MODELING - GAMA project Driftwood

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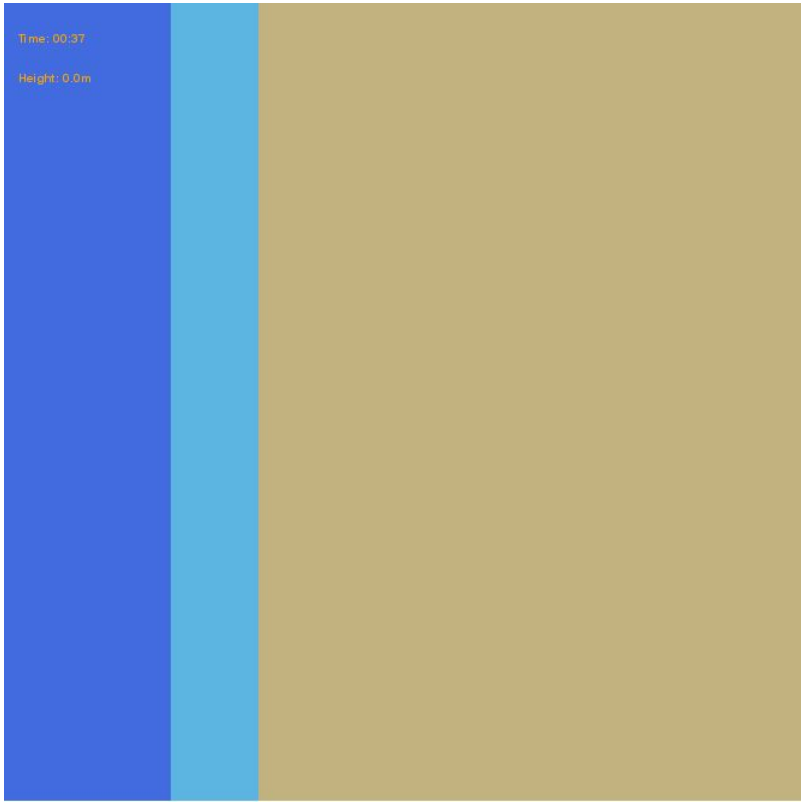
Overview of the Simulation

Key questions :

- What’s the impact of the stealing mechanism
- What is the impact of enforcement mechanisms
- How do group dynamics influence system stability?

The Environment



Description:

- A dynamic beach environment modeled as a grid.
- Features include:
  - Waves and tides influencing wood movement.
  - Zones: ocean, shoreline, and dry land.

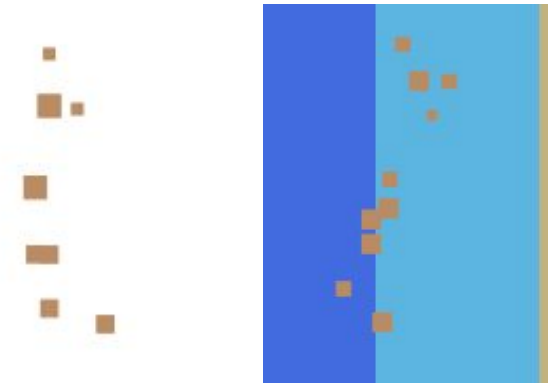
Visual Aids:

- Show a grid with tide zones, wave patterns, and color-coded areas.

Key Metrics:

- Average height, tide levels, and wave dynamics.

Driftwood Species



Role:

- Driftwood is the core resource for collectors.

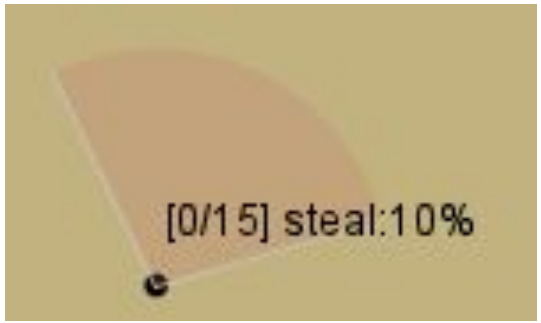
Behavior:

- Movement is influenced by waves, tides, and size categories.
- Sizes: Small, medium, large (affecting value and movement).

Visual Aids:

- Diagram showing driftwood moving across the grid with tide and wave effects.

Collectors



Behavior:

- Collect driftwood, build piles, and optionally steal from others.

Key Attributes:

- Greed: Influences decision-making.
- Stealing: Managed by probabilities that adjust after successes. (extend 1)
- Grouping: Form groups for efficiency and resource sharing. (extend 3)

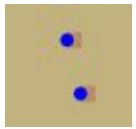
Visual Aids:

- A collector’s flowchart: From identifying wood to pile creation or theft.

