure, for example submerged plants limit methanogenesis [24]. Other greenhouse gases that have been recorded include the release of nitrous dioxide, though little research has been undertaken on natural or semi natural ponds. Temperature is a key factor in regulating **nitrification** processes, with higher temperatures increasing rates of denitrification in ponds. Sulphate ion concentration may impact nitrous oxide production, as sulphide inhibits the conversion of nitrous oxide to nitrogen [25].

Climate control

Both natural and man-made water bodies have cooling effects on local climates, due to evaporation processes. Hence, ponds have potential to mitigate high air temperatures due to climate change or the urban heat island effect [26]. Urbanisation itself influences pond temperatures, with ponds in urban areas having higher temperatures, particularly during the spring and summer months. This can cause insect larvae to develop earlier in urban ponds [14]

Biodiversity

Ponds support a range of ecosystem functions, which are required to maintain ecosystem health. At a regional level, ponds contribute the most to biodiversity out of any water ecosystem in southern England, both in terms of species richness and rare species [27]. Moreover, they provide excellent habitats for a range of terrestrial species. Many aquatic-terrestrial interactions have been studied; aquatic insects are vital for pollination and provide food sources for avian populations[16]. Aquatic insects at present are neglected in UK insect conservation goals [28]. Moreover, a range of aquatic biota such as aquatic fungi are neglected in the IUCN red list of species [29]. Dew ponds also have the potential to provide habitats for the UK's most endangered amphibian species [21] , which are important for aquatic-terrestrial interactions, such as the great crested newt.[21]

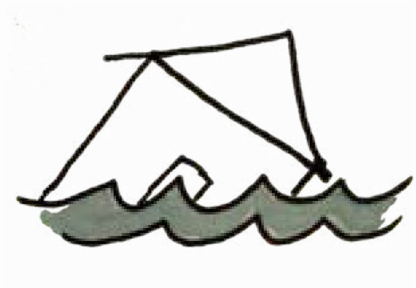
Fresh water provisions

The provisioning of freshwater is a vital function of ponds and other aquatic habitats. Whilst on campus freshwater for people may not be the main focus, freshwater for biodiversity of both flora and fauna is very important. Alongside aquatic species, insects, birds, livestock and vegetation rely on ponds for freshwater [16]. This makes freshwater provisions inseparable from other ecosystem services (e.g Biodiversity and Primary Production).

Freshwater pollution occurs from various sources. In the UK, 40% originates from agriculture and land management, 35% from the water industry and 18% from urban causes and transport [30]. The pollutants most commonly discussed are nitrogen and phosphorus, but from agricultural runoff we also see pesticide pollution and from urban environments we see heavy metals, road salts, and chloride [16 31]. **Eutrophication** in ponds can cause increased algal blooms as well as increased phytoplankton and macrophyte biomass [32]. This can lead to high **turbidity** and low oxygen content, causing organisms to die of hypoxia [33]. To establish the quality of freshwater sources on campus, we must test the levels of key pollutants in freshwater ponds.

FRESH WATER ECOSYSTEM SERVICES

Flood management



In the UK, rates of **fluvial** and **pluvial** flooding are set to increase, due to increased urbanisation and changes in the flow regime [34]. This is heightened in Urban and Peri-urban areas, due to the presence of impermeable surfaces [35]. Furthermore, in these areas, water runoff is often extremely polluted [34].

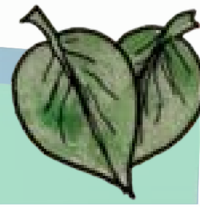
To control flooding, governmental bodies recommend the use of sustainable urban drainage systems [36]. These come in many forms, but include freshwater ponds, which have a sufficient attenuation storage volume [35]. Ponds can hold excess water (limiting local flooding) and store polluting bodies in their sediment (preventing leaching into the wider environment) [15]. However, this can have deleterious effects on ponds' biodiversity services, such as their ability to support dragonfly larvae (which utilise pond sediment for feeding)[37].

Education

The educational value of ponds is important in developing a better understanding of freshwater habitats and their threats. Studies of pond projects have demonstrated that young people tend to develop a stronger understanding of amphibian life and pond biodiversity, as well as change their attitudes [38]. Direct interactions with nature are depleting [39], therefore educational tools to re-engage individuals are important in the protection of our freshwater ecosystems.

Aesthetic value and health benefits

Blue spaces, such as ponds, satisfy our innate human desire to be in nature. Research has revealed that nature has positive effects on both our mental and physical health. For example, Frumkin and Fox (2011) found that patients recovered from surgery significantly faster when their ward was within view of nature in comparison to a wall [40]. Ponds and surrounding green spaces help relieve stressful work environments; individuals with views of vegetation and trees reported lower levels of stress [41]. This is especially important in areas like university campuses, where students report high stress levels, which can lower productivity [42]. Blue Health research project focuses on links between urban blue spaces and health. For example, increased physical activity occurs in blue space environments because their aesthetics encourage outdoor activity [43]. Ponds in close proximity to study areas e.g Arts A, C and Attenborough should invest in aesthetic value to maximise psychological and physical health benefits to students.



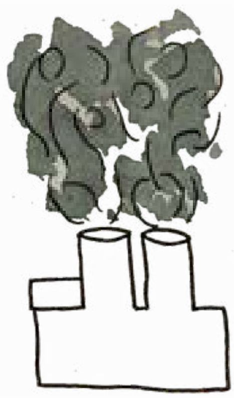
Our grading system

Ecosystem services can be difficult to measure and quantify [44]. However, to meaningfully evaluate the success of freshwater habitats, quantitative and qualitative data must be collected. Below, we have accumulated methodologies, which can be replicated in the future for freshwater habitat evaluations. This is vital, as standardised methodology is required for later result comparisons or comparisons to sites at different locations [45]. Within this report, several of these methods were used to form our grading of the Sussex campus ponds (Figure 5). Our grading system ranged from 'poor' to 'adequate' and 'good'. With 'poor' only supplying 1-2 ecosystem services to an acceptable level, 'Adequate' either supplying multiple ecosystem services to an acceptable level or 1-2 to a very high level. To be graded as 'Good', a site needed to meet many ecosystem services at an acceptable level and at least one ecosystem service at a very high standard. While rating systems like these can be subjective and oversimplified, [44] they are proven to be a good method of comparing ecosystem service delivery, and are often used in other fields.

Greenhouse gas emissions

To measure carbon fluxes for ponds across Sussex campus, samples of soil sediment should be taken over time and analysed in the lab for carbon content. Samples of soils should also be taken from other locations across campus, hence a relative net increase in carbon storage can be calculated [46]. Methane fluxes can be measured using floating chambers to estimate rates of total, diffusive, and ebulitive CH4 fluxes to the atmosphere, during each season of the year [47].

We can measure denitrifying bacteria in sediment samples from ponds with the nitrous oxide reductase gene (nosZ I) in order to predict nitrous oxide fluxes from a pond environment [48].



Climate control

Sussex campus is on the rural urban fringe; hence the urban heat island effect may be small. Nonetheless, Brighton has experienced extreme heat over recent years, and this may get worse with climate change. Air temperatures could be measured both next to ponds and across campus (throughout the year), in order to see if ponds contribute any significant cooling effect. In the future, high resolution satellite data for surface temperatures may be used, as has been shown from various projects such as ECOSTRESS [49].

Biodiversity

Pond biodiversity can be measured in a variety of ways. Using the PLOCH method [50], may be one option - which records a range of insect and plant taxa in a small patch of water and uses statistical techniques and extrapolation to provide a score for the whole pond. Continuous monitoring could also be achieved using Eco-acoustics [51] [52], which is a newly evolving field of research, and is presently being studied on Sussex university campus. However, to utilise the synergistic aspect of ecosystem services, we highlight the potential of citizen science to measure biodiversity. This would achieve study outcomes, whilst simultaneously increasing freshwater education. Citizen science is most effective when the methodology is short and clear and when the data collection process is simple [53]. We tested these methods (Table 1 and Figure 3). Results are enhanced by the use of modern technology for data collection (such as plant identification apps), as well as easily available guides which citizens are previously familiar with[54]. (See appendix for proposed methodology hand out).

