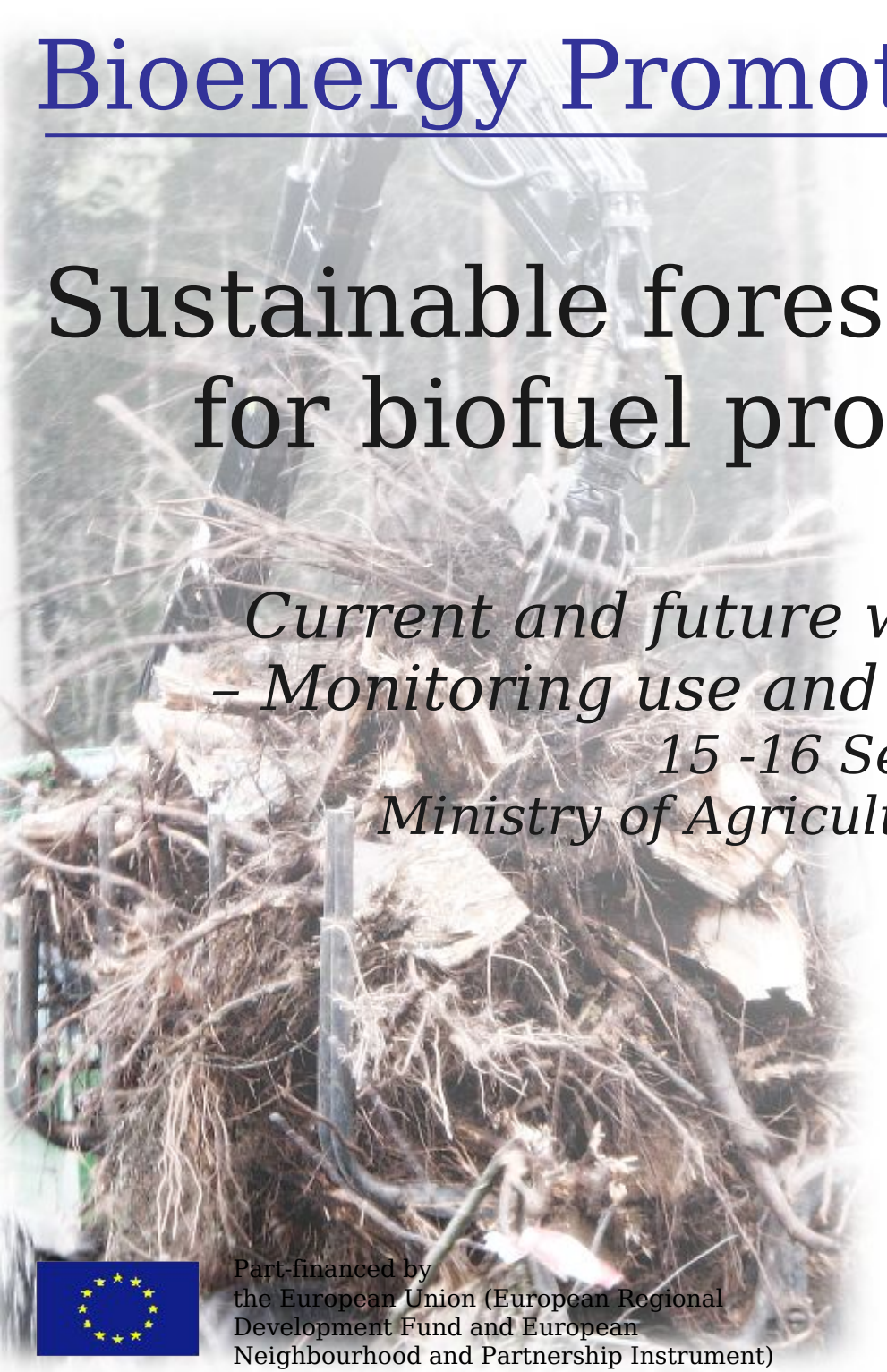
Bioenergy Promotion



Sustainable forest biomass resources for biofuel production in Latvia

Current and future woody biomass' for energy – Monitoring use and understanding technology

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Ministry of Agriculture of Republic of Latvia

Andis Lazdiņš, Dagnija Lazdiņa
LSFRI Silava, Riga street 111, Salaspils LV-2169
Phone: +37126595586, Fax: +37167901359
E-mail: andis.lazdins@silava.lv

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Sustainability criteria for the forest biofuel (*if transformed to liquids*)

- Biofuel should not be produced from biologically valuable areas:
  - natural forests, where forest management activities are forbidden or very limited;
  - *Natura 2000* and other protected areas, except cases, when biofuel production doesn't affect negatively protected species;
  - unmanaged biologically valuable grasslands.
- Biofuel should not be produced from organic soils:
  - swamps and wetlands, which is saturated with water for a long time;
  - forests on peat soils;
- Reduction of emissions of GHG after replacement of fossil fuel with wood should be at least 35% (*at least 50% after 2017*):
  - emissions from production of biofuel and efficiency of conversion comes into account.

