Appendix 1

ELEVEN YEARS OF PLANT MONITORING ON HAMPSTEAD HEATH

Contents

Introduction

It is important to know how plant communities are changing if the Heath is to be managed effectively. This document reports the results of a continuing programme of plant monitoring which has been carried out, in some cases, over eleven years. The programme focusses on selected areas and on potentially invasive native species. Alien species were not covered except for a non-native species of bramble. Some of the work was carried out through funding from the City Bridge Trust.

The areas and species surveyed

The areas and species surveyed are shown in figure 1 and were as follows.

- **Small Tumulus Field***,* an area of grassland and scrub on the eastern side of Parliament Hill. It was chosen as a site to monitor as it is valuable for biodiversity, but is changing, and contains potentially invasive species such as creeping thistle, ragwort, bramble and hogweed.

- **The 'Sparrows site' wildflower meadow**, above the running track and on the south slope of Parliament Hill. This was sown with wild flowers in spring 2010, and it is interesting and useful to see how the plant communities evolve.

- **A species-rich meadow on the Extension** which was sown with wild flowers after a gas pipeline was installed about 20 years ago.

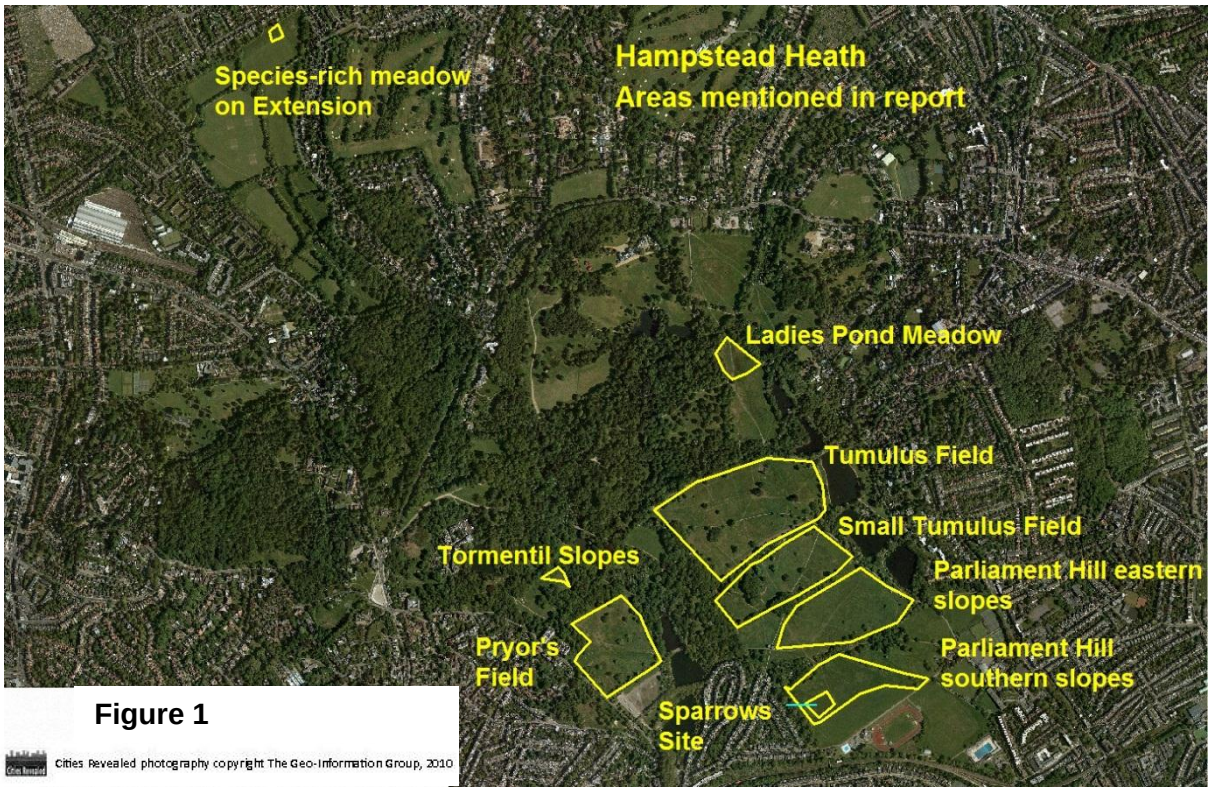


Figure 1

- **Selected areas of creeping thistle, hogweed, bramble, rush and bracken,** for example in Pryor's Field and on the southern slopes of Parliament Hill. Several of these native plants are important for biodiversity, for example providing nectar for bees and insects or cover for birds. However, if not managed, they can all spread, out-competing other plants and impeding access. It is therefore important we have information on how the populations of these plants are changing.

- **Tormentil at the 'Tormentil Slopes' near the Vale of Health**. Tormentil, which is not an invasive plant, is an 'indicator' species of acid grasslands and heathland, and would once have been common at the higher elevations of the Heath. Only one large population still exists, near the Vale of Health. This is monitored to check management is effective and assess attempts to extend the population.

Methods

Two methods were used for measuring the location and abundance of plants. Plant communities, such as the Sparrows Site, were monitored by recording the abundance of each species in carefully placed 'quadrats' one square metre in area located with GPS equipment. The quadrats were placed in a systematic arrangement and close to the same positions each year. A second method was used to record individual species; representative areas of these were selected to record and the edges of these patches were mapped.

The accuracy of measurements improved over the period of monitoring as better GPS equipment was available. The original device used provided a typical accuracy of 3 to 5 metres, which seemed excellent at the time, but a device purchased in 2013 with City Bridge Trust funding can obtain sub-metre accuracy in good conditions. The lesser accuracy of earlier measurements needs to be borne in mind when assessing the results of the monitoring. Not all the intended monitoring was carried out in 2014, principally due to lack of time.

Results

Small Tumulus Field

Much of Small Tumulus Field is grassy, but the east side is partly scrub. Monitoring began in 2009 and it was planned to record 44 quadrats in three long transects across this field. In fact not all quadrats could be surveyed every year, due to access problems where thistle and bramble were dense, because areas were cut before the survey date to try and control hogweed or thistle, or due to lack of time. Quadrats 1 and 2 were inaccessible from the first survey year due to dense thistle and bramble.

