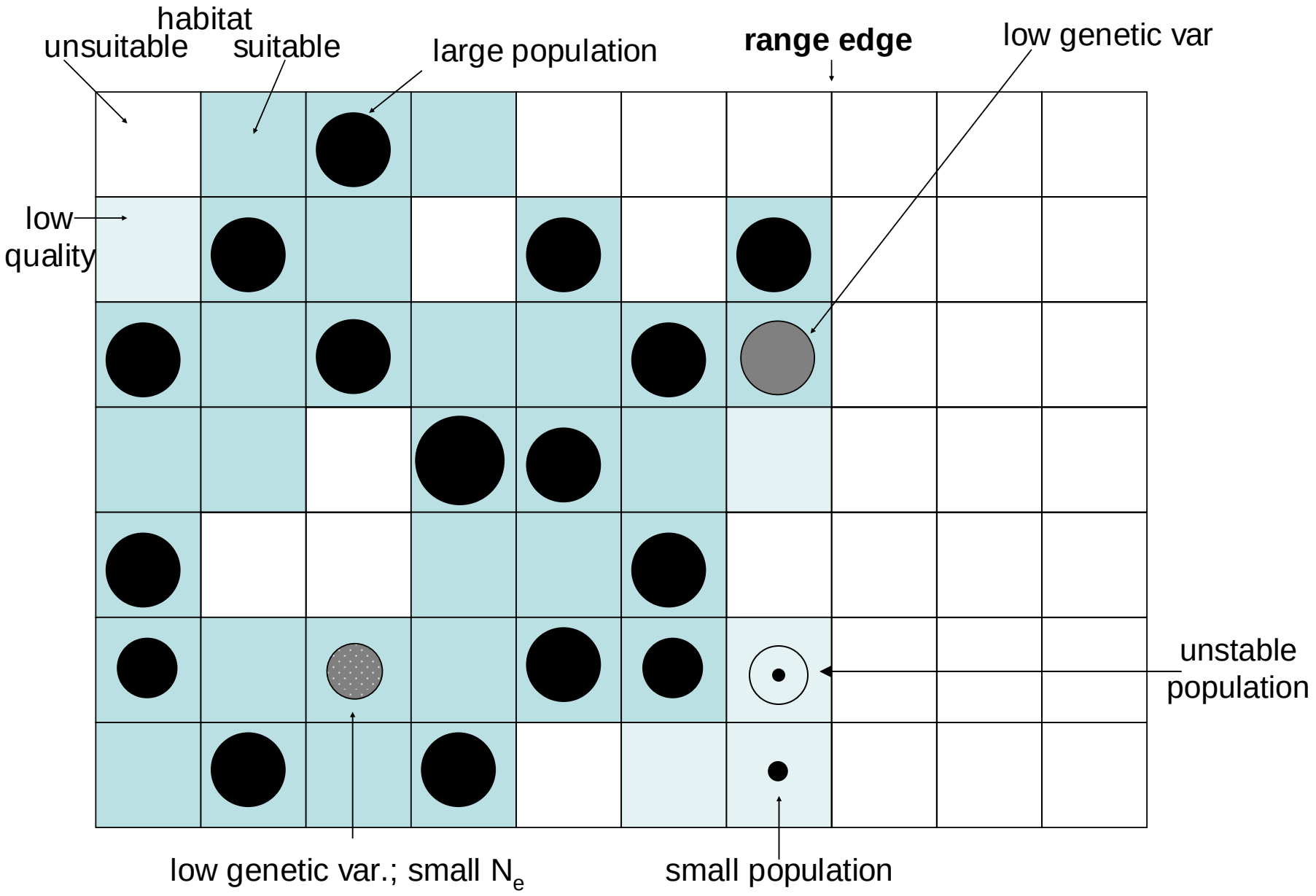
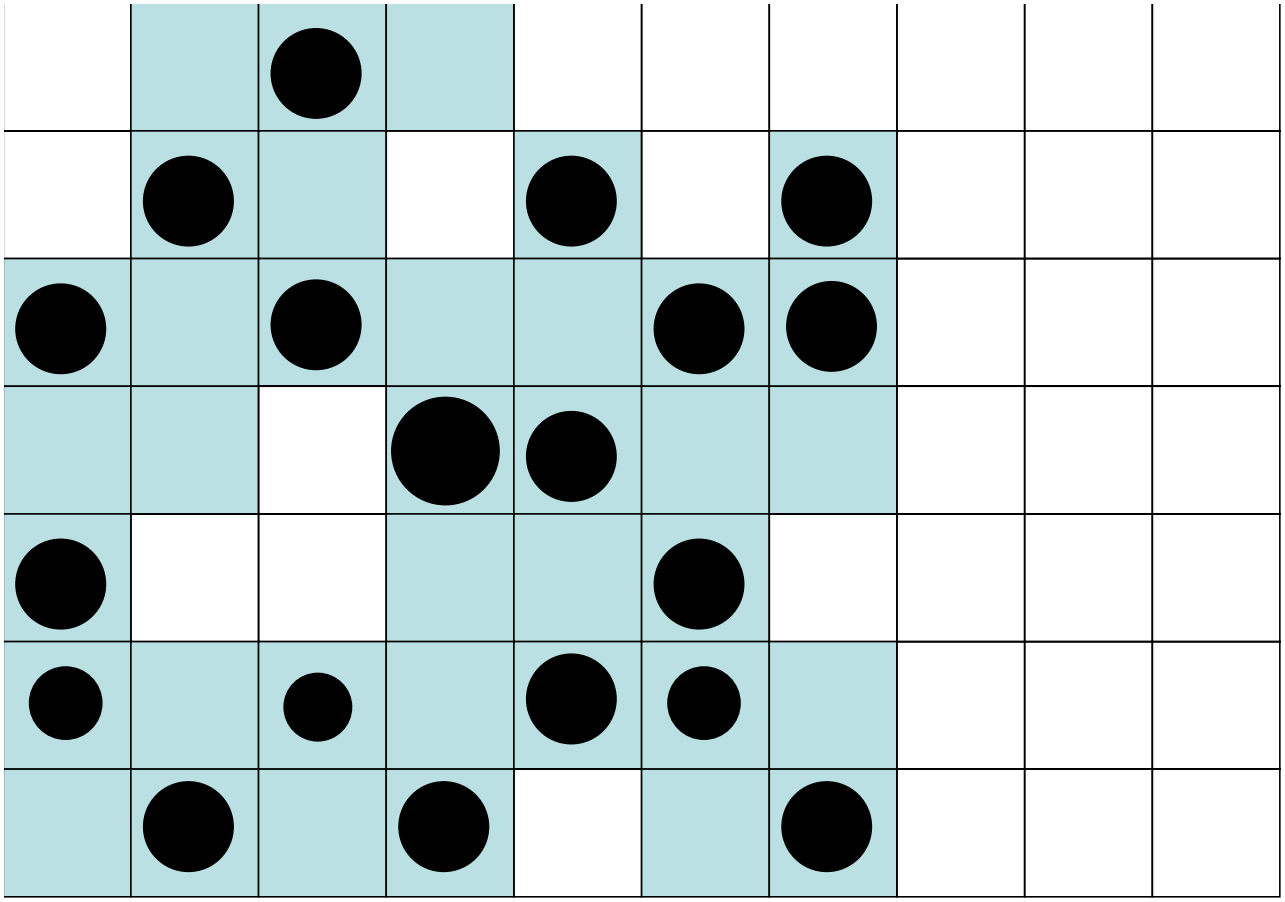
Visualizing causes of range limits: Landscape as grid



