**Predator-Prey Agent-Based Model – Plan & Approach**

We are thinking of developing a **predator-prey model** using **agent-based simulation**. The goal is to explore how different species interact in an ecosystem and observe population dynamics over time. We are thinking to simulate a scenario where predators hunt prey while both species reproduce, move, and react to their surroundings.

**How We Plan to Approach It:**

* We were considering modeling multiple species, possibly using wolves and rabbits, dinosaurs and small mammals, or other predator-prey pairs.
* We can add unique attributes like speed, energy consuption, vision range, reproduction etc.
* But also we are thinking to do more like probably from more different world like **LORD of THE RINGS** Orcs and Humans etc
* The simulation could be implemented in **various ways**, including a **grid-based system**, a **continuous-space model**, or even a **3D environment** depending on feasibility but we didn’t decide yet.
* We are also thinking different ways to represent movement—either **random motion**, **rule-based behaviors** (like prey fleeing predators), or more advanced techniques such as **pathfinding** for hunting.

**Technologies & Implementation:**

* We are thinking of using **Python** for flexibility and accessibility
* Libraries like **Mesa** (for agent-based modeling) or **Pygame** (for visualization) could be useful.
* We might use **Matplotlib** for analyzing population trends and possibly real-time visualization tools for interactive exploration.
* If feasible, we could expand the model with **terrain effects**, where movement and visibility are influenced by the environment.
* Another possibility is introducing **resource competition**—for example, prey needing grass to survive, which regrows over time.

**Scenarios:**

**1. Orc Raid on Human Villages (Classic Hunt Scenario)**

* **Predators:** Orcs
* **Prey:** Human villagers (non-combatants)
* **Twist:** Humans try to escape or hide, and orcs move in groups and raid.
* **Goal:** See how long humans can survive, how escape strategies affect outcomes.
* **Optional:** Add guards that defend or slow orcs down.
* **Focus:** Speed vs. intelligence, hiding behavior, clustered populations.

**2. Elves Defending the Forest Against Orcs (Territorial Defense)**

* **Predators:** Orcs trying to enter the forest
* **Prey:** Elves (but they are aggressive defenders, not passive)
* **Twist:** Elves don't run — they defend. Predator becomes prey if it enters protected zones.
* **Goal:** Study territorial behavior, zone-based interactions.
* **Optional:** Add magic zones or traps elves place.
* **Focus:** Area control, strategy, boundary effects.

**3. Giant Creature in the Wild (One Powerful Predator vs Many Prey)**

* **Predator:** Balrog or a Dragon
* **Prey:** Orcs and humans alike
* **Twist:** One huge predator roaming randomly; both species try to escape or manipulate it toward the other.
* **Goal:** Show how different groups react to a powerful shared threat.
* **Optional:** Make orcs more aggressive and humans more defensive.
* **Focus:** Complex dynamics when prey don’t cooperate.

**4. Orcs vs Dwarves: Predator and Prey Switch Roles**

* **Time-based role reversal scenario**
* **At night:** Orcs are predators, dwarves hide or defend
* **At day:** Dwarves become active and hunt orcs
* **Twist:** Role flips, prey becomes predator.
* **Goal:** Track survival and dominance over time.
* **Focus:** Temporal shifts, adaptive behavior, strategy.