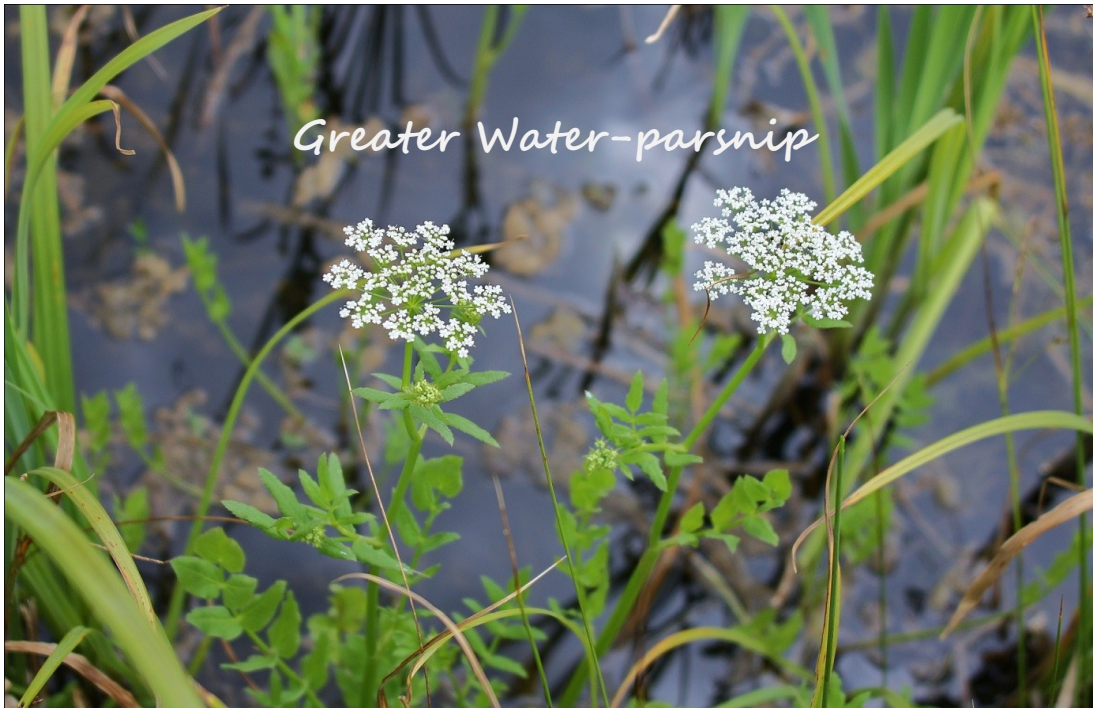
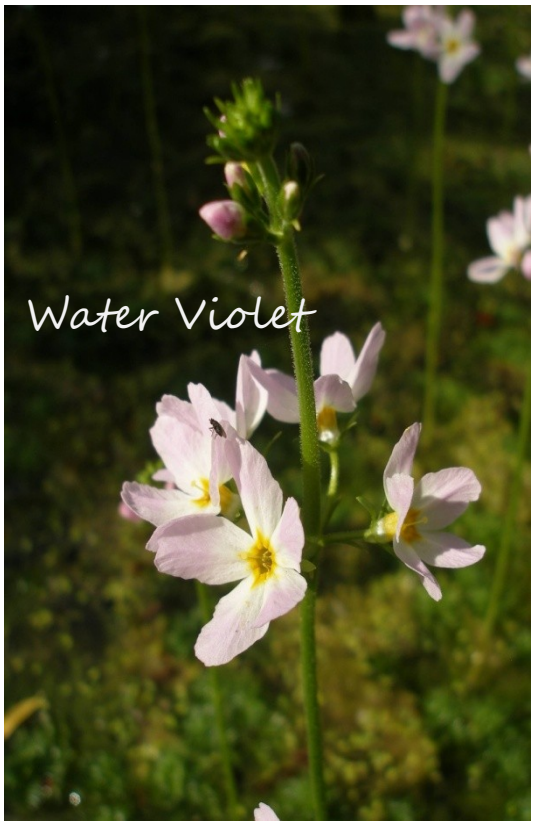
# The historic flora of the River Foss