Key Metrics:

- Active collectors, total thefts, and collection efficiency.

WoodPile Species



Role:

- Represents storage for driftwood collected by agents.

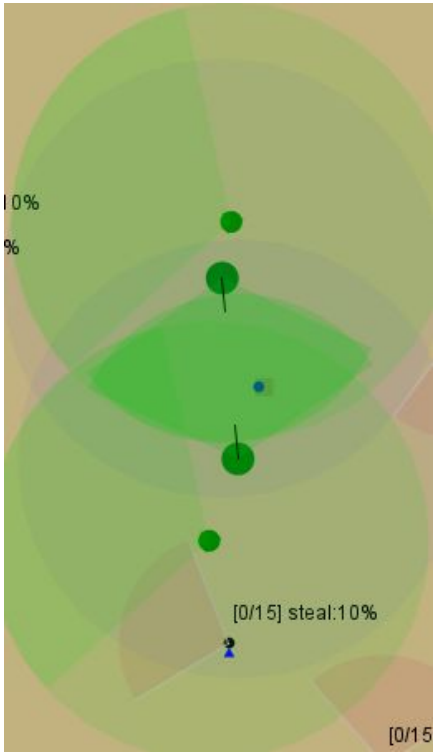
Behavior:

- Tracks ownership, value, and theft.
- Stability decreases with frequent thefts.

Visual Aids:

- Diagram showing wood being added to a pile, with theft reducing value.

Enforcement Mechanisms (extend 2)



Authority Species:

- Mobile patrols monitor and pursue thieves.
- Dynamic behavior: Patrol paths or stationary observation.

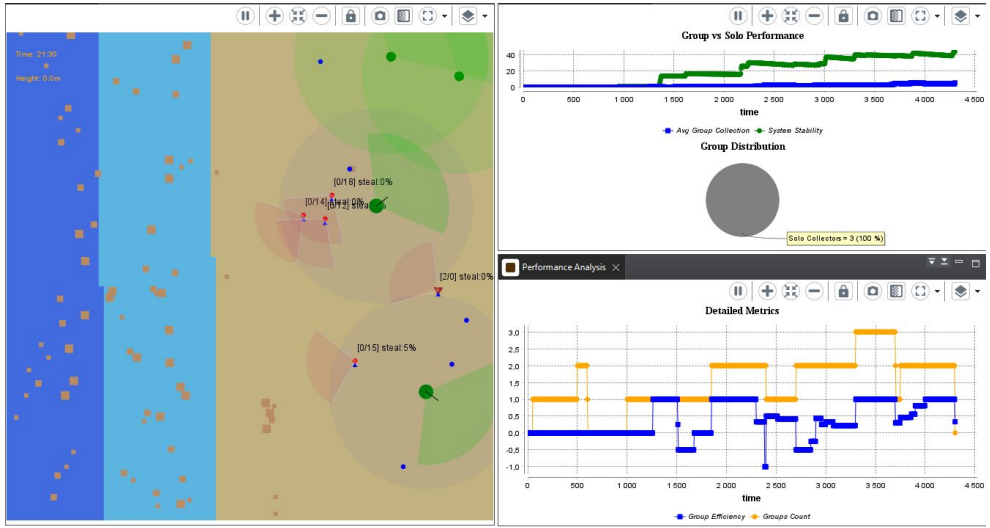
Security Cameras:

- Stationary enforcement agents with rotational FOV.
- Detect and penalize thieves within a defined radius.

Key Metrics:

- Active pursuits, total catches, and thief deterrence effectiveness.

Experiment Design



Interactive Parameters:

- Environmental: Waves, tides, and flow rates.
- Collector Behavior: Greed, stealing probabilities.
- Enforcement: Number of authorities/cameras, detection radius.
- Group Dynamics: Formation/breakup probabilities and cooperation bonuses.

Outputs:

- Graphs: Group vs. solo efficiency, theft rates, and system stability.
- Visualizations: Live beach simulation with color-coded agents.

Visual Aids:

- Example dashboard with parameters and real-time monitors.

Key Insights and Results

Findings:

- Peer pressure alone leads to moderate stability but frequent thefts.
- Adding enforcement reduces thefts significantly, especially with mobile patrols.
- Groups improve efficiency but may increase theft without enforcement.

Implications:

- Self-regulation and enforcement must be balanced for optimal stability.

Conclusion

Summary:

- The simulation highlights how resource competition can be modeled dynamically.
- Enforcement and group behavior are key to understanding resource stability.