Driftwood

Self-Regulating Access to Natural Resources

Modeling and Simulation of Complex Systems

Lecturer: Prof Alexis Drogoul, Arnaud Grinard, Athur Bulgiere

By: Phạm Gia Phúc

Contents

Introduction

Problem Statement

- Resource competition for driftwood collection on coastal shores
- Ownership marked by stone placement
- Theft possible when unobserved
- Need for effective self-regulation

Key Research Question

- Is it possible to achieve a stable resource management system through:
  - Peer pressure regulation
  - External enforcement
  - Group dynamics

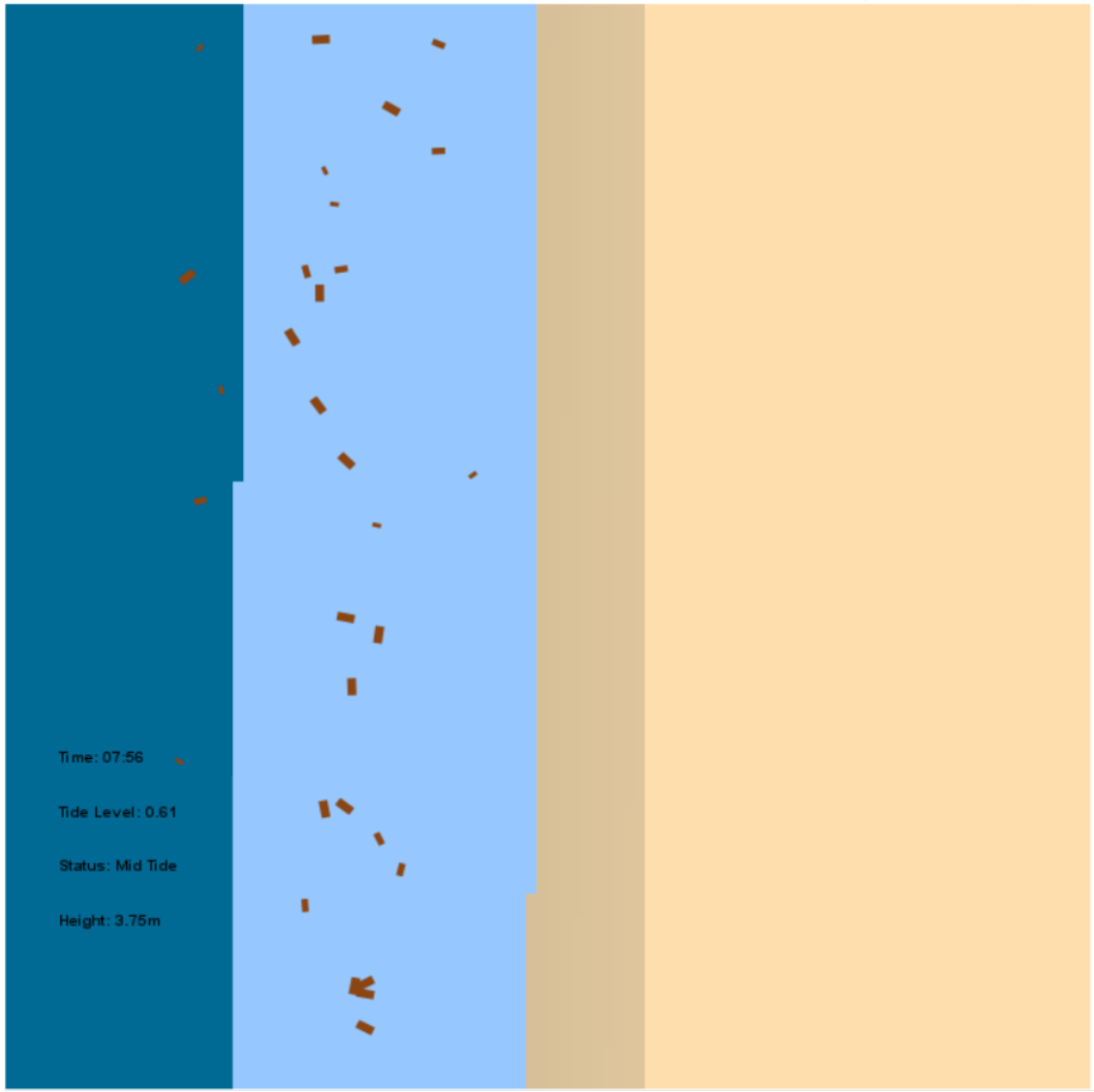
Mechanisms - Environment

Spatial Organization

- Deep Sea Zone (20% width)
- Tidal Zone (20-65%)
- Sandy Beach Zone (65-100%)

Dynamic Systems

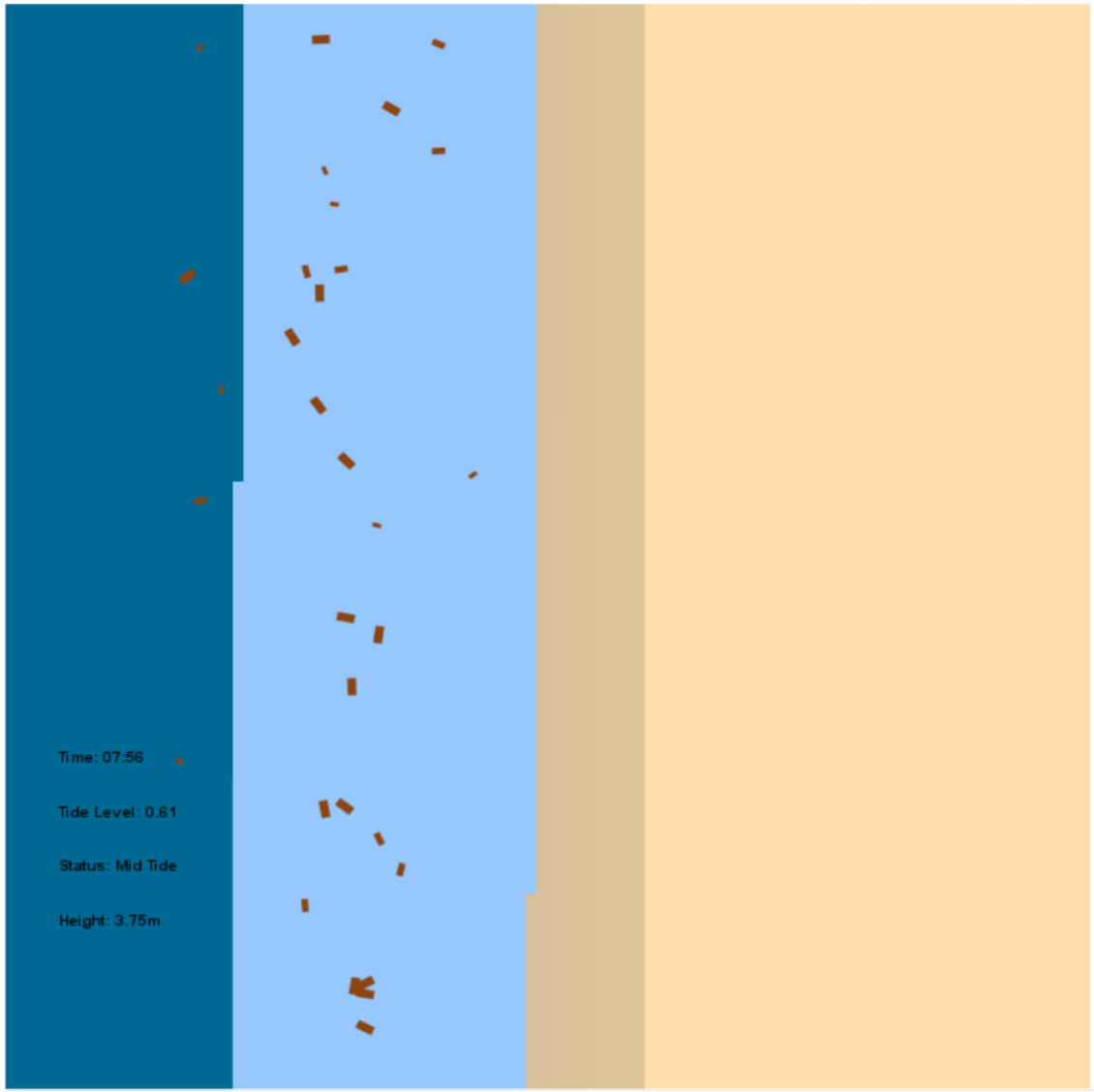
- 24-hour day/night cycle
- Synchronized tidal system
  - Rising: 0:00–6:00 and 12:00–18:00
  - Falling: 6:00–12:00 and 18:00–24:00
- Wave dynamics with parametric control
- Water depth calculations and beach topography



