Grazing assessor's report on status of cattle grazing and associated habitat monitoring across Epping Forest

Plate 1. Red Poll cattle, fitted with *Boviguard* collars, grazing in Whitehall Plain, Epping Forest (© P. Dennis)

Dr Peter Dennis

Institute of Biological, Environmental and Rural Sciences,
Cledwyn Building, Penglais Campus,
Aberystwyth University, Ceredigion, SY23 3DD

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1. Introduction

This is the fifth report by the Independent Grazing Assessor for the Conservators of Epping Forest. This follows a fact-finding visit to Epping Forest on 5-6 July 2016, and one day allocated to prepare a short report that focused on a review of the build-up of the cattle herd and developments in the management to realise truly extensive grazing and wood-pasture restoration. The visit concentrated on the 120 ha of the Fairmead large loop composed of the Whitehouse and Fairmead loop (north), Pear-tree and Fairmead loop (middle) as well as a visit to the Chingford and Bury Wood (south) loop . Within these areas, particular attention was paid to:

- Consideration of the current foraging patterns of the cattle within the Fairmead/ Almshouse/ Bury Wood area, as indicated by heat maps derived from records of cattle locations recorded by Geo-Positioning Satellite collars.
- A field assessment of the extent of grazing and vegetation consumed in the areas where cattle appeared to spend most time.
- A general assessment of the condition of the vegetation in different habitats and particular plant species that may be especially sensitive to grazing in relation to the current and projected herd size for summer grazing, 2016.
- Proposed measures to encourage cattle to increase their foraging from the open meadows and rides into the currently, sparsely vegetated wood pasture areas characterised by dappled shade.
- To review the effectiveness of the ecological monitoring programme set up to measure the effect of the increased cattle grazing.

2. Assessment of cattle grazing across the Fairmead large loop

The Whitehouse Plain, Almshouse Plain, Pear-tree Plain and Fairmead area had reverted to a single, 'extensive' grazed area of 120 ha with the use of northern and southern invisible-fenced loops laid out in linear formation to enclose the Red poll cattle. The total number of

2.5 year-old cattle stocked was 10 from 6 June, increased to 20 cattle in mid-June. The target for later in the summer was 35 cattle which translated to a stocking density of ca. 0.23 Grazing Livestock Units (GLU) ha^{-1}, an underestimate since large tracts of the enclosed compartment had little vegetation of suitable nutritional value as forage for cattle. This target of 35 was not reached with a maximum of only 28 during the autumn. Two additional 'extensive' grazed areas were anticipated to be ready by 2017 at Chingford (60 ha) and Big View (60 ha).

The target number of 35 cattle for the Fairmead large loop was reasonable but the slow build up in cattle numbers towards this total, observed at the time of the assessment visit, was inadequate and had not consumed the prolific vegetation growth through spring and early summer 2016. The final total of 28 cattle achieved after the assessment visit is likely to have ensured this remained the case throughout 2016. The consequence for Fairmead Bottom was minimal because a high stocking density of cattle had been fenced into this small compartment during 2015, whilst technical difficulties with the invisible fencing were resolved elsewhere. Also, there had since been chemical control of the bracken patches that had previously expanded into the meadow with apparent, effective clearance.

Elsewhere, cattle moved and foraged preferentially in the meadow and broader, illuminated rides (Plates 1: cover image and Fig. 1: heat map). Large areas of closed and more densely shaded woodland were not frequently accessed, and where access was apparent, this was most often only for rumination and shelter from flies during the day, rather than for grazing or browsing. There was little incentive to enter such areas for forage whilst open areas were under-stocked. There was clearly an effect of visual barriers, as described in the previous report (Dennis, 2015), represented by secondary woodland or dense thorn, bramble, aspen, willow or tall herbs that fringed the main areas of veteran trees and pollards or edges of rides. This was illustrated at the southwest corner of Whitehouse Plain (Catacombs' Corner) because cattle did not appear to cross the short, narrow gap composed of closed woodland through to Almshouse Plain, despite the additional incentive of a water trough a short distance to the south. Instead, access for drinking appeared to be exclusively via a return around the eastern fringe of North Long Hills and west along Almshouse Plain. At such a low stocking density, the damp grassland and marsh areas were also largely avoided by the Redpoll cattle. Expansion of Jointed Rush (*Juncus articulatus*) was observed on Fairmead opposite Lincoln's Lane (night camp or daytime use at a busy public access point?).

