RestREco

Restoring Resilient Ecosystems

*From the bottom up, **soils** in restored habitats.*

Samuel Hibdige
Post-Doc
Cranfield University
Sam.Hibdige@Cranfield.ac.uk



Restored Sites

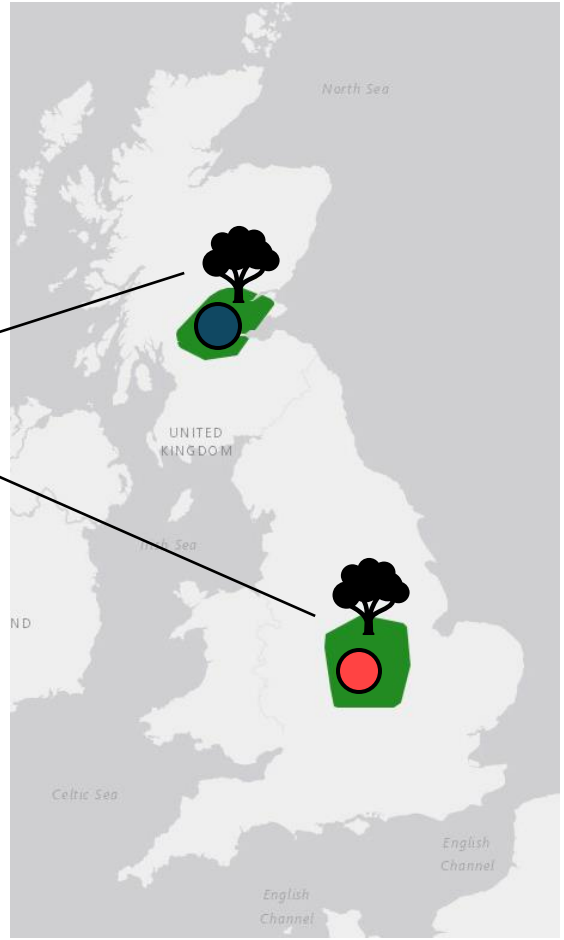
RestREco
Restoring Resilient Ecosystems

Woodland sites

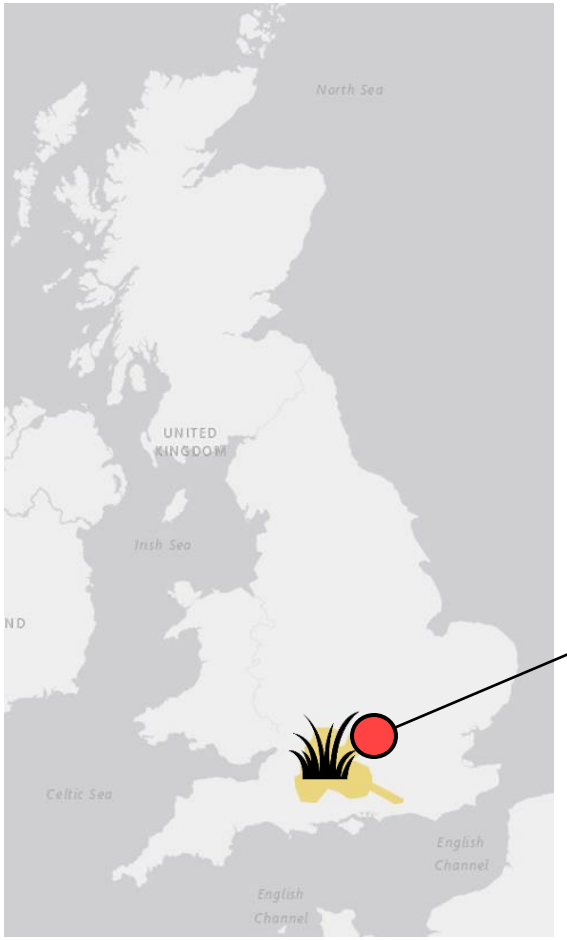


66 woodland

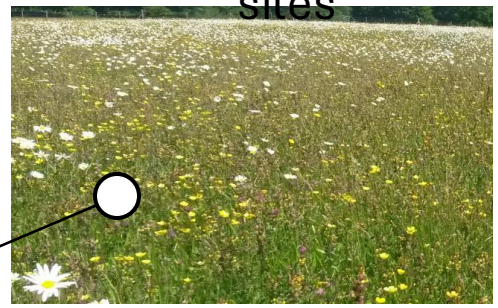
Age since restoration (10-140 years)



