Reclamation experience in Estonia: challenges and opportunities

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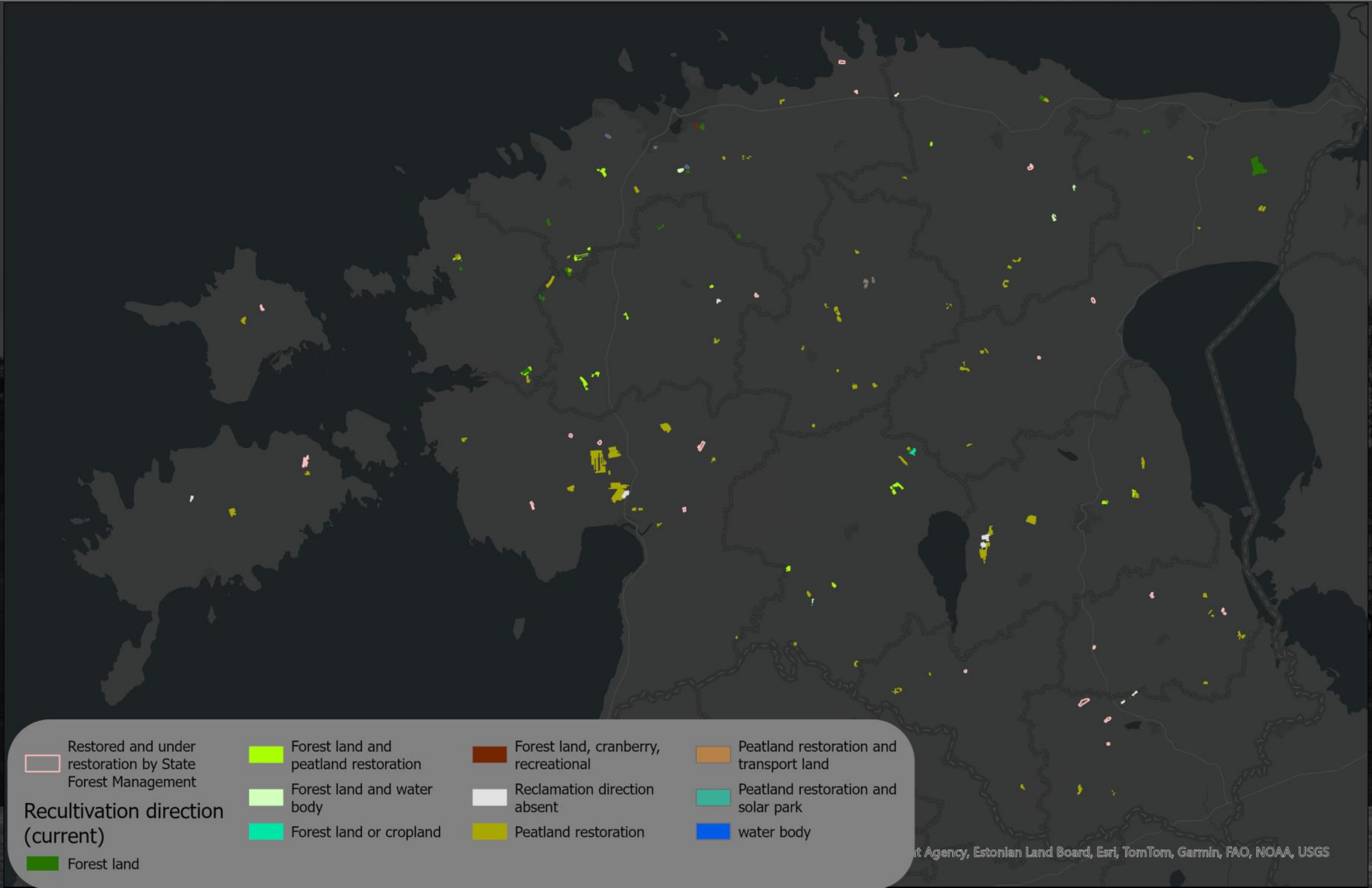
Peat production in Estonia

