NordBio

norden
Norræna ráðherranefndin

2016

Biodegradable Waste as a Resource for Innovation

Final Report

Guðrún Lilja Kristinsdóttir & Ingunn Gunnarsdóttir
THE ENVIRONMENTAL AGENCY OF ICELAND

ENVIRONMENT AGENCY OF ICELAND

Table of Contents

Introduction

Biodegradable waste is an underutilized resource. Substantial amounts of this potential resource go to waste with the associated environmental and financial costs. A trend in Europe has been to reduce waste disposal by keeping it within the economy, or a so-called circular economy, enabled through greater recycling and re-use. Thereby, waste can be considered a commodity of some value. This shift in the perception of waste does not occur unless there is market demand for the waste and that some potential value can be created from it. In order to promote innovation and the increased utilization of unused organic resources it is vital to secure a sufficient supply of that resource. It is therefore important to increase data collection and study of organic resources. Mapping these underutilized resources can stimulate innovation, create new fields of product development, and thereby potentially increase the sustainability of a nation's economy. Additionally, decreasing the disposal of biodegradable waste has numerous benefits, including a reduction in greenhouse gas emissions.

The Nordic bio-economy initiative (NordBio)[1] is a priority program under the Icelandic chairmanship of the Nordic Council of Ministers. The program is a three year (2014-2016) collaboration umbrella program of five Nordic councils of ministers. Numerous projects within the NordBio program promote the sustainable utilization of natural resources and adding value to the environment and society by promoting innovation, green economy, and regional development. The Nordic countries have a great opportunity to pave the path towards a stronger bio-based economy and thus lead by example.

The five pillar projects of the NordBio priority program are:

- *Biophilia*, motivate entrepreneurs and encourage the interest of children and youth in science and innovation.
- *Ermond*, facilitate new thinking and solutions in preventing damage and loss of lives due to natural disasters in the Nordic countries.
- *Innovation*, direct economic impact through innovation and value-creation in the Nordic bioeconomy, and thereby strengthen regional and economic growth.
- *Marina*, reduce emissions and increase the use of alternative fuels in the marine sector.

[1] http:www.nordbio.org

- *Woodbio*, highlight the role of forestry in the Nordic bio-economy with emphasis on wood biomass as raw material.

In addition, there are three smaller sub-projects:

- *Sustainable Nordic Protein Production*, map plant protein supply for the Nordic food and feed industry.
- *Nordic bio-resources: mapping sustainability criteria*, identify the bio-resources of the Nordic countries that contribute directly to Nordic economies and map quantitative goals for allowable/sustainable yield across all Nordic countries for the bio-resources identified.
- *Biodegradable waste as a resource for innovation*, map biodegradable waste in Iceland, Greenland, and the Faroe Islands, focusing on by–products and waste from the fishing and meat industry

This report will discuss the *Biodegradable waste as a resource for innovation* project which entails the mapping and quantification of biodegradable waste in Iceland, Greenland, and the Faroe Islands carried out with an emphasis on by–products and waste from the fishing and meat industry. The scope of the project was to investigate the magnitude and geographical distribution of this potential resource. The participating countries are heavily dependent on the import of products and supplies, therefore increasing domestic production is important. The results of this project will hopefully be useful to entrepreneurs and innovators that can utilize these resources by developing new products. Mapping biodegradable waste and by–products enables increased innovation, value creation, and a sustainable economy of the participating nations. Additionally, these results contribute significantly to another part of the NordBio-project, *Innovation in the Nordic bioeconomy* led by Matís[2].

[2] http://www.matis.is

Methods

An emphasis was placed on studying by-products and waste generated in the fishing industry, considering its importance to the three island states of this project; Iceland, Greenland, and the Faroe Islands. The meat industry and its associated by-products and waste were also studied in this project since it does significantly contribute to the nations' sustainability. The three island states located in the North Atlantic region are faced with many similar challenges, for example a cold climate, rough weather conditions, and challenges associated with being small isolated communities. Iceland, Greenland, and the Faroe Islands are greatly dependent on the long distance transportation of goods. Therefore, increased data collection and study of local resources is important for these three island states.

The project *Biodegradable waste as a resource for innovation* formally began in December 2014 and since then been presented on several different occasions. More specifically in meetings with stakeholders from Greenland and the Faroe Islands, closed and open meeting with other NordBio participants, and at a conference on Organic Waste organized the Soil Conservation Service of Iceland.

Data on waste and biodegradable waste in the three countries was provided by the relevant agencies in each country. Icelandic waste data was provided by multiple waste receiving stations in Iceland**.** Waste data from the Faroe Islands was collected by IRF (Interkommunali Renovatiónsfelagsskapurin L/F), Tórshavn commune and Umhvørvisstovan. In Greenland the Ministry of Finance, Statistikbanken, and others provided data on waste, fishing, and exportation. All of this data was used to produce the tables and graphs presented in this report.

Maps of the distribution of biodegradable waste in Iceland were produced using the QGIS software, an open-source geographic information system (GIS) application. The purpose of these maps was to assess the distribution of biodegradable waste generation in Iceland and thereby assist innovators in locating useful resources. Maps were only produced for Iceland since appropriate data has not been available in the other two countries.

Terminology on waste management is new and still changing. For this project, the term biodegradable waste was chosen rather than bio-waste or organic waste. The term biodegradable

waste encompasses more waste sources than the other two (see Table 1), although all terms apply to waste that can be broken down by micro-organisms into its base compounds.

Term	Waste sources according to the European Commission[3]:
Bio-waste (organic waste)	Biodegradable garden and park waste, food and kitchen waste from households, restaurants, caterers and retail premises, and comparable waste from food processing plants.
Biodegradable Waste	Bio-waste sources, forestry or agricultural residues, manure, sewage sludge, or other biodegradable waste such as natural textiles, paper or processed wood.

Table 1: Waste terminology

For further clarification, the diagram below (Figure 1) shows the main waste management strategies or actions discussed here. The diagram is a so-called waste hierarchy showing the most favorable action to the least favorable one. The most favorable action is to reduce the amount of waste produced. Thereafter, possibilities of reusing the waste are explored and utilized. If reuse is not possible, then the waste is turned into a new product through recycling. If all other options have been explored, the waste is disposed with some value recovery, such as producing energy. Hopefully most of the waste will be diverted to other streams at this point, but if not the waste is disposed of through incineration or to a landfill.

