Small Private Forestry in Finland

2016 Learning Tour Summary Report

H. Alexander, Dr. M. Hobbs P.Eng. RPF, P. Burchill RPF, J. Crooker, J. MacDougall RPF

Sponsors

The Forestry Lab (A joint project of NS Woodlot Owners & Operators Association [NSWOOA] & ACOA)
Port Hawkesbury Paper (PHP)
Federation of Nova Scotia Woodland Owners (FNSWO)
NS Landowners & Forest Fibre Producers Association (NSLFFPA)

Table of Contents

Foreword iii

Executive Summary v

1.0 Introduction 1

1.1 Learning Tour Participants 1

1.2 Learning Tour Rout 1

2.0 Forestry in Finland — The Big Picture 3

2.1 Forest Cover 3

2.2 Forest Ownership Structure 3

2.3 Forest Management Approach 4

2.4 Roundwood Markets 6

2.5 National Forest Economy 8

2.6 National Forest Policy: Strategy and Law 9

3.0 Private Forest Land Management in Finland 16

3.1 MTK 16

3.2 Intensive Sustainable Forest Management 20

4.0 A Comparison of the Small Private Forest Sector in Finland and Nova Scotia 23

5.0 Conclusion and Recommendations for Action in Nova Scotia 27

5.1 Next Steps 28

Appendices 30

Appendix 1 – Finland Learning Tour Itinerary 30

Appendix 2 – General Overview of Finland's Forest Ecology 31

Appendix 3 – Forestry Education in Finland 33

Appendix 4 – Typical Forest Management Regime in Finland, Investments and Cost Recovery 36

References 38

List of Tables

Table 1. Land base and ownership comparison of Finland and NS 4

Table 2. Typical Forest Management Treatment Regime in Finland 5

Table 3. Treatment schedule cost and revenues over the full treatment rotation 5

Table 4. Total Harvest of Logs, Pulpwood and Energywood in Finland, 2015 7

Table 5. Finland's Forest Based Markets and Value to the Country 9

Table 6. Comparing the Pohjois–Savo Region of Finland to the Seven Western Counties of Nova Scotia 18

Table 7. Average Forest Owner In Pohjois-Savo Region of Finland 21

Table 8. Stumpage Earnings 22

Table 9. Comparing the Small Private Forest Sectors of Finland and Nova Scotia 23-26

Table 10. Protected Land in Finland 32

Table 11. Forest Investment costs, administration costs and stumpage revenues, 2015 36

Table 12. Average stumpage rates by product, 2015 37

List of Figures

Figure 1. Comparison of Forest Ownership and Wood Supply 4

Figure 2. National annual growing stock volume change ('Increment') vs. harvest volume ('Drain'), 1900-2014. 6

Figure 3. Map of bioenergy facilities in Finland in 2016 11

Figure 4. Volumes of Wood Fuels Consumed for Energy Use in Finland, 2000-2015 12

Figure 5. The organizational support structures for small private forest owners in Finland 17

Figure 6. The Organization of MTK (2011) 17

Figure 7. Five geographic regions covered by the Finnish Government's Regional Forest Centres 19

Figure 8. Two service delivery areas of Finnish Government's Regional Forest Centres 19

Figure 9. Operating profit, per hectare, 1991-2015 22

Figure 10. Average stumpage rates paid in Finland by product, 2015 37

FOREWORD

There has been wide recognition recently that rural economies throughout the province of Nova Scotia are in deep decline and indeed their survival is uncertain. In February 2014, the report from the Nova Scotia Commission on Building Our New Economy (ONE Nova Scotia), entitled *Now or Never: An Urgent Call to Action for Nova Scotians,* stated, "Alarms continue to be sounded; almost every week there are additional voices in the media and other public forums expressing serious concerns about industry failures, slow business growth, faltering employment levels, the loss of young people and skilled workers to other provinces, and the shrinking viability of many rural communities."[1] The ONE Commission consulted with a lot of Nova Scotians in community meetings and concluded that the situation is more to do with our attitude and culture. The Commission stated there are problems with isolation, competition and conflict in Nova Scotia and the way to overcome them is through dialogue, collaboration, and co-operation. The report shows that there is a need for fundamental cultural change in Nova Scotia to produce economic change.

In 2015, the Nova Scotia Woodlot Owners and Operators Association (NSWOOA) wrote about similar challenges and problems of decline in Nova Scotia's forest sector because of "market pressures, economic downturns, mill closures, and supply constraints."[2] The scope of challenges is significant enough that stakeholders and communities of interest must collaborate across their differences to find workable solutions. Rather than continuing to expect someone else to solve their problems, the NSWOOA, with financial support from ACOA and the Nova Scotia Department of Natural Resources, initiated the Forestry Lab, modelled on similar labs in other countries which have been able to become "stable platforms to support the work of understanding a problem and experimenting to find a solution".[3] The social lab methodology is uniquely designed to offer a process of innovation and transformation.

Early in 2016 the NSWOOA approved funding for a project entitled "Forestry Learning Tour to Finland," as one of the prototype projects of the Forestry Lab. Finland was chosen for the tour because of forest sector similarities to Nova Scotia, having similar land ownership demographics, similar forest growing conditions and most importantly because Finland is considered a world leader in the successful management of small private forests. The tour took place in the fall of 2016 when a group of five advocates for Nova Scotia woodlot owners went to Finland to observe the organization and management of small private woodlots. The tour group talked to landowners, teachers, forestry equipment manufacturers, foresters and government representatives. The members picked up on the intensity of the atmosphere and after a few days started to call it the Finns' *focus on forestry*. Their gaze is fixed ahead. They anticipate demand with excellent R&D budgets for engineered wood, paperboard, bioenergy and the emerging bioeconomy markets. They assure supply by making intelligent investments in woodlot owner support, forest inventory and contractor training. The group met woodlot owners with a deep connection to their forest who also have business acumen. They invest in silviculture on their own forest land in order to supplement their future income. They employ others in their forests. It is their culture.

Like the ONE Nova Scotia Commission, this report from the Finland tour group recognizes the need for a cultural shift. It is imperative to create a sustainable forest culture in the province that runs as deep and strong as the forest culture in Finland. The Acadian forest should be celebrated and our forests should help bring our people sustenance. The prosperity of our rural areas is no mystery: it is tied up in the standing resource that is our forest. It is as plain as the trees outside your window.

The Finnish focus on forestry can help us imagine a new approach to socio-economic benefits in rural Nova Scotia. This is the Forestry Learning Tour Group's vision for small private woodlots. Creating a forest and wood products industry, rooted in the economic, social and cultural benefits in Nova Scotia tops our list of five key messages:

1**. Culture and attitude**: The culture of forestry needs an attitudinal shift from negative to positive. This group can explain and show that forestry can be a safe economic driver and provides paid employment, just like any trade. Forestry in Nova Scotia should be a good news story.

2. Strong landowner support network: Like MTK, the Finnish regional and national forestry entity, there needs to be a single, unified, provincial lobby for woodlot owners in Nova Scotia. With multiple local offices like Finland's Forest Management Associations (FMAs), providing forest management advice and related services to woodlot owners throughout the province, it would be possible to link with farming interests, as the Finnish lobby has done.

3. **Intensive Sustainable Acadian Forest Management:** It is necessary to update our Forest Strategy in Nova Scotia with regional-specific goals for annual roundwood harvests and to intensify sustainable management efforts to meet these goals. There is an abundant, underutilized standing forest resource on small private woodlots in Nova Scotia. Finland manages to produce over three times as much annual wood supply per hectare of forest land than is done in Nova Scotia. The tour group believes there is significant room for economic growth in Nova Scotia's forest sector.

4. Intensive Market Development: With a fully integrated forest product value chain that includes conventional forest products *and* new products in paper, construction, materials, and the bioeconomy, like food and pharmaceuticals, there could be market development. Finding low-grade markets, while leaving enough biomass in the woods would be a first goal. Bioenergy plants for district heat and power in Finnish towns have created a domestic demand for low-grade wood that is scalable to Nova Scotia towns. We need regional forest products market development teams to work toward this goal.

5. High-quality Forest Inventory and Information Transfer: Gathering data for a reliable forest inventory, and implementing IT systems to make the data publicly available and the analysis user friendly would be a critical help in forest management planning, motivating woodlot owners and attracting investment. It is necessary to see proof of a guaranteed long-term sustainable wood supply before attracting investors.

All of this will take a long-term strategy for providing stable investment, a policy framework and regular consultation with the stakeholders. In 2007, the Finns launched a plan to triple the investment in R&D in forest products by 2030, and this long view makes it possible to improve conditions for intensive sustainable forest management and for intensive market development. When municipal and provincial governments recognize forestry, they will recognize that a sustainable wood supply, improved roundwood markets, increased forest products manufacturing, provide economic growth and job creation.

EXECUTIVE SUMMARY

There are social and economic barriers to small private forestry in the Nova Scotia, which the people of Finland seem to have overcome. From September 29 to October 5, 2016, five woodlot representatives from Nova Scotia travelled to Finland on a learning tour funded by the Forest Lab and by ACOA to study Finnish woodlot management, marketing and governance. The purpose of the trip was to explore the question as to why the Finns are so successful in small private forestry in comparison with Nova Scotians. The goal was to bring back best practices, especially with regard to using or reusing pre-existing systems and organizations.

This report is a summary of the findings from the Forestry Learning Tour. The evidence of a small, self-sustaining private forestry sector in Finland made the trip very worthwhile because the authors were able to see best practices that could be applied in Nova Scotia. The tour group noted that the Finnish government has played a role in achieving conditions where woodlot owners can organize, carry out silviculture treatments and access domestic and international markets for their wood products, as well as provide training and education. In this way they have assured both supply and demand for woodlot owners today.

In order to create a fully integrated framework for woodlot owners in Nova Scotia, and to better manage the resource, the authors have identified five key areas:

1) Culture and attitude: Nova Scotian culture around forestry needs to change, starting with government engagement and encouragement, at the municipal and provincial levels.

2) Strong landowner support system: there should be a way to coordinate existing supports for woodlot owners, give them access to services and formal channels of communication with government, and a forum for sharing best practices.

3) Intensive sustainable forest management regime: early and periodic silviculture treatments have to be built into an expanded silviculture program designed to suit and sustain the health and structure of the Acadian forest.

4) Intensive market development: there is a need for a fully integrated forest product value chain focused especially on markets for low-grade wood. A bioenergy strategy for the province is needed immediately. A bioeconomy strategy is also needed for the province to keep pace with engineered wood products innovation and chemical derivatives over the longer term.

5) Quality forest inventory and information sharing: with a reliable forest inventory and good infrastructure (IT, transportation), the province can attract investors. This will happen when there is a guaranteed long-term sustainable wood supply.

The authors believe that the future of the forest sector depends on a renewed framework, and that acting on these five main points will begin the process of invigorating the industry. The outcome will add to the overall health of the rural economy, providing paid labour, and, in addition, giving better management to the resource.

1.0 Introduction

Finland is one of the dominant wood-producing nations in Europe. It has been intensively studied over time because it is a world-renowned model of intensive forest management, in particular for the success of small private forests. These woodlots currently generate 80 percent of the supply in a massive forest industry that generates significant economic benefits for the country, so much so that the Finnish people consider forests to be their "Green Gold".

The Finns' success in managing their small woodlots interested a group of Nova Scotia woodlot owner advocates. From September 29 to October 5, 2016, five representatives of the industry participated in a learning tour of woodlot management, marketing and governance in Finland, gaining insight into the policies and practices of their Finnish counterparts. The delegation was sponsored by the Forest Lab, a collaborative research project, with the goal of understanding why this is a vibrant sector in Finland compared to Nova Scotia, despite a similar forest ownership structure. With the majority of forest land in small private holdings in both places, it was felt that lessons could be learned from the Finnish model that would benefit the economy of rural Nova Scotia.

This report is a summary of the findings from the learning tour showing that the Finns have best practices that can be adopted in Nova Scotia in order to build capacity. This is not a proposal to replicate the forest management treatment regime in Finland because it is not wholly applicable to our more complex forest. Reviewing practices, building momentum, and effecting positive social change in rural Nova Scotia will help set a path towards a gradual improvement in the management of small private forests.

