

AGROFORESTRY SYSTEMS IN SWEDEN

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Introduction

Agroforestry Sweden (Agroforestry Sverige) is a national agroforestry association and was formed the 27th of February 2016. The aim of the association is to promote the development and spread of agroforestry in Sweden through national and international collaboration. The association will have activities revolving around agroforestry in its many different forms and give members a platform for sharing information and ideas for practical agroforestry. The association was initiated by a group of people with a variety of backgrounds. Among the participants were agroforestry farmers, researchers, a municipality representative and interested individuals, from different parts of Sweden. The association's formation was preceded by two conferences about agroforestry in Sweden, one in Stjärnsund 2014 followed by the agroforestry congress 2015 in Gothenburg. A great interest for agroforestry was demonstrated during the conferences, and one outcome was the resolution to create an agroforestry association.

This abstract intends to give a short overview of Swedish agroforestry systems, without expecting to cover all existing systems. The country has a long history of agroforestry, but these systems are being used to a lower extent today. The knowledge about strengths and difficulties is still limited, especially with regards to new innovative agroforestry systems. The conditions in Sweden are comparably harsh, with a short growing season and cold winters. This calls for trees that can handle cold winters as well as cold spells during the rest of the year, reducing the number of tree species that can be used in the systems.

Agroforestry Sweden hopes to contribute with increasing the knowledge about agroforestry in Sweden. We hope to inspire to ideas concerning agroforestry and the development of methods for agroforestry, including scientific research and development. In addition, members have envisaged policy work regarding agroforestry systems. These subjects will surely take on more concrete form with time, since the association is still very young. The association wishes to exchange knowledge with agroforestry initiatives in other countries.

Traditional agroforestry systems

Silvo-pastoral systems

The extensive forest has traditionally been used for grazing of cattle, sheep and goats. While forests were traditionally commonly owned and free ranged, meadows and crop fields close to the houses were private and fenced off. Thus the hay was protected and was harvested and saved for winter fodder, while the manure was used as a fertilizer on the crop fields. This agroforestry system has had great economic importance. It was a prerequisite for the economy in the farm households as it contributed with fodder and several other resources and services. Trees and bushes were used for food, feed, fuel, wood and construction material. Charcoal, potash and tar were also produced. Trees like oak (*Quercus robur*), hazel (*Corylus avellana*) and beech (*Fagus sylvatica*) produced bark, leaves and nuts, and mushroom and berries were important food products. The animal grazing had a considerable impact on the structure and composition of the forests. Coppicing was a common way of producing leaves and branches for winter fodder. Trees and bushes were cut close to the ground (30 cm or less), which triggered the growth of a multitude of new shoots that could be harvested within a couple of years. A similar method was pollarding, then trees were cut around 2 m from the ground level which caused massive induction of lateral branches, which were regularly harvested at a maintained height. These are today acknowledged for their cultural and biological values and maintenance is supported by the EU. According to a database of Swedish meadow- and pastureland (TUVA), which is based on national inventories run by the Swedish board of agriculture since 2002, there is at least 58 000 of these trees in the country today, it is however rare that they are actually used for fodder.

In northern parts of Sweden Sami people traditionally keep large herds of semi-domesticated reindeer for meat production, with the reindeer grazing freely in mountainous and forested areas. Wood from the forest is used as building material, fuel and for craftwork, and lichens on

trees are grazed by the reindeer (Sami parliament of Sweden 2015). The right of keeping reindeer this way is reserved for Sami people. The largescale herding and dependency of reindeer started around the 17th century. Reindeer are still kept this way, with a technical development corresponding to the rest of the society. About 2 500 - 3 000 Sami people are today dependent of reindeer for their income, out of the estimated 20 000 - 35 000 Sami people in Sweden.

Summer farms

The system of summer farms (**Figure 1a**) was important for the agricultural expansion and economy in the north of Sweden during 1500 to 1850. Cattle, sheep and goats were taken for free grazing in mountainous areas and used for meat, milk, cheese and butter production. Animals were moved to the farm in early summer and part of the farming family stayed on the site during the summer. The work at the summer farms were often organized conjunctly in the villages and young girls or women were employed for the activity. Today these activities are appreciated mainly for their cultural and natural values, and the management is supported by subsidies in CAP. The year 2014, 201 farms received this kind of support (Ann-Catrin Hedén 2014). According to the national association for summer farms, "Föreningen Sveriges Fäbodbrukare" there are between 250 and 300 summer farms in Sweden.