A report for the River Foss Society

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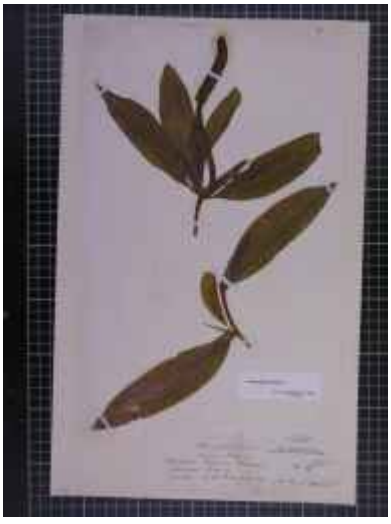
## Introduction

Some evidence of past environmental conditions on the lower Foss is provided by archaeological investigations adjoining the river. For example, deposits carbon-dated to the Anglo-Scandinavian period (9th to 11th century AD), recovered at Layerthorpe Bridge, contained remains of a few aquatic and water-margin plants such as River Water-dropwort *Oenanthe fluviatilis* and Parsley Water-dropwort *O. lachenalii* - neither species has been recorded from the Foss in modern times. Medieval sediments from the same location provide "a clear picture of a river with clean water and well-developed aquatic vegetation" (Hall *et al*, 2000). This included Horned Pondweed *Zannichellia palustris*, several other pondweeds (*Potamogeton* species), water-millfoils (*Myriophyllum* species), River Water-dropwort, Arrowhead *Sagittaria sagittifolia* and both White and Yellow Water-lilies (*Nymphaea alba* and *Nuphar lutea*). Medieval deposits from the King's Fishpool at Piccadilly also contained water plants including White Water-lily, Horned Pondweed and other pondweeds (York Archaeological Trust, 1992). Late medieval material from another location on Piccadilly produced remains of Rigid Hornwort *Ceratophyllum demersum* and Yellow Water-lily.

There is a rich archive of botanical records from the lower reaches of the river, stretching back to the Georgian period: in 1786, the Reverend James Dalton found Greater Water-parsnip *Sium latifolium* "in plenty" on the Foss Navigation at York. This species is now categorised as Endangered in Great Britain. Another late 18th century clergyman-botanist, Archdeacon Pierson collected Small Water-pepper *Persicaria minor* from Foss Islands, probably during the 1790s. With one or two exceptions (notably River Water-dropwort), the medieval river flora seems to have survived into relatively recent times but with a severe loss of species during the 20th century.



Shining Pondweed *Potamogeton lucens*, collected from the River Foss by Oswald Allen Moore in 1862 (Manchester Museum herbarium)

This data provides a useful insight into how the river environment has changed. Records of species not found recently in the Foss are summarised in Table 1, omitting some which may have been mis-identifications.

