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GRETA - “GReen infrastructure: Enhancing biodiversity and ecosysTem services for territoriAl development”

Applied Research

Estonia- Latvia Cross Border Area

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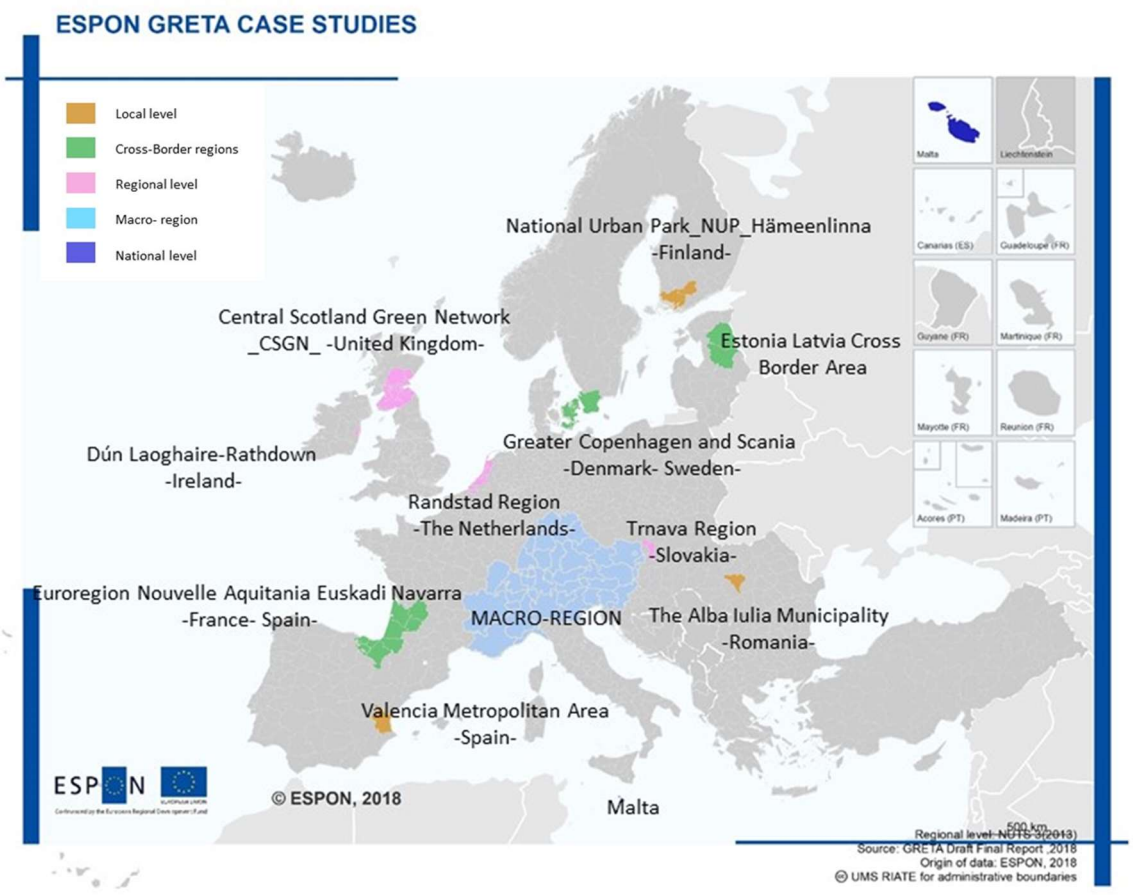
Abbreviations

EC	European Commission
EEZ	Exclusive Economic Zone
ES	Ecosystem Services
ESPON	European Territorial Observatory Network
EU	European Union
GI	Green Infrastructure
MSP	Maritime Spatial Plan
NUTS	Nomenclature of Territorial Units for Statistics
SAC	Special Areas of Conservation
SPA	Special Protection Areas

1 Introduction

GRETA investigated 12 case studies that represented different spatial, institutional and governance settings and that ranged from urban centres to rural countryside. The case studies served to:

i. gain knowledge on implementation factors, drivers and constraints in different planning systems and territorial realities;
ii. gain insights on the use and applicability of economic methods in decision making; and
iii. gather knowledge for policy and practice as input and inspiration for the policy recommendations.



Map 1. ESPON GRETA selected case studies

Method

The activities undertaken at the case study level incorporated a combination of desk-based analysis alongside online questionnaires and pre-structured interviews to key actors in each of the case study areas, including: (i) decision and policy making representatives; and (ii) those involved in designing, planning, implementing and managing green infrastructure (GI).

A series of three consultations were developed to gather relevant information from case studies on different aspects of GI spatial analysis, policies, planning and implementation. The consultation process was seen as a combined approach of an online survey and or a telephone interview (which used the survey questions as the basis) with stakeholders to facilitate getting good engagement and to address any clarifications needed.

Consultation A – Economic Valuation

The questionnaire included 20 questions structured in 2 main parts. The first part aimed at understanding the current use and awareness of valuation methods by respondents while the second part aimed at identifying their perceived barriers and interest of using such methods. We used a mix of open-ended and closed-ended questions to combine comparable results as well as qualitative material; respondents also had the possibility to comment on their responses. Analysis of Consultation A is described in Annex III-C.

Access to Consultation A

https://survey.tecnalia.com/limesurvey/index.php/214247?lang=en

Consultation B – Characterising green infrastructure and ecosystem services characterisation

The objective of this consultation was to identify good practice guidelines, opportunities and challenges that could be useful for a variety of regions and cities. Responses to Consultation B were used to assess the usefulness of the GRETA methodology, a methodology specifically developed to delineate and map the main green infrastructure (GI) elements and their multifunctionality, as well as identifying their capacity to support three main policy domains: Biodiversity, Climate Change and Disaster Risk Reduction, and Water Management. Questions in Consultation B were designed to help us gain further insight into the enabling factors that exist in different regions and cities. We also sought to gather information on the challenges and barriers that may compromise the implementation of GI. The final set of questions focused on identifying the general benefits and potential synergies and trade-offs associated with GI projects.

The maps produced for Consultation B in the GRETA project were intended to provide a starting point for discussion about the applicability of the GRETA methodology from European to local application. As such they did not aim to be a substitute for the maps or other planning material that already exist at local case study level nor were they aiming to characterize the GI on regional or local level. They were not developed to be used as an output from case study levels.

The landscape elements in the maps are produced based on standardized European data sets with a minimum mapping unit of 25ha (i.e. CORINE Land Cover 2012) – smaller geographical features are not depicted. The Consultation B aimed at finding the gaps between datasets produced at the European level and any other data sets produced at regional and local scales.

Access to Consultation B

https://survey.tecnalia.com/limesurvey/index.php/614564?lang=en

Consultation C - Analysis of governance, policy and financial frameworks

The successful implementation of green infrastructure (GI) projects requires a combination of governance structures, integrated policies and financial support. This consultation therefore aimed to investigate the governance systems in place in each case study area in order to determine how policies and policy makers enable the implementation of GI projects in the case study areas.

Responses to Consultation C aimed to help us identify: (i) how much funding (money and personnel) is currently used for GI in the case study regions; (ii) if this funding is sufficient for implementing and maintaining GI; and (iii) the main sources of funding (public tax-based funds, private investments, NGOs or others). Consultation C also examined whether policies compliment or conflict with GI and assesses policy makers' knowledge needs for making full use of GI development potential.