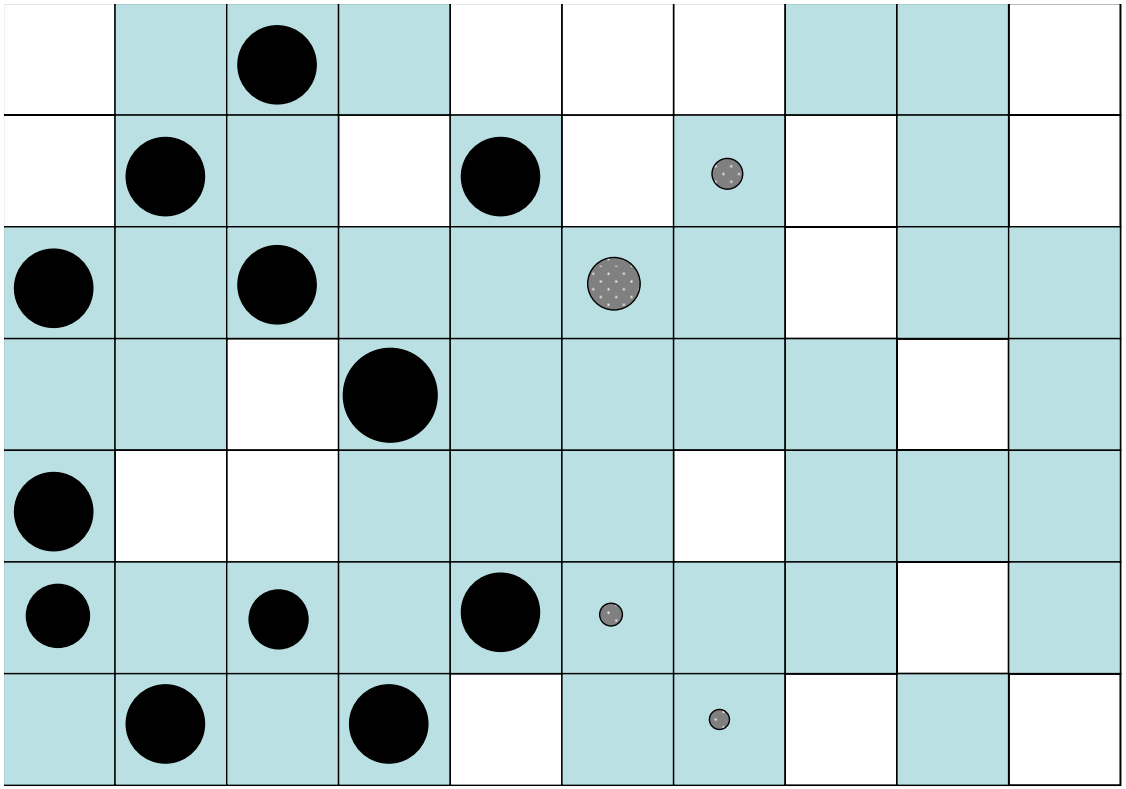
Scenario 1: Suitable habitat is absent beyond edge