**Table 1: records of plants not recently recorded from the River Foss**

| Species | English name | Record | Source(s)[1] | Status in England[2] |
|---|---|---|---|---|
| *Berula erecta* | Lesser Water-parsnip | River Foss | Baines (1840); LeTall (1879); *Herb* VIII (H.J. Wilkinson, 1881); Birmingham Museums Herbarium (collected H.S. Thompson, 1885); Wilkinson (1906). | LC (may still be present higher up the river) |
| *Bidens cernua* | Nodding Bur-marigold[3] | River Foss (banks and ditches) | Wilkinson (1906) | LC |
| *Groenlandia densa* | Opposite-leaved Pondweed | River Foss | *Herb* XI (1883); between Yearsley Bridge & Huntington in 1906 (Wilkinson, 1906). | VU [VU in GB] |
| *Hippuris vulgaris* | Mare's-tail | River Foss | Baker (1863); also listed as widespread and frequent in Fife & Walls (1981) but not recorded more recently. | LC |
| *Hottonia palustris* | Water Violet | "by Foss", 1883; Yearsley Bridge to Huntington | Bootham School Natural History Society (1883); Wilkinson (1906). | VU |
| *Littorella uniflora* | Shoreweed | "in the Foss reservoir near Coxwold" | Newman (1844) recorded this plant as Quillwort *Isoetes lacustris* but it was identified as Shoreweed by Baker (1863). Shoreweed could still be found at Oulston Reservoir in 1951 (Anon, 1951). | LC |
| *Lemna gibba* | Fat Duckweed | Lower Foss and near Strensall | Baker (1863 & 1892); Waller (1886). | LC |
| *Myriophyllum alterniflorum* | Alternate Water-millfoil[4] | River Foss | Near Yearsley Bridge, 1883 (*Herb Ann*.); Wilkinson (1906). Also medieval records. | LC but now scarce in lowland eastern England. |

[1] *Herb* refers to the herbarium of the Yorkshire Philosophical Society, held at the Yorkshire Museum. Roman numerals refer to volumes of the herbarium catalogue. *Herb Ann* is a copy of the catalogue annotated by H.J. Wilkinson and held in the museum library.

[2] Status is based on the Red List of vascular plants for England (Stroh *et al*, 2014); some species are also included in the Red List for Great Britain (Cheffings & Farrell, 2005). The following abbreviations apply: EN - Endangered; VU - Vulnerable; NT - Near Threatened; LC - Least Concern. An explanation of these categories is given in the relevant publications, though the 'gist' should be self-explanatory. Species of Principal Importance are defined under Section 41 of the Natural Environment & Rural Communities Act.

[3] A record of Triffid Bur-marigold *Bidens tripartita* "near the Foss" appeared in the Quaker Schools' *Natural History Journal* in 1892. This could be a mis-identification of *B. cernua*.

[4] Old records of Whorled Water-millfoil *Myriophyllum verticillatum* from the Foss may be mis-identifications though this species may well have occurred in the past.

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|---|---|---|---|---|
| *Nymphaea alba* | White Water-lily | River Foss at York and in Strensall district | *Herb* I (S. Hailstone, 1806); Baines (1840); Waller (1886); Hey (1887); Wilkinson (1906). Also medieval records. | LC but now scarce in lowland eastern England. |
| *Oenanthe aquatica* | Fine-leaved Water-dropwort | River Foss at York, Huntington and Strensall | Huntington, 1881 (*Herb* VIII); "River Foss between York and Huntington", 1877 (W. Whitwell per Watson & Ali, 2014); LeTall (1879); Waller (1886); Hey (1887); Wilkinson (1906). | LC |
| *Oenanthe fistulosa* | Tubular Water-dropwort | Between Yearsley Bridge and Huntington | Motley Herbarium, 1840 (Riddelsdell, 1902); LeTall (1879); Wilkinson (1906). | VU |
| *Persicaria minor* | Small Water-pepper | "banks of the Foss"; Foss Islands | Turner & Dillwyn (1805, citing Archdeacon Pierson); Foss Islands - Baker (1863). | LC<br>[VU in GB] |
| *Persicaria mitis* | Tasteless Water-pepper | "banks of the River Foss" | Baker & Nowell (1854) and Baker (1892); Foss Islands (Baker, 1863). | VU<br>[VU in GB] |
| *Potamogeton alpinus* | Red Pondweed | "old bed of the River Foss" in 1841 | Cheetham & Sledge (1941). | VU<br>Nearest surviving site is Newton Dale on NY Moors. |
| *Potamogeton compressus* | Grass-wrack Pondweed | Foss Islands | Baker (1863) but probably a mis-identification of *Potamogeton friesii*. | EN<br>[EN in GB]<br>Species of Principal Importance[5] |
| *Potamogeton friesii* | Flat-stalked Pondweed | River Foss near York | Cheetham & Sledge (1941) refer to an 1885 record ; also Wilkinson (1906). | VU |
| *Potamogeton gramineus* | Various-leaved Pondweed | River Foss and Oulston Reservoir | "River Foss at Huntington" Baines (1840); River Foss around York (Baker, 1863). "In the Foss reservoirs below Yearsley, and lower down the river about York" (Baker, 1892). Still at Oulston Reservoir in 1951 (Anon, 1951). | NT<br>Now scarce in lowland England. |
| *Potamogeton lucens* | Shining Pondweed | River Foss at York and Strensall | "Plentiful" near York (Baker & Nowell, 1854); collected by O.A. Moore in 1862 (Manchester Museum herbarium); "abundant in the Foss at York" | LC<br>Survives in the lower River Derwent. |

