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Strategic Case Study: Methodology for measuring the economic development of biomass value chains, in West Region, Romania

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Summary:

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- Introduction
- Assessment of the existing and potential biomass, in the region
- Assignment of an economic value for each type of biomass
- Determination of mobility potential
- Developing Equations for logistic analysis in biomass value chains
- Conclusions

Introduction

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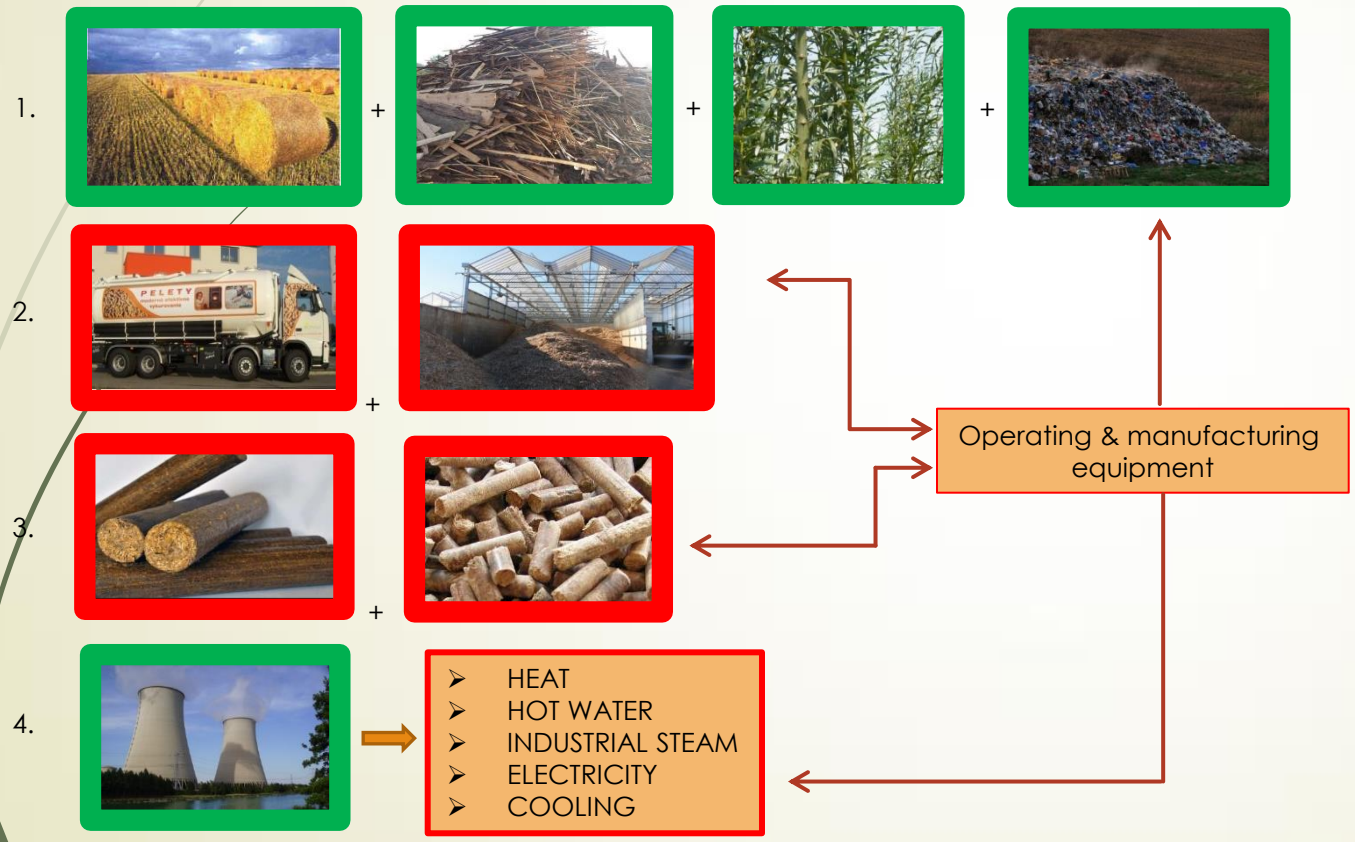
Value Chains Integration in the Local Economy



