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# Rerouting Finland's Agroforestry Scheme

***Henri Vanhanen<sup>1</sup>; Rainer Peltola<sup>1</sup>***

*Natural Resources Institute Finland – Luke<sup>1</sup>*

Agroforestry has long traditions in Finland in form of wood pastures and reindeer herding. However latter is nowadays the only form of agroforestry which is widely practiced in northern parts of Finland as area coverage of wood pastures has declined steeply from the beginning of 1950's. Finland has vast resources of forest, the total forest coverage being 71,6 % of Finland's total land area. This number is one of the highest in the world. However, new innovative and active agroforestry measures distinctive to the environment and culture has not been developed in the past though forests hold several, readily available Non-wood Forest Products (NWFP's). Forests have mainly been seen as a source of timber and pulp and the awareness of multiple uses of forest has not come to prominence until 1990's.

Berries and mushrooms are Finland's most important NWFPs. They are collected from the wild for incomes and recreation. The yearly value of forest berry- and mushroom harvests varies from 4 to 25 million € and from 300 000 to 4 million €, respectively. Berry- and mushroom harvests vary greatly between years, depending on weather conditions affecting the flowering, pollination and fruiting body formation. As wild berries and mushrooms are the most important NWFP's in Finland, MTT Agrifood Finland (as from 1.1.2015 Natural Resources Institute Finland – Luke) started to develop innovative, active agroforestry methods for high-yielding and constant berry and mushroom production. Two projects were launched; LUSTI in 2010 and RahaRäaseikkö in 2012. Both of them were funded by the EU Rural Development Programme for Mainland Finland 2007-2013.

Project LUSTI – Securing the Availability of Nature Derived Berries with Cultivation Practices, aimed to test the feasibility of several agroforestry - based cultivation practices to ensure higher and more stable wild berry harvests. Project RahaRäaseikkö aimed to develop mushroom production methods in low productive forests. Both of these projects aim to shape new cultural identity for Finnish agroforestry. These projects are presented briefly in this article.

## **Key words:**

Agroforestry, berries, lingonberry, bilberry, mushrooms, *Inonotus obliquus*

## Introduction

Agroforestry is a traditional land use practice in which livestock is herded or crops are cultivated in forested areas. It is a relatively new name for a very old practice which was once widely practiced throughout Europe. Agroforestry practices are commonly associated with the farming systems in tropics, but in Europe it is the oldest form crop and livestock production (Mosquera-Losada *et al.* 2009). Due to intensification of both agriculture and forestry, agroforestry practices gradually disappeared during the 20th century, when these two land - use practices were considered to be more effective when separated (McAdam *et al.* 2009). In many cases practicing agriculture – especially forest pastures - in forest was considered to be harmful for effective forestry.

Although agroforestry has been in decline in Europe during the 20<sup>th</sup> century, there is nowadays growing interest towards it. More overly it is seen and should be seen as a sustainable way of land management and not as conflicting between agriculture and forestry. Agroforestry systems have been developing especially in southern and central Europe, where forest farming, silvoarable, silvopasture, riparian buffer strips, improved fallow, multipurpose trees, woodland orchards and many other agroforestry practices are adopted (Mosquera-Losada *et al.* 2009).

In Finland agroforestry exists as wood pastures and reindeer husbandry. Beside these, also small scale beekeeping is practiced to produce specialty honey from flowers of forest berries such as bilberry, lingonberry and cloudberry. The areal coverage of wood pastures has declined steeply from the beginning of 1950's reflecting the trend in Europe and the growing importance of forestry in Finnish society (Vainio *et al.* 2001). Reindeer herding which is widely practiced in northern parts of Finland has grown as reindeer meat is seen as highly valued and priced foodstuff. The lack of development of new agroforestry systems distinct to Finland or Northern Europe has not been developed though for example in Finland the total forest coverage is 71,6 % of total land area. This number is one of the highest in the world. Although this resource would offer interesting business opportunities in addition to tree production, new agroforestry systems and related business models are lagging behind as compared to other Europe. As several pulp- and paper mills have been closed due to severe structural changes in Finnish forest sector, there has been demand for new operation models, new forest derived products and services (see Hetemäki *et al.* 2011). Also the change in national forest legislation in year 2014 gives more freedom for the forest owners when deciding forest management practices. It has been stated that joint production of timber and bilberries may have a surprisingly strong effect on both the profitability of forestry and optimal stand management (Miina *et al.* 2010).

Berries and mushrooms are Finland's most important NWFPs. They are collected from the wild mainly for household use and recreation purposes, but also by professional pickers. As mushroom and berry crops in forests are not actively managed, the crops vary greatly between years. The yearly value of

forest berries and mushrooms varies from 4 to 25 million € and from 300 000 to 4 million €, respectively (MMM 2009). The huge difference between years creates challenges for the berry- and mushroom refining industry which is dependent on availability of the raw material. Uncertainty between years decreases the investments in refining and huge amount of the yearly crop is sold directly as a raw material, without refining and increment value from refining.