Plate 2. Foraging activity of Red poll cattle in the Fairmead and Bury Wood compartment during summer 2016. Cattle ingress to tall herb fen encouraged by mechanically topped line through Marsh thistle (*Cirsium palustris*) canopy at Palmer's Bridge, Fairmead (top left), and encouragement into illuminated woodland by targeted wood pasture restoration (top right). Effective trampling and grazing effects on perennial tussock grasses in open meadow of Fairmead Bottom (bottom left) but undesirable consumption of Hemlock water dropwort (*Oenanthe crocata*) flowers of ditch banks at Palmer's Bridge (bottom right). Photo credits: top photos © John Phillips, bottom photos © Peter Dennis.

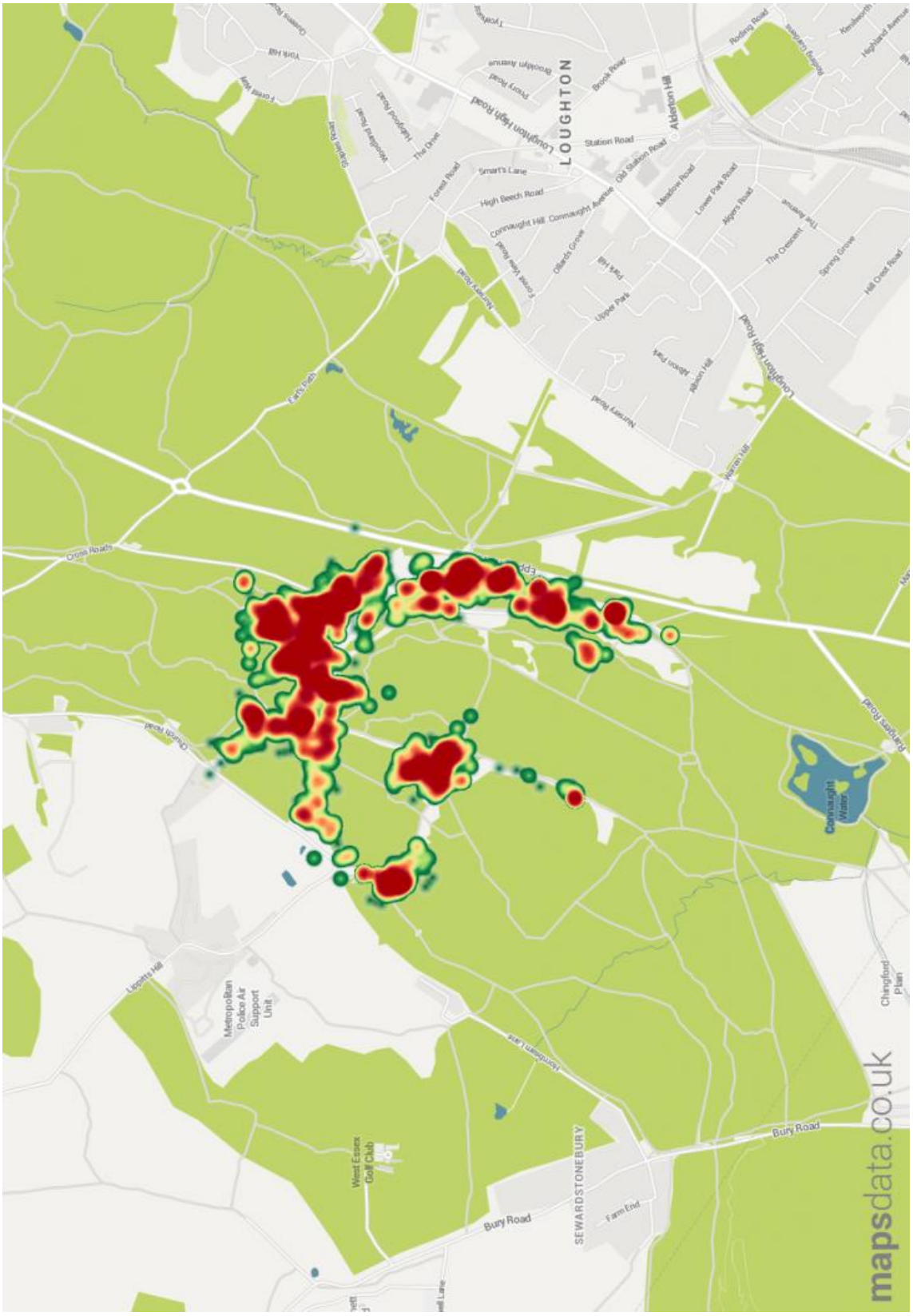

Figure 1. Heat map of cattle locations within Fairmead, Epping Forest, 14-15 June 2016 derived from co-ordinates recorded by GPS collars attached to four Red poll cattle (Base map sourced from www.mapsdata.co.uk; data provided by John Phillips, Conservators of Epping Forest).

3. Cattle density in management compartments

Cattle have been successfully introduced to the major compartment in the southern part of Epping Forest, now that the major technical limit of the *Boviguard* invisible fence has been adapted to the terrain. It was evident from the large Fairmead and Bury Wood compartment visited during July that there was potential, not yet realised, to achieve the three functions of conservation grazing:

1. Consumption of the biomass of annual vegetation productivity.
2. Selection of competitive and abundant plant species to sustain less competitive species of greater conservation value.
3. Halt ecological succession to perennial herbs, thorny vines, shrub and trees (especially Willow (*Salix* spp.), Aspen (*Populus tremulus*) and Birch (*Betula pendula*) in wetland, grassland and heath.

