REGIONAL NUTRIENT MANAGEMENT PLAN FOR ÅLAND ISLANDS

Sustainable Biogas
D.T2.9.1

JOHN NURMINEN FOUNDATION

June 2022

SUSTAINABLE BIOGAS

Interreg Central Baltic

European Union
European Regional Development Fund

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1. INTRODUCTION

This nutrient management plan has been developed as part of the Sustainable biogas project funded by the EU Interreg Central Baltic Programme. The aim of the project is to promote the sustainability of biogas from the point of view of water protection and to reduce nutrient leakages related to biogas production, considering the production of organic biomasses, processes in the biogas plant and the use of nutrient-rich digestates and other end products.

The management plan includes nutrient management challenges and solutions identified in Åland, in the nutrient maps and current status report by Vahanen (Vahanen, Sustainable Biogas Project 2022) and gathered from stakeholder interviews and workshops from Åland Islands. The management plan, including the nutrient maps, targets to guide regional decision-making with regards spatial planning and regulating the location of biogas facilities, e.g. in setting requirements on the usage of digestates for biogas facilities, and in planning other activities in relation to the nutrient flows induced by biogas production.

2. CURRENT CHALLENCES AND MANAGEMENT OPPORTUNITIES FOR NUTRIENT-RICH BIOMASSES

The production and use of nutrient-rich biomass was investigated in the Sustainable Biogas Project when producing regional nutrient maps for Åland (Vahanen, Sustainable Biogas Project 2022). The maps can be used to identify nutrient surplus areas as well as nutrient deficit areas where the nutrients could be transported to be used in the fields to complement or replace mineral fertilizers. Thus, the nutrient maps give an overall picture of the nutrient rich biomasses formed in the area and the regional challenges related to the management of these biomasses.

The main challenges identified when mapping the nutrient balances in Åland are: 1) phosphorus surplus on the level of the whole area of Åland islands 2) regional nutrient surpluses inside Åland islands especially in the areas with intensive animal production 3) management of sewage-based nutrients at the Lotsbroverket biogas plant.

2.1 Phosphorus surplus in the whole Åland Islands area

In nutrient mapping of Åland Islands, overall phosphorus surplus of 160,8 tons in comparison with plant needs and 141,8 tons in comparison with fertilisation levels defined in the environmental compensation scheme were identified. Annual phosphorus surpluses are challenging especially as there is already a significant legacy phosphorus reserve in soils of Åland, due to e.g. high fertilisation levels in the past and cultivation of nutrient-intensive crops. According to the statistics of the Natural Resources Institute, phosphorus levels in the soils of Åland are the highest in Finland.

The problem is challenging to solve due to logistical issues and high transport costs of manure and other nutrient-rich biomasses, and, thus, a need for production of more easily transportable digestates and nutrient products is obvious. Production of digestate based biochar in the new Svinryggen biogas plant could provide a way to make products which can be more easily transported over longer distances, even outside the Åland Islands, than the digestates or other biomasses as such. The next step needed in advancing the proposal for biochar production would be conducting a feasibility study for the investments needed in Svinryggen. However, there are also some rules and regulations that currently hinder nutrients from sewage-based sources to be circulated within the agricultural system, and, thus, would need to be

updated to the current situation and considering new technological advancements. I.e. biochar produced from sewage sludge is currently not allowed, even though the end-product would be clean.

2.2 Regional nutrient surpluses in the areas with intensive animal production

The regional nutrient map of Åland Islands shows that nutrients are concentrated into certain areas, especially in regions with intensive animal farming. Altogether 69,7 % of the phosphorus produced on the islands originates from animal production, 13,3 % from agricultural by-products, 9,1 % from municipal wastewater sludges, 6,8 % from biowaste from food production and from municipal biowaste 1,1 %. For nitrogen, 75,6 % comes from animal production, 13,7 % from agricultural by-products, 6,9 % from municipal wastewater sludges, 2,7 % from biowaste from food production and from municipal biowaste 1,1 %.

The nutrient content in manure varies depending e.g. on the animal species and also on the diet of the animal. Dairy cow manure has twice as much phosphorus as average cow manure, and although the differences in phosphorus production between different cows could not be considered in the nutrient mapping carried out in Sustainable Biogas project, the areas with high number of dairy cows can be expected having the highest phosphorus surpluses. Although Åland is a relatively small and compact area, local stakeholders clearly brought up that the transport costs are still too high for farmers to recycle manure to the fields where nutrients would be needed. In addition, coordination of such activity would be needed to enhance the circulation of nutrients inside the Åland Islands.