1.1 Learning Tour Participants

The team of delegates was made up of staff and board members from three provincial woodlot owner organizations (NSWOOA, FNSWOO and NSLFFPA) and two new regional woodlot service organizations (Service Areas) being piloted in Cape Breton and western Nova Scotia. They brought a wide range of experience in private woodlot ownership, entrepreneurship, consulting and extension service delivery to landowners, as well as knowledge in wood procurement and sales, contracting and sawmilling.

The tour was partly hosted and organized by staff of the Finnish organization MTK, the Central Union of Agricultural Producers and Forest Owners. It is a service organization for forest owners and farmers and works regionally and nationally with local Forest Management Associations (FMAs) by representing and lobbying for the interests of hundreds of thousands of Finnish woodlot owners in national sessions of government and at the European Union (EU) in Brussels. It is significant that MTK is responsible for furthering the interests of both farmers and forest owners.

1.2 Learning Tour Route

The tour group travelled north from the MTK office in Helsinki, the nation's capital, to the city of Kuopio, in a central forest region called Pohjois- Savo (also called Northern Savonia or North Savo). Pohjois- Savo was selected as a case-study region because it shares some forest and demographic traits with western Nova Scotia. Within this region there are 4 FMAs, one of which is located in the Kuopio area called Metsanhoitoyhydistys. Staff from this FMA and the Pohjois-Savo region hosted the tour group for two

days in the Kuopio area. They provided good insight into the direct services provided to small private woodlot owners at the local level by the FMA, and organized a visit with a woodlot owner's family. The family gave a presentation in their living room on the importance of small private woodlot management planning, woodlot economics and operational logistics. The delegation was impressed with the family's knowledge of the inventory and harvest decisions on their woodlot.

The tour consisted of these additional host sites (for dates and durations refer to the itinerary in Appendix 1):

- Suonenjoki Forest Seedling Nursery and Research Station. The National Research Institute, Luke (formerly Metla) provided a tour of their tree seedling research facility and staff gave a series of presentations on current research topics at Luke.
- Observation of an outdoor forestry machine-operator training class at one of several vocational colleges in Finland that provide state-funded training programs, one to three years in length.
- Kuopion Energy Oy. A tour of a large 420 MW bioenergy plant that supplies district heating and electricity to Kuopio. Managers gave presentations on current trends in Finnish bioenergy production, consumption, research and market challenges.
- Tour of the Ponsse plant. Staff of Ponsse, including one of the four brothers who inherited the company from their father, provided a plant tour and presentations describing their evolution from a small-town forestry equipment manufacturer to cutting-edge developers of nimble equipment and decision support systems software. Their machines and software, and especially their particular quality of family-oriented customer service, have helped them become a world leader in cut-to-length harvester and forwarder manufacturing, sales and service. Ponsse also provided a field visit to a thinning operation to see their latest model, the Ponsse Scorpion harvester, at work.

The itinerary was varied and gave a cross-section of forest activity in Finland. Importantly, it gave tour members a basic sense of national vs. regional and local-level, small, private-forest policy and organization. Upon return to Nova Scotia, tour members did additional research to complete descriptions of forestry in Finland as a nation (*See* Section 2.0 Forestry in Finland – The Big Picture), and, small private forestry in the rural regions that make up the Finnish countryside (*See* Section 3.0 – Private Forest Land Management in Finland).

2.0 Forestry in Finland — The Big Picture

One outcome of this tour was that the delegation gained insight into how Finnish forestry functions at the national level. In the following sections the authors share their findings about forest cover, ownership structure, forest management approach, the country's current growing stock and wood supply, forest inventory and information management, forest economy, forest policy, bioenergy strategy, ecologic concerns, forest certification, carbon management and forestry machine operator training.

2.1 Forest Cover

Finland is a land dominated by forests that fall within the Boreal Coniferous Forest Zone of Northern Europe. The commercial forestry focus is on the three dominant species: Norway spruce (*Picea abies*), Scots Pine (*Pinus sylvestris*) and Silver Birch (*Betula spp*.).

Finland is a northern country, but the area south of the Arctic Circle benefits from an enhanced growing climate due to the warm air of the Gulf Stream and relatively low wind exposure. The risk of blowdown from thinning appears to be lower in Finland than in Nova Scotia. Stem form was also noticeably better than Nova Scotia, with very straight trees. This may have something to do with the superior genetics of the seedlings used to reforest after harvest across Finland. In Nova Scotia, exposure to wind from the open ocean results in problems with tree blowdown and deformity. An overview of Finnish forest dynamics and ecology is provided in Appendix 2.

Finland's topography is fairly level with low hills and numerous lakes. The topography in Nova Scotia is more challenging for forestry operations, particularly in central and eastern counties where stream crossings and hilly slopes limit access.

2.2 Forest Ownership Structure

Forest ownership demographics in Finland are very similar to Nova Scotia, with private small-forest owners controlling 60 percent of the forest land. There are 346,400 private woodlots of at least 2 hectares in Finland. There are 632,000 woodlot owners (if each owner of a shared holding over 2 hectares is counted). This means that about 13 percent of the total population of 5 million people in Finland, or, 1 in every 8 people, is a woodlot owner. This is a large proportion of the population and it appears that the majority of landowners are active. The remaining forest area in Finland is predominately owned either by the government or by large industrial interests. The state owns 26 percent of Finnish forests, including 13 percent which are protected lands. State lands are managed by an agency called Metsähallitus.

The mandate of the learning tour was to study small private forest land management in Finland, with very little attention paid to management of industrial or state lands. Table 1 and Figure 1 compare the breakdown in forest land ownership between Finland and Nova Scotia and relative wood supply generated by private forests.

Table 1. Land base and ownership comparison of Finland and NS (Source: Metsähallitus and Nova Scotia Department of Natural Resources)

Region	Total Land base (ha)	Forested Land base (ha)	Protected or Strict Reserve* Land	Private Land Ownership	Wood Supply from Private
Finland	30,000,000	22,820,000	13% of total	60% of total	80%
Nova Scotia	5,258,400	4,240,000	14% of total	53% of total	63%

* In Nova Scotia, most of this is Crown Land, which in Finland would be translated as state land.

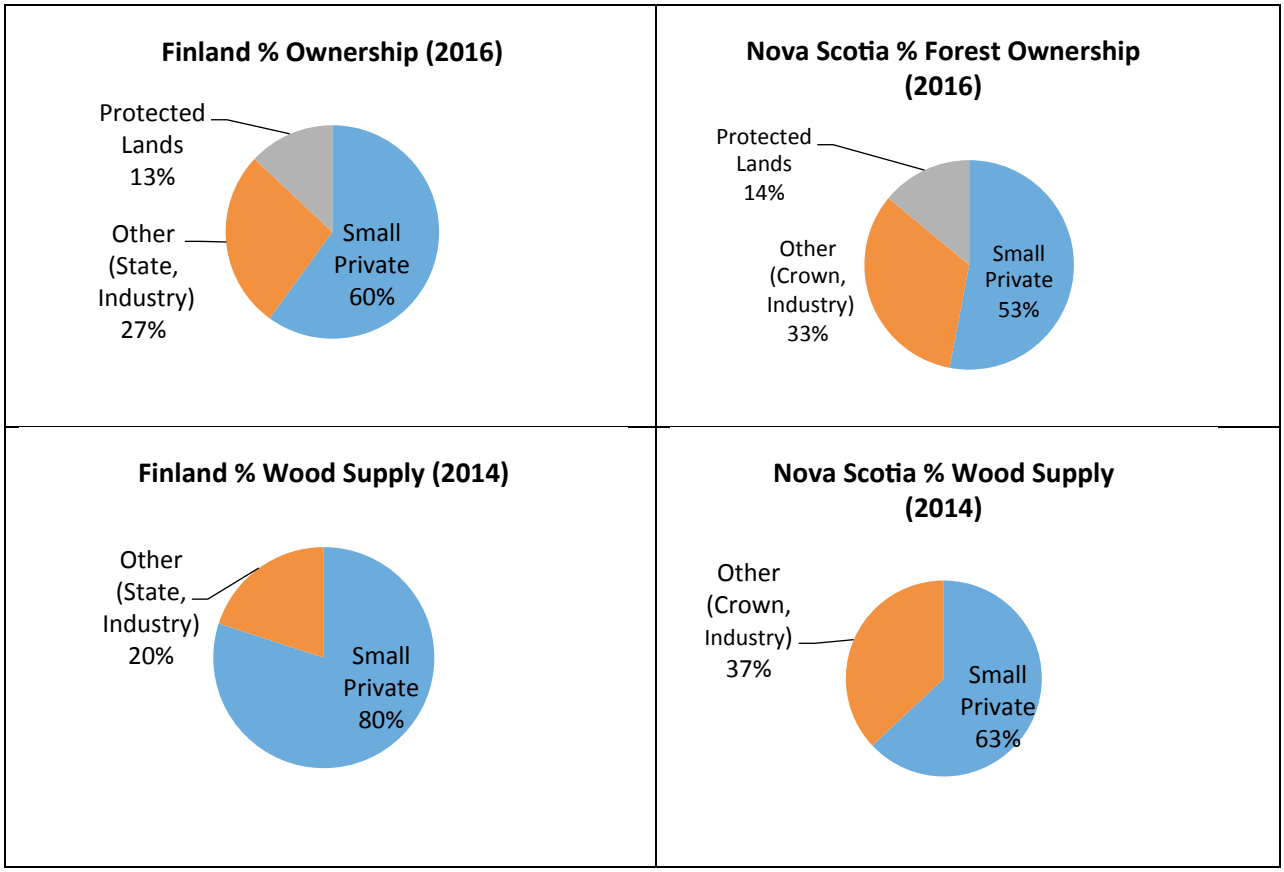

Figure 1. Comparison of Forest ownership and wood supply

2.3 Forest Management Approach

Finland is historically a forestry nation, with strong forest legislation dating from 1886 and an intrinsic forestry culture that runs deep in its people. There were concerns in the 1960s and 1970s that harvest levels were exceeding annual forest growth. To correct this, major investments were made in silviculture by government through the following twenty years. This included site preparation and seedling management, thinning at intervals to maximize yields over the full rotation and ditching 5 million hectares of poorly drained forest land to improve tree growth. The damage of ditching to wetland ecology has been recognized and has recently been curtailed by the Finnish government.

Planting and thinning remain the mainstays of Finnish forest management. The majority of forests in Finland today are of plantation origin and are thinned several times over the average stand rotation of 70-100 years. For example, 73 percent of the 612,000 hectares of forest land harvested in Finland in 2015 were merchantable thinnings. Table 2 describes the typical forest management treatment regime in Finland currently and Table 3 provides the expenses/revenues associated with each treatment.

Table 2. Typical Forest Management Treatment Regime in Finland

Table 3. Treatment schedule cost and revenues over the full treatment rotation

1. Age 0. Regeneration — Following harvest, all sites are regenerated either through planting (~65%) or direct seeding (~35%). All cutovers are site prepared with machines through mounding (rich sites) or scarification (poor sites).
2. Age ~5. Early competition control — All stands are manually or mechanically weeded of early competition to favour planted or seeded regeneration.
3. Age ~10-15. Second stage competition control — Depending on the site, a second early weeding is scheduled to reduce competition and allow 'free to grow' selected trees.
4. Age ~25-30. First merchantable thinning — First thinning in which the landowner receives some stumpage revenues and begins to see a return on their investment; primarily pulp and / or bio-energy wood (lowest grade) are removed.
5. Age ~45 – 65. Second merchantable thinning — As with the earlier thinning, the poorest quality trees are cut at roughly one-third removal, leaving the best quality trees growing for the final cut. While some logs are produced, most of the product is pulp and bio-energy wood. On the best sites there may be a third thinning but this does not appear to be the norm.
6. Age ~80-100. Final harvest – Clearcut. Most of the wood harvested is logs which are optimized to the highest end value. This stage offers the full economic return to the landowner with funds set aside for the forest rotation to begin anew by planting or seeding.

