

# Improved BioMass Market Efficiency and Price Discovery from Online Auctions

*Taner Türkmengil*

*Faculty of Forest and Environmental Sciences*

*Albert-Ludwigs-University*

*Freiburg, Germany*

**FORMEC**

**47th international symposium on forestry mechanisation  
23-26 september 2014, Gerardmer (France)**



# Introduction



- **Current Situation**
  - Growing market for wood energy
  - Market has evolved from rural area traditional use to modern wood chips and pellet technology
  - Localized, one to one relationship based market transactions
- **Objectives**
  - Transparent and efficient functioning market, where market structures achieve competitive market equilibrium
- **Problem Definition**
  - The process of trade and price discovery limits the market for functioning in an efficient manner with respect to optimization

# Solution Approach



- **Online auction**
  - Potential remedy for the market inefficiency and disorganizational loss from material flow moving in a costly manner
  - Expand the price discovery process to a larger audience of buyers/sellers who may arrive at prices in a more price competitive environment
- **Potential benefits to bioenergy firms**
  - Less time wasted with inspecting the stacks
  - More options to the buyer resulting in significant reductions in costs of operation that are then reflected in the prices paid for the material
  - Significant improvements in coordination of activities (chipper, truck)
- **Potential benefits to foresters**
  - Brings more buyers to the market and thereby expand the market
  - Improves pricing efficiency
  - Less time spent finding buyers

# Methodology

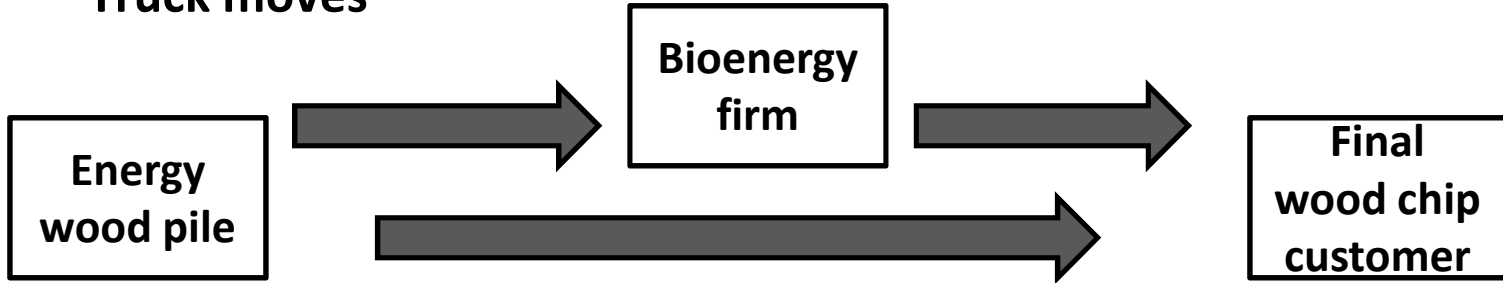


- **The supply shipment problem: transshipment problem of operations research**
  - supply (energy wood piles) located near forest
  - firms choose among supply and deliver to wood chip customers
- **The chipper relocation problem: travelling salesman problem of operations research**
  - Chipper moves around the energy wood piles
- **Mixed integer programming to optimize truck travel cost of bioenergy firms while satisfying the monthly customer demand**

