JTP GROUNDWORK TA to the restoration of peatlands in Latvia: assessment framework

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Regional and Urban Policy

Purpose of the assessment framework

This framework is developed in the context of the JTP Groundwork as an initial analysis tool for restoration/repurposing of historical peatlands. The framework will be further developed by Riga Technical University. The framework utilises available data and research to illustrate possible examples and can be used:

- To illustrate the analytical process identifying options to restore/repurpose historically extracted peat sites
- To analyze these options, taking into consideration climate, ecosystem and socio-economic factors.
- To acquaint decision makers, landowners and experts with the assessment process for peatlands, the data, information and expertise needed.
- As an input for generarting projects with the potential to apply for the JTF.

Definitions

Restoration options: this term largely refers to restoring the water table (rewetting) and restoring the peat-formation of the peatland. Options labelled restoration are recommended as these comply with enviropmental and climate objectives.

Repurposing options: A non-rewetting option. These forms may have a negative impact on the climate and the environment. They are therefore not recommended but could be considered under certain circumstances.

A 5-step assessment approach

Step 1 – determine the site (locations, ownership, etc.)

Step 2 – assess the conditions of the peatland
→ Greenhouse gas (GHG) assessment
→ Degradation assessment

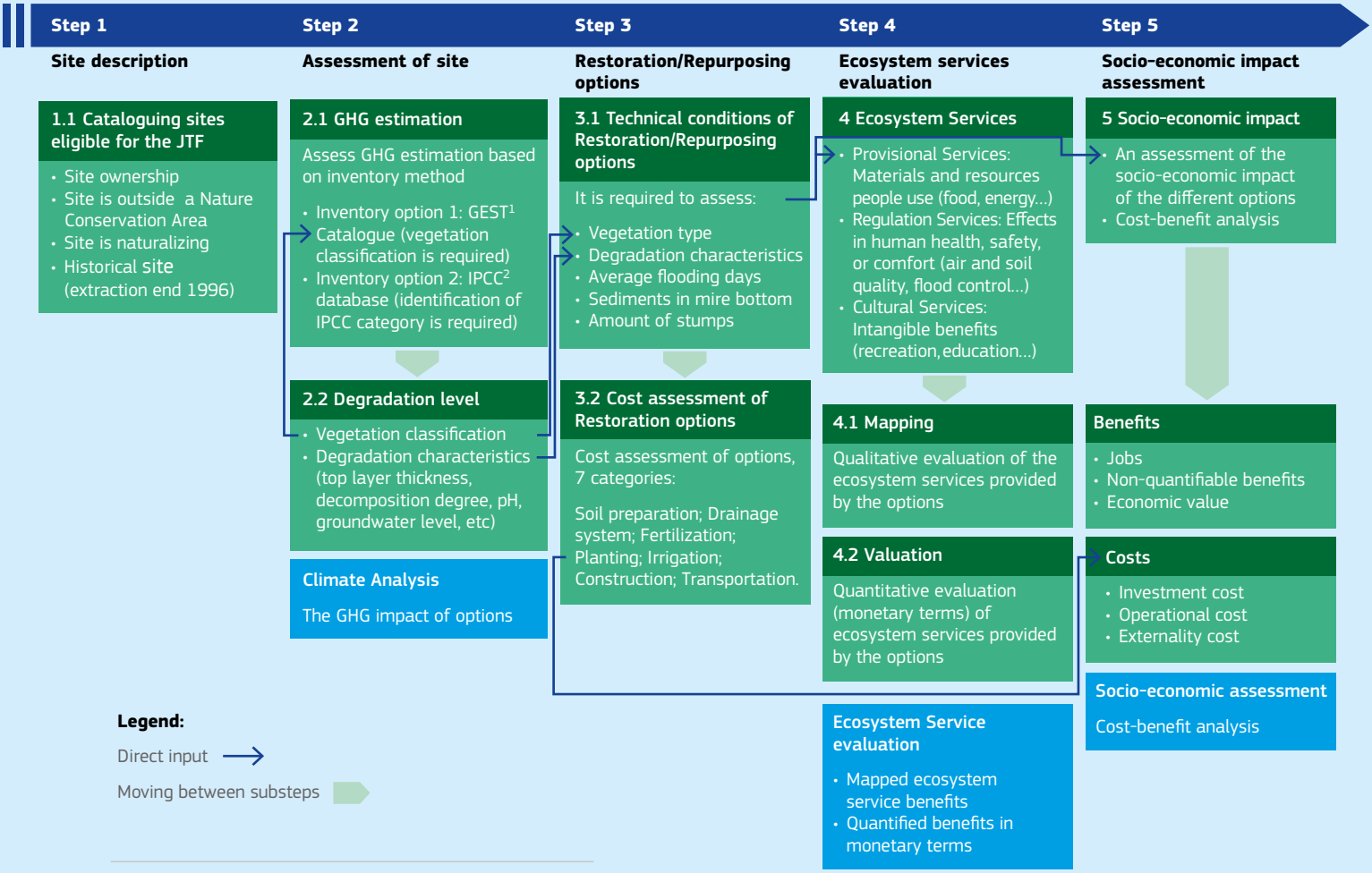
Step 3 – assessing restoration/repurposing options
→ 3.1 Technical conditions
→ 3.2 Costs

