

Simulating farm interactions at landscape level

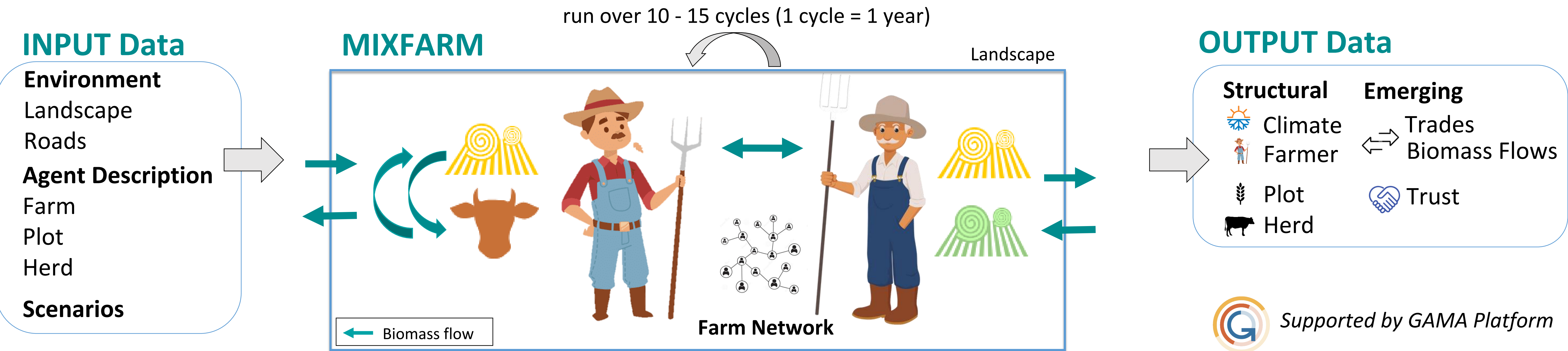
MIXed FARm interaction Model (MIXFARM) applied in Ariège

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An agent-based model (ABM) for farmer trades

ABM reproduce observed individuals' behaviors thanks to the implementation of simple **rule-based decisions**. We developed the **MIXFARM** model to **simulate interactions between farms** (crop, livestock, mixed) (agents) in a mixed **landscape**. Each farmer-agent choose with whom it will **trade biomass**, driven by its **distance** to others, its **needs**, and **trust** (no economic aspect involved).



Model Indicators : application in a NUTS3 region (Ariège, France) (not definitive results)

Simulation of 100 farms (types: 58 Livestock, 24 Crop, 18 Mixed)

