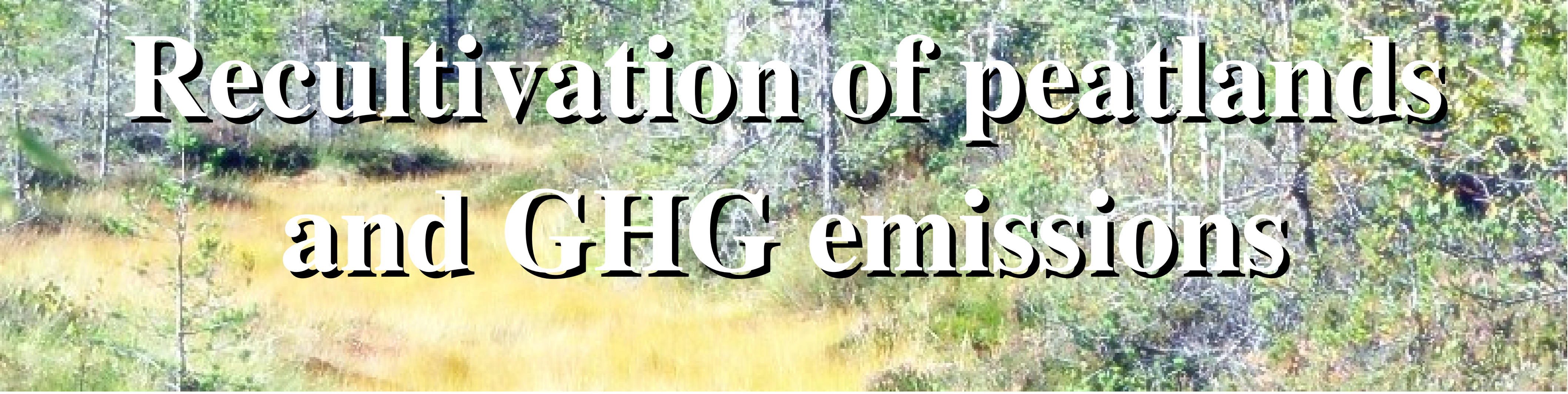

Recultivation of peatlands and GHG emissions

Seminar about peatland management in the context of GHG emission inventory – Norway case

