Slovenia's Ecological Footprint

Technical Report on the Ecological Footprint and Biocapacity of 12 Slovenian Regions

June 30, 2020 | *Updated: October 1, 2020*

Republic of Slovenia Ministry of
Environment and Spatial Planning

Slovenian Environment Agency

Global Footprint Network®
Advancing the Science of Sustainability

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Preliminary Technical Report on the Ecological Footprint and Biocapacity of Twelve Slovenian Regions

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Contents

Executive Summary

In 2018, the Slovenian Environment Agency implemented the first phase of the project, "The Ecological Footprint of Slovenia – Analysis of Data, Driving Forces, and Contributions by Sectors". Carried out by the Ministry of the Environment and Spatial Planning of the Republic of Slovenia (MOP) in collaboration with Global Footprint Network, the purpose of the project was planning and monitoring Slovenia's Ecological Footprint reduction policies. In 2020, the second phase of the project began with an emphasis on the Ecological Footprint calculations of twelve Slovenian statistical regions and the integration of the Ecological Footprint into regional environmental development. This second phase contributes to Slovenia's Ecological Footprint reduction efforts in accordance with the objectives of the Slovenian Development Strategy (SDS) 2030, specifically *Goal 9 – Sustainable Natural Resource Management*.

In the first phase of the project, Ecological Footprint accounting[1] was applied at the national level as a tool for monitoring resource dependency and resource security, and climate change mitigation. The comparison between resource consumption and generation shows that Slovenians consume much more energy products, food, and raw materials than what the country can provide, leaving Slovenia in a biocapacity deficit. The carbon Footprint is the largest component (62%) of Slovenia's Ecological Footprint and presents the greatest opportunity for transition to a resilient, resource-secure economy that supports a thriving society.

Implementing change is difficult if it is not monitored and analysed, thus the Ecological Footprint approach is critical for monitoring Slovenia's national resource consumption.

In order to support the environmental objectives of the Slovenian Development Strategy 2030 (SDS), these regional Ecological Footprint and biocapacity results for the twelve statistical regions of Slovenia were calculated using a top-down methodology and inform regional development programs for the 2021-2027 period. The initial results support two primary goals:

- informing regional development planning policy by identifying priority development areas (the main report)
- improving local capacity to develop accurate regional Ecological Footprint and biocapacity accounts by identifying data gaps (Annex A) and training of a national representative(Annex D).

Over the course of this project, national scenarios and projections of the carbon component of the Ecological Footprint of Slovenia were also verified and a Slovenian national representative was trained on the Ecological Footprint methodology to support the regional development programs and the realization of SDS's environmental objectives. Details on both these latter activities are reported in the annex section (Annex B).

The initial results provided clear indications of the distribution of biocapacity and consumption footprints across Slovenia. Nine of twelve regions show a biocapacity deficit, meaning their residents consumed more biocapacity to support their daily life than what was available in that respective region in 2016; three regions show a biocapacity reserve. Variations in absolute Ecological Footprints are largely explained by the differences in total population of each region; together, the three most populated regions account for over 50% of the biocapacity consumed in Slovenia.

The process of preparing regional results revealed major gaps in standardized consumption data at sub-national levels, and a lack of detailed economic proxy data (Annex A). The low resolution of input data support conclusions made on total results by region, but per-capita results lack a degree of resolution and allow only ordinal conclusions. The

[1] Also compare with "Ecological footprint of European countries" from EEA, published on 20 April 2020, available at https://www.eea.europa.eu/data-and-maps/indicators/ecological-footprint-of-european-countries-2/assessment. It provides top-level national results for ecological footprint and biocapacity of all European countries.

addition and improvement of key statistics in the categories of transportation, housing, and energy are a priority for improving results.

Key to this analysis is that Ecological Footprint and biocapacity accounting is an understanding that biological resources are the underlying basis of all economies and economic success. By focusing on this biological context, the analysis promotes long-term success by emphasizing the building blocks of thriving, sustainable economies. The recommendations herein provide a framework for measuring, monitoring, and approaching long term regional development. Recommendations include:

- Focus on investments with long lifespans, including infrastructure decisions, especially in Koroska, Osrednjeslovenska, and Obalno-kraska.
- Prioritize forest management and regenerative agricultural practices to preserve and enhance biocapacity. Continued priority needs to be given to forest management, especially in forest-rich regions of the south.

1. Introduction

According to the UN (UN, 2019), the world population is likely to grow to 9 billion people by 2050, 65% of which are expected to live in urban areas. Cities and regions critically contribute to direct and indirect global impacts related to energy use, changes in land use and climate, and increases in resource consumption. They also represent ideal solution spaces through innovative and sustainable planning, participatory governance, economies of scale, and smart, local resource management (Bettencourt et al 2007, Galli et al., 2020). It is becoming increasingly important to address resource security at regional and municipal levels because population centres depend on ecosystems to sustain life, health, and all economic activities. Regional development, which shapes how people live and move, produce, and consume, largely determines resource consumption (Baabou et al., 2017). As such, sustainability planning and resource management is particularly relevant at the local and regional level.

The COVID-19 pandemic has highlighted various important aspects of our economies and how we respond to challenges. The rapid spread of disease and the resulting shocks to the global supply chain has highlighted that we are biological in origin and all interconnected. Ultimately, resilient economies will emerge from disruption events to be successful economies. As we proceed, it is pertinent to identify which development strategies will lead to success.

We know the future playing field in which our economies will compete - it is a world without fossil-fuel based energy, and a world which will experience more frequent extreme weather events. In this world of over 9 billion people, the total supply of biological resources increasingly limits humanity, and is further complicated by supply chain disruptions. Our current overuse of biocapacity only increases the severity of future disruptions.

Slovenia has already taken steps to secure a successful economy in this future context. This leadership is critical because economies that invest into their own long-term success also make it more likely for others to succeed. Slovenia's success leads the way and helps others, creating a positive-sum game. Ecological Footprint accounting is a tool that helps economies succeed in a time of increasing uncertainty.

Ecological Footprint accounting builds on the premise that the planet's biological capacity to generate biological resources and ecological services is the most limiting factor to the human economy (Wackernagel et al. 2019). It tracks all the competing demands on the biosphere's regeneration (Wackernagel, 2019). These include the use and consumption of biological resources, the occupation of productive land for buildings and roads, and the absorption of waste such as carbon dioxide emissions from fossil fuel. Since the Earth is a limited planet, with physically defined borders, it has a finite capacity to provide natural resources and ecosystem services. The Ecological Footprint is a quantitative framework to assess the extent to which human consumption activities are demanding the natural resources and ecosystem services available on the planet (Isman et al., 2018).

The regional analysis presented in this report is calculated following a top-down approach based on national Footprint data supplemented with local data (e.g. Baabou et al., 2017; Pearson, 2013); this approach allows for consistent comparisons with national Footprint and biocapacity results, and avoids time and cost constraints of extensive local data collection and/or life cycle assessments. This approach is based on the research and applications of Global Footprint Network and grounded in its National Footprint and Biocapacity Accounts (Lin et al., 2018; Wackernagel et al., 2019).

The aim of this report is to present a first set of regional Ecological Footprint and biocapacity results, developed in coordination with Slovenian representatives in support of regional objectives around the key indicator. This study acknowledges that, beside known merits, there are also known limitations in the top-down approach used for the assessment, some of which could be overcome over time via the set-up of regional processes for bottom-up footprint assessment. Additional development and collection of detailed regional statistics is required to improve on results; therefore, this report provides a technical description of the methodology and results, documentation on the selection

and training of a national representative on sub-national methodology, and technical guidance on data gaps and needs for the further development of regional Ecological Footprint and biocapacity accounts (Annex A).

1.1 The current situation: global biocapacity and Ecological Footprint

The management of sustainability ultimately considers the planet's capacity to support human societies. Living within the means of the planet is the starting point to creating a future society where all people can thrive. "One planet" is not a goal, but rather it is our context: a reality which we must acknowledge and manage.

The challenge is multi-faceted. Policy makers are faced with an expanding global population while addressing legitimate growth aspirations. Simultaneously, they are charged with phasing out fossil fuels within a few decades and protecting the integrity of the planet's ecosystems and biodiversity. International platforms exist to address these cross-cutting challenges, including the Paris Agreement, Aichi Targets and Sustainable Development Goals. However, in the absence of strong agreement and implementation, regional entities that do not take global and national Ecological Footprint and biocapacity trends into account may be putting themselves at even more risk. In the context of regional development, the assessments introduced in this technical report are an opportunity to evaluate these trends to identify priority areas for action, potential gaps in their implementation capacity, and suggested next steps.

The Ecological Footprint is one of the most widely used and recognized integrated sustainability indicators for human pressure on ecosystems. It measures the sum of all human demands that compete for biologically productive surfaces and compares this demand with the amount of biologically productive surfaces available. The measurement unit used in this accounting metric are "global hectares" which are biologically productive hectare with world average productivity (see Box 2.1 for additional details). Using such a common measurement unit enables these accounts to compare not only different productive sectors or consumption activities within an economy in terms of the pressure they generate on the environment, but also to contrast them across geographies and time.

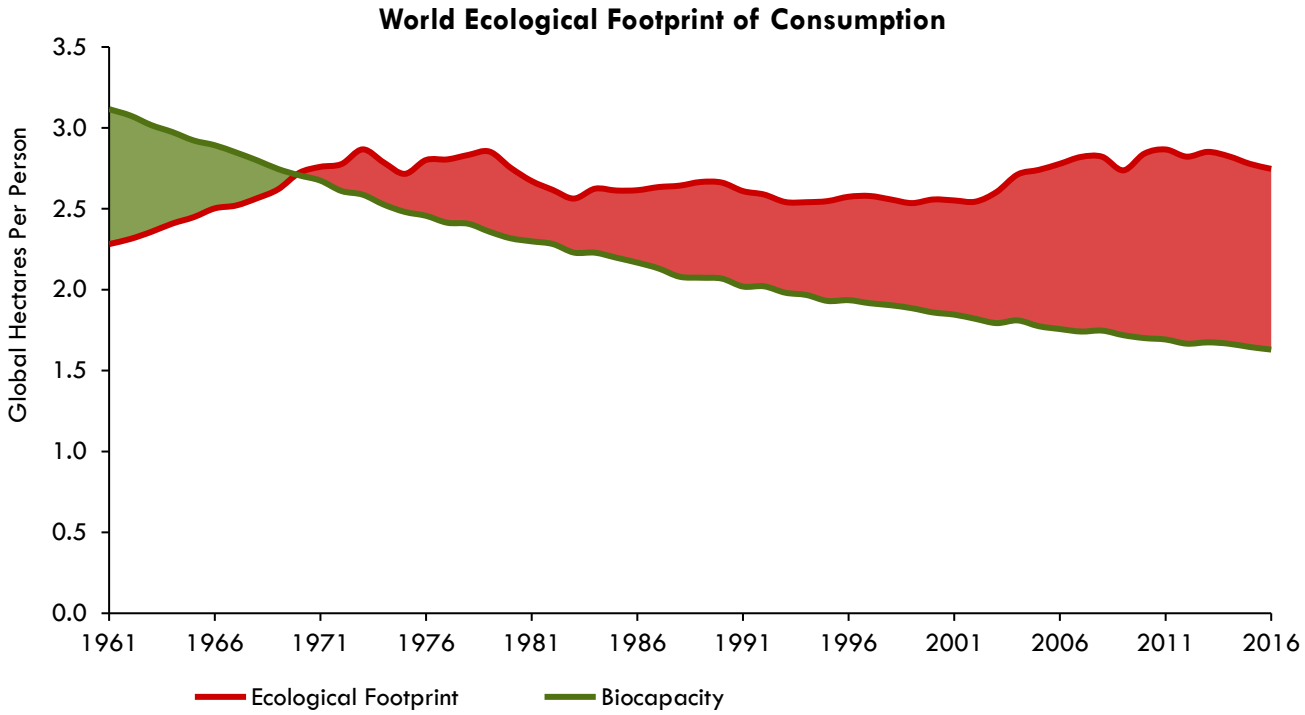


Figure 1.1 Per capita Ecological Footprint and biocapacity for the World, 1961-2016. In 2016, humanity's per capita footprint and World biocapacity were 2.8 gha and 1.6 gha, respectively.

Framing the environmental side of sustainability with an overarching metric such as the Ecological Footprint informs users of the overall human demand on ecosystems. According to the most recent Footprint accounts, humanity's demand has surpassed the Earth's biocapacity since the 1970s. By 2016, humanity's Ecological Footprint has grown to approximately 1.7 Earths (Figure 1.1). This indicates that natural resources and ecological services are used at a much faster rate than the planet is able to regenerate them, leading to natural capital liquidation. Furthermore, it is worth stressing that humanity needs to demand significantly less than one Earth to also maintain biodiversity, a key factor supporting the integrity and function of our ecosystems. In order to accommodate other species, E.O. Wilson suggests we reserve half the Earth (Wilson, 2016).

The loss of natural capital through deforestation and overfishing, the accumulation of CO_2 in the atmosphere, or the transgression of planetary boundaries (Rockstrom et al. 2009) are all manifestations of ecological overshoot. Despite international cooperation and global efforts, ecological overshoot has continued to grow at an average rate of 2% per year in recent decades,[2] mainly driven by increases in the Carbon and Cropland footprint components (Figure 1.2). As of 2016, carbon comprised 60% of the world's total Ecological Footprint. This is a significant increase over the 44% contribution in 1961 or the estimated 1% contribution of the pre-industrial revolution period (Ritchie and Roser, 2018).

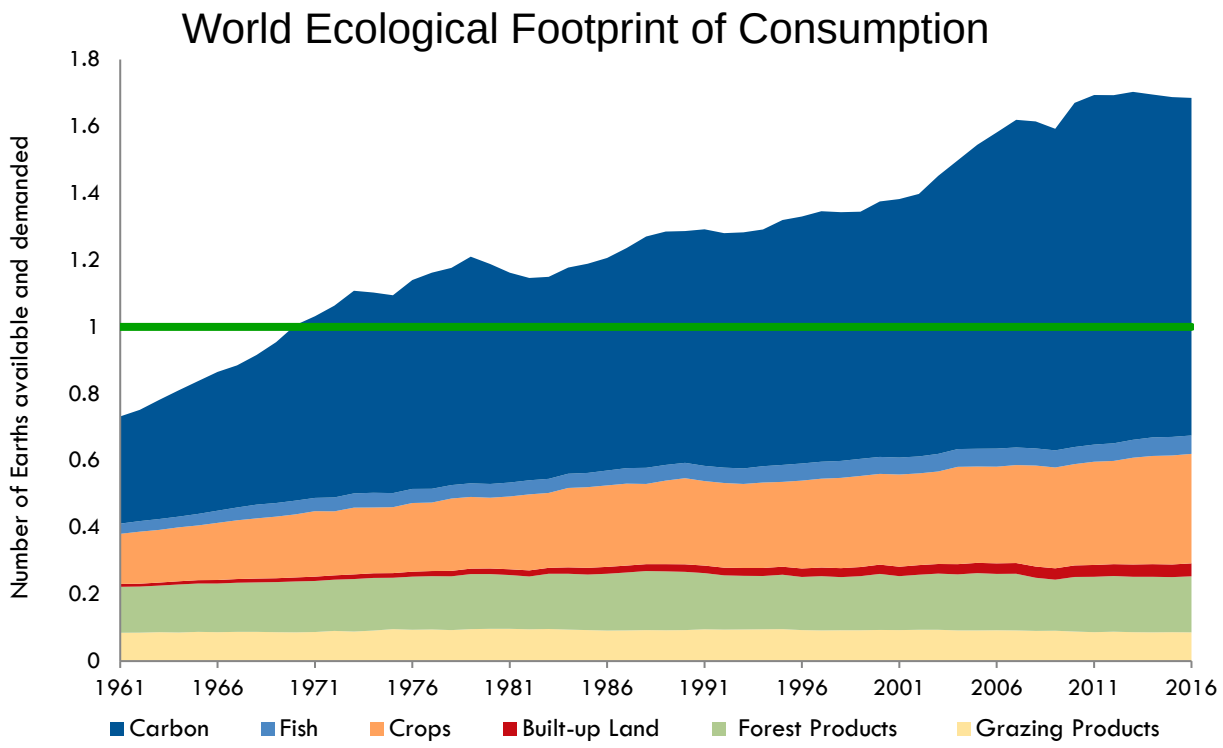


Figure 1.2 Contribution of land use types to global Ecological Footprint from 1961 to 2016. Ecological Footprint values in this graph are normalized to World biocapacity (indicated by the green line). In other words, the Ecological Footprint here is measured in *number of Earths* rather than in *global hectares*.

In 2020, the COVID-19 pandemic forced countries into "lock-down" leading to a reduction in resource demand – at great human and economic cost. This type of footprint reduction—as the result of a crisis—is not the type advocated for by policy makers seeking to improve the sustainability and well-being of their constituents. By contrast, the goal of

[2] Because of the COVID-19 pandemic and the associated lockdowns, Global Footprint Network estimated, using preliminary data, that at least for the first half of 2020, humanity's footprint dropped to 1.56 Earths. The estimate is documented in Lin et al., 2020.

sound resource management is to identify pathways that increase wellbeing and combat ecological overshoot, enhancing regional resource security.

Moving from recognition of the challenges into action requires more refined tools. One way to get more helpful information out of Ecological Footprint accounts is to break the results into consumption categories. Such detailed analysis allows decision makers to highlight inefficiencies and set actionable footprint and biocapacity targets, as this report will show for twelve Slovenian regions.

Sustainability is a trans-disciplinary issue and no single metric exists that alone can address the full complexity of sustainability. The same holds true for the Ecological Footprint as will be indicated throughout this report. On the contrary, it is an overarching metric best used to identify problem areas and alongside explanatory metrics.

2. Methodology

2.1 Overview: Ecological Footprint Accounting

Economic activities fundamentally depend on the capacity of the planet's ecological assets to provide primary resources and life-supporting ecological services, including the sequestration of carbon emissions (Mancini et al., 2018). Ecological Footprint accounting measures humanity's use of ecological assets by answering a simple research question: How much of the planet's (or a region's) regenerative capacity does a specific activity (or a set of activities) require from nature?

To measure and map human dependence on biocapacity, Ecological Footprint accounting relies on two principles: additivity and equivalence.

Additivity: Given that human life competes for biologically productive surfaces, these surface areas can be summed. The Ecological Footprint adds up all human demands on nature that compete for biologically productive space, such as providing natural resources, accommodating urban infrastructure, or absorbing excess carbon from burning fossil fuels. The Ecological Footprint then becomes comparable to the available biologically productive space, or biocapacity.

Equivalence: Biologically productive areas vary in their ability to produce biological flows (i.e., biological resources and services used by people). Therefore, areas are scaled proportionally to their biological productivity. As such, the unit of measurement for Ecological Footprint accounting, the global hectare (gha), represents a rate of biological regeneration equal to that of a world-average biologically productive hectare (see also Box 2.1). This regenerative productivity can be used for resource production, waste sequestration, or physical occupation, which are mutually exclusive (e.g., urban infrastructure can occupy productive areas).

BOX 2.1 - What is a global hectare?

A global hectare (gha) is an area-equivalent unit representing the capacity of a hectare of land with world-average productivity. Dividing the total biocapacity of Earth by the total number of bioproductive hectares yields the value of an average "global hectare." A gha is a measure of the inherent capacity of the biosphere to produce biomass that is appropriated by humans.