Step 4 – ecosystem evaluation
→ Valuation (monetary estimation)
→ Mapping (non-monetary assessment)

Step 5 – socio-economic impact analysis
→ Cost-benefit analysis (Economic and non-economic added value, associated costs, and job creation)

The five steps are described in more detail in the following sections.

Figure 1 – Steps in peatland evaluation



[1] Greeenhouse gas Emission Site Type
[2] The Intergovernemental Panel on Climate Change

Step 1 – Site description

Step 1 provides an overview of the necessary data to be collected in order to build an updated inventory of historical extraction sites.

This guide aims at providing a basis for stakeholders to apply for the Latvian JTF, and therefore provides specific details (e.g. if the site is 'historical') to determine whether stakeholder can/cannot apply for support.

The proposed data to be collected, can be adapted to support other purposes outside the JTF.

Table 1 – Site description

Criteria	Input	Comment
Historical site	Last year of extraction (1996)	This section will determine whether the site can be categorized as historical, and therefore subject to JTF funding. This means that the site does not fall under the "polluter pays" principle.
Site ownership	State/Municipal/Private	The identification of the land ownership will allow to get an overview of the possible restoration/repurposing strategy.
Nature Conservation Area	Is the site within a Nature Conservation Area?	For sites within a Nature Conservation Area only limited options are available.
Condition of the site	Is the site degraded or renaturalizing? What is the condition of renaturalization?	Sites with restored water table and peat-forming conditions may not need restoration work.
Location	Region, municipality	
Size (ha)	(Insert ha)	

Step 2 – Site assessment

This step identifies the information to be collected for the extracted sites. Assessing the site conditions is an important step for further analysis and provides the basis for understanding the conditions of a site and the current GHG emission level.

Two types of assessment are needed at this stage:
- the greenhouse gas (GHG) assessment – there are several methods for this assessment (step 2.1)
- the degradation level assessment (step 2.2)

Each of these assessments requires several inputs.

Step 2.1 – GHG assessment options

Suggested approach: GEST method and remote sensing

Requirements: The Greenhouse Gas Emission Site Types (GEST) Catalogue method entails the use of a predetermined emission factor, linked to vegetation type and water level and requires vegetation mapping and/or assessment of the annual water level of the site. This should be done by an experienced specialist. Remote sensing is used to identify the vegetation type, followed by the deduction of GESTs and associated emission factors from the remote sensing data.

While on-site mapping of vegetation and measurement of water level is a possible approach for single-site evaluation using the GEST approach, multiple and large sites can be assessed more efficiently using remote sensing (satellite imagery).

Note: GEST-systems are only regionally valid and must be calibrated and validated for 'new' regions.

This approach is suggested due to its ease of applicability.

Step 2.2 – Degradation assessment

An assessment of the degradation level of the site must be performed in order to understand the possible restoration/reuse options and the efforts related. The degradation level indicates the current conditions of the peatland.

→ **Degradation intensity:** Table 2 indicates the hydraulic and peat decomposition state of the site. The higher the degradation intensity, the more difficult it is to restore the site. The table is based on Ramsar 2021.
→ **Degradation characteristics:** Table 3 provides an overview of the different technical assessments to be performed on the degraded site. The assessment of these conditions will help determine what the possible course of action for that site are.

The conditions of a site determine what kind of restoration/repurposing options are possible for a site.