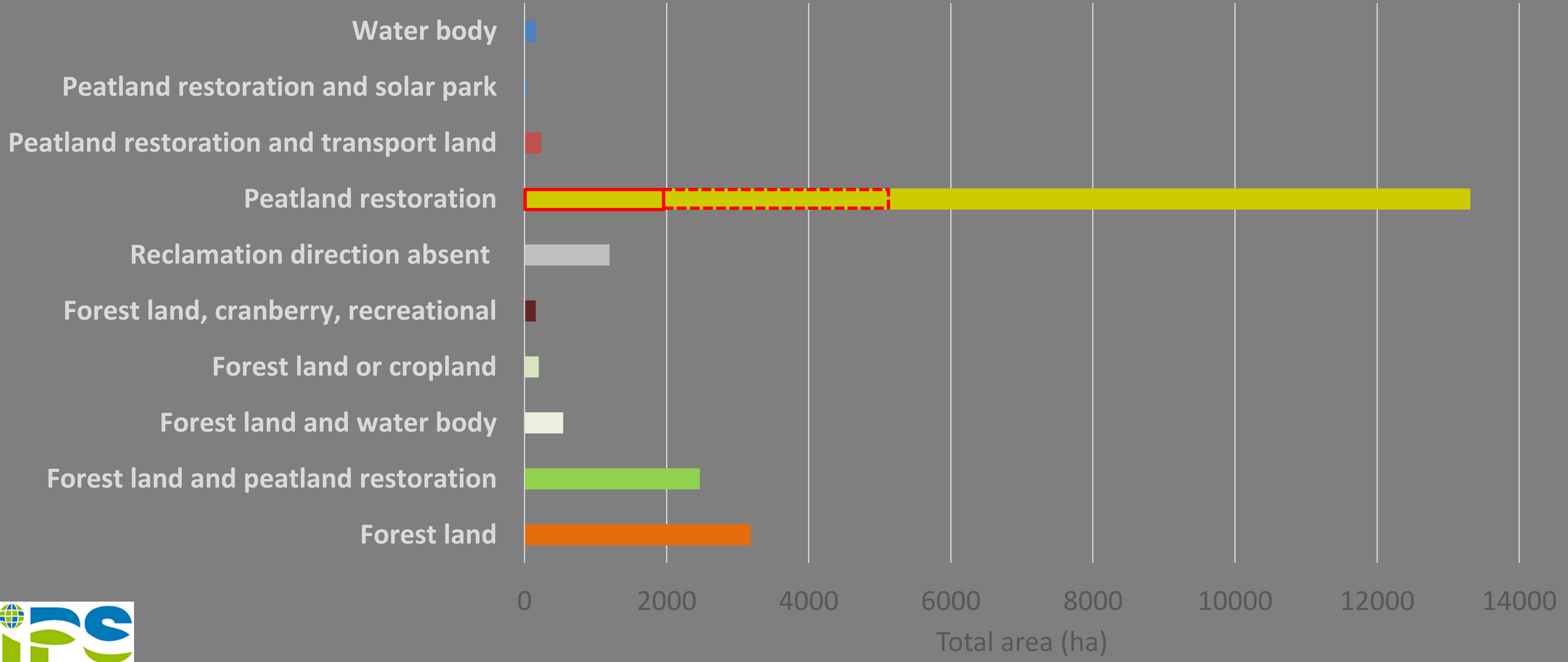
- Total 21 412 ha active production sites
- About 9 000 ha abandoned sites from Soviet and beginning of 1990s
  - From there over 2000 ha restored (rewetting and MLTT)
- Average production amount 2018 – 2022: 835 thousand tons annually
- Milled peat dominates
- Located mainly on state owned land
- Residual peat layer before after-use 20-50 cm (generally well decomposed)

