Knepp Wildland Project
Transect Survey 2010

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Knepp Wildland Project - Transect Survey 2010

1. Introduction

The Knepp Wildland project has provided a rare opportunity to explore the ecological effects of low intensity grazing under as near natural conditions as achievable. In order to assess these effects, the Knepp baseline Ecological Survey of 2005 (Greenaway 2006) established an ecological audit, using repeatable methodologies so that changes could be evaluated over time. This audit was limited by available funding, so was restricted to surveys to monitor the changes in vegetation structure and composition and changes in selected groups of vertebrates and invertebrates.

Prior to 2001, much of the Estate land was under arable cultivation with some pasture. This was gradually abandoned as the Wildland Project gained pace, with the historical deer park being the first area to have fallow deer (2002), followed by longhorn cattle, Exmoor ponies and Tamworth pigs. Land adjacent to the Deer Park was brought into the scheme in 2004, followed by an area north of the A272 in 2006. Finally, the New Barn / Brookhouse area in the southwest of the Estate was fenced in 2009, allowing the grazing initiative to be extended further.

As part of the baseline audit of the vegetation, one of the surveys commissioned in 2005 was to record vascular plants along eight 30m belt transects in four selected areas, with the intention of repeating this exercise every five years. Kate Ryland (Dolphin Ecological Surveys) carried out the survey in 2005, except for one transect that was surveyed by Rich Howorth (WWLP Officer, Sussex Wildlife Trust). The summer of 2010 was thus the first repeat belt transect survey, the field work for which was carried out by Sophie Miller (SJM Ecology).

2. Methodology

2.1. Transect methodology

In 2005, two 30m belt transects were set up in each of four areas A, B, C and D (Table 1). These areas were selected because they each had different treatments: Area A (reseeded 2001, grazed 2002), Area B (reseeded 2004, grazed 2005), Area C (grazed 2006); Area D (pony paddock on semi-improved grassland). 15 contiguous 2 x 2m quadrats were laid out from the transect marker post in the direction indicated on the post. This was felt to be sufficient to record the sward composition within the fields and cover the important ecotone between woodland and grassland areas. The ground was very hard and dry at the time of the 2005 survey and the marker posts did not remain in position, so in 2010 the transects commenced at the 10-fig Grid Reference (Table 1) and ran along the direction followed in 2005. Although arable ceased in Area D from 2002 onwards, it was not grazed until 2009, following the erection of a perimeter deer fence earlier that year.

In each transect, all vascular plants were recorded with species cover estimated in each quadrat using the DOMIN scale. An average height of the vegetation (excluding trees) in each quadrat was measured by taking a mean of 3 measurements (Table 2). These belt transects were planned to enable changes in vegetation structure and species composition of vascular plants to be monitored over time.

Bare ground was estimated in each quadrat also using the DOMIN scale and species diversity was evaluated on a presence or absence basis. The detailed information obtained will also enable changes in the abundance and distribution of key plant species to be evaluated. Digital photographs were taken along the line of each transect. These are held on a CD retained by Knepp Castle Estate.

Table 1. Position of transects.

Transect Number	Location	Direction of Transect	Description of Location
A1	TQ15272 22284	East	South end of Matches Wood, approximately 9m into woodland over an open bank
A2	TQ15184 22346	North-north-east	North edge of Spring Wood, approximately 10m into woodland
B1	TQ15752 20553	West	Mid point on the western edge of Jacksons Wood, approximately 10m into the woodland over a bank and ditch
B2	TQ16067 20643	North	North edge of Swallows Furzefield, ¼ of the way from the western edge of the wood, approximately 10m into the woodland over a bank
C1	TQ16146 23713	East	Eastern edge of Coates Furzefield, ½ way along the edge, approximately 12m into the wood on the ride edge near a tall birch tree. A fallen branch from the wood edge into the field crosses the barbed wire fence and marks the location
C2	TQ15756 23624	East	Eastern edge of Alder Copse, approximately 10m into the woodland at a path into the wood
D1	TQ14810 20106	East-north-east	Western side of lagg on the southern edge, approximately 1m from the hedgerow and approximately 7m north of a mature oak tree. Transect hits the ditch to the south of the hawthorn shrub
D2	TQ14427 20225	North	South edge of Lancing Brook lagg, approximately 1m from the hedge

2.2. Data analysis.

Plant species distribution was analysed using Ellenberg's indicator values. These indicator values (Ellenberg 1979, 1988 & Ellenberg *et al.* 1991) were based on the ecological tolerances of vascular plant species of central Europe. To render the values appropriate to the UK, Ellenberg's original values were re-calibrated under the ECOFACT Research Programme (Hill *et al.* 1999). Deriving indicator values for British plants can address a number of objectives, those relevant to the Knepp wildland Project being

> "*to produce overall indicators of change in botanical characteristics in the British countryside……and to provide accessible and readily understandable results"* (Hill *et al.* 1999).

The British indicator values are based on each species' individual tolerances of five ecological variables, Light, Moisture, Reaction (pH), Nitrogen (soil fertility) and Salt. Each variable is ranked according to a scale of values from 1-9 (except Moisture, 1-12 and Salt, 0-9). In order to achieve a realistic method of identifying vegetation changes

in Knepp, species recorded in the contiguous quadrats along the belt transects were ranked according to the scales for Light and Nitrogen. These two variables were those considered most likely to change following arable reversion and the progress of the wildland initiative, thus effecting a pragmatic and easily repeatable evaluation of vegetation changes over time. There is the potential for a far more detailed analysis of the data collected than has been possible to date.

3. Constraints

In 2005, grassland management had included both mowing and grazing prior to transect recording, which in some cases made species identification difficult. In particular, common and creeping bent-grasses *Agrostis capillaris* and *A. stolonifera.* and Timothy and lesser cat's-tail *Phleum pratense* and *P. bertolonii* were recorded as *Agrostis sto/cap* and *Phleum pra/ber* due to the length of time it would have taken to separating these species where both occurred within quadrats. This was not necessary in 2010, as these species were more easily identified, thus leading to a discrepancy in the analysis.

Although every care was taken to site the 2010 transects in the same position as those in 2005, the early displacement of the marker posts, together with possible fluctuations in GPS readings mean that there are likely to be some discrepancies. As the Ellenberg indicator values are being used to identify trends, any such discrepancies were not felt to affect the overall evaluation of any observed changes.

4. Results.

4.1. Trends in vegetation

In both 2005 and 2010 graphs were prepared of the average Ellenberg scores for light and nitrogen values for each quadrat along one transect (Appendix I) from each area. For areas A and B, these graphs show a distinct transition from shade-tolerant plants requiring medium soil nitrogen levels (quadrats placed in the woodland) to plants requiring high light levels but tolerant of lower nitrogen levels towards the centre of the ex-arable land. Area C (north of the A272) also showed similar trends, with C2 showing evidence of ecotone develoment. Area D, which up to 2005 had been heavily horse-grazed, not reseeded and with no woodland component, also showed no clear trend except for a tendency for plants requiring higher nitrogen levels towards wetter ground in 2005. Although there were no large differences between 2005 and 2010 in D1, in D2 there was far more bare ground in 2010. Graphs of the amount of bare land in 2005 and 2010 were produced to enable the results of each survey to be compared (Appendix II).

Area A (reseeded 2001, grazed since 2002) – Transects A1 and A2.

Transects A1 and A2 commenced in Matches Wood and Spring Wood respectively, extending into the grassland, so that the first 5 quadrats were within the woodland.

<u>Ellenberg scores for Light & Nitrogen</u>

A1: very similar results for 2005 & 2010.

A2: very similar results for 2005 & 2010.

Bare ground
A1: no change 2005 –2010, high scores for bare ground in woodland quadrats.
A2: an increase in 2010, but no change in grassland.

Area B (reseeded 2004, grazed 2005) – Transects B1 and B2.
Transect B1 started midway along the western edge of Jacksons Wood, approximately 10m into the woodland over a bank and ditch. Transect B2 started at the N edge of Swallows Furzefield a quarter of the way from the western edge of the wood, approximately 10m into the woodland over a bank.

Ellenberg scores for Light & Nitrogen
B1: very similar results for 2005 & 2010.
B2: the 2005 results are somewhat anomalous, this transect was surveyed by a different surveyor, and may not have started within the woodland. The 2010 data reflects the pattern seen in A1, A2 and B1.

Bare ground
B1: Less bare ground in 2010, in all quadrats except one.
B2: Much more bare ground in the first 6 quadrats in 2010, which could have been due the erroneous starting point in 2005.

Area C (reseeded 2004, grazing 2006) – Transects C1 and C2
Transect C1 started halfway along the edge of the eastern edge of Coates Furzefield, approximately 12m into the wood on the ride edge near a tall birch tree. Transect C2 started on the eastern edge of Alder Copse, approximately 10m into the woodland at a path into the wood.

Ellenberg scores for Light & Nitrogen
C1: Very similar results 2005 and 2010
C2: Very similar results 2005 and 2010

Bare ground
C1: A very similar pattern in 2005 and 2010 except for a patch of much higher levels of bare ground in the grassland quadrats in 2010.
C2: An increased amount of bare ground in 2010 in all quadrats except two.

Area D (semi-improved grassland) – Transects D1 and D2.
Transect D1 started on the W side of a small stream on the southern edge of the field, approximately 1m from the hedgerow and approximately 7m north of a mature oak tree. Transect extends to the ditch to the south of the hawthorn shrub. Transect D2 starts at the S edge of Lancing Brook, approximately 1m from the hedge.

Ellenberg scores for Light & Nitrogen
D1: Species of open, well-lit habitat similar in both 2005 and 2020, in 2010 there is a higher score for species of lower fertility than in 2005.
D2: Very similar results 2005 and 2010.

Bare ground
D1: More bare ground in 2005 than in 2010.
D2: No bare ground recorded in 2005, indicating a large increase in 2010.

4.2. Vegetation height

Average height in each quadrat in 2005 and 2010 is given in Table 2, together with comments on the vegetation structure of each transect.

Table 2. Height of vegetation.