Access to Consultation C

https://survey.tecnalia.com/limesurvey/index.php/129674?lang=en

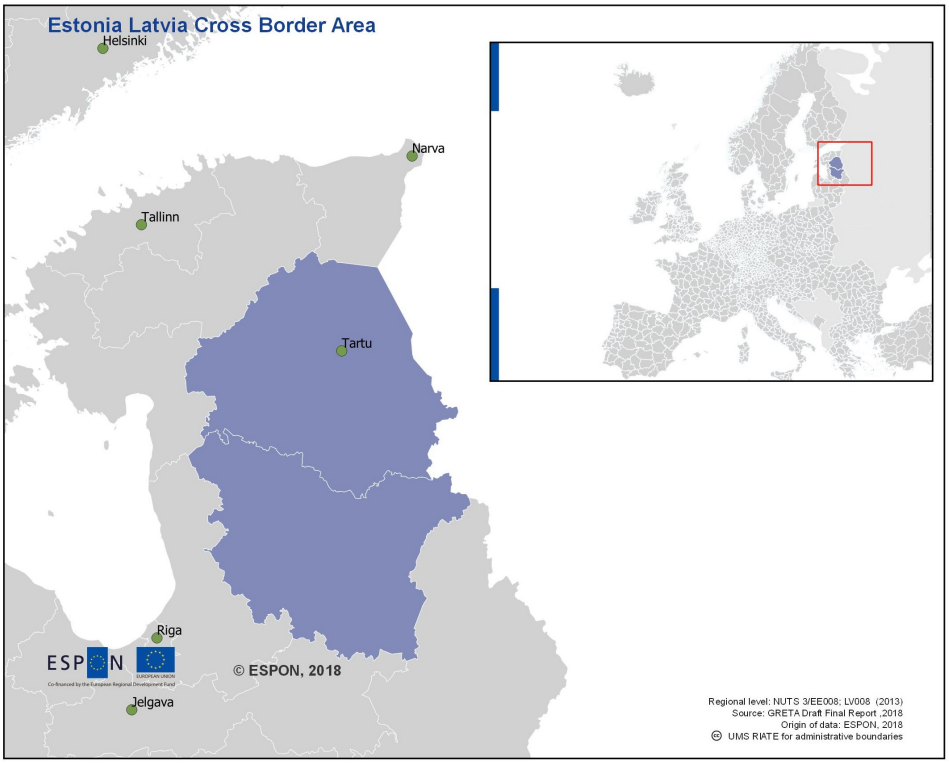
The content in this report is based on a mixed-method approach. The results presented are interpretations of semi-structured interviews, responses to a questionnaire on national policy and planning, responses to three consultations (Consultation A, B and C) via email, document analysis of plans and strategies (via desk-based analysis), and statistics.and spatial analysis using GIS resulting from the GRETA project. For all case studies, telephone conversations (and for some cases face-to-face meetings i.e. Copenhagen and Scania, Alpine region, Euroregion Aquitania- Euskadi-Navarra) allowed the completion of the consultations B and C.

The respondents who have contributed to this case study are people working in the public administration and academia in the states of Estonia and Latvia.

2 (Geographic) description of the Estonia- Latvia Cross-border Area

2.1 Case study outline

The present report provides an overview of the Green Infrastructure (GI) development and implementation in the cross border area of South Estonia (NUTS3 E008 Lõuna-Eesti) and North Latvia. Level (NUTS3 LV008 Vidzeme).This cross border area has 31.943 km^{2,} Lõuna-Eesti 16.698 km^2 in the Estonian side and Vidzeme 15.245 km^2 in the Latvian side.



Map 2 Estonia Latvia Cross Border Area

The population living in the case study area is 508.663 inhabitants: Lõuna-Eesti 316.869 inhabitants (2016) Vidzeme191.794 inhabitants (2017). The population density varies from 19 inh/km^2 in Lõuna-Eesti to 12.5 inh/km^{2}in Vidzeme[1]

[1] Eurostat http://ec.europa.eu/eurostat/data/database
Estonia: https://www.stat.ee/en
https://geoportaal.maaamet.ee/eng/
Latvia: http://www.csb.gov.lv/en
https://tradingeconomics.com/latvia/

Some socio-economic data below:

Employment	**Estonia** Total unemployment rate 5.3% (2018) Long term unemployment 2% (2018) Youth unemployment (15-24) 6.5 % (2018)[2] **Latvia** Total unemployment rate 8.1% (2018) Long term unemployment 3.40% (2018) Youth unemployment (15-24) 17.90 % (2018)[3]
GDP	GDP per capita Estonia 17 463.4 eur/person (2016) GDP per capita Latvia 14.118,06 eur/person (2016)
Life expectancy and perceived health	Life expectancy in Estonia (2015) Females 71,7 Males 65,5 Life expectancy in Latvia (2015) Females 68,5 Males 62,9 % of perceived health in Estonia 2016 Very good or good 52,9 Fair 32,7 Bad or very bad 14,4 % of perceived health in Latvia 2016 Very good or good 47,2 Fair 37,2 Bad or very bad 15,6

2.2 Territorial challenges

Estonia was the first country in Europe to develop the ecological network concept and to incoporate an evaluation model into a comprehensive plan and implementation programme. In 1983, this proposal was finalised as a plan to establish a national "Network of Ecologically Compensating Areas" (National Sustainable Development Plan, 2030+). Paralel activities were undertaken also in Latvia which ended up with the development of Ecological Network for Latvia.

Estonia is characterised by a high level of biodiversity, and the European Commission (EC) considers that, one of Estonia's greatest achievements is the fact that over 50% of its habitats and species assessments are reported as favourable. The EC regards the funding of Estonian Natura 2000 sites from different EU funds as especially successful which consitutes a good practice that other member states should learn from (European Commission, 2017)[4].

However, Estonia still faces important pressures on biodiversity by the unsustainable forest management and forest drainage. The strong economic significance of the forestry sector and

[2] https://www.stat.ee/stat-unemployment-rate
[3] https://tradingeconomics.com/latvia/unemployment-rate

[4] https://biodiversity.europa.eu/countries/gi/Estonia

its related policy in Estonia constitues a counter productive aspect that limits the GI development and implementation.

Overfishing, shipping and, more recently, activities connected with energy (e.g., electric cables, wind farms and gas pipes) are the main threats to coastal/marine ecosystems. Coastal ecosystems are also still influenced by housing developments and the resulting reduction of the natural buffer zone.

Latvia has also relatively high density of natural areas as compared to other EU countries. 11.53% of the national land area of Latvia is covered by Natura 2000 (EU average 18.1%), with Birds Directive SPAs covering 10.23% (EU average 12.3%). The protected nature territories in Latvia are grouped in eight categories: four national parks, one biosphere reserve, 42 nature parks, nine protected landscape areas, 261 nature reserves, four strict nature reserves, seven protected sea territories. It has been planned to create new microreserves in eight bird species colony sites. In Latvia, 333 territories occupying more than 7.9 thousand km2 or 12 % of the total land area are listed in the European Union network of protected areas Natura 2000: four strict nature reserves, four national parks, 239 nature reserves, 37 nature parks, nine protected landscape areas, seven protected sea territories, and 24 micro-reserves.[5] Latvia has designated 332 Special Areas of Conservation (SACs) covering an area of 12241,37 km2, from which 7877.3 km2 correspond to the terrestrial part of the country's share of the Natura 2000 network, and 4364.07 km2 to marine sites. Regarding Special Protection Areas (SPAs) for birds designated under the Birds Directive, Latvia has designated 102 sites covering 6609.6 km2, from which 6183.9 correspond to terrestrial sites (97) and 425.7 km2 to marine sites (European Commission, 2017)[6].

The Forest Policy in Latvia, already recognized the multiple functions of forests and prevention of the fragmentation and ecological degradation are principles in such policy. Nevertheless, data demonstrate that there is a decreasing in the connectivity between habitats which represent the main challenge in Latvia.

Joint efforts to boost connectivity of ecological network and green areas in the cross border area between Estonia and Latvia, are already happening since 2002(IUCN, 2002)[7]

[5]https://www.csb.gov.lv/en/statistics/statistics-by-theme/economy/gdp/search-in-theme/119-latvia-statistics-brief-2017

[6] https://biodiversity.europa.eu/countries/gi/latvia

[7] IUCN European Programme. Development of National ecological Networks in the Baltic Countries in the Framework of Pan-European Ecological Network. Warsaw August 2002. https://portals.iucn.org/library/efiles/documents/eep-032.pdfAs

3 The GI network and its potentialities for territorial development in the Estonia-Latvia cross border

3.1 What is the approach to GI and Ecosystem Services

Approach to GI and ES in Estonia

As already highilgthed Estonia was the first country to develop the ecological network concept in 1983. The approach to GI is very much aligned to the one by the EC, 2013 and stresses the importance of ecological connectivity. The concept is very much related to the concept of Landscape as stablishedd by the European Landscape Convention (ELC, 2004)[8] being an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors.

