



Bio-based Industries  
Consortium

# Mapping Lithuania's bio-based potential

Country Report





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# EXECUTIVE SUMMARY

Lithuania offers substantial opportunities for the bio-based industry. The potential of the country for bio-based activities comes across from the information gathered from publicly available sources even though this information is not complete.

Situated on the banks of the Baltic Sea, Lithuania's landscape is a mix of plains and low hills. Almost half of the country is arable land, while around a third of the country is covered by forests.

Agriculture, forest-based and chemical industries are among the strong drivers of Lithuania's economy. Also present are healthy blue economy, food and beverages, food-processing and wood-processing industries. A leading role is for the agriculture and food industries with a combined contribution of around 10% of the GDP.

These industries are a sound basis for a bio-based industry in Lithuania. The presence of many international actors in the biotechnology sectors and a well-organised innovation support infrastructure contribute to a significant list of ingredients for a sustainable bio-based sector. In addition, the country is currently drafting a bioeconomy strategy that should be great support for local, regional and national bio-based operations.

The industrial sectors in Lithuania have substantial residual streams and waste, most of which find low-value applications. These streams are relevant feedstocks for bio-based operations in the country. Being the largest sector, agriculture produces the

most residual streams (estimated at 8 million tonnes/year, with manure, straw and slurries taking the lion's share), while forestry can contribute an additional 270 kilo tonnes/year. The food and beverage industry and the pulp and paper sector are currently the main bio-based economic activities in the country. Residual streams from these activities are excellent feedstock for bio-based operations in Lithuania. However, data on waste generation across all industrial sectors are not available.

Lithuania is strengthening its position as a regional hub for biotech, having been ranked 16th globally in 2018. It has an infrastructure of universities, research centres and industries, and an active national biotech association. There is a strong support towards high-tech university spinoffs and start-ups. A network of technology parks and incubators has grown in recent years around the three main cities of Vilnius, Kaunas and Klaipeda, under the auspices of the Ministry of Economy and Innovation.

Several EU-funded research projects using biomass feedstock and biotechnologies have been running in Lithuania in the last few years (including some under the Bio-based Industries Joint Undertaking programme). This demonstrates the interest and commitment for bio-based activities by the scientific and industrial communities in the country.

“ This document is part of the ‘strategic outreach programme’ of the Bio-based Industries Consortium (BIC). The objective of the programme is to identify opportunities for bio-based industrial activities in European countries where these activities are relatively low. Bio-based activities heavily depend on innovation, and

hence are relatively low in moderate/modest innovator’ countries. This may be the result of insufficient knowledge of the potential for the bio-based industry in these countries, by actors in bio-based activities in these countries as well as by BIC. Additionally, actors in these countries may not be fully aware of the opportunities offered by BIC and the Bio-based Industries Initiative.

This report does not pretend to be complete. Nor may it be based on the most recent statistical data. The report is a first draft that has been prepared by collecting and analysing available data by BIC. The report is mainly feedstock-driven, in an effort to use relevant available feedstock for higher values than currently is the case. The Lithuanian representative in the States Representatives Group of the BBI JU has provided significant assistance in collecting and reviewing data used in this report.

BIC will now share this document with local actors and seek to assist in setting up action plans with local industry and governmental institutions for expanding the bio-based activities in Lithuania.

The following chapters describe the current economic basis of Lithuania, the potential for bio-based industrial operations and some examples of achieving high-value applications from comparable feedstocks elsewhere in Europe. The appendix contains additional tables and graphics related to the aforementioned chapters.



# 1

## CURRENT BASIS OF ECONOMIC ACTIVITIES

Lithuania's economy consists of some strong pillars that are also the needed drivers for a bio-based industry and a bioeconomy. These pillars feature agriculture, forest-based and blue economy activities, with subsequent food and beverages, wood-processing industries, as well as a chemical industry.

The figures on the right show the relative importance of the bio-based sectors in terms of Gross Value Added.

For sectors such as textiles and leather, chemicals, pharmaceutical and furniture it is not possible to distinguish between the bio-based and non-bio-based contributions. They are therefore shown in Figure 3 as 'partially bio-based'.

In addition, the country hosts many international actors in the biotechnology sectors, and it has a well-organised innovation support infrastructure.

Lithuania is made up of a geographical mix of plains and low hills. Around one-third of the country is covered with forests. It has low-lying and sandy coastal areas along the Baltic sea; more than half of its territory is protected by the Curonian Spit, a sand peninsula which encloses a large lagoon. The main cities are

Vilnius (the capital), Kaunas (an industrial centre) and the port city of Klaipėda.

Bioenergy has become an increasingly important energy source in Lithuania, particularly since the Ignalina Nuclear Power Plant was decommissioned in 2009. Recently, bioenergy has accounted for 73% of the production of primary energy

in Lithuania, of which firewood and wood waste for fuel account for 64%. Biodiesel and biogas made up about 5% and 2% respectively, and the remaining types of biofuel account for less than one percent each.

[LITBIOMA](#) is an association of actors in bioenergy.

Figure 1. Gross Value Added of bio-based primary sector (M€\*, Eurostat, 2017)



\*M = million

Figure 2. Gross Value Added of bio-based manufacturing sector (M€, Eurostat, 2017)

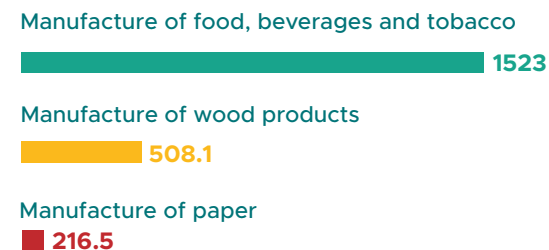
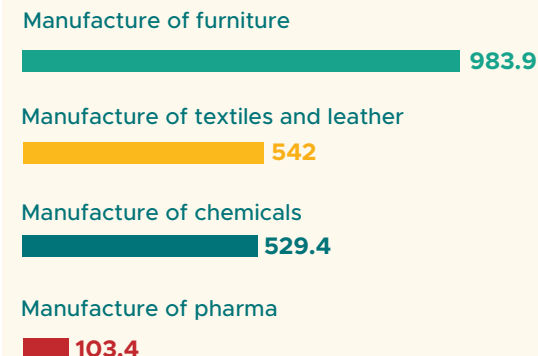


Figure 3. Gross Value Added of partially bio-based manufacturing sector (M€, Eurostat, 2017)







# 1.1. Agriculture

Agriculture and the food industry play a vital role in the economy, contributing to around 10% of GDP



**Gross value added (GVA) of agriculture and food and beverage industry combined / year**

€2.5B\*

Turnover

€7B

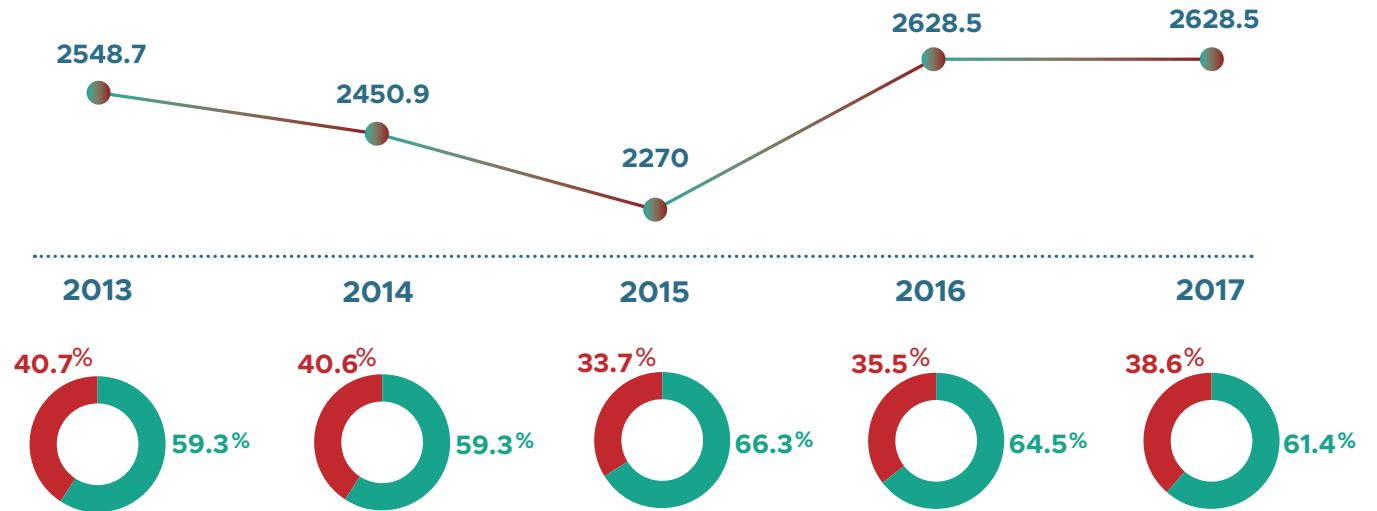
Employees

140,000

Agriculture and the food and beverage industry combined, account for a gross value added (GVA) around €2.5 billion /year and a turnover exceeding €7 billion /year, as well as over 140,000 employees. While traditionally livestock has had a greater production volume than crops, this has been inverted in recent years. Since 2011, crop production has been higher (and increased faster) than livestock production. In particular, crops production covers more than 80% of the total production value generated in the agricultural sector (see Figure 4).

Figure 4. Agricultural production trends (M€, Eurostat)

● Crop ● Livestock

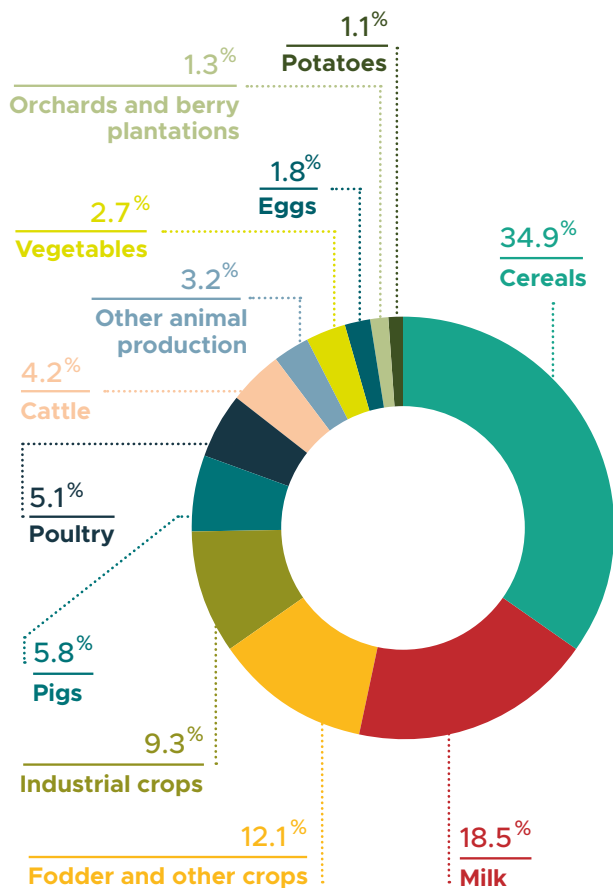


\*B = billion



The relative importance of crop and livestock production in the Lithuanian agricultural sector is shown in the chart below. In terms of value, cereals are the most important product category, followed by milk, fodder and other crops.

Figure 5. Gross agricultural production (2017)



## 1.1.1. Crop production

### Cereals

**Cereals are the most important crop product by value. From 2012 to 2017 production of grain crops increased by 20%. In 2017 grain crops accounted for about 75% of the total crop area in Lithuania.**

In the 2012-2017 period, the area of perennial grasses decreased by almost 3-fold, however, this was partially offset by an increase in permanent grasslands in the same period. According to the Ministry of Agriculture, this trend negatively impacts biodiversity, increases the demand for mineral fertilisers, uses soil intensively, and so on. The total production of cereals in Lithuania is more than one-third of the total agricultural production.

Winter and spring wheat account for the bulk of production, followed by spring barley and triticale. Lithuania was fifth in the EU in terms of wheat exports in 2017. However, with a relatively low output from mills of the export slate (18% in 2018), it appears that there is an untapped potential both to process products and create higher value-added products.



### Pulses

Production of dried pulse grains (2017)

**707.3 kt\***

### Rapeseed

Production of rapeseed (2017)

**543.5 kt**



The largest rapeseed refining company is “Pasvalio agrochemija”. Mestilla uses rapeseed for biodiesel production. Another player active in the field is JSC Rapsoila.

\*Kt = thousand tonnes

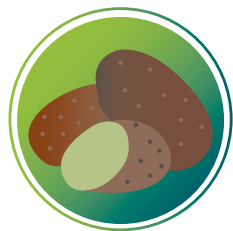


## Potatoes

Potatoes account for

# 3%

of all crops by value



Land area dedicated to potatoes has been constantly decreasing since 2013. As a result of a rainy autumn, potato production in 2017 was the lowest in the last five years at 237 thousand tonnes.

## Horticulture

Vegetables account for

# 3.7%

of agricultural production in value



The primary cultivations are cabbage (21.5%), beetroot (18.2%), carrot (17.4%) and onion (14.9%). Tomatoes and cucumbers are the main crops cultivated in greenhouses.

## Fruit & berries

The sector is small, accounting for

# 1%

of agricultural production



## Hemp

Hemp production is a small, but growing sector with big potential. Several companies are active in this sector: [Agropro](#), [Satimed](#), [Sanobiotec](#) and [JSC Borela](#).