Mechanisms - Environment

Driftwood

- 3 sizes:
  - Large: 5
  - Medium: 3
  - Small: 1
- Tide influenced movement
- Wave influenced movement



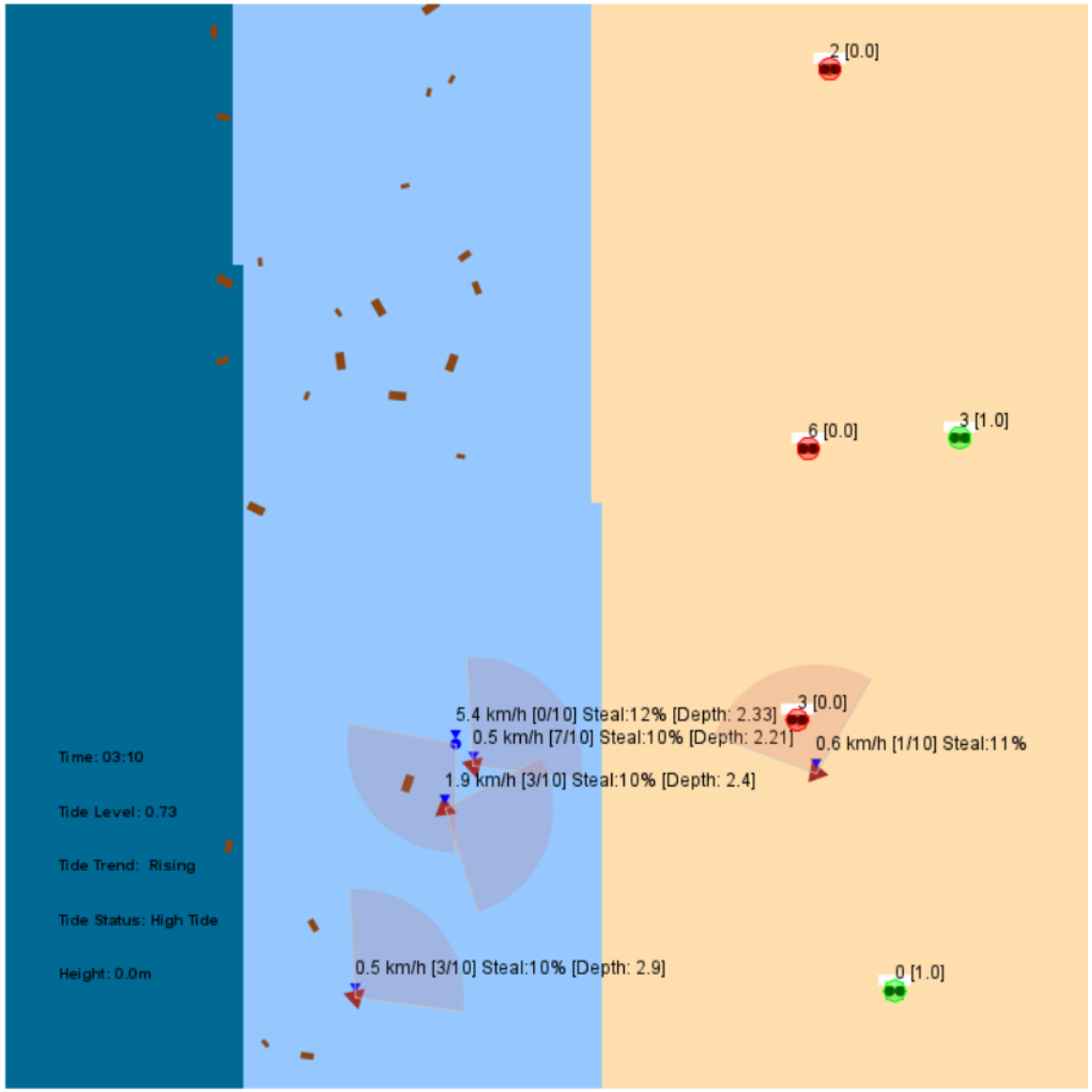
Extension 1: Self-Regulation and Pile Ownership

Collector Behavior

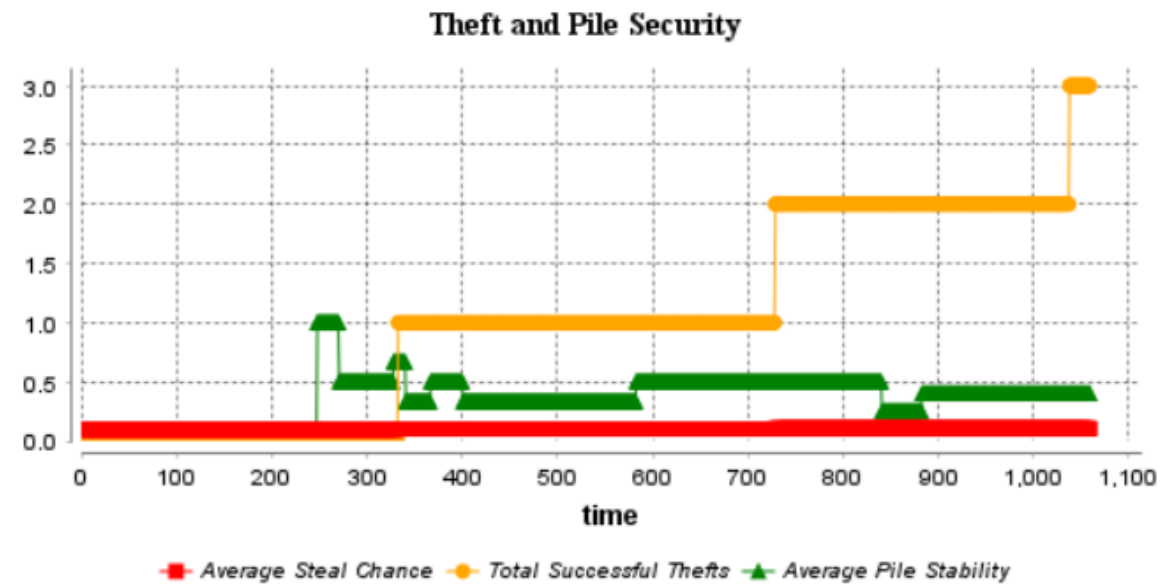
- Speed: 0-8 km/h
- Carrying capacity: 10 units
- Field of view: 100 degrees, 10m range
- Greediness factor: 0.3-0.8

