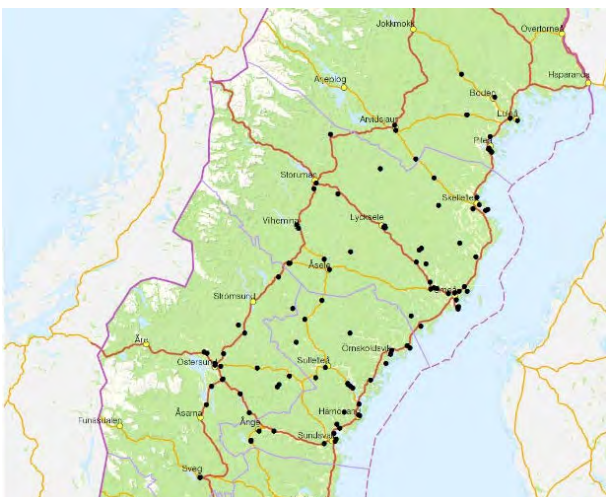


## Characteristics of Terminals in Botnia Atlantica Region

*Forest biomass is a source of thermal heat and electric power, transportation fuels, and a potential feedstock for many bio-based products that are currently produced from fossil fuels. Utilising terminals instead of transporting the biomass from the forest directly to a re-finishing facility has two main benefits: a) Terminals provide a stable and secure supply of biomass even though weather conditions do not permit access to the forest b) Biomass can be pre-treated and densified in order to improve the performance of the supply chain (in terms of cost, energy use and emissions).*

In the Swedish part of the Botnia Atlantica region we have identified up to now (January 2016) 110 terminals that are used permanently or temporarily for the storage of forest biomass in the form of roundwood or forest fuels (energy wood, branches, tops and young trees). The terminal map (Figure 1) will be updated when new terminals come to our knowledge. All terminals are located closer than 2.6 km to a bearing capacity class 1 road and an average of 13 km from a railway line.



*Figure 1. Roundwood and forest fuel terminals in Swedish part of Botnia Atlantica Region.*

The characteristics of the terminals are described in Table 1 regarding distance to railway, main roads and receiving industry as well as estimated terminal area. All distances were calculated by using the Network analysis module in ARCGIS 10.5 while terminal areas were calculated by using the "Measure" tool with the same software.

Most of the terminals (57%) are industry terminals (Figure 2) located at sawmills, pulp mills, heating plants or pellet production facilities. These terminals are run by the end customers themselves. The size of the terminals is affected by several factors as: industry size, terminal capacity, environmental restrictions, transport infrastructure and availability of satellite and feed-in terminals in the supply chain.



*Figure 2. A typical industry terminal in Swedish part of Botnia Atlantica Region.*

5 % of the terminals are identified as satellite terminals (Figure 3). These terminals are relatively large (7 ha in average) and located close to heating plants, sawmills and pulp mills. These terminals are used as buffer storages to balance unbalances between supply and demand (Table 1).



Figure 3. A typical satellite terminal.

15 % of the terminals were identified as transhipment terminals (Figure 4). The average area of these terminals is 7.8 ha and the majority of them are roundwood terminals with a truck to rail transhipment. These terminals store very low quantities of biomass for energy.



Figure 4. Transhipment terminal.

23% of the terminals were identified as forest fuel upgrading terminals. In these terminals natural drying of forest biomass during storage is utilised in order to increase the net calorific value of the biomass and thus upgrade the value of the biomass. The average area of these kinds of terminals was much lower than the industry, the transhipment and the satellite terminals.

Table 1. Terminal characteristics in the Swedish part of the Botnia Atlantica region.

	Distance to (km)						Area (ha)
	Railway	Main road	Saw-mill	Pulp mill	Heating plant		
Industry terminals	Average	8,40	0,36	11,92	80,15	12,54	6,58
	Median	2,15	0,32	1,98	74,55	5,23	4,50
	Standard deviation	13,53	0,30	18,83	66,29	16,08	5,94
	Max	60,82	1,20	62,23	217,25	76,97	30,00
Transhipment terminals	Average	2,84	0,43	23,33	102,57	12,70	7,80
	Median	1,26	0,26	19,21	102,39	8,67	7,74
	Standard deviation	2,86	0,40	21,25	80,26	11,26	5,83
	Max	8,91	1,45	80,23	249,56	37,21	21,86
Satellite terminals	Average	3,21	0,65	26,32	134,12	7,53	7,04
	Median	2,52	0,76	19,90	167,86	6,10	7,00
	Standard deviation	3,31	0,31	17,21	72,74	6,26	4,56
	Max	8,94	0,98	56,85	180,71	15,85	11,50
Forest fuel upgrading terminals	Average	14,92	0,39	39,63	89,73	17,56	3,27
	Median	5,04	0,21	33,86	75,31	10,19	2,19
	Standard deviation	16,97	0,55	27,31	66,84	17,51	3,01
	Max	58,98	2,58	115,27	212,85	58,99	14,00

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