Riga, November 3-4, 2015

Ministry of Agriculture, Republikas Laukums 2, Riga, Room 314

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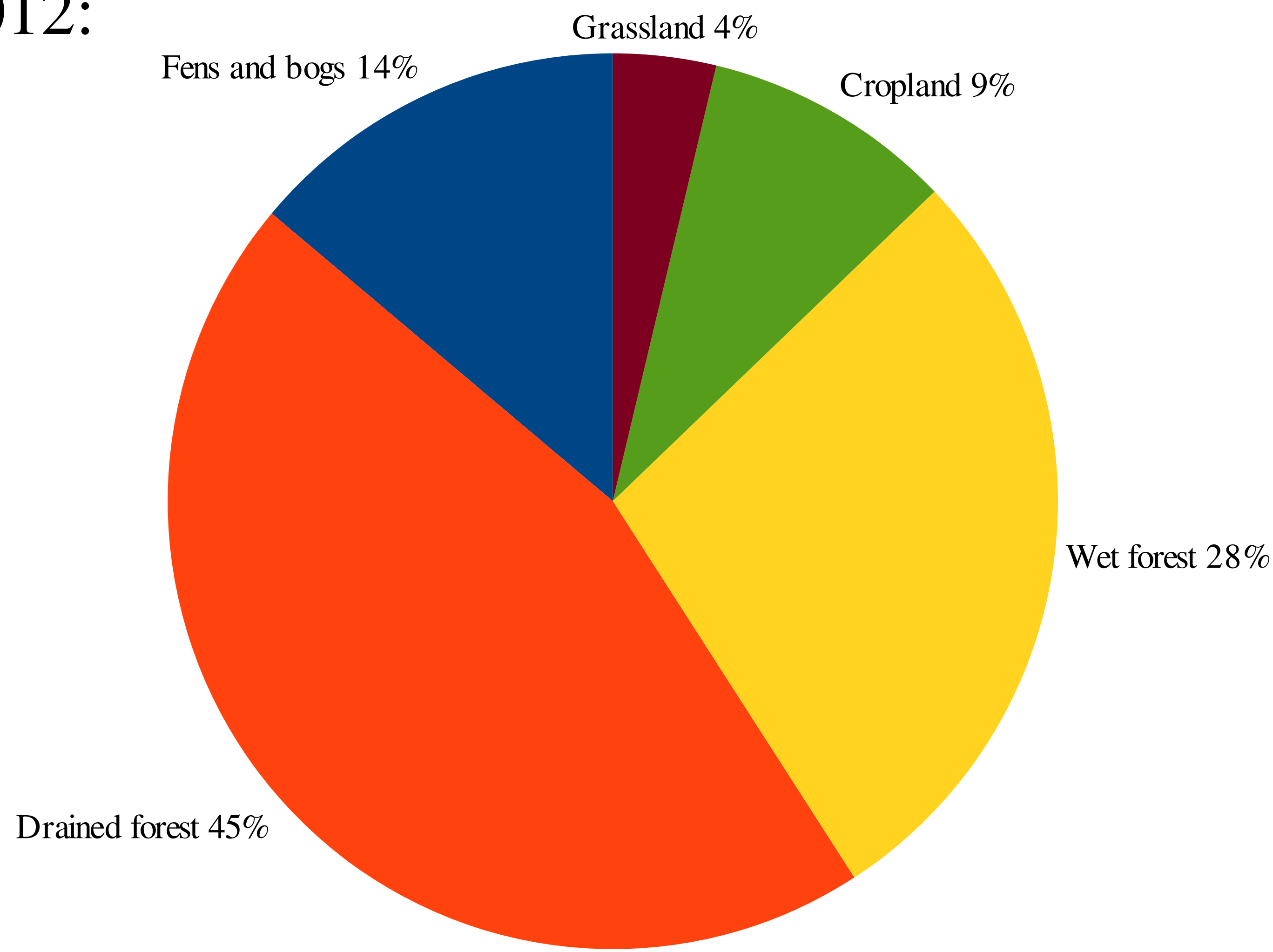
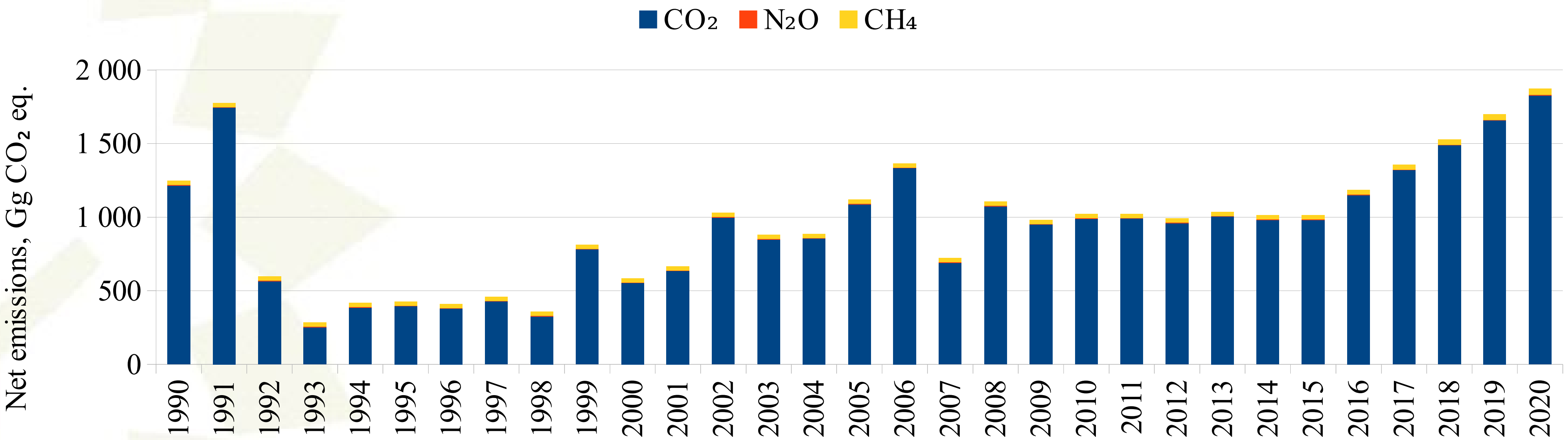
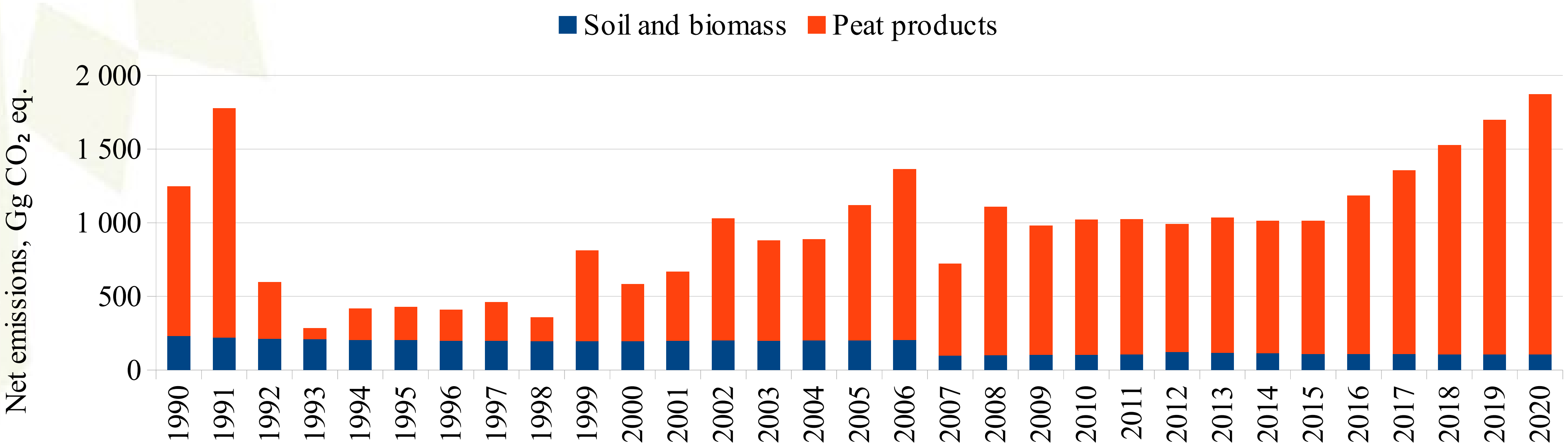
Organic soils in GHG inventory of Latvia