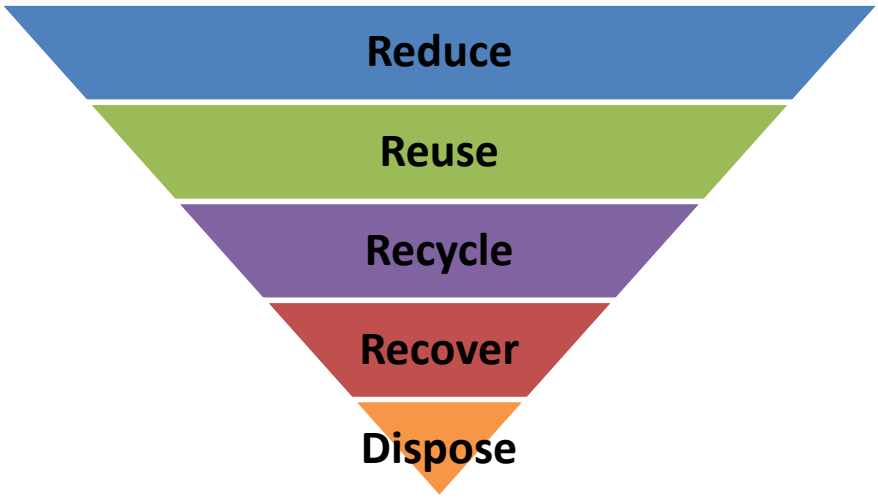


Figure 1: Waste management strategies listed from the most favorable action to the least favorable one.

[3] http://ec.europa.eu/environment/waste/compost/

Results

Iceland

Iceland is an island located in the North Atlantic Ocean with a population of about 330.000 people, thereof over 200.000 living in the capital region surrounding and including the capital, Reykjavík.

Iceland has ambitious goals of reducing the disposal of biodegradable waste along with an action plan to do so, published in its directive for the management of waste[4]. A graphical representation of these plans along with data collected on the disposal of biodegradable waste can be seen in Figure 2.

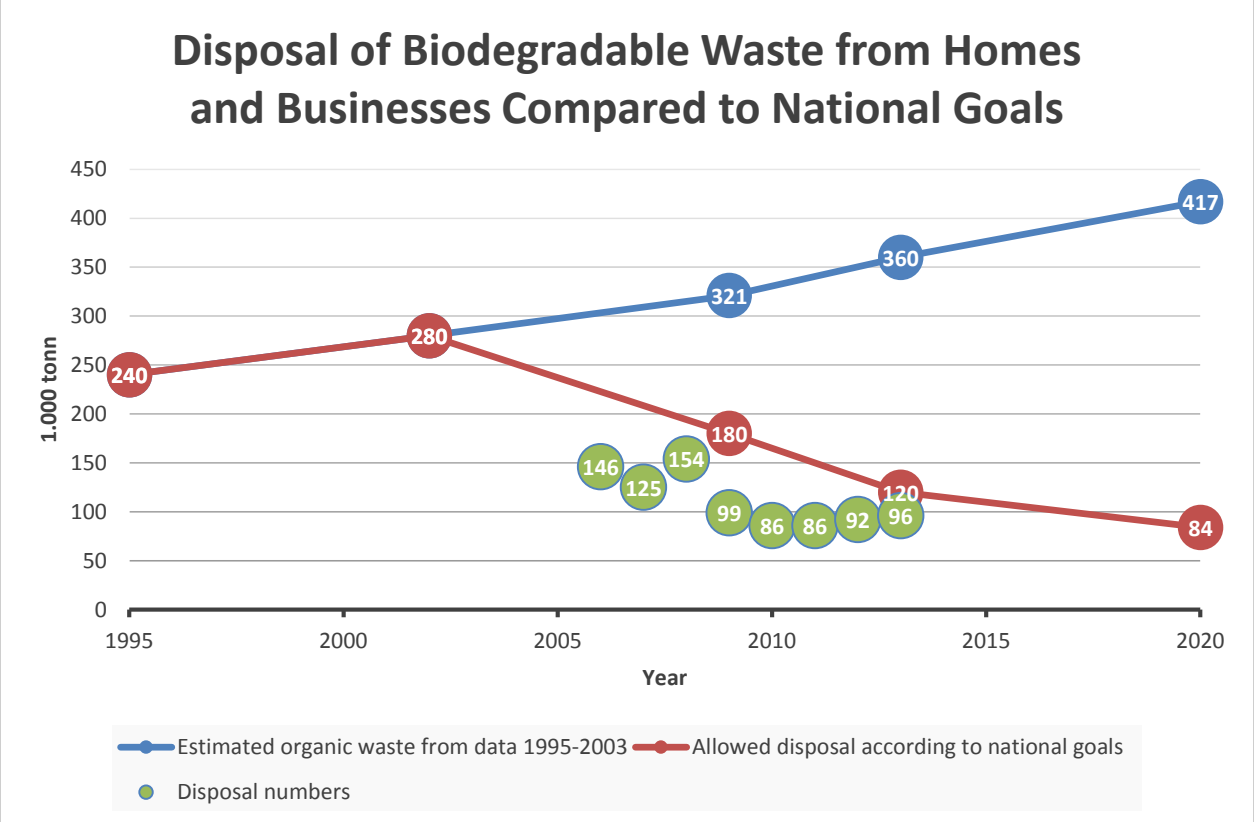


Figure 2: Estimated disposal of biodegradable waste based on values from 1995-2013, graphed with national goals and recorded numbers.