Transect Number	Quadrat Number	Average Vegetation Height (cm)		Comments on Vegetation Structure
		2005	2010	
A1	1	0	3	2005: Woodland floor is almost bare apart from tree seedlings. The canopy is uniform with a sparse, spindly shrub layer. The bank and ditch are generally bare with some bramble etc. The field has an even, uniform sward. 2010: Woodland floor continues to be almost bare with more species all at very low cover. Still a clear demarcation between woodland and grassland. Except for the increase in average height of the sparse woodland ground flora, the average height of the vegetation is lower in 2010 than it was in 2005.
	2	0	3	
	3	0 (3m and 10m trees)	2	
	4	0 (10+m tree)	1	
	5	0	3	
	6	30 (0)	16	
	7	15	12	
	8	20	16	
	9	25	19	
	10	25	17	
	11	25	12	
	12	25	14	
	13	25	12	
	14	25	16	
	15	15	18	
A2	1	10 (1m and 10m tree)	9	2005: Limited structural diversity in the woodland itself and an abrupt transition from woodland edge to the field. The woodland canopy is uniform throughout the plantation. The grassland sward is also uniform and this transect has two distinct zones with little transitional habitat. 2010: Higher levels of bare ground in the woodland quadrats in 2010, and higher average height of ground flora although a lower species diversity. Still two distinct zones with limited transitional habitat. Overall height of vegetation increased.
	2	10	13	
	3	10	16	
	4	10	17	
	5	0 (10)	17	
	6	40	10	
	7	20	25	
	8	15	32	
	9	10	19	
	10	15	22	
	11	10	21	
	12	5	16	
	13	10	18	
	14	10	11	
	15	10	8	
B1	1	0	16	2005: Woodland section was very desiccated, but the ground flora was formerly dominated by bluebell, common cleavers etc. and the woodland has a tall, even canopy and diverse shrub layer. The bank and ditch support dense bramble, nettle etc. adding to the variation in structure. The field had been topped and has a sparse, uniform sward with many bare patches on the dry, cracked ground. 2010: Overall less bare ground in 2010, the grassland areas recovering from cutting, with consistently taller vegetation. Still a clear demarcation between woodland and grassland
	2	0	22	
	3	5 (30)	21	
	4	10	28	
	5	10	7	
	6	0 (5-60)	10	
	7	60 (5)	20	
	8	5	22	
	9	5	17	
	10	5	18	
	11	5	16	
	12	5	25	
	13	5	16	
	14	5	13	

Transect Number	Quadrat Number	Average Vegetation Height (cm)		Comments on Vegetation Structure
		2005	**2010**	
	15	5	17	zones.
B2	1		14	***NB KR did not survey B2, and heights were not recorded.*** 2010: Large increase in bare ground in woodland. Two distinct zones, little transitional habitat.
	2		17	
	3		16	
	4		19	
	5		6	
	6		10	
	7		14	
	8		16	
	9		13	
	10		9	
	11		11	
	12		15	
	13		14	
	14		16	
	15		19	
C1	1	5 (40)	24	2005: Transect crosses a woodland ride and bank/ditch on wood edge – these sections show greatest structural variation. The grassland edge was mown but not grazed whilst the final section was both mown and grazed so had a very uniform sward. 2010: The ride / wood edge / field demarcation still apparent. Vegetation mostly taller than 2005, with localised effects of herbivore activity showing in Q14, which has a lot of bare ground.
	2	10	14	
	3	10 (1)	15	
	4	30	32	
	5	80 (0)	45	
	6	80 (0)	100	
	7	50 (5)	19	
	8	5 (20)	14	
	9	5	18	
	10	20	26	
	11	5	52	
	12	5	65	
	13	5	12	
	14	5	7	
	15	5	25	
C2	1	20	107	2005: Has a varied structure in the woodland edge though with a rather abrupt transition to the field. Grassland sward is uniform and was sheep grazed earlier in the year. 2010: Vegetation taller in woodland zone, similar in the grassland zone, with signs of a more species rich ecotone of somewhat shorter vegetation. Overall more bare ground in 2010.
	2	10 (20)	90	
	3	30 (5-80)	58	
	4	10 (100)	13	
	5	10	10	
	6	10	9	
	7	15	7	
	8	15	8	
	9	15	10	
	10	15	14	
	11	15	13	
	12	15	14	
	13	10	11	
	14	10	11	
	15	15	17	
D1	1	10	12	2005: Heavily horse grazed and parched grassland with a very low, even sward until the edge of the ditch where the vegetation is more lush. The ditch contains ungrazed, tall herb species and therefore has a much greater vegetation height.
	2	5	8	
	3	2	13	
	4	2	42	
	5	2	18	
	6	3	27	

Transect Number	Quadrat Number	Average Vegetation Height (cm)		Comments on Vegetation Structure
		2005	**2010**	
	7	3	19	2010: Taller vegetation and less bare ground reflecting the reduction in grazing pressure.
	8	2 (10)	10	
	9	2	63	
	10	3	27	
	11	3	63	
	12	10	78	
	13	15	103	
	14	15 (100)	18	
	15	100	38	
D2	1	40	88	2005: A taller grass dominated sward, but horse grazed and trampled causing a decrease in structural diversity. Occasional tussocks of rushes and tufted hair-grass provide the main variation. 2010: Reduction in intensity of grazing allowing further structural diversity to develop, together with areas of bare ground.
	2	30	10	
	3	15	7	
	4	20	8	
	5	20	35	
	6	20	28	
	7	30	24	
	8	25	75	
	9	40	21	
	10	30	24	
	11	30	17	
	12	30	19	
	13	40	24	
	14	40	48	
	15	40 (80)	15	

4.3 Species diversity and abundance

Overall species diversity across all eight transects varied little, with about 120 species recorded in 2005 and 127 in 2010. These are not absolute numbers, as a very few plants in both years were not identifiable beyond genus. There were 28 species recorded in 2005 but not in 2010, and 35 recorded in 2010 that had not been recorded in 2005. Graphs of species diversity in 2005 and 2010 enable the transect results of each survey to be compared (Appendix III).

<u>Species diversity in all transects.</u>

A1: Higher diversity in woodland in 2010, lower diversity in grassland.
A2: Lower diversity in woodland in 2010, higher at ecotone, very similar further into grassland.

B1: In 2005, a steady increase out of woodland onto grassland. In 2010, erratic swings in woodland and ecotone, with overall increase in diversity, decreases in diversity in grassland quadrats.
B2: Very erratic in 2005, still fairly erratic in 2010, although higher overall.

C1: Somewhat higher species diversity observed in most quadrats in 2010.
C2: Diversity very similar in the woodland and grassland quadrats in 2005 and 2010, but is higher in the ecotone quadrats in 2010.

D1: An increase in diversity observed in the first 6 quadrats, the remainder very similar in both 2005 and 2010.

D2: Except for 2 quadrats, diversity much higher in 2010 than in 2005.

The most abundant species in each transect were assessed on the basis of the DOMIN scores of cover. Yorkshire fog *Holcus lanatus*, bent grasses *Agrostis capillaris* and *stolonifera* and white clover *Trifolium repens* were found to be the most abundant species in both 2005 and 2010. The species cover data should be evaluated far more comprehensively after the next repeat in 2015, when trends will be more readily identifiable.

Species frequency also varied little between the two surveys. Yorkshire fog, creeping buttercup and rough meadow grass *Poa trivialis* occur in all 8 transects in both years (Table 3). Common bent grass, creeping bent and also lesser cat's-tail grasses occur in all transects in 2010 and it is highly probable that this was also the case in 2005, when they were not always identified to species. Two species that were recorded in all transects in 2005, rye grass *Lolium perenne* and curled dock *Rumex crispus* were less widespread in 2010. Creeping thistle *Cirsium arvense*, cleavers *Galium aparine*, dock *Rumex sanguineus*, white clover *Trifolium repens* and nettle *Urtica dioica* are all species that have increased their spread into all 8 transects in 2010, although most were present in 6 or seven transects in 2005. Over half of all species recorded in both years were present in only one or two transects – 61% in 2005 and 64% in 2010.

Table 3. Species frequency in 2005 and 2010.

2005	
Species	**Transects**
Achillea millefolium	1
Ag cap & sto	8
Agrostis capillaris	4
Agrostis stolonifera	2
Alopecurus geniculatus	1
Alopecurus pratensis	2
Anagallis arvensis	4
Anthoxanthum odoratum	1
Aphanes arvensis	3
Arctium minus	2
Arrhenatherum elatius	5
Arum maculatum	1
Brachypodium sylvaticum	4
Bromus hordeaceus	4
Cardamine hirsuta	1
Cardamine pratensis	1
Carex flacca	1
Carex hirta	1
Carex pendula	1
Carex remota	2
Carex spicata	1
Carex sylvatica	1
Carpinus betulus seedling	1
Centaurea nigra	1
Centaurium erythraea	3
Centaurium pulchellum	1
Cerastium fontanum	7
Circaea lutetiana	1

2010	
Species	**Transects**
Acer campestre sdlng	1
Acer pseudoplatanus seeding	1
Achillea millefolium	1
Agrostis capillaris	8
Agrostis stolonifera	8
Ajuga reptans	1
Alopecurus geniculatus	2
Alopecurus pratensis	3
Anagallis arvensis	1
Anthoxanthum odoratum	1
Apium nodiflorum	1
Arctium minor	1
Arrhenatherum elatius	4
Ballota nigra	1
Brachypodium sylvaticum	4
Bromus hordeaceus	1
Calystegia sepium	1
Cardamine pratensis	1
Carex pendula	1
Carex sylvatica	2
Carpinus betulus seedling	1
Centaurea nigra	2
Cerastium fontanum	7
Circaea lutetiana	1
Cirsium arvense	8
Cirsium palustre	2
Crataegus monogyna seedling	1
Cruciata laevipes	1

Cirsium arvense	7
Cirsium palustre	1
Cirsium vulgare	4
Crataegus monogyna	1
Cruciata laevipes	1
Cynosurus cristatus	5
Dactylis glomerata	7
Deschampsia cespitosa	1
Elytrigia repens	2
Euonymus europaeus	1
Festuca arundinacea	1
Festuca pratensis	3
Festuca rubra	6
Fraxinus excelsior seedling	2
Galium aparine	7
Geranium dissectum	3
Geum urbanum	3
Glechoma hederacea	5
Heracleum sphondylium	1
Holcus lanatus	8
Holcus mollis	2
Hordeum secalinum	2
Hyacinthoides non-scripta	2
Hypochoeris radicata	1
Juncus acutiflorus	1
Juncus bufonius	3
Juncus conglomeratus	1
Juncus effusus	6
Juncus inflexus	3
Kickxia elatine	3
Kickxia spuria	1
Lapsana communis	2
Lathyrus pratensis	1
Lepidium campestre	1
Leucanthemum vulgare	1
Lolium perenne	8
Lonicera periclymenum	3
Lotus corniculatus	2
Lotus pedunculatus	1
Lycopus europaeus	1
Lysimachia nummularia	1
Mentha aquatica	1
Mercurialis perennis	3
Moehringia trinervia	1
Myosotis arvensis	1
Myosotis ramosissima	2
Myosotis sylvatica	2
Oenanthe crocata	1
Persicaria maculosa	1
Phleum bertolinii	3
Phleum pratense	2
Plantago lanceolata	1
Plantago major	7