[5] Species of Principal Importance for the conservation of biodiversity are identified under Section 41 of the Natural Environment & Rural Communities Act 2006; they were formerly referred to as UK Biodiversity Action Plan species.

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| | | | (Baker, 1863); LeTall (1879); in the Foss near Strensall (Waller, 1886); present between Yearsley Bridge & Huntington (Wilkinson, 1906). | |
| *Potamogeton pusillus* | Lesser Pondweed | River Foss | Baker (1863), Wilkinson (1906). | LC (a sporadic plant which might well re-occur) |
| *Potamogeton trichoides* | Hair-like Pondweed | Foss at York | Cheetham & Sledge (1941). | LC (a tricky species, possibly mis-identified) |
| *Ranunculus flammula* | Lesser Spearwort | Banks and ditches between Yearsley Bridge – Hungton | Wilkinson (1906) | VU<br>Still in lakeside fen at Oulston Reservoir but not by the river itself. |
| *Ranunculus hederaceus* | Ivy-leaved Water-crowfoot | River Foss; Yearsley Bridge – Huntington section | Wilkinson (1906) | LC<br>Now uncommon in lowland eastern England. |
| *Ranunculus peltatus* | Pond Water-crowfoot | Yearsley Bridge – Hungton | Wilkinson (1906) | LC |
| *Rumex hydrolapathum* | Great Water Dock | River Foss at Huntington | Baker (1863); Waller (1886). | LC |
| *Rumex longifolius* | Northern Dock | "about the Foss at Heworth and Earsley Bridge" | O.A. Moore per Baker (1863). Listed as widespread in Fife & Walls (1981) but this more likely refers to the common *R. crispus*. | LC (an upland species in North Yorkshire nowadays). |
| *Rumex palustris* | Marsh Dock | "about the Foss near Peaseholme Green Bridge" | Baker (1863); also identified from medieval deposits at Layerthorpe Bridge (Hall *et al*, 2000). | LC |
| *Salix triandra* | Almond Willow | By Foss at Huntington | Baker & Nowell (1854). | LC (might still occur locally). |
| *Sium latifolium* | Greater Water-parsnip | Lower Foss, York to Strensall | "In plenty" on Foss Navigation at York, 1786 (*Herb VIII*, J. Dalton); Watson (1835); "in ditches by the Foss, York" according to Baines (1840); "several places about the lower part of the Foss" (Baker, 1863); "Foss-side near Huntington", 1877 (W. Whitwell per Watson & Ali, 2014); "between York and Huntington (LeTall, 1879); | EN;<br>[EN in GB];<br>Species of Principal Importance.<br>Nearest surviving populations in Lower Derwent Valley. |