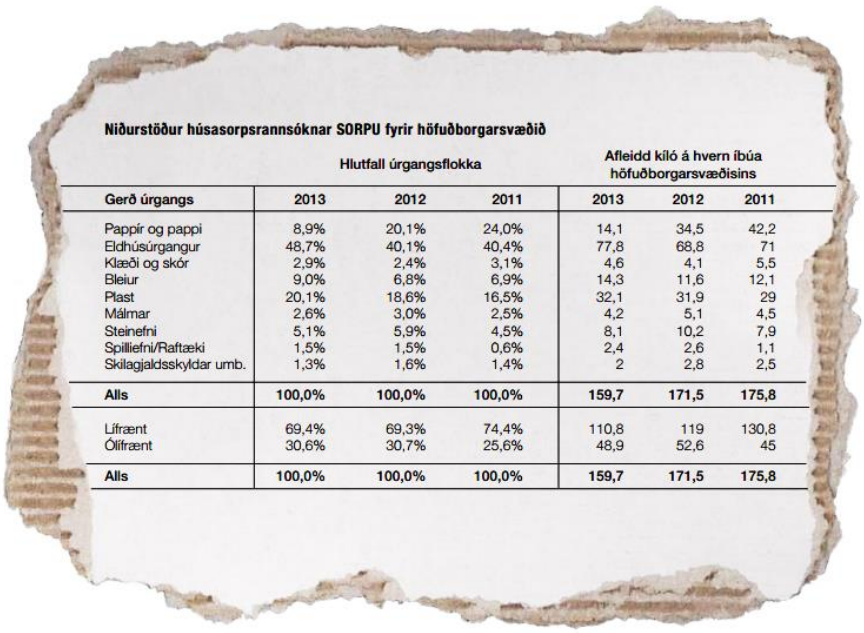
Data collected on the disposal of biodegradable waste in Iceland shows that Iceland is meeting its national goals. However, these goals call for a steady decline in biodegradable waste disposal each

[4] Reglugerð um meðhöndlun úrgangs, 737/2003

year and therefore it is vital to continue finding new solutions to even further decrease the disposal of biodegradable waste in Iceland.

Currently, experts from the EAI (The Environmental Agency of Iceland) and Matís (Icelandic Food and Biotech R&D) are discussing potential opportunities and possible innovation projects based on data gathered in Iceland. This data on waste is collected annually by the EAI and summary waste numbers are publicly available on the website of Statistic Iceland[5]. In order for the data to be useful to potential users, it is essential that data is collected more frequently and on a smaller geographical scale (current numbers represent the entire country).

For this analysis of biodegradable waste, sources such as paper, textiles, timber and household waste were not included. Nevertheless, Sorpa[6] collects data annually on household waste which indicates that around 70% of the total weight of household waste is organic waste, see Figure 3.



Niðurstöður húsasorpsrannsóknar SORPU fyrir höfuðborgarsvæðið

	Hlutfall úrgangsflokka			Afleidd kíló á hvern íbúa höfuðborgarsvæðisins		
Gerð úrgangs	**2013**	**2012**	**2011**	**2013**	**2012**	**2011**
Pappír og pappi	8,9%	20,1%	24,0%	14,1	34,5	42,2
Eldhúsúrgangur	48,7%	40,1%	40,4%	77,8	68,8	71
Klæði og skór	2,9%	2,4%	3,1%	4,6	4,1	5,5
Bleiur	9,0%	6,8%	6,9%	14,3	11,6	12,1
Plast	20,1%	18,6%	16,5%	32,1	31,9	29
Málmar	2,6%	3,0%	2,5%	4,2	5,1	4,5
Steinefni	5,1%	5,9%	4,5%	8,1	10,2	7,9
Spilliefni/Raftæki	1,5%	1,5%	0,6%	2,4	2,6	1,1
Skilagjaldsskyldar umb.	1,3%	1,6%	1,4%	2	2,8	2,5
Alls	**100,0%**	**100,0%**	**100,0%**	**159,7**	**171,5**	**175,8**
Lífrænt	69,4%	69,3%	74,4%	110,8	119	130,8
Ólífrænt	30,6%	30,7%	25,6%	48,9	52,6	45
Alls	**100,0%**	**100,0%**	**100,0%**	**159,7**	**171,5**	**175,8**

Figure 3: Results from research on household waste indicating that biodegradable (lífrænt) waste content is around 70% (reference: http://www.sorpa.is/files/arsskyrslur/arsskyrsla_sorpa_2013_net.pdf).

[5] http://hagstofan.is/
[6] Sorpa is an independent firm owned and run by Reykjavík and five other municipalities.

Data collected by EAI in 2013 was used for this analysis. In 2013, total waste generated in Iceland was estimated to be 525.187 tons, thereof 274.123 tons of inorganic waste and 251.064 tons of biodegradable waste (Figure 4).

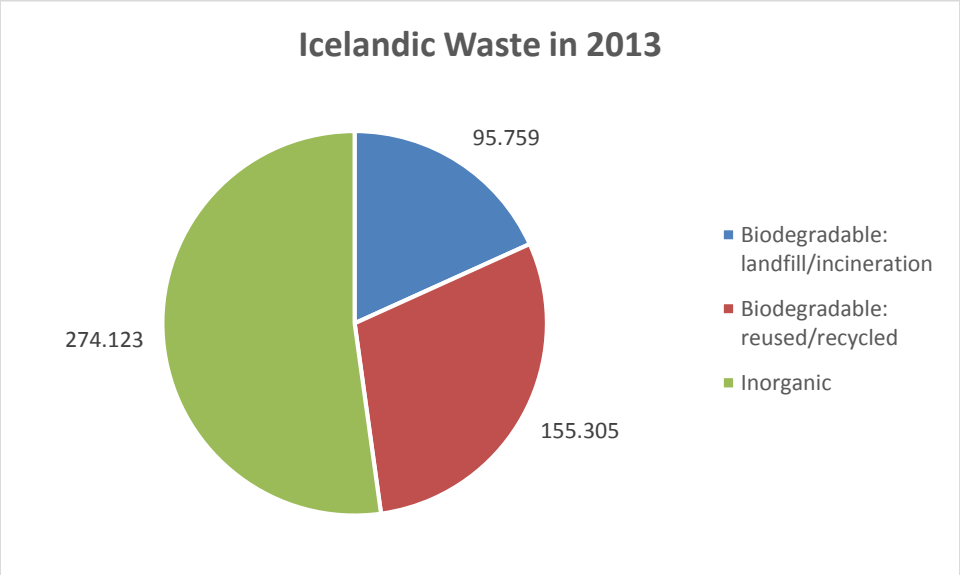


Figure 4: Estimated quantities of Icelandic biodegradable and inorganic waste.