Additional silviculture related sustainability criteria

- Poor mineral soils (*mainly pine stands*) are excluded from technically available stock of forest biofuel (*harvesting residues and stumps*).
- Naturally wet mineral soils are excluded as well, (*harvesting residues and stumps*) because slash is necessary for packing into strip-roads.
- Harvesting losses are taken in account (*from 1% for firewood to 40% for stumps*).

How sustainability criteria are applied to forest biofuel

- Criteria corresponding to <u>biologically valuable areas</u>:
  - protected areas with harvesting (*no commercial thinning or clear-cut allowed*) limitations are excluded from technically available stock of biofuel;
  - no attempts to produce biofuel from biologically valuable grasslands (*while they are grasslands*);
- Criteria corresponding to <u>wetlands and organic soils</u>:
  - drained and naturally wet organic as well as mineral wet soils are excluded from calculation (*also due to silviculture reasons*);
- <u>Reduction of GHG emissions</u>:
  - calculated taking in account emissions from fuel consumption during the production and supply of biofuel to a customer as well as from utilization of wood ash (*compensatory fertilization*);
  - average harvesting and supply conditions are used in calculation (*terrain transport 500 m, road transport of chips 50 km, stump road transport 5 km*), potential of concentration of forest management operations is not taken in account.

Other assumptions

- Harvesting technologies:
  - combination of harvester & forwarder for extraction, comminution at a road-side, truck with 2 containers with total capacity of 70 m^3 for transport of stumps and wood chips;
  - *Bracke C16.a* head is used for harvesting of small trees;
  - caterpillar excavator and ordinary forwarder are used for stump extraction.
- Productivity figures:
  - firewood and slash from clear-cuts – *Extraction of logging residues at LVM (Latvia's State Forests)*, LSFRI Silava & Skogforsk, 2004-2006;
  - small dimension trees and stumps – *Forest energy from small dimension stands, "infrastructure objects" and stumps*, LSFRI Silava & Skogforsk, 2006-2008;
- Sustainability estimations:
  - *Implementation of criteria of sustainability of biomass and elaboration of supporting action plan*, Vides projekti, LSFRI Silava, Latvia University of Agriculture.

Input data on forest lands

- Forest area in Latvia according to National statistical forest inventory from the total county area:
  - including forests and other reforested areas with number of trees < 1000 ha^{-1} – 57,4%;
  - including only forests and reforested areas with number of trees > 1000 ha^{-1} – 54,7%.

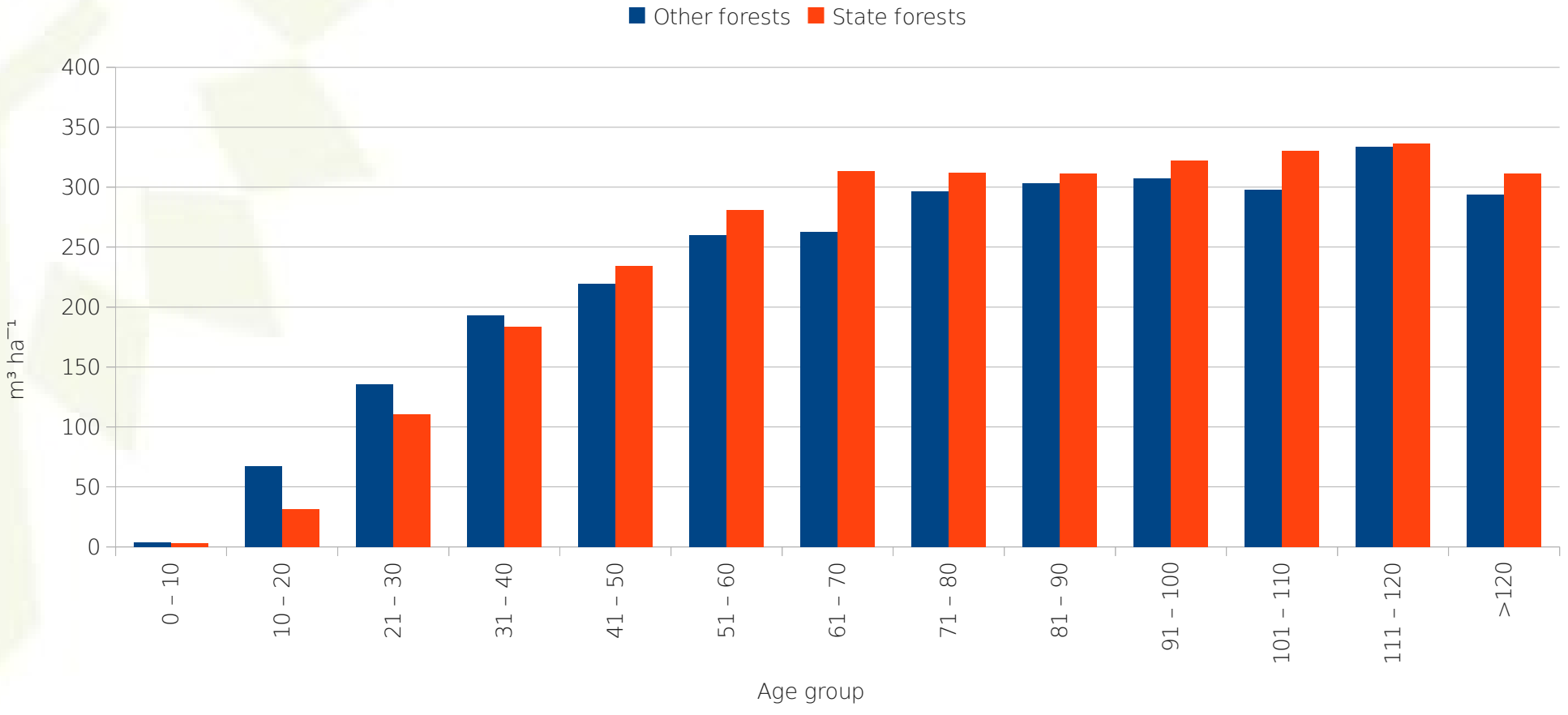
	forests	**non-forest lands**	**total forested land**
Area, th.ha	3535,73	252,17	3787,9
Stock, mill.m^3	650,16	4,06	654,22
Stock, m^3 ha^{-1}	183,88	16,08	172,71