Grassland sites



66 Grassland sites



Cranfield University

Amplicon Sequencing

RestREco
Restoring Resilient Ecosystems

Analysis of Amplicon sequencing data

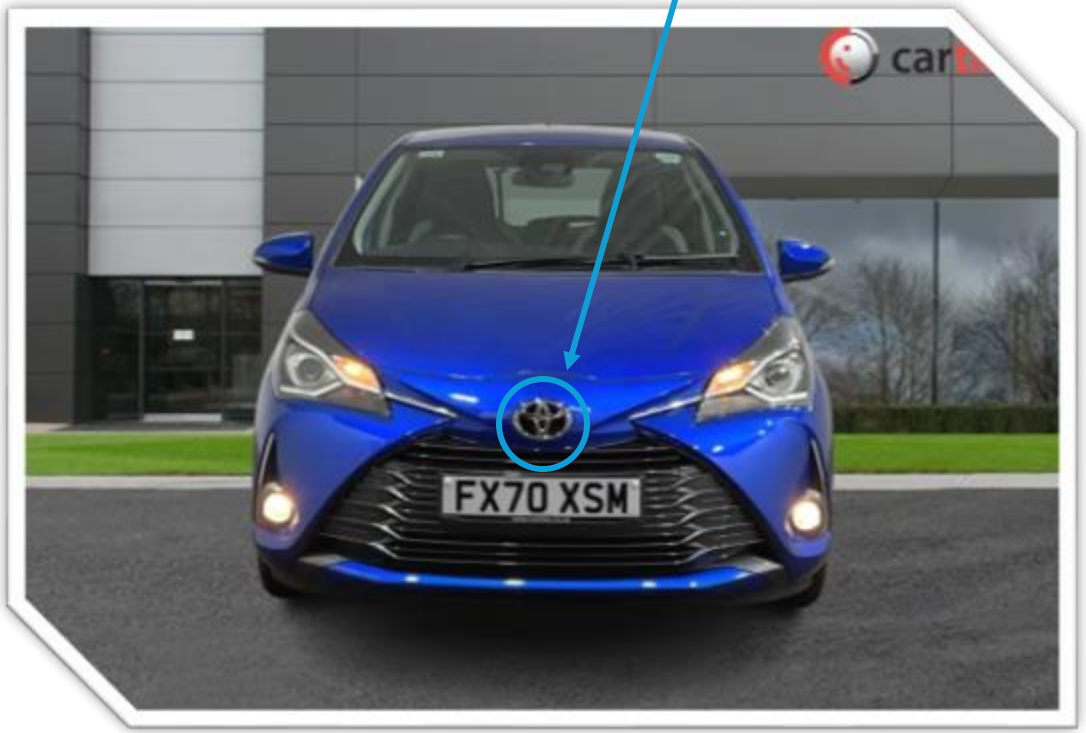
Bacterial 16s gene



Previously established primers : "Earth Microbiome Project"

earth microbiome project

"Conserved region yet identifiable"
Identifiable to "*Genus*" level



Cranfield University

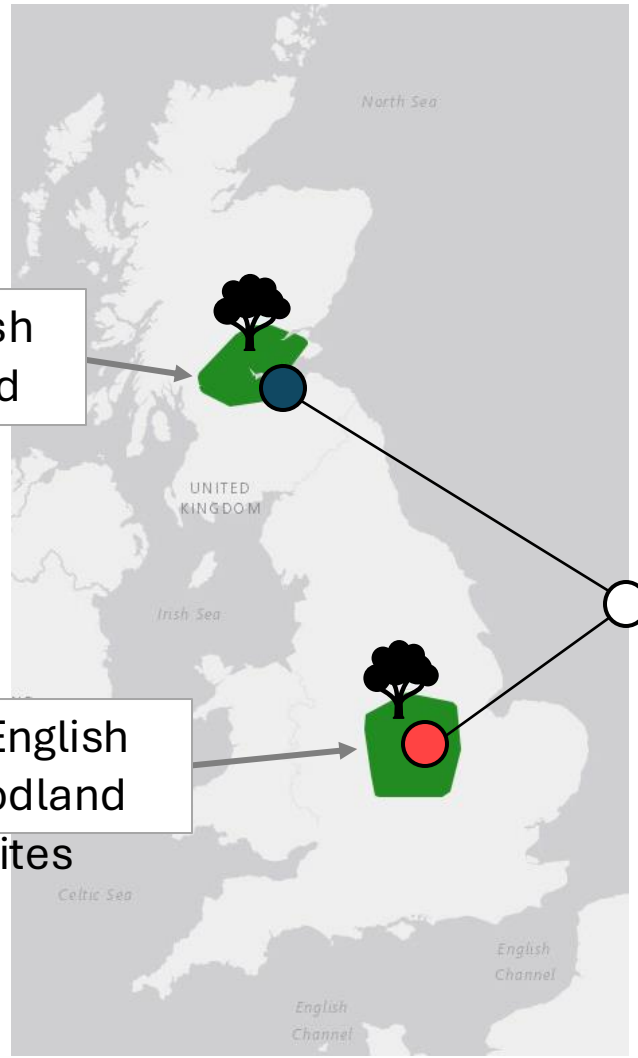
Woodland Sites

RestREco
Restoring Resilient Ecosystems

Woodland sites

30 Scottish woodland sites

30 English woodland sites



Age since restoration (10-140 years)