Data on biodegradable waste in different regions of Iceland are limited. The following analysis is based on information provided by waste receiving stations in Iceland which are distributed all over the country. The analysis excludes mixed waste from homes and industry, timber, paper, cardboard and textile. Therefore, estimated numbers presented here are rather conservative or low. Waste is collected from the surrounding area of each station. In rural areas, these stations can be disperse and therefore some inaccuracy with regards to where the waste is generated is likely.

The following figure (Figure 5) shows the distribution of biodegradable waste disposed in Iceland.

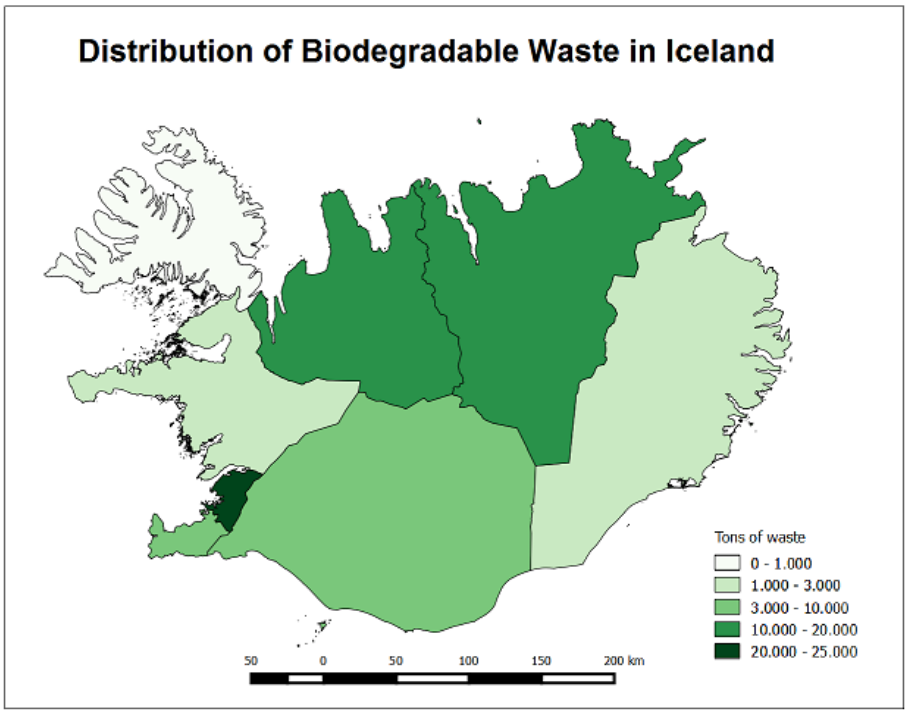


Figure 5: Geographical distribution of biodegradable waste in Iceland, based on data from waste receiving stations.

For this analysis, the following sources of biodegradable waste were investigated:

- Biodegradable garden waste
- Animal carcass
- Biodegradable waste from fish industry
- Biodegradable waste from meat industry
- Sludge from septic and sewage systems
- Biodegradable waste from canteens and kitchens
- Manure from domestic animals
- Agricultural and forestry waste

The magnitude of each source, in tons, is shown in Figure 6.

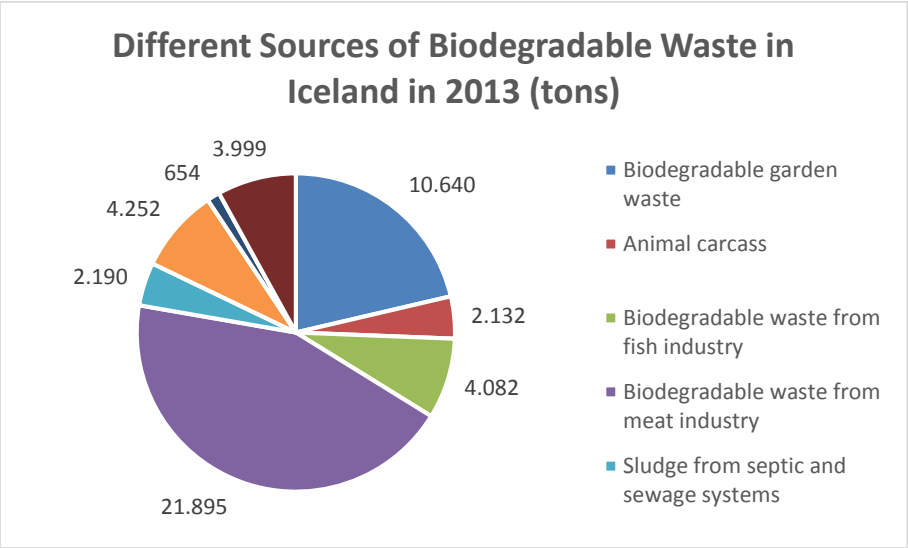


Figure 6: Different sources of biodegradable waste in Iceland 2013, based on data from waste receiving stations.

Some of the biodegradable waste is utilized in some manner and therefore only a portion of the waste studied here is landfilled. According to data from the waste receiving stations, there are seven potential waste management methods used for biodegradable waste received at the stations, see Table 2.

Biodegradable Waste Management	Recycling			Recovery		Disposal	
	Compost	Mink-feed	Other recycling	Landfill Cap	Biodiesel	Incineration	Landfill
Biodegradable waste	X		X	X			X
Animal carcass						X	X
Biodegradable waste from the fishing industry	X					X	X
Biodegradable waste from the meat industry		X	X			X	X
Sludge from septic and sewage systems							X
Biodegradable waste from cafeterias and kitchens	X		X		X		X
Manure from domestic animals	X			X			X
Agricultural waste	X	X		X			X

Table 2: Waste management methods used for the different sources of biodegradable waste in Iceland.

The data from the waste receiving stations does not entail information on the share of each waste management method used and therefore there is no data on how much biodegradable waste is landfilled or incinerated. It is known, however, that there are many possibilities for better utilization of the waste and numerous opportunities to create value streams from these resources.