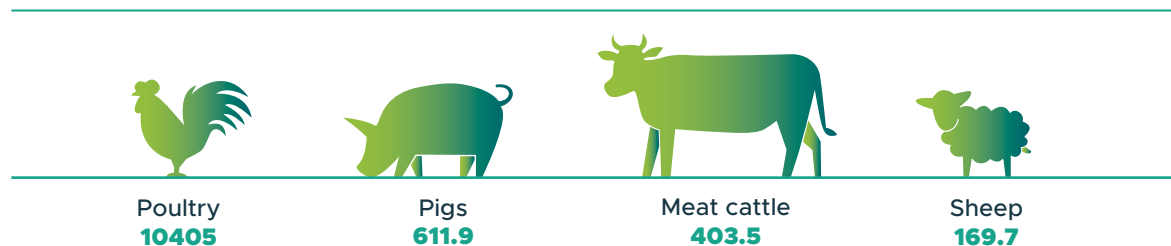
### 1.1.2. Livestock

#### Meat livestock

While having experienced a slight decline in the last years, livestock still represents almost half the value of the agricultural production. Cattle, swine and poultry are the main types of livestock raised, with a substantial presence of sheep.

In terms of farm structure, small farms having less than 10 animals represent the vast majority. However, large farms (>100 animals) are more significant when considering the total headcount. This is particularly evident for swine, where large farms (less than 1% in number) host 87% of the total pig population.

Figure 6. Animal headcount (K\*, 2017)



#### Milk cows

**Milk is the largest sector in livestock production, the second largest in the agricultural sector besides cereals**

Lithuania has over 40,000 dairy farms including 270,000 cows (2017). Almost 90% of dairy farms are small, having less than 10 cows. However, there is a continuing trend towards an increase in the average size of farms. In the period 2013-2017 the number of small farms has diminished by 38% (32.8% in terms of headcount), while the number of large farms increased by 10.2% (13.5% in headcount).

\*K = thousand



## 1.2. Forest

While agricultural land covers about 50% of Lithuania's territory, around 33% of the overall land area is forested land, which corresponds to about 2.2 million hectares.<sup>1</sup> The southeastern region of Lithuania is the most forested, where forests reach around 45% of the total land. The Lithuania's forest stock has been consistently growing in the last 20 years.

The forest-based value chains, including both forestry and wood processing combined GVA / year

€650M

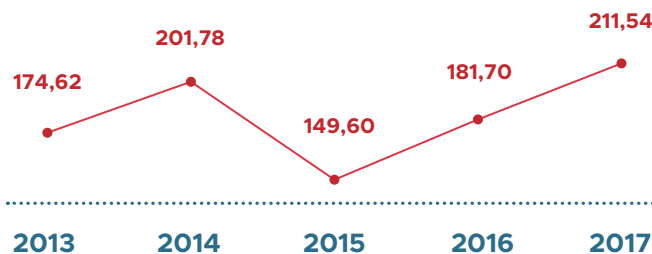
Turnover<sup>2</sup>

€1.4B

Employees

30,000

Figure 7. Trend of the Gross Value Added of forestry (M€, Eurostat)

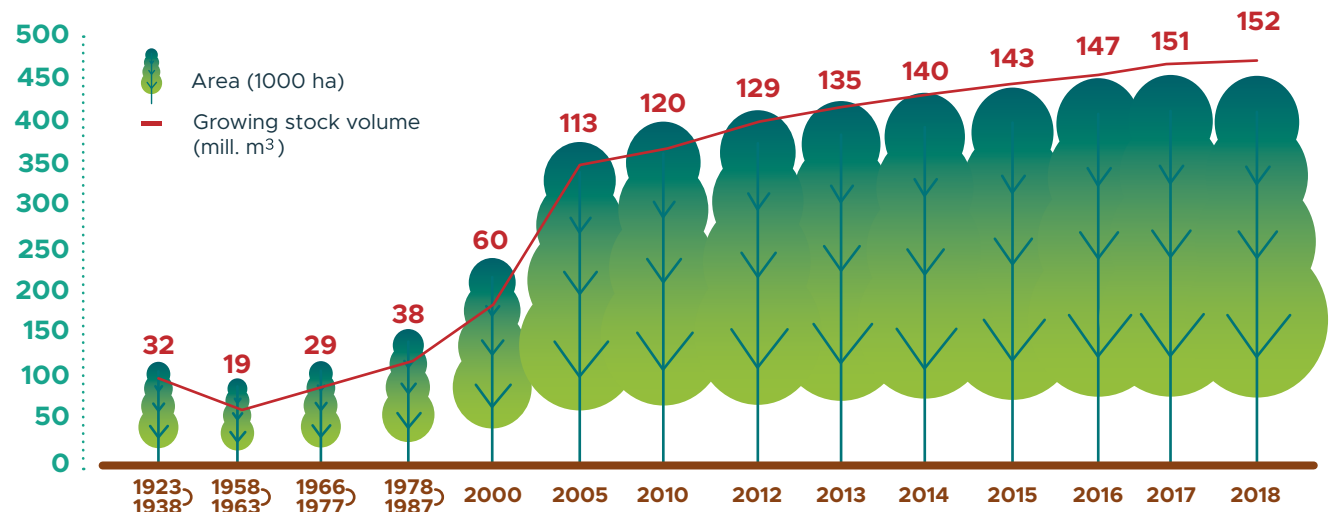


Lithuanian forests mostly consist of broadleaves and a mixture of broadleaves and coniferous stands. The figure below shows the overall composition of forests in Lithuania, in terms of tree species.

Over 60% of Lithuanian forests belong to the state. At the end of 2018, all forests reserved for restitution (which correspond to about 10% of state forests) would have been transferred to State companies or sold in auctions. With efficient forest management

activities, it is envisaged that the overall wood supply would increase by up to 10% (Committee on Forests and the Forest Industry). The remaining 40% of forested land (around 858,000 hectares) belongs to private companies or individuals. There are about 250,000 private owners in Lithuania, who own forests that are generally small in size (3.4 hectares each on average).

Figure 8. NFI data about forest of III-IV group since 2003 (Source: The Chronicles of Lithuanian forests XX century, State Forest Service)



<sup>1</sup> UN FAO Global Forest Resources Assessment

<sup>2</sup> More detailed figures on bioeconomy are available in the Appendix

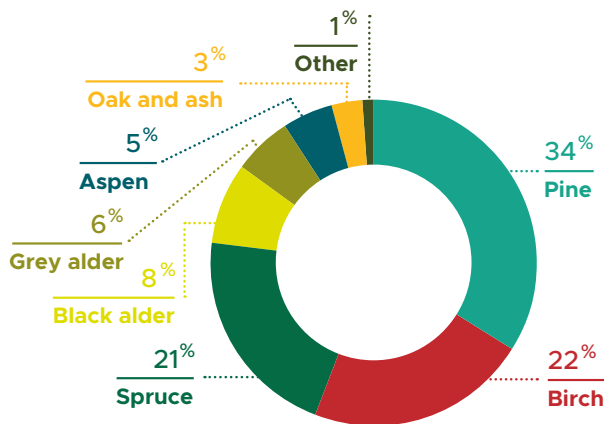


The Lithuanian Forest Law dictates that the annual volume of forest cutting must not exceed the gross annual tree increment. For this reason, the amount of annual forest cuttings in state forests must be approved by the government. For the period 2014-2018 this cutting was 3.15 million cubic metres.

The felling volume in state forests is almost stable (about 3.8-3.9 million cubic metres). On the other hand, the felling volume in private forests is less stable, the volume being more affected by wood price fluctuations (e.g. it reached 3.8 million cubic metres in 2014, and then decreased to 2.9 million cubic metres as a consequence of wood price's decrease in 2015).

The [Forest Owner Association of Lithuania \(FOAL\)](#) is the national interest organisation for the forest owners in Lithuania and has the status of an independent, public NGO.

Figure 9. Distribution of tree species in Lithuanian forest



## 1.3. Fisheries, aquaculture and the blue economy

### 1.3.1. Fisheries

Catch by Lithuanian vessels (2016)

105 kt



*Almost the entire fish catch from long-distance ocean fisheries and 85% of the Baltic Sea catch was sold directly to foreign countries. Lithuania is a net exporter of fish and seafood products in terms of value and net importer in terms of volume*

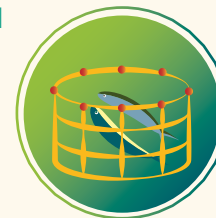
USDA, 2017, Fish and seafood market in Lithuania

This means that fish processing companies in Lithuania import fish and sell manufactured products abroad.

### 1.3.2. Aquaculture

In 2017, the overall production amounted to

3.4 kt



even though aquaculture activities are increasing in the recent years mainly due to [EU support](#). Aquaculture is performed only in inland (fresh) waters. The most common species is carp (over three-quarters of the total).

### 1.3.3. Algae

Algae cultivation is not yet fully established in Lithuania, however, there are some starters. A Lithuanian startup has developed an algae-based food packaging material. The material uses chalk powder with algal agar as a stabiliser. Researchers from the universities of Vilnius and Kaunas are working on developing [algal biofuel](#), [algal biogas](#) and on using algae grown on municipal wastewaters for [nutrient recovery](#). The Klaipėda University hosts a [Marine Research Institute](#).



# 1.4. Food and beverages

The food and beverage industries account for about 4.3% of GDP

Employing

# 42,000 workers

In 2017 the sector counted

# 979 companies

# 98.8%

of companies are SMEs

# 42%

of produce is exported

The European Union is the main destination of food and beverage exports

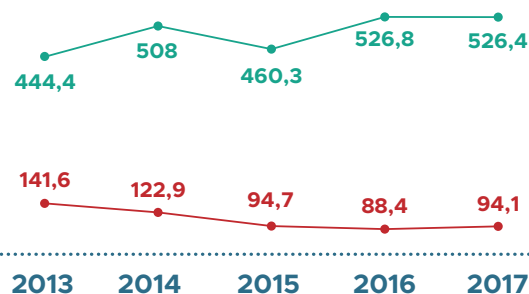
# 84%

of the total



Figure 10. Trend of Gross Value Added of food, beverages and tobacco production (M€, Eurostat)

● Manufacture of beverages ● Manufacture of food products



## 1.4.1. Meat



Yearly poultry production

# 110kt

Lithuania is the largest poultry meat producer among the Baltic countries. Poultry meat is mainly exported, although domestic consumption of poultry has been growing in the last years.



Yearly pork production

# 100kt

Lithuania is the largest producer of swine among the Baltic States. Lithuania is a net exporter of live swine (mainly to Poland) and importer of pork products (mainly from Poland). Pork is prominent in the domestic consumption of meat (62% of domestic meat consumption as of 2014).



Yearly beef production

# 50kt

More than half of it is exported, mainly to Italy, Poland and the Netherlands. Domestic consumption is low as beef amounts to only 5% of domestic meat consumption.

## Main players

- ✓ **Biovela** is one of the leading producers of fresh and processed meat (beef and pork). Meat production stands at 50 thousand tonnes per year, with an average turnover exceeding €200 m. Around 50% of the produce is exported.
- ✓ **Vilnius&Kaisiadorys (KG Group)** is the leading producing of poultry meat. The Group also has a feed factory producing own animal feed. It employs over 3000 persons.
- ✓ **Nematekas** is another large scale producer of poultry meat and eggs.
- ✓ **Idavang** is one of the largest pork providers in the Baltics and North-Western Russia.



## 1.4.2. Fish and aquaculture products

**49** Fish processing plants in Lithuania

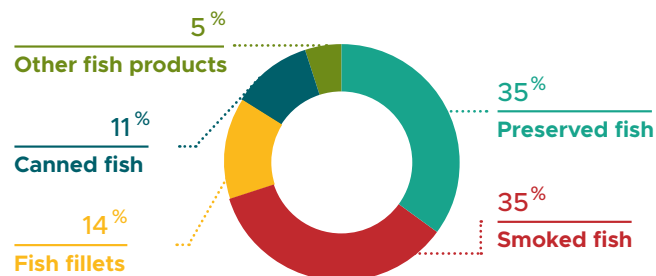
Fish processing production (2015)

**707.9** Kt

Value

**€479**M

### Main fish products



The main processed fish are herring (mainly imported from Norway and Iceland), sprat (mainly imported from Latvia and Poland) and salmon (mainly imported from Norway).

## Main players

- ✓ The **Viciunai Group** is the largest fish processor in Lithuania and one of the largest in Europe, with a combined annual production of 150 thousand tonnes of different fish products in 13 processing plants, 6 in Lithuania and 7 abroad. Company headquarters are in Kaunas.

## 1.4.3. Beverages

**€498** M Turnover beverage production (2016)



Beer brewing turnover

**€227.8**M



Soft drinks turnover

**€100.6**M

Source : Eurostat

## Main players

Two large groups dominate the brewing scene:

- ✓ **Svyturys-Utenos** (owned by Carlsberg), based in the city of Klaipeda
- ✓ **Kalnapolis-Tauras** (owned by Royal Unibrew), based in Panevezys

Another brewery, also active in soft drinks, is **Volfas Engelman**. The **Zemaitijos Pienas** group has subsidiaries active in dairy products, soft drinks and snacks. **SVF** is a producer of herbal drinks and tea, owning approximately 80% of the local market. **Anykščių vynas** produces cider and spirits.