(Source: Metsähallitus)

Forest Management Treatment Regime in Finland				*based on exchange of $1.51 Can./1 Euro)	
Age	Treatment	Cost *($/ha)	Subsidy *($/ha)	Revenue *($/ha)	Net Income *($/ha)
0	Regeneration (site prep and seedling establishment)	$ 2,265.00			$ (2,265.00)
5	First Weeding	$ 604.00	$ 241.60		$ (362.40)
15	Second Weeding	$ 755.00	$ 347.30		$ (407.70)
30	First Merchantable Thinning			$ 755.00	$ 755.00
55	Second Merchantable Thinning			$ 3,020.00	$ 3,020.00
90	Clearcut			$ 18,120.00	$ 18,120.00
				Net Income	**$ 18,859.90**

When travelling the roads of Finland, it is difficult to see any forest stands of any age that have not been thinned. Intensive forest management of forests for commercial use is commonplace. In Nova Scotia, the opposite is true, where intensive forestry is the exception rather than the rule and seeing thinned stands along the roads is actually rare.

2.3.1 Current Growing Stock and Wood Supply

Following more than 40 years of intensive silviculture shepherded by the government of Finland, the country is now benefitting from a significant surplus in forest growing stock. The total standing timber in Finland is 2.3 billion cubic metres. The annual growth is 104.5 million cubic metres with a current surplus growth over annual harvest levels of 23 million cubic metres per year. Figure 2 shows how the forest growing stock increased in Finland from 1965 to present, while harvest levels also increased during the same period. These increasing harvest levels coincide with a significant expansion in Finland's forest sector since 1965. The current excess of annual forest growth over annual harvest gives Finland a huge advantage in attracting new investment in their forest sector. The very sophisticated forest inventory information available in Finland enables this enviable situation.

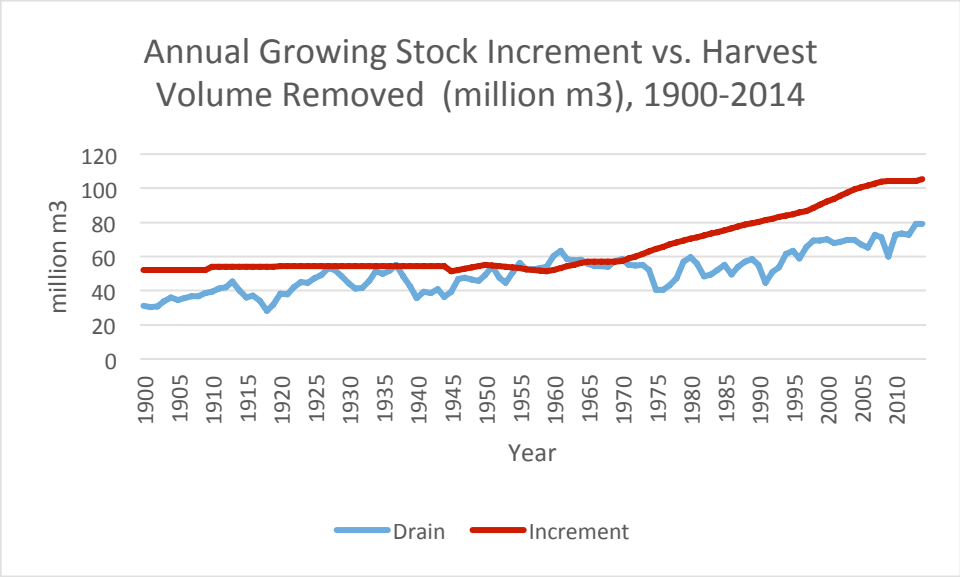

Figure 2. National annual growing stock volume change ('Increment') vs. harvest volume ('Drain'), 1900-2014. (Source: National Resources Institute Finland)

2.4 Roundwood Markets

Roundwood markets in Finland are expansive and well developed for any of the three major commercial species, regardless of tree size. All wood fibre harvested in Finland is sorted for the highest end value and there is a constant effort to improve efficiencies along the full value chain. The effort pays off in the collective prosperity for woodlot owners (stumpage), harvesting contractors, truckers, industry, and governments (taxes). Currently, woodlot owners and forestry operators in Nova Scotia are having difficulty finding and accessing roundwood markets and can only dream about the sheer magnitude of the roundwood markets for all grades of wood now existing in Finland. Table 4 shows the breakdown of the roundwood harvest in Finland for 2105, with 64 percent of the harvest being pulpwood and energywood.

Table 4. Total Harvest of Logs, Pulpwood and Energywood in Finland, 2015 (Source : Luke Natura Resources Institute, Finland)

Primary Product	Harvest (m3)
Logs	24,873,000
Pulpwood	33,976,000
Energywood	9,186,000
Total Harvest	**68,035,000**

In Finland:

1. Highest quality sawlogs of all three major species go to veneer mills.
2. Tree sections (bolts) greater than 15 cm top diameter, of all three major species, go to sawmills.
3. Bolts with 7-15 cm tops of all three major species go to pulp, paper or paperboard mills.
4. Remaining small trees and tops, branches and occasionally stumps, go for biomass and are chipped as fuel, mostly for district bioenergy plants.

The highest value to Finnish forest owners is the log market for the wood products industry, accounting for 43 percent of the harvest but three times the stumpage price of pulp.

2.4.1 National Forest Inventory and Information

Finland has a comprehensive and continually updated forest inventory. It has the highest proportion of private land inventoried in the world (10 Million ha). The inventory goes back over 150 years. Early attempts at resource inventory began in 1858, becoming more or less official by the 1920s. Satellite imagery and digital map data were introduced in the early 1980s.[4]

Forest growing stock and the annual harvest are rigorously documented. Forest treatments are registered in advance and all harvest volumes are documented and summarized by product by region.

The online availability of data made public from the Finnish Forest Research Institute is remarkable. The summary information is publicly available online by region through downloadable data files. These are updated monthly. The MultiSource National Forest Inventory (MSNFI) used in Finland today includes LiDar (Light Detecting and Ranging) data combined with field inventories and previous technologies for publicly available forest statistics and thematic maps.[5]

The forest statistics and other information produced by the MS-NFI are used in the following ways:

- Forest policy at national and international levels
- Regional and national forest management planning
- Planning of forest industry investments
- Assessing sustainability of forestry and forest certification
- Evaluation of greenhouse gas emissions and changes in carbon storage
- Research

The Finns are able to plan because of the wealth of forest inventory data like this, and the open and frequent information sharing. Obviously, the high quality of Finland's national forest inventory allows for accurate sustainable harvest projections and growing stock calculations. The open sharing of high quality inventory data has led to progressive management planning and really stimulated the use of forest resources over time. Having accurate wood supply projections also helps to attract foreign investors.

2.5 National Forest Economy

Forest products are the number one export from Finland, totalling roughly €11.6 billion ($17.5 billion CAD) in 2015.

Pulp and paper industries account for over 80 percent of exports and are a main driver of the forest industry, accounting for $11 billion CAD in exports and 50 percent of the harvest. While most of the world experienced a decline in pulp and paper production after 2008, the Finnish Industry reorganized by adapting some mills to produce new products like paperboard and by attracting additional pulp mills.

The total forest industry production was valued at almost €20 billion ($30 billion CAD) in 2013. The forest industry accounts for 4 percent of GDP and 160,000 direct and indirect jobs in Finland. According to a 2016 Gardner Pinfold report for Forests Nova Scotia, the Nova Scotia forest sector generated 11,500 total jobs in fiscal 2015. This means that Finland currently generates approximately 3 times as many jobs per hectare of forest land as Nova Scotia. It is not unreasonable to think that Nova Scotia could add 10,000 new jobs in the forest sector over the next several decades with an improved forest strategy and effort.

In 2013, there were 49 pulp, paper and paperboard plants and 190 large industrial sawmills in Finland. Domestic roundwood production totaled 68 million cubic metres in 2015. Over 9 million cubic metres was consumed in the form of chips from stumps, small trees and logging residues for bioenergy. In Table 5 there is also an accounting by agencies like Statistics Finland, the Natural Resources Institute of Finland and the Bioenergy Association of Finland to track non-timber market values like recreation, berries and game husbandry specific to Finnish customs and culture. It is telling how the government values and tracks these small, specialized markets like any other commercial market (Table 5).

Table 5. Finland's Forest Based Markets and Value to the Country (Source: Statistics Finland; Natural Resource Institute Finland; Bioenergy Association of Finland; *preliminary data)

Forest Based Market	Value (1000 euros)
Pulp and paper industry, gross value of production (2012)	€ 12,945,000
Wood product industry, gross value of production (2012)	€ 5,578,000
Stumpage money income, gross	€ 1,950,000
Nature tourism, estimated value added (2011)	€ 1,226,000
Forestry, output at basic price*	€ 4,216,000
Energy, garden and environment peat, estimated total turnover (2012)	€ 300,000
Forest chips + fuelwood, value at the place of use	€ 361,000
Berries, mushrooms and lichen, trade value + estimate of household use, direct sales and sale in open-air market places (2012)	€ 220,000
Game husbandry, calculated value	€ 64,000
Reindeer husbandry, calculated value	€ 15,000
The value of recreational use of forests by pricing the visits to forests for outdoor recreation has been calculated at about 1.93 billion euros a year.	

2.6 National Forest Policy: Strategy and Law

Finland has a long history of implementing forest policies that anticipate the needs of future generations because successive governments have understood the significance of the forests and forestry to the nation's economy. Finland's assertive and innovative forest legislation, started in 1886, has had a profound effect on the country's forestry resource, working on the principle of using the carrot, not the stick, to motivate people to comply. Consistent with their culture, Finnish forestry laws operate on a philosophy of co-operation, consensus and incentives.

The Private Forest Act of 1928 set up a forestry extension service to help small forest owners. Some innovations of this Act were:

- the requirement to replant after harvesting
- limits on how much land companies can acquire, thus helping maintain the small private ownership structure
- creation of forestry organizations to supervise and assist private forest owners to meet requirements under the Act.

In the 1960s financial subsidies were created as incentives for silviculture, and in 1996 the Act on the Financing of Sustainable Private Forestry set out a schedule for grants from government to small forest owners for government sanctioned silviculture and harvest activities.

Finland's national forest laws and forest strategy were updated in 2014-15, giving direction for the management of the resource until 2050.[6] The intent of the reforms is to promote biodiversity,

profitability, energy wood, and freedom of choice for forest owners. The document states objectives for the next 10 to 35 years. Eleven specific projects were designed to implement the strategy. In addition to ecological benchmarks, encouraging more uneven-aged forest treatments, silviculture investment forecasts, carbon sequestration estimates, social benefits and numerous other indicators, there are stated targets of

- an increase in annual forest growth by 10-30 percent by 2050 (from 99 million to 130 million cubic metres per year)
- 15 million cubic metres of forest chips used for solid fuel energy use by 2025
- public infrastructure funding for secondary private and public roads to support forestry network
- public infrastructure funding for a railway network that supports timber transportation
- an additional 15 million cubic metres of annual harvest by 2025.

Today, in Finland, the portfolio of the Ministry of Agriculture and Forestry is comprehensive. Forestry is one of twelve files including food, fisheries and rural areas. In addition to five regional Forestry Centres, the ministry operates the natural resources research institute, Luke (formerly called Metla), and the state forest enterprise Metsahallitus.

The current government is also looking ahead to the new bioeconomy. The Strategic Programme for the Forest Sector worked in conjunction with the Ministry of Employment and the Economy to get the market conditions and precursors right by 2015 for wood products use, exports and the new bioeconomy. Forestry is part of their 'green' bioeconomy strategy, which includes the high-end refinement of wood fibre into chemicals, pharmaceuticals, cosmetics etc. for export markets.

The benefits of these policies and statutes in Finland were very obvious to the Forestry Learning Tour Group in 2016. They include a culturally intact sense of pride in the nation's forests, as well as recognizing forestry as a major economic driver, and as a result, an incredible forest setting for a people who vigorously embrace outdoor activities.