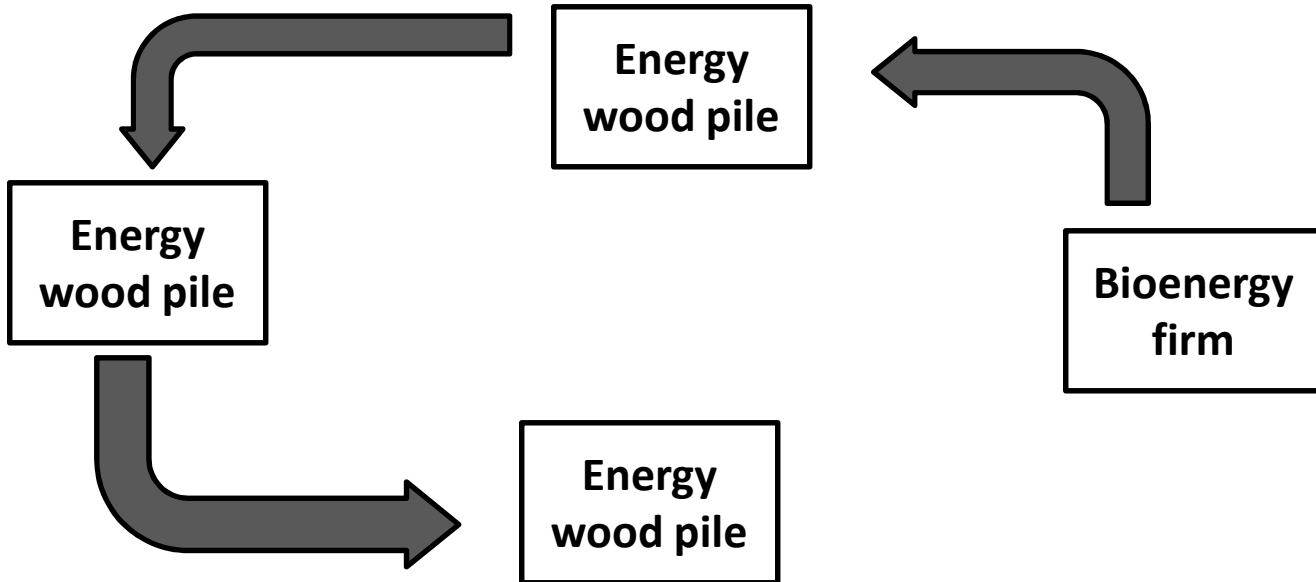
# Methodology



- Truck moves



- Chipper moves

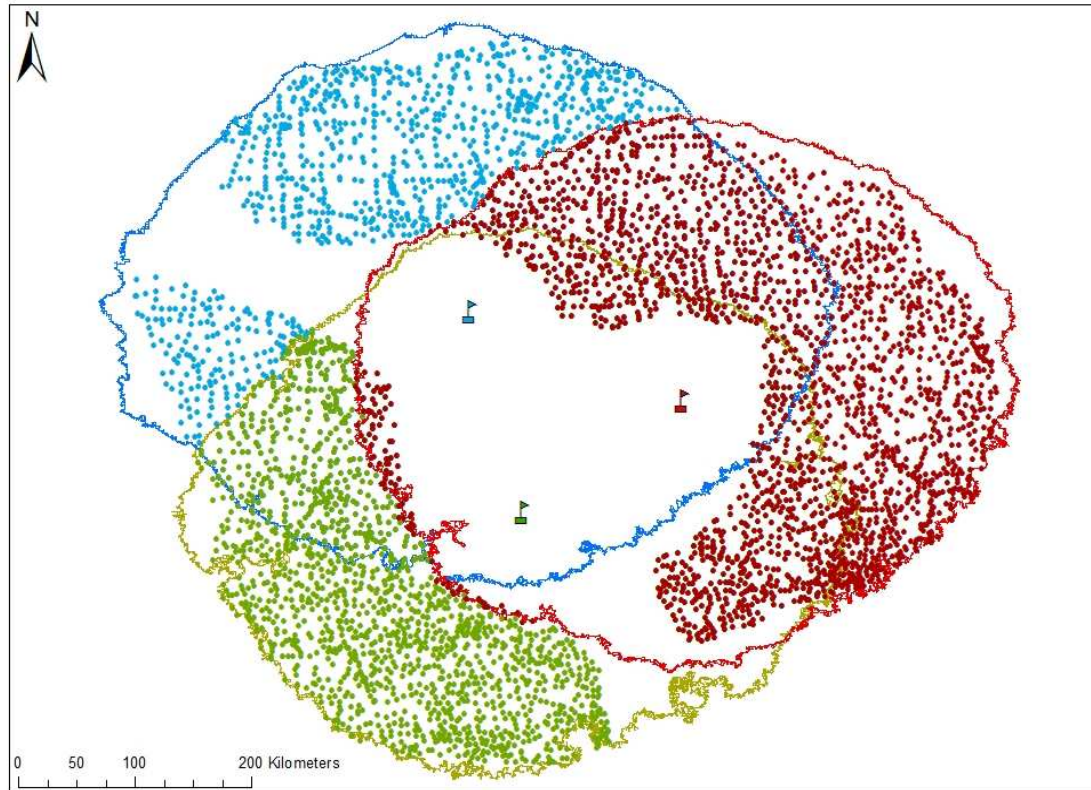


# Data Collection

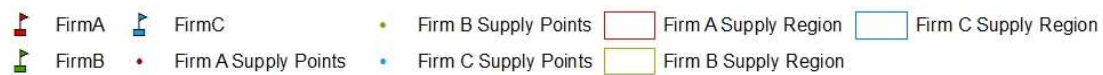


- **Represent real world conditions in south-western Germany**
- **3 bioenergy firms are located in the model**
  - Supply points and customers are in certain proximity
- **Data are acquired through interviews with local firm**
  - Monthly demand amount of customers
  - Monthly supply amount of suppliers
  - Cost parameters (chipping cost, chipper relocation cost, truck transport cost)
  - Distance and time to travel information