- According to the GHG inventory data **982 837** ha *(16 % of country area)* in 2012:

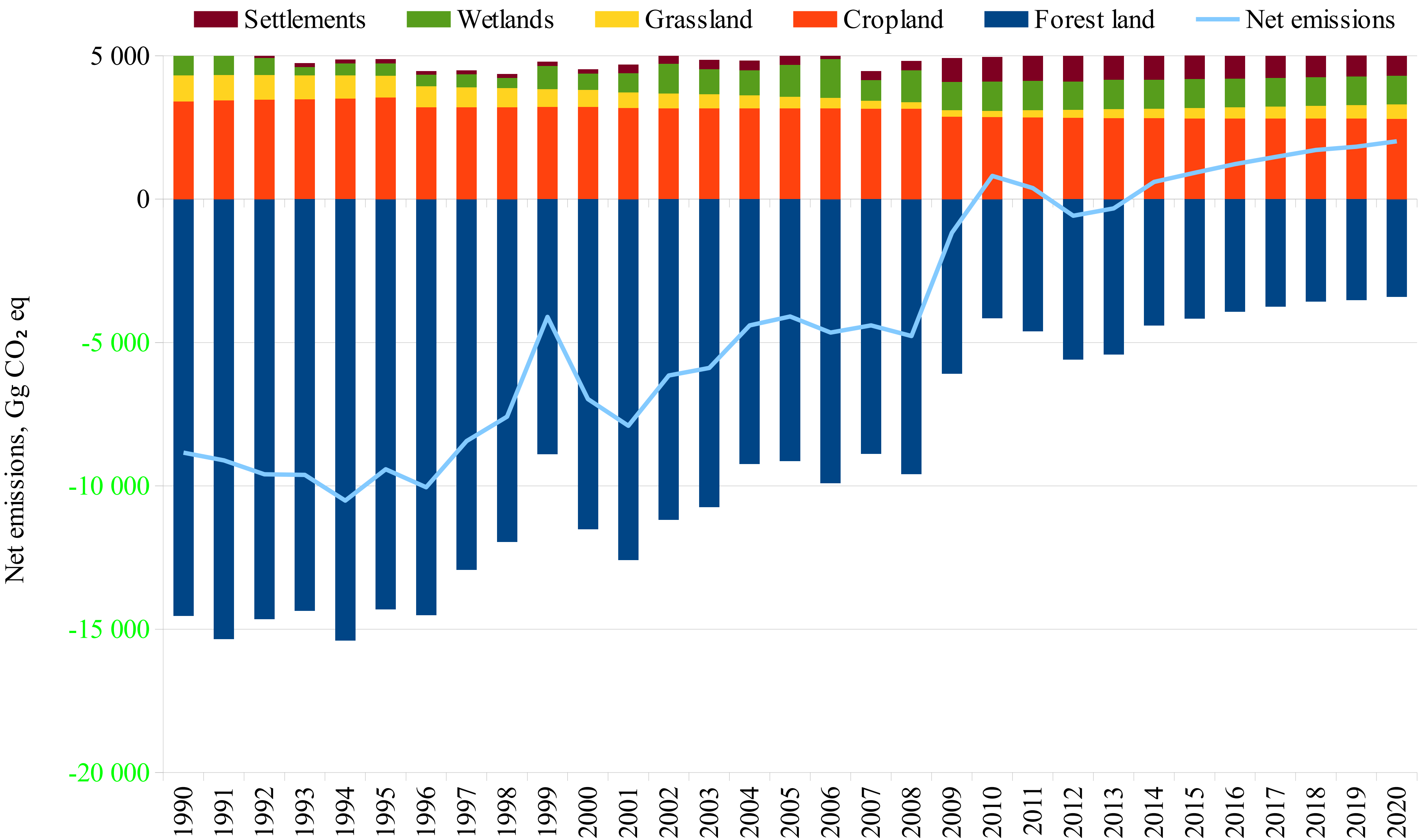


GHG emissions from wetlands in Latvia





Summary of emissions from LULUCF sector



GHG emissions from fens and bogs

- Dominating processes normally are **CO_2 removals** in peat and **CH_4 emissions** from non-aerated peat layers.
- According to studies CO_2 removals in peat in boreal zone varies from **220 g CO_2 eq m^{-2} to -310 g CO_2 eq m^{-2} annually** *(peatland can be sink and source of CO_2 emissions).*
- According to study in Sweden *ombrotrophic bogs* can be source of CO_2 emissions – 150 g m^{-2}, but *minerotrophic fens* – source of removals *(230 g CO_2 m^{-2} annually).*
- Nearly twice more CH_4 is emitted from *minerotrophic (nutrients rich)* fens – 17 ± 13 g m^{-2} annually.

Indirect impact on GHG emissions from bogs

Peat extraction and GHG emissions

- Drainage of bogs reduces CH_4 emissions, but increases N_2O and CO_2 emissions, especially during 5 years after drainage.
- CO_2 emissions:
  - in Sweden CO_2 during extraction are 230-1020 g m^{-2} *(up to 2.7 tonnes C ha^{-1})* annually, 600 g CO_2 m^{-2} in average, but if peat storages are considered – **1000 g CO_2 m^{-2}**;
  - production of **milled peat results in higher CO_2 emissions** *(1948-2478 g m^{-2} annually)*;
- CH_4 and N_2O emissions:
  - emissions of CH_4 in milled peat production fields are **7.23 g m^{-2} annually**, CH_4 **emissions grow also in surrounding area** *(in Sweden 5.25 g m^{-2} annually)*;
  - emissions of CH_4 from peat extraction fields are 7000 times smaller than in natural bogs;
  - emissions of N_2O from milled peat production fields are **0.31 g m^{-2} annually**, N_2O and CH_4 comes mostly from ditches.