2.6.1 Bioenergy Strategy

The use of wood biomass for generating energy (both heat and electricity) is a growing component of the forest sector in Finland, and is a high priority for its current government. Through a country-wide effort in the last decade, the bioenergy share of the heat and electricity generation market in Finland has increased almost four-fold, from 8-9 percent ten years ago to 30 percent today. There are over 800 heating and power plants which use wood chips. These range in size from small (1-4mW) local-level heating centres to large CHP (Combined Heat and Power) district heating and electricity production centers which can generate more than 400mW (see Figure 3).

Kuopion Energia, a large combined heat and power plant in Kuopio City, was visited by the forestry tour group. The plant was located in a residential neighbourhood, beside a lake.

Biomass supply can come from thinning and harvest waste or mill residues. Small trees thinned from young stands and branches, tops, stumps and otherwise unmerchantable stemwood from harvesting operations. The material is piled on the forest site to dry for one season (six months to a year) then brought to roadside where it is covered in a tarpaulin for another six months to a year. Then it is chipped and delivered to a nearby district heating plant or sold into the bioenergy market. The piles are covered

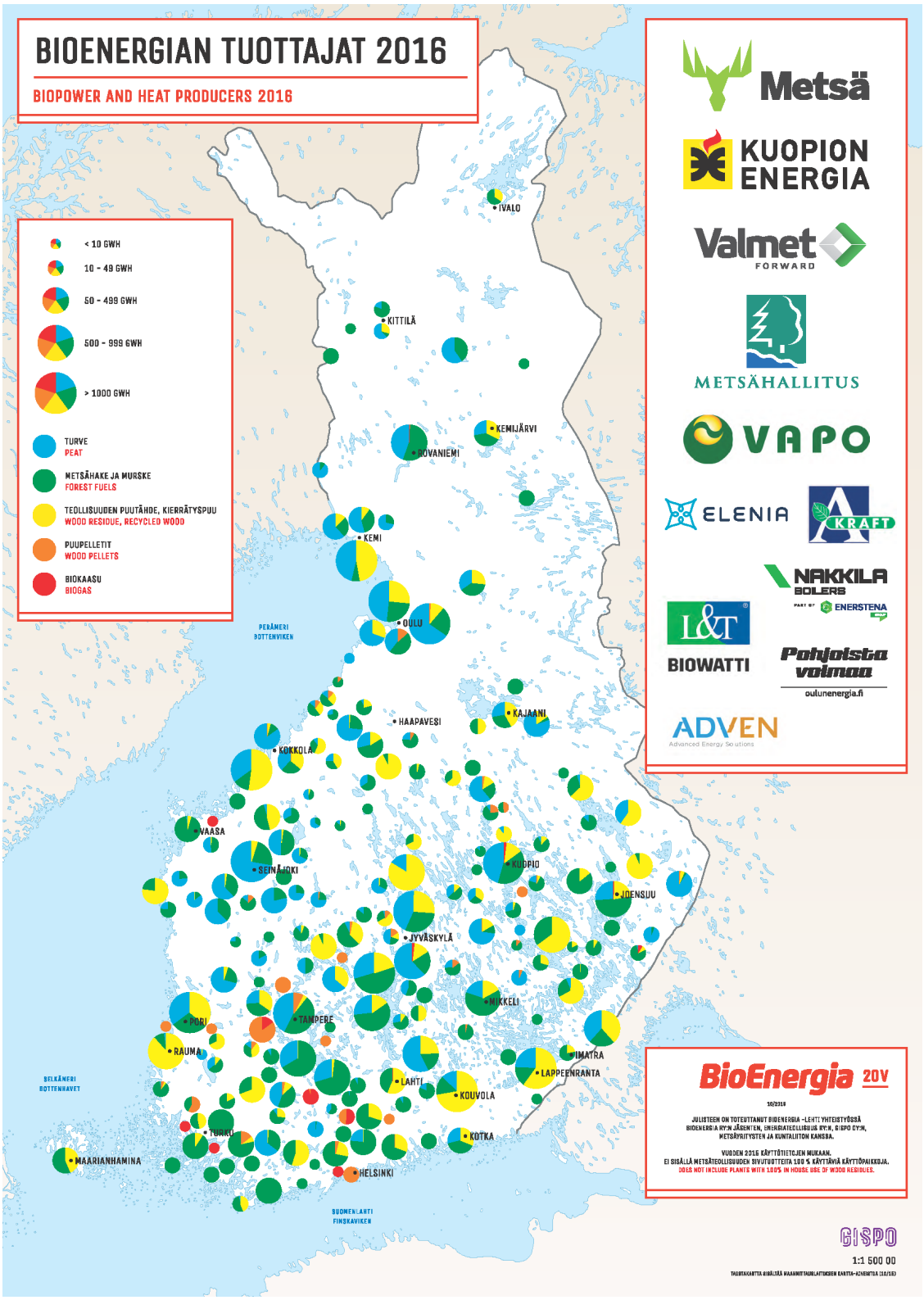

Figure 3. Map of bioenergy facilities in Finland in 2016

to aid the drying process and keep snow off, since most forest residues are chipped in winter during peak heat loads. This biomass is referred to as energy wood in Finland. Significant quantities of biomass also come from forest industry residues such as bark, sawdust and shavings. Table 4 (page 7) shows the volume of energywood produced relative to pulp and roundwood in Finland in 2015.

The two main drivers of the recent nationwide growth of the bioenergy industry in Finland are

1. The European Union initiative to cut greenhouse gas emissions by 40 percent in 2030 from 1990 levels. Burning forest biomass to generate energy is considered to be carbon neutral compared to burning fossil fuels in Finland.
2. The financial benefits to the Finnish economy by improving energy self-sufficiency through using locally grown and produced forest biomass to replace imported coal from Russia.

District heating plants provide significant markets for energy wood for the Finnish forest sector. The rise in the consumption of chips for energy from 2000 to 2015, shown in Figure 4, is the result of the effort to increase the use of low-grade wood from harvest sites for bioenergy. This pays the landowner a small amount (~2 € per cubic metre) but it is an important link in the value chain and helps maintain the domestic market created to meet national energy-use targets.

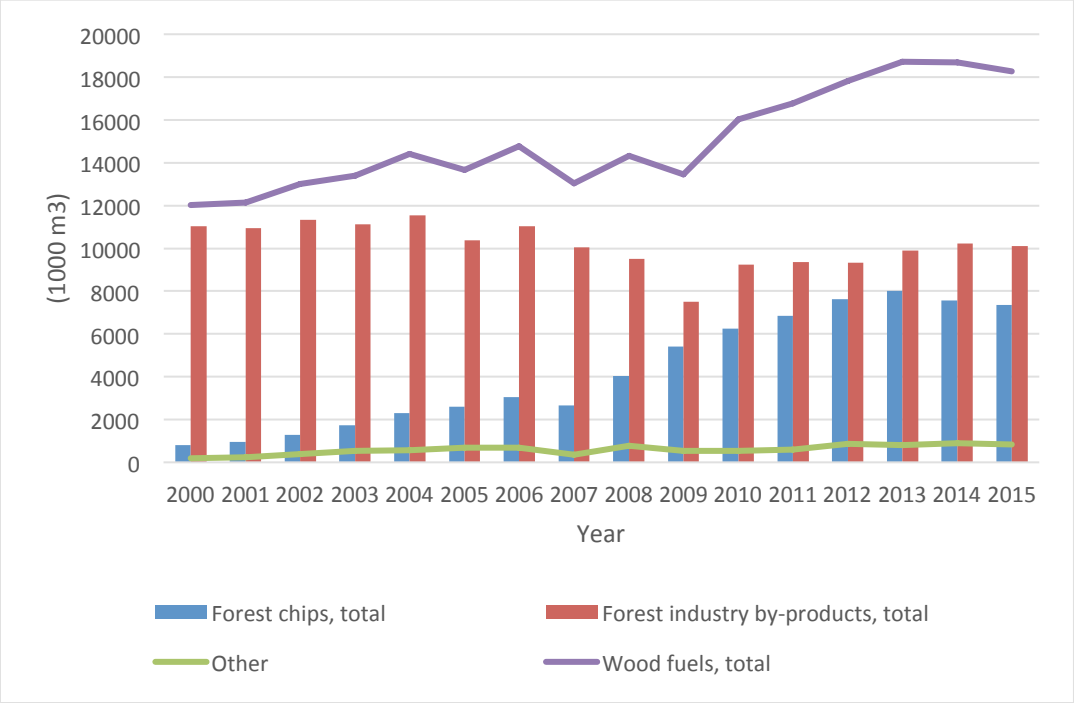

Figure 4. Volumes of Wood Fuels Consumed for Energy Use in Finland, 2000-2015. (Source: Natural Resources Institute Finland, Wood in energy generation)

The domestic bioenergy market for low-grade wood seen in Finland is something that should be explored for Nova Scotia. Since the closure of the former Bowater Mersey paper mill in Liverpool in 2012, there are no economic low-grade roundwood markets in western Nova Scotia and insufficient

markets throughout the rest of the province. An intelligent and ecologically aware bioenergy program in the province would create markets for low-grade wood and insure that enough woody debris and harvest residues on the forest floor are conserved to maintain ecosystem structure, habitat and soil nutrient cycles.

2.6.2 Ecologic Concerns in Finland

Major sustainability policy changes were made in the 1990s in Finland to reflect concern for the environment. The current status of forest sustainability in Finland has been explained in the 2016 European Union Policy report.[7] This document is a good source of information for further reading on current biodiversity and sustainability concerns in Finland today.

Prominent biodiversity concerns raised in Finland today include the following:

- Biodiversity reduction through intensive plantation management
- Decline and under-representation in old growth forest types
- Not leaving enough coarse woody debris for nutrient management and wildlife habitat after the removal of fuel grade products like unmerchantable wood, branches, tops and stumps from the harvest site for energy wood. Managed forests currently have about 3 cubic metres per hectare of coarse woody debris while natural forests have about 100 cubic metres per hectare. Also tied to fuel consumption is the assumed neutrality of the carbon flux over time from burning wood. This has come under renewed debate in 2016/2017.
- Uneven distribution and representation of protected and restricted-use forest. The vast majority of protected forest areas are in the northern, less productive areas of the country. Efforts are underway to protect significant or representative forest types, like herb-rich forests, over the remainder of the country but this remains a challenge considering the high proportion of privately owned and intensively managed forest.
- Pesticide use

Forest certification and carbon management systems have been instituted in Finland as the understanding of forest ecology and science has improved.

2.6.2.1 Forest Certification in Finland

Forest certification is widely accepted and practised throughout the whole value chain in Finland. It is a voluntary, market-based tool that verifies that Finnish forests are managed sustainably. PEFC (Program for the Endorsement of Forest Certification) is the chosen forest certification model for small or family forest owners, as well as for large-scale forest owners. PEFC absorbed the original Finnish certification scheme for private forests and has been in place since 1999. The Finns view is that sustainability is for the whole of society and that for their goals to be reached, everyone needs to do their part: governments, the private sector and civil society. About 90 percent of Finnish forests are PEFC certified, equivalent to about 16.5 million ha.

The Sustainable Forest Management Associations (SFMAs) hold regional PEFC group certificates. In 2015 there were 13 regions and 6 certificates. Further consolidation to five regions was planned in 2016.

Individual PEFC certificates exist for forest companies as well, like UPM-Kymmene Oy and for Metsahallitus (the company that manages state forests.)

Private forest owners who become members of an SFMA will automatically get a PEFC Certified management plan and become part of the PEFC management system. There is no additional charge to the forest owner for certification. The cost of certification is paid for by MTK (1/3) and the various forest companies (2/3).

Forest owners, forest industry, and other entrepreneurs who work in certified forests are required to follow PEFC criteria. If a forest owner uses a contractor who has not participated in PEFC, the forest owner is responsible for the PEFC criteria. In standing timber sales, the owner of the harvesting rights is responsible for the PEFC criteria. Information about PEFC-enrolled companies and entrepreneurs is updated regularly in a *pefc.fi* database to verify commitment of subcontractors. Forest owners use the database to verify the quality of forest service providers.