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|---|---|---|---|---|
| | | | Huntington, 1881 (H.J. Wilkinson per *Herb I*); 1887 (Manchester Museum herbarium, collected by George Webster); Hey (1887); Le Tall (1879); Waller (1886); Wilkinson (1906). | |
| *Sparganium natans* | Least Bur-reed | River Foss near York | Baines (1840); Foss Islands - Baker (1863). | VU<br>Now rare in lowland England. |
| *Spirodella polyrhiza* | Greater Duckweed | Lower Foss | Watson (1835); Baker (1863 & 1892); Waller (1886) | LC |
| *Symphytum officinale* | Common Comfrey | ditches near Foss | Baines (1840); Le Tall (1879). Listed as "very rare" in the middle to lower section of the river corridor by Fife & Walls (1981) but not recorded more recently and apparently replaced by the naturalised hybrid Russian Comfrey *Symphytum* x *uplandicum*. | LC |

Early records of species still found in the Foss are provided in Table 2.

**Table 2: early records of plants still present in the River Foss**

| Species | English name | Record | Source(s) | Status |
|---|---|---|---|---|
| *Butomus umbellatus* | Flowering Rush | River Foss near York | First herbarium specimen 1801 (*Herb* XI); also LeTall (1879) and collected by W. Whitwell in 1866 (Watson & Ali, 2014). | LC |
| *Ceratophyllum demersum* | Rigid Hornwort | River Foss and Foss Islands | Baines (1840)[6]; Baker & Nowell (1854); Baker (1863); near Monk Bridge (YNU, 1955); 1978 or 1979 (Anon, 1979); locally abundant in 1994-95 (M. Hammond). | LC |
| *Elodea canadensis* | Canadian Pondweed | River Foss | Baker (1863 & 1892) reported this species from Foss Islands under the name *Anacharis alsinastrum*. Also Le Tall (1879) and *Herb Ann*, 1881. | LC (non-native) |
| *Myosoton aquaticum* | Water Chickweed | River Foss | *Herb* I (O.A. Moore, 1840); Foss Islands (Baker, 1863). | LC |
| *Myriophyllum spicatum* | Spiked Water-millfoil | River Foss | Baines (1840); *Herb Ann.* (1883). | LC |
| *Nuphar lutea* | Yellow Water-lily | River Foss beyond Monk Bar | *Herb* I (S. Hailstone, 1806). | LC |

[6] Listed in error by Baines as Soft Hornwort *C. submersum* (Baker & Nowell, 1854)

| | | | | |
|---|---|---|---|---|
| *Potamogeton crispus* | Curled Pondweed | River Foss | *Herb* I (H.J. Wilkinson, 1883). | LC |
| *Potamogeton pectinatus* | Fennel Pondweed | River Foss | Baines (1840). Identified from medieval deposits at Layerthorpe Bridge (Hall *et al*, 2000). | LC |
| *Rorippa amphibia* | Greater Yellow-cress | Banks of the Foss near York | Baines (1840). | LC |
| *Sagittaria sagittfolia* | Arrowhead | River Foss | First herbarium specimen 1800 (*Herb* XI); also collected by James Backhouse in 1821 (Royal Botanic Garden Edinburgh herbarium). | LC |
| *Schoenoplectus lacustris* | Common Club-rush | River Foss at York | *Herb* I (W. Middleton, 1810); Baines (1840). | LC |
| *Sparganium emersum* | Unbranched Bur-reed | River Foss | Baines (1840). | LC |

More recent plant records are provided in Fife & Walls (1981) and Hammond (1991). There are probably some mis-identifications in the former publication (e.g. Northern Dock and Cowbane *Cicuta virosa*) but it demonstrates the relatively recent disappearance of "the marshland and reed beds which mark the old bed of the river, locks and inlets". These supported wetland plants like Marsh Marigold *Caltha palustris*, Greater Spearwort *Ranunculus lingua* and Ragged Robin *Silene flos-cucculi* which are now scarce or absent from river corridor. Mare's-tail *Hippuris vulgaris* was listed as frequent in the marginal zone of all sections of the river but has not been confirmed more recently. Common Reed *Phragmites australis* was also widespread and locally-frequent in the river margins but is another species not recorded in 2017.