Notes:
- Some Latvian peatlands have already been assessed, and some may need to be reassessed.
- The list is not exhaustive (more characteristics can be added)
- Not all characteristics are relevant for every option.

Table 2 – Degradation intensity

Peatland degradation intensity							
Degradation intensity	Peatland components						Site characteristics
	Fauna/Flora	Vegetation	Hydrology	Peat hydraulics	Form and relief	Peat deposits	
Minimal	Moderately affected	Not affected	Not affected	Not affected	Not affected	Not affected	Populations of single peatland species or have been greatly reduced, or where the vegetation has been damaged or removed, but not completely eradicated; high chance for self-regeneration but may require some intervention to re-introduce species.
Minor	Moderately affected	Moderately affected	Not affected	Not affected	Not affected	Not affected	Similar to the previous one but at a higher intensity.
Modest	Moderately affected	Moderately affected	Moderately affected	Not affected	Not affected	Not affected	Recently been drained or otherwise hydrologically impaired, and hydraulic properties have not irreversibly changed, Restoration measures can be limited to making the drainage infrastructure ineffective.
Moderate	Strongly affected	Moderately affected	Moderately affected	Moderately affected	Not affected	Not affected	Moderate changes in peat hydraulics, while peatland hydrology and vegetation still allow for peat accumulation; change of mire type from percolation or acrotelm mire to surface flow mire.
Major	Strongly affected	Strongly affected	Strongly affected	Strongly affected	Moderately affected	Not affected	substantial changes in hydraulics have taken place, mostly under the influence of long-term drainage and a high degree of peat decomposition.
Most	Strongly affected	Strongly affected	Strongly affected	Strongly affected	Strongly affected	Moderately affected	Peat body has become completely out of hydrological balance (e.g., by peat extraction). Natural self-regulation or anthropogenic modification may restore the balance; no change will lead to progressive degradation.
Maximal	Strongly affected	Strongly affected	Strongly affected	Strongly affected	Strongly affected	Strongly affected	Peatland has virtually stopped being a peatland and restoration must start from scratch; may not be possible to restore within a human lifetime.

Source: Convention on Wetlands. (2021). Global guidelines for peatland rewetting and restoration. Ramsar Technical Report No 11. Gland, Switzerland: Secretariat of the Convention on Wetlands.

Table 3 – Degradation Characteristics

Peatland degradation characteristics
Thickness of the remaining top layer (m)
Type upper peat layer
Degree of degradation of the top peat layer (%)
pH of the top peat layer
Groundwater level (m)
Sediment in the mire bottom
Average flooding days

Source: Priede A., Cancone A. (eds.) 2019. Sustainable and responsible after-use og peat extraction areas. Baltijas krasti, Riga.

Step 3 – Assessment of restoration options

Detailed evaluation of the conditions

7 aspects to be evaluated for each option (as required)

- Each option **requires different conditions** of the site (note that some options are not relevant for very degraded sites).
- This part of the assessment should **help identify the possible option(s)** based on the technical conditions
- Depending on the condition of the site, some options will be better suited than others.
- Note that some restoration options may be predetermined for the JTF.

Assessing the costs of the options

7 different cost groups (types) have been identified:

- **cost ranges** have been established providing an indication of the costs
- **detailed cost estimates** will have to be made for each site

As each restoration option is different and will require **different measures and investments**

- the cost of draining, soil preparation, is not the same in the different options
- but will depend on needs both in terms of the condition of the site and the required option.

The cost for each option will thus be different.

Step 3.1 – Assessment of options

Each option is only viable if a set of conditions are in place at the site. Therefore, a first step is to assess whether the site fulfils the required conditions for the specific options:

1. are the required conditions in place, or
2. if it is possible to fulfil those conditions (such as change in soil pH or groundwater level to achieve the conditions for a specific restoration option).

Table 4 contains a total of eight technical aspects of the site (upper layer peat type, peat layer thickness, upper layer pH, etc) to take into consideration when assessing the possible restoration options and the conditions required for each option. Depending on the condition of the technical aspect, the site may or may not already comply with the required conditions for specific restoration options:

Five out of the eight technical aspects are based on the assessment of the degradation characteristics in step 2.2. The other three aspects are not directly related to human intervention in the peat site and refer to natural aspects of the site, such as the average days of flooding, the sediments in the bottom of the mire, and the amount of stumps in the area. These technical aspects are not directly influenced by the extraction activity on the site, and therefore are not classified as degradation characteristics.