The innovation sector identifies a big potential of utilizing by-products from the fishing and meat industries. When utilizing natural resources it can be vital to boost value creation and productivity throughout the value chains of these sectors.

The following figures show how biodegradable waste from the fishing and meat industry is distributed in Iceland, based on data from waste receiving stations. The data does not account for the fact that some of the waste is already being utilized in some manner, for example fish- and meat meal.

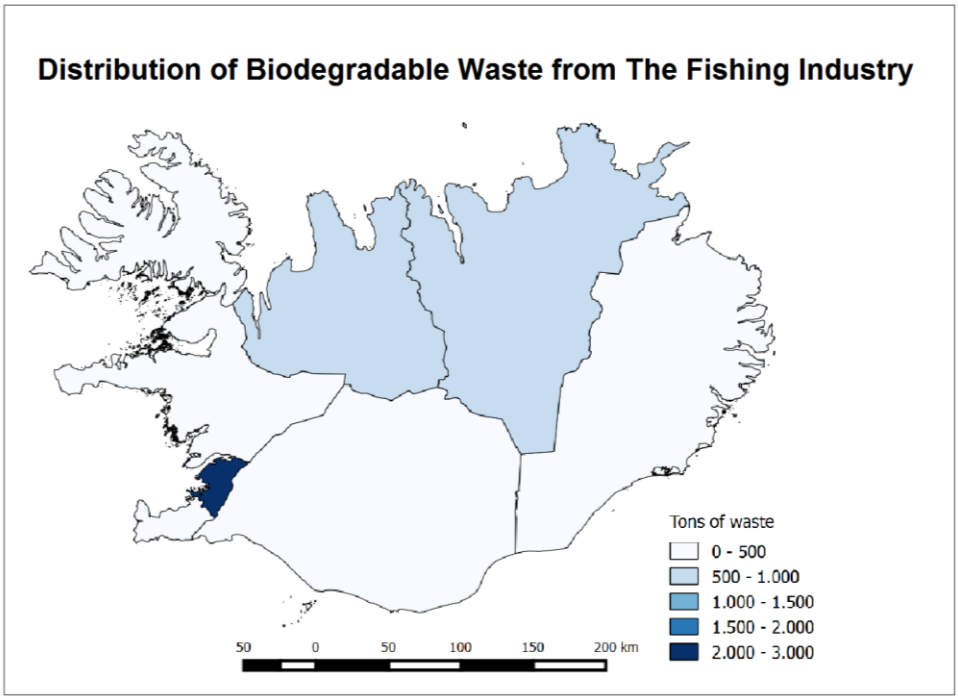


Figure 7: Geographical distribution of biodegradable waste from the fishing industry in 2013, based on data from waste receiving stations.

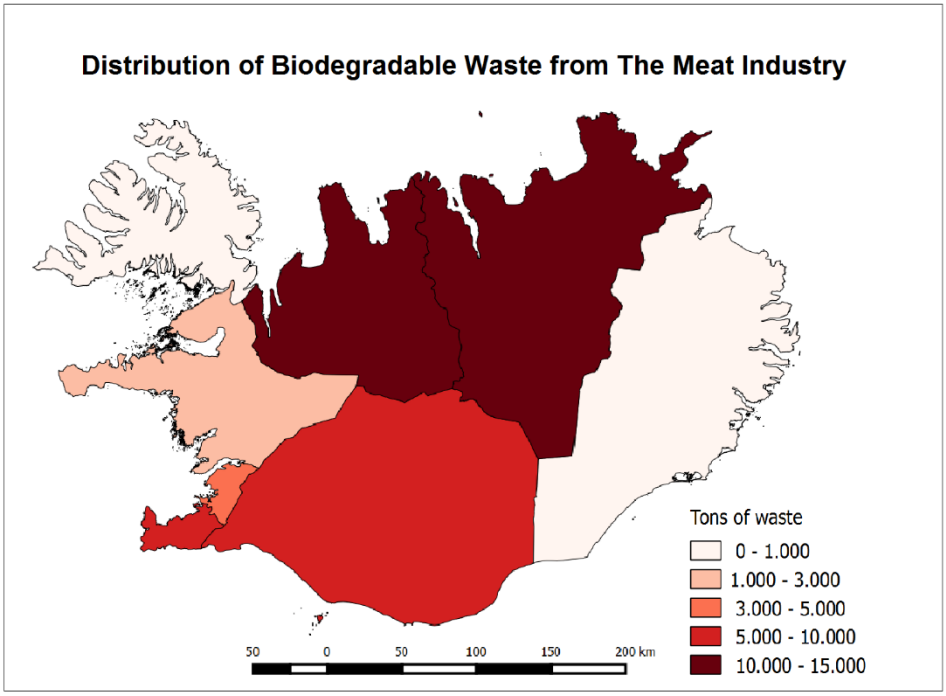


Figure 8: Geographical distribution of biodegradable waste from the meat industry in 2013, based on data from waste receiving stations.

Faroe Islands

The Faroe Islands are an island group located in the North Atlantic Ocean and have been a self-governing country within the Danish Realm since 1948. The country has a population of about 49.000 people, thereof approximately 13.000 living in the capital, Tórshavn[7].

In March 2015, the EAI met with IRF (Interkommunali Renovatiónsfelagsskapurin L/F), Tórshavn commune and Umhvørvisstovan in the Faroe Islands. Data on waste disposed in the Faroe Islands over the past few years was collected both from IRF and Tórshavn commune. IRF waste handling company handles waste from 28.665 people living in the Faroe Islands, while Tórshavn commune handles waste from the 13.000 people living in the capital. IRF collects both waste and sludge from septic tanks from municipalities. For this analysis, data collected in 2014 and 2013 was analyzed when available. Data from both IRF and Tórshavn commune was used for a more comprehensive analysis.

Both IRF and Tórshavn commune use several waste management methods; such as incineration, recycling, landfill, special treatment of hazardous waste, and waste used for power generation. Some of the waste generated in the Faroe Islands is exported mainly due to a lack of infrastructure to appropriately handle or reuse the waste. The breakdown of waste management by IRF can be seen in Table 3.