Current after-use directions

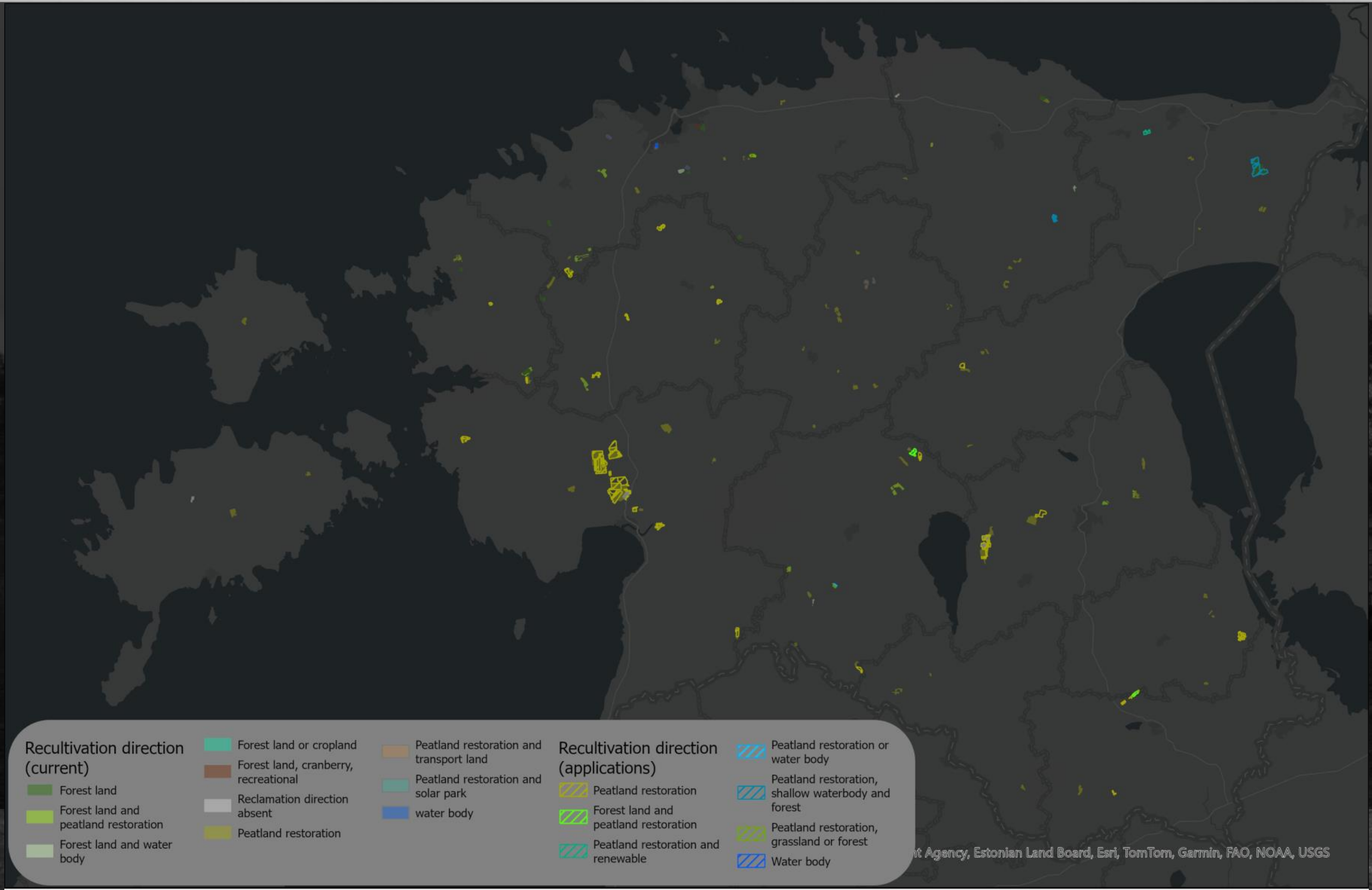


Based on Estonian Land Board data WFS, status of 29.08.2024

Current after-use directions



Applied after-use directions



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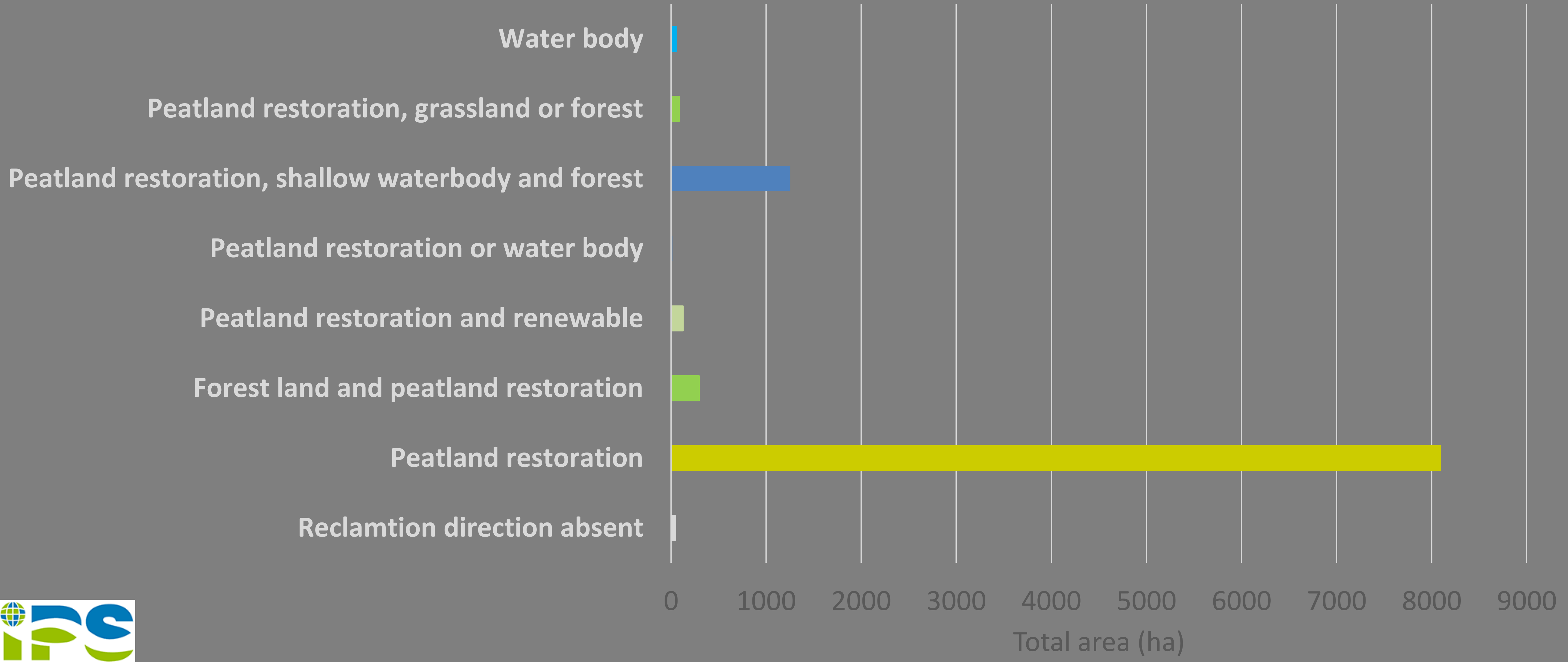
Applied after-use directions



