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Home range impacts of cattle and pony grazing on a lowland east Devon Pebblebed Heath

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Home range impacts of cattle and pony grazing on a lowland East Devon Pebblebed Heath

by

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Copyright statement

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Authors Declaration

At no time during the registration for the degree of Research Masters has the author been registered for any other University award, without the prior agreement of the Doctoral College Quality Sub-Committee.

Work submitted for this research degree at the University of Plymouth has not formed part of any other degree either at the University of Plymouth or at another establishment.

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Abstract

Home range impacts of cattle and pony grazing on a lowland East Devon Pebblebed Heath by Philippa Ingle

Lowland heath is of ecological importance due to the rarity of the habitats and of the species supported. Bicton Common is an East Devon lowland Pebblebed heath comprised of Atlantic wet heath, dry heath and mire, of which the former two are both Annex I habitats. Both the wet heath and mire are in favourable recovery whereas, the dry heath is in unfavourable recovery partly due to the dominance of *M. caerulea*. The main aim of this study was to assess the impact of grazing after two seasons on the three types of habitats in relation to two control sites: dry heath and a mosaic habitat. This was achieved by the construction of a robust methodological protocol, which was successfully used to collect vegetative data within this short term study. Secondly, the baseline vegetative conditions of the five sites were investigated. This was achieved by comparing the vegetative data with the existing NVC floristic tables. It was found that the wet heath and the dry heath within both the non-control and control sites were typical NVC habitats whereas, the mire displayed non-typical characteristics. Unsurprisingly, the mosaic habitat displayed characteristics of both the dry heath and wet heath habitats. Finally, GPS collars were used on one cow and one pony in order to collect data that was used to identify home ranges (HRs), habitat preferences and grazing behaviour. A semi-structured interview was also carried out to validate the results. It was found that the cow had 18 HRs in contrast to the pony that only had four. There were a greater number of GPS points recorded within the dry heath and wet heath, relative to the mire, by types of animal. Additionally, both the cow and pony used the tracks to commute and graze. The results of this study indicate that grazing did contribute to a number of changes within the vegetation: a decrease in the percentage cover of *E. angustifolium* and *C. vulgaris*; an increase in percentage cover of *U. gallii*, *E. cinerea* and *M. caerulea*; a decrease in the biodiversity of both the dry and wet heath; an increase in the biodiversity of the mire.

Key words: Lowland heath, Grazing, GPS, Home Ranges, Biodiversity

List of Abbreviations

AONB	Area of Outstanding Natural Beauty
BBS	British Bryophyte Society
BL	Baseline
BLS	British Lichen Society
CDH	Control Dry Heath
CES	Conservation Enhancement Scheme
CMo	Control Mosaic
DH	Dry Heath
DPHT	Dartmoor Pony Heritage Trust
EC	European Commission
EU	European Union
GAP	Grazing Animals Project
GY1	Grazing Year 1
GY2	Grazing Year 2
JNCC	Joint Nature Conservation Committee
M	Mire
MoD	Ministry of Defence
NE	Natural England
NVC	National Vegetation Classification
PHCT	Pebblebed Heath Conservation Trust
RHS	Royal Horticultural Society
RM	Royal Marines
RSPB	Royal Society for the Protection of Birds
SCA	Special Areas of Conservation
SPA	Special Protection Areas
SSSI	Site of Special Scientific Interest
SW	South West
WES	Wildlife Enhancement Scheme
WH	Wet Heath

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List of Species Identified

Latin Name	Common Name
Agrostis canina sens.lat.	Velvet bent
Agrostis capillaris	Common bent
Agrostis curtisii	Bristle bent
Alnus glutinosa	Alder
Anagallis tenella	Bog pimpernel
Aneura pinguis	Greasewort
Anthoxanthum odoratum	Sweet vernal grass
Aulacomnium palustre	Bog grove moss
Betula pubescens	Downy birch
Calluna vulgaris	Heather (ling)
Calypogeia fissa	Common pouchwort
*Calypogeia muelleriana****	
Campylium stellatum var. stellatum	Yellow starry feather moss
Campylopus brevipilus	Swan-neck moss
Campylopus introflexus	Heath star moss
Campylopus paradoxus	Rusty swan-neck moss
Campylopus pyriformis	Dwarf swan-neck moss
Carex binervis	Green-ribbed sedge
Carex echinata	Little prickly sedge
Carex panicea	Carnation sedge
Carex pilulifera	Pill sedge

Cephalozia bicuspidata	Two-horned pincerwort
Cephalozia connivens	Forcipated pincerwort
Cirsium dissectum	Meadow thistle
*Cladonia arbuscular**	
*Cladonia chlorophaea**	
*Cladonia coccifera**	
*Cladonia crispate**	
*Cladonia fimbriata**	
*Cladonia florekeana**	
*Cladonia furcate**	
*Cladonia impexa**	
*Cladonia portentosa**	
*Cladonia subcervicornis**	
*Cladonia uncialis**	
*Cladonia verticillate**	
Coenagria mercurial	Southern damselfly
*Ctenidium molluscum***	
Cuscuta epithymum	Dodder
Dactylorhiza maculata	Heath spotted orchid
Danthonia decumbens	Heath grass
Deschampsia flexuosa	Wavy hair grass
Dicranum scoparium	Broom fork moss
Diplophyllum albicans	White ear wort
*Drepanocladus revolvens***	

Drosera intermedia	Oblong-leaved sundew
Drosera rotundifolia	Round-leaved sundew
Drytopteris dilatate	Broad buckler-fern
Eleocharis multicaulis	Many-stalked Spike-rush
Erica ciliaris	Dorset heath
Erica cinerea	Bell Heather
Erica tetralix	Crossed leaved heath
Erica vagans	Cornish heath
Eriophorium angustifolium	Common cottongrass
Eriophorum vaginatum	Hare's-tail cotton grass
Caprimnulgus europaeus	European nightjat
Festuca ovina	Sheep's-fescue
Festuca rubra agg.	Red fescue
Filipendula ulmaria	Meadowsweet
Galium saxatile	Heath bedstraw
Gentiana pneumonanthe	Marsh gentiana
Gymnocolea inflata	Notchwort
Holcus lanatus	Yorkshire-fog
Hypnum cupressiforme sens.lat.	Cypress-leaved plait moss
Hypnum jutlandicum	Heath plait moss
*Hypogymnia physodes**	
Iris pseudacorous	Yellow iris
Juncus acutiflorus	Sharp-flowered rush
Juncus bulbosus	Bulbous rush

Juncus effusus	Soft-rush
Juncus squarrosus	Heath rush
*Kurzia pauciflora****	
Lacerta agilis	Sand lizard
*Leucobryum glaucum ***	
*Lophocolea bidentate****	
Luzula multiflora	Heath-wood rush
Melitaea athalia	Heath fritillary
Molinia caerulea	Purple moor grass
Myrica gale	Bog-myrtle
Nardus stricta	Matt-grass
Narthecium ossifragum	Bog Asphodel
*Odontoschisma denudatum****	
Odontoschisma sphagni	Bog-moss flapwort
Pedicularis palustrus	Marsh lousewort
Pedicularis sylvatica	Lousewort
Pinguicula lusitanica	Pale butterwort
Pinus sylvestris	Scots pine
Pleurozium schreberi	Red stemmed feather moss
Pohlia nutans	Nodding thread moss
Polygala serpyllifolia	Heath milkwort
Polygala vulgaris	Common milkwort
Polytrichum juniperinum	Juniper haircap
Potamagen polygoniferous	Bog pond weed

Potentilla erecta	Common cinquefoil
Pseudoscleropodium purum	Feather moss
Pteridium aquilinium	Bracken
Quercus robur	Common oak
*Racomitrium lanuginosum***	
Rhynchospora alba	White beak sedge
Riccardia multifida	Germanderwort
Rubus fruticosus	Blackberry
Rynchospora alba	White beak-sedge
Salix repens	Creeping willow
Schoenus nigricans	Black bog-rush
*Scorpidium scorpioides***	
*Sphagnum auriculatum***	
*Sphagnum compactum***	
Sphagnum cuspidatum **	
*Sphagnum mole***	
*Sphagnum palustra***	
*Sphagnum palustre***	
*Sphagnum papillosum***	
*Sphagnum subnitens***	
*Sphagnum tenellum***	
Succisa pratensis	Devil’s-bit scabious
Syvia undata	Dartford warbler
Trichophorum cespitosum	Deer grass

Ulex europeaus	Gorse
Ulex gallii	Western gorse
Ulex minor	Dwarf gorse
Urtica dioica	Common nettle
Vaccinium myrtillus	Bilberry
Viola lactea	Pale dog violet

Common names for higher plants thus excluding lichens (*), bryophytes (**), liverworts (***)

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Chapter 1 - Introduction

1.1 Lowland heath

Lowland heaths are typically associated with nutrient poor and acidic soils, found at altitudes below 300m. Dry heaths are typically found on free draining soil whereas the drainage on wet heaths is impeded and may contain a layer of peat. Both types of heath are largely dominated by ericoid species. In terms of habitat composition, lowland heaths are typically heterogeneous and all successional stages can be observed from bare ground through to scrub cover with management, largely determining which successional stages are present (JNCC, 2009a).

Lowland heaths are predominantly found across Europe in the following countries: The Netherlands, Belgium, Iceland, Western Norway, Southern Sweden, Denmark, Northern Germany, Poland, Northern France, UK, Ireland, Shetland Islands and the Faeroe Islands (Webb & Haskins, 1980; Webb, 1998; Hjelle, Halvorsen & Overland, 2010). Within the UK, lowland heaths can be found in the following counties: Cornwall, Devon, Dorset, Hampshire, Surrey, Suffolk, Norfolk, Staffordshire, Pembrokshire, West Glamorgan and West Gwynedd (FC, 2015). The area within the UK makeup 20% of Europe's total area of lowland heath (PHCT, 2015). There is approximately 58,000ha of heathland in England (JNCC, 2015a, 2015b), of which, 14,500ha (25% of UK lowland heath) is found in the South West (SW) of England. In East Devon, the Pebblebed Heaths (Figure 1.1) comprise 1,111.9 ha (7.7% of the SW total) (PHCT, 2015) of the UK area.

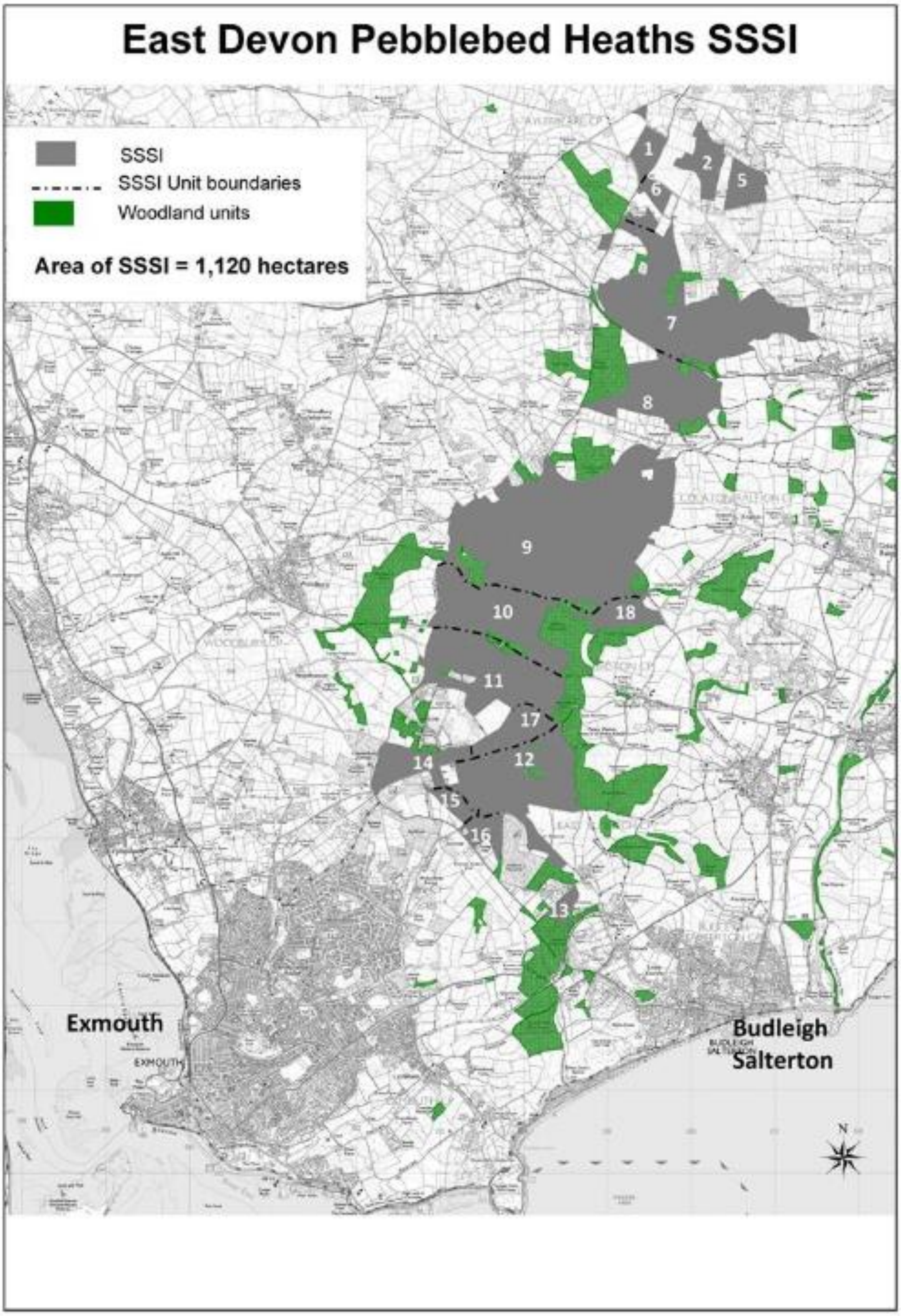

Figure 1.1. The location of the Pebblebed Heaths, East Devon identified as numbered SSSI units (Bridgewater & Kerry, 2016).

The East Devon Pebblebed heaths are comprised of multiple areas (Figure 1.1), associated with historical areas of common land and local parishes. This research project was located on Bicton Common (Figure 1.2), an area covering 132.68 ha (NE, 2015a, 2015b).

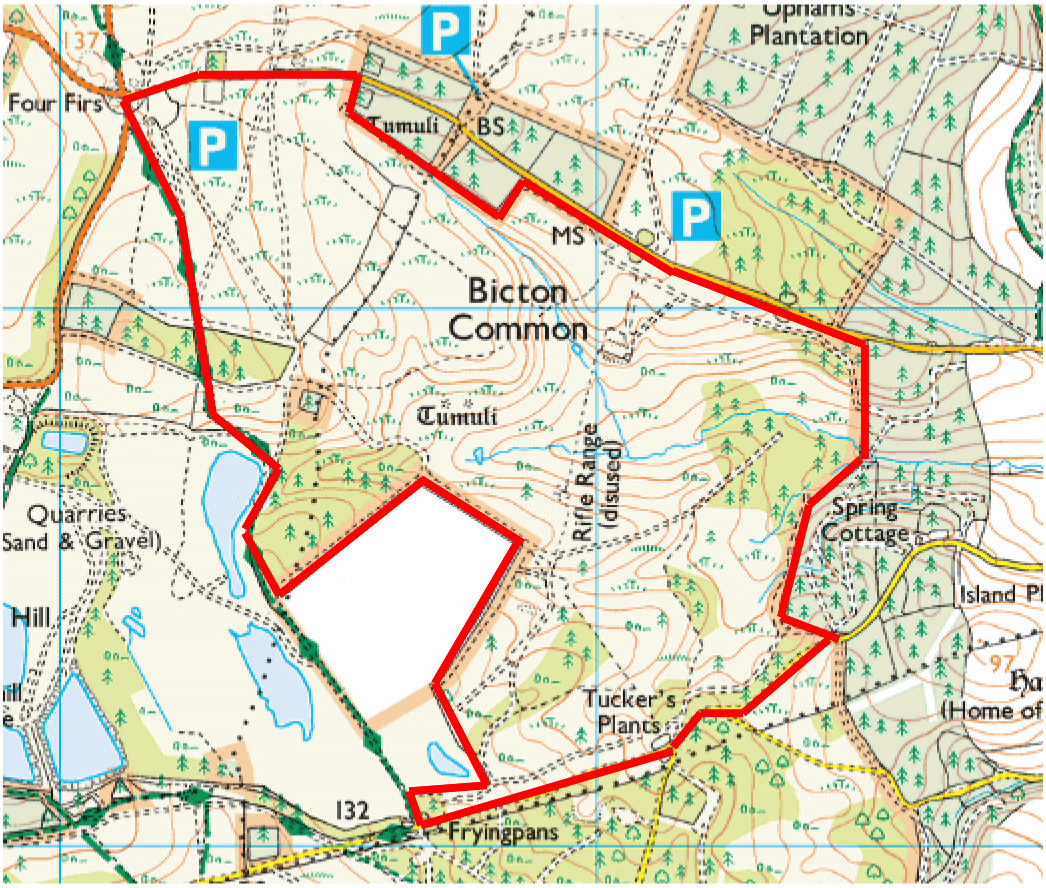

Figure 1.2 Ordinance survey map of the sampling area, Bicton Common. The red line denotes a stock proof fence circumscribing the study area.

The vegetation of Bicton Common has been mapped by Kerry (2014) using the National Vegetative Classification (NVC) system (JNCC, 2009b) (Figure 1.3) with the following vegetation types present: Northern Atlantic Wet heath *Erica tetralix-Sphagnum compactum* (M16); European Dry heaths, characterised by H4, *Ullex gallii-Agrostis curtisii* vegetation which also includes the presence of *Calluna vulgaris*, *Erica cinerea*, *Molinia caerulea*, *Erica tetralix* and *Potentilla erecta* (JNCC, 2015c). Other notable habitats include *Schoenus-Narthecium* mire (M14) and *Narthecium-Sphagnum papillosum* mire (M21) (Bridgewater & Kerry, 2016).

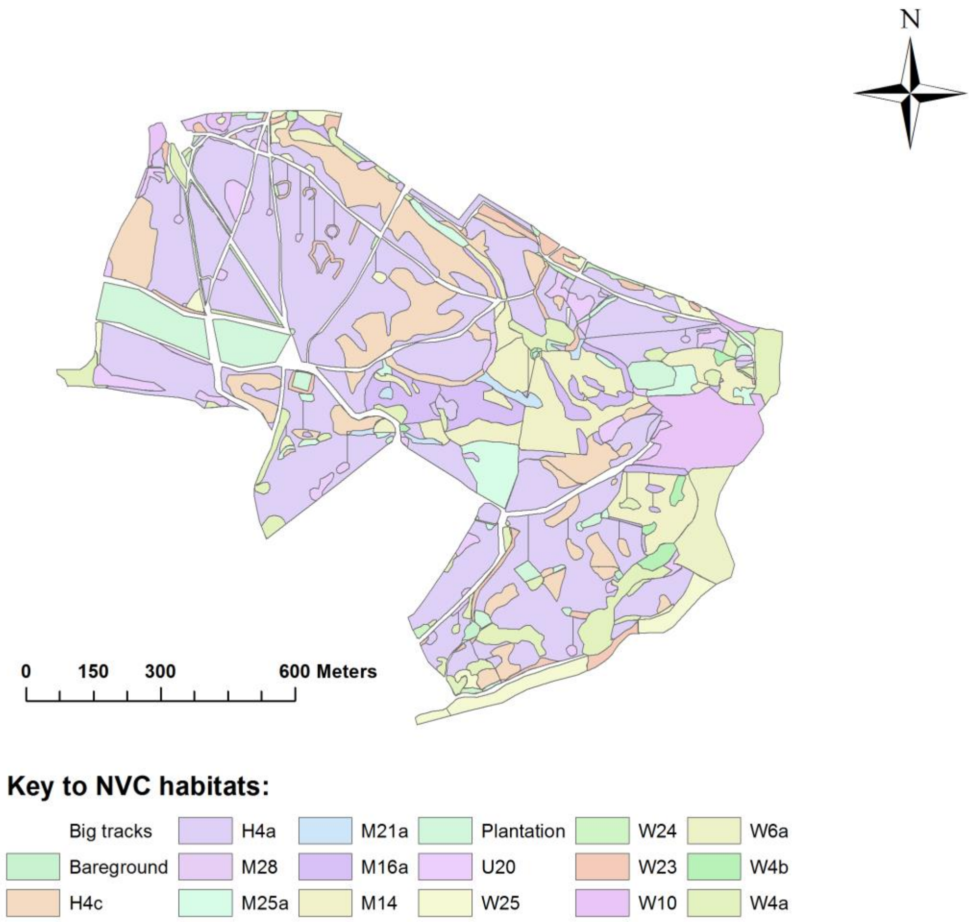

Figure 1.3 NVC habitat map of the study area, Bicton Common (Kerry, 2014).

1.2 The importance of lowland heath

Lowland heath is of high conservation value due to the rarity of the habitats and species supported. It is classified as a priority Annex I habitat because it provides habitats for Annex II designated species (JNCC, 2015d) such as Sand lizard (*Lacerta agilis*), European Nightjar, (*Caprimulgus europaeus*), Dartford Warbler (*Sylvia undata*), Marsh gentian (*Gentiana pneumonanthe*), Southern damselfly (*Coenagrion mercurial*) and Heath fritillary (*Melitaea athalia*) (Burgess, Evans & Sorensen, 1990; EN, 2002, 2005a; Biodiversity Reporting & Information Group, 2007; Tubbs, 1974; Webb and Haskins, 1980). The ecological importance of lowland heath is reflected in the status designations afforded to many sites which include: Site of Special Scientific Interest (SSSI), Areas of Special Scientific Interest (Ireland) ASSI, Special Area of Conservation (SAC) and Special Protection Area (SPA) (JNCC, 2015e) of which the latter two are European designations under the EU Habitat Directive. Any lowland heath that has been granted SAC or SPA status becomes part of the Natura 2000 EU network (JNCC, 2009a; EC, 2015).

With regards to the East Devon Pebblebed Heaths, they were formally designated as Sites of Special Scientific Interest (SSSI) between 1952-1986; as an Area of Outstanding Natural Beauty in 1963; Special Area of Conservation (SAC) and Special Protected Area (SPA) in 1996 (Pebblebed Heath Conservation Trust, 2015). The SAC status was awarded due to the presence of Annex I designated habitats: North Atlantic wet heath and dry heaths and having populations of the Annex II species, Southern damselfly (*Coenagrion mercurial*). The SPA status was awarded due to supporting 8% of the breeding populations of European Nightjar, (*Caprimulgus europaeus*), and 2.4% of the breeding populations of Dartford Warbler (*Sylvia undata*) (JNCC, 2015e, 2015f, 2015g; Bridegewater & Kerry, 2016), of which at the time of designation, were considered stable populations (PHCT, 2015).

1.3 The condition of lowland heath

The condition of lowland heath SSSI are assessed by Natural England (NE), using the Common Standards Monitoring Guidance for Lowland Heathland Habitats (JNCC, 2004). The standardised categories include the following: favourable; unfavourable recovering; unfavourable no change; unfavourable no change; part destroyed; destroyed (NE, 2012; 2015c) (Table 1.1) which relate to specific features and associated targets of a habitat (Tables 1.2 & 1.3).

Table 1.1 Terminology and appropriate definitions used when assessing the condition of SSSIs (NE, 2012).

Condition	Definition
Favourable maintained	Feature in a favourable condition with no change recorded from previous assessment
Favourable recovered	The previous condition was unfavourable but current condition is favourable
Unfavourable recovering	Appropriate management practices are being carried out but one or more targets have not been achieved.
Unfavourable no change	Appropriate management practices are not being carried out but feature does not seem to be deteriorating
Unfavourable declining	Appropriate management practices are not being carried out but feature is deteriorating
Partially destroyed	Part of the feature has either been removed or altered
Destroyed	The whole feature has been removed or altered beyond recovery

Table 1.2 Summary of lowland dry heath features and associated conservation objectives as stated within the Common Standards Monitoring Guidence for lowland heathland (JNCC, 2004).

Feature	Target
Habitat extent (ha)	No decline in area of the habitat unless there is a target to increase the area of another habitat
Bare ground (%)	Between 1-10% cover. The feature should be firm, exposed to sunlight, sunlit, horizontal/sloping/vertical
Vegetation structure: % cover of dwarf shrubs	Between 25-90% cover
Vegetation structure: % cover of *Ulex spp.*	Total cover: *Ulex* and/or *Genista spp*. <50%; *Ulex europaeus* <25%.
Vegetation structure: growth phase composition of ericaceous cover	Total cover: Pioneer/pseudo-pioneer phase between 10-40%; Building/mature phase between 20-80%; Degenerate phase <30%; Dead: <10%
Vegetation composition: dwarf shrubs	At least two species both present and at least frequently abundant.
Vegetation composition: graminoids	At least one species, at least frequent; Two species at least occasional; *Deschampsia flexuosa* and *Nardus stricta* no more than occasional and <25% cover
Vegetation composition: desirable forbs	At least 2 species, at least occasionally abundant
Vegetation composition: bryophytes and lichens	Percentage cover to be maintained or increased
Negative indicators: signs of disturbance	Less than 1% of habitat heavily eroded.
Negative indicators: Species	Exotic species less than 1%; Ragwort, nettle, thistles and other herbaceous spp less than 1%; Trees & scrub less than 15%; Bracken less than 10% dense canopy form);

	Acrocarpous mosses less than occasional

Table 1.3 Summary of lowland wet heath features and associated conservation objectives as stated within the Common Standards Monitoring Guidence for lowland heathland (JNCC, 2004).

Feature	Target
Habitat extent (ha)	No decline in area of the habitat unless there is a target to increase the area of another habitat
Bare ground (%)	Between 1-10% cover. The feature should be muddy and exposed.
Vegetation structure: % cover of dwarf shrubs	Between 25-90% cover
Vegetation structure: growth phase composition for ericaceous spp.	Presence of heather in all stages of growth
Vegetation composition: dwarf shrubs	At least two species both present and at least frequently abundant.
Vegetation composition: graminoids	At least one species, at least frequent; Two species at least occasional;
Vegetation composition: desirable forbs	At least 2 species, at least occasionally abundant
Vegetation composition: bryophytes and lichens	Total cover: *Sphagna* (if naturally present) greater than 10%; Lichens (if naturally present) greater than 5%
Negative indicators: signs of disturbance	No artificial functioning drains; Trampling/paths less than 1%; No silt or leachate
Negative indicators: Species	Exotic species less than 1%; Ragwort, nettle, thistles and other herbaceous spp less than 1%; Trees & scrub less than 15%;

	Bracken less than 5% dense canopy form); *Ulex europaeus* less than 10% *Acrocarpous* mosses less than occasional

The condition of England's SSSI and SACs are far from healthy, as only 17% of the former sites are favourable with 47% of such sites being considered as unfavourable recovering. Similar values are the case for SACs, whereby 21% of sites are considered favourable with 43% of such sites being of unfavourable recovery (JNCC, 2015b). Nationally, the European dry heaths are most at risk, as 66% of this habitat has been assessed as being unfavourable and not recovering. The Northern Atlantic wet heaths, however, are faring a little better with 21% of these habitats being favourable, and the percentage of unfavourable recovering wet heath being of intermediate value (51%) between the other 2 habitats (JNCC, 2015b). This UK trend observed amongst Northern Atlantic wet heaths is reflected on Bicton Common.

The areas of wet heath and mire, on Bicton Common, are classified as being in favourable condition (NE, 2015a, 2015b; PHCT, 2015). However, in contrast, the dry heath, are considered to be in unfavourable recovery. The key reasons for failure was the amount of bare ground across the SSSI unit, the uneven diversity of age structure and the lack of forb diversity. An additional issue of concern is the dominance of *M. caerulea* (NE, 2015a, 2015b; Bridgewater & Kerry, 2016). This species forms tussocks or swards and is a widespread perennial grass found throughout Europe and the UK. Although, seed formation and dispersal can account for the distribution of *M. caerulea*, the species can also propagate vegetatively which enables it to be a successful competitor and thus, a dominant species (Taylor, Rowland & Jones, 2001) resulting in poor species diversity on Bicton Common (NE, 2015a, 2015b).

1.4 The decline of lowland heath

According to the Joint National Conservation Committee (JNCC), only one sixth of the lowland heath present in 1800 now remains in the UK equating to an approximate 72% decline (PHCT, 2015). Within the UK, there are approximately 25,000 ha of Northern Atlantic Wet Heath, of which 127 ha are found on the East Devon Pebblebed Heaths. In contrast, there are 320, 000 ha of European Dry heath within the UK, of which 635 ha can be found on The East Devon Pebblebed Heaths (JNCC, 2015a; Bridgewater & Kerry, 2016). Since 1800 the area of lowland heath, in the UK, has decreased by 3179 $km^{2,}$ at a rate of 15.9 km^2 per year (EN, 2002).

There has been a decline of 30% in the area of the Pebblebed heaths since 1906 (PHCT, 2015c). The reasons for the decline in lowland heath can be attributed to many factors: habitat fragmentation (Webb & Vermaat, 1990; Fagúndez, 2013) and destruction (Fagúndez, 2013), changes in land use of which are linked to less grazing, afforestation, quarrying (Marrs, Hicks & Fuller, 1986) and peat cutting (Webb & Vermaat, 1990); natural succession and lack of management (Webb & Vermaat, 1990; Fagúndez, 2013), pollution (Fagúndez, 2013) in the form of nitrogen deposition (Strandberg *et al*., 2012) and invasive vegetative species (Bokdam & Gleichman, 2000; Fagúndez, 2013). With regards to invasive species, *M. caerulea* is considered to be a natural part of the heathland vegetation however, it can also encroach across lowland heath.

The encroachment of *M. caerulea* is sometimes associated with nitrogen deposition from aerial pollution or, through frequent fires thought to be partially responsible for the decrease in the dwarf ericaceous shrub component of typical heath vegetation (Milligen *et al*., 2004). *M. caerulea* has been found to outcompete Cross-leaved heath (*E. tetralix*) (Bokdam & Gleichman, 2000) and along with Wavy Hair-grass (*D. flexuosa*) has succeeded Heather (*C. vulgaris*) and *E. tetralix* in some lowland heath locations, thus reducing plant diversity (Stace, 2010). Such studies are significant because the reduction in biodiversity, as a result of this invasive grass, is one of the main reasons why the dry heath habitat, on Bicton Common is in an unfavourable recovering condition (Bridgewater & Kerry, 2016). Lowland heath is considered to be a cultural landscape created and maintained by management practices. The available literature widely supports the theory of succession within lowland heath which, in the absence of any type of management, reverts to scrub and ultimately woodland. This can take as little as 30 years, which is important when considering management strategies to protect against further habitat loss (Tubbs, 1974; Harrison, 1976; Marrs, Hicks & Fuller, 1986; Mitchell *et al*., 1997; Marrs & Britton, 2000).

The PHCT set out its 10 year management plan in 2015, based on condition assessments carried out by Natural England (2002-2008) (Bridgewater & Kerry, 2016). Within the 10 year management plan, it confirms that Bicton Common is in an unfavourable recovering condition, whilst stating the primary aim of facilitating and maintaining the favourable recovery of each heath area by 2020 based on the conservation objectives set by NE (Table 1.4) (Underhill-Day, 2009). In order to achieve the objective of favourable recovery, the Trust values the need for rigorous biological monitoring which are used to inform management practises. In particular, the Trust supports the suggestion that grazing would be beneficial for the recovery of the dry heath (NE, 2015a, 2015b).

Table 1.4 Summary of the vegetative conservation objectives required for Bicton Common, based on condition assessment carried out by NE (2002-2008), which relate to the NVC habitats surveyed during this thesis research (Underhill-Day, 2009).

Conservation objective of maintaining the following habitats:
• Current areas of wet and dry heath • Current areas of H4 dry heath & continue to keep dwarf shrubs in favourable condition • Current area of M14 and M21, within the mire & continue to keep in favourable condition • Current area of M16 within the wet heath & continue to keep in favourable condition • Current populations of Annex II species: *C. europaeus, S. undata & C. mercuriale*

1.5 Aims and objectives of this study

The main aim of this research thesis is to assess the impact of grazing on three sites focusing on Bicton Common, an East Devon Pebblebed Heath: dry heath (DH), wet heath (WH), mire (M) on lowland heath in relation to a control plot containing both dry heath (CDH) and a mosaic habitat (CMo) which is comprised of dry heath and mire communities. To ensure that clear understanding of the impact is fully appreciated, a few other smaller studies were carried out either prior or during the time frame of the research.

The objectives of these smaller studies are:

1. To construct a methodological protocol that will be trialled as a short term study with a view for it to be used as part of a long term study to measure the impact of grazing. The protocol will provide a standardised approach which can then be adopted by other researchers.

2. To investigate the baseline vegetative conditions of the three sites prior to the introduction of grazing in order to confirm existing NVC habitat categories and vegetation structure.

3. To identify the Home Ranges (HR), habitat preferences, grazing behaviour and grazing impact of introduced animals (pony and cattle) within Bicton Common using GPS collar on lead animals. A semi structured interview with the Senior Warden, an experienced grazier, will supplement the data used to assess the impact of grazing.

Chapter 2 - Baseline study of vegetation

2.1 Introduction

2.1.1 The importance of baseline vegetative data

It is widely supported that the collection of baseline data is crucial when taking a science based approach to monitoring habitats and identifying any changes in species abundance and distribution (Marrs & Britton, 2000; Stewart, Coles & Pullin, 2005; Newton *et al*., 2009). Through the use of interviews and meta analysis, Stewart, Coles and Pullin, (2005) identified that an evidence based approach is predominantly lacking in conservation biology. In agreement, Newton *et al*., (2009) carried out a systematic review of published literature documenting the management of lowland heath of which, the emphasis was placed on the management practices of grazing, cutting, burning and mowing. Surprisingly, out of 3608 references identified, through bibliographical database and web based searches, only 7.4% of such studies were found to be relevant. One of the main conclusions drawn by Newton *et al*., (2009) is that the diverse range of methodologies used by scientists has contributed to the studies being effectively non-comparative. Taking just four grazing studies of lowland heath (Bullock & Pakeman, 1997; Vandvik *et al*., 2005; Måren, Vandvik & Ekelund, 2008; Mandaluniz, Aldezabal & Oregui, 2011) and summarising for comparison (Table 2.1), it is clear that Newton *et al*., (2009) have made a valid point. All four studies differ in terms of the following aspects: length of study; collection of baseline data; site location, area (m^2) and number of sites; quadrat area (m^2) and sample size; type of vegetative data recorded; the use of a control plot.

Table 2.1 Summary of methodological approaches (aims and length of study; site description; type of vegetative sampling and use of a control plot) used within four research studies (Bullock & Pakeman, 1997; Vandvik *et al*., 2005; Måren, Vandvik & Ekelund, 2008; Mandaluniz, Aldezabal & Oregui, 2011).

Authors	Aims and length of study	Methdology			
		Sites	Sample size	Vegetative sampling	Control plot
Bullock & Pakeman, 1997	The comparison of management techniques in relation to the impact on vegetation (percentage cover and species richness). Carried out for one year.	Five heathland sites, subjected to different management techniques: long term grazing; recently introduced grazing; burning with grazing; cutting with grazing.	Five $2m^2$ quadrats in three sites; five-fifteen $1m^2$ quadrats in two other sites	Percentage cover of both vegetation and bare ground. Sampling carried out in two or three vegetative layers.	No control plot included. All sites had been subjected to the same management technique for at 20 years prior to the study.
Vandvik *et al*., 2005	To investigate the aspects of fire, grazing and habitat on species composition and diversity within coastal	Two areas: grazed and ungrazed within which 12 experimental plots ($100m^2$) were sited.	Five permanent $1m^2$ quadrats sited within each experimental plot	Frequencies of all vascular plants, bryophytes and lichens	Control plots were not set up prior to their burning schedule therefore, they compensated for this by sampling in a site

	heathland. Carried out for six years.			Baseline data collected in 1993, the sites were burnt in 1994, and further vegetative sampling was carried out in 1995-1998.	of similar slope, aspect and close to the site of burning
Måren, Vandvik & Ekelund, 2008	Investigating the impact on species composition and diversity by different mechanical and herbicide treatments within a mosaic heathland. Carried out for 7 years.	Two sites: invaded (A) and not invaded by bracken (B)	Site A: four plots (25 m^2) x five treatments; Site B: 4 plots (25 m^2) x four treatments. Three 0.5 m^2 permanent quadrats per plot.	Percentage cover data Baseline and environmental parameters were collected prior to treatment. Subsequent vegetative data was collected for 6 years.	Control plots: those containing bracken and those that did not, for each treatment carried out.
Mandaluniz, Aldezabal & Oregui, 2011	Investigating the diet selection of cattle in two Atlantic grassland-	Two grazed areas.	Five – ten 20m linear transects per area. Intercepts	Categorised the vegetation intercepted into the following	Did not set up a control plot.

	heathland mosaic site. Carried out for one year, sampled four times.		every 20cm along transect.	categories: graminoids, forbs, heather, gorse and ferns	

The differences between these four studies highlight the main recommendations put forward by Newton *et al*., (2009) in which they state that any future study requires replicate data; a suitable time scale (27 months plus); suitable spatial and temporal scales; robust measure of abundance; baseline data of which, exact community types are ascertained and the use of control plots. The incorporation of base line data into a study is important because it is involves the statistical testing of data against data from the same sampling site, post management practice in order to identify any changes. The need to devise a rigorous and robust methodology, as described by Newton et al., (2009), is a crucial component to this thesis research of which, will help to assess the impact on heathland vegetation, located on Bicton Common by grazing animals.

2.1.2 The decision to graze Bicton Common

NE carried out a condition assessment of the SSSI units that cover The Pebblebed Heaths between 2002-2008, in which it was found that only 0.03% was considered in a favourable condition in contrast to 93.89% unfavourable-recovering and 6.08% unfavourable-declining (Underhill-Day, 2009; JNCC, 2015a). The significance of these statistics meant that heath management plans will need to focus on returning the plant communities back into favourable condition, as included within the conservation objectives, stated by NE (Underhill-Day, 2009). In response to NE, an appraisal of suitable management options was commissioned by the PHCT of which grazing was selected as an appropriate way to manage Bicton Common (Bridgewater & Kerry, 2016). After a public consultation in 2011 and planning permission obtained in 2012, the permanent enclosure of Bicton Common was carried out in 2014 (Bridgewater & Kerry, 2016) with the aim of releasing grazing animals in 2015. An NVC mapping survey (Kerry, 2014) was carried out to provide a baseline NVC map, prior to grazing and the start of this research thesis from which sampling sites were later selected to obtain baseline data of species composition and abundance.

2.1.3 Aims and objectives

The first aim of this research was to devise a methodological protocol that could be used in a short term study in order to be used as part of a longer term study to assess the impact of grazing on the three sites: dry heath (DH), mire (M) and wet heath (WH) relative to the two control sites: control dry heath (CDH) and control mosaic (CMo). The second aim was to identify the baseline vegetative conditions of the five sites prior to the introduction of grazing. The two aims were achieved through the following objectives:

1. To use the recommendations suggested by Newton *et al.*, (2009) to devise a methodological protocol of which was used to collect biannual baseline vegetative data and then later, data biannually from both the three sites and two control sites, post grazing for two years.

2. To assign the vegetative data collected from the five sites a frequency of species class and a DOMIN cover value which was then assessed against the NVC floristic tables (JNCC, 2009b) to identify whether they were floristically unique or, typical of the NVC habitats.

2.2 Materials and Method

2.2.1 Sampling site

The study area is heterogeneous in terms of habitat composition and distribution (Figure 2.1 & Table 2.2). The dry heath (H4) typically dominates on the raised areas and upper slopes with the wet heath transitioning into mire along the valley bottoms due to impeded drainage. The collection of biannual baseline (BL) vegetative data, prior to the introduction of grazing animals, was carried out in 2014, across three sites, identified in March 2014 as: *Ulex gallii-Agrostis curtisii* heath (European dry heath (DH)), *Erica tetralix-Sphagnum compactum* (North Atlantic wet heath (WH)) and *Schoenus nigricans – Narthecium ossifragum* mire (M) (Figure 2.1). This would later be used to compare against data from these three sites, for two consecutive grazing years (2015 (GY1); 2016 (GY2)), to look for changes in the percentage cover of species, biodiversity and even whether the sites have become less typical of the initial NVC habitats identified through this study.

The control plot, surrounded by a stock proof fence was set up in 2015, prior to grazing, on a north east facing slope and was sampled at two sites: *Ulex gallii-Agrostis curtisii* heath (European dry heath (CDH)) and a mosaic site (CMo) of which was predominantly comprised of *Schoenus nigricans-Narthecium ossifragum* mire and transitional *Ulex gallii-Agrostis curtisii* heath. The intention of the control plot was to have an area that would never be grazed and so the biannual data collected, over the course of this thesis research could be compared against the BL, GY1 and GY2 data collected from the three no-control sites and thus used to discuss the impact of grazing (Chapter 4). For the purpose of the rest of this study, the classification of habitat types will follow the NVC classification of habitats, on Bicton Common, as laid out by Kerry (2014).

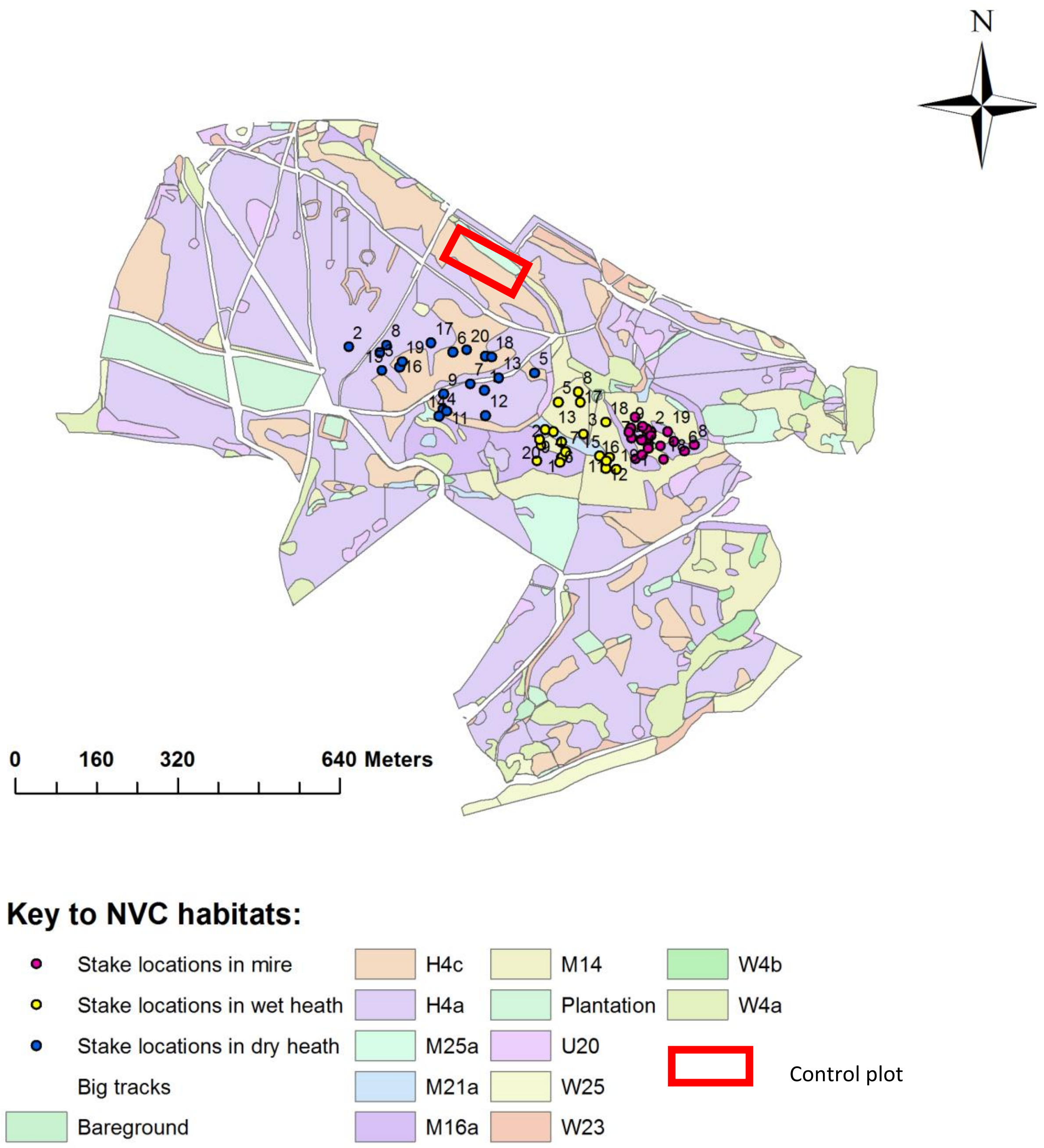

Figure 2.1 The locations of the control plot, sampling sites (dry heath, mire and wet heath), permenant stakes within the study area, Bicton Common, in relation to the NVC habitat map created by Kerry (2014).

Table 2.2 List of NVC habitats identified on Bicton Common by Kerry (2014).

NVC Classification	NVC Habitat
H4a	*Ulex gallii-Agrostis curtisii* heath *Agrostis curtisii-Erica cinerea* sub-community
H4c	*Ulex gallii-Agrostis curtisii* heath *Erica tetralix* sub-community
M14	*Schoenus nigricans-Narthecium ossifragum* mire
M16a	*Erica tetralix-Sphagnum compactum* Typical sub-community
M21a	*Narthecium ossifragum-Sphagnum papillosum* valley mire *Rynchospora alba-Sphagnum auriculatum* sub-community
M25a	*Molinia caerulea-Potentilla erecta* mire *Erica tetralix* sub-community
M28	*Iris pseudacorus-Filipendula ulmaria* mire
W4a	*Betula pubescens-Molinia caerulea* woodland *Dryopteris dilatata-Rubus fruticosus* sub-community
W4b	*Betula pubescens-Molinia caerulea* woodland *Juncus effusus* sub-community
W6	*Alnus glutinosa-Urtica dioica* woodland
W10	*Quercus robur-Pteridium aquilinum-Rubus fruticose* woodland
W23	*Ulex Europeaus-Rubus fruticose* scrub
W24	*Rubus fruticosa-Holcus lanatus* underscrub
W25	*Pteridium aquilinium-Rubus fructicosa* underscrub
U20	*Pteridium aquilinium-Galium saxatile* community
Plantation	

The underlying bedrock of the area is of sandstone pebbles which were formed 240 million years ago, during the Triassic period (Cooper, 2007). The soil of the Pebblebed heaths has a sandy loam profile which is free draining and is typical of lowland heath by being acidic and low in nutrients (Underhill-Day, 2009). Bicton Common is situated within the South West which is a region that on average experiences mean temperatures between 11-12°C, 1600 hours of sunshine and between 900-1000mm of rainfall annually (Met Office, 2018a).

A stratified sampling method was adopted, based on Newton *et al*., (2009), in which twenty 1m tall metal stakes were positioned randomly within each site. The global positioning system (GPS) location of each stake was recorded using a GARMIN eTrex® 10 device. All stakes have been left in place indefinitely (Figures 2.2-2.4). The quadrats within the DH site were situated between 94.6-120.3m asl. The DH is situated on a southern slope that transitions into the wet heath site, whereby the quadrats within this site fall between 70.3-87.9m asl. The WH gently levels off and transitions into the M site, with quadrats located between 67.2-78.1m asl. The CDH and CMo was situated on a north easterly slope with quadrats within the CDH located between 101-109m and between 98-99m within the CMo.

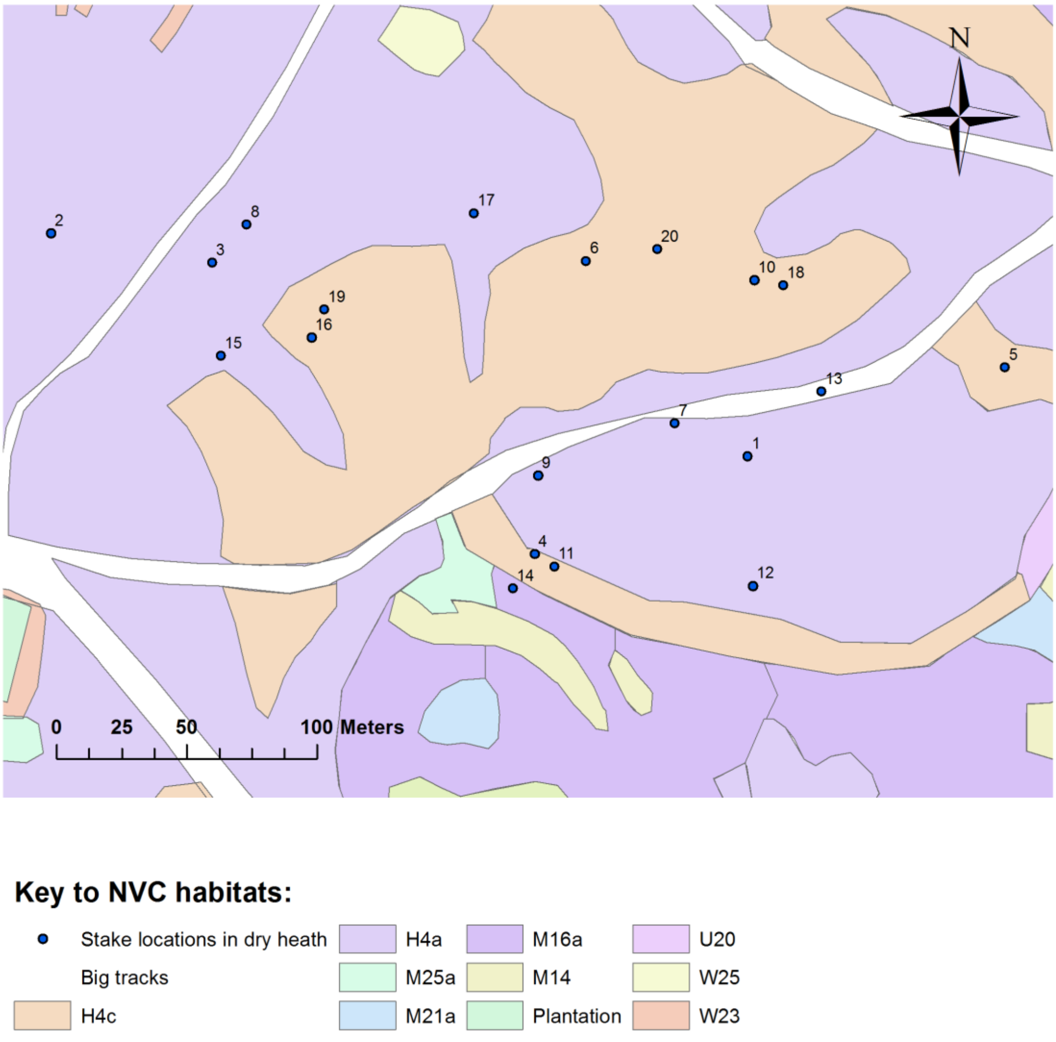

Figure 2.2 The location of 20 stakes positioned within the DH, Bicton Common, in relation to the NVC map created by Kerry (2014).

**Although quadrat 13 is depicted as being located along a main track, it is indeed located within H4a vegetation.

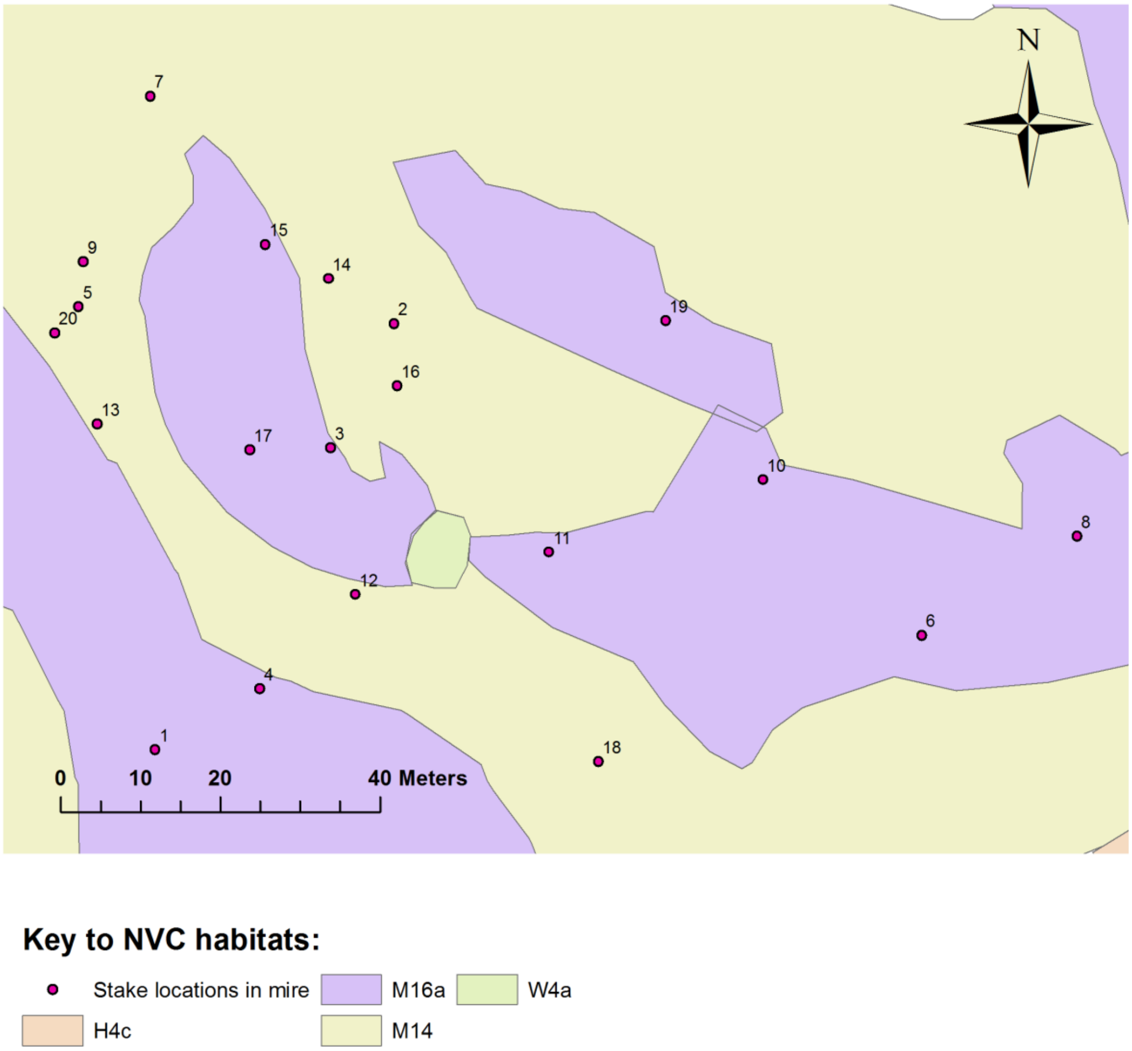

Figure 2.3 The location of 20 stakes positioned within the M site, Bicton Common, in relation to the NVC map created by Kerry (2014).

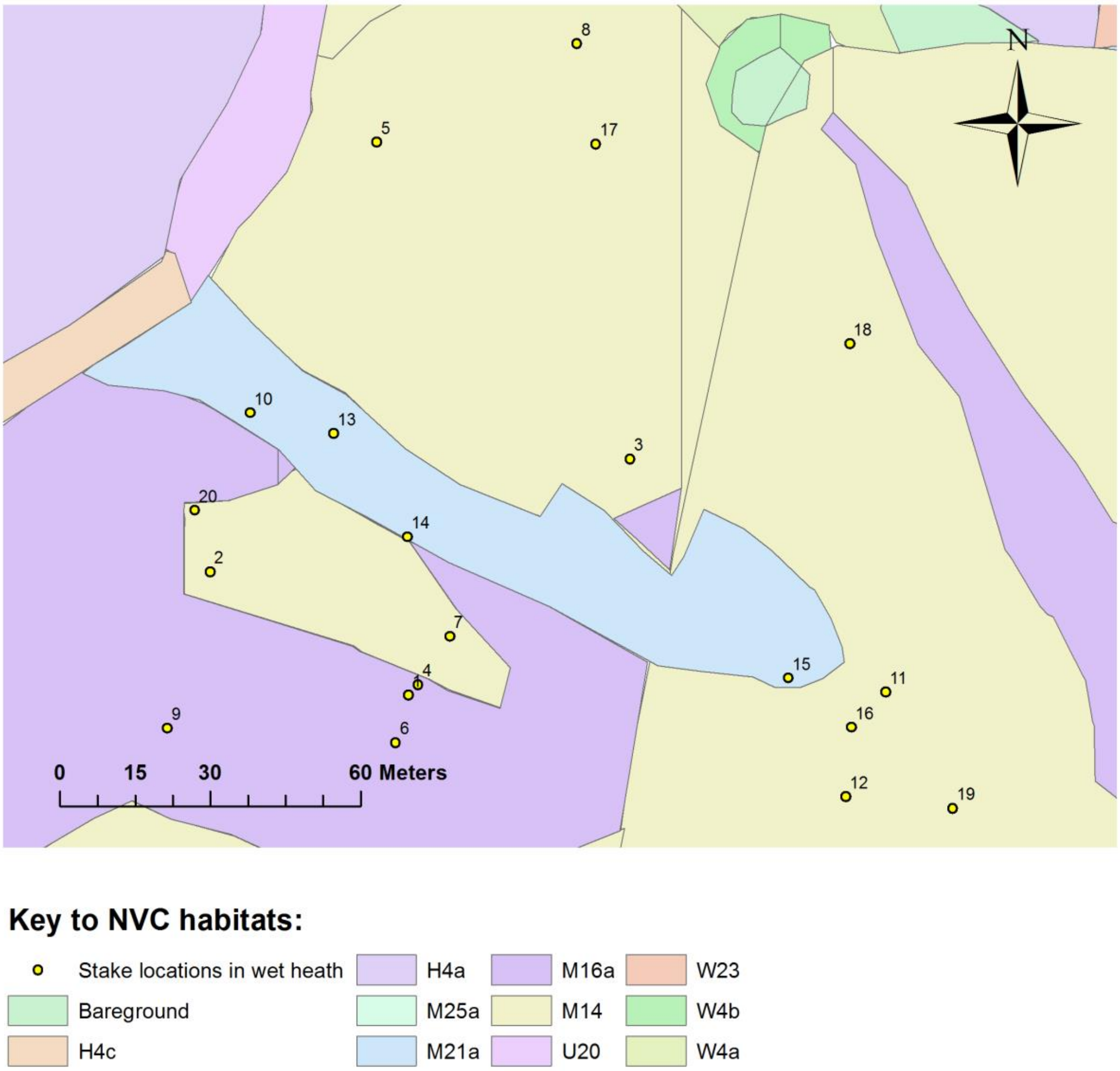

Figure 2.4 The location of 20 stakes positioned within the WH, Bicton Common, in relation to the NVC map created by Kerry (2014).

Figs. 2.2-2.4 were used to identify the specific NVC habitats, located at each stake position, of which two NVC communities were identified within each site (Table 2.3). In the case of quadrat 14, located in the WH, it was difficult to identify one single NVC habitat from Figure 2.4 therefore, this quadrat has been categorised as being located between both habitats.

Table 2.3 Specific NVC habitats associated within each site and the distribution of the permanent quadrats within each habitat.

	NVC Habitats and distribution of permanent quadrats				
Site	**H4a**	**H4c**	**M14**	**M16a**	**M21a**
Dry heath	1-3, 7-9, 12, 13, 15, 17 (n=10)	4-6, 10-11, 16, 18-20 (n=9)	*	14 (n=1)	*
Mire	*	*	2, 5, 7, 9, 12, 13, 14, 16, 18, 20 (n=10)	1, 3, 4, 6, 8, 10, 11, 15, 17, 19 (n=10)	*
Wet heath **	*	*	2, 3, 5, 7-8, 11-12, 16-20 (n= 12)	1, 4, 6, 9 (n=4)	10, 13, 14, 15 (n=4)

**Quadrat 14 – M14/M16a

A collapsible 2m x 2m quadrat was used as a sampling unit, within which, the percentage cover, of each species present was recorded. Vegetative layers often overlapped therefore, the percentage cover value was often >100%, as was the case with vegetative data collected by Bullock and Pakemen (1997). A definitive list of all species recorded in each of the five sites was constructed. The percentage cover of surface soil and water was also noted as any changes may influence the percentage cover of species and biodiversity. As an example, an increase in soil cover may provide space for additional species to establish and thus, increase biodiversity or, provide an opportunity for an already established species to increase its cover. In contrast, any increase in water cover may have the opposite effect by changing the abiotic conditions that make the sampling site less favourable for existing species thus reflected by a decrease in percentage cover and/or biodiversity. In addition, the sward height of 20 random *M. caerulea* (Purple Moor grass) leaves were recorded in each quadrat. This will provide BL data from which to compare against the grazed data sets to assess the impact of the animals. Vegetative data were collected twice during 2014: June and October. The June survey effort ensured that maximum species diversity would be recorded whereas the October effort would be used to identify any seasonal changes between the species data through the comparison of the June and October data sets. Field work was carried out, during daylight hours, between 7th and 28th June; 18th and 26th October. When sampling, the metal stake was always positioned in the bottom left corner. Each quadrat was set up to face in a NW direction, using a Silva Explorer 203 compass.

The nomenclature used to identify plant species included: trees (Johnson, 2006; Stace, 2010), wildflowers (Rose & O'Reilly, 2006; Stace, 2010), grasses (Hubbard, 1984; Stace, 2010), sedges (Jermy *et al*., 2007; Stace, 2010), rushes (Stace, 2010), lichens (Dobson, 2000), bryophytes (Atherton, Bosanquent & Lawley, 2010). Additional guidance for the identification of vascular plants was also given by Dr Sam Bridgewater and Lesley Kerry. For professional identification of bryophytes and lichens, samples were sent to Mark Pool, Regional Recorder for the British Bryological Society and Barbara Benfield, 1st Referee, The British Lichen Society. Within this thesis, Latin names are initially stated in full and thereafter, species are referred to by their abbreviated Latin forms. A full list of Latin and common names can be found on page xi-xvi.

2.2.2 Data analysis

The raw percentage cover of each species, recorded during the June survey effort, was used to calculate a mean percentage cover of each species per NVC habitat type (NVC H4a, H4c, M14 & M16a). The mean percentage cover was assigned a frequency of species class and a DOMIN cover value which was then assessed against the species listed within the NVC floristic tables (JNCC, 2009) to identify whether the NVC habitats on Bicton Common were floristically unique or, typical. In order for a NVC habitat on Bicton Common to be deemed typical of the NVC system only those species grouped within the JNCC floristic tables that had a frequency class value of IV or V were compared to the same species recorded on Bicton Common. If the frequency classes of species recorded from the June BL data effort was the same/very similar then it was concluded that the sampled NVC habitat was typical of the NVC system. The DOMIN scale was not used for comparison as it documented that those species with relatively high frequency classes may indeed have relatively lower abundance values (JNCC, 2009b) and therefore, may not be a good indicator of whether a habitat is typical or otherwise.

Minitab 18 was used to statistically analyse the raw June BL data collected from the three sites for the following factors: percentage cover of eight species most abundantly found (Table 2.4); water and soil percentage cover; sward height of *M. caerulea*. The BL data sets for June and October, 2014 were analysed for seasonal variation. The same type of data was collected from the two control sites and analysed in the same way as for the BL data with the exception of the percentage cover for *E. angustifolium*, as this species was not recorded within the control sites.

The methodology for collecting the dependent data for each species/substrate/sward height ensured that each sample has been selected at random and were independent of each other. The data collected was checked to identify whether the data was normally distributed using the Anderson-Darling normality test and whether the variences were equal/homogenous. If the data was not normally distributed then the distribution of residuals were checked for normal distribution using the same test. For any data that was identified as not being normally distributed, attempts were made to see if the data set could be transformed using the Identification Distribution Function. For data sets that either displayed normal distribution or could be transformed were further analysed using the ANOVA General Linear Model with any significant differences between data further analysed using Tukey's pairwise comparison at both 95 and 99% Confidence Intervals ($P = 0.05$ & $P = 0.001$). All other data that did not meet the assumptions of normal distribution, equal variences and which could not be suitably transformed, required for ANOVA, were analysed using the Kruskal-Wallis non-parametric test. The main difference between both types of statistical test is the type of output data presented. In the case of the Kruskal-Wallis test, median values are involved whereas for the ANOVA General Linear Model, means are calculated. Within the results section and the subsequent discussions, both the medians and means are used. Further to the reporting of median values post non-parametric testing, means have also been used as statistcally, are they provide an indication of a mathematical average rather than the mid point of data. Microsoft Excel was used to calculate a mean Shannon Weiner diversity index for each site during each month. The mean (± SE) biodiversity values were then compared.

Table 2.4 A list of the most abundantly recorded species within the five sites (DH, M, WH, CDH & CMo).

Species	**Common name**
Calluna vulgaris	Heather
Erica tetralix	Crossed-leaved Heath
Molinia caerulea	Purple moor grass
Ulex gallii	Western Gorse
Erica cinerea	Bell Heather
Narthecium ossifragum	Bog Asphodel
Eriophorium angustifolium	Common Cottongrass
Sphagnum subnitens	***

***Common names not used for bryophytes

2.3. Results

2.3.1 NVC habitats

2.3.1.1 Dry Heath

The comparison between the typical NVC H4a (JNCC, 2009b) and the NVC H4a habitat located within the DH site highlights the presence of the five main species on Bicton Common: *Ulex gallii*, *Agrostis curtisii*, *Calluna vulgaris*, *Molinia caerulea*, *Ulex gallii* and *Erica cinerea* (Table 2.5). *U. gallii*, *M. caerulea* and *E. cinerea* had the same species constancy value to that of the JNCC (2009b) floristic table data therefore, it can be considered that H4a, DH is typical of the NVC H4a.

Table 2.5 A comparison between the species identified, species constancy value and abundance of each species found within NVC H4a, DH site and the NVC floristic table for H4a (JNCC, 2009b).

Species Name	NVC H4a		H4a, DH	
	Species constancy value	Maximum abundance of species	Species constancy value	Maximum abundance of species
Ulex gallii	V	8	V	5
Agrostis curtisii	V	9	II	5
Calluna vulgaris	V	8	IV	5
Molinia caerulea	IV	8	V	5
Erica cinerea	V	8	V	5
Potentilla erecta	IV	5	*	*
Erica tetralix	I	3	*	*
Vaccinium myrtillus	II	8	*	*
Danthonia decumbens	II	4	*	*
Galium saxatile	II	4	*	*
Pteridium aquilinum	I	3	*	*
Carex binervis	I	2	*	*
Carex pilulifera	I	1	*	*
Agrostis capillaris	I	3	*	*
Pleurozium schreberi	I	7	*	*
Agrostis caninasens	I	2	*	*
Pseudoscleropodium purum	I	4	*	*
Carex panicea	I	1	*	*
Dicranum scoparium	I	5	*	*
Polygala serpyllifolia	II	2	*	*
Hypnum cupressiformesens	II	5	*	*
Nardus stricta	I	3	*	*
Cladonia impexa	I	10	*	*
Cladonia floerkeana	I	1	*	*
Festuca rubra agg.	I	1	*	*

Campylopus paradoxus	I	4	*	*
Cephalozia bicuspidata	I	2	*	*
Pohlia nutans	I	2	*	*
Deschampsia flexuosa	I	7	*	*
Anthoxanthum odoratum	I	1	*	*
Calypogeia fissa	I	1	*	*
Pedicularis sylvatica	I	1	*	*
Lophocolea bidentata	I	2	*	*
Hypogymnia physodes	I	1	*	*
Cladonia arbuscula	I	1	*	*
Polytrichum juniperinum	I	4	*	*
Calypogeia muelleriana	I	3	*	*
Viola lactea	I	1	*	*
Campylopus introflexus	I	5	*	*
Sphagnum papillosum	*	*	I	1

Out of the six species listed within the NVC H4c floristic tables, five of these species were recorded within the NVC H4c, DH (Table 2.6). Within the DH, *A. curtisii* was recorded as having a frequency class of II whilst *E. tetralix* was assigned a higher frequency class than was typical of the NVC habitat however, these may represent slight variation found within the sampling site. It can be considered that H4c, DH is typical of the NVC H4c.

Table 2.6 A comparison between the species identified, species constancy value and abundance of each species found within NVC H4c, DH site and the NVC floristic table for H4c (JNCC, 2009b).

Species Name	NVC H4c		H4c, DH	
	Species constancy value	Maximum abundance of species	Species constancy value	Maximum abundance of species
Ulex gallii	V	8	V	6
Agrostis curtisii	V	9	II	3
Calluna vulgaris	V	10	V	5
Molinia caerulea	V	7	V	7
Erica cinerea	V	7	*	*
Potentilla erecta	III	5	*	*
Erica tetralix	IV	8	V	5
Festuca ovina	I	2	*	*
Vaccinium myrtillus	II	5	*	*
Danthonia decumbens	I	5	*	*
Galium saxatile	I	3	*	*
Pteridium aquilinum	I	7	*	*
Carex binervis	I	3	*	*
Carex pilulifera	I	3	*	*
Agrostis capillaris	I	2	*	*
Pleurozium schreberi	I	1	*	*
Agrostis canina sens.lat.	I	1	*	*
Pseudoscleropodium purum	I	2	*	*
Carex panicea	II	5	*	*
Erica ciliaris	II	10	*	*
Erica vagans	II	6	*	*
Salix repens	I	3	*	*
Dicranum scoparium	II	3	*	*
Leucobryum glaucum	I	6	*	*

Polygala serpyllifolia	II	3	*	*
Hypnum cupressiforme sens.lat.	I	8	*	*
Nardus stricta	I	4	*	*
Cladonia impexa	I	9	*	*
Cladonia floerkeana	I	3	*	*
Festuca rubra agg.	I	3	*	*
Campylopus paradoxus	I	4	*	*
Cephalozia bicuspidata	I	3	*	*
Pohlia nutans	I	7	*	*
Deschampsia flexuosa	I	1	*	*
Anthoxanthum odoratum	I	3	*	*
Calypogeia fissa	I	2	*	*
Pedicularis sylvatica	I	3	*	*
Lophocolea bidentata	I	3	*	*
Hypogymnia physodes	I	5	*	*
Cladonia coccifera	I	3	*	*
Cladonia chlorophaea	I	3	*	*
Juncus squarrosus	I	4	*	*
Cladonia crispata	I	3	*	*
Calypogeia muelleriana	I	2	*	*
Viola lactea	I	2	*	*
Campylopus introflexus	I	2	*	*
Cuscuta epithymum	I	2	*	*
Racomitrium lanuginosum	I	3	*	*

Polygala vulgaris	I	3	*	*
Diplophyllum albicans	I	7	*	*
Luzula multiflora	I	2	*	*
Cladonia fimbriata	I	4	*	*
Cladonia uncialis	I	3	*	*
Cladonia furcata	I	6	*	*
Cladonia subcervicornis	I	4	*	*
Cladonia floerkeana	*	*	I	1

2.3.1.2 Mire

The NVC M14, M habitat only shares three species of similar frequency class to the typical NVC M14: *S. nigricans*, *M. caerualae* and *E. tetralix* (Table 2.7). Within the M, *N. ossifragum* and *S. subnitens* had a relatively lower frequency class and there were five species typical of IV values that were not recorded within the M therefore, it is considered that the M14, M habitat is floristically unique to Bicton Common.

Table 2.7 A comparison between the species identified, species constancy value and abundance of each species found within NVC M14, M site and the NVC floristic table for M14 (JNCC, 2009b).

Species Name	NVC M14		M14, M	
	Species constancy value	Maximum abundance of species	Species constancy value	Maximum abundance of species
Schoenus nigricans	V	8	V	5
Molinia caerulea	V	8	V	7
Erica tetralix	V	6	IV	3
Narthecium ossifragum	V	5	II	2
Sphagnum subnitens	IV	5	I	1
Anagallis tenella	IV	3	*	*
Campylium stellatum var. stellatum	IV	5	*	*
Aneura pinguis	IV	4	*	*
Scorpidium scorpioides	IV	5	*	*
Sphagnum auriculatum	IV	4	*	*
Hypnum jutlandicum	III	3	*	*
Kurzia pauciflora	III	2	*	*
Drosera rotundifolia	III	2	I	1
Juncus acutiflorus	II	4	*	*
Calypogeia fissa	II	2	*	*
Calluna vulgaris	II	4	II	1
Sphagnum papillosum	II	4	*	*

Eriophorum angustifolium	II	3	*	*
Carex panicea	II	2	*	*
Eleocharis multicaulis	II	3	*	*
Drosera intermedia	II	2	*	*
Riccardia multifida	II	2	*	*
Pinguicula lusitanica	II	3	*	*
Potentilla erecta	II	2	I	1
Sphagnum palustre	II	4	*	*
Rhynchospora alba	II	2	*	*
Myrica gale	II	4	*	*
Polygala serpyllifolia	I	2	*	*
Odontoschisma sphagni	I	2	*	*
Drepanocladus revolvens	I	2	*	*
Sphagnum tenellum	I	1	*	*
Ulex gallii	I	1	II	4
Juncus bulbosus	I	1	*	*
Ctenidium molluscum	I	1	*	*
Pinus sylvestris	I	2	*	*
Pedicularis sylvatica	I	1	*	*
Erica cinerea	*	*	*	*
Carex echinata	*	*	I	1
Cladonai floerkeana	*	*	I	1

Potamagen polygoniferous	*	*	II	2
Sphagnum papilosum	*	*	I	1

The typical NVC M16a habitat has five species with a frequency class of either IV or V, of which, three of these species are found within the NVC M16a, M: *E. tetralix*, *C. vulgaris* and *M. caeruale* (Table 2.8). Four additional non-typical species were recorded within the M which included *S. nigricans*. *S. nigricans* was assigned a V for frequency class which may contribute to *E. tetralix* receiving a III and *C. vulgaris* a IV which typically would be expected to be recorded as a V. Based on the presence of the main species and the additional non-typical species recorded, it can be considered that NVC M16a, M is floristically unique.

Table 2.8 A comparison between the species identified, species constancy value and abundance of each species found within NVC M16a, M site and the NVC floristic table for M16a (JNCC, 2009b).

Species Name	NVC M16a		M16a, M	
	Species constancy value	Maximum abundance of species	Species constancy value	Maximum abundance of species
Erica tetralix	V	9	III	3
Calluna vulgaris	V	9	IV	3
Molinia caerulea	V	9	V	7
Sphagnum compactum	V	8	*	*
Potentilla erecta	II	3	*	*
Succisa pratensis	I	4	*	*
Polygala serpyllifolia	I	3	*	*
Carex panicea	I	3	*	*
Sphagnum auriculatum	I	4	*	*
Salix repens	I	4	*	*
Sphagnum papillosum	I	5	II	2
Juncus acutiflorus	I	4	*	*
Myrica gale	I	7	*	*
Cirsium dissectum	I	3	*	*
Ulex gallii	I	7	III	2
Juncus effusus	I	3	*	*
Luzula multiflora	I	2	*	*
Kurzia pauciflora	II	4	*	*
Drosera intermedia	I	3	*	*
Drosera rotundifolia	II	3	*	*

Campylopus brevipilus	I	7	*	*
Hypnum jutlandicum	II	4	*	*
Cladonia impexa	II	7	*	*
Juncus squarrosus	II	5	*	*
Dicranum scoparium	I	4	*	*
Cladonia uncialis	I	5	*	*
Pohlia nutans	I	2	*	*
Pleurozium schreberi	I	5	*	*
Campylopus paradoxus	I	3	*	*
Sphagnum tenellum	IV	10	*	*
Trichophorum cespitosum	III	5	*	*
Narthecium ossifragum	II	5	III	1
Eriophorum angustifolium	II	8	I	1
Odontoschisma sphagni	I	5	*	*
Pinus sylvestris	I	3	*	*
Cephalozia connivens	I	3	*	*
Cephalozia bicuspidata	I	3	*	*
Ulex minor	I	5	*	*
Carex echinata	I	6	I	1
Pedicularis sylvatica	I	1	*	*
Dactylorhiza maculata	I	1	*	*

Leucobryum glaucum	I	6	*	*
Sphagnum subnitens	I	6	I	1
Nardus stricta	I	4	*	*
Gymnocolea inflata	I	3	*	*
Cladonia furcata	I	3	*	*
Sphagnum cuspidatum	I	6	*	*
Betula pubescens	I	2	*	*
Cladonia verticillata	I	3	*	*
Sphagnum molle	I	5	*	*
Eriophorum vaginatum	I	7	*	*
Odontoschisma denudatum	I	3	*	*
Campylopus pyriformis	I	1	*	*
Aulacomnium palustre	I	6	*	*
Erica cinerea	*	*	*	*
Cladonia florekeana	*	*	II	1
Pedicularis palustrus	*	*	I	1
Potamagen	*	*	II	1
Schoenus nigrans	*	*	V	4

2.3.1.3 Wet heath

The typical NVC M14 habitat has 10 species with a frequency class of either IV or V, of which, four of these species are found within the NVC M14, WH (Table 2.9). Within a typical NVC M14 habitat, only four species are given the frequency class of V, of which, three of these four were recorded within the WH: *S. nigricans*, *M. caerulea* and

E. tetralix. Both *C. vulgaris* and *U. gallii*, recorded within the WH, were assigned a V which may indeed contribute to the relatively fewer species recorded. With only one non-typical species having been recorded, it can be considered that NVC M14, WH is typical of this habitat.

Table 2.9 A comparison between the species identified, species constancy value and abundance of each species found within NVC M14, WH site and the NVC floristic table for M14 (JNCC, 2009b).

Species Name	NVC M14		M14, WH	
	Species constancy value	Maximum abundance of species	Species constancy value	Maximum abundance of species
Schoenus nigricans	V	8	V	4
Molinia caerulea	V	8	V	8
Erica tetralix	V	6	V	5
Narthecium ossifragum	V	5		
Sphagnum subnitens	IV	5	II	4
Anagallis tenella	IV	3	*	*
Campylium stellatum var. *stellatum*	IV	5	*	*
Aneura pinguis	IV	4	*	*
Scorpidium scorpioides	IV	5	*	*
Sphagnum auriculatum	IV	4	*	*
Hypnum jutlandicum	III	3	*	*

Kurzia pauciflora	III	2	*	*
Drosera rotundifolia	III	2	I	1
Juncus acutiflorus	II	4	*	*
Calypogeia fissa	II	2	*	*
Calluna vulgaris	II	4	V	4
Sphagnum papillosum	II	4	II	4
Eriophorum angustifolium	II	3	II	1
Carex panicea	II	2	*	*
Eleocharis multicaulis	II	3	*	*
Drosera intermedia	II	2	*	*
Riccardia multifida	II	2	*	*
Pinguicula lusitanica	II	3	*	*
Potentilla erecta	II	2	I	1
Sphagnum palustre	II	4	*	*
Rhynchospora alba	II	2	*	*
Myrica gale	II	4	*	*
Polygala serpyllifolia	I	2	*	*
Odontoschisma sphagni	I	2	*	*
Drepanocladus revolvens	I	2	*	*
Sphagnum tenellum	I	1	*	*

Ulex gallii	I	1	V	5
Juncus bulbosus	I	1	*	*
Ctenidium molluscum	I	1	*	*
Pinus sylvestris	I	2	*	*
Pedicularis sylvatica	I	1	*	*
Cladonia portentosa	*	*	I	1
Cladonia florekeana	*	*	II	4

Within the NVC M16a, WH three out of the four species assigned a V, typical of M16a were recorded: *E. tetralix*, *C. vulgaris* and *M. caerulea* (Table 2.9). *U. gallii* was assigned a IV class instead of the typical I therefore, this may have attributed to the relatively fewer number of species recorded. It can be considered that NVC M16a, WH is typical of this habitat.

