# WeedEco

This repository stores the R package WeedEco. This package contains functions which conduct linear discriminant analysis using one of three modern models (i.e., sets of discriminated modern arable fields) to classify archaeobotanical data or other cases the investigator wishes to classify, such as survey data from other farming regimes, on the basis of relevant functional ecological traits (or attributes) of weed species. Other functions include those related to data organisation, as well as functions for plotting the results of the linear discriminant analysis in comparison with the selected modern model.

## Referencing

The package draws on data from the functional trait database, as well as models constructed by [Bogaard et al. (2016)](https://doi.org/10.1007/s00334-015-0524-0), [Bogaard et al. (2018)](https://doi.org/10.1080/14614103.2016.1261217) and [Bogaard et al. (2021)](https://library.oapen.org/handle/20.500.12657/58568).

When publishing results obtained via the use of this package please cite the package and its version, as well as the functional trait database and the model used. A best practice example paragraph is provided in Stroud et al. (2023).

**Package citation**: Stroud, E., (2023) WeedEco: Classification of unknown cases using linear discriminant analysis to understand farming regimes. R package version 0.1.0, <<https://github.com/\>>.

**Functional trait database**: <ORA link>

**Model 1**: Bogaard, A., Hodgson, J., Nitsch, E. *et al.* (2016) Combining functional weed ecology and crop stable isotope ratios to identify cultivation intensity: a comparison of cereal production regimes in Haute Provence, France and Asturias, Spain. *Veget Hist Archaeobot* **25**, 57–73. [DOI: 10.1007/s00334-015-0524-0](https://doi.org/10.1007/s00334-015-0524-0)

**Model 2**: Bogaard, A., Styring, A., Ater, M., *et al.* (2018) From Traditional Farming in Morocco to Early Urban Agroecology in Northern Mesopotamia: Combining Present-day Arable Weed Surveys and Crop Isotope Analysis to Reconstruct Past Agrosystems in (Semi-)arid Regions, Environmental Archaeology, 23:4, 303-322, DOI: [10.1080/14614103.2016.1261217](#X6589fc6ab0dc82cf12099d1c2d40ab994e8410c)

**Model 3**: Bogaard, A., Hodgson, J., Kropp, C., *et al.* (2022) Lessons from Laxton, Highrove and Lorsch: Building arable weed-based models for the investigation of Early Medieval Agriculture in England in McKerracher, M., and H. Hamerow (eds) *New Perspectives on the Medieval ‘Agricultural Revolution’: Crop, Stock and Furrow*. Liverpool University Press. [Online resource](https://library.oapen.org/handle/20.500.12657/58568)

**Example paper**: Stroud et al. (in prep). Seeing the fields through the weeds: introducing the WeedEco R package for comparing past and present arable farming systems using functional weed ecology. Vegetation History and Archaeobotany

## Installation

You can install the package WeedEco from [GitHub](https://github.com/) with:

# install.packages("devtools")  
devtools::install\_github("elizabethastroud/FIBS-R-Package")

## Example

This is a basic example which shows the use of the package with a simulated data set. Please see Stroud et al. (2023) for a fully worked example using archaeobotanical data. Please note that each species used requires its correct four\_three code - the unique identifier which links it with the corresponding species within the functional trait database. More details can be found here <insert link>.

library(WeedEco)  
## Random data created to represent survey data or archaeobotanical counts  
species<-c("Chenopodium album" , "Anthemis cotula", "Brassica rapa",  
 "Raphanus raphanistrum", "Agrostemma githago" , "Poa annua" )  
Four\_three\_code<-c("chenalb", "anthcot", "brasrap","raphrap","agrogit", "poa\_ann")  
s.1246<-sample(1:3, 6, replace=T)  
s.46178<-sample(1:5, 6, replace=T)  
s.1<-sample(0:8, 6, replace=T)  
s.23<-sample(0:3, 6, replace=T)  
s.987<-sample(3:9, 6, replace=T)  
dataset<-data.frame(species,Four\_three\_code,s.1246,s.46178,s.1,s.23,s.987) # the random dataset  
## Creation of random flowering period dataset  
# Note that flowering period (max duration) is not provided and must be collected from relevant literature  
FLOWPER<-sample(3:9, 6, replace=T)  
x<-data.frame(Four\_three\_code,FLOWPER)   
## Data organisation - function used to organise archaeobotncial or survey data for LDA analysis  
results<-wdata\_org(dataset, samples=3, codes=2, codename="Four\_three\_code,", model=1, fl\_pr=x)  
#> SLA ARNODE LOGCANH LOGCAND FLOWPER  
#> s.1246 23.78448 12008.417 5.5 5.500000 6.000000  
#> s.46178 23.78448 12008.417 5.5 5.500000 6.000000  
#> s.1 25.00962 12802.710 5.4 5.600000 5.400000  
#> s.23 26.36158 7345.286 5.0 4.666667 7.666667  
#> s.987 23.78448 12008.417 5.5 5.500000 6.000000

## LDA anaylsis classification using model 1  
LDA<-wmodel.LDA(results, model = 1)  
#>   
#> Results and linear discriminant scores:  
#> CLASS\_std\* Prob.1\_std\* Prob.2\_std\* LD1\*  
#> s.1246 2 0 1 -3.380  
#> s.46178 2 0 1 -3.380  
#> s.1 2 0 1 -3.202  
#> s.23 2 0 1 -3.518  
#> s.987 2 0 1 -3.380  
#>   
#> Centroids:  
#> Group Centroid1  
#> 1 1 2.441  
#> 2 2 -2.833

## Visulastion using wplot\_basic  
wplot\_basic(model = 1, LDA$`LD1\*`)