## 1.4.4. Dairy products

Dairy is the single largest food sector industry



Turnover (2016)

€915.4M

Source : Eurostat

### Main players

The dairy segment is mainly concentrated in 6 companies:

- ✓ [Zemaitijos Pienas](#), who also has subsidiaries active soft drinks and snacks
- ✓ [Rokiskio Suris](#), focusing on cheese and dried milk powder
- ✓ [Pieno zvaigzdes](#)
- ✓ [Vilkyskiu pienine](#)
- ✓ [Marijampoles pieno konservai](#)
- ✓ [Pienas LT](#)

## 1.4.5. Cereal-based foods, bakery, sweets

Bakery and cereal-based products annual turnover

The sector is quite fragmented

€301.5M



600

companies are registered under this sector

Source : Eurostat

### Main players

- ✓ [Birzu duona](#), located in Birzai, is a large producer of baked products like bread, biscuits and breadsticks
- ✓ [Cerera foods](#), located near Kaunas, produces cereals for breakfast under the brand Palaseja
- ✓ [Danvita](#) is a producer of crackers and snacks
- ✓ [Ekofrisa](#) is a producer of crackers and cereal-based products
- ✓ [Grainmore](#) is a large processor of grains and producer of flakes, granolas and probiotics
- ✓ The [Zemaitijos Pienas](#) group has subsidiaries active in dairy products, soft drinks and snacks
- ✓ [Viktorija](#) and [Ustukių malūnas](#) are producers of biscuits



## 1.5. Wood products

Lithuania has an active furniture and wood processing industry, accounting for around 30% of the total manufacturing industry

Companies in the furniture and wood processing industry (2016)

# 895



# 97.5%

 of companies are SMEs

Lithuania is also home to some large companies, including a local branch of **IKEA**

## Main players

- ✓ Besides **IKEA**, the country also hosts a local branch of Bauwerk Boen, a large Swiss-based floor and board manufacturer
- ✓ **SBA Furniture Group**, the largest furniture company group in the Baltic states, with a strong business also in the apparel sector.
- ✓ **Vakarų Medienos Grupė** is a large company active in furniture and board products
- ✓ **Baltic Furniture Cluster** groups and markets furniture products from a network of local producers

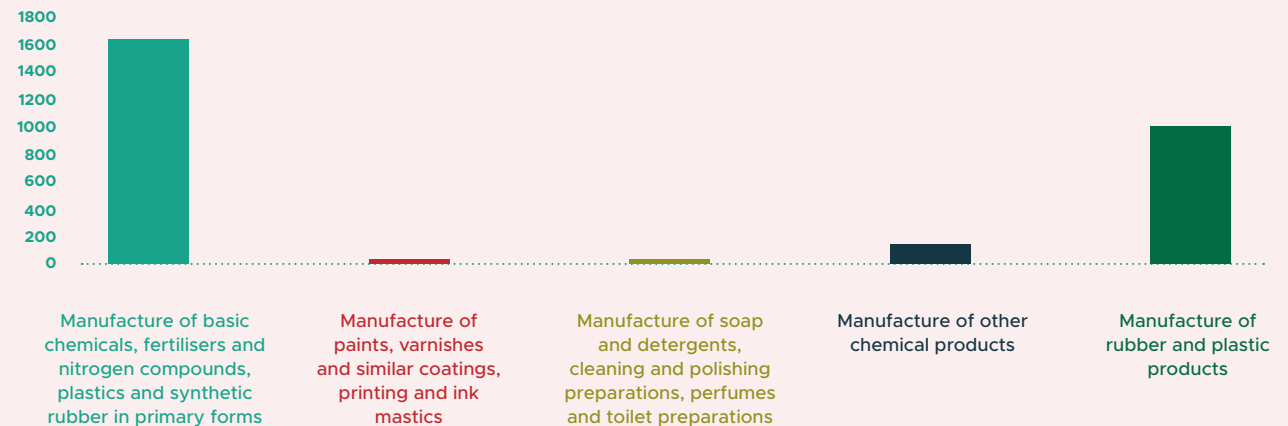


## 1.6. Chemical industry

Lithuania has a strong chemical industry, counting 144 companies for a turnover of €1774.8 million. Basic chemicals, fertilisers and plastic products are the main subsectors



Figure 11. Production value of the chemical sector (M€, Eurostat, 2017)



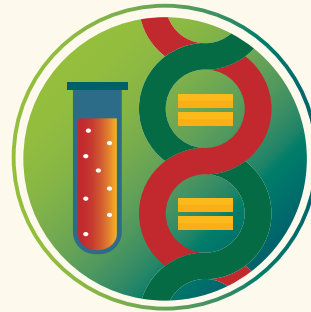
## Main players

- ✓ **Achema** is a large local producer of nitrogen fertilisers and chemical products. The headquarters of the company are in Rukla
- ✓ **Lifosa**, part of Eurochem, produces nitrogen-phosphorus fertiliser in a plant located at Kedainiai
- ✓ **Neo Group** and **Orion Global Pet** are two foreign-capital plastics producers based in Klaipėda



## 1.7. Biotech industry

Lithuania is home to a fast growing biotech industry (ranked 16th globally in 2018), featuring both national and international players



### Main players

- ✓ **ThermoFisher Baltics** is a subsidiary of the ThermoFisher group, producing molecular tools
- ✓ **Sicor Biotech**, part of the TEVA group, is a pharmaceutical company active in agricultural chemicals
- ✓ **Roquette Amilina**, part of the Roquette group, is the third largest wheat biorefining company in Northern Europe
- ✓ **Bioenergy LT** produces products for plants nutrition and soil improvement
- ✓ **Satimed** is a pharmaceutical company extracting active principles from hemp
- ✓ **Profarma** produces protein-based pharmaceuticals
- ✓ **ProBioSanus** is a producer of detergents based on probiotic bacteria
- ✓ **IMD Technologies** and **Caszyme** are enzyme technology providers
- ✓ **Froceth** is a biotech company producing advanced therapy products
- ✓ **Droplet Genomics** is a technology provider of microfluidic tools for molecular biology
- ✓ **Sanobiotec** works on extraction and refinement of active principles from bio-based resources (cannabinoids, terpenes, flavonoids)
- ✓ Other biotech companies are Biokonversija, Biocentras and Biomica



## 1.8. Clusters & organisations

According to **MITA**, the governmental Agency for Science, Innovation and Technology, cluster development is still at an early stage in Lithuania. However, some clusters already operate

- ✓ **Photovoltaic Technology Cluster**
- ✓ **Alliance of Baltic Beverage Industry (ABBI)**
- ✓ **Laser and Light Science and Technology Association**
- ✓ **Modern Housing Development Cluster**
- ✓ **SMART FOOD CLUSTER**
- ✓ **Cleantech Cluster Lithuania**

Other than these, notable clusters and associations of interest for the bioeconomy are:

- ✓ **Lithuanian Biotechnology Association**
- ✓ **Association of Wood and Furniture Industry**
- ✓ **Lithuanian Biomass Energy Association (LITBIOMA)**



## 1.9. Academia and research centres

The Ministry of Economy has established a centralised innovation support infrastructure, consisting of four industrial parks, two free economic zones, nine science and technology parks (STPs) and five science, studies and business centres. These entities sometimes overlap (e.g. Sunrise Valley hosts an STP and a business centre).

### Industrial Parks

- Siauliai
- Kedainiai
- Panevezys
- Alytus

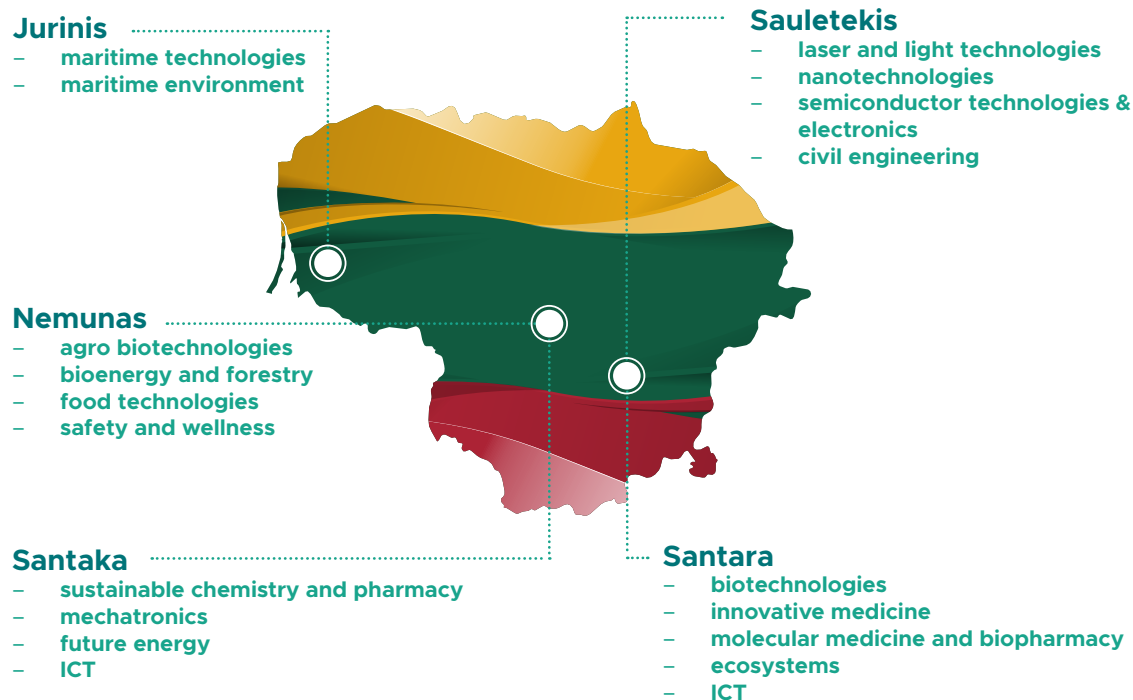
### Science and Technology Parks

- Sunrise Valley Science and Technology Park
- Kaunas Science and Technology Park
- Northtown Technology Park
- Visoriai Information Technology Park
- Science and Technology Park of Institute of Physics
- Science and Technology Park TECHNOPOLIS
- Klaipėda Science and Technology Park
- Panevėžys Science and Technology Park
- Liepiskes Technology Park

### Science, studies and business centres

- Santara Valley (Vilnius)
- Sunrise Valley (Vilnius)
- Santaka Valley (Kaunas)
- Nemunas Valley (Kaunas)
- Jurinis Maritime Valley (Klaipėda)


Figure 12. Location of Technology and Industrial Parks in Lithuania






## 1.10. Research projects

### **US4GREENCHEM - Combined ultrasonic and enzyme treatment of lignocellulosic feedstock as substrate for sugar based biotechnological applications**

 **Project duration 2015 - 2019**


US4GREENCHEM was a BBI project combining ultrasonic and enzyme treatment of lignocellulosic biomass to obtain high quality sugars and lignin. [UAB Biocentras](#) was a partner in the project.

### **TERMINUS - In-built triggered enzymes to recycle multi-layers: an innovation for uses in plastic-packaging**

 **Project duration 2019 - 2023**

TERMINUS addresses the challenge of recycling and reuse of flexible multi-layer and multi-compounds packaging materials. The aim of the project is to develop a range of smart enzyme-containing polymers with triggered self-biodegradation properties, acting as adhesives or tie layers in the design and manufacturing of multi-layer plastics for food and non-food applications. [Center For Physical Sciences And Technology \(FTMC\)](#) is a partner in the project.

### **TREASURE - Diversity of local pig breeds and production systems for high quality traditional products and sustainable pork chains**

 **Project duration 2015 - 2019**

The project has tackled innovative approaches to answer socio-economic demands of regional pork chains involving partners from different sectors. The ambition was to enhance existing and create new networks between academia and non-academia partners, within and between regions and to tackle the value chain for regional high quality pork products, focusing on diverse and so far untapped pig breeds, their production systems and pork products. [Lithuanian University of Health Sciences \(LSMU\)](#) was a partner in the project.


### **DIABOLO - Distributed, integrated and harmonised forest information for bioeconomy outlooks**

 **Project duration 2015 - 2019**

DIABOLO was a project whose aim was to build a strong methodological framework towards more accurate, harmonised and timely forest information, making use also of field-collected data and geo-referenced data. The [Vytautas Magnus University](#) was a partner in the project.




## **SAGRIS - Sentinels-Based Agriculture Information Service Component**

 **Project duration 2017 - 2018**


The project was an SME Instrument Phase 1 project by Lithuanian SME GEOMATRIX UAB. It involved development of an open-source software component for operational monitoring updates on dynamics of solar irradiation and surface temperature, development of grassland and crops biomass, soil and vegetation wetness, vegetation age and stress indications, geo-location and mapping of “problematic” patches, assessment of drainage systems for agriculture.

## **PANACEA - A thematic network to design the penetration PAtH of Non-food Agricultural Crops into European Agriculture**

 **Project duration 2017 - 2020**


The project aims at creating a network of stakeholders to support introduction of dedicated non food crops in European agriculture, by closing gaps in supply chains and policy frameworks. Lithuanian Research Centre for Agriculture and Forestry (LAMMC) is a partner in the project.

## **COSMOS - Camelina & crambe Oil crops as Sources for Medium-chain Oils for Specialty oleochemicals**

 **Project duration 2017 - 2019**

The project is studying the use of camelina and crambe as sustainable, multipurpose, non-GMO European oil crops for the production of oleochemicals, in particular medium-chain fatty acids and medium-chain polymer building blocks. Center For Physical Sciences And Technology (FTMC) is a partner in the project.