Table 2.10 A comparison between the species identified, species constancy value and abundance of each species found within NVC M16a, WH site and the NVC floristic table for M16a (JNCC, 2009b).

	NVC M16a		**M16a, WH**	
Species Name	**Species constancy value**	**Maximum abundance of species**	**Species constancy value**	**Maximum abundance of species**
Erica tetralix	V	9	V	5
Calluna vulgaris	V	9	V	4
Molinia caerulea	V	9	V	5
Sphagnum compactum	V	8	*	*

Potentilla erecta	II	3	I	1
Succisa pratensis	I	4	*	*
Polygala serpyllifolia	I	3	*	*
Carex panicea	I	3	*	*
Sphagnum auriculatum	I	4	*	*
Salix repens	I	4	*	*
Sphagnum papillosum	I	5	I	1
Juncus acutiflorus	I	4	*	*
Myrica gale	I	7	*	*
Cirsium dissectum	I	3	*	*
Ulex gallii	I	7	IV	5
Juncus effusus	I	3	*	*
Luzula multiflora	I	2	*	*
Kurzia pauciflora	II	4	*	*
Drosera intermedia	I	3	*	*
Drosera rotundifolia	II	3	*	*
Campylopus brevipilus	I	7	*	*
Hypnum jutlandicum	II	4	*	*
Cladonia impexa	II	7	*	*
Juncus squarrosus	II	5	*	*
Dicranum scoparium	I	4	*	*
Cladonia uncialis	I	5	*	*
Pohlia nutans	I	2	*	*

Pleurozium schreberi	I	5	*	*
Campylopus paradoxus	I	3	*	*
Sphagnum tenellum	IV	10	*	*
Trichophorum cespitosum	III	5	*	*
Narthecium ossifragum	II	5	II	4
Eriophorum angustifolium	II	8	I	1
Odontoschisma sphagni	I	5	*	*
Pinus sylvestris	I	3	*	*
Cephalozia connivens	I	3	*	*
Cephalozia bicuspidata	I	3	*	*
Ulex minor	I	5	*	*
Carex echinata	I	6	*	*
Pedicularis sylvatica	I	1	*	*
Dactylorhiza maculata	I	1	*	*
Leucobryum glaucum	I	6	*	*
Sphagnum subnitens	I	6	I	4
Nardus stricta	I	4	*	*
Gymnocolea inflata	I	3	*	*
Cladonia furcata	I	3	*	*

Sphagnum cuspidatum	I	6	*	*
Betula pubescens	I	2	*	*
Cladonia verticillata	I	3	*	*
Sphagnum molle	I	5	*	*
Eriophorum vaginatum	I	7	*	*
Odontoschisma denudatum	I	3	*	*
Campylopus pyriformis	I	1	*	*
Aulacomnium palustre	I	6	*	*
Cladonia portentosa	*	*	II	1

2.3.1.4 Control dry heath

Out of the six species (IV-V) typical of NVC H4c, five were recorded within the CDH, *E. tetralix* was recorded as one class higher and *C.vulgaris* as one class lower than typically expected (Table 2.11). It can be considered that the CDH reflects a typical NVC H4c habitat.

Table 2.11 A comparison between the species identified, species constancy value and abundance of each species found within NVC H4c, CDH site and the NVC floristic table for H4c (JNCC, 2009b).

Species Name	NVC H4c		H4c, CDH	
	Species constancy value	Maximum abundance of species	Species constancy value	Maximum abundance of species
Ulex gallii	V	8	V	7
Agrostis curtisii	V	9	*	*
Calluna vulgaris	V	10	IV	4
Molinia caerulea	V	7	V	5
Erica cinerea	V	7	V	4
Potentilla erecta	III	5	*	*
Erica tetralix	IV	8	V	4
Festuca ovina	I	2	*	*
Vaccinium myrtillus	II	5	*	*
Danthonia decumbens	I	5	*	*
Galium saxatile	I	3	*	*
Pteridium aquilinum	I	7	*	*
Carex binervis	I	3	*	*
Carex pilulifera	I	3	*	*
Agrostis capillaris	I	2	*	*
Pleurozium schreberi	I	1	*	*
Agrostis canina sens.lat.	I	1	*	*
Pseudoscleropodium purum	I	2	*	*
Carex panicea	II	5	*	*
Erica ciliaris	II	10	*	*
Erica vagans	II	6	*	*
Salix repens	I	3	*	*
Dicranum scoparium	II	3	*	*
Leucobryum glaucum	I	6	*	*

Polygala serpyllifolia	II	3	*	*
Hypnum cupressiforme sens.lat.	I	8	*	*
Nardus stricta	I	4	*	*
Cladonia impexa	I	9	*	*
Cladonia floerkeana	I	3	*	*
Festuca rubra agg.	I	3	*	*
Campylopus paradoxus	I	4	*	*
Cephalozia bicuspidata	I	3	*	*
Pohlia nutans	I	7	*	*
Deschampsia flexuosa	I	1	*	*
Anthoxanthum odoratum	I	3	*	*
Calypogeia fissa	I	2	*	*
Pedicularis sylvatica	I	3	*	*
Lophocolea bidentata	I	3	*	*
Hypogymnia physodes	I	5	*	*
Cladonia coccifera	I	3	*	*
Cladonia chlorophaea	I	3	*	*
Juncus squarrosus	I	4	*	*
Cladonia crispata	I	3	*	*
Calypogeia muelleriana	I	2	*	*
Viola lactea	I	2	*	*
Campylopus introflexus	I	2	*	*
Cuscuta epithymum	I	2	*	*
Racomitrium lanuginosum	I	3	*	*

Polygala vulgaris	I	3	*	*
Diplophyllum albicans	I	7	*	*
Luzula multiflora	I	2	*	*
Cladonia fimbriata	I	4	*	*
Cladonia uncialis	I	3	*	*
Cladonia furcata	I	6	*	*
Cladonia subcervicornis	I	4	*	*
Cladonia portentosa	*	*	I	1

2.3.1.5 Control mosaic

Within the CMo, only two species are assigned frequency class V as typical of NVC M14: *M. caerulea* and *E. tetralix* (Table 2.12). *C. vulgaris* has a relatively higher frequency class of IV rather than the expected II and this also applies to *U. gallii* that is assigned a V but typically, is given a I. In addition, 4 non-typical species were recorded within the CMO. The supporting information indicates that CMo is not typical of NVC M14 but in fact, shares some similarities with H4c: C. *vulgaris* and *U. gallii* therefore, is indeed an area of transitional vegetation characteristic of both NVC M14 and NVC H4c habitats.

Table 2.12 A comparison between the species identified, species constancy value and abundance of each species found within NVC M14, CMo site and the NVC floristic table for M14 (JNCC, 2009b).

Species Name	NVC M14		M14, CMo	
	Species constancy value	Maximum abundance of species	Species constancy value	Maximum abundance of species
Schoenus nigricans	V	8	III	4
Molinia caerulea	V	8	V	8
Erica tetralix	V	6	V	5
Narthecium ossifragum	V	5	I	1
Sphagnum subnitens	IV	5	II	1
Anagallis tenella	IV	3	*	*
Campylium stellatum var. stellatum	IV	5	*	*
Aneura pinguis	IV	4	*	*
Scorpidium scorpioides	IV	5	*	*
Sphagnum auriculatum	IV	4	*	*
Hypnum jutlandicum	III	3	*	*
Kurzia pauciflora	III	2	*	*
Drosera rotundifolia	III	2	*	*
Juncus acutiflorus	II	4	*	*
Calypogeia fissa	II	2	*	*
Calluna vulgaris	II	4	IV	3
Sphagnum papillosum	II	4	*	*
Eriophorum angustifolium	II	3	*	*
Carex panicea	II	2	*	*

Eleocharis multicaulis	II	3	*	*
Drosera intermedia	II	2	*	*
Riccardia multifida	II	2	*	*
Pinguicula lusitanica	II	3	*	*
Potentilla erecta	II	2	I	1
Sphagnum palustre	II	4	*	*
Rhynchospora alba	II	2	*	*
Myrica gale	II	4	*	*
Polygala serpyllifolia	I	2	*	*
Odontoschisma sphagni	I	2	*	*
Drepanocladus revolvens	I	2	*	*
Sphagnum tenellum	I	1	*	*
Ulex gallii	I	1	V	4
Juncus bulbosus	I	1	I	1
Ctenidium molluscum	I	1	*	*
Pinus sylvestris	I	2	*	*
Pedicularis sylvatica	I	1	*	*
Cladonia portentosa	*	*	I	1
Erica cinerea	*	*	I	1
Sphagnum papillosum	*	*	I	1

2.3.2 Percentage cover within DH, M & WH

2.3.2.1 *C. vulgaris*

The analysis highlighted a significant difference between sites ($F_{(2, 97)} = 41.82$, $P<0.001$ (adjusted for ties)) in which Tukey's pairwise comparison ($P = 0.05$) identified the DH having a significantly greater mean ($\bar{X} = 25.55 \pm 2.753$) to both the M ($\bar{X} = 4.15 \pm 1.123$) and WH ($\bar{X} = 8.20 \pm 0.868$) (Figure 2.5).

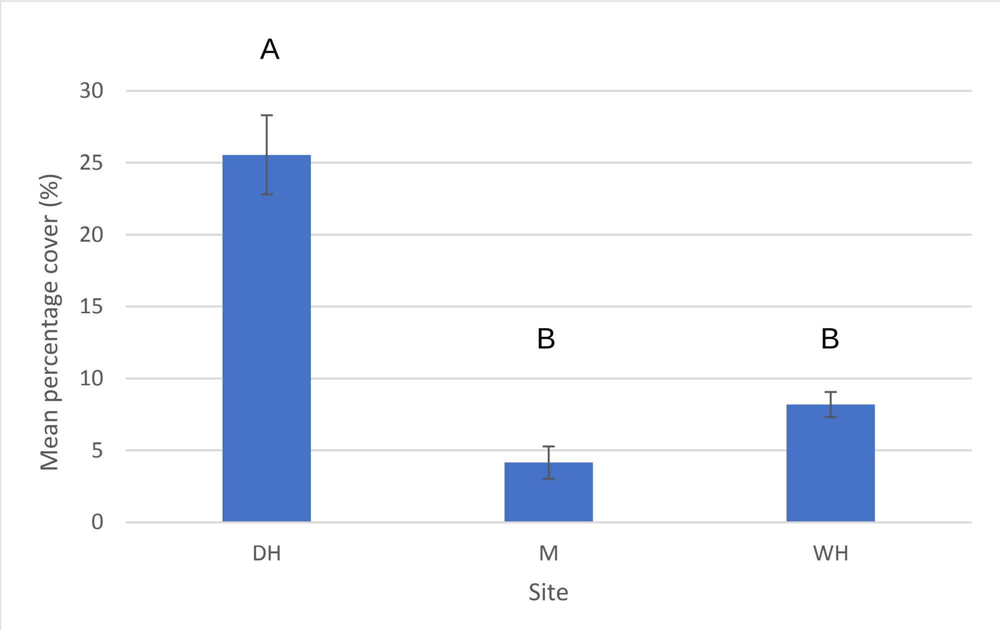

Figure 2.5 Mean (± SE) percentage cover of *C. vulgaris* at each site
Means that do not share a letter are significantly different (Tukey's pairwise comparison at P= 0.05).

The month ($F_{(1,\ 97)}$ = 5.99, P<0.05 (adjusted for ties)) showed significant difference between the two months . October ($\bar{X}$ = 15.12 ± 2.073) is identified as being significantly higher than June ($\bar{X}$ = 10.15 ± 12.594) (Tukey's pairwise comparsion at P=0.05).

2.3.2.2 *E. tetralix*

There was a significant difference between sites ($F_{(2,\ 114)}$ = 20.10, P<0.001(adjusted for ties)) in which Tukey's pairwise comparison (P= 0.001) identified that the mean for the WH ($\bar{X}$ = 17.952 ± 1.358) is significantly different to both the M ($\bar{X}$ = 6.125 ± 1.084) and DH ($\bar{X}$ = 3.625 ± 0.786) thus, resulting in the M and DH being grouped together.

The significant difference between month ($F_{(1,\ 114)}$ = 5.08, P<0.05 (adjusted for ties)) was reflected by June ($\bar{X}$ = 7.5333 ± 0.861) being significantly lower than October ($\bar{X}$ = 10.916 ± 1.440), according to Tukey's pairwise comparison (P=0.001).

In addition, there was a significant difference between both site and month ($F_{(1, 114)}$ = 6.64, P<0.001(adjusted for ties)). Tukey's pairwise comparison (P=0.001) has identified five different groupings (A, B, BC, CD and D) (Figure 2.6).

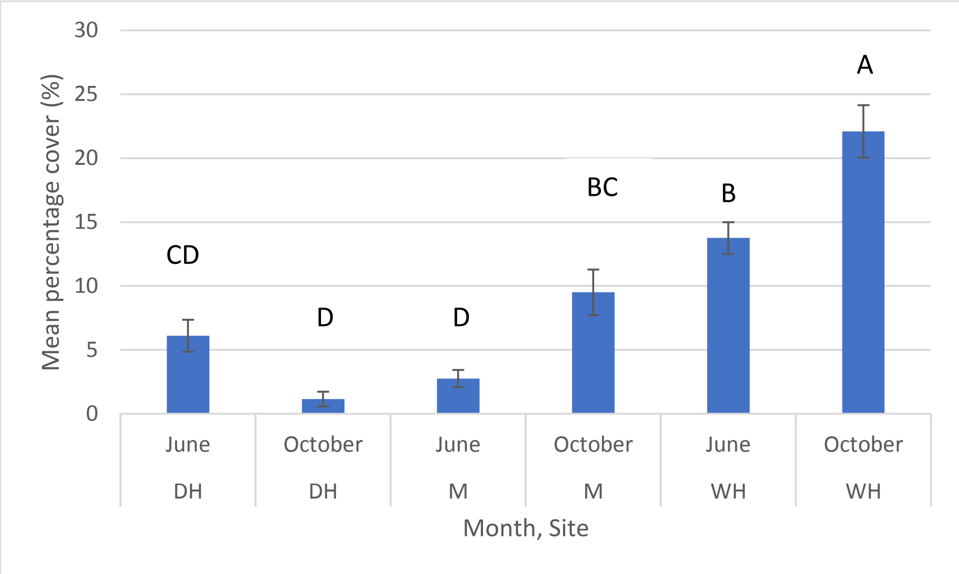

Figure 2.6 Mean (± SE) percentage cover of *E. tetralix* at each site, during both months.

Means that do not share a letter are significantly different (Tukey's pairwise comparison at P= 0.001).

2.3.2.3 *M. caerulea*

The month ($F_{(1, 114)}$ = 6.66, P<0.05 (adjusted for ties)) was statistically different with June ($\bar{X}$ = 39.12 ± 3.15) having a significantly greater mean to October ($\bar{X}$ = 29.10 ± 2.38).

2.3.2.4 *U.gallii*

The significant difference between site ($F_{(2, 114)}$ = 27.81, P<0.001 (adjusted for ties)), through Tukey's pairwise comparison (P=0.05) was represented by the DH ($\bar{X}$ = 24.05 ± 1.930) having a greater mean relative to the M with the lowest ($\bar{X}$ = 5.72 ± 1.301) (Figure 2.7).

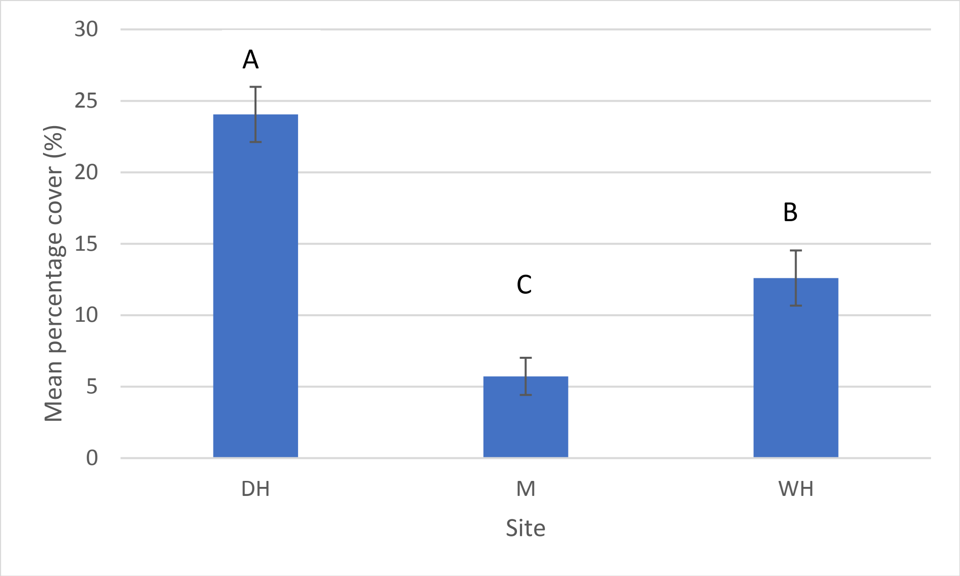

Figure 2.7 Mean (± SE) percentage cover of *U. gallii* at each site.
Means that do not share a letter are significantly different (Tukey's pairwise comparison at P= 0.05).

Data analysis identified a significant difference between site and quadrat ($F_{(38, 60)}$ = 5.02, P<0.001 (adjusted for ties)) and based on the statistical groupings through Tukey's pairwise comparison (P=0.05) quadrat 1, WH is significantly different to six other quadrats within the same site (2, 4, 6, 7,15 & 17) (Table 2.13).

Table 2.13 Summary of significant groupings of quadrats in WH, based on Tukey's pairwise comparison (P=0.05)

Site	Quadrat and associated grouping through Tukey's Pairwise Comparison	Quadrat and associated grouping through Tukey's Pairwise Comparison
Wet Heath	1 (ABCD)	2, 4, 6, 7, 15, 17 (FGHI)

2.3.2.5 *E. cinerea*

There is a significant difference between the data for sites ($H_{(2)}$ = 51.53, P<0.001 (adjusted for ties)) in which the median for the DH ($\tilde{x}$ = 20.275 ± 2.150) is greater than both the WH ($\tilde{x}$ = 2.675 ± 0.317) and M ($\tilde{x}$ = 1.975 ± 0.367). Additionally, there is a significant difference for month ($H_{(1)}$ = 51.53, P<0.05 (adjusted for ties)) whereby the median for June ($\tilde{x}$ = 11.4 ± 1.824) was higher than October ($\tilde{x}$ = 5.2167 ± 0.962).

2.3.2.6 *N. ossifragum*

The percentage cover of *N. ossifragum* is significantly different between sites ($F_{(2, 116)}$ 11.71, P<0.001 (adjusted for ties)). Whilst *N. ossifragum* was not recorded in the DH, Tukey's pairwise comparison (P=0.05) highlights that the means for both the WH ($\bar{X}$ = 6.53 ± 1.230) and M ($\bar{X}$ = 5.80 ± 1.370) are not significantly different.

Additionally, there was significant difference between months (($F_{(1, 116)}$ = 4.70, P<0.05 (adjusted for ties)) in which October ($\bar{X}$ = 5.41 ± 1.120) had a significantly higher value than June ($\bar{X}$ = 2.80 ± 0.688).

2.3.2.7 *E. angustifolium*

There was significant difference between the site data ($F_{(2, 116)}$ = 5.50, P<0.05 (adjusted for ties)) in which the WH and DH are not significantly different to each other but are both significantly different to the M (Figure 2.8).

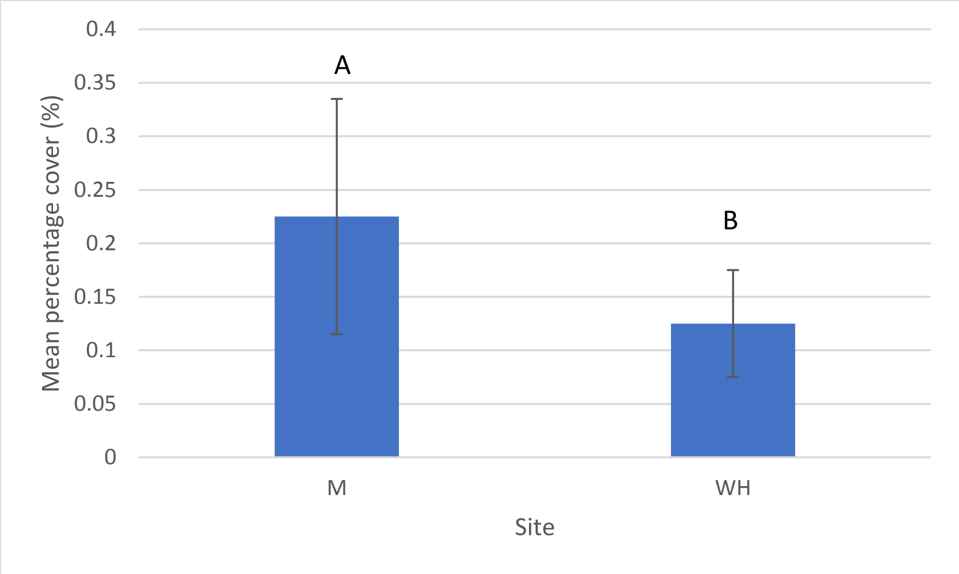

Figure 2.8 Mean (± SE) percentage cover of *E. angustifolium* at each site. Means that do not share a letter are significantly different (Tukey's pairwise comparison at P= 0.05).

2.3.2.8 *S. subnitens*

The site ($H_{(2)}$ =15.10, P<0.05 (adjusted for ties)) showed significant difference in which the median for M ($\tilde{x}$ = 5.45 ± 1.900) was relatively greater than the WH ($\tilde{x}$ = 2.42 ± 1.128) (Figure 2.9).

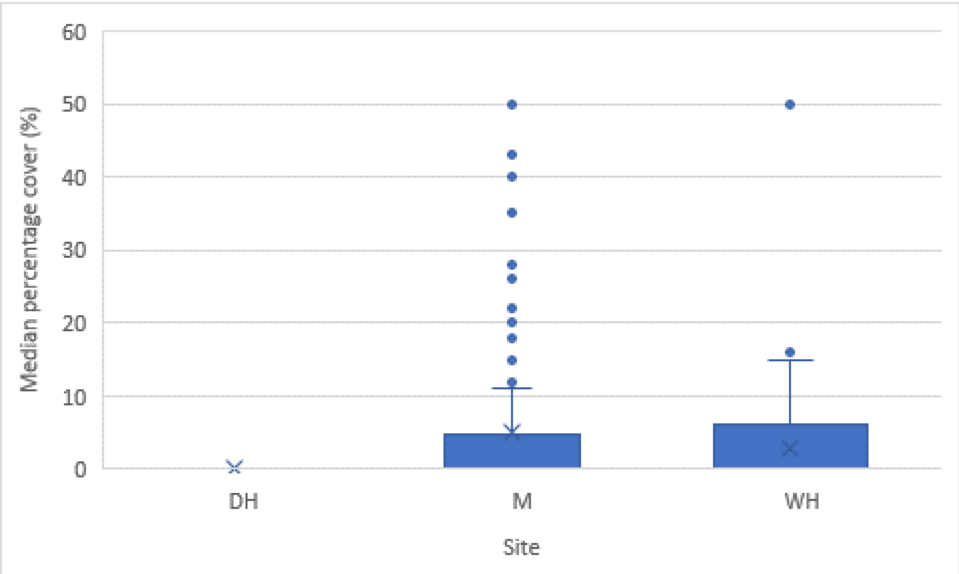

Figure 2.9 Median percentage cover of S*. subnitens* at each site.

2.3.2.9 Soil, rock and water

Only the water was found to have been significantly different between sites ($H_{(2)}$ =34.39, P<0.000 (adjusted for ties)). Percentage water cover was not recorded within the DH but the median was greater in the M ($\tilde{x}$ = 16.25 ± 3.750) than the WH ($\tilde{x}$ = 1.35 ± 0.665).

2.3.3 Sward Height within DH, M & WH

There is a significant difference between sites ($F_{(2, 2394)}$ = 13.34, P<0.001 (adjusted for ties)) in which the M ($\bar{X}$ = 40.40 ± 0.555) is significantly lower than the DH ($\bar{X}$ = 44.42 ± 0.673) and WH ($\bar{X}$ = 43.95 ± 0.581) (Figure 2.10).

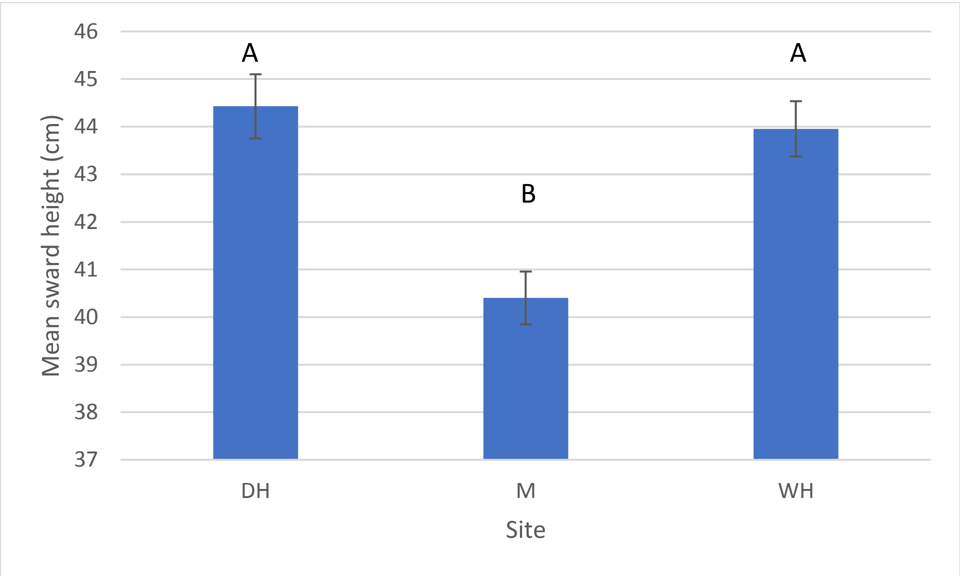

Figure 2.10 Mean (± SE) sward height of *M. caerulea* at each site.

Means that do not share a letter are significantly different (Tukey's pairwise comparison at P= 0.05).

The mean sward height between months ($F_{(1, 2394)}$ = 16.51, P<0.001 (adjusted for ties)) identifies that June ($\bar{X}$ = 44.34 ± 0.525) is significantly higher than for October ($\bar{X}$ = 41.51 ± 0.463) (Figure 2.11).

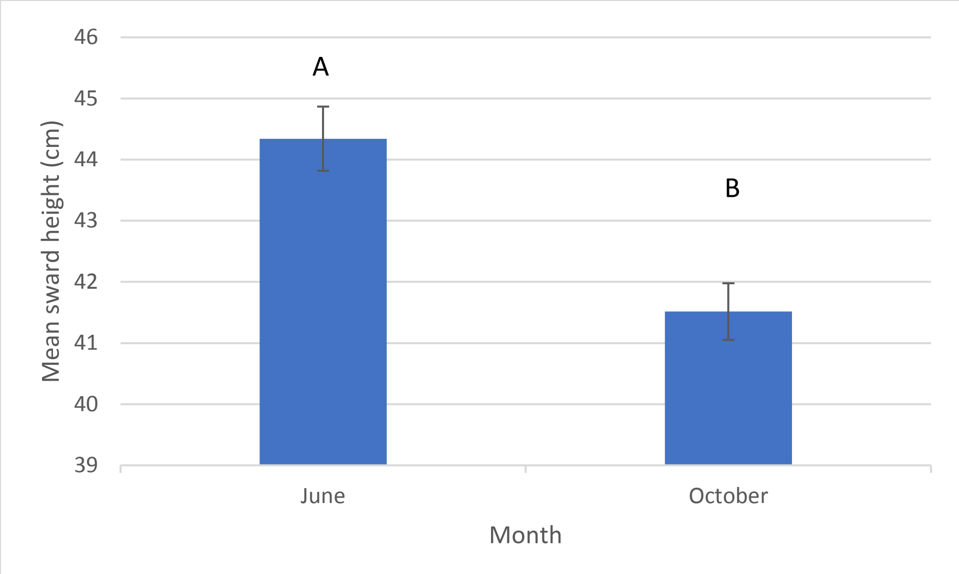

Figure 2.11 Mean (± SE) sward height of *M. caerulea* found during each month. Means that do not share a letter are significantly different (Tukey's pairwise comparison at P= 0.05).

There is also significant difference between month and site ($F_{(2,2318)} = 5.31$, $P<0.05$ (adjusted for ties) (Figure 2.12). For each site, the October value is significantly different to the June value, based on the groupings.

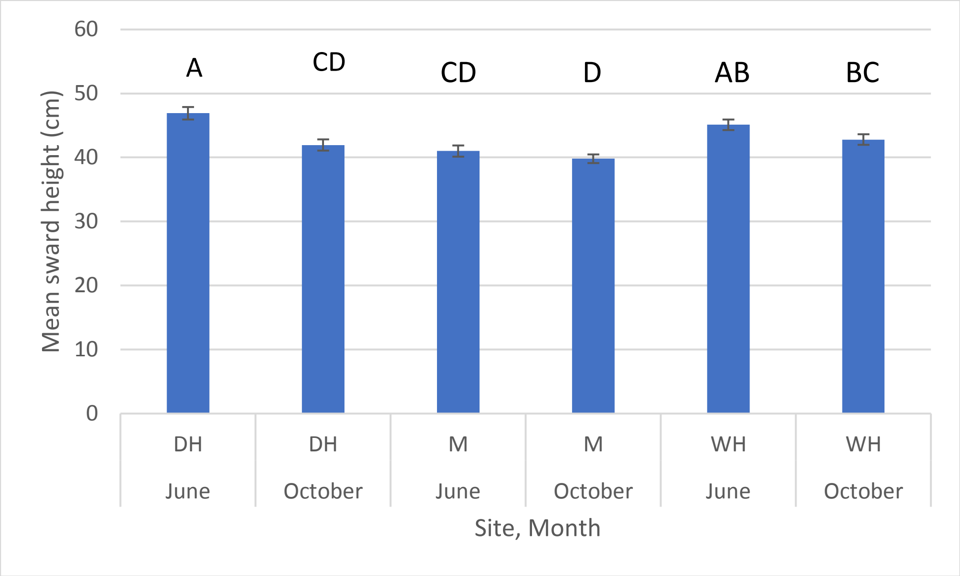

Figure 2.12 Mean (± SE) sward height of *M. caerulea* at each site, during each month.

Means that do not share a letter are significantly different (Tukey's pairwise comparison at P= 0.05).

<u>2.3.4 Biodiversity within DH, M & WH</u>

The results of the Shannon Weiner index (Figure 2.13) show that during the highest mean biodiversity values were recorded in the WH (October) ($\bar{X}$= 1.391 ± 0.048), M (October) ($\bar{X}$= 1.366, ± 0.048) and WH (June) ($\bar{X}$= 1.349 ± 0.041). The least biodiverse site was the DH (October) ($\bar{X}$= 0.333 ± 0.186).

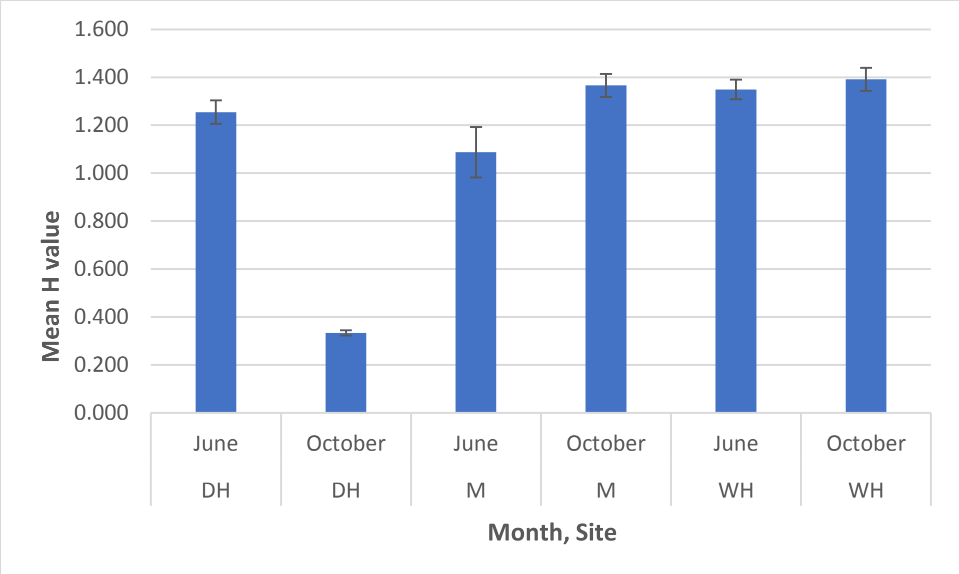

Figure 2.13 Mean (± SE) Shannon Weiner biodiversity indices for each month, at each site

2.3.5 Percentage cover within CDH & CMo

2.3.5.1 C. vulgaris

The analysis highlighted a significant difference between sites ($H_{(1)}$ = 6.31, P<0.05 (adjusted for ties)) in which the CDH had a significantly greater median ($\tilde{x}$ = 7.25 ± 1.590) to the CMo ($\tilde{x}$ = 3.45 ± 0.457).

2.3.5.2 *E. tetralix*

There was a significant difference between sites ($F_{(1, 116)}$ = 6.89, P<0.05 (adjusted for ties)) in which Tukey's pairwise comparison (P= 0.05) identified that the CMo ($\bar{X}$ = 13.62 ± 0.857) is significantly greater than the CDH ($\bar{X}$ = 10.73 ± 1.350) (Figure 2.14)

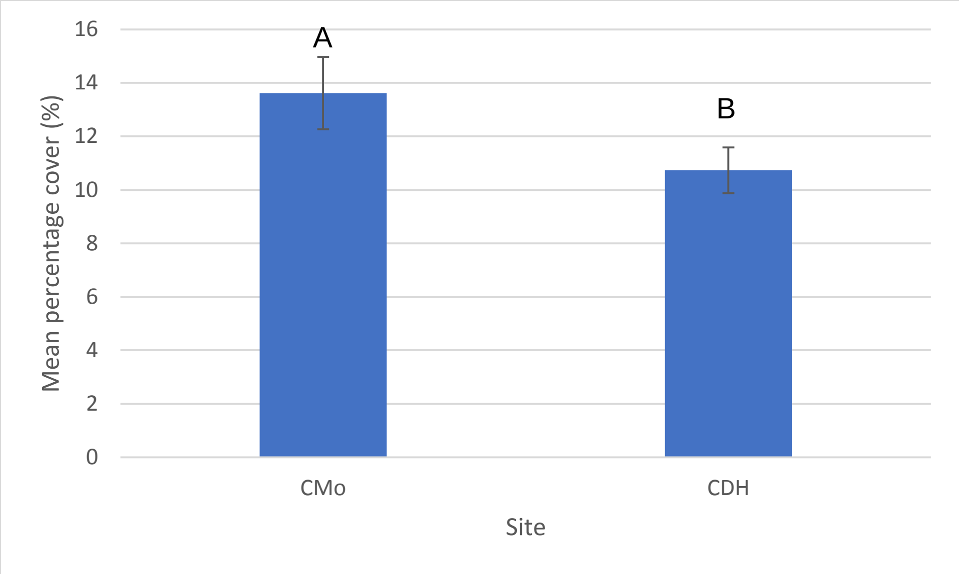

Figure 2.14 Mean (± SE) percentage cover of *E. tetralix* at each control site. Means that do not share a letter are significantly different (Tukey's pairwise comparison at P= 0.05).

2.3.5.3 *M. caerulea*

The site ($H_{(1)}$ = 33.32, P<0.001 (adjusted for ties)) was statistically different with the CMo ($\tilde{x}$ = 54.29 ± 2.020) having a significantly greater median to the CDH ($\tilde{x}$ = 31.50 ± 2.950).

2.3.5.4 *U.gallii*

The significant difference between the site ($H_{(1)}$ = 46.59, P<0.001 (adjusted for ties)) was reflected by the CDH ($\tilde{x}$ = 30.57 ± 1.970) having a greater median relative to the CMo ($\tilde{x}$ = 10.40 ± 1.180).

2.3.5.5 *E. cinerea*

Site ($H_{(1)}$ = 31.57, P<0.001 (adjusted for ties)) showed significant difference in which the CDH ($\tilde{x}$ = 12.55 ± 1.820) had a significantly greater median to that of the CMo ($\tilde{x}$ 2.026 ± 0.576).

2.3.5.6 *N. ossifragum*

A

There was no significant difference between site or month.

2.3.5.7 S. *subnitens*

This species was not recorded within the CDH whilst it was within the CMo ($\bar{X}$ = 2.28 ± 0.827).

2.3.5.8 Soil, rock and water

Water was not recorded within the DH but was recorded within the CMo ($\bar{X}$ = 2.70 ± 0.845).

<u>2.3.6 Sward height within CDH & CMO</u>

There is a significant difference between sites ($F_{(1, 4796)}$ = 29.92, P<0.001 (adjusted for ties)) in which the CDH ($\bar{X}$ = 59.40 ± 0.487) is significantly higher than the CMo ($\bar{X}$ = 55.76 ± 0.376) (Figure 2.15).

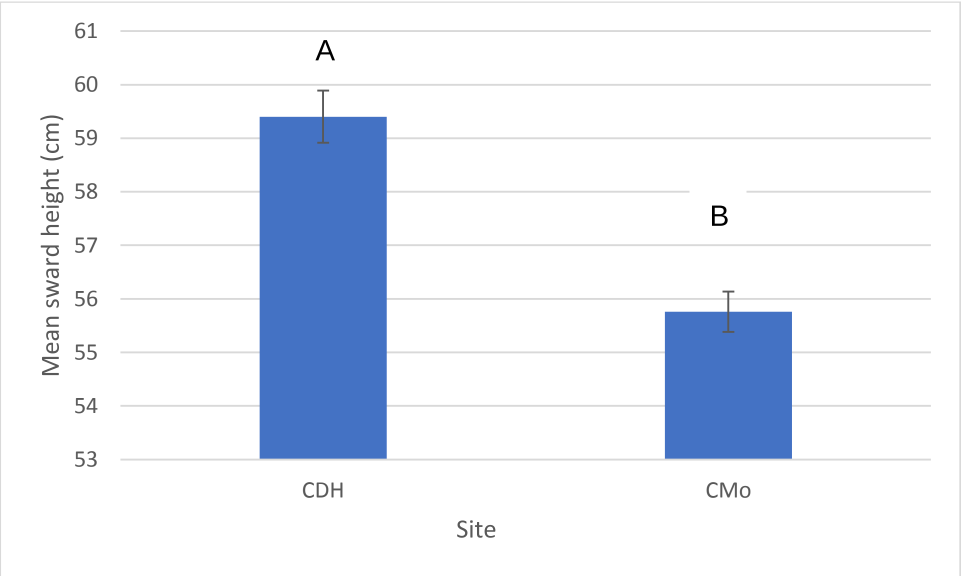

Figure 2.15 Mean (± SE) sward height of *M. caerulea* at each control site

Means that do not share a letter are significantly different (Tukey's pairwise comparison at P= 0.001).

There is also a significant difference between months ($F_{(1, 4796)}$ = 6.18, P<0.05 (adjusted for ties)) in which June ($\bar{X}$ = 58.41 ± 0.434) is significantly higher than October ($\bar{X}$ = 56.75 ± 0.413) (Figure 2.16).

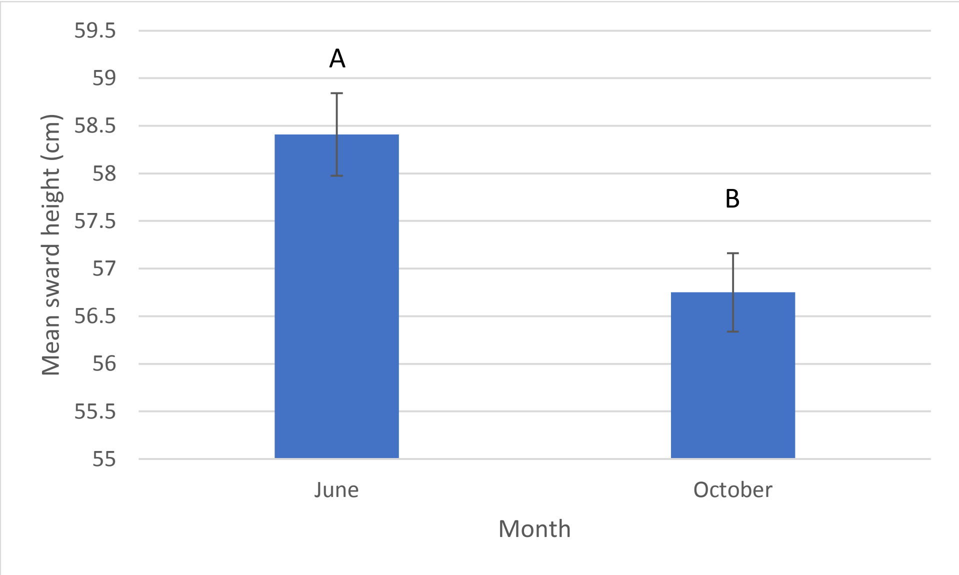

Figure 2.16 Mean (± SE) sward height of *M. caerulea* for each month
Means that do not share a letter are significantly different (Tukey's pairwise comparison at P= 0.05).

2.3.7 Biodiversity within CDH & CMo

The highest mean biodiversity values were recorded during October for both sites of which, the CDH ($\bar{X}$= 1.35 ± 0.028) had the relatively highest mean relative to the CMo ($\bar{X}$= 1.34 ± 0.040) (Figure 2.17).

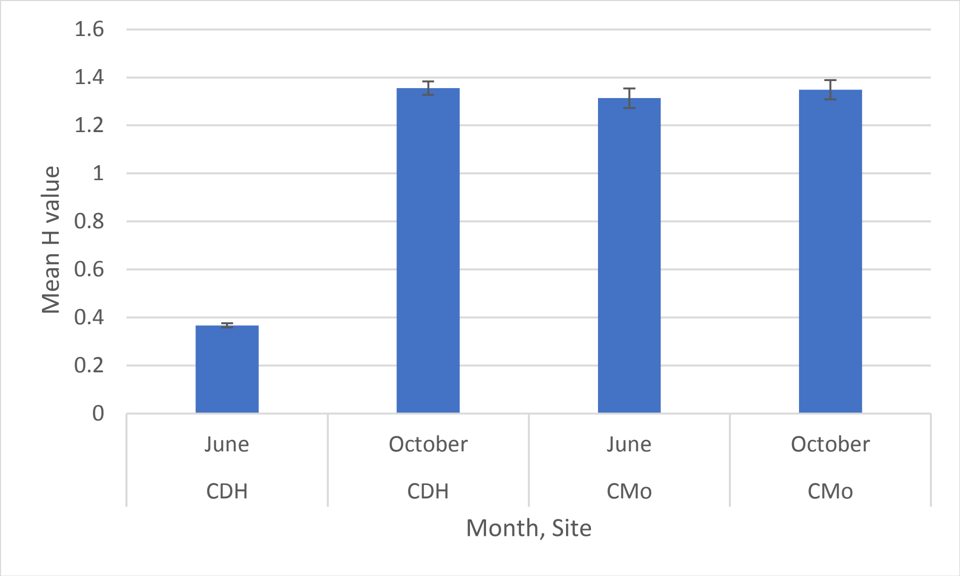

Figure 2.17 Mean (± SE) Shannon Weiner biodiversity indices for each month, at each control site.

2.4 Discussion

2.4.1 NVC habitats

Within the DH, both H4a and H4c are considered to be typical of these NVC habitat groups however, the presence of the atypical species *S. papillosum* within the H4a habitat is interesting because this bryophyte predominantly requires the water table to be slightly below or at the ground surface level (Elkington *et al*., 2001). It is therefore, likely that this species was recorded in a transitional patch of vegetation located between the DH and WH. The nature of the CMo site reflects species presence and abundance of both NVC H4c and M14 which is why the significance of such transitional areas identified within this study may help to explain the presence of some non-typical species. Examples of non-typical species have been the presence of *C. portentosa* (M14 & M6a) and *C. floerkeana* (M14) within the WH. These two species favour dryer conditions (PlantLife, 2010) and therefore, may well be located within a transitional area between both the WH and DH. To provide another explanation, it is also possible that the presence of *C. portentosa* may be attributed to acid type soils and/or dryer conditions that may be provided by the tussocks of *M. caerulea* (Rose & O'Reilly, 2006; Stace, 2010; BLS, 2016). It is relevant to consider plant species interactions as such associations may influence whether the NCV habitats on Bicton Common are typical or otherwise.

With regards to *M. caerulea*, the tussocks have also been found to have provided a rooting medium for ericaceous species, particularly *C. vulgaris* (Rutter, 1955) and therefore, may also facilitate the presence of *E. tetralix* within the WH thus, contributing to both the M14 and M16a being floristically typical. In contrast, the presence of *C. echinata*, within M16a of the M although typically found within acid bogs and marshes (Stace, 2010), is more widespread in M6, M7 and M15 communities and therefore, is another indicator of possible floristic uniqueness.

2.4.2 Percentage cover

It is important to try to understand the interactions between plant species and any associations with specific abiotic conditions as they may in fact provide explanations of the patterns identified from the vegetative BL data collected. It is therefore, likely that the significantly greater median cover value of *C. vulgaris*, *U. gallii* and *E. cinerea,* in the DH, relative to the M and WH is due to the species' preference for dryer conditions (Rose & O'Reilly, 2006; Stace, 2010). This would also explain the greater mean percentage cover recorded within the CDH in relation to the wetter conditions of the CMo. The ability of these three species to form a closed canopy may therefore, reduce the establishment and subsequent increase in abundance of other plant species, due to their ability of successfully out-competing non-ericaceous types (Rutter, 1955). Specifically, Aerts (1989) describes how *C. vulgaris* can outcompete *M. caeruale* due to it's tolerance of low nutrient soils through the symbiotic relationship with mycorrhiza in its root system. Further evidence for the importance of abiotic conditions, in relation to cover, can be supported by the significantly greater cover of *E. tetralix* recorded within the WH and CMo, and *S. subnitens* recorded within the CMo and not CDH due to this species favouring wetter conditions (Rose & O'Reilly, 2006; Stace, 2010). It is also not surprising to note that the overall the cover of water was significantly higher within the M relative to the WH and high in the CMo in comparison to the CDH, which would therefore, account for the significantly lower cover of *U. gallii* within the M in comparison to the other two sites. With regards to the both the rock and bare soil, there was no significant difference between site or between months from the BL data set therefore, any future changes in the substrate cover may well be the result of animal activity.

In a number of instances, the data for *C. vulgaris*, *N. ossifragum* and *E. cinerea* found within the M and WH show no significant difference therefore, it is prudent to consider that some of the quadrats sampled may lie within an ecotone of transitional vegetation.

With regards to the *U. gallii* BL data set, there are significant differences between the mean percentage ocver in some quadrats which provide further support of the presence of transitional areas of vegetation. Quadrat 1 found within the WH is categorised as being within an area of M16a but is significantly different from a grouping of six other quadrats. Based on the ArcGIS maps generated, the six are found within M14, M16a and M21a habitats therefore, based on the notion of similarity provide further support for some quadrats having been located within areas that transition between NVC habitats. When considering the DH, quadrats 2 and 3 are located within H4a whilst, quadrat 11 on the ArcGIS map is situated within H4c but yet appears very close to H4a. This could further support quadrat 11 being within a transitional area or, there is the potential to argue that the ArcGIS map is inaccurate and quadrat 11 is in fact located within H4a hence the similarity with the other two quadrats within the statistical grouping. The significance of inaccurate maps raises a point of limitations within this study and will further be discussed within Chapters 3 and 5. The final area yet to be discussed is the impact of season on vegetative cover.

Seasonal variation, across the BL sites was reflected by data from five species: *M. caerulea* and *E. cinerea* had relatively greater data values within June whereas for *C. vulgaris*, *N. ossifragum* and *E. tetralix* the opposite trend occurred. It is therefore possible that the former two species suffered from annual dieback before the second survey effort hence reduced cover and for the latter three species, the annual dieback of other species within the sites may have attributed to the relatively greater cover. It is not possible to draw conclusions as to the exact interactions between the five species but at least four of the species were found within each of the NVC habitats recorded. In contrast, seasonal differences were not identified within the control sites and this may be due to its north easterly aspect and the fact that the sites slope down towards a valley bottom which may offer a degree of protection from the weather.

2.4.3 Sward height of *M. caerulea*

There are no significant differences between the DH and WH data sets thus indicating a potential transitional zone with suitable abiotic conditions. With regards to differences between the two months, each BL site has a relatively higher mean sward height in the June which may be attributed to the dieback of *M. caerulea* during autumn. Within the control plots, although sites were not identified by the analysis, the value in June was also significantly higher. This seasonal trend is really important to note because in future studies involving grazing animals, any changes in the height of *M. caerulea* across the BL sites, may not necessarily be accredited to animal activity, particularly if it is also noted within future control plot data.

2.4.4 Biodiversity

It is difficult to conclude as to why biodiversity within each site, with the exception of the DH, was higher during October than June because of seemingly conflicting data. *M. caerulea* is found within each site, whereas *E. cinerea* is only recorded within the DH and CDH however, the suggestion of seasonal dieback of these two species is unlikely to open up enough space, later on in the season for other species to establish and thus be recorded. It is possible that the cover of *C. vulgaris* and *E. tetralix* within the sites provided a degree of shelter for herbaceous species and thus had not succumbed to seasonal dieback at the time of the October survey effort. Alternatively, maybe the ambient air temperatures were favourable at this time in the season however, without meterological data from Bicton Common this suggestion cannot be validated, although in hindsight, the use of meterological data collected from Exeter Airport or, Sidmouth by the Met Office could have been used. In contrast, the explanation as to why the sites with the wetter conditions (WH, CMo and M) had relatively lower cover of *C. vulgaris*, *U. gallii* and *E. cinerea,* in relation to the DH and CDH and thus a relatively higher October biodiversity is far more plausible. As discussed within the percentage cover section, dense canopies can be formed by these species (Rutter, 1955), which when tying this in with the biodiversity of the dryer sites, may explain the relatively lower values calculated.

2.5 Conclusion

This study has successfully compared BL data collected from five habitats, having assessed and identified whether the site habitats were floristically unique or, typical of the NVC habitats identified by Kerry (2014). From the findings it can be concluded that the following represent typical NVC habitats: H4a and H4c within the DH; M14 and M16a within the WH; H4c within the CDH. CMo is a site with characteristics of both NVC M14 and NVC H4c. Within the M, both M14 and M16a are non-typical. Abiotic conditions, such as relatively lower moisture levels, are likely to have influenced the mean percange cover values of *C. vulgaris*, *U. gallii* and *E. cinerea* between the non-control sites and the median value within the CDH. In contrast, *E. tetralix* and *S. subnitens* are likely to have been recorded within the WH and CMo for the former and CMo for the latter species due to the relatively higher site moisture levels. A possibility that some quadrats across the sites may lie within areas of transitional vegetation is supported by the percentage cover data that was not significantly different between the WH and M for *C. vulgaris*, *N. ossifragum* and *E. cinerea* or, between the DH and WH for *U. gallii*. Additionally, seasonal variation was identified between months from the BL data sets of five species: *M. caerulea, E. cinerea, C. vulgaris*, *N. ossifragum* and *E. tetralix* but not within the control sites. Also, seasonal variation was identified for the sward height of *M. caerulea* in all five sites. Finally, the study identified that the biodiversity was greater during October in each site with the exception of the DH. Regardless of the findings from this study, the results are crucial because they provide a BL set of data to analyses with data collected from grazing years. Without such BL data, any conclusions drawn on the impact of gazing would be less meaningful.

Chapter 3 - Using GPS technology and grazier insights to identify animal home ranges

3.1 Introduction

3.1.1 GPS technology and home ranges (HRs)

The use of GPS technology to identify the spatial movement of grazing animals has been successful used within a variety of habitats (Table 3.1). GPS is particularly useful as animals do not move or graze in an uniform manner (Wehn, 2009) across heterogeneous landscapes and the positional data can therefore, be used to construct maps reflecting home ranges (HRs). It is the home ranges (HRs) of animals that have been described as non-defended geographical use of space (Van Moorter *et al*., 2016) and of which, are considered to reflect a cognitive map of an animal (Powell, 2016). With this in mind, it can be inferred that an animal consciously makes selective behavioural decisions (Powell, 2012) based on factors such as water sources (Howery *et al*., 1996; Rutter, 2007; Kaufmann *et al*., 2013), food selectivity and food location (Rutter, 1997) as well as intra-social relationships (Howery *et al*., 1996).

Table 3.1 Summary of published studies that have successfully used GPS to identify the spatial movements of grazing animals within habitats that are similar to habitats found within the UK.

Type of Animal	Type of Habitat	Authors
Sheep	UK Uplands	Rutter, Beresford & Roberts, 1997; Hulbert *et al*., 1998
Cattle	UK Uplands	Bevan & Hibbins, 2011
	Semi-natural grasslands	Hessle, Rutter & Wallin, 2008; Orr *et al*., 2012; 2014
	Open fields & forest	de Weerd *et al*., 2015
	Grasslands, heath & wetlands	Putfarken *et al*., 2008

Bicton Common is a suitable area from which to base a study of the spatial movements of grazing animals for a number of reasons. Firstly, the common is of suitable size, measuring 132.68 ha, in which to support a light grazing intensity of 0.5 LU per ha^{-1}. Secondly, the erection of stock-proof fencing around the boundary of Bicton Common in 2015 provided a fully enclosed area within which the released animals could freely graze but were unable to leave the sampling area. The significance of the fence ensured that the grazing intensity was consistent during the season and maintained the safety of the animals as the sampling area, on Bicton Common, is surrounded by roads on three sides. Historically, Bicton Common has never been grazed prior to the release of animals in 2015, therefore, no animal movement lines existed prior to this study which could influence either the HRs, selectivity or behaviour of the lead cow and pony. The common however, is open for recreational use by the public and for military training by the Royal Marines (Underhill-Day, 2009) so the impact of these two user groups does need to be recognised when considering the results of this study. Additionally, the support of the head grazier was important component of this study because of his experience and willingness to feedback his regular observations of animal movements and behaviour.

3.1.2 Importance of semi-structured interviews

Semi structured interviews should not just be limited to studies of a social science nature, instead they provide a perfect opportunity for the consultation of an experienced expert within an ecological context (Ingram, 2008; O'Keefe *et al.*, 2010; Maffey *et al*., 2013; Shaw *et al*., 2015; Young *et al*., 2018) of which, would benefit the identification of HRs on Bicton Common. Such interviews can help to direct management objectives and long term planning through an interdisciplinary dialogue (O'Keeffe *et al.*, 2010; Young *et al*., 2018) between scientists, estate managers and graziers. The preparation of questions used for this study provided an opportunity to consider the areas of knowledge that are required to help understand this research and validate the empirical data collected (Grinsted, 2005; Young *et al*., 2018). There are both advantages and disadvantages to carrying out such interviews.

The advantages to the researcher of being able to focus the ability to: ask further clarification of answers provided (Grinsted, 2005; Young *et al*., 2018); probe answers further to gather further depth (Young *et al*., 2018); to read non-verbal cues such as body language and facial cues to enhance both the depth of answer and an appreciation of the knowledge base of the interviewee. In contrast, the disadvantages may include the following: time taken to undertake and analyse the transcript; the interviewee may not fully divulge their opinion based on loyalty/pressures associated with their employers. In the case of this study, the experienced expert was Paul Swain, Senior Warden, Clinton Devon Estates who has both local knowledge and extensive experience as a grazier and habitat manager (Appendix B). Interviewing just one person can be seen as a limited strategy due to the focus on a restricted yet knowledge rich participant base however, there is only herdsman responsible for the grazing animals on Bicton Common. The advantage of this approach is that the interview questions are solely based on the research from Bicton Common and associated groups of grazing animals thus providing a case study. The behaviour of each group of grazing animals will be different based on group dynamics (Howery *et al*., 1996) and resource availability (Howery *et al*., 1996; Rutter, 2007; Kaufmann *et al*., 2013) therefore, extending semi-structured interviews to experienced experts not connected to this research may be rather generic and less useful when helping to explain the data collected from this study.

3.1.3 Aims and objectives

The first aim of this research was to identify the home ranges (HR), habitat selectivity and grazing behaviour of the animals (cow and pony) released onto Bicton Common. The second aim was to collect information from the head grazier to try to substantiate the data generated through this study with seasonal observations from an experienced expert. The aim was achieved through the following objectives:

1. To use GPS collars on lead animals to collect positional fixed data which can be used to construct maps of cow and pony HRs.

2. To use the positional fix data to identify the selected habitats by the lead animals.

3. To collect observation information through a semi-structured interview.

3.2 Methods

3.2.1 Study area and type of animals

The study area was the same area from which the baseline vegetative data (BL) was collected in Chapter 2. This area included the following habitat sites: *Ulex gallii-Agrostis curtisii* heath (European dry heath (DH)), *Erica tetralix-Sphagnum compactum* (North Atlantic wet heath (WH)) and *Schoenus nigricans – Narthecium ossifragum* mire (M). Additionally, a control plot, surrounded by a stock proof fence was set up in March 2015 which was comprised of European dry heath (CDH) and a mosaic site (CMo), of which, was predominantly *Schoenus nigricans-Narthecium ossifragum* mire and transitional *Ulex gallii-Agrostis curtisii* heath. A herd of 25 mixed heritage breed heifers (North Devon, Dexter, and Aberdeen Angus) and 25 Dartmoor ponies were released onto Bicton Common between the end of March and the start of May, 2015 and were left to graze until the end of October. The choice of cattle breed is based on the following: hardiness to withstand environmental conditions of heat and cold; ability to maintain condition on rough grazing; ability to be handled by grazier; docile temperament which is important with regards to public safety (GAP, 2009a-c). The same selection criteria is true of the Dartmoor breed (GAP, 2009d).

The combination of animal types was based on a test pilot of Dartmoor ponies alongside cattle, on Dalditch Plantation, another East Devon Pebblebed Heath (Appendix B, lines 11-15; 17) and one lead mare and a cow were selected to wear a collar and Ninjatracker GPS unit by the Senior Warden, Mr Paul Swain, based on their ability to be handled (Appendix B, lines 734; 736-737; 739-740). During the season, the collar was found to be causing sores around the neck of the lead mare through rubbing (Appendix B, lines 740-741) so for welfare reasons the GPS unit was transferred to a second mare (non-lead), which was also selected based on its ability to be handled (Appendix B, line 734).

3.2.2 GPS technology

The GPS device was set to record a positional fix every 10 minutes of which the successful GPS fix values ranged from 59-95% during the study. During the grazing season there were significant data gaps relating to periods of battery failure, lost units (cow) or, the problems caused by the webbing strap rubbing the lead mare (Tables 3.2 & 3.3).

Table 3.2 The total number of days and corresponding dates of GPS transmission obtained for the cow during 2015.

Date	Number of days
29th- 30th April	2
1st – 31st May	31
1st-12th June	12
15th-17th June	3
10th July	1
13th-24th July	12
29th-31st July	3
1st-5th August	5
11th-13th September	3
Total number of days	**72**

Table 3.3 The total number of days and corresponding dates of GPS transmission obtained for the pony during 2015.

Date	Number of days
27th-31st March	5
1st-23rd April	23
17th-19th May	3
22nd May	1
11th June	1
10th July	1
13th-16th July	4
15th-25th August	11
28th-31st August	4
1st-11th September	11
18th-19th September	2
Total number of days	**66**

3.2.3 Data analysis

Within ArcGIS 10.3, the GPS positional data was used to calculate Kernel Density Estimates (KDE) for each type of grazing animal. KDE is a tool in which the density of point features (positional fixes) around each raster cell (matrix of cells derived from the NVC map layer), from this a smooth curve is created around each point (ESRI, 2011). From the KDE, Percent Volume Contours (PVC) (50%) were generated of which, contain 50% of the positional GPS data and are therefore, used to represent the HRs for both grazing animals: cow (cHR) and pony (pHR). In some cases, the GPS unit was still transmitting when it was being transported from Bicton Common to the Clinton Devon Estate Office, of which is a 1.9 mile distance by road. Therefore, to counteract this problem a 50m buffer zone, situated outside of the fixed boundary, was created within ArcGIS 10.3 and outlier points were removed before KDE and PVC were generated.

In addition, the positional GPS data was over laid onto a digital version of the BL NVC map (Kerry 2014) constructed for chapter 2 and through spatial analysis the following information was gathered: number of GPS counts, NVC habitat type and area of NVC habitat (m^2). The same statistical methodology was applied to the data, as described in Chapter 2 and the Kruskal-Wallis, non-parametric test was selected. The percentage of GPS counts per NVC habitat type was calculated from the raw GPS data. ArcGIS 10.3 was used to generate movement lines from both observed and the positional data to evaluate the use of GPS technology for this study.

3.2.4 Direct observations

Direct observations of a non-lead mare were carried out on 16th August 2015 whilst the lead mare was observed on 30th August 2015. Observations were carried out from dawn to dusk using Opticron Oregon 4 LE WP binoculars 10 x 42 binoculars and direct sight to observe the mare at all times. Direct comparison of both GPS data and observations was not carried out for the cow due to the loss of the GPS tracker.

3.2.5 Interview

A list of questions was devised and fell under one of six sub headings: Grazing Preliminary; Reflection and plans for next season; Herdsman Route; Grazing Animals; Habitat and GPS Collars (Appendix A) and were suitably open ended and unambiguous to allow for an opinion to be freely given. The questions were given to Paul Swain one week in advance of the interview date so that the interviewee could reflect on the questions and hopefully provided as much information as possible. During the interview (26th January 2015), the questions were used to assist the conversation and direct the flow of information towards the six topic areas. The full interview was transcribed (Appendix B) but qualitative analysis software was not used due to only carrying out one semi structured interview. The interview was carried out in a meeting room at Clinton Devon Estates, Rolle Estate Office, Bicton Arena, East Budleigh, Budleigh Salterton, Devon. This was a non-pressurised environment which was familiar to the interviewee. At the start of the interview, obligatory permission was sought (Appendix C), as required by the University of Plymouth Research Ethics policy and it was made clear that the interview could have been terminated at any stage.

Both the interviewer and interviewee had copies of the semi-structured interview questions (Appendix A) to refer to throughout the interview.

3.3 Results

3.3.1 HRs and GPS points

3.3.1.1 cHR

Eighteen HRs (Figure 3.1) have been identified from the cattle GPS data (Figure 3.1) of which, cHR 2, 4 and 6 were personally observed as resting sites. A summary of the locations includes detail regarding specific NVC habitats, water sources and footpaths (Table 3.4).

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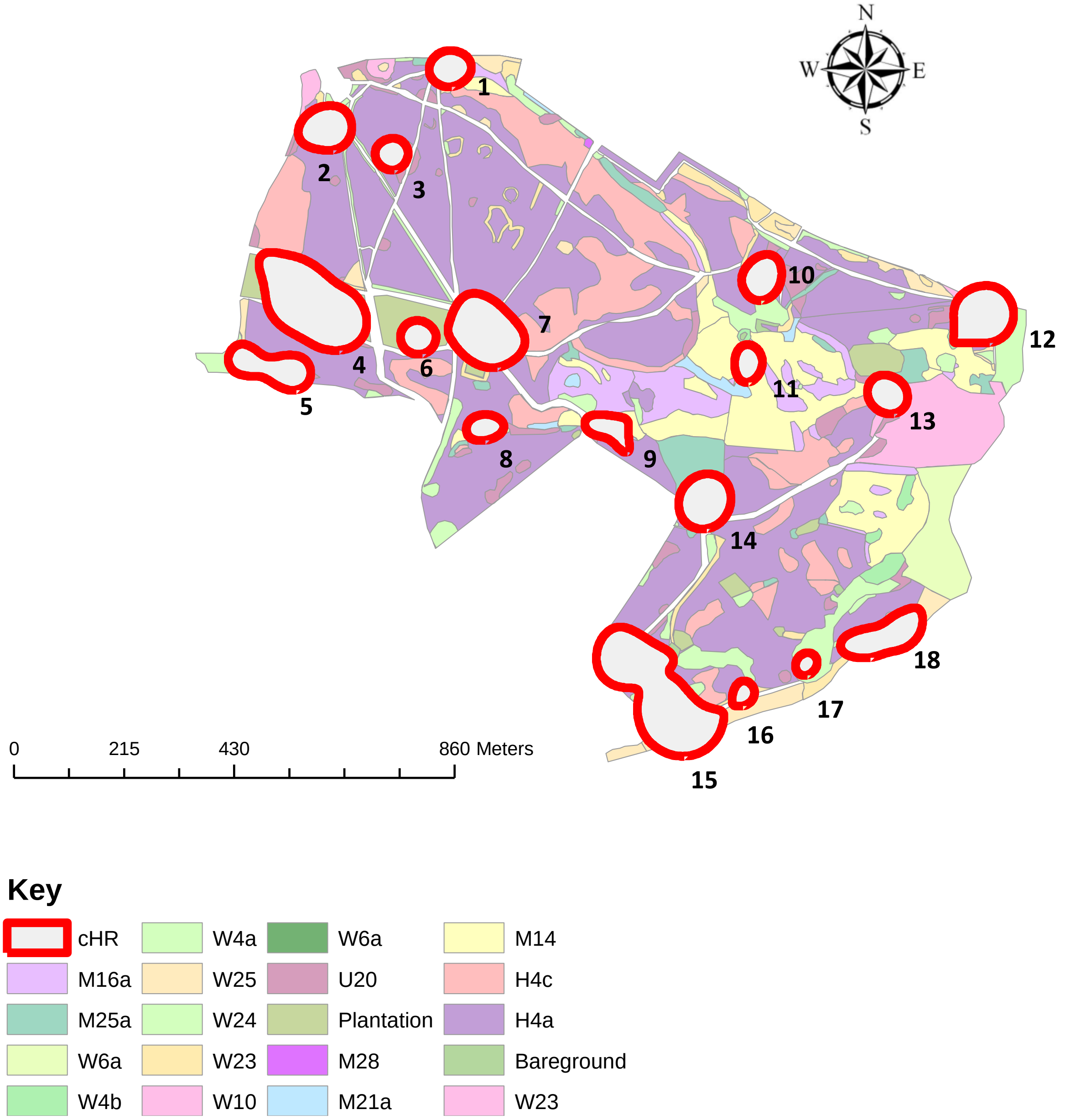

Figure 3.1 The distribution of cHRs (1-18) on Bicton Common, 2015.

Table 3.4 The description and area (m^2) of each cHR located on Bicton Common, 2015.

HR	Area of HR (m^2)	Description of HR
1	4539	Footpaths run along western edge from north to south. Patches of M25, W4a, W25, W24, W23, M14, H4a & H4c.
2	7194	Foot paths run from north to south in the eastern half of the range. Patches of H4a, H4c, W23, W24, U20, W4a,
3	3115	NVC U20 and H4a vegetation.
4	26302	Predominantly plantation with a footpath running along the northern edge and from the north-west to south-east of the range. To the north of the range patches of H4a, H4c and W23 are found. To the south, patches of H4a and H4c are found.
5	8650	Predominantly, H4a and H4c vegetation, with patches of W25 and W4a.
6	3592	A patch of plantation bordering a footpath.
7	15446	Predominantly an area of H4a vegetation to the north-east of a footpath intersection. To the north-east and south, areas of plantation exist. Small patches of W24 and W23 are present.
8	2930	Patches of NVC H4a, H4c, U20, M25a, M16a, W4a vegetation
9	4037	A small area of footpath to the western edge of the home range. Patches of NVC U20, H4a, M21a, M14 and W4b. Water source present in the form of a small pond.
10	5395	Patches of H4a, H4c, U20, W23 and W4a.
11	3137	Predominantly NVC M14 with a relative small patch of M16a. Water source present in the form of a stream.
12	11023	A footpath runs from north west to south east. Patches of NVC plantation, W4b, W4a, W10, U20 and W24.
13	4622	Predominantly, NVC W10 with patches of M16a, M25a, U20, M14, H4c and H4a. Water source present in the form of a stream.

14	8631	A footpath runs from west to south west. Patches of NVC H4a and M25a vegetation.
15	31252	Three parallel footpaths in the northern, middle and southern areas of the home range. Patches of NVC H4a, H4c, M25a, W4a, W25, W24, W23 and bare ground.
16	1691	A footpath runs along the southern are of the home range. Patches of H4a, W25, W4a and W23.
17	1451	Predominantly an area of NVC W4a and a small patch of H4a.
18	9137	NVC H4a, H4c, W4a, W24 and W23.

From the eighteen cHRs only three contain water sources (Figures 3.2-3.4) in the form of a small pool (Figure 3.2) and streams (Figures 3.3 & 3.4). There are additional pools that fall outside of cHRs 9 (Figure 3.2) and 11 (Figure 3.3), which also provide a suitable water source and therefore, may contribute to the use of the immediate habitats outside of the cHRs and thus, influence grazing within those areas. Interestingly, cHR11 is within the WH sampling site which supports the presence of the cattle in the site and indicates that the WH provides a source of water.

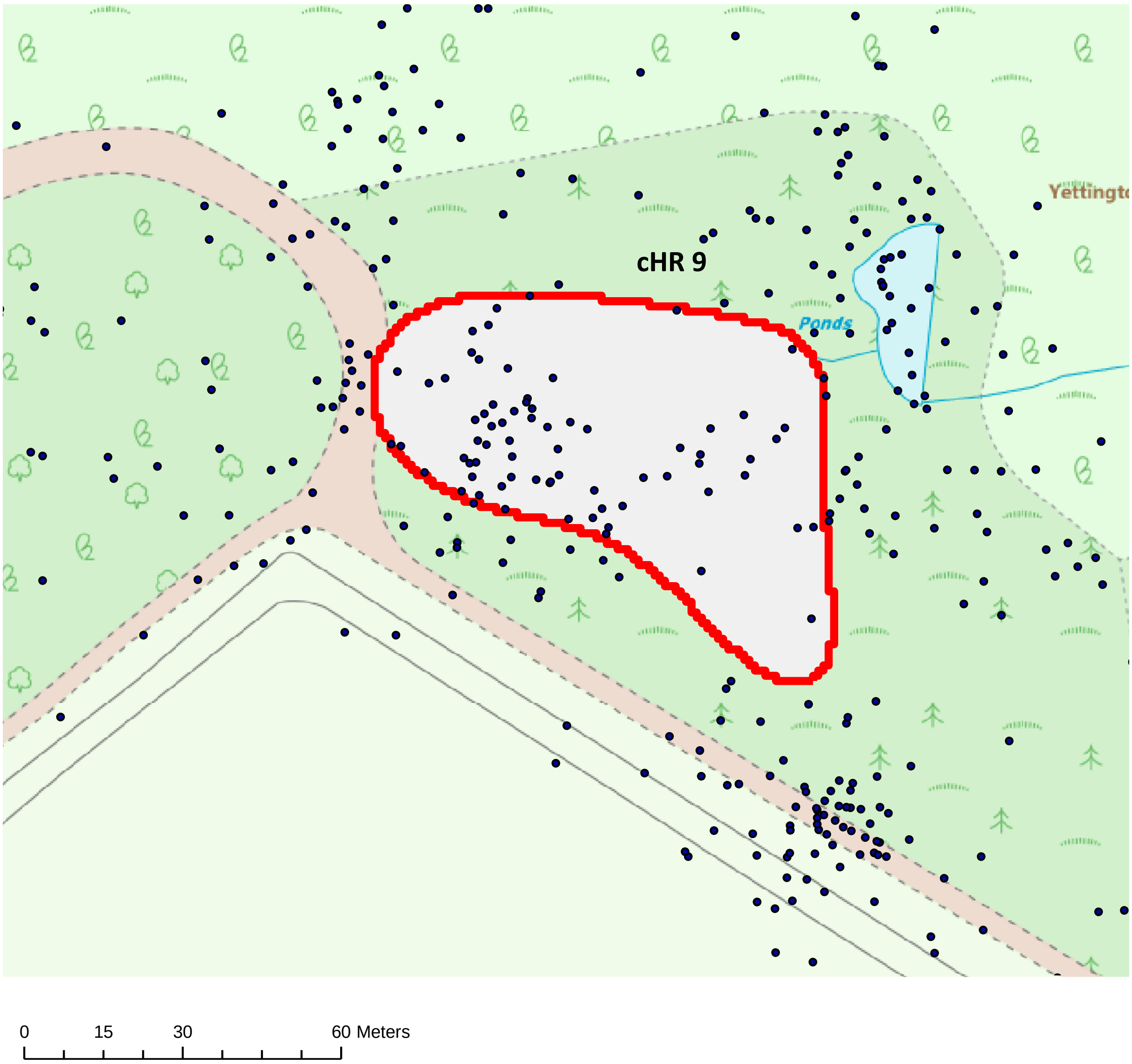

Figure 3.2 Recorded cow GPS points, in relation to cHR 9, Bicton Common, 2015.

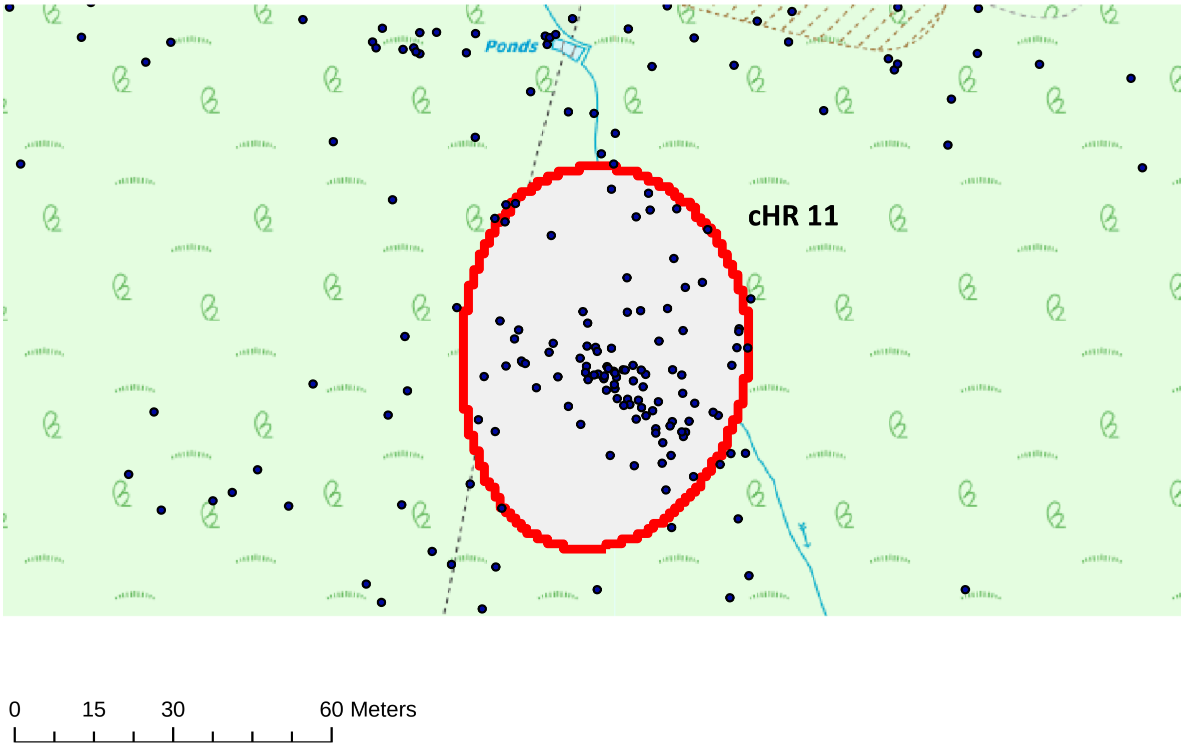

Figure 3.3 Recorded cow GPS points, in relation to cHR 11, within the WH, Bicton Common, 2015.

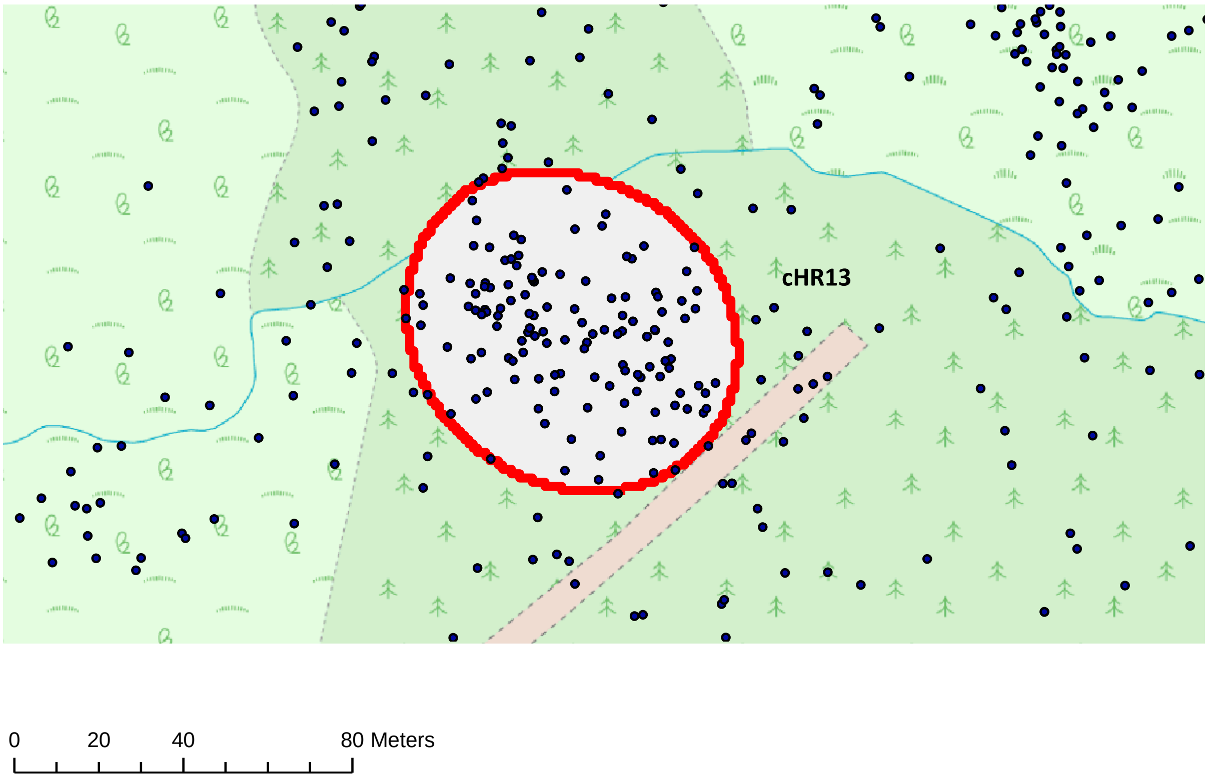

Figure 3.4 Recorded cow GPS points, in relation to cHR 13, Bicton Common, 2015.