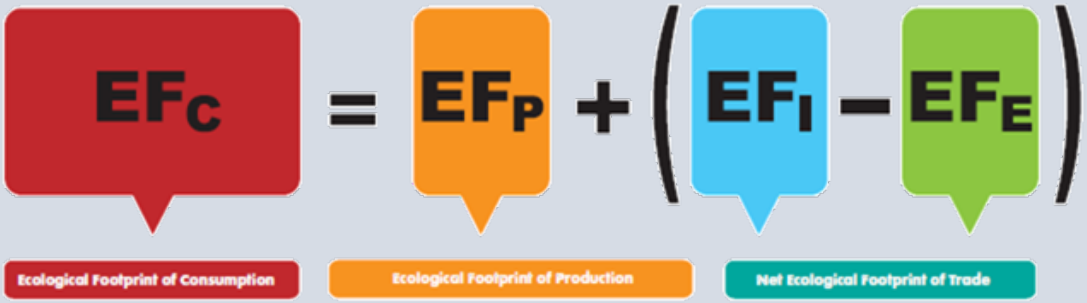
A parallel with the unit CO_2eq can further clarify the nature of this unit. The release of one ton of CO_2eq does not mean that this amount has actually been released. Rather, it means that various greenhouse gases with the equivalent global warming potential of one ton of CO_2 have been released. Similarly, having an ecological footprint of 2.8 gha does not mean that 2.8 ha of physical land are used. It rather means that the equivalent capacity of 2.8 ha of land with world average productivity is needed to produce (via photosynthesis) the resources and services one demands – this biocapacity could be anywhere in the world and could be originating from an actual land area smaller or larger than 2.8 hectares.

Source: Galli, 2015.

The most widely used application of Ecological Footprint accounting is the National Footprint and Biocapacity Accounts (NFAs), a framework published annually by Global Footprint Network that incorporates continuous improvements and implementations in science and accounting methodology (Lin et al., 2018). NFAs provide annual accounts of biocapacity and Ecological Footprint for the world and nearly 200 countries with historical data reaching back to 1961.[3] Each NFA edition provides updated results for the entire accounting timeline based on the latest methodology.

[3] National Footprint and Biocapacity Accounts data for all countries of the world are freely available on-line at: http://data.footprintnetwork.org/

BOX 2.2 - Tracking production, consumption, and net trade with the Ecological Footprint



The Ecological Footprint of consumption indicates the consumption of biocapacity by a country's inhabitants.

In order to assess the total domestic demand for resources and ecological services of a population, we use the Ecological Footprint of consumption (EFc). EFc accounts for both the export of national resources and ecological services for use in other countries, and the import of resources and ecological services for domestic consumption.

EFc is most amenable to change by individuals through changes in their consumption behavior.

The Ecological Footprint of production indicates the consumption of biocapacity resulting from production processes within a given geographic area, such as a country or region.

It is the sum of all the bioproductive areas within a country necessary for supporting the actual harvest of primary products (cropland, pasture land, forestland and fishing grounds), the country's built-up area (roads, factories, cities), and the area needed to absorb all fossil fuel carbon emissions generated within the country.

This measure mirrors the gross domestic product (GDP), which represents the sum of the values of all goods and services produced within a country's borders.

The Ecological Footprint of imports and exports indicate the use of biocapacity within international trade.

Embedded in trade between countries is a use of biocapacity, the net Ecological Footprint of trade (the Ecological Footprint of imports minus the Ecological Footprint of exports). If the Ecological Footprint embodied in exports is higher than that of imports, then a country is a net exporter of renewable resources and ecological services.

Conversely, a country whose Footprint of imports is higher than that embodied in exports depends on the renewable resources and ecological services generated by ecological assets from outside its geographical boundaries.

The Ecological Footprint associated with each country's total consumption is calculated by summing the Footprint of its imports and its production and subtracting the Footprint of its exports. This means that the resource use and emissions associated with producing a car that is manufactured in China, but sold and used in Slovenia, will contribute to Slovenia's rather than China's Ecological Footprint of consumption.

For each country included in the NFAs, data on the amount of natural resources demanded (or carbon dioxide released) is first divided by the yield (or average carbon sequestration) of the ecological assets providing such resource (or sequestration services). The values obtained are then multiplied by equivalence factors and summed together to generate final national Ecological Footprint values in terms of hectare-equivalent units (i.e. global hectares, gha), according to the additivity and equivalence principles mentioned above. Since it takes a consumer perspective[4], the Ecological Footprint of a country is estimated by calculating the Footprint of all that is produced within that country, adding the Footprint embedded in imports and subtracting that embedded in exports (see Box 2.2).

[4] Please note that the Ecological Footprint methodology applies a consumption approach according to which the environmental impact of any given product/activity is assigned to the end consumer of that product/activity, irrespective of where the product/activity is produced. This is opposed to the more common producer approach in which the impact of a given product is assigned to the place in which the production activity took place, irrespective of where that product ends up being consumed.

Similarly, the total availability of biocapacity within each country is calculated as the sum of the biocapacity supplied by each ecological asset available in that country, i.e. the rate of resource supply and effluent waste disposal that can be sustained by that asset under current technology and management schemes.

(Full details on the Ecological Footprint and biocapacity calculations are provided in the Appendix.)

2.2 National Footprint and Biocapacity Accounts

National Footprint and Biocapacity Accounts (NFA) are produced annually by the Global Footprint Network and provide Ecological Footprint and biocapacity values for over 200 countries, regions, and the world. This continuously updated framework is based on United Nations (UN) data sets of up to 15,000 data points per country and year. Data points are individual numbers that describe resource production and use within a country, such as tonnes of apples harvested or hectares of forest land. Furthermore, the footprint can be disaggregated into demand types (Figure 2.1). See Lin et al., 2018 for a detailed review of the methodology and history of National Footprint and Biocapacity Accounts.

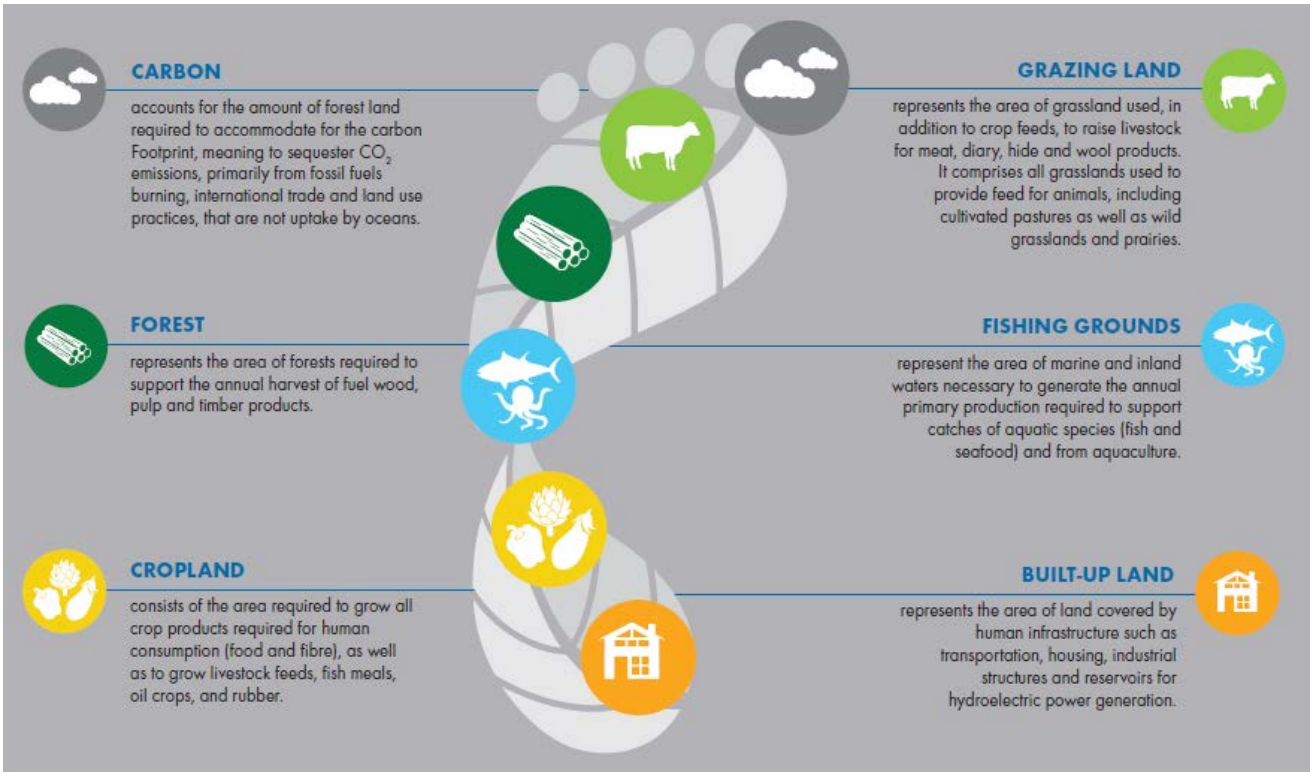


Figure 2.1: Major categories in Ecological Footprint and biocapacity accounting.

For a given country, the Ecological Footprint measures the ecological assets (i.e., the biologically productive land and sea areas) required by the population of that country to produce the biological resources and services it consumes. This includes plant-based food and fibre products, livestock and fish products, timber and other forest products, waste absorption (CO_2 from burning fossil fuels), and space for urban infrastructure (Borucke et al., 2013). The Ecological Footprint is then compared to the biocapacity of that country, which is a measure of the ecological assets available within the national borders (including forest lands, grazing lands, cropland, fishing grounds and built-up land) and their capacity to produce renewable resources and ecological services (Mancini et al., 2018). Ecological footprint and biocapacity are both expressed in global hectares (Galli et al., 2007).

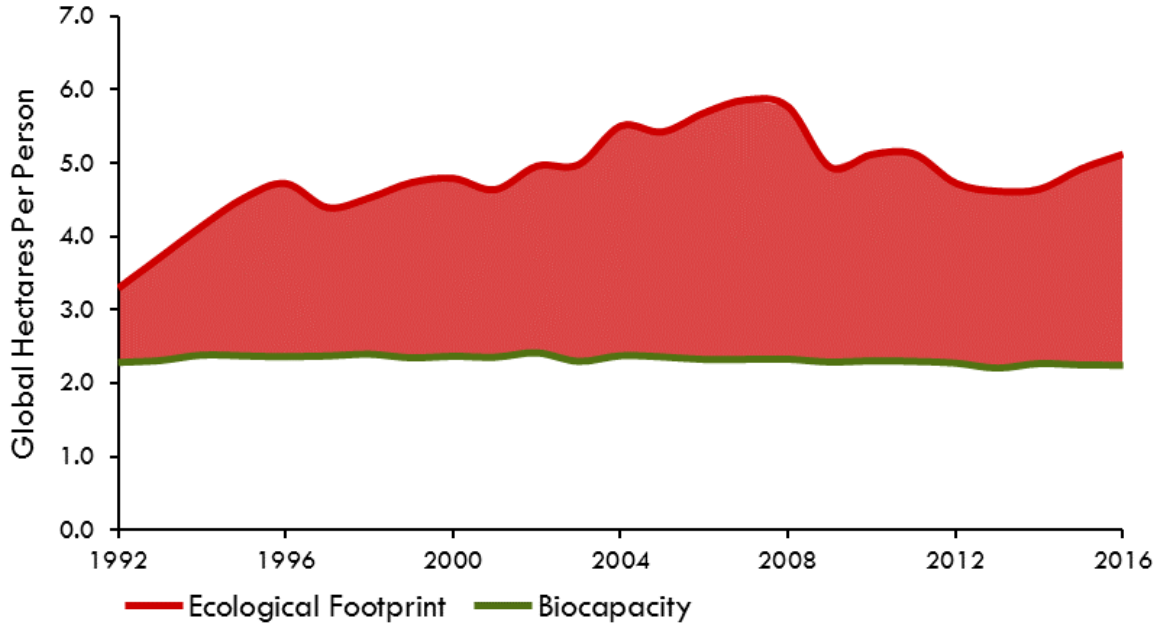


Figure 2.2 : Slovenia's Ecological Footprint and biocapacity 1992-2016

When a country's consumption of natural resources and services is greater than the capacity of its ability to supply them, a situation of biocapacity deficit is determined, which can occur through three different modes: 1) a country can import the natural renewable resources that it consumes but does not produce; 2) a country can overharvest its own resources for a time through unsustainable agricultural practices, overgrazing, overfishing, or deforestation, and 3) a country can emit more CO_2 in the atmosphere than it has the capacity to sequester. By importing biocapacity from other nations and by exploiting the global commons, nations can consume more than their local ecosystems can renew without degrading or depleting their local biocapacity.

2.3 National Ecological Footprint and Biocapacity Projections for 2030

Building upon the NFA data calculated for Slovenia (Annex G), projections were made in a separate report to analyse specific policy interventions (Annex C). A thorough review was conducted of the Stritih Consulting report "Ecological Footprint of Slovenia – Calculation of Projections and Scenarios for the reduction of Ecological Footprint for selected measures" (Stritih Consulting), herein referred to as the "2019 Ecological Footprint Projections and Scenarios". The project was reviewed and verified for appropriate technical and conceptual applications of projections and scenarios associated with selected policy measures and their effects on the Ecological Footprint of Slovenia.

The 2019 Ecological Footprint Projections and Scenarios assessment focused on four Ecological Footprint reduction measures and compared each to business-as-usual (BAU) or baseline projections for 2030 (Table 2.1). The baseline scenarios were based on current trends and applied a set of explicit assumptions to arrive at the best estimate BAU scenario. Subsequently, the report analysed the following scenarios:

1. Sustainable management of forests (increased biocapacity/reduced Ecological Footprint calculations)
2. E-mobility and energy self-sufficiency of single-family homes
3. Energy savings measures for public and commercial buildings
4. Reduction of F-gas emissions

Table 2.1 Key findings from Ecological Footprint projection study

Measure	Baseline 2030 scenario		Scenario with additional measures	
	Net impact [gha]	Net impact [%]	Net impact [gha]	Net impact [%]
Increased biocapacity on account of sustainable management of forests[5]	+623,020	+13%	+174,000	+3%
Reduced Ecological Footprint on account of sustainable management of forests	0	0%	-740,000	-7.5%
Reduced Ecological Footprint through the introduction of E-mobility and energy self-sufficiency of single-family homes	+44,000	+0.49%	-440,000	-4.5%
Reduced Ecological Footprint in public and commercial buildings due to energy savings	-15,000	-0.,15%	-27,000	-0.28%
Reduced Ecological Footprint due to expected reduction of emissions of F-gases	-32,000	-0.34%	-32,000	-0.3%
Total Ecological Footprint reductions	**-3,000**	**-0.003%**	**-1,239,000**	**-12.6%**

Source: Stritih Consulting, 2019. "Ecological Footprint Slovenia – Calculation of Projections and Scenarios for the Reduction of Ecological Footprint for Selected Measures."

Execution of the policies identified and measured in the assessment add up to a cumulative 12.6 percent decrease (at best) in Ecological Footprint compared to baseline, falling short of that goal. The National Development Strategy 2030 (adopted in December 2017) identified the Ecological Footprint as one of the leading indicators to assess the use of natural resources with a goal to reduce the national Ecological Footprint by approximately 20 percent by 2030 (from 4.7 gha/person in 2013 to 3.8 gha/person in 2030). Regional development measures built on these policy recommendations have the potential to improve this situation and make additional progress toward national targets. To achieve the 2030 goals, the detailed recommendations and specific measures proposed for national adoption ought to be implemented to an even greater degree while considering and optimizing for regional differences.

2.4 Consumption Land Use Matrix

Footprint results in the NFAs do not reveal which economic activities are demanded but rather the consequences, in terms of land appropriation, of demanding the outputs of economic activities (Mancini et al., 2018). However, attributing the overall demand on nature to human activities is essential to then be able to act upon such demand and requires an additional analytical step beyond basic Ecological Footprint accounting (Galli, 2015). For specific study at the national level, Environmentally Extended Multi Regional Input-Output Analysis can be applied to derive Ecological Footprint values broken down into major categories of consumption[6] (Wiedmann et al., 2006). This is done by calibrating National Footprint and Biocapacity Accounts data with Multi Regional Input-Output (MRIO) tables from the

[5] Increase of biocapacity does not reduce the ecological footprint; however, it changes the environmental deficit, which is the difference between biocapacity and ecological footprint.

[6] The "Classification Of Individual Consumption According to Purpose" (COICOP) is the internationally agreed classification system for reporting household consumption expenditures. It is published by the United Nations Statistics Division for use in expenditures classification, National Accounts, Household Budget Survey and the Consumer Price Index.

Global Trade Analysis Project (GTAP) database[7]. The result is a Consumption Land Use Matrix (CLUM) for the country under study (Weinzettel et al., 2014).

Since statistical offices track how households, government, and industry spend their money, we can use these estimates to translate land-based Ecological Footprint results into activity-based Ecological Footprint results, shifting the analysis from *where* human pressure is being placed to *which* human activities are responsible to such pressures (Galli et al., 2017). The CLUM for Slovenia is shown in Table 2.2.

Table 2.2 Consumption Land-Use Matrix (CLUM) , 2016. See official COICOP classification for further details on each individual category. The CLUM presents Ecological Footprint per capita of each consumption category broken down by land-use.

Consumption Category or Sector							
[gha person^{-1}]	Cropland	Grazing Land	Forest Products	Fishing Grounds	Built-up Land	Carbon	Total
Household subtotal	0.59	0.17	0.81	0.03	0.01	2.18	3.80
Food and non-alcoholic beverages	0.44	0.13	0.03	0.02	0.00	0.21	0.83
Alcoholic beverages, tobacco and narcotics	0.03	0.00	0.01	0.00	0.00	0.05	0.09
Clothing and footwear	0.02	0.02	0.03	0.00	0.00	0.12	0.19
Housing, water, electricity, gas and other fuels	0.01	0.00	0.55	0.00	0.00	0.47	1.03
Household furnishings, equipment and maint.	0.00	0.00	0.08	0.00	0.00	0.04	0.13
Health	0.01	0.00	0.00	0.00	0.00	0.03	0.04
Transportation	0.01	0.00	0.04	0.00	0.00	0.92	0.97
Communication	0.01	0.00	0.01	0.00	0.00	0.04	0.06
Recreation and culture	0.02	0.00	0.03	0.00	0.00	0.09	0.14
Education	0.00	0.00	0.00	0.00	0.00	0.01	0.02
Restaurants and hotels	0.03	0.00	0.01	0.00	0.00	0.06	0.11
Miscellaneous goods and services	0.01	0.01	0.02	0.00	0.00	0.14	0.18
Government subtotal	0.05	0.01	0.06	0.00	0.00	0.32	0.45
Fixed capital formation subtotal	0.03	0.01	0.16	0.00	0.01	0.67	0.88
Total Ecological Footprint	**0.66**	**0.19**	**1.03**	**0.04**	**0.02**	**3.17**	**5.13**

The *household consumption* component refers to consumables paid for by households and can be also disaggregated into 12 consumption categories and related footprint values. *Government* refers to the consumables paid for by government, such as school supplies in public schools, police equipment, and paper for public administration. *Gross Fixed Capital Formation* refers to lasting goods and assets, such as construction of buildings, roads, factories, and associated equipment.

2.5 Sub-National Ecological Footprint and Biocapacity Accounting

Calculation of sub-national Ecological Footprints can refer to any sub-national territory, such as a region, state, or city. The feasibility and accuracy of sub-national calculations are generally limited by the availability of data, and therefore either require extensive data collection efforts at the sub-national level or a top-down approach based on national data. Global Footprint Network recommends beginning with a top-down methodology for calculating sub-national Ecological Footprints, following the basic calculation framework explained by Baabou et al. (2017) as well as by Isman et al. (2018).