Waste Management by IRF		
Disposal Method	**2013**	**2014**
Incineration	129.508	141.946
Recycling	43.478	48.498
Landfill	1.821	2.848
Total	**174.807**	**193.291**

Table 3: Waste management by IRF in 2013 and 2014.

[7] http://www.hagstova.fo/en

Over six thousand tons of waste are recycled by IRF each year, as seen in Table 4. IRF gathers oil waste from ships, rinses the oil, recycles it, and then sells it for reuse. Furthermore, IRF recycles the heat from its incineration plant by supplying district heating and selling the heat to neighboring companies. Recycling facilities in Tórshavn commune also receive approximately six thousand tons of waste each year. At these recycling facilities the waste is recycled, used to generate power, treated appropriately if considered hazardous or composted as garden waste, see Figure 9. If none of those methods are applicable, the waste is landfilled.

Recycling by IRF in The Faroe Islands	Tons in 2014
Iron and metals	2.182
Paper and cardboard	1.550
Oil waste	1.797
Soft plastic	314
Electronics	76
Plastic bottles	68
Refrigerators and freezers	54
Aluminum cans	18
Isolation material	4
Total	**6.063**

Table 4: Quantities of recycled material received at recycling facilities managed by IRF.

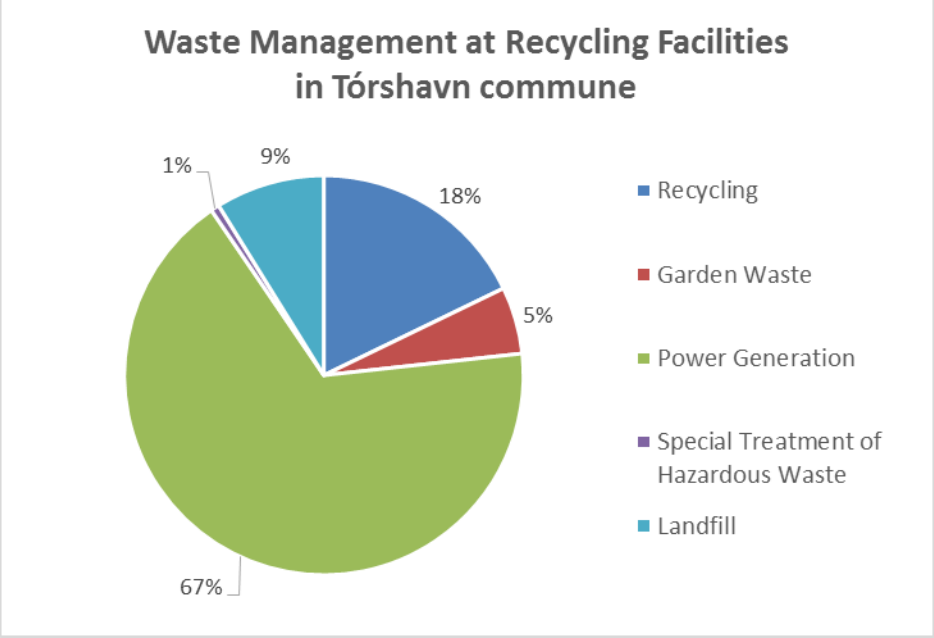


Figure 9: Waste management at Tórshavn commune's recycling facilities.

According to the data, approximately 3.600 tons of waste or ash were landfilled in Tórshavn and about 7.000 tons of waste and ash were landfilled in municipalities handled by IRF, see Table 5. Currently, IRF disposes sludge from septic tanks into landfills.

Landfilled Waste in 2014		Tons in 2014
Tórshavn commune	Waste	1.403
	Ash	2.198
IRF	Waste	2.195
	Ash	2.691
	Total:	**8.487**

Table 5: Data on landfilled waste in 2014 in the Faroe Islands

Since the focus of this project is on biodegradable waste, an attempt was made at estimating biodegradable waste disposed by various sources found in the Faroe Islands, as seen in Table 6.

Estimated Biodegradable Waste Disposed By:	Tons per year
Average Family	0,25
Tórshavn	2.000
Homes, institutions and small businesses	> 4.600
Fish processing plants, slaughter houses, restaurants, and hotels	3.000

Table 6: Estimations on the amount of biodegradable waste disposed by various sources in the Faroe Islands.

Data was collected on biodegradable waste and its main sources in Tórshavn, the capital of the Faroe Islands. The data indicates that household waste is by far the largest source of biodegradable waste. However, it is difficult to quantify and utilize biodegradable household waste unless it is collected separately and then it is usually composted. Other sources were biodegradable waste at recycling stations, garden waste, sludge from septic tanks and recycled paper and paperboard, see Figure 10. Additionally, 12.000 m^3 of trees and twigs and 350 m^3 of other biodegradable waste are disposed annually in Tórshavn commune. According to IRF, a lot of biodegradable waste is disposed of in the fall associated with the slaughter season. Slaughter waste, such as intestines and sheepskins from 50.000 to 60.000 sheep, is disposed of each fall. Additionally, significant amounts of biodegradable waste is sourced from the fishing industry. Sludge from septic tanks is considered biodegradable waste and can be used as a fertilizer following certain treatments of the sludge. IRF

collects sludge from septic tanks in most of the Faroe Islands and collected a total of 7.571 tons of sludge in 2014. As mentioned above, sludge is currently landfilled.