The Finns believe they have a global responsibility for sustainability and the carrying capacity of nature. Sustainability is already a traditional procedure and PEFC certification provides a common way for different actors to improve quality and social, ecological and economic sustainability.

2.6.2.2 Carbon Management

The forest carbon cycle in Finland is fairly well researched and inventoried by today's standards. The management of the sink and source of carbon dioxide equivalents in Finland is within the context of the European Union's targets for regulation and trade. However, there is currently no known carbon trade market for forest owners in Finland.

The national approach appears to be to demonstrate the current and projected sequestration level as a result of current management practices. These levels are undeniably high relative to the rest of the Europe and most of the world. This information in turn is lobbied to the EU for policy and regulatory influence.[8] Forest management carbon markets fall within a regulatory and/or voluntary jurisdiction. In both cases, actual carbon credits are eligible through the proven increase of $C0^2e^9$ storage within a forested land base over time, through a change in forest management over the baseline, or status quo scenario. This approach would not reward Finnish forest owners as the management practices today (status quo) already maximize yield.

2.6.3 Forestry in Finland

The Finns deliberately and with consideration adapt their forestry curricula and professional training to keep pace with changes in logging equipment, logging electronics and communications, and general industry organization. While the technological changes are obvious, more subtle is the change in human organization around forestry work.

In 1970, industry organized the wood supply and their foremen did site and harvesting planning and hiring of fleets. In 2017, it is the forest machine operators, working for small private harvesting companies that are responsible for the quality of logging, production report transmission from their machine to the mill, the maintenance of their machine and identification of habitats. They are therefore likened to harvest process *instructors* and *managers* rather than as rote machine operators. There is a weight of responsibility and an elevated sense of regard for forest machine operators in Finland.

Vocational Qualifications in Forestry takes 3 years of schooling during which 120 credits are accumulated (*See* Appendix 3). This is equivalent to the European Qualifications Framework (EQF) system of an EQF Level 4. This assures competence to *enter* employment in the field.

Students graduate with Qualifications in one of these specific occupations:

a) Forest worker
b) Forest machine operator (harvester/ forwarder)
c) Forest mechanic
d) Timber truck driver

Through work experience, also available as apprenticeship training, students can obtain 'Further Vocational Qualifications' to be considered a *skilled worker*, and 'Specialist Vocational Qualifications' to show they have *mastered the most demanding tasks* of the job in their field. These levels of training equate to Europe's scale as EQF 5 and EQF 5-6. By comparison, a bachelor's degree in Forestry is EQF 6.

Curricula are designed by committees that include employers from industry. This is to keep the lesson plan for new forest workers practical and relevant. It must be noted that vocational and university education in Finland is free.

3.0 Private Forest Land Management in Finland

Small private forests in Finland make up 60 percent of the forest land base and generate 80 percent of the wood used by the forest industry. Forest owners play a very active role in maximizing growth and yield on their woodlots. While there are some government subsidies and incentives for silviculture, woodlot owners willingly pay some of the site preparation, planting and weeding costs associated with early plantation establishment. This is basically returning some of their significant stumpage revenues from forest harvesting, as an investment in their future forests. The interdependence of woodlot owners and the economy is well understood in Finland where there is a tremendous amount of cooperation between woodlot owners, government and industry.

Supports for woodlot owners in Finland consist of government Forest Centres operated by the Ministry of Agriculture and Forestry, local Forest Management Associations (FMAs) and the Central Union of Agricultural Producers and Forest Owners called MTK.

3.1 MTK

MTK is a lobbyist for the FMAs, in partnership with industry, to the national government and to the European Union (EU). The state's Forest Centres and the FMAs offer regional and local support and services to small owners throughout Finland. In effect there is support for woodlot owners at all levels (see Figure 5). This has created an 'enabling environment' for woodlot owners, defined by MTK as 'the right balance of guiding tools, legislation, funding, advice and service providers to reach set goals.'

The Pohjois-Savo region visited on the tour is one of 13 designated forest regions in Finland where regional MTK offices serve and represent woodlot owners through the FMAs. In 2016 MTK had over 400,000 members, between farm producers, the forestry FMAs and other rural entrepreneurs, so it is a powerful lobby that is about to celebrate its 100th anniversary. Figure 6 shows the organizational structure of MTK in 2011. Although the 2011 numbers are a little dated , it still shows the association between small-forest owners, farmers and other rural entrepreneurs in Finland, under one umbrella that is MTK.

3.1.1 FMAs

Forest Management Associations (FMAs) are collectives of woodlot owners managing their own forestry activities. For decades they have been the mandatory forest advisor and service coordinator for small woodlot owners in Finland. In fact, until 2014 it was legislated that private woodlot owners had to belong to an FMA, although this statute was recently changed to allow small private forest owners the freedom to choose management service providers. Despite the new freedom, 80 percent of forest management activities on private forests are still carried out by FMAs. In 2016 there were 76 FMAs in Finland, after an amalgamation of smaller FMAs took place in recent years. This amalgamation resulted in more efficiency of service delivery, and the benefits of the economy of scale for wood supply and treatment scheduling that comes from a larger land base .

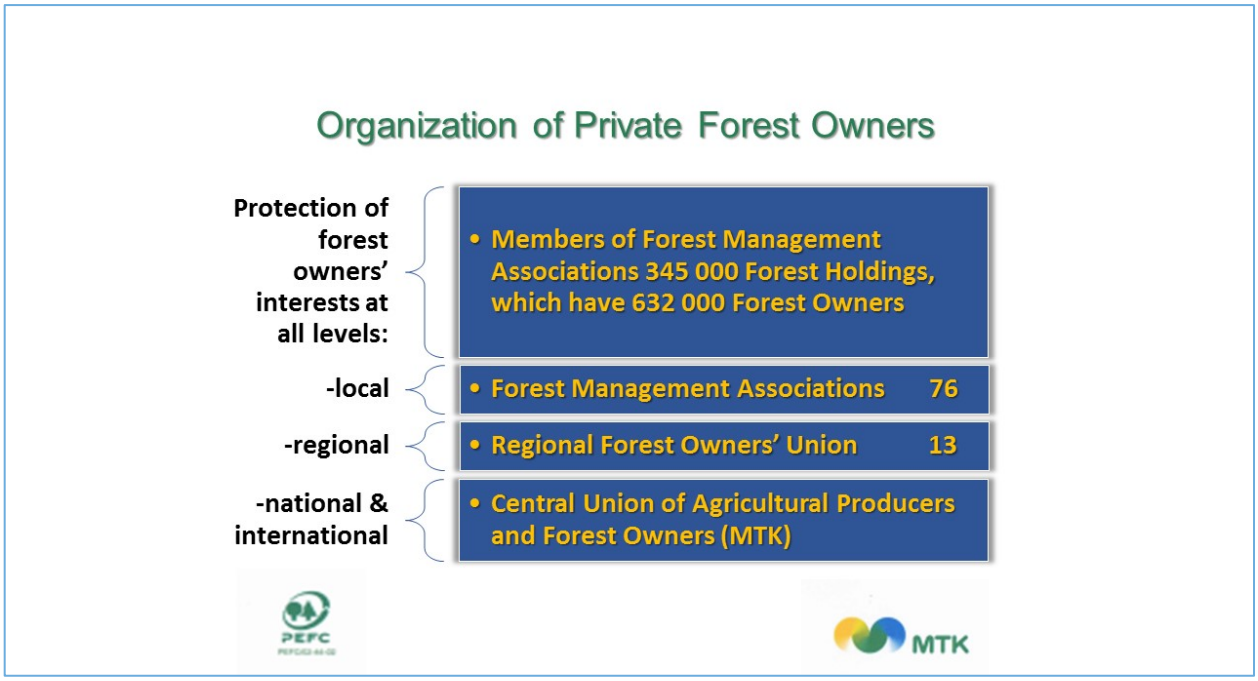

Figure 5. The organizational support structures for small private forest owners in Finland (2016 data).

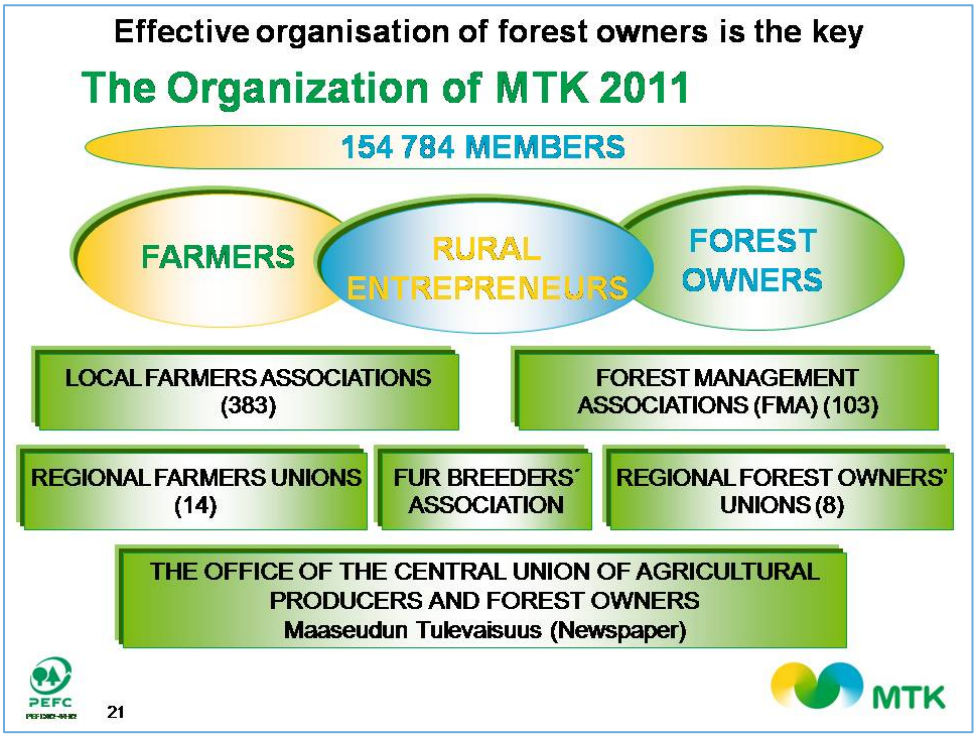

Figure 6. The Organization of MTK (2011).

FMA staffing includes managers, clerks, foresters, engineers, GIS experts, and sales managers. Trust in the local FMA was high at the one family woodlot we visited because, as the woodlot owner explained, they have had decades of contact with the same FMA forester. The FMA manager reports to an elected board of woodlot owner members. As an example of the power that comes from the collective, the MTK region visited during the tour, Pohjois-Savo (North Savo) represents 26,000 woodlot owners from the general population of 250,000. The landbase covers 1.4 million hectares of forest land, 71 percent of which is privately owned. The tour visited one of the four FMAs in the region, called Metsanhoitoy-hdistys. In 2015 this FMA had 5742 members, with 258,411 hectares of forest land.

Woodlot owners pay for services provided by the FMAs in three ways: (1) annual membership fees, which are about €100 per owner; (2) commission on harvest sales (€0.15 / cubic metres); and (3) fees for services, such as updating of management plans. These fees cover the full cost of all required FMA services. For woodlot owners, these expenses amount to a small fraction of the significant stumpage revenues received from wood sales. Table 6 compares the Pohjois–Savo Region statistics with the seven western counties of Nova Scotia. This table shows the positive impact the services provided by FMAs have on small private forest production in Finland.

Table 6. Comparing the Pohjois–Savo Region of Finland to the Seven Western Counties of Nova Scotia.

	Pohjois – Savo	Seven Western Counties
No. of Forest Owners	26,000	[unknown]
Small Woodlot Forest Area	1,000,000 ha	935,000 ha
Annual forest Growth	5,200,000 m^3/year	[unknown]
Annual Harvest (2015)	4,400,000 m^3/year	756,000 m^3/year
Large Sawmills (150 km. radius)	8-10	1 (Freeman's)
Pulp, Paper and / or Paperboard Mills (150 km radius)	6	0
Forestry Professionals working with woodlot owners	50-70	1

3.1.2 Government Forest Centers

Government support for the small private forest sector also comes from the state funded Finnish Forest Centres (Suomen metsäkeskus) which are staffed by the Ministry of Agriculture and Forestry. The state is acknowledged as the central actor in bolstering the forest sector through services such as this. The Forest Centres cover five service areas defined by region (Figure 7) and employ approximately 530 people (2016 figures).