According to the farmers in Åland, the main challenge preventing the recycling of nutrients from nutrient-rich areas to the areas, which could utilize them sustainably, is the cost of transportation. This is aggravated by the current cost crisis in agriculture. The situation is similar in the mainland Finland. However, it is noteworthy that even with relatively small distances, transport costs are the factor preventing sustainable usage of manure nutrients, as neither the animal nor plant farmers are ready to increase their costs, and, due to the low prices of mineral fertilizers, circulated nutrients are not yet competitive. To solve the issue, financial support for the farmers would be needed. In the mainland Finland, it has been estimated that relatively small financial support directed to manure processing and transport would enable more efficient recycling of manure-based nutrients. In addition, easy and ready-made systems to recycle organic nutrients between farms with as little extra work as possible would ease participation of farmers.

To balance nutrient usage in different regions of Åland, more cooperation and communication is also needed between producers and users of nutrients, e. g. animal farms, plant producers and apple farmers. There are diverse examples to facilitate such cooperation such as manure exchange markets/websites. One step further could be a “circular arranger” proposed by the local stakeholders - a company or organisation specialized in organizing exchange of nutrient-rich biomasses between local stakeholders. Companies like this exist in Germany, Sweden, and mainland Finland, where they act as intermediaries between the producers of nutrient-rich biomasses and plant farms. This also enables the biogas plants and other producers of nutrient-rich biomasses to focus on their core business instead of finding receivers for the biomass. However, there is a need for further development and financing for such activities, as “circular-arranger”- organisations don’t yet exist in Åland.

2.3 Management of sewage-based nutrients at the Lotsbroverket biogas plant

The nutrient management challenges at the Lotsbroverket wastewater treatment plant are 1) nitrogen-rich reject waters discharged from the Lotsbroverket facility’s biogas plant back to the wastewater treatment plant, adding so much nitrogen to the treatment process, that is causes problems for nitrogen removal at the plant; and 2) low demand for the sewage sludge based digestates originating from the biogas plant.

To solve the first problem, it would be important to improve nitrogen removal of the biogas plant's reject waters coming to the wastewater treatment plant. The extra nitrogen could potentially be utilized as fertilizer, e. g. in form of nitrogen concentrate, in agriculture. It was brought up by the local stakeholders that for example in southern Sweden there is a company which extracts nitrogen from the reject water with the aim to produce a mineralized eco-fertilizer approved by the authorities. According to the nutrient maps, there would be room for additional nitrogen in the agricultural fields in certain parts of the Åland Islands (Vahanen, Sustainable Biogas Project 2022). To advance nitrogen uptake from reject waters of the Lotsbroverket biogas plant, a feasibility study on the improved nitrogen extraction would be the first step.

Solving the problem with low demand for Lotsbroverkets digestates is more complicated, as there are many prejudices against wastewater-based biomass among farmers and the entire value chain of agricultural products. As one regional solution, development of sludge quality with effective and systematic upstream measures to reduce hazardous substances in sludge has been proposed by local stakeholders. Establishing quality systems and control for the digestates would also be needed to advance the usage of these biomasses in agriculture. Obviously, any actions on the development of better sludge-based fertilizers should be based on close dialogue with farmers. In addition, biochar production could be potential solution for enhancing the usage of sewage-based digestates, however, there are still regulatory obstacles preventing this development, as described in section 1).

3. CONCLUSIONS AND NEXT STEPS

Two stakeholder workshops organized by Sustainable Biogas Project in Åland have given a basic understanding of both the challenges but also the possibilities related to the management of different nutrient-rich biomasses formed in Åland. Topics for feasibility studies to advance technical solutions and investments for improving nitrogen uptake and the biochar production were identified, as well as the need and potential for a local company or organisation bringing various parties together as an "circular arranger" to enhance nutrient recycling and improve nutrient management regionally in the Åland Islands.

In addition, and maybe more important, as relevant local stakeholders were gathered by the workshops to discuss these topics, a network could be formed based on these stakeholders to develop the management proposals further also in the future. As a following step to the discussion started during the Sustainable Biogas Project, it would be important to continue the conversation and explore common opportunities further with the network of local actors. This would, however, require a coordinating body and maybe also some financing for the work, and, thus, perhaps a project-based consortium could be an efficient way in developing the solutions from paper to practise.