Cynosurus cristatus	4
Dactylis glomerata	7
Deschampsia cespitosa	1
Deschampsia flexuosa	2
Digitalis purpurea	1
Dryopteris dilatata	1
Epilobium ciliatum	2
Epilobium hirsutum	2
Festuca arundinacea	3
Festuca pratensis	2
Festuca rubra	4
Fraxinus excelsior seedling	1
Galium aparine	8
Galium verum	1
Geranium dissectum	2
Geranium robertianum	1
Geum urbanum	3
Glechoma hederacea	6
Glyceria fluitans	1
Gnaphthalium uliginosum	1
Holcus lanatus	8
Holcus mollis	1
Hordeum secalinum	1
Hyacinthoides non-scripta	5
Hypericum perforatum	2
Hypericum pulchrum	1
Juncus bufonius	1
Juncus effusus	6
Juncus inflexus	2
Lapsana communis	1
Lathyrus pratensis	1
Leucanthemum vulgare	1
Lolium perenne	6
Lonicera periclymenum	2
Lotus corniculatus	5
Lotus pedunculatus	2
Lycopus europaeus	2
Lysimachia nummularia	1
Mentha aquatica	3
Mercurialis perennis	3
Moehringia trinervia	2
Myosotis discolor	1
Oenanthe crocata	2
Persicaria maculosa	1
Phleum bertolonii	8
Phleum pratense	1
Picris echioides	2
Plantago lanceolata	2
Plantago major	4
Poa annua	6
Poa nemoralis	1
Poa pratensis	3
Poa trivialis	8

Poa annua	4
Poa nemoralis	1
Poa trivialis	8
Polygonum aviculare	1
Potentilla reptans	1
Prunella vulgaris	4
Prunus spinosa	3
Pteridium aquilinum	2
Pulicaria dysenterica	1
Quercus robur seedling	3
Ranunculus acris	2
Ranunculus repens	8
Rubus fruticosus agg.	2
Rumex acetosa	2
Rumex crispus	8
Rumex obtusifolius	2
Rumex sanguineus	4
Sagina procumbens	2
Sonchus asper	3
Stachys sylvatica	1
Stellaria graminea	2
Stellaria holostea	1
Tamus communis	1
Teucrium scorodonia	2
Trifolium campestre	2
Trifolium dubium	3
Trifolium pratense	3
Trifolium repens	7
Triplospermum inodorum	3
Urtica dioica	6
Veronica chamaedrys	4
Veronica hederifolia	2
Veronica montana	2
Veronica officinalis	1
Veronica polita	1
Veronica serpyllifolia	5
Vicia cracca	1
Viola arvensis	2
Viola riviniana	4

Polygonum aviculare	1
Potentilla erecta	1
Potentilla reptans	3
Primula vulgaris	2
Prunella vulgaris	5
Prunus spinosa sdlng	4
Pteridium aquilinum	1
Pulicaria dysenterica	4
Quercus robur seedling	1
Ranunculus acris	2
Ranunculus repens	8
Ranunculus sceleratus	1
Rubus fruticosus agg.	7
Rumex acetosa	1
Rumex conglomeratus	2
Rumex crispus	2
Rumex obtusifolius	2
Rumex sanguineus	8
Salix caprea sdling	1
Sambucus nigra sdlng	1
Scrophularia nodosa	1
Senecio erucifolius	2
Senecio jacobaea	4
Silene dioica	1
Sonchus asper	6
Stachys sylvatica	1
Stellaria graminea	3
Stellaria holostea	3
Stellaria media	4
Succisa pratensis	1
Tamus communis	1
Taraxacum sp.	1
Teucrium scorodonia	1
Trifolium dubium	1
Trifolium pratense	1
Trifolium repens	8
Triplospermum inodorum	1
Urtica dioica	8
Veronica chamaedrys	4
Veronica serpyllifolia	5
Vicia hirta	1
Vicia sativa	1
Vicia tetrasperma	1
Viola riviniana	5
Vulpia bromoides	1

5. Discussion

It is now 8 years since the first fallow deer were introduced to the historical Deer Park area, marking the beginning of the Knepp Wildland Project, and much of the project area has now had large herbivores on it for at least 4 years. There has usually only been a year or two between coming out of arable and into the new grazing regime.

Area D, the southern block, followed a different course, as until deer fencing was finally erected in early 2009 the only 'larger' herbivores were wild roe deer and rabbits. This meant that some fields in this southern block had been out of arable for up to seven years before longhorn cattle, Exmoor ponies and Tamworth pigs were introduced later in 2009. By the time these animals were introduced, there were clear differences apparent in the southern block, with extensive areas of sallow *Salix* spp scrub developing as well as large areas of tall forbs (grasses and other herbaceous species). Woodlands within this area also retained both understorey and ground flora. This area therefore started from a better baseline as far as vegetation structure was concerned before the larger herbivores were admitted. In 2010, this is visually still very apparent (Fig.1).

Fig.1. Transect D1, structural complexity. Sophie Miller.

Areas A, B and C have fared rather differently to date. Area A, the Deer Park, retains a clear demarcation between woodland and grassland. Ground flora and in places understorey has virtually disappeared (Fig 2).

Fig. 2. Woodland stretch of Transect A1. Sophie Miller

Some areas of woodland floor, for instance Matches Wood, are now devoid of vegetation following access by deer. Area B is similar and to a lesser extent so is Area C, although woodland here still retains more of its understorey and ground flora. The belt transects reflect this, with the overall pattern of Ellenberg scores in 2010 very similar to those of 2005. In six of the eight transects, there are increases in the amount of bare ground recorded, at least in the woodland quadrats. The fixed-point photography carried out in July each year since 2005 (Howorth 2010) supports these observations. The loss of woodland ground flora is cause for concern, so too is the very limited amount of tree seedlings recorded along the transects. The implication is that grazing/browsing levels are too high.

Species diversity was overall somewhat higher in 2010 than in 2005, only falling to any extent in the grassland quadrats of Transects A1 and B1 and the woodland quadrats of A2. This is a positive development, although many species were present at extremely low levels, 1 or 2 in the DOMIN scale, especially in the woodland quadrats. Amalgamating all the transect results, there were approximately 120 species recorded in 2005 and 127 in 2010. This approximation allows for the difficulty in separating common and creeping bent grasses and Timothy and lesser cat's-tail grasses in 2005, due to the later date the transects were surveyed and the time available in which to do it, and also the small number of records for which an identification below genus level was not possible. Tree records were not recorded in either estimation, although tree seedlings were.

28 species were recorded in 2005 but not in 2010 and 35 were recorded in 2010 but not in 2005. Most of these were species that only occurred at low levels in one or two transects. As might be expected, a few of the less competitive arable plants recorded in 2005 such as sharp-leaved fluellen *Kickxia elatine* and round-leaved fluellen *K. spuria* were among those not recorded in 2010. The two newcomers appearing more abundantly in 2010 were ragwort *Senecio jacobaea* and common chickweed *Stellaria media*, both common weeds of cultivated or bare ground.

There is considerable similarity in the most frequently occurring and abundant species in 2005 and 2010, with Yorkshire fog grass, creeping buttercup and rough meadow grass the most frequent species in both surveys, and Yorkshire fog grass, common bent grass and white clover the most abundant. Common and creeping bent grass and lesser cat's-tail grass also occurred in all transects in 2010. These are likely to have been similarly frequent in 2005 when they were not always identified to species. Rye grass and curled dock, recorded in all transects in 2005, were less frequent in 2010. Creeping thistle, cleavers, dock, white clover and nettle have all increased in frequency, present in all 8 transects in 2010, although most were present in 6 or seven transects in 2005. All these 13 species are widespread, common species of rather damp disturbed ground or pasture. Thistles and docks, together with ragwort *Senecio jacobaea* are classified as Injurious Weeds and as such their increased presence in Knepp has attracted some adverse comment from neighbouring landowners. The future dynamics of these species will be of interest.

A greater increase in vascular plant diversity across the transects would have been rewarding. The fairly low rate of increase is due in part to the rate at which individual species disperse. Many of the new or increasingly common species either have airborne-seeds, for example ragwort, thistles and willowherbs *Epilobium* species, or

spread by means of rhizomes or stolons, eg creeping thistle, nettle and white clover. Quadrats in woodland sections remain fairly species-poor, although with some increases in diversity albeit at very low cover. Grassland quadrats are more variable, with some gains and some losses in diversity. However, any evaluation of species occurrence and abundance should take into account that it is based on just 2 transects in each area.

Of most concern is the loss of woodland ground cover and the low level of structural change and woody species seedling recruitment. This is an indication that herbivore numbers, especially those of fallow deer, are too high, as there are also wild roe deer present. At present stocking levels, the results from transect surveys, fixed-point photography (Howorth 2010) and visual assessment indicate a simplification of woodland vegetation structure rather than a diversification in Areas A, B and C. If tree regeneration is prevented, the tendency will be towards a wood pasture structure of mature trees and grass as natural senescence and death of trees occurs in previously wooded areas, with grassland over the formerly arable areas. Wood pasture is a valuable, often species-rich habitat and one that should be increased, but not at the expense of woodlands with ground flora, understorey and canopy. The loss of diversity (plant and animal) resulting from over-grazing in woodland areas will not be compensated for by allowing these areas to become wood pasture.

Observing future changes in species composition will be of increasing interest, especially the effects of herbivore activity in the southern block. The next repeat of the transect survey will be due in 2015.