- Distribution of forests according to land use:

	Forest	Swamps	Glades	Wetlands	Infrastructure	Other forest lands
Area, th.ha	3257,15	130,4	27,28	38,82	78,63	3,46
Stock, mill.m^3	647,97	0,41	0,12	0,16	1,43	0,07
Stock, m^3 ha^{-1}	198,94	3,14	4,4	4,12	18,19	20,23

Growing stock in the state and other forests

- Average stock in the state forests – **234** $m^3\,ha^{-1}$.
- Average stock in other forests – **187** $m^3\,ha^{-1}$.

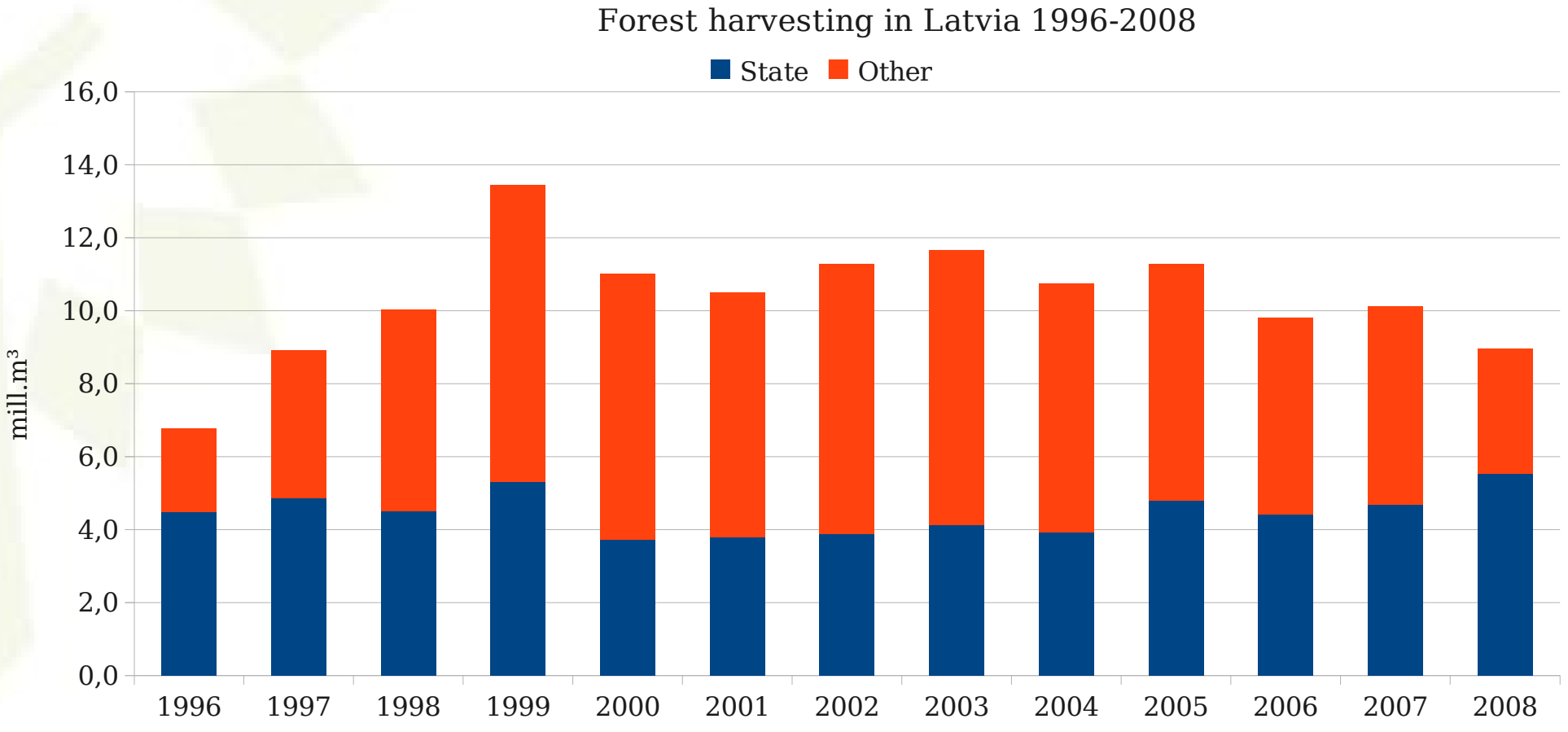


Input data for harvesting in 2007 according to the State Forest Service

- **9,8** mill.m^3 (*132 th.ha*) in total, including 4,4 mill.m^3 (*67 th.ha*) in the state forests and 5,4 milj.m^3 in other forests (*65 th.ha*);
- **8,1** milj.m^3 (*38 tūkst.ha*) harvested in clear-cuts, 1,7 milj.m^3 (*94 th.ha*) in other cuts;
- average harvesting stock 74 m^3 ha^{-1} (*66 m^3 ha^{-1} in state forests and 82 m^3 ha^{-1} in other forests*);
- average harvesting stock in clear-cuts is **211** m^3 ha^{-1} (*267 m^3 ha^{-1} in state forests and 182 m^3 ha^{-1} in other forests*),