Within such framework, national CLUMs serve as starting point, providing per capita national average Ecological Footprint values for each consumption category[8]. Supplemental data (see Annex A) is then used to calculate the

[7] Global Trade Analysis Project (GTAP 10 Data Base) consists of 65 sectors – 12 of which are agricultural – and includes 141 countries and regions (Narayanan and McDougall, 2015).

[8] The number of consumption categories ranges from five categories (Food, Transportation, Housing, Goods, Services) in the most aggregate form, to more than 40 (see Classification of Individual Consumption According to Purpose (COICOP) https://unstats.un.org/unsd/classifications/). The amount of disaggregation depends on the availability of consumer expenditure data for each country.

difference in consumption between the sub-national and the national populations and derive scaling factors for the appropriate consumption sub-category. For example, housing statistics may indicate that residents of a specific region live in 15% smaller buildings than the national average, and that the CO_2 intensity of municipal electricity generation is 10% greater than national average. These supplemental data would then be used to calculate scaling factors for the carbon and built-up Footprint associated with housing in the region. A top down approach allows a low-cost calculation with comparable results across regions. This methodology allows the accurate calculation of consumption footprints where data is available and assumes a national average consumption where detailed supplementary data is unavailable. Biocapacity values for sub-national territories are calculated using GIS data as described in section 2.5.2.

2.5.1 Regional Ecological Footprint Calculation

The Ecological Footprint results for the 12 Slovenian regions from 2011 to 2016 are calculated following the top-down approach described above. The national dataset used as the base for the sub-national calculation is the CLUM for Slovenia for the year 2014, which is produced by applying the NFA 2019 Edition Ecological Footprint results as an environmental extension to the GTAP version 10 model (see explanations in section 2.4). The top down approach to calculating Ecological Footprints is ideal for situations with multiple entities, such as the 12 statistical regions of Slovenia, as well as situations where data may be limited. This is primarily because the analysis is relatively low cost, and missing data automatically defaults to the national average. Incremental improvements in data will improve accuracy over time. With data intensive bottom-up approaches, major data gaps can result in major underestimates because the completeness of the analysis can be difficult to determine.

The primary data source used to differentiate consumption of regions from national average is national household expenditure for the same period – provided by Purchasing Power Parity (PPP) from Oxford Economics (Oxford Economics, 2014) for each region compared to the Slovenia benchmark, set at 100%. This dataset was chosen because it provides comparable and consistent results for Slovenian NUTS 3 regions disaggregated to 41 detailed consumption categories. Further, the dataset allows for international comparisons because it follows the UN COICOP classifications.

Using the expenditure data with detailed sub-category resolution, values are calculated for each region based on the relative contribution of each detailed category to the total expenditure at the related NUTS 3 level for each year during the period 2011-2016. Finally, annual scaling factors were calculated for each region and for each detailed consumption category as the ratio between the region and the national expenditure value. Such scaling factors were used to calculate the final Ecological Footprint of each detailed category for each region in 2016. The whole calculation process, from the assessment of the National Ecological Footprint value of Slovenia to that of each region is reported in Figure 2.3.

Notably, Tourism is a key industry for Slovenia and accounted for 10.8% of national GDP in 2019 (*Slovenia Economic Impact Report*, 2020). National and regional data do not currently allow separation of the Ecological Footprint associated with tourism, and as a result, the Ecological Footprint values for regions may be slightly overestimated.

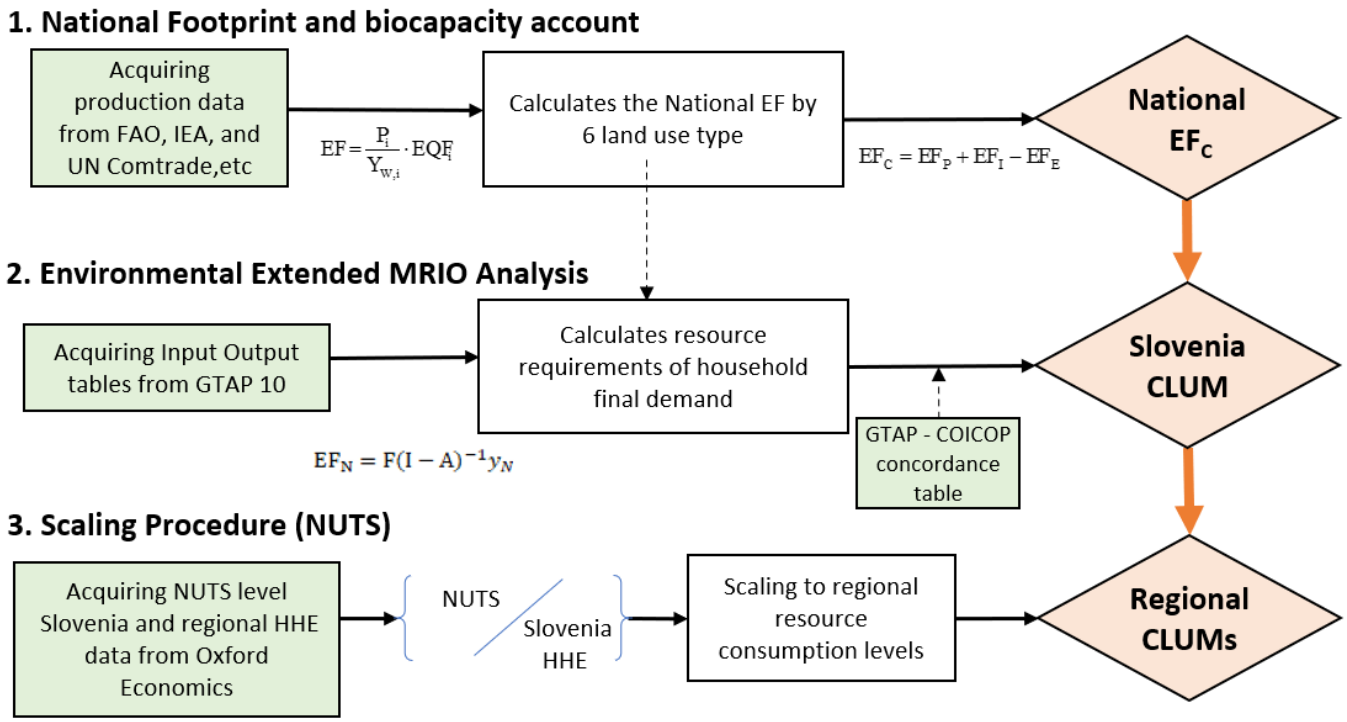


Figure 2.3 Regional Ecological Footprint: visual calculation flowchart. National Footprint and biocapacity account: EF = Ecological Footprint, Pi = The amount of each primary product i, Ywi = The annual world average yield of the production of commodity i, EQF = The equivalence factor for the land use type producing products i, EFc = Ecological Footprint of consumption, EFp= Ecological Footprint of production, EF_I= Ecological Footprint of import, EF_E= Ecological Footprint of export; 2. EE-MRIO: EF_N = country's EF embodied in total national final demand for biomass products y_N, F = the environmental extension matrix derived from EF of production, I = the identity matrix, A = technical coefficients matrix which reflects the monetary exchange between each sector in order to produce one currency unit worth of output from a specific sector of the economy$(I - A)^{-1}$ = the Leontief inverse equation and gives the total output from each sector for one unit of final demand from a specific sector; 3. Scaling Procedure: HHE = Household Expenditure survey data by COICOP categories.

2.5.2 Regional Biocapacity Calculation

Biocapacity at the sub-national level was calculated for the twelve regions reported below in Table 3.1, following the NFA calculation methodology, where biocapacity is calculated as the area of each land type multiplied by the yield factor (YF) and equivalence factor (EQF) for each land type. Area of each land type was calculated from the latest national Land use database produced by the Ministry of Agriculture, Forestry and Food. Each of 25 land use/land cover categories was classified into appropriate NFA land type for calculation (Figure 2.4).

To calculate the YFs for each district and region, a spatially explicit assessment of the bio-productivity was performed in ArcGIS on the basis of the average Net Primary Productivity (NPP) for Cropland, Grazing Land, and Forest land types. The calculation of YF for remaining biocapacity categories (Built-Up, Inland Water, Marine Areas) and derivation EQF values adhered to standards for sub-national calculation (GFN, 2009) in order to maintain consistency and comparability to global hectare values for Ecological Footprint and biocapacity in the NFA; Built-up land YF was set equal to cropland, Inland water was given a YF of 1.00, Marine Area YF was given Slovenia's YF value, 0.79, and EQF

values were consistent with those calculated in the NFA 2019 Edition. See appendix A for detailed yield factors and equivalence factors used in the calculation.

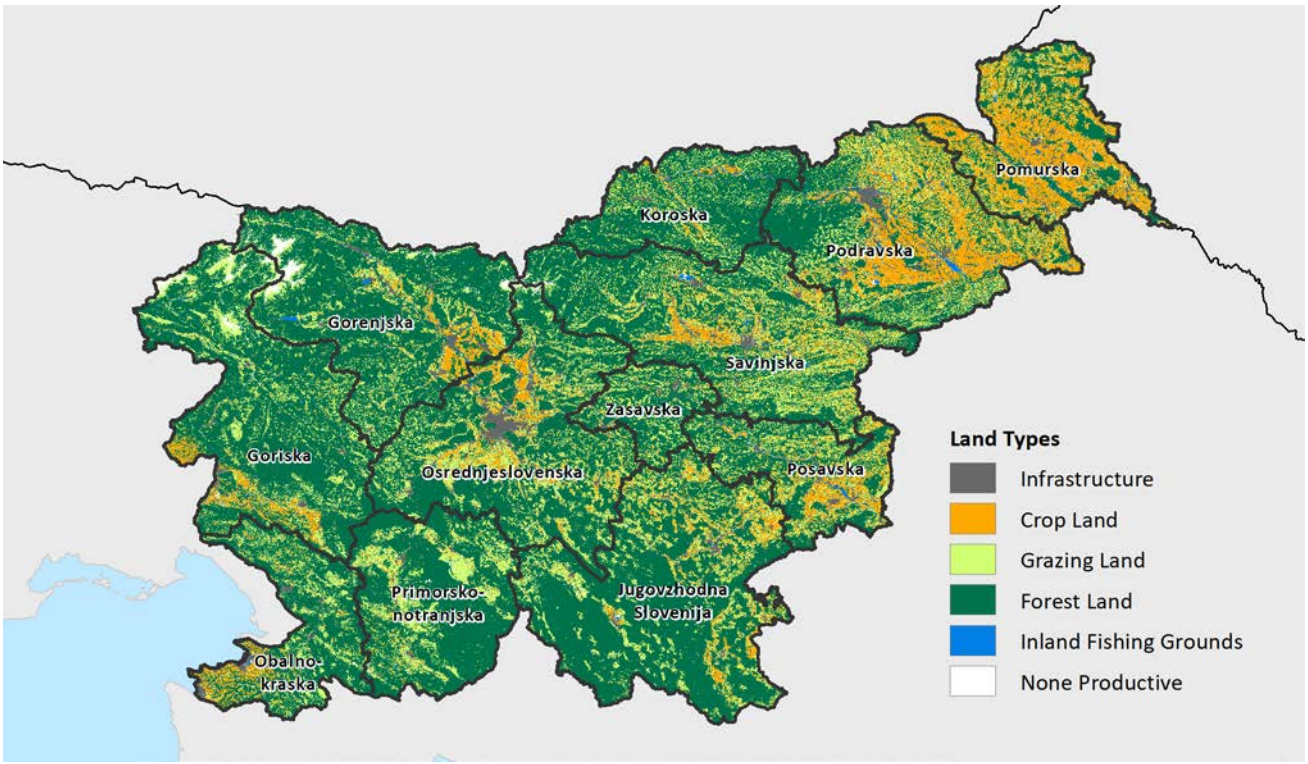


Figure 2.4 Land cover map of Slovenia grouped by biocapacity land types and delineated by statistical region

3. Results

3.1 Regional Ecological Footprint and Biocapacity

This section summarizes Ecological Footprint and biocapacity results for the twelve statistical regions. See Appendix B for detailed results by region.

Across all the statistical regions, the variations in absolute Ecological Footprints are largely explained by the differences in total population of each region (Figure 3.1); together, the three most populated regions, Osrednjeslovenska, Podravska, and Savinjska account for over 50% of the biocapacity consumed in Slovenia.

After the 2008 financial crisis, the Ecological Footprint of Slovenia decreased to its lowest point in 2013 and has since 2016 increased 5.7% (Figure 2.2), reaching a value of 5.2 gha per person. Increases in the carbon Footprint and forest products Footprint, Slovenia's two largest Ecological Footprint subcomponents, are the largest drivers of this increase. For all statistical regions, the carbon and forest products Footprint were also the largest components.

The results in this study suggest that the per capita Ecological Footprints do not vary widely between regions. The similarities between regions may be the result of inadequate input data, but also likely reflect some degree of similarity in consumption among populations. With the current state of data, the degree of each effect cannot be determined without additional consumption data. See Annex B for a more detailed discussion on data gaps and recommendations.

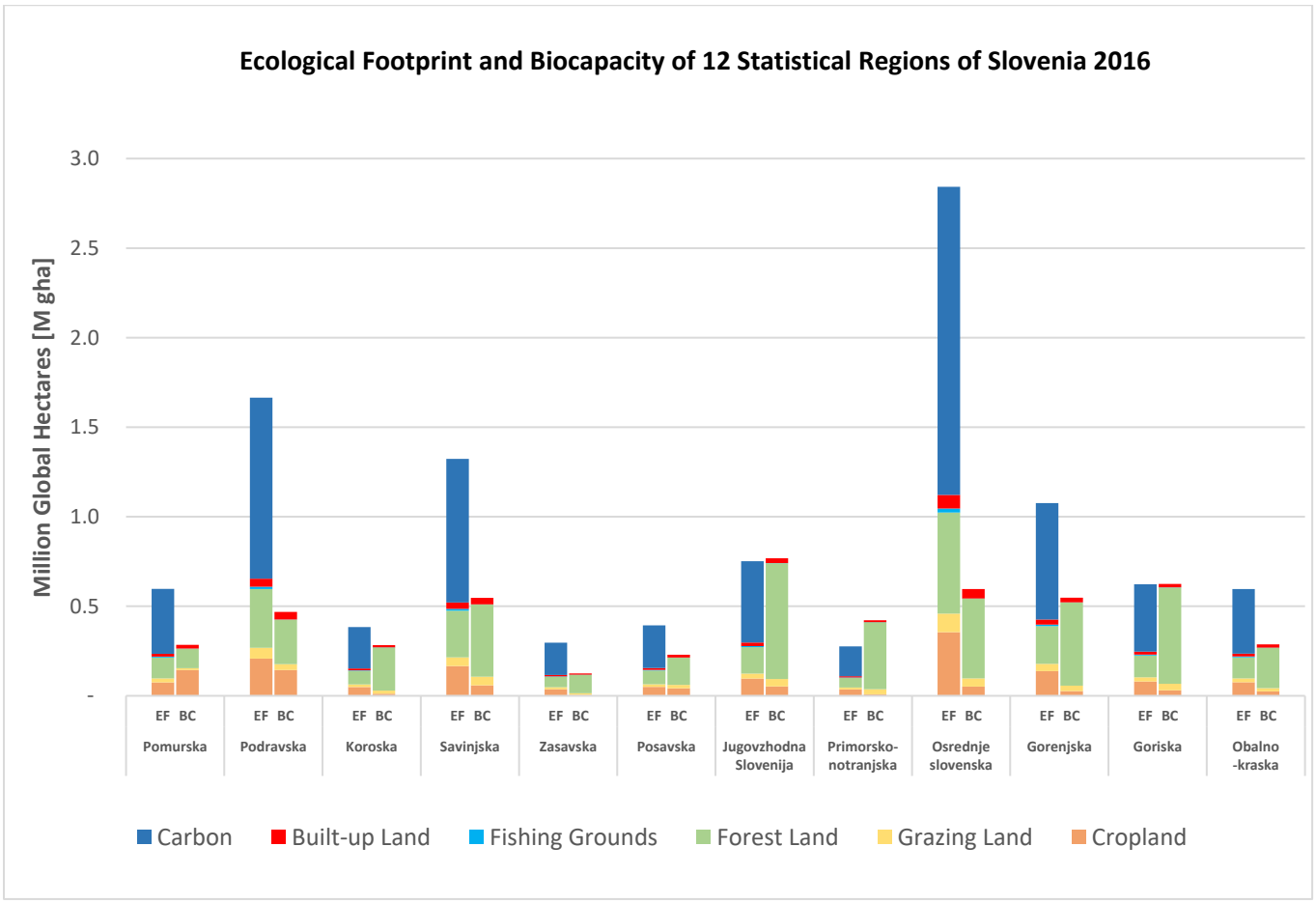


Figure 3.1 Ecological Footprint and biocapacity of Slovenian Regions

Intuitively, regions with thriving cities may appear to consume more resources per capita while others may appear to consume less. However, there tends to be more variation within regions and across socio-economic strata. A high cost of living can appear relate to larger consumption footprints, but this is not always the case, and in fact, cost of living often is more variable than consumption footprints. In support of this, Baabou et al. (2017) for instance found that a 1% increase in household expenses on food determines a 1.4% increase in the household footprint (as it represents a basic need, food makes up for the biggest part of households' resource requirements) while for all other macro-categories of consumption (e.g., housing, transportation, etc), a 1% increase in expenditure determines an increase in the Footprint value between 0.4% and 0.6% thus providing that higher expenditure do not necessarily lead to footprint increases. Additionally, regions size should also be considered when interpreting results and Slovenian regions are rather small with an average population of 155,000 (4 regions have less than 80,000 inhabitants and 8 regions less than 150,000).

Table 3.1 Biocapacity per hectare of Slovenia and regions

		Biocapacity per hectare (gha/ha)				
NUTS3 Region		Crop Land	Inland Fishing Grounds	Forest Land	Grazing Land	Total
	Slovenia	**2.56**	**0.37**	**3.21**	**0.87**	**2.58**
SI031	Pomurska	2.29	0.30	2.46	0.74	2.10
SI032	Podravska	2.44	0.33	2.77	0.80	2.18
SI033	Koroska	2.80	0.38	3.19	0.91	2.70
SI034	Savinjska	2.65	0.38	3.07	0.86	2.40
SI035	Zasavska	2.80	0.37	3.13	0.88	2.56
SI036	Posavska	2.57	0.34	3.11	0.84	2.37
SI037	Jugovzhodna Slovenija	2.84	0.42	3.44	0.93	2.91
SI038	Primorsko-notranjska	3.08	0.41	3.50	0.95	2.91
SI041	Osrednjeslovenska	2.84	0.41	3.28	0.91	2.62
SI042	Gorenjska	2.85	0.39	3.15	0.82	2.59
SI043	Goriska	2.82	0.41	3.29	0.83	2.69
SI044	Obalno-kraska	3.00	0.30	3.44	0.94	2.82

The Slovenian landscape is dominated by forest cover, which on average, contributed 75% of regional biocapacity[9]. Pomurska was the only region where forest biocapacity was not the largest. Across regions, the total amount of biocapacity is largely explained by the total size of each region; in other words, larger regions had greater biocapacity. However, there are notable differences in regional productivities. The southern regions of Jugovzhodna Slovenija and Primorsko-notranjska are proportionally the richest in forest biocapacity and had the highest biocapacity per hectare (Table 3.1), while Pomurska and Podravska in the northeast, by contrast, have higher proportion of croplands and the lowest biocapacity per hectare. These findings are relatively unexpected because, generally, regions with more

[9] Biocapacity reflects the ability of bio-productive areas to generate resources. Some countries have more diverse ecosystems (dryer or wetter parts, high mountains versus flat lands) which can make the productivity per region quite distinct. But this does not seem to be the case at the regional level in Slovenia.

cropland tend to be more productive on a per-hectare basis.[10] As expected, inland fishing grounds contributed less than one percent of the biocapacity of each region, while grazing lands contributed between 4 and 9%. The biocapacity occupied by infrastructure was more variable, ranging from 2% in Primorsko-notranjska to 9% in Podravska.