Provision of ES by GI in Estonia have been identified by the consulted stakeholders as follows:

Main services provided by your current and/or planned Green Infrastructure. Please select multiple options	Main current and/or anticipated threats for both Green Infrastructure development and maintenance. Please select multiple options if needed.	Main current and/or anticipated opportunities for Green Infrastructure development. Please select multiple options if needed.
x Biodiversity protection x Maintenance of ecosystem services x Cultural ☐ Economical ☐ Wellbeing and health ☐ Others:	x Infrastructures (i.e transport, energy) x Economic development x Territorial planning x Absence of community x Financial limitations x Others – simplified landscape greening/planning + Forestry + agening of green infrastructure	☐ Economic investment x Territorial planning x Local community x Agriculture, sustainable forest management, organic farming x Others: heritage support
Spatial data requirements (GIS data)		
x Ecosystem services x Land cover/land use data ☐ Green urban areas inventories x Protected areas/nature parks/areas of special ecological value	Topomaps Historic maps Biodiversity databases Soil maps	

Approach to GI and ES in Latvia

In Latvia there is not one single overarching national policy or strategy for GI but the GI principles are included in several sector policies. On national level, Latvia's National Development Plan 2014-2020 and the Sustainable Development Strategy of Latvia 2030 have relations to GI-principles. They both include the objective of restoring and increasing of natural capital which includes sustainable management of the natural resources, protection of the diversity of the Latvian nature and enhancements of ecosystem services. Some GI-related objectives like increasing of forest coverage and amelioration of the agricultural land are also incorporated as measurable outcomes for the goals of the plans (BISE, 2018, Saeima of Latvia,

[8] https://www.coe.int/en/web/landscape

2012; Saeima of Latvia, 2010). The Ministry of the Environmental Protection and Regional Development is the main body on national level responsible for implementing policy for environment protection.

Latvia has carried out a Mapping and Assessment of Ecosystems and their Services (MAES) for its marine waters, internal marine waters, territorial waters and Exclusive Economic Zone (EEZ). It was performed in 2016 as one of the steps for implementation of the ecosystem based approach within development of the national Maritime Spatial Plan (MSP) (MAES, 2018).

The ES provided by the GI network have been identified by the consulted stakeholders as follows:

Main services provided by your current and/or planned Green Infrastructure. Please select multiple options	Main current and/or anticipated threats for both Green Infrastructure development and maintenance. Please select multiple options if needed.	Main current and/or anticipated opportunities for Green Infrastructure development. Please select multiple options if needed.
X Biodiversity protection X Maintenance of ecosystem services X Cultural X Economical X Wellbeing and health ☐ Others:	☐ Infrastructures (i.e. transport, energy) X Economic development (i.e. *Forestry*) ☐ Territorial planning X Absence of community X Financial limitations ☐ Others	X Economic investment ☐ Territorial planning X Local community X Agriculture, sustainable forest management, organic farming X Others
Spatial data requirements (GIS data)		
☐ Ecosystem services X Land cover/land use data ☐ Green urban areas inventories X Protected areas/nature parks/areas of special ecological value		

Particularly in the Cross Border area

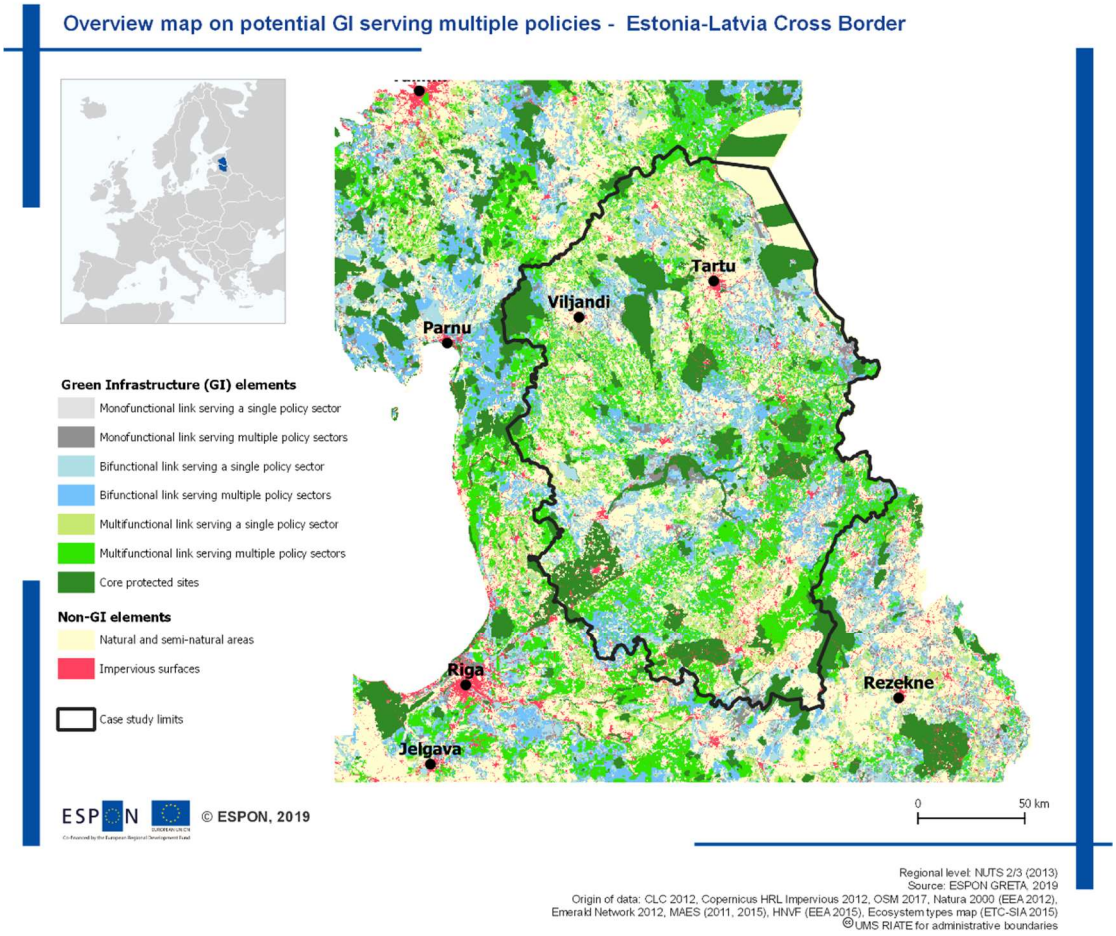
The GI concept in the cross border area of south Estonia-Latvia, relates, according to the consulted stakeholders, to an interconnected network of wetlands, woodlands, waterways and their respective wildlife habitats that is embedded in:

a) a separately protected area along the Latvian and Estonian border, which includes nature reserves and biosphere reserves and are

b) consequently united in a transboundary protected area officially acknowledged as the fifth transboundary RAMSAR site in the world.

3.2 Benefits of GI and ecosystem services for smart, sustainable and inclusive territorial development;

This section describes the potential GI network as delineated by GRETA, analyses the identified synergies and trade-offs between the ES provided by the GI network and its potential for serving several policy objectives, and provides a relative analysis of the region with the general EU patterns.



Map 3. Estonia Latvia Cross Border area GRETA case study. Overview map on potential GI serving multiple policies.

Table 1. Potentialities for GI network in Estonia Latvia cross border are

Questions related to maps	Description of phenomena in the case study	Implication for management
Extent of GI	Potential GI covers about 70% of the region with a highly homogenous distribution, i.e. spreading along spatially contiguous patches covering large	Most of the Estonia Latvia cross border area is well covered by GI, serving large part of the territory and probably giving balanced access to most of the population.

	areas. Moreover, there is a good connectivity on the border between the two countries.	
Integration of protected areas	The region shows a high level of connection of hubs (protected areas). Protected areas represent almost half of the total GI.	Potential GI is well structured in the sense that it ensures connectivity of protected areas. Therefore, GI could be a valuable instrument to ensure connectivity in the whole region. On the other hand, there is room for improvement since about 50% of the potential network at the regional level is composed of unprotected landscape elements that deserve special attention by stakeholders.
Support to policies related to: Biodiversity, Climate Change and Disaster Risk Reduction, and Water Management	The potential GI, and related ecosystem services, are able to support the purposes of water policies in the whole region. There is less capacity to support climate change policies in Southern Estonia, and less capacity to support biodiversity policies in Northern Latvia.	In terms of multifunctionality, most of the area is capable to support at least two of the three policy objectives. The limited capacity to support biodiversity policies is of special concern in parts of Latvia (lower habitat quality on average). In some parts of Estonia, there is limited capacity to support climate change policies.
Synergies and trade-offs	Most of the ES have a synergistic (in particular Latvia) or neutral relationship.	There is potential for improvement of multifunctionality with a multiplier effect, i.e. improving one ES can enhance other ES at the same time.
City level (information only available for Tartu)	The area around Tartu is one with lower potential GI in the region. Green urban areas cover about 38% of the city, which positions Tartu within the lowest range in Europe. This is compensated by larger coverage of GI in peri-urban areas, where Natura 2000 contributes up to 18% of the area of GI. Green urban areas have strongly decreased between 2006 and 2012.	There is a need to ensure the green urban area inside Tartu to avoid further shrinking and to improve the connection with the peri-urban area, where a strong competition for the land occur.