Figure 8 shows that, in 2016, the Forest Centres focused on two service delivery areas: forestry business services and forest data and auditing services. The tour group spent some time with a Forest Centre employee whose main responsibilities involve offering business counselling services to forestry

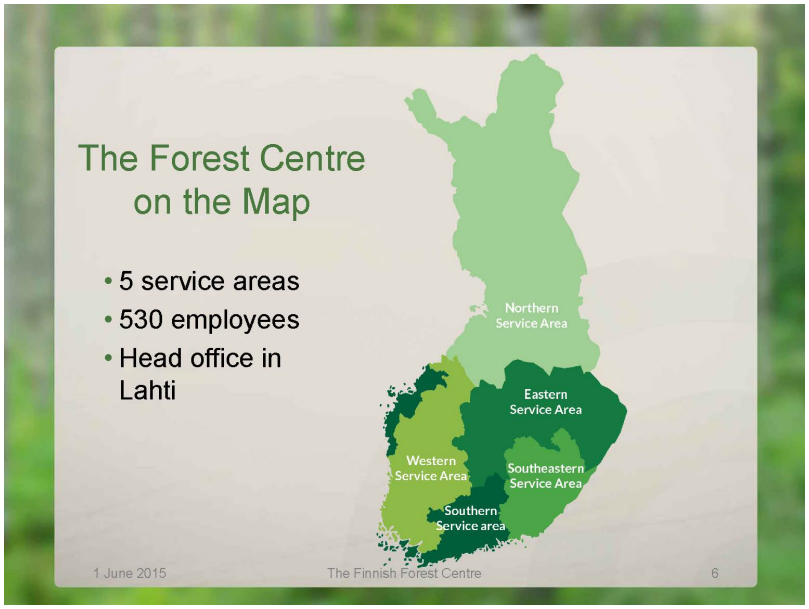

Figure 7. Five geographic regions covered by the Finnish Government's Regional Forest Centres (Source: Metsakeskus)

Figure 8. Two service delivery areas of Finnish Government's Regional Forest Centres (Source: Metsakeskus)

contractors in an effort to ensure they are successful and profitable. No such services are available to forestry contractors on a widespread basis in Nova Scotia.

Within their forest data responsibilities, the centres also provide full inventory support for private woodlot owners, collecting the inventory and audit data and sharing the information with all forest owners and forestry professionals through the *Metsaan.fi* database. Their programs have evolved to

online and mobile apps to give owners rapid access to their woodlot information and timber sales. The marketplace software allows for landowners, managers and wood purchasers to show available harvest volumes and make bids. It resembles Kijiji, with a real-time tracker of individual transactions not unlike a newsfeed or stock ticker. There is another e-marketplace for sales of firewood and non-timber forest products.

The web and mobile phone interfaces permit free access to information for forest owners and, therefore, better informed decision-making by absentee owners. As has been the case in Nova Scotia, there is a trend where the newer generations of woodlot owners are less connected to and less dependent on the land than their predecessors. This easy access to woodlot information online allows woodlot owners to be involved in the management of their forest holdings even though they may live a long distance away.

The Forest Centres are also responsible for the implementation of regional forest management planning, using the forest inventory data for this purpose. The regional plans are mainly a stand map and inventory database with stand-by-stand proposals for cuttings, silviculture and other forest activities. These regional plans are delivered at a reasonable price to the local FMA to support their extension services and operational annual planning for woodlot owners.

Under the regional plan, each owner is offered a more detailed individual management plan for their forest holding. Each regional Finnish Forest Centre and local FMA has specialists on staff (GIS systems, timber cruisers, management plan writers, business analysts) responsible for putting data together for the woodlot owner or forest entrepreneur (contractor). On average, about 60 percent of owners use this opportunity to receive a plan, available to them at half the actual cost. The plan comes with treatment schedules and associated harvest volumes and financial estimates. Forest management plans for individual forest holdings are created for a planning period of 10 years (20 years in northern Finland). The contents of an individual plan are confidential and accessible online only to the landowner and the responsible professional forester.

The Forest Centres also conduct audits of forestry operations on small private forests in order to enforce forestry legislation. Compliance is documented as very high, as the FMAs , MTK and the Forest Centres work together to create an ‘enabling environment’ for woodlot owners that motivates owners to sustainably manage their forests. Woodlot owners in Finland are constantly reminded of the need to manage their forest lands for the benefit of society.

3.2 Intensive Sustainable Forest Management

Private forests in Finland are predominantly artificially regenerated, known as plantation forestry, and are intensively managed through several thinnings, to maximize quality and volume over the full rotation of a given stand. On average, across Finland, clearcutting accounts for only 21 percent of the total harvest area while merchantable thinnings are 73 percent of the total. Typical activities scheduled over a forest stand rotation are listed in Table 2 (page 5). These treatments have widespread cultural acceptance. Forest owners are offered free training and understand the concept of silviculture. They accept the labour-intensive, time-consuming and unprofitable planting and weeding as necessary steps

in growing a forest and are part of the business model of owning a private woodlot. While some government subsidies do exist, the woodlot owner pays most of the cost (~ 70 percent) for regeneration and early tending. Planting and early tending, including weeding, are considered pragmatic long-term investments for maximum wood supply and economic return for woodlot owners. Table 7 shows forest statistics and woodlot income earned for the average woodlot owner in the Pohjois-Savo region of Finland. Equivalent information is not readily available in Nova Scotia.

Table 7. Average Forest Owner In Pohjois-Savo Region of Finland

- He is a retired man or older worker.
- He is 60 years old.
- He owns about 38 hectares of forest land.
- Total standing volume of trees on his woodlot is over 5000 cubic metres (2200 cords).
- Annual harvest is 180 cubic metres (80 cords) or 550 cubic metres every 3 years.
- Income is about $7500 CAD per year or $210 per hectare per year before taxes.

In 2015, the total net annual stumpage paid to small private woodlot owners in Finland was over €1.3 billion ($2 billion CAD). If all things in the small private forest sector in Nova Scotia were equal to Finland, this would mean that in 2015, woodlot owners would have received approximately $400 million in stumpage for sustainably harvested wood from their forest lands.

The annual incremental growth (in Pohjois-Savo) is currently 9.5 million cubic metres with harvest levels at 7.3 million cubic metres annually from operating on a landbase of 65,000 ha. This translates to 112 cubic metres per hectare over all harvest treatments, 77 percent of which are in merchantable thinnings. The return on this long-term investment and commitment can value at just under $19,000 CAD per hectare in today's dollars (see Appendix 4).

In Finland, the average woodlot size is 38-44 hectares and the average final clearcut harvest area is 3-4 hectares. This means that on average, a small woodlot owner would have 10-12 of these small harvests spread out over 80-100 years, that is, the growth cycle, or stand rotation, on their woodlots. On average, woodlot owners in Finland earn $145 CAD per hectare annually before taxes on their forest holdings (Figure 9). The estimated gross yearly income for a woodlot of 38 hectares at $145 per hectare is $5510 CAD per year.[10]

In 2015, the net annual stumpage paid was over €1.5 billion or $2.27 billion CAD, of which 87 percent was paid to owners of non-industrial small private forests (Table 8).

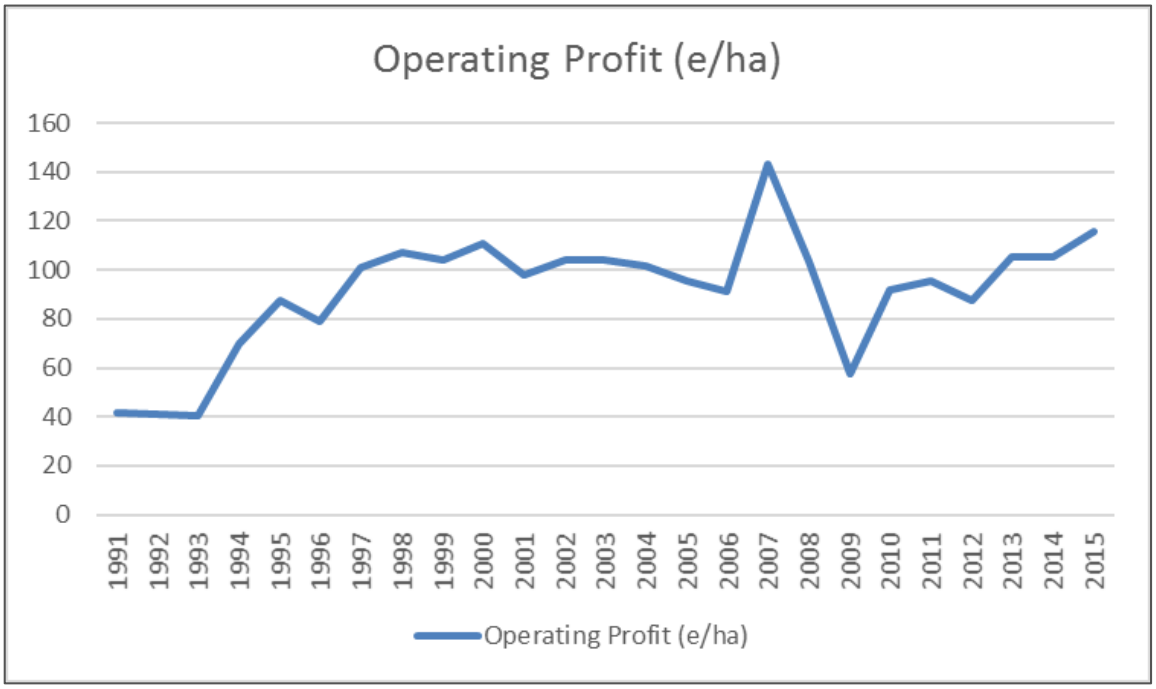

Figure 9. Operating profit, per hectare, 1991-2015 (€ / ha). (Source: Natural Resources Institute Finland)

Table 8. Stumpage Earnings (Source: Natural Resources Institute of Finland)

Land Tenure	Gross stumpage earnings	Net stumpage earnings
Non-industrial, private forests (NIPF)	€ 1,708,364,000	€ 1,345,000,000
Forest industries and the State	€ 292,910,000	€ 198,000,000
Total	**€ 2,001,274,000**	**€ 1,543,000,000**

4.0 A Comparison of the Small Private Forest Sector in Finland and Nova Scotia

In this section, Table 9 compares the Finnish and Nova Scotian small private forest sectors side-by-side on select attributes.

Table 9. Comparing the Small Private Forest Sectors of Finland and Nova Scotia

ATTRIBUTE	FINLAND	NOVA SCOTIA
1. Forest Statistics and ownership	The total forest area is 22,820,000 hectares; the total annual harvest is 68,000,000 cubic metres/year. Small private ownership: 60 percent of the total forest area; supply 80 percent of the total annual harvest. There are 632,000 owners. 346,400 owners have parcels greater than 2 hectares in size. The average woodlot size is 35-40 hectares.	The total forest area is 4,240,000 hectares; the total annual harvest is 4,000,000 cubic metres/year (2015) Small private ownership: 53 percent of the total forest area; supply 63 percent of the total annual harvest (2015). There is a deficit in data on cataloguing the number of owners in Nova Scotia. It is estimated that there are 35,000 small private forest parcels.
2. Tree species	Northern Boreal Forest (simple forest) Three main species: Norway Spruce, Scots Pine & Silver Birch	Acadian Forest (complex forest) Sixteen species with significant growing stock, eight of which are hardwood. Nova Scotia has potentially higher value softwoods and hardwoods than Finland.
3. Tree growth/Site Productivity	In Pohjois-Savo region of central Finland tree growth is approximately 7 cubic metres per hectare per year for Norway spruce and Scots pine. Tree improvement programs, site preparation, thinning regimes and forest fertilization over a long period of time positively impact this growth.	According to NSDNR forest inventory information, average potential tree growth in Nova Scotia for all forest lands is approximately 6 cubic metres per hectare per year. This growth could likely be enhanced with intensive forest management practices. Nova Scotia has challenges with windthrow and form because of exposure to open ocean.
4. Forest terrain conditions	*(See* Appendix 2) Very similar to Nova Scotia; not as hilly Limited access in summer because of wet ground.	Very similar to Finland; steep terrain is more common particularly in eastern Nova Scotia.