- average harvesting stock in other cuts is **18** m^3 ha^{-1} (*17 m^3 ha^{-1} in state forests and 20 m^3 ha^{-1} in other forests*).

Increment of carbon in timber biomass and losses due to harvesting

- Carbon removal and emission in 2007:
  - emission due to harvesting – 2,77 mill.t of carbon;
  - increment of timber biomass – 8,05 mill.t of carbon.



Types of evaluated forest biofuels

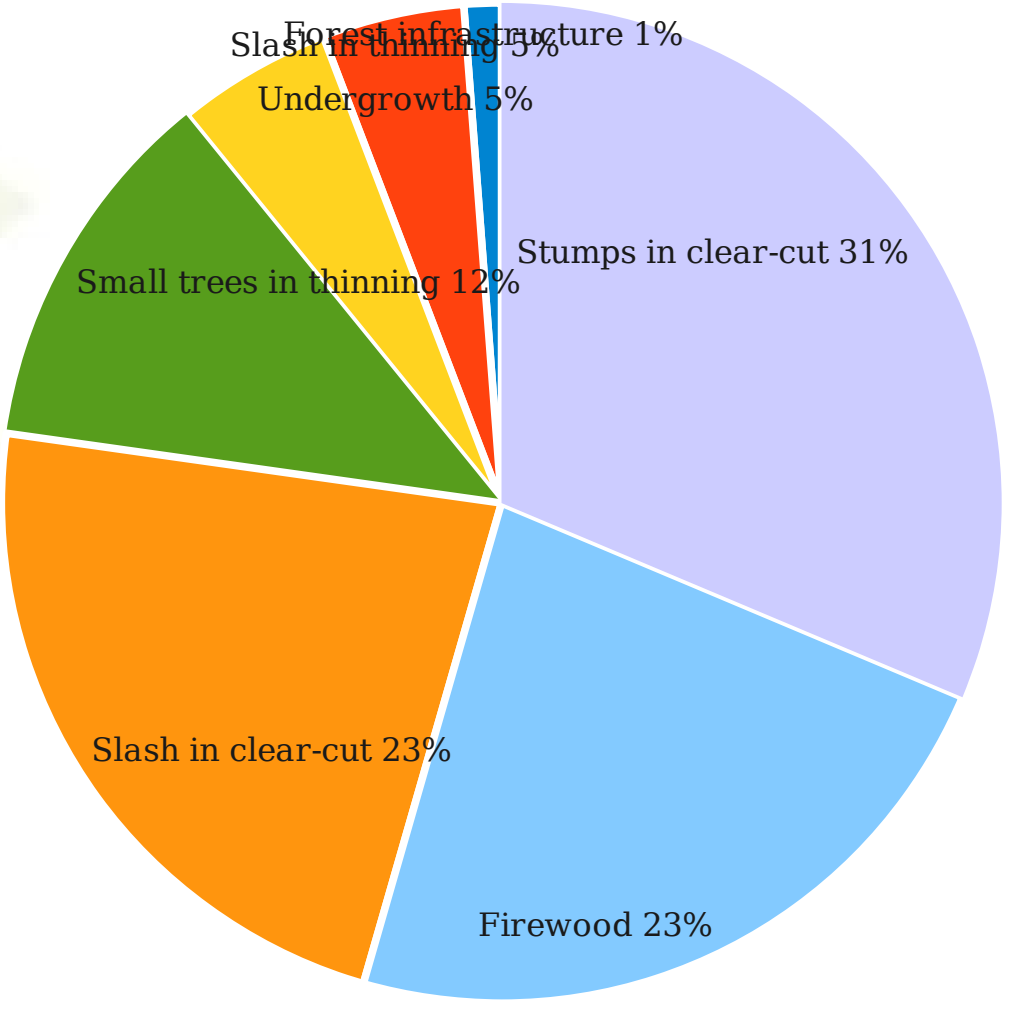
- Already utilized resources:
  - firewood, both from clear-cuts and other harvesting;
  - harvesting residues from clear-cuts.
- Easily accessible but not-utilized or partially used resources:
  - stumps from clear-cuts;
  - small dimension trees from the forest infrastructure (*drainage ditches, road-sides*).
- Costly and not-utilized resources:
  - small dimension trees from pre-commercial thinning;
  - small dimension undergrowth trees from commercial thinning and clear-cut;
  - mixed size trees and bushes from woody vegetation on abandoned farmlands (*harvesting takes place, generally, on account of land owners to convert land to something else*).

