

Butterfly discussion Recap

Butterflies congregate on areas of high elevation
- hilltopping

It is believed this for mating purposes

When butterflies travel to hilltops they use virtual corridors which are paths that are frequently used but have no apparent benefits

Agent-based modeling can be used to investigate these virtual corridors.

Butterflies are the agents
They adapt according to their environment
emergent phenomena
ie more likely to move uphill in their random walk

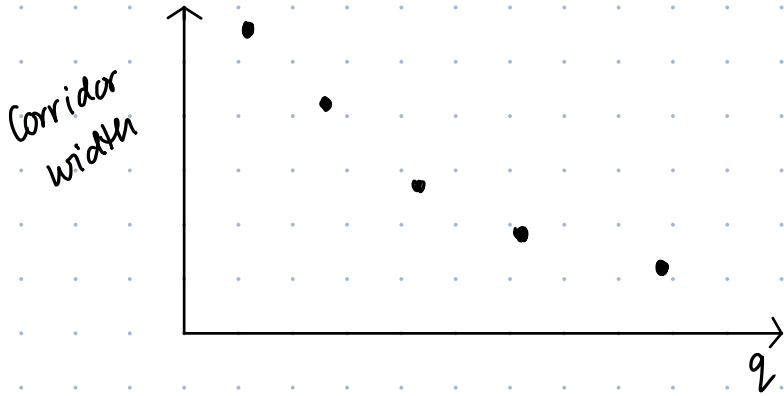
Stochasticity used to represent variability in butterfly motions they don't always fly uphill.

Random Walk in 2D - move to neighboring patch with highest elevation with probability $q = 0.4$
else move to random patch

Corridor width = $\frac{\text{number of patches visited by any butterfly}}{\text{mean distance between start \& end locations}}$

if $q \rightarrow 1$ high probability to move uphill \Rightarrow less randomness
 \Rightarrow less # of patches \Rightarrow corridor width low

if $q \rightarrow 0$ more randomness \Rightarrow more patches \Rightarrow
corridor width increases

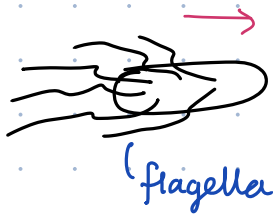


Chemotaxis & ABMs

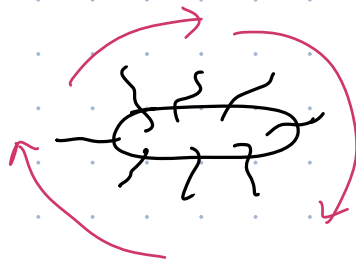
Chemotaxis: movement of an organism or entity in response to a chemical stimulus

eg. Bacteria finding food: swim towards highest concentration

E. coli



straight swim / run
counter clockwise



tumbling
clockwise

Bacteria move by alternating run & tumble motions
run - straight swim
tumble - change direction

Path taken by bacteria can be modeled by a random walk

Bacteria can bias their walks towards a high concentration of particular chemicals (moving up concentration gradient)

eg. E. coli in search of glucose

Bacteria can sense/detect when it is in regions of high vs. low concentrations as it interacts with the chemical's molecules

Bacteria use chemotaxis to wander towards food sources

Chemotaxis can also be used to escape poisons