This cross border region has a good potential to implement multifunctional GI. Hubs, i.e. protected areas, seem to be well connected in the whole region without a border effect. However, there may be some limitations to support biodiversity and climate change policies in part of Estonia. The observed synergies between most of ES may facilitate the implementation or improvement of the GI. Tartu is the most critical area given the strong pressure of urban development, which has reduced green urban areas and increased the risk of fragmentation of already week GI on the peri-urban area.

4 Capacity of GI network to meet the demand of ES in Estonia- Latvia Cross-border Area

In view of the territorial challenges identified in both countries, it could be argued that there is a need to strengthen and ensure the ecological connectivity to support biodiversity and climate change policies.

At the city level there is a need to ensure the green urban area inside Tartu to avoid further shrinking and to improve the connection with the peri-urban area, where a strong competition for the land occur.

The consideration of GI and ES in forestry policy is crucial in both countries but particularly relevant in Estonia.

4.1 What do GRETA analysis on ES supply and demand reveal?

GRETA have explored the capacity of GI network to meet the demand of ES where:

ES supply is defined as the capacity of ecosystems to provide ES, irrespective of them being used.

ES demand can be defined as the amount of a service required or desired by society in a given location and time. This demand depends on several factors such as socio-economic conditions, cultural/behavioural norms, technological innovations, availability of alternatives, among others.

	ES Supply – benefits provided	ES Demand -specific definitions	Approaches to quantify Demand
Regulating services	Benefits are provided by maintaining desirable environmental conditions	Amount of regulation needed to meet target conditions	Reduction of risk
Cultural services	Benefits are provided by experiencing the natural environment	Desired total use (if rival service) or individual use (if nonrival service)	Preference and values // direct use
Provisioning services	Benefits are derived from consumption of final goods	Amount of goods obtained per unit of space and time or per capita	Direct use // Consumption

Table 2 Relation between benefits provided by ES supply and the corresponding ES demand definitions and operationalisation approaches. Adapted from: Villamagna et al., 2013 and Wolff et al., 2015.

Demand for **regulating services** can be defined as the amount of those environmental conditions that ensure the provision of a desired regulation level. A reduction of risk approach has been usually applied to quantify demands for these services. Vulnerability to potential changes in regulating services may provide valuable insight into society's needs capturing main linkages from the socio-ecological system.

Demand for **cultural services** has been mostly assessed by preferences and values for attributes of certain landscapes, ecosystems or heritage sites. Preferences may be either quantified through stated preferences that relate to the desired level of services, or through revealed preferences (a proxy for the actual use of the service). Demand for cultural services has also been assessed by the direct use of a specific ecosystem, e.g. for recreation. This can be quantified by total visitor days per year or the number of fishing/hunting licenses, the presence of tourists or accounting the accessibility or proximity to recreational areas.

Demand for **provisioning services** has been quantified based on direct use and consumption of final. It is worthy to note that there is normally a spatial mismatch between the area where the service is provided and the area where the service is consumed, especially true for provisioning services. For this reason, interregional linkages have to be considered in order to properly identify faraway dependencies and assess magnitude of potential impacts

Following the proposed conceptual framework, we have combined demand and supply for each of the selected ES. The focus of this approach was to highlight those areas where there is a high demand and a low supply, i.e. those areas where GI is unable to cover the ES demand. It should be noted that these results are of a more exploratory nature in the whole GRETA project considering the following limitations:

- This is a research area still under development;
- There is need for a higher resolution of the data sources given the nature of the phenomena analysed;
- Balance between supply and demand is semiquantitative; and
- In some cases, a more sophisticated modelling would be required to have an appropriate quantitative balance.

Therefore, these results should be seen as illustration on how this demand and balance could be approached.

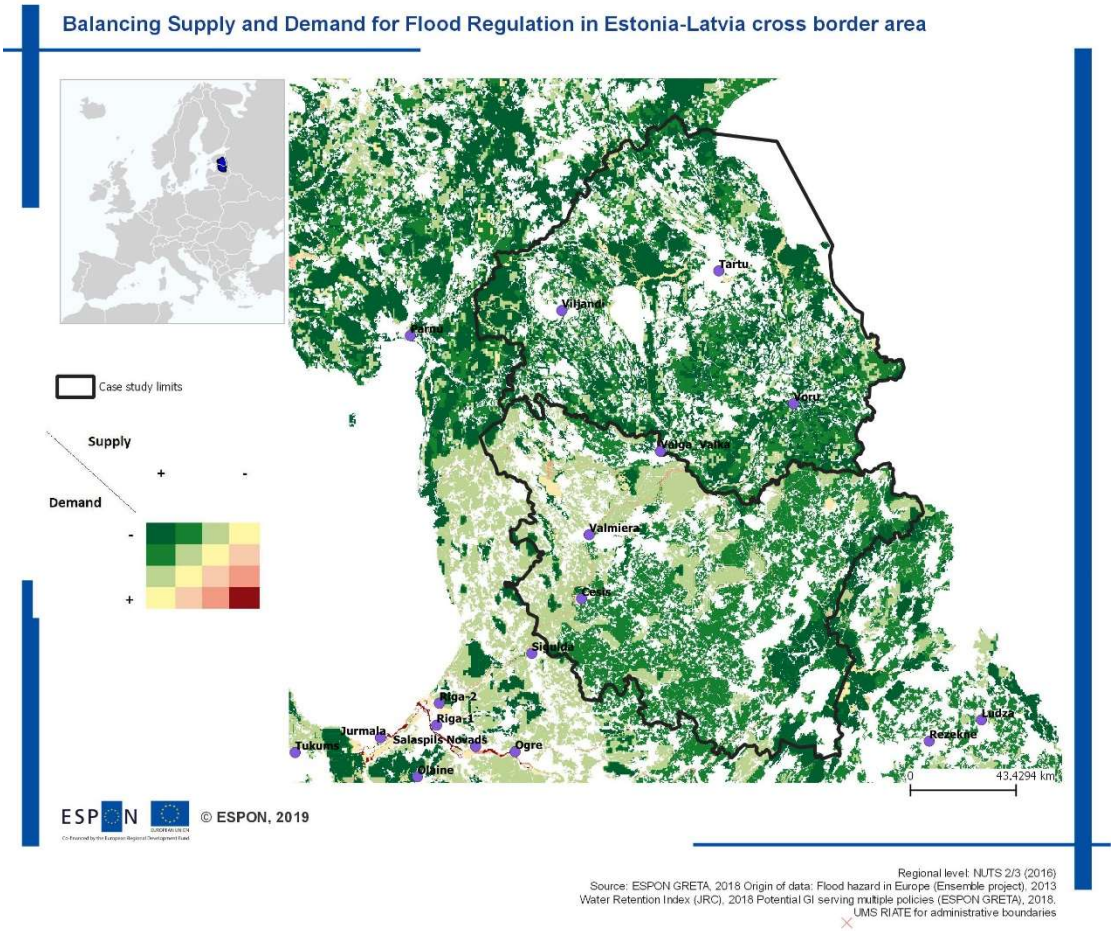
4.1.1 Analysis of supply and demand for Flood Regulation in Estonia- Latvia Cross-border Area

We have quantified demand for flood regulation based on the potential flood hazard. Exposure is described by the projected potential flooding risk[9]. On the other hand, benefits are provided by the water storage capacity of land to regulate floods. The supply for flood regulation is quantified by the Water Retention Index, which assesses the capacity of landscape to retain

[9] for the period 2011-2044 that results after applying the LISFLOOD model from the ENSEMBLES project

and regulate water passing through. This index is dimensionless and considers the role of interception by vegetation, the water-holding capacity of the soil, and the relative capacity of both the soil and the bedrock to allow percolation of water. The influence of soil sealing and slope gradient are additionally considered.

Map 4 presents a semi-quantitative analaysis of the balance between supply and demand for flood regulation in the Estonia- Latvia cross-border region. There is a predominant pattern of dark green areas showing the maximum capacity of supply and very low demand. These conditions are met in core protected areas There is still some room for improving or reinforcing the GI with the objective of water retention in the area Cesis, Valmiera and Valga.

