Report on the identified climate change mitigation targeted management practices on organic soils (A.1.3)

LIFE OrgBalt: "Demonstration of climate change mitigation potential of nutrients rich organic soils in Baltic States and Finland" LIFE18 CCM/LV/001158
KICK – OFF MEETING

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Scope and involved partners

- To evaluate the current status including **analysis of legal acts and proven management practices** for nutrient-rich organic soils.
- The main task is to analyse **existing national and international management practices for nutrient-rich organic soils**, as well as relevant policy documents.
- Evaluation of **GHG inventory reports** (uncertainties, applied methods) on their ability to report CCM measures.
- Report for non-scientists with summarized review in peer reviewed journal or proceedings
- Responsible person at LSFRI Silava: Andis Lazdiņš (andis.lazdins@silava.lv; +37 126 595 586). All partners involved.

Policy documents to be considered in reporting

- National forestry accounting plan according to LULUCF decision (2018/841/EU).
- Report on progress of implementation of measures in Land use, land use change and forestry sector according to EU decision 529/2013 Article 10.
- Report on emissions and removals due to cropland and grassland management according to EU decisions 529/2013/ES; 749/2014 Article 40, UNFCCC and COP decisions 6/CMP.9 and 2/CMP.8.
- Report on implementation of national systems of the GHG accounting due to grassland and cropland management according EU decision 529/2013/EU, implementation decision 749/2014 Article 39, UNFCCC and COP decisions 19/CMP.1 and 24/CP.19.
- National reports within the scope of UNFCCC and Kyoto protocol activities according to EC implementation decision 749/2014 Article 18, UNFCCC Article 12 and COP decisions 2/CP.17, 4/CP.5, 15/CMP.1, 9/CP.16 and 2/CP.17.
- Biannual report within the scope of UNFCCC according to EC implementation decision 749/2014 Article 18, UNFCCC Article 12, UNFCCC COP decisions 1/CP.16, 2/CP.17 and 19/CP.18.
- Report on policies, measures and emission projections according to EU monitoring decision 525/2013 Article 13 and 14.
- Annual GHG inventory report according UNFCCC COP decision 24/CP.19 and Kyoto Protocol; EC and EP decision 525/2013 Article 7.4.

Basic principles

- The report should cover all European countries in TCM climate zone.
- Accounting methods according to GHG inventory reports has to be summarized and potential issues identified *(e.g. key source accounting using tier 1 methods, separate accounting of nutrient-rich soils etc.).*
- Report is split into following chapters:
  - GHG inventory reports and accounting methods;
  - measures proposed by national policies;
  - measures proposed by research community;
  - synthesis of the-state-of-the-art and climate change mitigation potential.

Characterization of measures

- Common characteristics:
  - title and substantiation of the impact;
  - criteria for site selection;
  - addressed carbon pools and GHG emissions
- Country specific characteristics:
  - methods and models applied for impact assessment at local and national level;
  - how existing LPIS and other monitoring systems needs to be improved to verify the impact;
  - duration of impact and supplementary measures to sustain the impact;
  - quantitative implementation potential at a national level;
  - conformity with sustainability criteria and regulation in force;
  - estimation of cost and benefit ratio;
  - interferences and synergies with other sectors, land uses and policies;
  - status in national policy, existing support schemes;
  - references and study reports.
- Summarizing common characteristics:
  - applicability in other EU countries (TCM region);
  - knowledge gaps to be filled, uncertainties, collaboration needed.