Cranfield University

Woodland Sites – Former Land Use

RestREco
Restoring Resilient Ecosystems

Former land-use



Post-Industrial



15 Scottish
15 English

Post-Agriculture



15 Scottish
15 English

Cranfield University

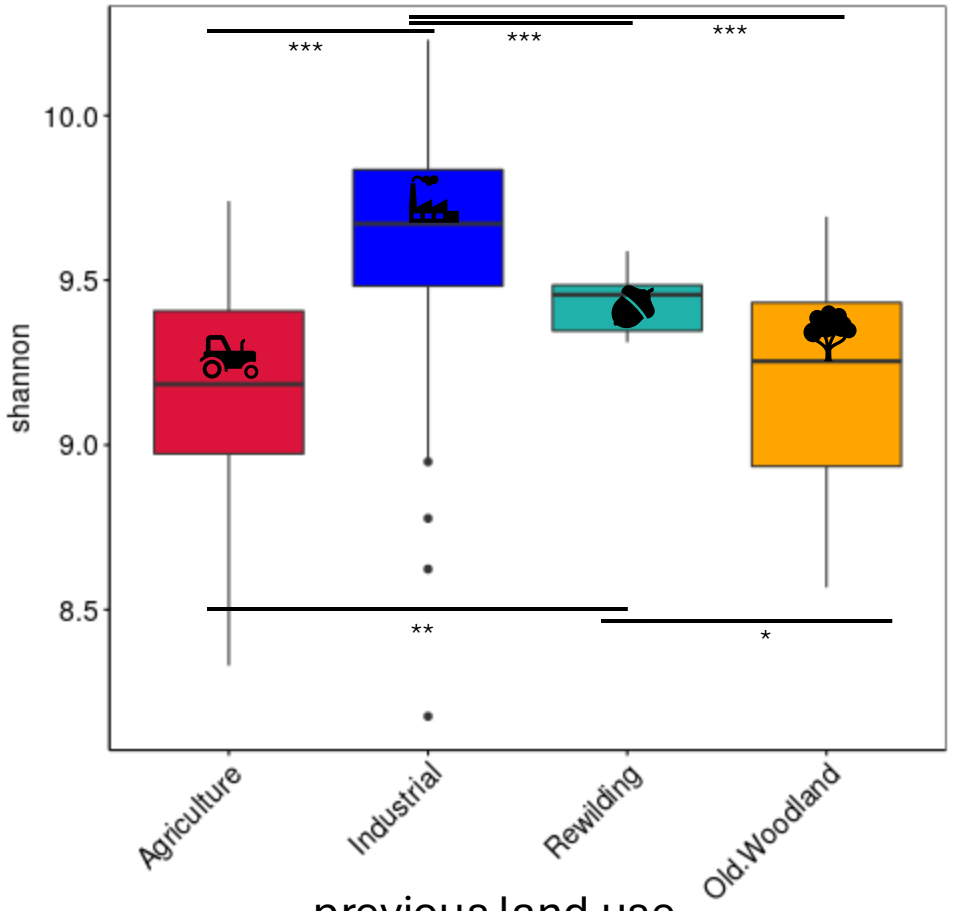
Woodland – Alpha Diversity

RestREco
Restoring Resilient Ecosystems

"Differences within samples" (16S)

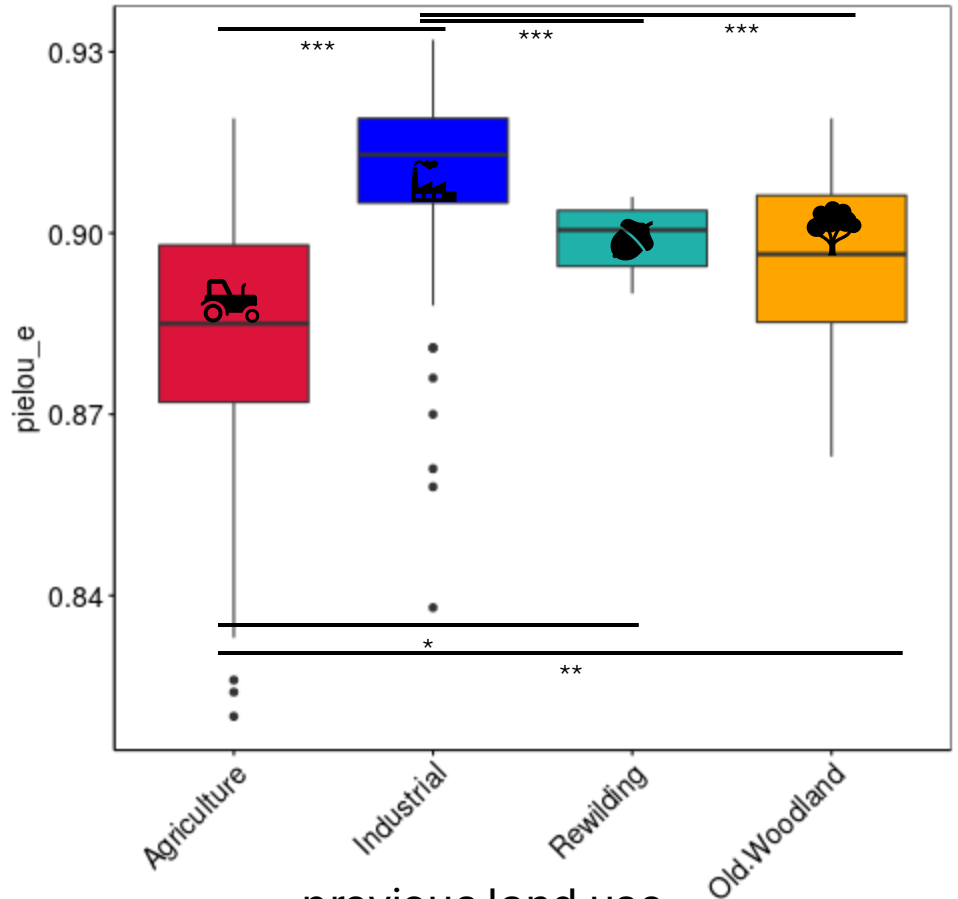
Analysis carried out using Qiime2

Shannon index



previous land use

Pielou eveness



previous land use

Cranfield University

Woodland – Beta Diversity

Beta diversity – Differences between samples (16S)

