Bryophytes are predicted to lag behind future climate change despite their high dispersal capacities

Flavien Collart

Species distribution models

- Based on niche concept
- Main assumption:
  
  species are at equilibrium with their environment

  → No dispersal limitations

MigClim

- Few required parameters

But not spatially explicit

→ Important to include spatial variation
Bryophytes, good models to study climate change

- Good wind disperser

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Highly sensitive to climate change

He et al., 2016. Persp. Plant Ecol. Evol. Syst.
Objective

• Implement a hybrid statistical-mechanistic approach that accounts for temporal and spatial variation of both climatic conditions and wind connectivity for wind dispersal organism

→ Determine the extent to which highly efficient dispersers like bryophytes can mitigate the loss of suitable habitats through rapid colonization of newly suitable areas
Part 1: Correlative SDMs

- 4 different biomes
- 40 bryophyte species
- 5 bioclimatic variables at 1km resolution
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Part 2: Dispersal kernels

Settling velocity

Wind speed

Release height

Canopy height
Dispersal probability curves

1 to 10 km

After 10km → long distance dispersal probability from phylogenetic evidence

Part 3: Simulation

Binarized Maps

Dispersal kernels
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Binarized Maps

Dispersal kernels

MigClim simulator
Correlative SDMs

- Arctic-Alpine species are the most impacted by climate change
- Opposite situation for the mediterranean one
Needed time to fully colonized new suitable areas in 2050

<table>
<thead>
<tr>
<th></th>
<th>P(LDD) = 0</th>
<th>P(LDD) = 0.1</th>
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<tbody>
<tr>
<td>Failed after 500 yrs</td>
<td>98%</td>
<td>35%</td>
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<tr>
<td>Succeed in 2050</td>
<td>0</td>
<td>25%</td>
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Extinction is higher than colonization

Substantial range contraction for all studied species
Conclusion

- Important to incorporate dispersal in SDMs

- Bryophytes are not equipped to track the very fast rates of ongoing climate change for the course of the next decades.