3.3.1.2 Cattle GPS points and the vegetative sampling sites

The comparison between the locations of the permanent quadrats (Chapter 2) and the positional data shows that only quadrats 2, 3 and 8 within the DH were in close proximity to a number of GPS points recorded (Figure 3.5). In contrast, quadrats 1, 4, 13 and 14 are in close proximity to at least one GPS point whereas, quadrats 5-7, 9 – 10, 12, 15-20 were not in close proximity to any recorded GPS points.

Figure 3.5 The distribution of recorded cow GPS points and cHR7 in relation to the NVC habitats, within the DH, Bicton Common, 2015.

Within the M not one of the twenty permanent quadrats were in the close vicinity of a recorded GPS point (Figure 3.6).

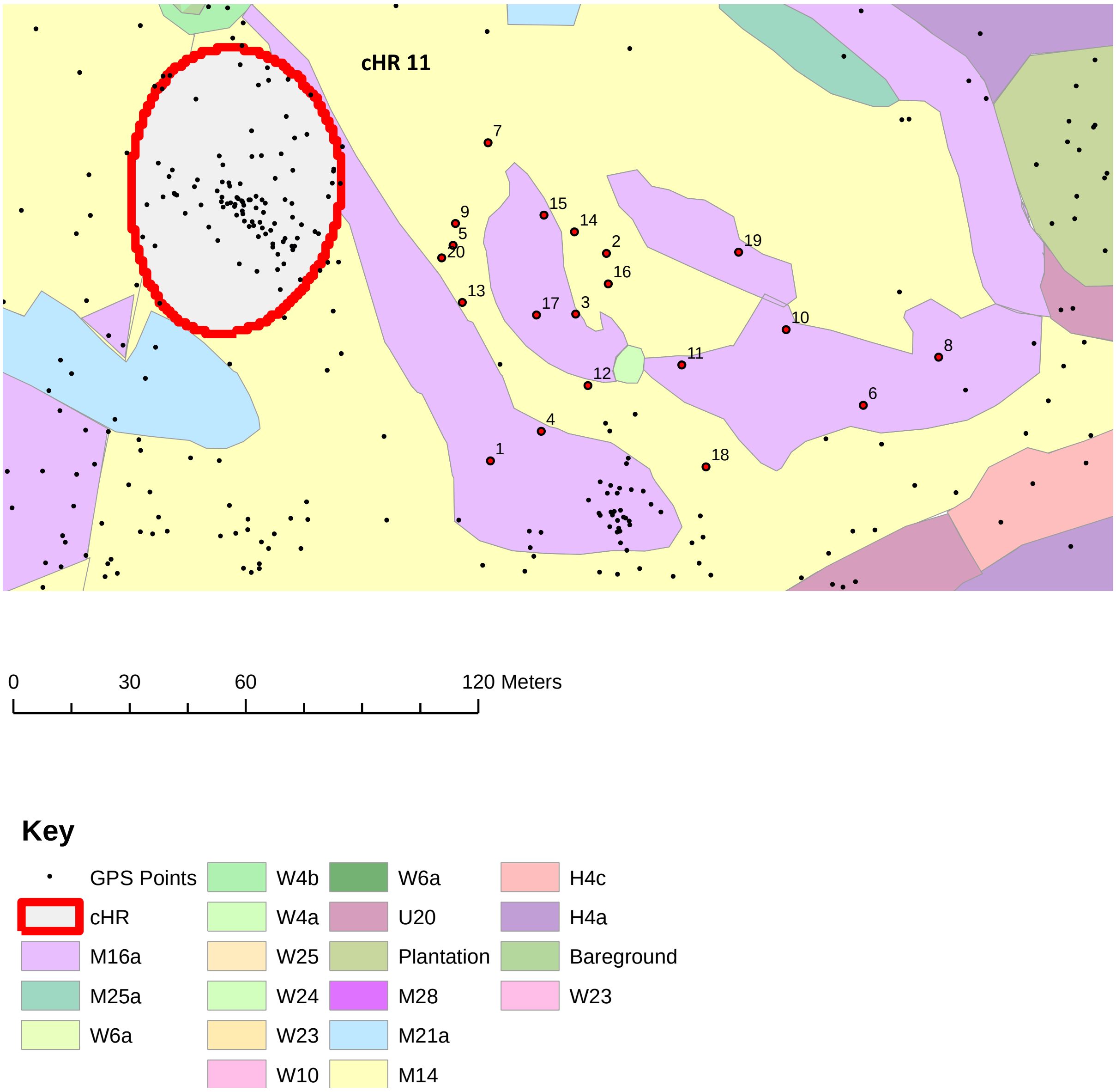

Figure 3.6 The distribution of recorded cow GPS points and cHR11 in relation to the NVC habitats, within the M, Bicton Common, 2015.

Within the WH, quadrat 18 is located within cHR11 whilst with the exception of quadrats 2, 10 and 20, all others are located within close proximity to a number of recorded GPS points (Figure 3.7).

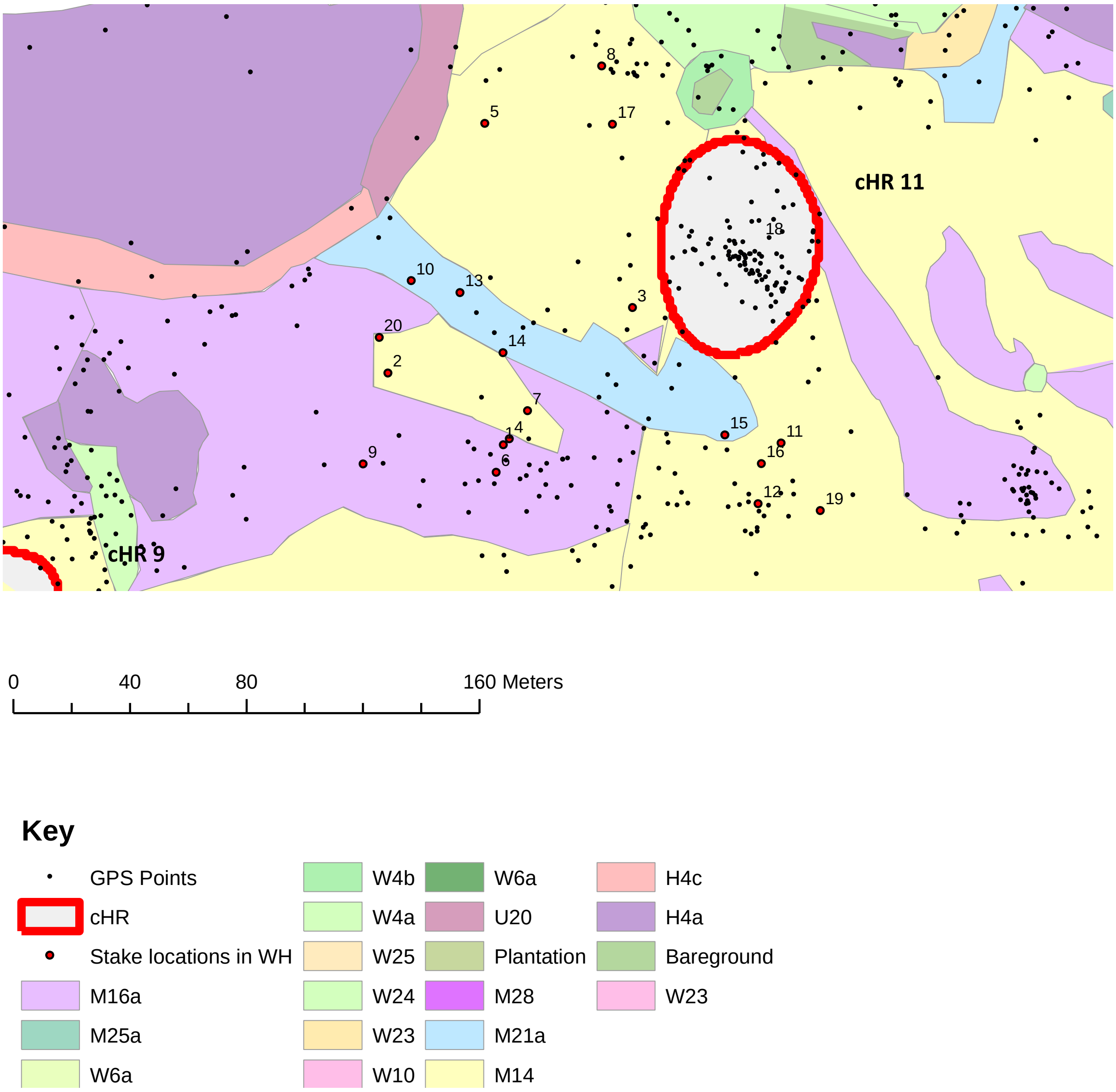

Figure 3.7 The distribution of recorded cow GPS points, cHR9 and cHR11 in relation to the NVC habitats, within the WH, Bicton Common, 2015.

3.3.1.3 pHRs

Four HRs have been identified from the pony GPS points (Figure 3.8) of which the descritpions of the locations have been summarised (Table 3.5).

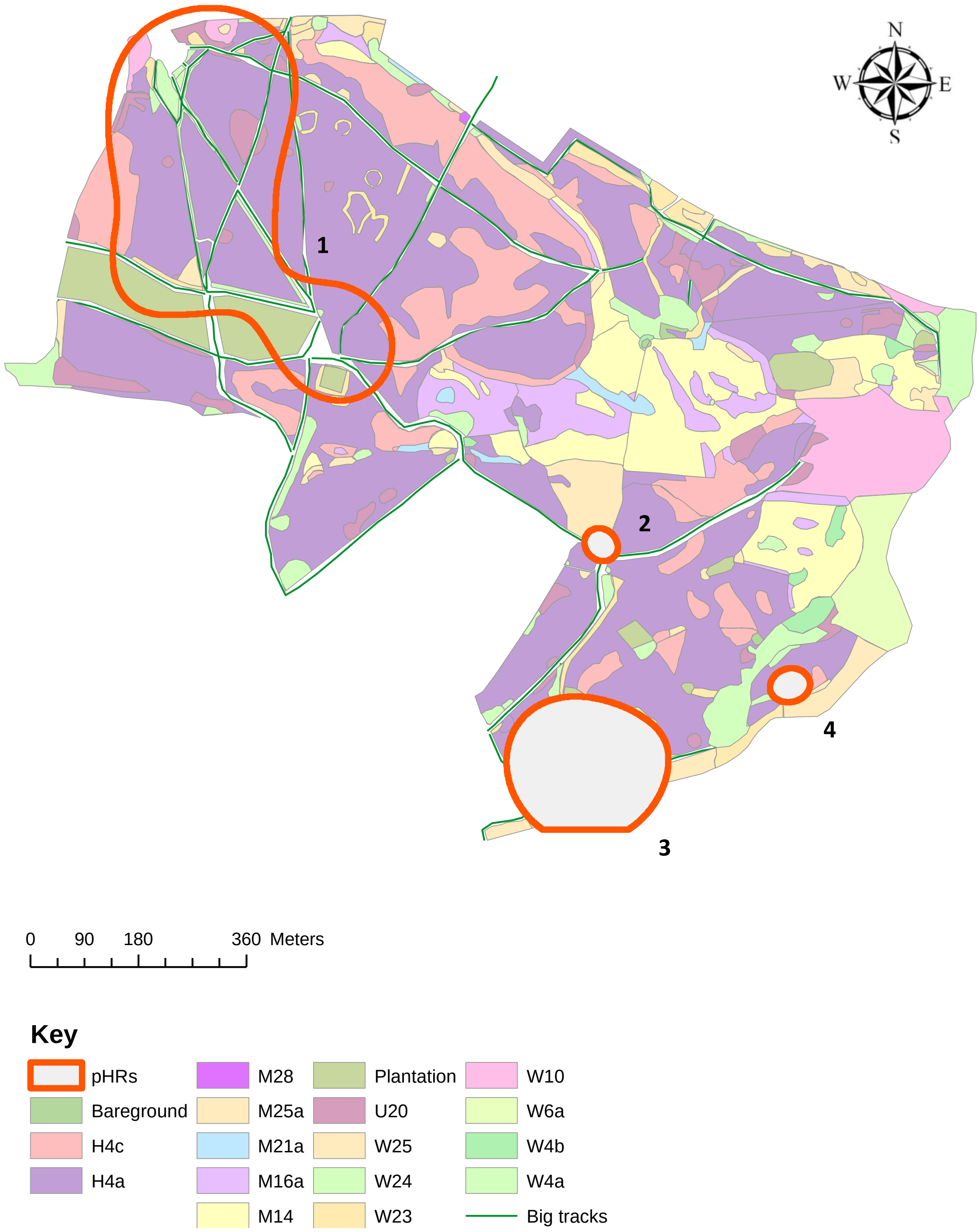

Figure 3.8 The distribution of pHRs (1-4), in relation to the NVC map created by Kerry (2014) on Bicton Common, 2015.

Table 3.5 Description and area (m^2) of each pHR located on Bicton Common, 2015.

HR	Area of HR (m^2)	Description of HR
1	170430	Numerous footpaths intersect the home range. Comprised of patches of NVC H4a, H4c, U20, M25a, plantation, W25, W24, W23, W10 and W4a.
2	2374	Footpath junction. Patches of H4a and M25a.
3	49348	Two footpaths and patches of H4a, H4cM25a, bare ground, plantation, W24, W25, W23 and W4a.
4	2963	Predominantly, H4a with patches of NVC H4c, W25 and W4a.

The comparison of cHRs with the pHRs shows that nine out of eighteen cHRs overlap with the four pHRs (Figure 3.9). The feeding pen lies within both pHR 1 and cHR7.

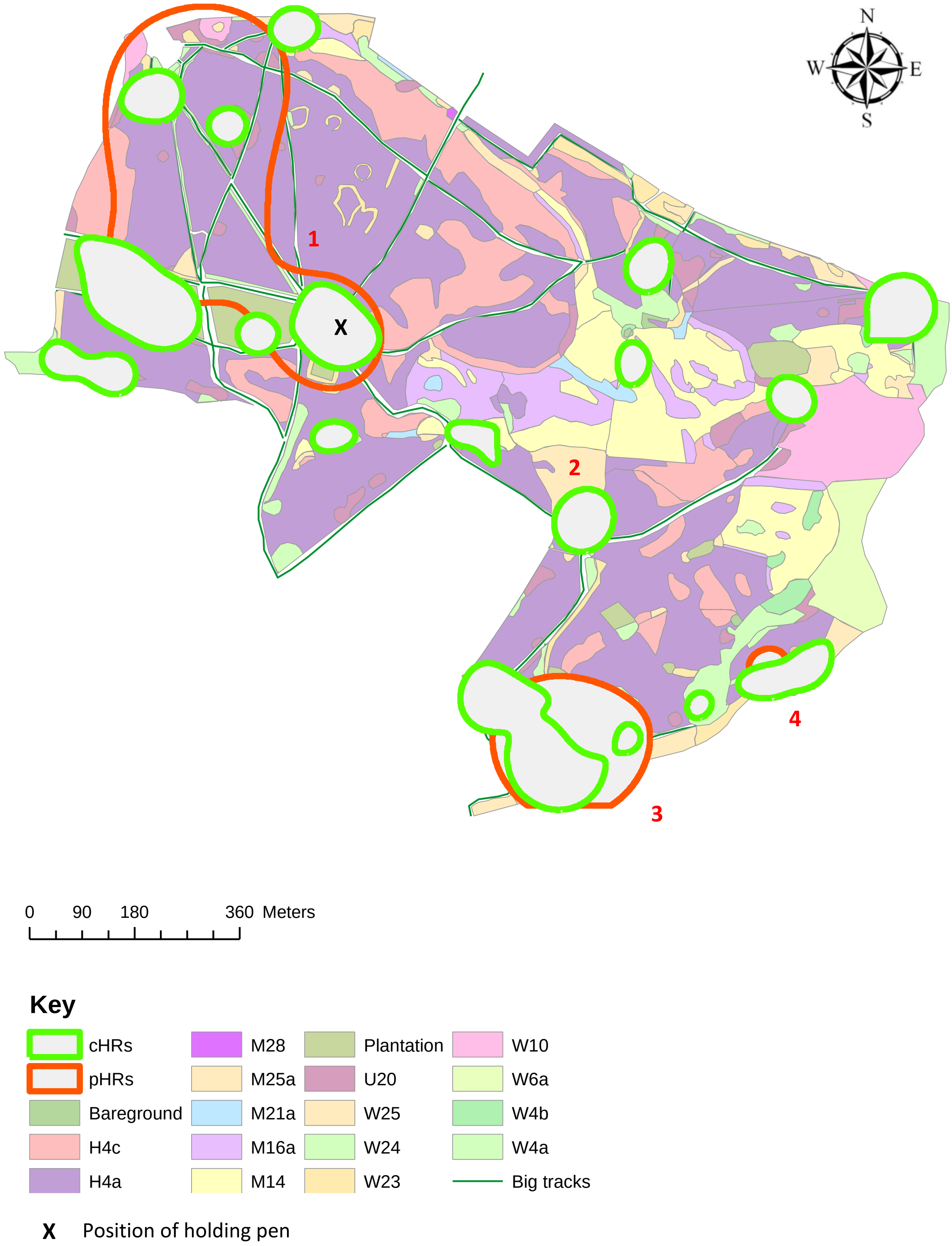

Figure 3.9 The distribution of cHRs and pHRs, in relation to the NVC map created by Kerry (2014), on Bicton Common, 2015.

3.3.1.4 Pony GPS points and the sampling sites

Within the DH, each of the twenty permanent quadrats are located in close proximity to the recorded GPS points of which, quadrats 2 and 15 are positioned very close to the edge of pHR1 (Figure 3.10).

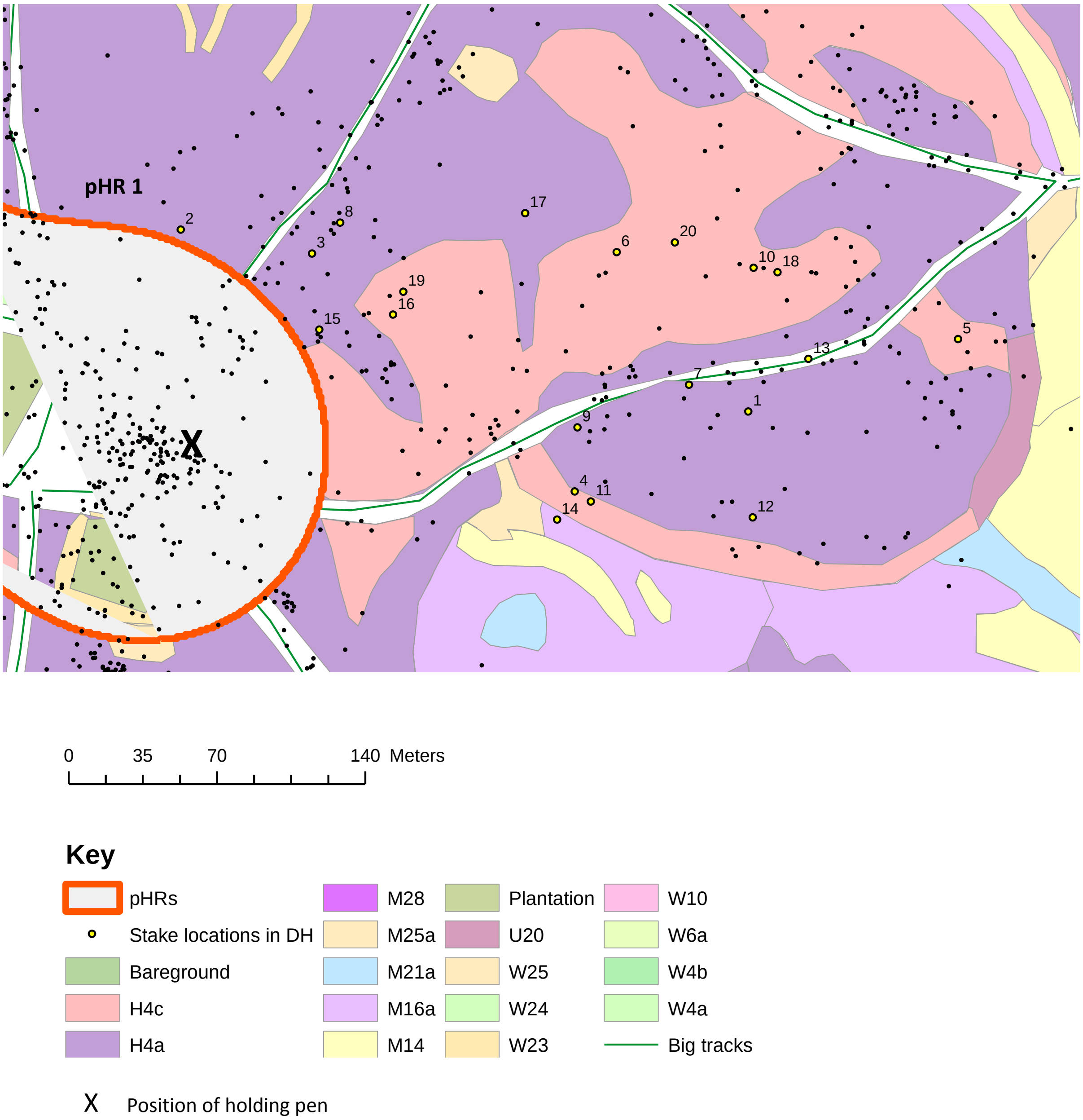

Figure 3.10 The distribution of recorded pony GPS points and pHR1 in relation to the NVC habitats, within the DH, Bicton Common, 2015.

Within the M, very few GPS points were recorded, and none were in close proximity to the twenty quadrats (Figure 3.11).

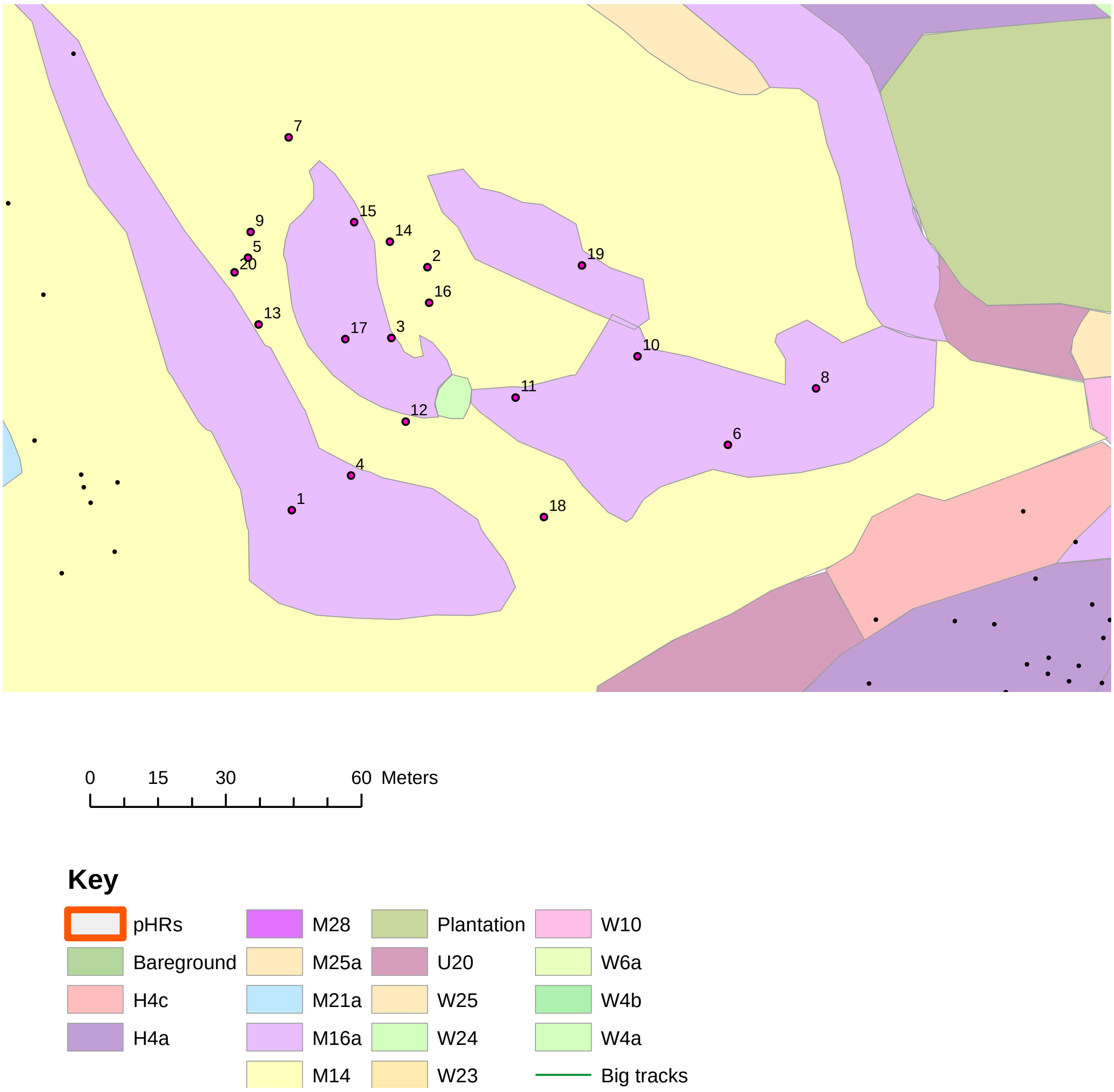

Figure 3.11 The location of permanant stakes and distribution of recorded pony GPS points in relation to the NVC habitats, within the M, Bicton Common, 2015.

Within the WH, permanent quadrats 5, 8, 11-12, 15-19 are in reasonable proximity to recorded GPS points whereas, quadrats 1-4, 6-7, 9-10, 13-14 and 20 are not positioned in areas of recorded GPS points (Figure 3.12).

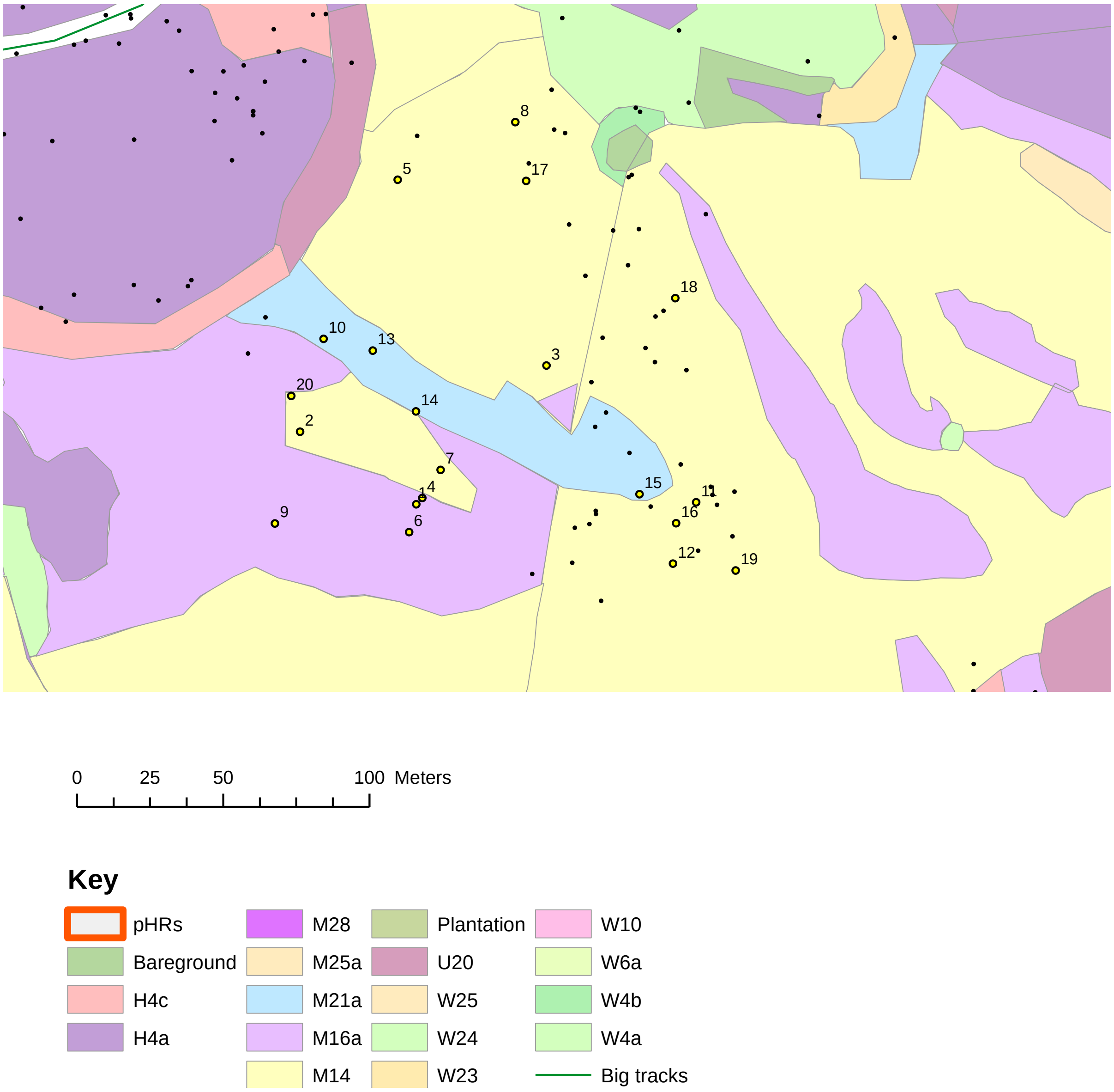

Figure 3.12 The location of permanant stakes and distribution of recorded pony GPS points in relation to the NVC habitats, within the WH, Bicton Common, 2015.

3.3.1.5 GPS data results

The maximum number of GPS counts that could be fixed within a 24 hour period is 144 and therefore, based on the number of days grazed (cow, 72 days; pony, 66 days) (Table 3. 6), the total number of expected GPS points for the cow was 10 368 and 9 504 for the pony. In reality, the actual number of GPS points recorded for each animal was lower than the expected number of GPS points recorded (n=91.4%, cow; n=81.5%, pony) (Table 3.6).

Table 3.6 A summary of the expected GPS points, actual GPS points and percentage of actual GPS points recorded relative to the expected number of GPS points, for both animal types recorded on Bicton Common, 2015.

Type of Animal	Expected GPS points recorded (max points per day*total days grazed)	Actual number of GPS points recorded	Percentage of actual GPS points recorded relative to the expected number of GPS points (%)
Cow	10 368	9484	91.4
Pony	9 504	7742	81.5

3.3.1.6 Cow GPS point and NVC habitats

The Kruskal-Wallis test identified that there was a significant difference between recorded cattle GPS positional data and NVC habitat type ($H_{(16)}$ =32.61, $P<0.05$ (adjusted for ties)) (Table 3.7). The greatest percentages of recorded GPS points were within H4a (28.61%), tracks (14.41%) and plantation (11.22%). When comparing area of NVC habitat type to the percentage of GPS points found in each habitat, H4a represented the largest area on Bicton Common with the greatest percentage of GPS points however, this trend was not noted for the tracks or plantation, instead H4c and M14 have the next greatest area (Table 3.7). The lowest percentage of GPS points were recorded within M28 (0.06%), bare ground (0.25%), W4b (0.42%), M21a (0.47%) and W6a (0.89%) all of which, have cover the lowest areas on Bicton Common.

Table 3.7 Summary of NVC habitat type, area of each NVC habitat type and the percentage of cow GPS points per NVC patch type on Bicton Common, 2015.

NVC Habitat Patch	Area of NVC habitat type (ha)	Percentage of GPS points per NVC habitat type (%)
Bare Ground	0.21	0.25
H4a	50.10	28.61
H4c	12.50	3.63
M14	9.60	5.17
M16a	4.10	2.45
M21a	0.63	0.47
M25	2.77	3.01
M28	0.02	0.06
Plantation	4.47	11.22
U20	3.62	6.13
W10	4.24	3.35
W23	2.31	1.83
W24	0.97	2.22
W25	3.13	7.76
W4a	6.10	8.14
W4b	0.64	0.42
W6a	2.05	0.89
Tracks	9.45	14.41

3.3.1.7 Pony GPS point counts

There was a significant difference between pony GPS counts and NVC habitat type ($H_{(15)}$ =34.43, P<0.05 (adjusted for ties)). The greatest percentage of GPS points per NVC patch type was recorded in H4a (34.13%) and along the tracks (25.57%) whereas, the lowest percentage was recorded within M21a (0.08%), W4b (0.16%) and bare ground (0.18) whilst no GPS points were recorded within M28 (Table 3.8). The percentage value recorded within H4a correlates to this habitat covering the greatest area but this trend is not seen for tracks in which H4c is found to cover the second largest area on Bicton Common. With regards to the lowest percentage values, all 4 correlate to the lowest areas of cover on the common.

Table 3.8 Summary of NVC habitat type, area of each NVC habitat type and the percentage of pony GPS points per NVC patch type on Bicton Common, 2015.

NVC	Total Patch Counts	percentage of patch counts
BareGround	9	0.18
H4a	1698	34.13
H4c	338	6.79
M14	54	1.09
M16a	34	0.68
M21a	4	0.08
M25	174	3.50
plantation	173	3.48
U20	143	2.87
W10	63	1.27
W23	142	2.85
W24	187	3.76
W25	339	6.81
W4a	310	6.23
W4b	8	0.16
W6a	27	0.54
nul	1272	25.57

3.3.1.8 Pony observations and GPS points

There were limitations of the GPS data and therefore, any movement routes created from the data would be inaccurate as emphasised by the observed route (red) and the ArcGIS 10.3 generated route (green) (Figure 3.13). Just after dawn, at 0600h, 16th August 2015, the pony was directly observed grazing in H4a vegetation (A), in close proximity to the DH, but in the absence of fixed GPS points between A and B, a direct movement line was generated by ArcGIS 10.3 rather than showing the pony's actual route via tracks, plantation and bare soil. The route observed from B to C was direct through the plantation however, the GPS route reflects that the pony crosses two tracks. From C to E the pony moves across Bicton Common via a track but in contrast, the four fixed GPS points, once joined together, reflect a different route.

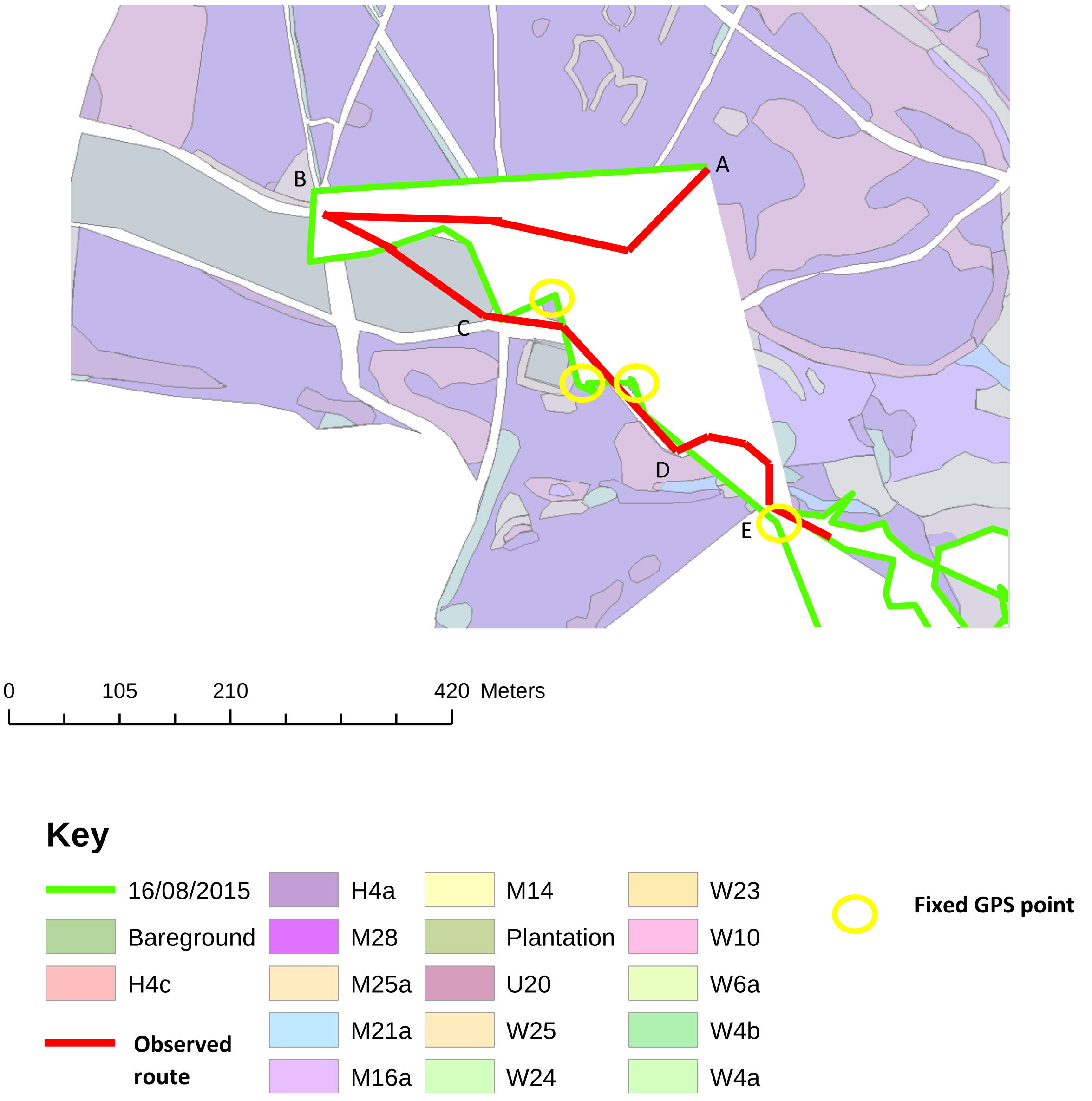

Figure 3.13 Comparison of the route generated from recorded pony GPS data and the actual route mapped from direct observations of the pony on 16th August 2015, in the north west area of Bicton Common.

3.4 Discussion

3.4.1 Spatial use of Bicton Common and grazing animal HRs

With regards to the cattle, 18 HRs were identified and there is little doubt that cHR 7 is largely attributed to the site of regular feeding of the cattle, by the Clinton Devon Estates Wardens (Appendix B, lines 709-712) thus supporting the idea that HR can based on the location of food and preference (Rutter, 2007). The presence of water sources can be used to explain the location of cHRs 9, 11 and 13 therefore, supporting other studies that have already made the links between spatial use and water (Howery *et al*., 1996; Rutter, 2007; Kaufmann *et al*., 2013). Importantly to note, the water sources within the cHRs were not the only sources present therefore, the cow has selected these sources to regularly return to use therefore, contributing to the generation of HRs. In contrast, the pHRs do not include water sources therefore, the presence of such a resource does not seemed to have influenced the pony during this study on Bicton Common. The fact that the pony would have needed, to have had, a regular intake of water to remain hydrated means that other sources of water are likely to have been obtained possibly through the ingestion of grasses and herbaceous species; small puddles; dew and rain water collected within the vegetation. Positional GPS data was recorded for the pony within the WH indicating that it had moved through the site but not enough fixes to generate a HR. Another fundamental factor contributing to HRs is the nature of intra-social relationships (Howery *et al*., 1996).

On Bicton Common, there was no strong herding instinct for the cattle due to the age structure being comprised of 18-24 months therefore, no dominant cow existed (Appendix B, lines 242-244; 354-357) and the cattle typically grazed the common in small groups of 2 or 3 (Appendix B, lines 369-372). The GPS points indicate that the collared cow did graze within each of the vegetative sampling sites however, due to the nature of the herd dynamics it is not possible to identify whether non-collared cows grazed within the vegetative sampling sites and certainly, no conclusions can be drawn with regards to whether the cHRs of different cattle groups overlapped. The same uncertainty regarding the spatial use of the common by non-collared ponies can be applied based on the breakdown of the group of twenty-five ponies into numerous smaller groups as the season went on (Appendix B, lines 318-321; 323-329) although, one of the stark differences between cHRs and pHRs was the area covered by the pony.

It was interesting to note that although only four pHRs had been identified, pHR1 covered a relatively large area (170430 m^2) of which, included the main grassy footpaths linking the car park, and areas of plantations. In the interview carried out with Paul Swain, (Appendix B, lines 38-39; 138-140; 142-144), he describes how, like the cattle, the ponies selected the easiest species first, such as the grasses and then grazed along the fire breaks, that are used as footpaths, as part of a grazing cycle therefore, it was not surprising that pHR1 is the largest pHR.

3.4.2 Sampling sites and selectivity

The behavioural concept of selectivity, in terms of grazing, is typically linked to heterogeneous landscapes of which are characterised by different plant communities, whereby vegetative species were possibly limited in abundance and not equally distributed (Utsumi *et al*., 2009). With regards to this study, selectivity of habitats by the grazing animals can be supported by GPS points recorded across Bicton Common.

3.4.2.1 Selectivity by cow

In the case of the cattle, on Bicton Common, observations discussed during the interview indicate that they consumed the grasses and stripped the birches first, before moving onto the grasses within the WH (Appendix B, 138-39; 147; 152-158). It is thought that this selective approach taken may have been attributed to the ease of accessing the forage (Appendix B, lines 138; 144-145). On Bicton Common the percentage of GPS points associated with tracks supports studies that have shown cattle to have used roads as corridors in which to commute to areas for grazing (Pratt *et al*., 1986; Howery *et al*., 1996). The significance of the network of footpaths across the common makes both the DH and WH accessible thus reflected by the greatest abundance of GPS points recorded close to the WH permanent quadrats, with some points recorded close to the DH quadrats. During the study, the tracked cow formed a small group with two other cows, which were identified as using the tracks during the time spent recording the vegetative data, not just for commuting but also for grazing. Another example whereby the correlation between the percentage of GPS counts and habitat type may not be solely attributed to grazing is reflected by the data obtained for H4a habitat types.

The H4a habitat, contributed to the greatest percentage cover of all NVC habitat types and taking into consideration the opinions put forward by Mandaluniz, Aldezabal and Oregui (2011) and Boland (20011), it is possible that the cattle were not selecting the DH vegetation to graze due the relatively density of the ericaceous species and their relatively lower nutritional availability (Mandaluniz, Aldezabal and Oregui, 2011) and palatability (Boland, 2011). This may mean that the GPS counts were recorded within this site was contributed to commuting to reach habitats from which they did selectively graze. The same applies to the plantation habitat in which this habitat does not offer grazing opportunities but instead, it is likely to be used as an area to shelter and rest as supported by the third highest percentage of recorded GPS points. With regards to accessibility, the M can be considered as harder to reach due to the only path in close proximity to this site being incredibly steep, with pebble substrate underfoot therefore, access is likely to be via other NVC habitats. In this case, the cow would have needed to selectively choose to continue to graze towards and within the M site or, to change cardinal direction and graze other vegetative habitat types. With regards to the M, it is likely that the high water table and the soft substrate created unstable conditions underfoot resulting in the cow not being recorded close to any of the twenty permanent quadrats. This may also be supported by the lowest percentage GPS count data having been recorded within the M28 habitat and the third lowest value calculated for W4b habitat types.

3.4.2.2 Selectivity by pony

As with the cow, the greatest percentage of GPS points were recorded within the H4a habitat which coincides with the ArcGIS map of the DH showing that the GPS points were recorded in close proximity to every permanent quadrat. Whilst undertaking vegetative sampling in June 2015, different groups of ponies were personally observed, walking along a relatively new movement line, grazing, as they crossed the DH, as well as grazing along the grassy tracks (Appendix B, lines 139-140; 142-144).

The footpaths provided a supply of easy to graze, fresh grass for the ponies and therefore, the paths, particularly those that fell within HR1, became part of their grazing circuit, as described by Paul Swain, (Appendix B, lines 139-140; 142-144) and supported by the GPS data having the second highest percentage of counts for this NVC habitat type. In support of other studies, it is also likely that the pony used the tracks as a commuter route to selectively reach desired habitat patches to graze (Pratt *et al*., 1986; Howery *et al*., 1996). From studies on horses, there is evidence to suggest that they select based on the nutritional quality of the vegetative species present (Loucougaray, Bonis and Bouzillé, 2004; Edouard *et al*., 2010) and that there is often a trade-off between quality and quantity of forage, thus resulting in alternating patch selectivity (Edouard *et al*., 2010). Loucougaray, Bonis and Bouzillé (2004) typically found that the grasses sampled within wet depressions, during early spring, were of greater biomass and nutritional value however, anecdotal evidence suggested that the pony was considered to have entered the WH much later in the grazing season (Appendix B, lines 152-158). It is therefore possible that the collared pony wanted to increase the volume of forage as the season progressed rather than select taller grasses with relatively higher levels of digestible protein earlier in the season (Edouard *et al*., 2010) which may explain why the pony grazed the WH later in the season and why 9 quadrats were in close proximity to GPS points. With regards to why the W21a, W4b and W6a habitats had the lowest recorded GPS points, soft substrate and continually high water table of the M may have made these habitat patches inaccessible to the ponies. In particular, M21a vegetation is typically comprised of *Sphagnum* species which holds water thus again, not providing a suitable surface from which to move.

<u>3.4.3 Evaluation of the use of GPS technology and direct observations</u>

One of the main limitations of this study was the use of just one GPS collar, per type of grazing animal, at any one time. Past studies have used more than one GPS collar in which Ungar *et al*., (2011) used five, Kaufmann *et al*., (2013) employed eleven whilst der Weerd *et al*., (2015) used nine. The single employment of the GPS units would have been less of a problem had all 25 individuals of each type of animal moved around together instead of breaking into a number of smaller groups therefore, not making it possible to draw conclusions about group dynamics and behaviour. Regardless of the number of GPS units involved, the topography can play a big role in the acquisition of GPS fixes (Buerkert & Schlecht, 2009). Through personal communication with Shaun Lewin, Senior Technician (Geospatial Technologies, University of Plymouth), it is thought that the valley running through Bicton Common, of which the mire habitat was situated, was significant enough to affect GPS fix acquisition and therefore, contributed to the less than expected number of GPS points collected. If the acquisition time between fixes was too long, the spatial data collected would only indicate the collared animal as moving in a straight line between two points (Rutter, 2007) which was supported by the ArcGIS 10.3 map generated from the pony GPS data which was inaccurate as validated by direct observations. Additionally, direct observations, between dawn and dusk, may not obtain all data relevant to animal activity and movement as studies of cattle have provided evidence for reduced grazing during the night or, if daily temperatures and/or humidly are relatively high, cattle are likely to spend longer grazing beyond dusk (Blackshaw, 1986). Finally, another factor that may influence the quality of observations and impact on the natural behaviour of grazing animals (Rutter, 2007) is the regular presence of a researcher, both stationary and moving.

This was certainly the case during direct observations carried out for this study, in which, the non-lead mare (16th August 2015) made contact with both the surveyor and members of the public. The friendly nature of this pony was also commented upon during personal communication with Paul Swain, Senior Warden, Clinton Devon Estates, whilst undertaking vegetative survey work (October 2015) and the interview (Appendix B, lines 734; 739-741; 743; 745). In contrast, the lead mare became a little uneasy in the presence of a researcher validated by the observations of the pony having stopped grazing and instead was watching the researcher or, walking away, rather than grazing. The significance of these observations raises the idea that the behaviour observed may in fact be a direct result of the animal's change in environment and the modified behaviour of a few individuals may indeed modify the behaviour of the majority or, all of the remaining group.

3.5 Conclusions

From this study, the GPS data was used to identify HRs for both the cow and pony and that there was evidence to suggest that habitat selectivity by both animals occurred. The significance of the cHRs relate to management and the need for regular monitoring of these HRs to identify areas that may become overgrazed and/or, damaged by trampling before such damage occurs. It would then be possible for a decision to be made to reduce grazing intensity or, protect a given area through the erection of fencing, although, this may not be possible if such areas contained known animal water sources. Grazier insights, collected from the semi-structured interview, were useful to validate some of the explanations concluded from the Arc GIS 10.3 maps and provide a greater understanding of the anecdotal observations from an experienced expert, that would not have been gained from current literature regarding Bicton Common. This understanding can therefore, be applied when assessing the impact of grazing. With this in mind, it is the analysis of GPS data and qualitative information that highlights the need for further vegetative surveys to be carried out within each site in order to assess the impact of grazing.

Chapter 4 - The impact of grazing

4.1 Introduction

4.1.1 *Grazing profiles*

In order to assess the impact of grazing animals on lowland heath it is important to fully understand morphologically and behaviourally, the differences between the way in which cattle and ponies graze. Cattle will cut vegetation with their teeth as well as, using their tongues to curl around vegetation to rip from the plant (EN, 2005; Burchett & Burchett, 2011). In contrast, ponies will cut vegetation (EN, 2005a) at much lower levels and will be less uniform in their grazing approach to vegetative heights (Burchett & Burchett, 2011). With regards to the length of time grazing, ponies will spend much of their time consuming vegetation due to their relatively small stomachs and the fact that they are non-ruminants and will digest their food relatively quickly (Appendix B, lines 174-175). Cattle however, will eat until they feel full, and then spend time relaxing as they digest and ruminate (Appendix B, lines 163; 169-172). The grazing profile and the selectivity choices discussed within Chapter 3, will contribute to the impact on lowland heath vegetation.

4.1.2 *The importance of grazing in lowland heath management*

Conservation grazing is considered beneficial in the management of lowland heath as a way to increase habitat diversity by introducing variation within structure height, composition of vegetative species (Bullock & Pakeman, 1997; EN, 2005a, b) and a way of controlling the spread of more invasive type species (EN, 2005a), such as *M. caerulea* and *P. aquilinum* (EN, 2002; Bullock & Pakeman, 1997), scrub (English Nature, 2002; Bullock & Pakeman, 1997) and trees (EN, 2002; Bullock & Pakeman, 1997). In turn, the changes in vegetation can thus positively influencing species richness (EN, 2005a) of birds (EN, 2002), invertebrates (Bullock & Pakeman, 1997; EN, 2002; Garcia *et al*., 2010; Buglife, 2017) and reptiles (Bullock & Pakeman, 1997; EN, 2002a; Edgar, Foster & Baker, 2010) who seek refuge within the lowland habitats.

Unfortunately, grazing, if not suitably managed may have a negative impact on habitats and thus detrimentally affect animal and plant populations (EN, 2003).

M. caerulea has been assessed as being a contributing factor in the unfavourable recovery condition of the DH on Bicton Common and with this in mind grazing could be of use. The resultant reduced height of the grass however, removes the structure to which spiders build their webs and it has been found that when gorse species are grazed, flowering will occur later thus having the potential to interfere with invertebrates who rely on the flowers and leaves as food sources (EN, 2003). With regards to other plant species, if grazing is not of a suitable intensity, *Betula spp*. (Birch) may still invade lowland heath as part of the successional process (Manning, Putwain & Webb, 2004). Interestingly, the grazing by cattle has been found not to have decreased the grass cover within grass heaths or, prevent the invasion of grass within heather instead, it was found to have increased species richness within the first five years, but which then later decreased (Bokdam & Gleichman, 2000).

Without a doubt, a scientific approach (EN, 2003) is required to assess the impact of grazing and this study has provided the opportunity to understand which vegetative species were selected, the impact on both *M. caerulea* and the biodiversity of a lowland heath habitats.

4.1.3 Aims and objectives

The aim of this study was to assess the impact of grazing (GY1 & GY2) on the three sampling sites (DH, WH & M) relative to the control plot (CDH & CMo) on Bicton Common. The aim was achieved through the following objective:

1. To carry out an analysis of the BL, GY1 and GY2 data sets to establish if there had been any changes in the following: percentage cover of eight species identified from Chapter 2; sward height for *M. caerulea;* biodiversity.

4.2 Materials and method

4.2.1 Sampling methods

The same protocol described in Chapter 2 for vegetative sampling was adopted for this study. The study area included the following habitat sites: *Ulex gallii-Agrostis curtisii* heath (European dry heath (DH)), *Erica tetralix-Sphagnum compactum* (North Atlantic wet heath (WH)) and *Schoenus nigricans – Narthecium ossifragum* mire (M). Additionally, a control plot, surrounded by a stock proof fence was set up in March 2015 which was comprised of European dry heath (CDH) and a mosaic site (CMo), of which, was predominantly *Schoenus nigricans-Narthecium ossifragum* mire and transitional *Ulex gallii-Agrostis curtisii* heath. A total of 25 mixed heritage breed cattle (Devon Ruby Reds, Dexters & Aberdeen Angus) and 25 Dartmoor ponies were released onto Bicton Common between March and May of 2015 (GY1) and 2016 (GY2) and then removed from the sampling area in October of each grazing year. Where the permanent stakes were no longer present during the vegetative surveys, GPS was used to identify the original position of the stakes.

4.2.2. Data analysis

The same methodology described in Chapter 2 is repeated for this chapter of which, also applies to the selection of statistical test used to analyse percentage cover of species, percentage cover of substrate and sward height of *M. caerulea* are summarised in Table 4.1.

Table 4.1 Summary of the values for normal distribution, normal distribution of residuals, R-sq (adj) and the appropriate statistical test for each species, soil and water recorded across the five sites, for BL, GY1 and GY 2 data sets.

Species	Normal Distribution (P value)	Distribution of Residual (P value)	R-sq (adj) (%)	Statistical Test
C. vulgaris	<0.005	<0.005	39.01	Kruskal-Wallis Test
E. tetralix	<0.005	<0.005	21.06	Kruskal-Wallis Test
M. caerulea	<0.005	0.478	28.19	ANOVA
U. gallii	<0.005	<0.005	43.72	Kruskal-Wallis Test
E. cinerea	<0.005	<0.005	0.97	Kruskal-Wallis Test
N. ossifragum	<0.005	<0.005	17.37	Kruskal-Wallis Test
E. angustifolium	<0.005	<0.005	1.60	Kruskal-Wallis Test
S. subnitens	<0.005	<0.005	7.26	Kruskal-Wallis Test
Soil	<0.005	<0.005	0.75	Kruskal-Wallis Test
Water	<0.005	<0.005	32.97	Kruskal-Wallis Test
Sward height	<0.005	<0.005	35.90	Kruskal-Wallis Test

4.3 Results

4.3.1 Percentage cover of vegetation

4.3.1.1 C. vulgaris

The mean percentage cover of *C. vulgaris* showed significant difference for site ($H_{(4)}$ = 150.29, P<0.001 (adjusted for ties)) with the greatest median percentage cover having been recorded within the CMo ($\tilde{x}$ = 13.33) in contrast to the lowest value found within the WH ($\tilde{x}$ = 3.97) (Table 4.2).

Table 4.2 Summary of the median percentage cover for each species across each site.

Species	Site				
	DH	**M**	**WH**	**CDH**	**CMo**
C. vulgaris	11.84 (± 1.042)	10.54 (± 1.136)	3.97 (± 0.383)	10.06 (± 1.494)	13.33 (± 1.045)
E. tetralix	7.51 (± 0.843)	6.92 (± 0.619)	16.00 (± 0.678)	13.08 (± 0.972)	14.85 (± 0.561)
E. cinerea	11.00 (± 1.196)	0.00 (± 0.000)	0.85 (± 0.198)	61.66 (± 48.841)	3.81 (± 0.488)
U. gallii	27.39 (± 1.148)	4.70 (± 0.682)	14.23 (± 1.186)	32.08 (± 1.200)	11.48 (± 0.772)
N. ossifragum	0.00 (± 0.000)	4.16 (± 0.725)	4.89 (± 0.681)	0.42 (± 0.242)	0.76 (± 0.200)
E. angustifolium	0.34 (± 0.236)	0.59 (± 0.358)	0.00 (± 0.000)	0.00 (± 0.000)	0.07 (± 0.029)
S. subnitens	0.00 (± 0.000)	2.90 (± 0.541)	4.97 (± 1.073)	0.00 (± 0.000)	2.53 (± 0.691)

A significant difference was found between year ($H_{(2)}$ = 8.91, P<0.05 (adjusted for ties)) in which there was a decrease in the median percentage cover from BL ($\tilde{x}$ = 13.66) to GY2 ($\tilde{x}$ = 4.90) (Table 4.3).

Table 4.3 Summary of the median of percentage cover for each species, during each year (BL, GY1 & GY2).

Species	Year		
	BL	**GY1**	**GY2**
C. vulgaris	13. 66 (± 1.309)	11.10 (± 0.761)	4.90 (± 0.541)
E. tetralix	12.27 (± 0.919)	11.12 (± 0.535)	12.62 (± 0.278)
E. cinerea	1.05 (± 0.278)	5.50 (± 0.623)	24.55 (± 17.796)
U. gallii	14.85 (± 1.272)	16.67 (± 0.948)	18.57 (± 0.956)
N. ossifragum	0.00 (± 0.000)	4.43 (± 0.665)	4.71 (± 0.748)
E. angustifolium	0.39 (± 0.237)	0.25 (± 0.027)	0.00 (± 0.000)

4.3.1.2 E. tetralix

The median percentage cover of *E. tetralix* showed significant difference for site ($H_{(4)}$ = 119.39, P<0.001 (adjusted for ties)) with the greatest value having been calculated for the WH site ($\tilde{x}$ = 16.00 ± 0.678) and the lowest recorded within the M ($\tilde{x}$ = 6.92 ± 0.619) (Table 4.2). Grazing has resulted in significant difference between years ($H_{(2)}$ = 24.25, P<0.001 (adjusted for ties)) causing an increase in the median percentage cover from BL ($\tilde{x}$ = 12.27 ± 0.919) to GY2 ($\tilde{x}$ = 12.62 ± 0.278) (Table 4.3).

4.3.1.3 U.gallii

The median of the percentage cover of *U. gallii* showed significant difference for site ($H_{(4)}$ = 250.42, P<0.001 (adjusted for ties)) in which the highest median values were recorded within the CDH ($\tilde{x}$ = 32.08 ± 1.200) and DH ($\tilde{x}$ = 27.39 ± 1.148) with the lowest value from the M ($\tilde{x}$ = 4.70 ± 0.682) (Table 4.2).

A significant difference between years ($H_{(2)}$ = 6.73, P<0.05 (adjusted for ties)) is also reflected by an increase in the median from BL data ($\tilde{x}$ = 14.85 ± 1.272) to GY2 ($\tilde{x}$ = 18.57 ± 0.956) (Table 4.3).

4.3.1.4 E. cinerea

The median percentage cover of *E. cinerea* showed significant difference for month ($H_{(1)}$ = 5.18, P<0.05 (adjusted for ties)) in which there was a greater value of cover in October ($\tilde{x}$ = 19.08 ± 14.039) relative to June ($\tilde{x}$ = 5.08 ± 0.534).

The significant difference between site ($H_{(4)}$ = 193.49, P<0.001 (adjusted for ties)) was reflected by the highest median values having been recorded within the CDH ($\tilde{x}$ = 61.66 ± 1.200) and DH ($\tilde{x}$ = 11.00 ± 1.196) with this species having not been recorded within the M (Table 4.2).

There was a significant difference between years ($H_{(2)}$ = 52.64, P<0.001 (adjusted for ties)) reflected by a large increase in the median from BL ($\tilde{x}$ = 1.05 ± 0.278) to GY2 ($\tilde{x}$ = 24.55 ± 17.796) (Table 4.3).

4.3.1.5 N. ossifragum

The median of percentage cover of *N. ossifragum* showed significant difference for site ($H_{(4)}$ = 119.39, P<0.001 (adjusted for ties)) with the highest values having been recorded within the WH ($\tilde{x}$ =4.89 ± 0.681) and M ($\tilde{x}$ = 4.16 ± 0.725) whilst it was not recorded within the DH (Table 4.2).

There was a significant difference between years ($H_{(2)}$ = 24.25, P<0.001 (adjusted for ties)) reflected by the presence of this species in GY1 ($\tilde{x}$ = 4.43 ± 0.665) and subsequent increase of median in GY2 ($\tilde{x}$ = 4.71 ± 0.748) (Table 4.3).

4.3.1.6 E. angustifolium

The median percentage cover of *E. angustifolium* showed significant difference for site ($H_{(4)}$ = 61.93, P<0.001 (adjusted for ties)). The greatest values recorded within the M ($\tilde{x}$ = 0.59 ± 0.358) and DH ($\tilde{x}$ = 0.34 ± 0.236) whilst no data was recorded within the WH and CDH (Table 4.2).

The significant difference between years ($H_{(2)}$ = 16.54, P<0.001 (adjusted for ties)) was reflected by the decrease of the median between BL ($\tilde{x}$ = 0.39 ± 0.237) and GY1 ($\tilde{x}$ = 0.25 ± 0.027) followed by the absence of this species in GY2 (Table 4.3).

4.3.1.7 S. subnitens

The median percentage cover of *S. subnitens* showed significant difference for site ($H_{(4)}$ = 78.18, P<0.001 (adjusted for ties)) in which the highest value was recorded within the WH ($\tilde{x}$ = 4.97 ± 1.073) but was not recorded within the DH or CDH (Table 4.2).

4.3.1.8 M. caerulea

The mean percentage cover of *M. caerulea* showed significant difference for site ($F_{(4, 566)}$ = 78.18, P<0.001 (adjusted for ties)) in which Tukey's pairwise comparison (P= 0.01) highlighting that the data from M ($\bar{X}$ = 26.75 ± 1.714) and DH ($\bar{X}$ = 26.20 ± 1.419) are grouped together indicating that they are not significantly different. This trend also applies to the WH ($\bar{X}$ = 37.78 ± 2.246) and CDH ($\bar{X}$ = 35.03 ± 2.73) (Figure 4.1).

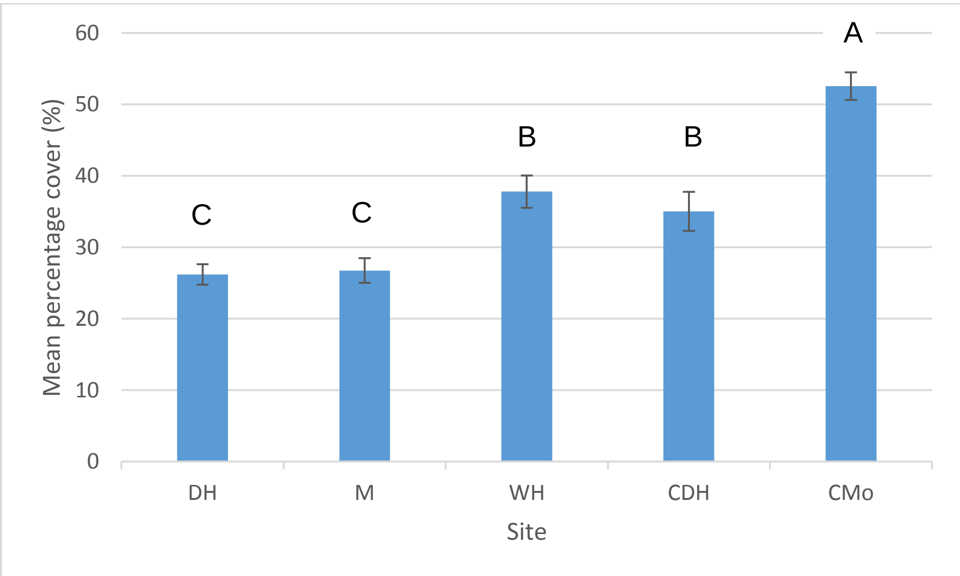

Figure 4.1 Mean (± SE) percentage cover of *M. caerulea* found at each site

Means that do not share a letter are significantly different (Tukey's pairwise comparison at P= 0.01).

The analysis highlights that there is a significant difference between years ($F_{(2, 566)}$ = 4.93, P<0.05 (adjusted for ties)) with Tukey's pairwise comparison (P= 0.01) highlighting that the BL data ($\bar{X}$ = 34.14 ± 2.014) is significantly different from GY2 ($\bar{X}$ = 39.09 ± 1.232) (Figure 4.2).

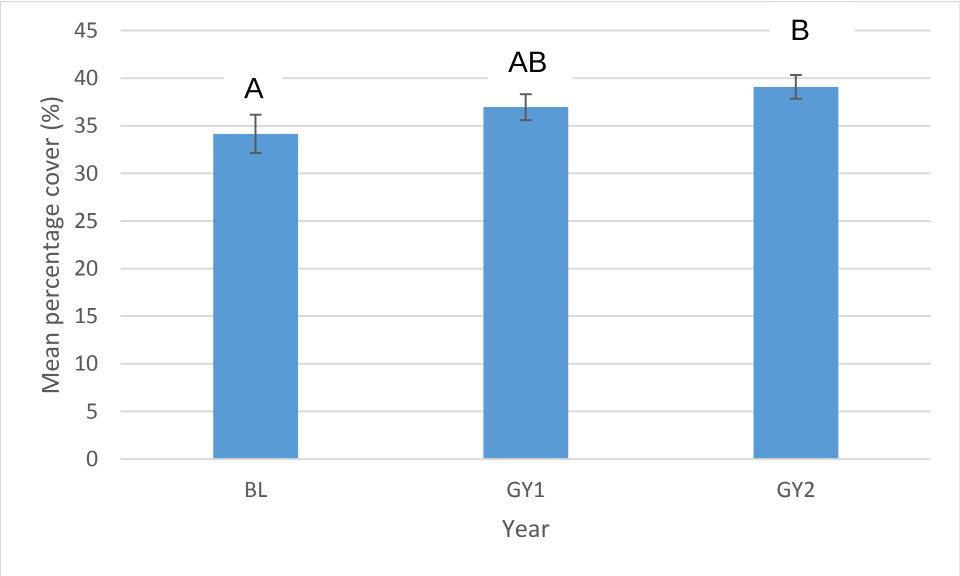

Figure 4.2 Mean (± SE) percentage cover of *M. caerulea* found during each year (BL, GY1 & GY2).

Means that do not share a letter are significantly different (Tukey's pairwise comparison at P= 0.01).

4.3.1.9 Soil, rock and water

The median of percentage cover of soil showed significant difference for site ($H_{(4)}$ = 18.16, P<0.05 (adjusted for ties)) with the greatest value having been recorded in the CMo ($\tilde{x}$ = 0.79 ± 0.274) but was not recorded within the CDH (Figure 4.3). The median percentage cover of water showed significant difference for site ($H_{(4)}$ = 204.13, P<0.001 (adjusted for ties)), the highest median value was recorded within the M ($\tilde{x}$ = 17.03 ± 2.127) whilst no water was recorded within the DH or, CDH (Figure 4.3).

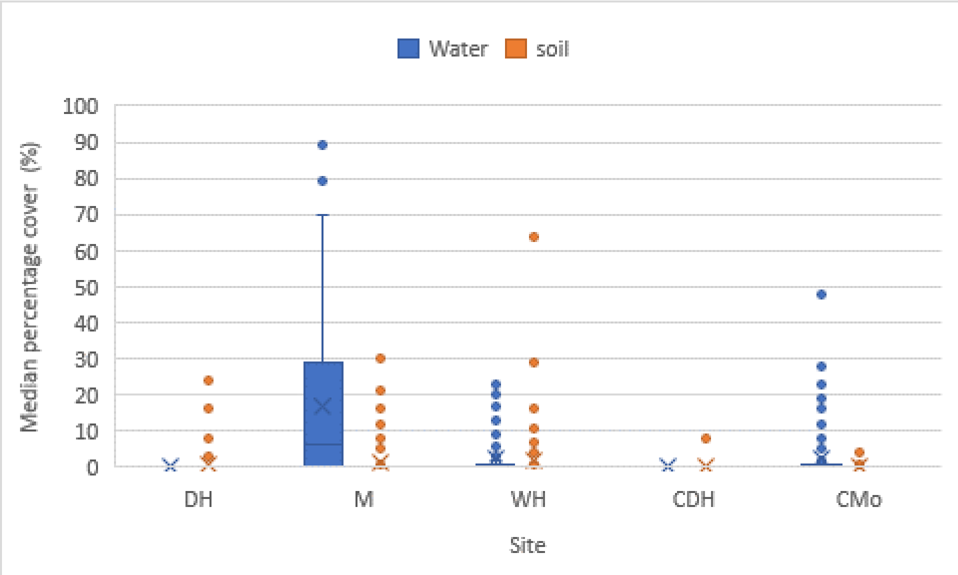

Figure 4.3 Median percentage cover of soil and water found across each site

4.3.2 Mean sward height of *M. caerulea*

The analysis identified significant difference between sites ($H_{(4)}$ = 3551.05, P<0.001 (adjusted for ties)) in which the median sward height was higher in the CDH ($\tilde{x}$ = 58.94 ± 0.345) and CMo ($\tilde{x}$ = 54.80 ± 0.280) relative to the M ($\tilde{x}$ = 33.00 ± 0.370) (Figure 4.4).

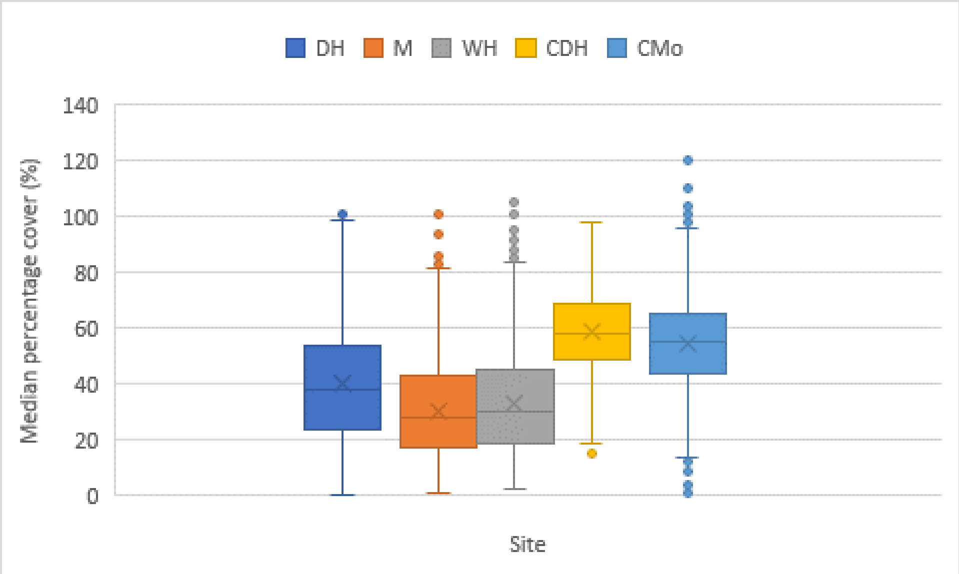

Figure 4.4 Median percentage sward height of *M. caerulea* for each site

The data for year also showed significant difference for year ($H_{(2)}$ = 8.72, P<0.05 (adjusted for ties)) in which the median sward height was higher in GY2 ($\tilde{x}$ = 44.35 ± 0.320) relative to the BL data ($\tilde{x}$ = 43.09 ± 0.344) (Figure 4.5).

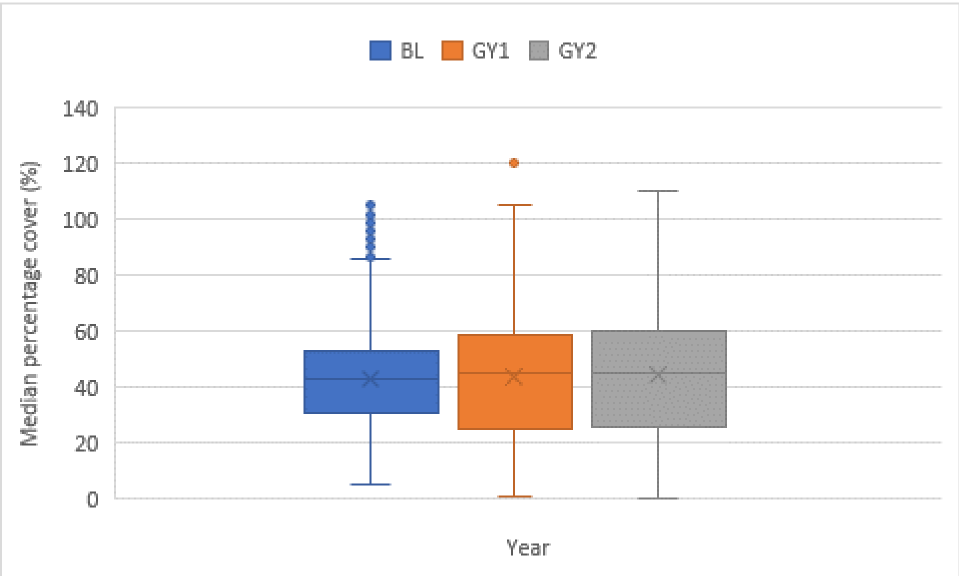

Figure 4.5 Median percentage sward height of *M. caerulea* for each year

There was also a significant difference between month ($H_{(1)} = 4.76$, $P<0.05$ (adjusted for ties)) in which the median sward height was shorter in October ($\tilde{x} = 43.24 \pm 0.268$) relative to June ($\tilde{x} = 44.16 \pm 0.266$).

The median of the sward height had decreased in CMo but not CDH as a result of GY 1 and GY2. The difference in median height over the three years was 23.00 cm (M), 20.50 cm (WH) and 10.00 cm (DH) (Table 4.4).

Table 4.4 Summary of the median sward height (cm), across each site during BL, GY1 & GY2.

Site	**Year**		
	BL	**GY1**	**GY2**
DH	44.00 (± 0.641)	35.00 (± 0.683)	34.00 (± 0.621)
M	40.00 (± 0.555)	23.00 (± 0.569)	17.00 (± 0.419)
WH	43.00 (± 0.581)	22.50 (± 0.549)	22.50 (± 0.511)
CDH		58.00 (± 0.487)	58.00 (± 0.403)
CMo		56.00 (± 0.376)	55.00 (± 0.335)

4.3.3 Biodiversity

The three relatively higher mean biodiversity values from this study, are all found within the M and are higher than the equivalent BL data analysed within Chapter 2 (Table 4.4). This is supported by an increase in the total number of species recorded in GY2 (Figure 4.7) of which, the additional species recorded were typical of the M. In contrast, the lowest mean biodiversity value remains the same post grazing for the DH but the third lowest value in GY2 is lower than the equivalent from the BL data (Table 4.5). A decrease in the total number of species was recorded for the DH and WH in GY1, which remained the same in GY2 (Figure 4.7).

Table 4.5 Comparison of the relatively highest and lowest mean Shannon-Weiner biodiversity H values between the BL data and all of the data sets (BL, GY1 & GY2).

	BL Data (Chapter 2)	**All data (Chapter 4)**
Relatively higher biodiversity values	WH, October ($\bar{X}$= 1.391± 0.048)	M, June, GY1 ($\bar{X}$= 1.709 ± 0.338),
	M, October ($\bar{X}$= 1.366 ± 0.048)	M, October, GY1 ($\bar{X}$= 1.700 ± 0.341)
	WH, June ($\bar{X}$= 1.349 ± 0.041)	M, June, GY2 ($\bar{X}$= 1.532 ± 0.521)
Relatively lower biodiversity values	DH, October ($\bar{X}$= 0.333 ± 0.11)	DH, October, BL ($\bar{X}$= 0.333 ± 0.11)
	M, June ($\bar{X}$= 1.08 ± 0.468)	CDH, June, GY1 ($\bar{X}$= 0.367 ± 0.059)
	DH, June ($\bar{X}$= 1.25 ± 0.217)	DH, October, GY1 ($\bar{X}$= 0.401 ± 0.149)

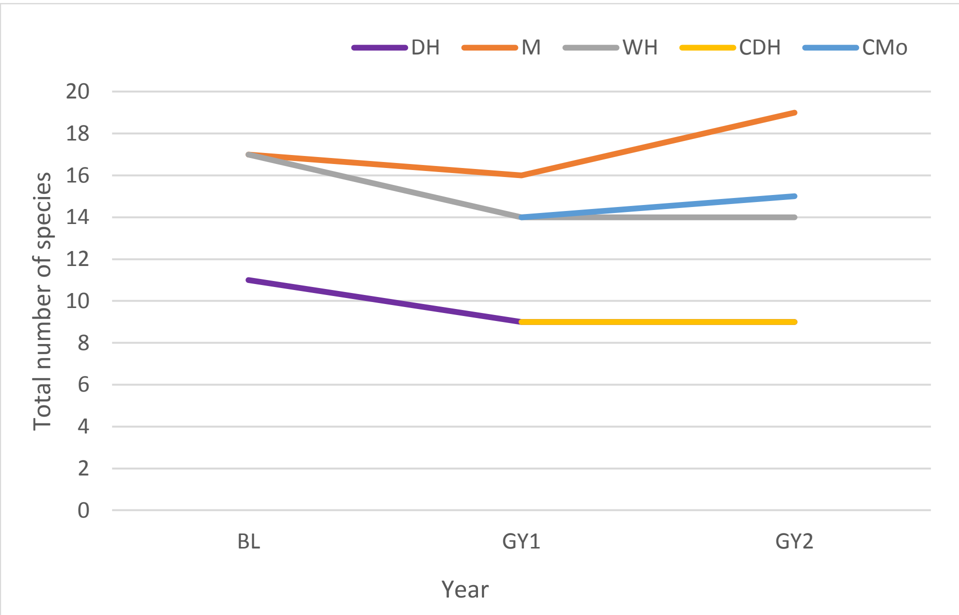

Figure 4.7 Total number of species per site, per year

**The curve for DH (GY1-GY2) is masked by the curve for CDH

4.4 Discussion

4.4.1 Percentage cover of species

4.4.1.1 C. vulgaris

It could be argued that the relatively lower median cover value of *C. vulgaris* recorded within the WH is likely to be due to this species having a preference for dryer conditions (Rose & O'Reilly, 2006; Stace, 2010) however, this is contradicted by a relatively greater value having been recorded in the M. The higher value recorded within the M is unlikely to be attributed to an area of transitional vegetation because the abiotic conditions are not favourable instead, the analysed data is important because it supports grazing having had an impact. Firstly, the significant difference of cover between years is reflected by a median cover range of 8.76%, from BL to GY2, of which the cover decreased. Secondly, GPS data points confirm the presence of both types of grazing animal within the WH whereas, fewer GPS points were recorded within the M for each collared animal. Finally, the interview confirmed that both types of animals had spent time within the WH (Appendix B, lines 152-157) and that the ponies had grazed on scrub and gorse (Appendix B, lines 20-21; 189-191) of which, it is likely that *C. vulgaris* would have been found within this type of vegetation and possibly consumed. In terms of future management, these results highlight that *C. vulgaris* may be vulnerable to over grazing and that this species would need to be continually monitored to ensure that the cover was sufficient enough not to impact on the biodiversity and also to extend sampling to include height of this species to fully document the impact of grazing.

4.4.1.2 E. tetralix

It is not surprising to note that the higher values were found within the WH and CMo because this species favours a wetter set of abiotic conditions (Bannister, 1966; Rose & O'Reilly, 2006; Stace, 2010).The cover for the M site is lower due to the conditions being unfavourable and less likely due to grazing because the analysis of the Arc GIS maps highlights fewer GPS points within the M by both animals. In contrast, there is a larger cover values in the CDH in relation to the DH which may indicating that grazing has had an impact. The animals did not enter the control plot but both the cow and pony were recorded as having spent time within the DH however, statistically, the impact on this species from grazing has been to increase cover from BL to GY2, which based on studies by Bannister (1966) is not surprising because this species is considered to be less palatable in relation to *C. vulgaris*. With such contradictory results, further years of data collection is required to help draw conclusions.