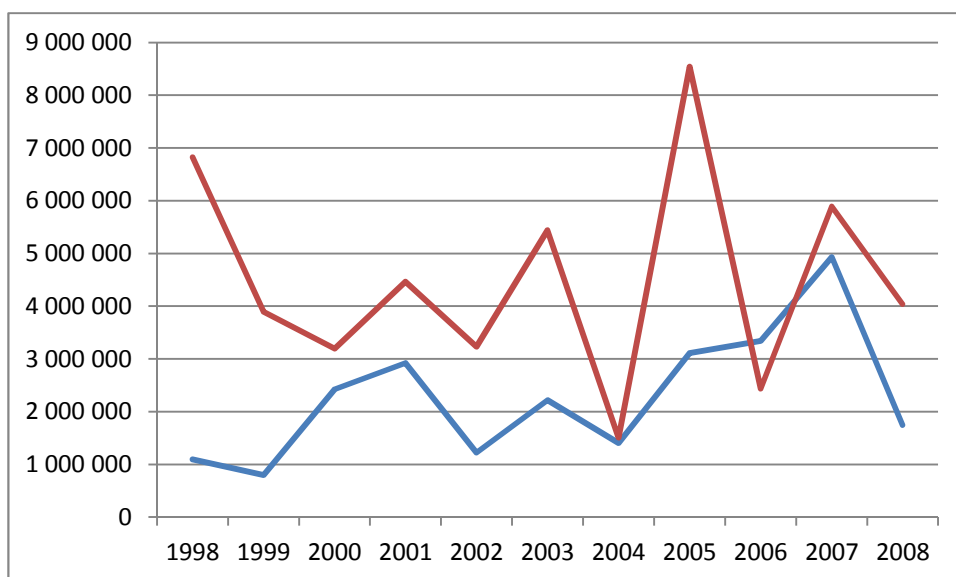
There are several active agroforestry measures developed for both forest berries and mushrooms, but none of them have been trialed or applied in Finland. Mushrooms have been cultivated as an agroforestry practice in China as early as 600 C.E. (Chang 1993) and there are well developed cultivation methods for lowbush blueberry (*Vaccinium angustifolium*) in North America (Yarborough 2012, Drummond *et al.* 2012). In the following chapters we will present two projects which aim to develop innovative agroforestry measures distinctive to the environment and culture. Two projects that were launched were LUSTI – Securing the Availability of Nature Derived Berries with Cultivation Practices and RahaRääseikkö – cultivation of Pakuri (*Inonotus obliquus*).

### **LUSTI – Securing the Availability of Nature Derived Berries with Cultivation Practices**

LUSTI-project started in 2010, it aimed to test the feasibility and economy of several cultivation practices to ensure higher and more stable wild berry harvests from agricultural and forested land in Kainuu and Lapland regions.

Bilberries (*Vaccinium myrtillus*) and lingonberries (*Vaccinium vitis-idaea*) are derived from forests for both domestic and wholesale markets. Currently berries are collected from the wild and Everyman's right, which is applied in Finland and in other Nordic countries, allows collecting them no matter who owns the land. Most of the yearly crop is collected from Northern Finland, North-Karelia, Kainuu, North Ostrobothnia and Lapland but the crop varies significantly from year to year (Picture 1). Currently most of the harvest (80%) is collected by foreign workers, mainly from Thailand, since locals pick berries mostly for household use. These pickers do not have a formal employment relationship. Instead, they act as "freelancers", selling the berries they have picked and covering the expenses through part of their berry-incomes. Foreign berry-pickers have roused a debate in Finland, in which accusations of human trafficking, labour deprivation and misuse of everyman's right have been presented. (Rantanen & Valkonen 2011, Peltola 2013).

Yearly variations of crop and uncertainty of availability of foreign work labour creates unsustainable situation for wholesale markets and refinement industry. Though Finland boasts one of the biggest wholesale companies in the world of wild berries, significant refinement industry is lagging. One of the reasons for this is the unstable influx of raw material.



Picture 1. Yearly amounts (kg) of berries for wholesale markets. Lingonberry – redline, bilberry - blue line. MMM 2009 - Marsi 2008

All of the R&D targets in LUSTI - project (cultivation of lingonberry on agricultural land, developing pollination services/ enhanced pollination (bumblebees, solitary bees) and production of specialty honey for lingonberry and bilberry) aim to increase berry yields in select areas in order to concentrate harvest management and logistics. Preliminary results of the project are promising. In cultivation trials lingonberry yields have been up to 2-5 metric tons per hectare on farmland and with solitary- or honey bee - enhanced pollination on forested land the increase of bilberry harvest has been two- to threefold (Peltola *et al.* 2014, Vanhanen & Peltola 2015, Lasala *et al.* 2015).