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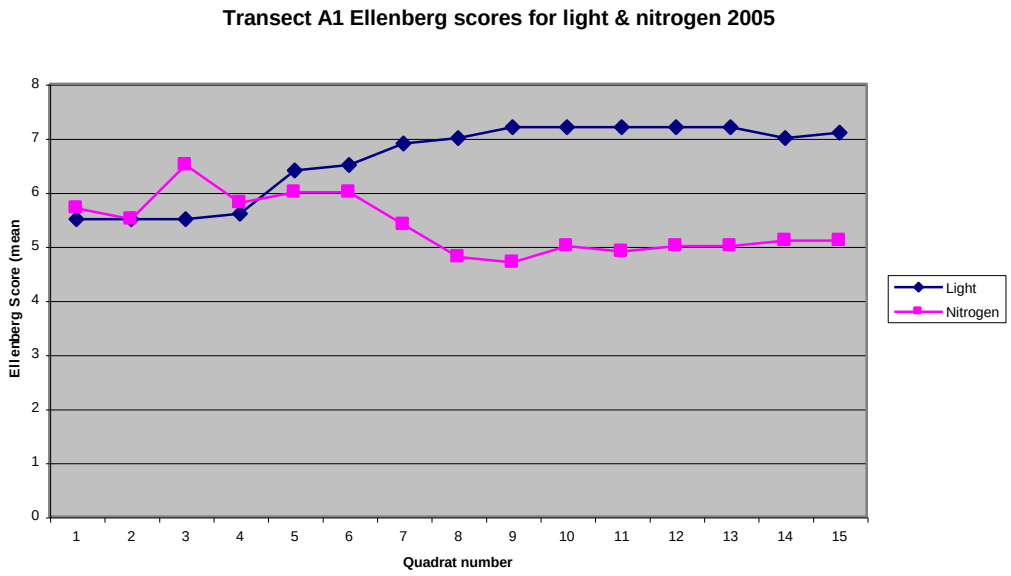
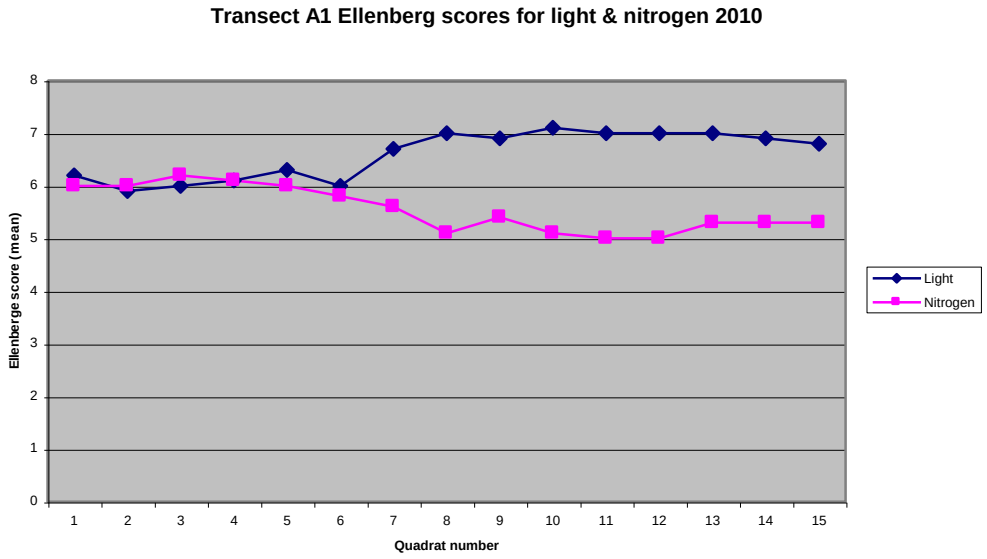
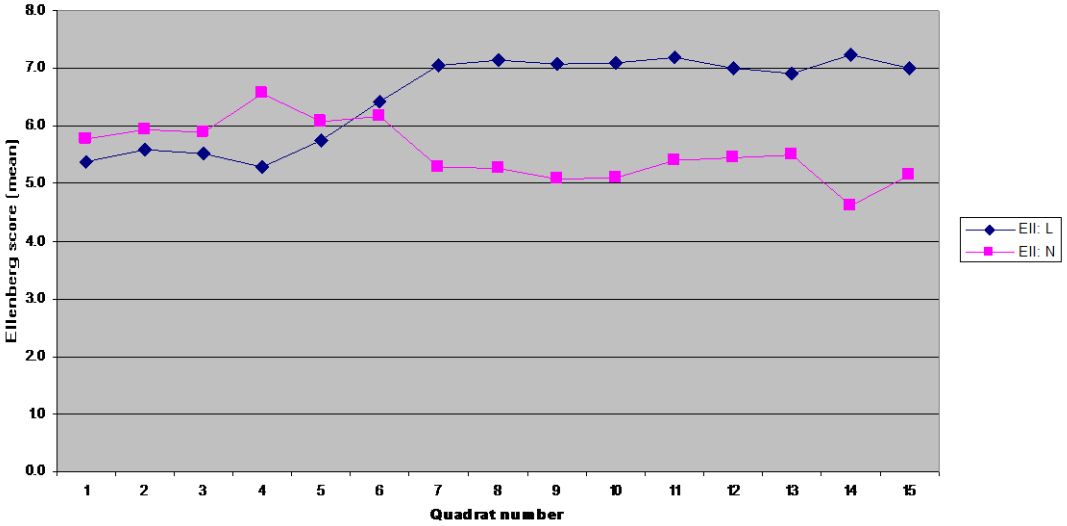
Appendix I. Ellenberg scores for Light and Nitrogen





Transect A2 Ellenberg scores for light & nitrogen 2005



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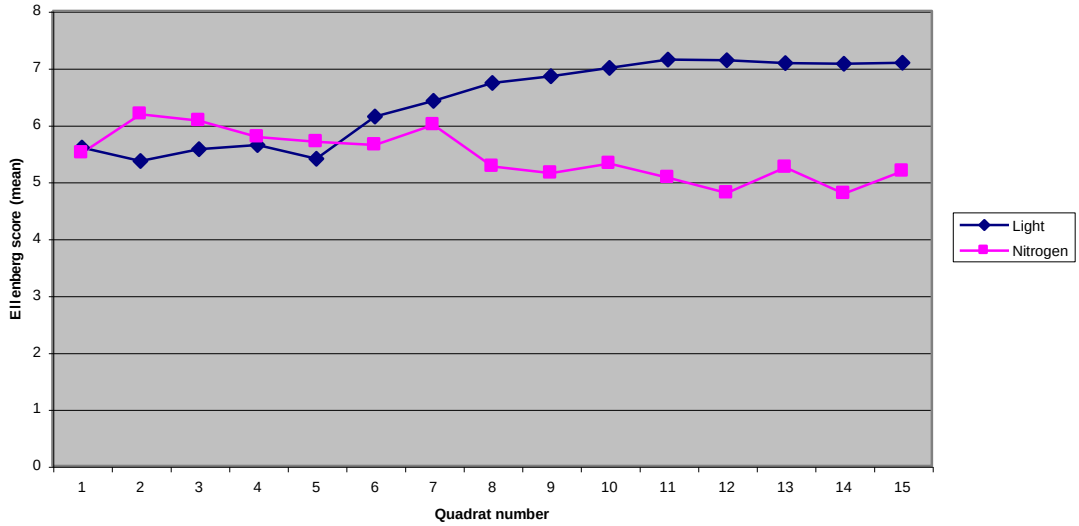

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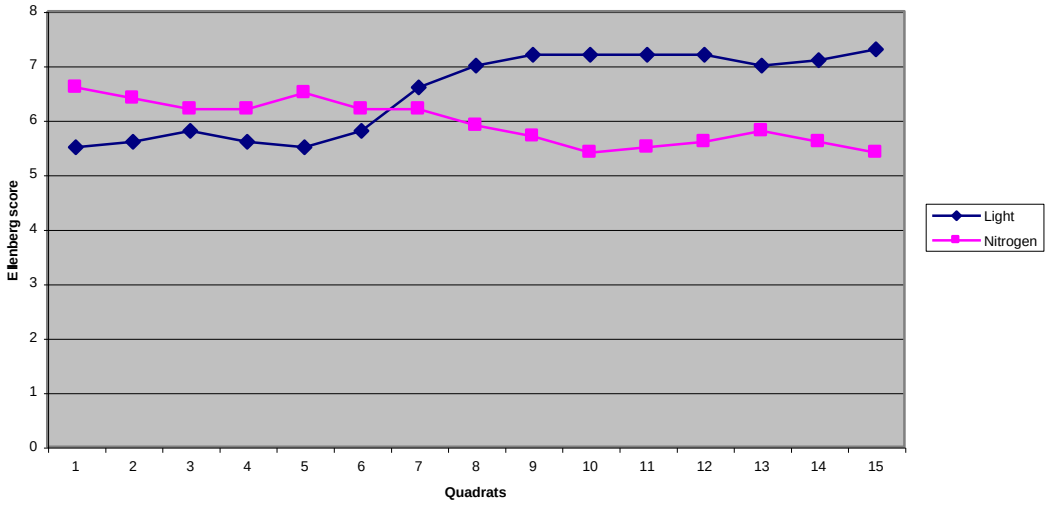

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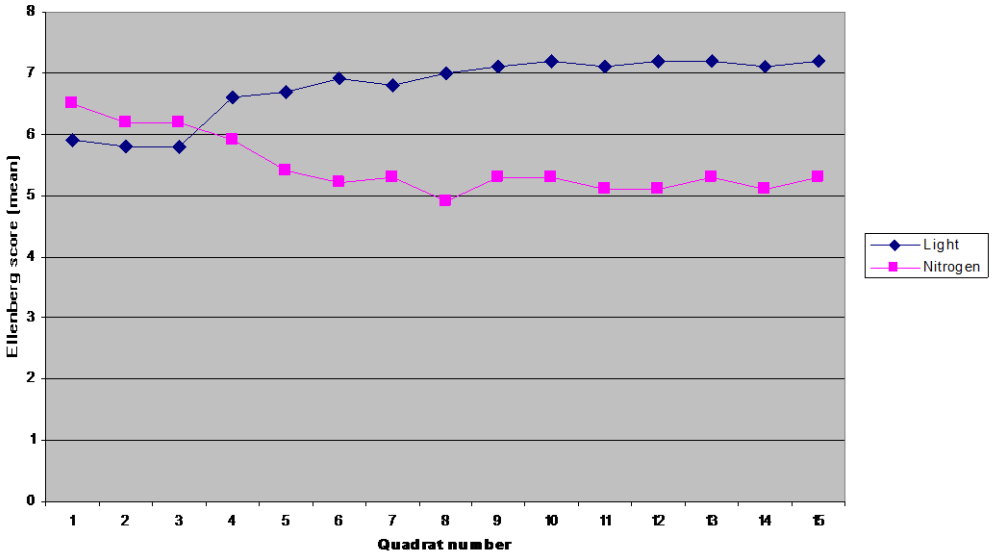