The build-up in numbers to 20 Red poll cattle by June and 28 cattle for the rest of the summer in the Fairmead and Bury Wood compartment, albeit modest stocking densities, demonstrated evidence that these cattle were foraging a variety of vegetation types across the mosaic (Plate 2). The number of cattle available remained insufficient to graze across this and other invisible-fenced compartments at a density to 'harvest' the annual productivity of the vegetation but grazing was achieved across several compartments (Table 1). Nonetheless, there were frequent instances of grazing, browsing and trampling effects on, for example, perennial tussock-forming grasses (Plate 2, bottom left), marsh thistle and willow (e.g., browsed either side of ride at Suntrap Plain).

Ecological succession has not halted because of under-grazing of recent years associated with technical factors that delayed the onset of an appropriate stocking density of cattle. The extent and effectiveness of the invisible-fenced compartments, the fit of the *Boviguard* collars to the smaller sized necks of Red poll cattle and effectiveness of the GPS units for tracking cattle movements have all been resolved. The delay to the onset of grazing has led to further increases in species such as Purple moor grass (*Molinia caerulea*), Tufted hair grass (*Deschampsia caespitosa*), Marsh thistle (*Cirsium pallustris*) and Willow in wetter areas, and of Bramble (*Rubus fruticosus*), Dog rose or Briar (*Rosa canina*), Hawthorn (*Crataegus monogyna*) and Blackthorn (*Prunus spinosa*), Bracken (*Pteridium aquilinum*) and Birch in the drier habitats (as reported in Dennis, 2015). Resurvey of the eight transects across significant transitions in Epping Forest in 2015, compared with the data from the initial survey of 2013, corroborated the more widespread field observations and recorded significant increases in Bramble (5 of 8 transects), Bracken (2 of 8 transects), Birch (1 of 8 transects) and an overall increase in vegetation height in 5 of the 8 transects (Bealey, 2016). In those particular sites, vegetation changes were considered to confirm that mechanical management had inhibited regeneration of shrub and perennial grasses in the areas of wood pasture but that a ground flora of greater nature conservation value would be achieved by targeted grazing (Bealey, 2016).