ATTACHMENTS

Vahanen 2022, Nutrient maps for Åland Islands as part of the Sustainable Biogas Project

sustainablebiogas.eu

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JOHN NURMINEN FOUNDATION

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The Sustainable Biogas project worked together with the biogas sector and various stakeholders to reduce nutrient discharges from the whole production chain of the biogas production: from the handling of raw materials to the production and to the safe utilisation of nutrient-rich digestates.

According to the results of the project, sustainable nutrient management in biogas production requires careful consideration when planning, permitting and operating the biogas facilities so that the regional nutrient balance is considered, storages for the feedstocks and digestates are adequate and appropriate, and digestate application is based on the plant needs.

Improving the quality of recycled nutrients and promotion of their use are needed. In addition, the reconciliation of the partly contradictory objectives for sewage sludge management - pollution prevention, nutrient recycling and climate change mitigation - should be continued.

The project, funded by the EU Interreg Central Baltic Programme, was implemented by the John Nurminen Foundation, the ELY Centre for Southwest Finland, the Finnish Biocycle and Biogas Association, Latvian State Environmental Services, and the Latvian Biogas Association.

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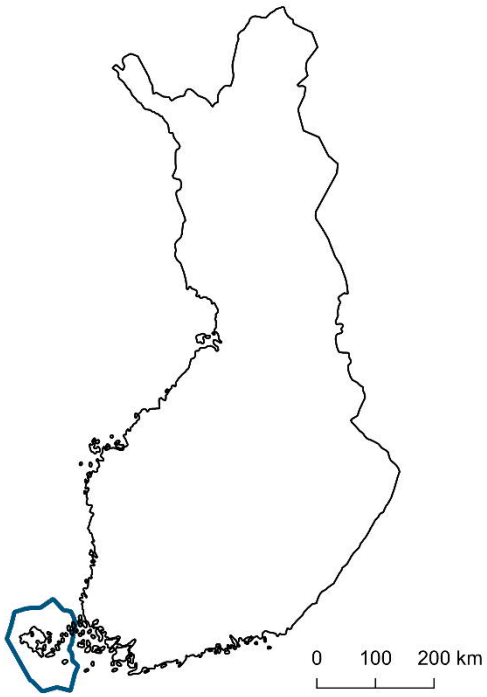
NUTRIENT MAPS FOR ÅLAND ISLANDS AS A PART OF THE SUSTAINABLE BIOGAS PROJECT

THE JOHN NURMINEN FOUNDATION

ENV2479

UPDATED 24TH FEBRUARY 2022



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1 Introduction

The Sustainable Biogas project is a 2.5-year project funded by the EU Interreg Central Baltic program. The John Nurminen foundation is the lead partner of the project implemented trough Finnish-Latvian cooperation. The goal of the Sustainable Biogas project is to promote sustainability of biogas from water protection perspective and to reduce nutrient leakage throughout its whole lifecycle. One of the project deliverables will be nutrient maps for southwestern Finland, Åland and the Zemgale region in Latvia. These maps can be used to identify nutrient surplus areas from which nutrients should be transferred to nutrient deficit areas. Nutrient maps enable detailed examination of both nitrogen and phosphorus production in the target area and give an overall picture of the nutrient rich biomasses formed in the area.

During this assignment, nutrient maps for all 16 municipalities in the Åland Islands were produced. These maps provide information on nutrient balances and support local authorities in the regional nutrient management. The aim was to illustrate on maps:

1. The annual amount of nutrients, both phosphorus and nitrogen, in organic matter produced in the area
2. The annual potential for field application of the nutrients in the Åland Islands
3. Nutrient deficit and surplus areas.

The mapping was done in GIS data format and the information on the maps is presented on a 5 x 5 km grid. Produced maps present annual production of phosphorus and nitrogen in biomasses, namely manure of production animals, wastewater sludges from municipal wastewater treatment plants, municipal biowaste, organic industrial by-products and wastes and agricultural by-products (e.g., hay from protection zones, etc.).

Similar maps have already been prepared for the Southwestern Finland. Same calculation methods and assumptions according to the available data was used during this assignment. Hence, these maps are comparable with each other.

The nutrient maps for Åland Islands were carried out by M.Sc. Petrina Köngäs, M.Sc. Jari Ruohonen and PhD. Anne Liljendahl from Vahanen Environment Oy on an assignment by The John Nurminen Foundation. Maija Salmiovirta, Marjukka Porvari and Henri Nikkonen from The John Nurminen Foundation, Mia Westman and Leila Lindström from Ålands Landskapsregering and Sanna Tikander from Centre for Economic Development, Transportation and the Environment of Southwest Finland participated in directing the work.