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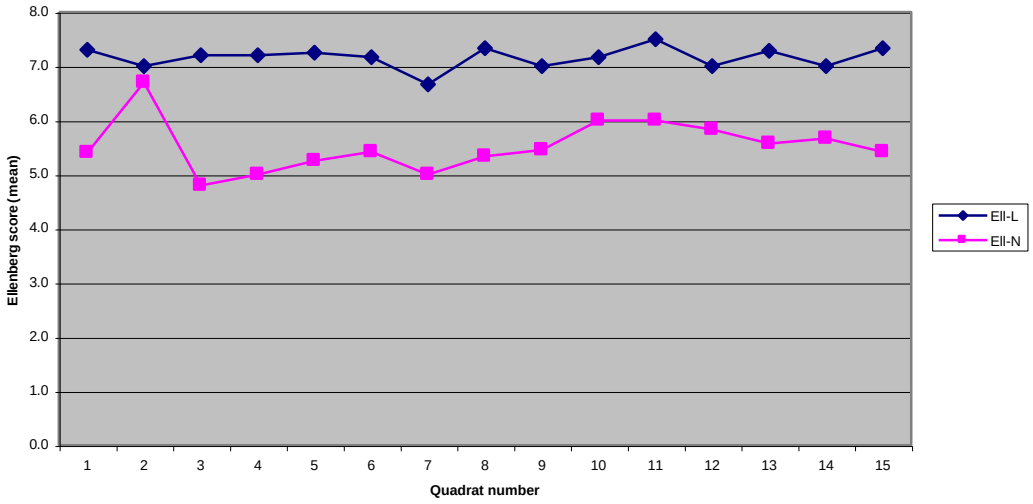

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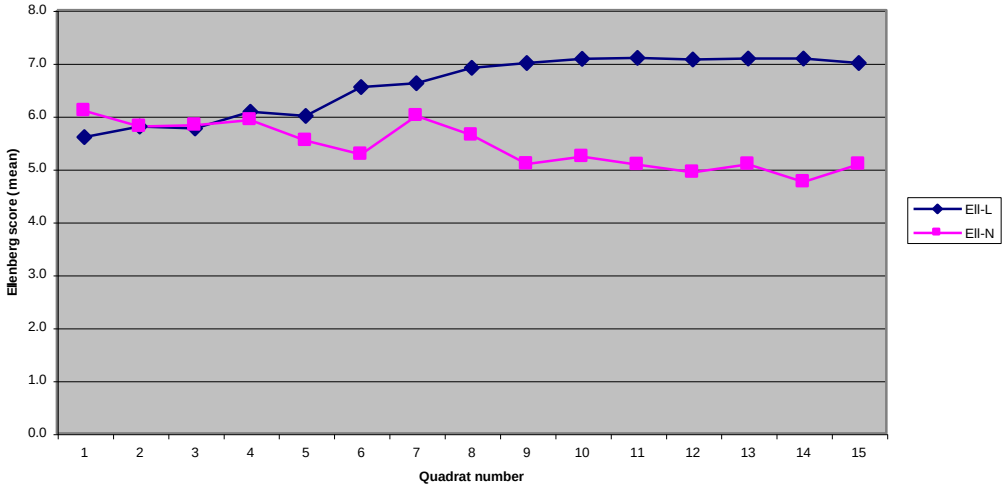

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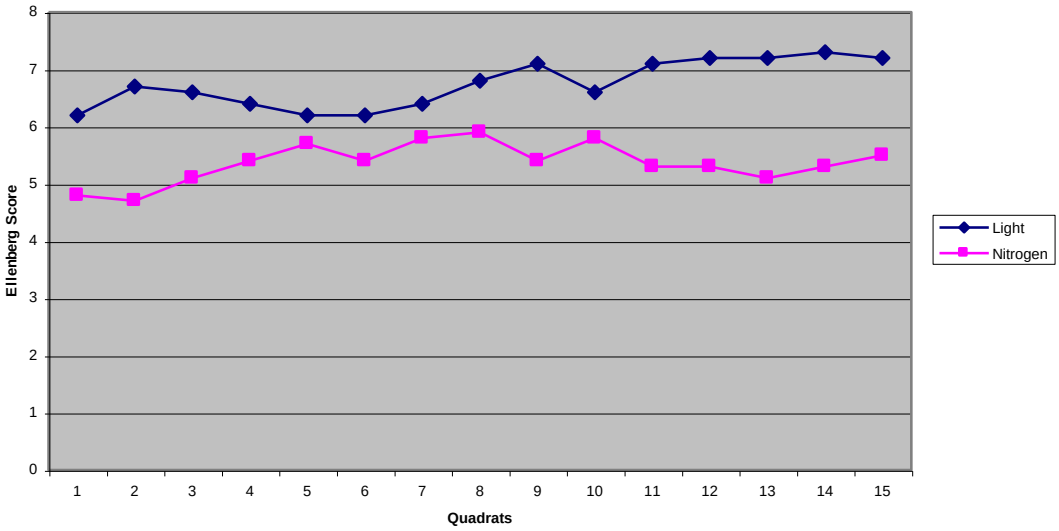

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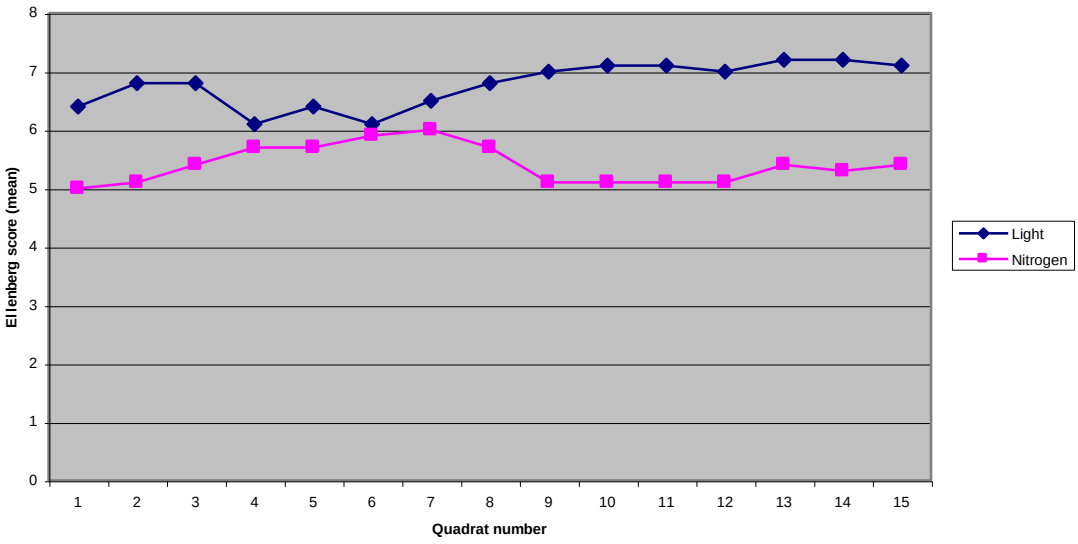

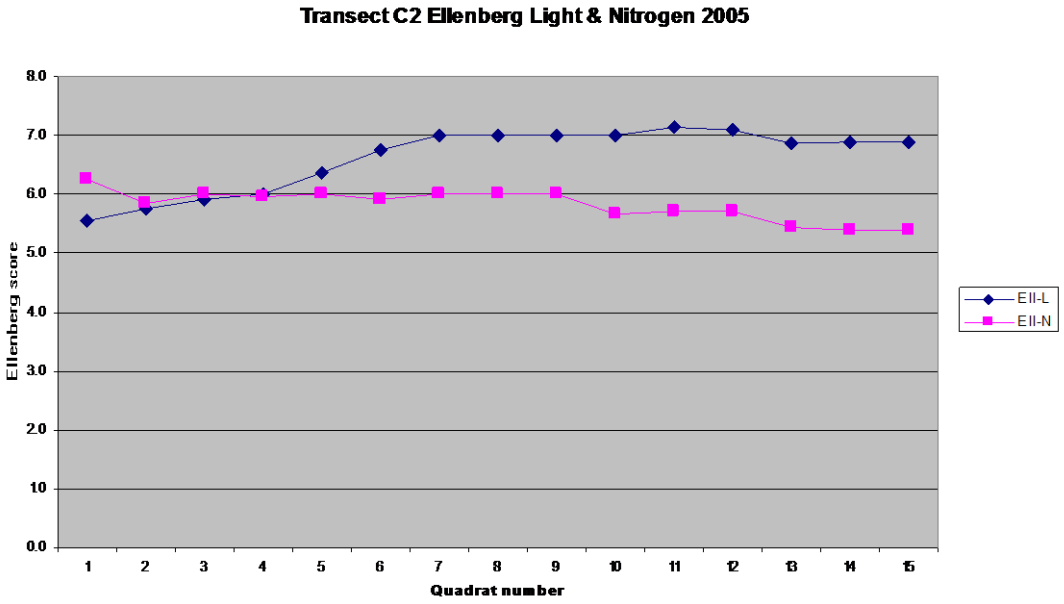
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7.0
6.0
5.0
4.0
3.0
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Quadrat number
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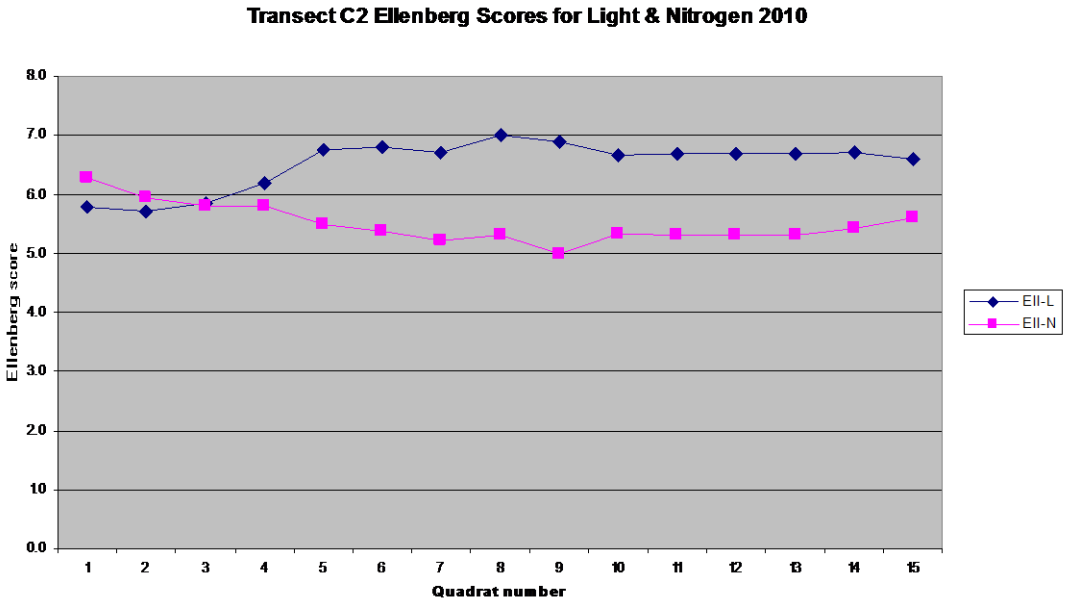
EII-N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Ellenberg score
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2.0
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Quadrat number
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EII-N