→ 2006 findings:

Pollinator distribution?	Yes (specialists absent beyond border)?
Precipitation?	Yes (declines beyond border)?
Soil?	No (suitable beyond border)?
Slope/aspect?	No (suitable beyond border)?
Herbivores?	

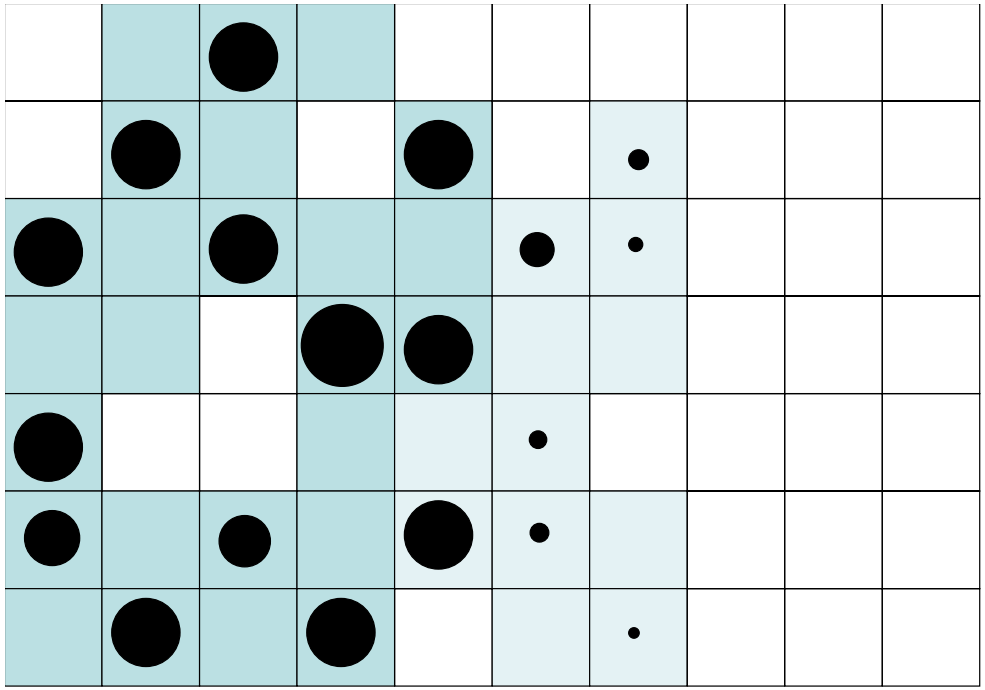
Scenario 2: Suitable habitat occurs beyond edge; the species just hasn't reached there yet