2 Research area

The research area covers all 16 municipalities of the Åland Islands (Fig 1). The area is divided into 300 squares (5x5 km) which covers a total of 7 500 km^2. However, 134

squares are in areas where no nutrients are produced or where nutrients cannot be applied to the fields.

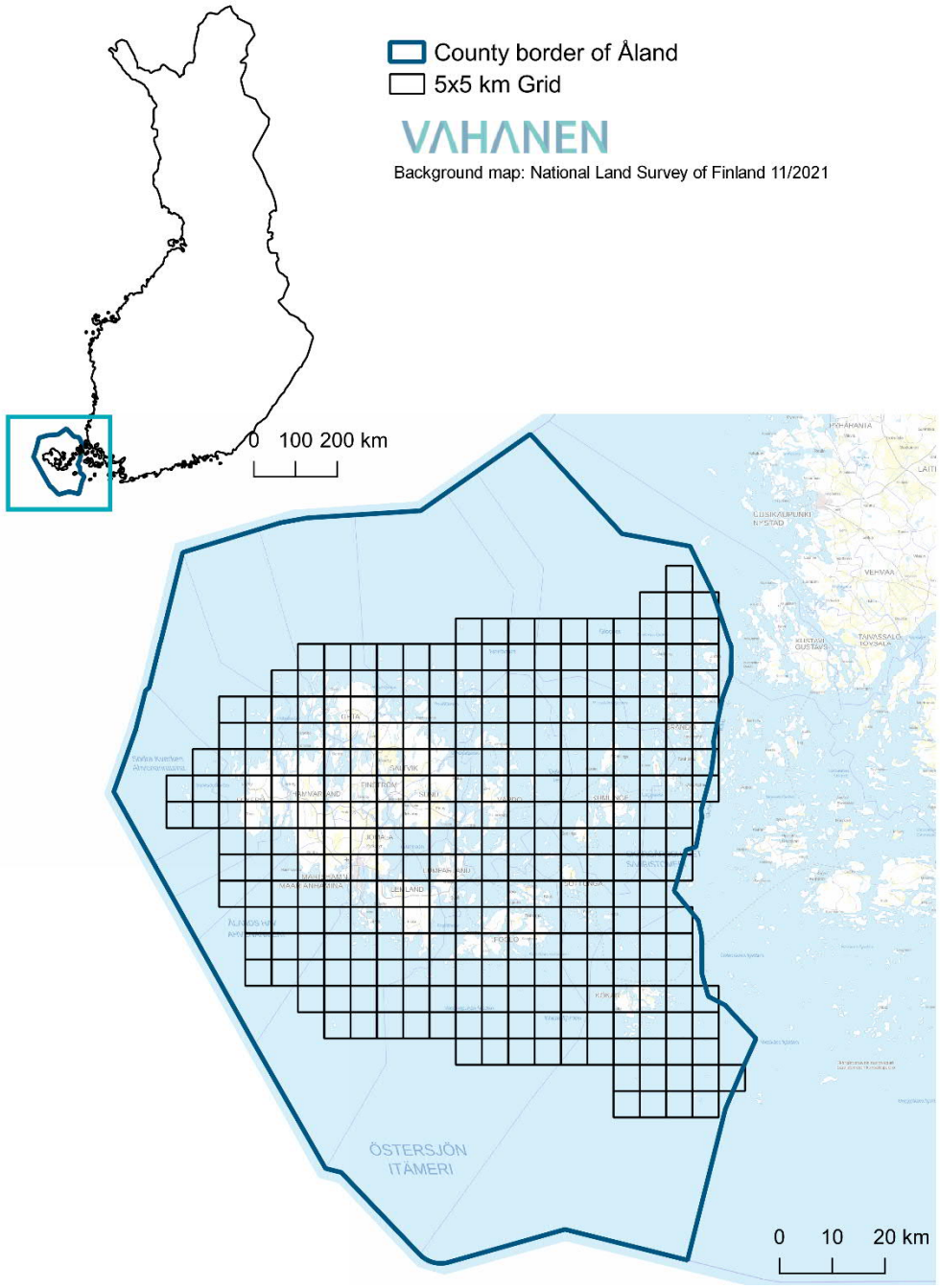

Figure 1. Location of the research area (Åland) and coverage of the 5x5 km grid.