Development of bio-based industries

= Growth of:

- Rural economy
- Quality of life in rural areas
- Non-agricultural activities
- Energy independence
- Significant contribution to the objectives of Europe 2020 Strategy

How:

- Encourage cooperation and association among actors in line with sustainable development principles (like fair trade)
- Support the pooling of actors into integrated supply chains
- Regional and trans-regional cooperation

Assessment of the existing biomass potential

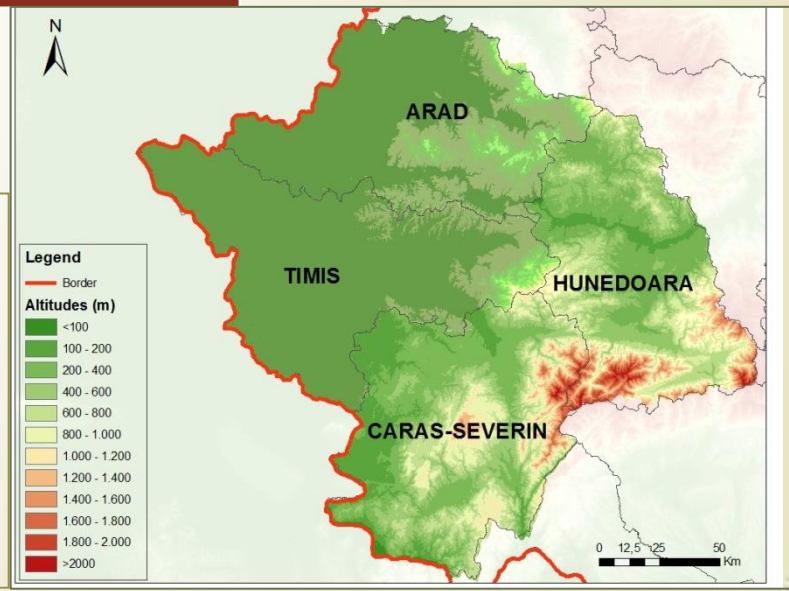
- **Administrative and Natural background of the area - Western Region -**

County	Occupied area	Administrative capital	Total No. of inhabitants
Timis	8,696 km^2	Timisoara	650.544
Arad	7,754 km^2	Arad	409,072
Caras-Severin	8,519 km^2	Resita	274,277
Hunedoara	7,062 km^2	Deva	485,712
WEST REGION	**32,033 km^2**	**TImisoara**	**1,819,605**

Administrative background

Natural background:

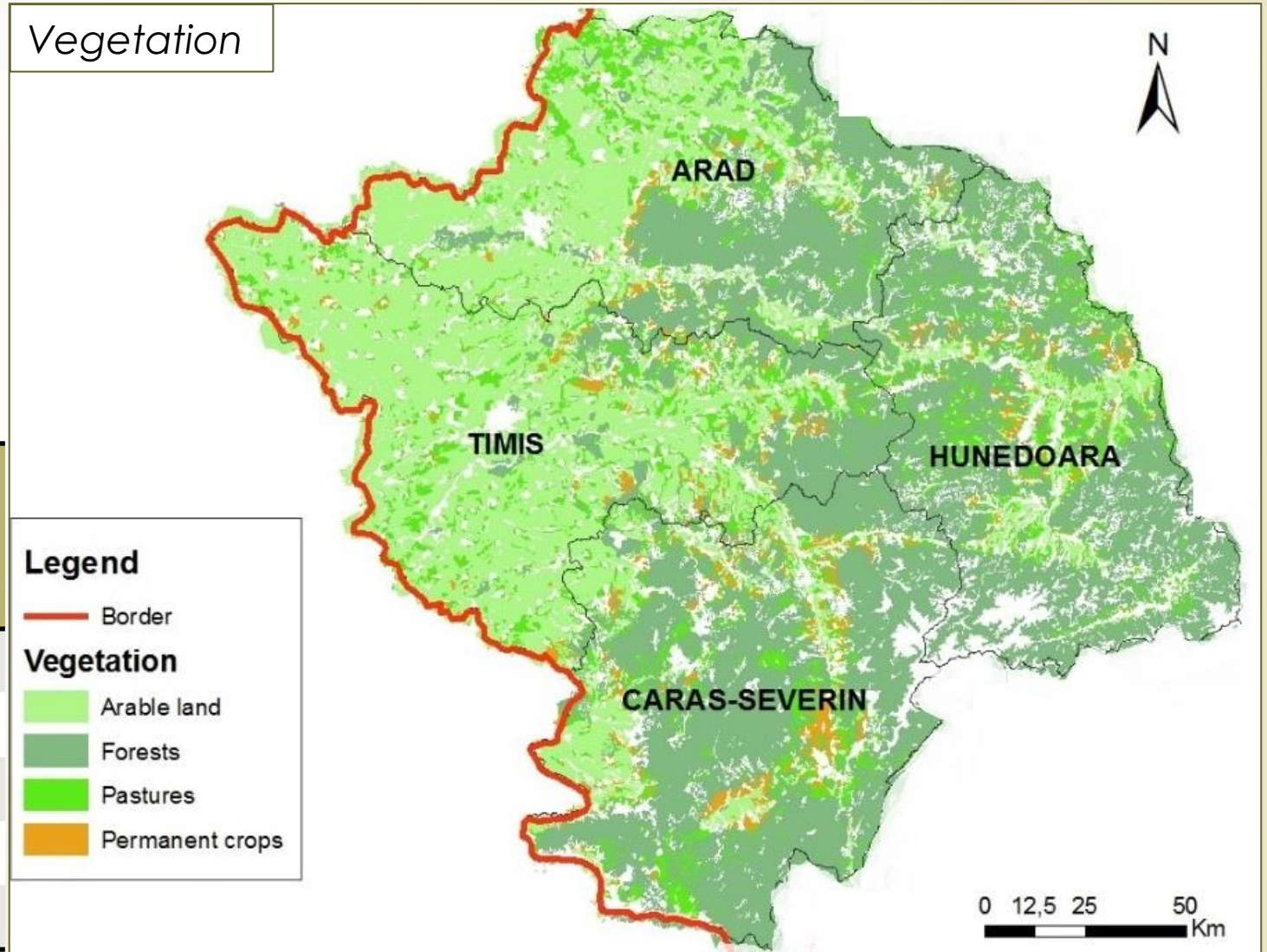
- *Variety of landscapes*
- *Temperate continental climate, with sub-meditereanean influences*
- *Rich hydrographic resources, Danube natural border*



Assessment of the existing biomass potential

- **Administrative and Natural background of the area - Western Region -**

The use of land	Agriculture	Forests or forested vegetation
Timis	80.6%	12.5%
Arad	66%	27.3%
Caras- Severin	46.7%	48.3%
Hunedoara	39.7%	51.8%
West Region	59%	34%



Assessment of the existing biomass potential

- **Primary and secondary agriculture residues**

Area (ha) x Specific biomass output (t/ha) = Potential (t)

Agricultural surface by use categories (ha)

	Arad	Caras-Severin	Hunedoara	Timis
Occupied area	775,409	851,976	706,267	869,665
Agriculture surface	510,624	397,276	280,377	698,638

	West Region	Arad	Caras-Severin	Hunedoara	Timis
Arable	1,090,197	349,856	127,226	79,615	533,500
Pastures	550,236	126,109	184,036	11,7566	122,525
Grassland	210,541	25,495	73,557	82,274	29,215
Vineyards and nurseries	8,573	3,577	768	-	4,228
Orchards and nurseries	27,368	5,587	11,689	922	9,170

Assessment of the existing biomass potential

- **Primary and secondary agriculture residues**

Area (ha) x Specific biomass output(t/ha) = Potential (t)

Main crops and crops residues in West Region

Culture		West Region
Wheat	ha	242,244
	Production t/ha	4.01
Maize	ha	288,660
	Production t/ha	3.5
Barley	ha	43,510
	Production t/ha	2.6
Sunflower	ha	44,842
	Production t/ha	1.8
Sugar beet	ha	641
	Production t/ha	36.5

