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Butterfly Monitoring Results from Home Farm Marsh

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Introduction

Butterflies are important indicator species of farmland biodiversity throughout Europe (Dover, 1999). They have short life-cycles, limited dispersal and tight food-plant specialisation. They respond rapidly to subtle habitat and climatic changes and as such are good representatives of the responses of other wildlife. Recent research has indicated that butterflies are in fact declining faster than birds and wild flowers in the UK (UKBMS, 2011). Of the 482 species of butterfly in Europe, over a third have experienced population declines since 2000 (Van Swaay *et al.*, 2010). The primary cause of these declines is through habitat loss and degradation predominantly as a result of agricultural intensification and cessation of sensitive management practises (Skórka *et al.*, 2006; Van Swaay *et al.*, 2010; Dover *et al.*, 2011).

Moreover, this problem is exacerbated by the trend in setting aside 'fortress' protected areas and a reluctance towards the importance of maintaining biodiversity over whole landscapes and meta-populations (Dover *et al.*, 2011). It is only through sensitive management of the wider countryside system that improvement can be made to agricultural biodiversity and more wildlife-friendly protocols are needed to deliver this economically. The current EU Common Agricultural Policy (CAP) has so far fallen short of targets to support transitions from intensive to High Nature Value (HNV) farming practises and funding for agri-environment schemes in the EU currently receives less than

25% of the CAP budget (Joint Links, 2011). However, changes to the CAP are proposed in 2013 for effect between 2014 and 2020.

In an attempt to curb the declines of butterflies and day-flying moths in the UK, the National Butterfly Monitoring Scheme has been set up in order to collate data on species population trends throughout the country. This research has been conducted since 1976 and a total of 16.4 million butterflies have been counted and logged by Butterfly Conservation and the Centre of Ecology & Hydrology (UKBMS, 2011). Over these 35 years, general trends have become apparent including the declines in abundance and range of habitat specialist species and the expansion of generalist ones. It is under this scheme (and its methodology) that the current research has been conducted. The scheme's Devon co-ordinator is John Randall who should be contacted by email (jmrandall@blueyonder.co.uk) at the beginning and end of each 27 week transect year (1st April and 6th October) for data dissemination.

Methodology

Home Farm Marsh is a 72ha wildlife-friendly farm near Yelland in north Devon owned by the Gaia Trust and let under a farm tenancy agreement since 2002. The farm sits on the southern shore of the Taw/Torridge Estuary SSSI within the UNESCO Biosphere Reserve and on the edge of the North Devon AONB. The Gaia Trust is the registered charity which has pioneered the management and restoration of the farm under a 10-year Countryside Stewardship Scheme. This work has included the creation and extension of ponds and scrapes, the set aside of un-cropped buffer and conservation zones, grassland management and scrub clearance. The reserve is still a working dairy farm with the small-scale production of arable fodder crops and cereals, but widespread de-intensification is restoring the once-intensely managed farm back to a high nature value area. Wildlife-rich habitats now include an estuary embankment of unimproved maritime grassland, multiple dense hedgerows, a small copse, rotational arable fields (with margins), bird-seed mix headlands, ponds, scrapes, brackish water-courses and reed-bed. In 2012 however, the stewardship scheme ends and entry into Higher Level Stewardship is proposed.

From the 10th August to 5th October 2011, 8 transect weeks were conducted. Due to the small number of visits (full-time university studies took precedence) the succeeding results are by no means conclusive as to annual butterfly population dynamics but give a general guideline to how future management could evolve to complement butterfly diversity. The total transect consisted of 6 sections and totalled around 2.3km in length (see Figure 1). The habitats covered include coastal unimproved herb-rich grassland, improved grazing pasture, hedgerow and arable field. Transects were conducted during the middle of the day when weather conditions were favourable to flight, i.e. not raining. The transect width was set at 5 metres (2.5m either side of walked line) and all butterfly species observed within this zone were recorded. Factors measured included species, location, abundance, wind direction, wind strength, weather type, temperature and any behavioural notes. This data was entered into the Home Farm Marsh Databoard Excel file and onto the Transect Walker 2 program for packaging and sending to the county recorder.