Amongst the fully aquatic plants recorded in Fife & Walls (1981), River Water-crowfoot *Ranunculus fluitans* was reported to be frequent in the middle to upper sections of the river. In 2017, very small amounts of a plant presumed to be Stream Water-crowfoot *R. penicillatus* were observed upstream of Sheriff Hutton Bridge. This also appeared very locally in the bend below Lock Cottage in the early 1990s. The taxonomy of the water-crowfoots is complex and best left to specialists but it is interesting that one of the riverine 'streamer weed' crowfoots still occurs because these plants are valuable indicators of clean watercourses with firm substrates and moderate flows. If, as seems likely, river/stream crowfoot has declined in the Foss, this would be symptomatic of siltation and nutrient-enrichment. Equally, an increase in this plant would indicate a recovery in the health of the river environment. It would be useful to establish whether this plant occurs anywhere else upstream of Sheriff Hutton, though lack of public footpaths would make this a challenging task.

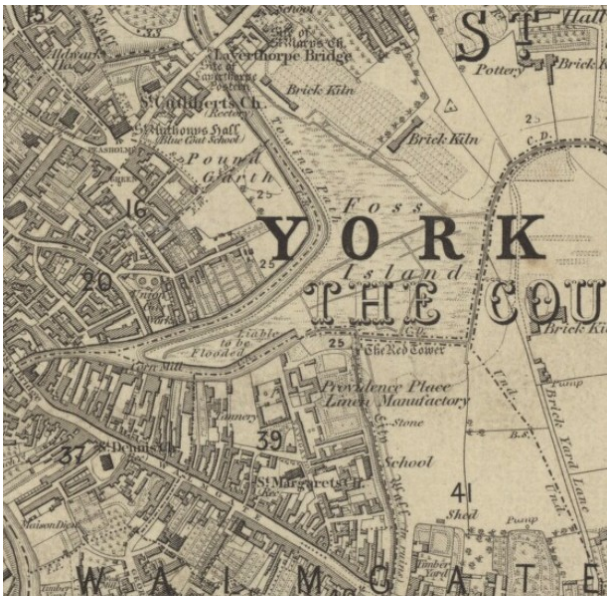
Perfoliate Pondweed *Potamogeton perfoliatus* was listed as rare in the upper section of the river. This is an uncommon plant in Yorkshire rivers, though it is occasional in the Derwent

and rare in the Ouse. It often occurs with Shining Pondweed, so its former occurrence in the Foss is quite credible.

Hammond (1991) provided details of a botanical survey of the river between the York Outer Ring Road and Foss Islands in summer 1991. In the 26 years between 1991 and 2017, changes in the flora of the lower Foss have been limited. There appears to have been some contraction in distribution of Fennel Pondweed, Reed Sweet-grass *Glyceria maxima*, Common Club-rush and Flowering Rush but it would be difficult to attribute this to environmental change, the first two being robust, tolerant species. Single clumps of Bogbean *Menyanthes trifoliata* and Greater Spearwort were present in 1991, just downstream of Lock Cottage (New Earswick), but it was not known whether these were genuine relics of riparian wetlands, introductions or garden escapes. Neither species was seen in 2017 but a large cultivar of Marsh Marigold *Caltha palustris* was seen in several places and is evidently an escapee or planted. In general, there has been little change amongst the riparian flora with uncommon plants like Green Figwort *Scrophularia umbrosa* and Water Chickweed *Myosoton aquaticum* still occurring locally.

## What do these data tell us?

In the 19th and early 20th century, the lower Foss supported a much more diverse aquatic flora than today including ten *Potamogeton* species and plants which are now seriously declining nationally such as Water Violet, Opposite-leaved Pondweed and Greater Water-parsnip. During this period, the river flora featured most of the plants tolerant of nutrient-rich conditions which still survive in the Foss, but also species characteristic of relatively low-nutrient waters such as White Water-lily, Red Pondweed, Various-leaved Pondweed and Least Bur-reed. The disappearance of these plants reflects a common pattern throughout the arable and urban lowlands of eastern England as river water quality has deteriorated due to nutrient pollution from treated sewage, agricultural run-off and urban effluents.