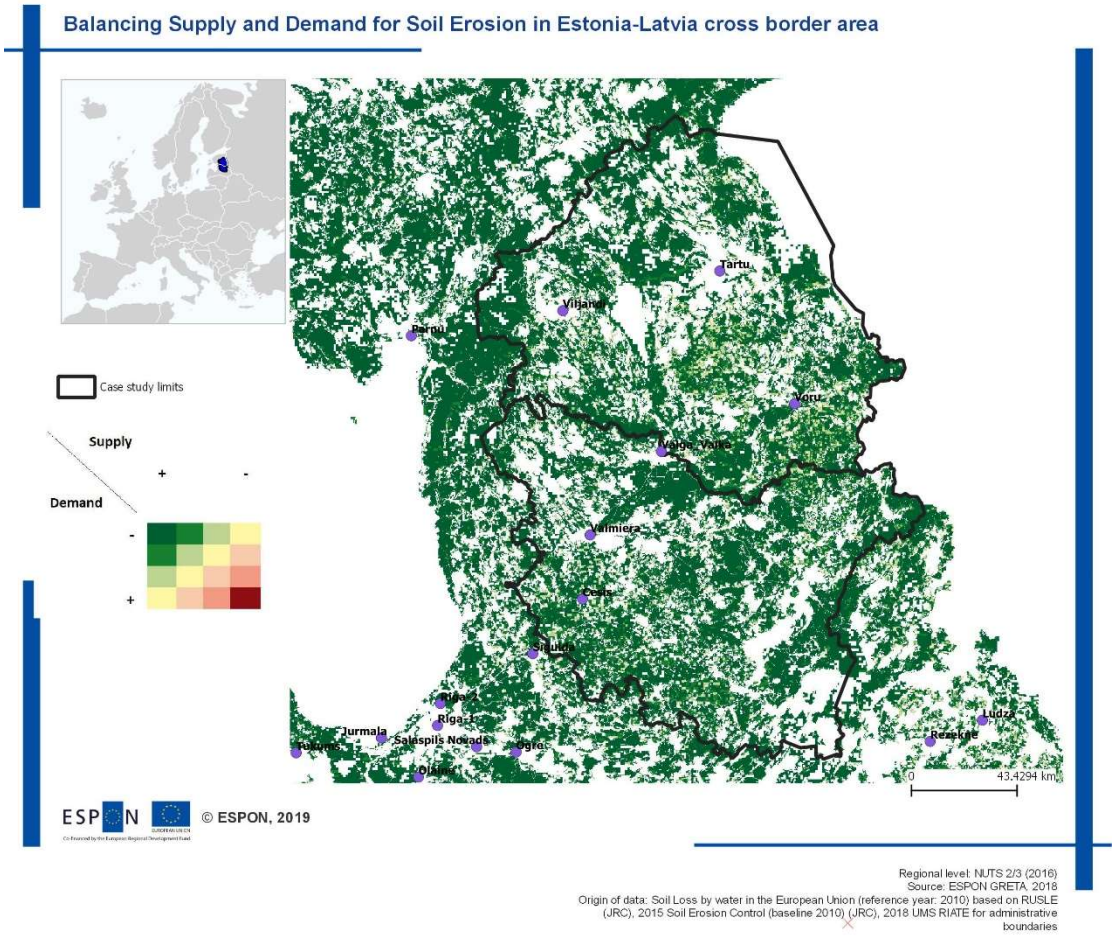


Map 4 Balancing Supply and Demand for Flood Regulation in Estonia- Latvia Cross-border Area

4.1.2 Analysis of supply and demand for Reducing Soil Erosion in Estonia-Latvia Cross-border Area

We have assessed the demand for the reduction of soil erosion by water producing a negative impact on several ES; in particular to the ones related to crop production, drinking water and carbon stocks. Soil erosion by water is mainly affected by precipitation, soil type, topography, land use and land management. Exposure is described by the soil loss rate[10] (t ha^{-1} yr^{-1}). Benefits are provided by the capacity of vegetation to control or reduce erosion rates. The supply is quantified by the Soil Erosion Control dataset (JRC) that describes the capacity of ecosystems to avoid soil erosion.

From the resulting Map 5, we can observe an strong positive trend between supply and demand, with high potential for soil erosion control supply and low demand.



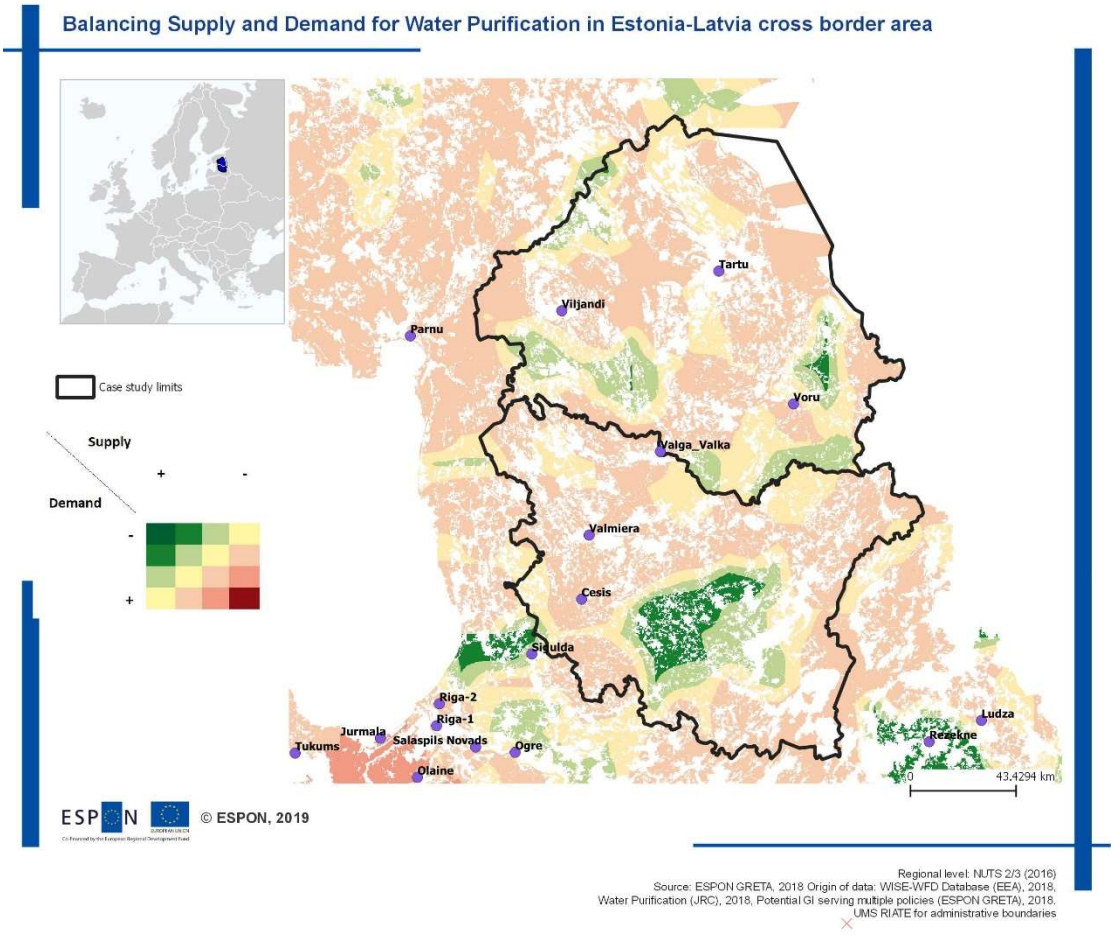
Map 5. Balancing Supply and Demand for Soil Erosion in Estonia- Latvia Cross-border Area

[10] as estimated by the modified version of the Revised Universal Soil Loss Equation (RUSLE) model

4.1.3 Analysis of supply and demand for Water Purification in Estonia- Latvia Cross-border Area

We have quantified demand for water purification based on the level of pollutants emitted to freshwater ecosystems by polluting sectors, primarily agriculture and waste water treatment discharges from industry and households. Exposure is described by mean annual concentration of nitrates in water [11](. The supply is quantified by the Water Purification dataset (JRC) that assesses the in-stream retention efficiency of ecosystems to dilute or degrade nutrients.

Resulting Map 6 shows that water pollution is still a big challenge and substantial increase on the provision of water purification is still required under current status. Potential for cross-border cooperation in that connection is particularly relevant in the eastern part of the region (i.e. around Miso) where the difference in terms of supply and demand in the two countries is quite obvious.