Visual representation of data, PCoA

Unweighted unifrac

- Shows effects of rare taxa

Weighted unifrac

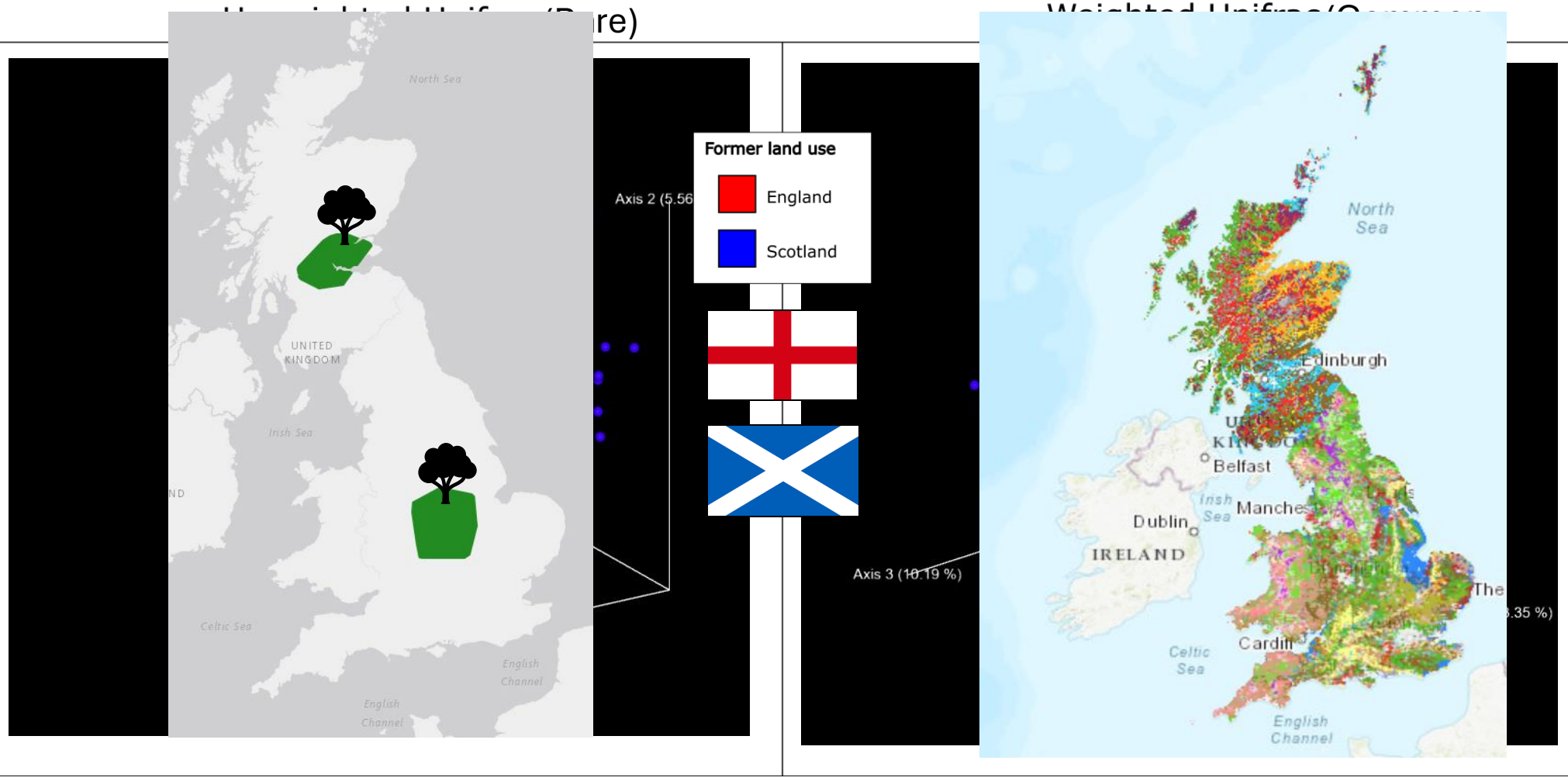
- Shows effects of common taxa

Individual data points represent single repeats (five per site).