## **NutriBiomass4LIFE - Nutrient recycling circular economy model for large cities water treatment sludge and ashes to biomass to bio-energy**

 **Project duration 2018 - 2022**

The project, under the LIFE programme, aims at creating a self-sustained closed-loop circular economy model for nutrient-rich waste recycling for Vilnius, the largest city in Lithuania. This will involve using municipal sewage sludge and biomass ash on biomass plantations close to the city. The project is coordinated by UAB “Pageldyni plantacija” and features other Lithuanian partners: the Lithuanian Center of Agrarian and Forest Sciences, the Lithuanian Forest and Landowners Association, the Kirtimų water treatment plant and the Vilnius water authority.

## **AlgaeService for LIFE - Algae – Economy based ecological service of aquatic ecosystems**

 **Project duration 2018 - 2023**

The project, under the LIFE programme, aims at facing massive growth of macroalgae and cyanobacteria on rivers, lakes and the Curonian Lagoon. In particular, the project will develop new harvesting machines to effectively recover macroalgae and cyanobacteria to produce biofuels, bioplastics, fertilisers and other products. The project is coordinated by Nature Research Centre (NRC). Other Lithuanian partners are: Joint Stock Company (JSC) Baltic Environment (BE), Nature Heritage Fund (NHF) and SPILA, UAB.



# 2.

## CURRENT OPPORTUNITIES FOR BIO-BASED ACTIVITIES

This chapter explores the opportunities to expand bio-based industrial activities in Lithuania. It lists existing or potentially new feedstocks for the bio-based industry from the industrial sectors covered in chapter 1. These are mainly residual streams and waste that today find a low-value destination. By feeding these streams into bio-based operations, they could be converted into higher-value applications than the state of the art in the country.

Success of these new developments also depends on regional and national strategies regarding bioeconomy. Sub-chapter 2.2 lists current strategies and programmes on a national basis and international in the Baltic region.



## 2.1. Bio-based residue: availability and use

### 2.1.1. Agricultural residues

According to the Lithuanian Official Statistics Portal (OSP), the overall amount of organic waste generated in agriculture in 2016 was over 8 million tonnes. This is a significant amount of agricultural residues that could serve as feedstock for the bio-based industry. Straw, manure and slurry are the three dominating contributors.

The most common treatment these streams undergo is 'treated/recycled on site', which may also indicate spreading on the ground for soil amendment. Since there is a large volume produced, it is feasible to divert a substantial part of these streams as feedstock to the bio-based industry without impoverishing soil resources.

Forest felling residues are the only stream where 'delivery to other uses' is the main use. Bioenergy and heating are the most probable destination thereof. These residues are also candidate for higher-value uses.

The fraction of agriculture waste diverted to other uses is small (700 thousand tonnes in 2016, less than 10% of the total). The OSP counts 36.5 thousand tonnes of agriculture waste suitable for [energy use](#) produced in 2017, of which 13.7 thousand tonnes were used for energy production. Further 25.3 thousand tonnes of it were exported (the balance is reached considering 1.9 thousand tonnes were imported while 0.6 thousand tonnes were mobilised from stock).





Figure 13. Use of organic agriculture waste (Kt, 2016)

	Amount at the end of the year	Treated delivered to other users	Treated delivered to waste managers	Treated disposed on the site	Treated incinerated	Treated recycled on the site
Animal tissue waste		0.7	2.7		0.1	0.1
Cereal cleaning waste	0.4	10.7	1.1	2.5	1	18.7
Dead infected animals	10.3		7.6	0.1	0.7	
Forest felling residues	16.8	189.7		0.4	23.1	44.9
Garden and park biodegradable waste	0.2	0.4	1	3.1	1.9	3.3
Green residues	1.4	16.6	3.5	24.2	0.2	156.5
Manure	205.5	218.2	28.4	311.1		2259.6
Sludge from washing and cleaning			0.1	2.8		0.3
Slurry	181.4	235.2	40.6	30.5		934.7
Straw	40.1	29.1	38.2	403.3	18.9	2799.5
Wood waste	2.8	0.3	1.7	0.1	7.1	6.5



Most of the bio-based residual streams appear to never leave farms' gates: of the 8 million tonnes generated, only around 40 thousand tonnes enter the [material flow statistics](#).

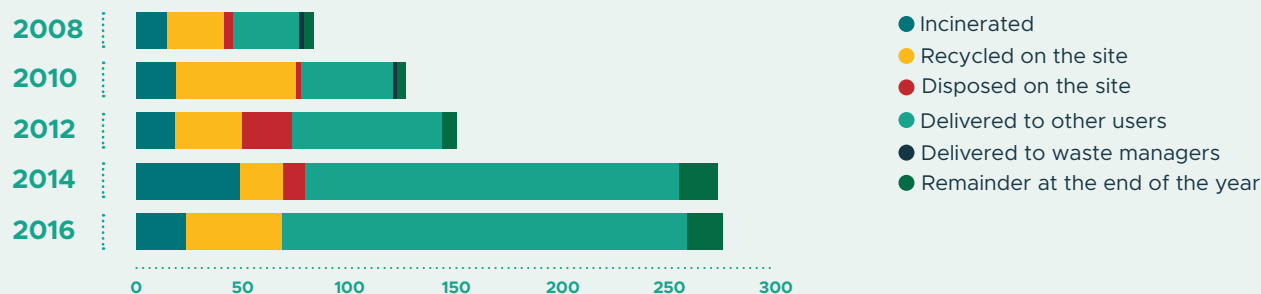
The destiny of the rest of the agricultural side streams is not indicated. Probably a substantial part thereof is used for soil amendment. It appears therefore that Lithuania possesses a substantial amount of agricultural residues that could be used sustainably as feedstock for the bio-based industry.

## 2.1.2. Forestry residues

The total amount of forest felling residues after forest cutting is shown in the figure below. The quantities now going to incineration, delivery to other uses and remaining at the end of the year are potential feedstock for the bio-based industry. Their overall total is around 230 thousand tonnes.

Lithuania has established a B2B – B2C biomass trading webplatform named [BALTPPOOL](#). BALTPPOOL, whose shareholders are State-owned energy and oil companies UAB EPSO-G and AB Klaipėdos Nafta, is the operator of the Lithuanian Energy Exchange entitled to organise trade of solid biofuel products. The company also acts as the administrator of public service obligations (PSO) funds and is engaged in the collection, payment and administration of PSO funds.

Figure 14. Forest felling residues (Kt, Source: Statistics Lithuania)



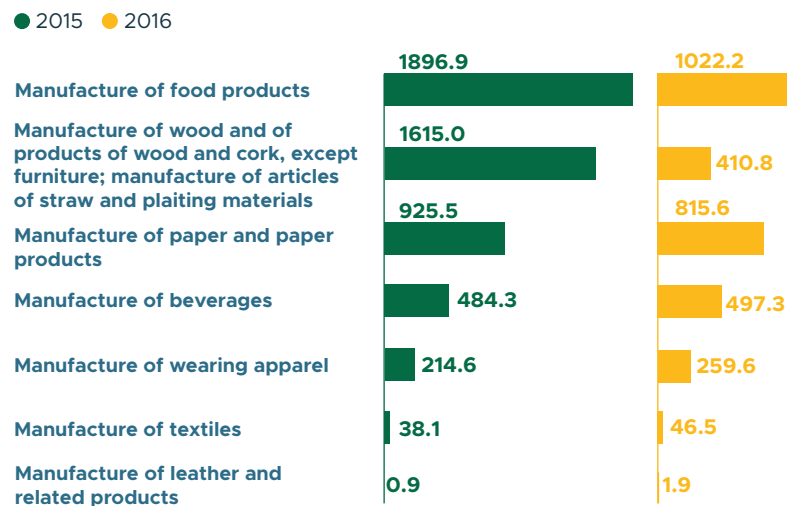


## 2.1.3. Residues from bio-based economic activities

No statistics on the generation of organic waste in industry was found. However, the following table, showing the income related to using industrial by-products per sector, may give an insight into the potential for bio-based industrial activities.

Not surprisingly, food, wood and paper are the sectors having the highest turnover associated with waste resources. A large share of such waste streams is organic in nature. The current use of them is not indicated; production of energy, biogas and/or fertilisers are the most probable destinations. It should be possible to divert at least part of these streams to higher-value uses.

Figure 15. Income of enterprises from by-products (K€)



## 2.2. Bioeconomy strategies and programmes

### 2.2.1. National strategy

**Lithuanian national smart specialisation strategy (RIS3) includes six broad fields, one being ‘Agro-innovation and food technologies’. Priority areas within this field cover sustainable use of biomaterials, functional food and innovative development, improvement and processing of biological raw material (biorefinery).**

Lithuania is currently drafting a bioeconomy strategy. In 2017 it published a feasibility study on the development of a national bioeconomy. The study was developed with the support from Norwegian funds and, therefore, it includes the analysis of Norwegian bioeconomy and identification of cooperation opportunities between Lithuania and Norway in this field. The document provides figures on the current status of the country’s bioeconomy. Its final recommendations include the following goals for the future bioeconomy strategy:



#### To pursue sustainable and strategically-oriented development of bioeconomy

- To ensure inter-institutional interaction of all stakeholders in solving the problems of strategic development of bioeconomy
- To ensure strategically-oriented development of bioeconomy
- To inform and educate the Lithuanian business sector and the society on bioeconomy issues



#### To increase the efficiency and sustainability of biomass production and recycling as well as biowaste utilisation

- To increase the volume of demanded biomass production by using the resources suitable for this production
- To increase the production and use of bioenergy
- To increase the efficiency of biomass logistics
- To develop R&D for creating new innovations



- To intensify the development and implementation of prototypes of innovative technologies (especially biotechnology methods and processes) and bioproducts
- To increase the use of biomass for producing higher value-added products, to manage biowaste more efficiently



### To increase the demand of bioproducts and to improve their consumption

- To improve the conditions for selling bioproducts
- To reduce food waste

## 2.2.2. International cooperation in the Baltic Sea Region

The Baltic Sea Region is a highly-connected region, hosting several international initiatives.



### Interreg Baltic Sea Region Programme

The Interreg Baltic Sea Region Programme is an agreement between EU member states Denmark, Estonia, Finland, Latvia, Lithuania, Poland, Sweden and the northern parts of Germany as well as partner countries Norway, Belarus and the northwest regions of Russia.



## EU Strategy for the Baltic Sea Region

Policy Area Bioeconomy in EU's Baltic Sea Region Strategy covers sustainable use of biomass, agriculture, forestry, fisheries and rural development. It is coordinated by the Nordic Council of Ministers (based in Denmark).

### Bioeconomy projects in the Baltic States



Proteins - The Green Gold of Baltic Sea Region Bioeconomy



Partner(s) from Latvia: Latvian Farmers Union



Developing cross-cutting stakeholder involvement for realizing the bioeconomy



Partner(s) from Estonia: Estonian Forest Industry Association, Estonia Chamber of Commerce and Industry, Stockholm Environment Institute in Tallinn



Bio-resources for innovative and sustainable non-food uses



Partner(s) from Latvia: Latvian State Institute of Wood Chemistry



Factsheet plant protein arena



Partner(s) from Lithuania: Lithuanian Research Centre for Agriculture and Forestry, UAB Eko Farm




Partner(s) from Latvia: Pure Horticultural Research





Partner(s) from Estonia: Estonian Crop Research Institute




✓ Factsheet Integrated Blue Biotechnology Strategy for the Baltic Sea Region

 Partner(s) from Lithuania: Coastal Research and Development Institute, Klaipeda Science and Technology Park


 Partner(s) from Latvia: Latvian Institute of Aquatic Ecology, Latvian Biotechnology Association, Riga Planning Region

 Partner(s) from Estonia: Tartu Biotechnology Park, Ida-Viru Region

✓ Local Capital - Realizing the Bioeconomy in the BSR

 Partner(s) from Latvia: Dzintars Vaivods SIA “Latvijas Lauku konsultāciju un izglītības centrs”

✓ Markets for woody biomass and wood-based energy around the Baltic Sea Region

 Partner(s) from Lithuania: Vytautas Magnus University Agriculture Academy

 Partner(s) from Latvia: Latvia University of Agriculture

## Norway grants



A bilateral R&D programme between Norway and Lithuania, targeting development of SMEs, is presently running under the supervision of the Agency for Science, Innovation and Technology (MITA). The donor of the programme is Innovation Norway, while beneficiaries are [Lithuanian SMEs](#).

## Baltic Research Programme



A joint R&D initiative by the three Baltic republics and three donor countries (Iceland, Lichtenstein and Norway). The Lithuanian call for proposals is expected to open in 2020.

## Other initiatives

The Baltic Sea States Subregional Cooperation (BSSSC) brings together regional authorities from all the countries in the Baltic Sea Region. The Conference of Peripheral Maritime Regions (CPMR) and its Baltic Sea Commission bring together the peripheral maritime regions of the Baltic Sea Region. The Union of the Baltic Cities (UBC) is a network for municipalities and cities in the Baltic Sea Region. There is also a number of networks covering specific fields such as the Baltic Development Forum (BDF).



## 3. POTENTIAL USE/VALORISATION OF BIO-BASED STREAMS

This chapter offers some possible opportunities for converting the residual streams and waste listed in Chapter 2 into high-value sustainable products and applications. These opportunities can be derived from successfully completed or running projects using similar or comparable feedstocks as those present in Lithuania.