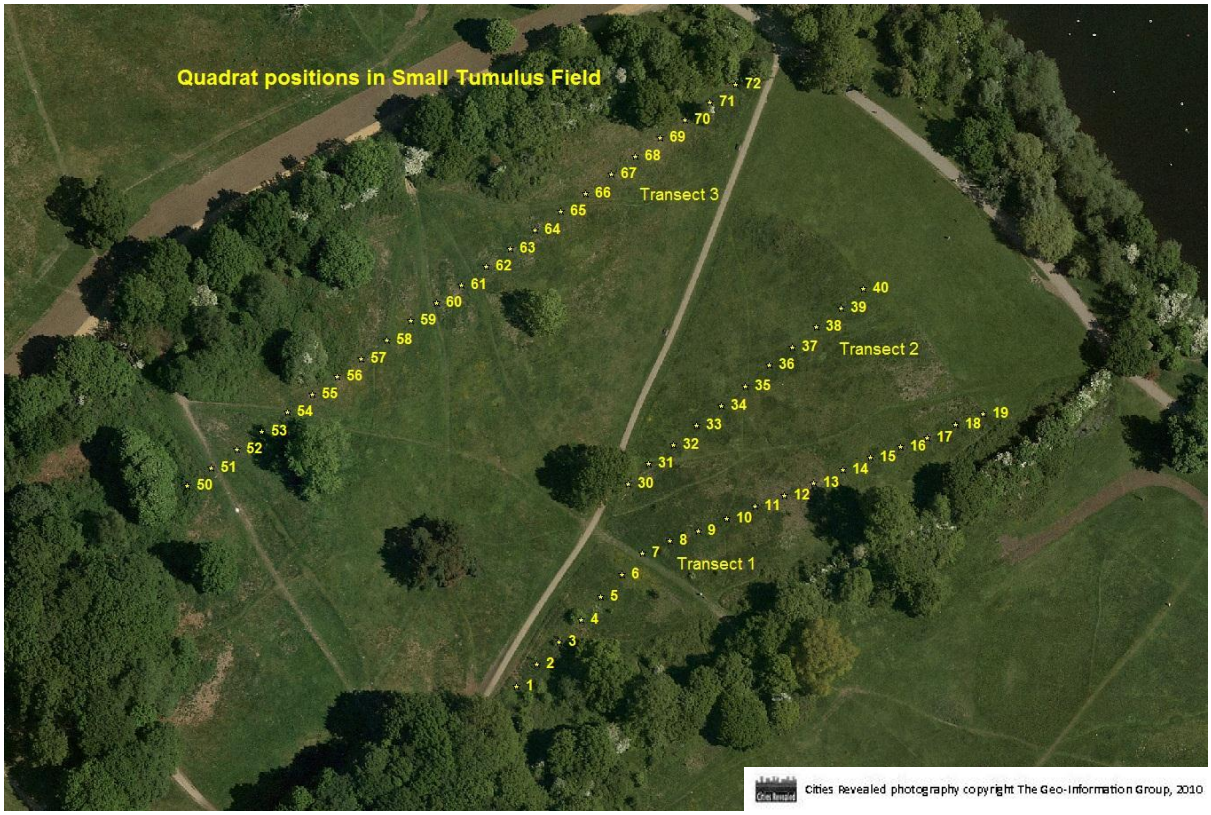


Figure 2

<u>The south-west corner, quadrats 1-10</u>

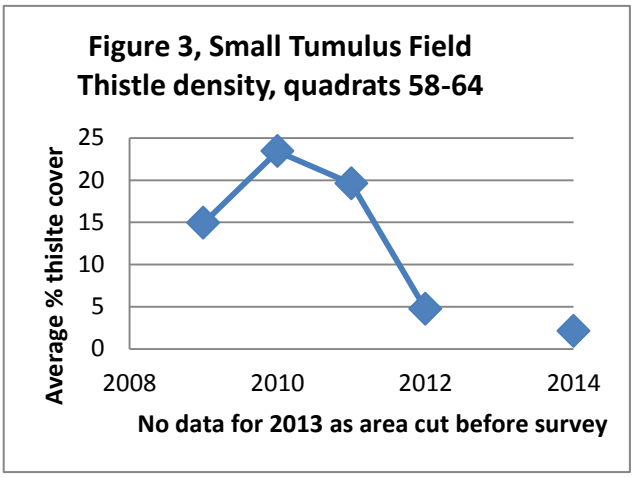
During the survey years, no management was undertaken in the south-west area, quadrats 1-6. Grass was a significant component of the vegetation in the south-west in 2009 and 2010, with some thistle and bramble, but this area has changed, progressively becoming more overgrown since then, and is now dominated by thistle and bramble together with several bushes and saplings. Bramble has also expanded around quadrats 7 to 10 lower down the slope.

Scrub and bramble is an exceptionally important habitat, providing nectar, seeds, fruits, shelter and nest sites for invertebrates, birds and small mammals. Notably, whitethroat are often seen in this area and probably breed here in most years. A range of scrub ages and structure is important if the value for wildlife is to be maximised, and its value will be lost unless it is managed. At the same time the area of grassland should not be eroded. For these reasons the plan is to cut back the scrub here every five years or so to create habitat variety and prevent expansion of bramble thickets down slope; not all of it will be cut at once.

This management has been planned for several years, but was not carried out until 2014, due to pressure of other work and weather conditions: cutting cannot be undertaken until the end of the bird nesting season and needs to be done before heavy rain makes conditions too soft for machinery. In 2014 bramble around quadrats 7-10 was reduced, leaving isolated clumps. In this case regrowth in most of the cut areas will be recut throughout 2015 to prevent regrowth and maintain the grassland areas which were present earlier. The scrub around quadrats 1-6 will be cut in sections over the next several year but then allowed to regrow, to create more habitat diversity and prevent succession to bushes and eventually woodland.

Creeping thistle

In 2009 creeping thistle (figure 4) was abundant in the grassland around quadrats 58-64. Since then the patches of thistle have been cut annually, normally in July. This has substantially reduced the density of thistle in this area, although the number of quadrats in which it was found did not reduce. This shows how annual cutting reduces thistle density but does not eradicate it, at least not in just a few years. Further discussion of thistle can be found in the section on thistle monitoring.



Ragwort

Ragwort is an attractive native plant which is valuable ecologically, being the recorded food plant of 77 species of invertebrate, including the cinnabar moth, and providing nectar for many invertebrates. It is a biennial or short-lived perennial which spreads by seed, requiring disturbed or bare soil to establish, such as droughted areas, mole hills or areas scratched up by dogs. The survival of the seed bank is relatively short: near the soil surface only 1% of seeds are viable after five years, although buried seed can survive for longer.

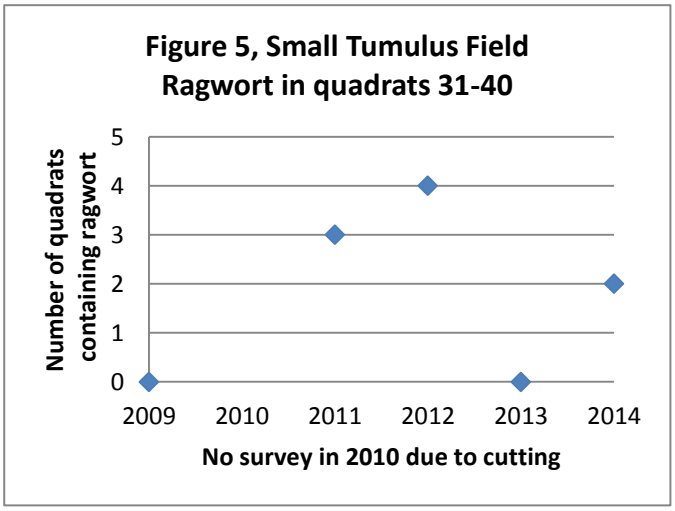
Fig. 4, Ragwort (yellow) and creeping thistle (mauve)

Ragwort contains an alkaloid which is poisonous to horses and other stock, and may be harmful to humans through the skin when pulling up the plant, or through the air if it is flailed. Landowners who have failed to follow a code of practice on controlling ragwort may be sued by neighbours if there is a danger of ragwort spreading to their land and causing nuisance, principally through risk to livestock. It is not unlawful for ragwort to be present on land, and as the Heath is not in an agricultural area there appears to be no legal reason requiring it to be controlled. However, it can become too dominant, especially where the sward is thin, for example because of drought. In addition, the grassland on the Heath is cut and baled, and the bales are taken to a recycling centre where they are disposed of for animal bedding. A small amount of ragwort can be tolerated for bedding, but the sward would need to be free of

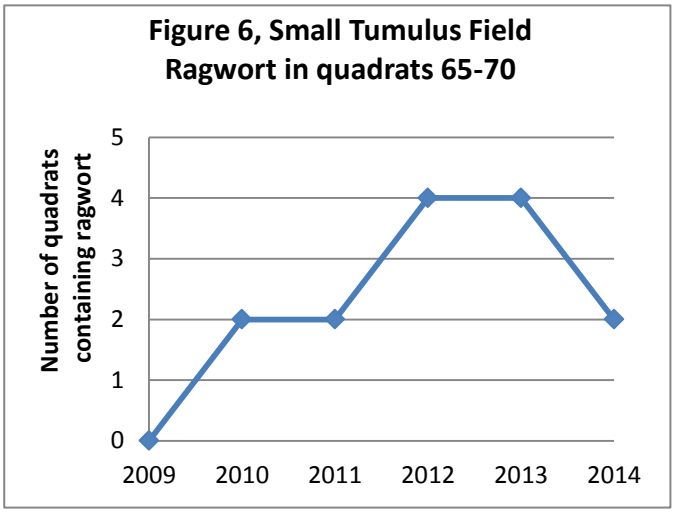
the plant should there ever be a wish to upgrade to disposal for hay or haylage. The less ragwort in the meadows which are cut and baled, therefore, the better, and this is another reason for trying to control it on the meadows.

The quantity of ragwort present in Small Tumulus Field varies from year to year. Historically there has been a good deal in the south-west, quadrats 1-6, but over the past six years it has increased in the grassy areas in the centre and north-east of the meadow, where it was formerly absent.