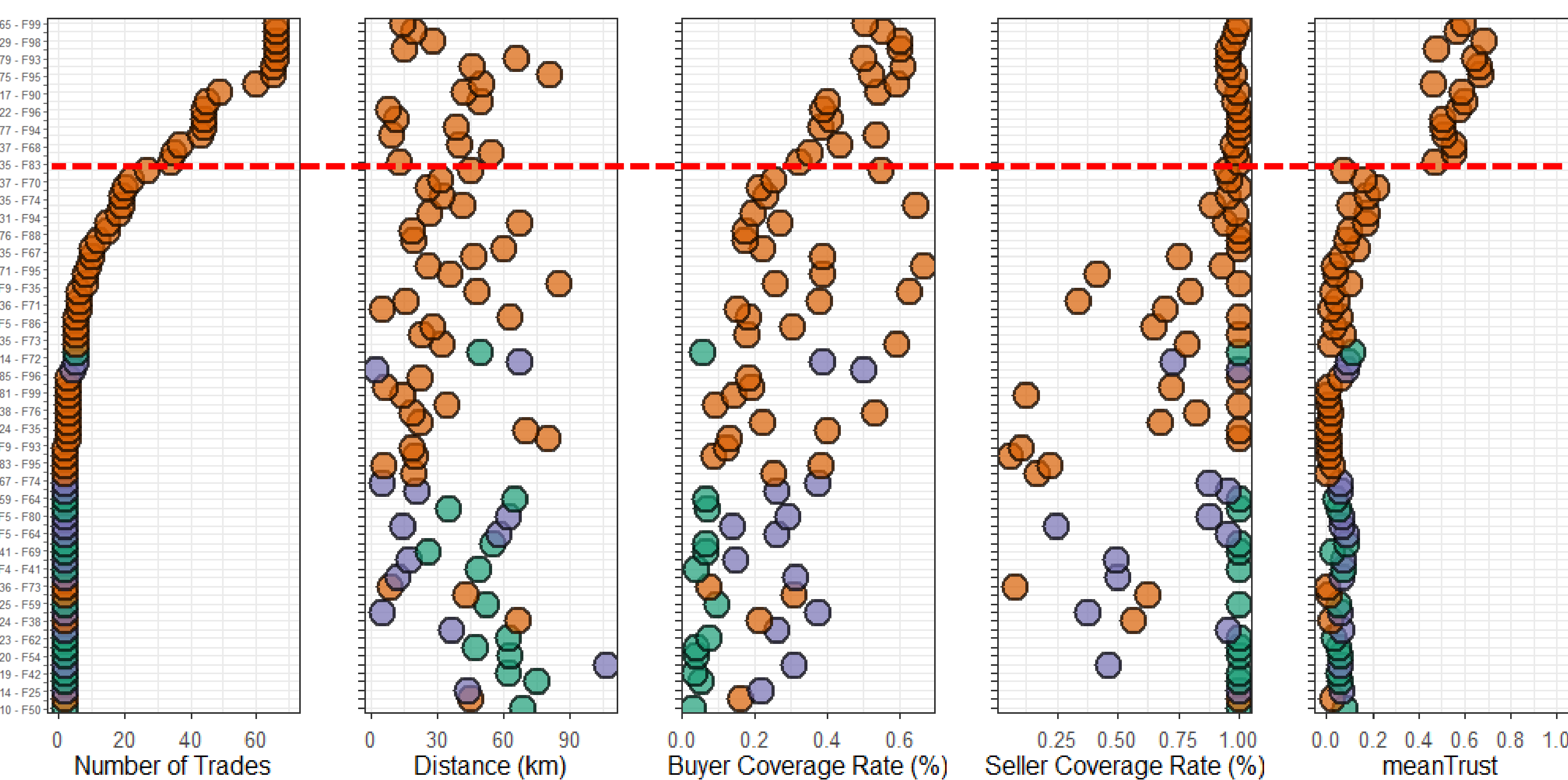
Trade mechanisms

Farmers are more likely to trade if:

distance is short

farmer's need coverage is

trust is high



Partnerships observed for 5 years of simulation

N.B. Values filtered for nbTrades > 1

Farm to Farm Interactions:

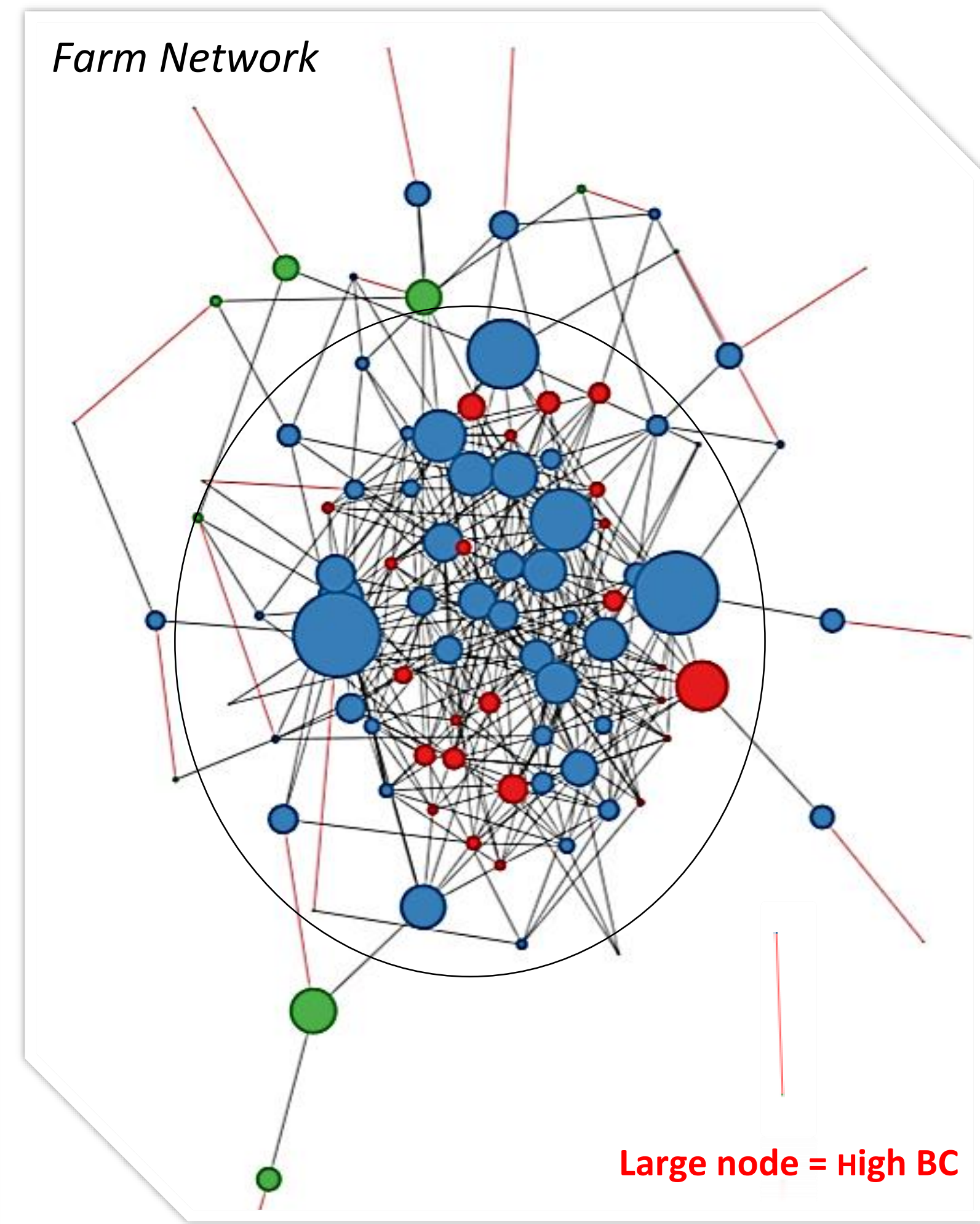
- Mixed – Livestock (68%)
- Crop – Livestock (16%)
- Livestock – Livestock (16%)

Most frequent interactions are between **mixed and livestock** farms.