Forest biomass resources in Latvia, excluding reforested farmlands

- Potential resources – **3,8** mill.t yearly:
  - harvesting stock and area in 2007 is taken in account;
- Sustainable resources – **3,2** mill.t yearly:
  - excluding wet soils, organic soils and poor sandy soils;
  - all firewood is assumed sustainable as it is side product of roundwood production.
- Technically available resources – **2,4** mill.t yearly:
  - excluding harvesting and other losses;
- *Technically available resources is about 75% of sustainable part and 61% of total potential in 2007.*

Type of resources	***Firewood***	***Clear-cut***			***Thinning***		***Forest infrastructure***	***Total***
		undergrowth	***slash***	***stumps***	***slash***	***small trees***		
Potential (t yearly)	550 537	257 548	969 652	1 349 572	229 985	441 000	29 900	**3 828 194**
Sustainable resources (t yearly)	550 537	170 211	767 429	1 231 979	154 997	280 870	29 900	**3 185 923**
Available amount (t yearly)	545 031	119 148	537 201	739 187	108 498	280 870	28 405	**2 358 340**
Harvestable stock (t ha^{-1})	5	2	21	24	2	14	12	**8**

Sustainable forest biomass resources, excluding abandoned farmlands



Potential of naturally reforested farmlands

- Naturally afforested farmlands in Latvia:
  - total area **353** th.ha, growing stock **3,6** mill.m^3;
  - characteristic indicators (*high variability of species and density, different size and form of separate fields*).
- Biofuel potential:
  - thinning and reconstruction of the stands would lead to production of at least **0,6** mill.t of biofuel in short term and **5** mill.t in long term during clear-cut;
  - grey alder and aspen may be used as a coppice crops for direct solid biofuel production in 15-30 years rotation cycle.

Costs and emissions of the forest biofuel production

- C emissions from biofuel production:
  - max. **46** th.t yearly (12,5 kg t of biomass),
  - 0,4-14,6% (*3,6% in average*) from carbon stock in biofuel.

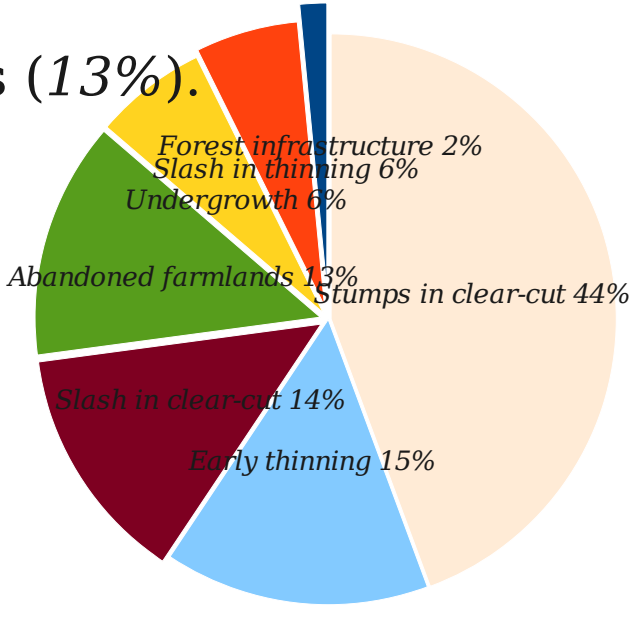
Type of resources	***Firewood***	***Clear-cut***			***Thinning***		***Forest infrastructure***
		undergrowth	***slash***	***stumps***	***slash***	***small trees***	
Technically available resources:							
t C yearly	272 516	59 574	268 600	369 594	54 249	140 435	14 203
MWh yearly	2 888 665	631 485	2 847 163	3 917 692	575 039	1 488 611	150 547
Time consumption for production and supply (E_0 hours per ton)	0,25	9,69	0,98	1,38	0,98	1,02	1,14
Carbon emissions during production (kg per ton)	1,78	50,97	8,54	17,26	8,54	13,84	12,57
Production topics (EUR per ton)	10,7	-	43,1	61,9	43,1	41,8	47,2
Sum of carbon emissions:							
tons yearly	979	8 676	6 555	21 265	1 324	3 886	376
kg per ton of C in biofuel	3,59	145,64	24,41	57,54	24,41	27,67	26,46
kg MWh^{-1}	0,34	13,74	2,30	5,43	2,30	2,61	2,50
Carbon in biofuel and consumed fossil fuel (C_{in} / C_{out})	0,36%	14,56%	2,44%	5,75%	2,44%	2,77%	2,65%