Figure 5 shows how ragwort has spread into the grassland in the centre of the field, quadrats 31-40. It was not seen in 2009, but was found in three and then four quadrats in 2011 and 2012 respectively. Pulling is a recommended method of non-chemical control, and the ragwort in this area was pulled by corporate volunteers in spring 2013. No ragwort was subsequently found in the quadrats that year, although a few seedlings were seen outside the quadrats. In 2014, two seedlings were found, in two separate quadrats. Unfortunately no pulling took place that year.



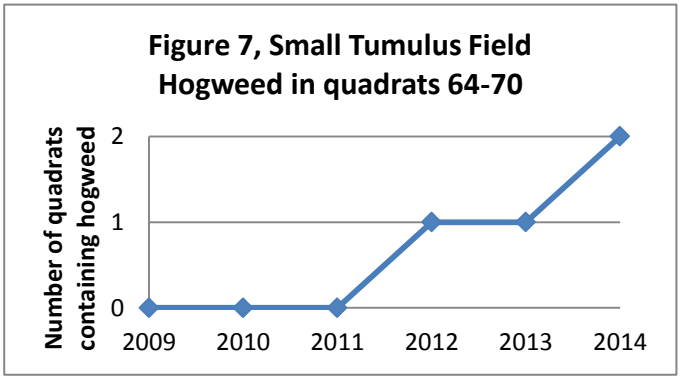
No ragwort has been found so far in quadrats 50-64. However, from 2010 it had spread into the north-east of the field, quadrats 65-70 (figure 6). Ragwort in a small part of the area was pulled in 2013.



In summary, then, in 2009 ragwort was not found in any quadrat in transects 2 and 3, but it has subsequently spread into this area, the main grassland. There is some evidence that pulling may be effective at reducing it, but this needs to be carried out consistently over several years to produce a long-term decline.

<u>Hogweed</u>

Hogweed is abundant from about quadrats 12 to about 16. This is a relatively new population; no hogweed was recorded here in the London Natural History Society's plant survey of the Heath, 1997- 2003. Since 2013, this area has been cut early in the season and then monthly to try to prevent the plant spreading, and is no longer monitored, but it is evident from regrowth that this treatment is not eradicating the plant. Hogweed was first found in in the north-west of the field in quadrats 64-70 in 2012 (figure 7), and it appears to be spreading here. More discussion of hogweed appears later in this report.



The Sparrows Site

The 'Sparrows Site', above the Athletics Track at Parliament Hill, was successfully sown with wild flowers in 2010, and is now a wonderful flowery meadow in summer (figure 8). It is managed as a hay meadow and is cut annually.

The vegetation is relatively uniform. Monitoring began in 2011 using 13 quadrats placed throughout the site.

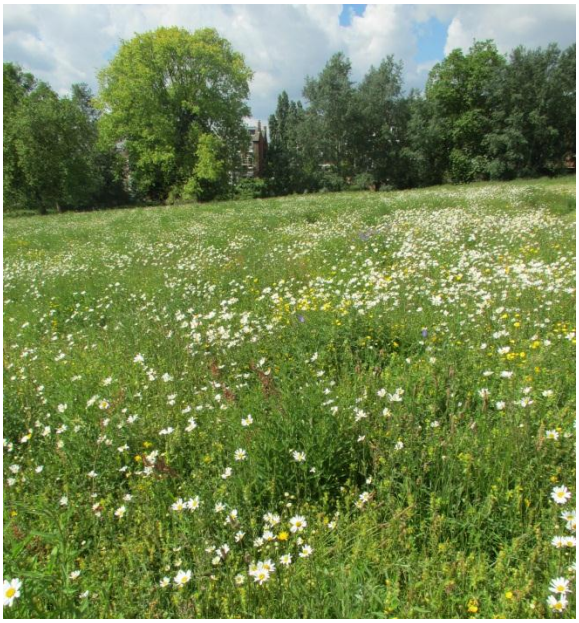
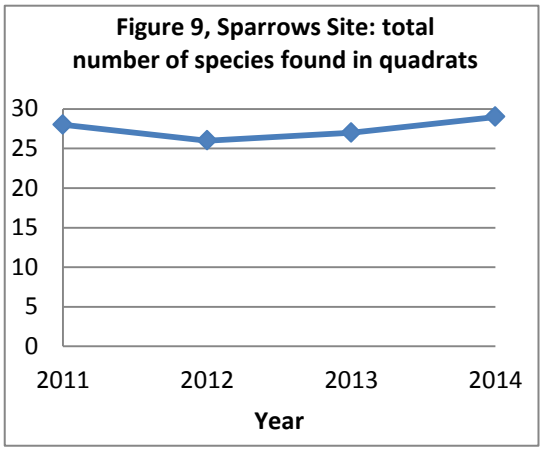
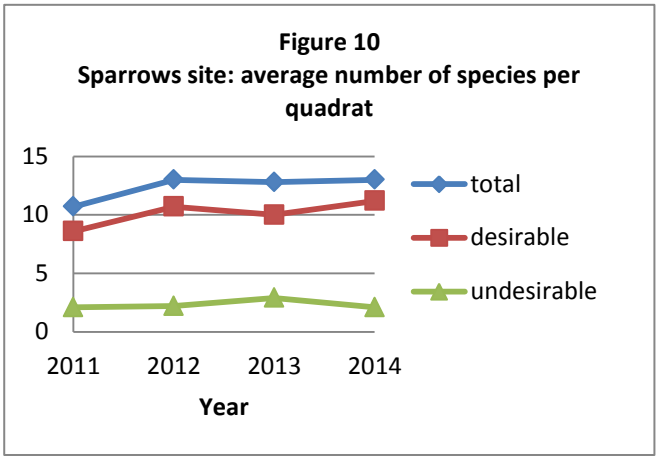


Figure 8, The Sparrows Site, 2014

Species diversity

More than 25 plant species have been found in total in the quadrats in every year. This is a very good number, and the highest of anywhere on the Heath with the possible exception of the Writer wildflower meadow, sown with a seed mix in 2006 and now very thistly. Additional plants would have been picked up if a thorough search of the whole area had been made, but this would have meant trampling through the meadow which, despite being unfenced, remains pleasingly undamaged. There was an initial small (and probably statistically insignificant) drop in 2012 in the total number of plants found in the quadrats (figure 9), but this was followed by a rise, showing that the species diversity of the meadow has been sustained over the first few years.

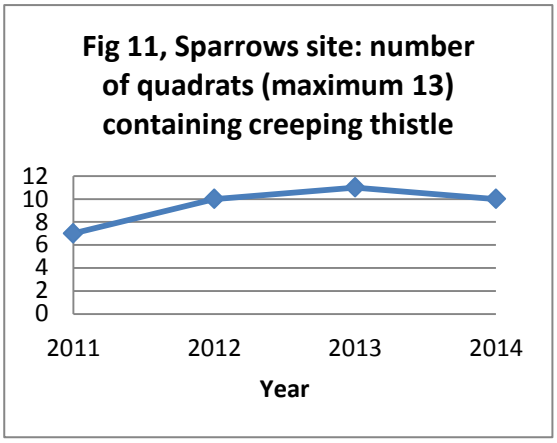




Plants can be divided into 'desirable' and 'undesirable' in the context of a wildflower meadow. Creeping thistle, bramble, dock, and coarse grasses such as Yorkshire fog which can come to dominate a sward, were classed as 'undesirable'. Over the past four years there has been no significant change in the average number of either desirable or undesirable species in the quadrats (figure 10).

Creeping thistle

Figure 11 shows the number of quadrats containing creeping thistle. This species is a concern, and is dense over some of the nearby ground. The Writer wildflower meadow, sown in 2006, is now largely dominated by it, excluding other plants. Most quadrats in the Sparrows Site now contain thistle (figure 11), though mostly in small amounts. Some pulling was undertaken with volunteers following monitoring in 2014 to try and reduce its prevalence, and it is hoped to continue this.

