SUSTAINABLE HABITAT CREATION UTILISING SOIL INVERSION: EVIDENCE FROM CASE STUDIES

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SOIL INVERSION: Innovative habitat creation
A technique introduced by Landlife Liverpool

Habitat creation for species-rich grassland and heathland is constrained on former agricultural soils.

High P concentration key constraint + Nitrogen and high soil fertility.

Soil inversion - alternative solution to soil stripping, importing low fertility subsoils or recurrent cutting and removal of herbage.

Existing 'weedy' seedbank will be buried.

LANDLIFE -700 ha inversion 60% grassland
25% woodland 6% heathland.

TWO CASE STUDIES

Evidence from 15 sites. Glen *et.al*. (2017) Restoration Ecology ,25, 72-81.

AIM

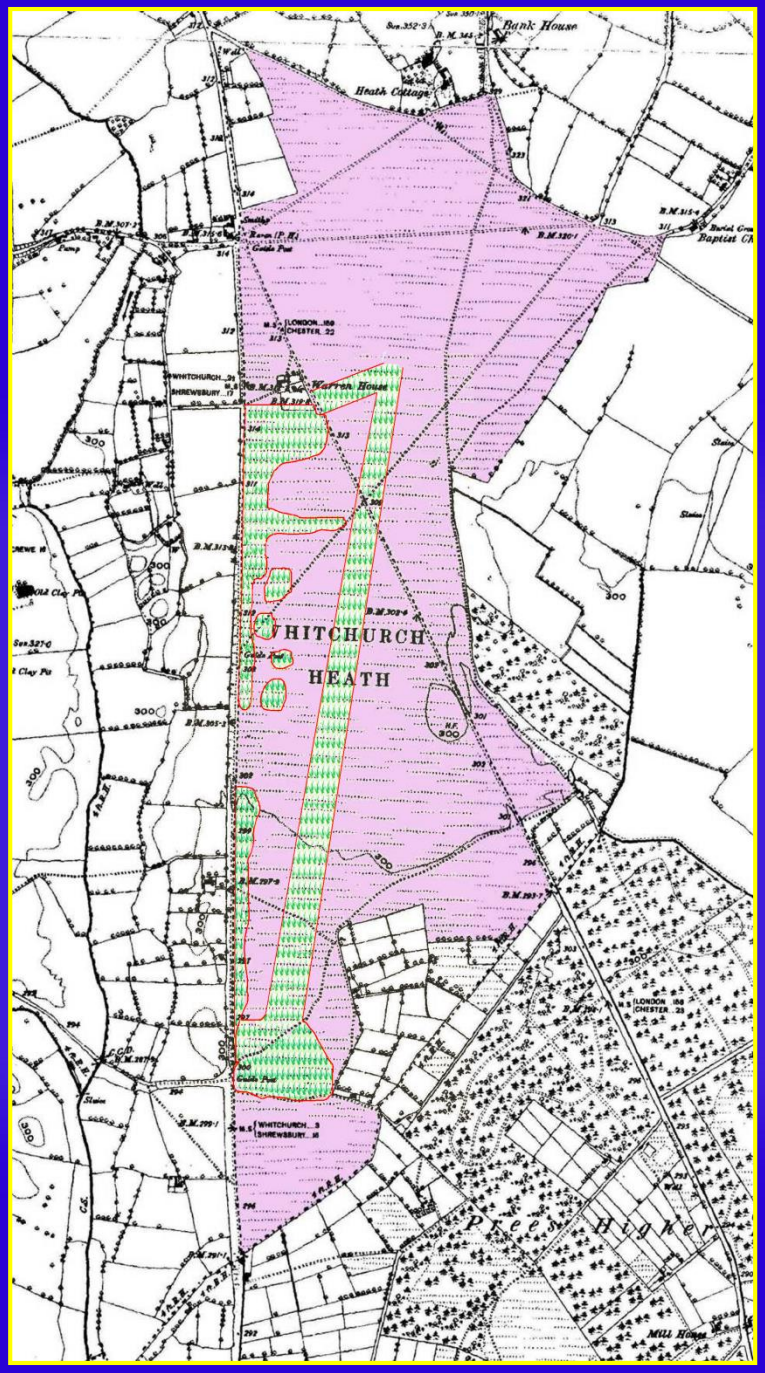
TO RE-CREATE HEATHLAND HABITAT FOR SILVER- STUDDED BLUE BUTTERFLY

Last population of *Plebejus argus* in the English Midlands

HEATHLAND RE-CREATION AT PREES HEATH COMMON RESERVE

PRE-2006 Potatoes-Wheat-Beans

