Nutrient removal capacity of willow short rotation forest – Estonian case study

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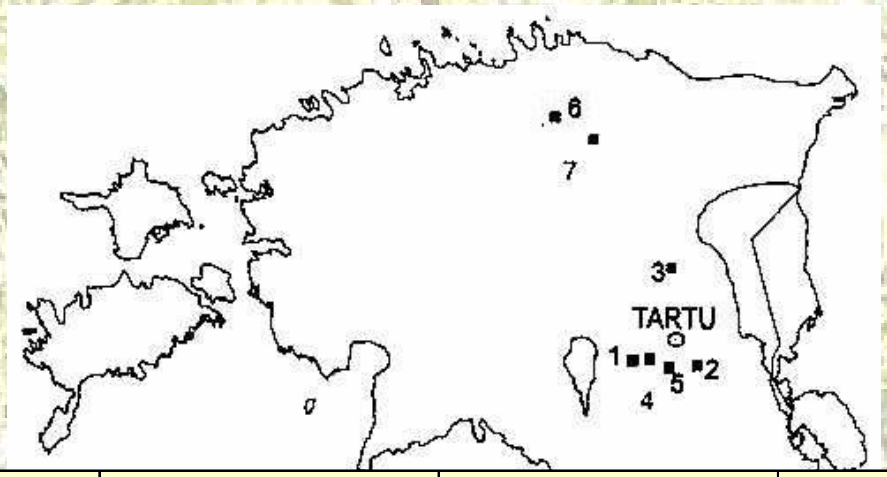
SRF plantation in Estonia - two goals

- Energy production

- Nutrient recycling

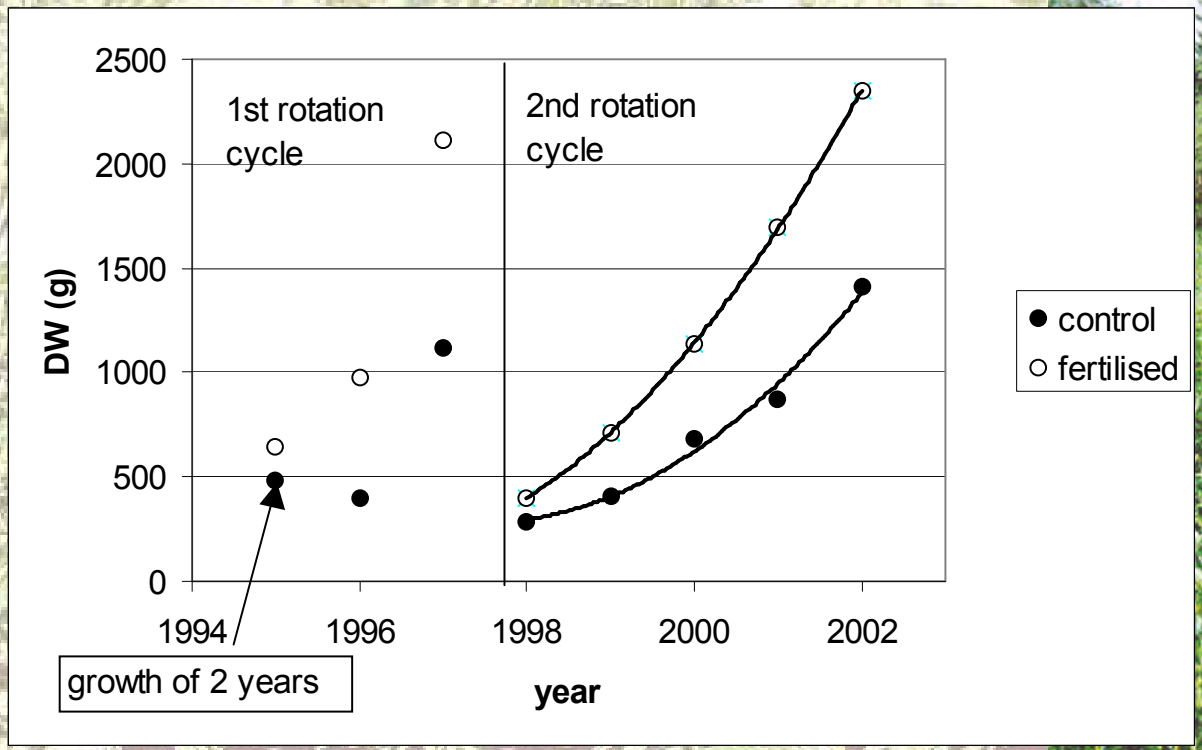
Willow plantations in Estonia



No	Location	Area (ha)	Established in	Studies
1	Tõravere	0.2	1993	Light use efficiency
2	Kambja	0.3	1993	Productivity
		16	2003	Seasonal wastewater purification
3	Saare	0.6	1993	Productivity, fertilisation effect
4	Nõo	0.4	1994, 1995	Municipal sludge utilisation
		0.4	2001	Clone selection
5	Aarike	0.18	1995	Wastewater purification
6	Vohnja	4.1	2003	Annual wastewater purification
	Kihlevere	1.45	2003	Freeflow wastewater purification & constructed wetland
7	Väike-Maarja	0.2	1993	Wastewater purification

Saare plantation

Productivity studies



Saare plantation

Productivity studies

Results:

- 1. Fertilisation doubles growth (mechanism- allocation pattern changes)
- 2. Stability over 3 rotation periods
- 3. Clone differences

Photo: July 2003, 3rd rotation

Productivity

		Annual production (t ha^{-1})	
		Average of 7 clones	Best clone
1st rotation period	Control	5,2	8,7
	Fertilised	11,0	14,7
2nd rotation period	Control	5,0	6,5
	Fertilised	7,4	10,9

Nõo plantation

Municipal sludge utilization studies

Area: 0.44 ha

Municipal sludge: 6.3 t (d.w.)