„New“ after use

We have

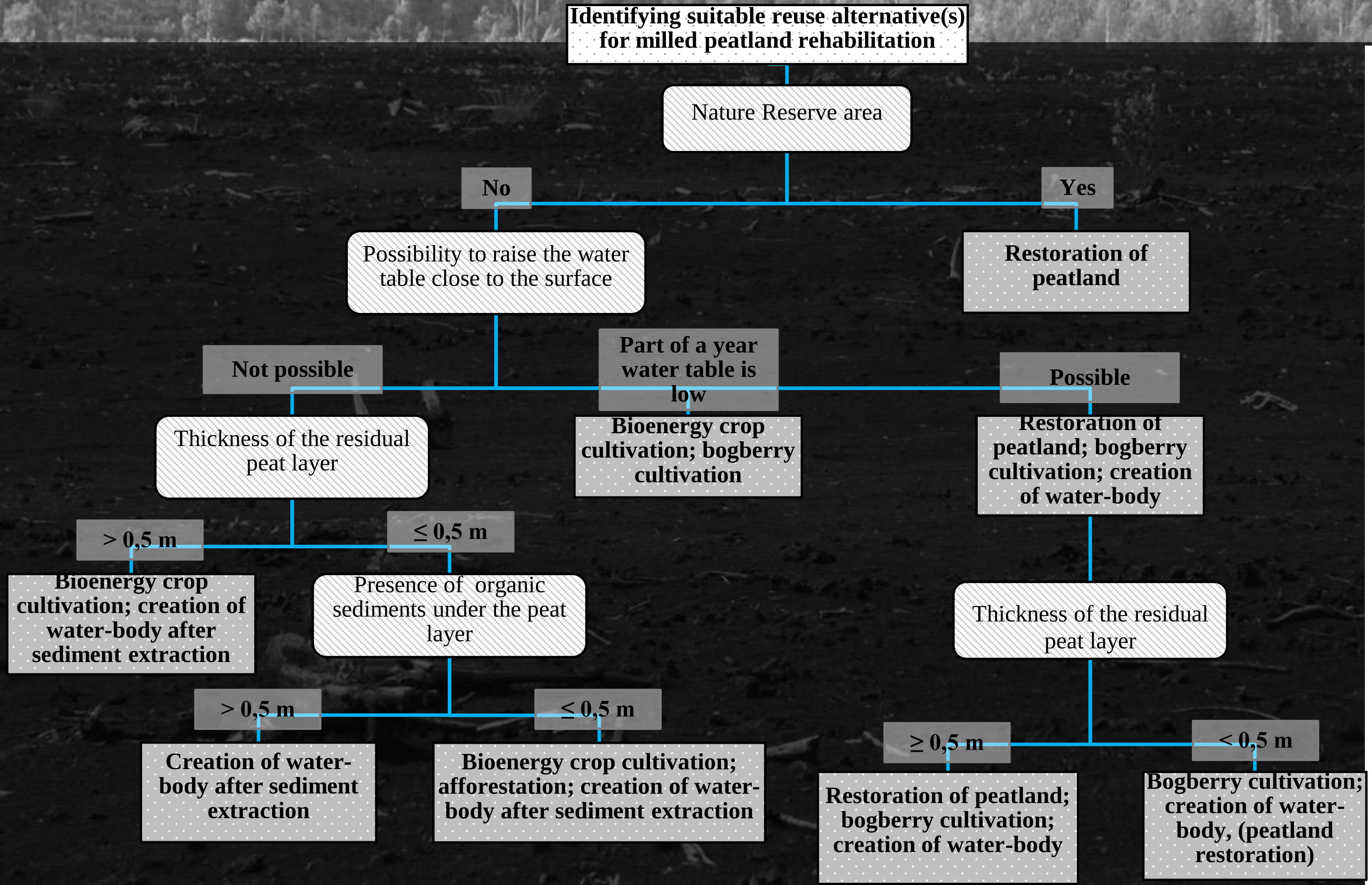
- Wet forest ecosystems (peatland forests on old sites)
- Renewable energy
  - Wind and/or solar

- We do not (yet) have:
  - *Sphagnum* farming
  - Paludiculture

Transitional mire forest (wet) in Elbu peat production site

Tootsi-Sopi solar and wind park (photo by Estonian Land Board)

How to choose?



		Comparison criteria	Percentage of respondents (%)
C1	Area-specific criteria	Nitrogen concentration in groundwater	33
C2		Phosphorus concentration in groundwater	30
C3		Suspended solids in groundwater	20
C4		Mineralization	46
C5	Ecosystem services	Biodiversity	78
C6		Gas regulation—balance of GHG	49
C7		Water buffering	65
C8		Fire resistance	46
C9		Food production	14
C10		Raw materials production	15
C11		Scientific value	38
C12		Recreational possibilities	46
C13	Social aspects	Compliance with local and county plans	46
C14		Possibility of employment	27
C15		Wishes of local people	65
C16		Wishes of landowner	63
C17	Economic aspects	Time required in order area has the visual aesthetic value	37
C18		Price of reuse alternative implementation	68
C19		The annual cost of maintenance	68

Padur, K., Ilomets, M., Põder, T. 2017. Identification of the Criteria for Decision Making of Cut-Away Peatland Reuse. *Environmental Management*.

Process

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Reclamation direction

- By applicant of the mining permit
- Can be changed with changing the permit
- Stakeholders engaged

Reclamation conditions

- By the Environmental Board
- By law takes up to 6 months
- Stakeholders engaged

Technical reclamation project

- Fieldwork/survey
- Technical engineering
- Approval by the Environmental Board and reviewed by competent engineer

Reclamation works

- Constructing reclamation infrastruture
- Acceptance of the reclamation works by the reclamation commission

„After“ works

- Monitoring
- Regulating water tables if needed, repairments
- Changing the extraction permit to „count out“ the reclaimed area

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Peatland reclamation in Estonia: current situation

- During **Soviet period** afforestation and berry cultivation, accidental rewetting and abandonment

- From the **beginning of 2000s** – Estonian Fund for Nature, State Forest Management, Tallinn and Tartu Universities
  - Experimental sites of moss-layer-transfer-technique (MLTT; Tässi, Viru, Ohtu, Seli)
  - Large-scale rewetting and MLTT

- **Since 2020s** – Estonian Peat Association target to **rewet/restore** 5000 ha of active extraction sites by 2030
  - 1990 ha in engineered (projects submitted for acceptance or work done)
  - About 4000 ha more currently „in progress“ (bureaucratic processes or engineering)


Hara peat field 10 years after rewetting


Viru experimental field (control vs MLTT; 10 years after)

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Restoration of one full site: Pihla