Utilization of wood ash

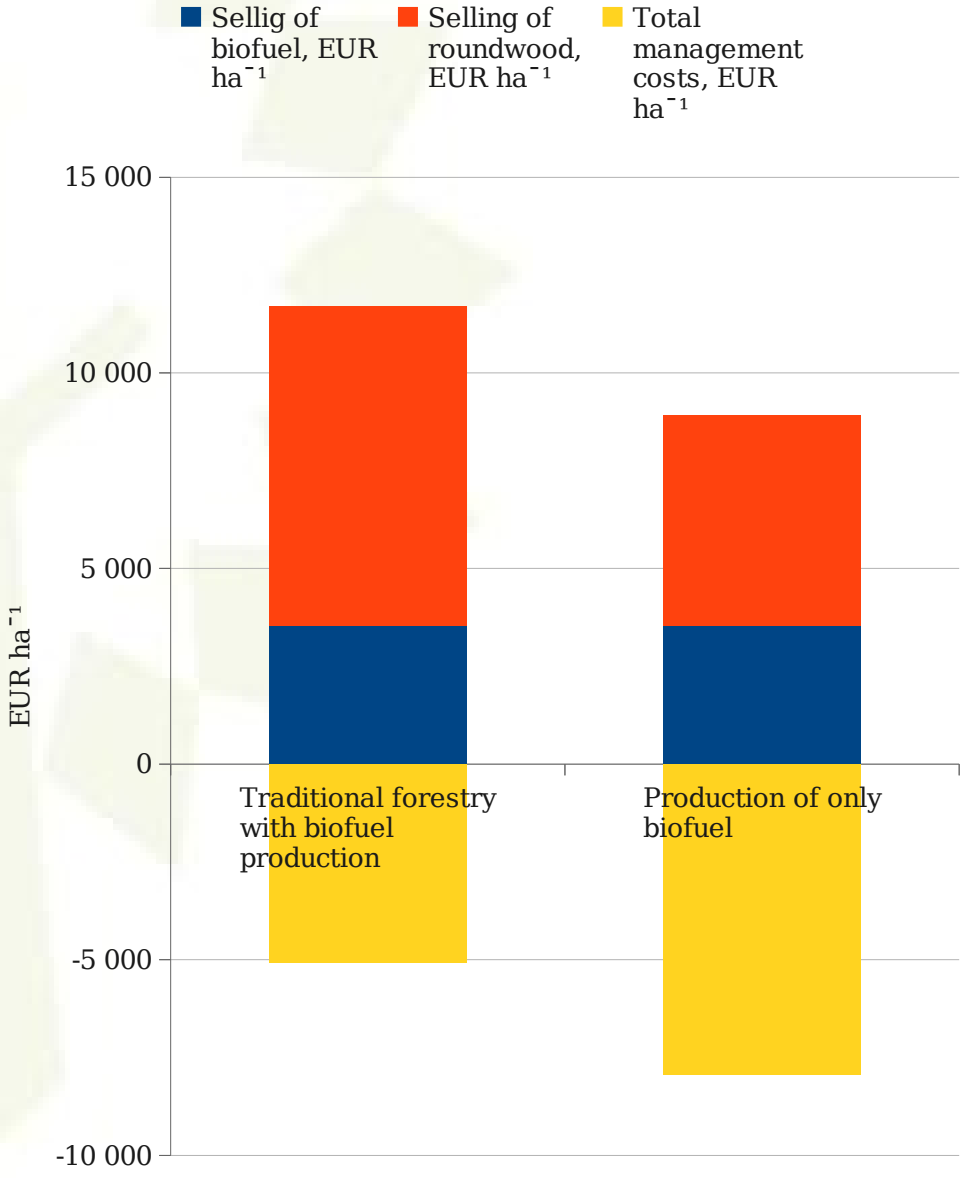
- Maximal amount of wood ash production – **124** th.t yearly (*0,9 t ha^{-1} of harvested area in average*);
- Area necessary for utilization of wood ash:
  - according to regulations of Cabinet of Ministers No 362 on utilization of wastewater sludge **87** th.ha of forests or plantations are necessary to utilize all amount of wood ash (*area of clearcuts in 2007 38 th.ha, area of selective cuts and thinnings – 94 th.ha*),
  - dosage of wood ash – 7,5 t ha^{-1} (*once per 5 years*), limiting element – cadmium (*Cd*),
- Costs – max. 3,1 mill.EUR yearly (*1,2 EUR t of biomass*);
- Additional carbon emissions – max. 269 t yearly (0,1 kg t of biomass).