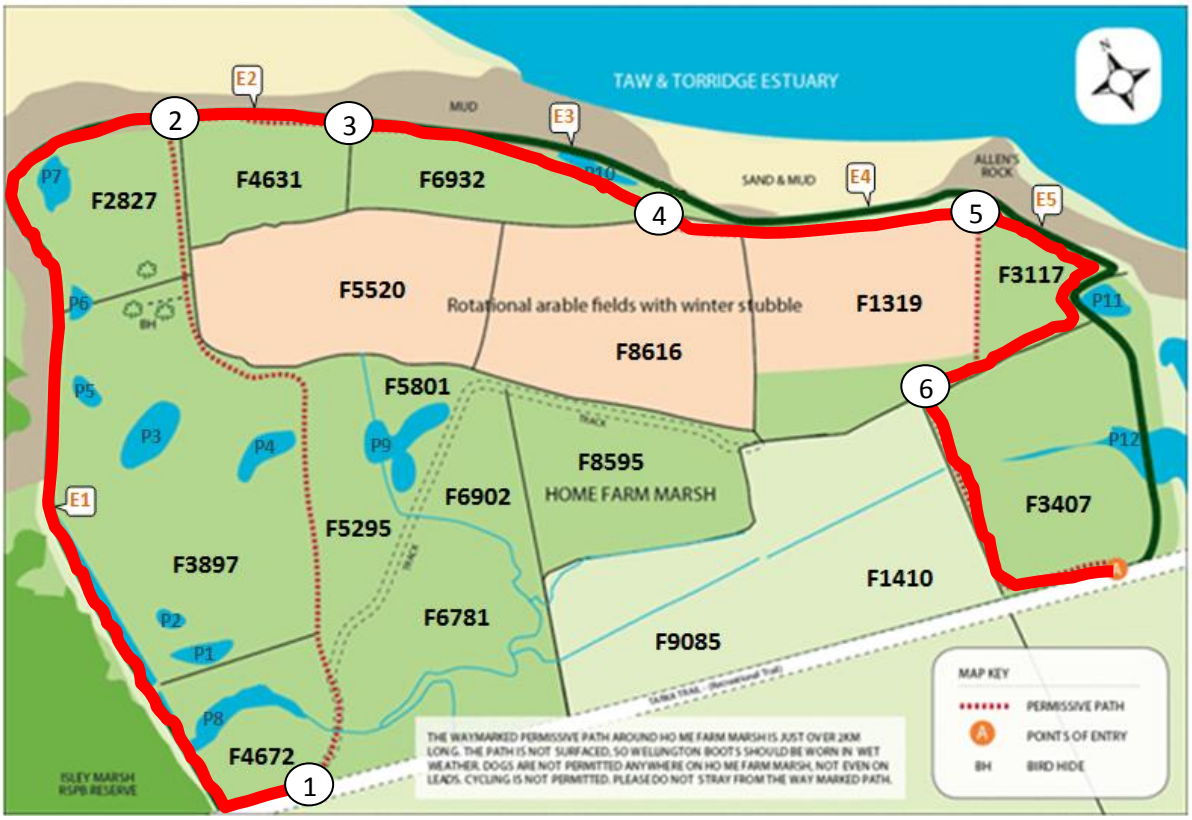


Figure 1: Map outlining the Home Farm Marsh BMS transect route (bold red line). Numbers indicate the start of each transect section (1 to 6).

Results

During 2011, 15 species of butterfly and day-flying moth were recorded on the transect route. The majority of species recorded during the monitoring period were observed on the unimproved embankments fringing the reserve's western end that borders the Taw/Torridge Estuary SSSI and RSPB Isley Marsh (transect sections 1 and 2). Here, numbers of Common Blue (*Polyommatus icarus*) and Meadow Brown (*Maniola jurtina*) were particularly high with 49 and 81 individuals counted, respectively. Peak numbers of Common Blues were found in warm spells during the middle of August (Figure 2) and ninety-six percent of all Common Blues recorded were in sections 1 and 2. Abundance of every species recorded and overall species richness itself drops dramatically between transect sections 3 and 6 in comparison to sections 1 and 2 (Figure 4). This is in line with a considerable decrease in wild flower species richness due to the improvement of pasture for cattle grazing and the cultivation of arable crops between sections 3 and 6. One generalist species, the Speckled Wood (*Pararge aegeria*) did increase in abundance within the more intensively farmed sections (Figure 3). However, all others followed the presiding pattern of decrease within these latter transects.

Some species were rather incidental and were recorded in very low numbers during the survey period, these include Brown Argus (*Aricia agestis*); 2 records in Sections 1 and 2 (E1/E2), Green-veined White (*Pieris napi*); 1 record in Section 2 (E2), Ringlet (*Aphantopus hyperantus*); 1 record in

Section 1 (E1), Large Yellow Underwing (*Noctua pronuba*); 2 records in Sections 2 and 6 (E2/F3407) and Comma (*Polygonia c-album*); 1 record in Section 2 (E2).

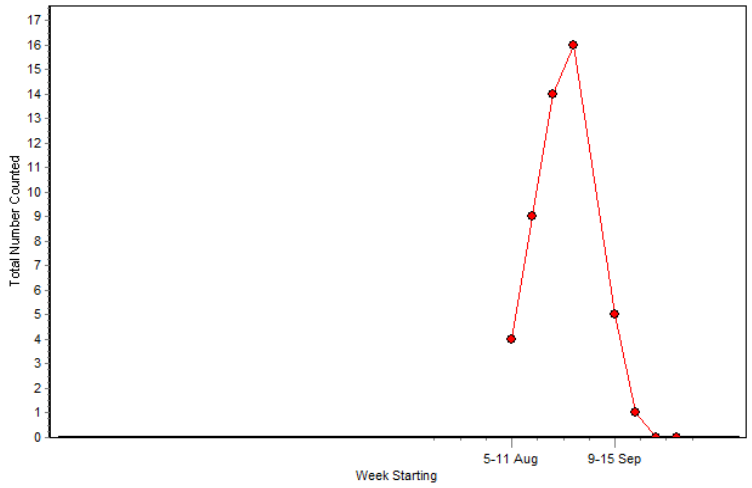


Figure 2: Scatter graph showing peak numbers of Common Blues (*P. icarus*) during the middle of August 2011.