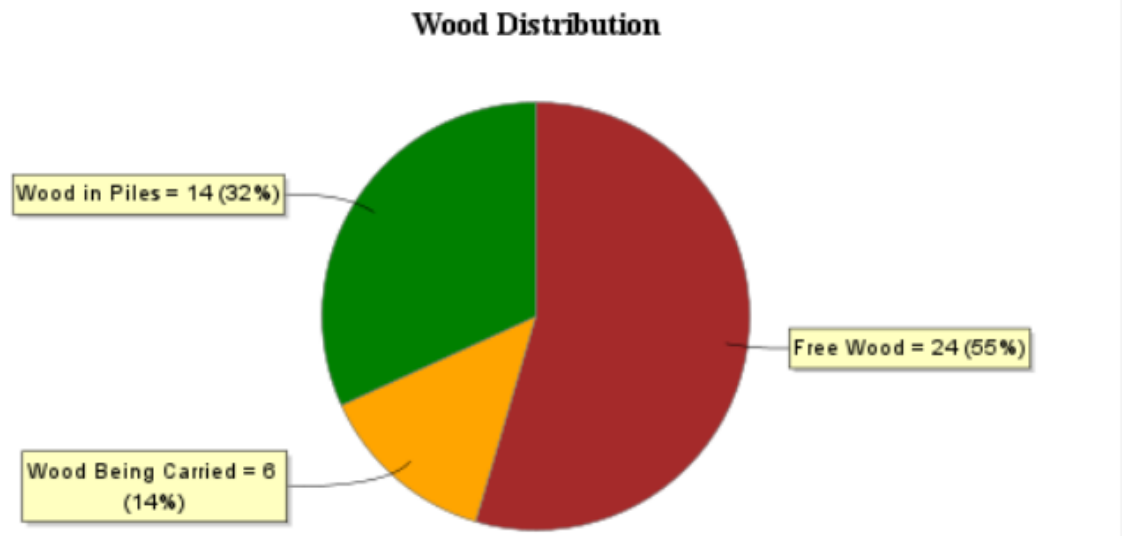
Theft Mechanics

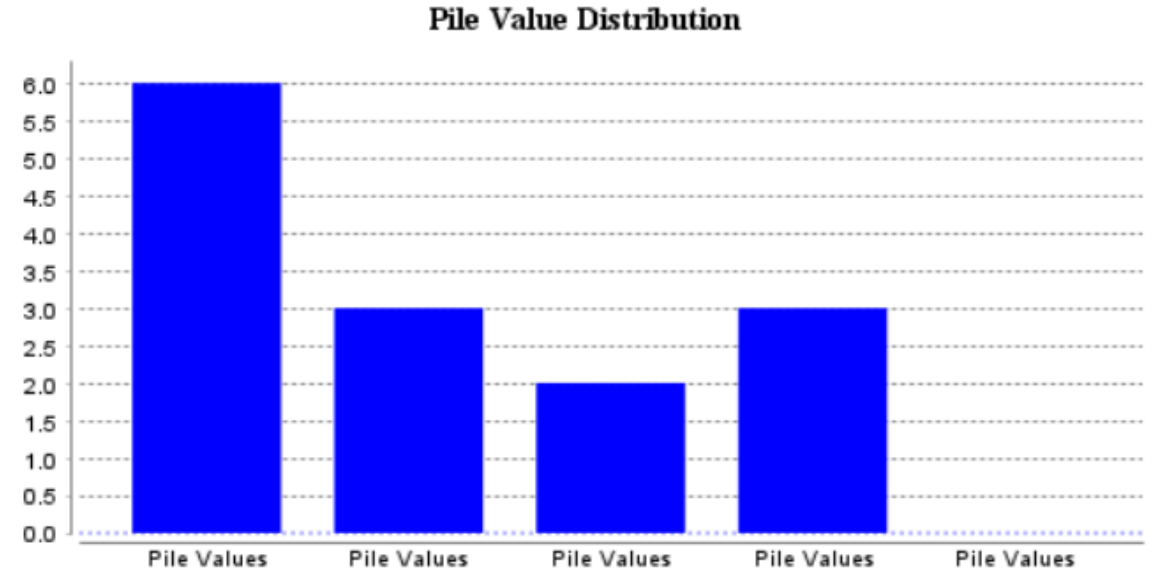
- Initial steal chance: 10%
- Maximum: 20%
- Success-based increase: 1%