Woodland – Beta Diversity Region

Woodland sites

Bacteria 16s
PCoA
Region



Woodland – Beta Diversity, pH

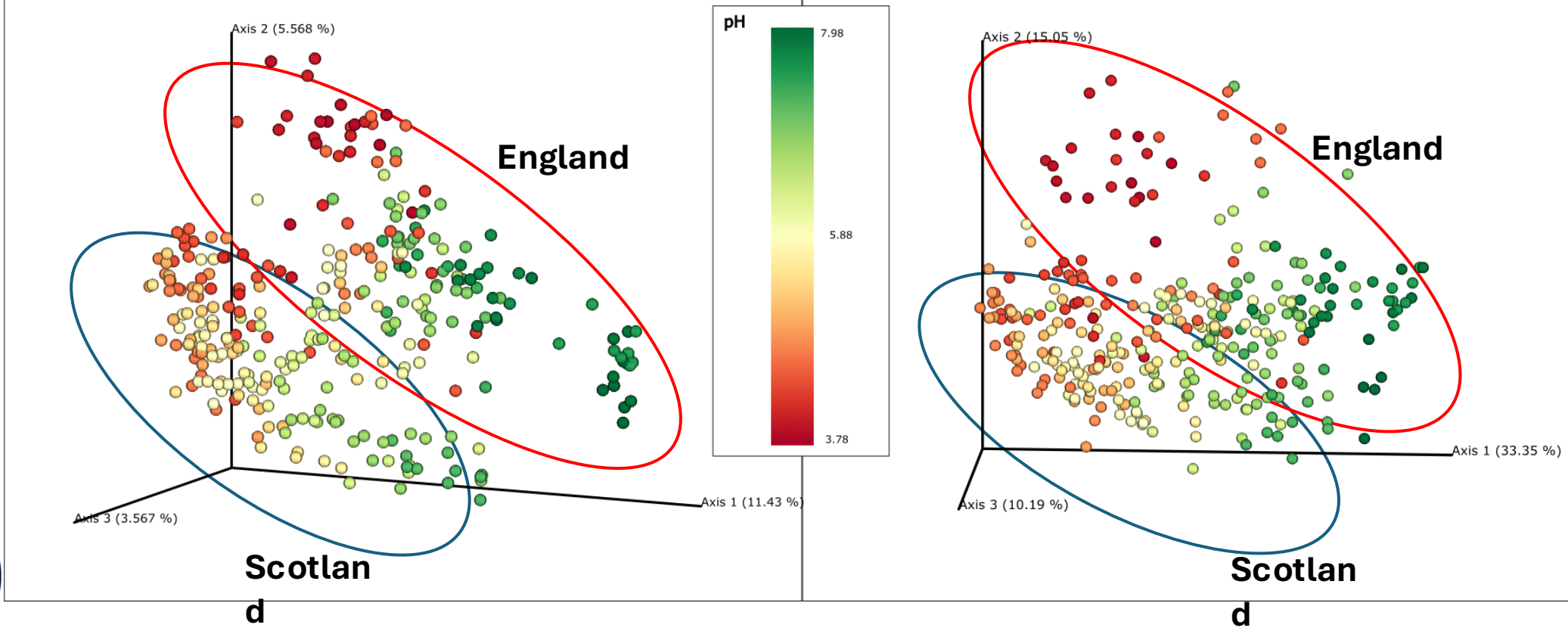
RestREco
Restoring Resilient Ecosystems

Woodland sites

Bacteria 16s
PCoA
pH

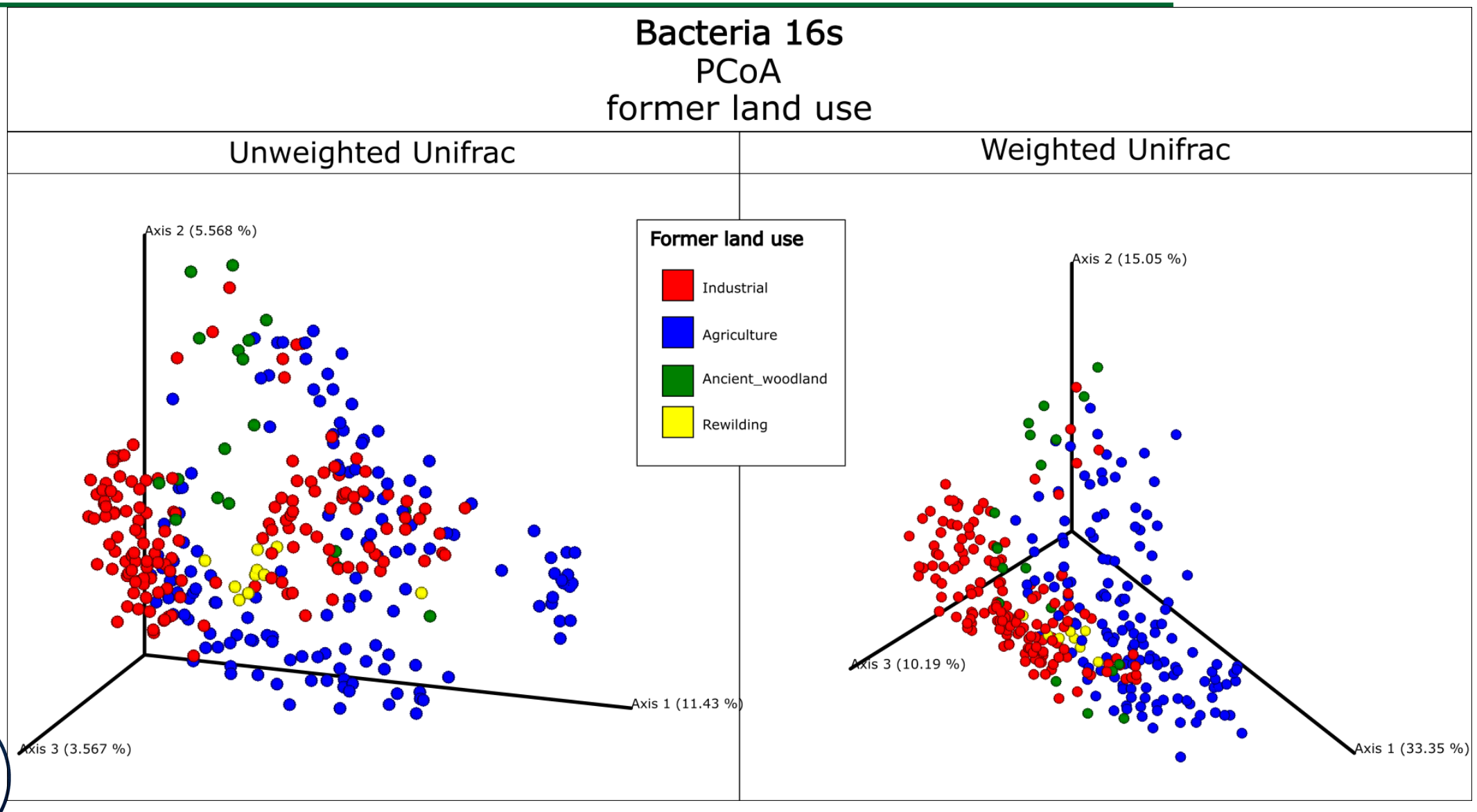
Unweighted Unifrac(Rare)

Weighted Unifrac(Common)



Cranfield University

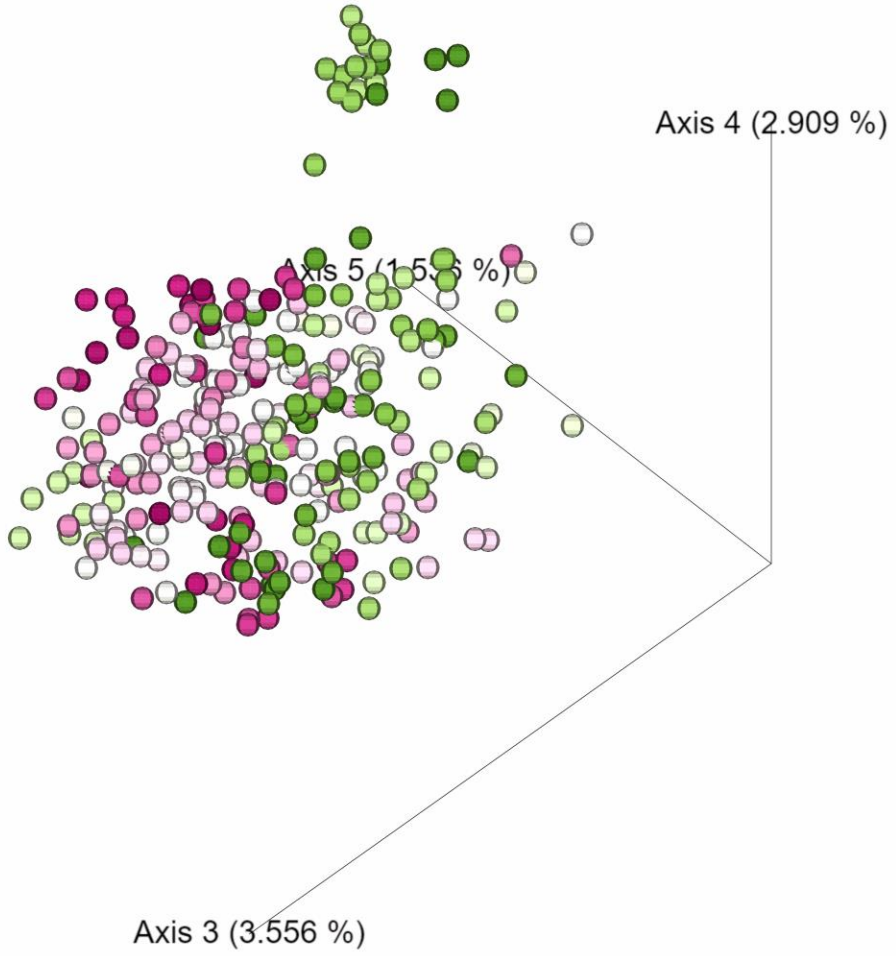
Woodland – Beta Diversity, Former Land Use