Restoration of bog / rewetting

- In long term accumulation of carbon equals to **122 g CO_2 m^{-2}** annually:
  - some studies in Finland approves that bog became sink of CO_2 removals in second year after rewetting;
  - in winter season CO_2 emissions can compensate removals during vegetation season;
  - other studies in Finland approves that extracted bogs remain a source of CO_2 emissions 15 years after rewetting *(594-1038 g m^{-2} annually minerotrophic areas and 198-370 g m^{-2} annually ombrotrophic areas)*.
- CH_4 increases after rewetting:
  - CH_4 emissions increase after development of continuous vegetation coverage;
  - according to studies in Sweden CH_4 emissions remains at a level 3.35 ± 1.77 g m^{-2} annually without reference to period after rewetting;
  - another studies approves that CH_4 returns to initial level *(17 g m^{-2} annually)*.

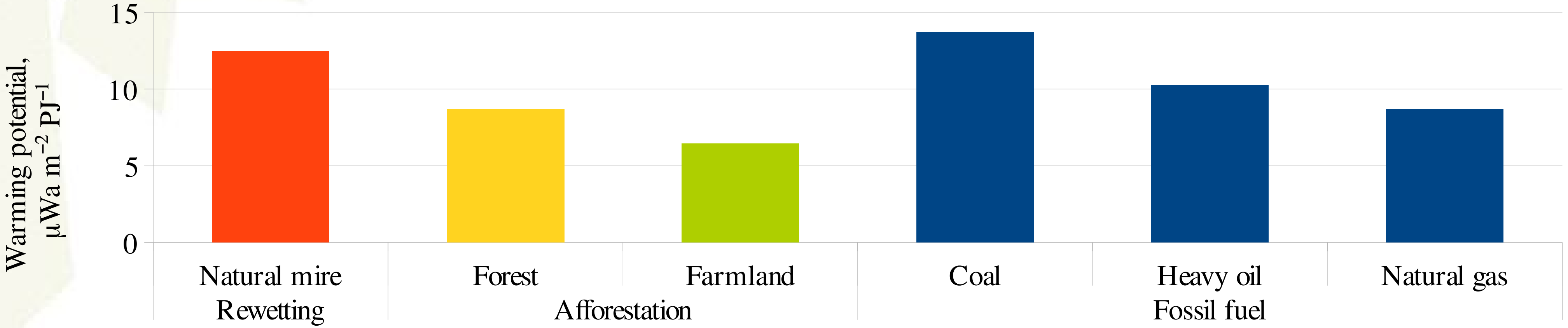
Different situations to choose between rewetting and other scenarios

Afforestation and short rotation crops

- Ratio of CO_2 emissions & removals depends from growth conditions and management practice:
  - according to some study data CO_2 emissions in afforested peatlands decreases to 1100 g m^{-2} annually during the first rotation;
  - if the average annual increment of living biomass is **at least 7.1 m^3 ha^{-1} annually**, afforested peatland will became a sink of CO_2 removals within 85 years accumulating 820 g CO_2 m^{-2} annually;
  - **in average CO_2 removals in biomass are compensating soil emissions after reaching 30 years age**.
- CH_4 and N_2O emissions:
  - average CH_4 emissions -0.05 g m^{-2} *(0.03-0.09 g m^{-2} annually)*, i.e. afforested area is net sink CH_4 removals;
  - average N_2O emissions 0.15 g m^{-2} *(0.02-0.75 g m^{-2} annually)*;
  - in long term N_2O reduces from 0.15 g m^{-2} to 0.06 g m^{-2};
  - average N_2O emissions from coniferous stands according to Finnish studies are 0.86 ± 0.73 g m^{-2}, from coniferous stands – 1.00 ± 1.12 g m^{-2} annually.