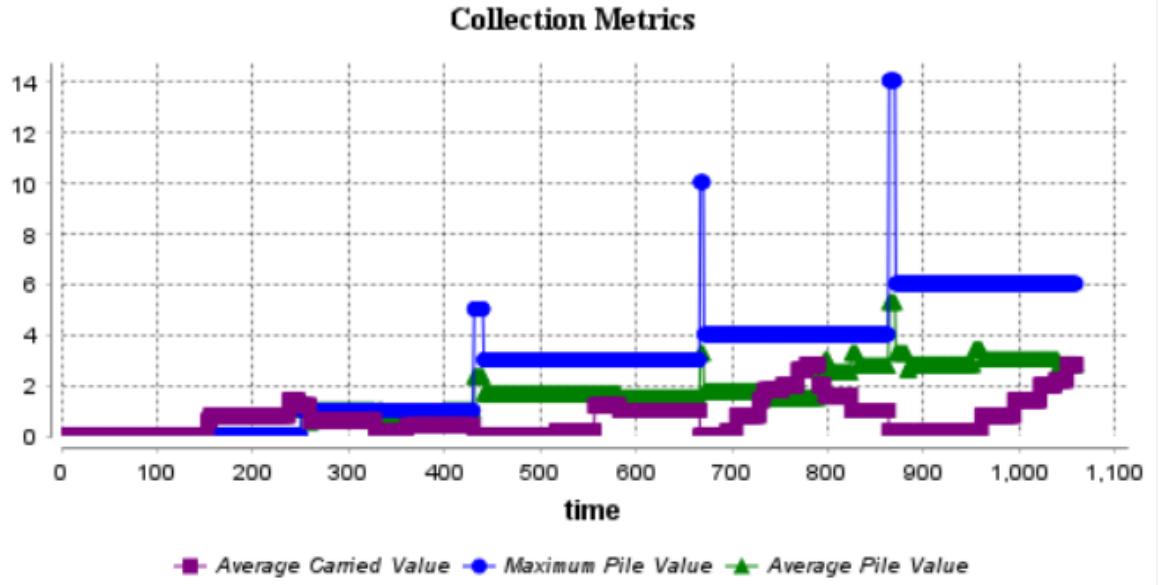


Ext1: Self-Regulation and Pile Ownership – Analysis

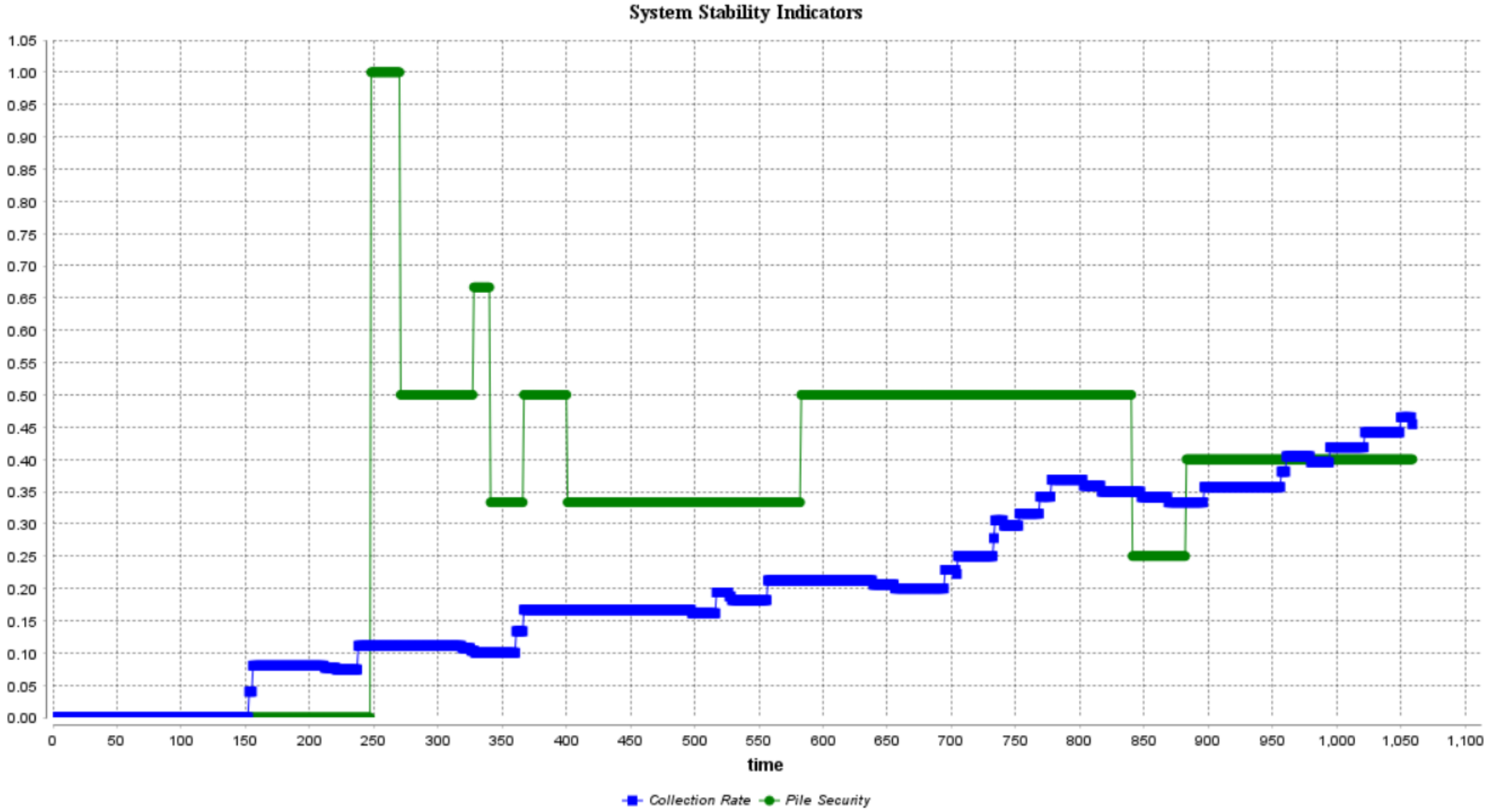








Ext1: Self-Regulation and Pile Ownership – Analysis



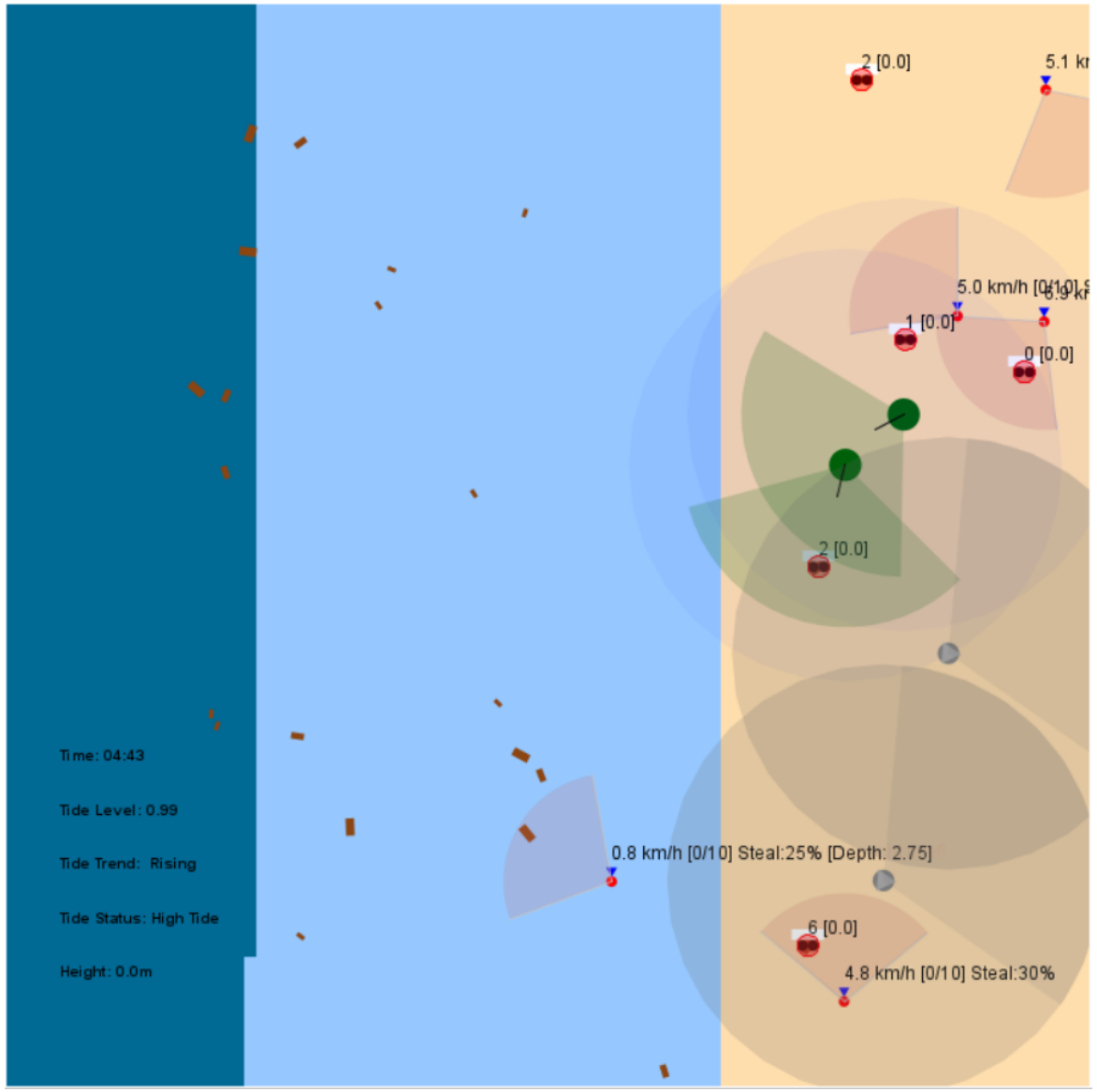
Extension 2: External Enforcement

Enforcement Mechanisms

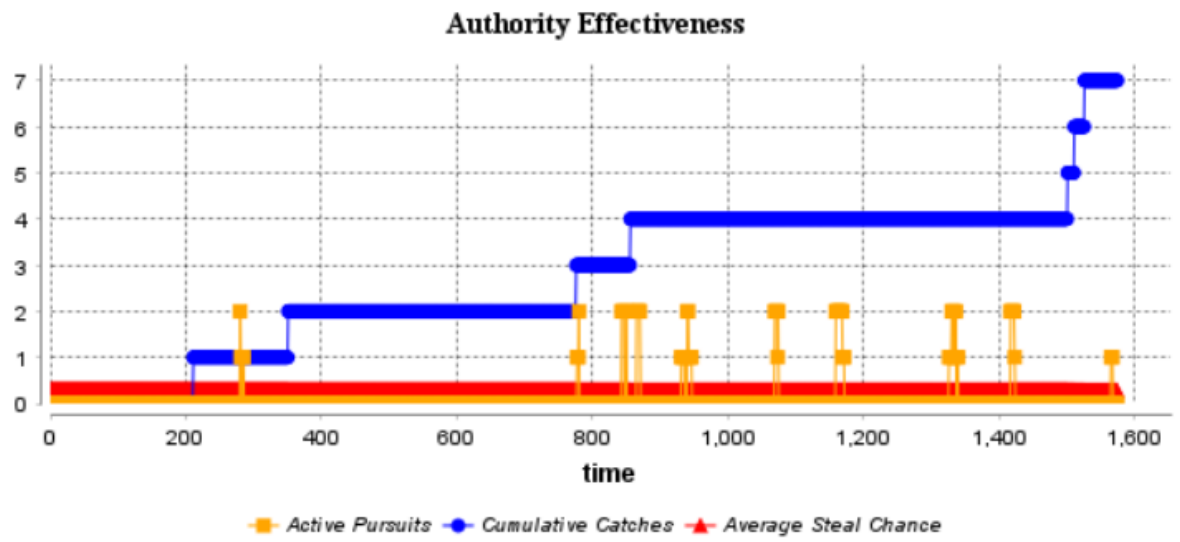
- Authority agents with enhanced FOV
- Security cameras
- Active pursuit system
- Punishment mechanics