Nine of twelve regions show a biocapacity deficit (Table 3.2), meaning their residents consumed more biocapacity to support their daily life than what was available in that respective region in 2016, while three regions show a biocapacity reserve. Ecological reserves and deficits represent the degree to which consumption can be met by the biocapacity within a region. Highly urbanized regions tend to be in deficit and draw upon biocapacity from outside their borders.

In Slovenia, the regions with the largest Ecological Footprints also had the largest biocapacity deficits correspond with the largest population and population density. This is especially true for Osrednjeslovenska and Podravska region with two largest cities in Slovenia (Ljubljana in Osrednjeslovenska and Maribor in Podravska region). Working towards reducing the resource demand of the Slovenian residents would thus seem to require a focus on environmental management practices in these two regions. The sectors and daily activities to prioritize are discussed in section 3.2 below.

Table 3.2 Ecological footprint and biocapacity by region. Biocapacity deficit or reserve is calculated as the difference between consumption (Ecological Footprint) and regeneration (biocapacity) in a region. Region equivalent of consumption is calculated as the consumption (Ecological Footprint) of the regional population divided by the biocapacity of the region and represents the number of regions required to supply the equivalent biocapacity consumed by the population of the region.

Region	Total Ecological Footprint (EF)	EF % of Slovenia	Total Biocapacity (BC)	BC % of Slovenia	Biocapacity deficit	Ratio EF/BC
Pomurska	597,040	5.5%	284,442	5.5%	-312,597	2.10
Podravska	1,664,812	15.4%	468,740	9.0%	-1,196,072	3.55
Koroska	383,787	3.5%	282,546	5.5%	-101,241	1.36
Savinjska	1,323,416	12.2%	547,359	10.6%	-776,057	2.42
Zasavska	296,305	2.7%	125,196	2.4%	-171,109	2.37
Posavska	393,110	3.6%	229,550	4.4%	-163,559	1.71
Jugovzhodna Slovenija	751,747	6.9%	768,230	14.8%	16,482	0.98
Primorsko-notranjska	276,371	2.6%	421,757	8.1%	145,387	0.66
Osrednjeslovenska	2,842,183	26.3%	595,875	11.5%	-2,246,308	4.77
Gorenjska	1,076,355	9.9%	547,945	10.6%	-528,410	1.96
Goriska	623,290	5.8%	624,922	12.1%	1,632	1.00
Obalno-kraska	595,802	5.5%	287,573	5.5%	-308,229	2.07

3.2 Ecological Footprint by Household Consumption Category

Consumption-based Ecological Footprints can be allocated into corresponding household consumption categories (see section 2.3 for methodology), which provide a framework more suitable for recommendations targeting consumers, economic sectors, and consumption-based policies. Regional results for Slovenia show a high degree of variation in the biocapacity availability between regions while the differences in Ecological Footprint are much smaller (see

[10] This is a reflection of how fertile different surface areas are. For example, desert has very low biocapacity per hectare while rainforest usually has very high biocapacity per hectare.

appendix). As discussed above, the similarity of per capita Ecological Footprint could either be the result of real-world similarity in consumption or a reflection of limited data resolution (see Annex A for detailed discussion and recommendations). The input data takes cost of living into account, however the variance across detailed consumption categories relies on appropriate resolution in input data. Given the limited data resolution, the following discussion is limited to specific household consumption at the national level.

Three categories of household consumption, namely transportation (25-26%); housing, water, electricity, gas and other fuels (26-27%); and food and non-alcoholic beverages (21-23%), make up 72 to 76 percent of household consumption for all regions.

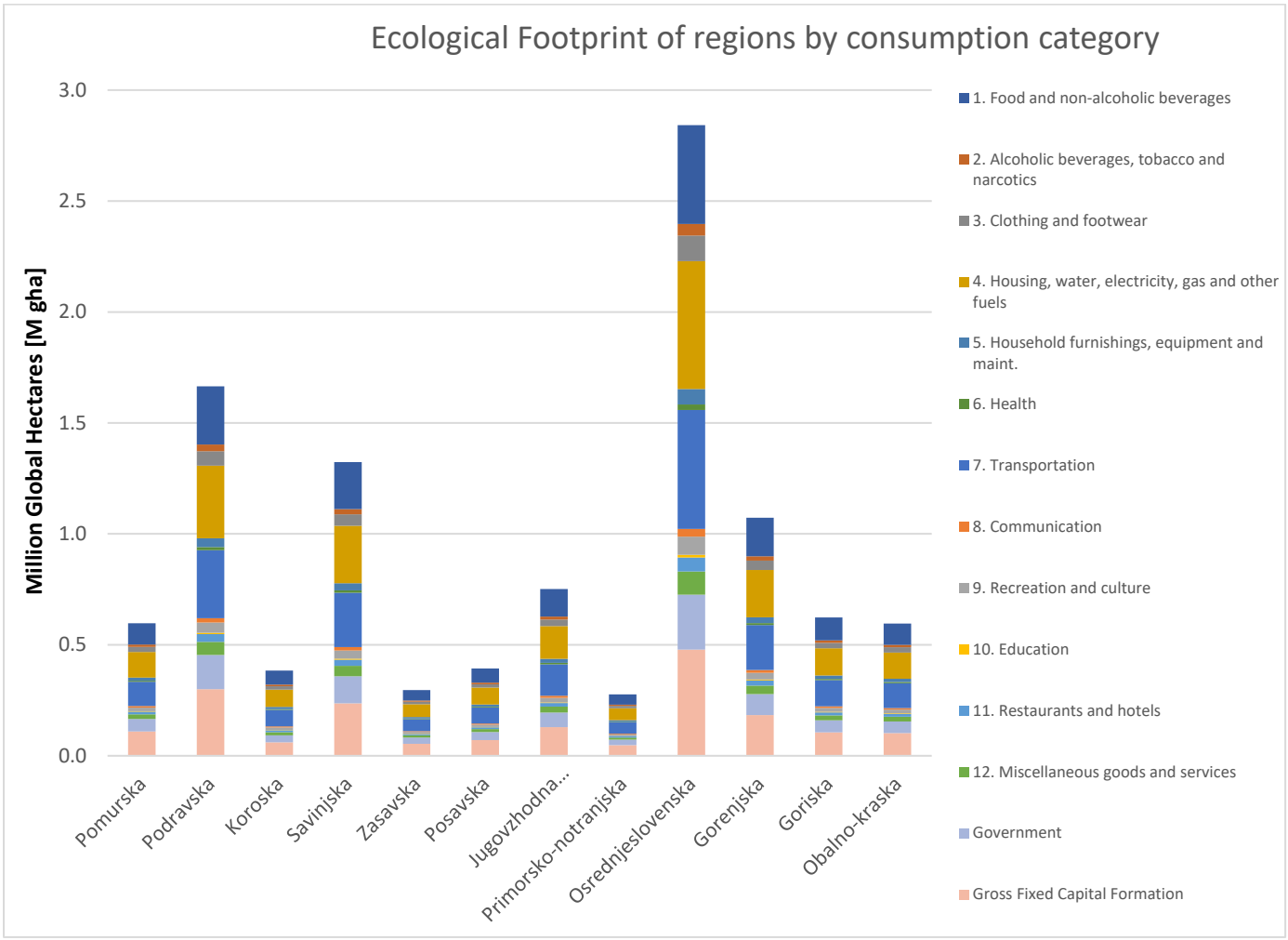


Figure 3.2 Ecological Footprint of regions by household consumption type

4. Recommendations and Conclusions

4.1 Technical Recommendations

To improve regional statistics and build the capacity for monitoring Ecological Footprint and biocapacity accounts, improved input data is required. Most importantly, a combination of economic and physical consumption data can be used to improve the accuracy of results. While the potential data sources available to develop top-down assessments are abundant, several key dataset types have the greatest potential to improve the tracking of Ecological Footprint to the degree that they will be responsive enough to monitor the effect of various policy implementations. These priority datasets must reflect the consumption activity associated with the cross section of the largest footprint category (carbon footprint) and the largest consumption categories (personal transportation and housing). Regional CO2

intensity of energy consumption is a factor that affects all consumption and is crucial to monitor the renewable energy transition. See Annex A for further discussion and detail on specific types of data recommended for improving results.

4.2 Regional Development Priorities

4.2.1 A framework for long-term planning

Given that biological resources provide essential services for our economies, Ecological Footprint and biocapacity provide a context for planning and development strategies intended to secure their long-term success. Ecological Footprint and biocapacity trends for the world, one's own country, and the country's trading partners shape the context for development planning, particularly as resource security is becoming an ever more significant parameter of long-term success.

The analysis of demand by consumption categories provides deeper insight into where the Footprint demand originates. It offers opportunities for identifying interventions. Analytically, it becomes a benchmark that allows policymakers to track changes in various aspects of people's consumption and puts that in the context of the overall demand and can track the overall trajectory over time.

The economies of countries are defined by their structures and economies: energy systems, zoning laws, industries, transportation networks, etc. Each of these is characterized by large time lags. In other words, they cannot be adjusted from one day to the next. To secure long-term wellbeing, we must make sure that infrastructure is able to operate in a future we can anticipate: one with increasing climate change and resource constraints.

Using foresight and innovation, forward-looking decisions enable us to turn around natural resource consumption trends while improving quality of life for all. We identify five key areas that are most significant in defining our long-term trends, and all of them are shaped by both individual and collective choices: *cities, energy, food, planet,* and *population.*

Cities, and more broadly speaking, our built environment shapes how people live and consume over the infrastructure's lifespan. Transportation infrastructure guides where and how we move and building design greatly affects the energy we need for heating and cooling. The cumulative impact of historic development, hundreds to thousands of years ago, continues to shape societies today. For example, the medieval urban designs still define the inner portions of many European cities.

Energy systems power our economies. They make up the largest portion of our Ecological Footprint globally, in Slovenia and for in all Slovenian regions. Stable and predictable energy systems are key to resilient economy. Ongoing investment into fossil fuel-based energy systems both delay our investment into a resilient economy, but also become stranded assets in the future.

Food is a fundamental service we derive from our environment. We cannot live without food, but we can optimize food systems by breaking down and targeting elements of the supply chain, starting from production all the way to consumption.

Our **planet**'s biocapacity supports our livelihood. Management of our productive lands should aim to maintain natural ecosystems and improve cultivated ecosystems. In Slovenia, forests are a vital natural asset; a long history and strong cultural connection exists between forests and Slovenian people. Over 80% of Slovenia's biocapacity is from forest, while the forest products footprint per person, for consumption in Slovenia, is among the 10 highest in the world.

Population is a global factor in sustainability: with smaller populations, more resource capacity, per person, would be available. For instance, if Italian fertility rates were adopted around the world, the world population would, by 2100, shift to just over 4 billion people. The consequence would be about three times as much biocapacity per person as in

the median projection of the UN. As Slovenia may have already experienced, smaller families lead to better educational and health outcomes for their children. This shows how social, ecological, and ecological advantages can go hand in hand.

These five crosscutting categories build upon each other and are key to long-term planning. Some have greater impact in the near term (changes in consumption patterns), while others are changing more slowly but have vast cumulative impact over time (built infrastructure and population, both of which change only slowly over decades). All of them are interrelated and influence a country or region's resource security.[11]

4.2.2 Opportunities for Intervention

Recommendation #1: Energy-efficient urban planning, including net-zero buildings

Housing and transportation are the two categories that make up the largest portions of Slovenia's Ecological Footprint. Identifying population centres and areas of rapid infrastructure development will be particularly important in setting the stage for Slovenia's success in 2030. Careful planning of infrastructure that reduces energy demand in every-day life, from urban planning to net-zero buildings are a key component of resilient, resource-efficient Slovenia. It also involves retrofitting what already exists, since not all infrastructure can be replaced in time. This energy focus is a priority for regions with the largest per capita transportation and housing footprints such as Koroska, Osrednjeslovenska, and Obalno-kraska.

- **Net-Zero buildings:** New construction should aim for zero net energy consumption, when averaged over the building lifespan. This requires both reducing the energy load of buildings through efficient lighting, heating, and cooling systems, and allowing them to generate their own energy through distributed renewables such as solar panels.

- **Building retrofitting:** New construction makes up only a small minority of buildings**.** In most cases it is preferable to retrofit existing structures and individually implement energy-saving practices, such as improved insulation and lighting, and more efficient appliances and HVAC systems.

- **Reducing the need for cars with dense and walkable urban areas:** It ought to be possible to enjoy a high individual standard of living, with good access to services and opportunities, without owning a car. Achieving this requires additional investment in public transportation, and the prioritization of walking and bicycling in both existing city centres and in new developments. The latter can be achieved through building standards which encourage density and accessibility.

- **Electric Cars:** Just as focusing on building retrofitting recognizes that new construction cannot be expected to solve the problem on its own, encouraging the adoption of electric cars recognises that most Slovenians are not currently well served by public transportation and will therefore keep using private cars. Widespread adoption of electric cars is necessary to reduce transportation-related emissions, but also requires the widespread distribution of charging stations.

[11] These solution areas are explained in detail here: www.overshootday.org/solutions.

Recommendation #2: Transition to low- and eventually no-carbon renewable energy systems

Ongoing investment into fossil fuel-based energy systems both delay our investment into a resilient economy, but also become stranded assets in the future. This is a critical need—early action results enable cumulative benefits and increase the chance to complete the transition in time. Energy systems make up the largest portion of our Ecological Footprint globally, in Slovenia, and for all Slovenian regions. Reduction and transition to carbon-free renewable energy systems are key to achieving the goal set out in the Paris Climate Agreement.

Achieving it requires even more than net zero emissions, since we will also have to find ways to lower the concentration of greenhouse gases already in the atmosphere. More importantly, stable and predictable energy systems are a key to resilient economy.

- **Utility-Scale Renewables:** Hydroelectric power plants, biomass reactors, and arrays of wind turbines and photovoltaics are all examples of utility-scale renewables: large plants which take advantage of economies of scale to provide cheap and clean energy. Slovenia already makes substantial use of nuclear and hydroelectric energy, but there is much room to expand the use of intermittent renewables such as wind and solar.

- **Distributed Renewables:** Rooftop solar panels are an example of distributed renewables. These have the potential to provide clean local energy and improve the resilience of the energy grid. Small-scale hydroelectric plants and biomass reactors also fall into this category. Smarter, more flexible electric grids are necessary to make the most of distributed renewables.

- **Utility-Scale Energy Storage:** The inherent variability of certain forms of renewables such as wind and solar (which do not produce energy at night or when the wind isn't blowing) means that there is a need to smoothen energy production over time. Examples of utility-scale storage include pumping water back into hydroelectric reservoirs, and arrays of batteries. Besides ensuring that energy supply can match demand, utility-scale energy storage eliminates the need for polluting "peaker" plants, which only serve to satisfy spikes in demand.

- **Distributed Energy Storage:** Electric vehicles and standalone batteries can be used for localized energy storage, facilitating the implementation of distributed renewables and net-zero buildings.

Recommendation #3: Increase share of food from domestic production

From a global perspective, Slovenia's Ecological Footprint associated with the consumption of food ranks among the lowest 25% of EU countries. Still, in 2016, Slovenia's biocapacity to support food production (from cropland, grazing land, and fishing grounds) provided less than half the biocapacity demanded by Slovenia's food consumption. Minimizing risks from global supply chain shocks through deeper analysis of trade partners and internationally imported resources will promote stability as extreme weather events increase and global food demand rises. This is particularly important in the northeast regions where Slovenia's cropland is concentrated. These actions can improve resource security in the face of supply chain shocks, as experienced in the current pandemic, and which are becoming more likely in times of growing global climate change.

- **Plant-rich diets:** In an average Slovenian diet, just under half of the overall ecological footprint is the result of animal products. Increasing the proportion of plant-based foods in the average diet will both reduce the average Slovenian's footprint, and increase the proportion of calories which can be satisfied by domestic agriculture.

- **Reduced food waste:** Approximately one third of global food is wasted, meaning that the resources – water, energy, land, emissions - which went into its production are also wasted. Cutting down on food waste both reduces the overall footprint of the agricultural sector and increases the extent to which domestic agriculture can satisfy local demand.

Recommendation #4: Prioritize forest management and regenerative agriculture to preserve and enhance biocapacity

Continued priority needs to be given to forest management, especially in forest rich regions of the south. According to the projections report from Stritih Consulting, sustainable management of forests has the potential to decrease Slovenia's Ecological Footprint by 740,000 global hectares (7.5%) by 2030, compared to baseline projections. As regions update their forest management plans, revisions should incorporate climate change adaptation measures.

Since croplands are primarily located in the northeast (Podravska and Pomurska region contain 48% of Slovenia's cropland), in these regions regenerative practices will improve the biocapacity of the land. This is a critical need to secure Slovenia's future biocapacity. Given current trends, it is inevitable that agricultural capacity will become more limited around the world and the cost of natural resources will increase.

- **Regenerative and Conservation agriculture:** These agricultural practices enhance and sustain the health of soil by preventing erosion and restoring its carbon content. It emphasizes minimizing soil disturbance and maintaining soil cover, enabling high levels of productivity without recourse to fertilizers or other soil-depleting measures. Regenerative practices include crop rotations, the absence of tillage and a diversity of cover crops, and they have the outcome of improving the long-term viability of agricultural lands.

- **Forest Restoration:** Restoring degraded and deforested lands offers substantial climate mitigation opportunities, as young forest regrowth is often rapid and results in high rates of carbon sequestration.

4.3 Economic Relevance

In a world of climate change and resource constraints, running biocapacity deficits becomes an increasing risk, first and foremost for those with low income who are less able to import goods and services. These risks barely appear in financial analyses because natural capital is still incredibly cheap. But since natural capital is so fundamental, inadequate access can make the entire economy lose in value.

The distribution of resources in Slovenia can optimize production and consumption. Running a biocapacity deficit is not necessarily a negative situation, and in most cases, it is expected that consumption is concentrated in population centres. It becomes increasingly important to understand the source of resources and the ability of those producers to continue providing resources for future populations. Not only is the state of international trade partners important, internal optimization and promotion of local production and consumption supports strong regional and interregional sustainability and resilience.

Every country which invests in its own long-term success makes it more likely for other countries (and cities and companies) to succeed – because the success of one leads to the success of others as well. It becomes a positive-sum game. Therefore, careful resource accounting that helps manage a country or region's resource security helps them succeed in a time of increasing ecological constraints. Optimizing inter-regional production and consumption enhances self-sufficiency and resiliency while building on the capital wealth of each region.

4.4 Conclusion

Having established an initial benchmark for Slovenia and its regions, Ecological Footprint accounting can be taken to the next level to actively support decision making. For that, more detailed assessments would be needed. With a baseline now established, the ability to track the performance over time is essential to set meaningful targets, evaluate progress, and identify intervention points. In conjunction with more refined data and tools, it would be possible to assess investments, from infrastructure to programs, in order to determine to what extent it helps to reduce Slovenia's Ecological Footprint.