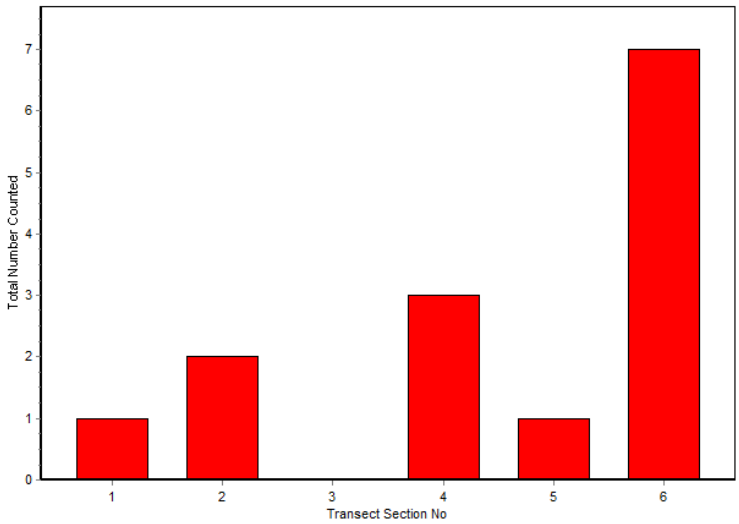


Figure 3: Bar chart showing the increased abundance of Speckled Wood (*P. aegeria*) in more intensively-farmed transect sections; the only species to show this pattern.

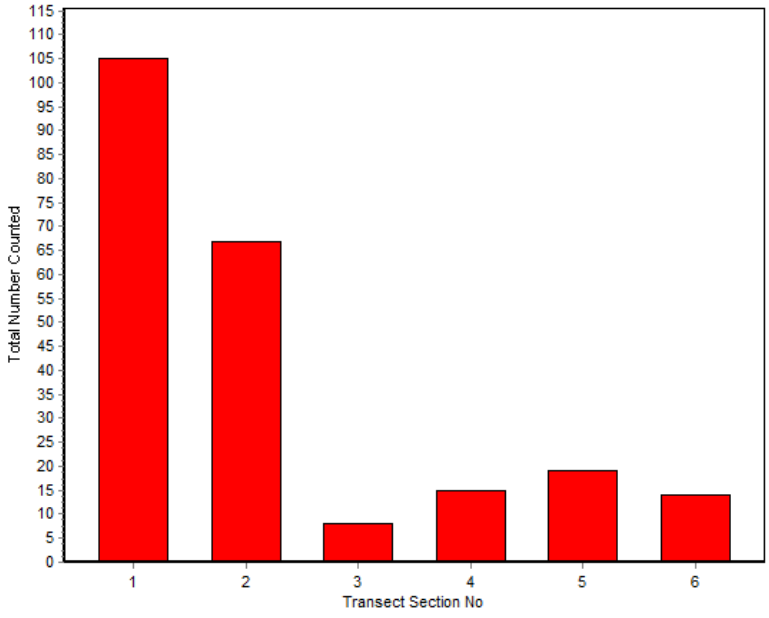


Figure 4: Bar chart displaying the general drop in all (but Speckled Wood) butterfly species abundance throughout transects 3-6. These latter transects are all set on agriculturally-improved pasture and arable land, whilst transects 1-2 are on the estuary embankment which does not receive any artificial nutrient addition and is cut once yearly in the autumn.