In 1863, J.G. Baker described Foss Islands as "a small piece of boggy ground which is intersected by ditches, near the junction of the stream [i.e. the Foss] with the Ouse". Around this time, seasonally-exposed muddy water margins here formerly supported uncommon wetland annual plants such as Small Water-pepper, Tasteless Water-pepper, Marsh Dock and Nodding Bur-marigold. Reclamation of Foss Islands during the late 19th century resulted in the loss of this habitat.

**Foss Islands on the first edition Ordnance Survey 6" map, surveyed 1846-51. This area had been drained by the time the first 25" maps were published in 1892.**

Amongst the non-native plants, Canadian Pondweed *Elodea canadensis* was first noted at Foss Islands in the early 1860s (Baker, 1863) not long after its initial appearance in England in 1847. The closely-related Nuttall's Waterweed *E. nuttallii* was not recorded until 1991. Both still occur but the latter is more frequent than the former, reflecting its association with more nutrient-enriched conditions. In the early 1990s, Water Fern *Azolla filiculoides* briefly dominated the river at Foss Islands but disappeared after two years and has not returned.

## Nutrient status

Table 3 gives the Species Trophic Rank (STR) and Ellenberg nitrogen (N) scores for submerged and floating water plants which have disappeared from the River Foss[7]. The first score was devised to assess the impact of nutrient enrichment on river plants (macrophytes) (Holmes *et al*, 1999). A value is assigned to a species from 1 to 10, reflecting its tolerance to eutrophication. Low scores indicate tolerance while high scores indicate intolerance of eutrophic conditions. This second score is based on the work of the German botanist Heinz Ellenberg but adapted using British data (Hill *et al*, 1999). Species with a score of 10 are associated with very fertile conditions while those with a score of 1 are indicative of very low fertility environments. Emergent plants have been excluded as they are less directly influenced by water quality.

**Table 3: Species Trophic Rank (STR) and Ellenberg Nitrogen (N) values for aquatic plants which have disappeared from the River Foss**

| Species | English name | STR | N |
|---|---|---|---|
| *Groenlandia densa* | Opposite-leaved Pondweed | 3 | 5 |
| *Hippuris vulgaris* | Mare's-tail | 4 | 4 |
| *Hottonia palustris* | Water Violet | n/a | 5 |
| *Myriophyllum alterniflorum* | Alternate Water-millfoil | 8 | 3 |
| *Nymphaea alba* | White Water-lily | 6 | 4 |
| *Oenanthe aquatica* | Fine-leaved Water-dropwort | n/a | 6 |
| *Potamogeton alpinus* | Red Pondweed | 7 | 5 |
| *Potamogeton friesii* | Flat-stalked Pondweed | 3 | 5 |
| *Potamogeton gramineus* | Various-leaved Pondweed | 7 | 3 |
| *Potamogeton lucens* | Shining Pondweed | 3 | 6 |
| *Ranunculus hederaceus* | Ivy-leaved Water-crowfoot | 6 | 5 |
| *Ranunculus peltatus* | Pond Water-crowfoot | 4 | 6 |
| *Sparganium natans* | Least Bur-reed | n/a | 3 |
| *Spirodella polyrhiza* | Greater Duckweed | 2 | 7 |
| | Mean score | 4.82 | 4.79 |

[7] Possible misidentifications (e.g. Hair-like Pondweed) and species which may have been overlooked in recent years (e.g. Fat Duckweed, Lesser Pondweed) have been omitted.