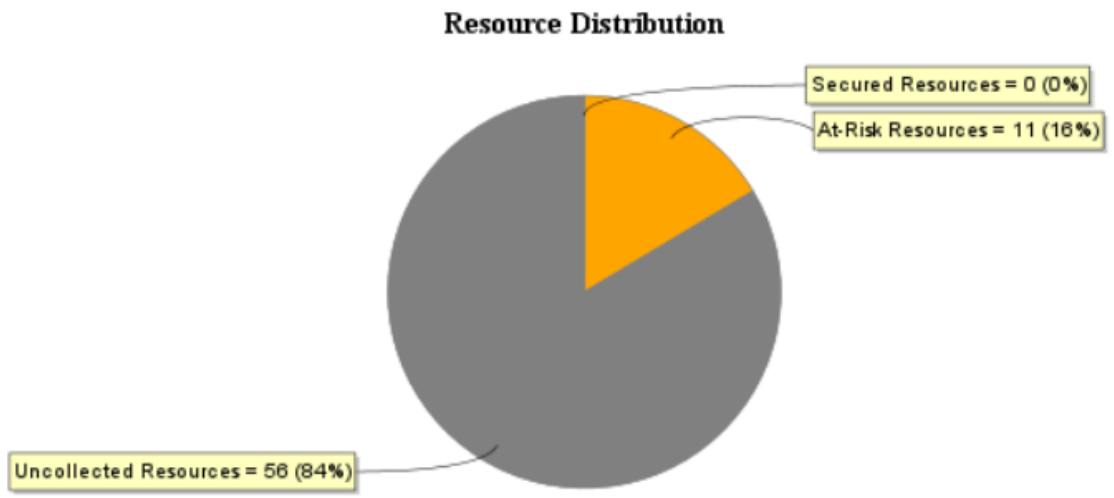
Impact Analysis

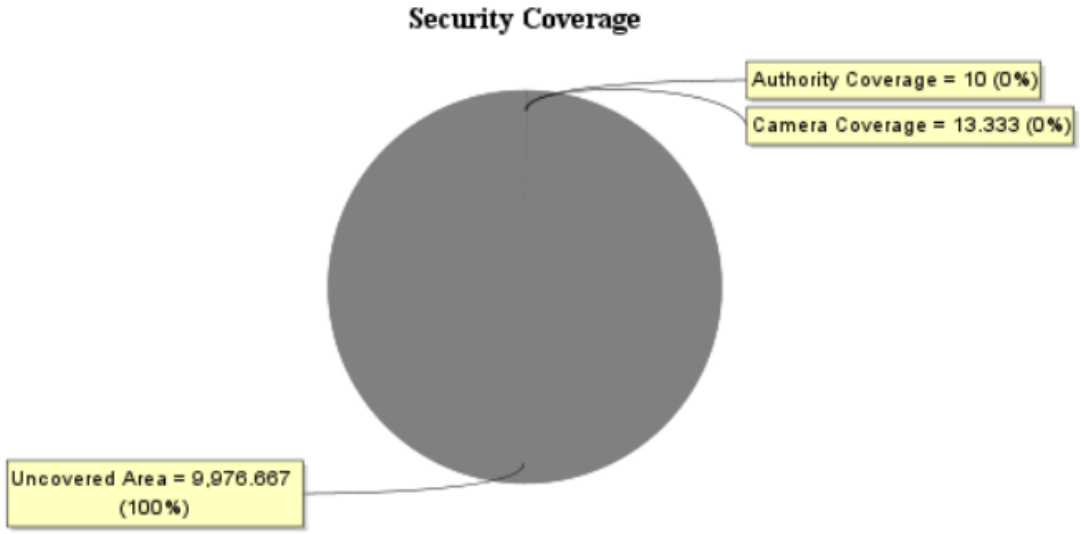
- Catch rates
- System stability
- Resource security
- Theft deterrence