4.4.1.3 U. gallii

As expected, *U. gallii* was recorded as having relatively higher median cover values within the dryer conditions (Rose & O'Reilly, 2006; Stace, 2010) of the CDH and DH relative to the wetter conditions of the M. The CDH had a relatively greater value to the DH as a result that it is situated within the control plot and therefore, could not be grazed. Interestingly, at several times within the interview Paul Swain mentioned that the ponies had been observed eating the gorse (Appendix B, lines 20-21; 148; 189-191) however, the statistical analysis supports an increase in this species from BL to GY2. It is therefore, possible that any grazing undertaken and/or the impact of trampling was not sufficient enough to have reduced cover and in actual fact, animal movements within the sites, particularly the DH and WH may have opened up the relatively closed canopies of *C. vulgaris* and enabled further establishment and/or growth of *U. gallii*.

4.4.1.4 E. cinerea

E. cinerea is another ericaceous species that prefers dryer abiotic conditions (Rose & O'Reilly, 2006; Stace, 2010) which again, explains the relatively higher median values being calculated form the CDH and DH data sets. When considering these two sites, it is easy to argue that the CDH has a much greater value because it was located within the control plot and had not been grazed. From, BL to GY2, the median cover value increased with a final range of 23.5%. It can therefore be argued that this is another example of how trampling and grazing within the DH and WH did not reduce cover and as with *U. gallii*, the animals may have selected other plant species, such as *C. vulgaris*, to graze. With regards to the month, the statistical analysis indicates that there is a seasonal difference for this species. The relatively lower median value in June could be attributed to the growth of new shoots which are then selected for grazing due to the comparatively higher content of simple carbohydrates and protein then as the season progresses, the plant becomes less palatable (Boland, 2011) and digestible (Mandaluniz, Aldezabal and Oregui, 2011) resulting in the animals selecting other species. The reduced selectivity and continued growth of this species may therefore contribute to the higher value for October. The implications of this impact of grazing should be considered when constructing long term management plans, through the identification of potential species which may suffer from reduced cover and thus affect biodiversity and/or may alter the characteristics of the NVC habitats.

4.4.1.5 N. ossifragum

The requirements of this species for wetter abiotic conditions (Rose & O'Reilly, 2006; Stace, 2010) would account for the presence of this species within the WH, M and CMo and not within the DH. By the end of GY2, the species was recorded as having an increased median cover value which although could be partially contributed to relatively lower presence of grazing animals within the M, it is likely to be a result of *N. ossifragum* being comprised of photodynamic molecules which contribute to photosensitisation and nephrotoxicity in cattle thus, was not selectively grazed (Pollock *et al*., 2015).

4.4.1.6 E. angustifolium

E. angustifolium is typically found within lowland bogs (Stace, 2010) thus providing the explanation for the greater median value having been recorded within the M and lower values recorded within the CMo and absence within the CDH. Contradictorily, the focus on favourable abiotic conditions does not support the presence of this species within the DH. Animal presence, based on the GPS points was limited within the M therefore, the reduction of this species to zero at the end of GY2 may be due to the increased median cover value of the water in the M, although this cannot be substantiated by the statistical data and would therefore, require further years of data collection to explore the trends highlighted so far.

4.4.1.7 S. subnitens

The only significant difference highlighted for *S. subnitens* was based on site, of which, data was linked to the WH, M and CMo due to the preference of this moss species for relatively wet abiotic conditions (BBS, 2013). The analysis did not highlight any significant differences based on year therefore, it can be concluded that grazing had not impacted on this species however, the largest median cover value for this species was identified within the WH which was a site visited by the grazing animals therefore, there is a possibility that this species was either not selected sufficiently to cause a difference or, was not a favoured species to consume. Further studies would be required to explore why there is no change as literature is limited with regards to grazing and *S. subnitens*.

4.4.1.8 M. caerulea

When considering the analysis for year, *M. caerulea* has actually increased it's cover over the two grazing years, supporting the same findings from Bokdam and Gleichman (2000) in which growth is stimulated by the removal of seed heads and dead growth (RHS, 2018). The very nature of grazing through forage consumption has implications when considering the conservation objective of the reduction of *M. caerulea* within a habitat. In such cases, management plans may need to incorporate an integrated approach and included burning or, increase the intensity of grazing so that the growth rate of *M. caerulea* is restricted. In the context of differences between sites, the cover values are likely to be attributed to site characteristics as is the case of the relatively lower values associated with the M due to the unfavourable <4 pH of peaty soil (Gore & Urqhuart, 1966; Elkington *et al*., 2001). In contrast, the DH was assessed as being densely covered by ericaceous species (JNCC, 2006) of which may contribute to the relatively lower cover value for *M. caerulea* in comparison to the WH, CDH and CMo.

4.4.1.9 Substrate

The greatest cover of soil was found within the CMo of which, has a stream running through the site and therefore, edges of the stream that are not vegetated will have contributed to the cover value. Whereas, the relatively high median values of water within the M, WH and CMo are based on the typical abiotic site characteristics. For both soil and water cover, there was no significant difference between year therefore, grazing statistically, has not had an impact so far on Bicton Common. If there had have been a significance increase in soil and/or water at the end of GY2, this may have been a result in a decrease in species cover and/or biodiversity therefore, there are implications if the cover values change as a result of future grazing.

4.4.2 Mean sward height of M. caerulea

As described in Chapter 2, the lower mean sward height in October relative to June is likely to be due to the annual dieback of the species thus indicating that this species is sensitive to seasonal changes. When considering sites, the relatively higher mean sward heights were recorded within the CDH and CMo thus supporting the principle of a control plot which was not accessible by grazing animals. In contrast, the lowest mean height was recorded within the M which may be attributed to lower growth rates due to the wet conditions rather than grazing, as the GPS data within Chapter 3 indicates limited activity within the M by both grazing animals. Interestingly, the mean sward height over the years increased but based on the overall increase of *E. tetralix*, *U. gallii* and *E. cinerea*, from BL to GY2, it cannot be argued that the animals selected other species which therefore, allowed the *M. caerulea* to increase its growth rate due to reduced competition. With this in mind, the management of sites would possibly benefit from a higher grazing intensity and/or encouraging animals into a target area with a detrimental presence of *M. caerulea* through the siting of a salt lick tablet or, even enclosing areas with fencing within which animals could target graze. In contrast, the only species that decreased it's cover over the study was *C.vulgaris* but further study would be required to explore the type of interaction between these two species based on the negative correlation identified from this study.

4.4.3 Biodiversity

Out of the three sites, the DH had the relatively lowest biodiversity both at the start of the study and at the end. In contrast, the biodiversity within the M had increased from BL to GY2 which is often a management objective. When considering the total number of species, both the M and WH sites started with the same value but during the study the total number of species within the M increased whilst the opposite trend was highlighted for the WH. Additionally, the total number of species also decreased within the DH during the study. The presence of the grazing animals within the DH and WH during GY1 and the decrease in total number of species supports the conclusion that grazing has had a negative impact on these two sites although, how much is attributed to consumption in relation to trampling is unclear and would require further study. The negative changes in species richness and biodiversity highlights that maybe the grazing intensity was too high and therefore, other practices may need to be employed to protect these habitats through the use of fencing to exclude grazers or, encouraging animals to graze in other areas, again, through carefully sited salt lick tablets.

4.5 Conclusion

From the study, it can be concluded that grazing has decreased the mean percentage cover of *E. angustifolium* and *C. vulgaris* over the three years. The reduction in *E.angustifolium* is likely to be linked to the decrease in mean biodiversity of the WH whereas, the reduction in *C. vulgaris* may have aided the increase of *U. gallii, E. cinerea* and *M. caerulea*. The increase of the ericaceous dwarf shrub species and *M. caerulea* may well be linked to the decrease in the mean biodiversity of the DH. The significance of such results can be used to conclude that in the short term, grazing may not yield the positive benefits associated with this form of conservation practice. It is therefore, possible that maybe the level of grazing intensity was too light and needs to be readdressed with regards to the DH and WH habitats. A longer term study of between 5-10 years may result in different conclusions however, in contrast, the increased mean biodiversity within the M is a positive result of this study.

Chapter 5 - Discussion and conclusion

5.1 Thesis aim and objectives

The aim of this research thesis was to assess the impact of grazing on three sites: DH, M & WH and to compare the grazing data with data from two control sites: CDH & CMo. In order to achieve this aim, several smaller studies were required: the construction of a methodological protocol; the collection of BL data and validation of the existing BL NVC habitats, as mapped by Kerry (2014); identification of cow and pony HRs; interviewing the Senior Warden, an experienced grazier for insights regarding animal behaviour and selectivity.

5.1.1 Methodological protocol

The first objective of this research thesis was successfully achieved through the creation of a rigorous methodological protocol based on the recommendations of Newton *et al*., (2009). The protocol which was used to collect biannual BL data, subsequent grazed data and control plot data during a short term study of three years and was designed so that a sufficient volume of data could be collected and to enable statistical analyses to be carried out. It is with confidence that the study could easily be extended and carried out as a long term study of between 5-10 years; the protocol could easily be replicated by other researches thus, contributing to empirical based studies to compare with thesis. There are however, future implications of extending this research into a longer study due to the regular disturbance of the sites on Bicton Common whilst undertaking vegetative surveying.

A number of studies consider the effect of human trampling on vegetation (Bayfield & Brookes, 1979; Harrison, 1981; Bokdam & Gleichman, 2000; Gallet & Rozè, 2002). In particular, research carried out by Bayfield and Brookes (1979) found that the annual surveying of *C. vulgaris*, over an eight year period was sufficient enough to decrease the percentage cover and height of this species. This is of importance to the research on Bicton Common because over the study, the DH, M & WH sites would have been surveyed six times and therefore, it is possible that intensity of trampling may be enough to cause damage that could not be countered by regeneration (Bayfield & Brookes, 1979) and therefore, contributed to the decrease in percentage cover of *E. angustifolium* and *C. vulgaris* by the end of GY2. To counter this finding, Bokdam & Gleichman (2000) carried out a study on open heath and found that it was found that only the pioneer and building stages of *C. vulgaris*, are more tolerant of both trampling and grazing, of which, these stages were the ones recorded throughout the five sites on Bicton Common. The significance of this study implies that maybe the impact of human trampling is not so important. The work of Gallet and Rozè (2002) focuses on seasonal impact and found that the seasonal timing of trampling had little effect on the tolerance of *E. cinerea* but that this species was more tolerant to trampling under dryer conditions than wet. In a study carried out by (Harrison, 1981) it was found that summer trampling, of *C. vulgaris*, results in an accumulative effect of damage which often, does not recovery, particularly, through the winter, which partially, supports the work of Bayfield & Brooks (1979). From a community scale, Gallet and Rozè (2002) identified that the dry heath was relatively more tolerant than the wet heath to trampling, of which, both had a higher tolerance to trampling in winter.

With regards to this study on Bicton Common, the conclusions drawn by Gallet and Rozè (2002) are interesting because although the vegetative survey work for this research was carried out in summer and the autumn, the analysis of the complete research data set did not yield any significant differences between months. Only extending the data collection for several more years may a conclusion be drawn on the seasonal impact. An additional implication of the research by Gallet and Rozè (2002) is the realisation that the impact of trampling on the vegetation within the pemanent quadrats on Bicton Common was not mitigated against. It is therefore advisable that not stepping within the 2m^2 quadrat and/or, approaching the permanent stakes from a particular angle/navigational baring would need to be recommended in a updated methodological protocol. Additionally, it would be interesting to creating a site to specifically study the impact of human trampling on vegetation, in a similar way to Bayfield and Brooks (1979).

5.1.2 Validation of site NVC habitats

The specific methodological protocol was easy to follow and therefore, the objective of collecting such BL data was achieved. It could however, be argued that an initial weakness of the study was the location of sampling sites within the DH, M and WH as it was unknown as to whether the animals would graze in those areas. It was however, the inclusion of a control plot that meant that any changes, in the absence of grazing, would be noted and may help to determine the impact of grazing within the non-controlled sites. Several years of additional BL data could have only enhanced this research project by providing replicate data to analyse for differences but that was not possible due to the management time scales put in place by The Pebblebed Heath Conservation Trust. In contrast to the collection of the BL data, the validation of the NVC habitats found within each site was trickier and there were limitations to the conclusions drawn.

Firstly, the three BL sampling sites were selected based on the decision to select sampling areas within DH, M and WH. These three areas were identified at a landscape scale through the use of the baseline NVC map (Kerry, 2014) and through consultation of the thesis supervisory team. At this stage, the NVC map (Kerry, 2014), had not been digitised or, uploaded into ArcGIS 10.3 to identify either specific NVC habitats or, relative GPS points of the permanent quadrats, the creation of GIS maps was later carried out in 2015 once the BL data had been gathered. This meant that when it came to validate the NVC habitats within the sites, decisions had to be made regarding whether the habitats were typical or unique, based on the NVC floristic tables and the BL data, yet, the M16a within the WH had only data from four quadrats for comparison whereas, H4a (DH) and both the M14 and M16a (M) were based on ten quadrats (Table 2.3). This could be considered as a limitation and based on the scientific principle of replication therefore, further sampling within the habitats on Bicton Common is required.

As a system of classifying plant communities and associated characteristics of a habitat, the NVC has been devised based on 31, 450 sampling plots from across the UK of which the all types of species (vascular plants, bryophytes and macro lichens) are recorded using the DOMIN scale (Rodwell *et al*., 2000). Although it could be argued that the DOMIN scale is rather a subjective method by which to measure the abundance of species present within a quadrat, the size of intervals from one rating to another means that competent field scientists, working independently, should be consistent in their data collection. Additionally, not every plant community will fit the classification system exactly (Elkington *et al*., 2001) but this can be overcome by recording the unique species as was the case for this research project when surveying, as recorded within Tables 2.5-2.11. By considering the use of the DOMIN scale and the classification system not being a perfect fit, the use of the NVC to validate the habitats on Bicton Common was suitable and successful because the system is familiar to plant ecologists and researchers and is comparable.

5.1.3 GPS, Arc GIS & HRs

An NVC survey is typically carried out by an experienced ecologist who initially distinguishes different habitats visually, followed by the validation of habitats through the use of quadrats sampling (Rodwell, 2006). Both the habitat areas and quadrats used by the NVC surveyor are spatially referenced using a GPS unit. Within this study, GPS was also used as a source of spatial referencing for the permanent quadrats set up in March 2015. There was a margin of error however, by up to 4-5m from the unit used. The consequences of using a GPS unit to gather location points meant that the digitised NVC map created by ArcGIS and the permanent quadrat locations did not match exactly and therefore, the outcome of this error is likely to have affected the categorisation of some quadrat locations to a particular NVC habitat. This was certainly the case within the DH for quadrat 13, as it was depicted as being situated along a main track whereas it was actually located within H4a habitat (Figure 2.2). This same problem can also be extended to consider the location of GPS points recorded from the collar units on the grazing animals whereby, the animals, in reality, may have actually been located within a different NVC habitat to where they had been recorded. The implications of this means that the identification of habitat selectivity by both types of animals raises suggestions rather than solid conclusions. On a more positive note, the use of GPS units fixed to the collars of a cow and pony did allow for the successful identification of HRs thus, another thesis objective achieved.

The identification of HRs was important because it identified the areas that were comprised of 50% of the recorded GPS points and highlighted whether or not the animals had grazed within the DH, M and/or, WH. Although, that there would have been a margin of fixed error, typically 4-5m, for the GPS points, the benefits of HRs are the fact that they were large enough to encompass a number of different habitat patches and so the spatial scale involved in HRs is typically larger than the patch scale involved in the Chapter 4 discussion and can be used confidently.

Unfortunately, the limited number of units attached to the grazing animals and the group dynamics within both the cattle and ponies meant that there were a number of smaller groups of each type of animals of which, there was no HR data. The implications of this has resulted in only understanding the movements of just one cow and pony however, employing multiple GPS tracker units is unrealistic for a short term research project due to cost. Long term, the success of the identification of HRs from this study may be sufficient enough to obtaining funding from external organisations to extend the research on Bicton Common and so the limited results may be a precursor to a future larger scale project.

5.1.4 Interview

The semi-structured interview was useful in which observational information from an experienced expert was discussed and was then used to help to explain some of the results obtained in Chapters 3 and 4. With this in mind, the objective was successfully achieved and was beneficial to this study by providing an insight into the behaviour of cattle and ponies and how the animals used Bicton Common during the grazing season of 2015. The level of knowledge used to supplement the discussion of HRs and the impact of grazing specifically related to Bicton Common could not have been provided by other interviewees unconnected to this research thesis. The interview (Appendix B) provided information about the following: the priority by ponies placed on grazing the grassy fire breaks (lines 138-140) and how they grazed a mixed variety of species (lines 186-191); the timing of the animals entering the WH (lines 152-158);

the impact of grazing on vegetative species and habitats (lines 751-753, 755-756); how the changes in weather affected animals movements (lines 425-428); behavioural interactions between the ponies and cattle (lines 246-247, 251-253, 260-263); hindsight of how 20 additional animals could have had a greater impact (line 300). There are of course benefits to interviewing additional, experienced experts.

By discussing the behaviour of grazing animals on lowland grazing with other organisations comparisons between the conclusions drawn from this study with other experts could be used to validate whether the cattle and ponies on Bicton Common behaved in a typical manner. It would also provide a useful dialogue as to how to extend this thesis research into a longer term study therefore, the organisations that would be useful to approach would be the Dartmoor Pony Heritage Trust (DPHT) whom are big advocators of using ponies for conservation grazing. They are successfully working with NE to supply Dartmoor ponies across England to help to manage the succession of woodland and to maintain both lowland and upland heath (DPHT, 2018). Additionally, it would also be useful to carry out semi-structured interviews with individuals responsible for grazing from the following organisations on relatively local sites: Royal Society for the Protection of Birds (RSPB) manage Aylesbere Common on behalf of the PCHT, which they also graze; BugLife to discuss appropriate grazing levels of local lowland heath based at their Chudleigh Knighton site, Devon, which is also partly managed by Devon Wildlife Trust and Golden Cap National Trust, Dorset. Another main advantage to networking with other researchers, ecologists and experienced graziers is the opportunity to work together collaboratively on research to further the understanding of how conservation grazing can impact lowland heath on other sites, with different grazing intensities or, maybe different heritage breeds but still using the same methodological protocol as developed from this thesis research.

5.1.5 Impact of grazing

One of the major problems with trying to collect data that would reflect the impact of grazing was to actually identify possible sites that the animals would move into. Prior to the start of releasing grazing animals there was no certainly as to whether the animals would walk through and/or graze the DH, M & WH sites therefore, at the time three different habitats were chosen and were sited in relatively close proximity of each other, based around the natural slope of the landscape. Despite some of the limitations already discussed, the analysis of the data collected has highlighted the decrease in mean percentage cover of *E. angustifolium* and *C. vulgaris*; increase in *E. cinerea*, *U. gallii* and *M. caerulea*.; increase in mean sward height of *M. caerulea* at the end of GY2; decrease in biodiversity of DH and WH; increase in biodiversity of M. These results reflect that changes have taken place post grazing and that there is the justification for carrying out studies to examine the impact that animals may have on vegetation. Unfortunately, time would not allow for multiple sites of DH, M & WH to be sampled in different areas of Bicton Common and thankfully, the limited GPS data, did reflect a degree of habitat selectivity by the cow and pony. With regards to the cow it was recorded has having the greatest percentage of GPS points within the H4a (28.61%), on tracks (14.41%) and within the plantation (11.22%) (Table 3.7) which is similar to the pony in which the greatest percentage of GPS was recorded within the H4a (34.13%) and on the tracks (25.57%) (Table 3.8). To build upon the data collected from this study, it would now be possible to identify H4a, H4c, M14 and M16a habitats within the cHRs and pHRs from which to study long term by analysing how the vegetative cover has changed over time. Alternatively or, in addition, based upon the NVC map created by Kerry (2014) large patches of habitats, such as H4a or H4c, could be split with one half fenced and the other unfenced to record how the fenced patches recover post grazing and the continual impact of grazing on the unfenced areas.

5.1.5.1 Vegetative species

Through the exploration of published literature regarding grazing, the impact of grazing on Bicton Common can only be considered positive or negative based on the conservation objectives laid out by Natural England and summarised by Underhill-Day (2009) (Table 1.4). It can therefore, be concluded that grazing so far has resulted in an increase in biodiversity within the M and therefore, this habitat is still likely to be classified as favourable condition (NE, 2015a, 2015b; PHCT, 2015). With regards to the DH, it was considered to be in unfavourable recovery with the key reasons for failure was the amount of bare ground across the SSSI unit, the uneven diversity of age structure and the lack of forb diversity. An additional issue of concern was the dominance of *M. caerulea* (NE, 2015a, 2015b; PHCT, 2015; Bridgewater & Kerry, 2016). Unfortunately, it is likely that the increase in *E. cinerea*, *U. gallii* and *M. caerulea*.; increase in mean sward height of *M. caerulea* and decrease in biodiversity still means that favourable recovery has not yet been achieved through grazing. It is certainly the results of an increased cover of *M. caerulea* after two years of grazing, on Bicton Common, that raises concern as this species is documented as being problematic on lowland heath due to its invasive type nature (EN, 2002; Bullock & Pakeman, 1997).

With regards to the WH, the increase in *M. caerulea*; increase in mean sward height of *M. caerulea* and decrease in biodiversity should be noted by the PCHT for further monitoring as the WH was initially assessed as being in favourable recovery and therefore, maybe at risk of a downgrade in condition. Despite literature supporting an increase in *M. caerulea*, post grazing (Bokdam & Gleichman, 2000) the length of this research thesis has been too short to be able to fully conclude how long this trend may last and whether eventually, the cover may reduce. Having collected data on *M. caeruale* for three years, it is hoped that a long term monitoring programme could be set up in conjunction with Bicton College students to provide them with the experience of ecological monitoring and an understanding if heathland management. The importance of cascading a research experience to students interested in countryside management could be a way of inspiring future individuals who may be passionate about working within the conservation sector.

5.1.5.2 Other animal species

This research thesis focused only on vegetation but changes to the vegetative structure, caused by grazing, can impact on both invertebrate and bird species within a lowland heath setting. In the case of Bicton Common, populations of the Annex II species *C. mercurial* are present therefore, annual monitoring is carried out by Lesley Kerry, an experienced ecologist to record sightings of this species. Eventually, it is hoped to release *C. mercurial* individuals (Appendix B, lines 770-773) therefore, the population data of this species and the vegetative data can be analysed together as a separate study to make decisions on how best to support this invertebrate species. From an applied approach, if other researchers were keen to study spiders, as an example, then population monitoring could be carried out within the five sites, the vegetative methodological protocol used and the additional collection of species heights could be included. It is therefore, pleasing to note that future studies can benefit from the data collected so far and a robust methodological protocol that has been tested and has proved to have been a success.

5.1.5.3 Animal activity

The GPS units were certainly useful for recording the exact locations of the grazing animals however, this type of data does not enable an understanding of the type of activity undertaken by the animals. In order to build on this thesis research, the use of both a GPS unit and pedometer, as was employed by Ungar *et al*., (2011), would enable a timeline of cattle activity such as standing and lying to be created alongside the number of steps and locational fixes. In addition, a vibro-recorder, as used by Wallis De Vries (1996) would be able to identify jaw movements and thus identify the times when the animals were consuming vegetation. Collectively, these two approaches could be used to identify the location of grazing, trampling and periods of rest which would breakdown the concept of grazing impact into specific forms of animal activity. Furthermore, it would enable the identification of habitats that have been selected, from those habitat patches which the animals have only travelled through. From this information, habitat managers would be able to decide whether they needed to manipulate animal movements into and/or away from particular habitats.

5.1.5.4 Other useful data

There are a number of other types of data that would have been useful when drawing conclusions from this research thesis. Firstly, meterological data may have supported the seasonal changes of a decrease of BL *E. tetralix*, *M. caerulea* and *E. cinerea* data by October 2014. Unfortunately, data from the Met Office that is in relative proximity to Bicton Common is only available from Exeter Airport (semi rural), Yarner Woods, Dartmoor (upland), Dunkeswell (rural) and Sidmouth (coastal) (Met Office, 2018b) which may not match the microclimate of the lowland heath, therefore, the only way to obtain such data would the installation of a weather station, by the PCHT, from which the data could be regularly downloaded. Although, an initial expense it would be also useful to match animal behaviour and habitat selectivity to the meteorological data for example, it is possible that during hot, dry days the grazing animals may spend greater time within the WH due to the presence of water sources. It would also be possible to explore whether the HRs changes as a result of changes in weather and therefore, the applications of this type of data can help to further analyse the GPS data already collected.

Additional types of data to provide an overview of the edaphic condition such as soil pH, moisture and nutrient content is useful because it was De Graaf *et al*., (2009) that collated data from lowland heaths and found that within wet and dry heaths, it was concluded that soil acidity that had a stronger influence than nutrient content, with regards to vegetative gradients. From a practical point of view, collecting edaphic data is relatively easy and only requires simple kits although, a university or, agricultural laboratory would be required to run C:N analysis. Edaphic data would be beneficial when trying to explain the presence/absence of certain species based on their preferred set of abiotic conditions. Regardless of the absence of the additional types of data, this thesis research did identify that grazing caused changes across Bicton Common. In this case there was an increase in the biodiversity of the M site thus supporting the opinion by Natural England that conservation grazing is beneficial, as discussed within Chapter 4.

5.2 Current policy regarding conservation grazing

There is no current policy that states that grazing must be employed on lowland heaths although, the benefits of a variety of conservation strategies are well known, for example, reduction in the impact of species that act in an invasive manner such as, *M. caeruleaa* and *P. Aquilinium* (EN, 2002, 2005a; Bullock & Pakeman, 1997);

increasing species richness (EN, 2005b; Bullock & Pakeman, 1997); creation of variation within sward height (EN, 2005b; Bullock & Pakeman, 1997). There is however, government led Conservation Enhancement Scheme agreements (CES) that support land owner/organisations that manage SSSIs to reach the site specific NE conservation objectives (NE, 2018). In England, Wildlife Enhancement Schemes (WHS) fall within this wider CES category (NE, 2016) of which the Higher Tier Stewardship Schemes are a component (GOV.UK, 2017a). The Higher Tier Stewardship Schemes are tailored to the actual site and appropriate management practices as advised by NE. With regards to lowland heath there are two which would incur financial payment: LH1: Management of lowland heathland at £274 (ha) (GOV.UK, 2017a) and SP6: Cattle grazing supplement at £45 (ha) (GOV.UK, 2017b) which the latter can be paid in addition to the LH1 payment.

When managing an area such as Bicton Common, a Higher Tier payment of any value and the advice provided by NE officers can only been seen as beneficial in the conservation of an SSSI. With this in mind, it is not surprising that landowners and organisations release grazing animals when there is a suitable area therefore, this research thesis is of significance for a number of reasons. Firstly, this study has successfully been implemented across three years due to a methodology that can be replicated supporting that it can easily be extended from a short term study to a long term study, lasting between 5-10 years. An extended study will provide a large empirical data set which may enable any short term changes that have been identified to be superseded by long term changes. As an example, it was found that *M. caerulea* increased its cover across Bicton Common at the end of GY2 however, one of the NE objectives of this SSSI is to reduce its impact therefore, a longer term study would identify whether this objective is possible. There of course, lies uncertainty with regards to CES agreements in light of leaving the EU in March 2019 and whether environmental payments will continue after current Higher Tier agreements with landowners/organisations expire. If costs towards conservation grazing are not offered then there may be a reduction in the use of grazing animals to manage lowland heath and less interest in supporting studies, such as this one. With this in mind, the continuation of data collection for this study is important because it has the potential to be used by habitat managers who may rely on empirical data to make an informed management decision.

The discussion of the limitations of this study provide areas requiring further modification in order to extend this thesis research from a short term 3 year study to a long term study lasting anywhere between 5-10 years. As a piece of unique research, this study has highlighted additional areas of study which were beyond the scope of this thesis yet could enhance the assessment of grazing impact on lowland heath.

5.3 Conclusion

From this research thesis it can be concluded that the aim of the impact of grazing was explored and the two years worth of grazing data has found that there has been a decrease in mean percentage cover of *E. angustifolium* and *C. vulgaris*; increase in *E. cinerea*, *U. gallii* and *M. caerulea*.; increase in mean sward height of *M. caerulea* at the end of GY2; decrease in biodiversity of DH and WH; increase in biodiversity of M. As the study developed the four objectives were successfully achieved: a scientifically robust methodological protocol has been devised, tested as a part of a short term project; BL data was collected of the five sites and the NVC habitats within each site were validated as being either typical or, non-typical NVC communities; GPS units were employed from which the identification of cHRs and pHRs was achieved; a semi structured interview enable the gathering of supplementary information regarding animal behaviour, selectivity and movements. As a piece of unique research, the discussion of the limitations of this study have highlighted areas requiring further modification in order to extend this thesis research from a short term 3 year study to a long term study of between 5-10 years: mitigation to avoid over trampling during data collection; increased number of individuals of both types of grazing animal wearing GPS units; interviewing other experience professionals from other organisations involved in the grazing of lowland heath; carry out subsidiary studies that focus on the impact of grazing on other animals such as invertebrates and bird populations; collection and use of meteorological and edaphic data in analysis.

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Appendix A

Semi-structured questionnaire for use by Philippa Ingle to interview Paul Swain, Senior Warden, Clinton Devon Estates.

Grazing Preliminary

1. How long has the site been grazed?
2. Why were cattle and ponies chosen, rather than other animals (sheep, goats, pigs etc.)?
3. What breeds of cattle and ponies were used and why?
4. Do different breeds graze in a different way? If so, how?
5. How do the diet preferences of cattle and ponies differ?
6. Describe the grazing behaviour of both the cattle and ponies. What are the similarities and differences?
7. Does grazing behaviour differ with the age of the animal?
8. What are the positive and negative interactions between the cattle and ponies, if any?
9. What is the right grazing density in terms of Livestock Units used for the site?
10. Spatially, how do the ponies use the common? Has the spatial use changed during the grazing season? Suggest explanations for any changes.
11. Spatially, how do the cattle use the common? Has the spatial use changed during the grazing season? If so, describe how? Suggest explanations for any changes.
12. Describe the social groups and group dynamics formed by the ponies throughout the grazing season.
13. Describe the social groups and group dynamics formed by the cattle throughout the grazing season.
14. How does the age of the grazing animals affect group dynamics of both the cattle and ponies?
15. How does the weather affect the spatial use of the common?
16. Does the weather affect the movements of the cattle?
17. Does the weather affect the movements of the ponies?

18. How does the weather affect the length of time spent grazing? Are there similarities and differences between the ponies and the cattle?
19. Are any of the grazing animals influenced by the presence of people? Explain
20. Are any of the grazing animals influenced by other grazing animals? Explain.
21. Does the presence of dogs on the common affect grazing animal behaviour? Explain.

Reflection and plans for next season

1. What were your expectations at the start of this grazing season?
2. Have these expectations been met? Explain
3. Has there been any event/animal/change in habitat structure that has surprised you?
4. What have been the positives of grazing during the first season? Have there been any negatives?
5. How does the presence of grazing animal’s impact on other aspects of management (felling/spraying/swailing etc.)
6. Bearing in mind the associated costs of fencing etc. is grazing a more or less cost effective management method?
7. Are you going to keep the herd size the same in future years? Explain.
8. How are you going to structure the ages within the cattle and pony group next year?
9. Are you going to keep some of this year’s individuals? Explain.
10. What are the benefits of keeping some of this year’s grazing animals?
11. What is your understanding of hefting as far as this site is concerned?
12. What are your desired outcomes, with regards to habitat structure, for the end of next season?

Herdsman Route

1. What time do you predominately undertake your rounds?
2. Do you follow the same route each time or, do you modify the route?
3. If you modify the route, explain why.

4. Do you continue around the common until you have encountered every animal?
5. Do you rely on seeing the animals at a handling distance or, do you use binoculars?
6. What is the reason for feeding the animals?
7. Do you feed every group of animals that you encounter? Explain.
8. What do you feed them? How much?

Grazing animals

1. Why did you select the white pony, grey pony and the speckled cow to wear the GPS collars?
2. Describe the temperaments of the chosen animals?

Habitat

1. Describe changes, if any, noted in the dry heath, wet heath and mire sites.
2. Has grazing affected the pine and birch trees? Explain.
3. Which type of grazing animal is responsible for the changes to the sites?
4. What is the reason for siting the metal pen in its current location?
5. How has the grazing affected invertebrates, birds and reptiles?
6. What are the negative impacts if one over-grazes heathland?

GPS Collars

1. Describe the successes of the GPS collars.
2. Describe the difficulties encountered with the GPS collars?
3. Would you use the ninja tracking collars again? Explain.
4. What are the alternatives to using the ninja tracking collars?

Appendix B

Interview transcript

Interviewer	Philippa Ingle (PI)
Interviewee (PSw)	Paul Swain, Senior Warden, Clinton Devon Estates
Date	26th January 2016
Time	1240 GMT
Place	Clinton Devon Estates, Rolle Estate Office, Bicton Arena, East Budleigh, Budleigh Salterton, Devon, EX9 7BL
Length of Interview	1:03:55

PI Thank you, Paul, for coming along. If we start off then with the grazing preliminary section and we work through from 1 to 21. Please answer freely.

PI Question 1 – How long has the site been grazed for?

PSw This is the first year of grazing so we started in April 2015. The horses went in and the cattle were added in, in the May and then they all came off in the October 2015.

PI Question 2 – Why were cattle and ponies chosen rather than any other grazing animals?

PSw Historically, we have used cattle on a lot of our wetland site as it has shown to work in terms of target species and habitat management. We test piloted Dartmoor ponies to see if they could also be worked alongside cattle and that seemed to be good with their food intake. So, with this as our grazing site we decided that it would be better to put them together so we needed to find the right ponies.

So, those 2 units put together, from my experience, would work well.

The reason we wouldn't use sheep is because of their grazing habits – how they eat, what they eat. They find small plants and they graze down the floor. Much life ponies but Dartmoor ponies, in particular, will eat a lot more gorse based, shrub based, scrub based stuff that the sheep won't eat.

Goats are good nibblers but they wouldn't cope out there. To get enough goats out there would be mental.

Pigs wouldn't do the grazing at all. Although pigs do have a benefit for bracken sites. People have done it on low land areas to control bracken. They fence the bracken off, put pigs in there and they will up root all the rhizomes and tear apart the bracken, we do control bracken out there but that's not our top priority so therefore that we wouldn't use sheep, goats or pigs.

PI You mentioned other wetland areas – which ones have you used then?

PSw We used a wet spot on Dalditch (Dalditch Plantation) to test case how ponies would respond around water, tracking a small little offsite which meant we could contain cattle the first year, horses the second and look at their grazing habits. We realised that within a couple of weeks that what the cattle were targeting, the horses weren't.

So, they all take the easy, which were the grasses, the fire breaks but the horses weren't grazing constantly.

PI So when did you start grazing Dalditch (Dalditch Plantation) for your experiments?

PSw The cattle had been there for quite a lot of years but it was only the year before our trial ponies, so it was 2014 that I wanted to test ponies.

Once you found you found the right supplier of ponies then we thought 'right'. I wanted to get them in on a small pocket site to see how they moved, how they grazed so I spent half the summer watching these guys and their movement was constant, where cattle feed and lie down.

PI And presumably these ponies from Dalditch had come from the Dartmoor Pony Preservation Society?

PSw So that is why I had to make sure that my working relationship with the owner of the ponies could work and also make sure that the ponies were handle-able as that particular site has a lot of regular dog walkers but nowhere near what we've got there and more importantly it has got more horse riders because we are next to a riding school so if they (ponies) are not worrying horse riders and they are not worried too much about dogs and they are eating the right products, it's a win-win.

If one dropped dead, one of the ponies dropped dead from eating too much bracken, the owner isn't worried, so having the right owner, the owner of Dartmoor ponies works brilliantly.

PI I didn't realise that you trailed it. That's good. That makes it brilliant….

PSw Only in our little pocket because, you know, to put them out on 300 acres would, you know, need new permanent fencing and a lot more gates, a lot more public, a lot more dogs.

It also lowered the cattle presence as well because although they are eating similar products, they are eating at different times and in different ways so, you know, to have 50 cattle out there would have been a lot harder.

It wouldn't have been as effective.

PI That makes the stats stand up really well because of the fact that you have trialled the ponies.

PSw We didn't do, there's no in terms of the grazing impact there's no science behind that but what there is, and it satisfies me, is health and safety, the way cattle and ponies graze differently because I can see the end results on a small site which was slopped down into wet, you know, do they go into the wet, yes they do. I'm not a fan and I've only had problems with Exmoor ponies which are bigger and more flightier animals so a heap of circumstances led me to have Dartmoor ones. I am quite happy with the way that they have reacted.

PI OK, then, we have covered Question 3 – the breed of ponies? Why did you choose them or Devon Ruby Reds as a cattle bred?

PSw Only I have worked with them…..they have to be a native bred and one that is probably dying out in one sense and it just so happens that Devon's are on the up. So a) we need a hardy animal – so that the old style beef cow.

We actually ended up with not just Devon's, there are only a couple in there and they were still crossed. So we have Aberdeen Angus cross, again a good hardy breed that isn't frightened of working for food.

So it was a combination of the right animal and Devon's is our preferred, I'd rather have all red Devon as I know them, I know how they, they're bomb proof in one sense but any hardy breed, you know, could be highland cattle, but what is close, what is local and also what farmers can provide.

He knows he's going to lose money if he sends out animals that aren't going to cope on site because they'll either die, or get ill. His policy and what he does with his beef it works that they comes out on heathland grazing sites releases and area of the land to him so that he can then harvest through the summer months and he's got animals that are fattening slowly.

PI They are tenant farmers, aren't they?

PSw No, no………a farmer that I have worked with for quite a few years, yeah, the point being is it has to be these hardy breeds.

PI With your knowledge, then, of cattle and ponies, do the breeds graze in different ways? We are talking about the hardy ones, If you put a less hardy breed of cattle out on the common, and obviously they don't cope with the vegetation and the weather and so on, which one would you say, which breeds would you say you would be highly unsuitable for the common?

PSw So, any animal that is producing milk. So, typically a Freisian because they are designed to produce milk. Once they have got that milk level up, even if they are a none milk breed but they are the same genetics, so the same, their food intake and their food conversion is down to either, you know, use of milk so therefore if they are not getting enough food they will just go back and back and back.

If you put a milk cattle out there you would have to be pretty damn cruel to keep them there because they would run around for such a long time and probably get ill. It is just not, historically, what they are used to. They are bred to have food in front of them, eat it, have a production line for milk and wait.

PI So are there are any less hardy meat cows?

PSw Not generally. Obviously you got…if you've got milking cows and then in a year they have a calf, it is 50/50 whether you get a little boy calf or a little girl calf. Girl calves grow to continue making produce, boy calves go off to market but those cow, yes they go for meat. They can get pretty leery after 18 months if they are kept entire, normally they are castrated in the first 6 few weeks. They need quite a lot of food to fill.

PI Right, so they need still need to pasture graze rather than anything else.

PSw

…………pasture graze and then like in winter, it would be housing.

PI Question 5 – How do the diet preferences of cattle and ponies differ, what would they prefer to eat and go for first?

PSw Primarily they either or will go for the easiest food, much like a kid with cake, the easiest and less distant, the freshest, the cleanest so grasses are top priority. So 100 yards after the car park is where they'll start eating the grass because of the amount of dog waste.

Then it doesn’t matter who has been there first, or not, the horses do their cycle so they are continually moving around and they are keeping everything lawn like, so the fire breaks never get away again. Whereas the cattle, once it is low, too low, they can’t wrap their tongue around and rip it and they are designed to also eat more course material as well.

Cattle will strip the birch in the spring, you know once it starts shooting out. Ponies don’t seem to want to bother. They will go to the top of gorse. The young new shoots of the gorse.

The cattle will look at it but they are not too worried.

As soon as that food is starting to run thin or they are keeping on top of it then they start moving into the wet. The wet stuff is that bit later and then they’ve got to go through the grasses they can get there. Obviously on the tussocky areas there is the old, which is all that brown stuff that they’ll move it around. The ponies will, perhaps chew a little bit of it, so they’ve got to work even harder, so the ponies will still wait and try to find something a little easier first whereas the cattle will just dive in, it is like real boot leather. They (cattle) will be targeting your birch growth up to the height that they can reach and any grass they can get.

Basically they eat the same stuff, it is how much volume and how long the spend eating it which is the difference.

So cattle will eat until they are fat and sit down and they will have their, sort of, direction of travel between, once you know, you’re in a bog and you want to get out of a bog, once they want to lay down so they normally find a high spot, shady if it’s hot or it’s windy, if it’s still hot or chucking down with rain, shelter belt of trees. You know, a van or anything.

Ponies will also move off and away from the wet conditions. The difference is they seem to graze whatever, constantly as ponies top up more. So they are less weather effected, they will fill up and then that’s it they will find somewhere to lay up and you might not see them for a day and a half. They are still eating, obviously but the remnants are there, they are regurgitating what they have just filled up on.

Ponies has such a small stomach that, you know, it’s in, it’s processed and it’s gone. Hungry. So that is why they are eating on such a regular basis.

PI I did notice that about the ponies. I always that that being a pony would be quite cool but now, actually, they don't do much. I'd rather be a cow so that you can nap in the sunshine.

PSw You know, it does sound like they very rarely sleep but they do quite often on the foot. You know, stood up.

PI What about the gorse and the bracken? Towards the end of the season I did see them, towards the end of October, I did see starting to go towards that and eat.

PSw They will all instinctively know, the horses have a such a long way back, they are true Dartmoors and they know what they need and this why they are selective grazing so they will chew just a tiny little bit of something and you will literally stand there and watch one…there's a bit of bramble, there's a bit of gorse, there's a bit of birch maybe or a bit of grass…they don't sit there stripping, stripping, stripping the grass until it is gone and they go 'oh nothing left' they have a bit of good grass, a bit of gorse and then they start eating bracken.

And then you go what the hell is going on when there is still grass by your feet! So, historically, they know what the body needs. So there could be, we know it is poisonous…

PI …but they're gaining some benefit from that aren't they?

PSw Yeah, it could be, could – I'm not saying it is, but it could be medicinal for their stomach. It could also, flip side, they might feel a bit constipated and it might just help get a reaction. They seem to eat it and the only times that I think you get a weak horse eating it and that could kill it, obviously, they have died, not with us but they have died because of bracken poisoning chances are it is because they are low on food sources of something else so they have OD on it. Chances are.

There is something somewhere.

PI There must be some physiological reason why they are eating that, then. Just like cats and grass. It induces the vomiting.

PSw Same with dogs. They do the same thing.

It is odd and a lot of people…we have a lot of phone calls about this and they must want it…even the ones that are part tame as still doing it when I say part tame, they have been handled.

PI …it's a breeding instinct thing.

PSw I saw it for the first time in the first year and there was lots of popular bracken and they completely smashed it all up and it was like, it was really not the bracken, they are only eating the young shoots. They are not eating the course fibrous stems.

Of course everything they walk through it they are knocking it around.

PI Question 7 – Does grazing behaviour differ with the age of the animal, so for both cattle and ponies?

PSw Yes. Volume. Volume, so you have a little calf so it will only eat a little bit. A baby calf, once it is weened, we wouldn't have baby calves, normally we wouldn't have foals up there. So let's take those two bits out of the equation, so once they are on solid food, it is just how much they would eat.

So you are looking at a guess and I think whether, again, if you are cold you generally eat more. If is incredibly hot you probably just drop back a bit and drink more volume of water. So weather conditions, obviously, can effect, I think on how much they eat.

We are not going to have a frost through the summer but if we a have constant rain with quite a high backing wind, they are burning a lot of energy because they are having to work harder and you can see animals looking a bit head down after 4 days rain and they are a bit 'oh', you know. Its like 'still got to go for it', you know, probably picking up more food.

PI Question 8 – Are there any positive or negative interactions between the cattle and the ponies as, obviously, they are using the same area?

PSw The only thing, because of the age structure of the cattle were, like 10 year olds, so they were 2yrs, 18months-2yrs cattle – they were like big kids, therefore there was no real dominance in the structure.

The horses had all ages and they basically just shoved the cows off of everything. So if the cows were too close they'd just whack'em and the cows were stuffed.

PI Oh, really? In what way, as in nudging head wise or kicking?

PSw The horses? They just turned and kicked the hell out of them, 2 or 3 just pitching on them. Ed might have a video of one of them (biting) so you can see how horses fight…they don't just wade in, you just see them turn a little bit and then strike out.

PI I've seen ponies do this to each other on the moor.

PSw That is exactly what that they'll do and that's their way. They'll bite and they'll kick and literally in this video, he is looking at a cow and suddenly the horse kicks the back of the cow.

The cows were actually were, had the utmost respect for the horses and it was only at the end when we had to give them a bit of supplement food that there was this sort of slight standoff they had a bit, then the horses would start turning around and the cattle would bunch in a bit more. But then at the end of the end of the season everyone is fighting for food.

PI Presumably at that stage, when you have that interaction going on the cow will just wonder off and that would be it?

PSw It is just that they have learned that it hurts if you get near a horse, by association really.

PI Do they keep their distance once they have learned this?

PSw Yeah, if a pony rocked up and if the horses were coming in a bit late from nowhere the cows would just move off and not get involved.

Had the cows been perhaps 5-6 year olds, we would probably had a different ball game and if, which we don't, but if those cows had young with them I wonder what would have happened. It would be very interesting. But at that particular site, why we grazed in age structure that we do, many down to health and safety for the public, so we will never be able to do that. It will always be 18moths-2yrs.

PI Question 9 – What is the right grazing density then, in terms of livestock units for the site, that you feel is best?

PSw It is based on, you have an idea, you have got 300 acres and you could read a text book and it will say you should ½ a cow per hectare. And what we do is we will have a recce. the site and see the volume of grass and work to avoid cutting the fire breaks, let the animals do it and the Dartmoor ponies come in in April if I wanted to cut the fire brakes I would have brought the ponies down in May but I want them to do it and they have started working hard so then they are coming down on holiday so as soon as they hit 7-8oC warmer and there is real food, it's green in comparison to Dartmoor.

So in effect I can see that we have this land mass and I know that on other sites, smaller sites, 8-10 can do a particular job with cows so therefore I multiplied it up and came up with a figure of around about 50 units, livestock units. And then, we can monitor from that basis to work out for the next season. So we don't know exactly how much they are going to eat but we can surmise that any one point, both the horse person and the cow person will know that if I'm feeling that there is overgrazing then I need to thin them out in which case I will relocate them as I have other sites that I could use or they have to go back. but actually the effects were about right.

We could probably have done with another 20 odd animals so they then would have branched out quicker. But also we had to consider, this year, you know the impact of you know, nearly 50 animals out there. How would the public opinion go, how would we manage them. How many cattle can we hold if there is a problem, as in capture and save.

So 25 of each can seem about right, I don't think it was enough if you just take grazing as a target, to be honest we could probably put a couple of hundred out there for the first season to really smash it around and then come back maintenance, that would probably be 20 horses but also you have got to remember that we are doing other works through the winter, now, which will then impact on our grazing for next season. So there will be lots of birch stump regrowth's and pine removal. Ok, the pine stumps don't grow but it will create a disturbance and light to the floor which then other foreigns will come up so……I haven't yet, I have seen them nibbled pine, a young pine, a little bit but I haven't held them tight enough for long enough to know whether they would actually skin it apart, the horses, the cattle wouldn't bother.

PI Question 10 – Basically, how do the ponies use the common and has their spatial use changed during the grazing season?

PSw Yes. Based on food and also their family bonding, if you will. Soo we have, therefore, mostly a clockwise rotation. At one point, for nearly 2 weeks whereby a lead mare over there and another lead mare here and they were doing this around the common. It didn't matter where, they just kept themselves apart. 2 groups.

In the meanwhile when the cattle came in and threw it around a bit but the cattle just stomped on through. So the best food kept them. If they don't have to walk too far, they won't. So they have to find their water course which they found but they all basically boundary tested the whole site and then they started getting used to their trails, their lines, their grazing and, you know, where they preferred to be. So they design their own routes and at one point there were 3 units and then there were just 2 and then as they start to get hungry those units broke down even more so there were 3 or 4 here, 2 or 3 over there but they were all aware of where each other are.

Whereas with cattle, they can get lost. They have to shout and go and work out where their neighbours are. So when we have some cattle out on the road, someone left a gate open, 2 of the mates were on the inside of the fence doing absolutely shouting and shouting and the 1 on the road is desperate to get back and the 2 are desperate to get out on the road with the other one.

Those 2 did get out. So now we have 3 out but once they got together they all wanted to come back so down the road and back in the gate. Job done.

PI It wasn't speckled cow and 2 brown cows? I just kept seeing those 3 and they were hilarious. I didn't realise about cows not having an appreciation of where the others were as they moo a lot don't they?

PSw Horses have spatial awareness. One will be grazing and they'll make a snuffling noise and the other horses, which could be you know 400yrds away – you don't realise but they are looking for one particular horse, and there's another horse completely outside just

off, there ears are more like cats – they are constantly trying to pick up sound and noise.

PI Are all cows like that? Not so aware of their surroundings……………………?

PSv I think horses are more aware. From my experience this year, they are far more in tune with each other's movements. Even if they don't want to get on, they are very much aware of where each other is and all their sort of history. Not family politics almost but their herding instinct.

Whereas if we had a couple of old cows running with a load of youngsters the old cows would have knocked youngsters into shape and would have been, like, the dominant cow, but because we have very similar ages it was a bit like a nursery, or a load of 10yr olds they would literally be grazing and wonder off and like, 'where are all my mates' and start shouting and then they're on their way.

There is a massive difference. I haven't got to the bottom of how much the difference is but it is almost like the horses are so much more intelligent and more in tune with what is going on and where everyone is. It is not fact, but that is certainly how it appears.

PI It is interesting and there are so many different things that I want to go back to and read further about actually, based upon that.

PI What about the cattle, how do they use the common and how do they spatially change? How does that change during the season?

PSw They basically kept themselves, for the better part, in 2 groups. Why I don't know. They were very much more visual, very much more going home. They had a few favourite spots and because of their age they were quite playful. You know, you'd see them messing around on the mound or running through bracken for a laugh.

PI How did their spatial use change during the season?

PSw Generally, they were far more visual, they had to travel further as they went on and therefore the groups again broke down to slightly smaller so they were working harder as the season went on, which is always the case.

Of course, they were more confident as they were that bit older and as the season dropped they were having to work harder for food so they were a bit more bold but, yeah, they were never at any point particularly hungry they just had to work that much harder but again weight gain on all of them, except 4, was pretty good. The famer was more interested in that. A lot of the cattle weren't particular tidy there was a couple of barrels but most of them were pretty low.

PI So why do you think there wasn't so much of a weight gain on 4 of them?

PSw Just genetics and rough ride, runt of the litter, they've got mixed in the farmer basically went to market over the winter months, looking, but cattle prices were too high for medium quality and then got towards sort of March and then a whole load, lorry loads, were coming into the market place and some were pretty damn poor, probably never out much, and that meant the prices were lower, as there were 2 rogue ones in with a group of ten, the usual market practise and so, yeah, only 4 looked they hadn't done much but the for the rest the weight gain was good.

PI So looking at 13 and 14, in terms of the social group, I think that we have answered 13, really as we have gone through, so we have done that one.

How did the age of the grazing animals effect the group dynamics? Again, you have mentioned about the young cattle being of a similar age and again how the age has changed the ponies, and you talk about, you have spoken, I think about how does the weather effect the spatial use of the common. Are there any particular areas that they favoured, the cattle and the ponies?

PSw Rough and wet, they were down in the mires under the trees below the mires. It was quiet, plenty of water and that's the cattle.

The ponies didn't spend a lot of time there. They trekked through but, like I say, they have to keep grazing so that's what they do.

PI So that explains 16 and 17, doesn't it in terms of where they are.

Question 18 – how does the weather effect the length of time spent grazing? Would the cattle stop grazing during the really heavy weather?

PSw Yeah, they will shut down. They can afford to take longer.

PI Whereas the ponies were just out regardless, weren't they, from what I noticed?

PSw Yeah, they have to keep going. They might hang back a touch but no, the cattle just sometimes want to save energy and stay down on the floor for longer.

PI Would they seek shelter, the cattle, or they quite happy….

PSw …they do wind breaks when they can.

The horses will move, you know, if the weather is coming in, especially from the high point you will see them all sort of moving off and you think ‘what is going on’ and you look behind and see the Ex estuary belting in. So, they have already pre-empted the weather movement and so they have gone over back grazing on the other side where it is a bit more sheltered but still open heath

PI Question 19 – Are any of the grazing animal influenced by the presence of people?

PSw To start off with, yes. The horses were bolshy and the cattle wondered what was going with dogs and then there was the noise pollution and marine activity, vehicle movement. Sometimes they would up and move off but as they have got more used to it they will stand in the middle of the track and people would just walk round them, the cattle.

PI Do you think this is because of their age?

PSw Partially their age and the fact they had no younger ones with them. Obviously, sometimes they got a bit skittish and bolted back up on their feet but all cattle are incredibly curious. Some will see a push chair – ‘oh, let’s have a look’ which can be quite off putting and the dog situation and how cattle behave we have had to advise people to the letter of the law reference what to do if you cattle come to you because you have a dog tied to your arm but we didn’t actually have any problems.

PI Did anyone complain?

PSw We encouraged people to speak to us, talk to us and we just reminded them before they exited on to the common that there is another 2,500 acres directly behind us and if you have concerns, raise them, that is where you could always go to use an ungrazed bit if you wanted.

PI So how long do you think it took then for the cattle to calm down and get used to the people?

Psw Fairly quickly, really. Even they can get a bit daft about the weather on a windy dry day. Yet one of the youngster’s bulling, you know. That will stir up a group in no time, so we have had that and a bit of scrapping if there is no space to move.

PI Second section – a reflection on the plans for the next season – recap this time last year, what were your expectations at the start of the grazing season? What were you expecting?

PSw More or less what we got which was taking the easy food, slowly but surely moving into the wets so that they could get down in on there. I was hoping that they would tackle more of the willow on the furthest mire and but actually once you stood in the bog it is higher than it looks so there is some long term work that we want to do down there to shorten the height so that they can eat it, they did eat the lower but they couldn't reach the tops on the willow. It was still surprising how hard it was to find them, their movement across the whole of the common was good and better than I thought that it would be.

PI Any event, animal, change in habitat structure that has surprised you that you were anticipating?

PSw No. I think that the only, it's not surprised me, as we knew that ponies were a lot of tracking work and they have opened up these movement lines which actually stand out quite considerably but because we have the marines there training too and doing a lot of their stomach work is on these particular valleys it could be the combination of both so there is already a flat going through and the horses have made it even more noticeable. Then also one of the areas that they graze on, I was gobsmacked, looked fine but when I walked into it they had absolutely ripped everything up, really it was shocking, I don't know if Sam took you out. (PI – Whereabouts is that?) more towards the fir site, a big wide fire break, little copse of trees where they do shelter building.

PI Right on the top of the hill, I call it marine woods and their little dug out and it's one the right hand side as you go up the hill?

PSw Probably, yeah. Anyway, the point being was that they, I thought and always looked at it and I remember felling young trees and it looked really nice and I went through it and it just showed me how much grass was in there. Because they have eaten it, all the grass easy, they haven't touched the heather, I actually thought that it was full of crap on the lower side and it look liked it had been all eaten but it wasn't. It was really weird as the front edging made it look really nice and I took Sam round, you could almost say that it is overgrazing. I had taken some photographs if you want to look...

PI …that's up by the big pine tree because I've done some extra sampling up there. That's the area?

PSw …actually the product plan was very different to how it looked. The horses continued but they hadn't overgrazed the heather and gorse it just looked like there was more heather and gorse there. There were tussocks there as where, something is odd.

PI What have been the positives of grazing this season? Have there been any negatives in this grazing?

PSw At this point in time, no. If there had been negatives in terms of plant structures, we would have done it wrong. There is a little bit of, I think, by overgrazing on one of the mires adjoining the track and it is because it is a way in and an easy way out, which the cattle started but that has been assessed and monitored, obviously you've looked at samples and bits and pieces.

Success wise, outside the management, there has been the attraction of people. People has just loved it and loved having the animals, finished it off and made it wild again. Very very ………………….

PI That's true. When you go up there now and they are not there, you miss them, actually. I quite like hearing them moo and having a bit of a wonder round with them.

PSw Again, we have had a lot of people just loving it. Some people still think that they are there?

I went up there the other day and he said to me,' oh how did you get on?' He said, 'I had a look round and I was only up for about 20mins and I couldn't see them horses up there'

I said 'oh right, well, you'd better keep looking.

PI Question 5 – How does the presence of grazing animal's impact on other areas of management? Because you have had the grazing out this year, what are you now going to do with regards to felling, spraying, swailing or anything like that? What are you not going to do and what do you need to do?

PSw Felling doesn't make any difference about livestock grazing because there are two types of season.

Spraying has a massive impact as we can't go and control bracken and we can't go a control any of the regrowth but if we fell, we cut young birch, it is lower enough for the cattle to graze. So where the birch has been felled we will be able to show people next season, look it's all gone, The little new shoots that come up in Spring they will be all gone, I've done it on other sites so I know it will work so you save on chemicals and extra work.

And, if I took those cattle and horses off, it takes about 5-6 years before they root stock and there is still a seed bank. It means we can fell without worry of chemical and we have done what we call proof felling as well. We have taken out various areas, we can show people that was live and now it's not. Why isn't it? That's because the leaves have gone. We can isolate one and see what growth rate is after if you want.

We have also felled a lot of pine because of the nature of the site. We have a lot of mature pine like that. Not that that really effects grazing because we haven't got re-growth from stumps but it has put open space on floor, light to floor, which is nutrient rich because they are needles and all of that and potential other seeds that come up, so we will see how that goes and what grows there.

Swailing, again it is out of season when we go in. If we swail and it would be very unlikely this year because of the weather, basically that is where the animals will go. If I was to do a swail in February, every animal, horse or cow will be on there because it is the freshest, cleanest growth and it will all be Molinia.

PI Are you reducing the other management techniques because the cattle and the ponies have been, because of their impact of them and you therefore need to cut back on doing some of the other techniques?

PSw No. If I didn't have the cattle, I'd have to somehow open up those mires. We haven't got the facilities or skills.

I don't have to do the fire breaks and I don't have to do so much chemical treatment so there is enough positives to put down there.

PI Question 6, bearing in mind the cost of fencing, initially, is it more or less effective to go down the grazing route from a management point of view?

PSw Grazing is part of a management plan whether it costs you money, or not. It helps and assist good heathland management. Providing you have the right stock and densities, the right type of animal eating up there, it helps from a practical land management point of view to what heathland whether it be wet or dry should be. Cattle and ponies are part of that make up and are not the end result and the reason that I can say that is that for invasive birch and willow, for example, there is a point when it becomes too high for the animal and again if we didn't put animals in there the mire could be managed in a different way.

Again it is a lot of skill and a lot of hours and money.

So trees that have got too far too big, we have to take down. It's our responsibility and the animals can support that.

We like to think that eventually in 20 years that at this level, this rate, we would have cleared enough trees , we've done this, grazed that, now it just needs a few horses to be let out. Sadly, I think this is a myth because trees will inherently, it's what happens in heathland, and they will return and will regrow. Even in a 5-10 year period you can see the impact but the horses and the ponies keep it in check so I don't think part of your work will show lots of different things but from my perspective and how the site is manged, whether it is Bicton and 300 acres or wherever it is, they are part of the management tool.

PI Question 7 – Are you going to keep the herd size the same in future years?

PSw Certainly for this year. I might have slightly more horses this year and just lower the cattle a little bit but there will be a mixture, it's not a plan for renewal, year on year to mirror, it is based on grazing, availability, movement, managing all sites.

As far as Bicton is concerned, I have at least 25 horses up there and probably 10-12 cows.

PI Question 8 – How are you going to structure the age groups within the cattle and pony groups next year? What would you like to have?

PSw As I said earlier, the cattle I have got to have anything from 13 months to 2 years, I have no choices. That is what I have to have.

The ponies can be varied, it doesn't matter.

PI What is the optimal, in terms of how many older ponies are required within a social group?

PSw It doesn't matter, actually, because, you know, they change as their dominance came out so two lead mares that haven't met each other will sort it out so there is only one lead mare.

The dynamic can change – one might have a foal, one might lose the fight and then it all changes and they are all mad as a box of frogs for a week. So to me, it's nice to have more experienced horses and it is also nice to have one that's good to handle so that then we can fit a collar. We can use one as bait, especially if a lead mare that it is easy to handle, is a bonus. Again the same as the cows.

PI Question 9 – Are you going to keep some of this year's individuals? In terms of the ponies, now obviously the cattle have gone and in terms of the ponies, have they gone back to Dartmoor? Are they currently on Dartmoor?

PSw Most are them are bred all over the shop, several have gone to other sites I believe but I don't know. The chances are that we perhaps will have 5 of the ones that came out last time.

PI Would you have that lead mare back, the lovely white one?

PSw Again, it depends on what sort of winter she has had.

I prefer them to look more traditional Dartmoor. Obviously, being brilliant white, it completely raises questions!

PI What are the benefits of keeping some of this year's ponies? If you were to have some of the ponies back, what would be the benefits of doing that?

PSw They would recognise our routines, you know, within a week. So, they would recognise the sound of the vehicles or buggies or calls. If they were more dominant they would show the area more quickly. They'll remember things, probably much more but, the funny thing, you probably didn't notice it in the early days of last season but we had 8 yearling horses out there, the patchwork quilt one, they stayed as a group for ages and ages, most of the grazing season and they were the lowest in the food chain so they tried to join other groups and gradually they did split and actually one or two of them did fit in with a social group. But, they were outcasts compared to the main bulk, so you know, foals are top priority.

Once you become a yearling, you're nothing. You have to fight your way up……..scared to go anywhere near anything.

PI Do you think it's likely if you were to bring back some of the more experienced ones, would they go back to, are they likely to remember their favourite, once they have familiarise themselves with the area will they be likely to go back to their favourite feeding patches?

PSw They certainly, I think they would find their older tracks. I don't know if they can remember them or not but they have this inherent way of grazing so they can fall into that pattern again.

But again, because we don't have breeding stock technically out there, we can't have a stallion because of all the horse riders, those yearlings will be like, special treatment, because they are ready to breed, had we had a stallion. So they would have been less isolated, because of the lead mare, in charge, she doesn't want those toe rags hanging around until they become useful, they are not useful.

PI Question 12 – What are your desired outcomes with regards to the habitat structure for the end of this year? So the second season of grazing, what are you hoping for?

PSw I would like to see the willow end in the wet more hit and continue grazing.

What will happen is that all they graze now will reshoot for England, as in grass species. So they've got to go back through it otherwise we have achieved nothing.

A little bit more tracking further in the mire where I think there is more poaching but their exit is slightly over, as to whether they can find a new line in, probably not, because of the nature of the site and, yeah, we could do with a couple of burns just to force them to cut the corners.

As I say, at the moment I am quite happy with what they are doing.

PI Herdsmans routes – What time did you predominately undertake your rounds?

PSw It was usually between 8am and 12noon, between 8am and 9am unless there were problems.

PI Did you follow the same route each time or did you modify the route based upon what you could see and where they were?

PSw Yeah, on the approach. We’ve got to consider erosion and third party, as in people. Quite often you’re going down the track and there’s 2 dogs, a couple of people, a bicycle so you go around this way so it’s less hassle for them and us.

So never, I say never the same route. We have certain links to get good viewing points from high and low. Some areas we didn’t want to drive on because we’d trash it but made it up as we go. It was just getting head count as the horses were moving so much they were never in the same place twice.

PI Question 4 – Did you continue around the common until you encountered every animal? Did you make sure you did a head count every day?

PSw That was our target and the sometimes we did have days where you just could not find horses. Cattle usually worked out every day. But horses were a sod to do a head count.

PI Did you get close to most animals or did you then get out a pair of binoculars and counted them in that respect?

PSw Very rarely I used a pair of binoculars because I wanted to see them and there were times when I thought there was no point driving down there to look at those 5 when I can see they are healthy from here. They’re grazing. Or if there is 1 you can’t find because they are off colour so generally, visually, the naked eye is good enough

PI So are you looking for cuts, dodgy eyes, lameness…

PSw Body language is the primary look for me. So for example if one is isolated or something is not stood naturally, like you would with a child, you know that they are not 100%. If you question mark – why is that there, it feels out of character, then you investigate. Chances are there is nothing wrong.

Then once you are investigating it is all about using the senses, eyes, sound, nose, temperature, dung if you can see that. Stomachs, are they tucked? all the usual automatic things you would check without, just chilling out, then again, you’ve done all of that in 20 seconds because you’ve just got a little bit of food slightly further away, are they interested in food, whilst they’re doing that and moving, you’ve just seen them turn, they’re not laying, are they in discomfort, are they breathing right…..you know, in a few seconds you have just done all that, you know, visual checks.

PI Would you feed them every day? Would you feed all of them every day?

PSw That's purely control and a way of moving them if we have and or keeping them interested without feeding them. The first 2-3 weeks we get them a little bit to associate the noise of the buggy with us and food and then they start coming out the woodwork. The cattle come one side, the horses from the other and you just have to drive off!

PI Was it always the same sort of hay you feed, or was it a variety of food?

PSw No. We used a very low, not low grade, a low protein haylage. It's easy to store, fairly cheap and good shelf life. Obviously, you are paying £8 per bale you don't want to be throwing it around and you want them to eat plants not food. So we used that and for emergencies or problems with capture we have a high protein cake, one for cows and one for horses.

PI Of, would they automatically drawn to that.

PSw It sometimes takes you a couple of days.

For example, cattle, quite often plastic bag as is in a cake bag, none of them had that before so it was scary. They associated the noise and smell (of cake) with horses, which is that in a bucket or rattle so they assume (the cows assume) that they're eating it (horses eating), it must be food so I had to put cow cake in a bucket.

It could be putting a collar on, it could be reading an ear tag, looking at an eye.

PI Right. Grazing animals, then. Two questions. Question 1 – Why did you select the white pony and the grey pony and then the speckled cow to where the GPS collars?

PSw Purely because of handling. That simple.

The speckled cow, as you saw, all it wanted was cuddles. You very rarely get that so you imagine taking a collar off or putting it on any cow, in a pen, going nuts.

It was just luck and again, the lead mare, you can control it with a bit of food when you put that round her. Then she had blisters and then had to move it from that one to another one, so her jaw could heal, and the whole collar system

PI What temperaments of the chosen animals, the white one, and the grey and the….

PSw Chilled out.

PI Question 1 - Habitat – Describe any changes, if you noticed any in the dry heath, wet heath and the mires

PSw Dry is a bit more open now with more tracking.

The wet heath – more poaching, more open space, more flow of water when it is heavy rain going into those mire sites and a bit of birch, not birch, willow clearance down at the bottom by the cows so that was good.

A lot of the tussocks in the wet heath have been grazed right round which is brilliant because on other sites, we tried to create that effect either by swathing which is hard in wet areas or strimming.

So the grass, when it grows, will be like that, which is perfect for the Southern Damselfly to do its tricks. You know one of those edges of river that is now, we haven't got southern damselflies there but there are other damselfly, dragon flies can benefit from that shaping. So that is good. Well it's improved. It has not done all of that but it has improved.

PI How long do you think it will take, then, for that improvement to manifest itself?

PSw The grass grows every year so it is going to keep coming back. You know, you've got to, basically, you know, on those little tussocks, it's just a mountain of food so grass is going to grow. So if you cut all those tussocks off and put it under water, it still grows.

What we want, what would be nice, is to find small rivelets, in the areas, and same sort of effect of grazing and then see, keep watch. I am thinking and spoke to the southern damselfly bods, Lesley Kerry, when we went off to the moor, the guys have been down here. Once we have done another year's grazing and look to see if we have suitable habitat to do a release.

You have to convince a lot of people, enough people to say well now the site is fit for purpose. So when you talk about long term plans that is one of them.

Another one is off the back of erosion, obviously there are the marine lines and the cattle have used those marine lines and expanded them so we'll watch that.

PI Question 2 – How has grazing effected the pine and the birch?

We have kind of done that one haven't we?

PSw Pine not really.

Birch, obviously, has been eaten – what they can reach.

PI Question 3 – Which of the grazing animals is responsible for the changes in the site that you mentioned?

PSw It could be both, if I am honest.

In terms of the grass that being eaten, the cattle will do more poaching work and the horses are far more selective about how they move. Whereas cattle, just seem to drop off the edge and eat any food. So I think that both have taken apart in terms of the and wet heath and mires.

Dry heath six of one, half a dozen of the other.

PI Question 4 – What is the reason for siting that large metal pen on the location on top of the hill?

PSw High spot. Flat enough, big enough to load.

PI You can get the lorry up there, presumably?

PSw No. We do it all ourselves. Actually when we came to muster out we had 4-5 pens and gates and put the pens in various areas because we had to do it all quickly and in order to capture the 26 ponies so we had a pen here, a pen there, a pen over there. It was also a big statement. It an unpleasant unit which reminds people that there are activities going on here which all round livestock. That unit has to move as well and have to go off site and to other sites. But yeah, that it is why it was focused there. Visual and level enough.

Most of the horse weren't caught there, any five of them.

PI How has the grazing affected the invertebrates, birds and reptiles?

PSw I would say very little, but that it just me, probably wishing, I have no idea.

In summer, the cattle and horses, especially the horses, are a bit wary of adders. Animals brushing through, you could say a bit disturbed but the perfect Dartford warbler height gorse isn't where you saw ponies grazing, particularly. There's no grass and the gorse is at that set stage where it is perfect for Darties (Dartford warblers) and not really for eating.

PI Question 6 – What are the negative impacts on overgrazing the heathland?

PSw Age structure, too similar. So as simple as that. We'd end up with just a whole place of grass.

PI Finally then, under the GPS section – What were the success of the GPS collars that were selected in the end?

PSw What, in terms of the actual type unit or….?

I think that the important thing is, is that it is a good way of getting an amount of data and movement. We knew the cattle move like they do, and we knew that ponies are pretty much on the foot all the time.

We have an amount of information to show that, but the collars, basically were a nightmare to manage, a nightmare to handle, and totally inappropriate for horses and it's pretty hard to mess about with.

Weight issues, yeah. Plastic crappy cases, so yeah, disappointing and you've just, reminded me I need to have a word with Sam (Dr Sam Bridgewater, Conservation Manager, Clinton Devon Estates) about that! So yeah, bought for the right reasons but clearly we need a better system now. To be functional, to be accurate. If somebody want to look at a whole load of data and dots means do-do-do-do!, you know, when a collar comes off, which it has done, it hits the floor pretty hard, is it still working? We had 4 collars now we only have 2.

Yes, they are fairly accurate to find them because we have found them when they have been live and yeah a whole new rethink. The actual facts, the GPS does give an amount of data but, you know, you can just walk out there and spend 3 hours on foot and you can see where the cattle have been and where the ponies have been and you can see how far they have been, where they have been and even this time of year you can see the effects of grazing.

So…we will have to run something again to support all the work that is going on but, you know, I don't think much will be concluded from it because it doesn't…we have created a whole massive crowd pen if we had too many animals in there and too cold weather it would be a very different story than if we only had a couple.

That isn't necessarily how herding instinct works, it's just volume, yeah? So, who is to say whether 25 horses should be 50 horses? That effect, if so, the evidence we have of movements is that actually really accurate based on the area that they have got. And, then to put it into a control so we can have an area equivalent to the same size to mirror it, it is really difficult and so that's another thing I have to bear in mind when I put livestock back in, as a grazier, I need to make sure that for the right level of grazing is, not too much, not too little so the numbers will vary.

You could say science based, to rely on that GPS you could say that you have exactly the same animals, is more or less the same age structure but that is not realistically going to happen.

PI	So what is the alternative to using the tracking collars? Is there anything better?

PSw	We are going to have to find something smaller, hardier, lighter.

I cannot believe that the world of technology that there isn't.

PI	You mentioned before, something under the skin?

PSw	You can jab them, but of course if you know you'll get the same cow back next year, great. The chances are however, they are in a shed getting fat.

PI Are they quite expensive, those under the skin type...?

PSw Yes. I'm not sure how that would work and I would imagine that, you know, people would frown upon it.

But equally, we have got to find a lighter weight more efficient why, it's only a signal.

Basically all the information and the hardware is on the computer. There has got to be a better system than this so, we spend a lot of time pratting about and, uhm, for nothing.

So we have got some blocks of information, people have found it really interesting and I think that there is some science to be gained from it in some shape or form. That could be looked at, however, as I say we have to find a better, lighter thing to go around their necks somehow, but you know, if we choose to change it we can.

PI What would suit the ponies because they were the big problem, weren't they?

PSw The actual collar itself is fine, it's this great big thing floating. You've got to have such a lot of weight. Every time they bend down it is dropping forward and it would be nice if we could perhaps tie one, you know, a unit, to a head collar sort of a friendlier one and then you just clip it on securely, I don't know. Or, tie it into the mane, without this lump.

The cases were absolutely crap, I said on day one when they rocked up, I looked at this and said this is rubbish. Absolute rubbish, this is not going to work but we committed so we tried it.

PI So the casing itself, was too bulky or was it just ..?

PSw You've got 2 bags of sugar, neigh on, in weight hanging wise with a strap that goes through and cross pins that the strap went through the gap. I mean you could sneeze and it would break and you're putting this on, you know…scratching, rolling

PI Was the webbing strap themselves ok, though?

PSw Oh yeah, they were fine. It is just what we need to do is put a staple on the inside next time so that can't slip back sometimes.

PI Would the ponies then be happy to wear a head collar?

PSw We need to get the right trackers and to do this properly and to have consistent information we need to have the proper trackers so unquestionably, I'm not putting those ones back on at all.

Appendix C

Pebblebed Heaths
CONSERVATION TRUST

Philippa Smith

Masters student

Plymouth University

11th November 2015

Dear Philippa,

I am writing as a member of the senior management team on behalf of Clinton Devon Estates to grant you permission to interview any of our staff, and in particular, our lead grazier Paul Swain, as part of your research into heathland conservation grazing.