Testing the country's and the regions' competitiveness strategies would allow Slovenia to assess to what extent various interventions help them reduce their resource dependence. Conventional competitiveness strategies are typically blind to the resource dimension of economies, as exemplified by the World Economic Forum's Competitiveness Report.[12]

Slovenia is a powerful country, relatively well endowed with biocapacity, and with possibilities to generate its energy renewably. Slovenia deserves a thriving future and getting there requires understanding its context and using that to inform its key decisions.[13] There is no need to wait on a global consensus to take action.

[12] While the WEF Competitiveness Report has started to use the ecological footprint as a "context indicator" the actual measure, made up of over 100 aspects of an economy does not contain one single environmental / resource / energy / climate / water metric describing the future-fitness of a country.

[13] This is consistent to the recommendations of the EEA's "From Words to Action: How Can EU Policy Drive Sustainability Transitions?" report. This Background Paper for the EEA-EPSC High-Level Workshop on 10 September 2019 is available here: www.eea.europa.eu/themes/sustainability-transitions/how-can-eu-policy-drive-1/from-words-to-action-how/view

About Global Footprint Network

Global Footprint Network is an international sustainability organization that is helping the world live within the Earth's means and respond to climate change.

Global Footprint Network's purpose is to help countries develop their own national and regional calculations and use effective global practices when planning measures to reduce their Ecological Footprint. For example, Global Footprint Network's regional footprint projects demonstrate that Ecological Footprint assessments are not only useful for development purposes and monitoring resource consumption, but also for communicating and raising awareness.

Since 2003 we've engaged with more than 60 countries, 40 cities, and 70 global partners to deliver scientific insights that have driven high-impact policy and investment decisions. Together, we're creating a future where all of us can thrive within the limits of our one planet.

www.footprintnetwork.org

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Michelle Shaffer

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Appendix A: Yield and equivalence factors for biocapacity calculation of Slovenia and statistical regions

Yield Factors

	Crop Land	Inland Fishing Grounds	Forest Land	Grazing Land	Infrastructure
SLOVENIA	**1.02**	**1.00**	**2.51**	**1.89**	**1.02**
Pomurska	0.91	0.81	1.92	1.61	0.88
Podravska	0.97	0.89	2.16	1.73	0.94
Koroska	1.12	1.04	2.49	1.98	1.08
Savinjska	1.06	1.03	2.40	1.86	1.02
Zasavska	1.12	1.02	2.45	1.92	1.03
Posavska	1.03	0.93	2.43	1.83	0.98
Jugovzhodna Slovenija	1.13	1.13	2.69	2.02	1.09
Primorsko-notranjska	1.23	1.11	2.74	2.06	1.11
Osrednjeslovenska	1.13	1.12	2.56	1.97	1.07
Gorenjska	1.14	1.07	2.46	1.79	1.08
Goriska	1.13	1.11	2.57	1.82	1.08
Obalno-kraska	1.20	0.82	2.69	2.05	1.07

Equivalence Factors by footprint type

	Crop Land	Inland Fishing Grounds	Forest Land	Grazing Land	Infrastructure
EQF	**2.50**	**0.37**	**1.28**	**0.46**	**2.50**

Appendix B: Ecological Footprint and biocapacity results by statistical region

Pomurska's Ecological Footprint and biocapacity by land use, base year 2016

Ecological Footprint					Biocapacity					Deficit / Reserve		
Demand Category	Total (gha)	Per-capita (gha)	% of National Total	% of Regional Total	% of Regional Total	% of National Total	Per-capita (gha)	Total (gha)	**Supply Category**	Total (gha)	Per-capita (gha)	Ratio EF/BC
Cropland	75,137	0.65	0.7%	12.6%	50.5%	24.0%	1.24	143,539	Cropland	-68,402	0.59	0.5
Grazing Land	21,872	0.19	0.2%	3.7%	3.8%	3.2%	0.09	10,941	Grazing Land	10,931	-0.09	2.0
Fishing Grounds	4,772	0.04	0.0%	0.8%	0.1%	7.7%	0.00	381	Fishing Grounds	4,391	-0.04	12.5
Built-up Land	16,076	0.14	0.1%	2.7%	7.3%	7.2%	0.18	20,749	Built-up Land	-4,672	0.04	0.8
Forest Products	116,819	1.01	1.1%	19.6%	38.3%	2.8%	0.94	108,833	Forest Land	370,349	3.06	4.4
Carbon	362,364	3.13	3.3%	60.7%								
Total	**597,040**	**5.15**	**5.5%**	**100.0%**	**100.0%**	**5.5%**	**2.46**	**284,442**	**Total**	**312,597**	**-2.70**	**2.1**

Pomurska's Ecological Footprint per capita by Consumption Category and Year

	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
1. Food and non-alcoholic beverages	0.84	0.76	0.73	0.79	0.82	0.83	0.83	0.82
2. Alcoholic beverages, tobacco and narcotics	0.09	0.08	0.08	0.08	0.09	0.09	0.09	0.09
3. Clothing and footwear	0.19	0.18	0.18	0.18	0.19	0.20	0.20	0.19
4. Housing, water, electricity, gas and other fuels	0.77	0.77	0.79	0.87	0.92	1.00	0.99	0.97
5. Household furnishings, equipment and maint.	0.09	0.09	0.09	0.11	0.11	0.12	0.12	0.12
6. Health	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
7. Transportation	0.98	0.92	0.89	0.85	0.91	0.94	0.94	0.93
8. Communication	0.06	0.05	0.05	0.05	0.06	0.06	0.06	0.06
9. Recreation and culture	0.13	0.12	0.12	0.13	0.13	0.14	0.14	0.14
10. Education	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
11. Restaurants and hotels	0.10	0.09	0.09	0.10	0.10	0.10	0.10	0.10
12. Miscellaneous goods and services	0.17	0.17	0.16	0.16	0.17	0.18	0.18	0.17
Household Sub Total	**3.47**	**3.30**	**3.25**	**3.37**	**3.56**	**3.72**	**3.71**	**3.65**
Government	0.54	0.48	0.46	0.45	0.47	0.49	0.49	0.50
Gross Fixed Capital Formation	1.03	0.93	0.89	0.86	0.91	0.95	0.95	0.97
Total	**5.04**	**4.70**	**4.59**	**4.68**	**4.95**	**5.15**	**5.15**	**5.11**

Podravska's Ecological Footprint and biocapacity by land use, base year 2016

Ecological Footprint					Biocapacity					Deficit / Reserve		
Demand Category	Total (gha)	Per-capita (gha)	% of National Total	% of Regional Total	% of Regional Total	% of National Total	Per-capita (gha)	Total (gha)	**Supply Category**	Total (gha)	Per-capita (gha)	Ratio EF/BC
Cropland	207,971	0.65	1.9%	12.5%	30.6%	24.0%	0.45	143,620	Cropland	64,351	-0.20	1.4
Grazing Land	60,516	0.19	0.6%	3.6%	7.1%	9.8%	0.10	33,222	Grazing Land	27,294	-0.08	1.8
Fishing Grounds	13,252	0.04	0.1%	0.8%	0.2%	18.9%	0.00	930	Fishing Grounds	12,322	-0.04	14.3
Built-up Land	44,711	0.14	0.4%	2.7%	9.1%	14.8%	0.13	42,486	Built-up Land	2,225	-0.01	1.1
Forest Products	327,825	1.02	3.0%	19.7%	53.0%	6.3%	0.77	248,483	Forest Land	1,089,880	2.90	5.4
Carbon	1,010,538	3.14	9.3%	60.7%								
Total	**1,664,812**	**5.18**	**15.4%**	**100.0%**	**100.0%**	**9.0%**	**1.46**	**468,740**	**Total**	**1,196,072**	**-3.72**	**3.6**

Podravska's Ecological Footprint per capita by Consumption Category and Year

	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
1. Food and non-alcoholic beverages	0.85	0.76	0.73	0.78	0.81	0.82	0.81	0.81
2. Alcoholic beverages, tobacco and narcotics	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.09
3. Clothing and footwear	0.20	0.19	0.18	0.18	0.20	0.20	0.20	0.20
4. Housing, water, electricity, gas and other fuels	0.82	0.80	0.82	0.89	0.94	1.02	1.01	1.01
5. Household furnishings, equipment and maint.	0.09	0.09	0.09	0.11	0.11	0.12	0.12	0.12
6. Health	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
7. Transportation	1.03	0.94	0.92	0.86	0.92	0.95	0.95	0.94
8. Communication	0.06	0.06	0.05	0.06	0.06	0.06	0.06	0.06
9. Recreation and culture	0.14	0.13	0.13	0.13	0.14	0.14	0.14	0.14
10. Education	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
11. Restaurants and hotels	0.11	0.10	0.10	0.10	0.11	0.11	0.11	0.11
12. Miscellaneous goods and services	0.19	0.17	0.17	0.17	0.18	0.18	0.18	0.18
Household Sub Total	**3.64**	**3.39**	**3.33**	**3.41**	**3.62**	**3.76**	**3.75**	**3.73**
Government	0.51	0.47	0.45	0.44	0.46	0.48	0.48	0.48
Gross Fixed Capital Formation	0.98	0.90	0.86	0.85	0.90	0.93	0.94	0.94
Total	**5.13**	**4.76**	**4.64**	**4.70**	**4.98**	**5.18**	**5.17**	**5.16**

Koroska's Ecological Footprint and biocapacity by land use, base year 2016

Ecological Footprint					Biocapacity					Deficit / Reserve		
Demand Category	Total (gha)	Per-capita (gha)	% of National Total	% of Regional Total	% of Regional Total	% of National Total	Per-capita (gha)	Total (gha)	**Supply Category**	Total (gha)	Per-capita (gha)	Ratio EF/BC
Cropland	49,211	0.69	0.5%	12.8%	4.3%	2.0%	0.17	12,098	Cropland	37,113	-0.52	4.1
Grazing Land	14,311	0.20	0.1%	3.7%	6.2%	5.1%	0.24	17,397	Grazing Land	-3,087	0.04	0.8
Fishing Grounds	3,108	0.04	0.0%	0.8%	0.1%	6.1%	0.00	302	Fishing Grounds	2,807	-0.04	10.3
Built-up Land	10,032	0.14	0.1%	2.6%	4.0%	4.0%	0.16	11,412	Built-up Land	-1,380	0.02	0.9
Forest Products	75,916	1.07	0.7%	19.8%	85.4%	6.1%	3.40	241,337	Forest Land	65,787	5.59	1.3
Carbon	231,209	3.26	2.1%	60.2%								
Total	**383,787**	**5.40**	**3.5%**	**100.0%**	**100.0%**	**5.5%**	**3.98**	**282,546**	**Total**	**101,241**	**-1.43**	**1.4**

Koroska's Ecological Footprint per capita by Consumption Category and Year

	2011	2012	2013	2014	2015	2016	2017	2018
1. Food and non-alcoholic beverages	0.91	0.82	0.78	0.83	0.88	0.89	0.89	0.89
2. Alcoholic beverages, tobacco and narcotics	0.10	0.09	0.09	0.09	0.10	0.10	0.10	0.10
3. Clothing and footwear	0.21	0.20	0.19	0.19	0.21	0.22	0.22	0.22
4. Housing, water, electricity, gas and other fuels	0.86	0.84	0.86	0.94	1.01	1.10	1.10	1.09
5. Household furnishings, equipment and maint.	0.10	0.10	0.10	0.12	0.13	0.14	0.14	0.14
6. Health	0.05	0.04	0.04	0.04	0.05	0.05	0.05	0.05
7. Transportation	1.10	1.01	0.98	0.92	1.01	1.05	1.05	1.04
8. Communication	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.07
9. Recreation and culture	0.15	0.14	0.14	0.14	0.15	0.16	0.16	0.16
10. Education	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
11. Restaurants and hotels	0.12	0.11	0.11	0.11	0.12	0.12	0.12	0.12
12. Miscellaneous goods and services	0.20	0.19	0.18	0.18	0.19	0.20	0.20	0.20
Household Sub Total	**3.88**	**3.62**	**3.53**	**3.64**	**3.93**	**4.11**	**4.11**	**4.09**
Government	0.48	0.44	0.42	0.41	0.43	0.44	0.44	0.44
Gross Fixed Capital Formation	0.92	0.84	0.81	0.79	0.82	0.85	0.85	0.86
Total	**5.28**	**4.89**	**4.77**	**4.85**	**5.18**	**5.40**	**5.40**	**5.39**

Savinjska's Ecological Footprint and biocapacity by land use, base year 2016

Ecological Footprint					Biocapacity					Deficit / Reserve		
Demand Category	Total (gha)	Per-capita (gha)	% of National Total	% of Regional Total	% of Regional Total	% of National Total	Per-capita (gha)	Total (gha)	**Supply Category**	Total (gha)	Per-capita (gha)	Ratio EF/BC
Cropland	166,453	0.65	1.5%	12.6%	10.7%	9.8%	0.23	58,467	Cropland	107,986	-0.42	2.8
Grazing Land	48,444	0.19	0.4%	3.7%	8.9%	14.3%	0.19	48,549	Grazing Land	-105	0.00	1.0
Fishing Grounds	10,578	0.04	0.1%	0.8%	0.1%	11.0%	0.00	542	Fishing Grounds	10,036	-0.04	19.5
Built-up Land	35,460	0.14	0.3%	2.7%	6.7%	12.8%	0.14	36,673	Built-up Land	-1,213	0.00	1.0
Forest Products	260,060	1.02	2.4%	19.7%	73.6%	10.2%	1.58	403,128	Forest Land	659,353	3.71	2.6
Carbon	802,422	3.15	7.4%	60.6%								
Total	**1,323,416**	**5.19**	**12.2%**	**100.0%**	**100.0%**	**10.6%**	**2.15**	**547,359**	**Total**	**776,057**	**-3.05**	**2.4**

Savinjska's Ecological Footprint per capita by Consumption Category and Year

	2011	2012	2013	2014	2015	2016	2017	2018
1. Food and non-alcoholic beverages	0.88	0.78	0.75	0.79	0.83	0.83	0.83	0.84
2. Alcoholic beverages, tobacco and narcotics	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.09
3. Clothing and footwear	0.21	0.19	0.18	0.19	0.20	0.20	0.20	0.21
4. Housing, water, electricity, gas and other fuels	0.84	0.81	0.83	0.90	0.95	1.02	1.02	1.03
5. Household furnishings, equipment and maint.	0.10	0.09	0.10	0.11	0.12	0.12	0.13	0.13
6. Health	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04
7. Transportation	1.06	0.96	0.93	0.87	0.93	0.96	0.96	0.97
8. Communication	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
9. Recreation and culture	0.14	0.13	0.13	0.13	0.14	0.14	0.14	0.15
10. Education	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
11. Restaurants and hotels	0.11	0.10	0.10	0.10	0.11	0.11	0.11	0.11
12. Miscellaneous goods and services	0.19	0.18	0.17	0.17	0.18	0.18	0.18	0.19
Household Sub Total	**3.76**	**3.46**	**3.39**	**3.46**	**3.65**	**3.79**	**3.79**	**3.84**
Government	0.50	0.46	0.44	0.44	0.46	0.48	0.48	0.47
Gross Fixed Capital Formation	0.95	0.88	0.85	0.84	0.89	0.93	0.93	0.92
Total	**5.20**	**4.79**	**4.68**	**4.73**	**5.00**	**5.19**	**5.20**	**5.23**

Zasavska's Ecological Footprint and biocapacity by land use, base year 2016

Ecological Footprint					Biocapacity					Deficit / Reserve		
Demand Category	Total (gha)	Per-capita (gha)	% of National Total	% of Regional Total	% of Regional Total	% of National Total	Per-capita (gha)	Total (gha)	**Supply Category**	Total (gha)	Per-capita (gha)	Ratio EF/BC
Cropland	37,106	0.65	0.3%	12.5%	4.1%	0.9%	0.09	5,092	Cropland	32,014	-0.56	7.3
Grazing Land	10,800	0.19	0.1%	3.6%	7.6%	2.8%	0.17	9,505	Grazing Land	1,294	-0.02	1.1
Fishing Grounds	2,361	0.04	0.0%	0.8%	0.1%	2.9%	0.00	141	Fishing Grounds	2,220	-0.04	16.7
Built-up Land	7,979	0.14	0.1%	2.7%	5.5%	2.4%	0.12	6,923	Built-up Land	1,056	-0.02	1.2
Forest Products	58,141	1.01	0.5%	19.6%	82.7%	2.6%	1.80	103,534	Forest Land	134,525	3.92	2.3
Carbon	179,917	3.13	1.7%	60.7%								
Total	**296,305**	**5.16**	**2.7%**	**100.0%**	**100.0%**	**2.4%**	**2.18**	**125,196**	**Total**	**171,109**	**-2.98**	**2.4**

Zasavska's Ecological Footprint per capita by Consumption Category and Year

	2011	2012	2013	2014	2015	2016	2017	2018
1. Food and non-alcoholic beverages	0.87	0.77	0.73	0.78	0.82	0.82	0.82	0.82
2. Alcoholic beverages, tobacco and narcotics	0.10	0.09	0.08	0.09	0.09	0.09	0.09	0.09
3. Clothing and footwear	0.21	0.19	0.18	0.18	0.19	0.20	0.20	0.20
4. Housing, water, electricity, gas and other fuels	0.84	0.80	0.81	0.88	0.93	1.00	1.01	1.01
5. Household furnishings, equipment and maint.	0.10	0.09	0.09	0.11	0.11	0.12	0.12	0.12
6. Health	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04
7. Transportation	1.06	0.95	0.92	0.85	0.91	0.94	0.95	0.95
8. Communication	0.06	0.06	0.05	0.05	0.06	0.06	0.06	0.06
9. Recreation and culture	0.14	0.13	0.13	0.13	0.14	0.14	0.14	0.14
10. Education	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
11. Restaurants and hotels	0.11	0.10	0.10	0.10	0.10	0.11	0.11	0.11
12. Miscellaneous goods and services	0.19	0.17	0.17	0.16	0.17	0.18	0.18	0.18
Household Sub Total	**3.74**	**3.41**	**3.33**	**3.39**	**3.59**	**3.73**	**3.75**	**3.76**
Government	0.50	0.46	0.45	0.44	0.47	0.49	0.48	0.48
Gross Fixed Capital Formation	0.95	0.89	0.86	0.85	0.90	0.94	0.94	0.94
Total	**5.19**	**4.77**	**4.64**	**4.69**	**4.96**	**5.16**	**5.17**	**5.18**

Posavska's Ecological Footprint and biocapacity by land use, base year 2016

Ecological Footprint					Biocapacity					Deficit / Reserve		
Demand Category	Total (gha)	Per-capita (gha)	% of National Total	% of Regional Total	% of Regional Total	% of National Total	Per-capita (gha)	Total (gha)	**Supply Category**	Total (gha)	Per-capita (gha)	Ratio EF/BC
Cropland	49,720	0.66	0.5%	12.6%	18.4%	7.0%	0.56	42,149	Cropland	7,571	-0.10	1.2
Grazing Land	14,472	0.19	0.1%	3.7%	8.3%	5.6%	0.25	19,165	Grazing Land	-4,693	0.06	0.8
Fishing Grounds	3,152	0.04	0.0%	0.8%	0.2%	8.9%	0.01	438	Fishing Grounds	2,714	-0.04	7.2
Built-up Land	10,530	0.14	0.1%	2.7%	6.8%	5.5%	0.21	15,676	Built-up Land	-5,147	0.07	0.7
Forest Products	77,009	1.02	0.7%	19.6%	66.3%	3.8%	2.01	152,122	Forest Land	163,114	4.14	2.1
Carbon	238,226	3.15	2.2%	60.6%								
Total	**393,110**	**5.19**	**3.6%**	**100.0%**	**100.0%**	**4.4%**	**3.03**	**229,550**	**Total**	**163,559**	**-2.16**	**1.7**