The chapter focuses on the Bio-based Industries Joint Undertaking (BBI JU) programme, executing the strategic innovation and research agenda (SIRA) of the **Bio-based Industries Consortium (BIC)**. The BBI JU is an industry-led PPP between BIC and the European Commission. BIC and

the Commission agree on annual work programmes that will be opened as annual calls for proposals to any and all actors in the bioeconomy fields. BBI JU started under Horizon 2020 (2014-2020) and since 2014 and through the 2018 call there are 101 granted projects at different technology readiness levels. The objective of the programme is to assist an accelerated commercialisation of excellent, innovative solutions for societal challenges towards a sustainable future. The commercialisation is to materialise in the country itself, on a local, regional or national basis.

Along with offering examples of projects on comparable bases as those present in Lithuania, BIC also offers its European and international network and events to assist local actors in establishing partnerships for bio-based activities, both in Lithuania and in Europe.

### 3.1. BBI JU projects of interest

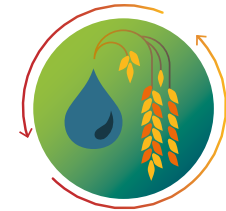
Lithuania has substantial residual biomass available from crops (mainly straw), forest and OFMSW. While no statistical data on residues from the food industry is available, the size of its subsectors (meat, fish processing, beverages, dairy and bakery products) indicates that a substantial amount of bio-based residues should be available from this industry also.

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The following sub-chapters list outlines of running or completed BBI JU projects using residual streams and waste from comparable sectors as those mentioned above sectors. These may serve as examples for exploitation of the residual streams and waste (potentially) available in Lithuania. More information on these projects and more projects can be found on the website of the [BBI JU](#).



## 3.1.1. Crop residues



### LIGNOFLAG: Converting wheat straw into bioethanol

Project description

[lignoflag-project.eu](http://lignoflag-project.eu)

Type of action : IA - Flagship

Duration :  
06/2017 - 05/2022

Overall budget :  
€34.9M

Pilot plant location(s) :  
Romania

The LIGNOFLAG project demonstrates an integrated and whole value chain oriented approach to drive forth the bio-based production of ethanol as sustainable transport fuel or chemical building block. The project approach involves the collaboration of the relevant actors along the whole value chain – from feedstock (straw) supply and logistics via

process co-products (lignin as biochar, sludge as fertiliser) utilisation and valorisation to advanced bio-ethanol production and product distribution. The core part of the project is the first-of-a-kind commercial flagship plant for lignocellulosic feedstock to ethanol conversion (60000 tonnes/year) that serves to showcase the techno-economic viability of an innovative bio-refinery concept and shall boost EU bio-ethanol production.

Coordinator : Clariant (Germany) | Biomass(es) : Wheat straw | Process(es) : Enzymatic conversion

Product(s) : Primary product: bioethanol/ Secondary product: biochar, fertilisers



### OPTISOCEM: Converting wheat straw into green chemicals

Project description

[optisochem.eu](http://optisochem.eu)

Type of action : IA – Demo

Duration :  
06/2017 - 05/2021

Overall budget :  
€16.3M

Pilot plant location(s) :  
Germany

OPTISOCEM goal is to demonstrate the performances, reliability as well as environmental and socio-economic sustainability of the entire value chains, for the transformation of excess wheat straw into bio-Isobutene (bio-IBN) derivatives. To achieve these goals a team of 6 partners, leaders in their field, originating from 4 EU-member states, will join efforts. OPTISOCEM consists in showcasing the technical accessibility and economical sustainability

of the value chains, from wheat straw to 2 different families of chemicals derived from bio-based IBN. These compounds, oligomers (DIB, TIB, TeIB) and polyisobutylenes (PIBs) are currently used in a wide range of applications such as lubricants, adhesives, sealants, flavours & fragrances and substituted phenols. This large market is today supplied entirely by products derived from fossil-based isobutene. Products derived from bio-based IBN, using the same process as fossil-based IBN, and with at least as good performances, would provide a renewable supply.

Coordinator : Global Bioenergies (France) | Biomass(es) : Wheat straw | Process(es) : Biocatalysis

Product(s) : Bio-Isobutene and derivatives: lubricants, adhesives, sealants, flavours and fragrances and substituted phenols



## EXCORNSEED

### Project description

[excornseed.eu](http://excornseed.eu)

Type of action : RIA

Duration :  
06/2018 – 11/2021

Overall budget :  
€4.5M

Pilot plant location(s) :  
Italy, Slovakia

The EXCornsEED project will combine chemistry, biology, engineering and biotechnology tools and expertise to develop and validate processes for recovering a range of bioactive compounds from bioethanol and biodiesel refinery sidestreams, specifically corn oil/thin stillage from bio-ethanol and rapeseed meal.

It will valorise the potential of the sidestreams of these two growing sectors at a time when changes in legislation on liquid biofuels are likely to strongly increase demand for biofuels will maximise the value of biofuels production and make them increasingly competitive.

Coordinator : Università degli studi di Roma La Sapienza (Italy) | Biomass(es) : Corn oil, rapeseed meal, bioethanol stillage

Process(es) : Separation, fractionation and isolation

Product(s) : Proteins, polyphenols, amino acids, fibers, lipid compounds, alkaloids and tannins



## AGRIMAX: Converting crop and food residues into several products

### Project description

[agrimax-project.eu](http://agrimax-project.eu)

Type of action : IA - Demo

Duration :  
10/2016 – 09/2020

Overall budget :  
€15.5M

Pilot plant location(s) :  
Spain, Italy

Approximately one third of all food produced globally is wasted every year throughout the whole value chain-from farmers to consumers. To extract the significant amounts of valuable compounds contained in these wastes, AgriMax will combine affordable and flexible processing technologies (ultrasound assisted and solvent extraction, filtration, thermal and enzymatic treatments) for the valorisation of side streams from the horticultural culture and food processing industry to be used in a cooperative approach by local stakeholders.

Through the selection of case-scenarios previously developed to a pilot scale by the participating RTOs and their industrial transfer in new applications as food additives, packaging and agricultural materials among others, the project will disclose the holistic potential of four new agro-value chains (residues and by products from the culture and processing of tomato, cereals, olives, potato). Any by-product generated along the production cycle will be valorised in a cascade manner to reach over 40% of high value use of the waste.

Coordinator : IRIS (Spain) | Biomass(es) : Residues of tomato, cereals, olives, potato

Process(es) : Ultrasound extraction, filtration and enzyme treatment

Product(s) : Primary products: food additives, packaging and agricultural materials / Secondary products: fibres, biogas and fertilizers





# PROMINENT

## PROMINENT: Proteins from cereal side-streams

Project description

[prominent-protein.eu](http://prominent-protein.eu)

Type of action : RIA

Duration : 01/2015 – 10/2018

Overall budget : €3.1M

Pilot plant location(s) : Finland

There is a global need, from sustainability, food security and also health perspective, to increase dietary intake of plant protein. Side-streams from wheat and rice processing offer large under-exploited raw material potential, and we will work throughout the agro-industrial value chain to valorise that. The main aim of PROMINENT is to develop

techno-economically and environmentally viable protein-based ingredients and foods from cereal processing side streams. We will concentrate on novel fractionation and extraction technologies, such as bioprocessing, supercritical carbon dioxide (SC-CO<sub>2</sub>) -extraction, thermo-mechanical technologies, wet and dry fractionation, and expanded bed adsorption as well as their combinations as novel hybrid processing technologies.

Coordinator : VTT (Finland) Biomass(es) : Wheat, rice Process(es) : Bioprocessing, supercritical carbon dioxide extraction, thermo-mechanical technologies, wet and dry fractionation, and expanded bed adsorption  
Product(s) : Protein additives for pasta, biscuit, cake and beverage

## 3.1.2. Forest residues



# SWEETWOODS

## SWEETWOODS: High purity lignin and platform chemicals from wood-based sugars

Project description

[sweetwoods.eu](http://sweetwoods.eu)

Type of action : IA - Flagship

Duration : 06/2018 – 05/2022

Overall budget : €43.2M

Pilot plant location(s) : Estonia

The objective of the SWEETWOODS project is to demonstrate on an industrial level successful and profitable production of high purity lignin as well as C5 and C6 carbohydrates from hardwood by establishing a biorefinery having throughput capacity 80 bone-dry tonnes/day.

Unlike existing biorefinery concepts, SWEETWOODS plant utilises all the fractions of the biomass feedstock, with min. 95% of its initial carbon content utilised.

Coordinator : Graanul Biotech (Estonia) Biomass(es) : Hardwood  
Process(es) : Fractionation, enzymatic conversion  
Product(s) : From lignin: elastomer foams for tube insulation, rigid polyurethane foam panels for insulation, and polymer compounds intended for injection moulding / From C5 and C6 sugars: glucose, xylose and fructose, bio-isobutene, xylitol



## EXILVA: Microfibrillated cellulose from wood

Project description

[h2020-exilva.com](http://h2020-exilva.com)

Type of action : IA - Flagship

Duration :  
05/2016 – 04/2019

Overall budget :  
€44.6M

Pilot plant location(s) :  
Norwegian

Microfibrillated cellulose (MFC) is a revolutionary product, with potential in a huge range of applications, including personal care, cosmetics, home care, pharmaceutical excipients, adhesives and sealants, composites and resins, agricultural chemicals, oil field, fish, bait, concrete, and CO<sub>2</sub> capture. It also has the potential to replace many fossil fuel-based products.

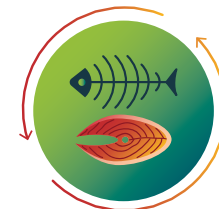
However, commercialisation of MFC has proved challenging, particularly making industrial quantities with sufficient running efficiency and stability. In addition, drying the MFC fibres in a cost-effective manner without losing significant performance is a major challenge.

The EXILVA project sets out to change this, by transferring technology from the existing pilot production and eventually scaling up to commercial levels.

Coordinator : Borregaard (Norway) | Biomass(es) : Wood (Norwegian spruce)

Product(s) : From microfibrillated cellulose: adhesives, coatings, agricultural chemicals, personal care products, home care products, construction materials

## 3.1.3. Fish residues



## AQUABIOPRO-FIT: Proteins and bioactives from aquaculture and agriculture sidestreams

Project description

[aquabioprofit.eu](http://aquabioprofit.eu)

Type of action : RIA

Duration :  
04/2018 – 03/2022

Overall budget :  
€4.1M

Pilot plant location(s) :  
Norway

The main objective of AQUABIOPRO-FIT is to promote efficient utilisation of European aquaculture, fisheries and agriculture side streams in feeds and nutritional supplement products promoting fitness and health. The project will develop side stream biomass processing technologies to up-concentrate

nutrients and bioactives maintaining product quality and minimising waste. The safety, bioactivity and acceptance of the developed ingredients and products will be documented through cell, animal, taste panel and intervention studies with humans, namely athletes and patient groups.

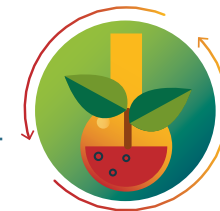
Coordinator : NOFIMA (Norway) | Biomass(es) : Fish by-products

Process(es) : Hydrolysis, extraction, separation/fractionation, stabilization, biofiltration

Product(s) : Protein-rich and/or Omega-3 rich nutraceutical products



## 3.1.4. Organic Fraction of Municipal Solid Waste (OFMSW)



### PERCAL: Chemical building blocks from MSW

#### Project description

[percal-project.eu](http://percal-project.eu)

Type of action : RIA

Duration :  
07/2017 – 06/2020

Overall budget :  
€3.4M

Pilot plant location(s) :  
Spain, Germany, Greece

PERCAL will use Municipal Solid Waste (MSW) as a feedstock for developing intermediate chemical products, producing high yield with high purity, making it attractive for industry. These will be complementary to the bioethanol (existing PERSEO Bioethanol® technology), thus creating a cascade of valorisation from the MSW components.

PERCAL aims to produce three main compounds. Lactic acid, which can be used to make eco-friendly ethyl lactate. This can be used in cleaning products, in ink and for hot-melt adhesives for cardboard; succinic acid, as an intermediate building block for the production of polyols for the polyurethane industry and biosurfactants from the remaining fraction of the MSW fermentation.

Coordinator : Industrias Mecanicas Alcludia (Spain) | Biomass(es) : OFMSW | Process(es) : Enzymatic pre-treatment, fermentation, extraction via membrane electrolysis

Product(s) : From lactic acid: solvents, inks, adhesives / From succinic acid: polyols / From proteins and lipids: biosurfactants



### URBIOFIN – Conversion of MSW into chemical building blocks and biopolymers

#### Project description

[urbiofin.eu](http://urbiofin.eu)

Type of action : IA - Demo

Duration :  
06/2017 – 05/2021

Overall budget :  
€14.6M

Pilot plant location(s) :  
Spain

Today in Europe, each inhabitant generates, on average, 0.5 tonnes of MSW per year, increasing at an annual rate of 10%. Around 40-50% of it correspond to organic waste. This organic fraction mainly contains carbohydrates, proteins and lipids, which are all useful raw material that can be converted to valuable products. Its valorisation will help to solve environmental pollution but also contributes to the transition from a linear to a renewable circular economy.