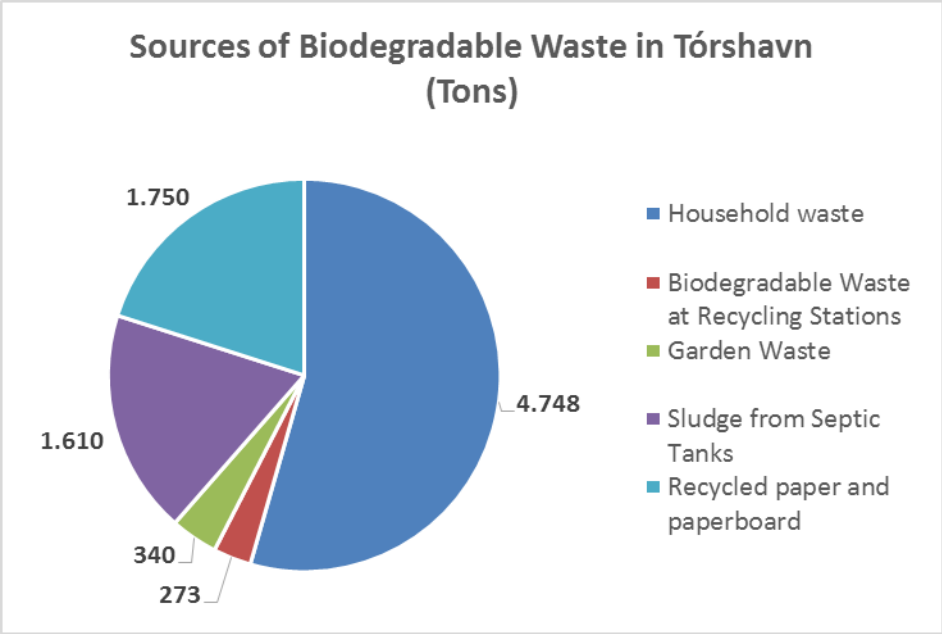


Figure 10: Sources and quantities of biodegradable waste in Tórshavn.

Greenland

Greenland is an autonomous country within the Danish Realm with approximately 56,000 inhabitants, thereof close to 17,000 living in Nuuk the capital[8]. Greenland is unique because of its size and scattered cities and settlements that are isolated due to lack of transportation infrastructure. There are 17 cities and 52 settlements of various sizes distributed along the coast of Greenland with a typical population of around 30-300 people.[9]

In early 2015, various stakeholders in Greenland were contacted by the Icelandic chairmanship of NordBio in order to study waste management, especially of biodegradable waste, in Greenland. Results of this study show that the majority of waste disposed in Greenland is burned in incinerators located in six different cities and contributing to the district heating system. Similarly, the smaller villages are equipped with smaller furnaces for burning waste. Landfills are not common, mainly due to the lack of suitable space and since the waste is utilized in the district heating system. Approximately 25% of household waste in Nuuk is recycled, however a proper recycling infrastructure is missing since the small quantity of recycled materials does not support one.[10]

Currently, data on biodegradable waste in Greenland is not systematically collected. However, there are not many sources of biodegradable waste material in the country since food production is minimal. Agriculture is uncommon and vegetable production is negligible mainly due to a lack of arable land, or only approximately 1% of the entire country[11]. The main sources of biodegradable waste are within the meat and fishing industry. Data from the report *Greenland in Figures* written by Statistics Greenland was used to assess potential sources of biodegradable waste in the meat and fishing industry. The bulk of the meat industry consists of approximately 20.000 lambs slaughtered each year[8]. Furthermore, Greenlanders greatly depend on hunting wild animals, though waste from these activities is scattered and difficult to quantify. In 2013 just over 100.000 seals were caught, however this figure has decreased significantly over the past few years with about 160.000 seals caught in 2008, for instance. Approximately 3.000 whales are caught each year and around 12.000 – 20.000 land mammals have been hunted annually over the past few years, which includes reindeers, musk ox, and polar bears. Similar to Iceland and the Faroe Islands, the fishing

[8] http://www.stat.gl
[9] http://www.matis.is/media/matis/utgafa/Bioeconomy-in-the-West-Nordic-countries-37-14.pdf
[10] http://www.eea.europa.eu/highlights/new-film-on-waste-management
[11] http://www.britannica.com/place/Greenland

industry in Greenland is very important to the national economy and local food supply. Therefore, data is collected continuously on the fishing industry, see Table 7[12]. Due to its size, the fishing industry is arguably the largest source of biodegradable waste in Greenland. Fully utilizing the fish caught would undoubtedly both increase the value of the fish and significantly decrease biodegradable waste.

Landings of Fish and Shellfish in Greenland (1.000 tons)		
	2012	2013
Fish, total	**45,3**	**55,3**
Cod	10,2	14,7
Greenland halibut	23,6	25,3
Redfish	0,1	0,2
Wolffish	0,9	0,9
Lumpfish	10,5	14,2
Shellfish, total	**51,9**	**46,9**
Snow Crab	1,8	2,0
Shrimp	50,1	44,9

Table 7: Figures on total landings of fish and shellfish in Greenland in 2012 and 2013.

Some figures on the main sources of biodegradable waste are presented here above. However, there is a significant lack of data on waste, especially biodegradable waste, in Greenland. Based on data from the fishing industry and exportation data from Statbank Greenland, an attempt was made at quantifying some of the biodegradable waste that is disposed in Greenland, see Table 8[13]. Some factors are not accounted for and therefore the utilization numbers are rather conservative, resulting in higher waste figures. Additionally, some fish is frozen and exported whole and therefore the associated biodegradable waste is not disposed in Greenland.

Source	Quanitity	Utilization	Unused Biodegradable Waste
Cod	26.000 tons	55% [14]	11.700 tons
Greenland halibut	26.500 tons	75% [13]	6.625 tons
Lumpfish	10.000 tons	15% [13]	8.500 tons
Snow crab	2.000 tons	25% [13]	1.500 tons
Shrimp	39.500 tons	40% [13]	23.700 tons

Table 8: Rougly estimated biodegradable waste disposed in the fishing industry in Greenland.

[12] *http://www.stat.gl/publ/en/GF/2015/pdf/Greenland%20in%20Figures%202015.pdf*
[13] *http://bank.stat.gl/pxweb/en/Greenland/Greenland__IE/IEXDETEX.px/?rxid=4916f342-b638-4de8-8fd8-dbf467ba6c41*
[14] *https://umraedan.landsbankinn.is/Uploads/Documents/FyrirtaekiFelog/Sjavarutvegur/Sjavarutvegur-timarit-2arg-2tbl.pdf*

The Technical University of Denmark conducted a study on *Biogas and bio-oil from fishing waste in Uummannaq, Greenland.*[15] The main reason for this study was Greenlander's practice of dumping fishing waste into the ocean which can negatively impact the environment and fully utilizing the fish would contribute to the economy. According to this study, waste generated in the fishing industry in Greenland is about 14,000 tons annually. This number is significantly lower than the estimated values above. As predicted, our estimated values are rather high. Nonetheless, the study by the Technical University of Denmark focused mainly on waste generated from halibut fishing while our estimations account for other types of fishing as well. Therefore, it is reasonably safe to assume that waste from the fishing industry lies somewhere between these two estimations presented here above.

