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Intensifying wild berry production in Finnish boreal forests

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The forest may at first seem to be quite an unexpected research field for scientists working in MTT Agrifood Finland, although it is administrated by the same Ministry of Agriculture and Forestry as the Finnish Forest Research Institute. Traditionally, Finnish forests have produced raw material for the pulp, paper and sawmill industries, whereas raw materials for the food industry have been produced by agriculture. However, forests produce many NWFPs (Non-Wood Forest Products), which are utilized by the food, pharmaceutical and wellbeing industries. Forest berries are the flagship of these NWFPs in Finland.

Wild berry businesses have long traditions in Finland. The commercial collecting of lingonberries started already in the 19th century, and at the beginning of the 20th century the Grand Duchy of Finland exported several thousand tons of lingonberries every year. Demand for forest berries has increased as knowledge about the health effects of wild berries has increased, although the bilberry is now more valued than the lingonberry. A berry-rich diet has been connected to a lower risk of cardiovascular diseases, obesity and type 2 diabetes. It has been estimated that in Finland these diseases of affluence cost €4–5 billion every year due to the increased demand for healthcare services and lost workdays.

The value of forest berries has been understood in North America, where large forest areas have been harnessed for lowbush blueberry (*Vaccinium angustifolium*) production (Fig. 1). Nowadays the state of Maine has 26 000 hectares of forest floor producing 40 000 metric tons of lowbush blueberry, resulting in an overall economic impact of ca. €180 million every year.



Fig. 1 Lowbush blueberry production in Maine, USA (Picture by Henri Vanhanen, MTT).

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In Finland, forest berries have been considered to be a “free” ecosystem service due to the lack of inputs aiming to increase the berry harvest. However, these inputs can be simple, supporting pollination being probably the most cost-effective. There are only two wind-pollinated wild berry species in Finland, namely sea buckthorn and crowberry. Other berry species rely on insect mediated pollination.

The most important pollinator of Finnish forest berries is the bumblebee (*Bombus* sp.). It has been estimated that a single bumblebee worker can visit several thousand berry flowers within one day, can fly in temperatures close to freezing and its hairy body is optimal for transferring pollen. However, bumblebees are not the only berry flower pollinators. Solitary bees (*Megachilidae*, for example) are also excellent pollinators, but unfortunately the populations of solitary bees have decreased due to modern forestry routines. Unlike ground nesting bumblebees, many solitary bee species require dead wood for their nests. Solitary bees do not live in communities, nor do they nurse their offspring. A solitary bee female lays its eggs in a hole or crevice in dead wood and supports the offspring by placing pollen and nectar into the hole. After this, the female covers the hole with organic material or sand and leaves the nest permanently.

As dead wood is scarce in managed forests, nesting sites for solitary bees can be offered by humans. An artificial nest for solitary bees is very simple. It can be composed of a block of birch or other deciduous tree, drilled full of 10 cm deep, 4 – 8 mm diameter holes. The block is hung roughly 1.5 – 2.0 metres high, so that the nesting holes face northeast (Fig. 2). Whether or not a solitary bee accepts the nest is clearly visible by the end of the summer. Reserved apartments are covered by green leaf-mass or grey sand.



Fig. 2 Artificial pollinator nests in Kivalo research forest (Picture by Henri Vanhanen, MTT)

Preliminary results from research initiated by MTT in 2012 suggest that the pollination efficacy and berry production is higher at up to 200 – 300 metres distance from the artificial nests as compared to more distant areas.

A network of pollinator nests and forest meadows with plants blooming after bilberry supports the pollinator populations during the whole growing season. These are low-cost inputs which may improve the berry harvests remarkably. It has been estimated that in beneficial conditions the value of a berry harvest can even exceed the value of timber production also in Finland. However, it must be emphasised that berry and timber production do not exclude each other. The simultaneous, goal-directed production of forest berries and NWFPs similar to forest berries can increase the overall profit from forests as compared to the situation in which the forest is harnessed to produce only one type of biomaterial.

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