List of already identified measures *(no measures set for wetlands yet)*

- Forest regeneration with species and varieties having higher potential of CO_2 removals and commercial value.
- Pre-commercial thinning to improve species composition, increase growth rate and reduction of rotation duration.
- Application of mineral fertilizers and wood ash following to reduction of rotation length.
- Amelioration and increase of productivity of nutrient-rich soils.
- Maintenance of existing amelioration systems after regenerative felling.
- Remedial ditching to enhance regeneration of forests on wet soils after regenerative felling.
- Intensification of management and reduction of rotations.
- Reconstruction (regeneration) of low valued forest stands.
- Timely regeneration of forests after natural calamities.
- Rewetting of low valued forests with limited growth potential.
- Introduction of innovative soil scarification methods to reduce regeneration period.
- **Afforestation of farmlands with organic soils.**
- Conversion of wet grasslands into woody paludicultures for HWP and biofuel production.
- Intensive cultivated SRF in marginal and fertile soils.
- Elimination of hotspots of methane emissions – strip harvesting on organic and wet mineral soils, maintenance of drainage systems.
- Fire prevention – mineralized belts, early warning systems, better equipped fire safety departments.
- Prevention of wind throws and snow-break risk by intensified rotations and more resilient stand composition.
- Reduction of risk of distribution of pests by increase of resilience of forest stands.
- Adaptation of drainage systems to optimal depth of groundwater – to avoid CH_4 emissions and to reduce CO_2 emissions.
- Avoiding degradation of natural surface water flows during thinning and regenerative felling.
- Slowing down of root rot distribution (stump treatment, stump extraction).
- Implementation of depth-to-water maps to improve forest management and production planning
- Utilization of harvesting residues and small dimension biomass in energy sector.
- Increase efficiency of utilization of timber – less biofuel and pulpwood and more harvested wood products with long half-life period.
- More efficient harvesting technologies to reduce timber damages.
- Low impact logging technologies to avoid formation of CH_4 hotspots during felling.
- Improved bucking instructions and laser scanning and image analysis technologies to improve output of assortments.
- Conversion of cropland to grassland (pastures) for fodder production.
- Reduced tillage to avoid GHG emissions and carbon losses due to wind erosion.
- Non-woody energy crops, e.g. reed canary grass, in cropland and grassland.
- Rewetting of grassland – conversion to wetlands, to avoid CO_2 emissions.
- Increase of use of legumes to reduce N_2O emissions.
- Adjust fertilizer application rates and timing in croplands to reduce N_2O emissions.
- Application of nitrification inhibitors to reduce N_2O emissions.
- Introduction of agroforestry systems to increase carbon storage.
- Optimize grassland management *(species introduction, increase of lifespan of grasslands, increase of productivity).*
- Adaptation of drainage systems to optimal depth of groundwater and outflows – to avoid CH_4 emissions and to reduce CO_2 and DOC emissions.
- Buffer zones alongside to drainage systems to compensate CO_2 emissions, to reduce nutrients leaching and DOC emissions.

Example of measure description - afforestation of farmlands with organic soils

- Five alternatives of afforestation:
  - intensified short rotation forests aimed at maximizing of production *(e.g. spruce stands with 40 years rotation)*,
  - extensified forest management systems following to management rules applicable in conventional forests *(e.g. spruce stands with 80 years rotation period)*,
  - perennial woody crops considering 2 potential scenarios - plantations with 20-30 years rotation *(e.g. hybrid poplar or hybrid aspen for pulp and bioenergy)*;
  - fast growing crops for biofuel production (e.g. willow plantations);
  - paludiculture – grey / black alder stand in areas with periodically increasing groundwater level.

Substantiation of impact

- Afforestation leads to increase of carbon stock in living and dead biomass carbon pool including litter by recreation these pools and increase carbon stock in soil.
- Notably that CO_2 removals in soil due to afforestation may be underestimated because changes of the soil bulk density is not considered.
- Afforestation also affects non-CO_2 emissions from soil, however this impact may be either negative or positive.
- Intensified management should be associated with fertilization (e.g. with wood ash) to boost increment.

Suitable areas and affected carbon pools

- Grassland and cropland with organic soil where afforestation is permitted according to national and local regulations.
- All carbon pools and non CO_2 emissions are affected.