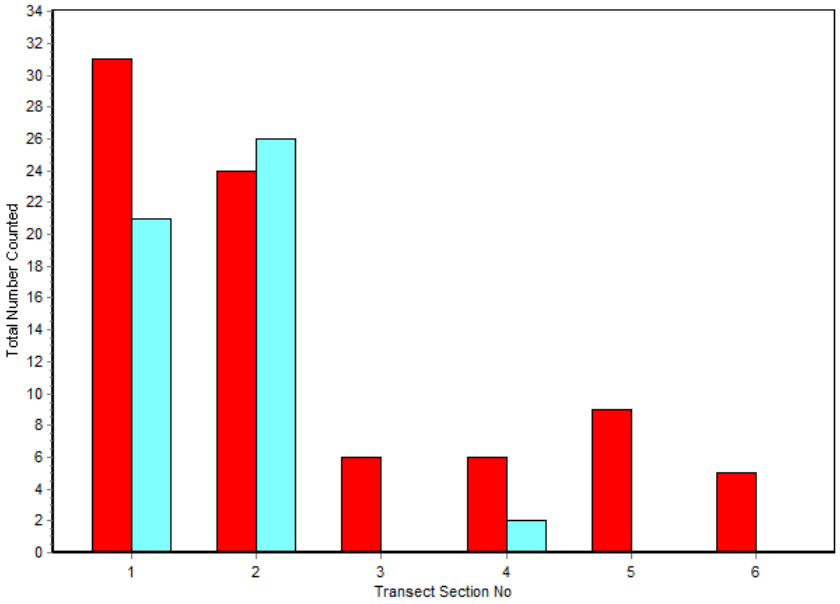


Figure 5: Bar chart displaying the dominance of Meadow Brown (*M. jurtina*) throughout all transects, where Common Blue (*P. icarus*), the second-most abundant species, drops away in number. Red bars represent Meadow Brown total numbers, and blue bars, Common Blue.

Overall, the most abundant species was the Meadow Brown (*M. jurtina*) which was dominant throughout all transects (Figure 5) and was by far the most regularly seen species when conducting the transect walks. Some species such as Six-spot Burnet (*Zygaena filipendulae*) and Silver Y (*Autographa gamma*) were very abundant (*Z. filipendulae* max. 14 over just 2 weeks) within very short periods (Figure 6). The burnet moth has such high abundance over a short period due to mass-hatching events where adults mate on the heads of knapweed plants (*Centauria* sp.). Peak abundance of the Silver Y moth is due to spikes in migration; sometimes coastal locations can become inundated with continental adults of this species (Butterfly Conservation, 2011).

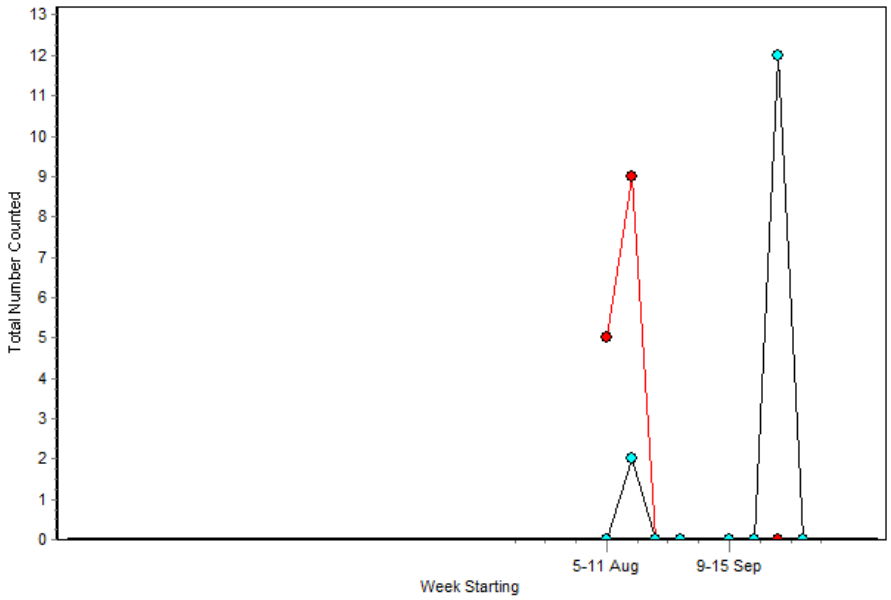


Figure 6: Scatter graph to show the boom-bust incidence of Six-spot Burnet (*Z. filipendulae*); red line, and Silver Y (*A. gamma*); black line. One hundred percent of records for these two species were from transect sections 1 and 2. High abundance periods are for different reasons explained in the above text.

Two species, the Small Copper (*Lycaena phlaeas*) and Small White (*Pieris rapae*) occurred in small numbers (8 and 11, respectively) in almost all (5 of the 6) transect sections, but in both cases, over 75% of records were from sections 1 and 2. Overall, **74.78% of all species recorded during 2011 were from sections 1 and 2 on the unimproved embankments**. No nationally rare, scarce or protected species were recorded during the survey period.

Discussion

It is quite clear from this short-term study that the majority of butterfly and day-flying moth species at Home Farm Marsh are using the flower-rich embankments (E1 and E2) for their primary habitat on the reserve. This stretch (around 1km) of unimproved maritime grassland is likely acting as a local source population from which founder individuals can, to a certain extent, spread across the surrounding farmland. As a primary point for future management, it is advised that these embankments are to be kept in a suitable state to ensure the viability of these butterfly populations and to uphold suitable numbers for dispersal. At present however, the embankments are coming under elevated pressure from dominant grass species (pers. obs.) which curtails the abundance and diversity of flowering herbs and ruderal grasses. This is a problem when considering the importance of flowers and sensitive grass species as both larval food-plants and adult nectar resources for butterflies (Dover, 1999).