Corresponding quantity of secondary residues

	Grain : straw
Wheat	1:1.3
Maize	1:1.6
Barley	1:1
Sun Flower	1:3
Sugar Beet	1:1

Total Biomass Potential of Agriculture =3.2 mil. t

Assessment of the existing biomass potential

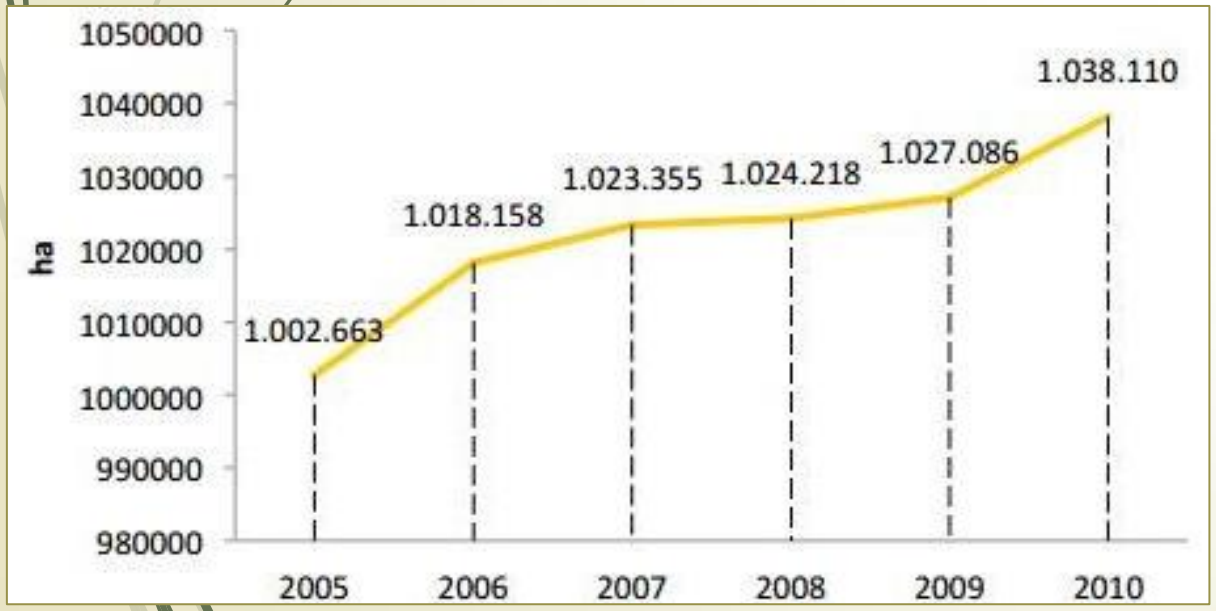
- **Wood residues**

Facts:

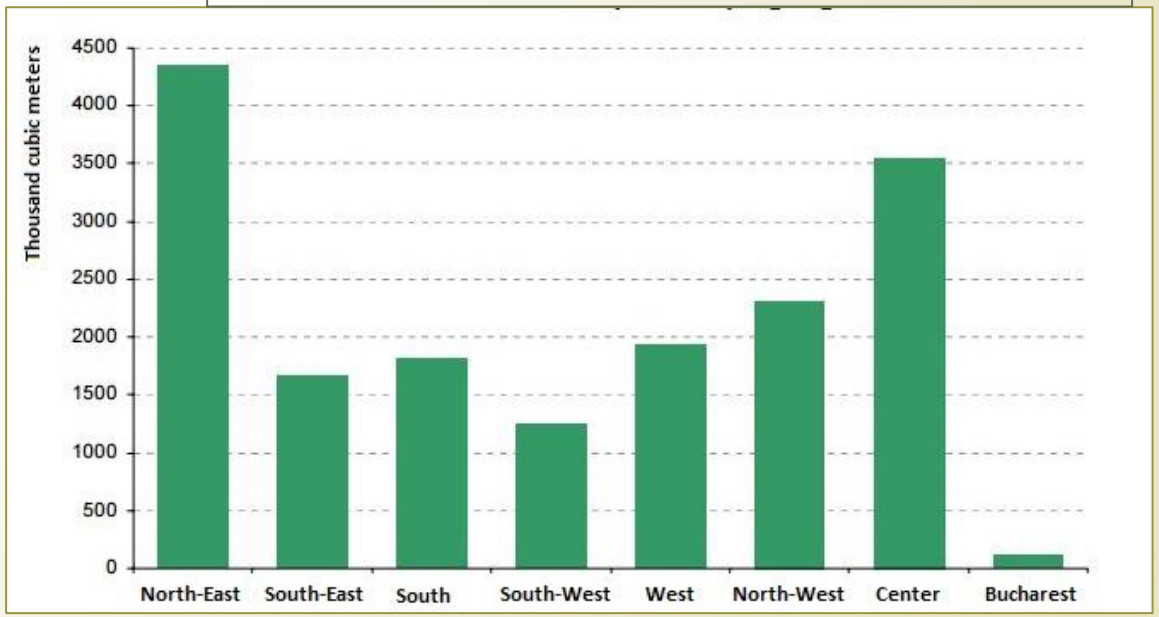
- Easy to access – by forestry roads
- Easy to process – high density(beech, oak, sycamore, etc)
- 5% to 10% of forest wood is residual (to be cleaned)
- 51,525-103,050 ha surfaces of residues

