

Driftwood: Self-Regulating Access to Natural Resources

Pham Gia Phuc
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1 Intructions

On the coast of a distant country, people compete for the gathering of driftwood brought to the shore by storms. Whoever is first onto a stretch of the shore after high tide is allowed to take whatever they wish up to their carrying capacity and to gather it into a pile above the high-tide line. To indicate ownership, piles are marked by placing two stones on their top. The wood it contains is then regarded as the property of a driftwood collector. Only wood pile owners always respect pile ownership. Collectors having not yet established a pile can head towards wood piles and “steal” the wood it contains, but only when no pile owner is observing them.

An Agent-Based Model (ABM) based on this description will be used to explore the value of this “peer-pressure” regulation in addressing wood theft. Is it possible, without any external enforcement, to reach a stabilized situation?

1. **Extension 1:** Modify the agent-based model to explore variations in the recognition of pile ownership. Introduce the ability to steal for owners and analyze the impact on the stability of pile ownership over time.
2. **Extension 2:** Extend the model to introduce external factors, such as the arrival of external authorities or external enforcement mechanisms. Explore how the introduction of external influences affects the stability of the system and the behaviors of wood collectors.
3. **Extension 3:** Conduct an exploration exercise by varying the size of the wood collector groups. Investigate how the size of collector groups influences the emergence of stabilized situations, considering aspects like cooperation, competition, and the prevention of wood theft. Analyze the system’s resilience to perturbations based on group size.

2 Core Mechanisms

2.1 Environment

Time: 24h, Day/Night

Deep sea: 20%

Tidal zone: 65% (shallow water)

Sandy beach: the rest

Height of the beach is calculated, whereas the deep sea area always at 0 meter, up to 5 meter at the highest point in the sandy beach.

Water has wave, calculated with the sine formula. Wave cover all areas where water exist. **Wave** can happens at both deep sea and tidal zone (aka shallow water).

- Wave has amplitude, frequency, speed and base level, all matched with simulation time and coordinates.

Every **cycle day/night** = 24h:

- 0-6: Rising to high tide
- 6-12: Falling to low tide
- 12-18: Rising to high tide
- 18-24: Falling to low tide

- Tide has min/max level and speed, match with simulation time and coordinates.

Water makes sand wet in a duration of time.

2.1.1 Driftwood

The driftwood spawns in the deep sea. Driftwood has 3 sizes: “Large”, “Medium”, “Small”.

- being pushed toward the beach in rising tide
- being pulled toward the sea in falling tide with lower speed compare to above

Each wood size has different movement speed in tide: Small wood move fastest, then comes the Medium and finally is the Large.

Waves also affect the movement of the driftwood with similar effects compare to tide.

2.2 Extension 1

Extension 1 introduces the **Collector** agent.

Collector has:

- speed

- carrying capacity
- greediness
- field of view

Collectors can only see wood in fov, can collect as many wood piece as they want (random) within carrying capacity.

Collectors have the ability to steal from other wood pile.

Speed of collectors can vary, but being reduced when carrying wood and in the water.

2.3 Extension 2

In this extension, the Authority and Security Camera apply some punishment on the thieves.

Authority wanders around while Security Camera stationed at a random position.

If collectors caught stealing, a fine will be applied, reducing a number of wood in their pile, and reducing steal rate. until reach 0.

2.4 Extension 3

Extension 3 gives collectors ability to form groups.

Groups boost the collectors' carrying capacity...

Perturbation put the negative effect on collectors.

And examine the system stability.

3 Conclusion

This is only a simple outline.