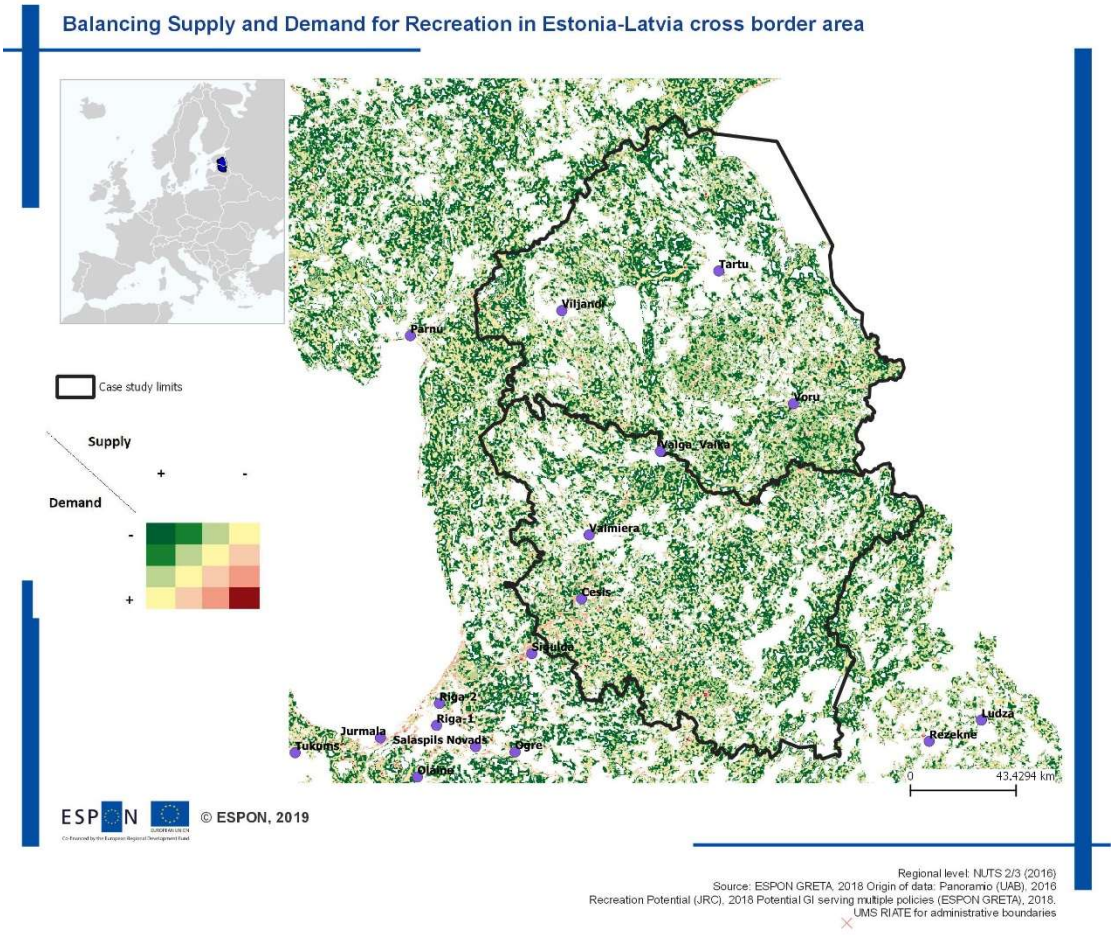
Map 6. Balancing Supply and Demand for Water Purification in Estonia- Latvia Cross-border Area

[11] tonne per year) captured in monitoring stations and aggregated by rivers (the WISE-WFD database)

4.1.4 Analysis of supply and demand for Recreation in Estonia- Latvia Cross-border Area

We have described demand for recreation by means of a proxy for visitation. Recreation and tourism are important elements for national and local economies, that also contribute to other intangible benefits. Recreation directly depends on environmental attributes like species richness, diversity of habitats, and climate. The usability of crowd-sourced information by means of location photographs has already been shown to be a reliable proxy for visitation rates to recreational sites. We have used the location of photographs in Panoramio as a proxy for landscape attractiveness for visitors. Demand is quantified by the number of pictures per square km. On the other hand, supply is described by the Recreation Potential dataset (JRC) that quantifies the potential for citizens for outdoor recreation.

The resulting Map 7 does show a combined patter of i) clear positive balance (dark green areas) where supply is high and demand is low, ii) areas where supply meet the demand for recreation.



Map 7. Balancing Supply and Demand for Recreation in Estonia- Latvia Cross-border Area

5 Governance practices, policy and planning instruments to implement GI and enhance ecosystem services in Estonia-Latvia Cross-border Area

5.1 Existing plans and targets for GI development in North Livonia

Desk based analysis of the preliminary outrearch with stakeholders and results to consultation reveales that:

- In terms of governance and decision making: there is a formal instrument elaborated "Master plan for North Livonia: wetland protection and rural development in the transboundary area of Latvia and Estonia" (2006) (http://www.digar.ee/arhiiv/en/books/11903) that presents an analysis of main transboundary biodiversity management issues and provides directions for tuned development of GI of the transboundary area, including recommendations for main management sectors (Protected area management, Water management and hydrology, Forestry, Eco-tourism, Cultural Heritage, Game management and hunting, Agriculture, the Estonian Native Cattle etc.).
- Part of above mentioned segments are included in sector policies and planning documents of the respective countries. Cultural and economical cooperation and area promotion through the transborder festival "Wetlivonia" Salacgrīva(LV)/ Häädemeeste (EE) is organized by the respective border municipalities
- Latvian-Estonian Future Co-Operation Report (2010) states: "Creating a cross-border national park (Livonian National Park) would underline the abundance of undeveloped and clean environments in both countries". Statement includes designation as well for further development of GI.

5.2 Policy overview in Estonia

Most environmental issues fall within the remit of **the Ministry of Environment** which acts through a central body, and a number of agencies/institutions. Local and county municipalities play a key role in building and territorial/spatial planning. The **Environmental Protection Law** adopted in 1990 defines the principles and objectives of Estonian environmental policy. In 1997 Estonia adopted its first Environment Strategy. Since then, Estonia adopted the first Act on Protected Nature Objects in 1994, and the latest Act on Nature Conservation in force since 2004. The objectives and principles of Estonian Environmental policy are defined by the **Estonian Environmental Strategy up to 2030**. The department on spatial planning falls under the Ministry of Finances.

The Estonian Environmental Strategy up to 2030 (2007) aims to define long-term development trends for maintaining a good status of the natural environment, while considering the links between the environmental, economic and social spheres, and their impact on the natural environment and people. The **Nature Conservation Development Plan (NCDP) 2020**

guides the implementation of the nature protection objectives of the environmental strategy.The main act on nature conservation is the **Nature Conservation Act**, approved in 2004.

Since the mid-1990s, Estonia has legislative and political support for ecological network applications (Act on Building and Planning, 1995, Act on Planning, 2002, Act on Planning 2015).

Estonia has viewed spatial planning as the appropriate mechanism through which to deliver the ecological network concept. The 1995 Sustainable Development Act, the 2004 Act on Nature Conservation, the 1995 Planning and Building Act, the 2002 Act on Planning, and the 2015 Act on Planning require that a green network be defined at state level, and all 15 counties and municipalities should prepare a map of the ecological network for their territory.

The nationwide spatial plan **"Estonia 2030+"** aims to achieve a rational use of space in Estonia. The main principles include "preserving the qualities of settlement pattern and landscape" and "preserving the good condition of the natural environment". The plan emphasises the importance of green infrastructure in the preparation of spatial measures (European Commission, 2017). The basic legislation for this network is the **Planning Act** that defines the green network and its elements. The establishment of the green network at national level was launched in 1995 (National Plan Estonia, 2010) and approved in 2000. At county level, a thematic spatial plan was launched in 1999. County thematic plans were approved during the period 2003-2007.

The respondent to the GRETA-survey indicated a number of sectors where GI principles are included in policy-making. The sectors where this is the case are: land use and spatial development plans; transportation; water management; agriculture, forestry and fisheries; environmental protection; cultural heritage and rural development. It seems logical that these sectors consider GI when making policy because they deal with nature and the environment in their activities. The respondent indicated uncertainty about whether GI is represented when making legislation, policy or strategy for climate change mitigation/adaptation; disaster protection;eEnergy; finance; health and social services.

See Annex IV of the Draft Final Report to access National Fact Sheet developed for Estonia which provides an extensive information on the policy backgraound, governance and decision making as well as tools and inceptives for GI implementation.