[15] Nielsen, U., Nielsen, K., Maj, P., & Frederiksen, O. (2006). *Organisk industriaffald i Grønland-Værktøjer til fremme af bedste tilgængelige teknik og nyttiggørelse af restprodukter. Realistiske muligheder for nyttiggørelse/udnyttelse af organisk industriaffal i Grønland nr. M. 127/001-0164.*

Discussions

The goal of this project was to study biodegradable waste in Iceland, Greenland, and the Faroe Islands and the potential for using this waste as a resource for innovation. Potential sources of biodegradable waste were analyzed, mainly from the fishing and meat industry. According to this analysis, the main challenge that needs to be tackled in order to increase the utilization of biodegradable waste is to make it more accessible to potential users and entrepreneurs. In order to do so it is essential to increase data collection and study on this potential resource and make the information readily available. Thereby, interested parties know when and where the resource is available and can form a connection with whoever is disposing the biodegradable waste. Although data was lacking in all three countries, it was possible to draw certain important conclusions on how to promote the increased utilization of this resource.

Data on biodegradable waste and waste in general was by far the most from Iceland. Therefore, it was possible to produce maps of the distribution of biodegradable waste disposed in Iceland, presented above. These maps show where most of the biodegradable waste is disposed and from what industry. This information is important for potential users that need to ensure a supply of the resource. Several different sources of biodegradable waste and how they were disposed of were studied. Currently, biodegradable waste in Iceland is utilized in several different ways. Nevertheless, there are numerous opportunities to even further increase the utilization of this resource and increase value creation, especially in light of new technologies. Various challenges have been associated with increasing the utilization of this resource, including the difficulty of obtaining the resource. Often it is easier and makes more economic sense for those that accumulate biodegradable waste to simply dispose it to the nearest waste site. However, by facilitating the connection of potential users and those that dispose biodegradable waste this could be minimized. Therefore, making information on who disposes biodegradable waste available to potential users is key.

Although there was a significant lack of data, the project's results indicate that biodegradable waste in the Faroe Islands is minimal since most of it is used. This analysis indicates that one of the main sources of biodegradable waste in the Faroe Islands is household waste. However, opportunities to increase the utilization of household waste are, at the moment, limited to composting. Agriculture in the Faroe Islands is limited, mainly due to weather conditions and availability of resources.

Sheep farming is the primary agriculture and the sheep are mostly slaughtered at the farms. In order to limit means of infection, all slaughter waste is burned, thus resulting in no biodegradable waste. According to Tórshavn commune, most of the by-products from fish processing plants is used for fishmeal and thereby fully utilized. Garden waste is commonly composted and sludge from septic tanks is landfilled. Although biodegradable waste is minimal in the Faroe Islands, there are numerous opportunities to better utilize the resources and thereby increase the monetary value of it. For instance, new technology utilizing previously unused parts of fish to create new products can substantially increase the value of certain types of fish. The same applies to slaughter waste where only specified risk material should be burned. Most biodegradable waste, including sludge from septic tanks, can be utilized in some manner or at least as a fertilizer following certain treatments. Therefore, negligible amounts of biodegradable waste should be put towards a landfill or disposed of in some other way.

The main results of this project in Greenland are that there is a significant lack of data on waste in Greenland. In order to promote increased utilization of unused resources and innovation, data on potential by-products and biodegradable waste that could be utilized needs to be collected. However, it is safe to assume that, similar to the Faroe Islands, there are definite opportunities to increase the utilization of biodegradable waste, especially in the fishing industry.

These three island states are all heavily dependent on fishing and therefore a substantial amount of opportunities for innovation and increased utilization lie within the fishing industry. The question is whether the quantity of the potential resource is large enough to justify the infrastructure necessary to fully utilize the resource. This especially applies to Greenland and the Faroe Islands that have significantly smaller populations and fish less than Iceland[16]. Exporting biodegradable waste presents certain challenges, especially considering the location of these three island states.

[16] http://www.theguardian.com/environment/datablog/2009/sep/02/fish-capture-country

Conclusions

In this report, an analysis of biodegradable waste accumulation and utilization in Iceland, the Faroe Islands, and Greenland is presented, based on data collected from each individual country. The main conclusion of this analysis is that there is a significant lack of data on biodegradable waste in these countries making a thorough analysis challenging. Nevertheless, it is possible to draw certain conclusions from the data presented here. Firstly, it is possible to determine that biodegradable waste is an underutilized resource in these countries. Therefore, there are numerous opportunities to increase the utilization of biodegradable waste or by-products from various industries, especially the fishing industry, and thereby reduce biodegradable waste significantly. Increasing the utilization of this resource has both economic and environmental benefits, in such that the monetary value of the product is increased or even a new product is created and thereby waste is decreased.

In order to promote the increased utilization of biodegradable waste it is vital to provide information on where, when, and by who the waste is disposed. Maps of the distribution of biodegradable waste disposed in Iceland are presented in this report. However, necessary data to create similar maps of Greenland and the Faroe Islands was not available. Potential users and innovators can utilize these maps and associated information to form a connection with those disposing biodegradable waste and thereby ensure a supply of the necessary resource for their potentially new product. Various challenges have been associated with increasing the utilization of this resource, including the difficulty of obtaining the resource. Increasing data collection and availability on biodegradable waste and who disposes it is vital to promote the increased utilization of this resource. Finally, most biodegradable waste can and should be used in some manner, for instance as a fertilizer to reclaim land.

Next Steps

One of the conclusions of this project is that it is vital to create a connection between the industries involved in generating biodegradable waste or potential by-products and those who want to and can utilize it. Creating this connection calls for new thinking to create these new possibilities. Therefore, a follow-up project has been launched where an interactive web-application will be developed to create these connections. The idea is to create a market place of sorts where industries can advertise their by-products or potential users can ask for specific materials. If the project is successful, it will create a direct link between industries and potential users and at the same time valuable data can be collected.