The life-cycle of butterflies includes a larval, pupal and adult stage. For a population to remain viable, biotic and abiotic conditions must be favourable to all stages of the life-cycle. It is often thought that the larval host plant population is the primary driver of population dynamics amongst many butterfly species, but it has been found in most recent work that sub-optimal adult resources (lack of nectaring flowers, shelter, temperature) may be of greater importance (Dover, 1999). Particularly, the lack of nectar resources has been found to significantly affect longevity and fecundity of adult butterflies in grassland environments (Feber *et al.*, 1996). Both nectar resources and shelter can be actively managed by conservationists with an eye to protecting butterfly diversity.

An ad-hoc study of butterfly taxa present at Home Farm Marsh was conducted during 2006 and 2007. When comparing the data from this year to these two base years, it is apparent that despite there being more individuals counted during the 2011 surveys than in the 2006/2007 surveys (a result of increased sampling effort), they are from fewer taxa. The first surveys in 2006/2007 produced abundance data for 22 identified species. The surveys in 2011 turned up just 15, of which 7 were dependent on grasses as a larval food-plant. During 2011, species such as Marbled White (*Melanargia galathea*), Large Skipper (*Ochlodes sylvanus*), Small Skipper (*Thymelicus sylvestris*) and Orange-tip (*Anthocharis cardamines*) were absent. This may be due to a number of reasons, including survey time period. Species such as Marbled White have a short flight period between June and July and Orange-tips, between April and May (Higgins and Riley, 1970), i.e. before the 2011 surveys took place. However, Large Skippers have an extended flight period reaching well into August, so their absence is more questionable and may be a result of a shifting floristic component; from a highly diverse matrix of important less competitive grass species (the skipper's larval foodplant) to domination by a few robust grasses and herbs. The decline in flowering plant abundance (pers. obs.) may also be a cause of the skipper's decline as the adults require diverse nectaring plants to feed and reproduce.

A study conducted by Field *et al.,* 2006 showed that grass margins with a varied floristic component are significantly important to maintaining butterfly populations and that other factors such as site protection and shelter also significantly contributed. Indeed on Home Farm Marsh, it was seen that margins which were bordered by a protective hedgerow yielded consistently higher butterfly diversity counts. The ideal floral component consists of a high number of both herbaceous annuals and perennials, but also a wide variety of grass species. Grasses such as *Festuca rubra*, *Dactylis glomerata* and *Agrostis tenuis* are larval foodplants for around 13 species found at Home Farm Marsh, and flowering herbs such as *Leucanthemum vulgare*, *Knautia arvensis*, *Centaurea* spp. and *Lotus corniculatus* serve as adult nectar resources. *Lotus corniculatus* is also a larval foodplant for a number of butterfly species present at the marsh. To date, *L. vulgare* and *K. arvensis* have vanished from the embankment being previously recorded there in high numbers during 2006 and 2007 and *Centaruea* spp. and *L. corniculatus* have both declined in abundance (pers. obs). With regards grasses, an extensive survey is required to determine what species are present on the embankment. At present, it is apparent that both *Holcus lanatus* and *Agropyron pungens* are very dominant here and these species out-compete the more valuable smaller grasses.

Pywell *et al.*, 2003 found that for immobile species, shelter spots, nectar resources from legume species and floristically diverse field-margins were the most important constraints on abundance. Some butterfly populations at Home Farm Marsh can be regarded as immobile in that they exist within a hostile matrix of farmed landscapes, such that dispersal is limited and populations rarely meet. It is thought that the Tarka Trail aids dispersal of some species by acting as a green corridor, and that the UNESCO Biosphere Reserve at Braunton Burrows across the estuary is a form of source where dispersers may originate to found Home Farm Marsh meso-populations. Butterflies such as the Brown Argus (*Aricia agestis*) almost certainly follow this dynamic with few individuals recorded at Home Farm Marsh each year (2006/2007 = 1, 2011 = 2). Again, this is another reason why floral diversity should be increased at the site.

Overall, the emphasis for future management should be on improving the integrity of the habitats present and attempting to develop connectivity between fragments on the farm. It is widely published that connectivity is vital in terms of maintaining demographic and genetic viability in insect populations (Lindenmayer and Burgman, 2005). From the above research, it is important that we maintain a mixture of diverse grass and flowering herb species on the embankment to complement the heterogenous landscape and to act as a generation point for local butterfly populations. The current Tamarisk (*Tamarix gallica*) hedge that protects part of the embankment from onshore winds is undoubtedly a positive factor given that research has shown shelter to significantly augment butterfly populations. The extension of both its length and its species composition could be researched and perhaps instigated along E1. Primarily however, it is the simplification of the ground flora component and competition by dominant grass species that poses the biggest threat to butterfly populations on the embankments, as well as (to an extreme extent) in the grazed and arable fields. This is likely the reason for the transition from a diverse mix of 22 species in 2006/2007 to a simpler largely grass-dependent composition of 15 species in 2011.