Yours faithfully

Sam Bridgewater

Nature Conservation Manager

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Email: Sam.Bridgewater@clintondevon.com

East Devon Pebblebed Heaths Conservation Trust
Rolle Estate Office, Bicton Arena, East Budleigh, Budleigh Salterton, Devon EX9 7BL
Tel: 01395 443881 Fax: 01395 446126
Registered Number: 5413877
Charity Number: 1109514

Raw Data

Substrate Percentage Cover

Year	Month	Site	Quadrat	Species	%
2014	June	Dry Heath	1	rock	0
2014	June	Dry Heath	2	rock	0
2014	June	Dry Heath	3	rock	0
2014	June	Dry Heath	4	rock	0
2014	June	Dry Heath	5	rock	0
2014	June	Dry Heath	6	rock	0
2014	June	Dry Heath	7	rock	0
2014	June	Dry Heath	8	rock	0
2014	June	Dry Heath	9	rock	0
2014	June	Dry Heath	10	rock	0
2014	June	Dry Heath	11	rock	0
2014	June	Dry Heath	12	rock	0
2014	June	Dry Heath	13	rock	0
2014	June	Dry Heath	14	rock	0
2014	June	Dry Heath	15	rock	0
2014	June	Dry Heath	16	rock	0
2014	June	Dry Heath	17	rock	0
2014	June	Dry Heath	18	rock	0
2014	June	Dry Heath	19	rock	0
2014	June	Dry Heath	20	rock	0
2014	October	Dry Heath	1	rock	0
2014	October	Dry Heath	2	rock	0
2014	October	Dry Heath	3	rock	0
2014	October	Dry Heath	4	rock	0
2014	October	Dry Heath	5	rock	0
2014	October	Dry Heath	6	rock	0
2014	October	Dry Heath	7	rock	0
2014	October	Dry Heath	8	rock	0
2014	October	Dry Heath	9	rock	0
2014	October	Dry Heath	10	rock	0
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2014	October	Dry Heath	13	rock	0
2014	October	Dry Heath	14	rock	0
2014	October	Dry Heath	15	rock	0
2014	October	Dry Heath	16	rock	0
2014	October	Dry Heath	17	rock	0
2014	October	Dry Heath	18	rock	0

2014	October	Dry Heath	19	rock	0
2014	October	Dry Heath	20	rock	0
2014	June	mire	1	rock	0
2014	June	mire	2	rock	0
2014	June	mire	3	rock	0
2014	June	mire	4	rock	0
2014	June	mire	5	rock	0
2014	June	mire	6	rock	0
2014	June	mire	7	rock	0
2014	June	mire	8	rock	0
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2014	June	mire	10	rock	0
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2014	June	mire	20	rock	0
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2014	June	Wet Heath	2	rock	0
2014	June	Wet Heath	3	rock	0

2014	June	Wet Heath	4	rock	0
2014	June	Wet Heath	5	rock	0
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2014	October	Wet Heath	19	rock	0
2014	October	Wet Heath	20	rock	0
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2015	June	Control Dry	4	rock	0
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2015	June	Control Dry	7	rock	0
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2015	June	Control Dry	14	rock	0
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2015	June	Control Dry	17	rock	0
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2015	October	Dry Heath	13	water	0
2015	October	Dry Heath	14	water	0
2015	October	Dry Heath	15	water	0
2015	October	Dry Heath	16	water	0
2015	October	Dry Heath	17	water	0

2015	October	Dry Heath	18	water	0
2015	October	Dry Heath	19	water	0
2015	October	Dry Heath	20	water	0
2015	June	mire	1	rock	0
2015	June	mire	2	rock	0
2015	June	mire	3	rock	0
2015	June	mire	4	rock	0
2015	June	mire	5	rock	0
2015	June	mire	6	rock	0
2015	June	mire	7	rock	1
2015	June	mire	8	rock	7
2015	June	mire	9	rock	8
2015	June	mire	10	rock	0
2015	June	mire	11	rock	8
2015	June	mire	12	rock	0
2015	June	mire	13	rock	5
2015	June	mire	14	rock	0
2015	June	mire	15	rock	8
2015	June	mire	16	rock	16
2015	June	mire	17	rock	0
2015	June	mire	18	rock	8
2015	June	mire	19	rock	0
2015	June	mire	20	rock	0
2015	June	mire	1	soil	0
2015	June	mire	2	soil	0
2015	June	mire	3	soil	0
2015	June	mire	4	soil	8
2015	June	mire	5	soil	12
2015	June	mire	6	soil	16
2015	June	mire	7	soil	0
2015	June	mire	8	soil	0
2015	June	mire	9	soil	7
2015	June	mire	10	soil	0
2015	June	mire	11	soil	0
2015	June	mire	12	soil	1
2015	June	mire	13	soil	2
2015	June	mire	14	soil	24
2015	June	mire	15	soil	3
2015	June	mire	17	soil	0
2015	June	mire	18	soil	0
2015	June	mire	19	soil	1
2015	June	mire	20	soil	30
2015	June	mire	1	water	52
2015	June	mire	2	water	22
2015	June	mire	3	water	25

2015	June	mire	4	water	1
2015	June	mire	5	water	20
2015	June	mire	6	water	27
2015	June	mire	7	water	0
2015	June	mire	8	water	15
2015	June	mire	9	water	11
2015	June	mire	10	water	18
2015	June	mire	11	water	20
2015	June	mire	12	water	10
2015	June	mire	13	water	7
2015	June	mire	14	water	9
2015	June	mire	15	water	8
2015	June	mire	16	water	12
2015	June	mire	17	water	10
2015	June	mire	18	water	10
2015	June	mire	19	water	12
2015	June	mire	20	water	0
2015	October	mire	1	rock	0
2015	October	mire	2	rock	0
2015	October	mire	3	rock	0
2015	October	mire	4	rock	0
2015	October	mire	5	rock	0
2015	October	mire	6	rock	0
2015	October	mire	7	rock	0
2015	October	mire	8	rock	0
2015	October	mire	9	rock	0
2015	October	mire	10	rock	0
2015	October	mire	11	rock	0
2015	October	mire	12	rock	0
2015	October	mire	13	rock	0
2015	October	mire	14	rock	0
2015	October	mire	15	rock	0
2015	October	mire	16	rock	0
2015	October	mire	17	rock	0
2015	October	mire	18	rock	0
2015	October	mire	19	rock	0
2015	October	mire	20	rock	0
2015	October	mire	1	soil	0
2015	October	mire	2	soil	0
2015	October	mire	3	soil	0
2015	October	mire	4	soil	0
2015	October	mire	5	soil	0
2015	October	mire	6	soil	7
2015	October	mire	7	soil	0
2015	October	mire	8	soil	0

2015	October	mire	9	soil	3
2015	October	mire	10	soil	0
2015	October	mire	11	soil	0
2015	October	mire	12	soil	0
2015	October	mire	13	soil	5
2015	October	mire	14	soil	32
2015	October	mire	15	soil	2
2015	October	mire	17	soil	0
2015	October	mire	18	soil	0
2015	October	mire	19	soil	3
2015	October	mire	20	soil	20
2015	October	mire	1	water	48
2015	October	mire	2	water	25
2015	October	mire	3	water	33
2015	October	mire	4	water	7
2015	October	mire	5	water	33
2015	October	mire	6	water	19
2015	October	mire	7	water	20
2015	October	mire	8	water	60
2015	October	mire	9	water	2
2015	October	mire	10	water	12
2015	October	mire	11	water	25
2015	October	mire	12	water	6
2015	October	mire	13	water	6
2015	October	mire	14	water	30
2015	October	mire	15	water	12
2015	October	mire	16	water	4
2015	October	mire	17	water	6
2015	October	mire	18	water	30
2015	October	mire	19	water	5
2015	October	mire	20	water	50
2015	June	Mosaic	1	rock	0
2015	June	Mosaic	2	rock	0
2015	June	Mosaic	3	rock	0
2015	June	Mosaic	4	rock	0
2015	June	Mosaic	5	rock	2
2015	June	Mosaic	6	rock	0
2015	June	Mosaic	7	rock	0
2015	June	Mosaic	8	rock	0
2015	June	Mosaic	9	rock	0
2015	June	Mosaic	10	rock	0
2015	June	Mosaic	11	rock	0
2015	June	Mosaic	12	rock	0
2015	June	Mosaic	13	rock	0
2015	June	Mosaic	14	rock	0

2015	June	Mosaic	15	rock	0
2015	June	Mosaic	16	rock	0
2015	June	Mosaic	17	rock	0
2015	June	Mosaic	18	rock	0
2015	June	Mosaic	19	rock	0
2015	June	Mosaic	20	rock	0
2015	June	Mosaic	21	rock	0
2015	June	Mosaic	22	rock	0
2015	June	Mosaic	23	rock	0
2015	June	Mosaic	24	rock	0
2015	June	Mosaic	25	rock	0
2015	June	Mosaic	26	rock	0
2015	June	Mosaic	27	rock	0
2015	June	Mosaic	28	rock	0
2015	June	Mosaic	29	rock	0
2015	June	Mosaic	30	rock	0
2015	June	Mosaic	31	rock	0
2015	June	Mosaic	32	rock	0
2015	June	Mosaic	33	rock	0
2015	June	Mosaic	34	rock	0
2015	June	Mosaic	35	rock	0
2015	June	Mosaic	36	rock	0
2015	June	Mosaic	37	rock	0
2015	June	Mosaic	38	rock	0
2015	June	Mosaic	39	rock	0
2015	June	Mosaic	40	rock	0
2015	June	Mosaic	1	soil	0
2015	June	Mosaic	2	soil	0
2015	June	Mosaic	3	soil	5
2015	June	Mosaic	4	soil	6
2015	June	Mosaic	5	soil	5
2015	June	Mosaic	6	soil	0
2015	June	Mosaic	7	soil	0
2015	June	Mosaic	8	soil	0
2015	June	Mosaic	9	soil	0
2015	June	Mosaic	10	soil	0
2015	June	Mosaic	11	soil	0
2015	June	Mosaic	12	soil	0
2015	June	Mosaic	13	soil	0
2015	June	Mosaic	14	soil	0
2015	June	Mosaic	15	soil	2
2015	June	Mosaic	16	soil	0
2015	June	Mosaic	17	soil	0
2015	June	Mosaic	18	soil	0
2015	June	Mosaic	19	soil	0

2015	June	Mosaic	20	soil	0
2015	June	Mosaic	21	soil	0
2015	June	Mosaic	22	soil	0
2015	June	Mosaic	23	soil	0
2015	June	Mosaic	24	soil	4
2015	June	Mosaic	25	soil	0
2015	June	Mosaic	26	soil	0
2015	June	Mosaic	27	soil	0
2015	June	Mosaic	28	soil	0
2015	June	Mosaic	29	soil	0
2015	June	Mosaic	30	soil	4
2015	June	Mosaic	31	soil	0
2015	June	Mosaic	32	soil	0
2015	June	Mosaic	33	soil	0
2015	June	Mosaic	34	soil	0
2015	June	Mosaic	35	soil	0
2015	June	Mosaic	36	soil	0
2015	June	Mosaic	37	soil	0
2015	June	Mosaic	38	soil	0
2015	June	Mosaic	39	soil	0
2015	June	Mosaic	40	soil	0
2015	June	Mosaic	1	water	0
2015	June	Mosaic	2	water	0
2015	June	Mosaic	3	water	0
2015	June	Mosaic	4	water	0
2015	June	Mosaic	5	water	0
2015	June	Mosaic	6	water	22
2015	June	Mosaic	7	water	0
2015	June	Mosaic	8	water	0
2015	June	Mosaic	9	water	2
2015	June	Mosaic	10	water	5
2015	June	Mosaic	11	water	0
2015	June	Mosaic	12	water	0
2015	June	Mosaic	13	water	0
2015	June	Mosaic	14	water	5
2015	June	Mosaic	15	water	1
2015	June	Mosaic	16	water	0
2015	June	Mosaic	17	water	0
2015	June	Mosaic	18	water	0
2015	June	Mosaic	19	water	0
2015	June	Mosaic	20	water	0
2015	June	Mosaic	21	water	0
2015	June	Mosaic	22	water	0
2015	June	Mosaic	23	water	4
2015	June	Mosaic	24	water	0

2015	June	Mosaic	25	water	0
2015	June	Mosaic	26	water	22
2015	June	Mosaic	27	water	0
2015	June	Mosaic	28	water	0
2015	June	Mosaic	29	water	3
2015	June	Mosaic	30	water	16
2015	June	Mosaic	31	water	0
2015	June	Mosaic	32	water	0
2015	June	Mosaic	33	water	0
2015	June	Mosaic	34	water	0
2015	June	Mosaic	35	water	0
2015	June	Mosaic	36	water	0
2015	June	Mosaic	37	water	0
2015	June	Mosaic	38	water	0
2015	June	Mosaic	39	water	0
2015	June	Mosaic	40	water	0
2015	October	Mosaic	1	rock	0
2015	October	Mosaic	2	rock	0
2015	October	Mosaic	3	rock	0
2015	October	Mosaic	4	rock	0
2015	October	Mosaic	5	rock	0
2015	October	Mosaic	6	rock	0
2015	October	Mosaic	7	rock	0
2015	October	Mosaic	8	rock	0
2015	October	Mosaic	9	rock	0
2015	October	Mosaic	10	rock	0
2015	October	Mosaic	11	rock	0
2015	October	Mosaic	12	rock	0
2015	October	Mosaic	13	rock	0
2015	October	Mosaic	14	rock	0
2015	October	Mosaic	15	rock	0
2015	October	Mosaic	16	rock	0
2015	October	Mosaic	17	rock	0
2015	October	Mosaic	18	rock	0
2015	October	Mosaic	19	rock	0
2015	October	Mosaic	20	rock	0
2015	October	Mosaic	21	rock	0
2015	October	Mosaic	22	rock	0
2015	October	Mosaic	23	rock	0
2015	October	Mosaic	24	rock	0
2015	October	Mosaic	25	rock	0
2015	October	Mosaic	26	rock	0
2015	October	Mosaic	27	rock	0
2015	October	Mosaic	28	rock	0
2015	October	Mosaic	29	rock	0

2015	October	Mosaic	30	rock	0
2015	October	Mosaic	31	rock	0
2015	October	Mosaic	32	rock	0
2015	October	Mosaic	33	rock	0
2015	October	Mosaic	34	rock	0
2015	October	Mosaic	35	rock	0
2015	October	Mosaic	36	rock	0
2015	October	Mosaic	37	rock	0
2015	October	Mosaic	38	rock	0
2015	October	Mosaic	39	rock	0
2015	October	Mosaic	40	rock	0
2015	October	Mosaic	1	soil	0
2015	October	Mosaic	2	soil	1
2015	October	Mosaic	3	soil	7
2015	October	Mosaic	4	soil	6
2015	October	Mosaic	5	soil	3
2015	October	Mosaic	6	soil	0
2015	October	Mosaic	7	soil	0
2015	October	Mosaic	8	soil	2
2015	October	Mosaic	9	soil	0
2015	October	Mosaic	10	soil	3
2015	October	Mosaic	11	soil	0
2015	October	Mosaic	12	soil	0
2015	October	Mosaic	13	soil	0
2015	October	Mosaic	14	soil	0
2015	October	Mosaic	15	soil	2
2015	October	Mosaic	16	soil	0
2015	October	Mosaic	17	soil	0
2015	October	Mosaic	18	soil	0
2015	October	Mosaic	19	soil	3
2015	October	Mosaic	20	soil	0
2015	October	Mosaic	21	soil	0
2015	October	Mosaic	22	soil	0
2015	October	Mosaic	23	soil	0
2015	October	Mosaic	24	soil	3
2015	October	Mosaic	25	soil	0
2015	October	Mosaic	26	soil	0
2015	October	Mosaic	27	soil	0
2015	October	Mosaic	28	soil	0
2015	October	Mosaic	29	soil	0
2015	October	Mosaic	30	soil	0
2015	October	Mosaic	31	soil	0
2015	October	Mosaic	32	soil	0
2015	October	Mosaic	33	soil	0
2015	October	Mosaic	34	soil	0

2015	October	Mosaic	35	soil	0
2015	October	Mosaic	36	soil	0
2015	October	Mosaic	37	soil	0
2015	October	Mosaic	38	soil	0
2015	October	Mosaic	39	soil	0
2015	October	Mosaic	40	soil	0
2015	October	Mosaic	1	water	0
2015	October	Mosaic	2	water	1
2015	October	Mosaic	3	water	0
2015	October	Mosaic	4	water	0
2015	October	Mosaic	5	water	0
2015	October	Mosaic	6	water	23
2015	October	Mosaic	7	water	0
2015	October	Mosaic	8	water	6
2015	October	Mosaic	9	water	2
2015	October	Mosaic	10	water	8
2015	October	Mosaic	11	water	0
2015	October	Mosaic	12	water	0
2015	October	Mosaic	13	water	0
2015	October	Mosaic	14	water	3
2015	October	Mosaic	15	water	1
2015	October	Mosaic	16	water	0
2015	October	Mosaic	17	water	0
2015	October	Mosaic	18	water	0
2015	October	Mosaic	19	water	0
2015	October	Mosaic	20	water	0
2015	October	Mosaic	21	water	0
2015	October	Mosaic	22	water	0
2015	October	Mosaic	23	water	0
2015	October	Mosaic	24	water	4
2015	October	Mosaic	25	water	0
2015	October	Mosaic	26	water	19
2015	October	Mosaic	27	water	9
2015	October	Mosaic	28	water	9
2015	October	Mosaic	29	water	28
2015	October	Mosaic	30	water	23
2015	October	Mosaic	31	water	0
2015	October	Mosaic	32	water	0
2015	October	Mosaic	33	water	0
2015	October	Mosaic	34	water	0
2015	October	Mosaic	35	water	0
2015	October	Mosaic	36	water	1
2015	October	Mosaic	37	water	0
2015	October	Mosaic	38	water	0
2015	October	Mosaic	39	water	0

2015	October	Mosaic	40	water	0
2015	June	Wet Heath	1	rock	0
2015	June	Wet Heath	2	rock	0
2015	June	Wet Heath	3	rock	0
2015	June	Wet Heath	4	rock	0
2015	June	Wet Heath	5	rock	0
2015	June	Wet Heath	6	rock	0
2015	June	Wet Heath	7	rock	0
2015	June	Wet Heath	8	rock	0
2015	June	Wet Heath	9	rock	0
2015	June	Wet Heath	10	rock	0
2015	June	Wet Heath	11	rock	0
2015	June	Wet Heath	12	rock	1
2015	June	Wet Heath	13	rock	0
2015	June	Wet Heath	14	rock	0
2015	June	Wet Heath	15	rock	0
2015	June	Wet Heath	16	rock	0
2015	June	Wet Heath	17	rock	0
2015	June	Wet Heath	18	rock	0
2015	June	Wet Heath	19	rock	0
2015	June	Wet Heath	20	rock	0
2015	June	Wet Heath	1	soil	0
2015	June	Wet Heath	2	soil	0
2015	June	Wet Heath	3	soil	0
2015	June	Wet Heath	4	soil	0
2015	June	Wet Heath	5	soil	0
2015	June	Wet Heath	6	soil	16
2015	June	Wet Heath	7	soil	5
2015	June	Wet Heath	8	soil	0
2015	June	Wet Heath	9	soil	0
2015	June	Wet Heath	10	soil	0
2015	June	Wet Heath	11	soil	0
2015	June	Wet Heath	12	soil	0
2015	June	Wet Heath	13	soil	0
2015	June	Wet Heath	14	soil	0
2015	June	Wet Heath	15	soil	0
2015	June	Wet Heath	16	soil	0
2015	June	Wet Heath	17	soil	0
2015	June	Wet Heath	18	soil	0
2015	June	Wet Heath	19	soil	0
2015	June	Wet Heath	20	soil	0
2015	June	Wet Heath	1	water	0
2015	June	Wet Heath	2	water	0
2015	June	Wet Heath	3	water	0
2015	June	Wet Heath	4	water	2

2015	June	Wet Heath	5	water	1
2015	June	Wet Heath	6	water	0
2015	June	Wet Heath	7	water	0
2015	June	Wet Heath	8	water	0
2015	June	Wet Heath	9	water	0
2015	June	Wet Heath	10	water	0
2015	June	Wet Heath	11	water	0
2015	June	Wet Heath	12	water	0
2015	June	Wet Heath	13	water	0
2015	June	Wet Heath	14	water	3
2015	June	Wet Heath	15	water	7
2015	June	Wet Heath	16	water	14
2015	June	Wet Heath	17	water	0
2015	June	Wet Heath	18	water	0
2015	June	Wet Heath	19	water	15
2015	June	Wet Heath	20	water	0
2015	October	Wet Heath	1	rock	0
2015	October	Wet Heath	2	rock	0
2015	October	Wet Heath	3	rock	0
2015	October	Wet Heath	4	rock	0
2015	October	Wet Heath	5	rock	0
2015	October	Wet Heath	6	rock	0
2015	October	Wet Heath	7	rock	0
2015	October	Wet Heath	8	rock	0
2015	October	Wet Heath	9	rock	0
2015	October	Wet Heath	10	rock	0
2015	October	Wet Heath	11	rock	0
2015	October	Wet Heath	12	rock	0
2015	October	Wet Heath	13	rock	0
2015	October	Wet Heath	14	rock	0
2015	October	Wet Heath	15	rock	0
2015	October	Wet Heath	16	rock	0
2015	October	Wet Heath	17	rock	0
2015	October	Wet Heath	18	rock	0
2015	October	Wet Heath	19	rock	0
2015	October	Wet Heath	20	rock	0
2015	October	Wet Heath	1	soil	0
2015	October	Wet Heath	2	soil	0
2015	October	Wet Heath	3	soil	4
2015	October	Wet Heath	4	soil	0
2015	October	Wet Heath	5	soil	4
2015	October	Wet Heath	6	soil	11
2015	October	Wet Heath	7	soil	0
2015	October	Wet Heath	8	soil	0
2015	October	Wet Heath	9	soil	0

2015	October	Wet Heath	10	soil	0
2015	October	Wet Heath	11	soil	1
2015	October	Wet Heath	12	soil	5
2015	October	Wet Heath	13	soil	0
2015	October	Wet Heath	14	soil	7
2015	October	Wet Heath	15	soil	0
2015	October	Wet Heath	16	soil	7
2015	October	Wet Heath	17	soil	0
2015	October	Wet Heath	18	soil	2
2015	October	Wet Heath	19	soil	0
2015	October	Wet Heath	20	soil	0
2015	October	Wet Heath	1	water	0
2015	October	Wet Heath	2	water	0
2015	October	Wet Heath	3	water	20
2015	October	Wet Heath	4	water	17
2015	October	Wet Heath	5	water	0
2015	October	Wet Heath	6	water	0
2015	October	Wet Heath	7	water	0
2015	October	Wet Heath	8	water	0
2015	October	Wet Heath	9	water	0
2015	October	Wet Heath	10	water	0
2015	October	Wet Heath	11	water	0
2015	October	Wet Heath	12	water	2
2015	October	Wet Heath	13	water	0
2015	October	Wet Heath	14	water	7
2015	October	Wet Heath	15	water	9
2015	October	Wet Heath	16	water	23
2015	October	Wet Heath	17	water	0
2015	October	Wet Heath	18	water	3
2015	October	Wet Heath	19	water	0
2015	October	Wet Heath	20	water	0
2016	June	Control Dry	1	rock	0
2016	June	Control Dry	2	rock	0
2016	June	Control Dry	3	rock	0
2016	June	Control Dry	4	rock	0
2016	June	Control Dry	5	rock	0
2016	June	Control Dry	6	rock	0
2016	June	Control Dry	7	rock	0
2016	June	Control Dry	8	rock	0
2016	June	Control Dry	9	rock	0
2016	June	Control Dry	10	rock	0
2016	June	Control Dry	11	rock	0
2016	June	Control Dry	12	rock	0
2016	June	Control Dry	13	rock	0
2016	June	Control Dry	14	rock	0

2016	June	Control Dry	15	rock	0
2016	June	Control Dry	16	rock	0
2016	June	Control Dry	17	rock	0
2016	June	Control Dry	18	rock	0
2016	June	Control Dry	19	rock	0
2016	June	Control Dry	20	rock	0
2016	June	Control Dry	1	soil	0
2016	June	Control Dry	2	soil	0
2016	June	Control Dry	3	soil	0
2016	June	Control Dry	4	soil	0
2016	June	Control Dry	5	soil	0
2016	June	Control Dry	6	soil	0
2016	June	Control Dry	7	soil	0
2016	June	Control Dry	8	soil	0
2016	June	Control Dry	9	soil	0
2016	June	Control Dry	10	soil	0
2016	June	Control Dry	11	soil	0
2016	June	Control Dry	12	soil	0
2016	June	Control Dry	13	soil	0
2016	June	Control Dry	14	soil	0
2016	June	Control Dry	15	soil	0
2016	June	Control Dry	17	soil	0
2016	June	Control Dry	18	soil	0
2016	June	Control Dry	19	soil	0
2016	June	Control Dry	20	soil	0
2016	June	Control Dry	1	water	0
2016	June	Control Dry	2	water	0
2016	June	Control Dry	3	water	0
2016	June	Control Dry	4	water	0
2016	June	Control Dry	5	water	0
2016	June	Control Dry	6	water	0
2016	June	Control Dry	7	water	0
2016	June	Control Dry	8	water	0
2016	June	Control Dry	9	water	0
2016	June	Control Dry	10	water	0
2016	June	Control Dry	11	water	0
2016	June	Control Dry	12	water	0
2016	June	Control Dry	13	water	0
2016	June	Control Dry	14	water	0
2016	June	Control Dry	15	water	0
2016	June	Control Dry	16	water	0
2016	June	Control Dry	17	water	0
2016	June	Control Dry	18	water	0
2016	June	Control Dry	19	water	0
2016	June	Control Dry	20	water	0

2016	October	Control Dry	1	rock	0
2016	October	Control Dry	2	rock	0
2016	October	Control Dry	3	rock	0
2016	October	Control Dry	4	rock	0
2016	October	Control Dry	5	rock	0
2016	October	Control Dry	6	rock	0
2016	October	Control Dry	7	rock	0
2016	October	Control Dry	8	rock	0
2016	October	Control Dry	9	rock	0
2016	October	Control Dry	10	rock	0
2016	October	Control Dry	11	rock	0
2016	October	Control Dry	12	rock	0
2016	October	Control Dry	13	rock	0
2016	October	Control Dry	14	rock	0
2016	October	Control Dry	15	rock	0
2016	October	Control Dry	16	rock	0
2016	October	Control Dry	17	rock	0
2016	October	Control Dry	18	rock	0
2016	October	Control Dry	19	rock	0
2016	October	Control Dry	20	rock	0
2016	October	Control Dry	1	soil	0
2016	October	Control Dry	2	soil	0
2016	October	Control Dry	3	soil	0
2016	October	Control Dry	4	soil	0
2016	October	Control Dry	5	soil	0
2016	October	Control Dry	6	soil	0
2016	October	Control Dry	7	soil	0
2016	October	Control Dry	8	soil	0
2016	October	Control Dry	9	soil	0
2016	October	Control Dry	10	soil	0
2016	October	Control Dry	11	soil	0
2016	October	Control Dry	12	soil	0
2016	October	Control Dry	13	soil	0
2016	October	Control Dry	14	soil	0
2016	October	Control Dry	15	soil	0
2016	October	Control Dry	17	soil	0
2016	October	Control Dry	18	soil	0
2016	October	Control Dry	19	soil	0
2016	October	Control Dry	20	soil	0
2016	October	Control Dry	1	water	0
2016	October	Control Dry	2	water	0
2016	October	Control Dry	3	water	0
2016	October	Control Dry	4	water	0
2016	October	Control Dry	5	water	0
2016	October	Control Dry	6	water	0

2016	October	Control Dry	7	water	0
2016	October	Control Dry	8	water	0
2016	October	Control Dry	9	water	0
2016	October	Control Dry	10	water	0
2016	October	Control Dry	11	water	0
2016	October	Control Dry	12	water	0
2016	October	Control Dry	13	water	0
2016	October	Control Dry	14	water	0
2016	October	Control Dry	15	water	0
2016	October	Control Dry	16	water	0
2016	October	Control Dry	17	water	0
2016	October	Control Dry	18	water	0
2016	October	Control Dry	19	water	0
2016	October	Control Dry	20	water	0
2016	June	Dry Heath	1	rock	0
2016	June	Dry Heath	2	rock	0
2016	June	Dry Heath	3	rock	0
2016	June	Dry Heath	4	rock	0
2016	June	Dry Heath	5	rock	0
2016	June	Dry Heath	6	rock	0
2016	June	Dry Heath	7	rock	0
2016	June	Dry Heath	8	rock	0
2016	June	Dry Heath	9	rock	0
2016	June	Dry Heath	10	rock	0
2016	June	Dry Heath	11	rock	0
2016	June	Dry Heath	12	rock	0
2016	June	Dry Heath	13	rock	0
2016	June	Dry Heath	14	rock	0
2016	June	Dry Heath	15	rock	0
2016	June	Dry Heath	16	rock	0
2016	June	Dry Heath	17	rock	0
2016	June	Dry Heath	18	rock	0
2016	June	Dry Heath	19	rock	0
2016	June	Dry Heath	20	rock	0
2016	June	Dry Heath	1	soil	0
2016	June	Dry Heath	2	soil	0
2016	June	Dry Heath	3	soil	0
2016	June	Dry Heath	4	soil	0
2016	June	Dry Heath	5	soil	0
2016	June	Dry Heath	6	soil	0
2016	June	Dry Heath	7	soil	0
2016	June	Dry Heath	8	soil	0
2016	June	Dry Heath	9	soil	0
2016	June	Dry Heath	10	soil	0
2016	June	Dry Heath	11	soil	0

2016	June	Dry Heath	12	soil	0
2016	June	Dry Heath	13	soil	0
2016	June	Dry Heath	14	soil	0
2016	June	Dry Heath	15	soil	0
2016	June	Dry Heath	17	soil	16
2016	June	Dry Heath	18	soil	0
2016	June	Dry Heath	19	soil	0
2016	June	Dry Heath	20	soil	0
2016	June	Dry Heath	1	water	0
2016	June	Dry Heath	2	water	0
2016	June	Dry Heath	3	water	0
2016	June	Dry Heath	4	water	0
2016	June	Dry Heath	5	water	0
2016	June	Dry Heath	6	water	0
2016	June	Dry Heath	7	water	0
2016	June	Dry Heath	8	water	0
2016	June	Dry Heath	9	water	0
2016	June	Dry Heath	10	water	0
2016	June	Dry Heath	11	water	0
2016	June	Dry Heath	12	water	0
2016	June	Dry Heath	13	water	0
2016	June	Dry Heath	14	water	0
2016	June	Dry Heath	15	water	0
2016	June	Dry Heath	16	water	0
2016	June	Dry Heath	17	water	0
2016	June	Dry Heath	18	water	0
2016	June	Dry Heath	19	water	0
2016	June	Dry Heath	20	water	0
2016	October	Dry Heath	1	rock	0
2016	October	Dry Heath	2	rock	0
2016	October	Dry Heath	3	rock	0
2016	October	Dry Heath	4	rock	0
2016	October	Dry Heath	5	rock	0
2016	October	Dry Heath	6	rock	0
2016	October	Dry Heath	7	rock	0
2016	October	Dry Heath	8	rock	0
2016	October	Dry Heath	9	rock	0
2016	October	Dry Heath	10	rock	0
2016	October	Dry Heath	11	rock	0
2016	October	Dry Heath	12	rock	0
2016	October	Dry Heath	13	rock	0
2016	October	Dry Heath	14	rock	0
2016	October	Dry Heath	15	rock	0
2016	October	Dry Heath	16	rock	0
2016	October	Dry Heath	17	rock	0

2016	October	Dry Heath	18	rock	0
2016	October	Dry Heath	19	rock	0
2016	October	Dry Heath	20	rock	0
2016	October	Dry Heath	1	soil	0
2016	October	Dry Heath	2	soil	0
2016	October	Dry Heath	3	soil	0
2016	October	Dry Heath	4	soil	0
2016	October	Dry Heath	5	soil	0
2016	October	Dry Heath	6	soil	0
2016	October	Dry Heath	7	soil	0
2016	October	Dry Heath	8	soil	0
2016	October	Dry Heath	9	soil	0
2016	October	Dry Heath	10	soil	0
2016	October	Dry Heath	11	soil	0
2016	October	Dry Heath	12	soil	0
2016	October	Dry Heath	13	soil	0
2016	October	Dry Heath	14	soil	0
2016	October	Dry Heath	15	soil	0
2016	October	Dry Heath	17	soil	24
2016	October	Dry Heath	18	soil	0
2016	October	Dry Heath	19	soil	0
2016	October	Dry Heath	20	soil	0
2016	October	Dry Heath	1	water	0
2016	October	Dry Heath	2	water	0
2016	October	Dry Heath	3	water	0
2016	October	Dry Heath	4	water	0
2016	October	Dry Heath	5	water	0
2016	October	Dry Heath	6	water	0
2016	October	Dry Heath	7	water	0
2016	October	Dry Heath	8	water	0
2016	October	Dry Heath	9	water	0
2016	October	Dry Heath	10	water	0
2016	October	Dry Heath	11	water	0
2016	October	Dry Heath	12	water	0
2016	October	Dry Heath	13	water	0
2016	October	Dry Heath	14	water	0
2016	October	Dry Heath	15	water	0
2016	October	Dry Heath	16	water	0
2016	October	Dry Heath	17	water	0
2016	October	Dry Heath	18	water	0
2016	October	Dry Heath	19	water	0
2016	October	Dry Heath	20	water	0
2016	June	mire	1	rock	0
2016	June	mire	2	rock	0
2016	June	mire	3	rock	0

2016	June	mire	4	rock	0
2016	June	mire	5	rock	0
2016	June	mire	6	rock	0
2016	June	mire	7	rock	0
2016	June	mire	8	rock	0
2016	June	mire	9	rock	0
2016	June	mire	10	rock	0
2016	June	mire	11	rock	0
2016	June	mire	12	rock	0
2016	June	mire	13	rock	0
2016	June	mire	14	rock	0
2016	June	mire	15	rock	0
2016	June	mire	16	rock	0
2016	June	mire	17	rock	0
2016	June	mire	18	rock	0
2016	June	mire	19	rock	0
2016	June	mire	20	rock	0
2016	June	mire	1	soil	0
2016	June	mire	2	soil	0
2016	June	mire	3	soil	0
2016	June	mire	4	soil	0
2016	June	mire	5	soil	0
2016	June	mire	6	soil	0
2016	June	mire	7	soil	0
2016	June	mire	8	soil	0
2016	June	mire	9	soil	2
2016	June	mire	10	soil	0
2016	June	mire	11	soil	0
2016	June	mire	12	soil	0
2016	June	mire	13	soil	6
2016	June	mire	14	soil	30
2016	June	mire	15	soil	0
2016	June	mire	17	soil	0
2016	June	mire	18	soil	0
2016	June	mire	19	soil	0
2016	June	mire	20	soil	0
2016	June	mire	1	water	89
2016	June	mire	2	water	36
2016	June	mire	3	water	36
2016	June	mire	4	water	0
2016	June	mire	5	water	39
2016	June	mire	6	water	35
2016	June	mire	7	water	33
2016	June	mire	8	water	67
2016	June	mire	9	water	13

2016	June	mire	10	water	14
2016	June	mire	11	water	22
2016	June	mire	12	water	14
2016	June	mire	13	water	15
2016	June	mire	14	water	37
2016	June	mire	15	water	22
2016	June	mire	16	water	9
2016	June	mire	17	water	17
2016	June	mire	18	water	38
2016	June	mire	19	water	19
2016	June	mire	20	water	58
2016	October	mire	1	rock	0
2016	October	mire	2	rock	0
2016	October	mire	3	rock	0
2016	October	mire	4	rock	0
2016	October	mire	5	rock	0
2016	October	mire	6	rock	0
2016	October	mire	7	rock	0
2016	October	mire	8	rock	0
2016	October	mire	9	rock	0
2016	October	mire	10	rock	0
2016	October	mire	11	rock	0
2016	October	mire	12	rock	0
2016	October	mire	13	rock	0
2016	October	mire	14	rock	0
2016	October	mire	15	rock	0
2016	October	mire	16	rock	0
2016	October	mire	17	rock	0
2016	October	mire	18	rock	0
2016	October	mire	19	rock	0
2016	October	mire	20	rock	0
2016	October	mire	1	soil	0
2016	October	mire	2	soil	0
2016	October	mire	3	soil	0
2016	October	mire	4	soil	0
2016	October	mire	5	soil	0
2016	October	mire	6	soil	0
2016	October	mire	7	soil	0
2016	October	mire	8	soil	0
2016	October	mire	9	soil	0
2016	October	mire	10	soil	0
2016	October	mire	11	soil	0
2016	October	mire	12	soil	0
2016	October	mire	13	soil	0
2016	October	mire	14	soil	0

2016	October	mire	15	soil	0
2016	October	mire	17	soil	0
2016	October	mire	18	soil	0
2016	October	mire	19	soil	0
2016	October	mire	20	soil	0
2016	October	mire	1	water	0
2016	October	mire	2	water	0
2016	October	mire	3	water	0
2016	October	mire	4	water	0
2016	October	mire	5	water	0
2016	October	mire	6	water	0
2016	October	mire	7	water	0
2016	October	mire	8	water	0
2016	October	mire	9	water	0
2016	October	mire	10	water	0
2016	October	mire	11	water	0
2016	October	mire	12	water	0
2016	October	mire	13	water	0
2016	October	mire	14	water	0
2016	October	mire	15	water	0
2016	October	mire	16	water	0
2016	October	mire	17	water	0
2016	October	mire	18	water	0
2016	October	mire	19	water	0
2016	October	mire	20	water	0
2016	June	Mosaic	1	rock	0
2016	June	Mosaic	2	rock	0
2016	June	Mosaic	3	rock	0
2016	June	Mosaic	4	rock	0
2016	June	Mosaic	5	rock	3
2016	June	Mosaic	6	rock	0
2016	June	Mosaic	7	rock	0
2016	June	Mosaic	8	rock	0
2016	June	Mosaic	9	rock	0
2016	June	Mosaic	10	rock	0
2016	June	Mosaic	11	rock	0
2016	June	Mosaic	12	rock	0
2016	June	Mosaic	13	rock	0
2016	June	Mosaic	14	rock	0
2016	June	Mosaic	15	rock	0
2016	June	Mosaic	16	rock	0
2016	June	Mosaic	17	rock	0
2016	June	Mosaic	18	rock	0
2016	June	Mosaic	19	rock	0
2016	June	Mosaic	20	rock	0

2016	June	Mosaic	21	rock	0
2016	June	Mosaic	22	rock	0
2016	June	Mosaic	23	rock	0
2016	June	Mosaic	24	rock	0
2016	June	Mosaic	25	rock	0
2016	June	Mosaic	26	rock	0
2016	June	Mosaic	27	rock	0
2016	June	Mosaic	28	rock	0
2016	June	Mosaic	29	rock	0
2016	June	Mosaic	30	rock	0
2016	June	Mosaic	31	rock	0
2016	June	Mosaic	32	rock	0
2016	June	Mosaic	33	rock	0
2016	June	Mosaic	34	rock	0
2016	June	Mosaic	35	rock	0
2016	June	Mosaic	36	rock	0
2016	June	Mosaic	37	rock	0
2016	June	Mosaic	38	rock	0
2016	June	Mosaic	39	rock	0
2016	June	Mosaic	40	rock	0
2016	June	Mosaic	1	soil	0
2016	June	Mosaic	2	soil	0
2016	June	Mosaic	3	soil	0
2016	June	Mosaic	4	soil	0
2016	June	Mosaic	5	soil	5
2016	June	Mosaic	6	soil	0
2016	June	Mosaic	7	soil	0
2016	June	Mosaic	8	soil	0
2016	June	Mosaic	9	soil	0
2016	June	Mosaic	10	soil	0
2016	June	Mosaic	11	soil	0
2016	June	Mosaic	12	soil	0
2016	June	Mosaic	13	soil	0
2016	June	Mosaic	14	soil	0
2016	June	Mosaic	15	soil	2
2016	June	Mosaic	16	soil	0
2016	June	Mosaic	17	soil	0
2016	June	Mosaic	18	soil	0
2016	June	Mosaic	19	soil	0
2016	June	Mosaic	20	soil	0
2016	June	Mosaic	21	soil	0
2016	June	Mosaic	22	soil	0
2016	June	Mosaic	23	soil	0
2016	June	Mosaic	24	soil	4
2016	June	Mosaic	25	soil	0

2016	June	Mosaic	26	soil	0
2016	June	Mosaic	27	soil	0
2016	June	Mosaic	28	soil	0
2016	June	Mosaic	29	soil	0
2016	June	Mosaic	30	soil	0
2016	June	Mosaic	31	soil	0
2016	June	Mosaic	32	soil	0
2016	June	Mosaic	33	soil	0
2016	June	Mosaic	34	soil	0
2016	June	Mosaic	35	soil	0
2016	June	Mosaic	36	soil	0
2016	June	Mosaic	37	soil	0
2016	June	Mosaic	38	soil	0
2016	June	Mosaic	39	soil	0
2016	June	Mosaic	40	soil	0
2016	June	Mosaic	1	water	0
2016	June	Mosaic	2	water	0
2016	June	Mosaic	3	water	0
2016	June	Mosaic	4	water	0
2016	June	Mosaic	5	water	0
2016	June	Mosaic	6	water	21
2016	June	Mosaic	7	water	0
2016	June	Mosaic	8	water	0
2016	June	Mosaic	9	water	2
2016	June	Mosaic	10	water	6
2016	June	Mosaic	11	water	0
2016	June	Mosaic	12	water	0
2016	June	Mosaic	13	water	0
2016	June	Mosaic	14	water	4
2016	June	Mosaic	15	water	1
2016	June	Mosaic	16	water	0
2016	June	Mosaic	17	water	0
2016	June	Mosaic	18	water	0
2016	June	Mosaic	19	water	0
2016	June	Mosaic	20	water	0
2016	June	Mosaic	21	water	0
2016	June	Mosaic	22	water	0
2016	June	Mosaic	23	water	0
2016	June	Mosaic	24	water	4
2016	June	Mosaic	25	water	0
2016	June	Mosaic	26	water	21
2016	June	Mosaic	27	water	8
2016	June	Mosaic	28	water	0
2016	June	Mosaic	29	water	0
2016	June	Mosaic	30	water	0

2016	June	Mosaic	31	water	0
2016	June	Mosaic	32	water	0
2016	June	Mosaic	33	water	0
2016	June	Mosaic	34	water	0
2016	June	Mosaic	35	water	0
2016	June	Mosaic	36	water	0
2016	June	Mosaic	37	water	0
2016	June	Mosaic	38	water	0
2016	June	Mosaic	39	water	0
2016	June	Mosaic	40	water	0
2016	October	Mosaic	1	rock	0
2016	October	Mosaic	2	rock	0
2016	October	Mosaic	3	rock	0
2016	October	Mosaic	4	rock	0
2016	October	Mosaic	5	rock	2
2016	October	Mosaic	6	rock	0
2016	October	Mosaic	7	rock	0
2016	October	Mosaic	8	rock	0
2016	October	Mosaic	9	rock	0
2016	October	Mosaic	10	rock	0
2016	October	Mosaic	11	rock	0
2016	October	Mosaic	12	rock	0
2016	October	Mosaic	13	rock	0
2016	October	Mosaic	14	rock	0
2016	October	Mosaic	15	rock	0
2016	October	Mosaic	16	rock	0
2016	October	Mosaic	17	rock	0
2016	October	Mosaic	18	rock	0
2016	October	Mosaic	19	rock	0
2016	October	Mosaic	20	rock	0
2016	October	Mosaic	21	rock	0
2016	October	Mosaic	22	rock	0
2016	October	Mosaic	23	rock	0
2016	October	Mosaic	24	rock	0
2016	October	Mosaic	25	rock	0
2016	October	Mosaic	26	rock	0
2016	October	Mosaic	27	rock	0
2016	October	Mosaic	28	rock	0
2016	October	Mosaic	29	rock	0
2016	October	Mosaic	30	rock	0
2016	October	Mosaic	31	rock	0
2016	October	Mosaic	32	rock	0
2016	October	Mosaic	33	rock	0
2016	October	Mosaic	34	rock	0
2016	October	Mosaic	35	rock	0

2016	October	Mosaic	36	rock	0
2016	October	Mosaic	37	rock	0
2016	October	Mosaic	38	rock	0
2016	October	Mosaic	39	rock	0
2016	October	Mosaic	40	rock	0
2016	October	Mosaic	1	soil	0
2016	October	Mosaic	2	soil	0
2016	October	Mosaic	3	soil	0
2016	October	Mosaic	4	soil	0
2016	October	Mosaic	5	soil	5
2016	October	Mosaic	6	soil	0
2016	October	Mosaic	7	soil	0
2016	October	Mosaic	8	soil	0
2016	October	Mosaic	9	soil	1
2016	October	Mosaic	10	soil	0
2016	October	Mosaic	11	soil	0
2016	October	Mosaic	12	soil	0
2016	October	Mosaic	13	soil	0
2016	October	Mosaic	14	soil	0
2016	October	Mosaic	15	soil	0
2016	October	Mosaic	16	soil	0
2016	October	Mosaic	17	soil	0
2016	October	Mosaic	18	soil	0
2016	October	Mosaic	19	soil	0
2016	October	Mosaic	20	soil	0
2016	October	Mosaic	21	soil	0
2016	October	Mosaic	22	soil	0
2016	October	Mosaic	23	soil	0
2016	October	Mosaic	24	soil	4
2016	October	Mosaic	25	soil	0
2016	October	Mosaic	26	soil	0
2016	October	Mosaic	27	soil	0
2016	October	Mosaic	28	soil	0
2016	October	Mosaic	29	soil	0
2016	October	Mosaic	30	soil	0
2016	October	Mosaic	31	soil	0
2016	October	Mosaic	32	soil	0
2016	October	Mosaic	33	soil	0
2016	October	Mosaic	34	soil	0
2016	October	Mosaic	35	soil	0
2016	October	Mosaic	36	soil	0
2016	October	Mosaic	37	soil	0
2016	October	Mosaic	38	soil	0
2016	October	Mosaic	39	soil	0
2016	October	Mosaic	40	soil	0

2016	October	Mosaic	1	water	0
2016	October	Mosaic	2	water	2
2016	October	Mosaic	3	water	0
2016	October	Mosaic	4	water	0
2016	October	Mosaic	5	water	12
2016	October	Mosaic	6	water	18
2016	October	Mosaic	7	water	0
2016	October	Mosaic	8	water	7
2016	October	Mosaic	9	water	2
2016	October	Mosaic	10	water	5
2016	October	Mosaic	11	water	0
2016	October	Mosaic	12	water	0
2016	October	Mosaic	13	water	0
2016	October	Mosaic	14	water	4
2016	October	Mosaic	15	water	
2016	October	Mosaic	16	water	0
2016	October	Mosaic	17	water	0
2016	October	Mosaic	18	water	0
2016	October	Mosaic	19	water	2
2016	October	Mosaic	20	water	0
2016	October	Mosaic	21	water	0
2016	October	Mosaic	22	water	0
2016	October	Mosaic	23	water	0
2016	October	Mosaic	24	water	5
2016	October	Mosaic	25	water	0
2016	October	Mosaic	26	water	23
2016	October	Mosaic	27	water	7
2016	October	Mosaic	28	water	0
2016	October	Mosaic	29	water	0
2016	October	Mosaic	30	water	0
2016	October	Mosaic	31	water	0
2016	October	Mosaic	32	water	0
2016	October	Mosaic	33	water	0
2016	October	Mosaic	34	water	0
2016	October	Mosaic	35	water	0
2016	October	Mosaic	36	water	0
2016	October	Mosaic	37	water	0
2016	October	Mosaic	38	water	0
2016	October	Mosaic	39	water	0
2016	October	Mosaic	40	water	0
2016	June	Wet Heath	1	rock	0
2016	June	Wet Heath	2	rock	0
2016	June	Wet Heath	3	rock	0
2016	June	Wet Heath	4	rock	0
2016	June	Wet Heath	5	rock	0

2016	June	Wet Heath	6	rock	0
2016	June	Wet Heath	7	rock	0
2016	June	Wet Heath	8	rock	0
2016	June	Wet Heath	9	rock	0
2016	June	Wet Heath	10	rock	0
2016	June	Wet Heath	11	rock	0
2016	June	Wet Heath	12	rock	0
2016	June	Wet Heath	13	rock	0
2016	June	Wet Heath	14	rock	0
2016	June	Wet Heath	15	rock	0
2016	June	Wet Heath	16	rock	0
2016	June	Wet Heath	17	rock	0
2016	June	Wet Heath	18	rock	0
2016	June	Wet Heath	19	rock	0
2016	June	Wet Heath	20	rock	0
2016	June	Wet Heath	1	soil	0
2016	June	Wet Heath	2	soil	0
2016	June	Wet Heath	3	soil	0
2016	June	Wet Heath	4	soil	0
2016	June	Wet Heath	5	soil	0
2016	June	Wet Heath	6	soil	17
2016	June	Wet Heath	7	soil	0
2016	June	Wet Heath	8	soil	0
2016	June	Wet Heath	9	soil	0
2016	June	Wet Heath	10	soil	0
2016	June	Wet Heath	11	soil	0
2016	June	Wet Heath	12	soil	0
2016	June	Wet Heath	13	soil	0
2016	June	Wet Heath	14	soil	5
2016	June	Wet Heath	15	soil	0
2016	June	Wet Heath	16	soil	0
2016	June	Wet Heath	17	soil	0
2016	June	Wet Heath	18	soil	0
2016	June	Wet Heath	19	soil	0
2016	June	Wet Heath	20	soil	0
2016	June	Wet Heath	1	water	0
2016	June	Wet Heath	2	water	0
2016	June	Wet Heath	3	water	4
2016	June	Wet Heath	4	water	13
2016	June	Wet Heath	5	water	4
2016	June	Wet Heath	6	water	0
2016	June	Wet Heath	7	water	0
2016	June	Wet Heath	8	water	0
2016	June	Wet Heath	9	water	0
2016	June	Wet Heath	10	water	0

2016	June	Wet Heath	11	water	0
2016	June	Wet Heath	12	water	0
2016	June	Wet Heath	13	water	0
2016	June	Wet Heath	14	water	4
2016	June	Wet Heath	15	water	5
2016	June	Wet Heath	16	water	20
2016	June	Wet Heath	17	water	0
2016	June	Wet Heath	18	water	7
2016	June	Wet Heath	19	water	0
2016	June	Wet Heath	20	water	0
2016	October	Wet Heath	1	rock	0
2016	October	Wet Heath	2	rock	0
2016	October	Wet Heath	3	rock	0
2016	October	Wet Heath	4	rock	0
2016	October	Wet Heath	5	rock	3
2016	October	Wet Heath	6	rock	0
2016	October	Wet Heath	7	rock	0
2016	October	Wet Heath	8	rock	0
2016	October	Wet Heath	9	rock	0
2016	October	Wet Heath	10	rock	0
2016	October	Wet Heath	11	rock	0
2016	October	Wet Heath	12	rock	0
2016	October	Wet Heath	13	rock	0
2016	October	Wet Heath	14	rock	0
2016	October	Wet Heath	15	rock	0
2016	October	Wet Heath	16	rock	0
2016	October	Wet Heath	17	rock	0
2016	October	Wet Heath	18	rock	0
2016	October	Wet Heath	19	rock	0
2016	October	Wet Heath	20	rock	0
2016	October	Wet Heath	1	soil	0
2016	October	Wet Heath	2	soil	0
2016	October	Wet Heath	3	soil	0
2016	October	Wet Heath	4	soil	0
2016	October	Wet Heath	5	soil	0
2016	October	Wet Heath	6	soil	29
2016	October	Wet Heath	7	soil	1
2016	October	Wet Heath	8	soil	2
2016	October	Wet Heath	9	soil	0
2016	October	Wet Heath	10	soil	0
2016	October	Wet Heath	11	soil	0
2016	October	Wet Heath	12	soil	0
2016	October	Wet Heath	13	soil	0
2016	October	Wet Heath	14	soil	4
2016	October	Wet Heath	15	soil	0

2016	October	Wet Heath	16	soil	0
2016	October	Wet Heath	17	soil	0
2016	October	Wet Heath	18	soil	0
2016	October	Wet Heath	19	soil	0
2016	October	Wet Heath	20	soil	0
2016	October	Wet Heath	1	water	0
2016	October	Wet Heath	2	water	0
2016	October	Wet Heath	3	water	0
2016	October	Wet Heath	4	water	2
2016	October	Wet Heath	5	water	6
2016	October	Wet Heath	6	water	0
2016	October	Wet Heath	7	water	0
2016	October	Wet Heath	8	water	0
2016	October	Wet Heath	9	water	0
2016	October	Wet Heath	10	water	0
2016	October	Wet Heath	11	water	2
2016	October	Wet Heath	12	water	0
2016	October	Wet Heath	13	water	0
2016	October	Wet Heath	14	water	0
2016	October	Wet Heath	15	water	1
2016	October	Wet Heath	16	water	17
2016	October	Wet Heath	17	water	0
2016	October	Wet Heath	18	water	8
2016	October	Wet Heath	19	water	0
2016	October	Wet Heath	20	water	0
2014	June	Dry Heath	1	soil	0
2014	June	Dry Heath	2	soil	0
2014	June	Dry Heath	3	soil	0
2014	June	Dry Heath	4	soil	0
2014	June	Dry Heath	5	soil	0
2014	June	Dry Heath	6	soil	0
2014	June	Dry Heath	7	soil	0
2014	June	Dry Heath	8	soil	0
2014	June	Dry Heath	9	soil	0
2014	June	Dry Heath	10	soil	0
2014	June	Dry Heath	11	soil	0
2014	June	Dry Heath	12	soil	4
2014	June	Dry Heath	13	soil	0
2014	June	Dry Heath	14	soil	0
2014	June	Dry Heath	15	soil	0
2014	June	Dry Heath	16	soil	0
2014	June	Dry Heath	17	soil	3
2014	June	Dry Heath	18	soil	0
2014	June	Dry Heath	19	soil	0
2014	June	Dry Heath	20	soil	0

2014	October	Dry Heath	1	soil	0
2014	October	Dry Heath	2	soil	0
2014	October	Dry Heath	3	soil	0
2014	October	Dry Heath	4	soil	0
2014	October	Dry Heath	5	soil	0
2014	October	Dry Heath	6	soil	0
2014	October	Dry Heath	7	soil	0
2014	October	Dry Heath	8	soil	0
2014	October	Dry Heath	9	soil	0
2014	October	Dry Heath	10	soil	0
2014	October	Dry Heath	11	soil	0
2014	October	Dry Heath	12	soil	0
2014	October	Dry Heath	13	soil	0
2014	October	Dry Heath	14	soil	0
2014	October	Dry Heath	15	soil	0
2014	October	Dry Heath	16	soil	0
2014	October	Dry Heath	17	soil	5
2014	October	Dry Heath	18	soil	0
2014	October	Dry Heath	19	soil	0
2014	October	Dry Heath	20	soil	0
2014	June	mire	1	soil	0
2014	June	mire	2	soil	0
2014	June	mire	3	soil	0
2014	June	mire	4	soil	0
2014	June	mire	5	soil	0
2014	June	mire	6	soil	0
2014	June	mire	7	soil	0
2014	June	mire	8	soil	0
2014	June	mire	9	soil	0
2014	June	mire	10	soil	0
2014	June	mire	11	soil	0
2014	June	mire	12	soil	0
2014	June	mire	13	soil	0
2014	June	mire	14	soil	0
2014	June	mire	15	soil	0
2014	June	mire	16	soil	0
2014	June	mire	17	soil	0
2014	June	mire	18	soil	0
2014	June	mire	19	soil	0
2014	June	mire	20	soil	0
2014	October	mire	1	soil	0
2014	October	mire	2	soil	0
2014	October	mire	3	soil	0
2014	October	mire	4	soil	0
2014	October	mire	5	soil	0

2014	October	mire	6	soil	0
2014	October	mire	7	soil	3
2014	October	mire	8	soil	0
2014	October	mire	9	soil	0
2014	October	mire	10	soil	0
2014	October	mire	11	soil	0
2014	October	mire	12	soil	0
2014	October	mire	13	soil	0
2014	October	mire	14	soil	0
2014	October	mire	15	soil	0
2014	October	mire	16	soil	0
2014	October	mire	17	soil	0
2014	October	mire	18	soil	0
2014	October	mire	19	soil	0
2014	October	mire	20	soil	0
2014	June	Wet Heath	1	soil	0
2014	June	Wet Heath	2	soil	0
2014	June	Wet Heath	3	soil	0
2014	June	Wet Heath	4	soil	0
2014	June	Wet Heath	5	soil	0
2014	June	Wet Heath	6	soil	64
2014	June	Wet Heath	7	soil	0
2014	June	Wet Heath	8	soil	0
2014	June	Wet Heath	9	soil	0
2014	June	Wet Heath	10	soil	0
2014	June	Wet Heath	11	soil	0
2014	June	Wet Heath	12	soil	0
2014	June	Wet Heath	13	soil	0
2014	June	Wet Heath	14	soil	0
2014	June	Wet Heath	15	soil	0
2014	June	Wet Heath	16	soil	0
2014	June	Wet Heath	17	soil	0
2014	June	Wet Heath	18	soil	0
2014	June	Wet Heath	19	soil	0
2014	June	Wet Heath	20	soil	0
2014	October	Wet Heath	1	soil	0
2014	October	Wet Heath	2	soil	0
2014	October	Wet Heath	3	soil	0
2014	October	Wet Heath	4	soil	0
2014	October	Wet Heath	5	soil	0
2014	October	Wet Heath	6	soil	2
2014	October	Wet Heath	7	soil	2
2014	October	Wet Heath	8	soil	0
2014	October	Wet Heath	9	soil	0
2014	October	Wet Heath	10	soil	0

2014	October	Wet Heath	11	soil	0
2014	October	Wet Heath	12	soil	0
2014	October	Wet Heath	13	soil	0
2014	October	Wet Heath	14	soil	0
2014	October	Wet Heath	15	soil	0
2014	October	Wet Heath	16	soil	0
2014	October	Wet Heath	17	soil	0
2014	October	Wet Heath	18	soil	0
2014	October	Wet Heath	19	soil	0
2014	October	Wet Heath	20	soil	0
2014	June	Wet Heath	1	Water	0
2014	June	Wet Heath	2	Water	0
2014	June	Wet Heath	3	Water	0
2014	June	Wet Heath	4	Water	0
2014	June	Wet Heath	5	Water	0
2014	June	Wet Heath	6	Water	0
2014	June	Wet Heath	7	Water	0
2014	June	Wet Heath	8	Water	0
2014	June	Wet Heath	9	Water	0
2014	June	Wet Heath	10	Water	0
2014	June	Wet Heath	11	Water	0
2014	June	Wet Heath	12	Water	6
2014	June	Wet Heath	13	Water	0
2014	June	Wet Heath	14	Water	0
2014	June	Wet Heath	15	Water	7
2014	June	Wet Heath	16	Water	4
2014	June	Wet Heath	17	Water	0
2014	June	Wet Heath	18	Water	7
2014	June	Wet Heath	19	Water	0
2014	June	Wet Heath	20	Water	0
2014	June	Dry Heath	1	Water	0
2014	June	Dry Heath	2	Water	0
2014	June	Dry Heath	3	Water	0
2014	June	Dry Heath	4	Water	0
2014	June	Dry Heath	5	Water	0
2014	June	Dry Heath	6	Water	0
2014	June	Dry Heath	7	Water	0
2014	June	Dry Heath	8	Water	0
2014	June	Dry Heath	9	Water	0
2014	June	Dry Heath	10	Water	0
2014	June	Dry Heath	11	Water	0
2014	June	Dry Heath	12	Water	0
2014	June	Dry Heath	13	Water	0
2014	June	Dry Heath	14	Water	0
2014	June	Dry Heath	15	Water	0

2014	June	Dry Heath	16	Water	0
2014	June	Dry Heath	17	Water	0
2014	June	Dry Heath	18	Water	0
2014	June	Dry Heath	19	Water	0
2014	June	Dry Heath	20	Water	0
2014	June	Mire	1	Water	0
2014	June	Mire	2	Water	0
2014	June	Mire	3	Water	16
2014	June	Mire	4	Water	50
2014	June	Mire	5	Water	55
2014	June	Mire	6	Water	70
2014	June	Mire	7	Water	79
2014	June	Mire	8	Water	14
2014	June	Mire	9	Water	2
2014	June	Mire	10	Water	2
2014	June	Mire	11	Water	0
2014	June	Mire	12	Water	0
2014	June	Mire	13	Water	0
2014	June	Mire	14	Water	10
2014	June	Mire	15	Water	3
2014	June	Mire	16	Water	0
2014	June	Mire	17	Water	0
2014	June	Mire	18	Water	0
2014	June	Mire	19	Water	0
2014	June	Mire	20	Water	35
2014	October	Wet Heath	1	Water	24
2014	October	Wet Heath	2	Water	0
2014	October	Wet Heath	3	Water	0
2014	October	Wet Heath	4	Water	0
2014	October	Wet Heath	5	Water	0
2014	October	Wet Heath	6	Water	0
2014	October	Wet Heath	7	Water	0
2014	October	Wet Heath	8	Water	0
2014	October	Wet Heath	9	Water	0
2014	October	Wet Heath	10	Water	0
2014	October	Wet Heath	11	Water	0
2014	October	Wet Heath	12	Water	0
2014	October	Wet Heath	13	Water	0
2014	October	Wet Heath	14	Water	0
2014	October	Wet Heath	15	Water	0
2014	October	Wet Heath	16	Water	6
2014	October	Wet Heath	17	Water	0
2014	October	Wet Heath	18	Water	0
2014	October	Wet Heath	19	Water	0
2014	October	Wet Heath	20	Water	0

2014	October	Mire	1	Water	50
2014	October	Mire	2	Water	0
2014	October	Mire	3	Water	50
2014	October	Mire	4	Water	4
2014	October	Mire	5	Water	27
2014	October	Mire	6	Water	60
2014	October	Mire	7	Water	0
2014	October	Mire	8	Water	35
2014	October	Mire	9	Water	0
2014	October	Mire	10	Water	0
2014	October	Mire	11	Water	0
2014	October	Mire	12	Water	0
2014	October	Mire	13	Water	3
2014	October	Mire	14	Water	30
2014	October	Mire	15	Water	5
2014	October	Mire	16	Water	0
2014	October	Mire	17	Water	0
2014	October	Mire	18	Water	0
2014	October	Mire	19	Water	0
2014	October	Mire	20	Water	50
2014	October	Dry Heath	1	Water	0
2014	October	Dry Heath	2	Water	0
2014	October	Dry Heath	3	Water	0
2014	October	Dry Heath	4	Water	0
2014	October	Dry Heath	5	Water	0
2014	October	Dry Heath	6	Water	0
2014	October	Dry Heath	7	Water	0
2014	October	Dry Heath	8	Water	0
2014	October	Dry Heath	9	Water	0
2014	October	Dry Heath	10	Water	0
2014	October	Dry Heath	11	Water	0
2014	October	Dry Heath	12	Water	0
2014	October	Dry Heath	13	Water	0
2014	October	Dry Heath	14	Water	0
2014	October	Dry Heath	15	Water	0
2014	October	Dry Heath	16	Water	0
2014	October	Dry Heath	17	Water	0
2014	October	Dry Heath	18	Water	0
2014	October	Dry Heath	19	Water	0
2014	October	Dry Heath	20	Water	0

Vegetative Percentage Cover

year	Site	Month	Quadrat	% C. vulgaris	E. tetralix	E. cinerea	% Mol	Agrostis	C. floerka	Eriophorium spp	Narthecium	Ulex	S.sub	S.pap	Schoenus	C.impexa
2014	Dry Heath	June	1	25	0	0	20	0	0	0	0	25	0	0	0	0
2014	Dry Heath	June	2	0	0	30	20	0	0	0	0	50	0	0	0	0
2014	Dry Heath	June	3	20	0	20	10	0	0	0	0	50	0	0	0	0
2014	Dry Heath	June	4	0	11	15	60	0	0	0	0	20	0	0	0	0
2014	Dry Heath	June	5	13	0	37	59	0	0	0	0	37	0	0	0	0
2014	Dry Heath	June	6	12	10	12	60	0	0	0	0	18	0	0	0	0
2014	Dry Heath	June	7	0	8	25	20	0	0	0	0	14	0	0	0	0
2014	Dry Heath	June	8	23	4	23	27	0	0	0	0	10	0	0	0	0
2014	Dry Heath	June	9	0	16	41	23	0	0	0	0	16	0	0	0	0
2014	Dry Heath	June	10	40	13	40	5	0	0	0	0	15	0	0	0	0
2014	Dry Heath	June	11	38	13	38	15	0	0	0	0	40	0	0	0	0
2014	Dry Heath	June	12	45	1	45	41	0	0	0	0	11	0	0	0	0
2014	Dry Heath	June	13	45	6	50	3	0	0	0	0	19	0	0	0	0
2014	Dry Heath	June	14	30	8	30	23	0	0	0	0	31	0	0	0	0
2014	Dry Heath	June	15	36	0	36	56	0	0	0	0	14	0	0	0	0
2014	Dry Heath	June	16	30	13	30	23	0	0	0	0	30	0	0	0	0
2014	Dry Heath	June	17	35	2	35	45	0	0	0	0	15	0	0	0	0
2014	Dry Heath	June	18	23	5	23	43	0	0	0	0	25	0	0	0	0
2014	Dry Heath	June	19	17	12	17	69	0	0	0	0	12	0	0	0	0
2014	Dry Heath	June	20	0	0	20	51	0	0	0	0	29	0	0	0	0

2014	Dry Heath	October	1	5	0	16	49	0	0	0	0	25	0	0	0	0
2014	Dry Heath	October	2	30	0	9	21	0	0	0	0	50	0	33	0	0
2014	Dry Heath	October	3	5	0	30	60	0	0	0	0	50	0	0	0	0
2014	Dry Heath	October	4	10	0	14	54	0	0	0	0	20	0	0	0	0
2014	Dry Heath	October	5	27	0	20	3	0	0	0	0	37	0	0	0	0
2014	Dry Heath	October	6	30	0	19	31	0	0	0	0	18	0	0	0	8
2014	Dry Heath	October	7	41	0	17	5	0	0	0	0	14	0	0	0	1
2014	Dry Heath	October	8	25	0	35	22	0	0	0	0	10	0	0	0	0
2014	Dry Heath	October	9	52	10	0	23	0	22	0	0	16	0	0	0	0
2014	Dry Heath	October	10	48	0	5	16	0	0	0	0	15	0	0	0	11
2014	Dry Heath	October	11	36	2	0	10	23	0	0	0	40	0	0	0	7
2014	Dry Heath	October	12	38	3	0	40	3	0	0	0	11	0	0	0	48
2014	Dry Heath	October	13	10	0	3	1	30	0	0	0	19	0	0	0	3
2014	Dry Heath	October	14	40	2	6	20	30	0	0	0	31	0	0	0	0
2014	Dry Heath	October	15	54	0	3	23	0	0	0	0	14	0	0	0	2
2014	Dry Heath	October	16	50	0	14	30	15	0	0	0	30	0	0	0	0
2014	Dry Heath	October	17	0	0	10	10	0	0	0	0	15	0	0	0	30
2014	Dry Heath	October	18	48	0	12	10	0	0	0	0	25	0	0	0	0
2014	Dry Heath	October	19	0	6	16	52	0	0	0	0	12	0	0	0	0
2014	Dry Heath	October	20	41	0	15	24	7	0	0	0	29	0	0	0	18
2014	Mire	June	1	1	0	1	11	0	0	0	0	5	0	8	6	0
2014	Mire	June	2	1	1	1	72	0	0	0	4	0	0	0	16	0
2014	Mire	June	3	0	0	0	71	0	0	0	5	0	0	0	0	0

2014	Mire	June	4	2	1	7	23	0	0	0	9	0	0	0	15	0
2014	Mire	June	5	0	0	0	17	0	0	0	12	0	0	0	12	0
2014	Mire	June	6	0	2	0	5	0	0	0	1	0	0	0	12	0
2014	Mire	June	7	0	2	0	0	0	0	1	1	0	0	0	16	0
2014	Mire	June	8	0	5	0	53	0	0	3	7	0	0	3	18	0
2014	Mire	June	9	3	1	3	63	0	0	0	0	13	7	0	12	0
2014	Mire	June	10	3	4	0	71	0	11	0	0	0	1	6	17	0
2014	Mire	June	11	5	0	5	78	0	0	0	0	8	9	0	0	0
2014	Mire	June	12	0	0	4	25	0	0	0	0	4	0	0	67	0
2014	Mire	June	13	3	1	3	69	17	0	0	0	0	9	0	14	0
2014	Mire	June	14	0	8	0	41	0	0	3	8	0	0	3	26	0
2014	Mire	June	15	9	6	9	11	0	0	0	0	8	7	0	6	0
2014	Mire	June	16	8	10	8	40	0	0	0	0	18	10	0	13	0
2014	Mire	June	17	3	3	3	73	0	0	0	5	13	0	0	0	0
2014	Mire	June	18	4	6	3	70	0	0	0	0	8	0	0	18	0
2014	Mire	June	19	0	5	4	86	0	0	0	0	3	2	0	0	0
2014	Mire	June	20	0	0	0	24	0	0	0	0	0	0	13	20	0
2014	Mire	October	1	0	3	1	5	0	0	2	0	32	0	0	11	0
2014	Mire	October	2	5	4	1	25	0	0	2	20	1	5	0	42	0
2014	Mire	October	3	0	0	0	12	0	0	0	25	0	0	0	13	0
2014	Mire	October	4	0	4	2	30	0	0	0	25	0	0	5	36	0
2014	Mire	October	5	0	0	0	3	0	0	0	20	0	0	0	50	0
2014	Mire	October	6	0	0	0	2	0	0	1	10	0	0	0	27	0
2014	Mire	October	7	0	26	0	25	0	0	0	25	0	0	0	21	0
2014	Mire	October	8	0	18	0	10	0	0	5	15	0	0	0	0	0
2014	Mire	October	9	7	2	2	25	0	0	0	0	20	0	0	31	0
2014	Mire	October	10	6	14	0	42	0	0	0	0	12	40	0	25	0
2014	Mire	October	11	7	24	3	23	0	0	0	0	16	50	0	40	0
2014	Mire	October	12	3	8	4	50	0	0	0	0	5	0	4	34	0

2014	Mire	October	13	12	12	3	10	0	0	0	0	0	40	7	60	0
2014	Mire	October	14	0	12	0	3	0	0	0	25	0	0	0	30	0
2014	Mire	October	15	27	20	3	17	0	0	0	0	24	18	10	0	0
2014	Mire	October	16	8	11	4	31	0	0	0	0	15	20	0	35	0
2014	Mire	October	17	35	6	2	34	0	0	0	0	0	0	0	25	0
2014	Mire	October	18	6	9	1	77	0	0	0	0	5	0	3	0	0
2014	Mire	October	19	8	14	2	44	0	0	0	15	19	0	0	0	0
2014	Mire	October	20	0	3	0	15	0	0	5	0	0	0	2	25	0
2014	Wet Heath	June	1	9	23	3	0	0	0	0	0	31	0	0	0	0
2014	Wet Heath	June	2	5	14	3	0	0	0	1	1	6	50	1	0	0
2014	Wet Heath	June	3	7	8	2	0	0	0	1	0	14	0	0	8	0
2014	Wet Heath	June	4	10	22	2	37	0	0	0	23	0	3	5	0	0
2014	Wet Heath	June	5	9	17	3	55	0	0	0	6	13	0	0	0	0
2014	Wet Heath	June	6	12	15	9	12	0	0	0	1	1	0	0	0	3
2014	Wet Heath	June	7	13	22	6	49	0	0	0	3	2	0	0	0	1
2014	Wet Heath	June	8	8	13	3	30	0	0	0	17	3	0	2	0	3
2014	Wet Heath	June	9	5	16	2	0	0	0	1	0	14	0	0	0	0
2014	Wet Heath	June	10	4	14	2	53	0	0	0	15	14	6	0	0	0
2014	Wet Heath	June	11	2	4	0	56	0	0	0	6	13	0	0	18	0
2014	Wet Heath	June	12	0	12	1	37	0	0	0	14	2	0	4	25	0
2014	Wet Heath	June	13	7	20	4	36	0	0	0	7	22	6	0	0	0
2014	Wet Heath	June	14	7	12	3	59	0	0	0	3	13	0	0	4	0
2014	Wet Heath	June	15	6	5	3	57	0	0	0	19	2	0	0	18	0
2014	Wet Heath	June	16	3	11	2	50	0	0	0	0	12	6	0	14	0

2014	Wet Heath	June	17	15	10	9	70	0	0	1	1	0	1	60	0	0
2014	Wet Heath	June	18	6	6	3	59	0	0	0	0	13	0	0	15	0
2014	Wet Heath	June	19	0	13	2	51	0	0	0	0	16	0	0	20	0
2014	Wet Heath	June	20	7	18	4	60	0	0	0	0	35	0	0	0	0
2014	Wet Heath	October	1	0	45	1	20	0	0	0	0	35	0	50	0	0
2014	Wet Heath	October	2	2	5	2	23	0	0	0	12	0	0	0	60	0
2014	Wet Heath	October	3	7	17	3	41	0	0	0	0	25	8	3	10	0
2014	Wet Heath	October	4	5	20	2	55	0	0	0	20	0	6	0	0	0
2014	Wet Heath	October	5	10	22	2	25	0	0	0	6	36	0	0	0	0
2014	Wet Heath	October	6	3	20	5	66	0	0	0	0	0	0	0	0	0
2014	Wet Heath	October	7	12	41	2	40	0	0	0	0	5	0	0	0	2
2014	Wet Heath	October	8	10	19	1	45	0	0	0	18	8	0	0	0	3
2014	Wet Heath	October	9	10	20	0	58	0	0	1	0	11	0	6	0	0
2014	Wet Heath	October	10	14	16	1	41	0	0	0	9	20	7	0	0	0
2014	Wet Heath	October	11	2	17	1	56	0	0	0	5	0	0	0	20	0
2014	Wet Heath	October	12	13	17	0	25	0	0	0	2	14	0	6	29	0
2014	Wet Heath	October	13	18	22	3	20	0	0	0	9	27	4	0	0	0
2014	Wet Heath	October	14	16	26	1	7	0	0	0	5	41	0	0	10	0
2014	Wet Heath	October	15	7	9	3	38	0	0	0	18	3	0	6	25	0
2014	Wet Heath	October	16	7	22	2	22	0	0	0	25	7	0	1	10	0
2014	Wet Heath	October	17	22	27	6	51	0	0	0	0	0	0	0	0	0
2014	Wet Heath	October	18	3	25	2	56	0	0	0	16	0	0	0	0	0

2014	Wet Heath	October	19	10	30	2	25	0	0	0	0	35	0	0	0	0
2014	Wet Heath	October	20	22	22	2	45	0	0	0	0	11	0	0	0	0
2015	Dry Heath	June	1	0	0	35	23	0	0	0	0	40	0	0	0	0
2015	Dry Heath	June	2	5	0	28	25	0	0	0	0	40	0	0	0	0
2015	Dry Heath	June	3	4	0	15	51	0	0	0	0	30	0	0	0	0
2015	Dry Heath	June	4	8	0	42	28	0	0	0	0	22	0	0	0	0
2015	Dry Heath	June	5	14	13	10	37	0	0	0	0	26	0	0	0	0
2015	Dry Heath	June	6	15	17	0	33	5	0	0	0	23	0	0	0	3
2015	Dry Heath	June	7	21	14	13	25	0	0	0	0	27	0	0	0	0
2015	Dry Heath	June	8	16	28	10	28	0	0	0	0	15	0	0	0	0
2015	Dry Heath	June	9	25	4	6	35	0	0	0	0	20	0	0	0	18
2015	Dry Heath	June	10	12	1	22	41	4	0	0	0	16	0	0	0	4
2015	Dry Heath	June	11	44	5	4	10	19	0	0	0	28	0	0	0	4
2015	Dry Heath	June	12	9	0	12	13	30	0	0	0	25	0	0	0	20
2015	Dry Heath	June	13	35	0	15	3	23	0	0	0	35	0	0	0	3
2015	Dry Heath	June	14	27	0	15	12	0	0	0	0	30	0	0	0	16
2015	Dry Heath	June	15	25	0	7	43	0	0	0	0	25	0	0	0	0
2015	Dry Heath	June	16	45	0	19	32	12	0	0	0	32	0	0	0	1
2015	Dry Heath	June	17	45	6	15	32	0	0	0	0	9	0	0	0	16
2015	Dry Heath	June	18	45	0	22	9	0	0	0	0	45	0	0	0	0
2015	Dry Heath	June	19	25	4	22	34	0	0	0	0	34	0	0	0	0
2015	Dry Heath	June	20	9	1	30	5	0	0	0	0	55	0	0	0	0

2015	mire	June	1	0	9	0	6	0	0	1	2	0	2	33	8	0
2015	mire	June	2	0	4	0	21	0	0	1	7	2	0	0	42	0
2015	mire	June	3	0	0	0	26	0	0	0	12	0	0	0	25	0
2015	mire	June	4	0	11	0	52	0	0	0	4	0	3	0	25	0
2015	mire	June	5	0	0	0	2	0	0	1	23	0	0	0	48	0
2015	mire	June	6	0	5	0	17	0	0	2	15	0	0	0	22	0
2015	mire	June	7	15	0	0	27	0	0	0	0	0	0	0	25	0
2015	mire	June	8	0	0	0	4	19	0	28	2	0	0	0	10	0
2015	mire	June	9	0	22	0	15	0	0	0	0	6	22	0	23	0
2015	mire	June	10	14	13	0	11	0	0	0	0	5	12	7	19	0
2015	mire	June	11	8	12	0	16	0	0	0	0	6	22	0	22	0
2015	mire	June	12	0	9	0	24	0	0	0	0	5	0	0	22	0
2015	mire	June	13	0	6	0	16	0	0	0	0	2	0	0	22	0
2015	mire	June	14	0	8	0	25	0	0	0	0	0	0	0	25	0
2015	mire	June	15	22	17	0	0	0	0	0	0	12	5	0	12	0
2015	mire	June	16	9	14	0	22	0	0	0	0	7	0	0	0	0
2015	mire	June	17	5	15	0	35	0	0	0	0	6	0	0	28	0
2015	mire	June	18	3	18	0	34	0	0	0	0	22	0	0	0	0
2015	mire	June	19	7	10	0	57	0	0	0	0	3	0	0	0	0
2015	mire	June	20	0	1	0	12	0	0	0	0	0	0	0	22	0
2015	Wet Heath	June	1	20	30	0	21	0	0	0	0	26	3	0	0	0
2015	Wet Heath	June	2	10	12	0	62	0	0	0	6	8	2	0	0	0
2015	Wet Heath	June	3	6	16	0	18	0	0	0	1	4	6	2	55	0
2015	Wet Heath	June	4	13	9	0	57	0	0	0	7	3	8	0	0	0
2015	Wet Heath	June	5	5	18	0	45	0	0	0	0	30	0	0	0	0
2015	Wet Heath	June	6	22	20	0	38	0	0	0	0	3	0	5	0	5
2015	Wet Heath	June	7	24	24	0	35	0	0	0	2	8	0	1	0	2

2015	Wet Heath	June	8	18	14	0	56	0	0	0	5	7	0	0	0	0
2015	Wet Heath	June	9	14	28	0	33	0	0	0	0	20	0	0	5	0
2015	Wet Heath	June	10	18	23	0	9	0	0	0	5	28	11	0	6	0
2015	Wet Heath	June	11	3	12	0	61	0	0	0	0	8	0	0	16	0
2015	Wet Heath	June	12	18	24	0	23	0	0	0	4	25	0	0	5	0
2015	Wet Heath	June	13	12	18	0	48	0	0	0	0	18	4	0	0	0
2015	Wet Heath	June	14	22	17	0	31	0	0	0	0	12	10	0	5	0
2015	Wet Heath	June	15	0	16	0	19	0	0	2	5	1	0	0	50	0
2015	Wet Heath	June	16	0	7	0	26	0	0	0	0	9	8	0	36	0
2015	Wet Heath	June	17	26	25	0	38	0	0	0	0	0	0	48	0	0
2015	Wet Heath	June	18	2	20	0	57	0	0	0	0	19	0	0	0	0
2015	Wet Heath	June	19	0	7	0	23	0	0	0	5	50	0	0	0	0
2015	Wet Heath	June	20	5	29	0	26	0	0	0	0	40	0	0	0	0
2015	Control Dry	June	1	11	20	8	31	0	0	0	0	30	0	0	0	0
2015	Control Dry	June	2	2	11	26	47	0	0	0	0	35	0	0	0	0
2015	Control Dry	June	3	7	22	18	32	0	0	0	0	45	0	0	0	0
2015	Control Dry	June	4	0	10	0	62	0	0	0	0	25	0	0	0	0
2015	Control Dry	June	5	14	9	7	37	0	0	0	0	33	0	0	0	0
2015	Control Dry	June	6	13	22	15	23	0	0	0	0	44	0	0	0	0
2015	Control Dry	June	7	8	18	11	44	0	0	0	0	28	0	0	0	1
2015	Control Dry	June	8	2	15	22	33	0	0	0	0	38	0	0	0	0
2015	Control Dry	June	9	8	25	10	37	0	0	0	0	28	0	0	0	2

2015	Control Dry	June	10	2	21	0	54	0	0	0	0	16	0	0	0	0
2015	Control Dry	June	11	8	26	0	48	0	0	0	0	26	0	0	0	0
2015	Control Dry	June	12	4	7	18	41	0	0	0	0	30	0	0	0	0
2015	Control Dry	June	13	3	15	14	24	0	0	0	0	47	0	0	0	0
2015	Control Dry	June	14	2	12	11	34	0	0	0	0	41	0	0	0	0
2015	Control Dry	June	15	6	15	29	28	0	0	0	0	42	0	0	0	0
2015	Control Dry	June	16	3	4	18	33	0	0	0	10	45	0	0	0	0
2015	Control Dry	June	17	3	1	30	20	0	0	0	0	50	0	0	0	0
2015	Control Dry	June	18	8	29	15	42	0	0	0	0	26	0	0	0	0
2015	Control Dry	June	19	2	0	28	32	0	0	0	0	38	0	0	0	0
2015	Control Dry	June	20	16	24	8	42	0	0	0	0	30	0	0	0	0
2015	Mosaic	June	1	2	15	0	38	0	0	0	0	2	3	0	40	0
2015	Mosaic	June	2	2	23	0	21	0	0	0	0	2	0	0	16	0
2015	Mosaic	June	3	0	21	0	57	3	0	0	0	0	0	1	0	0
2015	Mosaic	June	4	5	1	15	23	10	0	0	0	14	0	0	12	0
2015	Mosaic	June	5	48	22	11	32	0	0	0	0	26	0	0	25	0
2015	Mosaic	June	6	7	18	0	47	0	0	0	0	3	0	0	16	0
2015	Mosaic	June	7	7	22	6	62	0	0	0	0	3	0	0	15	0
2015	Mosaic	June	8	18	18	2	39	0	0	0	13	14	4	4	18	0
2015	Mosaic	June	9	2	7	3	59	0	0	0	0	10	0	0	11	0
2015	Mosaic	June	10	2	7	0	46	0	0	0	5	15	0	0	7	0
2015	Mosaic	June	11	8	9	4	56	0	0	0	11	4	6	0	0	0
2015	Mosaic	June	12	3	12	0	52	0	0	0	0	18	0	0	25	0
2015	Mosaic	June	13	3	22	0	48	0	0	0	0	15	2	0	0	0
2015	Mosaic	June	14	2	15	0	79	0	0	0	0	7	0	0	10	0