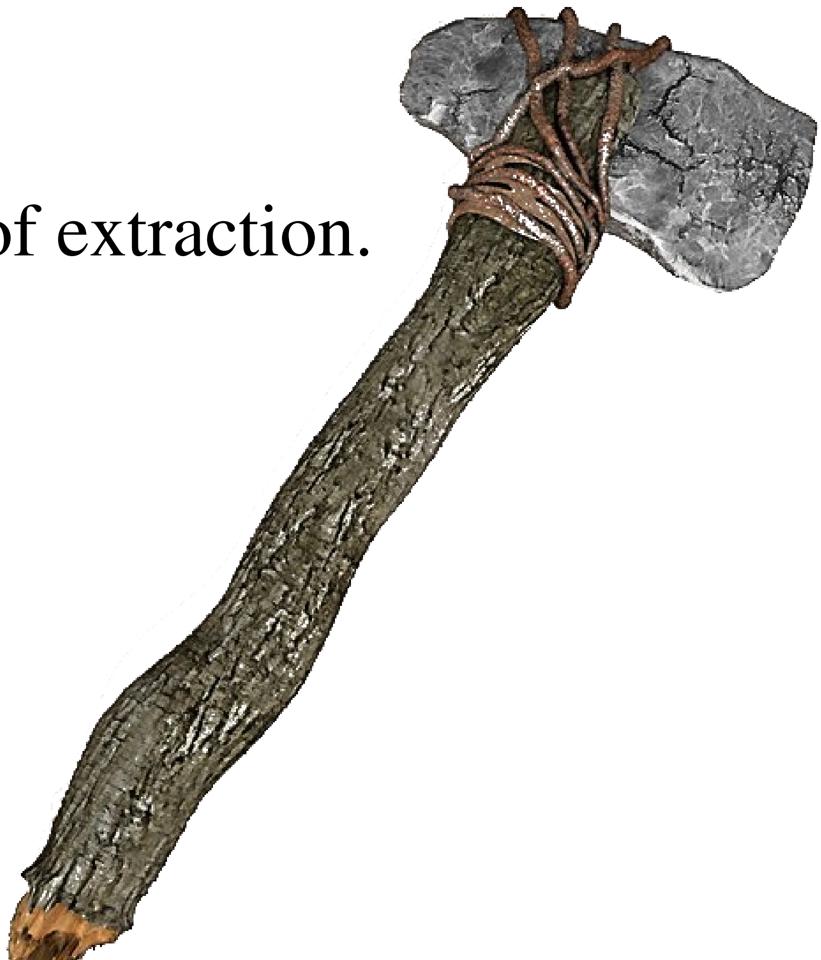
Utilization of peat in energy sector and climate change

- *According to Swedish and Finnish studies.*
- Main conclusions:
  - utilization of peat instead of coal at any scenario produces less GHG emissions than coal in a 100 years period;
  - peat production in natural peatland with following rewetting do not results in reduction of GHG emissions;
  - use of peat from forest land considering following afforestation results in less GHG emissions than use of coal, but the same amount or more emissions than use of gas or heavy fuel oil;
  - use of peat from farmland considering following afforestation results in less GHG emissions than use of coal, gas or heavy fuel oil.



Handmade decision making support tool

- GHG emissions in natural mire – base scenario.
- GHG emissions during:
  - preparation for extraction;
  - extraction;
  - processing and delivery of peat;
- GHG emissions after completion of extraction.
- *A bit outdated emission factors!*



GHG emissions during preparation for extraction

- Machinery, soil and vegetation:
  - ditching *(considers different types of ditches)*;
    - **input data** – length (km) and width (m);
    - **workload** – productivity (hours km^{-1}), capacity of machines (kW), fuel consumption (per hour);
    - **calculated parameters** – working hours, consumed fuel, machinery related CO_2 emissions, area of ditches, amount of extracted carbon in biomass and soil.
  - removal of vegetation;
    - additional calculations – emissions from soil and vegetation;
  - road construction *(2 types of reads)*;
    - additional calculations – emissions due to deforestation outside peatland;
  - construction of temporal storage outside peatland;
  - common data;
    - carbon in diesel 0.7 kg L^{-1};
    - density of soil 0.2 tonnes m^{-3};
    - carbon content in soil 500 kg $tonne^{-1}$;
    - natural vegetation 4.1 tonnes ha^{-1}.

GHG emissions during peat extraction

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- Products – milled peat, sod peat, fuel peat.
- Emissions from soil in drained area:
  - emission factors;
    - CH_4 – no emissions;
    - N_2O – 0.1 kg N_2O-N ha^{-1} annually;
    - CO_2 – 0.2 tonnes C ha^{-1} annually;
- Peat extraction machinery:
  - accounts up to 10 types of machines for every type of products + up to 10 general purpose machines;
  - additional data input – peat extraction (tonnes annually), peat moisture (40 %), carbon content in peat (500 kg $tonne^{-1}$), peat density (0.2 kg L^{-1}).