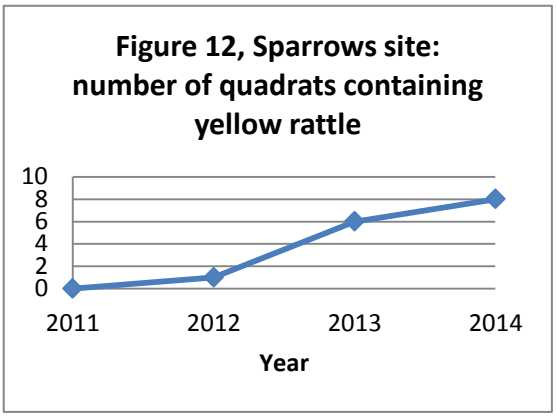


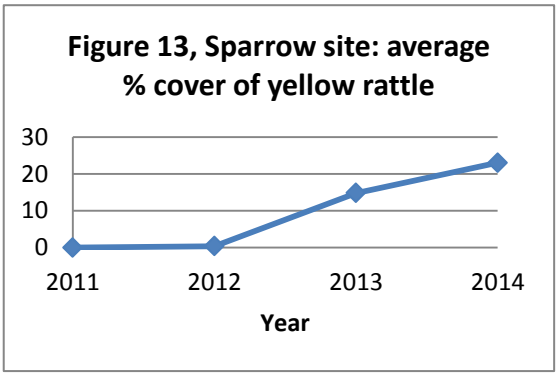
Yellow rattle

Yellow rattle is an uncommon native plant which is a partial parasite of grasses, and helps to reduce their vigour, a desirable characteristic for a wild flower meadow which is not grazed. It was perhaps never common on the Heath as a whole, as it dislikes acidic soils, but probably once grew on the lower meadows on the London Clay. Today the only yellow rattle on the Heath grows where wild flower seeds have been sown.

Yellow rattle has increased on the Sparrows Site, both in number of quadrats where found (figure 12) and in percent cover (figure 13). As it is an annual, which is unusual for a meadow plant, it is important that the Sparrows Site is not mown before sufficient seeds have set, usually by early July.

It is encouraging to see yellow rattle doing so well here. In 2014 seeds of it were collected by volunteers and scattered over mown grassland elsewhere, to try to spread it.





Hampstead Heath Extension

A gas pipeline was laid across the northern-most meadow on the Heath Extension in 1992. The land was restored using a wildflower meadow mix, and the sward remains rich in plant species. An experiment was initiated in 2011 to explore the effects on the sward of different mowing regimes. A relatively uniform area was divided into four sections, as shown in figure 14, which have been mown in April; in July; in April and July; or in September. The area was monitored in 2011-2013, but not in 2014.

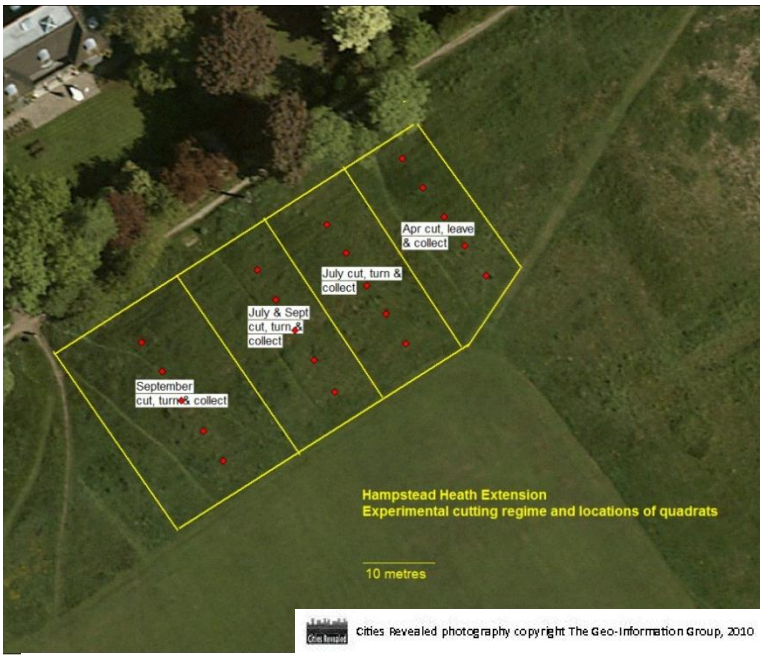
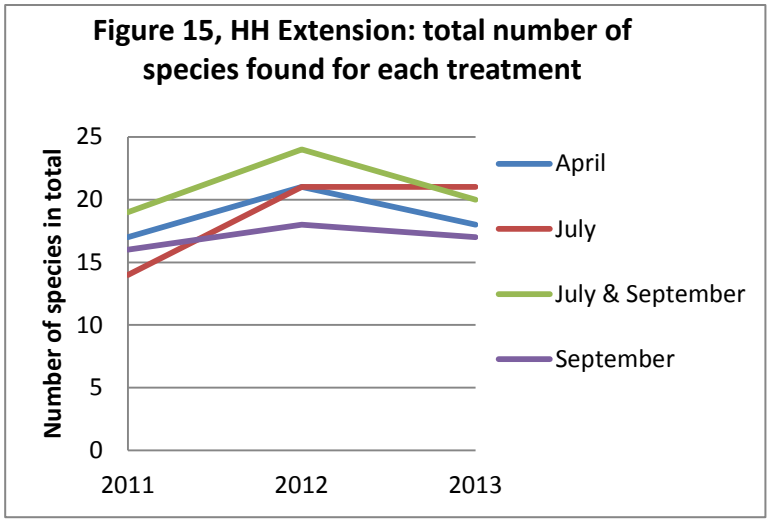
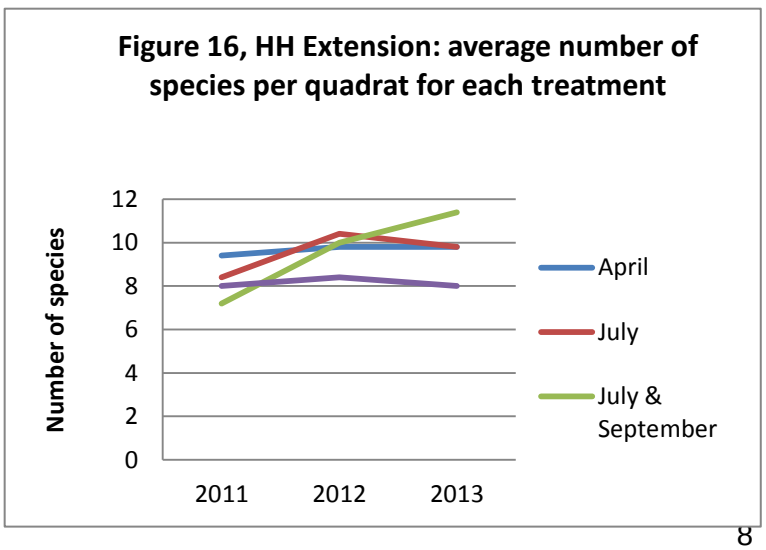


Figure 14: experimental cutting regime

Figure 15, showing total species count, would seem to suggest that the optimal treatment is cutting in July, whereas figure 16, showing average number of species per quadrat, suggests that although July is good, July and September is the optimal treatment. However, the differences are small and the experiment is long-term in nature, and it is too early to reach meaningful conclusions.





Creeping thistle

Thistle is an important plant for biodiversity. The flowers are very popular with feeding butterflies, bees and other invertebrates, and finches enjoy the seeds. Thistle in hedgerows, other edge habitats and scrub is entirely appropriate and desirable, but it will outcompete other plants and restrict public access if increasingly extensive areas of grassland become dominated by thistle.

Creeping thistle (figure 17) is increasing on the Heath. New patches are forming and existing patches spreading. Frequent and long-term cutting controls thistle, and there was undoubtedly far less of it on the Heath when the meadows were 'gang mown' – repeatedly close-cut - under GLC management. This ended in the 1980s, and thistle has been spreading ever since and continues to do so. Two examples of recent spread are shown below in figures 18 and 19.