The inputs required for the assessment of restoration options have already been catalogued for several sites by the LIFE project, as well as cost estimation for some of the restoration options. However, sites that have not been assessed yet will require expert assessment.

Table 4 – Site Conditions restoration/repurposing options

	Restoration	Restoration + land use				Repurposing			
	Renaturali-zation	Paludicul-tures	Estab-lishment of water bodies	Afforestation (wet soil)	Renewable energy	Croplands	Prennial sown grasslands	Blueberry	Cranberry
Technical aspects	**Conditions to when it is possible**								
Sediments in mire bottom	N/A	N/A	Water-proof	No data	No data	N/A	N/A	N/A	N/A
Upper peat layer type	N/A	N/A	N/A	No data	No data	Transitional, Low	Transitional, Low	High peat	High
Peat layer thickness (m)	>= 0.3	>=0.1	N/A	No data	No data	Transitional =<0.25, Low=<0.5	Transitional =<0.25, Low=<0.5	>=0.5	>=0.1
Upper layer pH	N/A	3-7	N/A	No data	No data	5-7	5.0-7.0	2.7-5.0	3.5-4.5
Decomposition degree	N/A	N/A	High	No data	No data	Moderate, High	Moderate, High	Low, Moderate	Low
Average groundwater level (m)	N/A	N/A	N/A	No data	No data	>=0.7	>=0.7	>=0.35	>=0.5
Average flooding days	<= 90	<=90	N/A	No data	No data	0	<=90	0	N/A

N/A: not applicable
No data: no data available from Latvian examples

Step 3.2 – Cost assessment

A second part of assessing the restoration options, is to estimate the costs of each of the relevant options. The costs are assessed taking into consideration characteristics of the siteand the restoration/reuse option as per Table 5.

Assessing the costs of the restoration options is a considerable task as a number of cost types and categories need to be included. Based on literature, 7 cost groups have been included. Under these cost categories are more detailed cost types.

Table 5 illustrates a number of possible cost categories: Soil preparation, upgrading of drainage system and irrigation systems, construction work, transport/access and planting.

Although general costs categories can be used (cost per HA) as illustrated in Table 5, full assessment of the cost will need to be done by experts in peat site restoration. An overview is provided indicating ranges of costs. It is important to remember that the cost included Table 5 primarily refer to the restoration costs (CAPEX). To this the maintenance costs will need to be added (OPEX).

Inspiration and guidance for costing can be taken from LIFE Restore which has calculated the costs of restoration for a number of sites and restoration options in Latvia. It is noted that these figures are possibly out of date and should be adjusted for inflation.

At the end of this step, it is now possible to determine which options are available and the costs.

Table 5 – Option cost assessment

	Restoration	Restoration + land use				Repurposing				
	Renaturali-zation	Paludicul-tures	Estab-lishment of water bodies	Afforesta-tion (wet soil)	Renewable energy	Afforesta-tion	Prennial sown grasslands	Blueberry	Cranberry	Croplands
Cost group	**Cost estimation (EUR)**									
Soil preparation (EUR/ha)	1,350-2,250	1,750-3,250	500-600	No data	No data	1,200-2,000	550-1,250	1,250-2,950	450-3,950	1,650-2,550
Drainage system (EUR/ ha)	400	400	N/A	No data	No data	500-2,500	500-2,500	500-2,500	500-2,500	500-2,500
Fertilization (EUR/ha)	N/A	550-700	N/A	No data	No data	550-700	550-700	250-390	250-390	N/A
Planting (EUR/ha)	750-1,250	250-650	N/A	No data	No data	558-1,200	100-150	10,620-55,620	8,000-15,000	136-10,956
Irrigation (EUR/ha)	N/A	N/A	N/A	No data	No data	N/A	N/A	5,000-6,000	5,000-6,000	N/A
Construction (EUR/ha)	50	N/A	4,000-6,000	No data	No data	N/A	N/A	N/A	N/A	50
Sum	2,850-4,250	2,950-5,000	4,500-6,600	No data	No data	2,808-6,400	1,700-4,600	17,620-67,460	14,200-27,840	2,336-16,056
Other [Dam construction (EUR/pcs)]	400-1,200	N/A	N/A			N/A	N/A	N/A	N/A	

Note: The numbers should be used as illustrative purposes only. The values comes form examples in different geographical areas and illustrate the heterogenity.
Source: Priede A., Gancone A. (eds.) 2019. Sustainable and responsible after-use of peat extraction areas. Baltijas krasti, Riga

Step 4 – Ecosystem services evaluation

The 4th step of the peat site assessment is to evaluate the ecosystem services for each option. Ecosystem services are defined as the direct and indirect benefits to human well-being provided by an ecosystem.