Posavska's Ecological Footprint per capita by Consumption Category and Year

	2011	2012	2013	2014	2015	2016	2017	2018
1. Food and non-alcoholic beverages	0.88	0.79	0.74	0.80	0.84	0.84	0.84	0.85
2. Alcoholic beverages, tobacco and narcotics	0.10	0.09	0.08	0.08	0.09	0.09	0.09	0.09
3. Clothing and footwear	0.20	0.19	0.18	0.18	0.20	0.20	0.20	0.20
4. Housing, water, electricity, gas and other fuels	0.82	0.80	0.80	0.88	0.94	1.01	1.01	1.03
5. Household furnishings, equipment and maint.	0.09	0.09	0.09	0.11	0.12	0.13	0.12	0.13
6. Health	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04
7. Transportation	1.05	0.96	0.91	0.86	0.93	0.96	0.96	0.98
8. Communication	0.06	0.06	0.05	0.05	0.06	0.06	0.06	0.06
9. Recreation and culture	0.14	0.13	0.12	0.13	0.14	0.14	0.14	0.14
10. Education	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
11. Restaurants and hotels	0.11	0.10	0.09	0.10	0.10	0.11	0.11	0.11
12. Miscellaneous goods and services	0.19	0.17	0.17	0.16	0.18	0.18	0.18	0.18
Household Sub Total	**3.72**	**3.43**	**3.31**	**3.41**	**3.64**	**3.78**	**3.78**	**3.84**
Government	0.50	0.46	0.45	0.44	0.46	0.48	0.48	0.47
Gross Fixed Capital Formation	0.96	0.89	0.87	0.85	0.89	0.93	0.93	0.92
Total	**5.18**	**4.78**	**4.63**	**4.70**	**5.00**	**5.19**	**5.19**	**5.23**

Jugovzhodna Slovenija's Ecological Footprint and biocapacity by land use, base year 2016

Ecological Footprint					Biocapacity					Deficit / Reserve		
Demand Category	Total (gha)	Per-capita (gha)	% of National Total	% of Regional Total	% of Regional Total	% of National Total	Per-capita (gha)	Total (gha)	**Supply Category**	Total (gha)	Per-capita (gha)	Ratio EF/BC
Cropland	96,249	0.67	0.9%	12.8%	6.8%	8.7%	0.36	51,971	Cropland	44,278	-0.31	1.9
Grazing Land	28,015	0.20	0.3%	3.7%	5.4%	12.3%	0.29	41,836	Grazing Land	-13,821	0.10	0.7
Fishing Grounds	6,076	0.04	0.1%	0.8%	0.1%	8.6%	0.00	421	Fishing Grounds	5,655	-0.04	14.4
Built-up Land	19,938	0.14	0.2%	2.7%	3.6%	9.5%	0.19	27,369	Built-up Land	-7,431	0.05	0.7
Forest Products	147,313	1.03	1.4%	19.6%	84.2%	16.4%	4.53	646,633	Forest Land	-45,164	6.68	0.9
Carbon	454,156	3.18	4.2%	60.4%								
Total	**751,747**	**5.27**	**6.9%**	**100.0%**	**100.0%**	**14.8%**	**5.38**	**768,230**	**Total**	**-16,482**	**0.12**	**1.0**

Jugovzhodna Slovenija's Ecological Footprint per capita by Consumption Category and Year

	2011	2012	2013	2014	2015	2016	2017	2018
1. Food and non-alcoholic beverages	0.91	0.82	0.78	0.83	0.87	0.87	0.87	0.88
2. Alcoholic beverages, tobacco and narcotics	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.10
3. Clothing and footwear	0.21	0.19	0.19	0.19	0.20	0.21	0.21	0.21
4. Housing, water, electricity, gas and other fuels	0.84	0.82	0.83	0.91	0.97	1.04	1.04	1.06
5. Household furnishings, equipment and maint.	0.10	0.10	0.10	0.11	0.12	0.13	0.13	0.13
6. Health	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.05
7. Transportation	1.08	0.99	0.96	0.90	0.96	0.99	1.00	1.02
8. Communication	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
9. Recreation and culture	0.14	0.13	0.13	0.13	0.14	0.15	0.15	0.15
10. Education	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
11. Restaurants and hotels	0.11	0.10	0.10	0.10	0.11	0.11	0.11	0.12
12. Miscellaneous goods and services	0.19	0.18	0.17	0.17	0.18	0.19	0.19	0.19
Household Sub Total	**3.82**	**3.54**	**3.45**	**3.56**	**3.77**	**3.90**	**3.92**	**3.98**
Government	0.49	0.45	0.43	0.42	0.45	0.46	0.46	0.45
Gross Fixed Capital Formation	0.94	0.86	0.83	0.82	0.86	0.90	0.90	0.88
Total	**5.24**	**4.85**	**4.72**	**4.79**	**5.08**	**5.27**	**5.28**	**5.32**

Primorsko-notranjska's Ecological Footprint and biocapacity by land use, base year 2016

Ecological Footprint					Biocapacity					Deficit / Reserve		
Demand Category	Total (gha)	Per-capita (gha)	% of National Total	% of Regional Total	% of Regional Total	% of National Total	Per-capita (gha)	Total (gha)	**Supply Category**	Total (gha)	Per-capita (gha)	Ratio EF/BC
Cropland	35,599	0.68	0.3%	12.9%	1.9%	1.3%	0.15	7,935	Cropland	27,664	-0.53	4.5
Grazing Land	10,365	0.20	0.1%	3.8%	6.8%	8.4%	0.54	28,584	Grazing Land	-18,219	0.35	0.4
Fishing Grounds	2,242	0.04	0.0%	0.8%	0.0%	2.8%	0.00	138	Fishing Grounds	2,103	-0.04	16.2
Built-up Land	7,339	0.14	0.1%	2.7%	2.4%	3.5%	0.19	10,165	Built-up Land	-2,826	0.05	0.7
Forest Products	53,918	1.03	0.5%	19.5%	88.9%	9.5%	7.13	374,935	Forest Land	-154,109	9.28	0.6
Carbon	166,907	3.17	1.5%	60.4%								
Total	**276,371**	**5.25**	**2.6%**	**100.0%**	**100.0%**	**8.1%**	**8.02**	**421,757**	**Total**	**-145,387**	**2.76**	**0.7**

Primorsko-notranjska's Ecological Footprint per capita by Consumption Category and Year

	2011	2012	2013	2014	2015	2016	2017	2018
1. Food and non-alcoholic beverages	0.94	0.84	0.79	0.85	0.88	0.88	0.88	0.88
2. Alcoholic beverages, tobacco and narcotics	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.09
3. Clothing and footwear	0.21	0.20	0.19	0.19	0.20	0.20	0.20	0.20
4. Housing, water, electricity, gas and other fuels	0.85	0.83	0.83	0.91	0.96	1.02	1.02	1.03
5. Household furnishings, equipment and maint.	0.10	0.10	0.10	0.11	0.12	0.13	0.13	0.13
6. Health	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04
7. Transportation	1.11	1.01	0.97	0.91	0.96	0.99	0.99	1.00
8. Communication	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
9. Recreation and culture	0.15	0.14	0.13	0.13	0.14	0.14	0.14	0.15
10. Education	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
11. Restaurants and hotels	0.12	0.11	0.10	0.10	0.11	0.11	0.11	0.11
12. Miscellaneous goods and services	0.20	0.18	0.17	0.17	0.18	0.18	0.18	0.19
Household Sub Total	**3.90**	**3.61**	**3.49**	**3.58**	**3.77**	**3.88**	**3.88**	**3.91**
Government	0.48	0.44	0.43	0.42	0.45	0.47	0.47	0.46
Gross Fixed Capital Formation	0.92	0.85	0.83	0.81	0.86	0.91	0.91	0.90
Total	**5.29**	**4.89**	**4.75**	**4.81**	**5.08**	**5.25**	**5.26**	**5.28**

Osrednjeslovenska's Ecological Footprint and biocapacity by land use, base year 2016

Ecological Footprint					Biocapacity					Deficit / Reserve		
Demand Category	Total (gha)	Per-capita (gha)	% of National Total	% of Regional Total	% of Regional Total	% of National Total	Per-capita (gha)	Total (gha)	**Supply Category**	Total (gha)	Per-capita (gha)	Ratio EF/BC
Cropland	355,266	0.66	3.3%	12.5%	8.6%	8.6%	0.10	51,242	Cropland	304,025	-0.57	6.9
Grazing Land	103,309	0.19	1.0%	3.6%	7.7%	13.5%	0.09	45,751	Grazing Land	57,557	-0.11	2.3
Fishing Grounds	22,651	0.04	0.2%	0.8%	0.1%	8.2%	0.00	401	Fishing Grounds	22,250	-0.04	56.5
Built-up Land	75,381	0.14	0.7%	2.7%	8.7%	18.1%	0.10	51,914	Built-up Land	23,467	-0.04	1.5
Forest Products	564,872	1.05	5.2%	19.9%	74.9%	11.3%	0.83	446,567	Forest Land	1,839,009	2.98	5.1
Carbon	1,720,703	3.20	15.9%	60.5%								
Total	**2,842,183**	**5.28**	**26.3%**	**100.0%**	**100.0%**	**11.5%**	**1.11**	**595,875**	**Total**	**2,246,308**	**-4.18**	**4.8**

Osrednjeslovenska's Ecological Footprint per capita by Consumption Category and Year

	2011	2012	2013	2014	2015	2016	2017	2018
1. Food and non-alcoholic beverages	0.89	0.79	0.75	0.79	0.83	0.83	0.83	0.83
2. Alcoholic beverages, tobacco and narcotics	0.11	0.10	0.09	0.09	0.09	0.10	0.10	0.10
3. Clothing and footwear	0.23	0.21	0.20	0.20	0.21	0.21	0.21	0.21
4. Housing, water, electricity, gas and other fuels	0.91	0.87	0.88	0.95	0.99	1.07	1.07	1.07
5. Household furnishings, equipment and maint.	0.10	0.10	0.10	0.11	0.12	0.13	0.13	0.13
6. Health	0.05	0.05	0.04	0.04	0.04	0.05	0.05	0.05
7. Transportation	1.13	1.03	0.98	0.90	0.96	1.00	1.00	0.99
8. Communication	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06
9. Recreation and culture	0.16	0.15	0.14	0.14	0.15	0.15	0.15	0.15
10. Education	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
11. Restaurants and hotels	0.13	0.11	0.11	0.11	0.11	0.12	0.12	0.12
12. Miscellaneous goods and services	0.21	0.19	0.18	0.18	0.19	0.19	0.19	0.19
Household Sub Total	**4.00**	**3.68**	**3.55**	**3.60**	**3.78**	**3.93**	**3.94**	**3.93**
Government	0.46	0.43	0.42	0.42	0.44	0.46	0.46	0.46
Gross Fixed Capital Formation	0.89	0.82	0.81	0.80	0.85	0.89	0.89	0.89
Total	**5.35**	**4.93**	**4.78**	**4.82**	**5.08**	**5.28**	**5.29**	**5.28**

Gorenjska's Ecological Footprint and biocapacity by land use, base year 2016

Ecological Footprint					Biocapacity					Deficit / Reserve		
Demand Category	Total (gha)	Per-capita (gha)	% of National Total	% of Regional Total	% of Regional Total	% of National Total	Per-capita (gha)	Total (gha)	**Supply Category**	Total (gha)	Per-capita (gha)	Ratio EF/BC
Cropland	138,141	0.68	1.3%	12.8%	4.9%	4.5%	0.13	26,741	Cropland	111,399	-0.55	5.2
Grazing Land	40,205	0.20	0.4%	3.7%	5.5%	8.8%	0.15	29,923	Grazing Land	10,281	-0.05	1.3
Fishing Grounds	8,714	0.04	0.1%	0.8%	0.1%	12.3%	0.00	604	Fishing Grounds	8,110	-0.04	14.4
Built-up Land	28,489	0.14	0.3%	2.6%	4.8%	9.1%	0.13	26,174	Built-up Land	2,315	-0.01	1.1
Forest Products	210,890	1.04	1.9%	19.6%	84.8%	11.7%	2.28	464,502	Forest Land	396,304	4.44	1.9
Carbon	649,916	3.19	6.0%	60.4%								
Total	**1,076,355**	**5.29**	**9.9%**	**100.0%**	**100.0%**	**10.6%**	**2.69**	**547,945**	**Total**	**528,410**	**-2.59**	**2.0**

Gorenjska's Ecological Footprint per capita by Consumption Category and Year

	2011	2012	2013	2014	2015	2016	2017	2018
1. Food and non-alcoholic beverages	0.90	0.80	0.77	0.82	0.85	0.85	0.85	0.85
2. Alcoholic beverages, tobacco and narcotics	0.10	0.09	0.09	0.09	0.09	0.09	0.10	0.10
3. Clothing and footwear	0.22	0.20	0.19	0.19	0.20	0.21	0.21	0.21
4. Housing, water, electricity, gas and other fuels	0.87	0.84	0.85	0.92	0.97	1.05	1.05	1.05
5. Household furnishings, equipment and maint.	0.10	0.10	0.10	0.11	0.12	0.13	0.13	0.13
6. Health	0.05	0.04	0.04	0.04	0.04	0.04	0.05	0.05
7. Transportation	1.11	1.00	0.97	0.90	0.96	0.99	1.00	1.00
8. Communication	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06
9. Recreation and culture	0.15	0.14	0.13	0.14	0.14	0.15	0.15	0.15
10. Education	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
11. Restaurants and hotels	0.12	0.11	0.10	0.11	0.11	0.11	0.11	0.11
12. Miscellaneous goods and services	0.20	0.18	0.18	0.17	0.18	0.19	0.19	0.19
Household Sub Total	**3.91**	**3.58**	**3.49**	**3.57**	**3.76**	**3.90**	**3.92**	**3.92**
Government	0.48	0.44	0.43	0.42	0.45	0.46	0.46	0.46
Gross Fixed Capital Formation	0.91	0.85	0.82	0.81	0.86	0.90	0.90	0.90
Total	**5.29**	**4.87**	**4.74**	**4.80**	**5.07**	**5.27**	**5.28**	**5.28**

Goriska's Ecological Footprint and biocapacity by land use, base year 2016

Ecological Footprint					Biocapacity					Deficit / Reserve		
Demand Category	Total (gha)	Per-capita (gha)	% of National Total	% of Regional Total	% of Regional Total	% of National Total	Per-capita (gha)	Total (gha)	**Supply Category**	Total (gha)	Per-capita (gha)	Ratio EF/BC
Cropland	79,994	0.68	0.7%	12.8%	4.9%	5.1%	0.26	30,639	Cropland	49,355	-0.42	2.6
Grazing Land	23,281	0.20	0.2%	3.7%	5.8%	10.7%	0.31	36,350	Grazing Land	-13,069	0.11	0.6
Fishing Grounds	5,046	0.04	0.0%	0.8%	0.1%	10.8%	0.00	532	Fishing Grounds	4,514	-0.04	9.5
Built-up Land	16,497	0.14	0.2%	2.6%	3.1%	6.8%	0.17	19,583	Built-up Land	-3,086	0.03	0.8
Forest Products	122,121	1.04	1.1%	19.6%	86.1%	13.6%	4.56	537,818	Forest Land	-39,347	6.72	0.9
Carbon	376,350	3.19	3.5%	60.4%								
Total	**623,290**	**5.29**	**5.8%**	**100.0%**	**100.0%**	**12.1%**	**5.30**	**624,922**	**Total**	**-1,632**	**0.01**	**1.0**

Goriska's Ecological Footprint per capita by Consumption Category and Year

	2011	2012	2013	2014	2015	2016	2017	2018
1. Food and non-alcoholic beverages	0.94	0.84	0.79	0.84	0.88	0.88	0.87	0.88
2. Alcoholic beverages, tobacco and narcotics	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.09
3. Clothing and footwear	0.22	0.20	0.19	0.19	0.20	0.21	0.21	0.21
4. Housing, water, electricity, gas and other fuels	0.88	0.85	0.86	0.93	0.97	1.04	1.04	1.04
5. Household furnishings, equipment and maint.	0.10	0.10	0.10	0.12	0.12	0.13	0.13	0.13
6. Health	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04
7. Transportation	1.14	1.03	0.99	0.92	0.97	1.00	1.00	1.00
8. Communication	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06
9. Recreation and culture	0.15	0.14	0.14	0.14	0.14	0.15	0.15	0.15
10. Education	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
11. Restaurants and hotels	0.12	0.11	0.11	0.11	0.11	0.11	0.11	0.11
12. Miscellaneous goods and services	0.20	0.19	0.18	0.17	0.18	0.19	0.19	0.19
Household Sub Total	**4.00**	**3.67**	**3.57**	**3.62**	**3.79**	**3.93**	**3.91**	**3.92**
Government	0.47	0.43	0.42	0.42	0.44	0.46	0.46	0.46
Gross Fixed Capital Formation	0.89	0.83	0.81	0.80	0.86	0.90	0.90	0.90
Total	**5.36**	**4.93**	**4.79**	**4.84**	**5.09**	**5.29**	**5.28**	**5.28**

Obalno-kraska's Ecological Footprint and biocapacity by land use, base year 2016

Ecological Footprint					Biocapacity					Deficit / Reserve		
Demand Category	Total (gha)	Per-capita (gha)	% of National Total	% of Regional Total	% of Regional Total	% of National Total	Per-capita (gha)	Total (gha)	**Supply Category**	Total (gha)	Per-capita (gha)	Ratio EF/BC
Cropland	75,399	0.67	0.7%	12.7%	8.5%	4.1%	0.22	24,466	Cropland	50,934	-0.45	3.1
Grazing Land	21,938	0.19	0.2%	3.7%	6.5%	5.5%	0.17	18,803	Grazing Land	3,135	-0.03	1.2
Fishing Grounds	4,782	0.04	0.0%	0.8%	0.0%	1.8%	0.00	88	Fishing Grounds	4,694	-0.04	54.1
Built-up Land	15,824	0.14	0.1%	2.7%	6.4%	6.4%	0.16	18,391	Built-up Land	-2,567	0.02	0.9
Forest Products	117,431	1.04	1.1%	19.7%	78.5%	5.7%	2.00	225,825	Forest Land	252,033	4.14	2.1
Carbon	360,427	3.18	3.3%	60.5%								
Total	**595,802**	**5.26**	**5.5%**	**100.0%**	**100.0%**	**5.5%**	**2.54**	**287,573**	**Total**	**308,229**	**-2.72**	**2.1**

Obalno-kraska's Ecological Footprint per capita by Consumption Category and Year

	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
1. Food and non-alcoholic beverages	0.90	0.80	0.77	0.81	0.85	0.85	0.84	0.83
2. Alcoholic beverages, tobacco and narcotics	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.09
3. Clothing and footwear	0.22	0.20	0.19	0.19	0.20	0.21	0.21	0.20
4. Housing, water, electricity, gas and other fuels	0.88	0.84	0.86	0.92	0.97	1.05	1.04	1.02
5. Household furnishings, equipment and maint.	0.10	0.10	0.10	0.11	0.12	0.13	0.13	0.13
6. Health	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04
7. Transportation	1.11	1.00	0.97	0.90	0.96	0.99	0.98	0.96
8. Communication	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06
9. Recreation and culture	0.15	0.14	0.14	0.14	0.14	0.15	0.15	0.14
10. Education	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
11. Restaurants and hotels	0.12	0.11	0.10	0.11	0.11	0.11	0.11	0.11
12. Miscellaneous goods and services	0.20	0.18	0.18	0.17	0.18	0.19	0.19	0.18
Household Sub Total	**3.93**	**3.59**	**3.52**	**3.55**	**3.76**	**3.90**	**3.86**	**3.80**
Government	0.47	0.44	0.42	0.42	0.45	0.46	0.47	0.48
Gross Fixed Capital Formation	0.91	0.85	0.82	0.81	0.86	0.90	0.91	0.93
Total	**5.31**	**4.88**	**4.76**	**4.79**	**5.07**	**5.26**	**5.24**	**5.20**

List of Annexes

Annexes to this report are attached in separate files, indicated below.