2015	Mosaic	June	15	2	25	1	62	0	0	0	0	15	0	0	40	0
2015	Mosaic	June	16	5	14	3	44	0	0	0	0	3	6	0	6	0
2015	Mosaic	June	17	5	27	4	14	0	0	0	0	2	64	0	14	2
2015	Mosaic	June	18	4	27	6	61	0	0	0	0	4	0	0	23	0
2015	Mosaic	June	19	1	18	0	48	0	0	0	0	3	0	0	40	0
2015	Mosaic	June	20	2	20	1	16	0	0	0	0	20	2	0	25	0
2015	Mosaic	June	21	4	25	0	53	0	0	0	0	25	0	0	0	0
2015	Mosaic	June	22	10	10	3	77	0	0	0	0	6	3	0	6	0
2015	Mosaic	June	23	8	12	2	66	0	0	0	0	4	0	0	3	0
2015	Mosaic	June	24	0	19	0	59	0	0	0	0	15	0	0	5	0
2015	Mosaic	June	25	3	13	4	78	0	0	0	0	14	0	0	9	0
2015	Mosaic	June	26	1	8	0	71	0	0	0	0	0	6	0	0	0
2015	Mosaic	June	27	1	13	1	77	0	0	0	0	4	1	0	0	0
2015	Mosaic	June	28	6	12	0	75	0	0	0	0	17	0	0	15	0
2015	Mosaic	June	29	2	12	6	52	0	0	0	3	9	0	0	2	0
2015	Mosaic	June	30	3	15	0	69	0	0	0	0	0	0	2	0	0
2015	Mosaic	June	31	5	18	8	68	0	0	0	0	13	5	0	0	0
2015	Mosaic	June	32	9	17	0	47	0	0	0	2	24	0	0	4	0
2015	Mosaic	June	33	6	16	0	44	0	0	0	0	25	5	0	6	0
2015	Mosaic	June	34	6	12	1	51	0	0	0	0	24	0	0	9	0
2015	Mosaic	June	35	2	18	1	61	0	0	0	3	17	0	0	22	0
2015	Mosaic	June	36	0	12	0	35	0	0	0	0	30	0	0	0	0
2015	Mosaic	June	37	4	19	32	44	0	0	0	0	10	0	0	16	0
2015	Mosaic	June	38	24	27	4	28	0	0	0	1	14	11	0	0	0
2015	Mosaic	June	39	0	8	0	56	0	0	0	0	40	0	0	10	0
2015	Mosaic	June	40	6	4	0	40	0	0	0	13	22	0	0	0	0
2015	October	Control Dry	1	12	19	1	40	0	0	0	0	28	0	0	0	0
2015	October	Control Dry	2	2	15	22	46	0	0	0	0	35	0	0	0	0

2015	October	Control Dry	3	10	28	18	31	0	0	0	0	47	0	0	0	0
2015	October	Control Dry	4	0	10	0	66	0	0	0	0	24	0	0	0	0
2015	October	Control Dry	5	9	15	2	41	0	0	0	0	33	0	0	0	0
2015	October	Control Dry	6	13	21	15	21	0	0	0	0	36	0	0	0	0
2015	October	Control Dry	7	10	18	12	50	0	0	0	0	21	0	0	0	0
2015	October	Control Dry	8	3	12	22	34	0	0	0	0	37	0	0	0	0
2015	October	Control Dry	9	15	21	13	39	0	0	0	0	22	0	0	0	0
2015	October	Control Dry	10	2	22	0	57	0	0	0	0	28	0	0	0	0
2015	October	Control Dry	11	8	21	0	43	0	0	0	0	28	0	0	0	0
2015	October	Control Dry	12	6	6	16	46	0	0	0	0	26	0	5	0	12
2015	October	Control Dry	13	4	14	18	25	0	0	0	0	49	0	0	0	0
2015	October	Control Dry	14	2	12	15	36	0	0	0	0	40	0	0	0	0
2015	October	Control Dry	15	4	15	28	28	0	0	0	0	41	0	0	0	0
2015	October	Control Dry	16	3	4	15	48	0	0	0	11	34	0	0	0	0
2015	October	Control Dry	17	3	1	26	30	0	0	0	0	40	0	0	0	0
2015	October	Control Dry	18	16	28	13	45	0	0	0	0	28	0	0	0	0
2015	October	Control Dry	19	3	0	24	40	0	0	0	0	33	0	0	0	0
2015	October	Control Dry	20	11	19	3	42	0	0	0	0	25	0	0	0	0
2015	October	Dry Heath	1	3	0	30	8	0	0	0	0	54	0	0	0	0
2015	October	Dry Heath	2	14	12	23	21	0	0	0	0	30	0	0	0	19
2015	October	Dry Heath	3	3	0	50	12	0	0	0	0	52	0	0	0	0
2015	October	Dry Heath	4	14	0	33	35	2	0	0	0	26	0	0	0	0

2015	October	Dry Heath	5	16	17	9	42	0	0	0	0	32	0	0	0	0
2015	October	Dry Heath	6	18	13	0	39	10	0	0	0	26	0	0	0	7
2015	October	Dry Heath	7	25	12	16	37	3	0	0	0	23	0	0	0	0
2015	October	Dry Heath	8	28	25	8	22	0	0	0	0	24	0	0	0	1
2015	October	Dry Heath	9	20	5	2	52	2	0	0	0	23	0	0	0	16
2015	October	Dry Heath	10	28	0	0	25	12	0	0	0	19	0	0	0	16
2015	October	Dry Heath	11	40	8	9	15	0	0	0	0	31	0	0	0	0
2015	October	Dry Heath	12	30	0	6	16	32	0	0	0	26	0	0	0	32
2015	October	Dry Heath	13	32	0	6	7	25	0	0	0	30	0	0	0	0
2015	October	Dry Heath	14	38	0	0	13	22	0	0	0	37	0	0	0	0
2015	October	Dry Heath	15	28	0	3	37	0	0	0	0	28	0	0	0	4
2015	October	Dry Heath	16	31	0	9	25	20	0	0	0	40	0	0	0	0
2015	October	Dry Heath	17	22	8	6	7	4	0	0	0	20	0	0	0	38
2015	October	Dry Heath	18	39	0	30	15	0	0	0	0	26	0	0	0	0
2015	October	Dry Heath	19	28	2	18	52	0	0	0	0	0	0	0	0	0
2015	October	Dry Heath	20	12	1	23	15	0	0	0	0	49	0	0	0	0
2015	October	mire	1	0	1	0	7	0	0	2	0	0	0	5	15	0
2015	October	mire	2	0	5	0	30	0	0	1	3	0	8	0	28	0
2015	October	mire	3	0	0	0	10	0	0	0	6	0	0	0	29	0
2015	October	mire	4	0	11	0	11	0	0	0	25	0	5	0	41	0
2015	October	mire	5	0	0	0	10	0	0	2	7	0	0	0	38	0
2015	October	mire	6	0	8	0	35	0	0	0	12	0	0	0	26	0
2015	October	mire	7	8	0	0	41	0	0	0	5	0	0	0	25	0
2015	October	mire	8	0	0	0	2	11	0	32	4	0	0	0	5	0

2015	October	mire	9	1	11	0	18	0	0	0	0	10	28	3	27	0
2015	October	mire	10	18	13	0	14	0	0	0	0	5	16	7	22	0
2015	October	mire	11	9	12	0	17	0	0	0	3	7	26	0	26	0
2015	October	mire	12	0	10	0	25	0	0	0	0	6	4	0	24	0
2015	October	mire	13	0	7	0	15	0	0	0	0	2	43	14	25	0
2015	October	mire	14	0	8	0	30	0	0	0	0	0	0	0	22	0
2015	October	mire	15	26	9	0	0	0	0	0	0	12	23	0	12	0
2015	October	mire	16	11	13	0	24	0	0	0	0	7	11	1	0	0
2015	October	mire	17	5	9	0	44	0	0	0	0	6	0	0	30	0
2015	October	mire	18	5	14	0	38	0	0	0	0	28	0	0	0	0
2015	October	mire	19	10	8	0	65	0	0	0	0	4	5	0	0	0
2015	October	mire	20	0	1	0	8	0	0	3	0	0	0	12	16	0
2015	October	Mosaic	1	0	15	5	49	0	0	0	0	11	6	0	14	0
2015	October	Mosaic	2	0	24	7	23	0	0	0	0	2	0	0	11	5
2015	October	Mosaic	3	0	25	0	48	6	0	0	0	0	4	0	0	0
2015	October	Mosaic	4	6	4	10	26	6	0	0	0	16	0	0	14	0
2015	October	Mosaic	5	0	26	26	38	0	0	0	0	22	2	0	22	0
2015	October	Mosaic	6	5	12	0	55	0	0	0	0	3	0	0	12	0
2015	October	Mosaic	7	8	22	6	56	0	0	0	0	1	0	2	15	0
2015	October	Mosaic	8	15	18	2	43	0	0	0	12	11	0	0	22	0
2015	October	Mosaic	9	2	6	2	54	0	0	0	0	9	0	0	13	0
2015	October	Mosaic	10	2	5	0	48	0	0	0	0	25	0	0	0	0
2015	October	Mosaic	11	6	9	2	62	0	0	0	10	6	8	0	0	0
2015	October	Mosaic	12	4	13	4	57	0	0	0	0	22	0	0	25	0
2015	October	Mosaic	13	7	25	0	52	0	0	0	0	11	0	0	0	0
2015	October	Mosaic	14	1	13	2	78	0	0	0	0	7	0	0	10	0
2015	October	Mosaic	15	4	26	1	62	0	0	0	0	15	0	0	36	0
2015	October	Mosaic	16	4	18	2	45	0	0	0	0	4	7	0	5	0
2015	October	Mosaic	17	2	21	5	17	0	0	0	0	2	60	0	16	0

2015	October	Mosaic	18	4	20	6	52	0	0	0	0	6	0	0	28	0
2015	October	Mosaic	19	1	16	0	42	0	0	0	0	3	2	0	43	0
2015	October	Mosaic	20	3	24	1	17	0	0	0	0	22	0	0	25	0
2015	October	Mosaic	21	4	26	1	48	0	0	0	0	24	0	0	0	0
2015	October	Mosaic	22	9	11	4	66	0	0	0	0	9	1	0	5	0
2015	October	Mosaic	23	7	16	2	68	0	0	0	0	4	2	0	3	0
2015	October	Mosaic	24	0	14	4	63	0	0	0	0	15	0	0	5	0
2015	October	Mosaic	25	4	11	4	77	0	0	0	0	13	0	0	9	0
2015	October	Mosaic	26	1	7	0	64	0	0	0	0	0	0	0	0	0
2015	October	Mosaic	27	4	16	1	66	0	0	0	0	4	0	0	0	0
2015	October	Mosaic	28	4	14	0	71	0	0	0	0	20	0	0	17	0
2015	October	Mosaic	29	1	15	5	50	0	0	0	2	8	0	0	3	0
2015	October	Mosaic	30	3	16	0	67	0	0	0	0	0	0	0	0	0
2015	October	Mosaic	31	2	16	9	67	0	0	0	0	12	4	0	0	0
2015	October	Mosaic	32	7	20	8	46	0	0	0	0	29	0	0	5	0
2015	October	Mosaic	33	6	17	5	46	0	0	0	0	21	0	0	10	0
2015	October	Mosaic	34	7	16	2	54	0	0	0	5	21	4	0	8	0
2015	October	Mosaic	35	3	19	1	67	0	0	0	2	16	0	0	25	0
2015	October	Mosaic	36	2	15	0	30	0	0	0	0	32	5	0	0	0
2015	October	Mosaic	37	3	19	31	47	0	0	0	0	10	0	0	16	0
2015	October	Mosaic	38	25	23	4	31	0	0	0	1	15	12	0	0	0
2015	October	Mosaic	39	3	9	3	56	0	0	0	0	23	0	0	10	0
2015	October	Mosaic	40	7	6	1	46	0	0	0	15	21	4	0	0	0
2015	October	Wet Heath	1	18	19	0	38	0	0	0	0	25	0	0	0	0
2015	October	Wet Heath	2	12	10	2	37	0	0	0	20	4	8	2	5	0
2015	October	Wet Heath	3	5	13	2	26	0	0	0	8	21	0	1	55	0
2015	October	Wet Heath	4	4	16	1	29	0	0	0	28	3	0	2	0	0

2015	October	Wet Heath	5	2	10	4	61	0	0	0	0	19	0	0	0	0
2015	October	Wet Heath	6	15	25	6	33	0	0	0	18	1	0	25	0	7
2015	October	Wet Heath	7	15	21	0	57	0	0	0	0	6	0	4	0	1
2015	October	Wet Heath	8	10	11	0	71	0	0	0	0	8	0	0	0	0
2015	October	Wet Heath	9	15	18	0	39	2	0	0	12	3	3	0	0	0
2015	October	Wet Heath	10	16	9	0	34	0	0	0	9	14	15	3	0	0
2015	October	Wet Heath	11	3	16	0	43	0	0	0	5	14	0	0	18	0
2015	October	Wet Heath	12	2	9	4	32	0	0	0	0	16	0	0	30	0
2015	October	Wet Heath	13	15	20	2	32	0	0	0	3	21	7	0	0	0
2015	October	Wet Heath	14	15	3	12	34	0	0	0	0	20	8	0	16	0
2015	October	Wet Heath	15	0	18	0	10	0	0	3	6	1	0	0	53	0
2015	October	Wet Heath	16	1	5	0	29	0	0	0	0	5	6	1	23	0
2015	October	Wet Heath	17	16	7	0	9	0	0	0	28	0	10	11	0	0
2015	October	Wet Heath	18	0	22	0	35	0	0	0	0	37	0	0	0	0
2015	October	Wet Heath	19	18	21	0	12	0	0	0	8	34	2	3	0	0
2015	October	Wet Heath	20	11	18	0	37	0	0	0	0	39	0	0	0	0
2016	June	Control Dry	1	18	22	0	35	0	0	0	0	35	0	0	0	0
2016	June	Control Dry	2	2	13	22	45	0	0	0	0	35	0	0	0	0
2016	June	Control Dry	3	8	24	12	32	0	0	0	0	45	0	0	0	0
2016	June	Control Dry	4	0	11	0	64	0	0	0	0	26	0	0	0	0
2016	June	Control Dry	5	13	11	5	42	0	0	0	0	35	0	0	0	0
2016	June	Control Dry	6	15	25	16	22	0	0	0	0	42	0	0	0	0

2016	June	Control Dry	7	7	18	12	44	0	0	0	0	24	0	0	0	0
2016	June	Control Dry	8	4	15	23	33	0	0	0	0	41	0	0	0	0
2016	June	Control Dry	9	12	22	11	34	0	0	0	0	25	0	0	0	0
2016	June	Control Dry	10	2	23	0	55	0	0	0	0	19	0	0	0	0
2016	June	Control Dry	11	6	26	0	44	0	0	0	0	28	0	0	0	0
2016	June	Control Dry	12	5	6	15	44	0	0	0	0	25	0	0	0	0
2016	June	Control Dry	13	4	15	15	22	0	0	0	0	45	0	0	0	0
2016	June	Control Dry	14	2	12	11	33	0	0	0	0	42	0	0	0	0
2016	June	Control Dry	15	5	15	26	22	0	0	0	0	38	0	0	0	0
2016	June	Control Dry	16	3	4	16	45	0	0	0	12	36	0	0	0	0
2016	June	Control Dry	17	2	1	28	25	0	0	0	0	45	0	0	0	0
2016	June	Control Dry	18	13	28	15	46	0	0	0	0	25	0	0	0	0
2016	June	Control Dry	19	2	0	29	35	0	0	0	0	36	0	0	0	0
2016	June	Control Dry	20	12	22	5	42	0	0	0	0	28	0	0	0	0
2016	June	Dry Heath	1	3	0	33	15	0	0	0	0	48	0	0	0	0
2016	June	Dry Heath	2	12	9	22	20	0	0	0	0	26	0	0	0	22
2016	June	Dry Heath	3	4	0	48	13	0	0	0	0	48	0	0	0	0
2016	June	Dry Heath	4	6	0	36	29	5	0	0	0	30	0	0	0	0
2016	June	Dry Heath	5	15	15	14	38	0	0	0	0	33	0	0	0	0
2016	June	Dry Heath	6	22	13	0	47	9	0	0	0	30	0	0	0	4
2016	June	Dry Heath	7	0	0	18	41	6	0	0	0	19	0	0	0	15
2016	June	Dry Heath	8	15	19	5	34	0	0	0	0	25	0	0	0	1

2016	June	Dry Heath	9	17	13	7	24	0	0	0	0	22	0	0	0	0
2016	June	Dry Heath	10	22	0	0	28	9	0	0	0	17	0	0	0	13
2016	June	Dry Heath	11	28	12	11	11	0	0	0	0	28	0	0	0	0
2016	June	Dry Heath	12	0	0	8	11	36	0	0	0	22	0	0	0	28
2016	June	Dry Heath	13	37	0	0	0	21	0	0	0	32	0	0	0	0
2016	June	Dry Heath	14	37	0	0	11	18	0	0	0	31	0	0	0	0
2016	June	Dry Heath	15	32	0	0	26	0	0	0	0	29	0	0	0	3
2016	June	Dry Heath	16	38	0	0	28	11	0	0	0	37	0	0	0	0
2016	June	Dry Heath	17	17	11	2	4	26	0	0	0	0	0	0	0	0
2016	June	Dry Heath	18	34	0	33	17	0	0	0	0	0	0	0	0	0
2016	June	Dry Heath	19	33	3	22	49	0	0	0	0	0	0	0	0	0
2016	June	Dry Heath	20	0	0	28	14	0	0	0	0	47	0	0	0	0
2016	June	mire	1	0	0	0	2	0	0	0	0	0	0	0	9	0
2016	June	mire	2	0	5	0	24	0	0	0	4	0	0	0	26	0
2016	June	mire	3	0	0	0	12	0	0	0	6	0	0	0	27	0
2016	June	mire	4	0	11	0	16	0	0	0	22	0	6	0	44	0
2016	June	mire	5	0	0	0	9	0	0	3	8	0	0	0	35	0
2016	June	mire	6	0	0	0	29	0	0	0	11	0	0	0	23	0
2016	June	mire	7	7	0	0	38	0	0	0	0	0	0	0	25	0
2016	June	mire	8	0	0	0	5	4	0	16	4	0	0	0	7	0
2016	June	mire	9	0	9	0	12	0	0	0	0	8	19	0	25	0
2016	June	mire	10	16	15	0	16	0	0	0	0	7	0	0	24	0
2016	June	mire	11	7	12	0	12	0	0	0	0	8	0	0	27	0
2016	June	mire	12	0	11	0	27	0	0	0	0	4	0	0	19	0
2016	June	mire	13	0	5	0	22	0	0	0	0	2	35	16	19	0

2016	June	mire	14	0	12	0	36	0	0	0	0	0	0	0	19	0
2016	June	mire	15	26	9	0	0	0	0	0	0	16	15	0	16	0
2016	June	mire	16	12	12	0	29	0	0	0	0	6	6	0	0	0
2016	June	mire	17	7	8	0	37	0	0	0	0	7	0	0	32	0
2016	June	mire	18	2	11	0	39	0	0	0	0	15	0	0	0	0
2016	June	mire	19	9	8	0	55	0	0	0	0	5	0	0	0	0
2016	June	mire	20	0	1	0	3	0	0	0	0	0	0	0	13	0
2016	June	Mosaic	1	0	18	7	45	0	0	0	0	3	6	0	18	0
2016	June	Mosaic	2	0	22	9	22	0	0	0	0	2	0	0	15	4
2016	June	Mosaic	3	0	22	0	56	0	0	0	0	0	0	0	0	0
2016	June	Mosaic	4	5	4	12	28	0	0	0	0	12	0	0	14	0
2016	June	Mosaic	5	0	25	0	33	0	0	0	0	24	0	0	24	0
2016	June	Mosaic	6	5	15	0	43	0	0	0	0	3	0	4	17	0
2016	June	Mosaic	7	8	22	6	55	0	0	0	0	3	0	2	17	0
2016	June	Mosaic	8	16	15	4	44	0	0	0	10	12	0	0	22	0
2016	June	Mosaic	9	2	8	2	55	0	0	0	0	8	0	0	12	0
2016	June	Mosaic	10	3	7	0	51	0	0	0	0	22	0	0	0	0
2016	June	Mosaic	11	7	8	4	60	0	0	0	10	6	9	0	0	0
2016	June	Mosaic	12	4	12	6	59	0	0	0	0	24	0	0	23	0
2016	June	Mosaic	13	8	27	0	45	0	0	0	0	19	0	0	0	0
2016	June	Mosaic	14	3	13	0	78	0	0	0	0	7	0	0	10	0
2016	June	Mosaic	15	4	24	1	62	0	0	0	0	14	0	0	37	0
2016	June	Mosaic	16	3	16	2	46	0	0	0	0	5	0	0	4	0
2016	June	Mosaic	17	5	26	4	17	0	0	0	0	2	62	0	16	0
2016	June	Mosaic	18	4	22	6	55	0	0	0	0	0	0	0	26	0
2016	June	Mosaic	19	1	16	0	46	0	0	0	0	4	0	0	42	0
2016	June	Mosaic	20	3	22	1	16	0	0	0	0	21	0	0	26	0
2016	June	Mosaic	21	4	25	1	47	0	0	0	0	24	4	2	0	0
2016	June	Mosaic	22	9	12	5	69	0	0	0	0	9	4	0	6	0

2016	June	Mosaic	23	8	15	3	67	0	0	0	0	5	0	0	4	0
2016	June	Mosaic	24	0	16	5	60	0	0	0	0	15	0	0	4	0
2016	June	Mosaic	25	4	12	4	76	0	0	0	0	14	0	0	9	0
2016	June	Mosaic	26	2	7	0	64	0	0	0	0	0	0	0	0	0
2016	June	Mosaic	27	6	16	1	67	0	0	0	0	5	0	0	0	0
2016	June	Mosaic	28	5	13	0	67	0	0	0	0	22	0	0	17	0
2016	June	Mosaic	29	2	13	6	52	0	0	0	2	9	0	0	3	0
2016	June	Mosaic	30	3	15	0	68	0	0	0	0	0	8	0	0	0
2016	June	Mosaic	31	6	16	9	69	0	0	0	0	13	2	0	0	0
2016	June	Mosaic	32	8	18	6	48	0	0	0	0	25	0	0	5	0
2016	June	Mosaic	33	5	16	0	47	0	0	0	0	25	0	0	11	0
2016	June	Mosaic	34	5	15	2	52	0	0	0	0	22	2	0	9	0
2016	June	Mosaic	35	4	18	1	65	0	0	0	2	17	0	0	25	0
2016	June	Mosaic	36	0	16	0	34	0	0	0	0	33	0	0	0	0
2016	June	Mosaic	37	2	22	30	48	0	0	0	0	11	0	0	16	0
2016	June	Mosaic	38	24	25	4	32	0	0	0	1	15	12	0	0	0
2016	June	Mosaic	39	0	0	0	57	0	0	0	0	0	0	0	10	0
2016	June	Mosaic	40	6	8	2	42	0	0	0	13	22	2	0	0	0
2016	June	Wet Heath	1	10	18	2	44	0	0	0	0	26	0	0	0	0
2016	June	Wet Heath	2	11	10	2	54	0	0	0	13	6	6	0	55	0
2016	June	Wet Heath	3	5	15	0	22	0	0	0	0	12	0	3	0	0
2016	June	Wet Heath	4	8	12	1	43	0	0	0	11	3	0	0	0	0
2016	June	Wet Heath	5	0	11	4	57	0	0	0	0	23	0	0	0	0
2016	June	Wet Heath	6	0	17	9	34	0	0	0	0	1	0	12	0	4
2016	June	Wet Heath	7	14	22	0	44	0	0	0	0	8	0	4	0	1
2016	June	Wet Heath	8	11	11	0	65	0	0	0	0	9	0	0	0	1

2016	June	Wet Heath	9	0	22	0	45	6	0	0	12	0	1	2	0	0
2016	June	Wet Heath	10	15	0	0	37	0	0	0	13	11	15	0	18	0
2016	June	Wet Heath	11	3	11	0	55	0	0	0	0	13	0	0	28	0
2016	June	Wet Heath	12	3	6	11	46	0	0	0	0	14	0	0	0	0
2016	June	Wet Heath	13	11	23	0	46	0	0	0	0	26	7	0	11	0
2016	June	Wet Heath	14	9	6	0	35	0	0	0	0	23	11	0	66	0
2016	June	Wet Heath	15	0	8	0	7	0	0	0	0	3	0	0	25	0
2016	June	Wet Heath	16	4	4	0	33	0	0	0	0	8	7	0	0	0
2016	June	Wet Heath	17	22	11	0	8	0	0	0	27	0	11	7	0	0
2016	June	Wet Heath	18	0	23	0	33	0	0	0	0	39	0	0	0	0
2016	June	Wet Heath	19	11	18	0	22	0	0	0	0	32	0	0	0	0
2016	June	Wet Heath	20	7	19	2	33	0	0	0	0	42	0	0		0
2016	October	Control Dry	1	18	25	0	35	0	0	0	0	35	0	0	0	1
2016	October	Control Dry	2	4	11	25	45	0	0	0	0	35	0	0	0	0
2016	October	Control Dry	3	8	25	15	35	0	0	0	0	42	0	0	0	0
2016	October	Control Dry	4	0	10	0	57	0	0	0	0	23	0	0	0	0
2016	October	Control Dry	5	13	12	6	43	0	0	0	0	32	0	0	0	0
2016	October	Control Dry	6	17	26	14	22	0	0	0	0	45	0	0	0	0
2016	October	Control Dry	7	8	18	11	43	0	0	0	0	21	0	0	0	0
2016	October	Control Dry	8	3	13	25	32	0	0	0	0	45	0	0	0	0
2016	October	Control Dry	9	8	26	12	34	0	0	0	0	22	0	0	0	0
2016	October	Control Dry	10	2	22	0	57	0	0	0	0	19	0	0	0	0

2016	October	Control Dry	11	2	25	0	46	0	0	0	0	28	0	0	0	0
2016	October	Control Dry	12	3	8	15	48	0	0	0	0	26	0	0	0	0
2016	October	Control Dry	13	5	16	3919	25	0	0	0	0	50	0	0	0	0
2016	October	Control Dry	14	2	11	11	36	0	0	0	0	40	0	0	0	0
2016	October	Control Dry	15	2	12	25	26	0	0	0	0	35	0	0	0	0
2016	October	Control Dry	16	2	4	11	43	0	0	0	11	36	0	0	0	0
2016	October	Control Dry	17	3	1	33	24	0	0	0	0	44	0	0	0	0
2016	October	Control Dry	18	14	24	12	46	7	0	0	0	28	0	0	0	0
2016	October	Control Dry	19	1	0	34	38	0	0	0	0	37	0	0	0	0
2016	October	Control Dry	20	11	16	2	44	0	0	0	0	26	0	0	0	1
2016	October	Dry Heath	1	1	0	29	20	0	0	0	0	50	0	0	0	0
2016	October	Dry Heath	2	16	7	24	28	0	0	0	0	21	0	0	0	27
2016	October	Dry Heath	3	3	0	44	11	0	0	0	0	45	0	0	0	0
2016	October	Dry Heath	4	2	0	38	25	4	0	0	0	31	0	0	0	0
2016	October	Dry Heath	5	20	17	12	35	0	0	0	0	32	0	0	0	0
2016	October	Dry Heath	6	27	17	0	58	8	0	0	0	35	0	0	0	1
2016	October	Dry Heath	7	0	0	22	45	6	0	0	0	14	0	0	0	23
2016	October	Dry Heath	8	1	18	3	51	0	0	0	0	22	0	0	0	1
2016	October	Dry Heath	9	14	19	13	15	0	0	0	0	26	0	0	0	0
2016	October	Dry Heath	10	19	0	0	36	11	0	0	0	22	0	0	0	11
2016	October	Dry Heath	11	8	15	18	2	7	0	0	0	30	0	0	0	0
2016	October	Dry Heath	12	27	0	4	19	33	0	0	0	24	0	0	0	25

2016	October	Dry Heath	13	46	0	0	0	19	0	0	0	35	0	0	0	0
2016	October	Dry Heath	14	42	0	0	18	14	0	0	0	26	0	0	0	0
2016	October	Dry Heath	15	25	3	0	13	3	0	0	0	33	0	0	0	3
2016	October	Dry Heath	16	30	0	0	34	6	0	0	0	30	0	0	0	0
2016	October	Dry Heath	17	3	14	0	1	35	0	0	0	0	0	0	0	0
2016	October	Dry Heath	18	29	0	45	26	0	0	0	0	0	0	0	0	0
2016	October	Dry Heath	19	38	1	27	46	0	0	0	0	0	0	0	0	0
2016	October	Dry Heath	20	0	0	38	10	0	0	0	0	52	0	0	0	0
2016	October	mire	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	October	mire	2	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	October	mire	3	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	October	mire	4	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	October	mire	5	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	October	mire	6	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	October	mire	7	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	October	mire	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	October	mire	9	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	October	mire	10	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	October	mire	11	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	October	mire	12	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	October	mire	13	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	October	mire	14	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	October	mire	15	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	October	mire	16	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	October	mire	17	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	October	mire	18	0	0	0	0	0	0	0	0	0	0	0	0	0

2016	October	mire	19	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	October	mire	20	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	October	Mosaic	1	0	13	0	52	0	0	0	0	15	4	0	14	0
2016	October	Mosaic	2	0	20	9	21	0	0	0	0	2	0	0	0	5
2016	October	Mosaic	3	0	26	0	55	0	0	0	0	0	0	0	11	0
2016	October	Mosaic	4	5	5	14	34	0	0	0	0	14	0	0	0	0
2016	October	Mosaic	5	5	27	2	38	0	0	0	0	22	0	0	14	0
2016	October	Mosaic	6	5	10	0	44	0	0	0	0	2	0	4	22	0
2016	October	Mosaic	7	10	20	6	51	0	0	0	0	4	0	2	12	0
2016	October	Mosaic	8	16	15	3	41	0	0	0	11	12	0	0	15	0
2016	October	Mosaic	9	2	9	3	61	0	0	0	0	11	0	0	22	0
2016	October	Mosaic	10	4	8	0	53	0	0	0	0	18	0	0	13	0
2016	October	Mosaic	11	8	8	4	60	0	0	0	8	8	10	0	0	0
2016	October	Mosaic	12	3	11	6	61	0	0	0	0	19	0	0	0	0
2016	October	Mosaic	13	8	27	0	44	0	0	0	0	18	0	0	25	0
2016	October	Mosaic	14	2	14	0	73	0	0	0	0	8	0	0	0	0
2016	October	Mosaic	15	4	20	1	60	0	0	0	0	14	0	0	10	0
2016	October	Mosaic	16	3	18	4	45	0	0	0	0	5	0	0	36	0
2016	October	Mosaic	17	4	25	4	14	0	0	0	0	3	61	0	5	0
2016	October	Mosaic	18	2	24	6	46	0	0	0	0	6	0	6	16	0
2016	October	Mosaic	19	1	18	0	46	0	0	0	0	2	0	0	28	0
2016	October	Mosaic	20	3	23	1	15	0	0	0	0	22	0	0	43	0
2016	October	Mosaic	21	3	23	1	46	0	0	0	0	26	6	2	25	0
2016	October	Mosaic	22	7	9	3	67	0	0	0	0	11	3	0	0	0
2016	October	Mosaic	23	8	16	2	64	0	0	0	0	4	0	0	5	0
2016	October	Mosaic	24	0	12	6	60	0	0	0	0	13	0	0	3	0
2016	October	Mosaic	25	4	9	5	73	0	0	0	0	14	0	0	5	0
2016	October	Mosaic	26	2	6	0	62	0	0	0	0	0	0	0	9	0
2016	October	Mosaic	27	6	18	1	66	0	0	0	0	4	0	0	0	0

2016	October	Mosaic	28	5	15	0	71	0	0	0	0	28	0	0	0	0
2016	October	Mosaic	29	1	15	6	48	0	0	0	2	10	0	0	17	0
2016	October	Mosaic	30	2	16	4	65	0	0	0	0	8	15	0	3	0
2016	October	Mosaic	31	7	18	9	72	0	0	0	0	13	0	0	0	0
2016	October	Mosaic	32	5	18	8	45	0	0	0	0	21	0	0	0	0
2016	October	Mosaic	33	6	13	0	47	0	0	0	0	22	0	0	5	0
2016	October	Mosaic	34	6	14	2	52	0	0	0	0	24	2	0	10	0
2016	October	Mosaic	35	2	18	1	62	0	0	0	3	17	0	0	8	0
2016	October	Mosaic	36	0	12	0	34	0	0	0	0	34	0	0	25	0
2016	October	Mosaic	37	3	24	33	46	0	0	0	0	10	0	0	0	0
2016	October	Mosaic	38	22	28	3	28	0	0	0	1	15	11	0	16	0
2016	October	Mosaic	39	5	11	4	56	0	0	0	0	26	0	0	0	0
2016	October	Mosaic	40	5	9	2	43	0	0	0	13	24	3	0	10	0
2016	October	Wet Heath	1	0	18	4	46	0	0	0	0	31	0	1	0	0
2016	October	Wet Heath	2	10	12	0	62	0	0	0	6	8	2	0	55	0
2016	October	Wet Heath	3	6	16	0	18	0	0	0	1	4	6	2	0	0
2016	October	Wet Heath	4	12	9	0	58	0	0	0	0	3	8	0	0	0
2016	October	Wet Heath	5	0	12	5	53	0	0	0	0	21	0	0	0	0
2016	October	Wet Heath	6	0	13	8	40	0	0	0	0	0	0	9	0	1
2016	October	Wet Heath	7	22	20	0	43	0	0	0	0	12	0	2	0	1
2016	October	Wet Heath	8	15	16	0	59	0	0	0	0	7	0	0	0	1
2016	October	Wet Heath	9	0	18	9	46	10	0	0	12	0	0	2	0	0
2016	October	Wet Heath	10	15	8	0	35	0	0	0	17	9	16	0	17	0
2016	October	Wet Heath	11	1	6	0	63	0	0	0	0	11	0	0	24	0
2016	October	Wet Heath	12	1	6	8	53	0	0	0	0	8	0	0	0	0

2016	October	Wet Heath	13	14	22	0	73	0	0	0	0	25	6	0	4	0
2016	October	Wet Heath	14	4	11	0	37	0	0	0	0	29	12	3	80	0
2016	October	Wet Heath	15	1	4	0	8	0	0	0	0	5	0	0	28	0
2016	October	Wet Heath	16	6	4	0	31	0	0	0	0	6	8	0	0	0
2016	October	Wet Heath	17	25	14	0	4	0	0	0	25	0	13	3	0	0
2016	October	Wet Heath	18	0	22	0	25	0	0	0	0	42	0	0	0	0
2016	October	Wet Heath	19	9	22	0	24	0	0	0	0	45	0	0	0	0
2016	October	Wet Heath	20	1	17	5	35	0	0	0	0	42	0	0	0	0

Sward Height

Year	Month	Site	Quadrat	Record	Height
2014	June	Dry	1	1	67.0
2014	June	Dry	1	2	72.0
2014	June	Dry	1	3	81.5
2014	June	Dry	1	4	60.0
2014	June	Dry	1	5	77.0
2014	June	Dry	1	6	60.0
2014	June	Dry	1	7	60.0
2014	June	Dry	1	8	85.0
2014	June	Dry	1	9	64.0
2014	June	Dry	1	10	50.0
2014	June	Dry	1	11	71.5
2014	June	Dry	1	12	61.0
2014	June	Dry	1	13	66.0
2014	June	Dry	1	14	62.0
2014	June	Dry	1	15	63.0
2014	June	Dry	1	16	65.0
2014	June	Dry	1	17	63.0
2014	June	Dry	1	18	50.0
2014	June	Dry	1	19	49.0
2014	June	Dry	1	20	68.0
2014	June	Dry	2	1	47.0
2014	June	Dry	2	2	70.0
2014	June	Dry	2	3	68.0
2014	June	Dry	2	4	78.0
2014	June	Dry	2	5	99.0
2014	June	Dry	2	6	65.0
2014	June	Dry	2	7	50.0
2014	June	Dry	2	8	83.0
2014	June	Dry	2	9	58.0
2014	June	Dry	2	10	81.0
2014	June	Dry	2	11	91.0
2014	June	Dry	2	12	69.0
2014	June	Dry	2	13	59.0
2014	June	Dry	2	14	69.0
2014	June	Dry	2	15	90.0
2014	June	Dry	2	16	59.0
2014	June	Dry	2	17	71.0
2014	June	Dry	2	18	53.0
2014	June	Dry	2	19	88.0
2014	June	Dry	2	20	83.0
2014	June	Dry	3	1	87.0

2014	June	Dry	3	2	73.0
2014	June	Dry	3	3	73.0
2014	June	Dry	3	4	83.0
2014	June	Dry	3	5	66.0
2014	June	Dry	3	6	80.0
2014	June	Dry	3	7	89.0
2014	June	Dry	3	8	63.0
2014	June	Dry	3	9	75.0
2014	June	Dry	3	10	91.0
2014	June	Dry	3	11	89.0
2014	June	Dry	3	12	67.0
2014	June	Dry	3	13	64.0
2014	June	Dry	3	14	72.0
2014	June	Dry	3	15	59.0
2014	June	Dry	3	16	45.0
2014	June	Dry	3	17	79.0
2014	June	Dry	3	18	38.0
2014	June	Dry	3	19	59.0
2014	June	Dry	3	20	72.0
2014	June	Dry	4	1	26.0
2014	June	Dry	4	2	48.0
2014	June	Dry	4	3	50.0
2014	June	Dry	4	4	61.0
2014	June	Dry	4	5	64.0
2014	June	Dry	4	6	66.0
2014	June	Dry	4	7	66.0
2014	June	Dry	4	8	61.0
2014	June	Dry	4	9	69.0
2014	June	Dry	4	10	63.0
2014	June	Dry	4	11	74.0
2014	June	Dry	4	12	58.0
2014	June	Dry	4	13	65.0
2014	June	Dry	4	14	67.0
2014	June	Dry	4	15	59.0
2014	June	Dry	4	16	55.0
2014	June	Dry	4	17	43.0
2014	June	Dry	4	18	39.0
2014	June	Dry	4	19	58.0
2014	June	Dry	4	20	44.0
2014	June	Dry	5	1	84.0
2014	June	Dry	5	2	76.0
2014	June	Dry	5	3	88.0
2014	June	Dry	5	4	46.0
2014	June	Dry	5	5	45.0
2014	June	Dry	5	6	30.0

2014	June	Dry	5	7	61.0
2014	June	Dry	5	8	47.0
2014	June	Dry	5	9	52.0
2014	June	Dry	5	10	66.0
2014	June	Dry	5	11	66.0
2014	June	Dry	5	12	44.0
2014	June	Dry	5	13	56.0
2014	June	Dry	5	14	52.0
2014	June	Dry	5	15	53.0
2014	June	Dry	5	16	43.0
2014	June	Dry	5	17	44.0
2014	June	Dry	5	18	69.0
2014	June	Dry	5	19	46.0
2014	June	Dry	5	20	54.0
2014	June	Dry	6	1	34.0
2014	June	Dry	6	2	31.0
2014	June	Dry	6	3	48.0
2014	June	Dry	6	4	49.0
2014	June	Dry	6	5	53.0
2014	June	Dry	6	6	49.5
2014	June	Dry	6	7	30.0
2014	June	Dry	6	8	36.0
2014	June	Dry	6	9	40.0
2014	June	Dry	6	10	40.0
2014	June	Dry	6	11	48.0
2014	June	Dry	6	12	44.0
2014	June	Dry	6	13	39.0
2014	June	Dry	6	14	45.0
2014	June	Dry	6	15	46.0
2014	June	Dry	6	16	22.0
2014	June	Dry	6	17	26.0
2014	June	Dry	6	18	31.0
2014	June	Dry	6	19	33.0
2014	June	Dry	6	20	32.0
2014	June	Dry	7	1	50.0
2014	June	Dry	7	2	50.0
2014	June	Dry	7	3	43.0
2014	June	Dry	7	4	42.0
2014	June	Dry	7	5	34.0
2014	June	Dry	7	6	34.0
2014	June	Dry	7	7	32.0
2014	June	Dry	7	8	56.0
2014	June	Dry	7	9	34.0
2014	June	Dry	7	10	34.0
2014	June	Dry	7	11	39.0

2014	June	Dry	7	12	37.0
2014	June	Dry	7	13	18.0
2014	June	Dry	7	14	31.0
2014	June	Dry	7	15	34.0
2014	June	Dry	7	16	27.0
2014	June	Dry	7	17	30.0
2014	June	Dry	7	18	34.0
2014	June	Dry	7	19	25.0
2014	June	Dry	7	20	35.0
2014	June	Dry	8	1	27.0
2014	June	Dry	8	2	71.0
2014	June	Dry	8	3	46.0
2014	June	Dry	8	4	58.0
2014	June	Dry	8	5	68.0
2014	June	Dry	8	6	49.0
2014	June	Dry	8	7	48.0
2014	June	Dry	8	8	43.0
2014	June	Dry	8	9	55.0
2014	June	Dry	8	10	50.0
2014	June	Dry	8	11	51.0
2014	June	Dry	8	12	37.0
2014	June	Dry	8	13	51.0
2014	June	Dry	8	14	42.0
2014	June	Dry	8	15	44.0
2014	June	Dry	8	16	53.0
2014	June	Dry	8	17	60.0
2014	June	Dry	8	18	47.0
2014	June	Dry	8	19	52.0
2014	June	Dry	8	20	43.0
2014	June	Dry	9	1	24.0
2014	June	Dry	9	2	30.0
2014	June	Dry	9	3	38.0
2014	June	Dry	9	4	30.0
2014	June	Dry	9	5	17.0
2014	June	Dry	9	6	21.0
2014	June	Dry	9	7	20.0
2014	June	Dry	9	8	30.0
2014	June	Dry	9	9	32.0
2014	June	Dry	9	10	38.0
2014	June	Dry	9	11	42.0
2014	June	Dry	9	12	36.0
2014	June	Dry	9	13	27.0
2014	June	Dry	9	14	37.0
2014	June	Dry	9	15	36.0
2014	June	Dry	9	16	42.0

2014	June	Dry	9	17	26.0
2014	June	Dry	9	18	52.0
2014	June	Dry	9	19	39.0
2014	June	Dry	9	20	37.0
2014	June	Dry	10	1	32.0
2014	June	Dry	10	2	37.0
2014	June	Dry	10	3	57.0
2014	June	Dry	10	4	34.0
2014	June	Dry	10	5	44.0
2014	June	Dry	10	6	30.0
2014	June	Dry	10	7	24.0
2014	June	Dry	10	8	40.0
2014	June	Dry	10	9	60.0
2014	June	Dry	10	10	40.0
2014	June	Dry	10	11	40.0
2014	June	Dry	10	12	40.0
2014	June	Dry	10	13	45.0
2014	June	Dry	10	14	39.0
2014	June	Dry	10	15	33.0
2014	June	Dry	10	16	34.0
2014	June	Dry	10	17	42.0
2014	June	Dry	10	18	43.0
2014	June	Dry	10	19	47.0
2014	June	Dry	10	20	26.0
2014	June	Dry	11	1	34.0
2014	June	Dry	11	2	28.0
2014	June	Dry	11	3	35.0
2014	June	Dry	11	4	24.0
2014	June	Dry	11	5	29.0
2014	June	Dry	11	6	34.0
2014	June	Dry	11	7	24.0
2014	June	Dry	11	8	19.0
2014	June	Dry	11	9	25.0
2014	June	Dry	11	10	18.0
2014	June	Dry	11	11	19.0
2014	June	Dry	11	12	17.0
2014	June	Dry	11	13	38.0
2014	June	Dry	11	14	40.0
2014	June	Dry	11	15	45.0
2014	June	Dry	11	16	23.0
2014	June	Dry	11	17	29.0
2014	June	Dry	11	18	35.0
2014	June	Dry	11	19	26.0
2014	June	Dry	11	20	18.0
2014	June	Dry	12	1	14.0

2014	June	Dry	12	2	12.0
2014	June	Dry	12	3	9.0
2014	June	Dry	12	4	15.0
2014	June	Dry	12	5	12.0
2014	June	Dry	12	6	19.0
2014	June	Dry	12	7	10.0
2014	June	Dry	12	8	9.0
2014	June	Dry	12	9	7.0
2014	June	Dry	12	10	16.0
2014	June	Dry	12	11	17.0
2014	June	Dry	12	12	8.0
2014	June	Dry	12	13	8.0
2014	June	Dry	12	14	14.0
2014	June	Dry	12	15	23.0
2014	June	Dry	12	16	28.0
2014	June	Dry	12	17	28.0
2014	June	Dry	12	18	20.0
2014	June	Dry	12	19	22.0
2014	June	Dry	12	20	23.0
2014	June	Dry	13	1	27.0
2014	June	Dry	13	2	36.0
2014	June	Dry	13	3	24.0
2014	June	Dry	13	4	37.0
2014	June	Dry	13	5	33.0
2014	June	Dry	13	6	34.0
2014	June	Dry	13	7	34.0
2014	June	Dry	13	8	29.0
2014	June	Dry	13	9	33.0
2014	June	Dry	13	10	23.0
2014	June	Dry	13	11	29.0
2014	June	Dry	13	12	32.0
2014	June	Dry	13	13	22.0
2014	June	Dry	13	14	23.0
2014	June	Dry	13	15	20.0
2014	June	Dry	13	16	24.0
2014	June	Dry	13	17	22.0
2014	June	Dry	13	18	26.0
2014	June	Dry	13	19	32.0
2014	June	Dry	13	20	25.0
2014	June	Dry	14	1	53.0
2014	June	Dry	14	2	39.0
2014	June	Dry	14	3	43.0
2014	June	Dry	14	4	55.0
2014	June	Dry	14	5	38.0
2014	June	Dry	14	6	47.0

2014	June	Dry	14	7	49.0
2014	June	Dry	14	8	36.0
2014	June	Dry	14	9	46.0
2014	June	Dry	14	10	54.0
2014	June	Dry	14	11	60.0
2014	June	Dry	14	12	67.0
2014	June	Dry	14	13	47.0
2014	June	Dry	14	14	58.0
2014	June	Dry	14	15	48.0
2014	June	Dry	14	16	56.0
2014	June	Dry	14	17	28.0
2014	June	Dry	14	18	29.0
2014	June	Dry	14	19	32.0
2014	June	Dry	14	20	27.0
2014	June	Dry	15	1	50.0
2014	June	Dry	15	2	46.0
2014	June	Dry	15	3	43.0
2014	June	Dry	15	4	50.0
2014	June	Dry	15	5	49.0
2014	June	Dry	15	6	52.0
2014	June	Dry	15	7	47.0
2014	June	Dry	15	8	51.0
2014	June	Dry	15	9	55.0
2014	June	Dry	15	10	40.0
2014	June	Dry	15	11	42.0
2014	June	Dry	15	12	47.0
2014	June	Dry	15	13	55.0
2014	June	Dry	15	14	45.0
2014	June	Dry	15	15	54.0
2014	June	Dry	15	16	22.0
2014	June	Dry	15	17	24.0
2014	June	Dry	15	18	41.0
2014	June	Dry	15	19	32.0
2014	June	Dry	15	20	43.0
2014	June	Dry	16	1	56.0
2014	June	Dry	16	2	38.0
2014	June	Dry	16	3	43.0
2014	June	Dry	16	4	65.0
2014	June	Dry	16	5	66.0
2014	June	Dry	16	6	43.0
2014	June	Dry	16	7	43.0
2014	June	Dry	16	8	59.0
2014	June	Dry	16	9	58.0
2014	June	Dry	16	10	49.0
2014	June	Dry	16	11	59.0

2014	June	Dry	16	12	48.0
2014	June	Dry	16	13	48.0
2014	June	Dry	16	14	42.0
2014	June	Dry	16	15	49.0
2014	June	Dry	16	16	61.0
2014	June	Dry	16	17	14.0
2014	June	Dry	16	18	38.0
2014	June	Dry	16	19	24.0
2014	June	Dry	16	20	26.0
2014	June	Dry	17	1	17.0
2014	June	Dry	17	2	14.0
2014	June	Dry	17	3	16.0
2014	June	Dry	17	4	18.0
2014	June	Dry	17	5	10.0
2014	June	Dry	17	6	9.0
2014	June	Dry	17	7	14.0
2014	June	Dry	17	8	21.0
2014	June	Dry	17	9	26.0
2014	June	Dry	17	10	32.0
2014	June	Dry	17	11	29.0
2014	June	Dry	17	12	29.0
2014	June	Dry	17	13	21.0
2014	June	Dry	17	14	22.0
2014	June	Dry	17	15	12.0
2014	June	Dry	17	16	24.0
2014	June	Dry	17	17	23.0
2014	June	Dry	17	18	22.0
2014	June	Dry	17	19	19.0
2014	June	Dry	17	20	18.0
2014	June	Dry	18	1	50.0
2014	June	Dry	18	2	63.0
2014	June	Dry	18	3	75.0
2014	June	Dry	18	4	55.0
2014	June	Dry	18	5	66.0
2014	June	Dry	18	6	64.0
2014	June	Dry	18	7	49.0
2014	June	Dry	18	8	52.0
2014	June	Dry	18	9	48.0
2014	June	Dry	18	10	56.0
2014	June	Dry	18	11	54.0
2014	June	Dry	18	12	52.0
2014	June	Dry	18	13	67.0
2014	June	Dry	18	14	79.0
2014	June	Dry	18	15	64.0
2014	June	Dry	18	16	88.0

2014	June	Dry	18	17	64.0
2014	June	Dry	18	18	79.0
2014	June	Dry	18	19	79.0
2014	June	Dry	18	20	74.0
2014	June	Dry	19	1	36.0
2014	June	Dry	19	2	57.0
2014	June	Dry	19	3	65.0
2014	June	Dry	19	4	50.0
2014	June	Dry	19	5	67.0
2014	June	Dry	19	6	73.0
2014	June	Dry	19	7	86.0
2014	June	Dry	19	8	57.0
2014	June	Dry	19	9	76.0
2014	June	Dry	19	10	60.0
2014	June	Dry	19	11	48.0
2014	June	Dry	19	12	46.0
2014	June	Dry	19	13	52.0
2014	June	Dry	19	14	65.0
2014	June	Dry	19	15	63.0
2014	June	Dry	19	16	66.0
2014	June	Dry	19	17	63.0
2014	June	Dry	19	18	71.0
2014	June	Dry	19	19	64.0
2014	June	Dry	19	20	72.0
2014	June	Dry	20	1	80.0
2014	June	Dry	20	2	72.0
2014	June	Dry	20	3	72.0
2014	June	Dry	20	4	80.0
2014	June	Dry	20	5	87.0
2014	June	Dry	20	6	83.0
2014	June	Dry	20	7	90.0
2014	June	Dry	20	8	73.0
2014	June	Dry	20	9	60.0
2014	June	Dry	20	10	73.0
2014	June	Dry	20	11	40.0
2014	June	Dry	20	12	47.0
2014	June	Dry	20	13	59.0
2014	June	Dry	20	14	73.0
2014	June	Dry	20	15	43.0
2014	June	Dry	20	16	40.0
2014	June	Dry	20	17	54.0
2014	June	Dry	20	18	74.0
2014	June	Dry	20	19	78.0
2014	June	Dry	20	20	68.0
2014	June	Mire	1	1	40.0

2014	June	Mire	1	2	36.0
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2014	June	Mire	1	5	27.0
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2014	June	Mire	3	4	30.0
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2014	June	Mire	3	6	23.0

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2014	June	Mire	3	10	57.0
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2014	June	Mire	5	9	10.0
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2014	June	Mire	9	17	45.0
2014	June	Mire	9	18	45.0
2014	June	Mire	9	19	36.0
2014	June	Mire	9	20	48.0
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2014	June	Mire	10	4	38.0
2014	June	Mire	10	5	32.0
2014	June	Mire	10	6	37.0
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2014	June	Mire	12	4	40.0
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2014	June	Mire	14	7	67.0
2014	June	Mire	14	8	39.0
2014	June	Mire	14	9	56.0
2014	June	Mire	14	10	55.0
2014	June	Mire	14	11	44.0

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2014	June	Mire	14	13	54.0
2014	June	Mire	14	14	54.0
2014	June	Mire	14	15	67.0
2014	June	Mire	14	16	41.0
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2014	June	Mire	16	12	72.0
2014	June	Mire	16	13	45.0
2014	June	Mire	16	14	33.0
2014	June	Mire	16	15	37.0
2014	June	Mire	16	16	34.0

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2014	June	Mire	16	18	42.0
2014	June	Mire	16	19	36.0
2014	June	Mire	16	20	33.0
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2014	June	Mire	18	14	62.0
2014	June	Mire	18	15	36.0
2014	June	Mire	18	16	50.0
2014	June	Mire	18	17	35.0
2014	June	Mire	18	18	37.0
2014	June	Mire	18	19	29.0
2014	June	Mire	18	20	34.0
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2014	June	Mire	19	2	45.0
2014	June	Mire	19	3	45.0
2014	June	Mire	19	4	46.0
2014	June	Mire	19	5	57.0
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2014	June	Wet	1	2	38.0
2014	June	Wet	1	3	51.0
2014	June	Wet	1	4	59.0
2014	June	Wet	1	5	53.0
2014	June	Wet	1	6	52.0

2014	June	Wet	1	7	54.0
2014	June	Wet	1	8	82.0
2014	June	Wet	1	9	66.0
2014	June	Wet	1	10	39.0
2014	June	Wet	1	11	54.0
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2014	June	Wet	3	7	56.0
2014	June	Wet	3	8	55.0
2014	June	Wet	3	9	68.0
2014	June	Wet	3	10	77.0
2014	June	Wet	3	11	64.0

2014	June	Wet	3	12	62.0
2014	June	Wet	3	13	49.0
2014	June	Wet	3	14	45.0
2014	June	Wet	3	15	48.0
2014	June	Wet	3	16	49.0
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2014	June	Wet	5	7	53.0
2014	June	Wet	5	8	43.0
2014	June	Wet	5	9	52.0
2014	June	Wet	5	10	49.0
2014	June	Wet	5	11	47.0
2014	June	Wet	5	12	50.0
2014	June	Wet	5	13	59.0
2014	June	Wet	5	14	42.0
2014	June	Wet	5	15	45.0
2014	June	Wet	5	16	47.0

2014	June	Wet	5	17	50.0
2014	June	Wet	5	18	47.0
2014	June	Wet	5	19	47.0
2014	June	Wet	5	20	54.0
2014	June	Wet	6	1	24.0
2014	June	Wet	6	2	26.0
2014	June	Wet	6	3	21.0
2014	June	Wet	6	4	17.0
2014	June	Wet	6	5	14.0
2014	June	Wet	6	6	18.0
2014	June	Wet	6	7	36.0
2014	June	Wet	6	8	33.0
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2014	June	Wet	6	11	14.0
2014	June	Wet	6	12	13.0
2014	June	Wet	6	13	11.0
2014	June	Wet	6	14	15.0
2014	June	Wet	6	15	22.0
2014	June	Wet	6	16	26.0
2014	June	Wet	6	17	19.0
2014	June	Wet	6	18	31.0
2014	June	Wet	6	19	19.0
2014	June	Wet	6	20	13.0
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2014	June	Wet	7	3	38.0
2014	June	Wet	7	4	42.0
2014	June	Wet	7	5	13.0
2014	June	Wet	7	6	9.0
2014	June	Wet	7	7	36.0
2014	June	Wet	7	8	34.0
2014	June	Wet	7	9	40.0
2014	June	Wet	7	10	31.0
2014	June	Wet	7	11	35.0
2014	June	Wet	7	12	35.0
2014	June	Wet	7	13	31.0
2014	June	Wet	7	14	59.0
2014	June	Wet	7	15	47.0
2014	June	Wet	7	16	47.0
2014	June	Wet	7	17	30.0
2014	June	Wet	7	18	28.0
2014	June	Wet	7	19	28.0
2014	June	Wet	7	20	46.0
2014	June	Wet	8	1	23.0

2014	June	Wet	8	2	25.0
2014	June	Wet	8	3	26.0
2014	June	Wet	8	4	32.0
2014	June	Wet	8	5	44.0
2014	June	Wet	8	6	26.0
2014	June	Wet	8	7	18.0
2014	June	Wet	8	8	19.0
2014	June	Wet	8	9	24.0
2014	June	Wet	8	10	19.0
2014	June	Wet	8	11	32.0
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2014	June	Wet	9	8	69.0
2014	June	Wet	9	9	34.0
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2014	June	Wet	9	16	49.0
2014	June	Wet	9	17	60.0
2014	June	Wet	9	18	52.0
2014	June	Wet	9	19	56.0
2014	June	Wet	9	20	70.0
2014	June	Wet	10	1	33.0
2014	June	Wet	10	2	31.0
2014	June	Wet	10	3	38.0
2014	June	Wet	10	4	44.0
2014	June	Wet	10	5	25.0
2014	June	Wet	10	6	44.0

2014	June	Wet	10	7	45.0
2014	June	Wet	10	8	56.0
2014	June	Wet	10	9	38.0
2014	June	Wet	10	10	30.0
2014	June	Wet	10	11	46.0
2014	June	Wet	10	12	41.0
2014	June	Wet	10	13	38.0
2014	June	Wet	10	14	41.0
2014	June	Wet	10	15	36.0
2014	June	Wet	10	16	38.0
2014	June	Wet	10	17	37.0
2014	June	Wet	10	18	31.0
2014	June	Wet	10	19	43.0
2014	June	Wet	10	20	48.0
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2014	June	Wet	11	2	42.0
2014	June	Wet	11	3	50.0
2014	June	Wet	11	4	47.0
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2014	June	Wet	11	6	51.0
2014	June	Wet	11	7	53.0
2014	June	Wet	11	8	48.0
2014	June	Wet	11	9	72.0
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2014	June	Wet	11	11	57.0
2014	June	Wet	11	12	58.0
2014	June	Wet	11	13	68.0
2014	June	Wet	11	14	63.0
2014	June	Wet	11	15	56.0
2014	June	Wet	11	16	54.0
2014	June	Wet	11	17	61.0
2014	June	Wet	11	18	39.0
2014	June	Wet	11	19	51.0
2014	June	Wet	11	20	51.0
2014	June	Wet	12	1	52.0
2014	June	Wet	12	2	61.0
2014	June	Wet	12	3	63.0
2014	June	Wet	12	4	62.0
2014	June	Wet	12	5	62.0
2014	June	Wet	12	6	64.0
2014	June	Wet	12	7	45.0
2014	June	Wet	12	8	52.0
2014	June	Wet	12	9	30.0
2014	June	Wet	12	10	62.0
2014	June	Wet	12	11	64.0

2014	June	Wet	12	12	28.0
2014	June	Wet	12	13	39.0
2014	June	Wet	12	14	51.0
2014	June	Wet	12	15	44.0
2014	June	Wet	12	16	60.0
2014	June	Wet	12	17	81.0
2014	June	Wet	12	18	64.0
2014	June	Wet	12	19	53.0
2014	June	Wet	12	20	59.0
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2014	June	Wet	13	7	40.0
2014	June	Wet	13	8	46.0
2014	June	Wet	13	9	40.0
2014	June	Wet	13	10	41.0
2014	June	Wet	13	11	49.0
2014	June	Wet	13	12	36.0
2014	June	Wet	13	13	42.0
2014	June	Wet	13	14	37.0
2014	June	Wet	13	15	39.0
2014	June	Wet	13	16	32.0
2014	June	Wet	13	17	42.0
2014	June	Wet	13	18	40.0
2014	June	Wet	13	19	44.0
2014	June	Wet	13	20	48.0
2014	June	Wet	14	1	39.0
2014	June	Wet	14	2	43.0
2014	June	Wet	14	3	49.0
2014	June	Wet	14	4	54.0
2014	June	Wet	14	5	43.0
2014	June	Wet	14	6	62.0
2014	June	Wet	14	7	48.0
2014	June	Wet	14	8	52.0
2014	June	Wet	14	9	28.0
2014	June	Wet	14	10	38.0
2014	June	Wet	14	11	47.0
2014	June	Wet	14	12	59.0
2014	June	Wet	14	13	53.0
2014	June	Wet	14	14	73.0
2014	June	Wet	14	15	43.0
2014	June	Wet	14	16	54.0

2014	June	Wet	14	17	72.0
2014	June	Wet	14	18	41.0
2014	June	Wet	14	19	64.0
2014	June	Wet	14	20	81.0
2014	June	Wet	15	1	61.0
2014	June	Wet	15	2	53.0
2014	June	Wet	15	3	49.0
2014	June	Wet	15	4	53.0
2014	June	Wet	15	5	56.0
2014	June	Wet	15	6	49.0
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2014	June	Wet	15	8	59.0
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2014	June	Wet	15	12	84.0
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2014	June	Wet	15	14	46.0
2014	June	Wet	15	15	38.0
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2014	June	Wet	15	17	44.0
2014	June	Wet	15	18	77.0
2014	June	Wet	15	19	44.0
2014	June	Wet	15	20	34.0
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2014	June	Wet	16	3	49.0
2014	June	Wet	16	4	37.0
2014	June	Wet	16	5	42.0
2014	June	Wet	16	6	48.0
2014	June	Wet	16	7	51.0
2014	June	Wet	16	8	32.0
2014	June	Wet	16	9	42.0
2014	June	Wet	16	10	45.0
2014	June	Wet	16	11	42.0
2014	June	Wet	16	12	25.0
2014	June	Wet	16	13	40.0
2014	June	Wet	16	14	53.0
2014	June	Wet	16	15	36.0
2014	June	Wet	16	16	58.0
2014	June	Wet	16	17	73.0
2014	June	Wet	16	18	75.0
2014	June	Wet	16	19	92.0
2014	June	Wet	16	20	82.0
2014	June	Wet	17	1	28.0

2014	June	Wet	17	2	20.0
2014	June	Wet	17	3	24.0
2014	June	Wet	17	4	22.0
2014	June	Wet	17	5	27.0
2014	June	Wet	17	6	22.0
2014	June	Wet	17	7	19.0
2014	June	Wet	17	8	23.0
2014	June	Wet	17	9	30.0
2014	June	Wet	17	10	24.0
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2014	June	Wet	17	12	34.0
2014	June	Wet	17	13	34.0
2014	June	Wet	17	14	19.0
2014	June	Wet	17	15	20.0
2014	June	Wet	17	16	23.0
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2014	June	Wet	17	18	33.0
2014	June	Wet	17	19	32.0
2014	June	Wet	17	20	36.0
2014	June	Wet	18	1	10.0
2014	June	Wet	18	2	22.0
2014	June	Wet	18	3	25.0
2014	June	Wet	18	4	30.0
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2014	June	Wet	18	8	43.0
2014	June	Wet	18	9	32.0
2014	June	Wet	18	10	37.0
2014	June	Wet	18	11	43.0
2014	June	Wet	18	12	19.0
2014	June	Wet	18	13	23.0
2014	June	Wet	18	14	26.0
2014	June	Wet	18	15	30.0
2014	June	Wet	18	16	33.0
2014	June	Wet	18	17	18.0
2014	June	Wet	18	18	34.0
2014	June	Wet	18	19	33.0
2014	June	Wet	18	20	37.0
2014	June	Wet	19	1	47.0
2014	June	Wet	19	2	48.0
2014	June	Wet	19	3	81.0
2014	June	Wet	19	4	60.0
2014	June	Wet	19	5	61.0
2014	June	Wet	19	6	76.0

2014	June	Wet	19	7	80.0
2014	June	Wet	19	8	96.0
2014	June	Wet	19	9	93.0
2014	June	Wet	19	10	86.0
2014	June	Wet	19	11	101.0
2014	June	Wet	19	12	71.0
2014	June	Wet	19	13	45.0
2014	June	Wet	19	14	73.0
2014	June	Wet	19	15	62.0
2014	June	Wet	19	16	48.0
2014	June	Wet	19	17	101.0
2014	June	Wet	19	18	105.0
2014	June	Wet	19	19	71.0
2014	June	Wet	19	20	62.0
2014	June	Wet	20	1	46.0
2014	June	Wet	20	2	56.0
2014	June	Wet	20	3	53.0
2014	June	Wet	20	4	60.0
2014	June	Wet	20	5	61.0
2014	June	Wet	20	6	51.0
2014	June	Wet	20	7	42.0
2014	June	Wet	20	8	31.0
2014	June	Wet	20	9	38.0
2014	June	Wet	20	10	49.0
2014	June	Wet	20	11	47.0
2014	June	Wet	20	12	26.0
2014	June	Wet	20	13	37.0
2014	June	Wet	20	14	62.0
2014	June	Wet	20	15	35.0
2014	June	Wet	20	16	53.0
2014	June	Wet	20	17	39.0
2014	June	Wet	20	18	53.0
2014	June	Wet	20	19	48.0
2014	June	Wet	20	20	52.0
2014	October	Dry	1	1	37.0
2014	October	Dry	1	2	64.0
2014	October	Dry	1	3	43.0
2014	October	Dry	1	4	35.0
2014	October	Dry	1	5	43.0
2014	October	Dry	1	6	79.0
2014	October	Dry	1	7	72.0
2014	October	Dry	1	8	80.0
2014	October	Dry	1	9	26.0
2014	October	Dry	1	10	40.0
2014	October	Dry	1	11	34.0

2014	October	Dry	1	12	56.0
2014	October	Dry	1	13	69.0
2014	October	Dry	1	14	63.0
2014	October	Dry	1	15	59.0
2014	October	Dry	1	16	70.0
2014	October	Dry	1	17	53.0
2014	October	Dry	1	18	37.0
2014	October	Dry	1	19	52.0
2014	October	Dry	1	20	22.0
2014	October	Dry	2	1	49.0
2014	October	Dry	2	2	37.0
2014	October	Dry	2	3	45.0
2014	October	Dry	2	4	46.0
2014	October	Dry	2	5	45.0
2014	October	Dry	2	6	43.0
2014	October	Dry	2	7	39.0
2014	October	Dry	2	8	43.0
2014	October	Dry	2	9	54.0
2014	October	Dry	2	10	38.0
2014	October	Dry	2	11	40.0
2014	October	Dry	2	12	42.0
2014	October	Dry	2	13	48.0
2014	October	Dry	2	14	44.0
2014	October	Dry	2	15	68.0
2014	October	Dry	2	16	73.0
2014	October	Dry	2	17	49.0
2014	October	Dry	2	18	46.0
2014	October	Dry	2	19	33.0
2014	October	Dry	2	20	42.0
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2014	October	Dry	3	2	45.0
2014	October	Dry	3	3	63.0
2014	October	Dry	3	4	78.0
2014	October	Dry	3	5	59.0
2014	October	Dry	3	6	78.0
2014	October	Dry	3	7	90.0
2014	October	Dry	3	8	60.0
2014	October	Dry	3	9	27.0
2014	October	Dry	3	10	38.0
2014	October	Dry	3	11	48.0
2014	October	Dry	3	12	30.0
2014	October	Dry	3	13	38.0
2014	October	Dry	3	14	37.0
2014	October	Dry	3	15	83.0
2014	October	Dry	3	16	101.0

2014	October	Dry	3	17	70.0
2014	October	Dry	3	18	63.0
2014	October	Dry	3	19	88.0
2014	October	Dry	3	20	59.0
2014	October	Dry	4	1	49.0
2014	October	Dry	4	2	52.0
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2014	October	Dry	4	4	43.0
2014	October	Dry	4	5	46.0
2014	October	Dry	4	6	59.0
2014	October	Dry	4	7	55.0
2014	October	Dry	4	8	44.0
2014	October	Dry	4	9	59.0
2014	October	Dry	4	10	57.0
2014	October	Dry	4	11	38.0
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2014	October	Dry	4	13	89.0
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2014	October	Dry	4	20	62.0
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2014	October	Dry	5	4	63.0
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2014	October	Dry	5	7	63.0
2014	October	Dry	5	8	53.0
2014	October	Dry	5	9	44.0
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2014	October	Dry	5	11	55.0
2014	October	Dry	5	12	56.0
2014	October	Dry	5	13	68.0
2014	October	Dry	5	14	44.0
2014	October	Dry	5	15	52.0
2014	October	Dry	5	16	75.0
2014	October	Dry	5	17	76.0
2014	October	Dry	5	18	72.0
2014	October	Dry	5	19	35.0
2014	October	Dry	5	20	66.0
2014	October	Dry	6	1	36.0

2014	October	Dry	6	2	29.0
2014	October	Dry	6	3	24.0
2014	October	Dry	6	4	38.0
2014	October	Dry	6	5	33.0
2014	October	Dry	6	6	51.0
2014	October	Dry	6	7	38.0
2014	October	Dry	6	8	58.0
2014	October	Dry	6	9	47.0
2014	October	Dry	6	10	44.0
2014	October	Dry	6	11	49.0
2014	October	Dry	6	12	37.0
2014	October	Dry	6	13	29.0
2014	October	Dry	6	14	33.0
2014	October	Dry	6	15	37.0
2014	October	Dry	6	16	45.0
2014	October	Dry	6	17	67.0
2014	October	Dry	6	18	56.0
2014	October	Dry	6	19	42.0
2014	October	Dry	6	20	36.0
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2014	October	Dry	7	2	53.0
2014	October	Dry	7	3	44.0
2014	October	Dry	7	4	44.0
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2014	October	Dry	7	10	42.0
2014	October	Dry	7	11	43.0
2014	October	Dry	7	12	41.0
2014	October	Dry	7	13	37.0
2014	October	Dry	7	14	49.0
2014	October	Dry	7	15	53.0
2014	October	Dry	7	16	35.0
2014	October	Dry	7	17	39.0
2014	October	Dry	7	18	40.0
2014	October	Dry	7	19	38.0
2014	October	Dry	7	20	39.0
2014	October	Dry	8	1	43.0
2014	October	Dry	8	2	72.0
2014	October	Dry	8	3	55.0
2014	October	Dry	8	4	66.0
2014	October	Dry	8	5	45.0
2014	October	Dry	8	6	57.0

2014	October	Dry	8	7	69.0
2014	October	Dry	8	8	74.0
2014	October	Dry	8	9	34.0
2014	October	Dry	8	10	59.0
2014	October	Dry	8	11	46.0
2014	October	Dry	8	12	38.0
2014	October	Dry	8	13	64.0
2014	October	Dry	8	14	58.0
2014	October	Dry	8	15	57.0
2014	October	Dry	8	16	57.0
2014	October	Dry	8	17	51.0
2014	October	Dry	8	18	55.0
2014	October	Dry	8	19	55.0
2014	October	Dry	8	20	54.0
2014	October	Dry	9	1	19.0
2014	October	Dry	9	2	17.0
2014	October	Dry	9	3	19.0
2014	October	Dry	9	4	23.0
2014	October	Dry	9	5	38.0
2014	October	Dry	9	6	30.0
2014	October	Dry	9	7	31.0
2014	October	Dry	9	8	30.0
2014	October	Dry	9	9	35.0
2014	October	Dry	9	10	39.0
2014	October	Dry	9	11	25.0
2014	October	Dry	9	12	25.0
2014	October	Dry	9	13	22.0
2014	October	Dry	9	14	21.0
2014	October	Dry	9	15	23.0
2014	October	Dry	9	16	18.0
2014	October	Dry	9	17	28.0
2014	October	Dry	9	18	30.0
2014	October	Dry	9	19	29.0
2014	October	Dry	9	20	42.0
2014	October	Dry	10	1	25.0
2014	October	Dry	10	2	31.0
2014	October	Dry	10	3	22.0
2014	October	Dry	10	4	36.0
2014	October	Dry	10	5	39.0
2014	October	Dry	10	6	25.0
2014	October	Dry	10	7	25.0
2014	October	Dry	10	8	31.0
2014	October	Dry	10	9	30.0
2014	October	Dry	10	10	20.0
2014	October	Dry	10	11	32.0

2014	October	Dry	10	12	38.0
2014	October	Dry	10	13	25.0
2014	October	Dry	10	14	37.0
2014	October	Dry	10	15	27.0
2014	October	Dry	10	16	21.0
2014	October	Dry	10	17	53.0
2014	October	Dry	10	18	54.0
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2014	October	Mire	17	11	70.0

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2014	October	Wet	1	18	36.0
2014	October	Wet	1	19	55.0
2014	October	Wet	1	20	64.0
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2014	October	Wet	6	10	12.0
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2014	October	Wet	13	6	44.0

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2014	October	Wet	17	13	17.0
2014	October	Wet	17	14	27.0
2014	October	Wet	17	15	30.0
2014	October	Wet	17	16	30.0

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2014	October	Wet	17	19	33.0
2014	October	Wet	17	20	30.0
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2014	October	Wet	19	17	40.0
2014	October	Wet	19	18	37.0
2014	October	Wet	19	19	39.0
2014	October	Wet	19	20	56.0
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2015	June	Dry	1	6	88.0
2015	June	Dry	1	7	59.0
2015	June	Dry	1	8	89.0
2015	June	Dry	1	9	81.0
2015	June	Dry	1	10	84.0
2015	June	Dry	1	11	82.0
2015	June	Dry	1	12	83.0
2015	June	Dry	1	13	61.0
2015	June	Dry	1	14	85.0
2015	June	Dry	1	15	94.0
2015	June	Dry	1	16	77.0
2015	June	Dry	1	17	51.0
2015	June	Dry	1	18	53.0
2015	June	Dry	1	19	85.0
2015	June	Dry	1	20	80.0
2015	June	Dry	2	1	60.0
2015	June	Dry	2	2	68.0
2015	June	Dry	2	3	68.0
2015	June	Dry	2	4	82.0
2015	June	Dry	2	5	76.0
2015	June	Dry	2	6	77.0

2015	June	Dry	2	7	101.0
2015	June	Dry	2	8	82.0
2015	June	Dry	2	9	70.0
2015	June	Dry	2	10	53.0
2015	June	Dry	2	11	54.0
2015	June	Dry	2	12	70.0
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2015	June	Dry	4	4	32.0
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2015	June	Dry	4	7	24.0
2015	June	Dry	4	8	22.0
2015	June	Dry	4	9	32.0
2015	June	Dry	4	10	37.0
2015	June	Dry	4	11	33.0

2015	June	Dry	4	12	33.0
2015	June	Dry	4	13	64.0
2015	June	Dry	4	14	37.0
2015	June	Dry	4	15	78.0
2015	June	Dry	4	16	38.0
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2015	June	Dry	4	19	43.0
2015	June	Dry	4	20	42.0
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2015	June	Dry	6	12	45.0
2015	June	Dry	6	13	35.0
2015	June	Dry	6	14	37.0
2015	June	Dry	6	15	53.0
2015	June	Dry	6	16	46.0

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2015	June	Dry	6	18	15.0
2015	June	Dry	6	19	33.0
2015	June	Dry	6	20	47.0
2015	June	Dry	7	1	50.0
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2015	June	Dry	7	6	29.0
2015	June	Dry	7	7	43.0
2015	June	Dry	7	8	40.0
2015	June	Dry	7	9	37.0
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2015	June	Dry	7	11	63.0
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2015	June	Dry	7	16	40.0
2015	June	Dry	7	17	38.0
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2015	June	Dry	8	14	63.0
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2015	June	Dry	8	16	62.0
2015	June	Dry	8	17	47.0
2015	June	Dry	8	18	48.0
2015	June	Dry	8	19	42.0
2015	June	Dry	8	20	39.0
2015	June	Dry	9	1	19.0

2015	June	Dry	9	2	14.0
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2015	June	Dry	9	4	19.0
2015	June	Dry	9	5	30.0
2015	June	Dry	9	6	23.0
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2015	June	Dry	9	9	31.0
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2015	June	Dry	9	14	38.0
2015	June	Dry	9	15	28.0
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2015	June	Dry	11	3	50.0
2015	June	Dry	11	4	53.0
2015	June	Dry	11	5	47.0
2015	June	Dry	11	6	50.0

2015	June	Dry	11	7	57.0
2015	June	Dry	11	8	62.0
2015	June	Dry	11	9	48.0
2015	June	Dry	11	10	52.0
2015	June	Dry	11	11	53.0
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2015	June	Dry	13	7	22.0
2015	June	Dry	13	8	21.0
2015	June	Dry	13	9	23.0
2015	June	Dry	13	10	18.0
2015	June	Dry	13	11	18.0

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2015	June	Dry	13	13	19.0
2015	June	Dry	13	14	20.0
2015	June	Dry	13	15	19.0
2015	June	Dry	13	16	15.0
2015	June	Dry	13	17	22.0
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2015	June	Dry	14	8	72.0
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2015	June	Dry	14	16	50.0
2015	June	Dry	14	17	49.0
2015	June	Dry	14	18	47.0
2015	June	Dry	14	19	46.0
2015	June	Dry	14	20	50.0
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2015	June	Dry	15	6	39.0
2015	June	Dry	15	7	42.0
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2015	June	Dry	15	9	58.0
2015	June	Dry	15	10	27.0
2015	June	Dry	15	11	37.0
2015	June	Dry	15	12	45.0
2015	June	Dry	15	13	36.0
2015	June	Dry	15	14	23.0
2015	June	Dry	15	15	44.0
2015	June	Dry	15	16	34.0

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2015	June	Dry	15	18	36.0
2015	June	Dry	15	19	39.0
2015	June	Dry	15	20	37.0
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2015	June	Dry	16	2	52.0
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2015	June	Dry	16	9	48.0
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2015	June	Dry	17	15	24.0
2015	June	Dry	17	16	23.0
2015	June	Dry	17	17	22.0
2015	June	Dry	17	18	19.0
2015	June	Dry	17	19	18.0
2015	June	Dry	17	20	22.0
2015	June	Dry	18	1	69.0

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2015	June	Dry	18	3	75.0
2015	June	Dry	18	4	51.0
2015	June	Dry	18	5	63.0
2015	June	Dry	18	6	59.0
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2015	June	Dry	18	10	62.0
2015	June	Dry	18	11	59.0
2015	June	Dry	18	12	56.0
2015	June	Dry	18	13	44.0
2015	June	Dry	18	14	52.0
2015	June	Dry	18	15	63.0
2015	June	Dry	18	16	85.0
2015	June	Dry	18	17	63.0
2015	June	Dry	18	18	61.0
2015	June	Dry	18	19	77.0
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2015	June	Dry	19	1	50.0
2015	June	Dry	19	2	36.0
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2015	June	Dry	19	4	34.0
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2015	June	Dry	19	6	67.0
2015	June	Dry	19	7	68.0
2015	June	Dry	19	8	82.0
2015	June	Dry	19	9	35.0
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2015	June	Dry	19	11	51.0
2015	June	Dry	19	12	61.0
2015	June	Dry	19	13	85.0
2015	June	Dry	19	14	64.0
2015	June	Dry	19	15	41.0
2015	June	Dry	19	16	42.0
2015	June	Dry	19	17	39.0
2015	June	Dry	19	18	34.0
2015	June	Dry	19	19	20.0
2015	June	Dry	19	20	31.0
2015	June	Dry	20	1	49.0
2015	June	Dry	20	2	52.0
2015	June	Dry	20	3	53.0
2015	June	Dry	20	4	46.0
2015	June	Dry	20	5	59.0
2015	June	Dry	20	6	69.0

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2015	June	Dry	20	8	77.0
2015	June	Dry	20	9	79.0
2015	June	Dry	20	10	68.0
2015	June	Dry	20	11	92.0
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2015	June	Dry	20	20	36.0
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2015	June	Mire	1	2	26.0
2015	June	Mire	1	3	13.0
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2015	June	Mire	1	5	27.0
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2015	June	Mire	1	11	18.0
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2015	June	Mire	1	17	15.0
2015	June	Mire	1	18	20.0
2015	June	Mire	1	19	24.0
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2015	June	Mire	2	5	26.0
2015	June	Mire	2	6	28.0
2015	June	Mire	2	7	32.0
2015	June	Mire	2	8	48.0
2015	June	Mire	2	9	55.0
2015	June	Mire	2	10	57.0
2015	June	Mire	2	11	59.0

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2015	June	Mire	2	13	55.0
2015	June	Mire	2	14	49.0
2015	June	Mire	2	15	50.0
2015	June	Mire	2	16	56.0
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2015	June	Mire	4	12	50.0
2015	June	Mire	4	13	23.0
2015	June	Mire	4	14	24.0
2015	June	Mire	4	15	43.0
2015	June	Mire	4	16	43.0