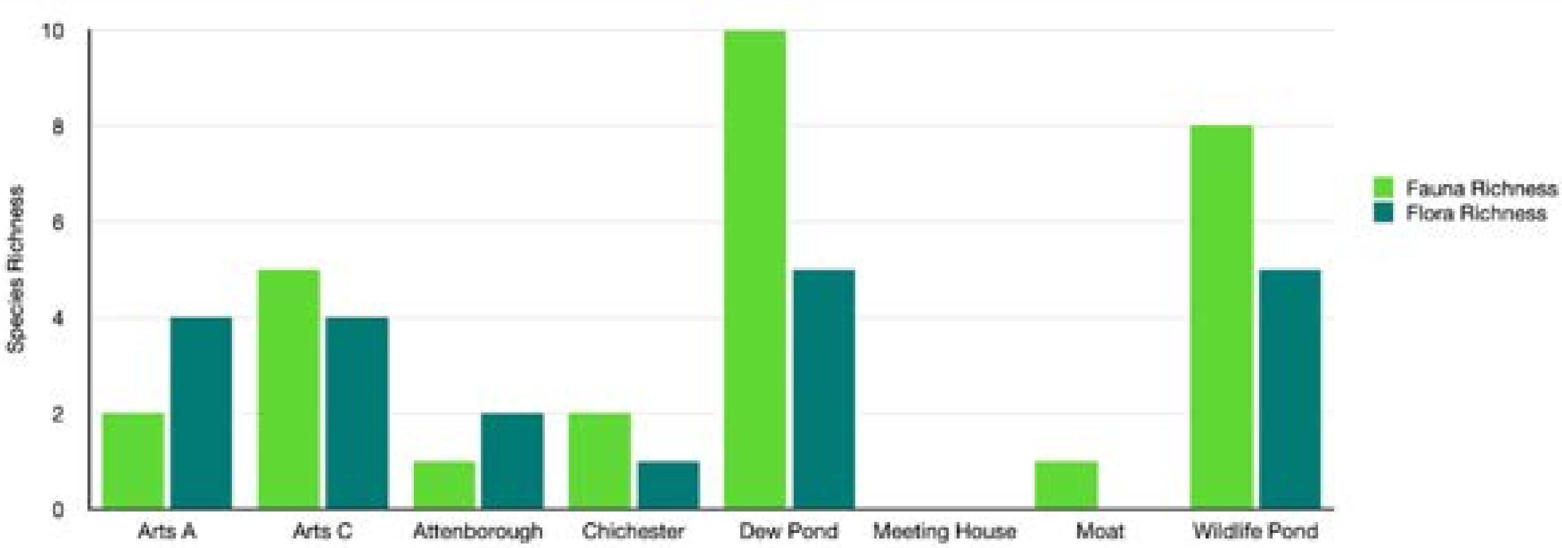


Figure 3: *Bar chart showing the species richness of flora and fauna at each of the eight ponds on the University of Sussex campus.*

Table 1: *results of citizen science methodology*

Pond	Fauna Species	Count	Flora Species	Percentage Cover
Arts A	Goldfish	180	Yellow Water-Lily	8
	Great Pond Snail	1	Cattails	5
			Threeway Sedge	5
			Unknown	2
Arts C	Goldfish	180	Common Duckweed	50
	Fly	3	Yellow Waterlily	15
	Blue Bottle Fly	2	Pickerel Weed	20
	Honeybee	1	Japanese Aralia	1
	Hoverfly	5		
Attenborough	Goldfish	100	Yellow Waterlily	5
			Yellow Iris	5
Chichester	Larvae	20	Common Duckweed	10
	Piedwigtail	1		
	Spider	1	Common Duckweed	40
Dew	Mosquito Larvae	20	Moss	10
	Dragonfly	1	Unknown	2
	Smooth Newt	2	Bristly Oxtongue	7
	Blackbird	1	Teasel	2
	Pigeon	1		
	Kestrel	1		
	Rabbit	2		
	Hoverfly	3		
	Large Larvae	3		
	N/A	N/A	Leaflitter	50
	Seagull	1	N/A	N/A
	Magpie	5	Common Duckweed	8
	Pond-skater	1	Brooklime	8
	Wasp	1	Marsh Marigold	5
	Woodpecker	1	Floating Marsh Pennywort	1
	Aphid Eggs	100	Yellow Iris	1
	Spider	2		
	Beetle	1		
	Larvae	50		

METHODS

Educational

Our methodology for assessing educational services included observations and email enquires (figure 4).

We recorded information boards, their whereabouts and content/accessibility. All information boards were situated directly next to the ponds.

→ Board location limits the educational value and reach to the target audience, individuals may be unaware of the ponds and therefore miss out on educational tools

→ There are currently no other educational aspects that promote pond life or habitat maintenance for students or staff.

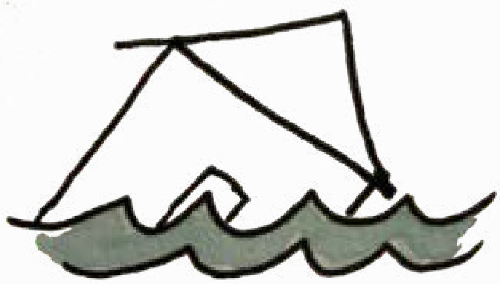
Figure 4: *Educational methods*

Fresh water

To test the chemical makeup of campus freshwater sites, samples must be taken. These should be taken approximately 1 metre away from the edge of the pond and placed in sealed beakers. In the field, pH, conductivity, dissolved oxygen content, and turbidity can be measured, using appropriate metre readers. In the lab, ion chromatography can be used to calculate the concentration of ammonia, nitrate, nitrite and phosphate. This can be done automatically from a calibration curve prepared from standards [56].

Flood management

All eight ponds on campus have the ability to hold excess water. Measurements of water volume increase in ponds after average and high rainfall will reveal the full flood management potential of these ponds. The Falmer Moat, the Meeting House Pond and the Attenborough centre pond are designed to store an increased water volume in high rainfall. University draft policy highlights plans to use this water to support wildflower gardens [22]. The Dew Pond also successfully stores water during high rainfall. However, the campus still regularly undergoes flooding in certain areas. The zebra crossing on Gardner Centre road (50°51'49.0"N 0°05’17.6”W), which acts as one of the main entrances into the university, is often flooded. On one occasion after heavy rainfall, we measured the depth as 7cm; which could be hazardous to human health.



Aesthetic value

We plan to measure the aesthetic value of the current ponds on campus using public surveys. Photographs and videos with audio (sounds of nature, for example songbirds, contribute to the aesthetic value of blue spaces) [57] will be recorded for each of the existing ponds on campus (See appendix for our example questionnaire). Following previously successful methodology [58], we will email our survey to a sample of students that attend Sussex university and request that they categorise how aesthetically pleasing they perceive each pond to be. We will use this data as a proxy for future pond development, so that we can ensure any new ponds on campus are able to deliver these aesthetic benefits. During our time at each pond, we recorded the number of benches, accessibility, and advertisement of ponds in common student/staff areas. We also assessed the visitations from students/staff/visitors during our observations. Arts A pond had three visitors sitting on the well placed benches, whilst the other ponds had no visitors during our observations.

General recommendations

We rated each individual pond using our methodology (figure 5). This highlighted the sites that require most improvement. With spending time in blue spaces suggested to improve wellbeing, we recommend that Sussex campus makes its ponds more accessible for students, so they are able to spend more time around them. With research suggesting that walks around and near blue spaces improves mental wellbeing,[19] we recommend that the ponds be advertised around campus, on either information boards or maps. This could also be added to the 'woodland walk' as a site of interest, so students and staff know that the woodland walk involves blue spaces. Pond restoration on campus could produce concurrent benefits for humans and the environment. Restoring ponds to increase biodiversity not only benefits our ecosystems, but also human health[17] . Additionally, green spaces with rich biodiversity have better associations with improved mental health compared to green spaces with less/minimal biodiversity [59]. We predict that increasing the biodiversity of campus ponds and their surrounding habitats will simultaneously improve the wellbeing of staff, students and campus visitors.