Table 9 Cont'd

ATTRIBUTE	FINLAND	NOVA SCOTIA
5. Forest Policy, Culture & Attitude **Advantage: Finland**	Strong, focused forestry legislation. Countrywide acceptance of forests and the sector as green gold for the Finnish economy. Strong co-operation between owners, industry and government. The government is currently focused on the new bioeconomy.	Lack of focused forest policy, particularly for small private forests. Disengaged small private woodlot sector. Described as a culture of conflict. The economic potential of intensive sustainable forest management is not well known or understood. There is huge untapped potential to create wealth for woodlot owners and the economy by sustainably intensifying forest management.
6. Woodlot owner support network **Advantage: Finland**	100 percent coverage of the small private landbase by local Forest Management Associations (FMAs). 85 percent of woodlot owners belong to FMAs. FMAs are assembled under 13 regional MTK offices and the national office. This creates a lobbying organization for discussions with government. Woodlot owners are very well organized and appear to be the power brokers in the Finnish forest sector, supplying 80 percent of the wood used by industry.	The woodlot-owner support network is fragmented with inconsistent availability and delivery of forest management services across the province. There is very low participation rates by woodlot owners in intensive sustainable forest management. Six of the original 18 former group ventures in the province are still offering various levels of forest management services to woodlot owners, mostly in central Nova Scotia and Cape Breton. The 'Service Area' concept is being slowly rolled out across the province. This started with the Cape Breton Privatelands Partnership (CBPP) which is in Year 3 of a five-year pilot project to serve Cape Breton Service Area. In 2017 the Western Woodlot Services Co-operative was launched to serve the seven westernmost counties.

Table 9 Cont'd

ATTRIBUTE	FINLAND	NOVA SCOTIA
7. Intensive sustainable forest management **Advantage: Finland**	Major investments were made 50-60 years ago by the government in tree/seedling improvement, thinning and ditching wet sites to improve tree growth. Finnish forests now grow 80 percent more wood than they did in 1970. There is 100 percent participation in intensive sustainable forest management by woodlot owners. Plantation forestry is the accepted regeneration strategy. Harvest is followed by site preparation, planting, manual/mechanical weeding, 2-3 commercial thinnings and a final harvest over 70-100 rotations. Each woodlot is managed as an independent forest entity with its own sustainable Annual Allowable Cut (AAC). The focus is on maximizing forest growth for woodlot owners and the Finnish economy.	Less than 10 percent of woodlots are being intensively and sustainably managed.Many woodlots are being "mined", meaning, clearcut from boundary to boundary. This is more the norm than sustainable management. Very little attention is paid to regeneration after harvest on the majority of small woodlots. Minimal consideration is given to future forests, their quality or their value.
8. Forest Inventory/Information Technology **Advantage: Finland**	The Finns have an inventory of every tree growing in their forests …species, age, size, location and who owns it! This extensive, accurate forest inventory and forest growth information uses leading edge technologies including LiDar. They have the most private forest inventoried of any country in the world and this information is used in forestry policy decision-making, forest management planning, new investments, sustainability, certification, carbon storage data and research. All data is made available to the public on-line through the Finnish Forest Research Institute and other government outlets. Inventory is easier because forests are less complex.	Nova Scotia has out-of-date forest resource information, strategies and technologies. Best guess estimates are made on standing timber volumes and forest growth. The task of gathering and managing inventory data is made more difficult by the variety of species, problems with form and uneven-aged stands of poor quality.

Table 9 Cont'd

ATTRIBUTE	FINLAND	NOVA SCOTIA
9. Roundwood markets **Advantage: Finland**	Roundwood markets are extensive for all products generated from thinning and final harvests of all three commercial species. All roundwood goes to the highest value end use: first, veneer logs, second, sawlogs, third, pulpwood, and fourth, energywood. There had been significant roundwood market expansion since the mid-1990s. Newsprint mills have been retooled to produce other pulp and paperboard products, resulting in continuing high demand for pulpwood throughout the country. The market for forest-based biomass, small trees, branches and stumps used in community district heating plants has seen rapid expansion over the past 10 years. Government incentives have been provided to the bioenergy industry to support conversions from foreign coal and oil to local renewable wood.	Approximately 50 percent of forest product markets for both sawn products and pulp and paper have disappeared over the last ten years. Currently, most mills that are still operating are over-supplied with roundwood. This results in depressed roadside roundwood prices and extreme challenges to forest operators to secure markets for all grades of wood. Intensifying forest management activities on small private forests will not be possible without expansion of market opportunities that are economically viable. No effective process in place for developing new roundwood markets at the present time, even though global markets for wood in energy production and construction are rapidly expanding.
10. Economic Benefits from Forests	In 2015, Finland sustainably harvested 3 cubic metres per hectare. Finland generated 5.7 times as much export value from every hectare of forest land compared to Nova Scotia. Finland generated 1.8 times as much export value per cubic metre harvested compared to Nova Scotia. Finland generated 2.6 times as many jobs per hectare of forest land compared to Nova Scotia.	In 2015, Nova Scotia harvested only 1 cubic metre per hectare from its small private forest area, even though, on average, the productivity and growth rates are not significantly different from Finland's.

5.0 Conclusion and Recommendations for Action in Nova Scotia

The basic purpose of the Forestry Learning Tour to Finland was to answer the research question 'Why is Finland so successful in managing their small private forests, while Nova Scotia is not?' The tour was one of several 'prototype' projects of the Forest Lab, a collaborative project of woodlot owners, industry workers and forest consultants from across Nova Scotia assembled to address social problems in the forest sector.

From September 29 to October 5, 2016, five representatives from Nova Scotia, participated in a forestry learning tour to Finland. The itinerary was designed to introduce tour participants to the system of service organizations that support the small private forest sector, giving woodlot owners access to government, as well as providing tools for managing their woodlots, in the context of a national strategy.

This report is a summary of the findings from the learning tour, which was successful in providing relevant information to conclude that Finland can be an effective model for small private forestry in Nova Scotia. The tour participants are proposing that Nova Scotia woodlot owners, service organizations and policy makers examine how the best practices observed in Finland could be implemented in order to build momentum and effect positive social and economic change in rural Nova Scotia.

1**. Culture and attitude** – The culture of forestry needs an attitudinal shift from negative to positive in Nova Scotia. We need to explain and show that forestry is an economic driver and a safe and worthwhile industry for the province. Forestry should be a good news story.

2. Strong landowner support network – Nova Scotia needs a single, unified, provincial lobby for woodlot owners, similar to MTK in Finland. In addition, we need local extension offices — Forest Management Associations (FMAs) — providing advice and services to woodlot owners throughout NS. This initiative has begun in the form of pilot projects in Cape Breton and the western counties. This approach requires long-term commitment with support at all levels of government.

3. **Intensive Sustainable Forest Management** — The Forest Strategy for Nova Scotia needs to be updated with specific goals for annual roundwood harvests at the county level and steps must be taken to intensify sustainable management efforts to meet these goals. There is an abundant, underutilized standing forest resource on small private woodlots in the province. Finland manages to produce over four times as much annual wood harvest per hectare on small private forest land than Nova Scotia. The tour group believes there is significant room for economic growth in Nova Scotia's small private forest sector.

4. Intensive Market Development – With a fully integrated forest product value chain that includes conventional forest products *and* new products in paper, construction, materials, and the bioeconomy

like food and pharmaceuticals, the industry would become economically viable. There is a particular need to find low-grade wood markets, while leaving enough biomass in the woods. Bioenergy plants for district heat and power in Finnish towns have created a domestic demand for low-grade wood that is scalable to Nova Scotia towns. With regional forest products market development teams, the province's forest industry could work toward this goal.

5. High quality forest inventory and information transfer - A reliable forest inventory and IT systems to make the data publicly available and user friendly would bring significant change to forest management planning, motivating woodlot owners and attracting investors. Investment is necessary but cannot happen without proof of a guaranteed long-term sustainable wood supply.

The foregoing will require a stable environment for investment, both time and money. The current situation in Nova Scotia — unlike Finland – is hesitation and uncertainty, lack of information, and a policy framework. Currently, small private forests in Finland produce 4 times as much wood harvest per hectare annually than Nova Scotian small private forests, even though tree growth is very similar in both places. By doubling the harvests to 2 cubic metres per hectare per year, one can estimate an increase of more than 7,000 direct and indirect jobs, mostly in rural communities.

The Nova Scotia government should give greater recognition to forestry and the small woodlot owners. In Finland the government has enabled the small private forest sector transformation over the past 100 years. If the municipal governments and economic development agencies in Nova Scotia became involved in this forest sector makeover, an increased sustainable wood supply, improved roundwood markets, increased forest products manufacturing, economic growth and job creation would follow.

5.1 Next Steps

The team that travelled to Finland are of one mind when it comes to the usefulness of their trip, because they saw that the challenges the forest sector faces in Nova Scotia could be mitigated by the implementation of some of the best practices that they saw in Finland.

For this reason they have organized their observations and data into this report, giving details and comparative analysis that demonstrate how forest management, particularly for small private forests, can be improved in Nova Scotia. They are convinced that such improvements would benefit the economy, especially the rural areas in terms of providing jobs, by managing the Acadian forest. It would also create new and diversified markets for wood products. This report is useful to policy makers, the media, woodlot owners, chambers of commerce, RENs and other economic development agencies.

The 5 key areas set out in the Conclusion are the outline for a framework that can initiate a concerted effort by all three existing woodlot-owner organizations in Nova Scotia towards a common goal. A working group would begin to develop policy initiatives and continue to establish service area organizations across the province, until there is forest management advice and service to every woodlot owner in Nova Scotia. This cannot be done without the assistance and coordination of the relevant

government departments (Natural Resources, Environment, Labour and Advanced Education, Agriculture). Therefore, the next steps must include communication across government, and throughout the value chain of the forest sector.

The Finland tour group suggests that their findings can be the foundation for renewal, and that best practices can be modelled and adapted for Nova Scotia. In Finland, government and industry took the long view, and included a wide range of stakeholders in order to develop the forest sector over the past fifty years. Given the current state of decline in the sector in Nova Scotia, it is recommended that this initiative be commenced without delay, that it be broad and inclusive, so that these changes will be more than just a benefit to one sector, but will have a ripple effect throughout the province.