May 2006 BUTTERFLY CONSERVATION purchased 60ha of Prees Heath Common



PREES HEATH COMMON

Heathland heritage

Extent of heath in 1880 - 126ha

1942 - Bomber airfield - WW2

1950's - Conversion to arable - 98% loss of heathland

Green shaded area = patchy relict heath

INVESTIGATION OF SOIL PROFILE

300 - 400 mm topsoil

over sand and gravel post-glacial outwash 17,000 years ago

October 2006

SOIL CHEMICAL ANALYSIS
Undisturbed profile

		Extractable mg/l		
Profile depth	pH	P	K	Ca
0 - 100 mm	7.0	58	300	1588
250 - 350 mm	6.9	38	116	1341
800 - 900 mm	6.3	6	15	70

Chicken Manure

DEEP PLOUGHING, MARCH 2007

Archaeological constraints assessed

Plough depth 900mm+

Two mouldboards

Immediately after ploughing
pH 6 - 6.5 at surface

Acidified with elemental sulphur 1.25 tonnes/ha

AN AERIAL VIEW AFTER SOIL INVERSION
Focus on Hangars Field bounded in red

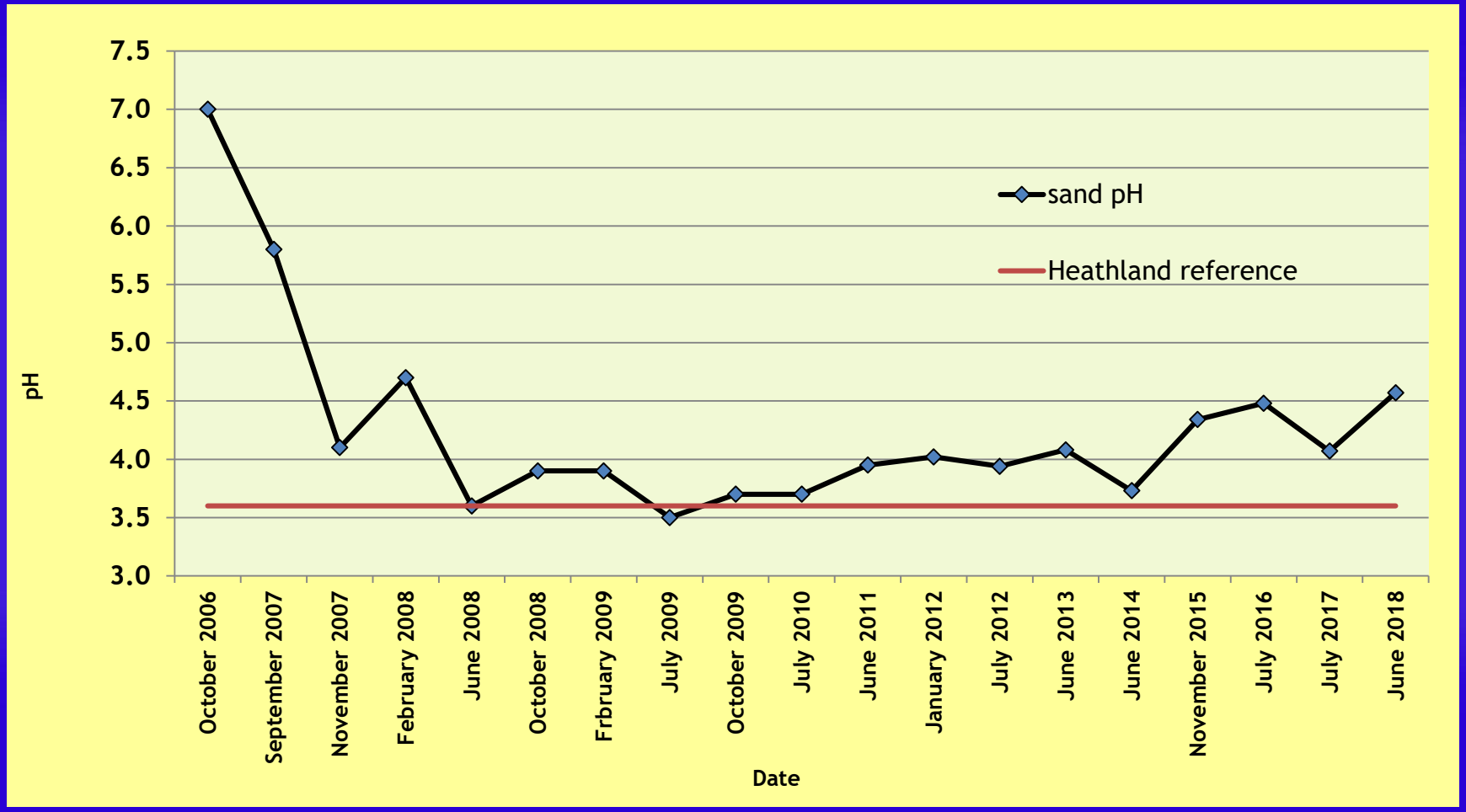
Showing the old runway which contains remnant heathland which has supported the Silver-studded Blue population.