Figure 17 Creeping thistle

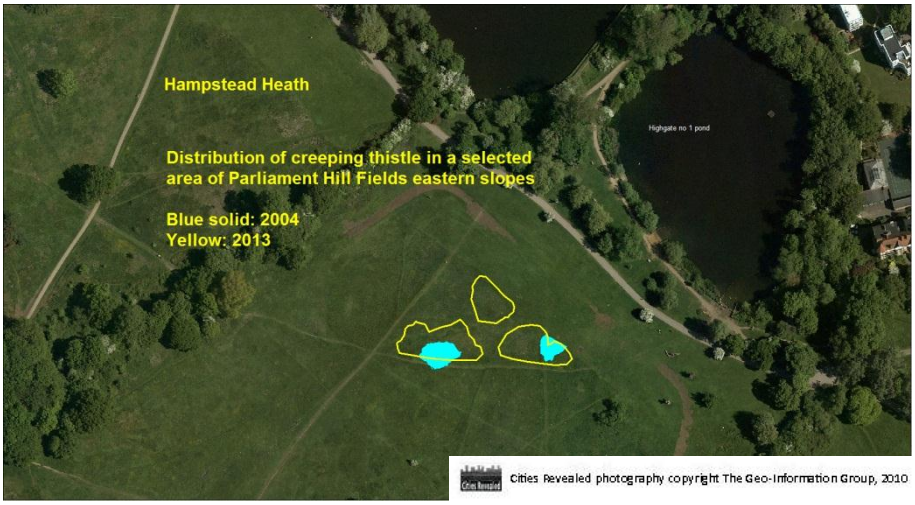


Figure 18

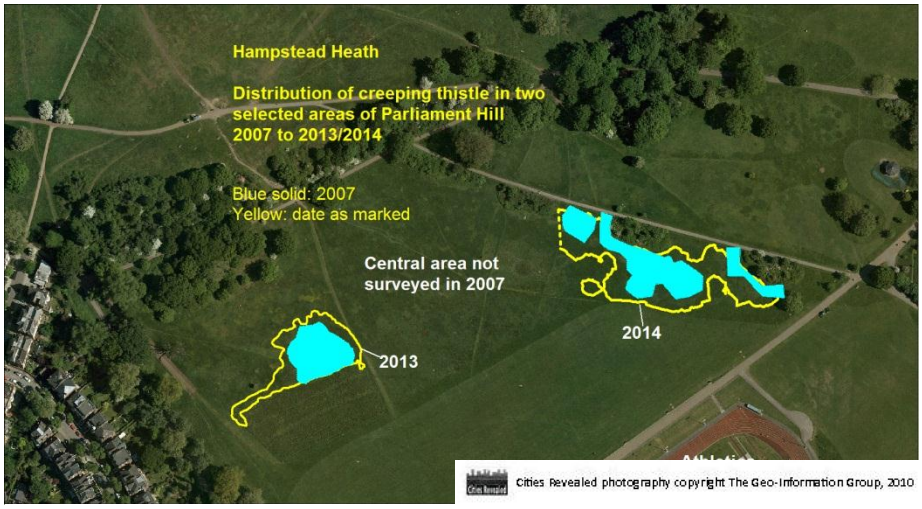


Figure 19

Spread is mainly from existing patches by underground rhizomes. Seedlings do not survive in a dense grassy sward, and require soil disturbance to establish, but unfortunately much of the Heath's grassland does contain bare patches, generated by moles, dogs, drought and illegal barbecues etc., and seedling establishment does occur on the Heath. Luckily seed does not usually spread far from the parent plant. The thistle 'down' that floats through on the wind does not in fact often have viable seed attached to it.

For many years a good deal of the thistle in the open grassland has been cut to try and contain it. Food reserves stored in the roots are least just before flowering, so this is the most effective time to cut. Previous advice was to top thistles and let the stems bleed, and this is what was done annually until recently. Now, following current advice, the stems are cut close to the ground. As found in Tumulus Field, cutting substantially reduces density and vigour (page 4). Pulling is said to be effective, but resources do not allow pulling in many areas.

In 2013 an experiment was initiated on the southern slopes of Parliament Hill to see if more frequent cutting is more effective. Under this regime, much of the thistle is mown monthly. This and the previous annual cutting has greatly reduced the density of thistle in the cut areas. A large patch is left for wildlife The area left in 2014 was in the centre of the field: see figures 20 and 21.

Thistle is also left for wildlife on the edges of meadows by hedgerows, trees and scrub.

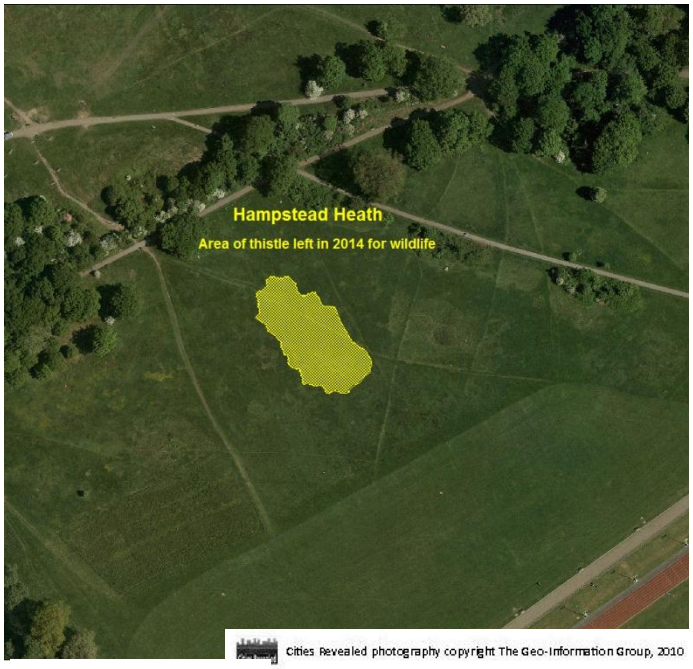


Figure 20

Figure 21: area with creeping thistle left for wildlife in 2014

Hogweed

Like creeping thistle, hogweed (figure 22), a native plant not to be confused with giant hogweed, is valuable for wildlife but is invasive. It is a robust plant which shades out vegetation below it, including grass, and also restricts public access. It is spreading to new locations on the Heath and that existing populations are increasing in size. The spread of existing populations is revealed in the map of Pryor's Field, figure 23: in eight years one patch approximately doubled in size. Another patch remained about the same size between 2011 and 2013, but is thought not to have been present or been at most very small in 2005. Hogweed may be increasing nationwide, perhaps due to climate change.

Figure 22: (common) hogweed

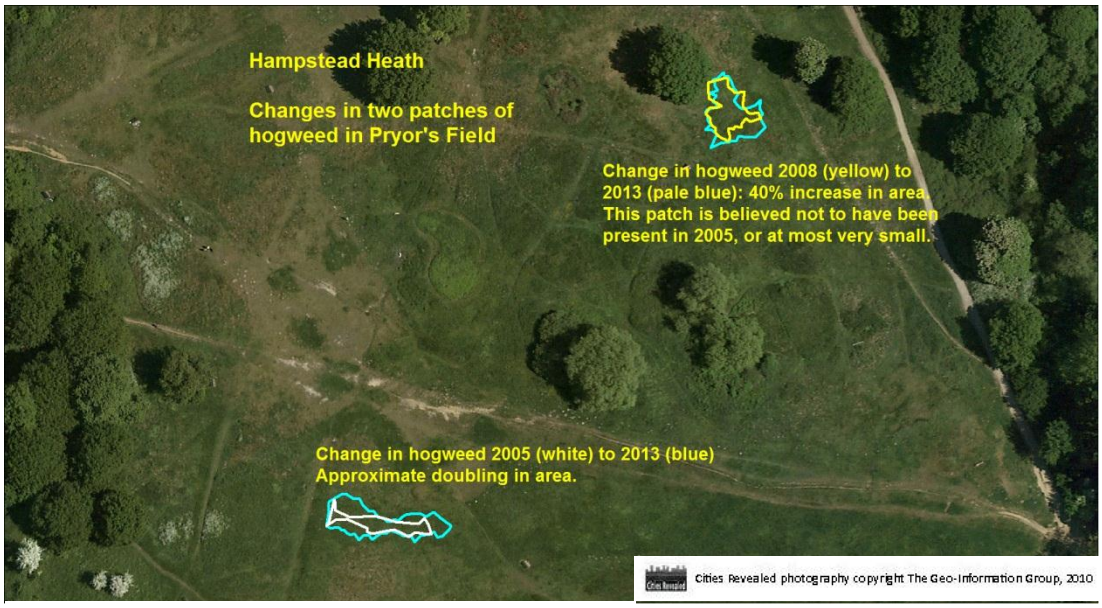


Figure 23

Hogweed is a perennial with a typical lifespan of 12-16 years, and spreads by seed. There is some evidence that repeated cutting reduces its frequency, although occasional cutting may actually benefit it by reducing the vigour of competitors such as coarse grasses. Flowers open sequentially, but the first flowers to open, at the top of the stem, produce most of the viable seed. Seed set swiftly follows flowering. Seed is not long lived, with few germinating after the first couple of years.