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There are approximately 30 000 residents in the Åland Islands (Ålands statistik- och utredningsbyrå (ÅSUB)). The population is mainly concentrated in the Mariehamn municipality which consist 39 % of all residents.

Most of the land area in the Åland Islands is forest (81.5 %). Agricultural areas cover 14 % and artificial surfaces 2.1 % of the land areas.

3 Nutrients produced in the research area

3.1 Manure from farm animals

There are a total of 62 699 farm animals in the Åland Islands, of which 123 individuals are equidae, 12 279 bovine animals, 38 823 poultry animals, 11 078 sheep, 162 goats, and 234 individuals are pigs. The numbers of animals and locations of animal farms were provided by Finnish Food Authority. The data did not include information of the age distribution or the type of the production animal (for example is the animal meant for meat production, milk production etc.). Additionally, the data did not define species distribution of poultry.

The amount of manure produced by farm animals and the amount of nutrients in the manure was estimated according to a guide by Finnish Ministry of Environment (Kotieläintalouden ympäristönsuojeluohje 2010). For equidae coefficients for horses >2-year-old (65 kg N/year and 12 kg P/year) and for pigs coefficients for slaughter pigs (12.7 kg N/year and 2.6 kg P/year) were used presuming the percentage of these animals is highest in these species. Coefficient of sheep's nutrient production (17 kg N/year and 3.5 kg P/year) was used for both sheep and goats. For the bovine animals weighted mean by the type of the livestock (58,83668 nitrogen/year and 9,899616 kg phosphorus/year) were used. The type of livestock was estimated according to the agricultural statistics of the Natural Resources Institute Finland[1]. For poultry a coefficient for layer hen (0.61 kg N/year and 0.16 kg P/year) was used since in the Åland Islands poultry mainly consist on layering hens (Natural Resources Institute Finland).

This calculation method includes uncertainties regarding the total amount of nutrient production in the area since generalizations for most of the animal types, age, and species distribution had to be made. Furthermore, the coefficients for nutrient production in the source material (Kotieläintalouden ympäristönsuojeluohje 2010) are old and the coefficients will be updated soon.

Farm animals in the Åland Islands produce 1 254 tons of nitrogen and 169 tons of phosphorus annually in their manure.

1 https://statdb.luke.fi/PXWeb/pxweb/fi/LUKE/LUKE__02%20Maatalous__04%20Tuotanto__12%20Kotielainten%20lukumaara/01_Kotielainten_lukumaara_kevaalla_ELY.px/

3.2 Wastewater sludges from municipal wastewater plants

Wastewater sludge is produced on all working wastewater treatment plants. In the Åland Islands there are 12 municipal wastewater treatment plants of which only Föglö and Kökar have their own separate sludge treatment. Other plants transport their sludge to Lotsbroverket treatment plant in Mariehamn. It should be noted that all nutrient content of the sludge, except the sludge from Föglö and Kökar, is presented on the maps as it was produced in Lotsbroverket. The amounts of sludge produced in the wastewater treatment plants, the nutrient content of these sludges, and the locations of the treatment plants were provided by Ålands Miljö- och Hälsoskyddmyndighet (ÅMHM).

Almost 60 % of residents in Åland live in houses that are connected to municipal wastewater treatment plants. Most of the waste waters from sparsely populated areas is taken into the nearest treatment plant. Locally treated sludges were not taken into account since there is no accurate information how many households treats them independently.

Wastewater sludges contain 22 tons of phosphorus and 33.5 tons of nitrogen annually.

3.3 By-product biowaste from food industry

The organic by-products and wastes of food Industry contain for example slaughter waste, entrails from fish, and leftover vegetable parts. In the Åland Islands biowaste from total of 11 factories were considered. Ålands Miljö- och Hälsoskyddmyndighet provided information about the amounts of organic waste from Orkla, Dahlmans slakteri, ÅCA, City of Mariehamn, Storgårds/Löfman, Filsö Fisk, Nordic Trout Ab, Storfjärdens Fisk Ab, Fifax and Brändö Lax Ab. The organic waste data based on the volumes received by the municipal compost facilities. In respect of fish farming waste, the data relied on companies own annual reports. The nutrient contents of these wastes were estimated by the John Nurminen Foundation. It should be noted that the waste data obtained for this report is likely not reflecting fully the real situation. For example, the amount of waste processed in the biogas facilities (Orkla and ÅCA) remained unknown.