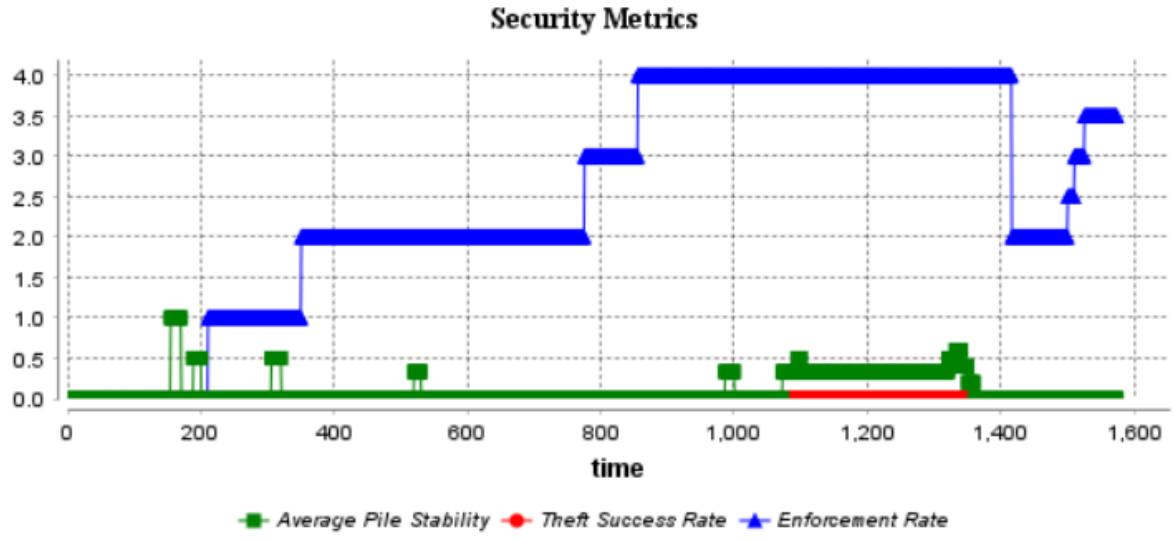


Ext2: External Enforcement – Analysis

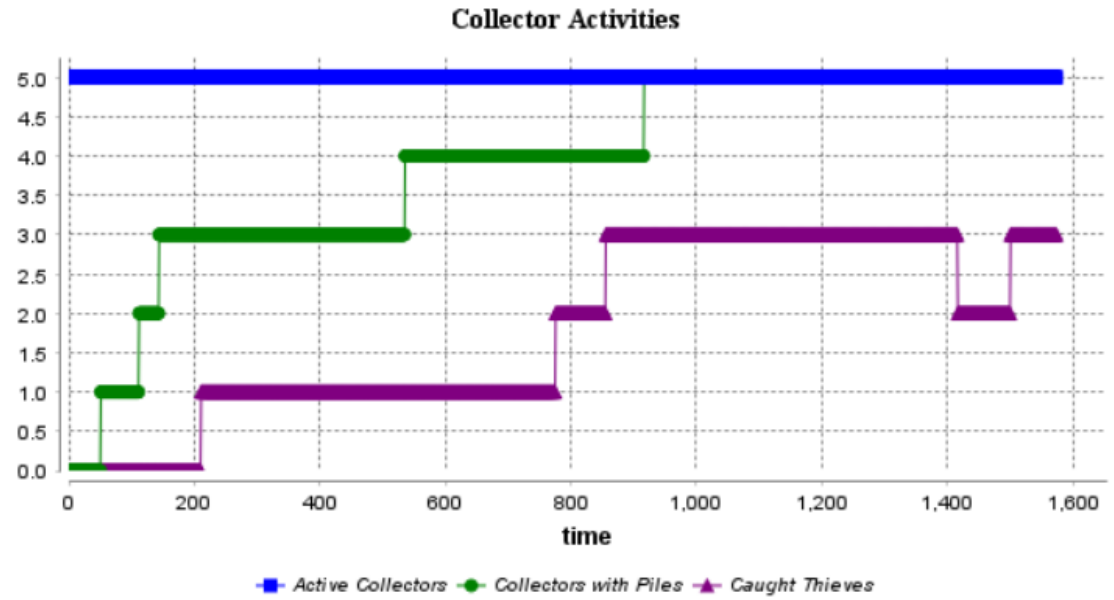


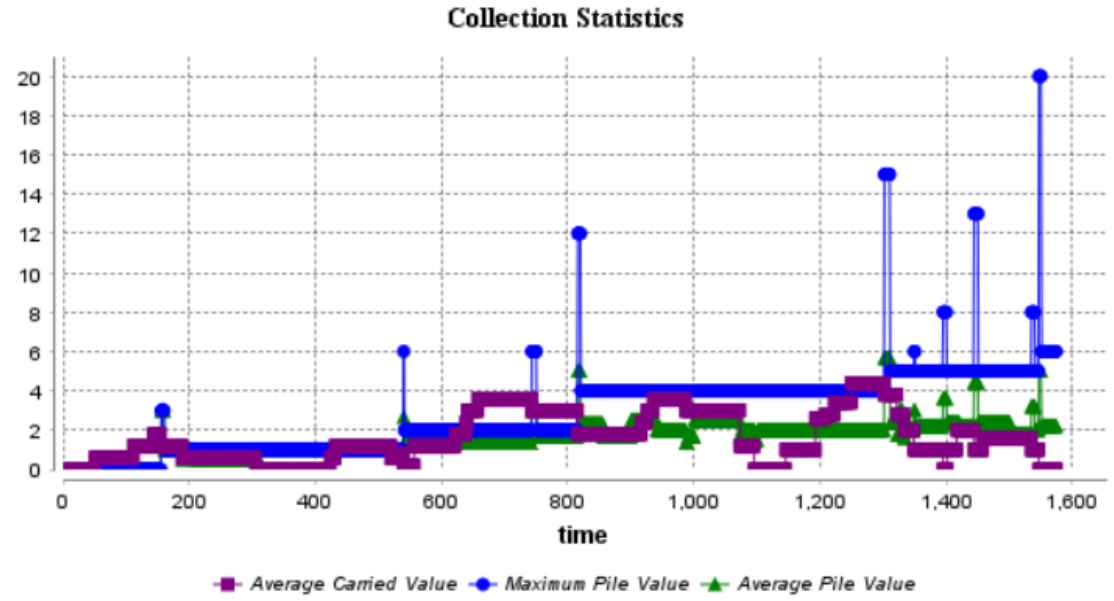


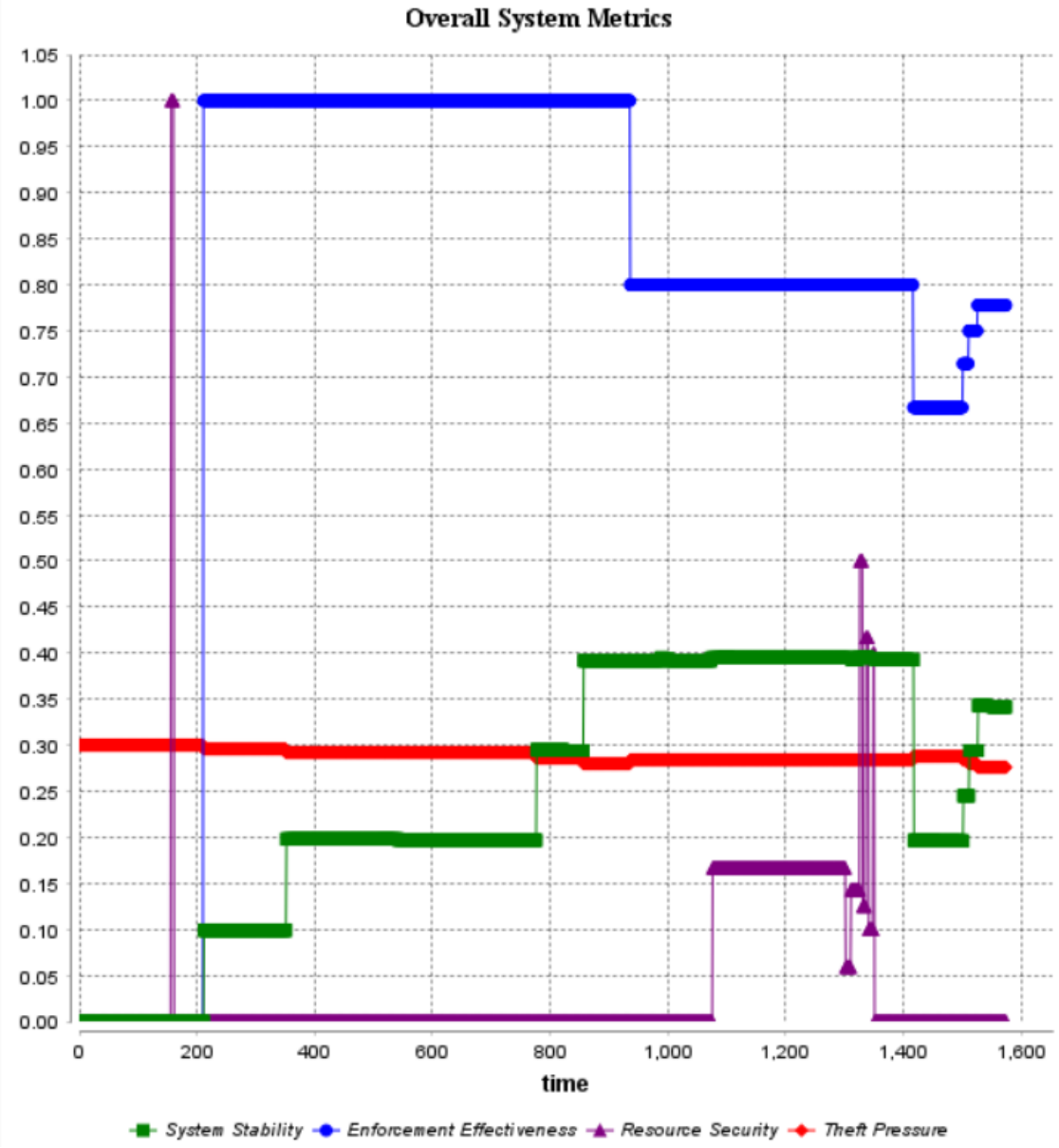




Ext2: External Enforcement – Analysis