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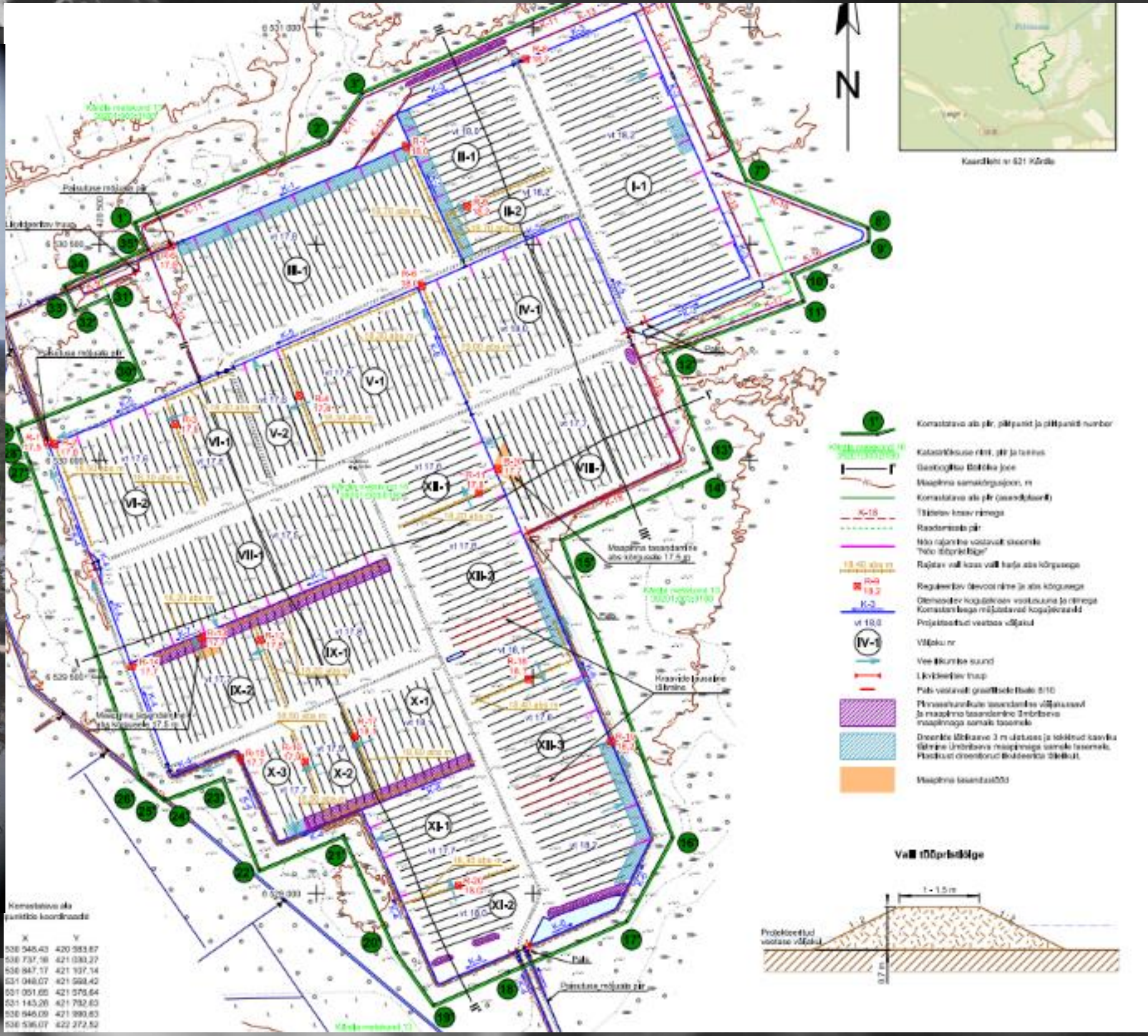
Pihla peat extraction site, after removal of drainage pipes