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2015	June	Mire	4	18	66.0
2015	June	Mire	4	19	80.0
2015	June	Mire	4	20	77.0
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2015	June	Mire	5	13	17.0
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2015	June	Mire	5	15	14.0
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2015	June	Mire	5	17	18.0
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2015	June	Mire	6	13	23.0
2015	June	Mire	6	14	28.0
2015	June	Mire	6	15	29.0
2015	June	Mire	6	16	21.0
2015	June	Mire	6	17	17.0
2015	June	Mire	6	18	14.0
2015	June	Mire	6	19	17.0
2015	June	Mire	6	20	11.0
2015	June	Mire	7	1	29.0

2015	June	Mire	7	2	46.0
2015	June	Mire	7	3	24.0
2015	June	Mire	7	4	57.0
2015	June	Mire	7	5	47.0
2015	June	Mire	7	6	45.0
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2015	June	Mire	7	9	28.0
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2015	June	Mire	20	15	16.0
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2015	June	Wet	4	19	51.0
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2015	June	Wet	7	4	20.0
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2015	June	Wet	12	12	40.0
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2015	June	Wet	12	14	22.0
2015	June	Wet	12	15	42.0
2015	June	Wet	12	16	62.0
2015	June	Wet	12	17	40.0
2015	June	Wet	12	18	32.0
2015	June	Wet	12	19	49.0
2015	June	Wet	12	20	58.0
2015	June	Wet	13	1	20.0
2015	June	Wet	13	2	17.0
2015	June	Wet	13	3	18.0
2015	June	Wet	13	4	23.0
2015	June	Wet	13	5	22.0
2015	June	Wet	13	6	40.0
2015	June	Wet	13	7	67.0
2015	June	Wet	13	8	55.0
2015	June	Wet	13	9	56.0
2015	June	Wet	13	10	60.0
2015	June	Wet	13	11	39.0
2015	June	Wet	13	12	38.0
2015	June	Wet	13	13	47.0
2015	June	Wet	13	14	58.0
2015	June	Wet	13	15	26.0
2015	June	Wet	13	16	26.0
2015	June	Wet	13	17	40.0
2015	June	Wet	13	18	33.0
2015	June	Wet	13	19	31.0
2015	June	Wet	13	20	50.0
2015	June	Wet	14	1	35.0

2015	June	Wet	14	2	46.0
2015	June	Wet	14	3	54.0
2015	June	Wet	14	4	24.0
2015	June	Wet	14	5	32.0
2015	June	Wet	14	6	55.0
2015	June	Wet	14	7	37.0
2015	June	Wet	14	8	78.0
2015	June	Wet	14	9	28.0
2015	June	Wet	14	10	27.0
2015	June	Wet	14	11	19.0
2015	June	Wet	14	12	14.0
2015	June	Wet	14	13	26.0
2015	June	Wet	14	14	19.0
2015	June	Wet	14	15	13.0
2015	June	Wet	14	16	53.0
2015	June	Wet	14	17	14.0
2015	June	Wet	14	18	26.0
2015	June	Wet	14	19	16.0
2015	June	Wet	14	20	16.0
2015	June	Wet	15	1	20.0
2015	June	Wet	15	2	21.0
2015	June	Wet	15	3	18.0
2015	June	Wet	15	4	19.0
2015	June	Wet	15	5	19.0
2015	June	Wet	15	6	34.0
2015	June	Wet	15	7	33.0
2015	June	Wet	15	8	47.0
2015	June	Wet	15	9	16.0
2015	June	Wet	15	10	24.0
2015	June	Wet	15	11	37.0
2015	June	Wet	15	12	23.0
2015	June	Wet	15	13	58.0
2015	June	Wet	15	14	54.0
2015	June	Wet	15	15	54.0
2015	June	Wet	15	16	55.0
2015	June	Wet	15	17	18.0
2015	June	Wet	15	18	17.0
2015	June	Wet	15	19	24.0
2015	June	Wet	15	20	9.0
2015	June	Wet	16	1	20.0
2015	June	Wet	16	2	10.0
2015	June	Wet	16	3	11.0
2015	June	Wet	16	4	21.0
2015	June	Wet	16	5	28.0
2015	June	Wet	16	6	8.0

2015	June	Wet	16	7	5.0
2015	June	Wet	16	8	35.0
2015	June	Wet	16	9	28.0
2015	June	Wet	16	10	15.0
2015	June	Wet	16	11	47.0
2015	June	Wet	16	12	20.0
2015	June	Wet	16	13	13.0
2015	June	Wet	16	14	45.0
2015	June	Wet	16	15	12.0
2015	June	Wet	16	16	7.0
2015	June	Wet	16	17	15.0
2015	June	Wet	16	18	10.0
2015	June	Wet	16	19	19.0
2015	June	Wet	16	20	8.0
2015	June	Wet	17	1	22.0
2015	June	Wet	17	2	23.0
2015	June	Wet	17	3	24.0
2015	June	Wet	17	4	31.0
2015	June	Wet	17	5	19.0
2015	June	Wet	17	6	16.0
2015	June	Wet	17	7	17.0
2015	June	Wet	17	8	15.0
2015	June	Wet	17	9	23.0
2015	June	Wet	17	10	28.0
2015	June	Wet	17	11	31.0
2015	June	Wet	17	12	33.0
2015	June	Wet	17	13	34.0
2015	June	Wet	17	14	30.0
2015	June	Wet	17	15	27.0
2015	June	Wet	17	16	34.0
2015	June	Wet	17	17	19.0
2015	June	Wet	17	18	21.0
2015	June	Wet	17	19	22.0
2015	June	Wet	17	20	30.0
2015	June	Wet	18	1	73.0
2015	June	Wet	18	2	49.0
2015	June	Wet	18	3	70.0
2015	June	Wet	18	4	69.0
2015	June	Wet	18	5	74.0
2015	June	Wet	18	6	75.0
2015	June	Wet	18	7	32.0
2015	June	Wet	18	8	33.0
2015	June	Wet	18	9	33.0
2015	June	Wet	18	10	70.0
2015	June	Wet	18	11	59.0

2015	June	Wet	18	12	55.0
2015	June	Wet	18	13	45.0
2015	June	Wet	18	14	46.0
2015	June	Wet	18	15	18.0
2015	June	Wet	18	16	21.0
2015	June	Wet	18	17	24.0
2015	June	Wet	18	18	13.0
2015	June	Wet	18	19	17.0
2015	June	Wet	18	20	13.0
2015	June	Wet	19	1	20.0
2015	June	Wet	19	2	19.0
2015	June	Wet	19	3	14.0
2015	June	Wet	19	4	14.0
2015	June	Wet	19	5	11.0
2015	June	Wet	19	6	11.0
2015	June	Wet	19	7	17.0
2015	June	Wet	19	8	63.0
2015	June	Wet	19	9	51.0
2015	June	Wet	19	10	30.0
2015	June	Wet	19	11	47.0
2015	June	Wet	19	12	37.0
2015	June	Wet	19	13	52.0
2015	June	Wet	19	14	66.0
2015	June	Wet	19	15	29.0
2015	June	Wet	19	16	28.0
2015	June	Wet	19	17	25.0
2015	June	Wet	19	18	26.0
2015	June	Wet	19	19	46.0
2015	June	Wet	19	20	41.0
2015	June	Wet	20	1	25.0
2015	June	Wet	20	2	27.0
2015	June	Wet	20	3	23.0
2015	June	Wet	20	4	43.0
2015	June	Wet	20	5	45.0
2015	June	Wet	20	6	49.0
2015	June	Wet	20	7	36.0
2015	June	Wet	20	8	50.0
2015	June	Wet	20	9	60.0
2015	June	Wet	20	10	36.0
2015	June	Wet	20	11	24.0
2015	June	Wet	20	12	28.0
2015	June	Wet	20	13	50.0
2015	June	Wet	20	14	45.0
2015	June	Wet	20	15	28.0
2015	June	Wet	20	16	37.0

2015	June	Wet	20	17	35.0
2015	June	Wet	20	18	34.0
2015	June	Wet	20	19	38.0
2015	June	Wet	20	20	11.0
2015	June	Control Dry	1	1	60.0
2015	June	Control Dry	1	2	34.0
2015	June	Control Dry	1	3	45.0
2015	June	Control Dry	1	4	43.0
2015	June	Control Dry	1	5	55.0
2015	June	Control Dry	1	6	47.0
2015	June	Control Dry	1	7	60.0
2015	June	Control Dry	1	8	55.0
2015	June	Control Dry	1	9	54.0
2015	June	Control Dry	1	10	60.0
2015	June	Control Dry	1	11	43.0
2015	June	Control Dry	1	12	30.0
2015	June	Control Dry	1	13	52.0
2015	June	Control Dry	1	14	43.0
2015	June	Control Dry	1	15	52.0
2015	June	Control Dry	1	16	53.0
2015	June	Control Dry	1	17	53.0
2015	June	Control Dry	1	18	78.0
2015	June	Control Dry	1	19	51.0
2015	June	Control Dry	1	20	38.0
2015	June	Control Dry	2	1	43.0
2015	June	Control Dry	2	2	56.0
2015	June	Control Dry	2	3	72.0

2015	June	Control Dry	2	4	75.0
2015	June	Control Dry	2	5	70.0
2015	June	Control Dry	2	6	58.0
2015	June	Control Dry	2	7	53.0
2015	June	Control Dry	2	8	72.0
2015	June	Control Dry	2	9	75.0
2015	June	Control Dry	2	10	83.0
2015	June	Control Dry	2	11	77.0
2015	June	Control Dry	2	12	90.0
2015	June	Control Dry	2	13	68.0
2015	June	Control Dry	2	14	80.0
2015	June	Control Dry	2	15	80.0
2015	June	Control Dry	2	16	78.0
2015	June	Control Dry	2	17	59.0
2015	June	Control Dry	2	18	83.0
2015	June	Control Dry	2	19	72.0
2015	June	Control Dry	2	20	73.0
2015	June	Control Dry	3	1	55.0
2015	June	Control Dry	3	2	59.0
2015	June	Control Dry	3	3	66.0
2015	June	Control Dry	3	4	59.0
2015	June	Control Dry	3	5	70.0
2015	June	Control Dry	3	6	54.0
2015	June	Control Dry	3	7	54.0
2015	June	Control Dry	3	8	65.0

2015	June	Control Dry	3	9	78.0
2015	June	Control Dry	3	10	76.0
2015	June	Control Dry	3	11	52.0
2015	June	Control Dry	3	12	55.0
2015	June	Control Dry	3	13	56.0
2015	June	Control Dry	3	14	60.0
2015	June	Control Dry	3	15	55.0
2015	June	Control Dry	3	16	59.0
2015	June	Control Dry	3	17	55.0
2015	June	Control Dry	3	18	67.0
2015	June	Control Dry	3	19	59.0
2015	June	Control Dry	3	20	47.0
2015	June	Control Dry	4	1	47.0
2015	June	Control Dry	4	2	48.0
2015	June	Control Dry	4	3	63.0
2015	June	Control Dry	4	4	58.0
2015	June	Control Dry	4	5	62.0
2015	June	Control Dry	4	6	74.0
2015	June	Control Dry	4	7	77.0
2015	June	Control Dry	4	8	85.0
2015	June	Control Dry	4	9	81.0
2015	June	Control Dry	4	10	87.0
2015	June	Control Dry	4	11	76.0
2015	June	Control Dry	4	12	74.0
2015	June	Control Dry	4	13	79.0

2015	June	Control Dry	4	14	46.0
2015	June	Control Dry	4	15	43.0
2015	June	Control Dry	4	16	54.0
2015	June	Control Dry	4	17	57.0
2015	June	Control Dry	4	18	59.0
2015	June	Control Dry	4	19	58.0
2015	June	Control Dry	4	20	58.0
2015	June	Control Dry	5	1	69.0
2015	June	Control Dry	5	2	68.0
2015	June	Control Dry	5	3	73.0
2015	June	Control Dry	5	4	62.0
2015	June	Control Dry	5	5	44.0
2015	June	Control Dry	5	6	49.0
2015	June	Control Dry	5	7	59.0
2015	June	Control Dry	5	8	51.0
2015	June	Control Dry	5	9	52.0
2015	June	Control Dry	5	10	53.0
2015	June	Control Dry	5	11	55.0
2015	June	Control Dry	5	12	46.0
2015	June	Control Dry	5	13	63.0
2015	June	Control Dry	5	14	57.0
2015	June	Control Dry	5	15	58.0
2015	June	Control Dry	5	16	73.0
2015	June	Control Dry	5	17	70.0
2015	June	Control Dry	5	18	39.0

2015	June	Control Dry	5	19	65.0
2015	June	Control Dry	5	20	52.0
2015	June	Control Dry	6	1	45.0
2015	June	Control Dry	6	2	48.0
2015	June	Control Dry	6	3	46.0
2015	June	Control Dry	6	4	50.0
2015	June	Control Dry	6	5	51.0
2015	June	Control Dry	6	6	46.0
2015	June	Control Dry	6	7	52.0
2015	June	Control Dry	6	8	57.0
2015	June	Control Dry	6	9	53.0
2015	June	Control Dry	6	10	54.0
2015	June	Control Dry	6	11	66.0
2015	June	Control Dry	6	12	56.0
2015	June	Control Dry	6	13	55.0
2015	June	Control Dry	6	14	62.0
2015	June	Control Dry	6	15	72.0
2015	June	Control Dry	6	16	54.0
2015	June	Control Dry	6	17	49.0
2015	June	Control Dry	6	18	47.0
2015	June	Control Dry	6	19	49.0
2015	June	Control Dry	6	20	51.0
2015	June	Control Dry	7	1	40.0
2015	June	Control Dry	7	2	47.0
2015	June	Control Dry	7	3	47.0

2015	June	Control Dry	7	4	36.0
2015	June	Control Dry	7	5	62.0
2015	June	Control Dry	7	6	60.0
2015	June	Control Dry	7	7	66.0
2015	June	Control Dry	7	8	56.0
2015	June	Control Dry	7	9	55.0
2015	June	Control Dry	7	10	43.0
2015	June	Control Dry	7	11	32.0
2015	June	Control Dry	7	12	40.0
2015	June	Control Dry	7	13	47.0
2015	June	Control Dry	7	14	36.0
2015	June	Control Dry	7	15	45.0
2015	June	Control Dry	7	16	56.0
2015	June	Control Dry	7	17	58.0
2015	June	Control Dry	7	18	65.0
2015	June	Control Dry	7	19	50.0
2015	June	Control Dry	7	20	34.0
2015	June	Control Dry	8	1	46.0
2015	June	Control Dry	8	2	55.0
2015	June	Control Dry	8	3	62.0
2015	June	Control Dry	8	4	60.0
2015	June	Control Dry	8	5	66.0
2015	June	Control Dry	8	6	63.0
2015	June	Control Dry	8	7	74.0
2015	June	Control Dry	8	8	60.0

2015	June	Control Dry	8	9	73.0
2015	June	Control Dry	8	10	60.0
2015	June	Control Dry	8	11	54.0
2015	June	Control Dry	8	12	34.0
2015	June	Control Dry	8	13	47.0
2015	June	Control Dry	8	14	52.0
2015	June	Control Dry	8	15	72.0
2015	June	Control Dry	8	16	58.0
2015	June	Control Dry	8	17	76.0
2015	June	Control Dry	8	18	89.0
2015	June	Control Dry	8	19	56.0
2015	June	Control Dry	8	20	71.0
2015	June	Control Dry	9	1	64.0
2015	June	Control Dry	9	2	43.0
2015	June	Control Dry	9	3	53.0
2015	June	Control Dry	9	4	52.0
2015	June	Control Dry	9	5	72.0
2015	June	Control Dry	9	6	52.0
2015	June	Control Dry	9	7	91.0
2015	June	Control Dry	9	8	59.0
2015	June	Control Dry	9	9	98.0
2015	June	Control Dry	9	10	82.0
2015	June	Control Dry	9	11	88.0
2015	June	Control Dry	9	12	76.0
2015	June	Control Dry	9	13	53.0

2015	June	Control Dry	9	14	67.0
2015	June	Control Dry	9	15	51.0
2015	June	Control Dry	9	16	62.0
2015	June	Control Dry	9	17	60.0
2015	June	Control Dry	9	18	58.0
2015	June	Control Dry	9	19	57.0
2015	June	Control Dry	9	20	42.0
2015	June	Control Dry	10	1	50.0
2015	June	Control Dry	10	2	66.0
2015	June	Control Dry	10	3	62.0
2015	June	Control Dry	10	4	63.0
2015	June	Control Dry	10	5	74.0
2015	June	Control Dry	10	6	63.0
2015	June	Control Dry	10	7	60.0
2015	June	Control Dry	10	8	59.0
2015	June	Control Dry	10	9	57.0
2015	June	Control Dry	10	10	47.0
2015	June	Control Dry	10	11	48.0
2015	June	Control Dry	10	12	49.0
2015	June	Control Dry	10	13	66.0
2015	June	Control Dry	10	14	70.0
2015	June	Control Dry	10	15	77.0
2015	June	Control Dry	10	16	78.0
2015	June	Control Dry	10	17	81.0
2015	June	Control Dry	10	18	40.0

2015	June	Control Dry	10	19	58.0
2015	June	Control Dry	10	20	78.0
2015	June	Control Dry	11	1	48.0
2015	June	Control Dry	11	2	62.0
2015	June	Control Dry	11	3	56.0
2015	June	Control Dry	11	4	60.0
2015	June	Control Dry	11	5	64.0
2015	June	Control Dry	11	6	40.0
2015	June	Control Dry	11	7	54.0
2015	June	Control Dry	11	8	73.0
2015	June	Control Dry	11	9	58.0
2015	June	Control Dry	11	10	57.0
2015	June	Control Dry	11	11	81.0
2015	June	Control Dry	11	12	75.0
2015	June	Control Dry	11	13	57.0
2015	June	Control Dry	11	14	65.0
2015	June	Control Dry	11	15	68.0
2015	June	Control Dry	11	16	63.0
2015	June	Control Dry	11	17	68.0
2015	June	Control Dry	11	18	56.0
2015	June	Control Dry	11	19	59.0
2015	June	Control Dry	11	20	66.0
2015	June	Control Dry	12	1	72.0
2015	June	Control Dry	12	2	58.0
2015	June	Control Dry	12	3	52.0

2015	June	Control Dry	12	4	46.0
2015	June	Control Dry	12	5	61.0
2015	June	Control Dry	12	6	65.0
2015	June	Control Dry	12	7	58.0
2015	June	Control Dry	12	8	59.0
2015	June	Control Dry	12	9	52.0
2015	June	Control Dry	12	10	73.0
2015	June	Control Dry	12	11	72.0
2015	June	Control Dry	12	12	54.0
2015	June	Control Dry	12	13	55.0
2015	June	Control Dry	12	14	73.0
2015	June	Control Dry	12	15	55.0
2015	June	Control Dry	12	16	69.0
2015	June	Control Dry	12	17	79.0
2015	June	Control Dry	12	18	65.0
2015	June	Control Dry	12	19	32.0
2015	June	Control Dry	12	20	39.0
2015	June	Control Dry	13	1	53.0
2015	June	Control Dry	13	2	48.0
2015	June	Control Dry	13	3	67.0
2015	June	Control Dry	13	4	67.0
2015	June	Control Dry	13	5	48.0
2015	June	Control Dry	13	6	44.0
2015	June	Control Dry	13	7	42.0
2015	June	Control Dry	13	8	48.0

2015	June	Control Dry	13	9	58.0
2015	June	Control Dry	13	10	52.0
2015	June	Control Dry	13	11	66.0
2015	June	Control Dry	13	12	58.0
2015	June	Control Dry	13	13	55.0
2015	June	Control Dry	13	14	43.0
2015	June	Control Dry	13	15	42.0
2015	June	Control Dry	13	16	48.0
2015	June	Control Dry	13	17	49.0
2015	June	Control Dry	13	18	58.0
2015	June	Control Dry	13	19	52.0
2015	June	Control Dry	13	20	51.0
2015	June	Control Dry	14	1	15.0
2015	June	Control Dry	14	2	56.0
2015	June	Control Dry	14	3	69.0
2015	June	Control Dry	14	4	59.0
2015	June	Control Dry	14	5	72.0
2015	June	Control Dry	14	6	77.0
2015	June	Control Dry	14	7	79.0
2015	June	Control Dry	14	8	70.0
2015	June	Control Dry	14	9	63.0
2015	June	Control Dry	14	10	63.0
2015	June	Control Dry	14	11	56.0
2015	June	Control Dry	14	12	59.0
2015	June	Control Dry	14	13	78.0

2015	June	Control Dry	14	14	71.0
2015	June	Control Dry	14	15	67.0
2015	June	Control Dry	14	16	69.0
2015	June	Control Dry	14	17	58.0
2015	June	Control Dry	14	18	52.0
2015	June	Control Dry	14	19	68.0
2015	June	Control Dry	14	20	67.0
2015	June	Control Dry	15	1	70.0
2015	June	Control Dry	15	2	56.0
2015	June	Control Dry	15	3	46.0
2015	June	Control Dry	15	4	50.0
2015	June	Control Dry	15	5	48.0
2015	June	Control Dry	15	6	36.0
2015	June	Control Dry	15	7	46.0
2015	June	Control Dry	15	8	48.0
2015	June	Control Dry	15	9	44.0
2015	June	Control Dry	15	10	72.0
2015	June	Control Dry	15	11	58.0
2015	June	Control Dry	15	12	42.0
2015	June	Control Dry	15	13	52.0
2015	June	Control Dry	15	14	45.0
2015	June	Control Dry	15	15	57.0
2015	June	Control Dry	15	16	60.0
2015	June	Control Dry	15	17	53.0
2015	June	Control Dry	15	18	58.0

2015	June	Control Dry	15	19	63.0
2015	June	Control Dry	15	20	58.0
2015	June	Control Dry	16	1	48.0
2015	June	Control Dry	16	2	46.0
2015	June	Control Dry	16	3	48.0
2015	June	Control Dry	16	4	47.0
2015	June	Control Dry	16	5	44.0
2015	June	Control Dry	16	6	68.0
2015	June	Control Dry	16	7	79.0
2015	June	Control Dry	16	8	63.0
2015	June	Control Dry	16	9	58.0
2015	June	Control Dry	16	10	45.0
2015	June	Control Dry	16	11	55.0
2015	June	Control Dry	16	12	57.0
2015	June	Control Dry	16	13	60.0
2015	June	Control Dry	16	14	51.0
2015	June	Control Dry	16	15	63.0
2015	June	Control Dry	16	16	88.0
2015	June	Control Dry	16	17	89.0
2015	June	Control Dry	16	18	82.0
2015	June	Control Dry	16	19	84.0
2015	June	Control Dry	16	20	76.0
2015	June	Control Dry	17	1	76.0
2015	June	Control Dry	17	2	96.0
2015	June	Control Dry	17	3	90.0

2015	June	Control Dry	17	4	67.0
2015	June	Control Dry	17	5	79.0
2015	June	Control Dry	17	6	69.0
2015	June	Control Dry	17	7	93.0
2015	June	Control Dry	17	8	64.0
2015	June	Control Dry	17	9	70.0
2015	June	Control Dry	17	10	92.0
2015	June	Control Dry	17	11	66.0
2015	June	Control Dry	17	12	75.0
2015	June	Control Dry	17	13	70.0
2015	June	Control Dry	17	14	89.0
2015	June	Control Dry	17	15	56.0
2015	June	Control Dry	17	16	70.0
2015	June	Control Dry	17	17	66.0
2015	June	Control Dry	17	18	82.0
2015	June	Control Dry	17	19	54.0
2015	June	Control Dry	17	20	63.0
2015	June	Control Dry	18	1	26.0
2015	June	Control Dry	18	2	49.0
2015	June	Control Dry	18	3	39.0
2015	June	Control Dry	18	4	62.0
2015	June	Control Dry	18	5	41.0
2015	June	Control Dry	18	6	49.0
2015	June	Control Dry	18	7	39.0
2015	June	Control Dry	18	8	59.0

2015	June	Control Dry	18	9	54.0
2015	June	Control Dry	18	10	63.0
2015	June	Control Dry	18	11	52.0
2015	June	Control Dry	18	12	44.0
2015	June	Control Dry	18	13	46.0
2015	June	Control Dry	18	14	56.0
2015	June	Control Dry	18	15	53.0
2015	June	Control Dry	18	16	58.0
2015	June	Control Dry	18	17	60.0
2015	June	Control Dry	18	18	63.0
2015	June	Control Dry	18	19	67.0
2015	June	Control Dry	18	20	68.0
2015	June	Control Dry	19	1	82.0
2015	June	Control Dry	19	2	91.0
2015	June	Control Dry	19	3	73.0
2015	June	Control Dry	19	4	77.0
2015	June	Control Dry	19	5	75.0
2015	June	Control Dry	19	6	79.0
2015	June	Control Dry	19	7	75.0
2015	June	Control Dry	19	8	65.0
2015	June	Control Dry	19	9	69.0
2015	June	Control Dry	19	10	78.0
2015	June	Control Dry	19	11	83.0
2015	June	Control Dry	19	12	84.0
2015	June	Control Dry	19	13	80.0

2015	June	Control Dry	19	14	86.0
2015	June	Control Dry	19	15	76.0
2015	June	Control Dry	19	16	90.0
2015	June	Control Dry	19	17	82.0
2015	June	Control Dry	19	18	65.0
2015	June	Control Dry	19	19	70.0
2015	June	Control Dry	19	20	59.0
2015	June	Control Dry	20	1	20.0
2015	June	Control Dry	20	2	26.0
2015	June	Control Dry	20	3	23.0
2015	June	Control Dry	20	4	25.0
2015	June	Control Dry	20	5	19.0
2015	June	Control Dry	20	6	27.0
2015	June	Control Dry	20	7	45.0
2015	June	Control Dry	20	8	48.0
2015	June	Control Dry	20	9	40.0
2015	June	Control Dry	20	10	46.0
2015	June	Control Dry	20	11	46.0
2015	June	Control Dry	20	12	52.0
2015	June	Control Dry	20	13	47.0
2015	June	Control Dry	20	14	54.0
2015	June	Control Dry	20	15	59.0
2015	June	Control Dry	20	16	46.0
2015	June	Control Dry	20	17	36.0
2015	June	Control Dry	20	18	55.0

2015	June	Control Dry	20	19	32.0
2015	June	Control Dry	20	20	45.0
2015	June	Mosaic	1	1	52.0
2015	June	Mosaic	1	2	57.0
2015	June	Mosaic	1	3	62.0
2015	June	Mosaic	1	4	68.0
2015	June	Mosaic	1	5	73.0
2015	June	Mosaic	1	6	68.0
2015	June	Mosaic	1	7	71.0
2015	June	Mosaic	1	8	78.0
2015	June	Mosaic	1	9	78.0
2015	June	Mosaic	1	10	78.0
2015	June	Mosaic	1	11	77.0
2015	June	Mosaic	1	12	74.0
2015	June	Mosaic	1	13	90.0
2015	June	Mosaic	1	14	89.0
2015	June	Mosaic	1	15	79.0
2015	June	Mosaic	1	16	70.0
2015	June	Mosaic	1	17	44.0
2015	June	Mosaic	1	18	46.0
2015	June	Mosaic	1	19	61.0
2015	June	Mosaic	1	20	83.0
2015	June	Mosaic	2	1	49.0
2015	June	Mosaic	2	2	55.0
2015	June	Mosaic	2	3	54.0
2015	June	Mosaic	2	4	58.0
2015	June	Mosaic	2	5	59.0
2015	June	Mosaic	2	6	47.0
2015	June	Mosaic	2	7	64.0
2015	June	Mosaic	2	8	63.0
2015	June	Mosaic	2	9	42.0
2015	June	Mosaic	2	10	46.0
2015	June	Mosaic	2	11	54.0
2015	June	Mosaic	2	12	48.0
2015	June	Mosaic	2	13	56.0
2015	June	Mosaic	2	14	57.0
2015	June	Mosaic	2	15	68.0
2015	June	Mosaic	2	16	66.0
2015	June	Mosaic	2	17	41.0
2015	June	Mosaic	2	18	43.0
2015	June	Mosaic	2	19	49.0
2015	June	Mosaic	2	20	40.0
2015	June	Mosaic	3	1	50.0

2015	June	Mosaic	3	2	55.0
2015	June	Mosaic	3	3	56.0
2015	June	Mosaic	3	4	45.0
2015	June	Mosaic	3	5	62.0
2015	June	Mosaic	3	6	57.0
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2015	June	Mosaic	3	8	56.0
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2015	June	Mosaic	4	19	34.0
2015	June	Mosaic	4	20	71.0
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2015	June	Mosaic	5	2	44.0
2015	June	Mosaic	5	3	48.0
2015	June	Mosaic	5	4	44.0
2015	June	Mosaic	5	5	47.0
2015	June	Mosaic	5	6	89.0

2015	June	Mosaic	5	7	46.0
2015	June	Mosaic	5	8	43.0
2015	June	Mosaic	5	9	50.0
2015	June	Mosaic	5	10	92.0
2015	June	Mosaic	5	11	56.0
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2015	June	Mosaic	5	20	73.0
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2015	June	Mosaic	6	5	44.0
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2015	June	Mosaic	7	7	48.0
2015	June	Mosaic	7	8	74.0
2015	June	Mosaic	7	9	88.0
2015	June	Mosaic	7	10	67.0
2015	June	Mosaic	7	11	67.0

2015	June	Mosaic	7	12	66.0
2015	June	Mosaic	7	13	68.0
2015	June	Mosaic	7	14	61.0
2015	June	Mosaic	7	15	72.0
2015	June	Mosaic	7	16	75.0
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2015	June	Mosaic	9	2	71.0
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2015	June	Mosaic	9	4	65.0
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2015	June	Mosaic	9	14	48.0
2015	June	Mosaic	9	15	48.0
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2015	June	Mosaic	11	17	63.0
2015	June	Mosaic	11	18	70.0
2015	June	Mosaic	11	19	60.0
2015	June	Mosaic	11	20	62.0
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2015	June	Mosaic	12	4	57.0
2015	June	Mosaic	12	5	69.0
2015	June	Mosaic	12	6	72.0
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2015	June	Mosaic	16	6	54.0
2015	June	Mosaic	16	7	62.0
2015	June	Mosaic	16	8	54.0
2015	June	Mosaic	16	9	23.0
2015	June	Mosaic	16	10	23.0
2015	June	Mosaic	16	11	50.0

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2015	June	Mosaic	16	15	43.0
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2015	June	Mosaic	18	14	56.0
2015	June	Mosaic	18	15	60.0
2015	June	Mosaic	18	16	59.0

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2015	June	Mosaic	18	18	72.0
2015	June	Mosaic	18	19	68.0
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2015	June	Mosaic	20	17	46.0
2015	June	Mosaic	20	18	43.0
2015	June	Mosaic	20	19	66.0
2015	June	Mosaic	20	20	64.0
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2015	June	Mosaic	21	4	45.0
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2015	June	Mosaic	21	6	75.0
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2015	June	Mosaic	21	9	58.0
2015	June	Mosaic	21	10	75.0
2015	June	Mosaic	21	11	40.0
2015	June	Mosaic	21	12	49.0
2015	June	Mosaic	21	13	30.0
2015	June	Mosaic	21	14	34.0
2015	June	Mosaic	21	15	58.0
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2015	June	Mosaic	21	17	60.0
2015	June	Mosaic	21	18	54.0
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2015	June	Mosaic	22	6	59.0
2015	June	Mosaic	22	7	70.0
2015	June	Mosaic	22	8	72.0
2015	June	Mosaic	22	9	79.0
2015	June	Mosaic	22	10	54.0
2015	June	Mosaic	22	11	62.0
2015	June	Mosaic	22	12	63.0
2015	June	Mosaic	22	13	73.0
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2015	June	Mosaic	22	15	62.0
2015	June	Mosaic	22	16	70.0
2015	June	Mosaic	22	17	42.0
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2015	June	Mosaic	22	19	46.0
2015	June	Mosaic	22	20	38.0
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2015	June	Mosaic	23	2	73.0
2015	June	Mosaic	23	3	49.0
2015	June	Mosaic	23	4	4.0
2015	June	Mosaic	23	5	47.0
2015	June	Mosaic	23	6	45.0

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2015	June	Mosaic	23	8	85.0
2015	June	Mosaic	23	9	89.0
2015	June	Mosaic	23	10	45.0
2015	June	Mosaic	23	11	78.0
2015	June	Mosaic	23	12	85.0
2015	June	Mosaic	23	13	88.0
2015	June	Mosaic	23	14	80.0
2015	June	Mosaic	23	15	88.0
2015	June	Mosaic	23	16	73.0
2015	June	Mosaic	23	17	48.0
2015	June	Mosaic	23	18	40.0
2015	June	Mosaic	23	19	68.0
2015	June	Mosaic	23	20	51.0
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2015	June	Mosaic	24	3	64.0
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2015	June	Mosaic	24	5	66.0
2015	June	Mosaic	24	6	56.0
2015	June	Mosaic	24	7	71.0
2015	June	Mosaic	24	8	46.0
2015	June	Mosaic	24	9	73.0
2015	June	Mosaic	24	10	74.0
2015	June	Mosaic	24	11	82.0
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2015	June	Mosaic	24	13	61.0
2015	June	Mosaic	24	14	62.0
2015	June	Mosaic	24	15	70.0
2015	June	Mosaic	24	16	63.0
2015	June	Mosaic	24	17	70.0
2015	June	Mosaic	24	18	71.0
2015	June	Mosaic	24	19	51.0
2015	June	Mosaic	24	20	46.0
2015	June	Mosaic	25	1	102.0
2015	June	Mosaic	25	2	105.0
2015	June	Mosaic	25	3	120.0
2015	June	Mosaic	25	4	72.0
2015	June	Mosaic	25	5	71.0
2015	June	Mosaic	25	6	83.0
2015	June	Mosaic	25	7	82.0
2015	June	Mosaic	25	8	82.0
2015	June	Mosaic	25	9	82.0
2015	June	Mosaic	25	10	90.0
2015	June	Mosaic	25	11	93.0

2015	June	Mosaic	25	12	83.0
2015	June	Mosaic	25	13	73.0
2015	June	Mosaic	25	14	88.0
2015	June	Mosaic	25	15	88.0
2015	June	Mosaic	25	16	60.0
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2015	June	Mosaic	26	5	39.0
2015	June	Mosaic	26	6	44.0
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2015	June	Mosaic	26	8	43.0
2015	June	Mosaic	26	9	46.0
2015	June	Mosaic	26	10	50.0
2015	June	Mosaic	26	11	33.0
2015	June	Mosaic	26	12	36.0
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2015	June	Mosaic	26	16	52.0
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2015	June	Mosaic	26	19	19.0
2015	June	Mosaic	26	20	34.0
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2015	June	Mosaic	27	4	56.0
2015	June	Mosaic	27	5	38.0
2015	June	Mosaic	27	6	48.0
2015	June	Mosaic	27	7	54.0
2015	June	Mosaic	27	8	30.0
2015	June	Mosaic	27	9	42.0
2015	June	Mosaic	27	10	43.0
2015	June	Mosaic	27	11	34.0
2015	June	Mosaic	27	12	46.0
2015	June	Mosaic	27	13	67.0
2015	June	Mosaic	27	14	68.0
2015	June	Mosaic	27	15	70.0
2015	June	Mosaic	27	16	52.0

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2015	June	Mosaic	27	18	72.0
2015	June	Mosaic	27	19	56.0
2015	June	Mosaic	27	20	41.0
2015	June	Mosaic	28	1	83.0
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2015	June	Mosaic	28	4	82.0
2015	June	Mosaic	28	5	74.0
2015	June	Mosaic	28	6	76.0
2015	June	Mosaic	28	7	86.0
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2015	June	Mosaic	29	14	43.0
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2015	June	Mosaic	29	17	52.0
2015	June	Mosaic	29	18	43.0
2015	June	Mosaic	29	19	60.0
2015	June	Mosaic	29	20	65.0
2015	June	Mosaic	30	1	30.0

2015	June	Mosaic	30	2	32.0
2015	June	Mosaic	30	3	40.0
2015	June	Mosaic	30	4	42.0
2015	June	Mosaic	30	5	36.0
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2015	June	Mosaic	30	18	38.0
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2015	June	Mosaic	31	14	62.0
2015	June	Mosaic	31	15	61.0
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2015	June	Mosaic	31	18	76.0
2015	June	Mosaic	31	19	78.0
2015	June	Mosaic	31	20	82.0
2015	June	Mosaic	32	1	86.0
2015	June	Mosaic	32	2	76.0
2015	June	Mosaic	32	3	59.0
2015	June	Mosaic	32	4	60.0
2015	June	Mosaic	32	5	65.0
2015	June	Mosaic	32	6	45.0

2015	June	Mosaic	32	7	47.0
2015	June	Mosaic	32	8	49.0
2015	June	Mosaic	32	9	56.0
2015	June	Mosaic	32	10	46.0
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2015	June	Mosaic	33	4	64.0
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2015	June	Mosaic	33	8	33.0
2015	June	Mosaic	33	9	47.0
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2015	June	Mosaic	33	13	53.0
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2015	June	Mosaic	33	16	50.0
2015	June	Mosaic	33	17	61.0
2015	June	Mosaic	33	18	65.0
2015	June	Mosaic	33	19	58.0
2015	June	Mosaic	33	20	62.0
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2015	June	Mosaic	34	2	64.0
2015	June	Mosaic	34	3	63.0
2015	June	Mosaic	34	4	66.0
2015	June	Mosaic	34	5	62.0
2015	June	Mosaic	34	6	57.0
2015	June	Mosaic	34	7	58.0
2015	June	Mosaic	34	8	55.0
2015	June	Mosaic	34	9	73.0
2015	June	Mosaic	34	10	64.0
2015	June	Mosaic	34	11	81.0

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2015	June	Mosaic	34	13	70.0
2015	June	Mosaic	34	14	71.0
2015	June	Mosaic	34	15	76.0
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2015	June	Mosaic	35	7	62.0
2015	June	Mosaic	35	8	69.0
2015	June	Mosaic	35	9	80.0
2015	June	Mosaic	35	10	72.0
2015	June	Mosaic	35	11	48.0
2015	June	Mosaic	35	12	55.0
2015	June	Mosaic	35	13	62.0
2015	June	Mosaic	35	14	58.0
2015	June	Mosaic	35	15	59.0
2015	June	Mosaic	35	16	60.0
2015	June	Mosaic	35	17	54.0
2015	June	Mosaic	35	18	59.0
2015	June	Mosaic	35	19	56.0
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2015	June	Mosaic	36	6	66.0
2015	June	Mosaic	36	7	54.0
2015	June	Mosaic	36	8	6.0
2015	June	Mosaic	36	9	62.0
2015	June	Mosaic	36	10	53.0
2015	June	Mosaic	36	11	51.0
2015	June	Mosaic	36	12	48.0
2015	June	Mosaic	36	13	72.0
2015	June	Mosaic	36	14	48.0
2015	June	Mosaic	36	15	52.0
2015	June	Mosaic	36	16	53.0

2015	June	Mosaic	36	17	66.0
2015	June	Mosaic	36	18	64.0
2015	June	Mosaic	36	19	63.0
2015	June	Mosaic	36	20	66.0
2015	June	Mosaic	37	1	51.0
2015	June	Mosaic	37	2	56.0
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2015	June	Mosaic	37	19	34.0
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2015	June	Mosaic	38	3	55.0
2015	June	Mosaic	38	4	78.0
2015	June	Mosaic	38	5	74.0
2015	June	Mosaic	38	6	63.0
2015	June	Mosaic	38	7	64.0
2015	June	Mosaic	38	8	44.0
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2015	June	Mosaic	38	10	63.0
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2015	June	Mosaic	38	14	25.0
2015	June	Mosaic	38	15	61.0
2015	June	Mosaic	38	16	39.0
2015	June	Mosaic	38	17	53.0
2015	June	Mosaic	38	18	58.0
2015	June	Mosaic	38	19	44.0
2015	June	Mosaic	38	20	45.0
2015	June	Mosaic	39	1	82.0

2015	June	Mosaic	39	2	85.0
2015	June	Mosaic	39	3	72.0
2015	June	Mosaic	39	4	72.0
2015	June	Mosaic	39	5	105.0
2015	June	Mosaic	39	6	38.0
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2015	June	Mosaic	40	9	63.0
2015	June	Mosaic	40	10	44.0
2015	June	Mosaic	40	11	48.0
2015	June	Mosaic	40	12	51.0
2015	June	Mosaic	40	13	58.0
2015	June	Mosaic	40	14	57.0
2015	June	Mosaic	40	15	62.0
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2015	June	Mosaic	40	17	70.0
2015	June	Mosaic	40	18	44.0
2015	June	Mosaic	40	19	46.0
2015	June	Mosaic	40	20	44.0
2015	October	Dry	1	1	33.0
2015	October	Dry	1	2	16.0
2015	October	Dry	1	3	37.0
2015	October	Dry	1	4	29.0
2015	October	Dry	1	5	12.0
2015	October	Dry	1	6	23.0

2015	October	Dry	1	7	23.0
2015	October	Dry	1	8	19.0
2015	October	Dry	1	9	25.0
2015	October	Dry	1	10	26.0
2015	October	Dry	1	11	28.0
2015	October	Dry	1	12	51.0
2015	October	Dry	1	13	80.0
2015	October	Dry	1	14	58.0
2015	October	Dry	1	15	42.0
2015	October	Dry	1	16	49.0
2015	October	Dry	1	17	18.0
2015	October	Dry	1	18	29.0
2015	October	Dry	1	19	11.0
2015	October	Dry	1	20	14.0
2015	October	Dry	2	1	6.0
2015	October	Dry	2	2	10.0
2015	October	Dry	2	3	11.0
2015	October	Dry	2	4	24.0
2015	October	Dry	2	5	11.0
2015	October	Dry	2	6	12.0
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2015	October	Dry	2	15	16.0
2015	October	Dry	2	16	16.0
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2015	October	Dry	2	18	19.0
2015	October	Dry	2	19	43.0
2015	October	Dry	2	20	23.0
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2015	October	Dry	3	4	29.0
2015	October	Dry	3	5	27.0
2015	October	Dry	3	6	34.0
2015	October	Dry	3	7	35.0
2015	October	Dry	3	8	25.0
2015	October	Dry	3	9	34.0
2015	October	Dry	3	10	19.0
2015	October	Dry	3	11	17.0

2015	October	Dry	3	12	80.0
2015	October	Dry	3	13	80.0
2015	October	Dry	3	14	59.0
2015	October	Dry	3	15	38.0
2015	October	Dry	3	16	45.0
2015	October	Dry	3	17	27.0
2015	October	Dry	3	18	67.0
2015	October	Dry	3	19	92.0
2015	October	Dry	3	20	82.0
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2015	October	Dry	4	4	19.0
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2015	October	Dry	4	11	44.0
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2015	October	Dry	4	13	30.0
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2015	October	Dry	4	18	37.0
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2015	October	Dry	5	9	34.0
2015	October	Dry	5	10	32.0
2015	October	Dry	5	11	64.0
2015	October	Dry	5	12	56.0
2015	October	Dry	5	13	30.0
2015	October	Dry	5	14	55.0
2015	October	Dry	5	15	30.0
2015	October	Dry	5	16	31.0

2015	October	Dry	5	17	28.0
2015	October	Dry	5	18	29.0
2015	October	Dry	5	19	19.0
2015	October	Dry	5	20	20.0
2015	October	Dry	6	1	9.0
2015	October	Dry	6	2	10.0
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2015	October	Dry	6	4	14.0
2015	October	Dry	6	5	26.0
2015	October	Dry	6	6	12.0
2015	October	Dry	6	7	11.0
2015	October	Dry	6	8	11.0
2015	October	Dry	6	9	13.0
2015	October	Dry	6	10	17.0
2015	October	Dry	6	11	22.0
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2015	October	Dry	6	13	46.0
2015	October	Dry	6	14	48.0
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2015	October	Dry	6	16	18.0
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2015	October	Dry	6	18	31.0
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2015	October	Dry	7	3	22.0
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2015	October	Dry	7	8	32.0
2015	October	Dry	7	9	38.0
2015	October	Dry	7	10	35.0
2015	October	Dry	7	11	12.0
2015	October	Dry	7	12	16.0
2015	October	Dry	7	13	40.0
2015	October	Dry	7	14	44.0
2015	October	Dry	7	15	12.0
2015	October	Dry	7	16	11.0
2015	October	Dry	7	17	16.0
2015	October	Dry	7	18	23.0
2015	October	Dry	7	19	18.0
2015	October	Dry	7	20	22.0
2015	October	Dry	8	1	29.0

2015	October	Dry	8	2	28.0
2015	October	Dry	8	3	35.0
2015	October	Dry	8	4	47.0
2015	October	Dry	8	5	27.0
2015	October	Dry	8	6	28.0
2015	October	Dry	8	7	53.0
2015	October	Dry	8	8	27.0
2015	October	Dry	8	9	23.0
2015	October	Dry	8	10	37.0
2015	October	Dry	8	11	36.0
2015	October	Dry	8	12	27.0
2015	October	Dry	8	13	26.0
2015	October	Dry	8	14	50.0
2015	October	Dry	8	15	37.0
2015	October	Dry	8	16	39.0
2015	October	Dry	8	17	53.0
2015	October	Dry	8	18	23.0
2015	October	Dry	8	19	52.0
2015	October	Dry	8	20	23.0
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2015	October	Wet	19	13	16.0
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2015	October	Wet	19	19	35.0
2015	October	Wet	19	20	21.0
2015	October	Wet	20	1	27.0
2015	October	Wet	20	2	27.0
2015	October	Wet	20	3	50.0
2015	October	Wet	20	4	57.0
2015	October	Wet	20	5	20.0
2015	October	Wet	20	6	19.0
2015	October	Wet	20	7	19.0
2015	October	Wet	20	8	26.0
2015	October	Wet	20	9	27.0
2015	October	Wet	20	10	44.0
2015	October	Wet	20	11	43.0
2015	October	Wet	20	12	14.0
2015	October	Wet	20	13	14.0
2015	October	Wet	20	14	34.0
2015	October	Wet	20	15	39.0
2015	October	Wet	20	16	18.0
2015	October	Wet	20	17	60.0
2015	October	Wet	20	18	27.0
2015	October	Wet	20	19	43.0
2015	October	Wet	20	20	52.0
2015	October	Control Dry	1	1	37.0
2015	October	Control Dry	1	2	44.0
2015	October	Control Dry	1	3	47.0
2015	October	Control Dry	1	4	48.0
2015	October	Control Dry	1	5	40.0
2015	October	Control Dry	1	6	51.0
2015	October	Control Dry	1	7	45.0
2015	October	Control Dry	1	8	45.0
2015	October	Control Dry	1	9	55.0
2015	October	Control Dry	1	10	34.0
2015	October	Control Dry	1	11	51.0

2015	October	Control Dry	1	12	46.0
2015	October	Control Dry	1	13	50.0
2015	October	Control Dry	1	14	42.0
2015	October	Control Dry	1	15	43.0
2015	October	Control Dry	1	16	53.0
2015	October	Control Dry	1	17	48.0
2015	October	Control Dry	1	18	37.0
2015	October	Control Dry	1	19	38.0
2015	October	Control Dry	1	20	46.0
2015	October	Control Dry	2	1	63.0
2015	October	Control Dry	2	2	55.0
2015	October	Control Dry	2	3	58.0
2015	October	Control Dry	2	4	63.0
2015	October	Control Dry	2	5	74.0
2015	October	Control Dry	2	6	74.0
2015	October	Control Dry	2	7	81.0
2015	October	Control Dry	2	8	68.0
2015	October	Control Dry	2	9	51.0
2015	October	Control Dry	2	10	73.0
2015	October	Control Dry	2	11	67.0
2015	October	Control Dry	2	12	66.0
2015	October	Control Dry	2	13	71.0
2015	October	Control Dry	2	14	58.0
2015	October	Control Dry	2	15	67.0
2015	October	Control Dry	2	16	51.0

2015	October	Control Dry	2	17	52.0
2015	October	Control Dry	2	18	64.0
2015	October	Control Dry	2	19	64.0
2015	October	Control Dry	2	20	71.0
2015	October	Control Dry	3	1	46.0
2015	October	Control Dry	3	2	53.0
2015	October	Control Dry	3	3	44.0
2015	October	Control Dry	3	4	53.0
2015	October	Control Dry	3	5	38.0
2015	October	Control Dry	3	6	48.0
2015	October	Control Dry	3	7	56.0
2015	October	Control Dry	3	8	58.0
2015	October	Control Dry	3	9	67.0
2015	October	Control Dry	3	10	65.0
2015	October	Control Dry	3	11	72.0
2015	October	Control Dry	3	12	60.0
2015	October	Control Dry	3	13	71.0
2015	October	Control Dry	3	14	54.0
2015	October	Control Dry	3	15	53.0
2015	October	Control Dry	3	16	54.0
2015	October	Control Dry	3	17	44.0
2015	October	Control Dry	3	18	47.0
2015	October	Control Dry	3	19	58.0
2015	October	Control Dry	3	20	39.0
2015	October	Control Dry	4	1	72.0

2015	October	Control Dry	4	2	85.0
2015	October	Control Dry	4	3	56.0
2015	October	Control Dry	4	4	54.0
2015	October	Control Dry	4	5	56.0
2015	October	Control Dry	4	6	57.0
2015	October	Control Dry	4	7	41.0
2015	October	Control Dry	4	8	40.0
2015	October	Control Dry	4	9	59.0
2015	October	Control Dry	4	10	50.0
2015	October	Control Dry	4	11	59.0
2015	October	Control Dry	4	12	70.0
2015	October	Control Dry	4	13	48.0
2015	October	Control Dry	4	14	43.0
2015	October	Control Dry	4	15	49.0
2015	October	Control Dry	4	16	52.0
2015	October	Control Dry	4	17	53.0
2015	October	Control Dry	4	18	59.0
2015	October	Control Dry	4	19	65.0
2015	October	Control Dry	4	20	72.0
2015	October	Control Dry	5	1	72.0
2015	October	Control Dry	5	2	73.0
2015	October	Control Dry	5	3	57.0
2015	October	Control Dry	5	4	63.0
2015	October	Control Dry	5	5	67.0
2015	October	Control Dry	5	6	46.0

2015	October	Control Dry	5	7	45.0
2015	October	Control Dry	5	8	55.0
2015	October	Control Dry	5	9	65.0
2015	October	Control Dry	5	10	73.0
2015	October	Control Dry	5	11	59.0
2015	October	Control Dry	5	12	69.0
2015	October	Control Dry	5	13	50.0
2015	October	Control Dry	5	14	60.0
2015	October	Control Dry	5	15	62.0
2015	October	Control Dry	5	16	43.0
2015	October	Control Dry	5	17	44.0
2015	October	Control Dry	5	18	62.0
2015	October	Control Dry	5	19	57.0
2015	October	Control Dry	5	20	56.0
2015	October	Control Dry	6	1	51.0
2015	October	Control Dry	6	2	59.0
2015	October	Control Dry	6	3	58.0
2015	October	Control Dry	6	4	69.0
2015	October	Control Dry	6	5	62.0
2015	October	Control Dry	6	6	67.0
2015	October	Control Dry	6	7	72.0
2015	October	Control Dry	6	8	58.0
2015	October	Control Dry	6	9	40.0
2015	October	Control Dry	6	10	42.0
2015	October	Control Dry	6	11	35.0

2015	October	Control Dry	6	12	45.0
2015	October	Control Dry	6	13	38.0
2015	October	Control Dry	6	14	54.0
2015	October	Control Dry	6	15	58.0
2015	October	Control Dry	6	16	62.0
2015	October	Control Dry	6	17	49.0
2015	October	Control Dry	6	18	45.0
2015	October	Control Dry	6	19	49.0
2015	October	Control Dry	6	20	49.0
2015	October	Control Dry	7	1	46.0
2015	October	Control Dry	7	2	50.0
2015	October	Control Dry	7	3	53.0
2015	October	Control Dry	7	4	42.0
2015	October	Control Dry	7	5	68.0
2015	October	Control Dry	7	6	33.0
2015	October	Control Dry	7	7	36.0
2015	October	Control Dry	7	8	53.0
2015	October	Control Dry	7	9	42.0
2015	October	Control Dry	7	10	40.0
2015	October	Control Dry	7	11	46.0
2015	October	Control Dry	7	12	37.0
2015	October	Control Dry	7	13	37.0
2015	October	Control Dry	7	14	40.0
2015	October	Control Dry	7	15	41.0
2015	October	Control Dry	7	16	45.0

2015	October	Control Dry	7	17	60.0
2015	October	Control Dry	7	18	57.0
2015	October	Control Dry	7	19	36.0
2015	October	Control Dry	7	20	61.0
2015	October	Control Dry	8	1	66.0
2015	October	Control Dry	8	2	70.0
2015	October	Control Dry	8	3	77.0
2015	October	Control Dry	8	4	72.0
2015	October	Control Dry	8	5	70.0
2015	October	Control Dry	8	6	58.0
2015	October	Control Dry	8	7	52.0
2015	October	Control Dry	8	8	73.0
2015	October	Control Dry	8	9	78.0
2015	October	Control Dry	8	10	63.0
2015	October	Control Dry	8	11	80.0
2015	October	Control Dry	8	12	79.0
2015	October	Control Dry	8	13	71.0
2015	October	Control Dry	8	14	74.0
2015	October	Control Dry	8	15	86.0
2015	October	Control Dry	8	16	82.0
2015	October	Control Dry	8	17	58.0
2015	October	Control Dry	8	18	73.0
2015	October	Control Dry	8	19	69.0
2015	October	Control Dry	8	20	72.0
2015	October	Control Dry	9	1	62.0

2015	October	Control Dry	9	2	67.0
2015	October	Control Dry	9	3	54.0
2015	October	Control Dry	9	4	53.0
2015	October	Control Dry	9	5	64.0
2015	October	Control Dry	9	6	58.0
2015	October	Control Dry	9	7	66.0
2015	October	Control Dry	9	8	68.0
2015	October	Control Dry	9	9	51.0
2015	October	Control Dry	9	10	55.0
2015	October	Control Dry	9	11	60.0
2015	October	Control Dry	9	12	46.0
2015	October	Control Dry	9	13	49.0
2015	October	Control Dry	9	14	52.0
2015	October	Control Dry	9	15	58.0
2015	October	Control Dry	9	16	59.0
2015	October	Control Dry	9	17	60.0
2015	October	Control Dry	9	18	48.0
2015	October	Control Dry	9	19	19.0
2015	October	Control Dry	9	20	62.0
2015	October	Control Dry	10	1	37.0
2015	October	Control Dry	10	2	47.0
2015	October	Control Dry	10	3	46.0
2015	October	Control Dry	10	4	45.0
2015	October	Control Dry	10	5	45.0
2015	October	Control Dry	10	6	39.0

2015	October	Control Dry	10	7	41.0
2015	October	Control Dry	10	8	81.0
2015	October	Control Dry	10	9	63.0
2015	October	Control Dry	10	10	84.0
2015	October	Control Dry	10	11	57.0
2015	October	Control Dry	10	12	63.0
2015	October	Control Dry	10	13	75.0
2015	October	Control Dry	10	14	78.0
2015	October	Control Dry	10	15	52.0
2015	October	Control Dry	10	16	57.0
2015	October	Control Dry	10	17	67.0
2015	October	Control Dry	10	18	53.0
2015	October	Control Dry	10	19	54.0
2015	October	Control Dry	10	20	62.0
2015	October	Control Dry	11	1	38.0
2015	October	Control Dry	11	2	47.0
2015	October	Control Dry	11	3	49.0
2015	October	Control Dry	11	4	39.0
2015	October	Control Dry	11	5	70.0
2015	October	Control Dry	11	6	40.0
2015	October	Control Dry	11	7	45.0
2015	October	Control Dry	11	8	46.0
2015	October	Control Dry	11	9	49.0
2015	October	Control Dry	11	10	63.0
2015	October	Control Dry	11	11	42.0

2015	October	Control Dry	11	12	43.0
2015	October	Control Dry	11	13	33.0
2015	October	Control Dry	11	14	38.0
2015	October	Control Dry	11	15	34.0
2015	October	Control Dry	11	16	27.0
2015	October	Control Dry	11	17	35.0
2015	October	Control Dry	11	18	38.0
2015	October	Control Dry	11	19	37.0
2015	October	Control Dry	11	20	52.0
2015	October	Control Dry	12	1	45.0
2015	October	Control Dry	12	2	55.0
2015	October	Control Dry	12	3	75.0
2015	October	Control Dry	12	4	78.0
2015	October	Control Dry	12	5	88.0
2015	October	Control Dry	12	6	35.0
2015	October	Control Dry	12	7	45.0
2015	October	Control Dry	12	8	43.0
2015	October	Control Dry	12	9	72.0
2015	October	Control Dry	12	10	67.0
2015	October	Control Dry	12	11	68.0
2015	October	Control Dry	12	12	66.0
2015	October	Control Dry	12	13	67.0
2015	October	Control Dry	12	14	40.0
2015	October	Control Dry	12	15	41.0
2015	October	Control Dry	12	16	44.0

2015	October	Control Dry	12	17	32.0
2015	October	Control Dry	12	18	39.0
2015	October	Control Dry	12	19	38.0
2015	October	Control Dry	12	20	61.0
2015	October	Control Dry	13	1	47.0
2015	October	Control Dry	13	2	60.0
2015	October	Control Dry	13	3	57.0
2015	October	Control Dry	13	4	70.0
2015	October	Control Dry	13	5	59.0
2015	October	Control Dry	13	6	70.0
2015	October	Control Dry	13	7	47.0
2015	October	Control Dry	13	8	44.0
2015	October	Control Dry	13	9	50.0
2015	October	Control Dry	13	10	77.0
2015	October	Control Dry	13	11	67.0
2015	October	Control Dry	13	12	55.0
2015	October	Control Dry	13	13	57.0
2015	October	Control Dry	13	14	68.0
2015	October	Control Dry	13	15	72.0
2015	October	Control Dry	13	16	80.0
2015	October	Control Dry	13	17	87.0
2015	October	Control Dry	13	18	68.0
2015	October	Control Dry	13	19	60.0
2015	October	Control Dry	13	20	73.0
2015	October	Control Dry	14	1	22.0

2015	October	Control Dry	14	2	25.0
2015	October	Control Dry	14	3	71.0
2015	October	Control Dry	14	4	65.0
2015	October	Control Dry	14	5	63.0
2015	October	Control Dry	14	6	66.0
2015	October	Control Dry	14	7	59.0
2015	October	Control Dry	14	8	82.0
2015	October	Control Dry	14	9	70.0
2015	October	Control Dry	14	10	69.0
2015	October	Control Dry	14	11	71.0
2015	October	Control Dry	14	12	70.0
2015	October	Control Dry	14	13	67.0
2015	October	Control Dry	14	14	65.0
2015	October	Control Dry	14	15	45.0
2015	October	Control Dry	14	16	44.0
2015	October	Control Dry	14	17	46.0
2015	October	Control Dry	14	18	55.0
2015	October	Control Dry	14	19	54.0
2015	October	Control Dry	14	20	53.0
2015	October	Control Dry	15	1	57.0
2015	October	Control Dry	15	2	70.0
2015	October	Control Dry	15	3	55.0
2015	October	Control Dry	15	4	67.0
2015	October	Control Dry	15	5	53.0
2015	October	Control Dry	15	6	60.0

2015	October	Control Dry	15	7	78.0
2015	October	Control Dry	15	8	44.0
2015	October	Control Dry	15	9	39.0
2015	October	Control Dry	15	10	56.0
2015	October	Control Dry	15	11	55.0
2015	October	Control Dry	15	12	54.0
2015	October	Control Dry	15	13	62.0
2015	October	Control Dry	15	14	65.0
2015	October	Control Dry	15	15	57.0
2015	October	Control Dry	15	16	58.0
2015	October	Control Dry	15	17	64.0
2015	October	Control Dry	15	18	45.0
2015	October	Control Dry	15	19	72.0
2015	October	Control Dry	15	20	58.0
2015	October	Control Dry	16	1	49.0
2015	October	Control Dry	16	2	48.0
2015	October	Control Dry	16	3	62.0
2015	October	Control Dry	16	4	64.0
2015	October	Control Dry	16	5	67.0
2015	October	Control Dry	16	6	57.0
2015	October	Control Dry	16	7	60.0
2015	October	Control Dry	16	8	61.0
2015	October	Control Dry	16	9	55.0
2015	October	Control Dry	16	10	70.0
2015	October	Control Dry	16	11	72.0

2015	October	Control Dry	16	12	79.0
2015	October	Control Dry	16	13	83.0
2015	October	Control Dry	16	14	62.0
2015	October	Control Dry	16	15	65.0
2015	October	Control Dry	16	16	74.0
2015	October	Control Dry	16	17	86.0
2015	October	Control Dry	16	18	97.0
2015	October	Control Dry	16	19	64.0
2015	October	Control Dry	16	20	72.0
2015	October	Control Dry	17	1	57.0
2015	October	Control Dry	17	2	62.0
2015	October	Control Dry	17	3	70.0
2015	October	Control Dry	17	4	73.0
2015	October	Control Dry	17	5	84.0
2015	October	Control Dry	17	6	59.0
2015	October	Control Dry	17	7	74.0
2015	October	Control Dry	17	8	79.0
2015	October	Control Dry	17	9	74.0
2015	October	Control Dry	17	10	84.0
2015	October	Control Dry	17	11	61.0
2015	October	Control Dry	17	12	73.0
2015	October	Control Dry	17	13	79.0
2015	October	Control Dry	17	14	86.0
2015	October	Control Dry	17	15	82.0
2015	October	Control Dry	17	16	87.0

2015	October	Control Dry	17	17	62.0
2015	October	Control Dry	17	18	63.0
2015	October	Control Dry	17	19	74.0
2015	October	Control Dry	17	20	76.0
2015	October	Control Dry	18	1	52.0
2015	October	Control Dry	18	2	42.0
2015	October	Control Dry	18	3	49.0
2015	October	Control Dry	18	4	54.0
2015	October	Control Dry	18	5	51.0
2015	October	Control Dry	18	6	56.0
2015	October	Control Dry	18	7	54.0
2015	October	Control Dry	18	8	59.0
2015	October	Control Dry	18	9	61.0
2015	October	Control Dry	18	10	63.0
2015	October	Control Dry	18	11	59.0
2015	October	Control Dry	18	12	55.0
2015	October	Control Dry	18	13	60.0
2015	October	Control Dry	18	14	57.0
2015	October	Control Dry	18	15	48.0
2015	October	Control Dry	18	16	57.0
2015	October	Control Dry	18	17	49.0
2015	October	Control Dry	18	18	57.0
2015	October	Control Dry	18	19	59.0
2015	October	Control Dry	18	20	58.0
2015	October	Control Dry	19	1	75.0

2015	October	Control Dry	19	2	82.0
2015	October	Control Dry	19	3	72.0
2015	October	Control Dry	19	4	62.0
2015	October	Control Dry	19	5	72.0
2015	October	Control Dry	19	6	70.0
2015	October	Control Dry	19	7	82.0
2015	October	Control Dry	19	8	84.0
2015	October	Control Dry	19	9	72.0
2015	October	Control Dry	19	10	71.0
2015	October	Control Dry	19	11	67.0
2015	October	Control Dry	19	12	54.0
2015	October	Control Dry	19	13	60.0
2015	October	Control Dry	19	14	44.0
2015	October	Control Dry	19	15	82.0
2015	October	Control Dry	19	16	68.0
2015	October	Control Dry	19	17	70.0
2015	October	Control Dry	19	18	52.0
2015	October	Control Dry	19	19	56.0
2015	October	Control Dry	19	20	61.0
2015	October	Control Dry	20	1	62.0
2015	October	Control Dry	20	2	48.0
2015	October	Control Dry	20	3	52.0
2015	October	Control Dry	20	4	55.0
2015	October	Control Dry	20	5	64.0
2015	October	Control Dry	20	6	68.0

2015	October	Control Dry	20	7	69.0
2015	October	Control Dry	20	8	54.0
2015	October	Control Dry	20	9	30.0
2015	October	Control Dry	20	10	31.0
2015	October	Control Dry	20	11	43.0
2015	October	Control Dry	20	12	50.0
2015	October	Control Dry	20	13	62.0
2015	October	Control Dry	20	14	54.0
2015	October	Control Dry	20	15	34.0
2015	October	Control Dry	20	16	58.0
2015	October	Control Dry	20	17	34.0
2015	October	Control Dry	20	18	43.0
2015	October	Control Dry	20	19	52.0
2015	October	Control Dry	20	20	63.0
2015	October	Mosaic	1	1	55.0
2015	October	Mosaic	1	2	58.0
2015	October	Mosaic	1	3	65.0
2015	October	Mosaic	1	4	68.0
2015	October	Mosaic	1	5	55.0
2015	October	Mosaic	1	6	59.0
2015	October	Mosaic	1	7	57.0
2015	October	Mosaic	1	8	59.0
2015	October	Mosaic	1	9	70.0
2015	October	Mosaic	1	10	61.0
2015	October	Mosaic	1	11	76.0
2015	October	Mosaic	1	12	51.0
2015	October	Mosaic	1	13	54.0
2015	October	Mosaic	1	14	37.0
2015	October	Mosaic	1	15	33.0
2015	October	Mosaic	1	16	35.0
2015	October	Mosaic	1	17	69.0
2015	October	Mosaic	1	18	69.0
2015	October	Mosaic	1	19	55.0
2015	October	Mosaic	1	20	62.0

2015	October	Mosaic	2	1	50.0
2015	October	Mosaic	2	2	54.0
2015	October	Mosaic	2	3	67.0
2015	October	Mosaic	2	4	60.0
2015	October	Mosaic	2	5	54.0
2015	October	Mosaic	2	6	61.0
2015	October	Mosaic	2	7	32.0
2015	October	Mosaic	2	8	34.0
2015	October	Mosaic	2	9	48.0
2015	October	Mosaic	2	10	62.0
2015	October	Mosaic	2	11	49.0
2015	October	Mosaic	2	12	47.0
2015	October	Mosaic	2	13	27.0
2015	October	Mosaic	2	14	34.0
2015	October	Mosaic	2	15	29.0
2015	October	Mosaic	2	16	39.0
2015	October	Mosaic	2	17	56.0
2015	October	Mosaic	2	18	65.0
2015	October	Mosaic	2	19	68.0
2015	October	Mosaic	2	20	55.0
2015	October	Mosaic	3	1	39.0
2015	October	Mosaic	3	2	35.0
2015	October	Mosaic	3	3	36.0
2015	October	Mosaic	3	4	49.0
2015	October	Mosaic	3	5	49.0
2015	October	Mosaic	3	6	51.0
2015	October	Mosaic	3	7	70.0
2015	October	Mosaic	3	8	60.0
2015	October	Mosaic	3	9	50.0
2015	October	Mosaic	3	10	69.0
2015	October	Mosaic	3	11	71.0
2015	October	Mosaic	3	12	58.0
2015	October	Mosaic	3	13	58.0
2015	October	Mosaic	3	14	60.0
2015	October	Mosaic	3	15	59.0
2015	October	Mosaic	3	16	57.0
2015	October	Mosaic	3	17	56.0
2015	October	Mosaic	3	18	59.0
2015	October	Mosaic	3	19	46.0
2015	October	Mosaic	3	20	53.0
2015	October	Mosaic	4	1	62.0
2015	October	Mosaic	4	2	58.0
2015	October	Mosaic	4	3	59.0
2015	October	Mosaic	4	4	63.0
2015	October	Mosaic	4	5	50.0

2015	October	Mosaic	4	6	53.0
2015	October	Mosaic	4	7	72.0
2015	October	Mosaic	4	8	73.0
2015	October	Mosaic	4	9	43.0
2015	October	Mosaic	4	10	43.0
2015	October	Mosaic	4	11	52.0
2015	October	Mosaic	4	12	67.0
2015	October	Mosaic	4	13	60.0
2015	October	Mosaic	4	14	38.0
2015	October	Mosaic	4	15	50.0
2015	October	Mosaic	4	16	51.0
2015	October	Mosaic	4	17	47.0
2015	October	Mosaic	4	18	54.0
2015	October	Mosaic	4	19	58.0
2015	October	Mosaic	4	20	61.0
2015	October	Mosaic	5	1	45.0
2015	October	Mosaic	5	2	47.0
2015	October	Mosaic	5	3	51.0
2015	October	Mosaic	5	4	52.0
2015	October	Mosaic	5	5	59.0
2015	October	Mosaic	5	6	57.0
2015	October	Mosaic	5	7	66.0
2015	October	Mosaic	5	8	50.0
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2015	October	Mosaic	30	20	77.0
2015	October	Mosaic	31	1	42.0
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2015	October	Mosaic	31	9	77.0
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2015	October	Mosaic	37	16	37.0
2015	October	Mosaic	37	17	42.0
2015	October	Mosaic	37	18	44.0
2015	October	Mosaic	37	19	56.0
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2016	October	Wet	1	15	28.0
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2016	October	Wet	1	17	75.0
2016	October	Wet	1	18	27.0
2016	October	Wet	1	19	51.0
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2016	October	Wet	2	16	19.0
2016	October	Wet	2	17	22.0
2016	October	Wet	2	18	23.0
2016	October	Wet	2	19	19.0
2016	October	Wet	2	20	26.0

2016	October	Wet	3	1	9.0
2016	October	Wet	3	2	6.0
2016	October	Wet	3	3	10.0
2016	October	Wet	3	4	8.0
2016	October	Wet	3	5	19.0
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2016	October	Wet	11	20	27.0

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2016	October	Wet	14	4	28.0
2016	October	Wet	14	5	22.0

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2016	October	Wet	14	8	48.0
2016	October	Wet	14	9	21.0
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2016	October	Wet	16	6	62.0
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2016	October	Wet	16	8	22.0
2016	October	Wet	16	9	24.0
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2016	October	Wet	18	12	12.0
2016	October	Wet	18	13	11.0
2016	October	Wet	18	14	11.0
2016	October	Wet	18	15	22.0

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2016	October	Wet	18	17	23.0
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2016	October	Wet	18	20	21.0
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2016	October	Wet	20	16	54.0
2016	October	Wet	20	17	49.0
2016	October	Wet	20	18	36.0
2016	October	Wet	20	19	52.0
2016	October	Wet	20	20	48.0

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2016	October	Control Dry	1	2	78.0
2016	October	Control Dry	1	3	33.0
2016	October	Control Dry	1	4	36.0
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2016	October	Control Dry	2	2	41.0
2016	October	Control Dry	2	3	57.0
2016	October	Control Dry	2	4	58.0
2016	October	Control Dry	2	5	55.0

2016	October	Control Dry	2	6	79.0
2016	October	Control Dry	2	7	49.0
2016	October	Control Dry	2	8	52.0
2016	October	Control Dry	2	9	56.0
2016	October	Control Dry	2	10	82.0
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2016	October	Control Dry	3	9	64.0
2016	October	Control Dry	3	10	68.0

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2016	October	Control Dry	5	18	90.0
2016	October	Control Dry	5	19	90.0
2016	October	Control Dry	5	20	78.0

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2016	October	Control Dry	7	2	55.0
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2016	October	Control Dry	7	4	44.0
2016	October	Control Dry	7	5	47.0

2016	October	Control Dry	7	6	49.0
2016	October	Control Dry	7	7	51.0
2016	October	Control Dry	7	8	58.0
2016	October	Control Dry	7	9	46.0
2016	October	Control Dry	7	10	66.0
2016	October	Control Dry	7	11	71.0
2016	October	Control Dry	7	12	58.0
2016	October	Control Dry	7	13	39.0
2016	October	Control Dry	7	14	44.0
2016	October	Control Dry	7	15	56.0
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2016	October	Control Dry	7	19	59.0
2016	October	Control Dry	7	20	28.0
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2016	October	Control Dry	8	3	57.0
2016	October	Control Dry	8	4	63.0
2016	October	Control Dry	8	5	60.0
2016	October	Control Dry	8	6	64.0
2016	October	Control Dry	8	7	75.0
2016	October	Control Dry	8	8	66.0
2016	October	Control Dry	8	9	59.0
2016	October	Control Dry	8	10	52.0

2016	October	Control Dry	8	11	70.0
2016	October	Control Dry	8	12	64.0
2016	October	Control Dry	8	13	70.0
2016	October	Control Dry	8	14	62.0
2016	October	Control Dry	8	15	58.0
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2016	October	Control Dry	8	17	44.0
2016	October	Control Dry	8	18	86.0
2016	October	Control Dry	8	19	69.0
2016	October	Control Dry	8	20	59.0
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2016	October	Control Dry	9	2	63.0
2016	October	Control Dry	9	3	77.0
2016	October	Control Dry	9	4	88.0
2016	October	Control Dry	9	5	88.0
2016	October	Control Dry	9	6	92.0
2016	October	Control Dry	9	7	81.0
2016	October	Control Dry	9	8	77.0
2016	October	Control Dry	9	9	70.0
2016	October	Control Dry	9	10	68.0
2016	October	Control Dry	9	11	83.0
2016	October	Control Dry	9	12	83.0
2016	October	Control Dry	9	13	77.0
2016	October	Control Dry	9	14	69.0
2016	October	Control Dry	9	15	61.0

2016	October	Control Dry	9	16	69.0
2016	October	Control Dry	9	17	55.0
2016	October	Control Dry	9	18	52.0
2016	October	Control Dry	9	19	60.0
2016	October	Control Dry	9	20	70.0
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2016	October	Control Dry	10	2	58.0
2016	October	Control Dry	10	3	42.0
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2016	October	Control Dry	10	15	50.0
2016	October	Control Dry	10	16	55.0
2016	October	Control Dry	10	17	49.0
2016	October	Control Dry	10	18	41.0
2016	October	Control Dry	10	19	58.0
2016	October	Control Dry	10	20	59.0

2016	October	Control Dry	11	1	80.0
2016	October	Control Dry	11	2	79.0
2016	October	Control Dry	11	3	72.0
2016	October	Control Dry	11	4	77.0
2016	October	Control Dry	11	5	42.0
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2016	October	Control Dry	11	18	63.0
2016	October	Control Dry	11	19	59.0
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2016	October	Control Dry	12	1	66.0
2016	October	Control Dry	12	2	71.0
2016	October	Control Dry	12	3	70.0
2016	October	Control Dry	12	4	55.0
2016	October	Control Dry	12	5	68.0

2016	October	Control Dry	12	6	73.0
2016	October	Control Dry	12	7	58.0
2016	October	Control Dry	12	8	78.0
2016	October	Control Dry	12	9	67.0
2016	October	Control Dry	12	10	47.0
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2016	October	Control Dry	13	4	68.0
2016	October	Control Dry	13	5	62.0
2016	October	Control Dry	13	6	55.0
2016	October	Control Dry	13	7	47.0
2016	October	Control Dry	13	8	46.0
2016	October	Control Dry	13	9	52.0
2016	October	Control Dry	13	10	53.0

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2016	October	Control Dry	13	12	69.0
2016	October	Control Dry	13	13	71.0
2016	October	Control Dry	13	14	69.0
2016	October	Control Dry	13	15	73.0
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2016	October	Control Dry	14	10	78.0
2016	October	Control Dry	14	11	44.0
2016	October	Control Dry	14	12	58.0
2016	October	Control Dry	14	13	52.0
2016	October	Control Dry	14	14	48.0
2016	October	Control Dry	14	15	51.0

2016	October	Control Dry	14	16	55.0
2016	October	Control Dry	14	17	45.0
2016	October	Control Dry	14	18	68.0
2016	October	Control Dry	14	19	41.0
2016	October	Control Dry	14	20	39.0
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2016	October	Control Dry	15	15	63.0
2016	October	Control Dry	15	16	54.0
2016	October	Control Dry	15	17	66.0
2016	October	Control Dry	15	18	61.0
2016	October	Control Dry	15	19	35.0
2016	October	Control Dry	15	20	42.0

2016	October	Control Dry	16	1	88.0
2016	October	Control Dry	16	2	79.0
2016	October	Control Dry	16	3	65.0
2016	October	Control Dry	16	4	69.0
2016	October	Control Dry	16	5	53.0
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2016	October	Control Dry	16	18	94.0
2016	October	Control Dry	16	19	89.0
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2016	October	Control Dry	17	1	66.0
2016	October	Control Dry	17	2	57.0
2016	October	Control Dry	17	3	63.0
2016	October	Control Dry	17	4	77.0
2016	October	Control Dry	17	5	74.0

2016	October	Control Dry	17	6	74.0
2016	October	Control Dry	17	7	78.0
2016	October	Control Dry	17	8	83.0
2016	October	Control Dry	17	9	70.0
2016	October	Control Dry	17	10	88.0
2016	October	Control Dry	17	11	65.0
2016	October	Control Dry	17	12	84.0
2016	October	Control Dry	17	13	75.0
2016	October	Control Dry	17	14	76.0
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2016	October	Control Dry	18	5	43.0
2016	October	Control Dry	18	6	47.0
2016	October	Control Dry	18	7	44.0
2016	October	Control Dry	18	8	36.0
2016	October	Control Dry	18	9	37.0
2016	October	Control Dry	18	10	77.0

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2016	October	Control Dry	18	12	65.0
2016	October	Control Dry	18	13	62.0
2016	October	Control Dry	18	14	55.0
2016	October	Control Dry	18	15	59.0
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2016	October	Control Dry	18	19	90.0
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2016	October	Control Dry	19	10	59.0
2016	October	Control Dry	19	11	58.0
2016	October	Control Dry	19	12	64.0
2016	October	Control Dry	19	13	75.0
2016	October	Control Dry	19	14	77.0
2016	October	Control Dry	19	15	61.0

2016	October	Control Dry	19	16	58.0
2016	October	Control Dry	19	17	77.0
2016	October	Control Dry	19	18	68.0
2016	October	Control Dry	19	19	73.0
2016	October	Control Dry	19	20	66.0
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2016	October	Control Dry	20	2	16.0
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2016	October	Control Dry	20	16	34.0
2016	October	Control Dry	20	17	34.0
2016	October	Control Dry	20	18	44.0
2016	October	Control Dry	20	19	58.0
2016	October	Control Dry	20	20	47.0

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2016	October	Mosaic	1	2	63.0
2016	October	Mosaic	1	3	45.0
2016	October	Mosaic	1	4	43.0
2016	October	Mosaic	1	5	61.0
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2016	October	Mosaic	1	18	66.0
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2016	October	Mosaic	1	20	60.0
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2016	October	Mosaic	2	5	68.0
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2016	October	Mosaic	3	2	35.0
2016	October	Mosaic	3	3	58.0
2016	October	Mosaic	3	4	63.0
2016	October	Mosaic	3	5	66.0

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2016	October	Mosaic	3	8	55.0
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2016	October	Mosaic	5	6	47.0
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2016	October	Mosaic	5	8	67.0
2016	October	Mosaic	5	9	34.0
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2016	October	Mosaic	7	11	16.0
2016	October	Mosaic	7	12	18.0
2016	October	Mosaic	7	13	21.0
2016	October	Mosaic	7	14	35.0
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2016	October	Mosaic	8	17	36.0
2016	October	Mosaic	8	18	35.0
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2016	October	Mosaic	9	18	38.0
2016	October	Mosaic	9	19	35.0
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2016	October	Mosaic	12	1	55.0
2016	October	Mosaic	12	2	43.0
2016	October	Mosaic	12	3	56.0
2016	October	Mosaic	12	4	67.0
2016	October	Mosaic	12	5	32.0