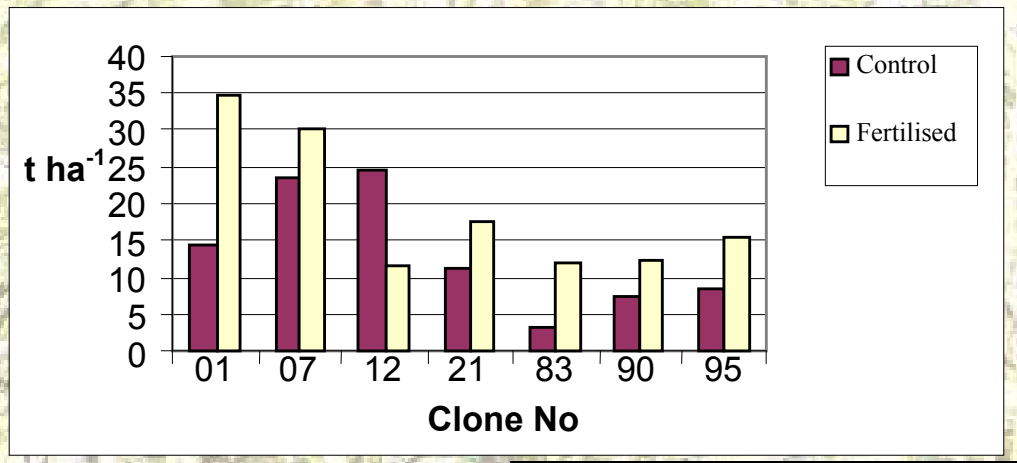
applied in May, 2001

N - 304 kg ha^{-1};

P - 217 kg ha^{-1};

K - 46 kg ha^{-1}

Municipal sludge utilization

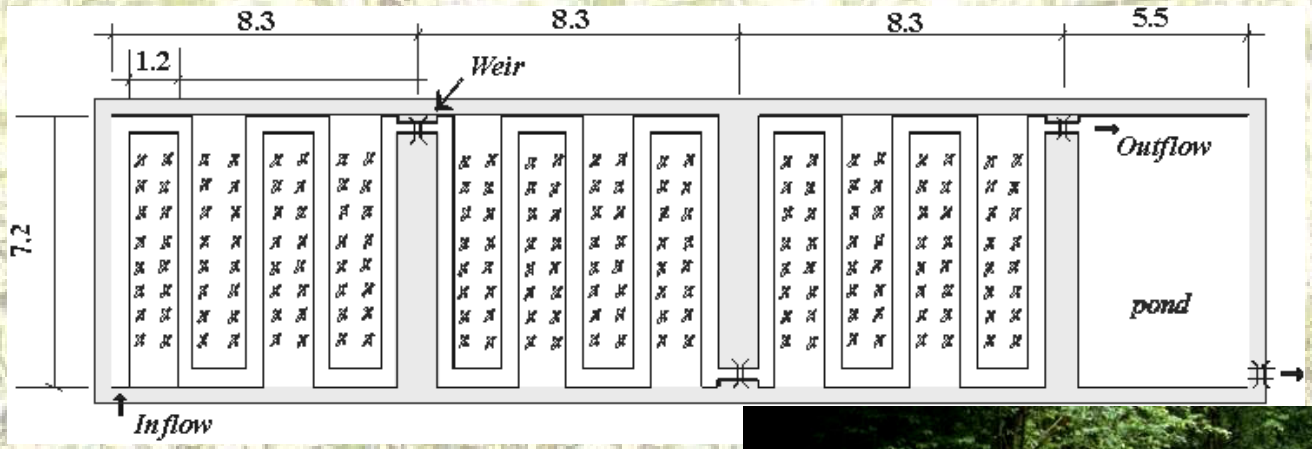


Year	Depth (cm)	Plot	BOD7 (mgO l^{-1})	N (mg l^{-1})	P (mg l^{-1})
2001	10	control	<3,0	3,9	2,3
		fertilised	4,5	4,8	1,3
	40	control	<3,0	1,7	0,4
		fertilised			0,3
2002	10	control	<3,0	1,3	0,1
		fertilised	<3,0	2,8	2,1
	40	control	<3,0	2,7	0,4
		fertilised	<3,0	2,4	0,5

- Municipal sludge almost doubled shoot productivity
- Sludge application did not cause nutrient leakage to groundwater