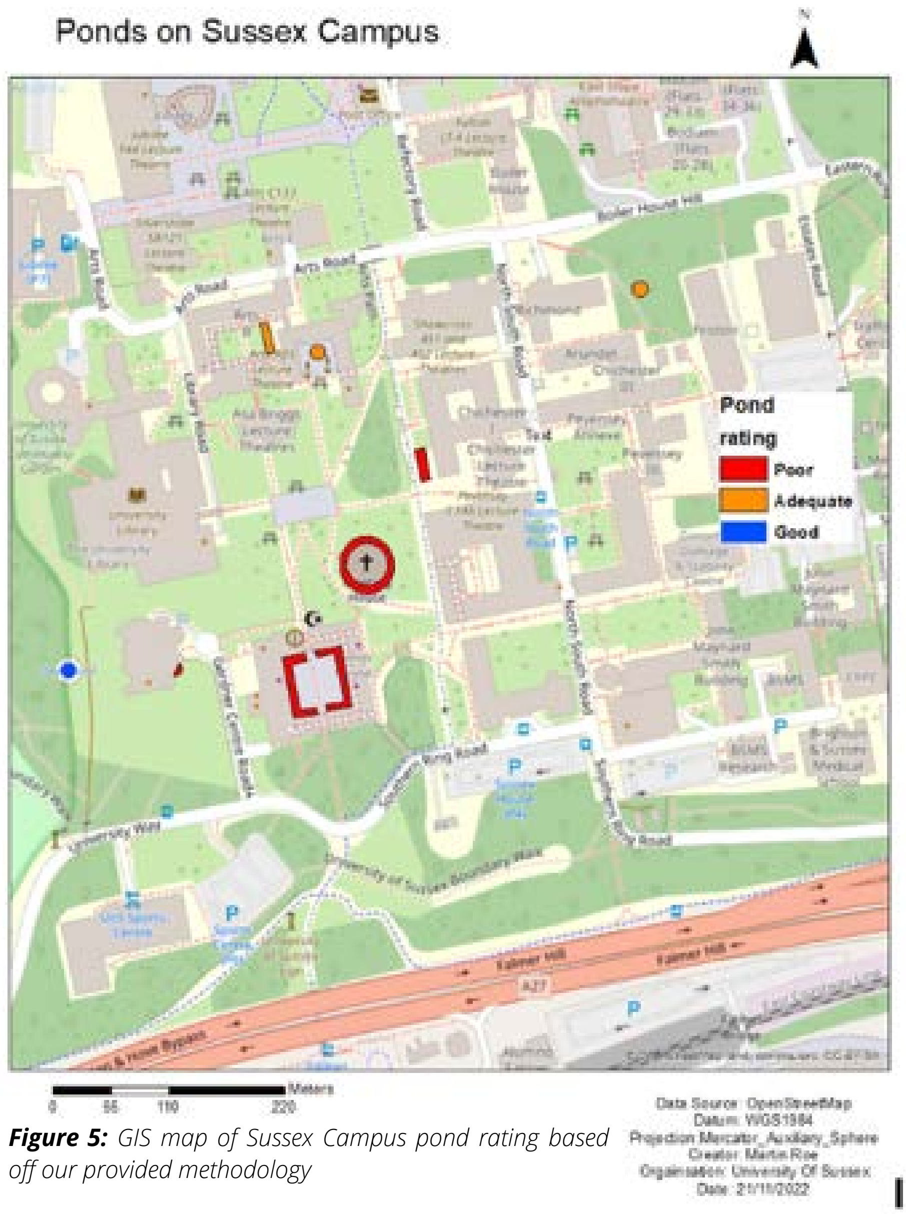
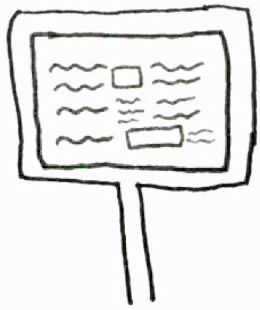


Figure 5: *GIS map of Sussex Campus pond rating based off our provided methodology*

Educational recommendations

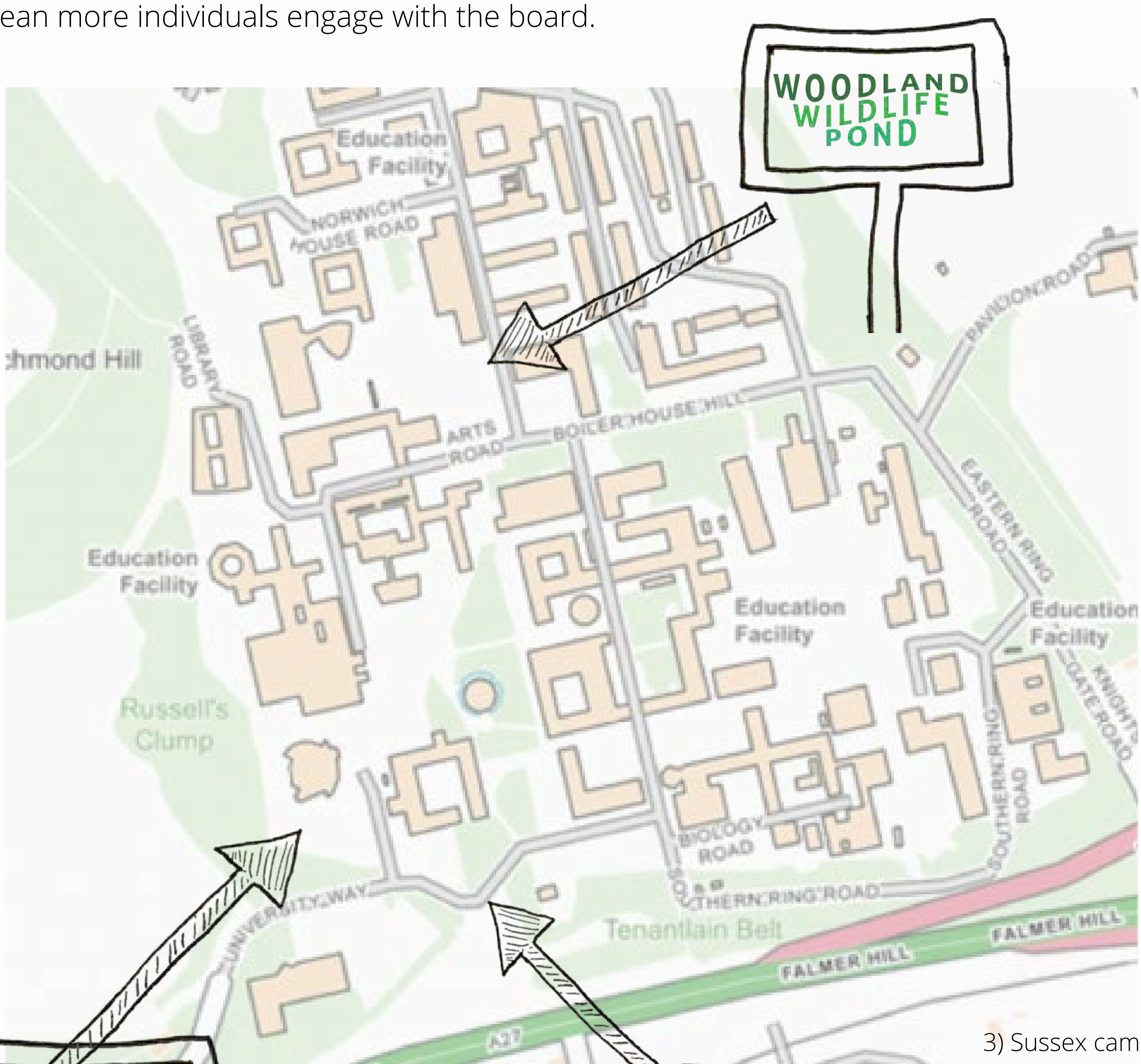
Improving the educational services provided by freshwater ecosystems on campus could increase community engagement and raise more awareness. We recommend that updated educational information boards are situated in accessible and widely used areas around campus (figure 6). This should boost interactions, knowledge and the accessibility of the habitats for all individuals. We will issue these information boards in places where footfall is highest. Examples of educational boards are given in figures 7, 8, 9a and 9b.

INFORMATION BOARDS



OUR RECOMMENDATIONS FOR INFORMATION BOARD LOCATION AROUND CAMPUS

1) Woodland Wildlife pond. We recommend that in addition to the information board by the pond, one is also placed by the co-operative. the high footfall of the area may mean more individuals engage with the board.



2) Creating your own wildlife pond board is recommended to be placed within the enhanced Attenborough area

3) Sussex campus dewpond board to be placed at the zebra crossing on gardeners centre road. this is a high footfall area that will hopefully increase interactions

__Figure 6:__ Information board location recommendations

SUSSEX CAMPUS DEWPOND

Kestrel

Dew ponds have been used throughout history as a means to supply water to hard-to-reach agricultural land. These man-made ponds are lined with hardened chalk to enable them to hold water. This process creates a rich habitat for amphibians, fresh water invertebrates, mammals and birds.

Smooth Newt

The campus Dew pond was created in 2016, using both an artificial liner and clay to hold water. If you sit and watch closely, you may see a variety of wildlife such as newts, kestrels or dragonfly nymphs.

Located behind the Attenborough Centre for Creative Arts. Come and visit for a relaxing lunch spot!

Figure 7: *Dew Pond information board.*

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WOODLAND WILDLIFE POND

Common Toad

Ponds are a vital part of freshwater ecosystems, holding a greater diversity of species than nearby lakes or rivers.

This pond provides an aquatic refuge for our campus visitors, such as newts, toads and frogs, as well as aquatic invertebrates such as dragonfly nymphs and water beetles. The wildlife pond also provides vital support for surrounding terrestrial wildlife . Birds and mammals utilise ponds for hydration and as feeding locations.