=> Up to 23,7 mil. m^3 residual wood (about 14 mill t)

Regional evolution of forested areas (2005-2010)



National volume of harvested wood



Assessment of the existing biomass potential

- **Energy Crops**

  - Popular in Timis and Arad counties, due to rich, fertile lands
  - 500 ha planted with energetic willow cultures
  - 100 ha planted with Miscanthus
  - One hectare of willow/miscanthus produces:
    - 20 tons with 8% humidity (natural ventilation in the sun)
    - 35 tons with 35% - 40% humidity

Willow culture in Dudestii Noi, Timis county

Willow seedlings

Assessment of the existing biomass potential

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- **Energetic potential of biomass use**

Type of biomass	Tons of residues produced yearly (t)	Theoretical Energetic Potential (MWh/t)	Technical Energetic Potential (MWh/t)	Achievable Energetic Potential_2020 (MWh/t)
Wheat straws	1,262,817	5,139,669	2,569,835	2,569,835
Maize residues	1,616,496	8,858,398	4,429,199	4,429,199
Barley straws	113,126	452,504	226,252	226,252
Sun flower	242,146	1,063,024	531,512	531,512
Sugar beet	23,396	21,005		
Wood residues	1,400,000	6,020,000	3,010,000	3,010,000
Energetic willow	10,000	57	57	57
Miscanthus	2,000	8.8	8.8	8.8
Total Energy Potential (MWh)		**21,661,874**	**10,830,937**	**10,830,937**

* Refference: Fraunhofer

Support in the development of a sustainable concept for harnessing renewable energies in Timis County

=> 11 TWh Achievable Energetic Potential of existing biomass

Assessment of the existing biomass potential

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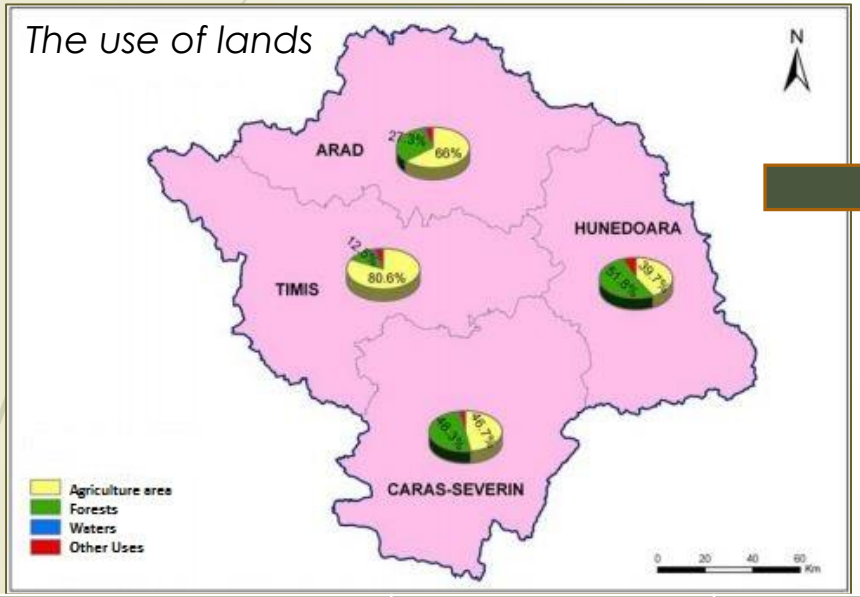
- **Assessment of energy potential of the unused lands**