Modelling solutions

- Forest growth model can be used to estimate carbon stock changes in living and dead biomass, as well as in HWP.
- Values typical for the highest fertility classes can be used in calculation; however, the afforestation period depends from quality of soil preparation, planting material and early tending.
- The highest uncertainty of the impact of afforestation on GHG emissions is characteristic for the first 2 decades after afforestation.
- Tier 2 methods can be used to estimate impact on soil carbon stock change and GHG emissions.
- The net GHG reduction potential in case of 70 years long rotation is 1855 tonnes CO_2 eq ha^{-1} (26 tonnes CO_2 ha^{-1} yr^{-1}). The net GHG reduction potential in case of 40 years long rotation is 1218 tonnes CO_2 eq ha^{-1} (30 tonnes CO_2 ha^{-1} yr^{-1}).
- Actual GHG emission reduction potential may be about twice smaller because the GHG emissions from soil in cropland in grassland can be overestimated in TCM climate zone.

How LPIS systems can be utilized & improved

- LPIS of forest land and farmland can be used to improve accuracy of monitoring of implementation of the measure *(land use, management activities).*
- Information on soil type and water regime needs to be added to the NFI plots.
- Global forest watch – land use *(forest and non-forest land).*
- LiDAR & Copernicus – growth rate, water regime.
- *Pristine wetlands?*

Duration of impact

- Measure with long term impact; for conventional management systems for living and dead wood, litter and HWP it is - 71-91 years according to the age based rotation lengths, for intensified plantation forest scenario it is 40-50 years.
- Impact on soil depends from carbon stock in organic soil, respectively it depends from carbon stock in soil at steady state and difference in decomposition rate.

Quantitative implementation potential at a national level

- Two alternatives are evaluated - intensified and extensified coniferous forests. The area of organic soils considered in the calculation is 152 kha.
- Conventional management systems for spruce or pine would lead to increase of CO_2 removals and reduction of GHG emissions by **79 mill. tonnes CO_2** in all carbon pools during 20 years period.
- Intensified management and shortening of rotation would lead to **90 mill. tonnes CO_2** removals during 20 years period.
- *GHG emissions from soil in cropland and grassland may be overestimated now, therefore the emission reduction will be smaller.*
- *GHG emissions from soil in nutrient-rich organic soils in forest land can also be smaller than the estimated emission rates, which will also affect GHG emission reduction rate.*

Cost benefit ratio

- *Economic modelling assumptions still needs to be agreed.*
- Cost of GHG emission reduction considering 20 years calculation period and 5% discount rate in case of extensive management is **6 € tonne^{-1} CO_2**.
- Total investments in both cases in current prices are **264-282 mill. €** depending from selected scenario (1740-1860 € ha^{-1}).
- Cost of emission reduction might change depending from the actual emissions from soil in cropland, grassland and forest land.

Interferences with other sectors

- Additional increment and outputs of roundwood and forest biofuel will create input to energy sector and wood processing industry.
- Wood ash can be utilized in afforested organic soils. Afforestation of large areas of organic soils will affect farm production potential, however, the most of organic soils are extensively utilized.
- Reduction of N_2O emissions in agriculture sector, however, should be proposed carefully, because the most of these emissions are due to use of fertilizers and will be transferred elswere.

National policies

- No dedicated support for afforestation of organic soils; however it is **not forbidden** and organic soils can be afforested within the scope of Rural development program.

International implementation potential

- The measure can be implemented in all Nordic and Baltic countries with considerable area of organic soils in cropland and grassland.
- *Data on distribution of organic soils is limited for the most of the countries. Global forest watch and international soil maps can be used to acquire activity data within the scope of the project.*

Knowledge gaps

- GHG emissions in nutrient rich organic soils and transition period to reach steady stage after afforestation, as well as impact of wood ash application on GHG emissions.
- Modelling tools including evapotranspiration model are necessary to evaluae water regime.

Interlinkage between measures