The build-up of the cattle herd although delayed is now back on track and is increasing to satisfy the future requirements for adequate stocking density in each compartment. In the short term, there will be a continued requirement for mechanical interventions to control the spread of the plant species listed above. During the period of build-up of cattle

numbers, mechanical topping and brush clearance, manual clearance of Birch and the chemical control of Bracken will be required to complement the cattle grazing. Regular, annual grazing should then extend the intervals before expensive mechanical interventions are required, especially if grazing in spring is feasible at sites with prolific Bramble and Briar.

Table 1. Cattle numbers stocked on significant compartments of Epping Forest in 2016 (information provided by John Phillips).

Compartment	Cattle number	Period
Fairmead and Bury wood	28	6th June - present
Long Running	7	3rd August - present
Chingford Plain	8	15th August - present
Fernhills	10	8th September – present
Sunshine Plain	0	Significantly grazed in 2015

4. Measures to encourage widespread, 'natural' grazing patterns within compartments

Several push and pull factors were discussed during 2015 (Dennis, 2015) and again in July 2016 to encourage cattle to forage across more of the vegetation types within the larger compartments, especially within the wood pasture restoration areas. Tall herbs, e.g., Marsh thistle (Plate 2, top left) and Jointed rush (Plate 3, top left) form a transition zone to the woodland edge which is not readily accessed by cattle. Recent action to initially, deploy a topper to mow a pathway to the woodland edge where such thicket had formed, for instance through Marsh thistle of overgrown wet meadow from Palmer's Bridge to Bury Wood edge (Plate 2, top left), was partially successful. Cattle were attracted to the woodland margin but no further due to the darkness under the closed canopy (e.g., Plate 3, bottom left). The veil of secondary growth at the Bury Wood transition was recently, partially cleared and the woodland opened up under wood pasture restoration management which encouraged ingress of cattle into the woodland (Plate 2, top right).

The wet meadow must not be entirely cleared and significant Willow cover must be retained because Purple Emperor butterfly (*Apatura iris*) requires such trees as territorial markers within this habitat. Pollarding and halo clearance of secondary tree growth (Plate 3, bottom right) is proposed in a funnel profile to encourage further movement of the cattle into the currently shaded and less vegetated woodland towards the illuminated wood pasture of Cuckoo Pits (Plate 3, top right). This site was last thinned in the 1990s to grade the woodland into meadow and the strategy of the current work, to map the glades and identify potential sites where additional thinning will generate 'stepping stones' to improve connections for cattle movement is to be commended. Opening up of Beech (*Fagus sylvaticus*) and Common oak (*Quercus robur*) in North Long Hills may attract cattle to extend their foraging from Almshouse Plain.

The impediment to cattle movement of physical and visual obstacles represented by overgrown interfaces between meadow, fen and woodland (e.g., Chingford Plain to Bury

Wood, Whitehouse Plain-Fairmead, Pear-tree Plain-Fairmead) was discussed above. The same effect applies to interfaces from rides into woodland where secondary regeneration and vegetation growth creates a veil, e.g., Suntrap Plain where there is grazing either side of the ride but limited penetration of grazing into adjacent woodland. Such rides can be widened to produce a more convoluted boundary and a soft transition from grass-herb fringe to shrub into woodland in order to increase illumination and encourage cattle both along them and into the woodland either side. Rides with a ditch associated with the fringe of tall herbs and woody growth require culverts for cattle to cross in addition to clearing to remove the visual barrier.

Plate 3. Partially trampled and grazed Jointed rush (*Juncus articulatus*) of increased extent at Whitehouse Plain (top left), illuminated glade with ground flora suitable for cattle grazing at Cuckoo Pits (top right), visual barriers to cattle foraging into Bury Wood (bottom left) to reach restored, illuminated wood pasture, suitable for cattle grazing (bottom right). Photo credit: © Peter Dennis.