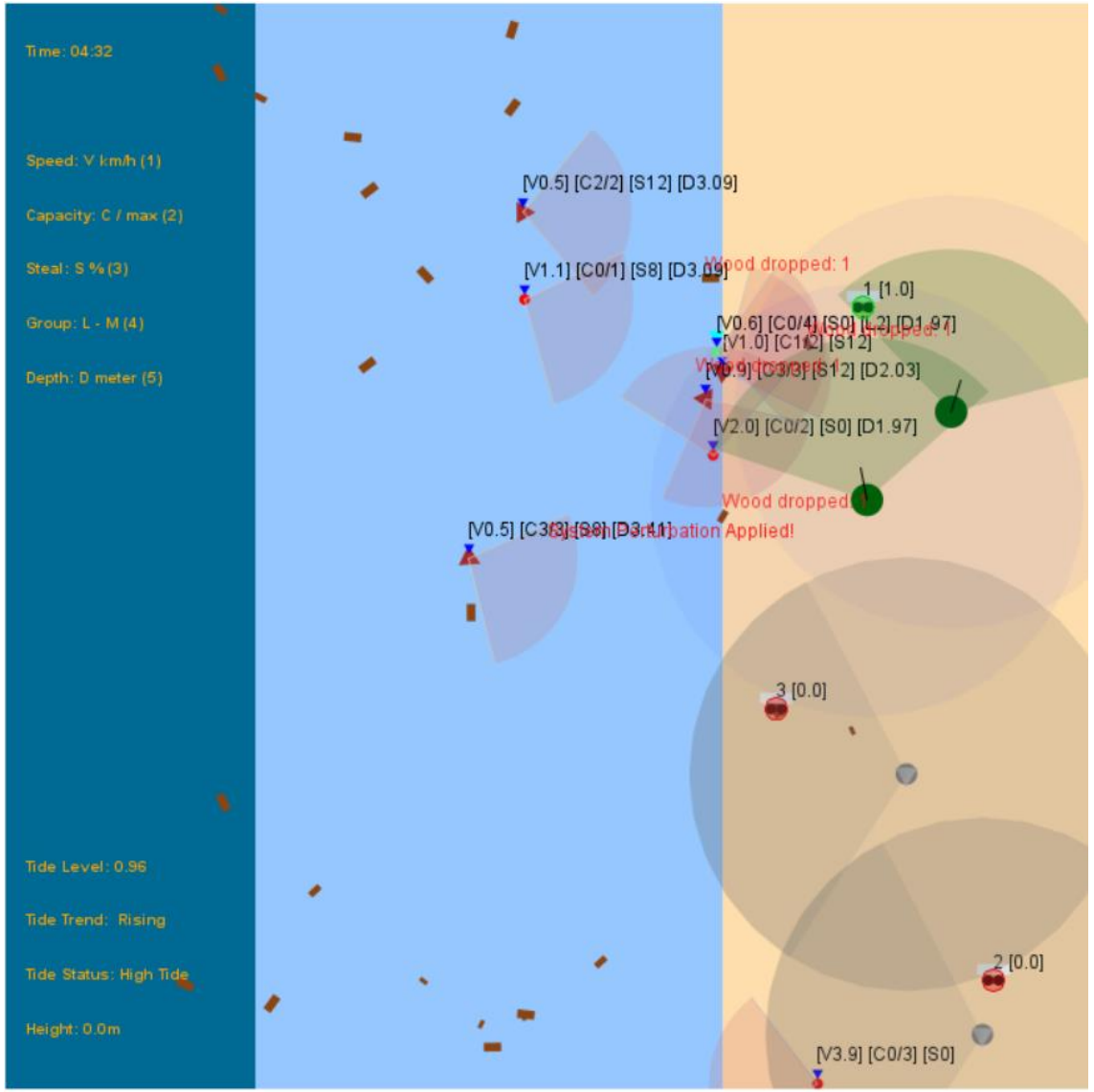
Extension 3: Group Dynamics

Group Formation

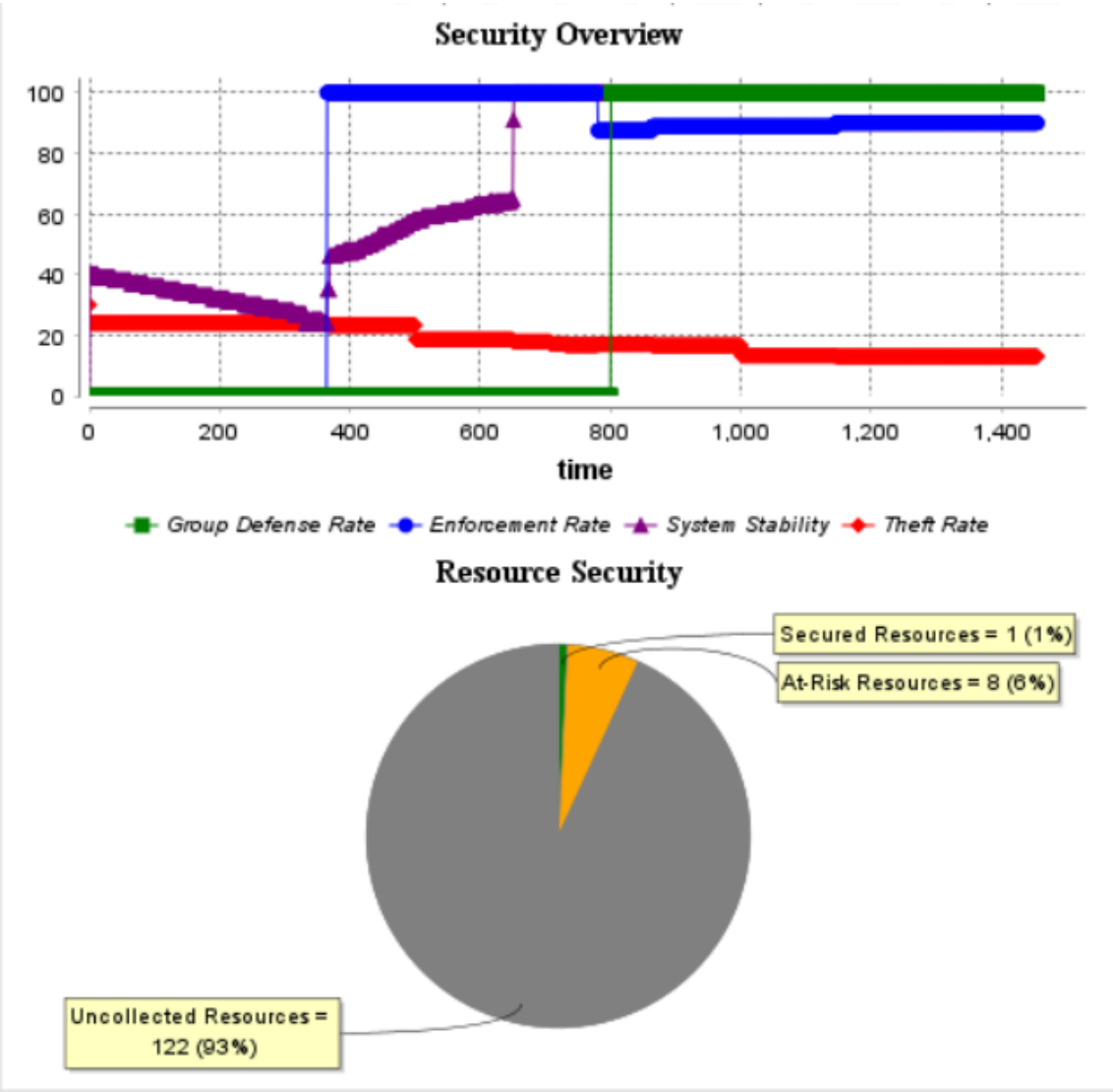
- Size: 2-4 members
- Formation chance: 30%
- Breakup chance: 10%
- Cooperation bonus: 20%