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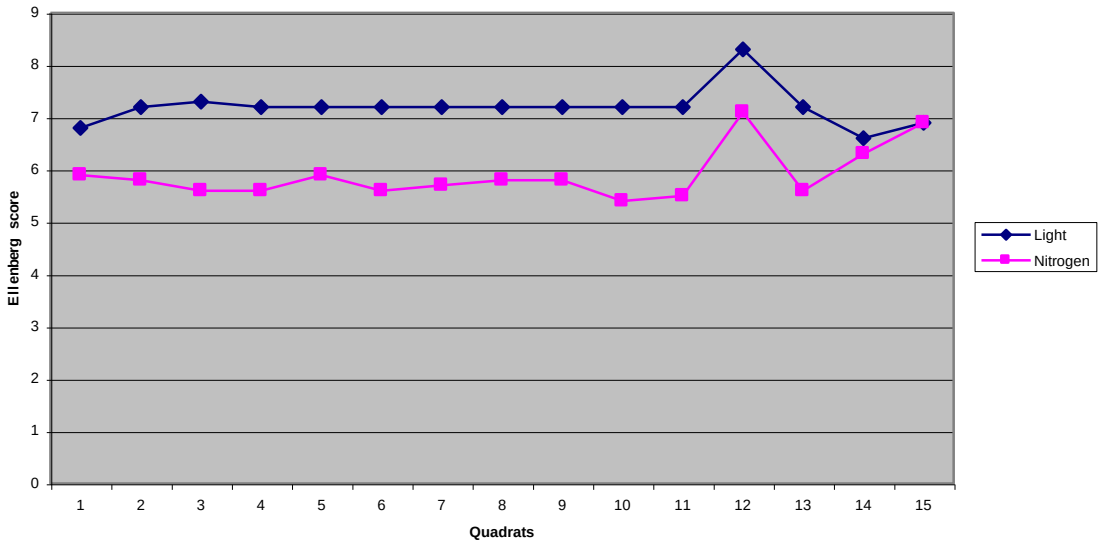

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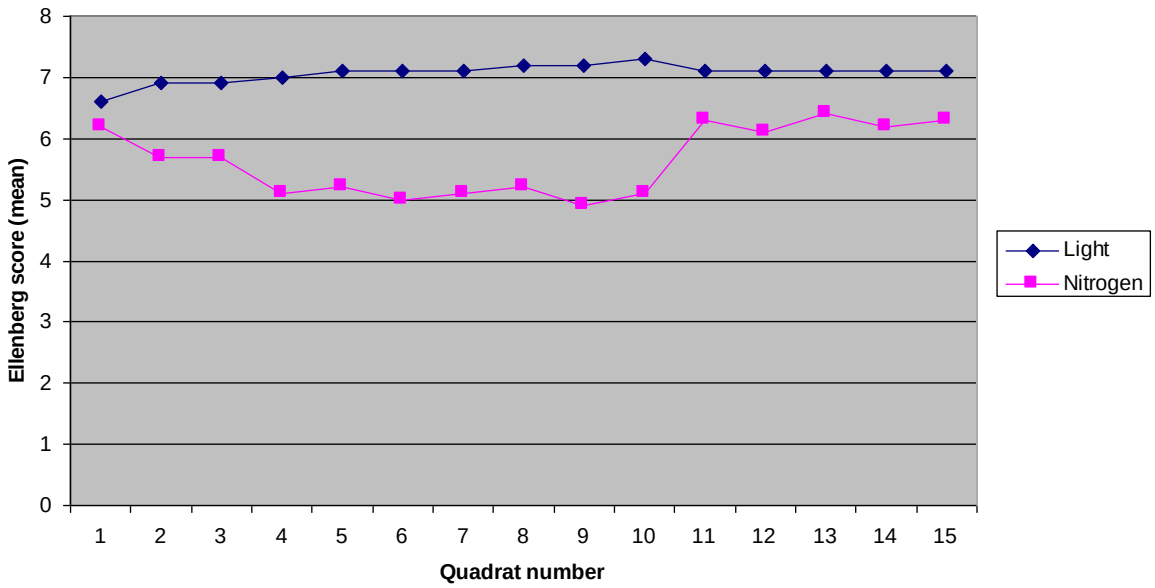

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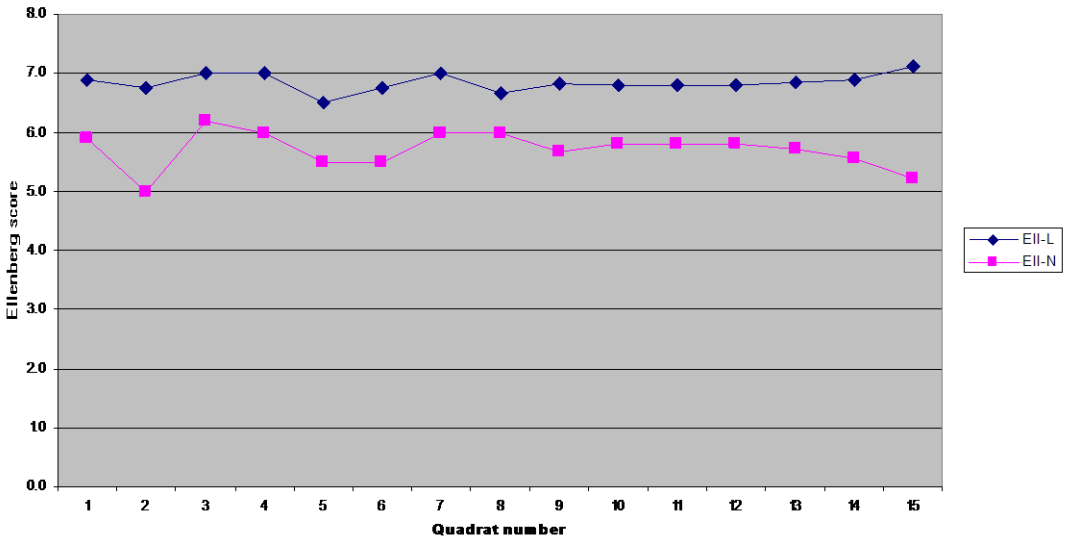