A revival of the English Longhorn herd will provide cattle more suitable than the Red Poll breed for grazing the range of coarser and less nutritious vegetation available as forage in the large compartments, and essential to achieve extensive grazing. The larger body weight, energy intake demand and lower selectivity of English Longhorns makes them better suited to this role as a free-ranging herd. To illustrate this point, haloed glades of North Long Hills were used by English Longhorn cattle in the 2000s but Red Poll cattle have not yet crossed through and foraged in this area.

A new water supply and drinking trough at Catacombs' Corner may encourage cattle movement between Whitehouse Plain and Almshouse Plain. The water pipe has been installed but Thames Water have not yet connected the supply (J. Phillips, pers. comm.). Further connections are proposed to supply water and provide drinking locations as pull

factors in Fernhills and Chingford, and to enable grazing of Yate's Meadow, where there is currently no suitable water supply.

Forthcoming trials of *Dog fence* as an alternative to *Boviguard* may enable the creation of larger loops and therefore bigger compartments from 2018. Naturalistic grazing across a substantial mosaic of wood pasture, broadened rides, open meadow and wetland will be better achieved with the larger compartments. The location of a small loop of *Dog fence* at Sunshine Plain as a test site for the system will also enable targeted grazing to reduce Purple moor grass foliage to sustain the increased density and vigorous growth of the Cross-leaved heath (*Erica tetralix)*, Heather (*Calluna vulgaris*) and Cotton sedge (*Eriophorum vaginatum)*.

There is also a short-term need to target recently haloed clearings of closed woodland with small, Invisible-fenced enclosures to encourage cattle grazing for short periods. This may be compatible with acclimation of the rumen microflora to novel forage such as Hornbeam (*Carpinus betulus*) leaves, Bramble and poorer quality grasses, e.g., Creeping soft grass (*Holcus mollis*). Bales of hay from open meadows may also serve to inoculate such areas with meadow grasses to achieve a higher nutritional value in future which may serve as an incentive for cattle to forage these areas in the context of the free-grazing in the whole compartment. It may be possible to extend this approach to calves, since access to novel forage is required early in life to avoid aversions in diet (re: Section 5).