Located behind Arundel on the woodland walk! Come and visit to listen to birds and a chance to see some pond life

Figure 8: *Wildlife Pond information board*

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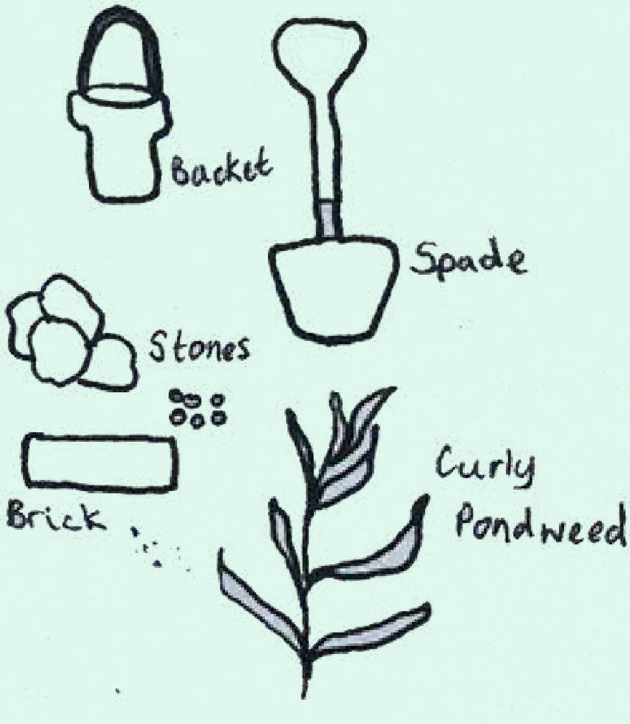
CREATE YOUR OWN WILDLIFE POND

YOU CAN MAKE YOUR OWN WILDLIFE POND WITH A FEW SIMPLE MATERIALS TO INCREASE YOUR GARDEN'S BIODIVERSITY

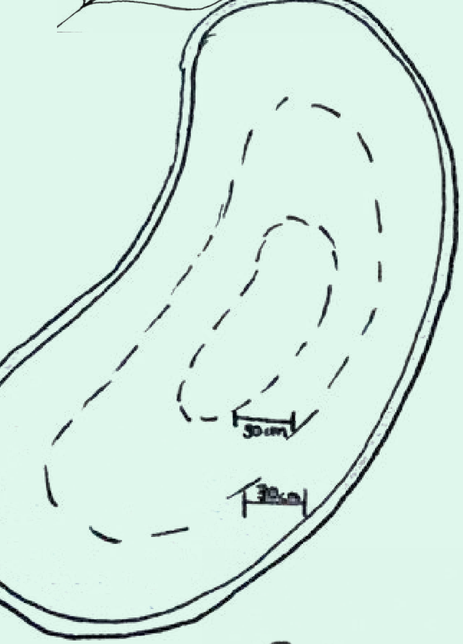


- DIG A HOLE FOR YOUR CONTAINER
- ENSURE THERE ARE NO SHARP STONES.
- LINE THE BOTTOM WITH SAND.
- FILL ANY GAPS AROUND THE CONTAINER WITH SOIL
- USE STONES AND BRICKS TO CREATE A SLOPE FOR WILDLIFE TO COME AND GO.

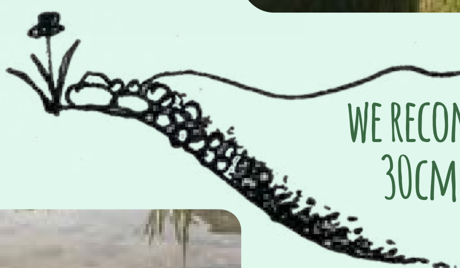
Figure 9a: *Attenborough Pond information board.*

Create your own wildlife pond

If you are lucky enough to have a large space and resources, here are our recommendations

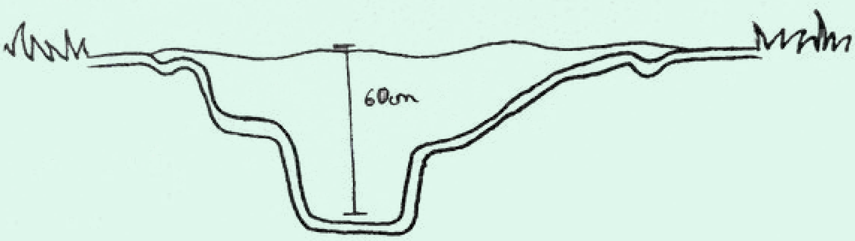


There are different ways you can create a pond. Using a liner is the more popular choice. When using a liner, it is important to remove any sharp stones that could impale the liner. We recommend curved edges to increase biodiversity. The distance between each sloping shelf should be roughly 30cm.



We recommend ensuring your liner extends 30cm around the outskirts of the pond.

Ensure that you have sloped gravel beaches to support
visiting wildlife.



For optimal biodiversity, we recommend a depth of 60cm to support overwintering aquatic invertebrates

Figure 9b: *Attenborough Pond information board*

External Stakeholder:

"I would happily provide two prerequisite workshops for Sussex University to educate students and staff around habitat management of water bodies and their importance"

***Figure 10:** Jennifer Hooper offering to provide 2 workshop sessions through Discovering Dewpond funding to Sussex University students [60].*

The University of Sussex often sees flooding in high rainfall. The addition of a new pond or another form of bio retention system could be explored as a method to limit this. We highlight the Zebra crossing on Gardner Centre road as a possible area of improvement. However, due to the chalk soil in this area, this addition may be both laborious and expensive. Alternative clay soil areas on campus may provide better surfaces for pond creation (figure 11). The scope of this report did not allow us to investigate this further.

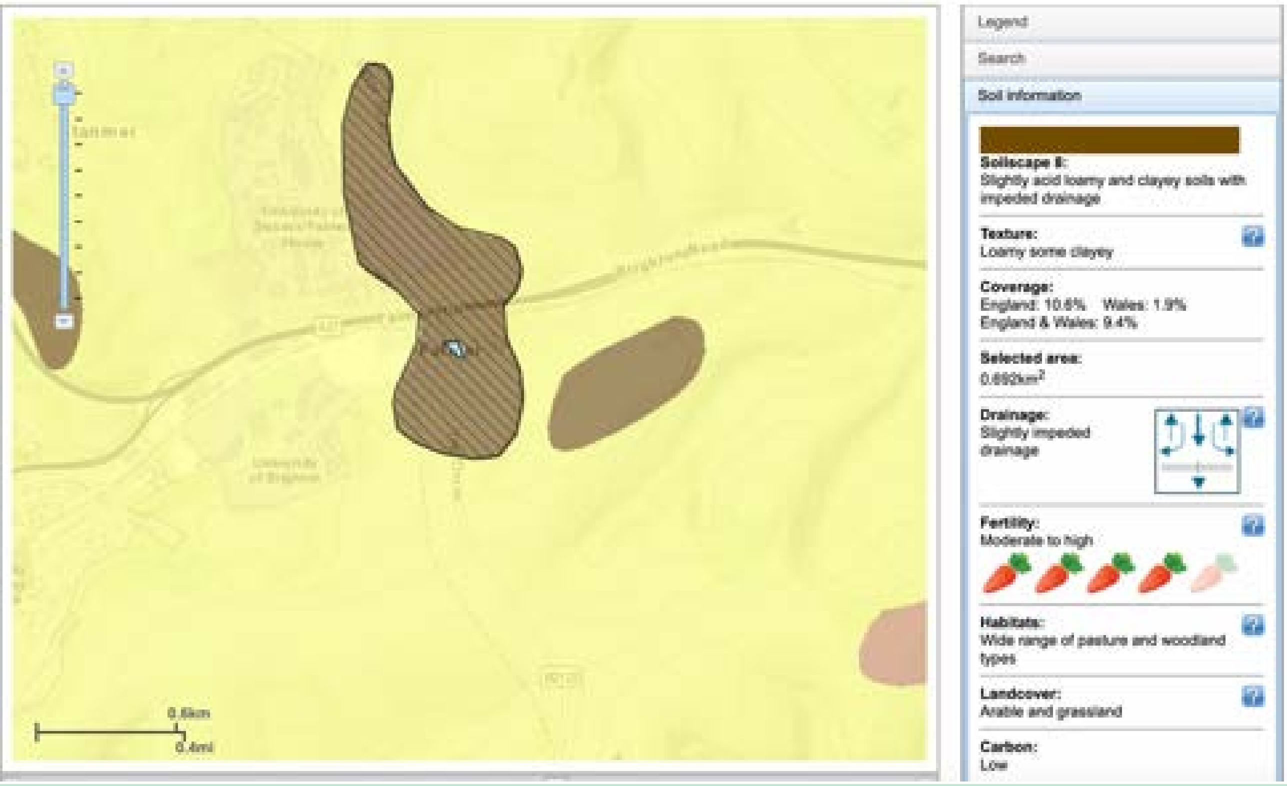


***Figure 11:** Soilscape map showing dominate soil types of Campus area. Including clay soil statistics [20].*

Pond recommendations

Arts A

Arts A is situated in a very central student area, where lots of students walk past. After observing multiple students utilising the benches provided, we do not see the need for additional seating. The surrounding environment is very urbanised (with lots of concrete). Further potted plants could be added to improve pollinator visits and support wildlife, as well as improve aesthetics.

Arts B

This pond has good vegetation around the outside (~16x11m), which likely supports local wildlife. Despite its location limiting pond accessibility for ground dwelling terrestrial species (it is surrounded by buildings), this pond has potential to support flying aquatic invertebrates such as Dragonflies and Damselflies, which rely on water habitats for their lifecycle.