Reference	Description	Location
Annex A	Technical Summary and Recommendations	Slovenia_regions_Annexes_A_D.pdf, p. 2
Annex B	Verification of Slovenia's Carbon Footprint	Slovenia_regions_Annexes_A_D.pdf, p. 5
Annex C	Consulting and Verification of Ecological Footprint Projections and Scenarios	Slovenia_regions_Annexes_A_D.pdf, p. 15
Annex D	Selection and training of the National Representative for Calculating Regional Ecological Footprints	Slovenia_regions_Annexes_A_D.pdf, p. 16
Annex E	Ecological Footprint: List of data sources, input data (Oxford Economics), Calculation file, regional results	Annex E_EF_input data and calculation.xlsx
Annex F	Biocapacity Calculation	Annex_F_BC_input data and calculation.xlsx
Annex G	National Footprint and Biocapacity Accounts (NFA) 2019 Edition Workbook, Slovenia, data year 2016.	Annex_G_Slovenia 2016 NFA workbook.xlsx

Annexes

Table of contents

Annex A. Technical Summary and Recommendations

Input Data: assessment and recommendations for the improvement of top down Ecological Footprint Assessments

Input data is a key component for all ecological footprint and biocapacity accounts. In situations where data gaps exist, the top down results for ecological footprint results are conservative and consumption patterns are assumed to be equivalent to the national average of Slovenia. In this study, the primary data source to differentiate regional consumption footprints from Slovenia-an national average footprint (table 2.1) was household expenditure (HHE) adjusted to purchasing power parity (PPP) with detailed resolution, obtained by COICOP category from Oxford Economics (Oxford Economics, 2014).

Research into improved dataset resolution suggests that coordination with regional statistical authorities, including national statistical databases (https://pxweb.stat.si, https://www.stat.si/) will be a key area to improve data quality and accuracy for regional ecological footprint calculations. While the top-down calculation applies a standard methodology and robust expenditure data, inclusion of locally gathered is important because it includes physical consumption data which can both supplement expenditure data and be used as a monitoring tool for annual update.

Category Resolution

In the most disaggregated form, the CLUM provides ecological footprints disaggregated into 52 detailed categories, which are defined according to COICOP household consumption categories. Ultimately, the top-down approach can provide accurate results to the degree that input data can reflect differences among regions for each COICOP category. The Oxford dataset provides PPP adjusted data at detailed resolution; however, the data are derived from internal models and may not reflect true consumer expenditures.

Economic and physical consumption statistics

Economic data can be highly reliable with proper resolution and proper adjustment. Outside the Oxford data, reliable results can be obtained with a combination of 3 data sources: detailed consumer expenditure, consumer price index (regional to national), local CO_2 intensity of energy consumption. The former two datasets allow a reliable economic proxy of consumption similar to PPP adjusted expenditure, and the latter, (CO_2) intensity, can reliably be used to determine carbon footprints at sub-national levels. In general, the availability of consistent economic data supports simple and comparable analyses, however, direct or physical data will provide even more robust results. Physical data can be used as the primary data source and supplemented by economic data for specific categories where scaling data is unavailable.

Housing and transportation are the largest footprint categories and can vary widely between regions; therefore, physical data reflecting the national average and regional averages is necessary for accurate results. Economic expenditure on these categories can also be useful, however these data need to be specifically adjusted with supplemental data to reflect differences in local pricing or else they will run a higher risk of capturing differences in local pricing rather than consumption.

Further coordination with regional statistics offices are recommended to align existing statistics and future collection with ecological footprint accounts. Table A.1.1 below provides a detailed disaggregation of consumption categories and sample physical or direct measures of consumption.

Regional Carbon intensity

CO2 emissions associated with energy consumption and vehicle tailpipe emissions make up most of our carbon footprint and are key parameters in monitoring the clean energy transition. The top down approach for ecological footprint accounting adjusts for the carbon intensities of various imported goods and services because it is based on a multi-regional input output model, which takes into account local CO2 emission intensities associated with all elements of the global supply chain from production to intermediate industries to final consumption. Within a country, CO2 emissions associated with energy consumption can vary greatly.

On both the supply side, the local CO2 intensity is a key factor that depends on the energy mix (renewable vs fossil-fuel based electricity production). Because local energy is used by both households and industry, consumption data is needed to differentiate between energy used by industries (which may be exported and consumed elsewhere) and energy consumed by household. CO2 intensity of production can also be used with additional information on the industrial vs household breakdown. On the demand side, factors like climate, and building construction (insulation, passive vs active heating and cooling) can greatly affect energy use.

Table A.1 below provides a detailed list with examples of data by consumption category. To develop a monitoring system for ecological footprint that is policy responsive, capturing elements which represent the largest footprints and fastest changing elements associated with policy implementations is critical. There are many potential data sources that can be used as proxy for consumption, however the identified proxies should be standardized across regions for have comparable results. Specifically, high priority categories are those associated with housing and transportation below, as well as regional carbon consumption intensities.

Additionally, as specific measures are passed, data which reflects the expected change in consumption associated with these measures can and should be recorded and incorporated into top-down calculations.

Table A.1 COICOP categories with suggested physical input data

Physical consumption or Proxy data (by category)		
COICOP category	**Notes / Example physical data**	**measurement units**
Food and non-alcoholic beverages		
Food	Food consumption by category or type eg. meat, dairy, fish, grains, vegetables.	kg/pers per year
Housing		
Actual rentals for housing	Average size of housing	m2/person
Imputed rentals for housing	% of main construction material in each dwellings	%
	Estimated CO2 in construction process in each construction material ($1m^2$)	t CO_2/m^2
	Estimated CO2 in construction process in each dwelling type ($1m^2$)	t CO_2/m^3
	a number of people in a household	person
	average durability of housing	year
Maintenance and repair of the dwelling	number of persons per household	persons per household
Water supply and miscellaneous services relating to the dwelling	water use per person	l per pers per day
	Carbon Intensity of water usage	kg co2/litre of water
Electricity, gas and other fuels	Carbon Intensity of Electricity production	co2(kg)/kwh
	Average electricity usage per person (In households vs non-household)	kwh/person per year
	use of gas (In households vs non-household)	kwh/person per year
	average contribution of renewable energy (solar power, etc.)	%
	carbon (and land) intensity of renewable energy source	co2(kg)/kwh
Service for household maintenance	expenditure	$
Transport		
Purchase of vehicles	number of cars	cars owned per 1000 people
	type of cars (%) and these average CO2 efficiency (CO_2/litre)	%, CO_2/litre
Operation of personal transport equipment	personal cars: km driven	km driven per person and year
	average gas mileage	l/100km
Transport services	Distance traveled by public transit and mode	km/person per year
	average CO2 intensity by mode	CO_2/km
	Flight distance or time each year?	hours/person per year
	average distance of air transport	km/person per year
	carbon intensity of air transport	CO2/km
Goods		
	Municipal waste statistics can be used as a general proxy for consumable goods, however this assumes a constant rate of goods disposal. Economic expenditure is more appropriate and captures much more detail on the type of goods purchased.	
Services		
	Ecological Footprint associated with services is best approximated with economic data.	

Annex B. Verification of Slovenia's Carbon Footprint

Carbon footprint verification

The carbon component of the Ecological Footprint is calculated as the bioproductive area demanded for the sequestration of anthropogenic CO_2 released in the atmosphere due to the combustion of fossil fuel. This includes the fossil fuels burned to produce electricity and direct emissions from vehicles. The carbon Footprint is the sum of the carbon footprint of four sub-categories (see table B.1 below): fossil fuel emissions, "other sources", traded electricity, and international transport

Table B.1. Carbon footprint of Slovenia by category, and by the production(EFp), trade(EFi, EFe), and consumption(EFc) flows as shown in the National Footprint and biocapacity accounts workbook(NFA 2019).

Name [-]	EF_P [gha]	EF_I [gha]	EF_E [gha]	EF_C [gha]
Fossil Fuel Emissions	4,545,288	8,661,423	7,609,789	5,596,923
Other Sources	367,877	-	-	367,877
Traded Electricity	-	812,025	799,851	12,174
International Transport	-	616,837	-	616,837
TOTAL	**4,913,166**	**10,090,285**	**8,409,640**	**6,593,811**

BOX B.1: Data parameters of the carbon component of the Ecological Footprint

Details of the standard data sources used to calculate the carbon component of the Ecological Footprint in the NFA are provided below:

Fossil fuel combustion emissions:

National (territorial) emissions
The primary source for national emissions data is the International Energy Agency (IEA). Overall national emissions are taken from the line item 'CO2 fuel combustion' which is then calculated with an Ecological Footprint intensity of carbon emissions.

Carbon Footprint in trade
Embodied emissions in traded commodities is calculated from data on traded commodities is the United Nations Commodity Trade Statistics Database (Comtrade). The National Footprint Accounts uses a statistical data cleaning and data filling algorithm (GFN, 2017) to catch outliers which are likely errors in the raw data, and to fill values for years where a commodity traded is missing where it is statistically identified as a gap in data.

Other sources:

Fugitive emissions refers mainly to flaring of associated gas in oil and gas production (in some cases including indirect CO2 from methane venting) (IPCC Source/Sink Category 1B) (IEA 2019).

Industrial Processes refer to production of cement, lime, soda ash, carbides, ammonia, methanol, ethylene and other chemicals, metals and to the use of soda ash, limestone and dolomite, and non-energy use of lubricants and waxes. Emissions exclude Fuel combustion emissions. (IPCC Source/Sink Category 2) (IEA 2019).

Traded electricity

The carbon footprint associated with electricity exports and imports is calculated from national production intensity + regional imports intensity (for exports) and regional production intensity (for imports)

Emissions from international transport

Data from both the IEA and Comtrade are used in the calculation of the Ecological Footprint from international transport. In line with the IPCC Greenhouse Gas Inventory Guidelines, the IEA reports emissions from international transport as adjunct Memo items (Memo: International Aviation, and Memo: Marine Bunker Fuels), not included in the overall emissions. As these reported emissions are for transport to and from a nation, and not necessarily linked to activities of a nation's residents, the National Footprint Accounts re-allocate these emissions between all nations by its proportion of global imports. In this way those emissions are linked to the transport of goods consumed, and the Comtrade trade data is used to calculate the proportions of global trade.

The standard source of national CO_2 emissions associated with fossil fuel combustion used in the Slovenia 2016 NFA workbook is the International Energy Agency, an intergovernmental organization established as part of the Organisation for Economic Co-operation and Development (OECD) framework, and which has been part of the process of developing the IPCC guidelines for emissions accounting. The IEA states that:

> "Based on the IEA globally collected energy data, the IEA estimates of CO2 emissions from fuel combustion are a global database obtained following harmonised definitions and comparable methodologies across countries. They do not represent an official source for national submissions, as national administrations should use the best available country-specific information to complete their emissions reporting. The IEA CO2 estimates can be compared with those reported by countries to the UNFCCC Secretariat to highlight

possible problems in methods, input data or emission factors. Still, care should be used in interpreting the results of any comparison since the IEA estimates may differ from a country's official submission for many reasons."

IEA, CO2 Emissions from Fuel Combustion: Database Documentation (2019 Edition)

The United Nations Framework Convention on Climate Change (UNFCCC) provides country reported GHG emissions which follow IPCC reporting guidelines and are expected to be consistent and comparable with IEA data, particularly for Annex I countries like Slovenia. Nevertheless, because methodologies may differ, results are not expected to be exactly the same. The values for Slovenia reported by IEA are 0.6% higher than those reported by UNFCCC.

Table B.2. Verified items in carbon Footprint of production

NFA 2016 Result (IEA)			Verification	
Name	**Production** [Mt CO_2 yr^{-1}]	**EF_P** [gha]	**Production** [Mt CO_2 yr^{-1}]	Source
CO2 Fuel Combustion	13.60	4,545,288	13.53	UNFCCC 1.AA Fuel Combustion - Sectoral Approach

Trade verification

The standard international data source for trade data in the NFA is the UN Comtrade, from which values are drawn in the SITC rev.1 coding system (Lin et al., 2017, Borucke et al., 2013). This coding system is used by Global Footprint Network as it is the oldest available coding system and the only one which allows the tracking of trade flows over the historical period of time covered by the National Footprint Accounts (1961-2016).

Because countries report their trade data in various coding systems, this comparison makes use of correspondence tables to match commodities in order to compare the values reported in different coding systems. The following sections compare 4-digit SITC rev.1 data from the Comtrade to Slovenia's reported data in 4 digit Combined Nomenclature and 2-digit SITC rev.4. At the time of development and publication of NFA 2019, the most recent year for which **Slovenia** trade data is available in UN Comtrade was 2016. Matching commodity groups from the 2016 Combined Nomenclature to the SITC-1 format used by GFN required a two-step process, where multiple correspondence tables were used to convert and reclassify categories to SITC-4, then to SITC-1. For major commodities and commodity groups, proper matching of codes was not a problem, however, more complex groupings (such as chemical products) which feature nested and overlapping categories are more difficult to compare across classification systems. For imports and for exports, the five largest commodities by ecological footprint were identified are compared side-by-side in tables B.3 and B.4. For each trade flow, the top five commodities represented 26% of the total Ecological Footprint either imported or exported, as tracked by the National Footprint and Biocapacity Accounts 2016 Edition.

Table B.3. Verified items in carbon Footprint of imports. The largest 5 commodities (of 625 total) by ecological footprint of imports represent 25.5% of the total Ecological Footprint of imported commodities.

Verified Import Commodities		Unverified			Verified		
		Imports (t/yr)	EF_I (gha)	Source	Imports (t/yr)	EF_I (gha)	Source
1	Products of polymerization and copolymerization	477,800	716,483	UN Comtrade	476,913	715,152	SiStat
2	Aluminium and aluminium alloys, unwrought	135,854	493,957	UN Comtrade	135,854	493,957	SiStat
3	Aluminium and aluminium alloys, worked	95,104	401,991	UN Comtrade	94,132	397,879	SiStat
4	Other inorganic bases and metallic oxides	457,903	343,323	UN Comtrade	402,912	302,092	SiStat
5	Iron & steel scrap	540,426	256,287	UN Comtrade	540,899	256,511	SiStat

Table B.4. Verified items in carbon Footprint of exports. The largest 5 commodities (of 625 total) by ecological footprint of exports represent 25.5% of the total Ecological Footprint of Exported commodities.

Verified Export Commodities		Unverified			Verified		
		Exports (t/yr)	EF_E (gha)	Source	Exports (t/yr)	EF_E (gha)	Source
1	Aluminium and aluminium alloys, worked	155,904	621,939	UN Comtrade	155,901	621,915	SiStat
2	Products of polymerization and copolymerization	302,428	428,013	UN Comtrade	330,496	467,733	SiStat
3	Aluminium and aluminium alloys, unwrought	91,622	314,408	UN Comtrade	105,540	362,165	SiStat
4	Passenger motor cars, other than buses	291,750	292,644	UN Comtrade	291,766	292,601	SiStat
5	Other metal salts & peroxysalts of inorganic acids	404,456	286,205	UN Comtrade	202,942	143,579	SiStat

The remaining 620 commodities were also compared in a similar manner, though the results featured some major differences when comparing at the 4-digit level. Unfortunately, the nature of category conversion and reclassification meant that it was unclear which differences were real and which were due to mismatched categories. To determine this, a secondary analysis was performed using 2016 data from

SiStat's "*Exports and imports by the Standard International Trade Classification, by countries, Slovenia, annually (cummulative data)".* Data is only available in the 2-digit SITC format, which makes this a much coarser analysis. Mismatching of codes was still a source of discrepancy between the datasets, however the aggregated categories provide a better view of which general categories are over or under-represented relative to data from UN Comtrade (table B.5).

Table B.5. Commodity Flow Comparisons using 2-digit SITC Categories, ordered by largest ecological footprint of trade (sum of import and export footprint)

	SLOVENIA (SiStat)				Tonnage - Footprint Conversion by 2-digit category		National Footprint and Biocapacity accounts (UN Comtrade)				Difference					
	[tonne yr^{-1}]		[1000 gha]		[1000 gha tonne^{-1}]		[tonne yr^{-1}]		[1000 gha]		[tonne yr^{-1}]		[1000 gha]		SiStat Estimate EF / NFA EF	
SITC Category Name	Slvn Imports	Slvn Exports	Efi	Efe	GFN EF/tonne imports	GFN EF/tonne exports	GFN Imports	GFN Exports	GFN EFi	GFN EFe	Dif Imports	Dif Exports	Dif EFi	Dif EFe	EF Import	EF Export
68 Non-ferrous metals	333,138	293,485	858	1,014	2.6	3.5	394,082	278,969	1,015	964	(60,943)	14,516	(157)	50	85%	105%
89 Miscellaneous manufactured articles, n.e.s.	126,049	232,589	182	285	1.4	1.2	614,332	540,739	886	662	(488,283)	(308,150)	(704)	(377)	21%	43%
52 Inorganic chemicals	448,750	377,883	340	269	0.8	0.7	1,259,121	772,435	955	551	(810,372)	(394,552)	(614)	(281)	36%	49%
78 Road vehicles (including air-cushion vehicles)	423,272	517,309	494	542	1.2	1.0	399,082	474,031	466	497	24,190	43,278	28	45	106%	109%
67 Iron and steel	1,195,563	625,011	590	277	0.5	0.4	1,158,099	609,937	571	270	37,465	15,074	18	7	103%	102%
77 Electrical machinery, apparatus and appliances, n.e.s., and electrical parts thereof (including non-electrical counterparts, n.e.s., o	186,639	324,779	326	536	1.7	1.6	172,945	280,170	302	462	13,694	44,609	24	74	108%	116%
64 Paper,paperboard and articles of paper pulp, of paper or of paperboard	748,477	759,056	374	373	0.5	0.5	545,435	604,466	273	297	203,042	154,591	101	76	137%	126%
24 Cork and wood	1,294,842	3,741,482	127	434	0.1	0.1	1,172,188	3,496,994	115	405	122,654	244,488	12	28	110%	107%
28 Metalliferous ores and metal scrap	1,110,629	589,484	419	238	0.4	0.4	794,951	442,921	300	179	315,679	146,563	119	59	140%	133%
58 Plastics in non-primary forms	98,905	73,968	148	105	1.5	1.4	173,435	152,134	260	215	(74,529)	(78,167)	(112)	(111)	57%	49%
11 Beverages	680,489	1,621,896	141	302	0.2	0.2	680,489	1,621,891	141	302	(0)	4	(0)	0	100%	100%
62 Rubber manufactures, n.e.s.	66,953	128,277	98	178	1.5	1.4	123,670	169,958	181	236	(56,717)	(41,681)	(83)	(58)	54%	75%
25 Pulp and waste paper	560,423	155,045	305	78	0.5	0.5	560,423	155,045	305	78	(1)	0	(0)	0	100%	100%
53 Dyeing, tanning and colouring materials	111,745	217,233	154	229	1.4	1.1	109,712	213,381	151	225	2,033	3,853	3	4	102%	102%
74 General industrial machinery and equipment, n.e.s., and machine parts, n.e.s.	106,029	163,453	135	197	1.3	1.2	107,494	170,789	136	206	(1,465)	(7,336)	(2)	(9)	99%	96%
66 Non-metallic mineral manufactures, n.e.s.	1,016,913	1,068,912	162	166	0.2	0.2	940,930	1,080,697	150	168	75,983	(11,785)	12	(2)	108%	99%
69 Manufactures of metals, n.e.s.	226,527	326,792	237	340	1.0	1.0	144,758	158,664	152	165	81,769	168,128	86	175	156%	206%
55 Essential oils and resinoids and perfume materials,toilet, polishing and cleansing preparations	106,725	117,853	113	147	1.1	1.2	119,242	151,553	126	189	(12,517)	(33,700)	(13)	(42)	90%	78%
51 Organic chemicals	384,387	170,715	327	110	0.8	0.6	327,112	40,145	278	26	57,275	130,570	49	84	118%	425%
08 Feeding stuff for animals (not including unmilled cereals)	651,919	372,518	238	145	0.4	0.4	463,341	345,809	169	135	188,578	26,709	69	10	141%	108%
59 Chemical materials and products, n.e.s.	177,744	173,144	140	147	0.8	0.9	178,768	171,564	141	146	(1,025)	1,580	(1)	1	99%	101%
71 Power-generating machinery and equipment	47,492	87,599	67	110	1.4	1.3	70,518	121,461	100	152	(23,026)	(33,863)	(33)	(42)	67%	72%
63 Cork and wood manufactures (excluding furniture)	286,411	294,386	79	119	0.3	0.4	291,742	345,538	81	139	(5,331)	(51,152)	(1)	(21)	98%	85%
54 Medicinal and pharmaceutical products	16,574	39,255	62	139	3.7	3.5	17,299	39,201	65	139	(725)	55	(3)	0	96%	100%
23 Crude rubber (including synthetic and reclaimed)	73,956	4,145	126	7	1.7	1.6	90,586	23,894	155	38	(16,630)	(19,749)	(28)	(32)	82%	17%