As the new heathland developed SSB colonised from this source area.

SOIL CHEMICAL ANALYSIS 0-100mm

Year of sampling	pH	P	Ca
Pre-plough 2006	7.0	58.0	1588
Post-plough 2007	4.1	11.9	119
Post-plough 2016	4.4	13.5	<200
Grassland control	5.6	26.6	740

Progressive change in mean substrate pH in Hangars Field from October 2006 until June 2018 (0 - 100mm)



SPREADING HEATHER BRASH NOVEMBER 2007

Heathland Source Cannock Chase

Erica cinerea
source Prees H
36,400 plugs

Tractor passes compress brash

HEATHLAND DEVELOPMENT 2017

Rabbit grazing beneficial

NVC
H12 or U1

EVIDENCE OF *Plebejus argus* BREEDING ON THE RESTORED HEATHLAND

Dependent on prior colonisation by mutualist black ant (*Lasius niger*).

Ants protect larvae and pupae from predation.

31st May 2014 larva + black ants first evidence of breeding

June 2018 - 700 adult butterflies recorded on one restored area in one day.

EVIDENCE OF Plebejus argus BREEDING ON THE RESTORED HEATHLAND

31st May 2014

MANAGEMENT LONG TERM

Maintain 15-20% open ground - crucial for black ants

Increase cover of *Erica cinerea* to 10-15%
Currently 2-3%

Regular removal of *Betula* young plants

Involvement of volunteers was crucial

NESS BOTANIC GARDENS
Creation of species-rich grassland

DEEP PLOUGHING IN MARCH 2008

Subsoil revealed
low soil fertility

Archaeology checked

SOIL CHEMICAL ANALYSIS

	Year of sampling		
Soil property	2007	2012	2015
pH	7.6	7.6	7.0
Phosphorus mg/l	42.0	23.6	13.0
Nitrate-N mg/kg	32.5	0.50	0.58

WILDFLOWER MEADOW
FIRST SPRING AND SUMMER
2008

23 species sown originally – now over 125 recorded cumulatively

Cornfield annuals dominant - 6 spp. sown

Species turnover at least 25 spp.

2011

June
ox-eye daisy
Leucanthemum vulgare

July/August
musk mallow
Malva moschata

2014

June

Yellow rattle

A crucial ingredient to supress grass competition

Cowslip Primula veris

Estimated 26,000 rosettes in April 2018

Hybrid Marsh orchids

Bee orchid

2018

CONTINUING MANAGEMENT

Late August - Mowing haymaking and baling

September - Disc harrowing

PLANT SPECIES RICHNESS

2009 – 55 species

Now over 125 species recorded cumulatively – circa 90 in any year

FLORA AND FAUNA BIOBLITZ 2014 over 750 spp.

Butterflies and bees recorded

20 species

Small Copper – 54 records in 2018

Common Blue on vetch

24 species

SOIL INVERSION - SUSTAINABLE OUTCOMES

Ness Gardens - species-rich grassland - greatly enhanced invertebrate biodiversity

Food plants - nectar - pollen **SOIL FERTILITY HAS FALLEN**

Prees Heath - long term objective - on course to optimise habitat for Silver-studded Blue.

Needs more *Erica cinerea* cover - grazing regime -rabbits and cutting is insufficient - common land issues for cattle grazing.

SOIL FERTILITY IS LOW but is pH stable?

10 years monitoring - has contributed to evidence base for the sustainability of soil inversion.

ERHC SIG will be be crucial here- provision of guidance

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Butterfly Conservation - Charity

THANK YOU FOR LISTENING AND WATCHING

Cheshire Wildlife Trust

Butterfly Conservation

ERS