We recommend that the fish are removed from this pond, as they can quickly dominate pond ecosystems by consuming aquatic invertebrate larvae (reducing overall biodiversity) [61]. It is important to note that written consent and health checks are required from the Environment Agency in order to move any wild fish (or fish spawn) to inland waters in England and Wales [61]

Pond recommendations

Chichester

This water body contributes to flood management on campus. Although this limits the recommend changes we can make to the water body itself, we do recommend changes to benefit other ecosystem services. This area is completely composed of concrete, so vegetation, i.e in the form of potted plants, could be introduced in the surrounding area to support pollinators. The two benches that are placed there could be brought further forward to allow people to access the area.

Wildlife pond

This pond supports high biodiversity, however maintenance such as silt and leaf litter removal could improve its functionality. We recommend this is done in autumn, due to plant dieback, and before amphibians return for the winter. During this maintenance, we recommend the removal of Floating Pennywort (Hydrocotyle ranunculoides). This is an invasive plant we identified using ISEEK [62]. It forms dense mats across the pond surface and depletes oxygen levels [63]. We recommend that there is more advertisement for this pond on campus via information boards and additional habitats to the Sussex Woodland Walk (see appendix)

Pond recommendations

Dew pond

We found this pond to be the most biodiverse on campus. Our recommendation would be to make it more accessible, by placing benches for students to have lunch.
We also suggest removing the metal wiring so small mammals can access the pond.
In the future, if deterioration of the dew pond is seen, maintenance could be achieved through puddling to bring the clay to the surface and reinforce the clay layer [61]. In addition to this, we highlight the possibility of connecting this pond to the Attenborough pond through a wildlife corridor.

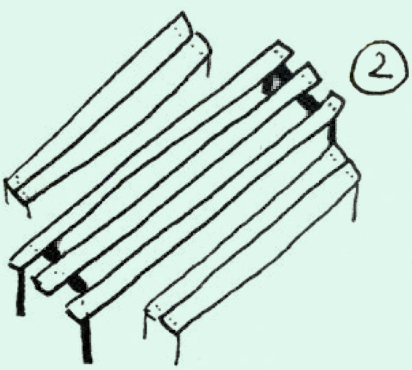
Attenborough pond

This pond is limited for wildlife as it has steep edges, little aquatic vegetation and goldfish. We recommend planting of flora in and around the pond to increase the biodiversity of the area. The Froglife 'Just Add Water' handbook advises that these must be native aquatic plants, due to the impacts non-native species would have on wildlife [61]. Recommendations for flora include; soft flowering rush (which will increase marginal vegetation height) and Yellow-flag Iris (which hosts a range of aquatic invertebrates such as Damselfly and Dragonfly nymphs, and is an essential breeding habitat for newts).
Deeper oxygenating plants such as Common water-crowfoot, Water starwort and floating leaved plants are also essential. We also recommend that the fish are removed from this pond as they can quickly dominate pond ecosystems [61]. See figure 12 for visual representation and information of Attenborough corridor recommendations.

1

WILDFLOWER BANK

A bank could be made using surplus soil from sloping the Attenborough pond. We recommend this is planted with wildflowers such as Foxglove, Bluebells, Lavender, Comfrey, Campion, Dandelions, Red Clover, Primrose, and winter flowering Heather. This will cover all seasons. This type of bank benefits early pollinators including the Early Bumblebee and Brimstone Butterflies.

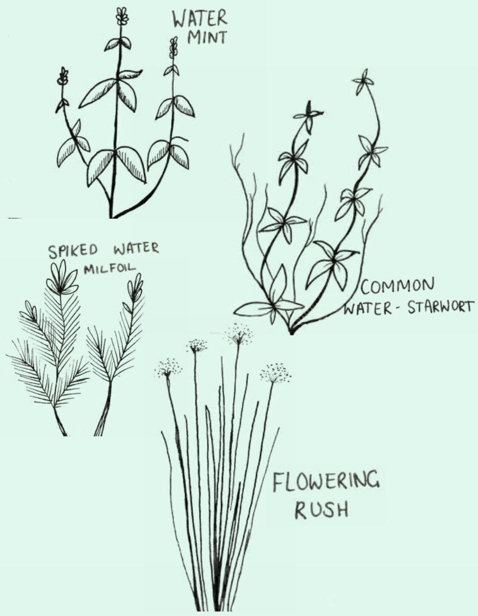


2

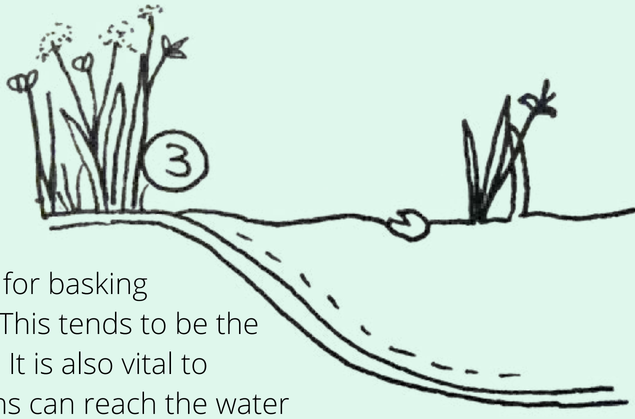
BENCHES

We recommend that more benches are introduced to allow students and staff to appreciate the pond and its surrounding area. This will increase cultural ecosystem service delivery.

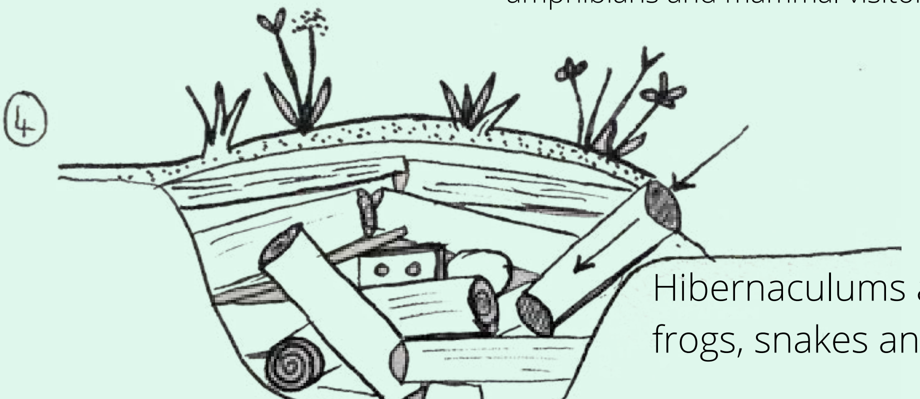
Figure 12: *Enhancing Attenborough Pond diagram*



SLOPED BANK & AQUATIC PLANTS



Sloped banks are important for basking invertebrates and tadpoles. This tends to be the most diverse part of a pond. It is also vital to ensure mammals/amphibians can reach the water for hydration in more arid seasons and not fall in. We recommend a slope is added to the Attenborough pond.We recommend that more aquatic plants are place in the pond, which would benefit aquatic invertebrates and pollinators. We recommend Flowering Rush be placed marginally to improve vegetation height to support amphibians and mammal visitors.



HIBERNACULUM

Hibernaculums are an important habitat to support frogs, snakes and toads over winter.

The hibernaculum we recommend introducing would involve a large hole being dug and a variety of material being strategically placed. This could include logs and other natural materials but also, hard core materials like brick or unused plant pots. These provide shelter for amphibians that have found their way in. A covering layer of soil is highly recommend to provide shelter from frost and the cold. Ensure good drainage for the soil. Grass can then be encouraged to grow over the top [64]. Very importantly, entrances must also be evident.

Figure 12a: *Enhancing Attenborough Pond diagram*

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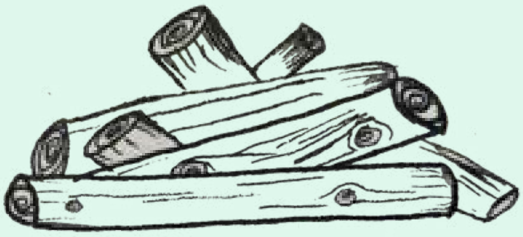
5



LOG PILES

Log piles are an important part of ecosystems. They provide an alternate habitat for many invertebrates and vertebrates. In doing so, they provide access to invertebrate prey items for amphibians, as well as year-round shelter.

COMPOST HEAP

6

The addition of a compost heap in this area would not only benefit wildlife, but also the Attenborough Cafe. The Cafe could use this to compost any appropriate food waste, providing a waste disposal ecosystem service. As a compost heap decomposes, it provides heat, which is beneficial to slow worms, slugs and snails. Slugs and snails are a food supply for amphibians.