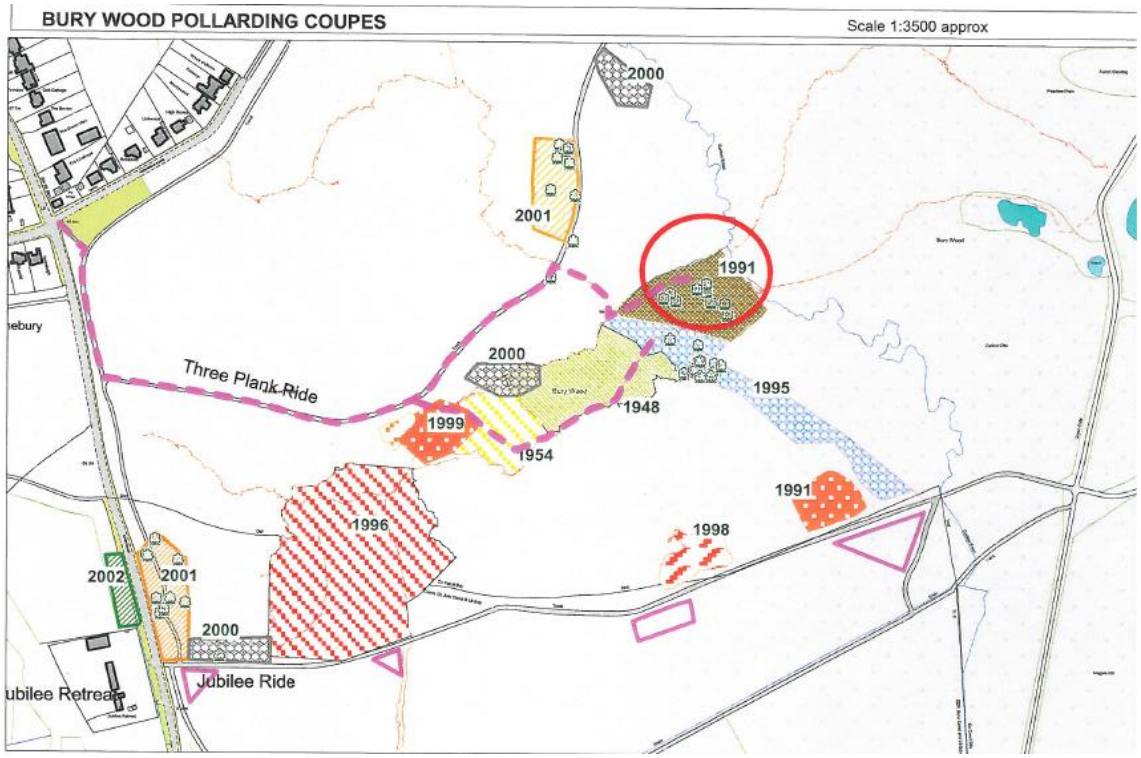

Figure 2. Successive pollarding coupes in Bury Wood, Epping Forest (Base map reproduced from the Ordnance Survey map of the City of London with the permission of The Controller of HMSO: Crown Copyright; overlaid polygons and labels: © City of London- produced by Open Spaces Department, Epping Forest).

The alignment of wood pasture restoration management (pollarding, crown reduction and haloing of secondary tree regeneration around veteran trees and pollards; e.g., Bury Wood, Fig. 2) with the build-up of cattle numbers in targeted compartments is desirable. Pollarding is expensive and has operated on a 30-year cycle for Hornbeam although this is being shortened to a 15- 20yr cycle (Fig. 2). However, a focus on halo work around pollards within the 60-80 ha invisible-fenced loop of the Chingford/ Bury Wood (south) compartment, is a cost effective strategy to increase illumination of the woodland floor, protect the ancient oak pollards and achieve extensive grazing within the wood pasture, in accordance with the Higher Level Stewardship agreement (Fig. 3). This can target discrete areas to create 'stepping stones' or 'funnels' of illuminated woodland across the current closed and shaded woodland, recognised to impede the free movement of cattle and facilitate cattle movement throughout a compartment.