To date, attempted control has been by cutting to the ground at or just before flowering to reduce vigour and seeding. In view of the above, it is important that cutting be undertaken before the first flowers show, and that it is repeated several times in the season.

The best way of controlling hogweed is said to be by cutting and removing the top 7-10cm of the deep tap roots, or 'spudding', which prevents regeneration. Ideally therefore a programme of spudding should be instigated. Unfortunately this would largely be impractical, as many patches are dense, with hundreds or thousands of plants. However it would be useful to spud or dig any isolated small patches.

Bramble

Bramble has expanded on the Heath, especially since the late 1980s when intensive management of grassland ceased. Bramble has also increased greatly nationwide, partly due to less intensive management of hedgerows and rough ground.

Bramble is of very great importance for biodiversity, and is a natural constituent of woods and hedgerows. It is vital to retain bramble in woodland and, especially, alongside hedges and woodland boundaries, Bramble can grow in denser shade than almost all other common native understorey plants except ivy: there is no point in removing bramble in woodland except where access is required, as removal will usually only result in bare ground or a carpet of ivy or non-native small balsam. There are several established patches of bramble in grassland on the Heath which are particularly important for birds, but bramble should not be allowed to expand further into open land.

The common species of bramble, *Rubus fruticosus* agg., actually consists of many micro-species, which are difficult to identify. It can grow quickly, but where appropriate can be controlled in a few years by cutting several times a year. Cutting can be done by machinery except on steep slopes or where anthills are present. In this case control will take longer, as laborious hand cutting is necessary, usually undertaken by Heath Hands volunteers.

A Heath-wide programme of bramble control using a tractor-mounted flail was begun in 2013, supplementing the work done by Heath Hands where machine access is impossible. Cutting is only aimed at controlling recent expansion of bramble where it is inappropriate, not eradicating bramble. Initial cutting takes place out of the bird-nesting season, and is followed up by cutting low regrowth in spring and summer. Full implementation of the programme was impossible in autumn 2013 as unusually wet ground prevented machine access, but the full programme of planned work was carried out in autumn 2014, and the areas cut will be recut in 2015.

Several patches of bramble in Pryors Field have been monitored over a number of years. Bramble is particularly important in Pryors Field for nesting whitethroat and it is vital to maintain significant areas, but these should not be allowed to increase. Figure 24 shows that the extent of clumps monitored in

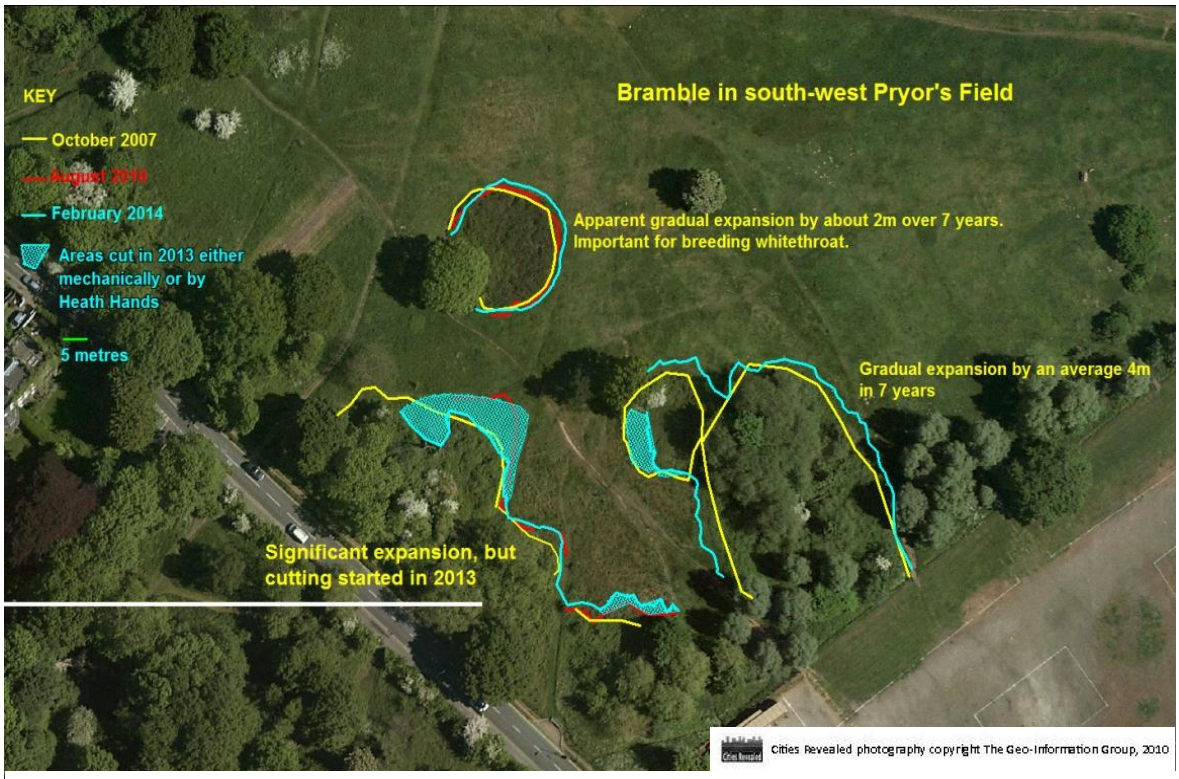


Figure 24

the south-west of the Field increased between 2007 and 2014. Bramble was also monitored in the north-east of the field, as shown in figure 25. The long-standing patch shown in the centre of the figure, where whitethroat has habitually bred, shows some recent expansion, although bramble in its centre is now becoming more sparse. Cutting mechanically and using volunteers was undertaken in 2013 and more extensively in 2014 to reduce recent increases.