72 Machinery specialized for particular industries	62,657	106,707	75	124	1.2	1.2	57,034	105,101	68	122	5,623	1,606	7	2	110%	102%
27 Crude fertilizers, other than those of division 56,and crude minerals (excluding coal, petroleum and precious stones)	2,488,635	944,750	146	31	0.1	0.0	2,584,012	964,224	151	31	(95,376)	(19,473)	(6)	(1)	96%	98%
65 Textile yarn, fabrics, made-up articles, n.e.s., and related products	69,903	99,287	92	125	1.3	1.3	55,878	66,799	74	84	14,026	32,489	19	41	125%	149%
05 Vegetables and fruit	434,402	128,326	92	15	0.2	0.1	568,499	246,468	120	29	(134,097)	(118,142)	(28)	(14)	76%	52%
33 Petroleum, petroleum products and related materials	3,588,734	1,537,897	878	240	0.2	0.2	480,680	50,388	118	8	3,108,053	1,487,509	760	233	747%	3052%
83 Travel goods, handbags and similar containers	3,603	1,758	1	0	0.2	0.2	154,655	331,721	36	80	(151,052)	(329,963)	(35)	(79)	2%	1%
01 Meat and meat preparations	98,670	53,801	67	34	0.7	0.6	107,331	57,950	73	37	(8,661)	(4,149)	(6)	(3)	92%	93%
87 Professional, scientific and controlling instruments and apparatus, n.e.s.	7,911	12,613	43	66	5.4	5.2	6,660	12,164	36	63	1,252	449	7	2	119%	104%
07 Coffee, tea, cocoa, spices, and manufactures thereof	38,237	12,554	11	4	0.3	0.3	179,831	137,999	53	39	(141,593)	(125,445)	(41)	(35)	21%	9%
02 Dairy products and birds' eggs	102,039	366,992	35	45	0.3	0.1	114,769	355,899	40	44	(12,731)	11,093	(4)	1	89%	103%
82 Furniture, and parts thereof, bedding, mattresses, mattress supports,cushions and similar stuffed furnishings	77,526	118,385	33	48	0.4	0.4	77,842	118,834	34	48	(316)	(449)	(0)	(0)	100%	100%
84 Articles of apparel and clothing accessories	24,143	8,731	63	22	2.6	2.5	21,612	9,372	56	23	2,532	(641)	7	(2)	112%	93%
04 Cereals and cereal preparations	476,702	237,766	67	32	0.1	0.1	329,552	118,038	47	16	147,150	119,727	21	16	145%	201%
26 Textile fibres (other than wool tops and other combed wool) and their wastes (not manufactured into yarn or fabric)	40,537	4,951	51	8	1.3	1.7	36,022	4,909	45	8	4,514	41	6	0	113%	101%
43 Animal or vegetable fats and oils, processed, waxes of animal or vegetable origin, inedible mixtures or preparations of animal or vege	12,302	9,541	6	4	0.5	0.4	66,958	12,039	34	5	(54,655)	(2,498)	(28)	(1)	18%	79%
73 Metalworking machinery	18,841	30,283	20	30	1.1	1.0	15,713	21,659	17	22	3,128	8,624	3	9	120%	140%
06 Sugars,sugar preparations and honey	89,508	43,456	24	11	0.3	0.3	92,977	44,614	25	12	(3,468)	(1,158)	(1)	(0)	96%	97%
00 Live animals other than animals of division 03	10,313	27,819	9	25	0.8	0.9	10,323	27,826	9	25	(10)	(7)	(0)	(0)	100%	100%
34 Gas, natural and manufactured	1,067,993	363,279	25	8	0.0	0.0	1,068,077	363,280	25	8	(83)	(0)	(0)	(0)	100%	100%
42 Fixed vegetable fats and oils, crude, refined or fractionated	59,208	17,043	23	6	0.4	0.4	58,812	17,043	23	6	397	(0)	0	(0)	101%	100%
21 Hides, skins and furskins, raw	19,494	21,980	13	14	0.7	0.6	19,539	22,016	13	14	(45)	(35)	(0)	(0)	100%	100%
88 Photographic apparatus, equipment and supplies and optical goods, n.e.s., watches and clocks	2,448	1,209	11	5	4.7	4.0	2,262	1,151	11	5	186	58	1	0	108%	105%
03 Fish (not marine mammals), crustaceans, molluscs and aquatic invertebrates, and preparations thereof	17,285	4,789	19	5	1.1	1.0	12,013	1,809	13	2	5,272	2,980	6	3	144%	265%
75 Office machines and automatic data-processing machines	4,113	3,174	19	7	4.5	2.2	2,298	2,032	10	4	1,815	1,142	8	3	179%	156%
76 Telecommunications and sound-recording and reproducing apparatus and equipment	6,836	3,256	13	6	1.9	1.8	4,854	1,913	9	3	1,981	1,343	4	2	141%	170%
79 Other transport equipment	14,521	18,180	17	20	1.2	1.1	3,217	7,682	4	8	11,305	10,498	13	11	451%	237%
85 Footwear	9,612	5,965	7	4	0.7	0.7	9,612	5,965	7	4	0	0	0	0	100%	100%

61 Leather, leather manufactures, n.e.s., and dressed furskins	7,025	7,802	5	5	0.7	0.6	7,084	7,881	5	5	(59)	(79)	(0)	(0)	99%	99%
81 Prefabricated buildings, sanitary, plumbing, heating and lighting fixtures and fittings, n.e.s.	28,794	94,218	26	91	0.9	1.0	7,967	1,965	7	2	20,827	92,253	19	89	361%	4795%
12 Tobacco and tobacco manufactures	4,837	382	8	0	1.7	0.5	4,837	382	8	0	0	0	0	0	100%	100%
29 Crude animal and vegetable materials, n.e.s.	19,720	14,782	6	2	0.3	0.1	19,460	14,779	6	2	260	3	0	0	101%	100%
22 Oil-seeds and oleaginous fruits	22,461	33,549	3	4	0.1	0.1	22,676	20,898	3	3	(215)	12,650	(0)	2	99%	161%
09 Miscellaneous edible products and preparations	67,496	36,785	15	5	0.2	0.1	21,253	6,750	5	1	46,243	30,035	11	4	318%	545%
32 Coal,coke and briquettes	460,363	3,386	5	0	0.0	0.0	460,364	3,413	5	0	(1)	(27)	(0)	(0)	100%	99%
41 Animal oils and fats	3,147	1,923	1	0	0.3	0.1	4,903	2,147	1	0	(1,756)	(224)	(0)	(0)	64%	90%
56 Fertilizers (other than those of group 272)	217,249	51,692	44	10	0.2	0.2	1,146	4	0	0	216,103	51,687	43	10	18953%	1174812%
96 Coin (other than gold coin), not being legal tender	0	-	0	-	0.4	0.4	0	0	0	0	0	(0)	0	(0)	100%	0%
35 Electric current	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
57 Plastics in primary forms	497,480	352,013	746	498	1.5	1.4	-	-	-	-	497,480	352,013	746	498	0%	0%
97 Gold, non-monetary (excluding gold ores and concentrates)	10	11	0	0	0.4	0.4	-	-	-	-	10	11	0	0		
TOTAL	**20,655,398**	**17,262,199**	**8,961**	**8,040**	**0**	**0**	**17,600,526**	**15,629,510**	**8,661**	**7,608**	**3,054,871**	**1,632,689**	**300**	**432**	**103%**	**106%**

Comparison at the 2-digit level revealed a number of differences at the aggregate category level, however because the deviations between data sources occur in both directions across so many categories, it is likely that the differences the result of mis-matching of categories. Two categories showing notable differences, include “56 Fertilizers (other than those of group 272)”, and “33 Petroleum, petroleum products and related materials”, and indicate trade flows 1-2 orders of magnitude larger in the SiStat database compared to UN Comtrade. It is deduced that specific commodities within these two aggregate categories likely make up the bulk of the difference between the total tonnage reported by the two datasets.

To estimate the total ecological footprint using Slovenia’s national statistics database, the aggregate footprint intensity per ton was calculated for each aggregate 2-digit category and applied to the raw tonnage reported in SiStat. Two categories, “57 Plastics in primary forms” and “97 Gold, non-monetary (excluding gold ores and concentrates)” were not present in the NFA dataset and footprints were approximated by assuming the intensity of similar categories, “56- plastic, non-primary" and “96 Coin (other than gold coin), not being legal tender” respectively. The totals were then applied to the calculation template and compared to the current footprint values.

Estimated Ecological Footprint from Carbon verification

The comtrade data used in the NFA underreported both the import and export trade flows, resulting in 3 and 6 percent differences, respectively, however, the final verified value for the carbon footprint, 6,439,560 gha (table B.6) and for total ecological footprint did not differ greatly from the original value reported in the NFA, 6,593,811 (table B.1). The effect of balancing trade flows, and the fact that the underreported categories had low footprint intensities resulted in the relatively small difference. Overall, the combined effect of applying the country reported CO2 emissions data for UNFCCC and estimated trade data from SiStat resulted in a difference of 0.1% to the total Ecological Footprint of Slovenia as compared to the standardized input data used by Global Footprint Network.

Table B.6. Carbon footprint of Slovenia by category, estimated after recalculation with trade data from SiStat and nationally reported CO2 emissions

Name [-]	EF_P [gha]	EF_I [gha]	EF_E [gha]	EF_C [gha]
Fossil Fuel Emissions	4,521,893	8,960,945	8,040,166	5,442,672
Other Sources	367,877	-	-	367,877
Traded Electricity	-	812,025	799,851	12,174
International Transport	-	616,837	-	616,837
TOTAL	**4,889,771**	**10,389,807**	**8,840,017**	**6,439,560**

References:

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IPCC (2006). 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Eggleston, S., Buendia, L., Miwa, K., Ngara, T., Tanabe, K. (eds.). IPCC-TSU NGGIP, IGES, Japan. Internet: www.ipcc-nggip.iges. or.jp/public/2006gl/index.html.

Annex C. Consulting and Verification of Ecological Footprint Projections and Scenarios

As part of this project, Global footprint network researchers corresponded with Stritih Consulting on the development of the report "Ecological Footprint of Slovenia – Calculation of Projections and Scenarios for the reduction of Ecological Footprint for selected measures", in particular for the proper application and integration of scenarios and projections to derive potential national outcomes in Ecological Footprint and biocapacity. Through our interaction and earlier participation in the 2018 workshop, as evidenced through the detailed application and discussion of ecological footprint and biocapacity outcomes by measure, we confirm that the calculations were applied in a consistent manner and the assumptions made suggest a high level of rigor and strong understanding of the calculations and accounting methodology in the National Footprint Accounts.

Clarifications

The report compared differences between UNFCCC and NFA National Footprint Biocapacity Accounts (NFA) framework and results, and here we offer minor clarifications.

1. Alignment of metric and results: Within the NFA, the production footprint component of the carbon footprint uses input data from International Energy Agency(IEA) and this data is aligned and comparable with CO2 emissions reported to UNFCC; both sources follow IPCC guidelines for greenhouse gas (GHG) reporting. While IEA is independently calculated, UNFCC data are self-reported by each country. Production, as well as trade flows, are used to calculate the Ecological Footprint of Consumption; and the projection report appropriately makes projections based on estimates of each of these components (production, import, and export) separately. Note that the NFA country workbook for Slovenia is produced to provide of calculation transparency and allows self-calculation and substitution of data in the case of updated, improved, or otherwise preferred data.
2. Net emissions in the UNFCC framework are reported as production(territorial) emissions adjusted by carbon uptake. Whereas these two opposing flows (emission and update) are captured and expressed in the NFA as the carbon footprint and forest biocapacity, respectively.
3. Other Greenhouse gases(GHG): The most current NFA(2019 Edition) calculations, include only CO2 emissions rather than a full set of GHG emissions reported in the UNFCC dataset. The conceptual framework for Ecological Footprint accounting does not limit the inclusion of greenhouse gases to CO2, but rather limitation of data to accurately trace additional greenhouse gas emissions embedded in trade has prevented inclusion of current ghg's into current (NFA) results. Future accounts should take steps to include basic estimates of production and trade flows to improve results.

The results, calculations and assumptions were reviewed and confirmed. They are carried out to the best available current assessment of the situation; however, we note that the assumptions should be reviewed

regularly and assessed as new information becomes available. For example, section 3.1.2 describes a baseline scenario for 2030. It is very difficult to quantitatively estimate the frequency and severity of extreme weather events with high certainty and in a spatially explicit manner, however the assumptions made in the report on these types of events are conservative and can be updated as new models are developed. Additionally, and world changing recent events such as COVID-19 have had significant effect on global production and consumption patterns which cannot be assessed under current levels of uncertainty associated with both the biophysical aspects of interaction between and humanity and our environment as well as the psychological aspect of societal decision making and the concept of connectedness. As the world adjusts and recovers from COVID-19 it would be prudent to re-assess baseline scenarios and potential reduction measures.

We fully support the conclusions of the report, “Ecological Footprint of Slovenia – Calculation of Projections and Scenarios for the reduction of Ecological Footprint for selected measures” and find that the examples and measures recommended are well researched, and would further add that the recommendations stated should be viewed as examples of solutions which form a subset of many possible existing interventions. These are strongly in alignment with our suggested framework, presented in the main report. We highly recommend the proposed solutions and emphasize that innovative solutions should not limited to those presented in the report.

The projections and scenarios themselves are well thought out, and we recommend further set of analyses to improve on the static elements of the approaches used. Such analysis would incorporate more dynamic elements to capture synergistic effects and complex interactions that may occur in the future and once developed, can be quickly re-parameterized to reflect the rapidly changing world.

Lastly and most importantly, the proposed recommendations are largely focused on Ecological Footprint and biocapacity effects and would be greatly improved if they are supported with additional analysis on economic effects. Cost benefit analyses of this nature are needed to assess the viability and practical implementation of measures.

Annex D. Selection and Training of the National Representative for Calculating Regional Ecological Footprints

Identification of candidate organizations

In the initial stage of selection and training of a national representative to support the realization of SDS' environmental objectives and of regional development programs, Global Footprint Network identified possible organizations who are potential matches to provide a national representative to participate in an in-depth training. These organizations operate in the field of implementing comprehensive assessments of the state of the environment. Eight institutions (Table 2) were identified, and evaluated in their organizational capacities based on three selection criteria: (1) capacity to perform technical ***calculation***, (2) capacity for ***interpretation*** of technical calculations to policy and action, and (3) capacity for ***communication*** activities.

From the initial list of 8 organizations, a subset of organizations was identified who function as research institutions and scored highly on the evaluation criteria. These organizations were the Statistical Office of the Republic of Slovenia, the Energy Efficiency Centre at the Jožef Stefan Institute, the University of Ljubljana Department of Geography, and the University of Primorska Department of Geography.

Table 2.2 High level evaluation of organizations.

Table D.1 Evaluation of national research institutions

Evaluation description:

-**Green**: Close match between ideal trainee profile and candidate organization expertise

-**Light Green**: Medium match between ideal trainee profile and candidate organization expertise

-**Grey**: Low match between ideal trainee profile and candidate organization expertise

Organization	Calculation	Interpretation	Communication
Statistical Office of the Republic of Slovenia			
Association of Municipalities and Towns of Slovenia			
Ministry of Environment and Spatial Planning of Slovenia			
Institute of Macroeconomic Analysis and Development of the Republic of Slovenia			
Energy Efficiency Centre at the Jožef Stefan Institute			
Institute for Youth Participation, Health and Sustainable Development			
University of Ljubljana, Faculty of Arts, Department of Geography			
University of Primorska, Faculty of Arts, Department of Geography			

It should be noted that statistical institutes, such as the Statistical Office of the Republic of Slovenia, are the main data producers in the country and theoretically have maximum authority for handling national and regional Footprint assessments. Statistical institutes seem to be ideal bodies for maintaining the Footprint calculation, both at the national and regional level, along with the interpretation and analysis of the results and communication. However, there could be difficulty in implementing top-down methodology in national statistical offices that are not fully committed to the Ecological Footprint framework and methodology. Additionally, the Ministry of Environment and Spatial Planning of Slovenia is responsible for the Slovenia's National Environmental Action Program 2030 and Development Strategy

2030. The ministry is well positioned to use the Ecological Footprint methodology and results at the regional level to support its work for ensuring policy coherence and assessing the sustainability progress in development actions, policies and strategies implemented within Slovenia.

Universities and official research institutions identified here are well situated to provide strong candidates in terms of technical ability to produce Ecological Footprint calculations and interpret results. However, the communication of the Ecological Footprint results by academic institutions for regional development planning, which are mainly done through municipalities and research offices, may require additional communications support from partner organizations.

Selection criteria for national representative

On January 30, 2020, the Slovenian Environment agency invited the identified organizations to nominate national representatives by the 31st of January in order to facilitate the original timeline of the project. Due to the short time span, the organizations were not able to prepare nominations. As of February 2nd, all identified organizations were informed that the deadline for nominees is extended to 7th of February, 2020.

The criteria for selecting nominees are (1) their experience with Ecological Footprint accounting concepts, (2) subnational calculation knowledge, and (3) technical ability to perform Ecological Footprint calculations. Technical abilities include analytical expertise (using data analysis tools such as MATLAB, Python, or R), high proficiency in Excel, and prior experience with Input-Output (IO) analysis.