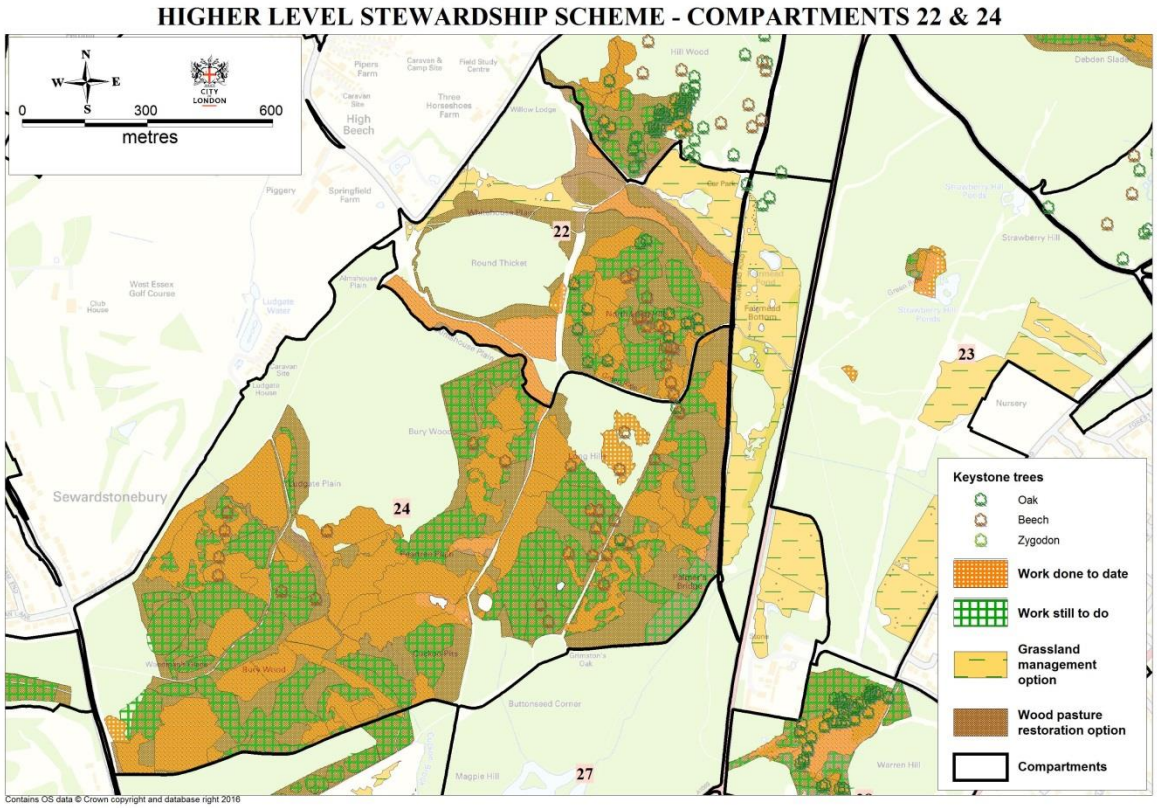

Figure 3. Wood pasture restoration areas of Fairmead/ Whitehouse Plain/ Peartree Plain/ Almshouse Plain/ Chingford and Bury Wood, Epping Forest managed under Environmental Stewardship - Higher Level Scheme (Base map reproduced from the Ordnance Survey map of the City of London with the permission of The Controller of HMSO: Crown Copyright; overlaid polygons and labels: © City of London- produced by Open Spaces Department, Epping Forest).

5. Limitations of management of the woodland ecosystem with one herbivore species

There are limits to the capability of one herbivore species to manage complex vegetation such as associated with wood pasture. The measures proposed and currently under implementation are significant advances but scientific research provides two further

options to achieve naturalistic grazing more widely across the large management compartments.

Neurological or physiological constraints, perhaps including the composition of the rumen microflora in ruminant herbivores, can strongly influence whether novel plant species are included in their diet (Burritt & Provenza, 1997; Villalba *et al*., 2012). Experience of novel plants during early life can avoid such neophobia and alter dietary choice in later life when exposed to novel environments (Burritt & Provenza, 1997). Experience of such plant species from weaning can also "develop the motor skills necessary to harvest and ingest (novel) forages" (Provenza & Balph, 1988). This research was conducted on sheep as a 'model' species but the authors assert that the results are equally applicable to other ruminants, including cattle. Adult herbivores do not learn to consume novel forage species and, therefore, forage less efficiently across the available plant species In a novel environment (Provenza & Balph, 1988; Catanese *et al*., 2015).

This extends to the development of aversions to undesirable plants, for example, Hemlock Water-dropwort (*Oenanthe crocata*) associated with water margins across Epping Forest. Hemlock Water-dropwort flowers were systematically grazed by Red Poll cattle at Palmer's Bridge glade pond fringe and ditch banks in July 2016 (Plate bottom right). The leaf, stem and rhizomes contain the toxin oenanthetoxin, a GABA antagonist which is lethal at 0.58 mg per kg bodyweight. The cattle appeared unaffected but the risk of poisoning of naïve cattle remains significant, especially if the highly toxic roots are exposed by trampling or ditch clearance. The results of the research implied that a system of grazing and cattle management where calves are weaned in the wood pasture areas, with exposure to the range of plant species accessible to forage, will lead to increased energy conversion and motivation to graze in these areas of Epping Forest (Catanese *et al*., 2012). Alternatively, tree and shrub forage can be fed to the cattle during calving, lactation and weaning (Launchbaugh *et al*., 1997).

The impacts of different functional groups of herbivores, founded on new research of relatively intact African savanna, clearly demonstrates the essential contribution of various larger and smaller browsers in addition to grazers to diminish thorny shrub and to maintain structural diversity in the vegetation (Hempson *et al*., 2015a; Fynn *et al*., 2016). Where grazing only by domesticated livestock has replaced the activity of native antelope and grazers, savanna vegetation has been much simplified and polarised into dense shrub and open grassland (Gill, 2015), including grazing lawns (Hempson *et al*., 2015b). A total of 92 wild herbivores were classified into herbivore functional types according to measurable traits (Hempson *et al*., 2015a). It is from an understanding of the interactions of such functional types with complex vegetation (architecturally and in plant species diversity) that an appreciation emerges that one species of one functional type cannot maintain the plant species diversity and vegetation patchiness required by the wider diversity of other wildlife (Gill, 2015). The implication for Epping Forest would be to increase the populations of different sized wild deer, where browsing would further reduce the reliance on intermittent mechanical intervention to compensate the deficiencies of cattle only grazing.