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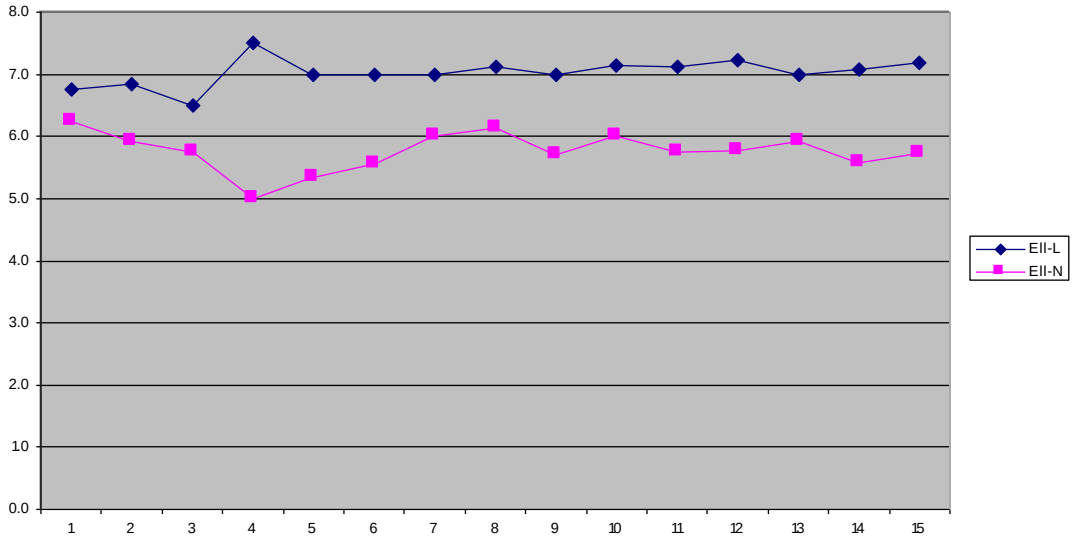
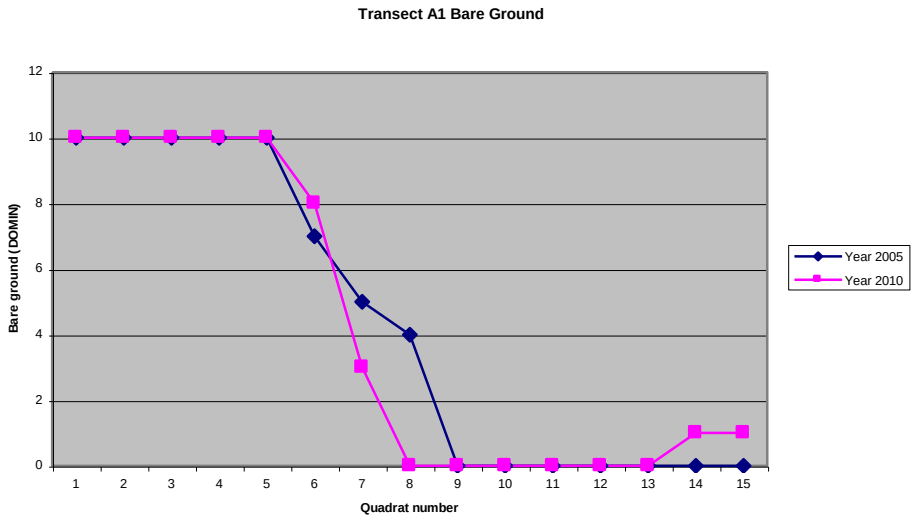
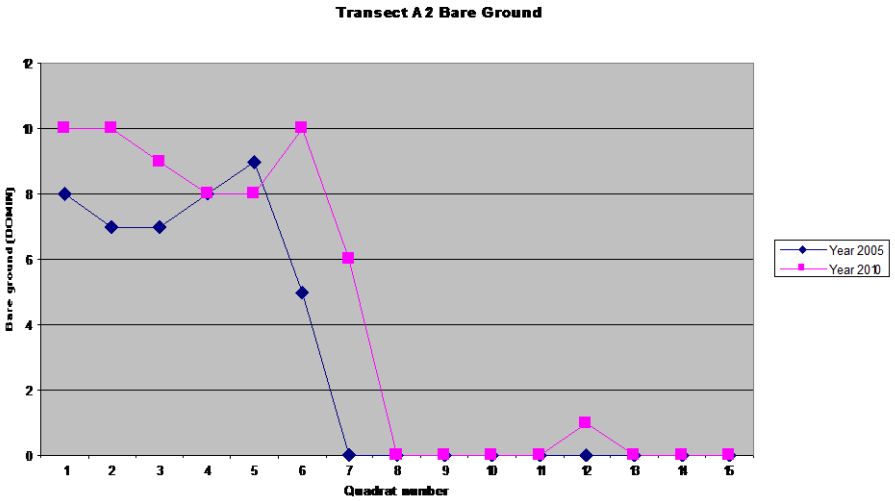
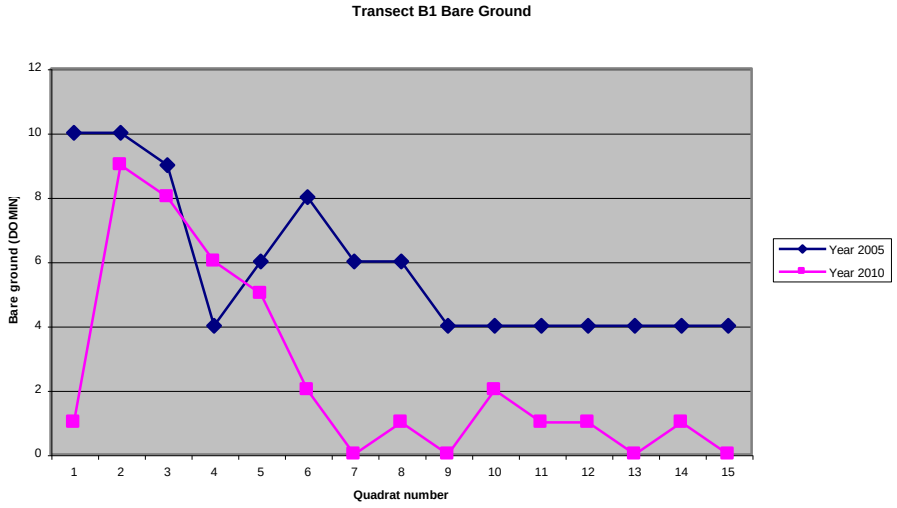


Appendix II. Bare ground







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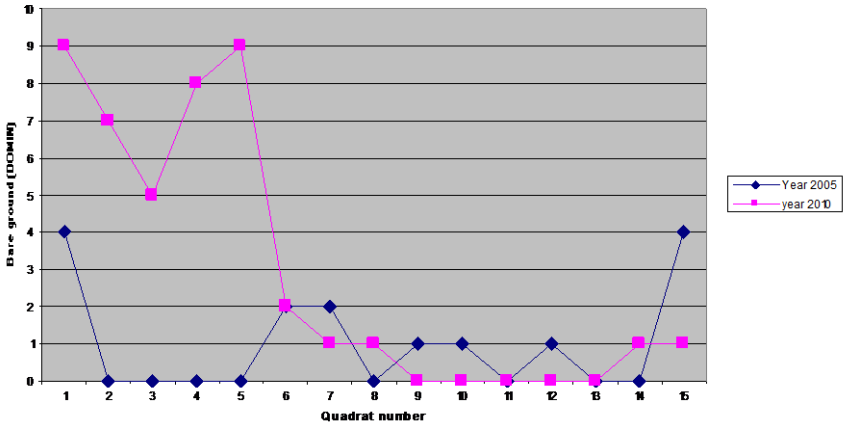

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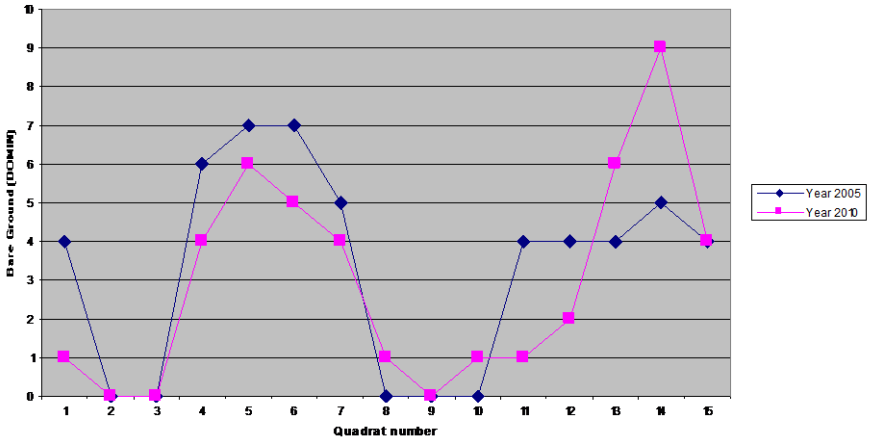

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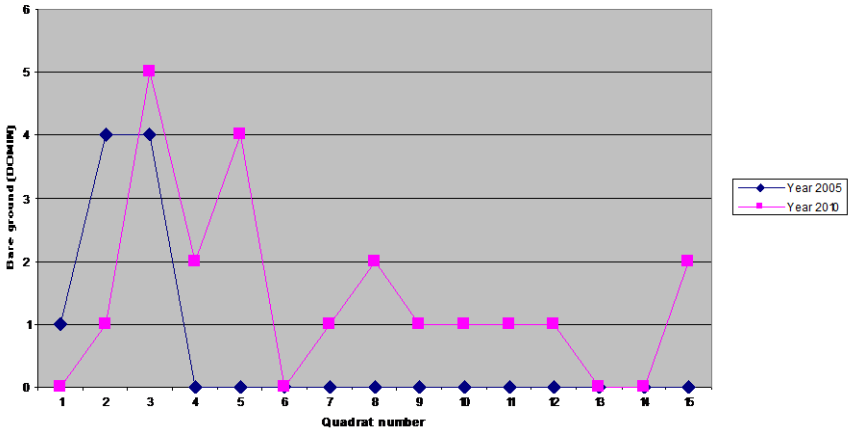

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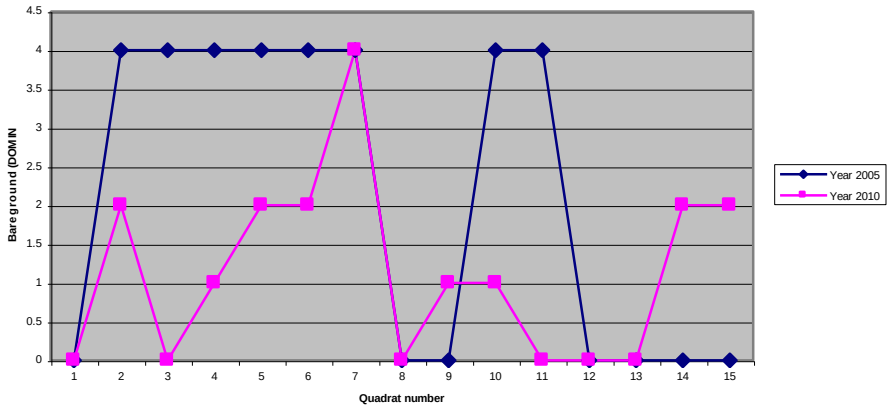