Emissions from peat products

- Input data:
  - share of different types of products;
  - life time of peat products *(for milled and sod peat 20 years, for fuel 1 year)*;
- Calculations:
  - separate calculation of decomposition of peat products during lifetime of facility and after closure of peatland.

GHG emissions during peat processing and transportation

- Emissions due to direct delivery of peat:
  - share of direct deliveries, average distance, average load, loading and unloading time, average driving speed loaded and empty;
  - up to 5 machine units and per product;
- Emissions from prepacked peat production:
  - input data – production (tonnes annually), factory life time in years, delivery distance of raw material, heated area and heat consumption (kWh m^{-2} annually), efficiency of boiler, heat losses in pipelines, heat value of fuel (MWh $tonne^{-1}$), carbon content in fuel (kg $tonne^{-1}$), electricity consumption (kWh annually), GHG equivalent of electricity (g CO_2 kWh^{-1});
  - up to 5 machine units per type of raw material and up to 5 general purpose engines.

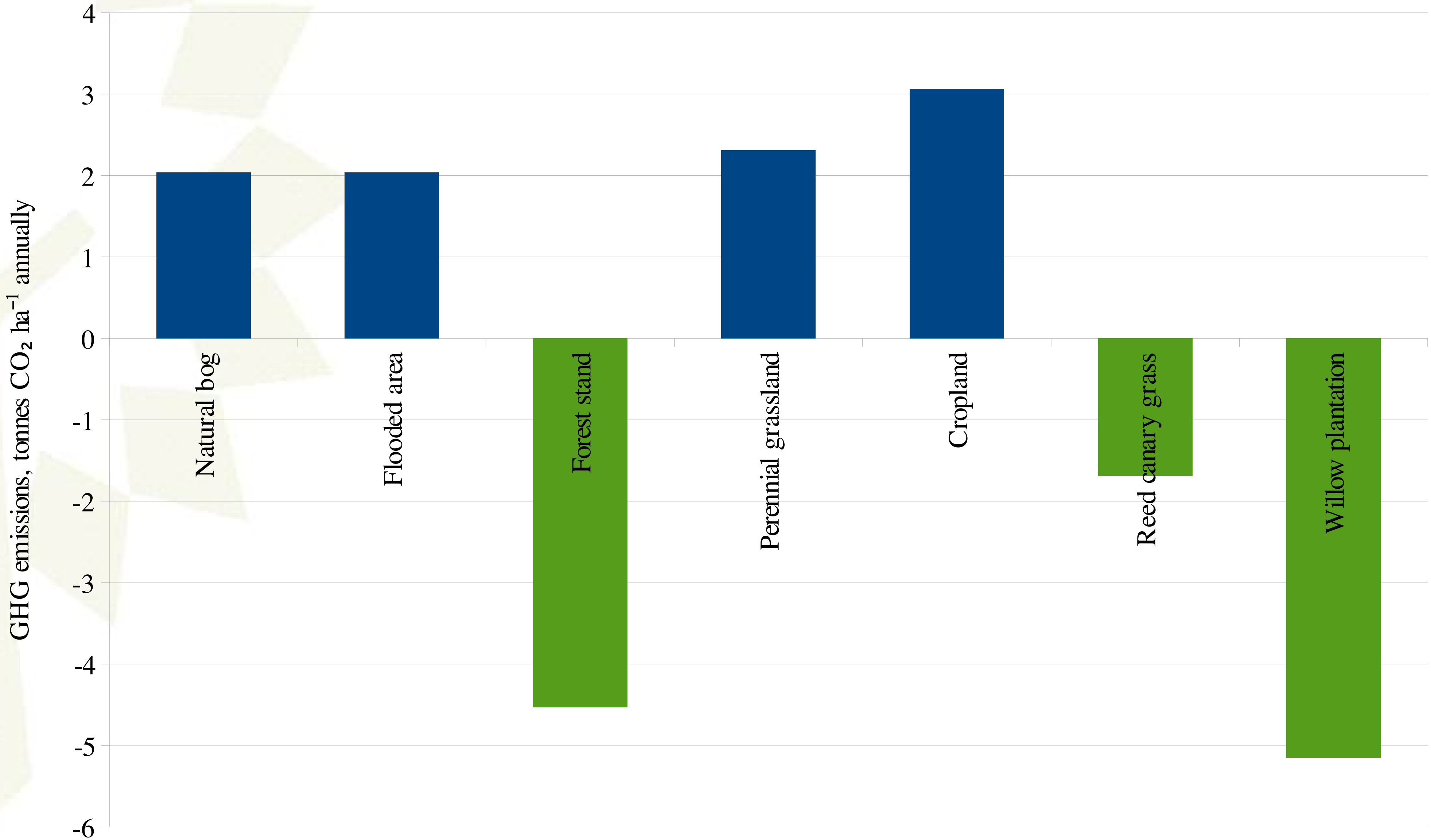
GHG emissions after completion of extraction