Aarike plantation

Wastewater purification studies



Period	BOD7	total-N	Total-P
1995	60	23	14
1996	72	29	19
1997	60	35	20
1998	60	41	18
1999	88	28	9
Average for the period	75	32	14

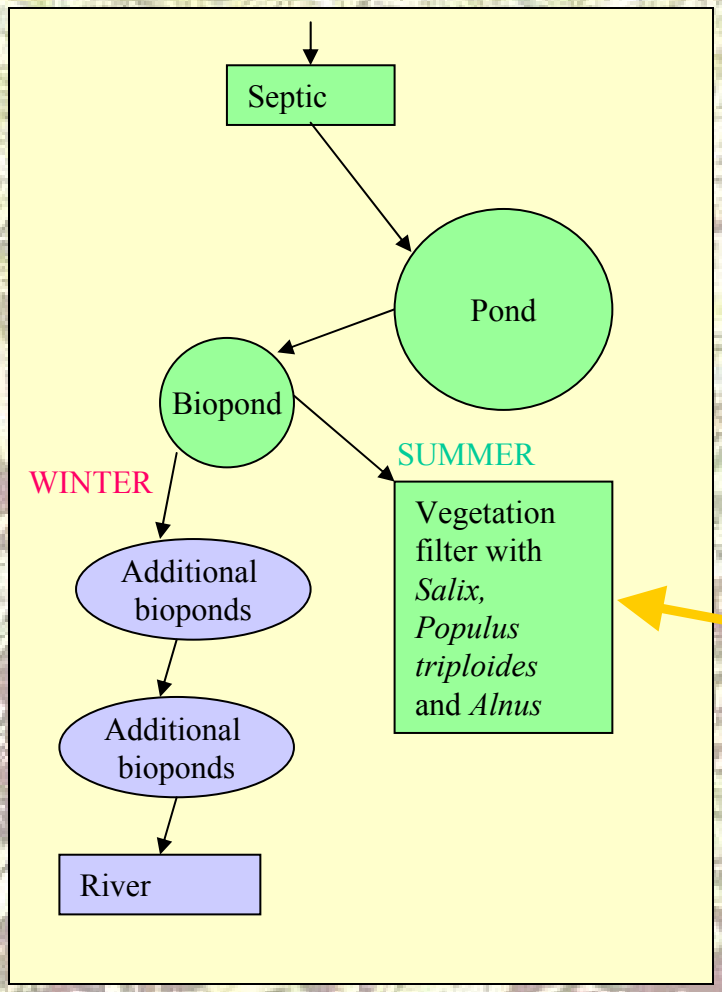
Nutrient removal

No of plants	205
Average plant shoot growth g y^{-1}	750
Wood productivity (kg y^{-1})	154

	N	P
Purification efficiency (%)	32	14
Annual removal (kg)	35,0	2,1
Concentration in shoots (%)	0,74	0,07
Stored in shoots (kg y^{-1})	1,14	0,11
Removal in biomass (%)	**3**	**5**

Kambja prototype

Vegetation filter



- Ca 1000 PE
- 9.1 ha *Salix* (+5.0 ha control)
- 1.6 ha *Alnus*+ *Populus*
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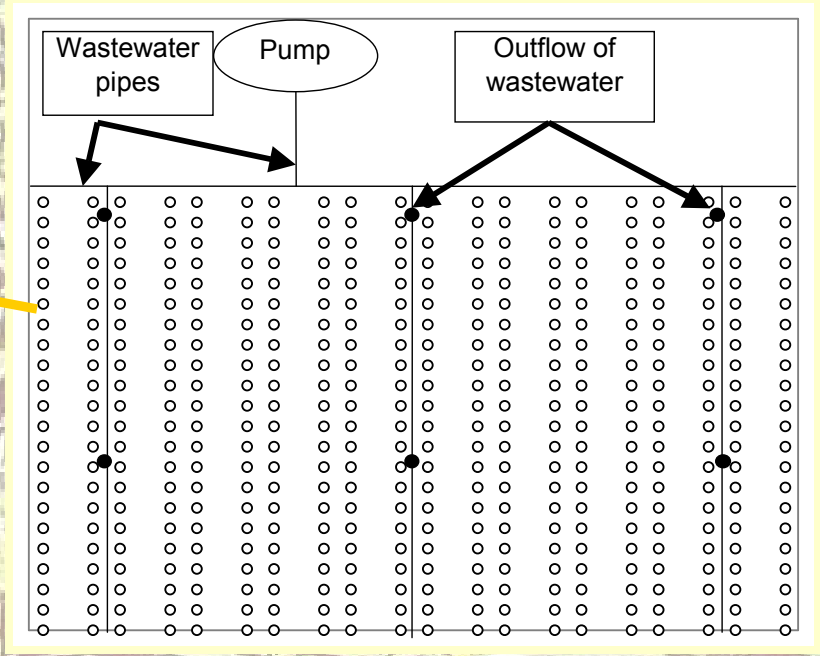

Kambja prototype

Vegetation filter

- nutrient load 440 kg N
  60 kg P
  100 kg K

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