→ 2006 findings:

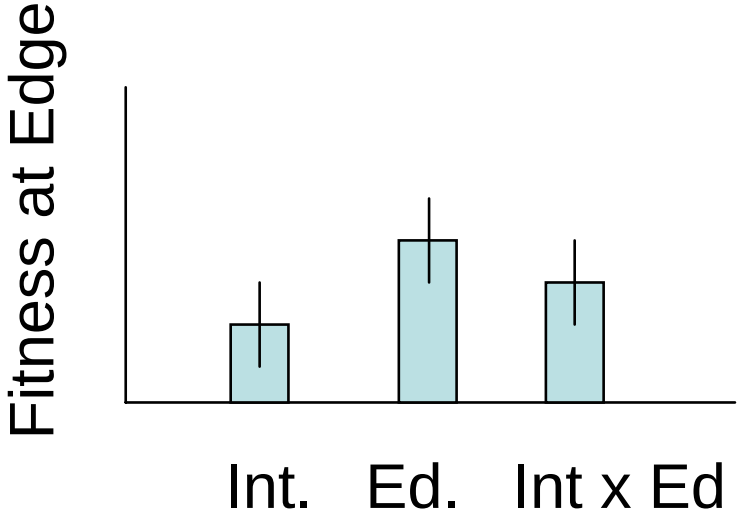
Pollinator distribution?	No (absent beyond border)?
Precipitation?	No (declines beyond border)?
Soil?	Yes (suitable beyond border)?
Slope/aspect?	Yes (suitable beyond border)?
Herbivores?	

Scenario 3: Environmental quality declines toward edge; gene flow from interior to range edge creates maladaptation



Interior (Int.) Edge (Ed.)