6. Monitoring of vegetation change

The various vegetation monitoring grids set up before the reintroduction of cattle grazing remain essential to monitor local changes of specific vegetation. There data collected in years before the onset of grazing provide an important benchmark for comparison. The mapping of individual plants of targeted species of higher nature conservation concern is another valuable method to provide an early indication where cattle grazing facilitates or imposes adverse effects on species, e.g., Lousewort (*Pedicularis sylvatica*). This approach could be expanded to other species of concern but the field mapping replaced with aerial photographs, taken by drone (Unmanned Aerial Vehicle) when the plants are in flower and easily identified on such images, e.g., to assess cattle access to and impact on Meadow Cranesbill (*Geranium pratense*) in the recently opened and grazed wet meadow of Palmer's Bridge, Greater Birds-foot Trefoil (*Lotus pedunculatus*) and Petty Whin(*Genista anglica*) associated with the Lousewort on Almshouse Plain and Lesser Spearwort (*Ranunculus flammula*) which is vulnerable to cattle trampling where ditches cross frequently used rides, e.g., Palmer's Bridge to Fairmead Bottom. The resurvey, albeit at reduced frequency, of the eight transects set out across identified transition zones in several compartments also provides a measure of more general change in vegetation height and species composition which can inform decision-making on the setting of stocking densities or intervention with mechanical operations.

7. Update on student projects

Two student projects began in 2015 (Dennis, 2015). Alexandra Broom had to pursue an alternative project as a contingency due to the lack of access to GPS location data for cattle in Fairmead and Chingford to realise the original investigation. Instead, she surveyed plant species browsed by cattle in the heath compartments which experienced varied intensities of cattle grazing during 2015. The dissertation was completed and submitted in May 2016 (Broom, 2016). Glenn Mulleady, the Forest Keeper on a distance-learning MSc Livestock Production course at Aberystwyth University, deferred the investigation of the nutritional value of vegetation after varied periods of grazing because of the further delays in the onset of proposed grazing, especially within the Chingford compartment. Glenn is currently considering an alternative Masters project.

8. Summing up

The layout of the grazing compartments across Epping Forest has now been adapted to address the technical limitations of the invisible fencing system. The factors leading to a delay in the build-up of the cattle herd have been largely overcome. In combination, it was pleasing to witness a substantial roll-out of grazing across many of the compartments. The cattle numbers remain insufficient to tackle the vegetation productivity and progress of ecological succession, expressed as increases in perennial tussock grasses, Bracken, Bramble, Briar, Hawthorn, Willow, Aspen and Birch. These plant species have established in the interim and cattle alone will not achieve the desired reduction in extent from the period of under-grazing. During the transition to widespread cattle grazing at higher stocking densities, secondary succession to shrub and young trees will not be effectively consumed by cattle alone, so mechanical cutting or manual pulling of Birch (in heath sites), topping of Tufted Hair-grass (*Deschampsia cespitosa*; Chingford), Creeping Soft-grass,

Bracken and Jointed Rush (Fairmead). The actions to initially, manually and mechanically clear woodland edges and wood pasture sections of compartments where thicket has formed, will encourage ingress of cattle (e.g., within Bury Wood). The instigation of actions to encourage movement of cattle into shaded and less vegetated areas in each compartment have been enacted with initial reports of partial success. Both the provision of water and supplementary feed in an increasingly illuminated series of pasture woodland patches, should encourage the natural grazing patterns by cattle anticipated to achieve extensive grazing and true wood-pasture restoration for desirable nature conservation outcomes across Epping Forest.

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