5.3 Policy overview in Latvia

In Latvia there is not one single overarching national policy or strategy for GI). This is in compliance with EU Green infrastructure strategy (2013), as this strategy is not a directive and therefore not enforced to be included as national law in the member states. Based on the GRETA-questionnaire, however, GI solutions and approaches are incorporated in land use governance, for instance in terms of improvements of agriculture land management and in the territorial planning of the municipalities.

Currently in Latvia there are few plans or activities directly relating to Green Infrastructure, e.g., flood management in cities and Natura 2000 development. However, several programmes and priority areas have high potential for Green Infrastructure development, either as a potential tool to reach the policy targets or promoting Green Infrastructure through stimulation in co-financing competitions or through supporting activities.

According to Greeninfranet- Interreg IV, concerning policy setting and on-going implementation in Latvia, very much relies on the Ministry of the Environmental Protection and Regional Development.

The ministry is the leading state administrative institution in the field of environmental protection, which includes the protection of the environment and nature, maintenance and rationa lutilization of natural resources, as well as sub-sectors of hydrometeorology and use of subsoil. It ensures planning and coordination processes of state and regional development, local governments' development and supervision, territorial development planning and implementation of e-Government. It also liases with international conventions and the EU.

Ongoing activities in GI development in Latvia can be broadly divided into five main groups:

1. Development of the Natura 2000 network;
2. Sustainable and integrated coastal zone management;
3. Management of inland waters (including integrated water basin management plans and flood protection measures);
4. Wetland management and creation of new wetlands (including reed filters to purify wastewater); and
5. Local GI elements, such as bicycle roads, street trees, green (water permeable) street covers and green elements of buildings, improving connectivity between natural Green Infrastructure elements.

5.4 Political commitment and decision-making for GI planning and implementation

The environmental governance in the case study area is undertaken separately in each respective country. It includes regular exchange of information on current and foreseen activities undertaken between Nature Conservation authorities of both countries.

The first coordination body between the Ministries of Environment of Latvia and Estonia regarding transborder cooperation with the above mentioned goals were established in the mid 1990s.

Additionally a Representative Group of the Republic of Latvia for the Intergovernmental Commission of the Republic of Latvia and the Republic of Estonia for the Promotion of Cross-Border Cooperation is established (Regulation of Cabinet of Ministers Order No 25., 25.01.2010) representing border municipality interests.

5.5 Resources

- Guidelines for management of habitats with regard to GI and ES (Forests. Mires, Grasslands, Waters. Coastal areas, Cliff outcops). Extensive set of 6 books,(translated as well in English) elaborated in 2018 under Life NAT-Programme Project. Each of these books contains a chapter describing the Ecosystem Service concept as well GI (and blue infrastructures) (https://www.daba.gov.lv/public/eng/publications1/#books).
- Guidelines for the Planning of Waterways and Waterfronts in the Vidzeme Region inland waters (See Chapter 53). http://www.vidzeme.lv/lv/vadlinijas_udenu_un_to_piekrastes_izmantosanas_planosanai/
- Nature Conservation Agency as the responsible body for managing nature conservation. Expert register already for more than 10 years. Expert register and Expert responsibilities are legally regulated by Minister Cabinet Regulations Nr.925, adapted already in 2010.30.09. Regarding content and minimum requirements for expert opinion of species and habitat protection experts.
- Official establishment of UNESCO Man and the Biosphere Chair within Vidzeme University of Applied Sciences in 2019. The given actor enlarges possibilities for future promotion of concepts of GI and ES (as set in Biosphere Reserve Concept) in Latvian –Estonian Transborder area. Additionally possible development of cooperation between Tartu University and Vidzeme University of Applied Sciences in developing outputs for the transborder activities can be achieved."

6 Lessons learned and good practice examples

6.1 Challenges for future GI development

Although in both countries there has been a great effort to delineate GI network, at both national and local government level, there are still some challenges particularly related to the cross-border area.

Main challenges in the cross border area

- Despite the guidelines and information available there is a still a need for capacity building about green network planning and management at local level.
- Need to improve the cohesiveness of the ecological network and analyse the information flow between national and local government.
- Distributions of competences and responsabilities in terms of land use with strong weight in the regional level.
- Need to operationalize the GI principles with regards to inter-disciplinarity and inter-sectoral co-ordination and integration in sectoral policies.
- Capacity building and training of relevant stakeholders to improve interaction across and between disciplines and sectors relevant for 'mainstreaming' Green Infrastructure.

- In Estonia the nationwide preparation and implementation of county plans in accordance with the EU Green Infrastructure Strategy.
- In Latvia progress is required on “Mapping and Assessment of Ecosystems and their Services” (MAES).
- Lack of a mechanisms for funding innovative nature conservation measures.
- Meed of promotion efforts emphasising socio-economic growth benefits of GI.
- Integrated constructed wetlands have not been taken up adequately in the Rural Development Plan for Latvia.
- Management measures required for conservation of species and habitats are being considered in isolation from the area's economic development, and not always measures provided for in the nature management plans fo rspecially protected natural territories are fully implemented.
- Generally speaking there is a lack of public awareness regarding natural assets and the importance of GI and ES.

6.2 Opportunities for GI through cooperation

- There is an opportunity for development of an inter-sectoral coordination mechanism, involving different departments of Ministry of Environmental Protection and Regional Development of the Republic of Latvia, namely Environmental, Nature Conservation, Regional Development and Spatial Planning Departments and Nature Conservation Agency, as well as other stakeholders and line ministries, e.g., Ministry of Transports and Ministry of Agriculture.
- Development of assessment and an incentives system and instruments for GI development.
- Analysis of available funding opportunities, development of programming for the next periods including opportunities for developing GI (not only environmental, but also rural development programmes, development of new local funding instruments for Green Infrastructure development, etc.).
- Capitalisation of the good potential for climate change adaptation integration in GI projects.

6.3 Achievements in GI implementation

Master Plan for North Livonia- Wetland Protection and Rural Development in the Transboundary Area of Latvia and Estonia[12]

- Example of daily management practices, and projects that enhance the quality of existing green/blue areas, linked/connected habitats or created or restored green areas.
- Nature Conservation Agency of Latvia Direct Responsibility for the maintenance of the Latvia Protected areas in the Latvian-Estonian border region.
- Interconnected network of wetlands, woodlands, waterways and their respective wildlife habitats is embedded in: a) separately protected area complex on Latvian and Estonian border areas, which includes Nature reserves and Biosphere Reserve and are b) consequently, united in transboundary protected area officially acknowledged as the fifth transboundary RAMSAR site in the World.
- The Master plan for North Livonia: wetland protection and rural development in the transboundary area of Latvia and Estonia" (2006) presents an analysis of main transboundary biodiversity management issues and provide directions for tuned development of Green Infrastructures of the transboundary area, including Recommendations for main management sectors (Protected area management, Water management and hydrology, Forestry, Eco-tourism, Cultural Heritage, Game management and hunting, Agriculture, the Estonian Native Cattle etc.).
- Part of above mentioned segments are included in sector policies and planning documents of respective countries.
- Cultural and economical cooperation and area promotion through the Transborder festival "Wetlivonia" Salacgrīva(LV)/ Häädemeeste (EE) is organized by the respective border municipalities
- Regular exchange of information on current and foreseen activities undertaken between Nature Conservation authorities of both countries.Additionally, a Representative Group of the Republic of Latvia for the Intergovernmental Commission of the Republic of Latvia and the Republic of Estonia for the Promotion of Cross-Border Cooperation is established (CM Regulation No 461, 2017) representing border municipality interests.

Wetland pilot project under the framework of the Baltic Deal

In 2011, a pilot project was launched to develop a new wetland – a new and innovative measure in Latvia - in the framework of the Baltic Deal project, a flagship project of the EU Strategy for the Baltic Sea Region. The aim of the project was to create a demonstration farm with a constructed wetland, in cooperation with research on water quality. The project was funded by the 2007-2013 Baltic Sea Regional Programme and by the NEFCO/NIB Baltic Sea Action Plan Trust Fund. The total budget was around EUR 4 million and the project ran from 2010 to 2013.

A farm to serve as the demonstration site was initially selected in the autumn of 2011. Priority was given to a farm with intensive agriculture in crop production and with a catchment area

[12] http://www.digar.ee/arhiiv/en/books/11903
https://www.researchgate.net/publication/286342661_Master_Plan_for_North_Livonia-_Wetland_Protection_and_Rural_Development_in_the_Transboundary_Area_of_Latvia_and_Estonia

covering more than 500 hectares. However, investment costs turned out to be too high (EUR 50,000) for the constructed wetland in this farm. Lessons learnt were applied in the search for a new farm, this time with a smaller catchment area and lower investment costs. The experience and necessary knowledge has helped to develop a sound proposal for the next Rural Development Plan period in which constructed wetlands would be included as a measure. The project was developed with support from WWF Latvia. The project is a valuable preparatory project for the integrated planning of Green Infrastructure, combining farming with restored habitats – wetlands in this case - that help reconnect or enhance existing natural areas.