Peatlands ecosystems are considered to have several benefit-potential-services. Some of these are listed by the International Peatland Society (IPS), such as provision of food and water, regulation of climate, water and erosion protection, recreational, education and aesthetic benefits, and biodiversity, soil formation and nutrient cycling.

The assessment should provide an overview of the different benefits of a restoration option, and is thus an important input for deciding on a restoration/reuse option.

The literature refers to four groups of ecosystem services:

- **Provisioning services:** products obtained from ecosystems
- **Regulation services:** benefits obtained from the regulation of ecosystem processes
- **Cultural services:** intangible benefits from ecosystem (recreation and education).
- **Supporting services:** services allowing for the other ecosystem services to be present

The ecosystem service assessment can be used as a baseline to understand the possibilities in relation to a restoration/reuse option, and whenever possible complemented/revised by an expert assessment for a particular site.

The ecosystem service evaluation estimates the economic value provided by ecosystems (to human well-being).

The four groups of services include the following categories

- **Provisional:** harvest, drinking water, timber, oils
- **Regulatory:** water and air purification, erosion and flood control, carbon storage and climate regulation
- **Cultural:** art, architecture, and recreation
- **Supporting:** nutrient cycling, soil formation, habitat provision

The services can be assessed in

- a qualitative manner (mapping exercise)
- monetary terms (valuation)

A **specialist** must conduct the assessment of the different options.

Table 6 – Ecosystem services table (illustrative options)

	Renaturalization	Paludiculture	Cranberry plantation
Provisional services			
Harvest	x	✓	✓
Wild produces	✓	✓	x
Biomass	x	✓	x
...	...	...	...
Regulatory services			
Climate mitigation	✓	✓	–
Erosion prevention	✓	✓	✓
Biodiversity	✓	x	x
...	...	...	...
Cultural services			
Recreation and tourism	✓	x	x
Education	✓	✓	✓
...	...	...	...

Note: For a more complete list of ecosystem services provided by peatlands, see Ramsar 2021
Sources: Ramsar (2021) Global guidelines for peatland rewetting and restoration; Rouquette, Jim (2014) Sustainable management of peatlands: An ecosystem services assessment ; LIFE Restore (2019) Sustainable and responsible after-use of peat exctraction areas

Step 5 – Socio-economic analysis

The final step for the assessment of restoration, is to assess the socio-economic impact of an option. A cost-benefit analysis aims to assess the net impact of each restoration option.

The socio-economic analysis includes:
- Costs (Direct financial costs + costs associated to externalities)
- Benefits (Direct financial revenue [provisional services] + benefits associated to positive externalities [provisional, regulatory, cultural and supporting services])
- Other benefits: these are benefits outside of the monetary calculation (job creation and non-quantifiable ecosystem services)

Note that this cost-benefit model includes a monetary and non-monetary aspect to be taken into consideration.

Table 7 – Cost-Benefit analysis (selected options)

		Restoration	Restoration + land use		Repurposing	
		Renaturalization	Establishment of water bodies	Paludicultures	Blueberry	Cranberry
Benefits	Turnover (financial revenue)	0	0	732	20,400	8,600
	Economic value generation (monetary value creation)	4,800	2,800	4,000	960	1,200
Costs	Investment costs	75	110	70	450	430
	Operational costs	0	0	60	10,200	5,000
	Maintenance costs	0	0	700	1,500	510
	Other costs (externalities impact assessment)	-	-	-	-	-
Monetary analysis	Balance	4,725	2,690	3,900	9,210	3,800
Non-monetary analysis	Job creation	-	-	-	-	-
	Non-monetary ecosystem benefit (mapping)	Step 4	Step 4	Step 4	Step 4	Step 4

Note: The numbers above are based on calculations developed by the LIFE model and should be used as illustrative purposes only

Summary of the assessment process