Woodland – Beta Diversity, Age

Woodland sites

Post-Agriculture + Post-Industrial



RestREco
Restoring Resilient Ecosystems

Summary of woodlands findings

- Post-industrial sites are more diverse than post-agricultural and ancient woodland.
- 3-5% of changes to microbial composition can be attributed to age
- Previous land use affects microbial community composition

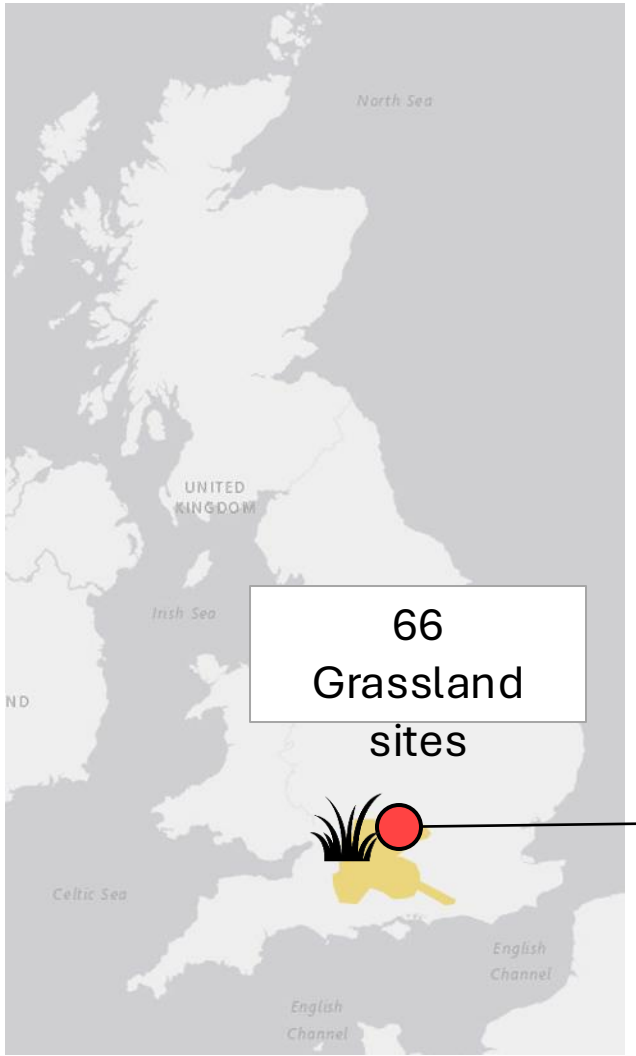
Cranfield University

Grasslands

RestREco
Restoring Resilient Ecosystems



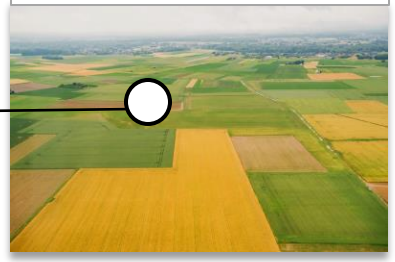




66 Grassland sites



Post-Agriculture





Cranfield University

Grassland factors

RestREco
Restoring Resilient Ecosystems

Chalk grasslands



Establishment
Green Hay
Natural Regen
“Seed Mix”

Management
Sheep
Cattle
Cutting

Cranfield University

Grassland – Alpha Diversity

RestREco
Restoring Resilient Ecosystems

Alpha Diversity – Differences within samples (Bacteria)

