

# USING FUNCTIONAL TRAITS TO MODEL PLANT COMMUNITIES IN ARABLE FIELDS

---

Helen Metcalfe, Jonathan Storkey, Alice Milne



ROTHAMSTED  
RESEARCH



# USING FUNCTIONAL TRAITS TO MODEL PLANT COMMUNITIES IN ARABLE FIELDS

The species of weeds present in an arable field are considered to be the product of a number of different **filters** acting on the community.



Environmental filters will exclude any species not adapted to those conditions



Management filters will exclude species temporarily based on current management practices



# USING FUNCTIONAL TRAITS TO MODEL PLANT COMMUNITIES IN ARABLE FIELDS

By using **traits** we can model multiple species (currently 136) using simple rules based on the traits of the plants



Plant Height affects the degree of competition with the crop



Flowering time affects how long the weed grows for



Specific Leaf Area affects the growth rate of the weed and the final biomass



Seed size relates to final seed production and the initial green area of the weed at crop emergence

# USING FUNCTIONAL TRAITS TO MODEL PLANT COMMUNITIES IN ARABLE FIELDS

We can model the growth of weeds in competition with crops using only information about the traits of those species as part of a wider landscape model

## Growth

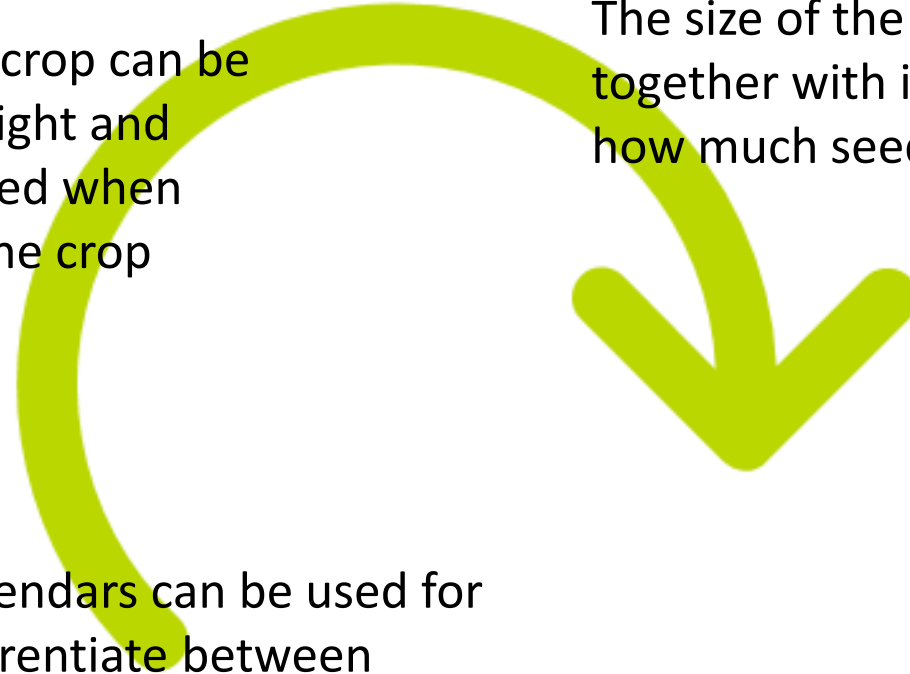
Competition with the crop can be determined by the height and growth rate of the weed when compared to that of the crop

## Fecundity

The size of the weed at harvest together with its seed size determine how much seed is produced