Food industry in the Åland Islands annually produces 16.5 tons of phosphorus and 87 tons of nitrogen.

3.4 Municipal biowaste

The amount of nutrients in the municipal biowaste was calculated per 5 x 5 km square by multiplying the amount of population in each square by the calculated amount of biowaste produced by one resident. The relative number of residents in one square was estimated by dividing the population in the municipality located in the central point of the square with the land area of the municipality in question and then calculating the total number of residents inside the 25 km^2 square. The grid squares located in areas where no residential households were assumed to exist (e.g., water areas, uninhabited islands), were excluded from the calculations.

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It's estimated that one person in a household produces about 83 kg of biowaste per year (Rasi et al. 2012, Roström & Uggeldahl 2003). Hence the households in the Åland Islands annually produce 2 500 tons of biowaste annually. Household biowaste contains approximately 0.4 % phosphorus and 2.0 % nitrogen of the total solid material, which in turn forms about 27 % of the total mass (Rasi et al. 2012). Accordingly, municipal biowaste produced annually in the Åland Islands contains 2.7 tons of phosphorus and 13.5 tons of nitrogen.

In addition to the above, biowaste is produced in public facilities and private services such as restaurants, hotels, and schools, which were not considered in these calculations. The amount of produced biowaste in public facilities is dependent on the number of people working or transacting in the premises. The amount of waste generated by the private facilities corresponds to the number of employees (Rasi et al. 2012). Information about the amount or locations of all public and private establishments in the Åland Islands or data on the number of employees or customers were not available.

3.5 Agricultural by-products

Agriculture generates by-products (vegetable waste) such as straws from cereals and oleaginous plants, plant tops from sugar beets, biowaste from potatoes and other vegetables as well as from greenhouse cultivation. Additionally, nature management fields and protection zones, which are uncultivated areas between fields and water bodies that grow perennial vegetation require annual mowing and therefore produce organic waste.

The amount of plant waste and nutrient content was estimated according to the plant species and field area and with the coefficients given in a publication by Rasi et al. (2012). Agricultural field areas and information about the cultivated vegetation were provided by the Finnish Food Authority.

In the Åland Islands there are approximately 20 580 hectares of agricultural land which produce 44 131 tons of biowaste annually. This biomass contains 172 tons of nitrogen and 32.3 tons of phosphorus.

Protection zones covers only 0.06 % and nature management fields 26 % of all cultivated areas in the Åland Islands. Together they annually produce 36.4 tons of biowaste that contains 0.15 tons of nitrogen and 0.03 tons phosphorus. These amounts are included in the total nutrient production values of agricultural by-products presented above.

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Table 1. Annual nutrient production (tons/a) in the Åland Islands.

Source	N tons/a	P tons/a
Manure from farm animals	948	169
Municipal wastewater sludges	33.5	22
By-product biowaste from food industry	87	16.5
Municipal biowaste	13.5	2.7
Agricultural by-products	172	32.3
Total	**1 254**	**242.5**

4 Annual nutrient demand and application potential

Annual phosphorus demand was determined in two different methods: 1) by estimating demand by crops using the model by MTT (Ylivainio et al. 2014) and 2) by estimating annual phosphorus application potential in the area using the maximum nutrient fertilization per plant and soil fertility category in the CAP/agri-environmental compensation scheme. Annual nitrogen application potential was estimated in the same way using the maximum fertilization in the CAP/agri-environmental compensation scheme.

The Finnish Food Authority provided the information on crop cultivated in the Åland Islands. 37.5 % of all cultivated areas, such as protection zones, nature management fields and fallow land areas, are not used for fertilization.

4.1 Phosphorus demand by crops

The agricultural areas in Åland Islands were divided into three classes according to the cultivated plant using the same method as the nutrient maps for Southwest Finland. 1) Appliable amount of phosphorus fertilization for hay, cereal and grass was determined by using the coefficient for Åland by the model of MTT (Ylivainio et al. 2014) (4,4 kg P/ha/a). Approximately 55 % of all cultivated areas were classified into this category. 2) In addition, other plants such as potatoes, oleaginous plants, and pulse are cultivated in the area. Phosphorus demand for these plants was estimated using coefficient presented in the TEHO Plus -project (Hannukkala et al. 2014). Optimal crop response for potatoes, carrots, and sugar beet is reached when applying 20 kg P/ha/a. 3) For protection zones, nature management fields, and fallow land areas phosphorus fertilization was assumed not to be applied.