7

INFORMATION BOARDS

Information boards are an important addition to improve educational services around ponds. We are going to place boards in the Attenborough area to inspire individuals to create their own wildlife ponds. We will make this accessible by including a mini pond guide, in addition to a larger pond creation guide. See appendix for information on board templates.

Figure 12b: *Enhancing Attenborough Pond diagram*

Pond recommendations

Falmer Moat

Falmer Moat is a flood management pond with proposed aesthetic value. To improve both aesthetic value and biodiversity, in agreement with Sussex University aims, we propose flower beds are developed around the moat. This should improve pollinator support and visitation.

Meeting house moat

The meeting house moat has the potential to be more biodiverse through the introduction of aquatic plants. These plants would oxygenate the water and their flowers would provide nectar for pollinators. Our plant recommendations are white or yellow water lily, potted water mint and yellow iris.

Conclusion

The eight ponds on campus showed significant variation in ecosystem service delivery. The wildlife and dew ponds delivered the most ecosystem services, and best supported biodiversity. The Chichester, Meeting house and Falmer ponds required extensive improvement. These have been designed mostly with flood management services in mind, and, as a result, supported minimal to no fauna or aquatic flora. Similarly, these ponds shared a deficit of adjacent terrestrial vegetation, and were instead surrounded by concreted open space. Freshwater restoration must not be limited to the ponds themselves. For optimal results, restoration should also take place in the surrounding habitat, for example through the planting of marginal vegetation, the placement of log piles, the creation of rockery banks and wildflower planting. Our recommendations to connect the dew pond and Attenborough pond would utilise both pond habitat and surrounding areas. It is important to mention that although the wildlife and dew pond scored highly overall, they too failed to deliver ecosystem services to their maximum potential. For example, we argue they could better fulfil their recreational services through the placement of benches in the surrounding areas (which were rare or absent). Similarly, we believe their potential as educational tools (to familiarise students and staff with the importance of freshwater habitats) was wasted. We argue ponds do not need to be large in order to maintain biodiversity; small ponds benefit amphibians during the warmer months by providing a means of thermoregulation, and provide vital water sources for mammals. Interventions on campus should look beyond restoration of existing ponds. New ponds could be strategically placed to create connections and ‘stepping stones’ between freshwater sources. Flood management is a serious issue on campus, which additional flood water drainage ponds may alleviate. Ponds on campus contribute to significant ecosystem service provisioning, but all sites could see great improvement. To make our recommendations sustainable, continuous monitoring and management will be necessary.

Acknowledgements

Firstly, we would like to thank our project supervisor Chris Sandom for his advice and expertise throughout the duration of our project. We would also like to thank Jennifer Hooper from the ‘Froglife’ charity for providing an excellent educational program to some of our team members, which discussed the importance of freshwater habitats. We are also very grateful for her offer to partake in the future of our project. Jennifer stated she would be happy to provide workshops on campus to educate students and staff about freshwater habitat management and the importance of these habitats.

REFERENCES

1. Millennium Ecosystem Assessment, (2005). Ecosystems and Human Well-being: Biodiversity Synthesis. World Resources Institute, Washington, DC.
2. Zavarzin, G.A. (2008) Microbial Cycles, Encyclopedia of Ecology, Academic Press, Pages 2335-2341
3. MacDonald,E.A. Burnham,D. Hinks,A. et.al. (2015). Conservation inequality and the charismatic cat: Felis felicis Global Ecol. Conservation, 3
4. UK National Ecosystem Assessment, Available at: http://uknea.unep-wcmc.org/EcosystemAssessmentConcepts/Glossary (Accessed 08/11/2022)
5. Nixon, S.W. (2009) Eutrophication and the macroscope. Hydrobiologia 629, 5–19 . https://doi.org/10.1007/s10750-009-9759-z
6. Lyu, Z, Shao, N, Akinyemi, T, Whitman, W.B. (2018) Methanogenesis. Curr Biol. 2018 Jul 9;28(13):R727-R732. doi: 10.1016/j.cub.2018.05.021. PMID: 29990451
7. Ergas, S.J. and Aponte-Morales, V. (2014) Biological Nitrogen Removal, Comprehensive Water Quality and Purification, Elsevier, Pages 123-149, ISBN 9780123821836
8. Nélieu,S , Lamy,I, Karolak,S. et al. (2021). Impact of peri-urban landscape on the organic and mineral contamination of pond waters and related risk assessment. Environ Sci Pollut Res 28, 59256–59267 https://doi.org/10.1007/s11356-020-10355-5
9. Oke,T.R. (1973) City size and the urban heat island, Atmospheric Environment, Volume 7, Issue 8, 1973, Pages 769-779
10. Strayer, D.L. & Dudgeon, D. (2010). Freshwater biodiversity conservation: recent progress and future challenges. Journal of the North American Benthological Society, 29, 344-358.
11. Céréghino, R, Biggs, J, Oertli, B. & Declerck, S. (2007). The ecology of European ponds: defining the characteristics of a neglected freshwater habitat. Pond conservation in Europe. Springer.
12. Wood, P, Greenwood, M.T. & Agnew, M. (2003). Pond biodiversity and habitat loss in the UK. Area, 35, 206-216.
13. Kuntz, K.L. (2015). Biodiversity and the role of bioturbating invertebrates in nutrient cycling in stormwater ponds, Rochester Institute of Technology.
14. Brans, K.I, Engelen, J.M, Souffreau, C. & De Meester, L. (2018). Urban hot-tubs: Local urbanization has profound effects on average and extreme temperatures in ponds. Landscape and Urban Planning, 176, 22-29.
15. Marsalek,J. Rochfort, Q. Grapetine L. (2005) Aquatic habitat issues in urban stormwater management: challenges and potential solutions.Ecohydrol. Hydrobiol., 5 , pp. 269-279

REFERENCES

16. Hill, M.J, Greaves, H.M. et.al (2021). Pond ecology and conservation: Research priorities and knowledge gaps. Ecosphere, 12, e03853.

17. Jean, D, Dooren, V.K, Weinstein, P. (2011). Does Biodiversity Improve Mental Health in Urban Settings? Medical Hypotheses 76, 877-880.

18. Dzhambov, A.M, Markevych, I, Hartig, T, Tilpv, B, Arabadzhiev, Z. et.al. (2018). Multiple Pathways Link Urban Green - and Bluespace to Mental Health 166, 223-233.

19. Vert, C, Gacon, M, Ranzani, O, Marquez, S, Triguero-Mas, M et.al (2020) Physical and Mental Health Effects of Repeated Short Walks in a Blue Space Environment: A Randomised Crossover Study. Environmental Research 188.

20. CSAFI The Cranfield Soil and AgriFood Institute. Soilscapes map from LandIS in association with the Department of Food and Rural Affairs. http://www.landis.org.uk/soilscapes/ (Accessed: 03/12/2022)

21. Beebee, T, (1997). Changes in dewpond numbers and amphibian diversity over 20 years on chalk downland in Sussex, England. Biological Conservation, 81(3), pp. 215-219.

22. University of Sussex (2021) Biodiversity strategy and draft biodiversity policy. https://www.sussex.ac.uk/webteam/gateway/file.php?name=biodiversity-policy.pdf&site=271 (Accessed 21/11/2022)

23. Marcé, R. Obrador, B. Gómez-Gener, L et.al. (2019). Emissions from dry inland waters are a blind spot in the global carbon cycle. *Earth-Science Review,* Volume 188, pp. 240-248.

24. Aben, R. Velthuis, M. Kazanjian, G. Frenken, T et.al (2022). Temperature response of aquatic greenhouse gas emissions differs between dominant plant types. Water research, Volume 226.

25. Audet, J. Carstensen, M.V, Hoffmann, C.C, (2020). Greenhouse gas emissions from urban ponds in Denmark. Inland Waters, 10(3), pp. 373-385.

26. Blicharska, j., 2016. In: J. D. M. M. A. C. Robert A. Francis, ed. Urban Landscape Ecology Science, policy and practice. London: Routledge, pp. 163-180.

27. Williams, P. Whitfield, M. Biggs, J, et.al. (2004). Comparative biodiversity of rivers, streams, ditches and ponds in an agricultural landscape in Southern England. Biological Conservation, 115(2), pp. 329-341.

28. Duffus, N.E & Morimoto, J. (2022). Current conservation policies in the UK and Ireland overlook endangered insects and are taxonomically biased towards Lepidoptera. Biological Conservation, Volume 266.

REFERENCES

29. Vatova, M. Rubin, C. Grossart, H. et.al (2022). Aquatic fungi: largely neglected targets for conservation. Front Ecol Environ, 20(4), pp. 207-209.

