i=point

s=species

j=replicate

Let be the occupancy status of point i for species s.

We assume that the occupancy parameters have the following prior:

where is a group indicator. In this model, is specified by the user. The reason for this is that the user has to decide how close the parameters have to be so that two species can be judged to belong to the same group.

In relation to the intercept , we assume a standard random effect prior:

We could also assume a similar clustering process for the detection parameters . However, researchers are typically much more interested in how the different covariates influence occupancy rather than detection. As a result, to simplify our model, we assume a more standard random effect prior for :

where is a diagonal matrix comprised of elements

Finally, we specify the following priors:

In this model, species can belong to different occupancy groups. This model clusters species that respond similarly to environmental variables.

#------------------------------------------------

Calculating likelihood

If , then:

If at least one , then:

#-------------------------------------------

Full conditional distributions for latent variables

* For and

We will sample this joint distribution using compositional sampling. More specifically, we rely on

1. For

Notice that we only sample whenever for all j. As a result, this expression becomes:

We sample this from a Bernoulli distribution

1. For

If , then

If , then

* For

If , then:

If , then:

#--------------------------------------------------

Full conditional distributions for gammas and its priors

* For

where represents all the observations (across all I and j) for species s for which . Similarly, represents the design matrix for which

This implies that

* For

where is the number of species. This implies that

* For

Where is the number of species

This implies that

#------------------------------------------------

Full conditional distributions for betas and its priors

* For

This implies that

* For

Where is the number of species assigned to group k

This implies that

#------------------------------------------------

Full conditional distributions for alpha.s and its prior

* For

where n is the number of points.

This implies that:

* For

Where is the number of species

* For

#---------------------------------------------------------

Full conditional distributions for other parameters

* For

Where is the number of slope parameters.

Taking log this becomes:

To propose a new group, we note that:

Taking log this becomes:

* For

This implies that