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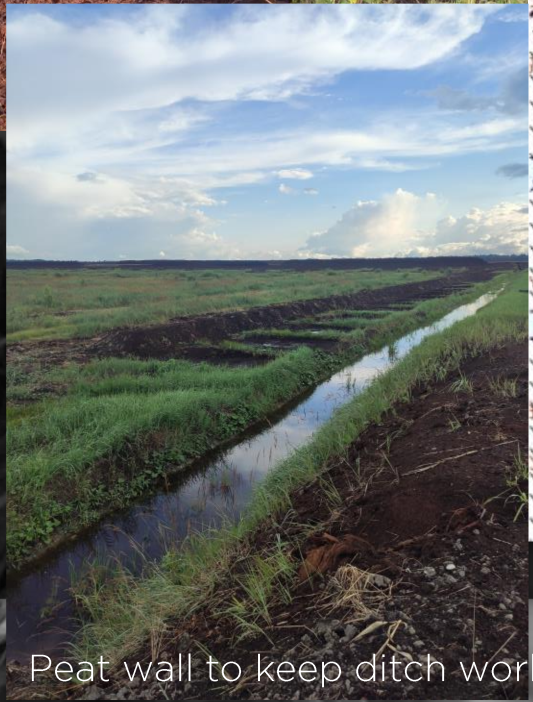
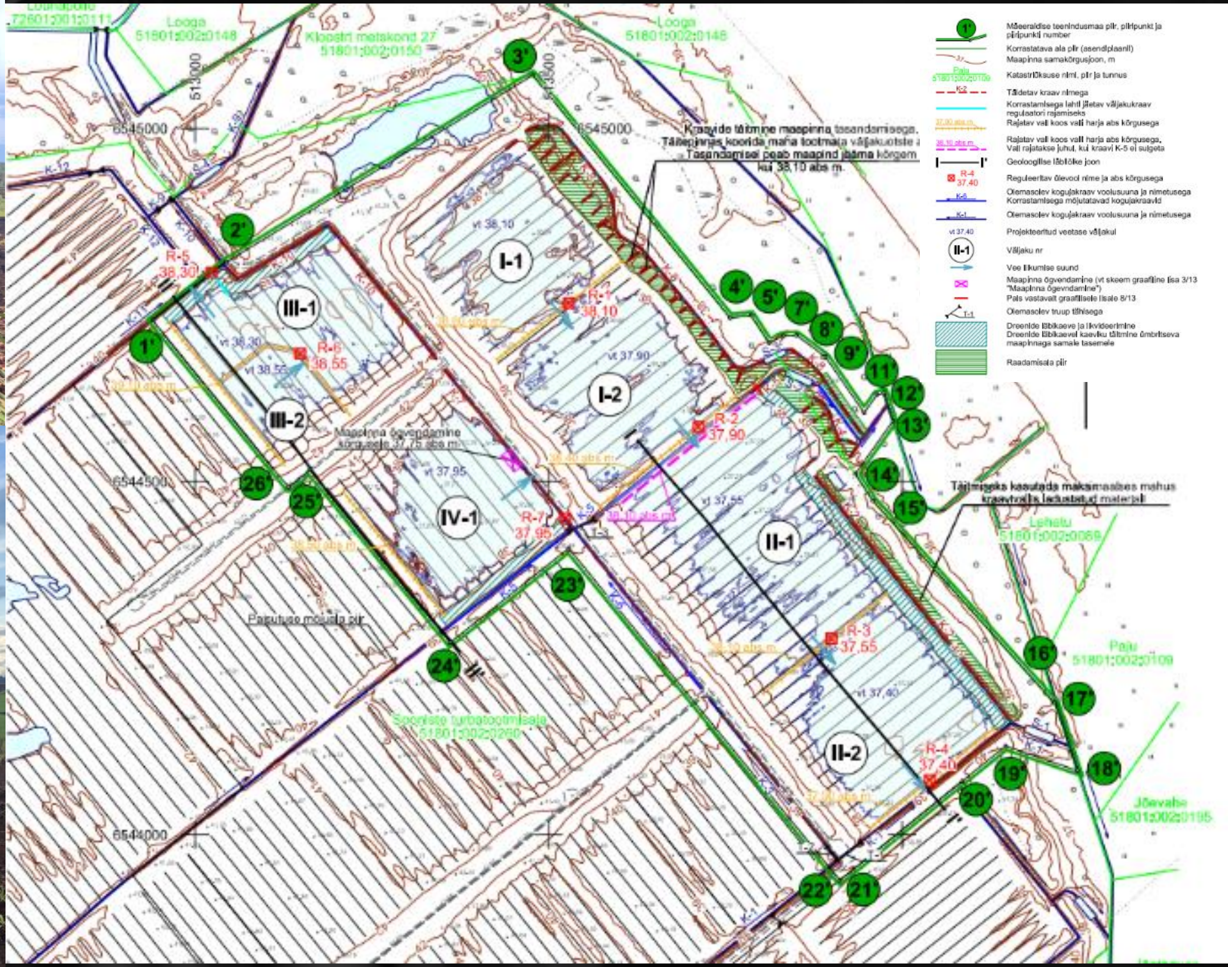
Step-wise restoration: Sooniste