7% of Total Area is unused

*calculations made using the characteristic land use of every county

Theoretical Energy Potential of unused lands:

10.5 TWh/ year

Possible use	Arad	Caras-Severin	Hunedoara	Timis	Western Region
Agriculture (MWh/year)	496.07	385.66	271.78	679.44	1,832.97
Energy crops (MWh/year)	1,689.26	3,283.81	2,919.45	867.49	8,760.01
Total theoretical potential (MWh/year)	2,185.33	3,669.47	3,191.24	1,546.94	10,592.98

Assignment of an economic value for each type of biomass

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- **Methodology**:
  - Market analysis for each type of biomass
  - Average economic value resulted from the analysis

*Selling costs for each type of biomass(*by the side of the road)*

Type of residue		Costs €/ kg	Costs €/t
Agricultural wastes	Wheat, hay	0.1- 0.2	100-200
	Maize	0.13	130
Forestry wastes	Sawdust	0.1-0.33	100-330
	Wood residues	0.05	50
Energetic crops	Energetic willow	0.03	30
	Mischantus	0.008	8

Determination of the mobility potential

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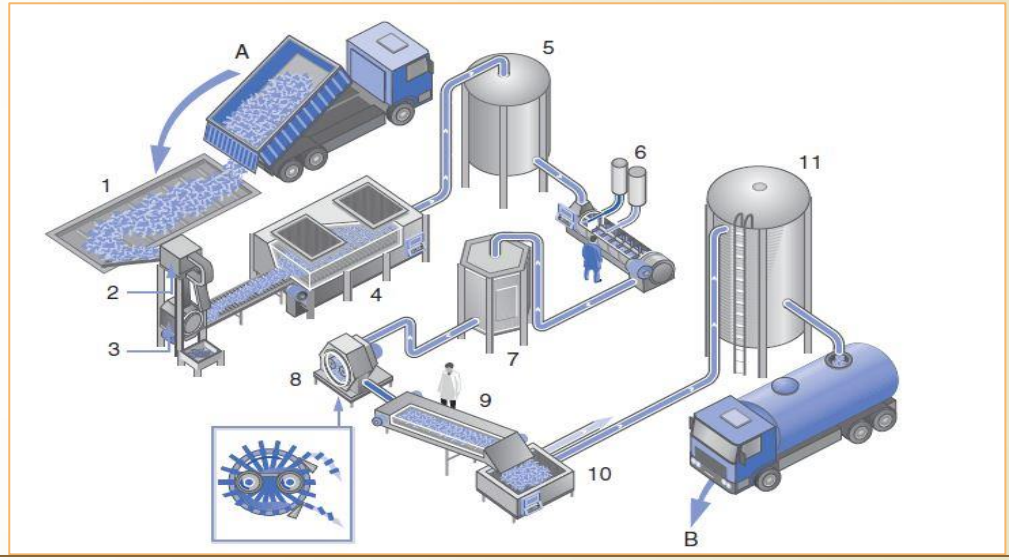
- **Economic value of the logistic and processes components**

  - The logistic components:
    - Transport 1 (from the source, to the processer)
    - Storage
    - Transport 2 (from the processer, to the user)

  - The process components :
    - Pelleting machinery
    - Briquetting machinery
    - Workers
    - Energy usage of the pelleting/briquetting machineries



Pelleting line : A. Raw material delivery; 1. Conveyor; 2. Sorter; 3. Hammer mill; 4. Drying installation; 5. Drying silo; 6. Conditioning device; 7. Ripening container; 8. Mold press; 9. Cooler; 10. Sieve; 11. Pellets silo; B. Transport to the final user