Shannon index

Analysis carried out using Qiime2

Faith PD











VS

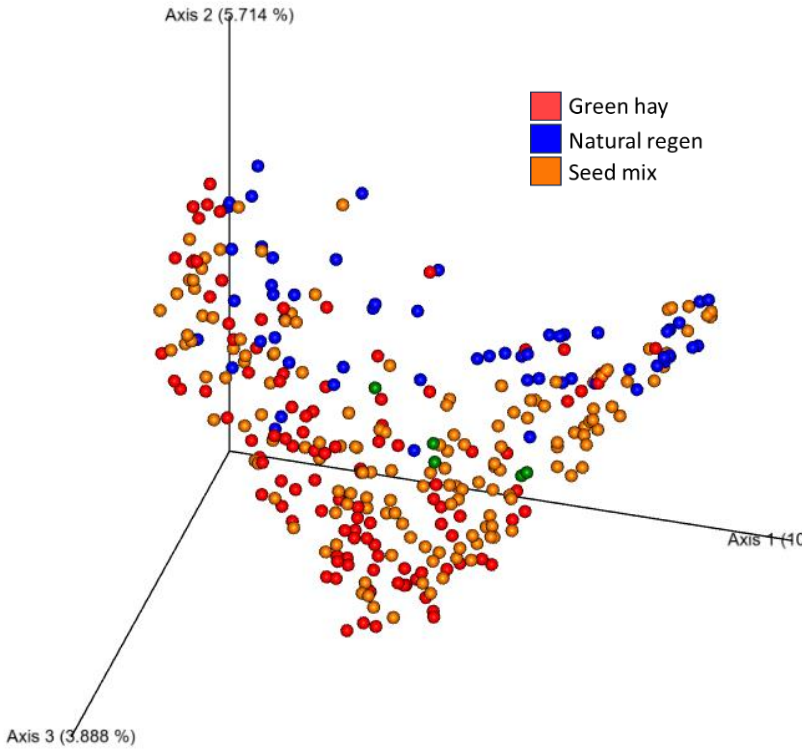


Cranfield University

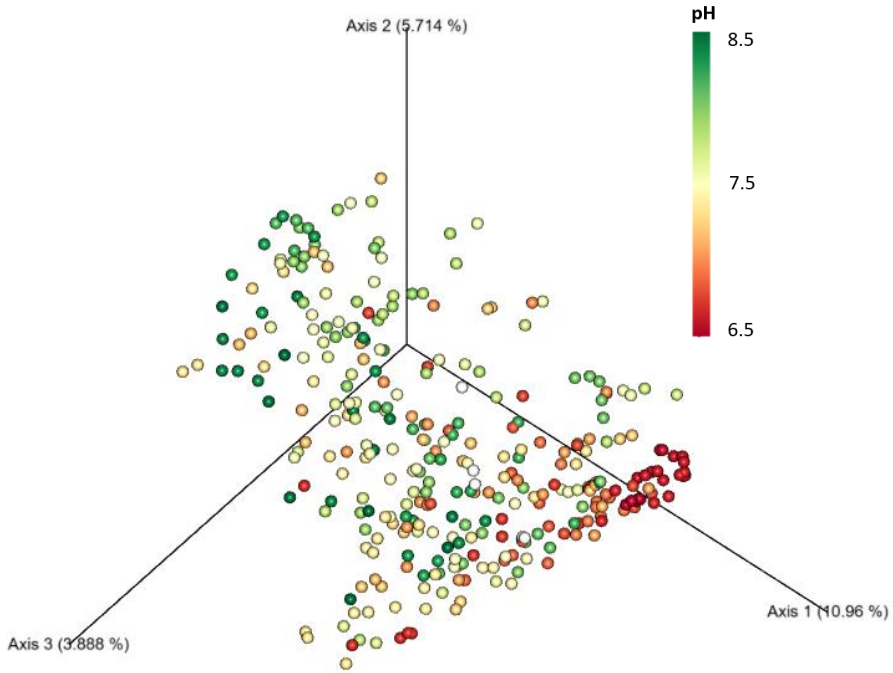
Grassland – Beta Diversity

RestREco
Restoring Resilient Ecosystems

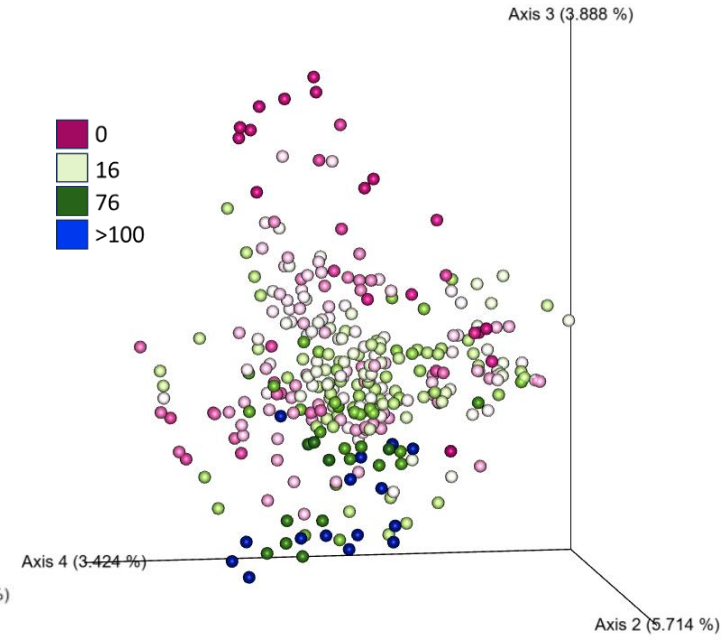
Establishment



pH

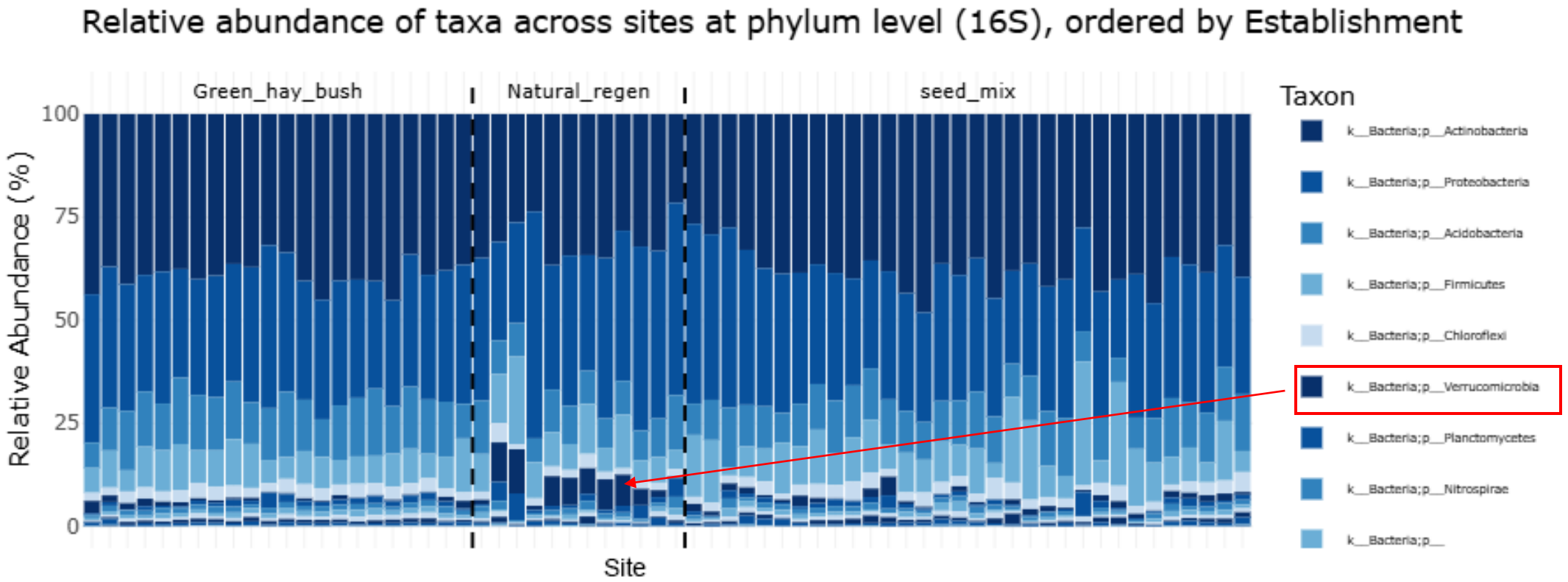


Age



Cranfield University

Grassland – Taxa abundances



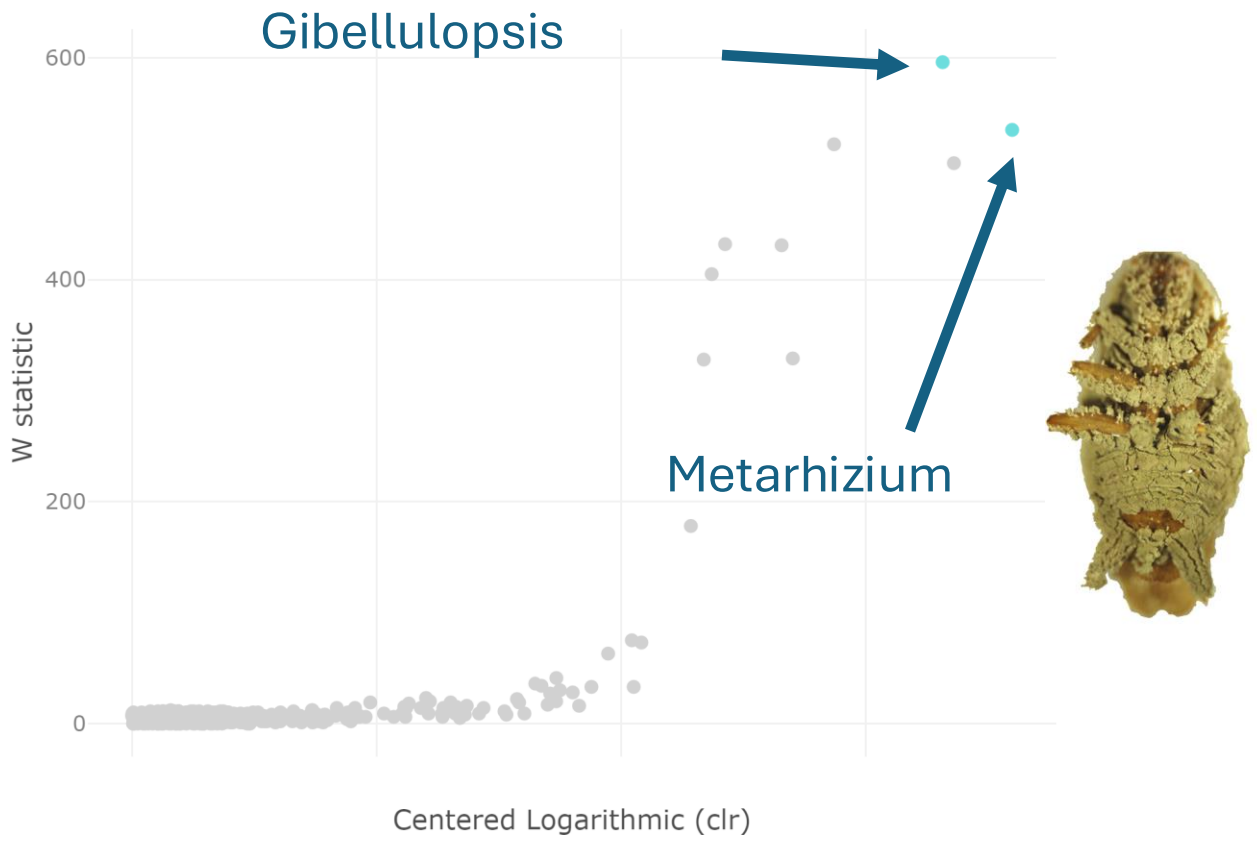
Data collapsed to site level

Kerry Hathway, Chloe Garampon, Shangda Zhu, Shabana Bi, Samuel Brocklehurst

Grassland- Differential Abundance

RestREco
Restoring Resilient Ecosystems

Fungi Differential Abundance in Grasslands



Cranfield University

Kerry Hathway, Chloe Garampon, Shangda Zhu, Shabana Bi, Samuel Brocklehurst

RestREco
Restoring Resilient Ecosystems

Summary of Grassland findings

- Establishment of grasslands has a detectable effect on the soil microbiome
- 3-5% of changes to microbial community could be attributed to age of restoration even within this relatively short time scale (10-70 years)
- Grasslands are more similar than difference with only a small percentage variation

Cranfield University

A big thanks to :

RestREco
Restoring Resilient Ecosystems

Jim Harris (PI), James M. Bullock, Kirsty Park, Rosie Hails, Ben Woodcock, Elisa Fuentes-Montemayor, Kevin Watts, Mark Pawlett, Alexey Larionov, Daniel Simms, Samuel Hibdige, Oscar Aguinaga Vargas, Matt Guy, Ross Barnett, Sam Rogerson, Maico Geert Weites, Melanie Freeman, Lynne Roxbee Cox, Emma Feeley, Ben McCarthy

Forest Research

Cranfield University

UNIVERSITY of STIRLING

UKCEH

National Trust



Acknowledgments – Funders – Natural Environment Research Council (NERC). **Landowners** for access to survey sites. **Students and volunteers** who helped with field and labwork



RestREco
Restoring Resilient Ecosystems

Will “restored” soils ever resemble ancient habitats?

Do they need to?

restreco.com

@RestREco1