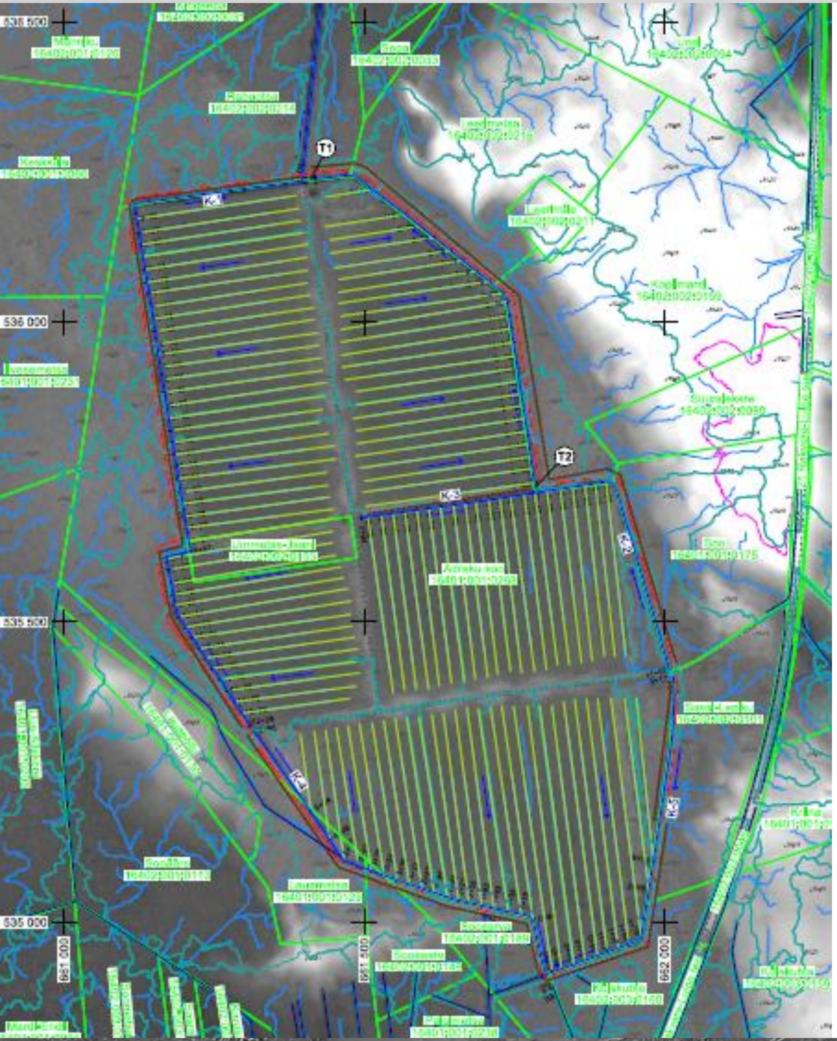

Complete closure of collector ditch

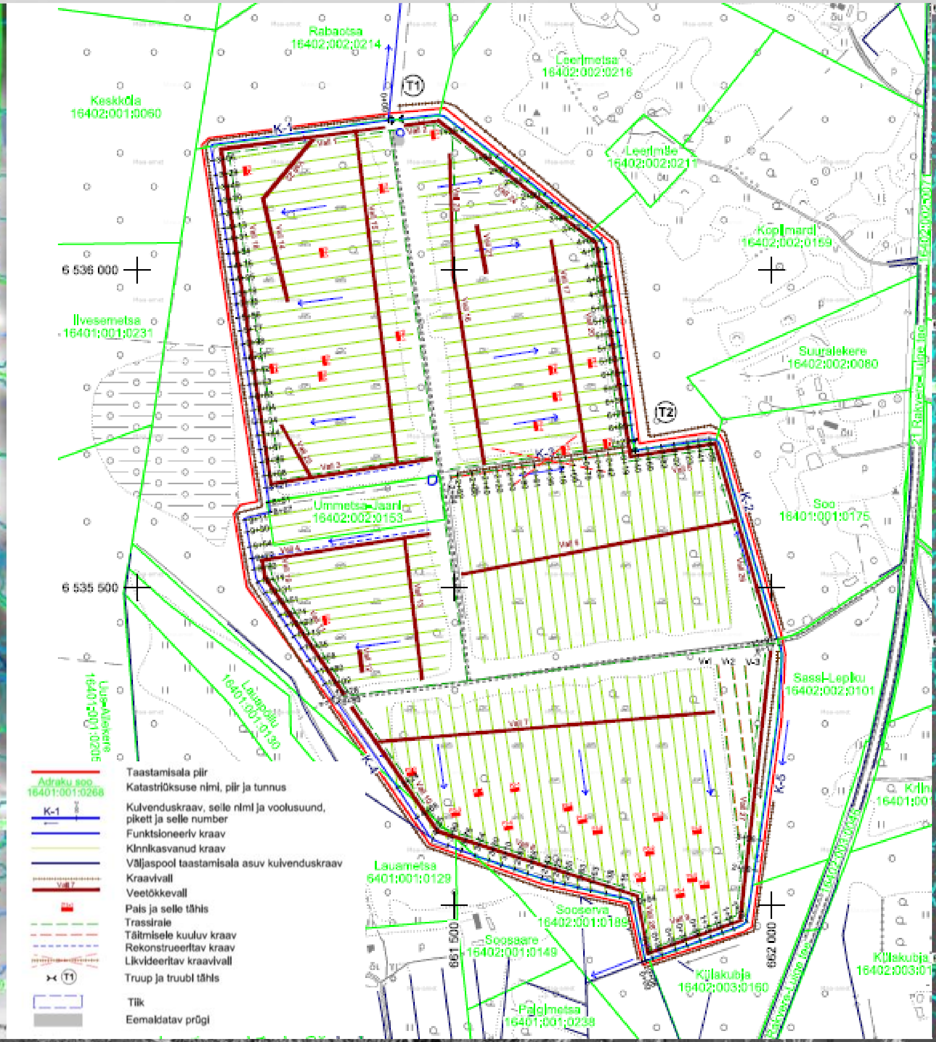

water level regulaator and peat wall

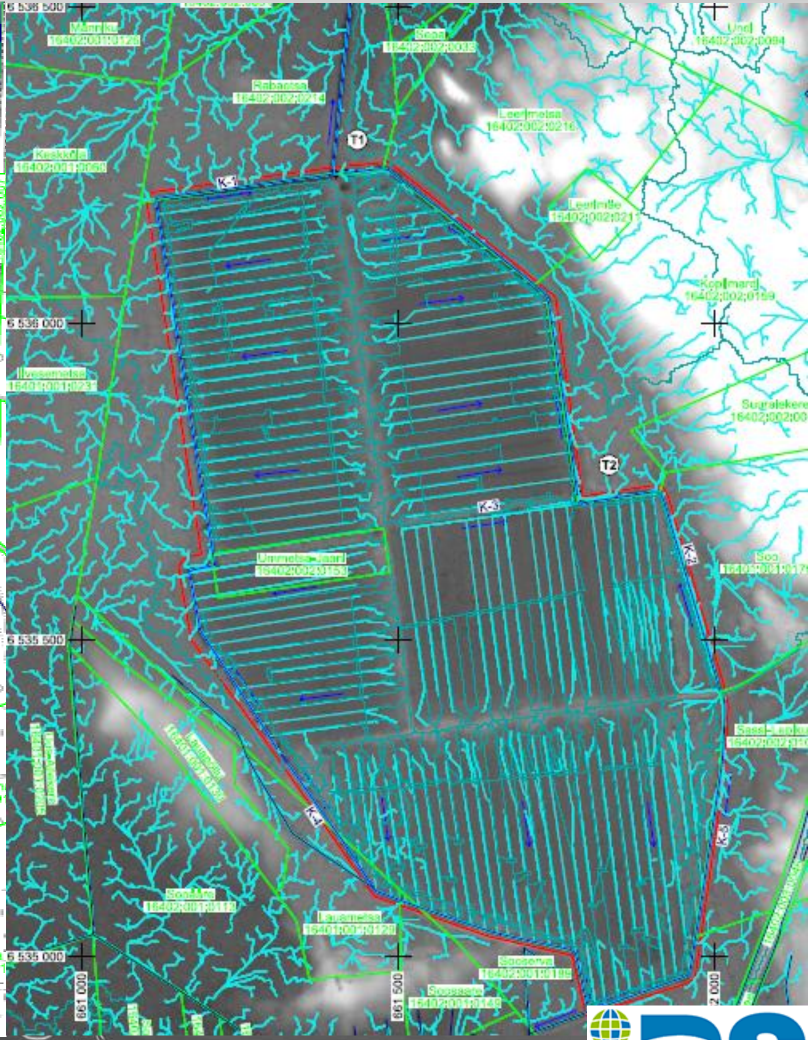

Peat wall to keep ditch working and but water on rewetted fields



Extreme cases of mitigation







Policies for organic soils and their management

- Nature Protection Development Plan (2012 – 2020?)
  - Peat production only on already drainage impacted areas
  - Sustainable use of peat and peatlands
  - Restoration of natural processes and landscapes
- Environmental Sector Development Plan 2030 (KEVAD): in preparation since 2021
  - Sustainable and extensive use of agricultural land on peat soils (including paludiculture, rewetting, extensive grasslands)
  - After the permit ends/exhaustion, all sites must be reclaimed
- Basics of Climate Policy until 2050 (accepted in 2017)
  - Climate neutrality by 2050 (added in 2023)
  - Carbon storage in peatlands is sustained or increased
  - No additional drainage impact, restoration and rewetting where possible
  - Existing sites will be exhausted and then peat mineralisation prevented (rewetted)

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GHG results from Estonian rewetted/restored

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t C or N ha^{-1} yr^{-1}	CO2-C	CH4-C	N2O-N	Viide
Active peat extraction	1,741	0,00012	0,00019	Salm jt 2012
Abandoned peat extraction	2,845 2,68	0,0700 0,00136	0,1800 0,00036	Salm jt 2012 Järveoja jt 2016
MLTT (2 years after)	1,10* 1,03**	0,00190* 0,00114**	0,000004* 0,000020**	Järveoja jt 2016
Rewetting (3 years after)	0,17**			Purre jt 2019
Rewetting (4 years after)	-0,5**			Purre jt 2019; Purre & Ilomets, 2021
MLTT (8 years after)	0,3**			Purre jt 2019
MLTT (9 years after)	-0,001*			Purre jt 2019
MLTT (10 years after)	0,3**			Purre jt 2019
MLTT (11 years after)	0,21**			Purre jt 2019
Rewetting (35 years after)	-0,25			Purre & Ilomets, 2021