transplant experiment prediction

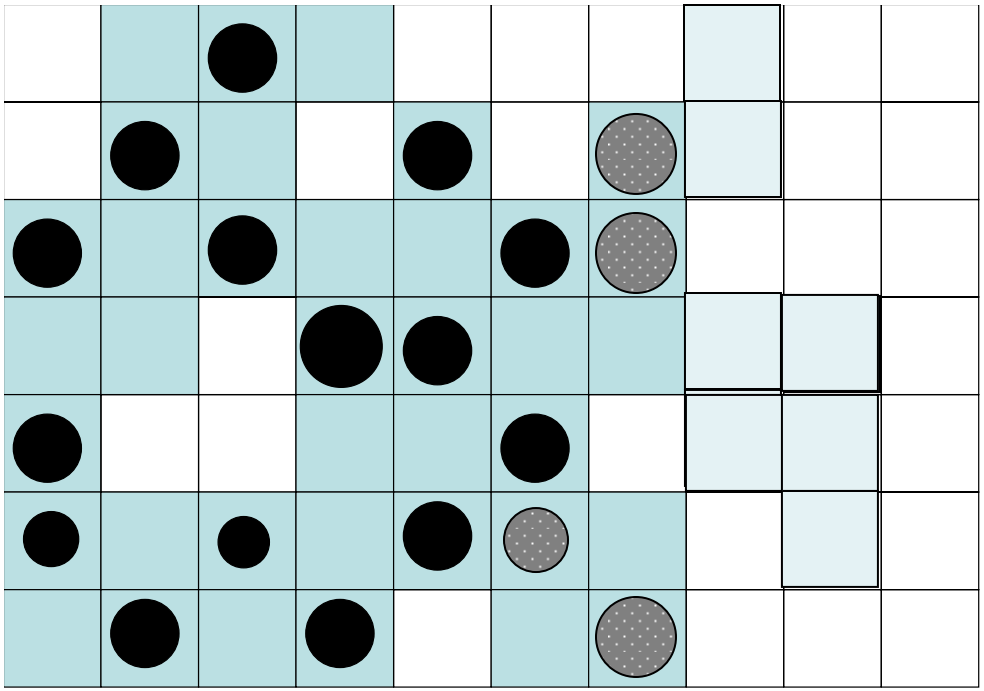


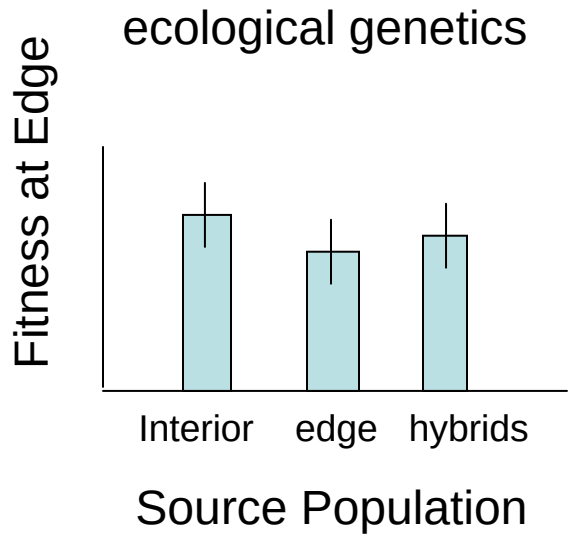
→ 2006 findings:

Germination
Survival
Water stress
Pollinator service
→ lower toward border?

Pollinator density?	Yes (lower near border)?
Precipitation?	No (no decline till beyond border)?
Soils?	Yes (harder near border)?
Slope/aspect?	No (suitable throughout range)?
Herbivores?	No (less abundant near border)?

Scenario 4: Insufficient genetic variation at edge prevents adaptation beyond edge

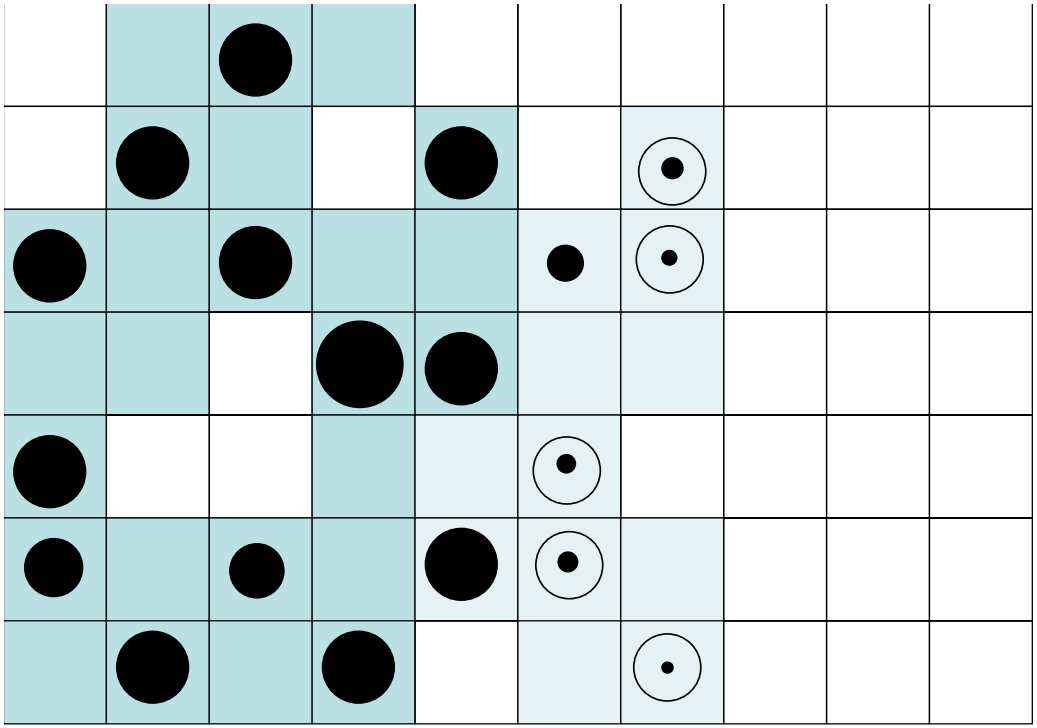




→2006 findings

No? population size, density, area similar across range?

Scenario 5: Greater variability (& higher extinction risk) among border populations



→ 2006 findings must wait for additional years