30. Environment Agency, Research and analysis. Water and sewerage companies in England: environmental performance report for 2020, https://www.gov.uk/government/publications/water-and-sewerage-companies-in-england-environmental-performance-report-2020/water-and-sewerage-companies-in-england-environmental-performance-report-for-2020 (accessed 14/11/2022)

31. Moss, B. (2017). Ponds and small lakes. Pelagic Publishing, Exeter, UK.

32. Smith, V.H, Schindler D.W (2009) Eutrophication science: where do we go from here? Trends Ecol. Evol., 24 (4) pp. 201-207, 10.1016/j.tree.2008.11.009

33. Waajen, G.W.A.M., Faassen, E.J. & Lürling, M. (2014) Eutrophic urban ponds suffer from cyanobacterial blooms: Dutch examples. Environ Sci Pollut Res 21, 9983–9994 https://doi.org/10.1007/s11356-014-2948-y

34. Miller, JD and Hutchins, M .(2017) The impacts of urbanisation and climate change on urban flooding and urban water quality: A review of the evidence concerning the United Kingdom. Journal of Hydrology: regional studies https://doi.org/10.1016/j.ejrh.2017.06.006

35. CIRIA (2015), The SuDS Manual. Department for Environment, Food and Rural affairs. ISBN: 978-0-86017-760-9

36. Ellis, JB and Lundy, L (2016) Implementing sustainable drainage systems for urban surface water management within the regulatory framework in England and Wales. Journal of environmental management. https://doi.org/10.1016/j.jenvman.2016.09.022

37. Perron, M.A.C and Pick, F.R. (2020). Water quality effects on dragonfly and damselfly nymph communities: A comparison of urban and natural ponds. Environ Pollut. 263(Pt B):114472. https://doi.org/10.1016/j.envpol.2020.114472

38. Sousa, E, Quintino, V, Palhas, J, Rodrigues A,M, Teixeria, J. et.al (2016) Can Environmental Education Change Public Attitudes? An Example Using Pond Habitat and Associated Biodiversity. PLoS ONE 11(5): e0154440. https://doi.org/10.1371/journal.pone.0154440

39. Soga, M and Gaston K,J. (2016) Extinction of Experience: The Loss of Human Nature Interactions. Frontiers in Ecology and the Environment 14(2), 94-101.

40. Frumkin, H. and Fox, J. (2011). Contact with nature. In Making Healthy Places (pp. 229-243). Island Press, Washington, DC.

REFERENCES

41. Kaplan, R and Kaplan, S. (1989) The Experience of Nature: A Psychological Perspective. Cambridge University Press, Cambridge, New York

42. Denovan.A, Dagnall.N, Dhingra.K & Grogan.S, (2019) Evaluating the Perceived Stress Scale among UK university students: implications for stress measurement and management, Studies in Higher Education, 44:1, 120-133, DOI: 10.1080/03075079.2017.1340445

43. Blue Health (2020). BlueHealth on BBC Radio 4. Available at: https://www.youtube.com/watch?v=jM48kK_0IGw&t=69s. (Accessed 05/12/2022).

44. Boerema.A, Rebelo.A.J, Bodi.M.B, Esler.K.J. et.al (2017) Are ecosystem services adequately quantified?. J. Appl. Ecol., 54 (2) pp. 358-370.

45. Crossman. N.D, Burkhard. B, Nedkov. S, Willemen. L, Petz. K, Palomo. I, Maes. J (2013) A blueprint for mapping and modelling ecosystem services. Ecosyst Serv 4:4–14. https://doi-org.ezproxy.sussex.ac.uk/10.1016/j.ecoser.2013.02.001

46. Gilbert, P.J, Taylor.S, Cooke,D.A et.al. (2021). Quantifying organic carbon storage in temperate pond sediments. Journal of Environmental Management, Volume 280.

47. Ortega, S.H, Gonzalez-Quijano, C.R, Casper,P et.al (2019). Methane emissions from contrasting urban freshwaters: Rates, drivers, and a whole-city footprint. Glob Change Biol, p. 4234– 4243.

48. Zhou. J, Kong. Y, Wu. M, et al. (2022). Effects of Nitrogen Input on Community Structure of the Denitrifying Bacteria with Nitrous Oxide Reductase Gene (nosZ I): a Long-Term Pond Experiment. Microb Ecol.

49. Anon. (2022). City heat extremes. [Online] Available at: https://www.esa.int/Applications/Observing_the_Earth/Copernicus/City_heat_extremes (Accessed 18/11/2022).

50. Oertli,B, Joye,D.A, Castella,E, et.al (2005). PLOCH: a standardized method for sampling and assessing the biodiversity in ponds. Aquatic Conserv, 15(6), pp. 665-679.

51. Linke, S, Gifford,T, Desjonquères, C, et.al. (2018). Freshwater ecoacoustics as a tool for continuous ecosystem monitoring. Front Ecol Environ, 16(4), pp. 231-238.

52. Greenhalgh, J.A, Stone, H.J.R, Fisher, T and Sayer, C.D. (2021). Ecoacoustics as a novel tool for assessing pond restoration success: Results of a pilot study. Aquatic Conservation: Marine and Freshwater Ecosystems, 31(8), pp. 2017-2028.

REFERENCES

53. Bonney, R, Cooper ,C.B, Dickinson, J, Kelling, S, Phillips, T, Rosenberg, K.V, Shirk, J (2009) Citizen science: a developing tool for expanding science knowledge and scientific literacy. BioScience 59:977–984

54. Donnelly, A, Crowe, O, Regan, E. et al. (2014) The role of citizen science in monitoring biodiversity in Ireland. Int J Biometeorol 58, 1237–1249. https://doi.org/10.1007/s00484-013-0717-0

55. Jurczak, T Wojtal-Frankiewicz, A, Kaczkowski, Z et.al. (2018) Restoration of a shady urban pond– the pros and cons J. Environ. Manag., 217, pp. 919-928, 10.1016/j.jenvman.2018.03.114.

56. Ma, J, Wu, S. et. al (2020) Determination of Physicochemical Parameters and Levels of Heavy Metals in Food Waste Water with Environmental Effects, Bioinorganic Chemistry and Applications, vol. 2020, Article ID 8886093, 9 pages. https://doi.org/10.1155/2020/8886093

57. Ferraro, M., D., Miller, D., Z., Ferguson, A., L. et al. (2020). The Phantom Chorus: Birdsong Boosts Human Wellbeing in Protected Areas. Royal Society of Biological Sciences. 287

58. Gunnarsson, B, Knez, I, Hedblom, M. et al. Effects of biodiversity and environment-related attitude on perception of urban green space. Urban Ecosyst 20, 37–49 (2017). https://doi.org/10.1007/s11252-016-0581-x

59. Bowler, D.E, Buyung-Ali, L.M., Knight, T.M. et al. (2010) A systematic review of evidence for the added benefits to health of exposure to natural environments. BMC Public Health 10, 456. https://doi.org/10.1186/1471-2458-10-456

60. Hooper, J. (2022). 'Froglife: The charity using community workshops to promote amphibian life' [Interview by Harriet Trueman, 13.11.22].

61. Froglife. (2022). Just Add Water. 7th Edition. Available at: https://www.froglife.org/wp-content/uploads/2022/03/Just-Add-Water-7th-Edition.pdf

62. Naturalist. Seek. Version 2.14.6 (last updated: 02/12/2022) https://www.inaturalist.org/pages/seek_app

63. Djeddour,D (2017) Datasheet: Hydrocotyle ranunculoides (floating pennywort). CABI Centre for Agriculture and Bioscience International. (Accessed 05/11/2022)

64. Wiltshire Wildlife Trust (2022). How to Build a Hibernaculum for amphibians and reptiles.. Available at: https://www.wiltshirewildlife.org/how-to-build-a-hibernaculum-for-amphibians-and-reptiles. (Accessed: 5th December 2022)

APPENDIX

Citizen Science methods
Fauna

1. Find an observation spot with a good view of the pond and its surrounding vegetation
2. Spend 10 minutes observing the area looking both in the water and on the vegetation around it
3. Record all the species you observe being as specific as possible e.g Robin, Bumblebee, Giant Pond Snail. This can be done through your own knowledge, the app SEEK by Inaturalist,or using guide books, such as Pocket Guide to British Birds by Harrap,S (2015) and Collins (2009) complete Guide to British Insects, which are available to loan from the university library.
4. Record the number of each species you see.

Fauna species	**Count**
e.g. Great Pond Snail	3

Hand this data sheet back to reception or email a picture to lifesci@sussex.ac.uk
.

Thank you!

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Citizen Science methods
Flora

1. Stand at a random point at the edge of the pond and measure a 1x1 metre square in front of you
2. Identify all the species you can see inside this square. This can be done through your own knowledge, the app SEEK by Inaturalist or using guide books, such as The Wildflower Key by Rose,F (2006), which is available in the university library.
3. Estimate the percentage area of your square this species is covering, e.g Yellow Waterlily 15%.
4. Record the major cover of the surrounding area, e.g grasses or pine trees or pavement.

Flora species	**Percentage Cover**
e.g. Yellow Water Lily	15%

Hand this data sheet back to reception or email a picture to lifesci@sussex.ac.uk

.

Thank you!