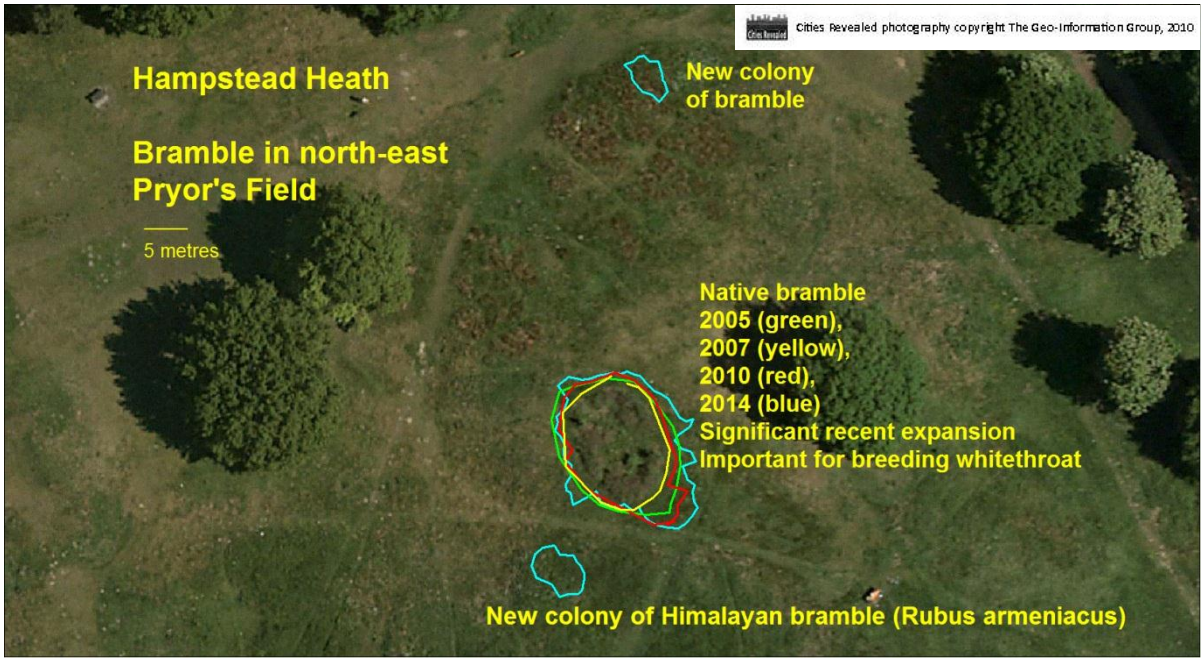


Figure 25

Two new colonies have also appeared in these areas of Pryor's Field. One is of a different species of bramble, Himalayan bramble, *Rubus armeniacus*, or perhaps a hybrid of this and *Rubus fruticosus* (figure 26). This alien species, native to eastern Europe, is a robust, vigorous plant with long, stout arching biennial stems, and leaves with white undersides. It originated from bramble planted commercially and in gardens for its fine large blackberries, and is still available to purchase as Himalayan Giant. Himalayan bramble is spreading in Britain and elsewhere, from Canada and the United States to Australia, but is not (yet) common on the Heath.

Himalayan bramble is reported to be difficult to control. Isolated plants may be dug up, although it is hard to get rid of the whole root system in one go. Frequent cutting over a number of years can also be used, but websites tend to make statements such as 'management and control of the Himalayan blackberry involves consistent effort for many subsequent years in order to exhaust root reserves' (British Columbia). It can establish by seed and from pieces of stem and root. A large patch of Himalayan bramble has also established in the north-east of Tumulus Field (figure 26); it was two metres tall when it was cut to the ground in autumn 2014. The patch in Pryor's Field has also been cut.

Figure 26: Himalayan bramble in Tumulus Field, April 2014

Efforts will continue to control the Himalayan bramble, but it may pose serious problems on the Heath in the long term. Other very robust brambles with pale green undersides to the

leaves are also present, and fairly common, on the Heath. These may be relatives of Himalayan bramble or just be native sub-species. Brambles are notoriously difficult to identify and it is not yet known if any of these are potentially troublesome.

Soft rush

The native plants hard rush and soft rush both grow on the Heath, although only soft rush is relatively common. Both rushes provide useful habitat, especially to spiders (notably the wasp spider), which use the spiky cylindrical leaves to support their webs. However, soft and hard rushes can exclude other plants, especially on damp ground, and are classified as serious agricultural weeds. On Stock Pond Meadow soft rush dominates about 16% of the area (figure 27), potentially threatening acid grassland containing heath bedstraw and oval sedge.

The origin of soft rush in this meadow arises from ground disturbance, which presumably allowed buried seed to germinate. Some of the meadow was ploughed in about 1986 and wild flower seed sown, and part of the population may date from this time. The central areas follow the route of a gas pipeline laid some years ago.

Figure 27 displays the results of surveys in 2010 and 2014. Bearing in mind that outliers are hard to spot and to record accurately, it appears that there has been little change during this period, except that the eastern patch may have reduced slightly in size. This conclusion is reinforced by air photos from 1997 and 2002, which show dark patches, probably of rush, covering similar areas. The rush is cut in autumn when ground conditions allow, and should continue to be cut and monitored here, but the risk of it causing a problem seems to be low.

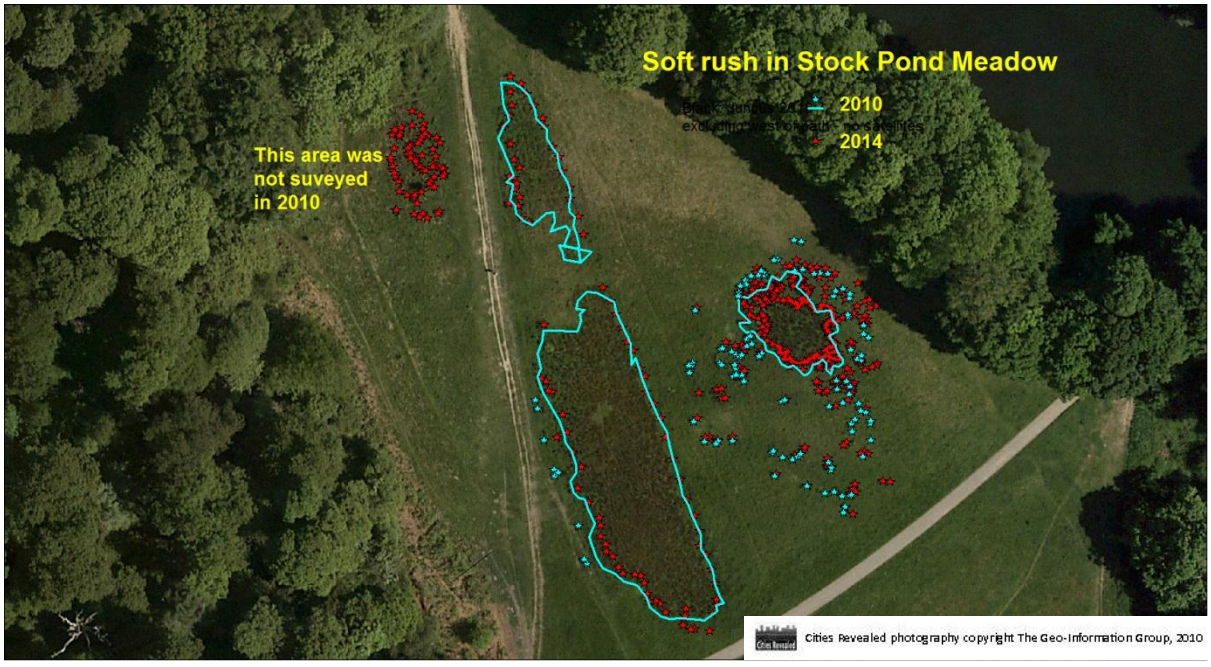


Figure 27

Bracken

Dense bracken is useful for biodiversity in that it helps reduce disturbance, especially from dogs, but by the same token it also impedes public access. It is not intrinsically particularly valuable for wildlife, although it does support a small number of invertebrates.

A band of bracken and bramble grows along the edge of Stock Pond Meadow adjacent to Kenwood, as shown in figure 28. The underlying air photo was taken in 2009 or 2010, and it shows that the width increased over the following two or three years. It is undesirable for it to expand far into the grassland, for the reasons stated above. Recent management of cutting it back has reduced the width, and the intention is to keep it to approximately its 2013 extent.