We can distinguish a **group** where trades are the most numerous, involving even more trust and need coverage (above the **red line**).

These observations help us to **validate the implementation** of rule-based decisions inside the model.

Betweenness Centrality



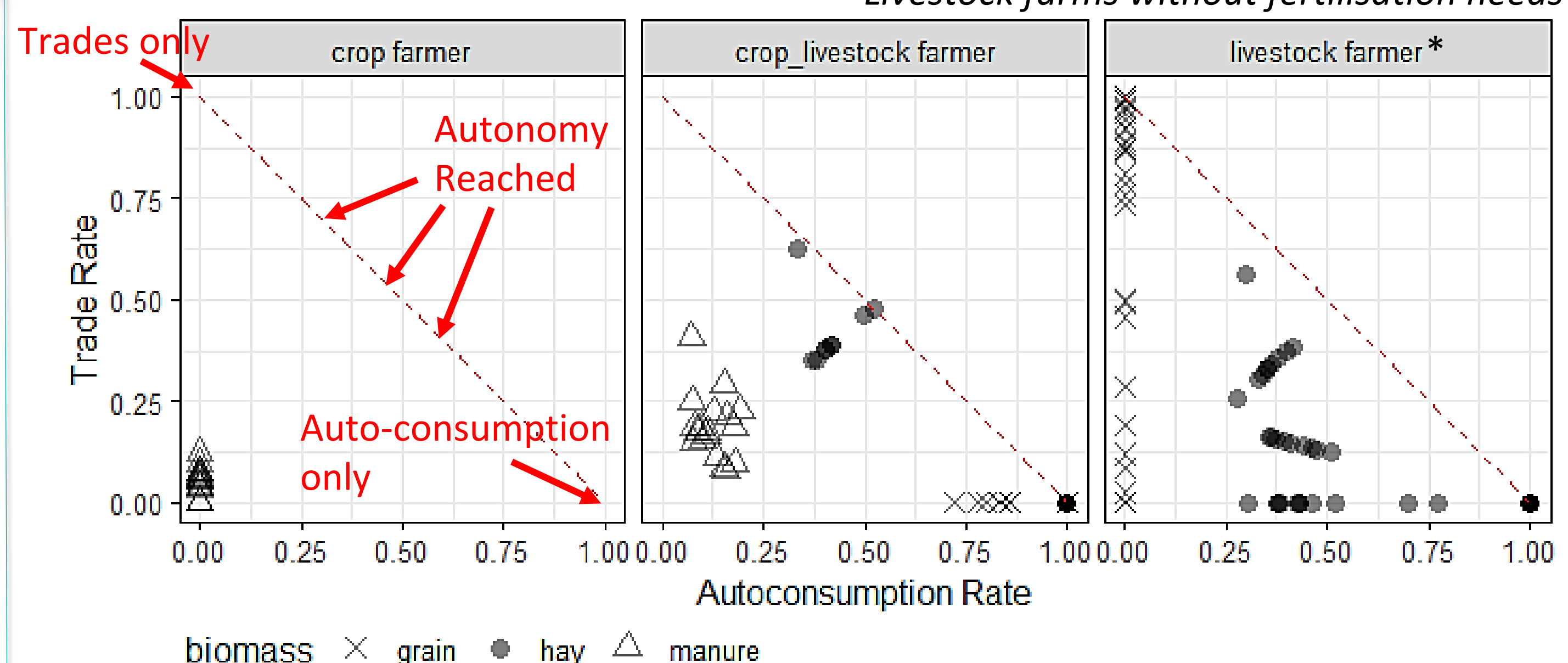
Betweenness centrality (BC) is individual's propensity to interpose between unconnected community members

Farm type influences individual position in the network:

- Livestock and crop farms are **central** and **mixed** farms are **peripheral**
- Livestock farms have higher BC than others, they are **network facilitators**

Local Autonomy

* Livestock farms without fertilisation needs



Grain autonomy can be reached with **auto-consumption in mixed farms**, and with **trades in livestock farms**.

Hay autonomy is reached with **auto-consumption and trades**.

Manure production is **too low** compared to farmer needs, no autonomy is possible for this biomass.

What's next for MIXFARM?

- Pattern Space Explorations (PSE) are under their way to **parametrize the model**.

This method is conducted with the software **OpenMOLE** and is designed to **cover the output space**, get **better insights** on the model's potential.

- Then we will be able to launch simulations under several **scenarios** and observe the **network resilience**.



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