According to the calculation method based on the phosphorus demand by crops, total of 81.8 tons of phosphorus per year can be applied to the fields of Åland Islands.

4.2 Phosphorus application potential

The phosphorus application potential was estimated by using the maximum amount of phosphorus fertilization allowed per plant and soil fertility category in CAP/agri-environmental compensation scheme. The laboratory of Ålands Miljö- och Hälsoskyddsmyndighet (ÅMHM Laboratoriet) provided the information on soil fertility in Åland region. More detailed information on municipality level was not available. Manure exemption was not used for maximum fertilization levels since there is no estimation on how much manure is used for fertilization in the Åland Islands. CAP/agri-environmental compensation scheme allows higher phosphorus fertilization for both cereal-, oleaginous plants, and pulse and annual and perennial feed grass in certain soil fertility classes if fertilized with manure alone. Therefore, if manure is used the phosphorus application potential might be locally higher. For protection zones, nature management fields, and fallow land areas phosphorus fertilization was assumed not to be applied.

According to the calculation method based on the phosphorus application potential, total of 100.8 tons of phosphorus can be applied on the fields of Åland annually.

4.3 Nitrogen application potential

The nitrogen application potential was also estimated by using the maximum amount of fertilization under CAP/agri-environmental compensation scheme per plant and soil organic content category. ÅMHM Laboratoriet provided the information on the soil organic content (soiling) in Åland region. More detailed information on municipality level was not available. For protection zones, nature management fields, and fallow land areas nitrogen fertilization was assumed not to be applied.

According to the nitrogen application potential, a total of 1 356 tons of nitrogen can be applied to the fields of Åland annually.

5 Conclusions

A total of 242,5 tons of phosphorus and 1 254 tons of nitrogen are produced in the Åland Islands annually. The most significant source of nutrients is the manure from farm animals. Manure contains 69.7 % of all produced phosphorus and 75.6 % of nitrogen. Agricultural by-products produce 13.3 %, municipal wastewater sludges 9.1 %, biowaste from food industry 6.8 % and municipal biowaste 1.1 % of all phosphorus generated in the area. Accordingly agricultural by-products produce 13.7 %, by-product biowaste from food industry 6.9 %, municipal wastewater sludges 2.7 % and municipal biowaste 1.1 % of all nitrogen generated in the Åland Islands.

Based on the phosphorus demand by crops, there is an annual overproduction of 160,8 tons of phosphorus in Åland. Within 123 grid squares used in the calculation, the phosphorus production exceeds the plants' need for fertilization inside the square.

According to the phosphorus application potential based on the maximum allowed phosphorus fertilization limits in the CAP/agri-environmental compensation scheme, there is an annual overproduction of 141,8 tons. Within 119 grid squares more phosphorus is produced than it is allowed to apply in the fields inside the square.

Despite the calculation method used to estimate phosphorus demand and application potential, the largest surplus areas are located near Mariehamn and Saltvik. The largest deficit areas are on the other hand in areas where most of the crop fields are located.

In the Åland Islands, there is an annual nitrogen deficiency. Under the CAP/agri-environmental compensation scheme, 101 tons more nitrogen could be applied to the crop fields than is produced in the Åland Islands. However, the nitrogen production is not evenly distributed. Within 89 grid squares used in the calculations, the nitrogen production exceeds the need of fertilization.

To conclude, the nutrient content in organic waste in the Åland Islands is approximately 2.5-3 times greater for phosphorus than is applicable to the crop fields. On the other hand, the nitrogen production in the area is not sufficient to cover the plant needs and 101 tons more nitrogen could be applied to the crop fields than is produced.

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APPENDIX 1

Nutrient maps

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Ålands näringskartor

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- Landskapsgräns
- Tätort
- Biogasanläggning
- Komposteringsanläggning
- Avloppsreningsverk
- Livsmedelsindustrianläggning

Gradnät 5x5km

Åland
Gustavs
Geta
Saltvik
Brändö
Hammarland
Eckerö
Kumlinge
Finström
Vårdö
Sund
Lumparland
Mariehamn
Pargas
Sottunga
Jomala
Lemland
Föglö
Kökar

0 5 10 15 20 25 km

N

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- Tätort
- Biogasanläggning
- Komposteringsanläggning
- Avloppsreningsverk
- Livsmedelsindustrianläggning

Produktionen av fosfor t/å
- 0,001 - 0,1
- 0,1 - 0,4
- 0,4 - 1
- 1 - 2
- 2 - 3,5
- 3,5 -

