

USTH 2024 – Project 2

Sheep movements



How do herd behavior and pathway tracks emerge from individual sheep behaviors?

Sheep typically display herding behaviors by following and keeping in close distance from each other. These behaviors may be an evolutionary response to predator risks and resource use optimization. The herd form and collective movement dynamics are emerging from the individual behaviors. Another emergent characteristic is that the herds follow pathways when moving in heterogeneous landscape with obstacles where they cannot go.

A research question is to assess the effects of obstacle spatial distribution on the emergence of frequently used pathways. An agent-based model describing the sheeps, their interactions, the obstacles and the pathway taken by the sheep (number of passages in an area or tramping) may serve to explore how obstacle distribution influences the emergence of pathway tracks in the landscape.

Extension 1: Extend the agent-based model to incorporate variations in the obstacle types, such as different sizes, shapes, or levels of complexity, to assess their distinct impacts on pathway emergence and utilization by the herding sheep.

Extension 2: Introduce environmental factors, such as specific vegetation attracting some sheeps or topography making some path less easy to use, into the model to examine how these factors interact with obstacle spatial distribution in shaping the emergence of pathways in the landscape.

Extension 3: Introduce a new species called *dog* which will scare sheeps and examine how these factors interact with spatial distribution.

Extension 4 (Bonus): Implement a real-time adaptation mechanism into the agent-based model, allowing the sheep to dynamically adjust their pathway choices based on evolving obstacle distributions and environmental conditions. Evaluate the impact of adaptive behaviors on the resilience and effectiveness of the emergent pathway patterns.