With the threat of diverting already inadequate Pillar II funds away from agri-environment schemes (European Environment Agency, 2009; Joint Links, 2011) and the ever-pressing 2020 UK government targets to halt-biodiversity loss, it is important that we take the most appropriate steps at the micro-scale to improve conservation efforts in the UK. In this light, I suggest that it is necessary to revert

the simplification of the embankment community and to extend a floristically-enhanced margin into pastoral and arable fields 6932, 8616, 1319, 3117 and 3407. Having recently discussed this potential project with the Gaia Trust director I believe we need to incorporate an autumn cutting regime that not only reduces sward height and dominance, but followed by clearance of debris, will decrease nitrogen deposition on the embankments. This should then be complemented by scarifying the current field margins extending from 6932 east to 3407 and sowing an agreed (Natural England supervisor) floristically-enhanced grass margin (HE10 under HLS agreement). Establishment by seed-sowing will require active weed repression before and during restoration and following establishment, appropriate cutting or grazing cycles to maintain the community quality. As mentioned at the meeting, this margin will both serve to increase insect diversity throughout the farm (including bee diversity; Natural England, 2011) and serve as an aesthetic feature for visitors using the permissive pathway (which follows this proposed wild flower corridor). Wild flower seed mixes should be discussed with a Natural England supervisor and should not include any one species of over 50% by weight. It is advisable to sow in either mid March to late April, or July to August (Natural England, 2011). The placement of this corridor will not hamper field production as the margins are already in place, they simply require enriching!

A final possibility for maintaining this proposed corridor is employing the tenancy of a local grazier who could graze appropriate livestock (sheep) predominantly on the embankment (see http://www.grazinganimalsproject.org.uk/ for more information on this option).

Although meadow and grassland restoration is possible, even decades after abandonment or cessation of suitable management (Skórka *et al.*, 2006), it is important in my eyes that we maintain the habitat we have now in an agreeable condition in order to retain its biological value. As time progresses and habitat simplification increases almost logarithmically, it will become harder and more costly to revert back to a favourable condition.

To conclude, progress points for future management should include:

- Extensive grass and herb species survey of embankments to determine exactly which grasses are dominant and which species are diminishing.
- Discussion and implementation with Natural England advisor on HE10 agreement, seed-mix, management, funding and path-way maintenance.
- Autumn cutting by Environment Agency followed by a targeted clearance of debris to prevent increased nutrient deposition.
- Annual butterfly surveys (NBMS) along current transect route (liase with John Randall (jmrandall@blueyonder.co.uk)) to monitor populations from April – October.
- Seed of indigenous target nectar plants should be spread on already established embankments including *Leucanthemum vulgare*, *Knautia arvensis*, *Centauria nigra* and *Echium vulgare*.
- The possibility of using a grazier to cap dominance levels consistently throughout the year.
- **See Appendix for a map outlining proposed management actions.**

References

Butterfly Conservation, (2011) Silver Y Factsheet. Available at http://www.butterfly-conservation.org/Moth/440/Moth.html?MothId=113.

Dover, J.W., (1999) Butterflies and field margins. In *Aspects of Applied Biology 54: Field Margins and Buffer Zones: Ecology, Management and Policy.* Association of Applied Biologists, Wellesbourne. 109-116.

Dover, J.W., Spencer, S., Collins, S., Hadjigeorgiou, I. and Rescia, A., (2011) Grassland butterflies and low intensity farming in Europe. *Journal of Insect Conservation* **15**, 129-137.

European Environment Agency, (2009) Technical Report – Distribution and targeting of the CAP budget from a biodiversity perspective.

Feber, R.H., Smith, H. and MacDonald, D.W., (1996) The effects on butterfly abundance of the management of uncropped edges of arable fields. *Journal of Applied Ecology* **33**, 1191-1205.

Field, R.G., Gardiner, T., Mason, C.F. and Hill, J., (2006) Countryside Stewardship Scheme and butterflies: a study of plant and butterfly species richness. *Biodiversity and Conservation* **15**, 443-452.

Higgins, L.G. and Riley, N.D., (1970) *Butterflies of Britain and Europe.* Collins Publishing, London. 54-132.

Joint Links, (2011) Crunch Time for CAP – choosing the right tools for a richer countryside. Available at http://www.wcl.org.uk/docs/crunch_time_for_cap_08nov11.pdf viewed on 17.11.11.

Lindenmayer, D. and Burgman, M., (2005) Landscapes and Habitat Fragmentation in: *Practical Conservation Biology*. CSIRO Publishing, Collingwood, Victoria. 255-292.