The average (mean) STR and N scores can be compared with those for submerged and floating plants recorded in the 2017 survey (Table 4). This shows that although some plants of nutrient-rich water have disappeared from the river, lost species are, on the whole, more indicative of less fertile waters than those which survive, i.e. the mean STR score is higher and the mean N score is lower. Moreover, ten of the lost species are associated with low to moderate nutrient levels (N = 3 to 5) compared to just two of the surviving species.

**Table 4: Species Trophic Rank and Nitrogen values for aquatic plants currently present in the River Foss**

| Species | English name | STR | N |
|---|---|---|---|
| *Apium nodiflorum* | Fool's Water-cress | 4 | 7 |
| *Butomus umbellatus* | Flowering Rush | 5 | 7 |
| *Elodea nuttallii* | Nuttall's Waterweed | 3 | 7 |
| *Lemna minor* | Common Duckweed | 4 | 6 |
| *Myriophyllum spicatum* | Spiked Water-millfoil | 3 | 7 |
| *Nasturtium officinale* | Water-cress | 5 | 7 |
| *Nuphar lutea* | Yellow Water-lily | 3 | 6 |
| *Persicaria amphibia* | Amphibious Bistort | 4 | 6 |
| *Potamogeton crispus* | Curled Pondweed | 3 | 6 |
| *Potamogeton natans* | Broad-leaved Pondweed | 5 | 4 |
| *Potamogeton pectinatus* | Fennel Pondweed | 1 | 7 |
| *Ranunculus penicillatus* | Stream Water-crowfoot | 5 | 5 |
| *Sagittaria sagittifolia* | Arrowhead | 3 | 6 |
| *Sparganium emersum* | Unbranched Bur-reed | 3 | 6 |
| | Mean | 3.64 | 6.21 |

## Oulston Reservoir

The flora of Oulston Reservoir is less well-recorded than that of the lower Foss. An early record of Quillwort *Isoetes lacustris*, cited by Newman (1844), was probably being a mis-identification of Shoreweed *Litorella uniflora.* Plants mentioned by Baker (1863 & 1892) included Shoreweed and Various-leaved Pondweed *Potamogeton gramineus*, both since gone, as well as Common Club-rush *Schoenoplectus lacustris*.

In 1951, marginal vegetation included Bottle Sedge, Bladder Sedge *Carex vesicaria* and Common Club-rush - all still present in the area, though Bladder Sedge is now confined to wet woodland above the lakes. Aquatic plants recorded in 1951 included Various-leaved Pondweed, Shoreweed and Bristly Stonewort *Chara hispida* (Robb, 1951). These are all plants of low-nutrient waters, particularly the first two species, and none have been recorded in recent years. The nearest site for Shoreweed is Gormire Lake. Although Bristly Stonewort has gone, Common Stonewort *Chara vulgaris* was locally-abundant in shallow open water in the lower lake in 2017.

## Conclusions

There is an important archive of plant records associated with the River Foss including remains identified from medieval deposits as well as botanical records stretching back to the late 18th century. Up to the early 20th century, the river supported an exceptionally rich and varied aquatic and riparian flora, including many species which are now scarce, rare or endangered in Great Britain. These included many submerged aquatic plants such as pondweeds as well as species associated with seasonally-exposed water margins at Foss Islands. The medieval flora included a few species not found since modern botanical recording began, such as River Water-dropwort, but it had much in common with the 19th century flora.

Reclamation of Foss Islands in the late 19th century, increased pollution and river engineering had apparently eliminated many species by the mid-20th century. There has been some further loss of more widespread wetland plants from the river margins and floodplain wetlands since the early 1980s though there has been little gross change in the flora of urban and peri-urban sections of the river since 1991.

It is likely that excessive nutrient loads have been the main driver of declining plant diversity in the River Foss, with loss of floodplain habitats being an important contributory factor. Changes in river management could have played a part but it must be remembered that the Foss was an important navigation in its botanical heyday so was subject to considerable boat traffic and associated maintenance operations.

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