Developing the Equations for logistic analysis of the biomass value chains

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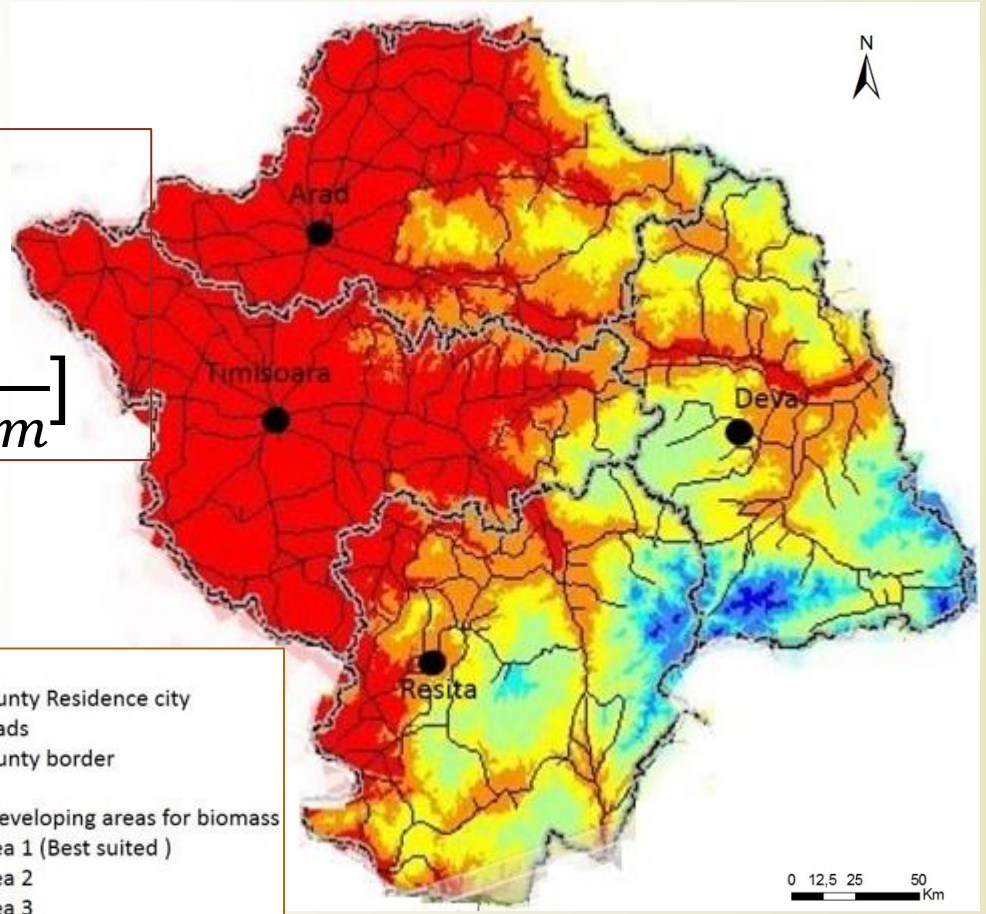
Equation for logistic analysis:

$$P\left[\frac{€}{t}\right] = r\left[\frac{€}{t}\right] + t1\left[\frac{€}{t*km}\right] + p\left[\frac{€}{t}\right] + t2\left[\frac{€}{t*km}\right]$$

P= pellets/briquettes final costs
r= raw material costs
t1,2= transport costs
p= processing costs