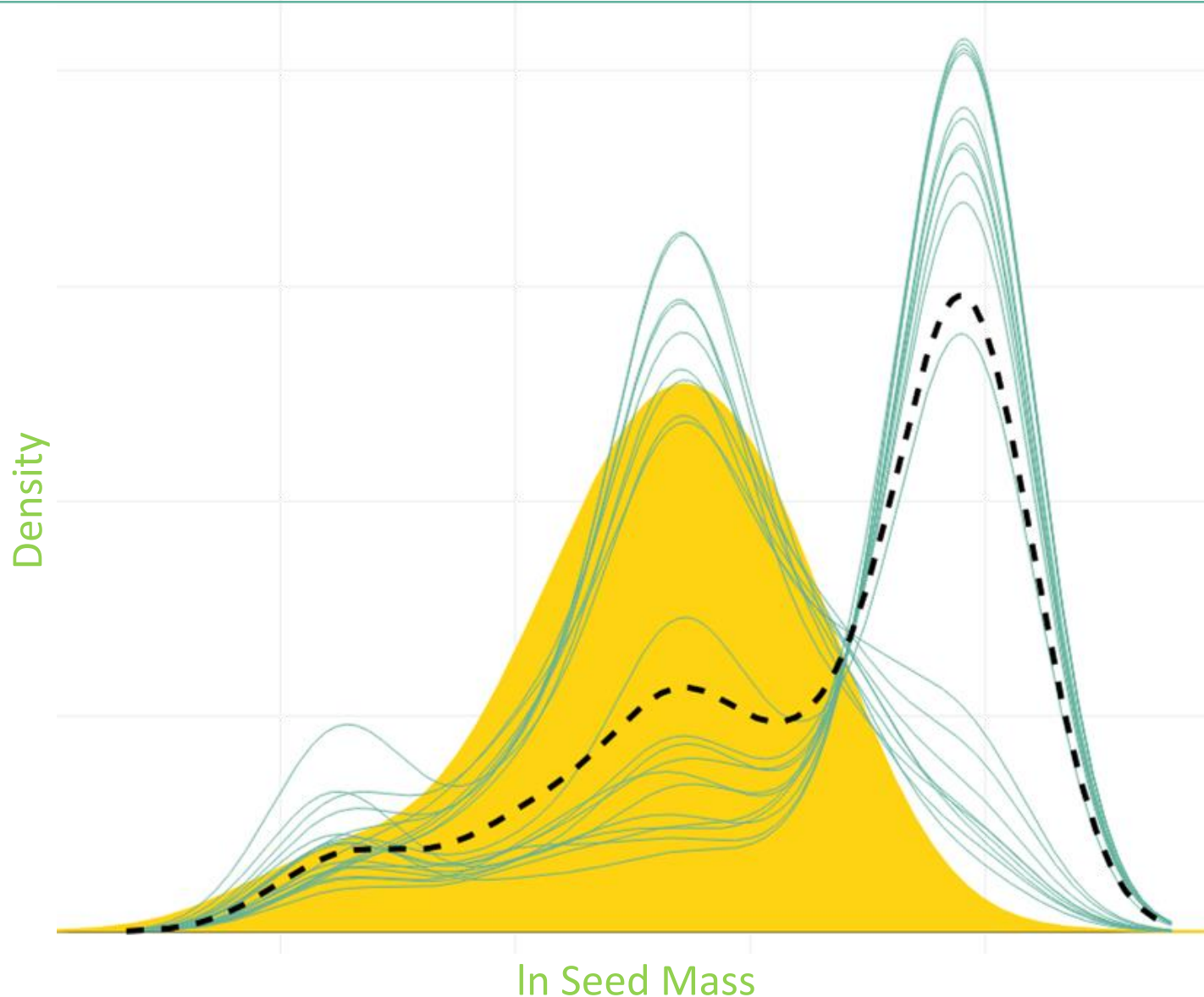
## Germination

Different emergence calendars can be used for different species to differentiate between spring and Autumn germinators





# USING FUNCTIONAL TRAITS TO MODEL PLANT COMMUNITIES IN ARABLE FIELDS



We simulated a field for which we knew all the management history.

Around half of the time the model **predicted** the suite of traits **observed** in the field, whilst the rest of the time it consistently **predicted** a different suite of traits – this indicates that there is some level of stochasticity in community filtering



ROTHAMSTED  
RESEARCH

# USING FUNCTIONAL TRAITS TO MODEL PLANT COMMUNITIES IN ARABLE FIELDS

Helen Metcalfe, Jonathan Storkey, Alice Milne

Rothamsted Research, West Common, Harpenden, Herts, UK



The species of weeds present in an arable field are considered to be the product of a number of different filters acting on the community.



Environmental filters will exclude any species not adapted to those conditions



Management filters will exclude species temporarily based on current management practices



FILTERS

By using traits we can model multiple species (currently 136) using simple rules based on the traits of the plants



Plant Height affects the degree of competition with the crop



Flowering time affects how long the weed grows for



Specific Leaf Area affects the growth rate of the weed and the final biomass



Seed size relates to final seed production and the initial green area of the weed at crop emergence

We can model the growth of weeds in competition with crops using only information about the traits of those species as part of a wider landscape model

## Growth

Competition with the crop can be determined by the height and growth rate of the weed when compared to that of the crop

## Fecundity

The size of the weed at harvest together with its seed size determine how much seed is produced

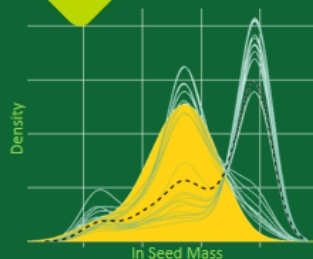


We simulated a field for which we knew all the management history.

Around half of the time the model predicted the suite of traits observed in the field, whilst the rest of the time it consistently predicted a different suite of traits – this indicates that there is some level of stochasticity in community filtering

## Germination

Different emergence calendars can be used for different species to differentiate between spring and Autumn germinators



By simulating different types of management practice we hope to be able to reconcile competing objectives for weed management by determining combinations of management practices which reduce yield loss whilst supporting ecosystem service delivery