Salm, J-O,, Maddison, M,, Tammik, S,, Soosaar, K,, Truu, J,, Mander, Ü, (2012) Emissions of CO_2, CH_4 and N_2O from undisturbed, drainedand mined peatlands in Estonia, *Hydrobiologia,*

Järveoja, J,, Peichl, M,, Maddison, M,, Soosaar, K,, Vellak, K,, Karofeld, E,, Teemusk, A,, Mander, Ü, (2016), Impact of water table level on annual carbon and greenhouse gas balances of a restored peat extraction area, *Biogeosciences*

Purre, A-H,, Pajula, R,, Ilomets, M, (2019): Carbon dioxide sink function in restored milled peatlands–The significance of weather and vegetation, *Geoderma*,

,

Purre, A, H,, Ilomets, M, (2021), Vegetation Composition and Carbon Dioxide Fluxes on Rewetted Milled Peatlands—Comparison with Undisturbed Bogs, *Wetlands*,

*-high WTL; **- Low WTL

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Currently large changes underway

- Possibility of „new“ sites limited (from 2024 July; temporal?)
- New „**Climate Resilient Economy Law**“ coming (consultation phase ends today).
    - For **peat sector** (compared to 2022 emission):
        - emission reduction by 2030: 12% ?
        - emission reduction by 2040: 50% ?
        - By 2050: climate neutrality ?
        - Principal changes to achieve these targets will be determined by 01.01.2026?
        - Decrease of emissions related to horticultural peat
        - Restoration of exhausted peatfields
        - Supporting peat value-chain within Estonia
    - For **agriculture**:
        - Paludiculture
        - On peat soils croplands to grasslands

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What the future brings?

- Stepwise exhaustion and restoration of extraction site
- Pressure to decrease GHG emissions from LULUCF
- Clear direction to peatland restoration
- Improvement of restoration techniques and approaches – optimisation of activities and results
- „New“ sites?
- Carbon credits? Currently not a topic (cannot avoid carbon leakages or provide additionality)

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Thank you!

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