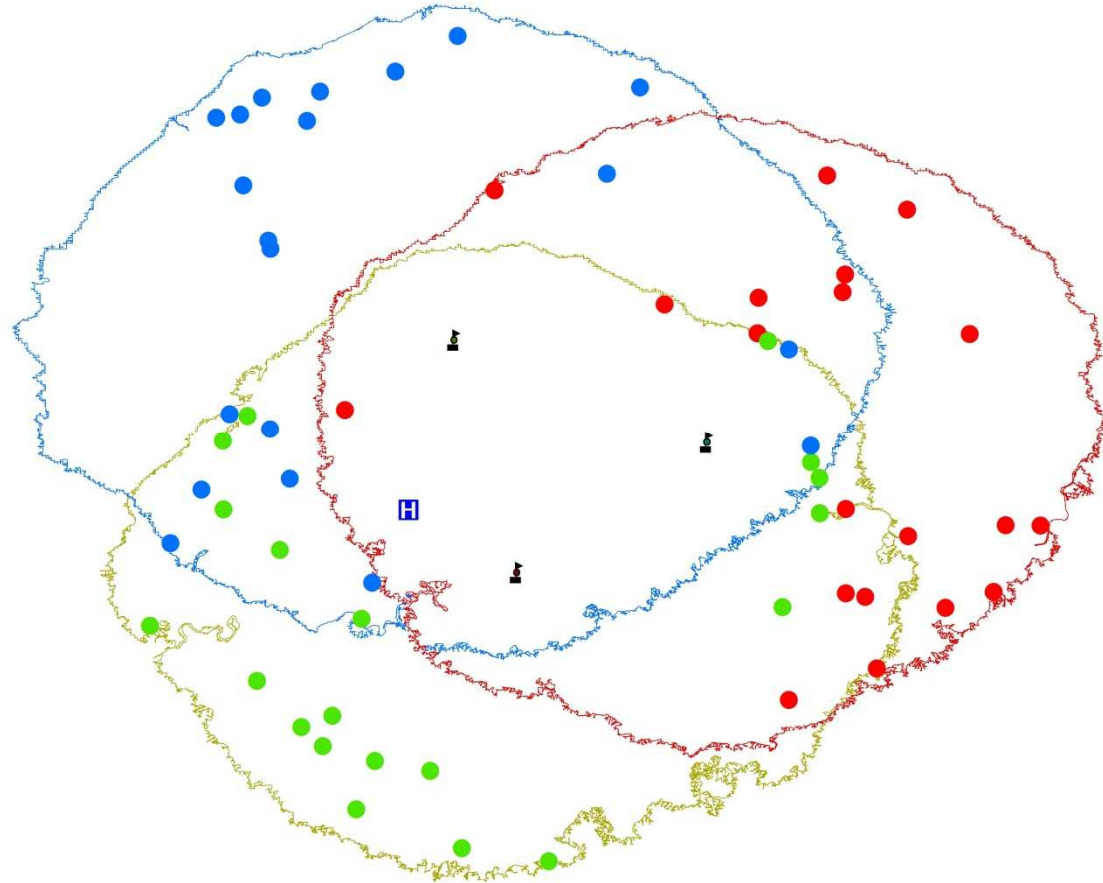
# Data Collection



## Legend



# Data Collection





# Simulation Studies



- **2 different scenarios are created**
  - current market functioning with limited number of suppliers
  - online auction model, where firms have complete information of available supply (common supply base, opportunity to reach all available supply)
- **3 bioenergy firms are simulated**
  - firms have the same market power
- **Operation costs**
  - chipping costs
  - truck transport costs
  - chipper relocation costs

# Findings

- **Truck transport cost per cubic meter (in €)**

months	current market functioning (in €)	online auction model (in €)	percentage savings (%)
1	0.62	0.54	13.72
2	0.50	0.43	14.28
3	0.53	0.48	10.17
4	0.54	0.50	8.15
5	0.53	0.50	6.48
6	0.80	0.72	10.16
7	0.74	0.71	3.95
8	0.77	0.76	1.37
9	0.56	0.49	11.84
10	0.51	0.44	13.23
11	0.53	0.46	12.20
12	0.55	0.48	12.23
Average	0.60	0.54	10.00

- **Chipper relocation cost per cubic meter (in €)**

months	current market functioning (in €)	online auction model (in €)	percentage savings (%)
1	0.16	0.13	13.42
2	0.14	0.10	23.36
3	0.14	0.12	12.17
4	0.16	0.15	4.73
5	0.18	0.13	29.77
6	0.22	0.17	21.55
7	0.21	0.20	4.29
8	0.23	0.22	1.62
9	0.15	0.11	27.11
10	0.15	0.12	18.66
11	0.15	0.12	18.98
12	0.13	0.12	12.32
Average	0.17	0.14	17.65

- **Constant chipping cost for both scenarios: 5,69 €/ cubic meter**

months	current market functioning (in €)	online auction model (in €)
1	6.47	6.36
2	6.33	6.22
3	6.36	6.29
4	6.39	6.34
5	6.40	6.31
6	6.71	6.58
7	6.64	6.60
8	6.69	6.68
9	6.40	6.29
10	6.35	6.25
11	6.36	6.27
12	6.37	6.29
Average	6.46	6.37

## Discussion



- Substantial cost reduction effect due to logistical efficiency gains
- Greater marketing transparency on the supply side
- More adequate market prices both for sellers and buyers
- Auction portals have the potential to strongly improve the competitiveness

**in**FRes

**Thank you for your attention!**