In future the project will be continued by adopting more practices from *V. angustifolium* cultivation from North America in order to develop methods especially for forested environment using existing *Vaccinium* vegetation.

### **RahaRääseikkö – cultivation of Pakuri (*Inonotus obliquus*)**

RahaRääseikkö (direct translation MoneyThicket) -project started in 2010 in co-operation with the University of Eastern Finland's Forest Department. Project aimed to develop production methods for specialty mushrooms. The project's target species was pakuri (*I. obliquus*) which grows as pathogen in living birch trees (*Betula* sp.) eventually killing its host. pakuri forms sterile conks on the side of the tree (Picture 2.). The conks are collected and used in, for example, beverages and nutraceuticals. It is highly valued in Asia due to its medicinal properties (Glamočlija *et al.* 2015). Although being an effective pathogen in forests managed for tree production, its value can exceed almost tenfold the value of the tree in which it grows. The stumpage price (€) for birch varies from 16 to 20 €/m<sup>3</sup> (MetInfo 2015). The price of dried pakuri is 30 - 60 €/kg, single birch trunk can host several conks. This makes

active collection and production of pakuri an intriguing option for forest owners as the profit from it goes directly to the forest owner as collecting pakuri is not considered to be a part of every man's right like berry picking.



Picture 2. Pakuri, a sterile conk of *Inonotus obliquus*. Photographer: Kai Pulkkinen.

In Finland, consumption of pakuri in beverages and nutraceuticals has increased.. Traditionally, pakuri was used in Tikka-tea ("Woodpecker-tea"), which was also commercially available. In Asia and Russia the market demand for pakuri is mostly supplied by raw material originating from Far East Russia (Pilz 2004).

In current situation, pakuri refinement industry in Finland obtains the raw material from contract collectors and pakuri is collected from selected areas to ensure high quality of the raw material. RahaRääseikkö project started to test the feasibility of cultivation practices to ensure higher and more stable crop from forested land by using living birch trees as a growing media. Wild pakuri strains were collected from several parts of Finland and the fastest growing strains were selected for field trials. These field trials were started in 2013 and final results are expected in coming years. However, preliminary results were gained in fall 2014 as small scale conk formation was already observed on birches inoculated with *I. obliquus* hyphae.

Cultivation of pakuri is possible in areas in which the tree production is marginal in terms of forestry – i.e. the average tree growth is 0.1 – 1.0 m<sup>3</sup>/ha/yr. In such a case the production of pakuri does not compete with tree production. In some cases cultivation could also be incorporated to current forest

management practices such as thinning. Constant supply of raw material by cultivation would ensure the availability of pakuri for refining industry and improve its competitiveness also in international markets.

## **Discussion**

In Finland time is prominent for R&D of NWFP sector due the changes in the operational environment as new income sources and value chains are sought by both the forest owners and the forest industry.

Finnish forest sector is often seen as conservative and slow regenerating as compared to other, more “modern” sectors like mobile- and game industry or even agricultural sector in which new ideas, innovations and crop plants are swiftly adopted and measures put to practice. This is quite understandable as the cycle time of tree production (time between final felling) is long, 60 – 120 years in Finland. However, wild berry- and mushroom harvests recur yearly and even pakuri should be collectible after 10 – 15 years. With current R&D, yields of NWFPs could be increased with novel agroforestry practices. Some of the processes may evolve bottom-up, without governmental incentives, but as many of the companies in NWFP sector are small and middle sized enterprises their influence is limited when nationwide forestry practices with long traditions should be adjusted. Therefore ruling bodies and authorities in question should be active when seeking ways to adjust regulations which are restrictive and limit the development NWFP entrepreneurship.

New innovations in primary production for NWFP's have and are been developed and also forest management practices are sought to increase the berry and mushroom yields. The profitability of joint timber production and NWFPs may well exceed the profitability of a model in which forests are harnessed for sole timber or NWFP production (Miina *et al.* 2009 and 2010, Turtiainen *et al.* 2013, Kurttila *et al.* 2013). Such a paradigm changes are always challenging, especially in the case of agroforestry, as the agroforestry practices are often considered to be obsolete. However, history teaches us about consequences when well-established practices are valued too much. Back in the 19<sup>th</sup> century, tar was the most important exported product of Finnish forests. When iron replaced wood in ship construction, demand of tar collapsed and many respected tar companies went to bankrupt. Those companies which were enlightened enough to change their business approaches flourished later in, for example, sawmill business.

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## **Contact:**

Henri Vanhanen

Natural Resources Institute Finland – Luke

Joensuu, Yliopistonkatu 6, FI-80101 Joensuu

+358 29 532 6609, [henri.vanhanen@luke.fi](mailto:henri.vanhanen@luke.fi)