Rough outline plan

Ideas I like

* Grimm et al 2020
  + A good review of the ODD protocol
  + “Overview, Design concepts, and Details”
* EDA-based ABM simulations (Butts et al 2022)
  + Deer example of EDA in ABM
  + Uses ODD
* SiMRiv (Quaglietta and Porto 2019, Quaglietta et al 2019)
  + “We are aware of no tools allowing simulating spatially-explicit multistate Markovian movements constrained to linear features or conditioned by landscape heterogeneity, which hinders movement ecology research in linear/dendritic (e.g. river networks) and heterogeneous landscapes.”
  + “allowing continuous-space mechanistic spatially-explicit simulation of multistate Markovian individual movements incorporating landscape bias on local behavior.”
  + “it avoids unrealistic assumptions, such as animal omniscience and planned final destination, generally found in the least cost path (LCP) modelling approach”

Other packages/software

* HexSim (Schumaker and Brookes 2018)
  + Seems to be more about long-term range shifts and population dynamics
  + GUI so I don’t know how much I’ll be able to edit
  + Transforms linear features into hex boundaries and this is a key feature of our system, seems like an afterthought here?
* abmR Gochanour et al 2023)
  + asdf
* abmAnimalMovement (Marshall and Duthie 2022)

Steps

1. **Define metrics**: Link specific quantitative metrics (see Butts et al 2020 paper) to the qualitative patterns we think are necessary to replicate, using EDA to explicitly define these characteristics. Here we might also define different movement states.
2. **Gather spatial data**: List spatial features and gather spatial data. Perhaps combine a few to have one map of water, one of landscape viability, and one of linear features. Would Robin’s Circuitscape output be useful here?
3. **Gather agent attributes**: List movement characteristics of agents and gather parameters from literature or from the data.
4. **Model implementation**: Choose a model or two and get a basic version running
5. **Model selection**: Try out simulations with different combinations of agent attributes and spatial features, then calculate metrics from step 1 to compare between models. Which ones accurately replicate the critical spatial patterns?
6. **Add time**: Once we have an MVP for the spatial component, what about temporal (seasonal) changes in the space? Specifically, vegetation, temperature, and water supply.
7. **Add individualization**: Elephants are not just randomly wandering about the landscape; they’d likely remember waterholes and fence gaps. In addition, bulls are known to *create* fence gaps; agents should be able to modify their landscape. Also, what about activity state? Could draw from TOD, time since last state change, etc. and determine whether the agent is foraging, exploring, or resting. This would then determine the characteristics of the distribution from which we’re drawing step lengths and turning angles (internal state x landscape resistance perhaps). Or is that too much in the weeds?