Benefits of the project include:

Improved knowledge on potential application of Green Infrastructure (wetlands) in sustainable land management; and

After realisation: improved environmental management and lowered non-point pollution (agricultural run-off), thus lowering pollution load in the Baltic Sea area.

Mapping and Assessing Ecosystem Services in Estonia

Estonia has provided one of the most complete Prioritised Action Frameworks (PAF) which has been used successfully to ensure funding to Natura 2000 sites from different EU funds.

Estonian Environmental Agency is leading a project that assesses the state of the environment Abbreviation for project name is **ELME**, more information in Estonian - http://www.keskkonnaagentuur.ee/et/eesmargid-tegevused/projektid/elme-elurikkuse-sotsiaal-majanduslikult-ja-kliimamuutustega-seostatud).

One of the aim of the ELME project is the mapping and assessing ecosystem services. One part of that project is assessing the performance of the Green Network. The project is still going on, but:

- the analysis of legislation has been completed. The legislation is sufficient to ensure biodiversity. No need to change the acts, we have to draw up a guide material to guide the practice.
- performance analysis has been completed. Experts analyzed the coherence of protected areas and the mobility of animals. Most of the protected areas are interconnected. The green network is suitable for living and moving animals.
- guidance material is being prepared (the deadline is April or May 2018). Guidance material will be for the local municipality to plan green network in a comprehensive plan.

This project constitutes a reference one that could provide evidence to inform decision making and planning.

State Forest Centre for enhancing Green Infrastructure.

State Forest Centre launched by the Ministry of Environment- awareness raising about the importance of GI and the impact of the current forest sector policy. Connected to that there is a particular initiative about delineating GI corridors based on the flying squirrel habitat.

GUIDOS Toolbox to define and map the "structural" connectivity of the elements of the GI network

GuidosToolbox (Graphical User Interface for the Description of image Objects and their Shapes) contains a wide variety of generic raster image processing routines, including related free software such as GDAL (to process geospatial data and to export them as raster image overlays in Google Earth), and FWTools (pre/post-process and visualize any raster or vector data).

All tools are based on geometric principles and can thus be applied at any scale and to any kind of raster data.

GuidosToolbox also includes MSPA (Morphological Spatial Pattern Analysis), a customized sequence of mathematical morphological operators targeted at the description of the geometry and connectivity of the image components. The MSPA website provides further information on MSPA features, application examples as well as links to download MSPA-plugins for GIS applications.

https://forest.jrc.ec.europa.eu/en/activities/lpa/gtb/

VivaGrass LIFE project- conducted in the Baltic states of Estonia, Latvia

Dealing with the multifunctional approach and trying to provide web tools to implement this approach in spatial planning The project generally aims to support maintenance of biodiversity and ecosystem services provided by grasslands, through encouraging ecosystem based planning and economically viable grassland management.

UNDP GEF Project"Biodiversity Protection in North Vidzeme Biosphere Reserve in Latvia".

During the given Project „Landscape Ecological Plan for North Vidzeme Biosphere reserve" was elaborated, covering noticeble part of ESPON Study area. The aim of the NVBR landscape ecological plan was to enhance the territory's economic development, at the same time guarantying assurances to protect and preserve the biological and culture/historical values and treasures.The given Plan at the stage of those time knowledges foresaw integration of green infrastructures (corridors , bioecenters etc) as well in social, cultural and economical segments. The given Plan as well followed the principle of tunning onnectivity of ecological corridors in Latvian Estonian border region described in ESPON Poject (See: Nikodemus O. et al., 2010. Implementation of landscape ecological knowledge into land management using landscape ecological planning. The Problems of Landscape Ecology, Vol. XXVIII. 123–133.). *agro.icm.edu.pl/agro/element/bwmeta1.../vol28_13_Nikodemus.pdf*

Biodiversity Protection in North Vidzeme Biosphere Reserve.

The project promoted conservation practices in Latvia's protected areas with emphasis on securing the biodiversity values of the North Vidzeme Biosphere Reserve and integrating conservation into the planning, management and sustainable use of the reserve. The project created several useful monitoring and management structures for the reserve including a landscape ecological plan whose principles have been included in four legally-binding Municipal Plans and are being incorporated into the working practices for selected important biodiversity areas, a GIS and management information system, and a public monitoring programme for the area called EcoWatch. Grant: US$ 2,910,000; Planned Co-financing: US$ 10,730,000 Realised Co-financing: US$ 59,560,000 (https://www.thegef.org/project/biodiversity-protection-north-vidzeme-biosphere-reserve)

7 Policy messages and recomendations in Estonia- Latvia Cross-border Area

The "Master plan for North Livonia: wetland protection and rural development in the transboundary area of Latvia and Estonia" (2006)[13] presents an analysis of main transboundary biodiversity management issues and provides directions for tuned development of GI of the transboundary area, including recommendations for main management sectors (Protected area management, Water management and hydrology, Forestry, Eco-tourism, Cultural Heritage, Game management and hunting, Agriculture, the Estonian Native Cattle etc.).

However a mechanism for cross-border cooperation has not been officially established yet at national level. So there is a need to reinforce cooperation between the two countries for effective and operational GI implementation.

- In particular more stress would be needed to address biodiversity: a number of rare species in this area that are affected by the felling of old forests.
- Attention needs to be directed at the ecological cohesiveness of the green network, in particular where the density of large structures in the green network is lower and cohesiveness is at risk (for instance, in the hinterland of main cities).

Improving awareness and knowledge about the benefits of the GI network in the public administrations is still needed

- The need for a green network is known, but there should be guidance on how to calculate the benefits (establishment and service monetary value) with good examples. First and foremost, the benefits of the green network in cities (both direct benefits saved money and indirect benefits through human well-being).

[13] http://www.digar.ee/arhiiv/en/books/11903

- In particular there is still a lack of knowledge with regard to Biodiversity and more data related to biodiversity indicators, connectivity and species distribution is required. How to use this data to build the GI network? How the network ecologically works really?

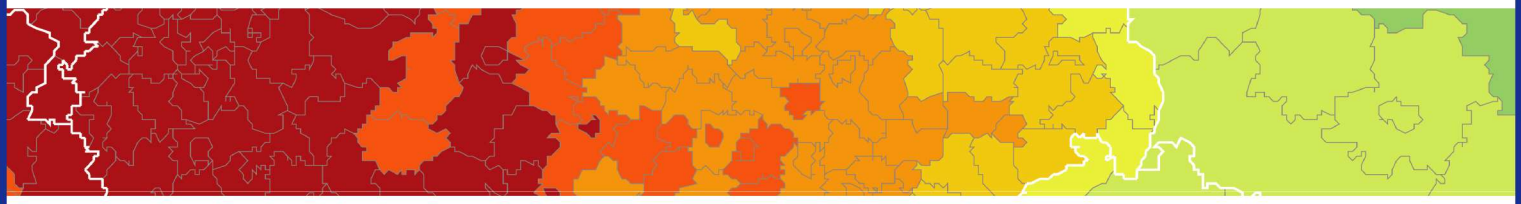
Improving the access and exploitation of available information and data is seen crucial to inform decision making and planning with particular emphaisis on cross border cooperation.

- Planners seems to be keen on making decisions based on GI and ES principles but still there is a need of knowledge based decisions.
- There is a need for clear criteria and recommendations for land use management.
- Data and guidelines about how to make use of it should be made available by National Authorities- so all regions could use it with a certain level of criteria. – ELME project is an example in that connection.

8 Apendix 1

The below table give an overview of the stakeholder engagement.

Type of stakeholder	**Workplace**	**Type of interaction**	**Date**
Technical expert Policy maker	Pubic administration National level	Responses to Consultation A	30/09/18
Technical expert	Researcher/academia	Responses to Consultation B	30/06/18
Technical expert Policy maker	Pubic administration National level	Responses to Consultation B	30/09/18
Technical expert	Technical expert	Phone interview on Consultaiton C	23/10/18
Technical expert Policy maker	Pubic administration National level	Review of the draft report	28/01/19



ESPON 2020 – More information

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