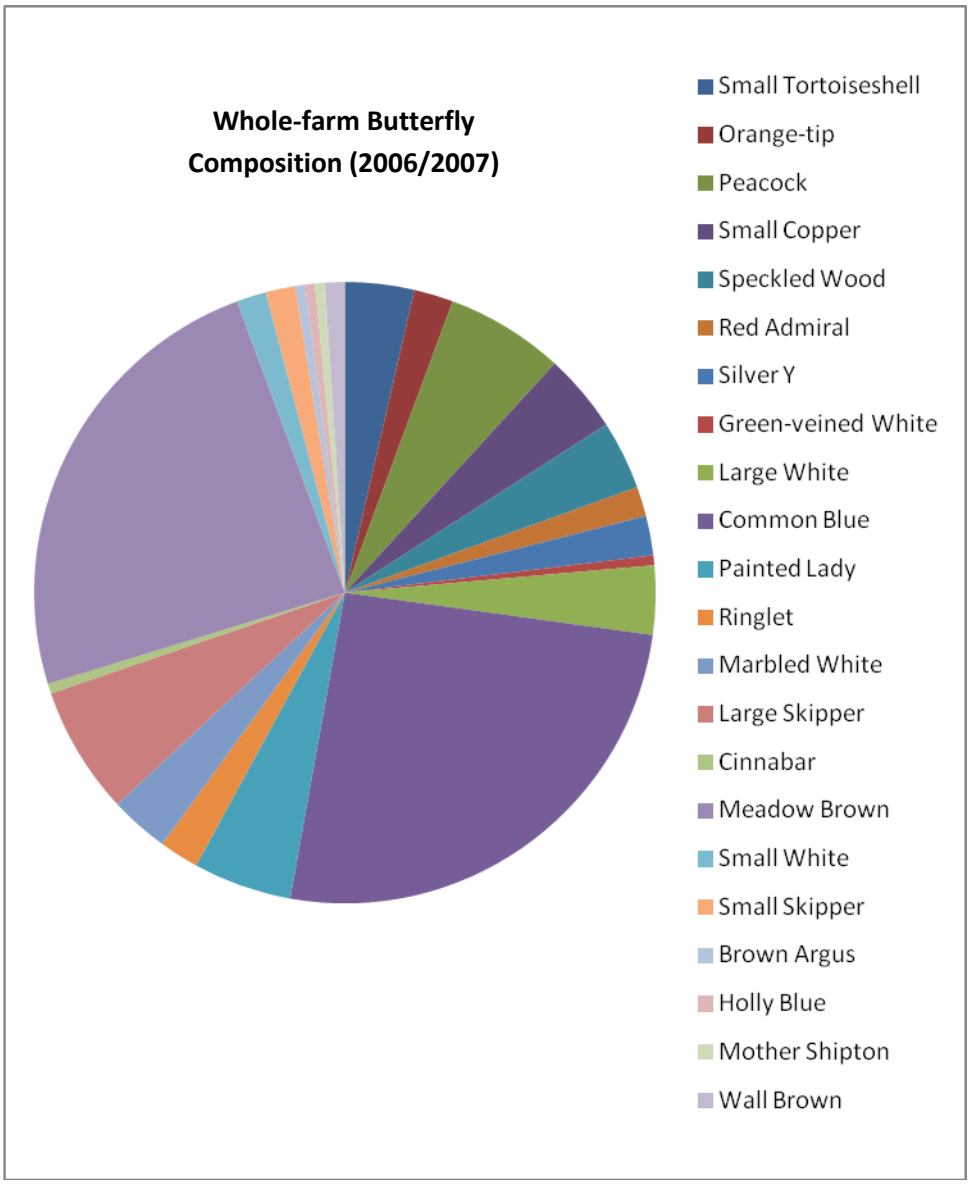
Natural England (2011) Natural England Technical Information Note TIN094.

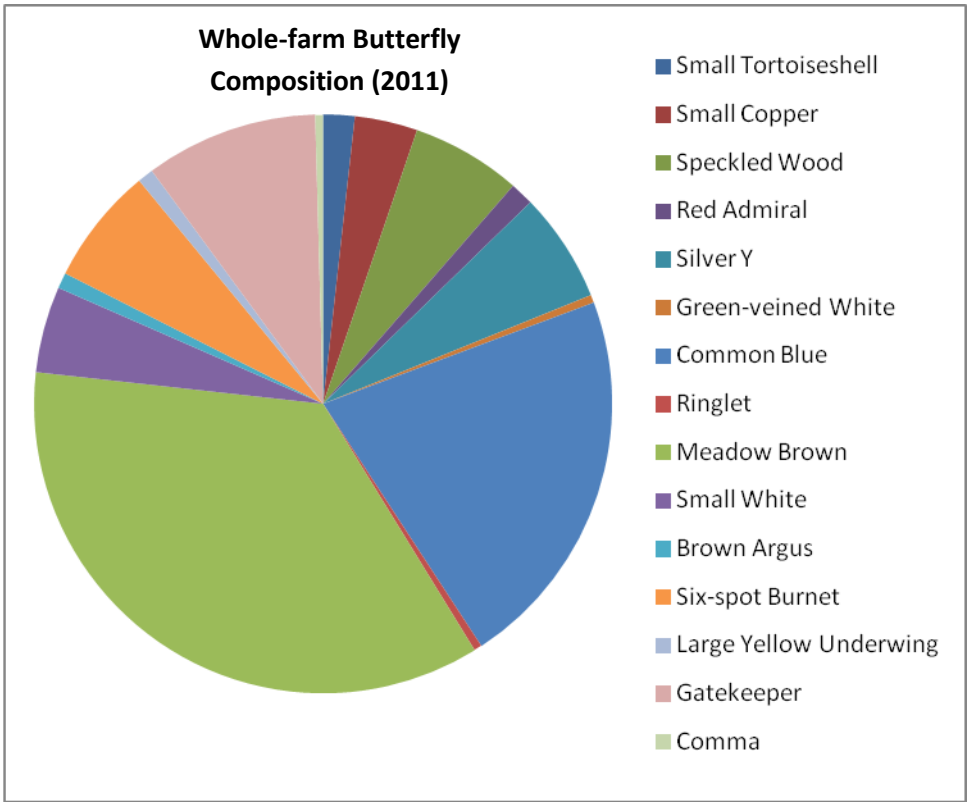
Skórka, P., Settele, J. and Woyciechowski, M., (2006) Effects of management cessation on grassland butterflies in Southern Poland. *Agriculture, Ecosystems and Environment* **121**, 319-324.