Digestion and composting have contributed to the reduction of the biodegradable fraction of MSW sent to landfill. The low economical value of compost and biogas is limiting the sustainable implementation of separate sourcing systems since increasing citizen environmental (waste) taxes is then needed to tackle important logistic costs. New biobased products can help to improve waste treatment environmental and socio-economical sustainability. The aim of URBIOFIN project is to demonstrate the techno-economic and environmental viability of the conversion at semi-industrial scale (10 tonnes/day) of the organic fraction of MSW (OFMSW) into: Chemical building blocks (bioethanol, volatile fatty



acids, biogas), biopolymers (polyhydroxyalkanoate and biocomposites) or additives (microalgae hydrolysed for biofertilisers). By using the biorefinery concept applied to MSW (urban

biorefinery), URBIOFIN will exploit the OFMSW as feedstock to produce different valuable marketable products for different markets: agriculture, cosmetics.

**Coordinator :** Industrias Mecanicas Alcludia (Spain) | **Biomass(es) :** OFMSW | **Process(es) :** Hydrolysis, fermentation

**Product(s) :** Chemical building blocks (bioethanol, volatile fatty acids, biogas), biopolymers (polyhydroxyalkanoate and biocomposites) or additives (microalgae hydrolysed for biofertilisers)



## NEWFERT – Mineral fertilisers from biowaste

### Project description

[newfert.org](http://newfert.org)

#### Type of action : RIA

**Duration :**  
07/2105 – 12/2018

**Overall budget :**  
€2.4M

**Pilot plant location(s) :**  
Spain

Most fertilisers currently rely heavily on fossil mineral resources for nutrient supply. The idea behind NEWFERT project was to build up an innovative concept for the fertiliser industry that essentially turns ashes of different origins and livestock effluent into a new generation of fertilisers.

Researchers identified and analysed more than 45 different types of biowaste from different areas of Europe and selected 10 for introduction into the fertiliser production process based on their physical

and chemical properties. Ashes containing high phosphorous or potassium content and nutrient availability were used directly for fertiliser production. In the case of ashes with insoluble nutrients, NewFert partners developed new biorefining technologies with low input and energy cost to increase nutrient recovery such as phosphate.

Furthermore, to free phosphate minerals (struvite) and nitrogen from pig slurry in a more cost-effective way, the scientists developed a new process. This reduced costs by substituting the traditional reagent with the action of bacteria that grow naturally in the medium and building a more efficient electrolysis cell for nitrogen recovery.

**Coordinator :** Fertiberia (Spain) | **Biomass(es) :** Biowaste of municipal and industrial origin

**Process(es) :** Microbial electrolysis

**Product(s) :** Fertilizers



## 3.1.5. Food industry residues



### GREENPROTEIN: Valorisation of vegetable processing industry residues into functional proteins

#### Project description

[greenproteinproject.eu](https://greenproteinproject.eu)

Type of action : IA – Demo

Duration :  
09/2016 – 02/2020

Overall budget :  
€5.5M

Pilot plant location(s) :  
The Netherlands

The economic costs of food waste are reckoned to total around €705 billion globally. There are also significant hidden environmental and social costs. RuBisCO protein is found in all green vegetables and plants and represents around 50 percent of the total protein content of green leaves.

GreenProtein is an industrial demonstration project that aims to produce high-added value, food grade proteins and other ingredients from vegetal food waste streams. The primary objective will be to extract and purify food-grade, fully functioning, RuBisCO protein isolate on an industrial scale using discards from the vegetal processing industry.

Coordinator : Royal Cosun (The Netherlands) | Biomass(es) : Green residues from vegetable processing (mainly of sugar beet)

Process(es) : Extraction

Product(s) : Food-grade functional RuBisCo protein and other ingredients



### PULP2VALUE: Conversion of low value sugar beet pulp into chemicals and biomaterials

#### Project description

[pulp2value.eu](https://pulp2value.eu)

Type of action : IA - Demo

Duration :  
07/2015 – 06/2019

Overall budget :  
€11.4M

Pilot plant location(s) :  
The Netherlands

Europe produces around 13 million tonnes of sugar beet pulp each year. Currently, most of this pulp finds its way into low value feed, bio-fertiliser or it is used for creating green fuel gas. By using multiple extraction techniques, PULP2VALUE will extend the high value products extracted from sugar beet

sidestreams, isolating microcellulose fibres (MCF), arabinose (Ara) and galacturonic acid (GalA). The project will demonstrate an integrated and cost-effective cascading bio-refinery system to refine sugar beet pulp and identify applications for approximately 65% of its mass in high value markets, increasing its current value by as much as 20-50 times.

Coordinator : Royal Cosun (The Netherlands) | Biomass(es) : Sugar beet pulp

Process(es) : Extraction

Product(s) : From microcellulose fibres: rheology modifiers for detergents, paints and coatings, composites /From arabinose: flavours and food additives / From galacturonic acid: personal care and chemical products



## PRO-ENRICH: Conversion of food industry side streams into food additives and chemical products

### Project description

[pro-enrich.eu](http://pro-enrich.eu)

Type of action : RIA

Duration :  
05/2018 – 04/20121

Overall budget :  
€4M

Pilot plant location(s) :  
Denmark

Pro-Enrich will develop a flexible biorefinery approach capable of processing a range of agricultural residues (rapeseed meal, olives, tomatoes and citrus fruits) in response to the increasing global demand for alternative sources of protein and phenolic product streams, tailored to the cross sectoral requirements of industry.

Pro-Enrich will optimise existing biomass fractionation technologies and validate novel extraction approaches beyond the current state of the art (from TRL 2 through to TRL 4-5) to isolate and purify proteins, polyphenols, dietary fibres and pigments. The products being targeted are food ingredients, pet food, cosmetics and adhesives.

Coordinator : Danish Technological Institute | Biomass(es) : Rapeseed meal, olives, tomatoes and citrus fruits

Process(es) : Fractionation, extraction

Product(s) : Proteins, polyphenols, dietary fibres and pigments



## AGRICHEMWHEY: An integrated biorefinery for the conversion of dairy side streams to high value bio-based chemicals

### Project description

[agrichemwhey.com](http://agrichemwhey.com)

Type of action : FLAGSHIP

Duration :  
01/2018 – 12/20121

Overall budget :  
€22M

Pilot plant location(s) :  
Ireland

The main objective of AgriChemWhey is to develop a biorefinery for converting food-processing residues from the dairy industry to bio-based chemicals.

It will see a dedicated plant developed in Ireland. The project will see a new value chain for lactic acid from dairy production residues.

Coordinator : Glanbia Ingredients Ireland | Biomass(es) : Dairy by-products

Process(es) : Fermentation

Product(s) : Lactic acid



## 3.2. Local actors already active in BIC or BBI JU projects

UAB Biocentras was a partner of the BBI JU project US4GREENCHEM.

## 3.3. Link to existing/emerging bio-based activities

### 3.3.1. Investment plan for Europe - the ‘Juncker plan’

**The European Commission launched the Investment Plan for Europe (also known as the Juncker Plan) in 2015, which aims to mobilise at least €315 billion of investment until 2020.**

The Juncker Plan is a collective, coordinated effort at European and Member State level to encourage investment through three strategic targets:

- Boosting job creation and economic growth
- Meeting the long-term needs of the economy and increase competitiveness
- Helping strengthen Europe’s productive capacity and infrastructure

In this view, the Investment Plan for Europe has operated through three main initiatives:

#### 1. The European Fund for Strategic Investments (EFSI)

- to overcome current market failures by addressing market gaps and mobilising private investment. It is jointly run by the European Investment Bank, the European Investment Fund and the European Commission. It supports strategic investments in key

areas such as infrastructure, education, research and innovation, as well as risk finance for small businesses;

#### 2. The European Investment Advisory Hub (EIAH)

- to strengthen support for project development and preparation across the Union. The EIAH supports projects which may be eligible for financing by the EIB (either under EFSI or otherwise), and it is not limited to EIB-financed projects;

#### 3. The European Investment Project Portal (EIPP)

- An online marketplace where worldwide investors and EU project promoters can meet. It offers EU-based private and public project promoters a convenient way to boost the visibility of their investment projects by filling in and submitting a project form. EIPP will showcase these projects aiming at attracting investors worldwide.

The Juncker plan will find its continuation as InvestEU in the period 2021-2027. The new plan is expected to mobilise at least €650 billion in additional investment between 2021 and 2027. As of July 2019, €424 billion in investment have been triggered EU-wide.

Mobilised from EFSI in Lithuania

€402 M

Additional investment expected to be triggered as a result

€1.6 B





21

Projects approved in the country

One of the Lithuanian projects is categorised under “bioeconomy”. It is reported in the figure below.



**Company : DASOS CAPITAL OY**

**Type of business : Forestry**

**EIF Financing : EIB loan**

**Financial intermediary : -**

**Title : DASOS TIMBERLAND FUND III**

**Description**

**Equity fund investing in sustainable forestry and biomass mainly in the EU. The fund will only invest in certified or certifiable forestry assets.**

### 3.3.2. European Circular Bioeconomy Fund (ECBF)

The [European Circular Bioeconomy Fund \(ECBF\)](#) will provide access to finance, in the form of equity, debt or quasi-equity, to innovative circular bioeconomy companies and projects of various sizes. ECBF management will raise funds from public and private investors with a target fund volume of €250 million. Reaching the target fund volume was scheduled for a first close in Q1 2020.

### 3.3.3. Country-specific EIF initiatives

EIF is advising, sponsoring or managing a number of equity Funds-of-Funds and guarantee / debt funds on behalf of third party investors, including national and regional governments as well as private strategic investors.

In Lithuania, it is supporting the Baltic Innovation Fund (BIF), a Fund-of-Fund initiative launched by the EIF in close co-operation with the Governments of Lithuania, Latvia and Estonia. BIF represents a €52 million investment by EIF with each Baltic Government committing €26 million through their respective national agencies (INVEGA in Lithuania, KredEx in Estonia and Altum in Latvia).



*In Lithuania, it is supporting the Baltic Innovation Fund (BIF), a Fund-of-Fund initiative launched by the EIF in close co-operation with the Governments of Lithuania, Latvia and Estonia. BIF represents a €52 million investment by EIF with each Baltic Government committing €26 million through their respective national agencies (INVEGA in Lithuania, KredEx in Estonia and Altum in Latvia).*



### 3.3.4. European Structural and Investment Funds (ESIF)

The ESIF includes five different funds, all covered by the Common Provisions Regulation – Regulation (EU) No 1303/2013 of the European Parliament and of the Council:

- The **European Regional Development Fund (ERDF)** provides financial support for developing and restructuring regional economies and aims to facilitate economic change, enhance competitiveness and boost territorial cooperation throughout the EU
- The **European Social Fund (ESF)** supports workers and companies by boosting access to employment and participation in the labour market, focusing on social inclusion of disadvantaged people, combatting discrimination and creating partnerships to manage employment reform
- The **Cohesion Fund (CF)**, aims to reduce economic and social disparities and promote sustainable development
- The **European Agricultural Fund for Rural Development (EAFRD)** aims to strengthen the EU's agriculture, forestry sector and boost rural areas
- The **European Maritime and Fisheries Fund (EMFF)**, supports the implementation of the reformed Common Fisheries Policy (CFP) and the EU Integrated Maritime Policy

Funds related to the ERDF are managed locally according to the Smart Specialisation Strategy that each region in the EU has published. In the following pictures, regions with bioeconomy research and innovation (R&I) priorities in agriculture, waste processing and biorefineries during funding period 2014-2020 are highlighted.

The whole Lithuania is eligible for projects under theme 'agriculture', while no Lithuanian region has set 'waste management' or 'biorefinery' as a theme in its SSS.