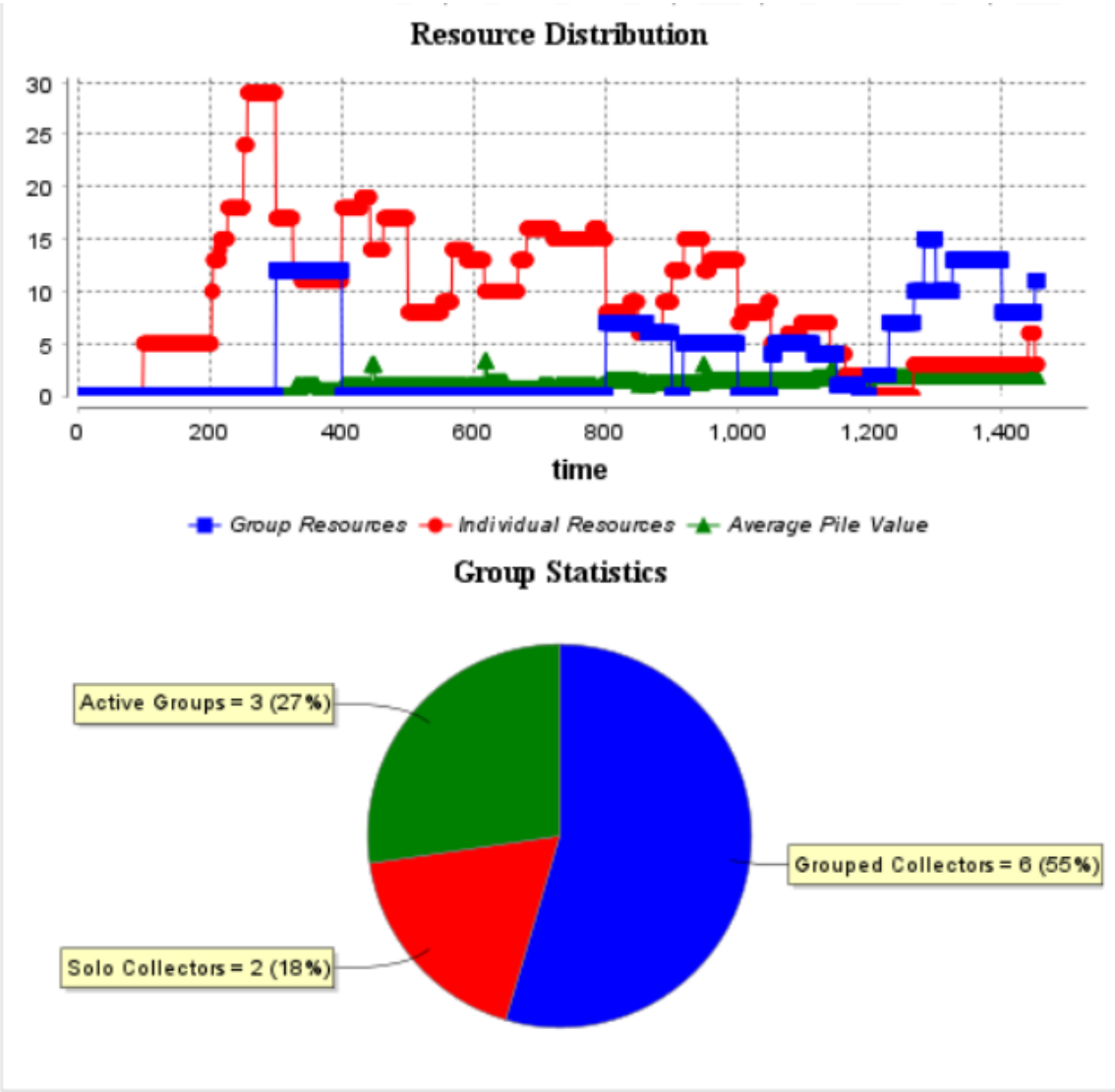
System Resilience

- Regular system disruptions (every 500 cycles)
- 20% impact strength
- Recovery period: 500 cycles
- Affects speed, capacity, and efficiency

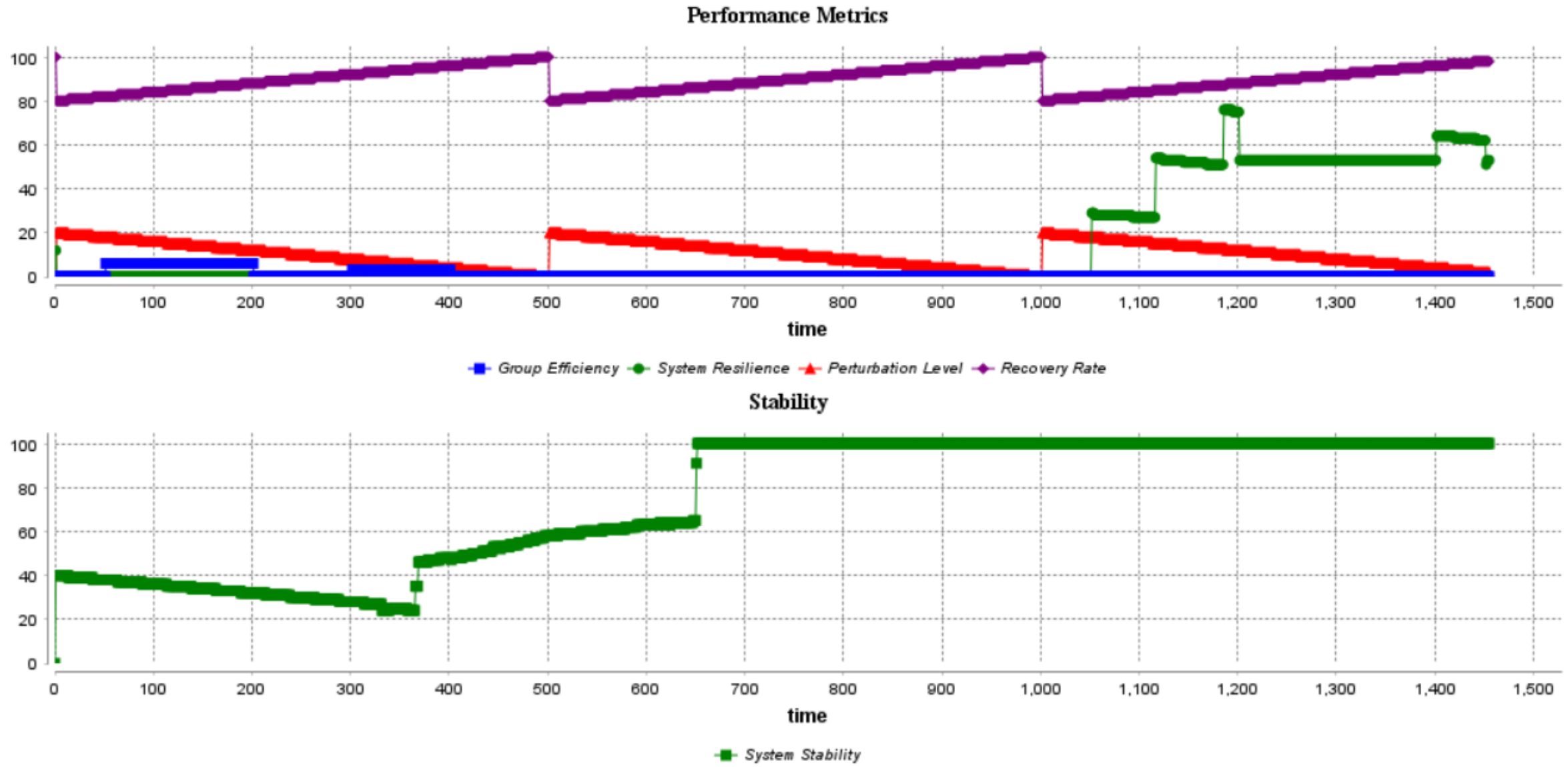


Ext3: Group Dynamics – Analysis





Ext3: Group Dynamics – Analysis



Conclusion

System Stability Achieved Through:

- Peer pressure mechanisms
- External enforcement
- Group cooperation

Key Contributions

- Demonstrated emergence of stable resource management
- Identified optimal enforcement strategies
- Validated group-based resilience

Thank you!