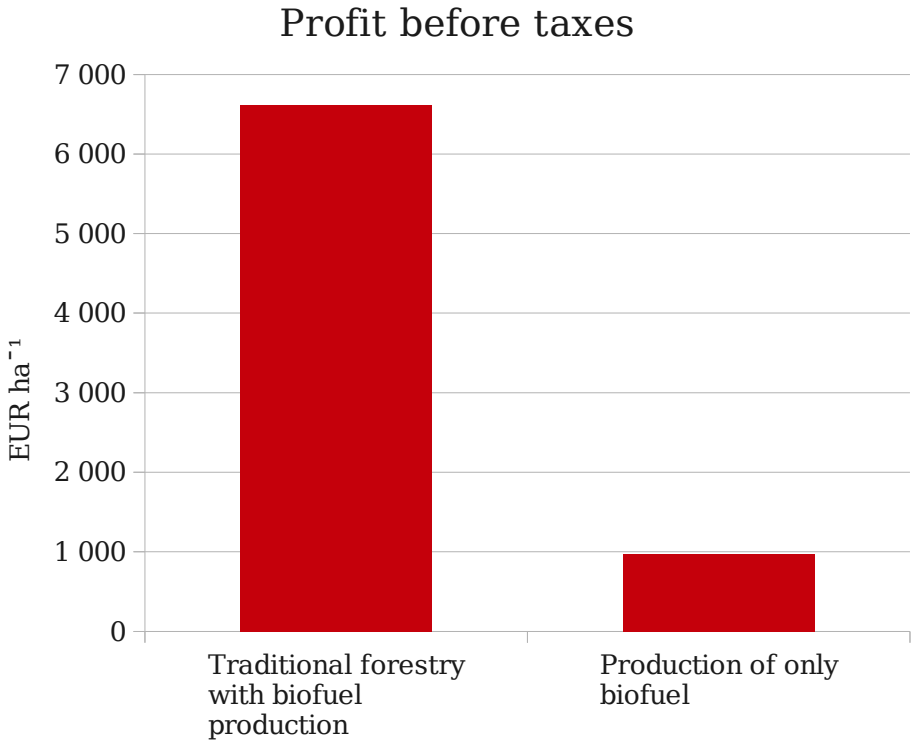
Potential of intensification of forest biomass production

- Total sustainable potential of intensification of production of forest biomass is **5** mill.MWh yearly:
  - there is no need to increase harvesting stock or forest management approach to reach that target;
- The most significant potential resources:
  - stumps (*44%*);
  - small trees in early thinning (*15%*);
  - slash in clear-cut(*14%*);
  - management of abandoned farmlands (*13%*).