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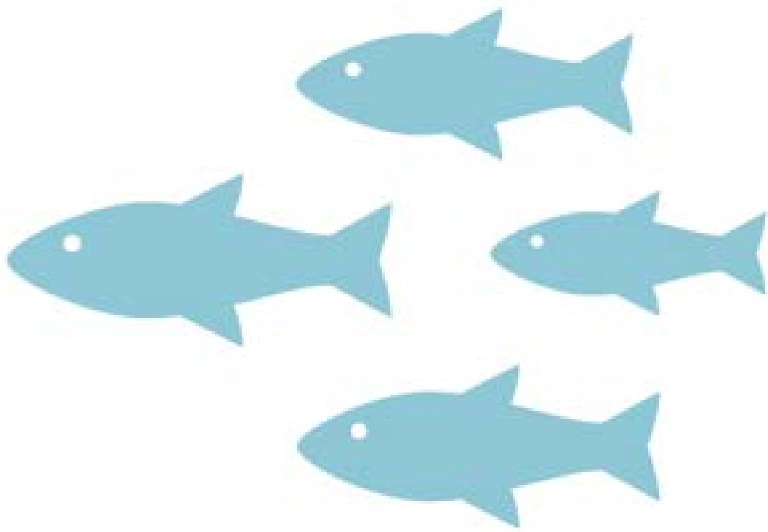
SUSSEX CAMPUS POND SURVEY



Please refer to the following figures when answering this questionnaire and listen to each 30 second audio clip

Figure 1

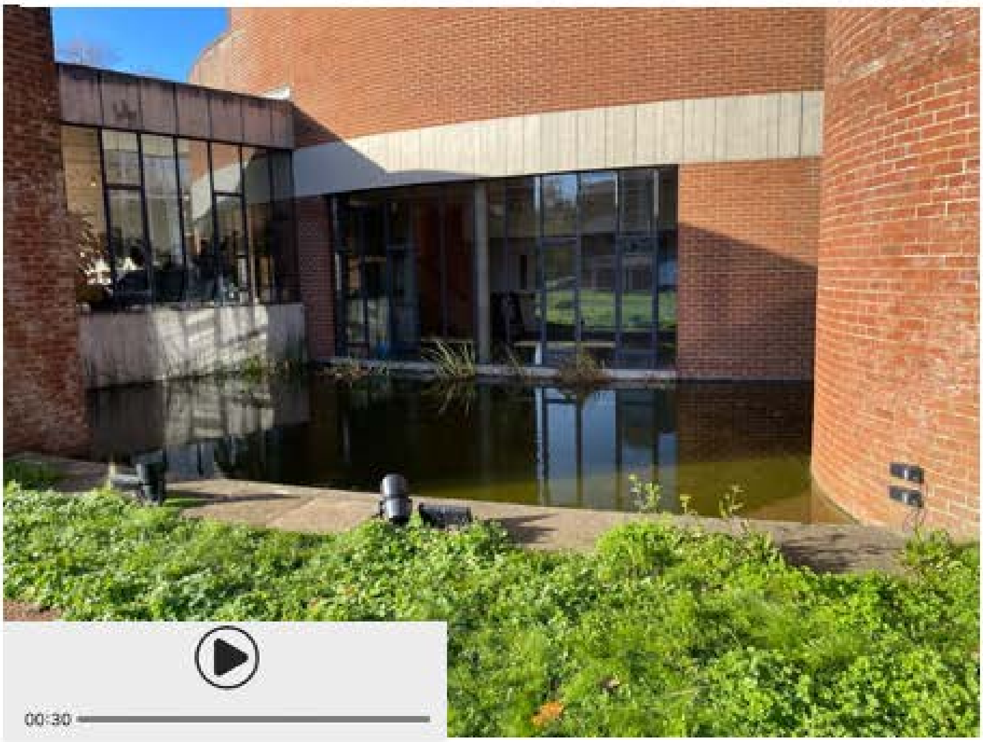


Figure 2

Figure 3

Figure 4

Figure 5

Figure 6

Figure 7

Figure 8

QUESTIONNAIRE

In your opinion, how visually and auditorily aesthetic is each pond?

Figure 1:

- ☐ **Very high** aesthetic value
- ☐ **High** aesthetic value
- ☐ **Medium** aesthetic value
- ☐ **Low** aesthetic value
- ☐ **Very low** aesthetic value

Figure 2:

- ☐ **Very high** aesthetic value
- ☐ **High** aesthetic value
- ☐ **Medium** aesthetic value
- ☐ **Low** aesthetic value
- ☐ **Very low** aesthetic value

Figure 3:

- ☐ **Very high** aesthetic value
- ☐ **High** aesthetic value
- ☐ **Medium** aesthetic value
- ☐ **Low** aesthetic value
- ☐ **Very low** aesthetic value

Figure 4:

- ☐ **Very high** aesthetic value
- ☐ **High** aesthetic value
- ☐ **Medium** aesthetic value
- ☐ **Low** aesthetic value
- ☐ **Very low** aesthetic value

Figure 5:

- ☐ **Very high** aesthetic value
- ☐ **High** aesthetic value
- ☐ **Medium** aesthetic value
- ☐ **Low** aesthetic value
- ☐ **Very low** aesthetic value

Figure 6:

- ☐ **Very high** aesthetic value
- ☐ **High** aesthetic value
- ☐ **Medium** aesthetic value
- ☐ **Low** aesthetic value
- ☐ **Very low** aesthetic value

Figure 7:

- ☐ **Very high** aesthetic value
- ☐ **High** aesthetic value
- ☐ **Medium** aesthetic value
- ☐ **Low** aesthetic value
- ☐ **Very low** aesthetic value

Optimising the Delivery of Ecosystem Services on Sussex Campus:
Group Work Reflection

Our first task as a group was to decide which project to pursue.There didn't seem to be significant enthusiasm for any topic. I discussed that I had read Chris Packham's book "Back to nature" and it had discussed the important of urban ponds, other group members also discussed their interest and enthusiasm in pond creation/maintenance, so we decided to pursue a project on freshwater habitats. It was important to choose a project with enthusiasm from all team members, so it was more likely every member would be committed leading to better results(Milton, 1965).

We set up a WhatsApp group chat and a google drive folder, where we could place research articles which may be useful for the report. The WhatsApp chat was important for communication and therefore helped to reduce stress levels within the group.

We had to produce a presentation on our chosen topic, hence each of us created a couple of slides on various aspects around pond creation and the ecosystem services they provide. I had put several articles on the google drive as well as Chris Packham's section in his book on urban ponds to aid our familiarity of urban ponds.

After our presentation, we explored the campus and located various ponds, I have good spatial and map reading skills and was able to show the group a variety of ponds which they were not aware off. On separate occasions we visited each pond, taking a variety of measurement and making observational comments, from the amount of biodiversity to depth of the pond to accessibility for students, to the amount off litter in ponds. Another group member also took pictures of each pond with a specialised camera for use in the report.We did lose some time hear trying to find ponds which no longer existed.

With about a month to go we split the written report into various task for each member to complete and met on at least a weekly basis in the same location to explain if we were having any issues and work out how to delegate further tasks – since we were always on campus remote meetings were not necessary. A plan was clearly made and put on the google drive – I emphasised creating a plan as quickly as possible as our meetings did become a bit redundance until we crated the plan, at times it became clear we should merge section together to improve the quality of the report, so various team members worked together when necessary to optimise the report structure. It was great we came from a range of scientific backgrounds from psychology, ecology, zoology, and data science, which is helpful for group performance(Mannix, 2005) and hence delegation of task was straight forward, as ecosystem services contains a range socio-ecological topic.

It was clear different group members had different skills to contribute. I was the only group member with familiarity with GIS software and hence produced a GIS map, at the same time explaining to group members what I was doing. Other team members had excellent design and organisational skills; we used software I was not familiar with to design our report. And the structure of the report was also well thought out by another member of the group. I am also local to the area and grew up in Brighton, so was able to pass on geographical knowledge on chalk hills, dew ponds and common species to Sussex. Other members also attended a dew pond restoration course, which I advertised.

Once the report was written, it was edited. Individuals could make comments about how to improve a specific section in a grammatical or theoretical sense and then these could be discussed and accepted or rejected depending on the quality of the new idea. One member also helped to reduce the word count to ensure we met the word limit.

I enjoyed writing the report with the group and learnt a variety of new skills and information, which will help me with further teamwork, report writing and the importance of ponds in urban ecosystems.

Bibliography

Mannix, E., & Neale, M. A. (2005). What Differences Make a Difference?: The Promise and Reality of Diverse Teams in Organizations. Psychological Science in the Public Interest, 6(2), 31–55. https://doi.org/10.1111/j.1529-1006.2005.00022.x

Milton, G. A. (1965). Enthusiasm vs Effectiveness in Group and Individual Problem-Solving. Psychological Reports, 16(3_suppl), 1197–1201. https://doi.org/10.2466/pr0.1965.16.3c.1197