- Transitional emissions from period of active extraction:
  - remaining peat products, emissions due to deforestation;
- Recultivation scenarios:
  1) rewetting or flooding *(initial groundwater level)*;
  2) forest *(N_2O 1.8 kg N ha^{-1}, CO_2 1.1 tonnes ha^{-1} annually, removals in living and dead biomass, stabilized carbon stock in soil, stabilization period 120 years, excluding living biomass – 60 years)*;
  3) perennial grassland *(certain amount of carbon in soil after 120 years period)*;
  4) cropland *(certain amount of carbon in soil after 120 years period, no agriculture related emissions are considered)*;
  5) reed canary grass *(certain amount of carbon in soil after 120 years period, replacement effect of biofuel);*
  6) willow plantation *(certain amount of carbon in soil after 120 years period, replacement effect of biofuel).*

Replacement effect

- **Natural gas** in base scenario.
- Characteristics of natural gas:
  - heat value (MWh m^{-3}); efficiency of boiler; CO_2, N_2O and CH_4 emissions (tonnes MWh^{-1});
- Characteristics of biomass:
  - average yield (tonnes ha^{-1} annually); C content (kg $tonne^{-1}$); heat value (MWh $tonne^{-1}$); efficiency of boiler; N_2O and CH_4 emission factor (tonnes CH_4 MWh^{-1}); production losses.

Summary of GHG emissions excluding peat products



«Restore - Sustainable and responsible management and re-use of degraded peatlands in Latvia»

PROJECT LOCATION: Latvia

BUDGET INFO:

Total amount: **1 828 318 EUR**

% EC Co-funding: **60,00%**

DURATION: Start: **01/09/15 - ** End: **30/08/19**

PROJECT'S TEAM:

Coordinating Beneficiary: Nature Conservation Agency

Associated Beneficiary(ies):

Baltic Coasts, NGO;

Silava, Latvian State Forest Research Institute (Tartu University)

Latvian Peat Producers Association

MAIN OBJECTIVE

Establishment of a decision support system for responsible and sustainable re-use and management degraded peatland in Latvia

MAIN PROJECT ACTIONS:

I. To study and **analyse** the **experience** of other countries in management of degraded peatlands;
II. To **approbate the methodology for GHG emissions accounting** in order to **elaborate** country **specific emission factors** and contribute to National GHG Inventory improvements and evaluation of impact of the proposed actions;
III. To **define** the **criteria for classification** of degraded peatlands and **determination** of optimal management **approach;**
IV. To **perform** an **inventory** of degraded peatlands and to **develop** a **database** of degraded peatlands;
V. To select the **demonstration territories** and perform **hydrological** and **habitat studies**, as well as economic **assessment** of the ecosystems and their services of the territories and adjacent areas;
VI. To **develop** a **decision support tool** – a map based land use optimization model and to perform **strategic EIA procedure** for the tool;
VII. To **test** and to **demonstrate** the optimisation model by implementing the scenarios of land re-use and management in selected demonstration territories, **develop a set of recommendations.**

EXPECTED IMPACTS

Indicator	
GHG emissions CO_2 (4 demo sites, 195 ha)	2227 tonnes yr^{-1}
Estimate for extrapolation of project results at the available area in Latvia (5000 ha)	*38 585 tonnes yr^{-1}*
Carbon sequestration (4 demo sites)	838 tonnes yr^{-1}
Total area to be affected by the project	195 ha
Planned area where project results will be replicated 3 years after the implementation ot the project (LV)	400 ha

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LATVIJAS VALSTS MEŽI