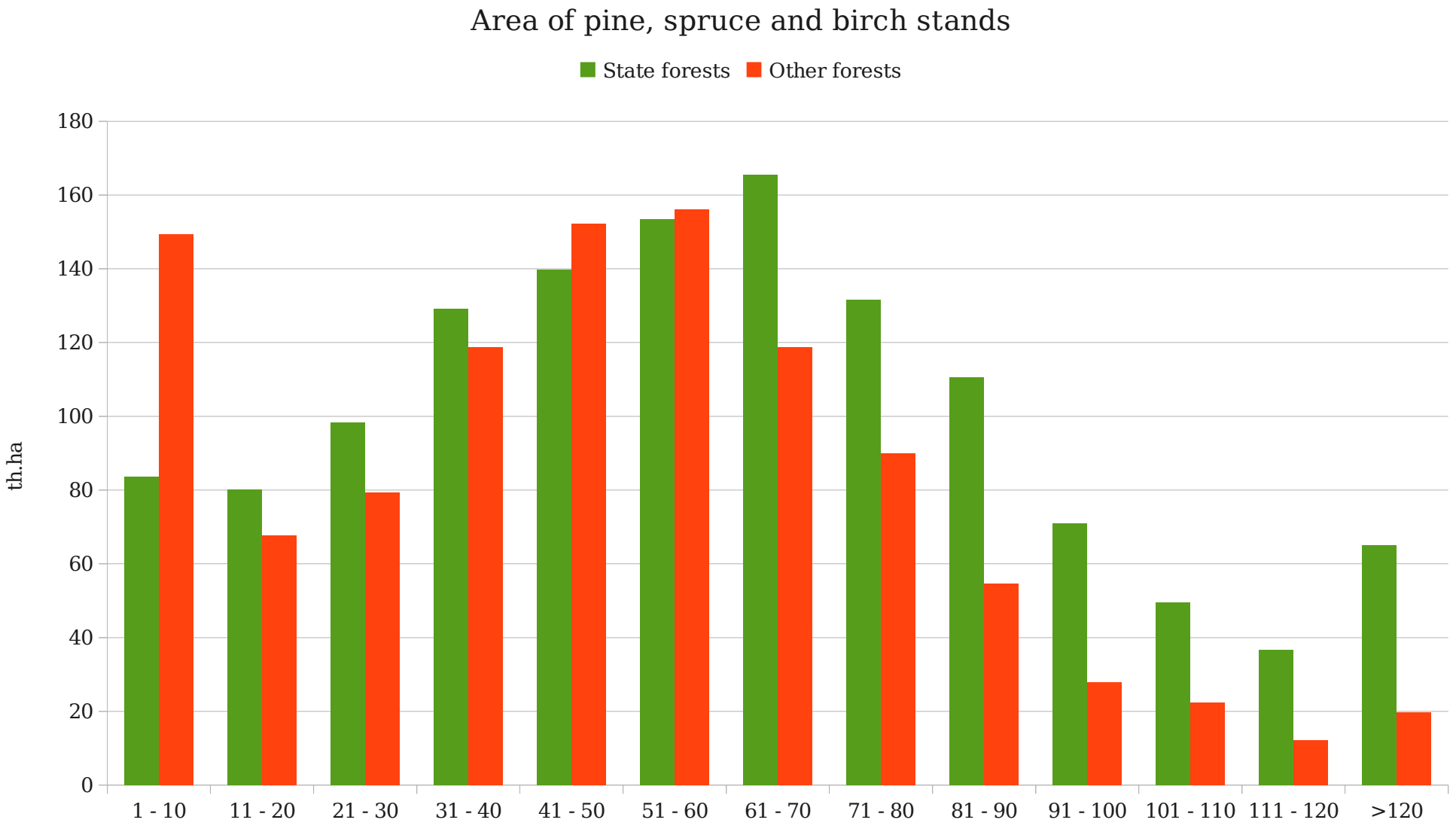


Forest industry is an important guaranty for sustainability

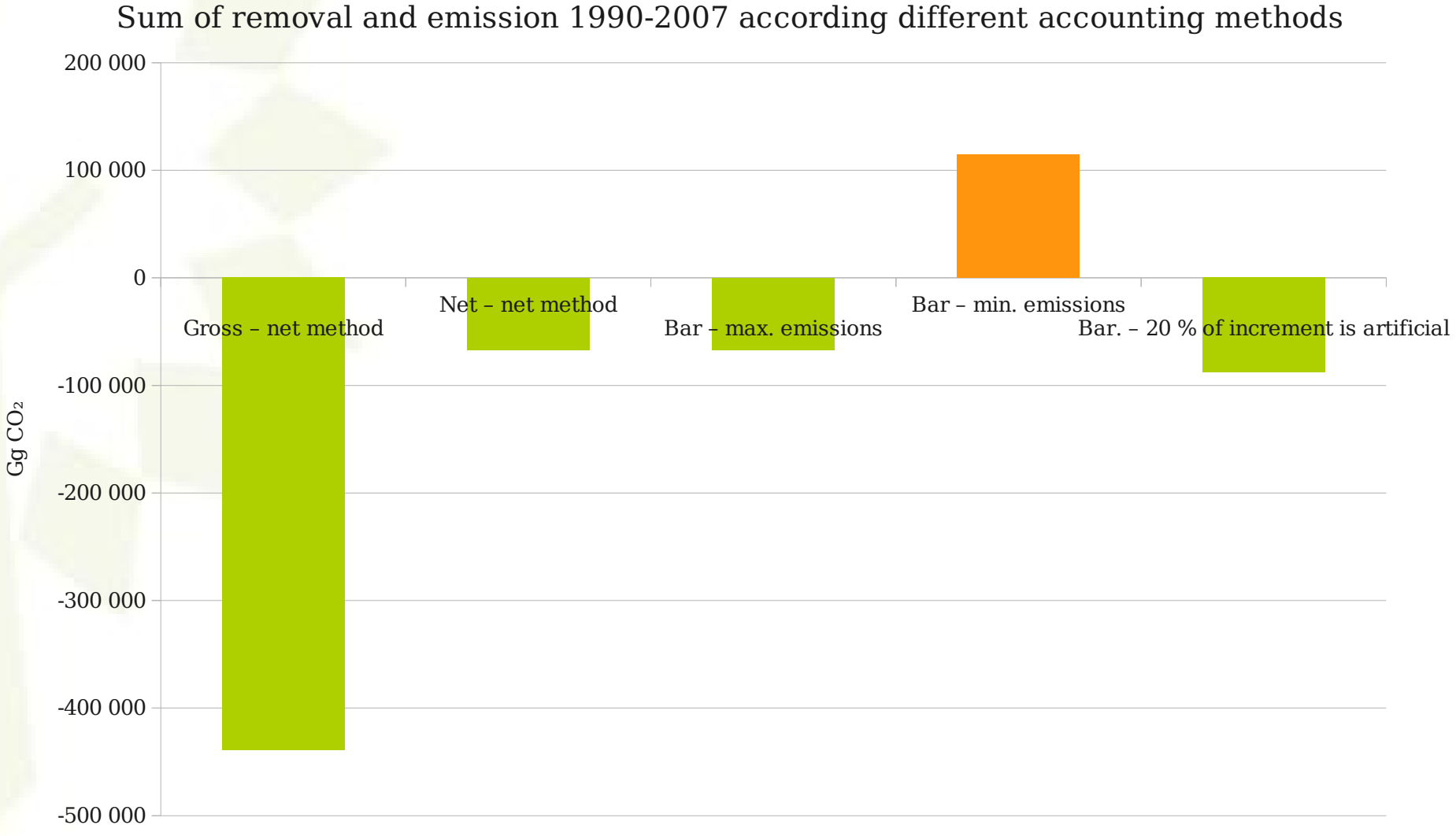




Age structure of Latvian forests



Consequences of carbon removal and coming Copenhagen decisions



Research and development as guarantee of sustainability

- Identified problems in Latvia:
  - too many laud voice based (*non-forestry*) expert assumptions;
  - too few long sustainability targeted forest research;
  - too few international cooperation in forest research to evaluate climatic and other trans-boundary issues.
- Model of role of R&D in biofuel sustainability:

Thank you for attention!

Andis Lazdiņš, Dagnija Lazdiņa
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