Semi-natural pastures with bushes and trees

Semi-natural pastures with bushes and trees (**Figure 1b**) are agroforestry systems that due to their contribution to natural values, for example biodiversity, are described as important to reach the Swedish national environmental quality objectives such as; "A varied agricultural landscape" and "A rich diversity of plant and animal life" (Swedish environmental protection agency 2015). Maintenance of such systems are remunerated with EU-subsidies. There are some rules regarding pastures in general which have a bearing on agroforestry. Until 2014, there were restrictions on the number of trees that were allowed on the pastures to be eligible for support. The reason was that Sweden earlier has been criticized for supporting areas with too many trees. From 2015, the ground needs to be covered with vegetation with fodder value to be defined as a pasture, and there are no set limitations on the number of trees allowed. This definition can account for more variation in the Swedish pastures. However, the maintenance of the pasture should not be tailored to benefit the growth of trees (identified for example by evenly spread, straight trees of the same age), in which case the area will be defined as a forest and not receive support (Swedish board of agriculture 2015). The usage of the definition of pasture in different agroforestry systems is vague, but may limit possibilities of getting area-based support.

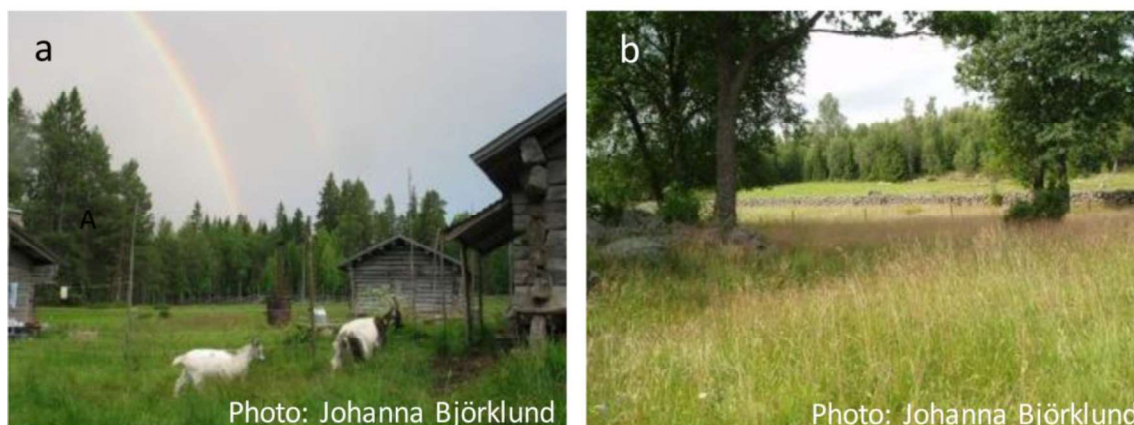


Figure 1: Traditional Swedish agroforestry systems. a) Active summer farm. Especially in northern parts of Sweden, it was common that part of the family and animals relocated to a summer farm where the animals could graze freely in the forest. b) Semi-natural pasture with bushes and trees.

More recent examples of agroforestry

Forest gardens are one type of agroforestry which aims at creating several layers of vegetation, for effective use of light and utilization of the different characters of plant species (**Figure 2a**). This type of agroforestry is also used in urban areas.

Energy forests of mainly *Salix* exist in Sweden today, and are used in agroforestry settings. They can for example be planted in connection to natural islands in the field and in other ways

incorporated in the landscape to increase biodiversity and perform other ecosystem services (JTI 2014). Other examples of tree species used in agroforestry systems are hazel, walnut and fruit trees. Silvo-arable systems (**Figure 2b**) are also tried out, but are, as much agroforestry practice in the country, still in the trial phase.



Figure 2: More recent examples of agroforestry in Sweden. a) Forest garden with species like apple, hazelnut, sea buckthorn and different herbs, part of a research project. b) Silvo-arable system, farmer experiment in a larger project. One hectare of alley cropping in 4 rows. One row with fruit trees, apples and pears, one with hazelnuts, one with saskatoon berries and one with different varieties of sea buckthorn. So far, areas in between the rows are cultivated with annual crops like grain. c) Silvo-pastoral system with pigs rooting in a newly cleared forest to promote reforestation. d) Ecosystem based forestry.

The forest is still a potent resource for grazing. Large forested areas in Sweden give plenty opportunities for keeping animals in conditions which allows more natural behaviour (**Figure 2c**). Animals like hen and pigs are also kept in other agroforestry systems than forests. Ecosystem based forestry systems have the local vegetation type as role model and guideline (**Figure 2d**). This gives them higher biodiversity than traditional production forestry, and production of several wood types. Selective cutting of mature trees and natural rejuvenation of the stand maintain the variety of natural habitats for both plants and animals. A diverse forest with local tree species is more resilient to both pests and abiotic threats like high wind speeds than a planted one layered monoculture.

There are few research projects going on in Sweden today, but we have the impression that there is a growing interest for developing agroforestry systems. Many individuals are trying out new systems and we hope that Agroforestry Sweden can create opportunities for sharing experiences and improve the field together.

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