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2016	October	Mosaic	12	9	40.0
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2016	October	Mosaic	12	11	56.0
2016	October	Mosaic	12	12	48.0
2016	October	Mosaic	12	13	44.0
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2016	October	Mosaic	38	4	56.0
2016	October	Mosaic	38	5	58.0
2016	October	Mosaic	38	6	45.0
2016	October	Mosaic	38	7	35.0
2016	October	Mosaic	38	8	43.0
2016	October	Mosaic	38	9	67.0
2016	October	Mosaic	38	10	52.0
2016	October	Mosaic	38	11	52.0
2016	October	Mosaic	38	12	69.0
2016	October	Mosaic	38	13	56.0
2016	October	Mosaic	38	14	51.0
2016	October	Mosaic	38	15	43.0
2016	October	Mosaic	38	16	52.0
2016	October	Mosaic	38	17	78.0
2016	October	Mosaic	38	18	59.0
2016	October	Mosaic	38	19	53.0
2016	October	Mosaic	38	20	47.0
2016	October	Mosaic	39	1	56.0
2016	October	Mosaic	39	2	60.0
2016	October	Mosaic	39	3	54.0
2016	October	Mosaic	39	4	55.0
2016	October	Mosaic	39	5	62.0

2016	October	Mosaic	39	6	72.0
2016	October	Mosaic	39	7	33.0
2016	October	Mosaic	39	8	75.0
2016	October	Mosaic	39	9	67.0
2016	October	Mosaic	39	10	35.0
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2016	October	Mosaic	39	17	88.0
2016	October	Mosaic	39	18	74.0
2016	October	Mosaic	39	19	92.0
2016	October	Mosaic	39	20	99.0
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2016	October	Mosaic	40	15	59.0
2016	October	Mosaic	40	16	62.0
2016	October	Mosaic	40	17	52.0
2016	October	Mosaic	40	18	62.0
2016	October	Mosaic	40	19	44.0
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2016	October	Dry	1	3	9.0
2016	October	Dry	1	4	13.0
2016	October	Dry	1	5	12.0
2016	October	Dry	1	6	19.0
2016	October	Dry	1	7	20.0
2016	October	Dry	1	8	73.0
2016	October	Dry	1	9	43.0
2016	October	Dry	1	10	36.0

2016	October	Dry	1	11	24.0
2016	October	Dry	1	12	76.0
2016	October	Dry	1	13	79.0
2016	October	Dry	1	14	58.0
2016	October	Dry	1	15	51.0
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2016	October	Dry	3	14	15.0
2016	October	Dry	3	15	14.0

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2016	October	Dry	5	18	56.0
2016	October	Dry	5	19	24.0
2016	October	Dry	5	20	52.0

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2016	October	Dry	6	3	17.0
2016	October	Dry	6	4	24.0
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2016	October	Dry	8	2	45.0
2016	October	Dry	8	3	30.0
2016	October	Dry	8	4	49.0
2016	October	Dry	8	5	29.0

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2016	October	Dry	8	8	12.0
2016	October	Dry	8	9	11.0
2016	October	Dry	8	10	9.0
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2016	October	Dry	10	7	
2016	October	Dry	10	8	
2016	October	Dry	10	9	
2016	October	Dry	10	10	

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2016	October	Dry	12	11	8.0
2016	October	Dry	12	12	9.0
2016	October	Dry	12	13	9.0
2016	October	Dry	12	14	7.0
2016	October	Dry	12	15	29.0

2016	October	Dry	12	16	24.0
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2016	October	Dry	12	18	45.0
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2016	October	Dry	12	20	52.0
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2016	October	Dry	14	16	19.0
2016	October	Dry	14	17	36.0
2016	October	Dry	14	18	12.0
2016	October	Dry	14	19	18.0
2016	October	Dry	14	20	15.0

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2016	October	Dry	15	4	16.0
2016	October	Dry	15	5	39.0
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2016	October	Dry	17	5	37.0

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2016	October	Dry	17	11	0.0
2016	October	Dry	17	12	0.0
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2016	October	Dry	17	17	0.0
2016	October	Dry	17	18	0.0
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2016	October	Dry	17	20	0.0
2016	October	Dry	18	1	86.0
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2016	October	Dry	18	4	38.0
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2016	October	Dry	18	14	35.0
2016	October	Dry	18	15	38.0
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2016	October	Dry	18	17	33.0
2016	October	Dry	18	18	34.0
2016	October	Dry	18	19	62.0
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2016	October	Dry	19	6	43.0
2016	October	Dry	19	7	44.0
2016	October	Dry	19	8	38.0
2016	October	Dry	19	9	39.0
2016	October	Dry	19	10	89.0

2016	October	Dry	19	11	90.0
2016	October	Dry	19	12	17.0
2016	October	Dry	19	13	18.0
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2016	October	Wet	1	5	11.0
2016	October	Wet	1	6	15.0
2016	October	Wet	1	7	6.0
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2016	October	Wet	1	9	5.0
2016	October	Wet	1	10	9.0
2016	October	Wet	1	11	44.0
2016	October	Wet	1	12	52.0
2016	October	Wet	1	13	37.0
2016	October	Wet	1	14	44.0
2016	October	Wet	1	15	47.0

2016	October	Wet	1	16	16.0
2016	October	Wet	1	17	15.0
2016	October	Wet	1	18	44.0
2016	October	Wet	1	19	26.0
2016	October	Wet	1	20	15.0
2016	October	Wet	2	1	19.0
2016	October	Wet	2	2	15.0
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2016	October	Wet	2	10	22.0
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2016	October	Wet	3	13	23.0
2016	October	Wet	3	14	22.0
2016	October	Wet	3	15	6.0
2016	October	Wet	3	16	7.0
2016	October	Wet	3	17	8.0
2016	October	Wet	3	18	9.0
2016	October	Wet	3	19	11.0
2016	October	Wet	3	20	9.0

2016	October	Wet	4	1	10.0
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2016	October	Wet	4	3	14.0
2016	October	Wet	4	4	7.0
2016	October	Wet	4	5	7.0
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2016	October	Wet	6	4	28.0
2016	October	Wet	6	5	26.0

2016	October	Wet	6	6	14.0
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2016	October	Wet	6	8	12.0
2016	October	Wet	6	9	7.0
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2016	October	Wet	8	8	8.0
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2016	October	Wet	8	12	17.0
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2016	October	Wet	8	14	15.0
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2016	October	Wet	10	13	8.0
2016	October	Wet	10	14	8.0
2016	October	Wet	10	15	8.0

2016	October	Wet	10	16	10.0
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2016	October	Wet	10	19	21.0
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2016	October	Wet	12	18	66.0
2016	October	Wet	12	19	65.0
2016	October	Wet	12	20	67.0

2016	October	Wet	13	1	32.0
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2016	October	Wet	15	2	68.0
2016	October	Wet	15	3	48.0
2016	October	Wet	15	4	56.0
2016	October	Wet	15	5	52.0

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2016	October	Wet	15	7	46.0
2016	October	Wet	15	8	48.0
2016	October	Wet	15	9	58.0
2016	October	Wet	15	10	59.0
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2016	October	Wet	15	14	62.0
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2016	October	Wet	17	6	40.0
2016	October	Wet	17	7	41.0
2016	October	Wet	17	8	44.0
2016	October	Wet	17	9	45.0
2016	October	Wet	17	10	20.0

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2016	October	Wet	17	14	27.0
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2016	October	Wet	18	19	46.0
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2016	October	Wet	19	11	20.0
2016	October	Wet	19	12	21.0
2016	October	Wet	19	13	5.0
2016	October	Wet	19	14	9.0
2016	October	Wet	19	15	7.0

2016	October	Wet	19	16	7.0
2016	October	Wet	19	17	5.0
2016	October	Wet	19	18	12.0
2016	October	Wet	19	19	15.0
2016	October	Wet	19	20	14.0
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2016	October	Wet	20	11	23.0
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2016	October	Wet	20	13	24.0
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2016	October	Control Dry	1	6	37.0
2016	October	Control Dry	1	7	43.0
2016	October	Control Dry	1	8	44.0
2016	October	Control Dry	1	9	47.0
2016	October	Control Dry	1	10	53.0
2016	October	Control Dry	1	11	46.0

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2016	October	Control Dry	1	14	42.0
2016	October	Control Dry	1	15	48.0
2016	October	Control Dry	1	16	43.0
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2016	October	Control Dry	2	12	46.0
2016	October	Control Dry	2	13	45.0
2016	October	Control Dry	2	14	65.0
2016	October	Control Dry	2	15	69.0
2016	October	Control Dry	2	16	57.0

2016	October	Control Dry	2	17	40.0
2016	October	Control Dry	2	18	48.0
2016	October	Control Dry	2	19	49.0
2016	October	Control Dry	2	20	52.0
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2016	October	Control Dry	3	17	49.0
2016	October	Control Dry	3	18	42.0
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2016	October	Control Dry	3	20	43.0
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2016	October	Control Dry	4	3	65.0
2016	October	Control Dry	4	4	74.0
2016	October	Control Dry	4	5	87.0
2016	October	Control Dry	4	6	72.0
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2016	October	Control Dry	5	4	79.0
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2016	October	Control Dry	5	6	47.0

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2016	October	Control Dry	6	7	54.0
2016	October	Control Dry	6	8	54.0
2016	October	Control Dry	6	9	62.0
2016	October	Control Dry	6	10	55.0
2016	October	Control Dry	6	11	41.0

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2016	October	Control Dry	6	14	47.0
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2016	October	Control Dry	7	12	59.0
2016	October	Control Dry	7	13	41.0
2016	October	Control Dry	7	14	44.0
2016	October	Control Dry	7	15	56.0
2016	October	Control Dry	7	16	41.0

2016	October	Control Dry	7	17	51.0
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2016	October	Control Dry	7	19	51.0
2016	October	Control Dry	7	20	26.0
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2016	October	Control Dry	8	17	43.0
2016	October	Control Dry	8	18	83.0
2016	October	Control Dry	8	19	65.0
2016	October	Control Dry	8	20	57.0
2016	October	Control Dry	9	1	60.0

2016	October	Control Dry	9	2	62.0
2016	October	Control Dry	9	3	72.0
2016	October	Control Dry	9	4	85.0
2016	October	Control Dry	9	5	87.0
2016	October	Control Dry	9	6	97.0
2016	October	Control Dry	9	7	86.0
2016	October	Control Dry	9	8	71.0
2016	October	Control Dry	9	9	72.0
2016	October	Control Dry	9	10	78.0
2016	October	Control Dry	9	11	88.0
2016	October	Control Dry	9	12	84.0
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2016	October	Control Dry	9	14	73.0
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2016	October	Control Dry	9	17	56.0
2016	October	Control Dry	9	18	58.0
2016	October	Control Dry	9	19	62.0
2016	October	Control Dry	9	20	66.0
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2016	October	Control Dry	10	2	57.0
2016	October	Control Dry	10	3	44.0
2016	October	Control Dry	10	4	43.0
2016	October	Control Dry	10	5	73.0
2016	October	Control Dry	10	6	60.0

2016	October	Control Dry	10	7	78.0
2016	October	Control Dry	10	8	74.0
2016	October	Control Dry	10	9	43.0
2016	October	Control Dry	10	10	44.0
2016	October	Control Dry	10	11	53.0
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2016	October	Control Dry	10	13	57.0
2016	October	Control Dry	10	14	45.0
2016	October	Control Dry	10	15	46.0
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2016	October	Control Dry	10	17	48.0
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2016	October	Control Dry	10	19	45.0
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2016	October	Control Dry	11	4	73.0
2016	October	Control Dry	11	5	47.0
2016	October	Control Dry	11	6	55.0
2016	October	Control Dry	11	7	56.0
2016	October	Control Dry	11	8	50.0
2016	October	Control Dry	11	9	64.0
2016	October	Control Dry	11	10	66.0
2016	October	Control Dry	11	11	56.0

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2016	October	Control Dry	11	13	48.0
2016	October	Control Dry	11	14	55.0
2016	October	Control Dry	11	15	54.0
2016	October	Control Dry	11	16	48.0
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2016	October	Control Dry	11	18	63.0
2016	October	Control Dry	11	19	58.0
2016	October	Control Dry	11	20	69.0
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2016	October	Control Dry	12	3	73.0
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2016	October	Control Dry	12	10	42.0
2016	October	Control Dry	12	11	67.0
2016	October	Control Dry	12	12	43.0
2016	October	Control Dry	12	13	68.0
2016	October	Control Dry	12	14	64.0
2016	October	Control Dry	12	15	48.0
2016	October	Control Dry	12	16	59.0

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2016	October	Control Dry	12	18	56.0
2016	October	Control Dry	12	19	72.0
2016	October	Control Dry	12	20	70.0
2016	October	Control Dry	13	1	58.0
2016	October	Control Dry	13	2	47.0
2016	October	Control Dry	13	3	52.0
2016	October	Control Dry	13	4	62.0
2016	October	Control Dry	13	5	68.0
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2016	October	Control Dry	13	14	74.0
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2016	October	Control Dry	13	17	59.0
2016	October	Control Dry	13	18	58.0
2016	October	Control Dry	13	19	66.0
2016	October	Control Dry	13	20	67.0
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2016	October	Control Dry	14	3	45.0
2016	October	Control Dry	14	4	56.0
2016	October	Control Dry	14	5	60.0
2016	October	Control Dry	14	6	49.0
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2016	October	Control Dry	14	8	47.0
2016	October	Control Dry	14	9	59.0
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2016	October	Control Dry	15	2	44.0
2016	October	Control Dry	15	3	53.0
2016	October	Control Dry	15	4	47.0
2016	October	Control Dry	15	5	45.0
2016	October	Control Dry	15	6	52.0

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2016	October	Control Dry	15	8	47.0
2016	October	Control Dry	15	9	53.0
2016	October	Control Dry	15	10	76.0
2016	October	Control Dry	15	11	78.0
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2016	October	Control Dry	15	13	49.0
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2016	October	Control Dry	16	9	49.0
2016	October	Control Dry	16	10	55.0
2016	October	Control Dry	16	11	53.0

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2016	October	Control Dry	16	14	45.0
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2016	October	Control Dry	17	10	85.0
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2016	October	Control Dry	17	12	88.0
2016	October	Control Dry	17	13	79.0
2016	October	Control Dry	17	14	77.0
2016	October	Control Dry	17	15	86.0
2016	October	Control Dry	17	16	85.0

2016	October	Control Dry	17	17	83.0
2016	October	Control Dry	17	18	78.0
2016	October	Control Dry	17	19	82.0
2016	October	Control Dry	17	20	79.0
2016	October	Control Dry	18	1	38.0
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2016	October	Control Dry	18	17	67.0
2016	October	Control Dry	18	18	63.0
2016	October	Control Dry	18	19	92.0
2016	October	Control Dry	18	20	86.0
2016	October	Control Dry	19	1	62.0

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2016	October	Control Dry	19	3	60.0
2016	October	Control Dry	19	4	68.0
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2016	October	Control Dry	19	6	53.0
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2016	October	Control Dry	19	19	70.0
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2016	October	Control Dry	20	2	18.0
2016	October	Control Dry	20	3	43.0
2016	October	Control Dry	20	4	49.0
2016	October	Control Dry	20	5	44.0
2016	October	Control Dry	20	6	58.0

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2016	October	Mosaic	1	6	69.0
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2016	October	Mosaic	1	11	89.0
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2016	October	Mosaic	1	17	66.0
2016	October	Mosaic	1	18	67.0
2016	October	Mosaic	1	19	51.0
2016	October	Mosaic	1	20	61.0

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2016	October	Mosaic	2	2	59.0
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2016	October	Mosaic	2	4	67.0
2016	October	Mosaic	2	5	68.0
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2016	October	Mosaic	2	9	34.0
2016	October	Mosaic	2	10	68.0
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2016	October	Mosaic	3	19	30.0
2016	October	Mosaic	3	20	32.0
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2016	October	Mosaic	4	3	50.0
2016	October	Mosaic	4	4	45.0
2016	October	Mosaic	4	5	58.0

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2016	October	Mosaic	4	8	53.0
2016	October	Mosaic	4	9	62.0
2016	October	Mosaic	4	10	71.0
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2016	October	Mosaic	4	12	54.0
2016	October	Mosaic	4	13	55.0
2016	October	Mosaic	4	14	59.0
2016	October	Mosaic	4	15	57.0
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2016	October	Mosaic	4	18	73.0
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2016	October	Mosaic	6	6	48.0
2016	October	Mosaic	6	7	29.0
2016	October	Mosaic	6	8	22.0
2016	October	Mosaic	6	9	15.0
2016	October	Mosaic	6	10	37.0

2016	October	Mosaic	6	11	38.0
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2016	October	Mosaic	6	14	33.0
2016	October	Mosaic	6	15	19.0
2016	October	Mosaic	6	16	44.0
2016	October	Mosaic	6	17	24.0
2016	October	Mosaic	6	18	62.0
2016	October	Mosaic	6	19	58.0
2016	October	Mosaic	6	20	67.0
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2016	October	Mosaic	8	12	83.0
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2016	October	Mosaic	8	19	42.0
2016	October	Mosaic	8	20	44.0
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2016	October	Mosaic	14	11	40.0
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2016	October	Mosaic	40	2	55.0
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2016	October	Mosaic	40	4	41.0
2016	October	Mosaic	40	5	44.0

2016	October	Mosaic	40	6	70.0
2016	October	Mosaic	40	7	71.0
2016	October	Mosaic	40	8	67.0
2016	October	Mosaic	40	9	59.0
2016	October	Mosaic	40	10	77.0
2016	October	Mosaic	40	11	63.0
2016	October	Mosaic	40	12	46.0
2016	October	Mosaic	40	13	49.0
2016	October	Mosaic	40	14	51.0
2016	October	Mosaic	40	15	44.0
2016	October	Mosaic	40	16	62.0
2016	October	Mosaic	40	17	56.0
2016	October	Mosaic	40	18	70.0
2016	October	Mosaic	40	19	44.0
2016	October	Mosaic	40	20	42.0
2016	June	Dry	1	1	11.0
2016	June	Dry	1	2	24.0
2016	June	Dry	1	3	16.0
2016	June	Dry	1	4	13.0
2016	June	Dry	1	5	12.0
2016	June	Dry	1	6	19.0
2016	June	Dry	1	7	20.0
2016	June	Dry	1	8	66.0
2016	June	Dry	1	9	12.0
2016	June	Dry	1	10	22.0
2016	June	Dry	1	11	24.0
2016	June	Dry	1	12	65.0
2016	June	Dry	1	13	79.0
2016	June	Dry	1	14	58.0
2016	June	Dry	1	15	51.0
2016	June	Dry	1	16	77.0
2016	June	Dry	1	17	80.0
2016	June	Dry	1	18	19.0
2016	June	Dry	1	19	79.0
2016	June	Dry	1	20	34.0
2016	June	Dry	2	1	30.0
2016	June	Dry	2	2	34.0
2016	June	Dry	2	3	35.0
2016	June	Dry	2	4	23.0
2016	June	Dry	2	5	26.0
2016	June	Dry	2	6	17.0
2016	June	Dry	2	7	18.0
2016	June	Dry	2	8	33.0
2016	June	Dry	2	9	60.0
2016	June	Dry	2	10	66.0

2016	June	Dry	2	11	34.0
2016	June	Dry	2	12	35.0
2016	June	Dry	2	13	22.0
2016	June	Dry	2	14	18.0
2016	June	Dry	2	15	31.0
2016	June	Dry	2	16	21.0
2016	June	Dry	2	17	19.0
2016	June	Dry	2	18	19.0
2016	June	Dry	2	19	34.0
2016	June	Dry	2	20	45.0
2016	June	Dry	3	1	34.0
2016	June	Dry	3	2	28.0
2016	June	Dry	3	3	22.0
2016	June	Dry	3	4	24.0
2016	June	Dry	3	5	44.0
2016	June	Dry	3	6	65.0
2016	June	Dry	3	7	72.0
2016	June	Dry	3	8	70.0
2016	June	Dry	3	9	81.0
2016	June	Dry	3	10	22.0
2016	June	Dry	3	11	19.0
2016	June	Dry	3	12	18.0
2016	June	Dry	3	13	19.0
2016	June	Dry	3	14	11.0
2016	June	Dry	3	15	17.0
2016	June	Dry	3	16	16.0
2016	June	Dry	3	17	19.0
2016	June	Dry	3	18	25.0
2016	June	Dry	3	19	27.0
2016	June	Dry	3	20	47.0
2016	June	Dry	4	1	12.0
2016	June	Dry	4	2	11.0
2016	June	Dry	4	3	18.0
2016	June	Dry	4	4	16.0
2016	June	Dry	4	5	11.0
2016	June	Dry	4	6	18.0
2016	June	Dry	4	7	20.0
2016	June	Dry	4	8	22.0
2016	June	Dry	4	9	45.0
2016	June	Dry	4	10	49.0
2016	June	Dry	4	11	67.0
2016	June	Dry	4	12	53.0
2016	June	Dry	4	13	30.0
2016	June	Dry	4	14	72.0
2016	June	Dry	4	15	67.0

2016	June	Dry	4	16	62.0
2016	June	Dry	4	17	45.0
2016	June	Dry	4	18	33.0
2016	June	Dry	4	19	72.0
2016	June	Dry	4	20	73.0
2016	June	Dry	5	1	18.0
2016	June	Dry	5	2	31.0
2016	June	Dry	5	3	34.0
2016	June	Dry	5	4	27.0
2016	June	Dry	5	5	22.0
2016	June	Dry	5	6	16.0
2016	June	Dry	5	7	17.0
2016	June	Dry	5	8	18.0
2016	June	Dry	5	9	11.0
2016	June	Dry	5	10	15.0
2016	June	Dry	5	11	24.0
2016	June	Dry	5	12	36.0
2016	June	Dry	5	13	48.0
2016	June	Dry	5	14	47.0
2016	June	Dry	5	15	50.0
2016	June	Dry	5	16	53.0
2016	June	Dry	5	17	59.0
2016	June	Dry	5	18	61.0
2016	June	Dry	5	19	36.0
2016	June	Dry	5	20	68.0
2016	June	Dry	6	1	28.0
2016	June	Dry	6	2	16.0
2016	June	Dry	6	3	19.0
2016	June	Dry	6	4	28.0
2016	June	Dry	6	5	36.0
2016	June	Dry	6	6	59.0
2016	June	Dry	6	7	55.0
2016	June	Dry	6	8	30.0
2016	June	Dry	6	9	35.0
2016	June	Dry	6	10	40.0
2016	June	Dry	6	11	58.0
2016	June	Dry	6	12	59.0
2016	June	Dry	6	13	62.0
2016	June	Dry	6	14	66.0
2016	June	Dry	6	15	46.0
2016	June	Dry	6	16	47.0
2016	June	Dry	6	17	14.0
2016	June	Dry	6	18	51.0
2016	June	Dry	6	19	68.0
2016	June	Dry	6	20	42.0

2016	June	Dry	7	1	17.0
2016	June	Dry	7	2	92.0
2016	June	Dry	7	3	97.0
2016	June	Dry	7	4	25.0
2016	June	Dry	7	5	22.0
2016	June	Dry	7	6	34.0
2016	June	Dry	7	7	36.0
2016	June	Dry	7	8	44.0
2016	June	Dry	7	9	37.0
2016	June	Dry	7	10	35.0
2016	June	Dry	7	11	17.0
2016	June	Dry	7	12	25.0
2016	June	Dry	7	13	18.0
2016	June	Dry	7	14	36.0
2016	June	Dry	7	15	25.0
2016	June	Dry	7	16	37.0
2016	June	Dry	7	17	31.0
2016	June	Dry	7	18	22.0
2016	June	Dry	7	19	29.0
2016	June	Dry	7	20	36.0
2016	June	Dry	8	1	44.0
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2016	June	Dry	8	3	17.0
2016	June	Dry	8	4	49.0
2016	June	Dry	8	5	29.0
2016	June	Dry	8	6	72.0
2016	June	Dry	8	7	56.0
2016	June	Dry	8	8	12.0
2016	June	Dry	8	9	11.0
2016	June	Dry	8	10	11.0
2016	June	Dry	8	11	16.0
2016	June	Dry	8	12	18.0
2016	June	Dry	8	13	15.0
2016	June	Dry	8	14	34.0
2016	June	Dry	8	15	38.0
2016	June	Dry	8	16	39.0
2016	June	Dry	8	17	44.0
2016	June	Dry	8	18	42.0
2016	June	Dry	8	19	11.0
2016	June	Dry	8	20	16.0
2016	June	Dry	9	1	22.0
2016	June	Dry	9	2	29.0
2016	June	Dry	9	3	50.0
2016	June	Dry	9	4	31.0
2016	June	Dry	9	5	22.0

2016	June	Dry	9	6	24.0
2016	June	Dry	9	7	45.0
2016	June	Dry	9	8	28.0
2016	June	Dry	9	9	55.0
2016	June	Dry	9	10	42.0
2016	June	Dry	9	11	27.0
2016	June	Dry	9	12	37.0
2016	June	Dry	9	13	43.0
2016	June	Dry	9	14	47.0
2016	June	Dry	9	15	46.0
2016	June	Dry	9	16	48.0
2016	June	Dry	9	17	58.0
2016	June	Dry	9	18	62.0
2016	June	Dry	9	19	62.0
2016	June	Dry	9	20	61.0
2016	June	Dry	10	1	15.0
2016	June	Dry	10	2	17.0
2016	June	Dry	10	3	22.0
2016	June	Dry	10	4	24.0
2016	June	Dry	10	5	32.0
2016	June	Dry	10	6	36.0
2016	June	Dry	10	7	24.0
2016	June	Dry	10	8	18.0
2016	June	Dry	10	9	19.0
2016	June	Dry	10	10	25.0
2016	June	Dry	10	11	22.0
2016	June	Dry	10	12	36.0
2016	June	Dry	10	13	22.0
2016	June	Dry	10	14	21.0
2016	June	Dry	10	15	13.0
2016	June	Dry	10	16	12.0
2016	June	Dry	10	17	42.0
2016	June	Dry	10	18	23.0
2016	June	Dry	10	19	17.0
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2016	June	Dry	11	3	34.0
2016	June	Dry	11	4	37.0
2016	June	Dry	11	5	56.0
2016	June	Dry	11	6	65.0
2016	June	Dry	11	7	60.0
2016	June	Dry	11	8	72.0
2016	June	Dry	11	9	80.0
2016	June	Dry	11	10	55.0

2016	June	Dry	11	11	62.0
2016	June	Dry	11	12	55.0
2016	June	Dry	11	13	75.0
2016	June	Dry	11	14	56.0
2016	June	Dry	11	15	42.0
2016	June	Dry	11	16	55.0
2016	June	Dry	11	17	62.0
2016	June	Dry	11	18	70.0
2016	June	Dry	11	19	62.0
2016	June	Dry	11	20	55.0
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2016	June	Dry	12	2	15.0
2016	June	Dry	12	3	24.0
2016	June	Dry	12	4	23.0
2016	June	Dry	12	5	11.0
2016	June	Dry	12	6	26.0
2016	June	Dry	12	7	34.0
2016	June	Dry	12	8	35.0
2016	June	Dry	12	9	45.0
2016	June	Dry	12	10	21.0
2016	June	Dry	12	11	11.0
2016	June	Dry	12	12	14.0
2016	June	Dry	12	13	17.0
2016	June	Dry	12	14	19.0
2016	June	Dry	12	15	32.0
2016	June	Dry	12	16	24.0
2016	June	Dry	12	17	54.0
2016	June	Dry	12	18	59.0
2016	June	Dry	12	19	63.0
2016	June	Dry	12	20	58.0
2016	June	Dry	13	1	31.0
2016	June	Dry	13	2	33.0
2016	June	Dry	13	3	29.0
2016	June	Dry	13	4	21.0
2016	June	Dry	13	5	25.0
2016	June	Dry	13	6	25.0
2016	June	Dry	13	7	22.0
2016	June	Dry	13	8	27.0
2016	June	Dry	13	9	19.0
2016	June	Dry	13	10	17.0
2016	June	Dry	13	11	22.0
2016	June	Dry	13	12	18.0
2016	June	Dry	13	13	31.0
2016	June	Dry	13	14	37.0
2016	June	Dry	13	15	33.0

2016	June	Dry	13	16	21.0
2016	June	Dry	13	17	26.0
2016	June	Dry	13	18	24.0
2016	June	Dry	13	19	19.0
2016	June	Dry	13	20	23.0
2016	June	Dry	14	1	27.0
2016	June	Dry	14	2	32.0
2016	June	Dry	14	3	33.0
2016	June	Dry	14	4	47.0
2016	June	Dry	14	5	52.0
2016	June	Dry	14	6	55.0
2016	June	Dry	14	7	62.0
2016	June	Dry	14	8	63.0
2016	June	Dry	14	9	59.0
2016	June	Dry	14	10	61.0
2016	June	Dry	14	11	45.0
2016	June	Dry	14	12	58.0
2016	June	Dry	14	13	41.0
2016	June	Dry	14	14	56.0
2016	June	Dry	14	15	55.0
2016	June	Dry	14	16	22.0
2016	June	Dry	14	17	36.0
2016	June	Dry	14	18	12.0
2016	June	Dry	14	19	18.0
2016	June	Dry	14	20	17.0
2016	June	Dry	15	1	31.0
2016	June	Dry	15	2	18.0
2016	June	Dry	15	3	17.0
2016	June	Dry	15	4	16.0
2016	June	Dry	15	5	22.0
2016	June	Dry	15	6	47.0
2016	June	Dry	15	7	19.0
2016	June	Dry	15	8	29.0
2016	June	Dry	15	9	31.0
2016	June	Dry	15	10	32.0
2016	June	Dry	15	11	47.0
2016	June	Dry	15	12	45.0
2016	June	Dry	15	13	32.0
2016	June	Dry	15	14	20.0
2016	June	Dry	15	15	19.0
2016	June	Dry	15	16	58.0
2016	June	Dry	15	17	31.0
2016	June	Dry	15	18	68.0
2016	June	Dry	15	19	32.0
2016	June	Dry	15	20	33.0

2016	June	Dry	16	1	48.0
2016	June	Dry	16	2	37.0
2016	June	Dry	16	3	33.0
2016	June	Dry	16	4	48.0
2016	June	Dry	16	5	35.0
2016	June	Dry	16	6	46.0
2016	June	Dry	16	7	63.0
2016	June	Dry	16	8	47.0
2016	June	Dry	16	9	58.0
2016	June	Dry	16	10	44.0
2016	June	Dry	16	11	32.0
2016	June	Dry	16	12	55.0
2016	June	Dry	16	13	70.0
2016	June	Dry	16	14	75.0
2016	June	Dry	16	15	58.0
2016	June	Dry	16	16	47.0
2016	June	Dry	16	17	64.0
2016	June	Dry	16	18	48.0
2016	June	Dry	16	19	45.0
2016	June	Dry	16	20	35.0
2016	June	Dry	17	1	35.0
2016	June	Dry	17	2	44.0
2016	June	Dry	17	3	49.0
2016	June	Dry	17	4	56.0
2016	June	Dry	17	5	42.0
2016	June	Dry	17	6	25.0
2016	June	Dry	17	7	46.0
2016	June	Dry	17	8	55.0
2016	June	Dry	17	9	42.0
2016	June	Dry	17	10	35.0
2016	June	Dry	17	11	56.0
2016	June	Dry	17	12	55.0
2016	June	Dry	17	13	31.0
2016	June	Dry	17	14	33.0
2016	June	Dry	17	15	34.0
2016	June	Dry	17	16	45.0
2016	June	Dry	17	17	27.0
2016	June	Dry	17	18	31.0
2016	June	Dry	17	19	0.0
2016	June	Dry	17	20	0.0
2016	June	Dry	18	1	99.0
2016	June	Dry	18	2	67.0
2016	June	Dry	18	3	30.0
2016	June	Dry	18	4	70.0
2016	June	Dry	18	5	60.0

2016	June	Dry	18	6	56.0
2016	June	Dry	18	7	65.0
2016	June	Dry	18	8	21.0
2016	June	Dry	18	9	81.0
2016	June	Dry	18	10	82.0
2016	June	Dry	18	11	79.0
2016	June	Dry	18	12	30.0
2016	June	Dry	18	13	88.0
2016	June	Dry	18	14	35.0
2016	June	Dry	18	15	38.0
2016	June	Dry	18	16	21.0
2016	June	Dry	18	17	33.0
2016	June	Dry	18	18	34.0
2016	June	Dry	18	19	35.0
2016	June	Dry	18	20	58.0
2016	June	Dry	19	1	27.0
2016	June	Dry	19	2	33.0
2016	June	Dry	19	3	35.0
2016	June	Dry	19	4	22.0
2016	June	Dry	19	5	43.0
2016	June	Dry	19	6	43.0
2016	June	Dry	19	7	36.0
2016	June	Dry	19	8	38.0
2016	June	Dry	19	9	45.0
2016	June	Dry	19	10	76.0
2016	June	Dry	19	11	86.0
2016	June	Dry	19	12	15.0
2016	June	Dry	19	13	18.0
2016	June	Dry	19	14	19.0
2016	June	Dry	19	15	15.0
2016	June	Dry	19	16	88.0
2016	June	Dry	19	17	91.0
2016	June	Dry	19	18	67.0
2016	June	Dry	19	19	92.0
2016	June	Dry	19	20	76.0
2016	June	Dry	20	1	67.0
2016	June	Dry	20	2	33.0
2016	June	Dry	20	3	46.0
2016	June	Dry	20	4	19.0
2016	June	Dry	20	5	18.0
2016	June	Dry	20	6	27.0
2016	June	Dry	20	7	20.0
2016	June	Dry	20	8	25.0
2016	June	Dry	20	9	30.0
2016	June	Dry	20	10	42.0

2016	June	Dry	20	11	67.0
2016	June	Dry	20	12	66.0
2016	June	Dry	20	13	36.0
2016	June	Dry	20	14	45.0
2016	June	Dry	20	15	42.0
2016	June	Dry	20	16	42.0
2016	June	Dry	20	17	55.0
2016	June	Dry	20	18	44.0
2016	June	Dry	20	19	51.0
2016	June	Dry	20	20	70.0
2016	June	Mire	1	1	18.0
2016	June	Mire	1	2	9.0
2016	June	Mire	1	3	9.0
2016	June	Mire	1	4	11.0
2016	June	Mire	1	5	10.0
2016	June	Mire	1	6	5.0
2016	June	Mire	1	7	6.0
2016	June	Mire	1	8	9.0
2016	June	Mire	1	9	5.0
2016	June	Mire	1	10	4.0
2016	June	Mire	1	11	9.0
2016	June	Mire	1	12	7.0
2016	June	Mire	1	13	5.0
2016	June	Mire	1	14	7.0
2016	June	Mire	1	15	6.0
2016	June	Mire	1	16	9.0
2016	June	Mire	1	17	4.0
2016	June	Mire	1	18	2.0
2016	June	Mire	1	19	1.0
2016	June	Mire	1	20	4.0
2016	June	Mire	2	1	11.0
2016	June	Mire	2	2	15.0
2016	June	Mire	2	3	17.0
2016	June	Mire	2	4	27.0
2016	June	Mire	2	5	15.0
2016	June	Mire	2	6	28.0
2016	June	Mire	2	7	16.0
2016	June	Mire	2	8	21.0
2016	June	Mire	2	9	25.0
2016	June	Mire	2	10	28.0
2016	June	Mire	2	11	21.0
2016	June	Mire	2	12	13.0
2016	June	Mire	2	13	14.0
2016	June	Mire	2	14	19.0
2016	June	Mire	2	15	25.0

2016	June	Mire	2	16	19.0
2016	June	Mire	2	17	10.0
2016	June	Mire	2	18	12.0
2016	June	Mire	2	19	25.0
2016	June	Mire	2	20	19.0
2016	June	Mire	3	1	22.0
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2016	June	Mire	3	3	11.0
2016	June	Mire	3	4	9.0
2016	June	Mire	3	5	12.0
2016	June	Mire	3	6	17.0
2016	June	Mire	3	7	19.0
2016	June	Mire	3	8	12.0
2016	June	Mire	3	9	18.0
2016	June	Mire	3	10	22.0
2016	June	Mire	3	11	19.0
2016	June	Mire	3	12	15.0
2016	June	Mire	3	13	18.0
2016	June	Mire	3	14	22.0
2016	June	Mire	3	15	18.0
2016	June	Mire	3	16	16.0
2016	June	Mire	3	17	19.0
2016	June	Mire	3	18	11.0
2016	June	Mire	3	19	9.0
2016	June	Mire	3	20	7.0
2016	June	Mire	4	1	11.0
2016	June	Mire	4	2	17.0
2016	June	Mire	4	3	9.0
2016	June	Mire	4	4	9.0
2016	June	Mire	4	5	7.0
2016	June	Mire	4	6	13.0
2016	June	Mire	4	7	11.0
2016	June	Mire	4	8	16.0
2016	June	Mire	4	9	22.0
2016	June	Mire	4	10	24.0
2016	June	Mire	4	11	32.0
2016	June	Mire	4	12	21.0
2016	June	Mire	4	13	5.0
2016	June	Mire	4	14	4.0
2016	June	Mire	4	15	11.0
2016	June	Mire	4	16	9.0
2016	June	Mire	4	17	19.0
2016	June	Mire	4	18	9.0
2016	June	Mire	4	19	19.0
2016	June	Mire	4	20	35.0

2016	June	Mire	5	1	9.0
2016	June	Mire	5	2	23.0
2016	June	Mire	5	3	19.0
2016	June	Mire	5	4	16.0
2016	June	Mire	5	5	13.0
2016	June	Mire	5	6	7.0
2016	June	Mire	5	7	16.0
2016	June	Mire	5	8	31.0
2016	June	Mire	5	9	19.0
2016	June	Mire	5	10	18.0
2016	June	Mire	5	11	25.0
2016	June	Mire	5	12	7.0
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2016	June	Wet	10	20	22.0
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2016	June	Wet	11	2	30.0
2016	June	Wet	11	3	45.0
2016	June	Wet	11	4	38.0
2016	June	Wet	11	5	25.0
2016	June	Wet	11	6	13.0
2016	June	Wet	11	7	35.0
2016	June	Wet	11	8	17.0
2016	June	Wet	11	9	16.0
2016	June	Wet	11	10	14.0
2016	June	Wet	11	11	33.0
2016	June	Wet	11	12	26.0
2016	June	Wet	11	13	31.0
2016	June	Wet	11	14	30.0
2016	June	Wet	11	15	21.0
2016	June	Wet	11	16	33.0
2016	June	Wet	11	17	32.0
2016	June	Wet	11	18	14.0
2016	June	Wet	11	19	16.0
2016	June	Wet	11	20	27.0

2016	June	Wet	12	1	21.0
2016	June	Wet	12	2	26.0
2016	June	Wet	12	3	16.0
2016	June	Wet	12	4	18.0
2016	June	Wet	12	5	15.0
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2016	June	Wet	13	7	51.0
2016	June	Wet	13	8	49.0
2016	June	Wet	13	9	62.0
2016	June	Wet	13	10	12.0
2016	June	Wet	13	11	16.0
2016	June	Wet	13	12	11.0
2016	June	Wet	13	13	15.0
2016	June	Wet	13	14	10.0
2016	June	Wet	13	15	64.0
2016	June	Wet	13	16	49.0
2016	June	Wet	13	17	55.0
2016	June	Wet	13	18	47.0
2016	June	Wet	13	19	15.0
2016	June	Wet	13	20	28.0
2016	June	Wet	14	1	16.0
2016	June	Wet	14	2	15.0
2016	June	Wet	14	3	22.0
2016	June	Wet	14	4	28.0
2016	June	Wet	14	5	22.0

2016	June	Wet	14	6	42.0
2016	June	Wet	14	7	43.0
2016	June	Wet	14	8	48.0
2016	June	Wet	14	9	21.0
2016	June	Wet	14	10	44.0
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2016	June	Wet	15	7	44.0
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2016	June	Wet	15	10	59.0
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2016	June	Wet	15	15	58.0
2016	June	Wet	15	16	52.0
2016	June	Wet	15	17	55.0
2016	June	Wet	15	18	48.0
2016	June	Wet	15	19	44.0
2016	June	Wet	15	20	55.0
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2016	June	Wet	16	3	66.0
2016	June	Wet	16	4	63.0
2016	June	Wet	16	5	60.0
2016	June	Wet	16	6	62.0
2016	June	Wet	16	7	34.0
2016	June	Wet	16	8	22.0
2016	June	Wet	16	9	24.0
2016	June	Wet	16	10	15.0

2016	June	Wet	16	11	20.0
2016	June	Wet	16	12	33.0
2016	June	Wet	16	13	22.0
2016	June	Wet	16	14	28.0
2016	June	Wet	16	15	31.0
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2016	June	Wet	17	18	31.0
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2016	June	Wet	18	5	105.0
2016	June	Wet	18	6	74.0
2016	June	Wet	18	7	80.0
2016	June	Wet	18	8	12.0
2016	June	Wet	18	9	14.0
2016	June	Wet	18	10	17.0
2016	June	Wet	18	11	22.0
2016	June	Wet	18	12	12.0
2016	June	Wet	18	13	11.0
2016	June	Wet	18	14	11.0
2016	June	Wet	18	15	22.0

2016	June	Wet	18	16	20.0
2016	June	Wet	18	17	23.0
2016	June	Wet	18	18	34.0
2016	June	Wet	18	19	46.0
2016	June	Wet	18	20	21.0
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2016	June	Wet	19	3	41.0
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2016	June	Wet	19	9	21.0
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2016	June	Wet	19	11	20.0
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2016	June	Wet	19	13	15.0
2016	June	Wet	19	14	21.0
2016	June	Wet	19	15	22.0
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2016	June	Wet	19	17	34.0
2016	June	Wet	19	18	11.0
2016	June	Wet	19	19	26.0
2016	June	Wet	19	20	11.0
2016	June	Wet	20	1	22.0
2016	June	Wet	20	2	36.0
2016	June	Wet	20	3	11.0
2016	June	Wet	20	4	12.0
2016	June	Wet	20	5	22.0
2016	June	Wet	20	6	12.0
2016	June	Wet	20	7	62.0
2016	June	Wet	20	8	26.0
2016	June	Wet	20	9	61.0
2016	June	Wet	20	10	22.0
2016	June	Wet	20	11	23.0
2016	June	Wet	20	12	25.0
2016	June	Wet	20	13	44.0
2016	June	Wet	20	14	26.0
2016	June	Wet	20	15	44.0
2016	June	Wet	20	16	54.0
2016	June	Wet	20	17	49.0
2016	June	Wet	20	18	36.0
2016	June	Wet	20	19	52.0
2016	June	Wet	20	20	48.0

2016	June	Control Dry	1	1	59.0
2016	June	Control Dry	1	2	78.0
2016	June	Control Dry	1	3	33.0
2016	June	Control Dry	1	4	36.0
2016	June	Control Dry	1	5	39.0
2016	June	Control Dry	1	6	40.0
2016	June	Control Dry	1	7	39.0
2016	June	Control Dry	1	8	42.0
2016	June	Control Dry	1	9	48.0
2016	June	Control Dry	1	10	58.0
2016	June	Control Dry	1	11	41.0
2016	June	Control Dry	1	12	50.0
2016	June	Control Dry	1	13	57.0
2016	June	Control Dry	1	14	41.0
2016	June	Control Dry	1	15	48.0
2016	June	Control Dry	1	16	44.0
2016	June	Control Dry	1	17	39.0
2016	June	Control Dry	1	18	58.0
2016	June	Control Dry	1	19	55.0
2016	June	Control Dry	1	20	42.0
2016	June	Control Dry	2	1	47.0
2016	June	Control Dry	2	2	41.0
2016	June	Control Dry	2	3	57.0
2016	June	Control Dry	2	4	58.0
2016	June	Control Dry	2	5	55.0

2016	June	Control Dry	2	6	79.0
2016	June	Control Dry	2	7	49.0
2016	June	Control Dry	2	8	52.0
2016	June	Control Dry	2	9	56.0
2016	June	Control Dry	2	10	82.0
2016	June	Control Dry	2	11	69.0
2016	June	Control Dry	2	12	48.0
2016	June	Control Dry	2	13	41.0
2016	June	Control Dry	2	14	63.0
2016	June	Control Dry	2	15	65.0
2016	June	Control Dry	2	16	57.0
2016	June	Control Dry	2	17	41.0
2016	June	Control Dry	2	18	48.0
2016	June	Control Dry	2	19	51.0
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2016	June	Control Dry	3	3	64.0
2016	June	Control Dry	3	4	51.0
2016	June	Control Dry	3	5	66.0
2016	June	Control Dry	3	6	32.0
2016	June	Control Dry	3	7	80.0
2016	June	Control Dry	3	8	63.0
2016	June	Control Dry	3	9	64.0
2016	June	Control Dry	3	10	68.0

2016	June	Control Dry	3	11	51.0
2016	June	Control Dry	3	12	47.0
2016	June	Control Dry	3	13	54.0
2016	June	Control Dry	3	14	69.0
2016	June	Control Dry	3	15	51.0
2016	June	Control Dry	3	16	53.0
2016	June	Control Dry	3	17	50.0
2016	June	Control Dry	3	18	39.0
2016	June	Control Dry	3	19	41.0
2016	June	Control Dry	3	20	39.0
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2016	June	Control Dry	4	4	72.0
2016	June	Control Dry	4	5	83.0
2016	June	Control Dry	4	6	72.0
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2016	June	Control Dry	4	8	79.0
2016	June	Control Dry	4	9	95.0
2016	June	Control Dry	4	10	55.0
2016	June	Control Dry	4	11	52.0
2016	June	Control Dry	4	12	90.0
2016	June	Control Dry	4	13	94.0
2016	June	Control Dry	4	14	66.0
2016	June	Control Dry	4	15	61.0

2016	June	Control Dry	4	16	70.0
2016	June	Control Dry	4	17	75.0
2016	June	Control Dry	4	18	61.0
2016	June	Control Dry	4	19	45.0
2016	June	Control Dry	4	20	56.0
2016	June	Control Dry	5	1	64.0
2016	June	Control Dry	5	2	72.0
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2016	June	Control Dry	5	4	77.0
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2016	June	Control Dry	5	9	52.0
2016	June	Control Dry	5	10	45.0
2016	June	Control Dry	5	11	61.0
2016	June	Control Dry	5	12	63.0
2016	June	Control Dry	5	13	65.0
2016	June	Control Dry	5	14	78.0
2016	June	Control Dry	5	15	78.0
2016	June	Control Dry	5	16	81.0
2016	June	Control Dry	5	17	84.0
2016	June	Control Dry	5	18	90.0
2016	June	Control Dry	5	19	90.0
2016	June	Control Dry	5	20	78.0

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2016	June	Control Dry	6	2	53.0
2016	June	Control Dry	6	3	58.0
2016	June	Control Dry	6	4	55.0
2016	June	Control Dry	6	5	65.0
2016	June	Control Dry	6	6	62.0
2016	June	Control Dry	6	7	55.0
2016	June	Control Dry	6	8	51.0
2016	June	Control Dry	6	9	68.0
2016	June	Control Dry	6	10	51.0
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2016	June	Control Dry	6	14	49.0
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2016	June	Control Dry	6	18	41.0
2016	June	Control Dry	6	19	40.0
2016	June	Control Dry	6	20	40.0
2016	June	Control Dry	7	1	43.0
2016	June	Control Dry	7	2	55.0
2016	June	Control Dry	7	3	57.0
2016	June	Control Dry	7	4	44.0
2016	June	Control Dry	7	5	47.0

2016	June	Control Dry	7	6	49.0
2016	June	Control Dry	7	7	51.0
2016	June	Control Dry	7	8	58.0
2016	June	Control Dry	7	9	46.0
2016	June	Control Dry	7	10	66.0
2016	June	Control Dry	7	11	71.0
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2016	June	Control Dry	7	13	39.0
2016	June	Control Dry	7	14	44.0
2016	June	Control Dry	7	15	56.0
2016	June	Control Dry	7	16	40.0
2016	June	Control Dry	7	17	55.0
2016	June	Control Dry	7	18	44.0
2016	June	Control Dry	7	19	59.0
2016	June	Control Dry	7	20	28.0
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2016	June	Control Dry	8	3	57.0
2016	June	Control Dry	8	4	63.0
2016	June	Control Dry	8	5	60.0
2016	June	Control Dry	8	6	64.0
2016	June	Control Dry	8	7	75.0
2016	June	Control Dry	8	8	66.0
2016	June	Control Dry	8	9	59.0
2016	June	Control Dry	8	10	52.0

2016	June	Control Dry	8	11	70.0
2016	June	Control Dry	8	12	64.0
2016	June	Control Dry	8	13	70.0
2016	June	Control Dry	8	14	62.0
2016	June	Control Dry	8	15	58.0
2016	June	Control Dry	8	16	57.0
2016	June	Control Dry	8	17	44.0
2016	June	Control Dry	8	18	86.0
2016	June	Control Dry	8	19	69.0
2016	June	Control Dry	8	20	59.0
2016	June	Control Dry	9	1	62.0
2016	June	Control Dry	9	2	63.0
2016	June	Control Dry	9	3	77.0
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2016	June	Control Dry	9	5	88.0
2016	June	Control Dry	9	6	92.0
2016	June	Control Dry	9	7	81.0
2016	June	Control Dry	9	8	77.0
2016	June	Control Dry	9	9	70.0
2016	June	Control Dry	9	10	68.0
2016	June	Control Dry	9	11	83.0
2016	June	Control Dry	9	12	83.0
2016	June	Control Dry	9	13	77.0
2016	June	Control Dry	9	14	69.0
2016	June	Control Dry	9	15	61.0

2016	June	Control Dry	9	16	69.0
2016	June	Control Dry	9	17	55.0
2016	June	Control Dry	9	18	52.0
2016	June	Control Dry	9	19	60.0
2016	June	Control Dry	9	20	70.0
2016	June	Control Dry	10	1	55.0
2016	June	Control Dry	10	2	58.0
2016	June	Control Dry	10	3	42.0
2016	June	Control Dry	10	4	72.0
2016	June	Control Dry	10	5	77.0
2016	June	Control Dry	10	6	56.0
2016	June	Control Dry	10	7	77.0
2016	June	Control Dry	10	8	72.0
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2016	June	Control Dry	10	10	47.0
2016	June	Control Dry	10	11	52.0
2016	June	Control Dry	10	12	55.0
2016	June	Control Dry	10	13	58.0
2016	June	Control Dry	10	14	49.0
2016	June	Control Dry	10	15	50.0
2016	June	Control Dry	10	16	55.0
2016	June	Control Dry	10	17	49.0
2016	June	Control Dry	10	18	41.0
2016	June	Control Dry	10	19	58.0
2016	June	Control Dry	10	20	59.0

2016	June	Control Dry	11	1	80.0
2016	June	Control Dry	11	2	79.0
2016	June	Control Dry	11	3	72.0
2016	June	Control Dry	11	4	77.0
2016	June	Control Dry	11	5	42.0
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2016	June	Control Dry	11	7	51.0
2016	June	Control Dry	11	8	55.0
2016	June	Control Dry	11	9	66.0
2016	June	Control Dry	11	10	69.0
2016	June	Control Dry	11	11	56.0
2016	June	Control Dry	11	12	51.0
2016	June	Control Dry	11	13	49.0
2016	June	Control Dry	11	14	47.0
2016	June	Control Dry	11	15	46.0
2016	June	Control Dry	11	16	49.0
2016	June	Control Dry	11	17	55.0
2016	June	Control Dry	11	18	63.0
2016	June	Control Dry	11	19	59.0
2016	June	Control Dry	11	20	60.0
2016	June	Control Dry	12	1	66.0
2016	June	Control Dry	12	2	71.0
2016	June	Control Dry	12	3	70.0
2016	June	Control Dry	12	4	55.0
2016	June	Control Dry	12	5	68.0

2016	June	Control Dry	12	6	73.0
2016	June	Control Dry	12	7	58.0
2016	June	Control Dry	12	8	78.0
2016	June	Control Dry	12	9	67.0
2016	June	Control Dry	12	10	47.0
2016	June	Control Dry	12	11	58.0
2016	June	Control Dry	12	12	58.0
2016	June	Control Dry	12	13	66.0
2016	June	Control Dry	12	14	59.0
2016	June	Control Dry	12	15	57.0
2016	June	Control Dry	12	16	60.0
2016	June	Control Dry	12	17	77.0
2016	June	Control Dry	12	18	62.0
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2016	June	Control Dry	13	3	55.0
2016	June	Control Dry	13	4	68.0
2016	June	Control Dry	13	5	62.0
2016	June	Control Dry	13	6	55.0
2016	June	Control Dry	13	7	47.0
2016	June	Control Dry	13	8	46.0
2016	June	Control Dry	13	9	52.0
2016	June	Control Dry	13	10	53.0

2016	June	Control Dry	13	11	58.0
2016	June	Control Dry	13	12	69.0
2016	June	Control Dry	13	13	71.0
2016	June	Control Dry	13	14	69.0
2016	June	Control Dry	13	15	73.0
2016	June	Control Dry	13	16	75.0
2016	June	Control Dry	13	17	61.0
2016	June	Control Dry	13	18	59.0
2016	June	Control Dry	13	19	63.0
2016	June	Control Dry	13	20	66.0
2016	June	Control Dry	14	1	47.0
2016	June	Control Dry	14	2	61.0
2016	June	Control Dry	14	3	44.0
2016	June	Control Dry	14	4	58.0
2016	June	Control Dry	14	5	62.0
2016	June	Control Dry	14	6	55.0
2016	June	Control Dry	14	7	52.0
2016	June	Control Dry	14	8	47.0
2016	June	Control Dry	14	9	61.0
2016	June	Control Dry	14	10	78.0
2016	June	Control Dry	14	11	44.0
2016	June	Control Dry	14	12	58.0
2016	June	Control Dry	14	13	52.0
2016	June	Control Dry	14	14	48.0
2016	June	Control Dry	14	15	51.0

2016	June	Control Dry	14	16	55.0
2016	June	Control Dry	14	17	45.0
2016	June	Control Dry	14	18	68.0
2016	June	Control Dry	14	19	41.0
2016	June	Control Dry	14	20	39.0
2016	June	Control Dry	15	1	46.0
2016	June	Control Dry	15	2	46.0
2016	June	Control Dry	15	3	55.0
2016	June	Control Dry	15	4	41.0
2016	June	Control Dry	15	5	43.0
2016	June	Control Dry	15	6	54.0
2016	June	Control Dry	15	7	44.0
2016	June	Control Dry	15	8	49.0
2016	June	Control Dry	15	9	51.0
2016	June	Control Dry	15	10	77.0
2016	June	Control Dry	15	11	73.0
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2016	June	Control Dry	15	13	49.0
2016	June	Control Dry	15	14	66.0
2016	June	Control Dry	15	15	63.0
2016	June	Control Dry	15	16	54.0
2016	June	Control Dry	15	17	66.0
2016	June	Control Dry	15	18	61.0
2016	June	Control Dry	15	19	35.0
2016	June	Control Dry	15	20	42.0

2016	June	Control Dry	16	1	88.0
2016	June	Control Dry	16	2	79.0
2016	June	Control Dry	16	3	65.0
2016	June	Control Dry	16	4	69.0
2016	June	Control Dry	16	5	53.0
2016	June	Control Dry	16	6	67.0
2016	June	Control Dry	16	7	62.0
2016	June	Control Dry	16	8	50.0
2016	June	Control Dry	16	9	48.0
2016	June	Control Dry	16	10	57.0
2016	June	Control Dry	16	11	55.0
2016	June	Control Dry	16	12	52.0
2016	June	Control Dry	16	13	49.0
2016	June	Control Dry	16	14	44.0
2016	June	Control Dry	16	15	61.0
2016	June	Control Dry	16	16	60.0
2016	June	Control Dry	16	17	67.0
2016	June	Control Dry	16	18	94.0
2016	June	Control Dry	16	19	89.0
2016	June	Control Dry	16	20	78.0
2016	June	Control Dry	17	1	66.0
2016	June	Control Dry	17	2	57.0
2016	June	Control Dry	17	3	63.0
2016	June	Control Dry	17	4	77.0
2016	June	Control Dry	17	5	74.0

2016	June	Control Dry	17	6	74.0
2016	June	Control Dry	17	7	78.0
2016	June	Control Dry	17	8	83.0
2016	June	Control Dry	17	9	70.0
2016	June	Control Dry	17	10	88.0
2016	June	Control Dry	17	11	65.0
2016	June	Control Dry	17	12	84.0
2016	June	Control Dry	17	13	75.0
2016	June	Control Dry	17	14	76.0
2016	June	Control Dry	17	15	83.0
2016	June	Control Dry	17	16	84.0
2016	June	Control Dry	17	17	88.0
2016	June	Control Dry	17	18	73.0
2016	June	Control Dry	17	19	83.0
2016	June	Control Dry	17	20	80.0
2016	June	Control Dry	18	1	56.0
2016	June	Control Dry	18	2	55.0
2016	June	Control Dry	18	3	42.0
2016	June	Control Dry	18	4	59.0
2016	June	Control Dry	18	5	43.0
2016	June	Control Dry	18	6	47.0
2016	June	Control Dry	18	7	44.0
2016	June	Control Dry	18	8	36.0
2016	June	Control Dry	18	9	37.0
2016	June	Control Dry	18	10	77.0

2016	June	Control Dry	18	11	52.0
2016	June	Control Dry	18	12	65.0
2016	June	Control Dry	18	13	62.0
2016	June	Control Dry	18	14	55.0
2016	June	Control Dry	18	15	59.0
2016	June	Control Dry	18	16	83.0
2016	June	Control Dry	18	17	70.0
2016	June	Control Dry	18	18	72.0
2016	June	Control Dry	18	19	90.0
2016	June	Control Dry	18	20	84.0
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2016	June	Control Dry	19	4	63.0
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2016	June	Control Dry	19	8	72.0
2016	June	Control Dry	19	9	60.0
2016	June	Control Dry	19	10	59.0
2016	June	Control Dry	19	11	58.0
2016	June	Control Dry	19	12	64.0
2016	June	Control Dry	19	13	75.0
2016	June	Control Dry	19	14	77.0
2016	June	Control Dry	19	15	61.0

2016	June	Control Dry	19	16	58.0
2016	June	Control Dry	19	17	77.0
2016	June	Control Dry	19	18	68.0
2016	June	Control Dry	19	19	73.0
2016	June	Control Dry	19	20	66.0
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2016	June	Control Dry	20	2	16.0
2016	June	Control Dry	20	3	44.0
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2016	June	Control Dry	20	13	41.0
2016	June	Control Dry	20	14	39.0
2016	June	Control Dry	20	15	34.0
2016	June	Control Dry	20	16	34.0
2016	June	Control Dry	20	17	34.0
2016	June	Control Dry	20	18	44.0
2016	June	Control Dry	20	19	58.0
2016	June	Control Dry	20	20	47.0

2016	June	Mosaic	1	1	66.0
2016	June	Mosaic	1	2	63.0
2016	June	Mosaic	1	3	45.0
2016	June	Mosaic	1	4	43.0
2016	June	Mosaic	1	5	61.0
2016	June	Mosaic	1	6	68.0
2016	June	Mosaic	1	7	61.0
2016	June	Mosaic	1	8	52.0
2016	June	Mosaic	1	9	57.0
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2016	June	Mosaic	3	1	33.0
2016	June	Mosaic	3	2	35.0
2016	June	Mosaic	3	3	58.0
2016	June	Mosaic	3	4	63.0
2016	June	Mosaic	3	5	66.0

2016	June	Mosaic	3	6	41.0
2016	June	Mosaic	3	7	49.0
2016	June	Mosaic	3	8	55.0
2016	June	Mosaic	3	9	58.0
2016	June	Mosaic	3	10	57.0
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2016	June	Mosaic	3	19	22.0
2016	June	Mosaic	3	20	26.0
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2016	June	Mosaic	5	6	47.0
2016	June	Mosaic	5	7	57.0
2016	June	Mosaic	5	8	67.0
2016	June	Mosaic	5	9	34.0
2016	June	Mosaic	5	10	30.0

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2016	June	Mosaic	5	13	56.0
2016	June	Mosaic	5	14	55.0
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2016	June	Mosaic	7	11	16.0
2016	June	Mosaic	7	12	18.0
2016	June	Mosaic	7	13	21.0
2016	June	Mosaic	7	14	35.0
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2016	June	Mosaic	9	18	38.0
2016	June	Mosaic	9	19	35.0
2016	June	Mosaic	9	20	36.0

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2016	June	Mosaic	12	3	56.0
2016	June	Mosaic	12	4	67.0
2016	June	Mosaic	12	5	32.0

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2016	June	Mosaic	12	9	40.0
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2016	June	Mosaic	14	6	62.0
2016	June	Mosaic	14	7	68.0
2016	June	Mosaic	14	8	72.0
2016	June	Mosaic	14	9	77.0
2016	June	Mosaic	14	10	62.0

2016	June	Mosaic	14	11	40.0
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2016	June	Mosaic	14	13	45.0
2016	June	Mosaic	14	14	73.0
2016	June	Mosaic	14	15	66.0
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2016	June	Mosaic	16	11	58.0
2016	June	Mosaic	16	12	49.0
2016	June	Mosaic	16	13	43.0
2016	June	Mosaic	16	14	43.0
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2016	June	Mosaic	18	16	58.0
2016	June	Mosaic	18	17	48.0
2016	June	Mosaic	18	18	68.0
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2016	June	Mosaic	20	18	62.0
2016	June	Mosaic	20	19	82.0
2016	June	Mosaic	20	20	68.0
2016	June	Mosaic	21	1	35.0
2016	June	Mosaic	21	2	72.0
2016	June	Mosaic	21	3	73.0
2016	June	Mosaic	21	4	24.0
2016	June	Mosaic	21	5	44.0

2016	June	Mosaic	21	6	37.0
2016	June	Mosaic	21	7	47.0
2016	June	Mosaic	21	8	83.0
2016	June	Mosaic	21	9	74.0
2016	June	Mosaic	21	10	87.0
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2016	June	Mosaic	21	16	68.0
2016	June	Mosaic	21	17	79.0
2016	June	Mosaic	21	18	62.0
2016	June	Mosaic	21	19	83.0
2016	June	Mosaic	21	20	35.0
2016	June	Mosaic	22	1	45.0
2016	June	Mosaic	22	2	67.0
2016	June	Mosaic	22	3	62.0
2016	June	Mosaic	22	4	72.0
2016	June	Mosaic	22	5	45.0
2016	June	Mosaic	22	6	66.0
2016	June	Mosaic	22	7	83.0
2016	June	Mosaic	22	8	84.0
2016	June	Mosaic	22	9	46.0
2016	June	Mosaic	22	10	49.0
2016	June	Mosaic	22	11	55.0
2016	June	Mosaic	22	12	59.0
2016	June	Mosaic	22	13	68.0
2016	June	Mosaic	22	14	76.0
2016	June	Mosaic	22	15	66.0
2016	June	Mosaic	22	16	79.0
2016	June	Mosaic	22	17	88.0
2016	June	Mosaic	22	18	90.0
2016	June	Mosaic	22	19	51.0
2016	June	Mosaic	22	20	67.0
2016	June	Mosaic	23	1	55.0
2016	June	Mosaic	23	2	52.0
2016	June	Mosaic	23	3	55.0
2016	June	Mosaic	23	4	78.0
2016	June	Mosaic	23	5	41.0
2016	June	Mosaic	23	6	46.0
2016	June	Mosaic	23	7	48.0
2016	June	Mosaic	23	8	29.0
2016	June	Mosaic	23	9	33.0
2016	June	Mosaic	23	10	59.0

2016	June	Mosaic	23	11	58.0
2016	June	Mosaic	23	12	62.0
2016	June	Mosaic	23	13	64.0
2016	June	Mosaic	23	14	61.0
2016	June	Mosaic	23	15	54.0
2016	June	Mosaic	23	16	34.0
2016	June	Mosaic	23	17	47.0
2016	June	Mosaic	23	18	51.0
2016	June	Mosaic	23	19	35.0
2016	June	Mosaic	23	20	29.0
2016	June	Mosaic	24	1	52.0
2016	June	Mosaic	24	2	73.0
2016	June	Mosaic	24	3	71.0
2016	June	Mosaic	24	4	65.0
2016	June	Mosaic	24	5	59.0
2016	June	Mosaic	24	6	54.0
2016	June	Mosaic	24	7	65.0
2016	June	Mosaic	24	8	77.0
2016	June	Mosaic	24	9	70.0
2016	June	Mosaic	24	10	69.0
2016	June	Mosaic	24	11	58.0
2016	June	Mosaic	24	12	58.0
2016	June	Mosaic	24	13	55.0
2016	June	Mosaic	24	14	55.0
2016	June	Mosaic	24	15	63.0
2016	June	Mosaic	24	16	61.0
2016	June	Mosaic	24	17	60.0
2016	June	Mosaic	24	18	49.0
2016	June	Mosaic	24	19	40.0
2016	June	Mosaic	24	20	48.0
2016	June	Mosaic	25	1	47.0
2016	June	Mosaic	25	2	67.0
2016	June	Mosaic	25	3	50.0
2016	June	Mosaic	25	4	38.0
2016	June	Mosaic	25	5	77.0
2016	June	Mosaic	25	6	39.0
2016	June	Mosaic	25	7	64.0
2016	June	Mosaic	25	8	68.0
2016	June	Mosaic	25	9	58.0
2016	June	Mosaic	25	10	69.0
2016	June	Mosaic	25	11	79.0
2016	June	Mosaic	25	12	70.0
2016	June	Mosaic	25	13	76.0
2016	June	Mosaic	25	14	59.0
2016	June	Mosaic	25	15	55.0

2016	June	Mosaic	25	16	42.0
2016	June	Mosaic	25	17	54.0
2016	June	Mosaic	25	18	88.0
2016	June	Mosaic	25	19	55.0
2016	June	Mosaic	25	20	48.0
2016	June	Mosaic	26	1	67.0
2016	June	Mosaic	26	2	55.0
2016	June	Mosaic	26	3	43.0
2016	June	Mosaic	26	4	45.0
2016	June	Mosaic	26	5	56.0
2016	June	Mosaic	26	6	51.0
2016	June	Mosaic	26	7	73.0
2016	June	Mosaic	26	8	47.0
2016	June	Mosaic	26	9	57.0
2016	June	Mosaic	26	10	48.0
2016	June	Mosaic	26	11	69.0
2016	June	Mosaic	26	12	69.0
2016	June	Mosaic	26	13	72.0
2016	June	Mosaic	26	14	75.0
2016	June	Mosaic	26	15	66.0
2016	June	Mosaic	26	16	65.0
2016	June	Mosaic	26	17	67.0
2016	June	Mosaic	26	18	55.0
2016	June	Mosaic	26	19	78.0
2016	June	Mosaic	26	20	41.0
2016	June	Mosaic	27	1	45.0
2016	June	Mosaic	27	2	50.0
2016	June	Mosaic	27	3	98.0
2016	June	Mosaic	27	4	110.0
2016	June	Mosaic	27	5	45.0
2016	June	Mosaic	27	6	38.0
2016	June	Mosaic	27	7	44.0
2016	June	Mosaic	27	8	61.0
2016	June	Mosaic	27	9	63.0
2016	June	Mosaic	27	10	72.0
2016	June	Mosaic	27	11	38.0
2016	June	Mosaic	27	12	30.0
2016	June	Mosaic	27	13	67.0
2016	June	Mosaic	27	14	73.0
2016	June	Mosaic	27	15	62.0
2016	June	Mosaic	27	16	37.0
2016	June	Mosaic	27	17	60.0
2016	June	Mosaic	27	18	66.0
2016	June	Mosaic	27	19	57.0
2016	June	Mosaic	27	20	58.0

2016	June	Mosaic	28	1	35.0
2016	June	Mosaic	28	2	45.0
2016	June	Mosaic	28	3	52.0
2016	June	Mosaic	28	4	55.0
2016	June	Mosaic	28	5	56.0
2016	June	Mosaic	28	6	41.0
2016	June	Mosaic	28	7	37.0
2016	June	Mosaic	28	8	29.0
2016	June	Mosaic	28	9	32.0
2016	June	Mosaic	28	10	52.0
2016	June	Mosaic	28	11	55.0
2016	June	Mosaic	28	12	56.0
2016	June	Mosaic	28	13	48.0
2016	June	Mosaic	28	14	51.0
2016	June	Mosaic	28	15	57.0
2016	June	Mosaic	28	16	77.0
2016	June	Mosaic	28	17	72.0
2016	June	Mosaic	28	18	70.0
2016	June	Mosaic	28	19	66.0
2016	June	Mosaic	28	20	79.0
2016	June	Mosaic	29	1	61.0
2016	June	Mosaic	29	2	62.0
2016	June	Mosaic	29	3	59.0
2016	June	Mosaic	29	4	78.0
2016	June	Mosaic	29	5	61.0
2016	June	Mosaic	29	6	82.0
2016	June	Mosaic	29	7	89.0
2016	June	Mosaic	29	8	63.0
2016	June	Mosaic	29	9	90.0
2016	June	Mosaic	29	10	62.0
2016	June	Mosaic	29	11	48.0
2016	June	Mosaic	29	12	52.0
2016	June	Mosaic	29	13	45.0
2016	June	Mosaic	29	14	46.0
2016	June	Mosaic	29	15	49.0
2016	June	Mosaic	29	16	43.0
2016	June	Mosaic	29	17	55.0
2016	June	Mosaic	29	18	48.0
2016	June	Mosaic	29	19	59.0
2016	June	Mosaic	29	20	62.0
2016	June	Mosaic	30	1	38.0
2016	June	Mosaic	30	2	39.0
2016	June	Mosaic	30	3	35.0
2016	June	Mosaic	30	4	52.0
2016	June	Mosaic	30	5	28.0

2016	June	Mosaic	30	6	21.0
2016	June	Mosaic	30	7	22.0
2016	June	Mosaic	30	8	43.0
2016	June	Mosaic	30	9	37.0
2016	June	Mosaic	30	10	55.0
2016	June	Mosaic	30	11	28.0
2016	June	Mosaic	30	12	15.0
2016	June	Mosaic	30	13	10.0
2016	June	Mosaic	30	14	12.0
2016	June	Mosaic	30	15	27.0
2016	June	Mosaic	30	16	42.0
2016	June	Mosaic	30	17	84.0
2016	June	Mosaic	30	18	77.0
2016	June	Mosaic	30	19	25.0
2016	June	Mosaic	30	20	39.0
2016	June	Mosaic	31	1	52.0
2016	June	Mosaic	31	2	44.0
2016	June	Mosaic	31	3	67.0
2016	June	Mosaic	31	4	60.0
2016	June	Mosaic	31	5	69.0
2016	June	Mosaic	31	6	33.0
2016	June	Mosaic	31	7	36.0
2016	June	Mosaic	31	8	49.0
2016	June	Mosaic	31	9	49.0
2016	June	Mosaic	31	10	55.0
2016	June	Mosaic	31	11	49.0
2016	June	Mosaic	31	12	56.0
2016	June	Mosaic	31	13	41.0
2016	June	Mosaic	31	14	47.0
2016	June	Mosaic	31	15	57.0
2016	June	Mosaic	31	16	35.0
2016	June	Mosaic	31	17	38.0
2016	June	Mosaic	31	18	62.0
2016	June	Mosaic	31	19	62.0
2016	June	Mosaic	31	20	63.0
2016	June	Mosaic	32	1	52.0
2016	June	Mosaic	32	2	67.0
2016	June	Mosaic	32	3	71.0
2016	June	Mosaic	32	4	38.0
2016	June	Mosaic	32	5	29.0
2016	June	Mosaic	32	6	48.0
2016	June	Mosaic	32	7	42.0
2016	June	Mosaic	32	8	48.0
2016	June	Mosaic	32	9	47.0
2016	June	Mosaic	32	10	60.0

2016	June	Mosaic	32	11	53.0
2016	June	Mosaic	32	12	40.0
2016	June	Mosaic	32	13	78.0
2016	June	Mosaic	32	14	58.0
2016	June	Mosaic	32	15	84.0
2016	June	Mosaic	32	16	59.0
2016	June	Mosaic	32	17	47.0
2016	June	Mosaic	32	18	56.0
2016	June	Mosaic	32	19	61.0
2016	June	Mosaic	32	20	57.0
2016	June	Mosaic	33	1	49.0
2016	June	Mosaic	33	2	57.0
2016	June	Mosaic	33	3	55.0
2016	June	Mosaic	33	4	62.0
2016	June	Mosaic	33	5	65.0
2016	June	Mosaic	33	6	50.0
2016	June	Mosaic	33	7	56.0
2016	June	Mosaic	33	8	44.0
2016	June	Mosaic	33	9	52.0
2016	June	Mosaic	33	10	90.0
2016	June	Mosaic	33	11	86.0
2016	June	Mosaic	33	12	73.0
2016	June	Mosaic	33	13	68.0
2016	June	Mosaic	33	14	63.0
2016	June	Mosaic	33	15	68.0
2016	June	Mosaic	33	16	69.0
2016	June	Mosaic	33	17	83.0
2016	June	Mosaic	33	18	69.0
2016	June	Mosaic	33	19	42.0
2016	June	Mosaic	33	20	59.0
2016	June	Mosaic	34	1	51.0
2016	June	Mosaic	34	2	53.0
2016	June	Mosaic	34	3	79.0
2016	June	Mosaic	34	4	74.0
2016	June	Mosaic	34	5	84.0
2016	June	Mosaic	34	6	53.0
2016	June	Mosaic	34	7	56.0
2016	June	Mosaic	34	8	66.0
2016	June	Mosaic	34	9	51.0
2016	June	Mosaic	34	10	62.0
2016	June	Mosaic	34	11	56.0
2016	June	Mosaic	34	12	58.0
2016	June	Mosaic	34	13	66.0
2016	June	Mosaic	34	14	48.0
2016	June	Mosaic	34	15	69.0

2016	June	Mosaic	34	16	66.0
2016	June	Mosaic	34	17	69.0
2016	June	Mosaic	34	18	56.0
2016	June	Mosaic	34	19	42.0
2016	June	Mosaic	34	20	58.0
2016	June	Mosaic	35	1	37.0
2016	June	Mosaic	35	2	83.0
2016	June	Mosaic	35	3	88.0
2016	June	Mosaic	35	4	64.0
2016	June	Mosaic	35	5	44.0
2016	June	Mosaic	35	6	48.0
2016	June	Mosaic	35	7	43.0
2016	June	Mosaic	35	8	48.0
2016	June	Mosaic	35	9	56.0
2016	June	Mosaic	35	10	32.0
2016	June	Mosaic	35	11	64.0
2016	June	Mosaic	35	12	69.0
2016	June	Mosaic	35	13	28.0
2016	June	Mosaic	35	14	26.0
2016	June	Mosaic	35	15	41.0
2016	June	Mosaic	35	16	38.0
2016	June	Mosaic	35	17	44.0
2016	June	Mosaic	35	18	46.0
2016	June	Mosaic	35	19	53.0
2016	June	Mosaic	35	20	49.0
2016	June	Mosaic	36	1	58.0
2016	June	Mosaic	36	2	67.0
2016	June	Mosaic	36	3	70.0
2016	June	Mosaic	36	4	46.0
2016	June	Mosaic	36	5	77.0
2016	June	Mosaic	36	6	74.0
2016	June	Mosaic	36	7	63.0
2016	June	Mosaic	36	8	43.0
2016	June	Mosaic	36	9	82.0
2016	June	Mosaic	36	10	83.0
2016	June	Mosaic	36	11	81.0
2016	June	Mosaic	36	12	42.0
2016	June	Mosaic	36	13	89.0
2016	June	Mosaic	36	14	48.0
2016	June	Mosaic	36	15	31.0
2016	June	Mosaic	36	16	26.0
2016	June	Mosaic	36	17	44.0
2016	June	Mosaic	36	18	26.0
2016	June	Mosaic	36	19	66.0
2016	June	Mosaic	36	20	34.0

2016	June	Mosaic	37	1	62.0
2016	June	Mosaic	37	2	79.0
2016	June	Mosaic	37	3	61.0
2016	June	Mosaic	37	4	58.0
2016	June	Mosaic	37	5	81.0
2016	June	Mosaic	37	6	88.0
2016	June	Mosaic	37	7	71.0
2016	June	Mosaic	37	8	62.0
2016	June	Mosaic	37	9	73.0
2016	June	Mosaic	37	10	82.0
2016	June	Mosaic	37	11	79.0
2016	June	Mosaic	37	12	67.0
2016	June	Mosaic	37	13	72.0
2016	June	Mosaic	37	14	73.0
2016	June	Mosaic	37	15	77.0
2016	June	Mosaic	37	16	43.0
2016	June	Mosaic	37	17	43.0
2016	June	Mosaic	37	18	35.0
2016	June	Mosaic	37	19	38.0
2016	June	Mosaic	37	20	45.0
2016	June	Mosaic	38	1	32.0
2016	June	Mosaic	38	2	55.0
2016	June	Mosaic	38	3	44.0
2016	June	Mosaic	38	4	56.0
2016	June	Mosaic	38	5	58.0
2016	June	Mosaic	38	6	45.0
2016	June	Mosaic	38	7	35.0
2016	June	Mosaic	38	8	43.0
2016	June	Mosaic	38	9	67.0
2016	June	Mosaic	38	10	52.0
2016	June	Mosaic	38	11	52.0
2016	June	Mosaic	38	12	69.0
2016	June	Mosaic	38	13	56.0
2016	June	Mosaic	38	14	51.0
2016	June	Mosaic	38	15	43.0
2016	June	Mosaic	38	16	52.0
2016	June	Mosaic	38	17	78.0
2016	June	Mosaic	38	18	59.0
2016	June	Mosaic	38	19	53.0
2016	June	Mosaic	38	20	47.0
2016	June	Mosaic	39	1	56.0
2016	June	Mosaic	39	2	60.0
2016	June	Mosaic	39	3	54.0
2016	June	Mosaic	39	4	55.0
2016	June	Mosaic	39	5	62.0

2016	June	Mosaic	39	6	72.0
2016	June	Mosaic	39	7	33.0
2016	June	Mosaic	39	8	75.0
2016	June	Mosaic	39	9	67.0
2016	June	Mosaic	39	10	35.0
2016	June	Mosaic	39	11	90.0
2016	June	Mosaic	39	12	99.0
2016	June	Mosaic	39	13	58.0
2016	June	Mosaic	39	14	74.0
2016	June	Mosaic	39	15	81.0
2016	June	Mosaic	39	16	91.0
2016	June	Mosaic	39	17	88.0
2016	June	Mosaic	39	18	74.0
2016	June	Mosaic	39	19	92.0
2016	June	Mosaic	39	20	99.0
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2016	June	Mosaic	40	3	44.0
2016	June	Mosaic	40	4	45.0
2016	June	Mosaic	40	5	44.0
2016	June	Mosaic	40	6	67.0
2016	June	Mosaic	40	7	69.0
2016	June	Mosaic	40	8	67.0
2016	June	Mosaic	40	9	59.0
2016	June	Mosaic	40	10	77.0
2016	June	Mosaic	40	11	63.0
2016	June	Mosaic	40	12	55.0
2016	June	Mosaic	40	13	49.0
2016	June	Mosaic	40	14	51.0
2016	June	Mosaic	40	15	59.0
2016	June	Mosaic	40	16	62.0
2016	June	Mosaic	40	17	52.0
2016	June	Mosaic	40	18	62.0
2016	June	Mosaic	40	19	44.0
2016	June	Mosaic	40	20	39.0