Åland
Geta
Saltvik
Brändö
Hammarland
Eckerö
Kumlinge
Finström
Vårdö
Sund
Lumparland
Mariehamn
Sottunga
Jomala
Pargas
Lemland
Föglö
Kökar

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Bakgrundskarta © LMV 2021

0 5 10 15 20 25 km

N

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Teckenförklaringar
- Kommungräns
- Landskapsgräns
- Tätort
- Biogasanläggning
- Komposteringsanläggning
- Avloppsreningsverk
- Livsmedelsindustrianläggning

Produktionen av kväve t/å
- 0,001 - 0,4
- 0,4 - 2
- 2 - 5
- 5 - 10
- 10 - 20
- 20 -

Åland
Geta
Saltvik
Brändö
Hammarland
Eckerö
Kumlinge
Finström
Vårdö
Sund
Lumparland
Mariehamn
Sottunga
Jomala
Pargas
Lemland
Föglö
Kökar

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0 5 10 15 20 25 km

N

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Teckenförklaringar
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- Landskapsgräns
- Tätort
- Biogasanläggning
- Komposteringsanläggning
- Avloppsreningsverk
- Livsmedelsindustrianläggning

Fosforbehov för växter t/å
- 0,001 - 1
- 1 - 2
- 2 - 3
- 3 -5
- 5 - 8
- 8 -

Åland
Geta
Saltvik
Brändö
Hammarland
Eckerö
Finström
Vårdö
Kumlinge
Sund
Lumparland
Mariehamn
Jomala
Sottunga
Pargas
Lemland
Föglö
Kökar

SUSTAINABLE BIOGAS
Interreg Central Baltic
EUROPEAN UNION
European Regional Development Fund

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0 5 10 15 20 25 km

N

John Nurminens Stiftelse
Ålands näringskartor

Teckenförklaringar
- Kommungräns
- Landskapsgräns
- Tätort
- Biogasanläggning
- Komposteringsanläggning
- Avloppsreningsverk
- Livsmedelsindustrianläggning

Åkrarnas mottagningspotential för fosfor t/å
- 0,001 - 1
- 1 - 2
- 2 - 3
- 3 - 5
- 5 - 8
- 8 -

Åland
Geta
Saltvik
Brändö
Hammarland
Eckerö
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- Komposteringsanläggning
- Avloppsreningsverk
- Livsmedelsindustrianläggning

Åkrarnas mottagningspotential för kväve t/å
- 0,001 - 2
- 2 - 5
- 5 - 10
- 10 - 20
- 20 - 50
- 50 -

Åland
Geta
Saltvik
Brändö
Hammarland
Eckerö
Kumlinge
Finström
Vårdö
Sund
Lumparland
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Jomala
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0 5 10 15 20 25 km

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Teckenförklaringar
- Kommungräns
- Landskapsgräns
- Tätort
- Biogasanläggning
- Komposteringsanläggning
- Avloppsreningsverk
- Livsmedelsindustrianläggning

Över- och underskottsområdena för fosfor (fosforbehov för växter) t/å
- -3 - -1
- -1 - 0
- 0 - 1
- 1 - 3
- 3 - 15
- 15 - 22

Åland
Geta
Saltvik
Brändö
Hammarland
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Vårdö
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Sottunga
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Lemland
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0 5 10 15 20 25 km

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Ålands näringskartor

Teckenförklaringar
- Kommungräns
- Landskapsgräns
- Tätort
- Biogasanläggning
- Komposteringsanläggning
- Avloppsreningsverk
- Livsmedelsindustrianläggning

Över- och underskottsområderna för fosfor (åkrarnas mottagningspotential) t/å
- -4 - -3
- -3 - -1
- -1 - 0
- 0 - 1
- 1 - 3
- 3 - 15
- 15 - 22

Åland
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0 5 10 15 20 25 km

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Ålands näringskartor

Teckenförklaringar
- Kommungräns
- Landskapsgräns
- Tätort
- Biogasanläggning
- Komposteringsanläggning
- Avloppsreningsverk
- Livsmedelsindustrianläggning

Över- och underskottsområderna för kväve (åkrarnas mottagningspotential) t/å
- -52 - -3
- -3 - -1
- -1 - 0
- 0 - 1
- 1 - 3
- 3 - 15
- 15 - 50
- 50 - 66

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Finström
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0 5 10 15 20 25 km

N