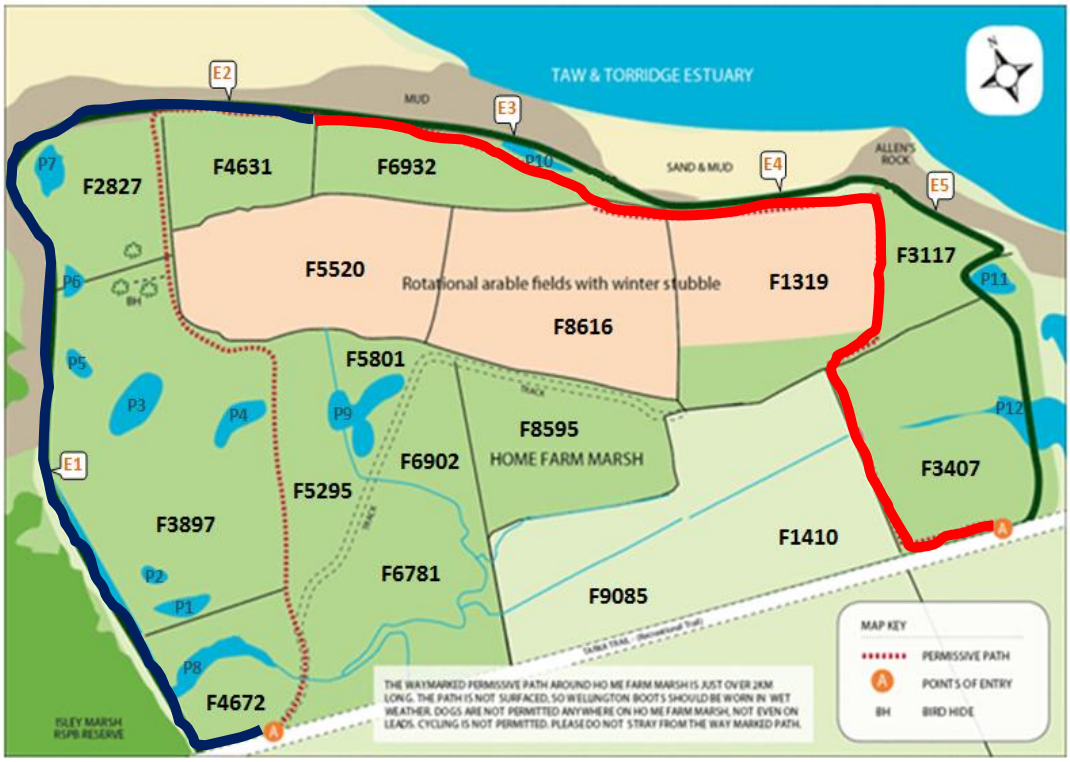
UK Butterfly Monitoring Scheme, (2011) The UK Butterfly Monitoring Scheme. Available at http://www.ukbms.org/.

Van Swaay, C., Cuttelod, A., Collins, S., Maes, D., Munguira, M.L., Ssic, M., Verovnik, R., Verstrael, T., Warren, M.S., Wiemers, M. and Wynhoff, I., (2010) European Red List of butterflies. *Publications Office of the European Union.* Luxembourg.

Appendix


Whole-farm Butterfly Composition (2006/2007)
Small Tortoiseshell
Orange-tip
Peacock
Small Copper
Speckled Wood
Red Admiral
Silver Y
Green-veined White
Large White
Common Blue
Painted Lady
Ringlet
Marbled White
Large Skipper
Cinnabar
Meadow Brown
Small White
Small Skipper
Brown Argus
Holly Blue
Mother Shipton
Wall Brown





Future Proposal: This map outlines (in navy blue) the current embankment which should be surveyed for species, cut in the autumn and thatch bundled and removed, undergo a targeted flower species introduction (lost species e.g. *L. vulgare*) and be maintained under continued cutting cycle or grazing. The red line indicates the proposed extension of the wild-flower corridor along the footpath to the second entrance point. This would complement the greatly improve the current set-aside strip and attract visitors.