Figure 16. EU Regions with Bioeconomy R&I Priorities

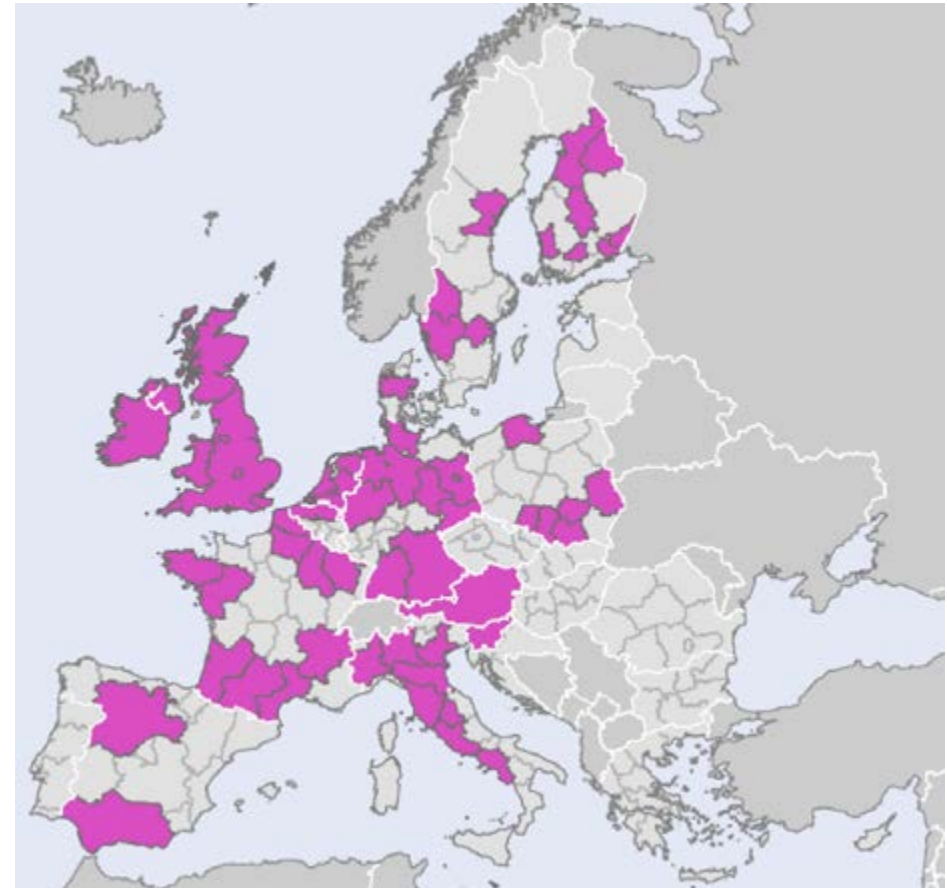
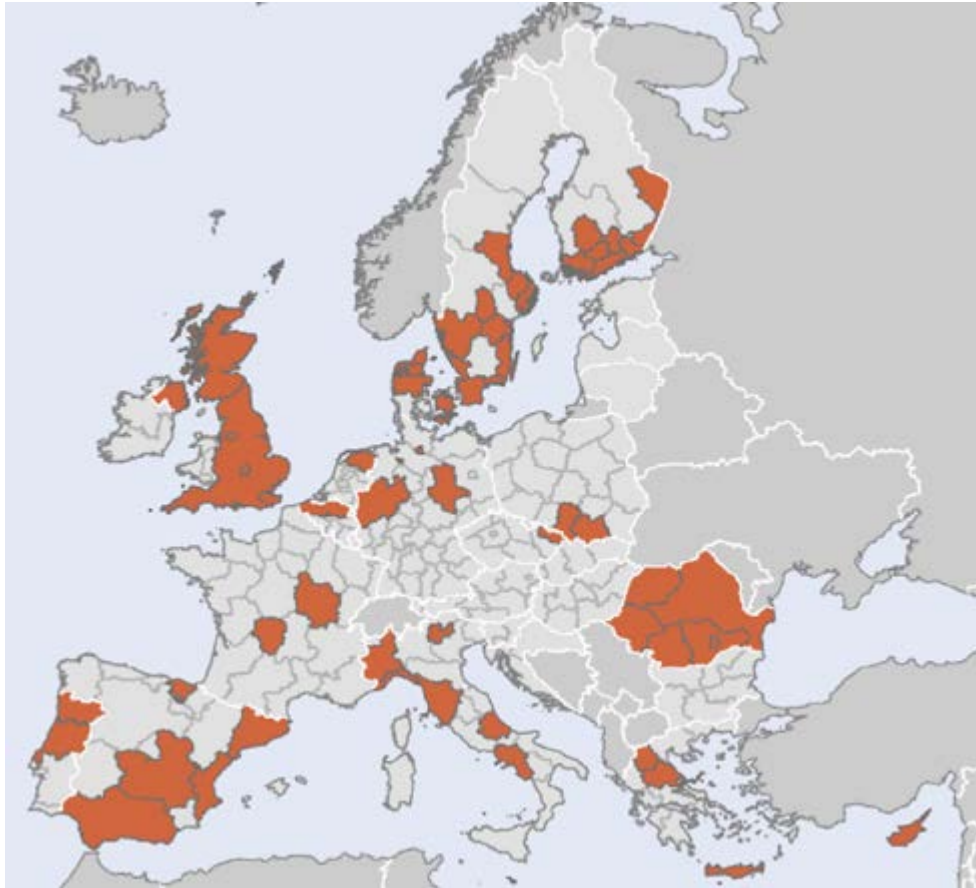
● Agriculture





Figure 16. EU Regions with Bioeconomy R&I Priorities

● Waste Processing ● Biorefinery





## 3.3.5. European Bank for Reconstruction and Development (EBRD)

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The European Bank for Reconstruction and Development (EBRD) is an international financial institution with a mandate to promote the transition to well-functioning market economies. The Bank finances projects and promotes policy dialogue in 37 countries from Central-Eastern Europe, Central Asia and the wider Mediterranean region.

In 2015, the Bank launched its **Green Economy Transition approach (GET)** to bolster innovative technologies by addressing market opportunities and failures related to resource use and environmental degradation.

The EBRD can offer the bioeconomy sector:

- **A broad range of financial products** such as of loans, equity, guarantees or hybrid structures which are tailored to each client.
- **Technical expertise and resources for structuring and implementation support** such as technical feasibility and market studies, project design improvement, project management and implementation support, as well as potential concessional co-financing or grants drawn from donor support
- **Rapid project scoping, approval and delivery**, moulded around a business-oriented banking structure.

Lithuania is eligible for EBRD funds.



# 4 APPENDIX: FIGURES

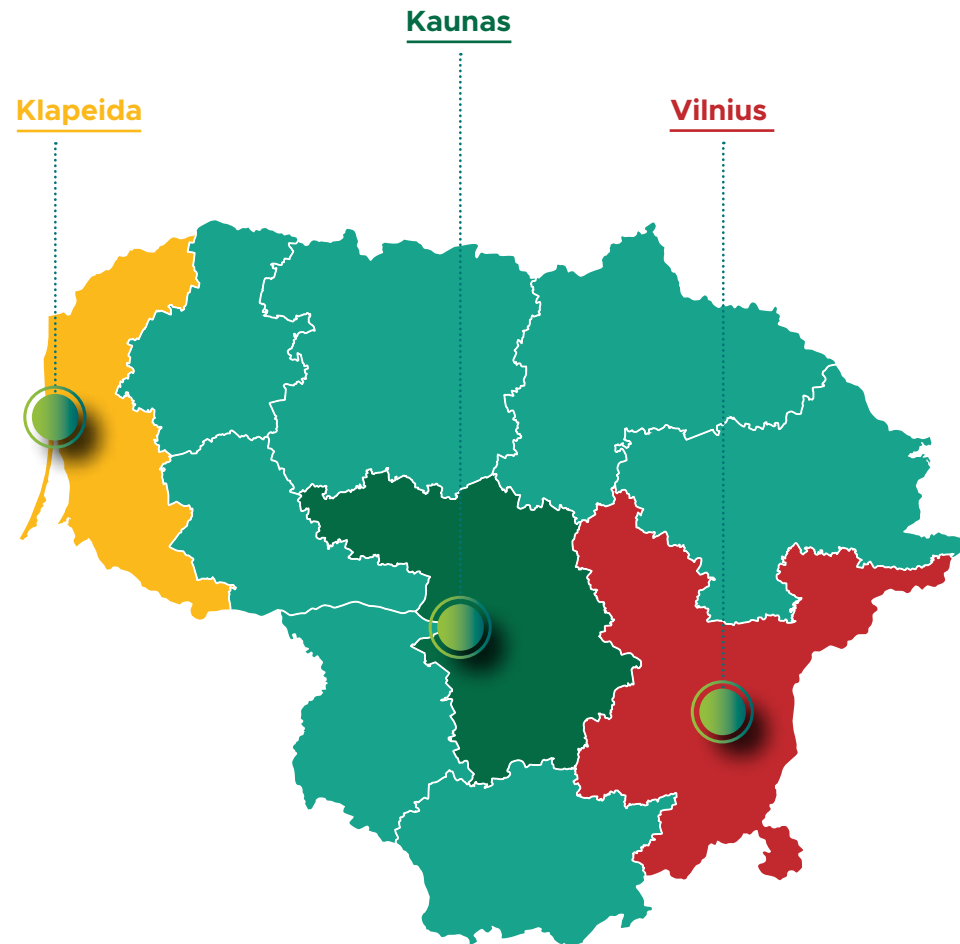
4.1. Agriculture

4.2. Forest

4.3. Wood products

4.4. Waste streams

Figure 4.1. Lithuania's main cities





## 4.1. Agriculture



Figure 4.2. Main indicators of Lithuanian bioeconomy - biomass production

	GVA (€M, 2014)	Turnover (€M, 2014)	Employees (K, 2015)
Agriculture	1019.7	2664.1	105.2
Forestry	201.6	400.2	13.7
Fishing and aquaculture	30.3	71.5	1.9
<b>Percent of all economic activities</b>	<b>3.4</b>	<b>4.1</b>	<b>9.1</b>



Figure 4.3. Main indicators of Lithuanian bioeconomy – fully bio-based manufacturing

	GVA (€M, 2014)	Turnover (€M, 2014)	Employees (K, 2015)
Manufacture of food, beverages and tobacco	1480.8	4575.8	43
Manufacture of wood products	455.3	1081.5	21.5
Manufacture of paper	177.8	412.5	4.8
<b>Percent of all economic activities</b>	<b>5.8</b>	<b>7.9</b>	<b>5.2</b>



**Figure 4.4. Main indicators of Lithuanian bioeconomy – partly bio-based manufacturing**

	GVA (€M, 2014)	Turnover (€M, 2014)	Employees (K, 2015)
Manufacture of bio-based textiles and apparel leather	369.2	815.2	21.1
Manufacture of bio-based chemicals	51	200.5	0.7
Manufacture of bio-based pharmaceuticals	133.6	215.4	0.2
Manufacture of bio-based furniture and other products	761.5	1125.3	22.3
<b>Percent of all economic activities</b>	<b>3.6</b>	<b>3.1</b>	<b>3.3</b>

**Figure 4.5. Bioenergy indicators (2016)**

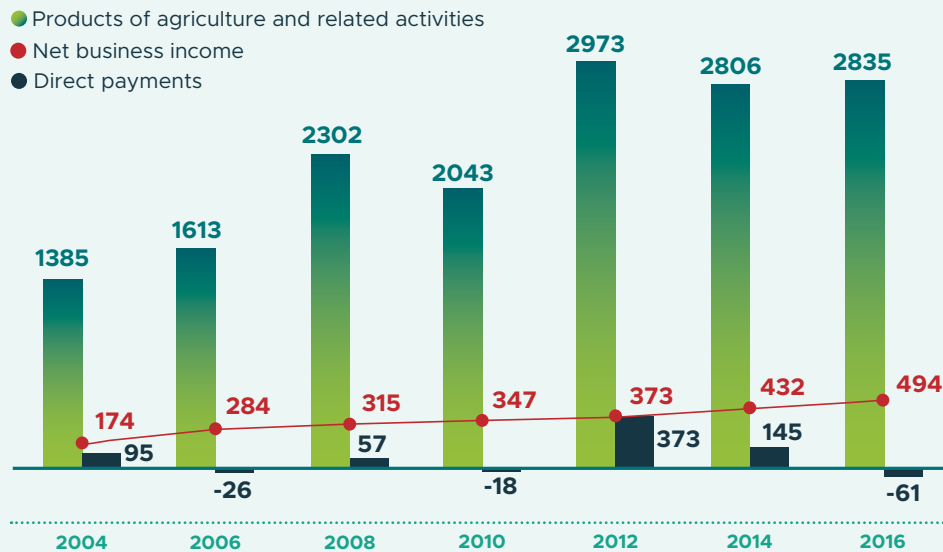
Bioenergy resource	Production	Gross consumption	Final consumption	Exports
Firewood and wood waste (km) <sup>3</sup>	6054.5	6130	3158.4	691.3
Charcoal (Kt)	0.5	1.3	1.3	5.9
Agriculture waste (Kt)	40.3	14.1	8.3	27.4
Renewable municipal waste (Kt)	99.4	98.4	6.2	
Bioethanol (Kt)	44.1	9.9	9.9	6.8
Biodiesel (Kt)	103.1	56.7	56.7	81.8
Biogas (km) <sup>3</sup>	67	67	17.2	





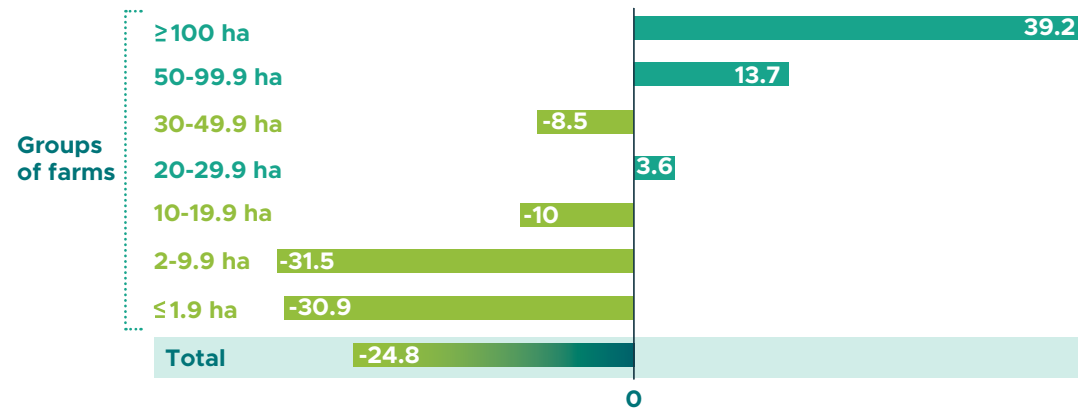
2016 was a difficult year for Lithuanian agriculture due to weather conditions. The value of agricultural production increased slightly with respect to previous years, but profitability dropped.

**Figure 4.6. Economic performance of Lithuanian agriculture**



Low productivity and ageing of workforce in smaller (often family-sized) farms is prompting a decrease in number of small farms, counterbalanced by an increase of the number of large farms of more than 100 hectares.