Conclusion

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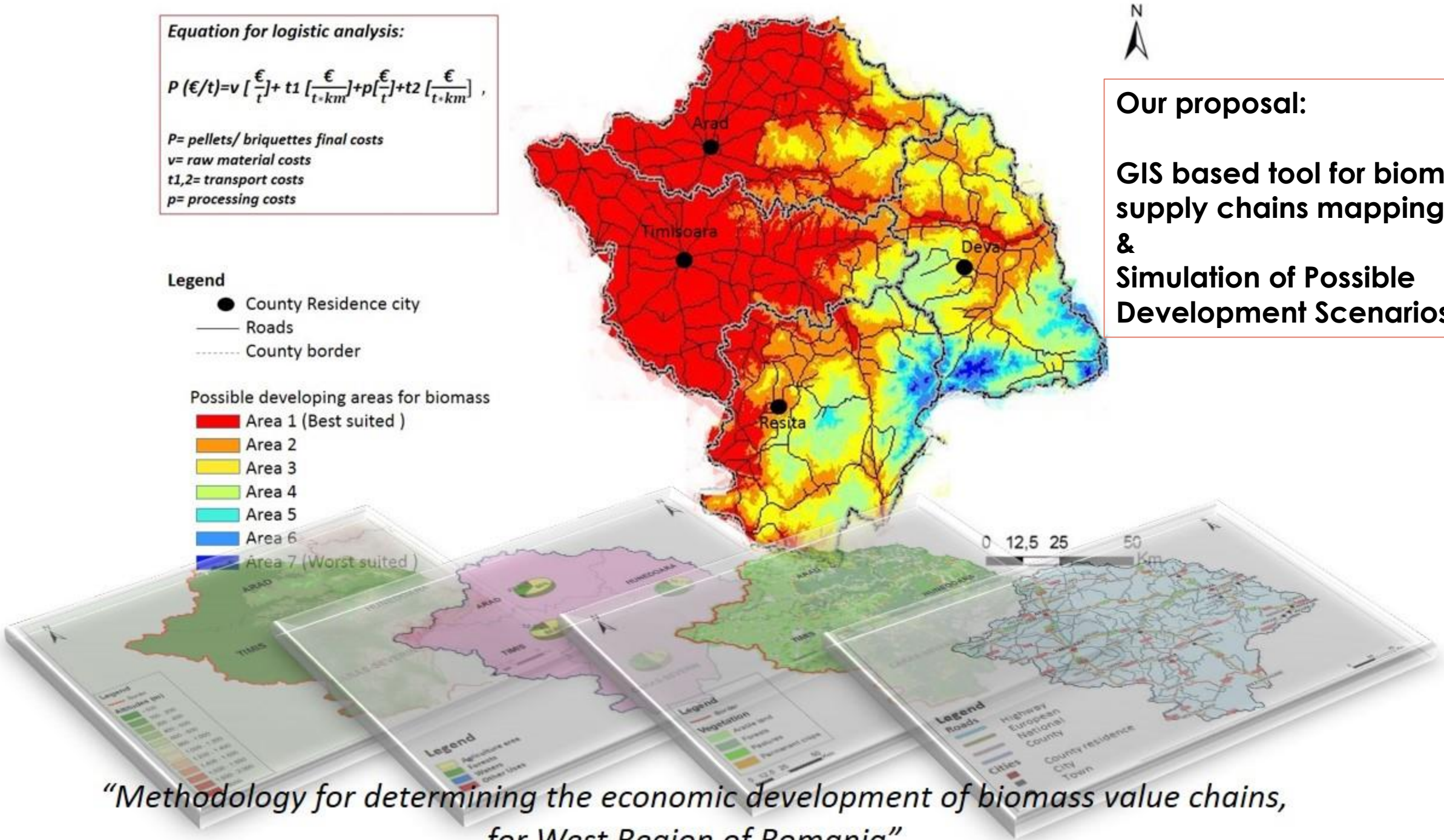
- 21.5 TWh/Year wasted potential
- There is supply of raw biomass and energy demand, but very little connection between them
- Drafting a business plan in biomass = a lot of guess work = NOT sustainable
- Lack of cooperation and association among actors

- **Possible solutions**:
- Integration of supply chains
- Accurate mapping of actors
- Equitable distribution of added value within the supply chain

Equation for logistic analysis:

$$P\ (€/t)=v\ [\frac{€}{t}]+\ t1\ [\frac{€}{t*km}]+p[\frac{€}{t}]+t2\ [\frac{€}{t*km}]\ ,$$

P= pellets/ briquettes final costs
v= raw material costs
t1,2= transport costs
p= processing costs



Our proposal:

GIS based tool for biomass supply chains mapping
&
Simulation of Possible Development Scenarios

"Methodology for determining the economic development of biomass value chains, for West Region of Romania"

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Strategic Case Study: Methodology for determining the economic development of biomass value chains, for West Region of Romania

Thank you for your interest!

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