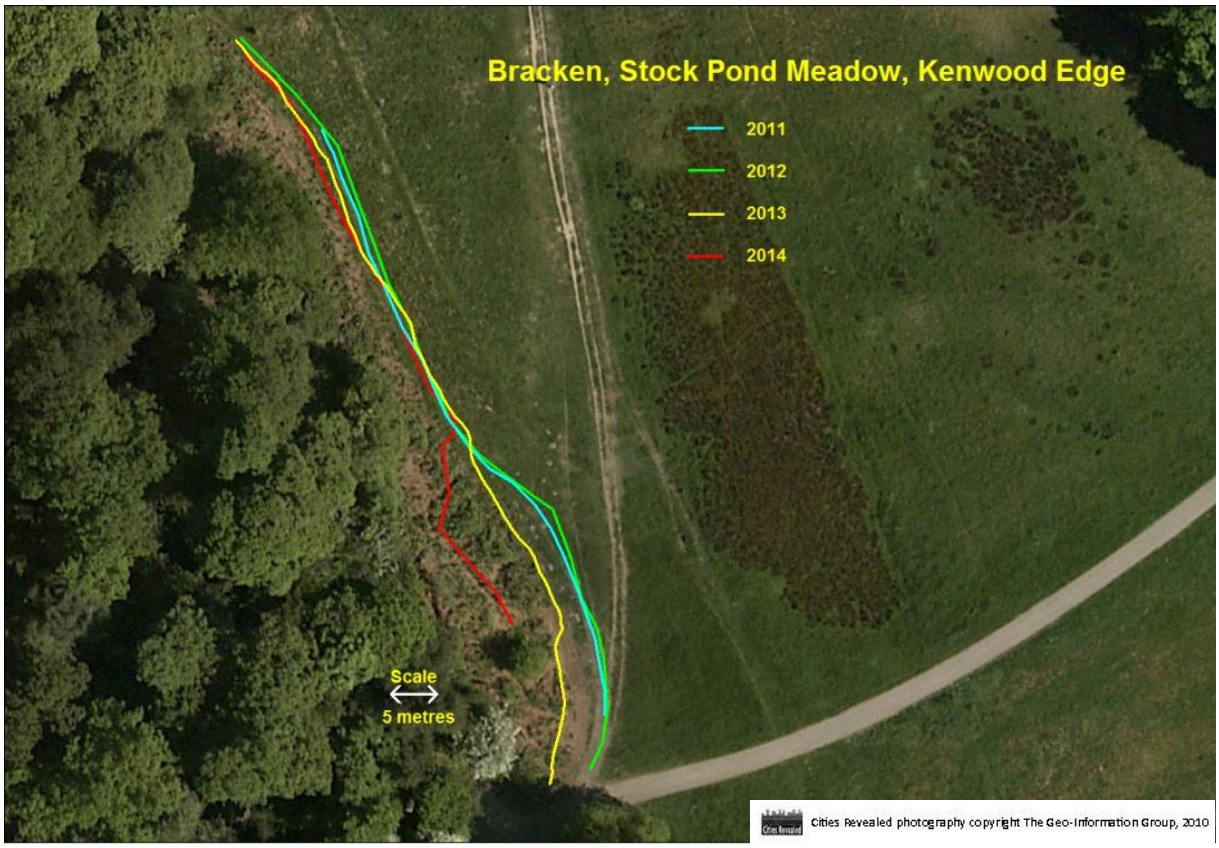


Figure 28

Tormentil

Tormentil (*Potentilla erecta*) is a characteristic plant of acid grassland. At the start of the 20th century it was common on West Heath and probably elsewhere on suitable soils, but the only extensive population left on the Heath is at the so-called 'Tormentil Slopes', a steep grassy incline on the south side of the Fleet Stream not far downstream of the Vale of Health pond, whose location is shown in figure 1.

Figure 29: Tormentil

Recent management has sought to preserve and extend the colony. In 2011 scrub and trees were felled on the north-west side to extend the open area; further but more minor clearance was undertaken in 2012; and bramble cutting was continued in 2013. A dense patch of bramble and rose-bay willowherb on the east side of the area was cut down in autumn 2014 and will be recut in 2015 with the aim of eradicating it.

Monitoring the population provided some difficulties. Unlike, say, bramble, the colony has diffuse edges. It is also small-scale, and major changes were not expected, so accuracy was required. Obtaining sufficient accuracy was compounded by the location, towards the bottom of a valley, limiting the number of satellites visible to the GPS equipment and so decreasing accuracy. Results therefore have to be treated with caution.

Figure 30 shows the results of monitoring in 2010, 2012 and 2013. It appears that the plant has spread towards the west, where trees and bramble were cut back, indicating the success of this management. In August 2012 shears were used to cut the tops off tormentil plants bearing ripe seed, and this was spread on newly exposed soil in this area. This may have been the origin of some of the expansion of the population, or it may have arisen from buried seeds or existing plants hidden among the bramble. However, there has been a loss of plants in the south-east. This is being addressed by clearing the patch of bramble and rosebay willowherb which has colonised this area. There is also an indication of a loss in the north-east, where there is a fringe of bramble beneath overhanging trees. It is planned to cut back the bramble and remove lower branches from trees here in 2015. This should also help protect a small population of lesser spearwort, another plant uncommon on the Heath.

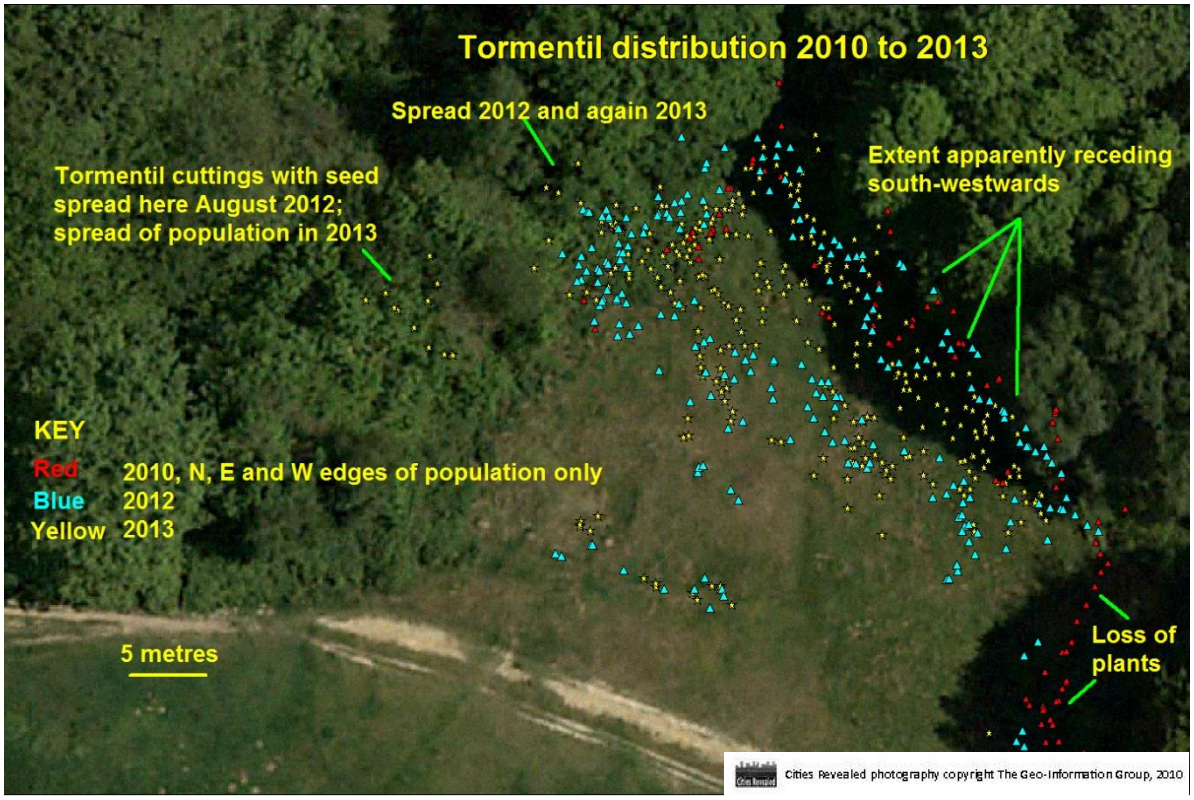


Figure 30

Conclusions

Plant populations are not static, and the programme of monitoring has provided valuable information on changes in the vegetation of Hampstead Heath. The results show positive changes in some cases, but indicate potential or actual problems in others.

On the positive side, it was found that the Sparrows Site meadow has retained its rich plant diversity over the five years since it was sown. Yellow rattle, an uncommon plant which suppresses grasses, is increasing on the site, to such an extent that seeds were taken from it and scattered elsewhere to try to spread it further. Management undertaken on the 'Tormentil Slopes' to try to increase the population of tormentil have apparently been successful, and action is planned to restore and expand further the extent of this species.

On the negative side, the conclusions from monitoring potentially invasive native species are more mixed. These plants are valuable for biodiversity but should not be allowed to dominate large areas of grassland. The extent of soft rush seems to be stable under existing management, and it is believed that unwanted expansions of bramble and bracken in grassland are being controlled. However, measures aimed at controlling creeping thistle, hogweed and ragwort have not been entirely successful: management has curtailed their spread but mechanical methods cannot eradicate unwanted populations unless grassland is mown frequently, which is not the ethos of Heath management. Volunteers have very usefully supplemented cutting by machine, but sufficient labour is not available to undertake manual control over much of the Heath. In the longer term it is possible that limited and targeted use of herbicides may be required.

It is important that both the programmes of vegetation management and monitoring are continued in order to retain the biodiversity of the Heath.