**Figure 4.7. Farm structure change (% , number of farms, 2010-2016)**



Dry weather in May and June caused stress on plants. In July-August, rainy weather prevented not only harvesting, but also cultivating winter crops for sowing. These climatic conditions not only negatively affect the yield, but, at the same time, when working through wet soil, the physical state of the soil deteriorates.

**Figure 4.8. Crops production (Kt, 2017)**

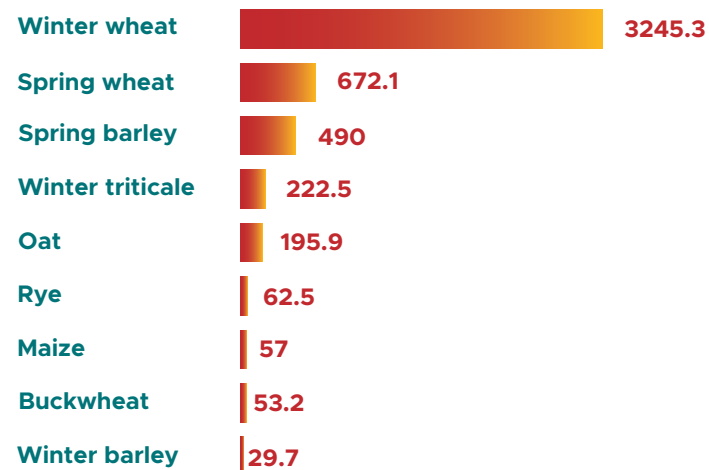
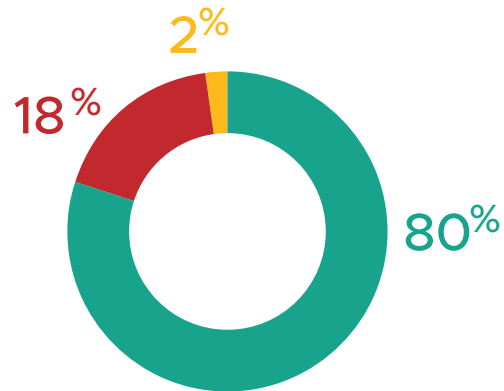




Figure 4.9. Cattle farms in Lithuania

- Small (<10 cows)
- Medium (10-100 cows)
- Large (>100 cows)

Share of cattle farms by size



Share of cattle heads by farm size

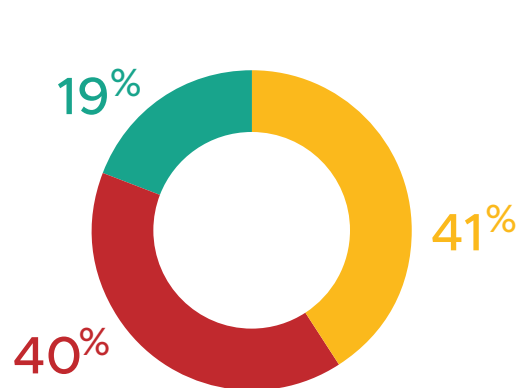
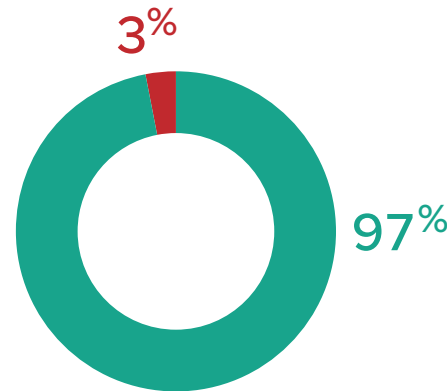


Figure 4.10. Swine farms in Lithuania

- Small (<10 pigs)
- Medium (10-100 pigs)
- Large (>100 pigs)

Share of swine farms by size



Share of swine heads by farm size

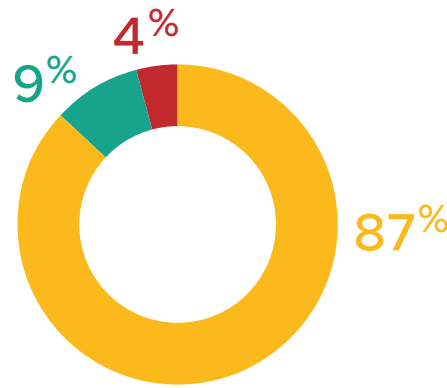
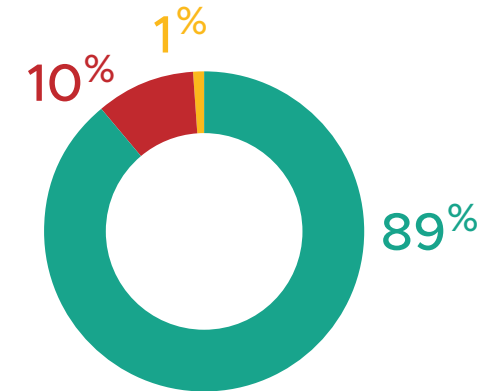


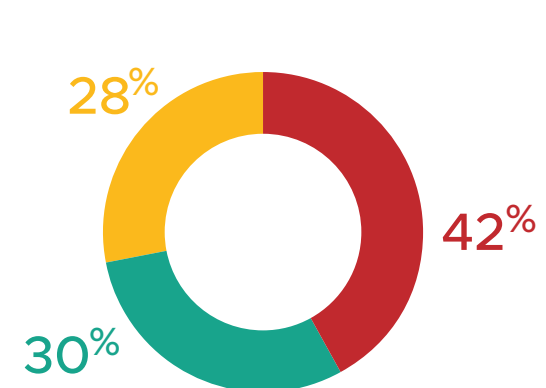
Figure 4.11. Dairy farms in Lithuania

- Small (<10 cows)
- Medium (10-100 cows)
- Large (>100 cows)

Share of dairy farms by size



Share of cows by farm size

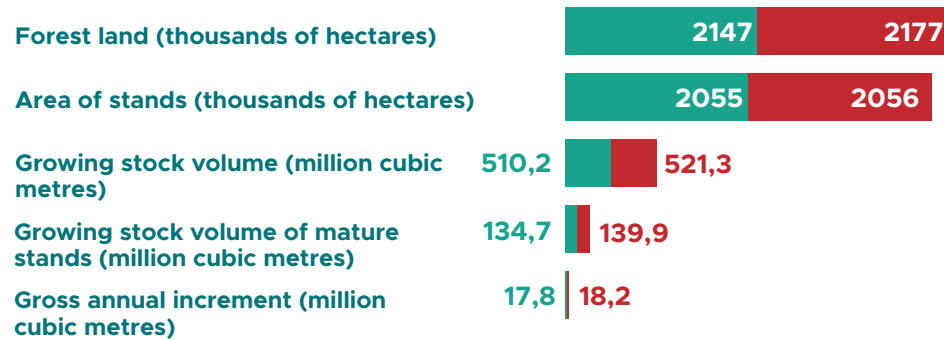




## 4.2. Forest

Figure 4.12. Forest stock in Lithuania

● 2013 ● 2014



Area covered with forests  
(2013 and 2014)

# 33.3%

Figure 4.13. Classification of forests in Lithuania

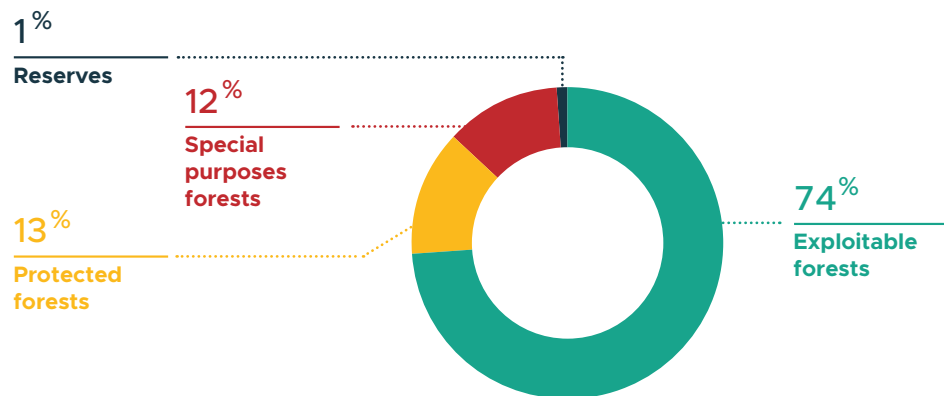
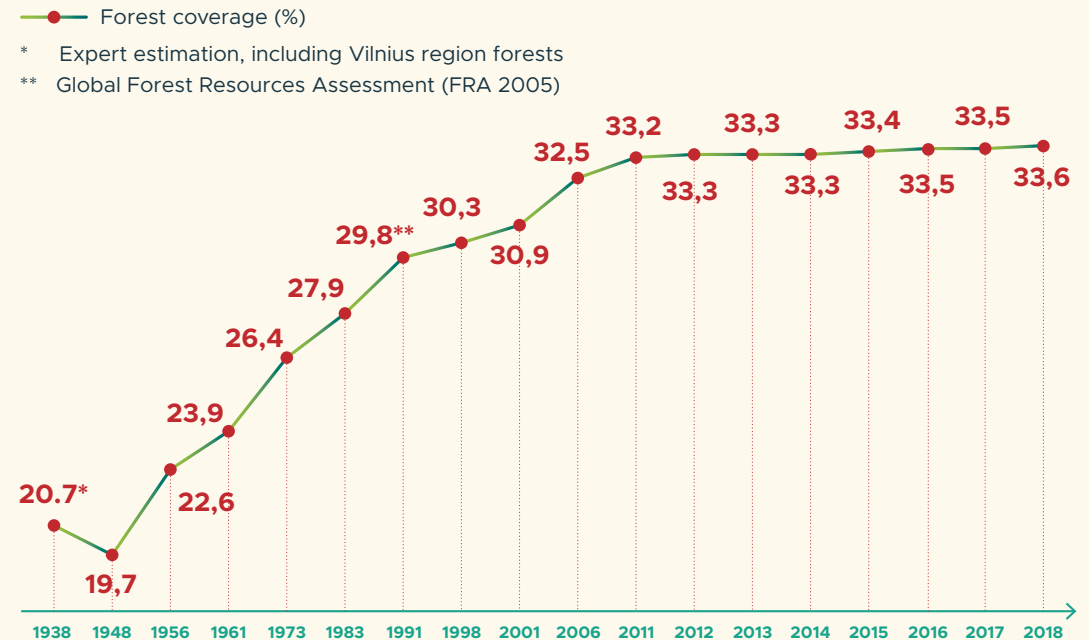


Figure 4.14. Evolution of forest stock



Source: The Chronicles of Lithuanian forests XX century, State Forest Service (SFI)



**Figure 4.15. Restrictions in the types of cutting according to the class of forests**

✓ Cutting allowed   ✗ Cutting prohibited   ! Cutting allowed with restrictions

Class of forest	Main type of cutting		
	Thinnings	Sanitas	Clear
Reserves	✗	✗	✗
Ecological forests (e.g. national parks)	✓	✓	✗
Protected forests	!	✓	!
Commercial forests	✓	✓	✓

**Figure 4.16. Gross felling, thousands of cubic metres of solid volume**

● Felling from privately owned forests   ● Felling from State forests



Source: Directorate General of State Forests

## 4.3. Wood products



**Figure 4.17. Furniture exports (M€, 2015)**

Wooden furniture (excl. for offices, kitchens, bedrooms, seats)	389
Seats	293
Furniture parts	250
Wooden bedroom furniture	134
Wooden furniture for offices	55
Wooden furniture for kitchen	23



## 4.4. Waste streams

Figure 4.18. Material flow (Kt, 2016)

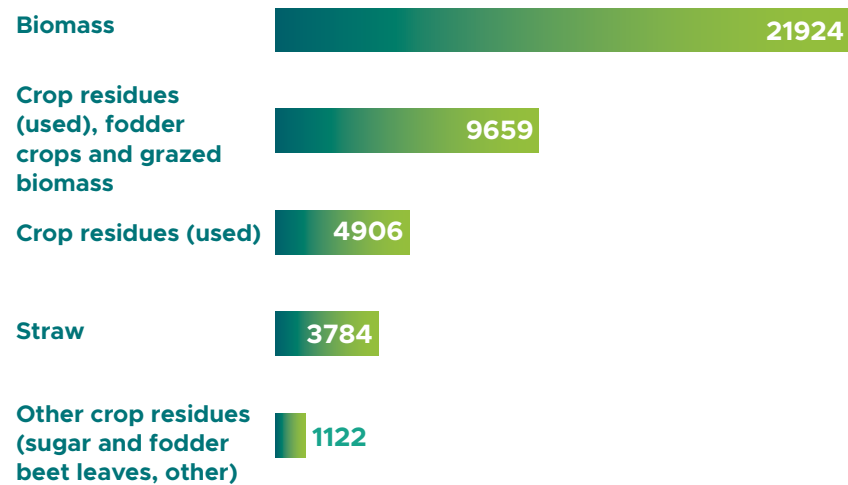


Figure 4.19. Forest felling residues (Kt)

	2008	2010	2012	2014	2016
Generated waste	83.4	126.1	150.3	272.5	274.9
Incinerated	14.3	18.3	18.2	48.7	23.1
Recycled on the site	26.5	56.5	31.2	20	44.9
Disposed on the site	4.4	2.3	23.3	10.4	0.4
Delivered to other users	30.8	43	70.7	175	189.7
Delivered to waste managers	2.4	2.1	0	0	0
Remainder at the end of the year	5	3.9	6.9	18.4	16.8



# Bio-based Industries Consortium

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