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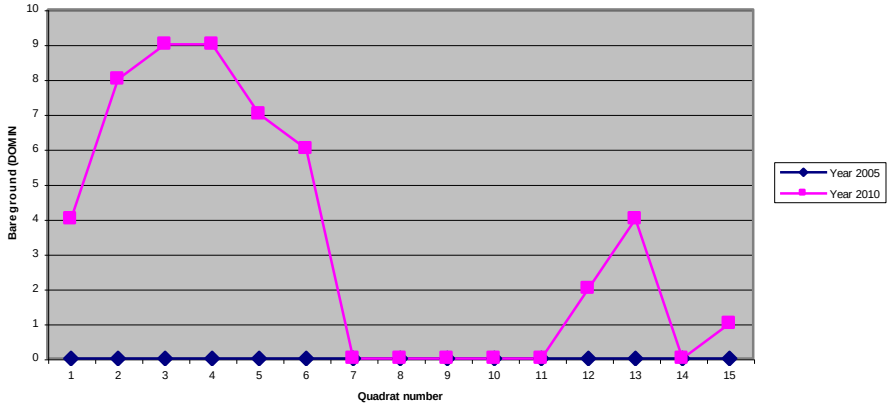
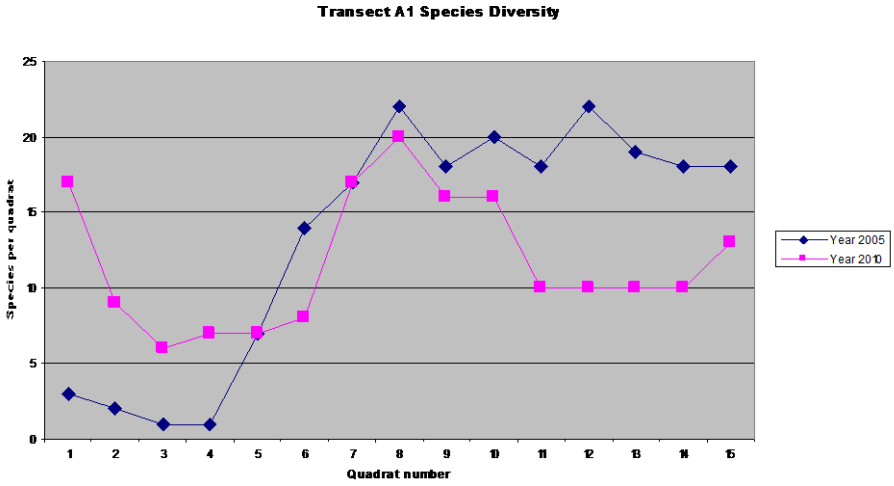
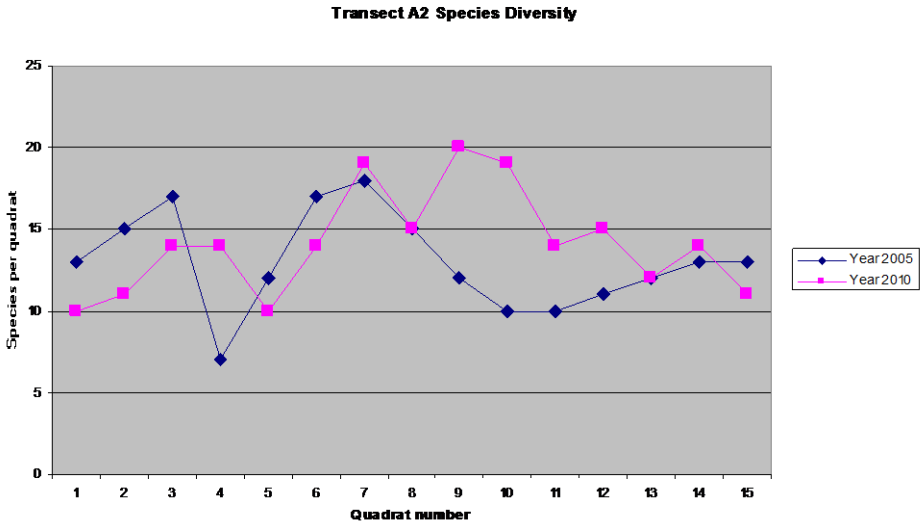
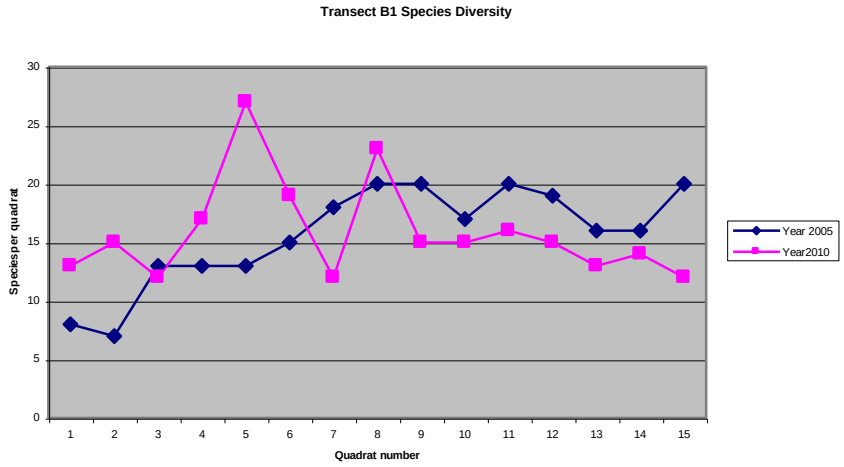


Appendix III. Species Diversity.







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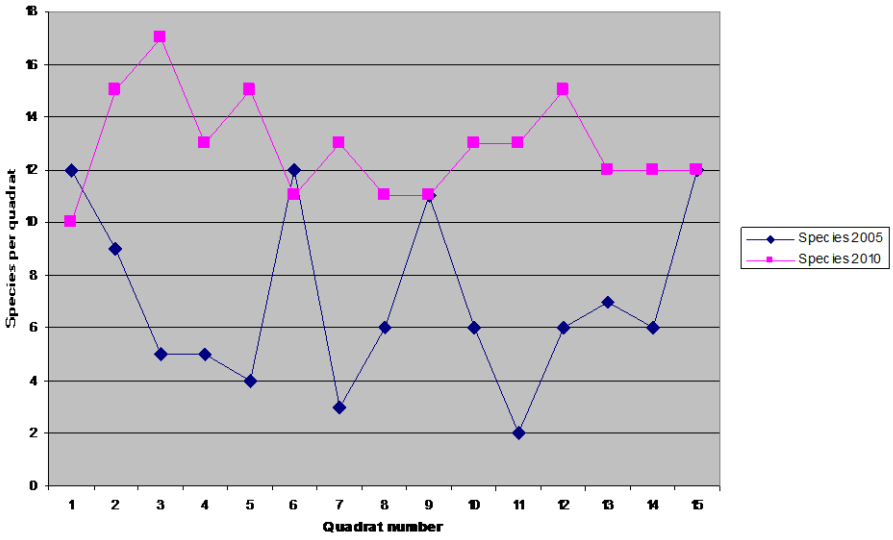

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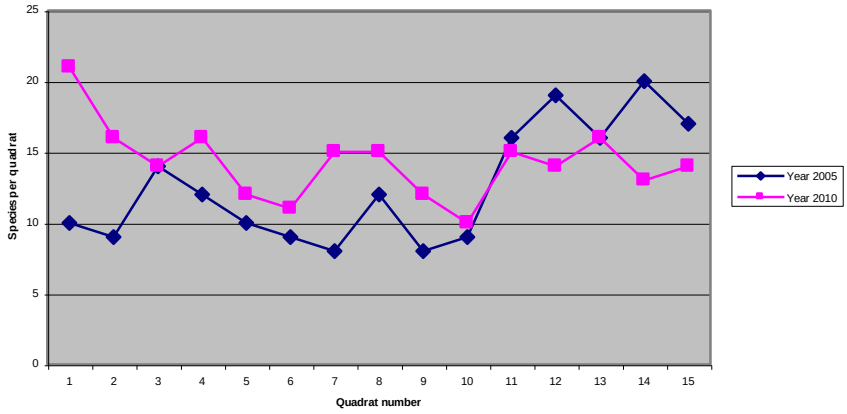

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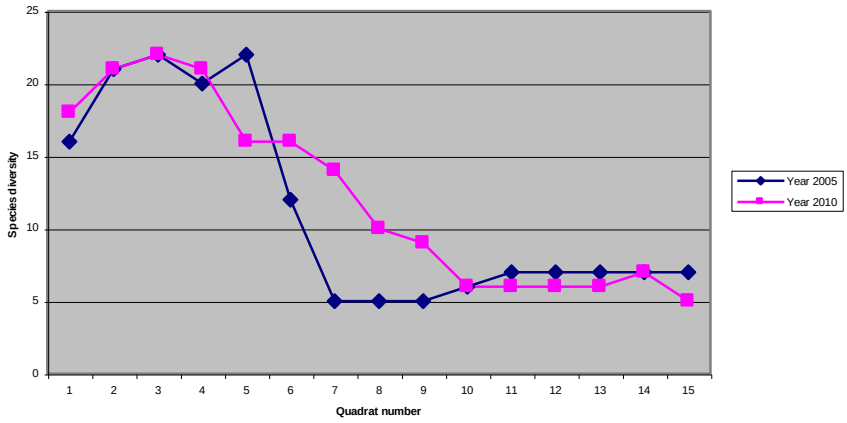

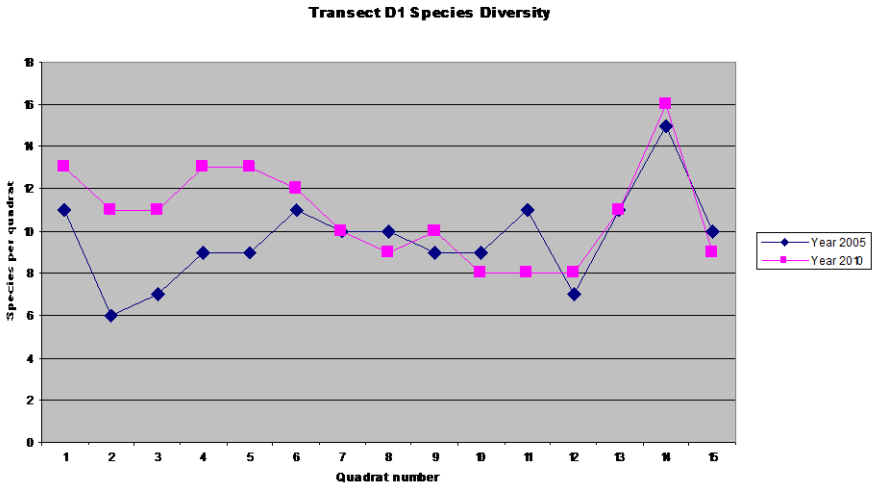
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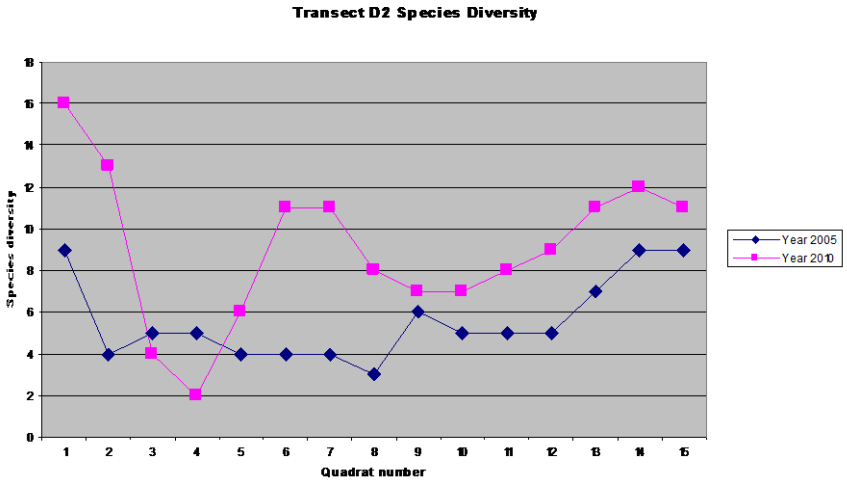
Species per quadrat
Quadrat number
Year 2005
Year 2010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