I

APPENDICES

APPENDIX 1 – FINLAND LEARNING TOUR ITINERARY

Monday Sept 26	
Evening	Depart Halifax 9:30 pm Icelandair Flight 606
Tuesday Sept 27	
Morning	
Afternoon	Arrive Helsinki 1:50 pm& pick up rental vehicles Travel to and check in at hotel Meet for dinner as a group
Wednesday Sept 28	
Morning	**History & Information about the Finnish Forest Sector** - MTK Helsinki Mr. Juha Hakkarainen and Ms. Satu-MarjaTenhiala
Afternoon	Utilize Wednesday afternoon or evening to travel from Helsinki to Kuopio (Note: 4.5 min hours driving time to Kuopio) Overnight lodging in Kuopio
Thursday Sept 29	
Morning	**Activities of the Forest Management Associations (FMA)** - Forest Management Association, Metsanhoitoyhdistys Pohjois-Savo Region, Kuopio - Mr. Juha Huttunen and Mr. Jukka Hujala
Afternoon	**Activities of the FMAs continued, field visits?** - Mr. Juha Huttunen and Mr. JukkaHujala / Overnight lodging in Kuopio
Friday Sept 30	
Morning	**Activities of the FMAs continued, selected topics** - Mr. Juha Huttunen and Mr. JukkaHujala
Afternoon	**Activities of the FMAs continued, field visits?** - Mr. Juha Huttunen and Mr. JukkaHujala /Overnight lodging in Kuopio area
Monday Oct 3	
Morning	**Visit Forest Research Station in Suonenjoki** - Ms. Katri Himanen
Afternoon	**Visit Forest Harvester Training Site in Airaksela** - Mr. Jouni Seppanen / Overnight in Kuopio
Tuesday Oct 4	
Morning	**Visit Ponsse in Vierema** - Mr. Eero Lukkarinen
Afternoon	**Visit with Ponsse (continued)** - Mr. Eero Lukkarinen / Overnight in Kuopio
Wednesday Oct 5	
Morning	**Visit with Kuopion Energia** - Mr. Esa Lindholm
Afternoon	Travel to Helsinki
Evening	- Meeting with Mr. Ero Jarvinen
Thursday Oct 6	Depart for Halifax, NS

Appendix 2 – General Overview of Finland's Forest Ecology

This overview was transcribed and paraphrased from a website on the Boreal Forest[11]

Geology–The bedrock and the soil in general have been formed by the ice ages. The inland ice has eroded the bedrock, scraping off soil from here and leaving heaps there. In places the rock is totally exposed. The tens of thousands of lakes in Finland are post-glacial. Another unique phenomenon, land elevation, is also an effect of the glaciers. Finland is rising from the Baltic Sea at an annual rate of 0.5-0.8 cm, which means that its land area is continuously growing.

Peatland — Various kinds of peatlands are a fundamental element of the Finnish landscape. In the cool and humid climate, the soil becomes waterlogged, which creates the right conditions for peatland vegetation and the formation of peat. Originally, about one third of Finland was covered by peatlands. They have been drained for farming, forestry and peat extraction purposes. About half of the original peatland area has been preserved in its virgin state.

Climate — Finland's climate is affected by the Gulf Stream, maintaining favourable growing conditions at latitudes of 60-70 degrees. Winters average 3-6 months (south to north), and in Lapland, in the north, there can be a metre of snow. In southern Finland the average annual precipitations is 700 mm, while in the north it is 400 mm. Although the growing season is short, there is more or less full light, enabling intensive growth.

Forest Type — About half of the forest area consists of mixed stands. Rarer species are found mostly as solitary trees. The south-western corner and the south coast of Finland are touched by a narrow zone growing oak, maple, ash and elm. Finnish forestry aims at imitating the natural succession. Here it is quite unproblematic to practice near-nature forestry: the commercially valuable tree species belong to Finland's natural flora and can be grown on their natural sites. Forest regeneration is comparable with forest fires or storms, and intermediate felling resembles natural thinning. The forests are managed one compartment at a time, i.e., felling or management work is directed at a part of the forest with a homogenous tree stand. The average size of a compartment is less than two hectares. Even a natural forest has a certain mosaic-like structure: young stands here and more mature ones there. Forests are allowed to grow for between 60 and 120 years, depending on the tree species and the composition of the site.

Tree Species — There are about twenty indigenous tree species growing in Finland, the most common ones being pine (*Pinus silvestris*), spruce (*Picea abies*) and birch (*Betula pendula* and *B. pubescens*). Usually two or three tree species dominate a forest. Naturally pure pine stands are found in rocky terrain, on top of arid eskers and on pine swamps. Natural spruce stands are found on richer soil. Birch is commonly found as part of a mixed wood, but it can occasionally form pure birch stands.

Forest Ecology in Management– Rather than being systematic and dull, the forests are rich in variety and subtlety of detail. Especially in the southern and central parts of the country, one can find a great variety of forest types within even a small area: dense stands of spruces, pines scattered thinly on poor, heathy soils, clearcut areas, scrub in river and stream valleys and stunted growth in valley bogs.

Individual hardwood trees grow scattered among conifers and here and there one finds homogeneous stands of white birches. The trees also vary widely in age. They are not monocultures, nor do the trees stand in straight, evenly spaced lines. Yet Finnish forests could not be said to be in a natural state, either. Agriculture, tree harvesting and active silviculture have been re-shaping the forests down through the ages. As a rule, not even the oldest and apparently most natural forests prove to have remained completely untouched by the woodsman's axe when one looks two or three centuries back into their history. Prolonged use has gradually made the forests more uniform and consistent in character. In the 20th century, foresters have favoured conifers, especially pine, at the expense of other species. The oldest generations of trees have been gradually felled and the forests have in general become younger. Forestry and forest roads have fragmented large contiguous wilderness areas. Forest fires and other natural disasters have been largely prevented, and effective management has increased growth rates. Managed commercial forests of this kind now cover over 90% of Finland's productive forest land.

Protected Areas– Finland excels in forest land protection relative to total forested area. Most of this is in the north. This amounts to 9 percent of the forested landbase (productive and non-productive).

Table 10. Protected Land in Finland

Land Classification	Area (ha)	Total Area (ha)	% of Total Forested
Protected	2,048,000		9%
Restricted Land Use	915,000		4%
Total Protected and / or Restricted Forestry Use		2,963,000	13%
Total Forested		22,820,000	

References and other reading:

BorealForests.org. https://www.borealforest.org/world/world_finland.htm

Biodiversity.fi. http://www.biodiversity.fi/en/habitats/forests/

Finnish Forest Association: http://www.smy.fi/

This is Finland: https://finland.fi/life-society/environmental-protection-in-finland/

Ministry of Agriculture and Forestry: http://mmm.fi/en/forests/biodiversity-and-protection

Unfolding the organised irresponsibility: Ecosystem approach and the quest for forest biodiversity in Finland, Peru, and Russia. http://www.rktl.fi/www/uploads/pdf/EY/hiedanpaa_et_al_2010_unfolding.pdf

World Wildlife Fund. https://wwf.fi/en/WWF-Finland-s-forest-vision/

Forest Biodiversity Programme for Southern Finland (METSO). http://www.metsonpolku.fi/en-US/METSO_Programme

Biodiversity at risk.
https://cmsdata.iucn.org/downloads/finland_s_biodiversity_at_risk_fact_sheet_may_2013.pdf

Sustainable Forestry in Finland: ENVI Delegation in May 2016.
file:///D:/Finland/Sustainable%20forestry%20in%20Finland,%20ENVI%20delegation%20in%20May%202016.pdf

Appendix 3 — Forestry Education in Finland

General Education

Basic descriptors of the Finnish school system that Finns themselves consider set their system apart, are:

- Lower pressure, self-paced learning. Young students can voluntarily take an additional year.
- Later start for young children (age 7). Shorter school day and longer recess.
- More freedom of choice and guided but self-directed learning for students.
- Abundant resources and full support for the mix of ability deliberately placed in the same class.
- Respected, juried teachers who compete for acceptance in training and are well paid.

This is the basic education of 7-16 year olds in comprehensive schools. This information sets the context for understanding how forestry training happens in Finland.

Forestry Training

The Finns deliberately and with consideration change their forestry curricula and professional training to keep pace with changes in logging equipment, logging electronics and communications, and general industry organization. While the technological changes are obvious, more subtle is the change in human organization around forestry work.

In 1970, industry organized the wood supply and their foremen did site and harvesting planning and hiring of fleets. In 2017, it is the operators, working for small private harvesting companies, who are responsible for the quality of logging, production report transmission from their machine to the mill, the maintenance of their machine and identification of habitats. They are therefore likened to harvest process *instructors* and *managers* rather than as rote machine operators. There is a weight of responsibility and an elevated sense of regard for forest machine operators in Finland.

Forestry schools in Finland

According to the Tampere University of Applied Sciences, there are in Finland in 2015

- 9 institutes to train forest machine operators (out of 27 vocational institutes in the country)

- 6 universities of applied sciences in forest education where a Bachelor's Degree in Forestry can be obtained. Universities of applied sciences are distinct from other universities.
- 2 universities offer Masters and PhD degrees in Forestry

Vocational and university education in Finland is free.

Forest Concepts for Children and the Public

Nature games and wood use and wood products are used in young children's programs. Outdoor play and appreciation is important. Also significantn is the bringing inside of outdoor imagery and wood as a building material. Images of forest tree species and nature appear in public spaces in the form of murals, wall panels, sculpture, architecture and art, business and home décor and Finnish brand logos. Nature imagery seems to be imprinted on the general population this way. The Finnish Forest Association, the second oldest forest organization in Finland after Metsahallitus, takes on many responsibilities for outreach to young children and the public.

Youth entrants in forestry school

A child may grow in the Finnish education system to select forestry as a career option, starting at age 16. It can be approached two ways:

1. **Upper Secondary School & University of Applied Sciences** — Students at 16 years of age can take matriculation examinations and proceed for three years in a general upper secondary school. These students can enter the university stream for a Bachelor's degree in Forestry from a university of applied sciences which can take another 3-4 years. They can also choose to enter the vocational school system at this point.

2. **Comprehensive School & Vocational School** — From upper secondary school, or more typically direct from their basic comprehensive schooling at age 16, students can enter a vocational institution to receive vocational qualifications.

   Vocational qualifications in Forestry take 3 years of schooling during which 120 credits are accumulated. This is equivalent to the European Qualifications Framework (EQF) system of an EQF Level 4. This assures competence to *enter* employment in the field.

   To receive 'Qualifications' in a trade requires periods of on-the-job learning under a written contract with an accepted company. The student has an on-the-job instructor and they are not considered an employee. Demonstration of competencies is also arranged in genuine working environments over the three-year training period.

   Students graduate with Qualifications in one of these specific occupations:

   e) Forest worker
   f) Forest machine operator (harvester/ forwarder)
   g) Forest mechanic

h) Timber truck driver

Through work experience, also available as apprenticeship training, students can obtain further vocational qualifications to be considered a *skilled worker*, and specialist vocational qualifications to show they have *mastered the most demanding tasks* of the job in their field. These levels of training equate to Europe's scale as EQF 5 and EQF 5-6.

By comparison, a bachelor's degree in Forestry is EQF 6.

Adult entrants in forestry

An adult may receive forestry training at a later point in their career, and it can take 1-2 years. The process of building qualifications with adults is based mainly on demonstrating certain competencies.

The system is regulated by Ministry of Education's Vocational Education Act and Decree. The Finnish National Board of Education developed the nation's Core Curricula.

The Requirements for Competence-Based Qualifications are guidelines set by the Finnish National Board of Education. This guideline sets out the requirements for the 'further' and 'specialist' vocational qualifications noted above. The vocational training modules have been developed with people in the business of each profession (Subject Matter Experts or SME's) for real life work tasks.

National qualification requirements are developed collaboratively with employers, trade unions and student unions. Regardless of the wider structural decisions students have personal study plans.

Breakdown of credits for Vocational Qualifications as a Forest Machine Operator

3 years equates to 120 credits. 90 credits are in vocational studies, with 20 credits in common or core (cross-sector) subjects. 10 credits are free choice studies. On the job periods have a minimum of 20 credits in the vocational studies.

Appendix 4 — Typical Forest Management Regime in Finland, Investments and Cost Recovery

Table 11. Forest Investment costs, administration costs and stumpage revenues, 2015 (euros / ha)

Source	Total	Total Cost	Profit (e/ha)
Preparation of regeneration areas	2.2		
Artificial regeneration	2.7		
Forest regeneration		*4.9*	
Tending of seedling stands	2.7		
Management of young stands		*4.7*	
Improvement of young stands	1.2		
Pruning	0		
Initial clearings of intermediate felling areas	0.8		
Forest fertilisation	0.5		
Forest ditching	0.6		
Construction and basic improvement of forest roads	1.5		
Forest improvement		*2.7*	
Forestry fees	1.3		
Maintenance of forest roads	0.6		
Other costs (roundwood sales, education, membership fees etc.)	2.6		
Forestry administration costs		*4.5*	
Total costs in wood production		***16.80***	**(16.80)**
Revenues			**128.4**
Plus State Subsidies			**4.3**
Operating Profit			**115.9**

OSF: Natural Resources Institute Finland, Operating profit in non-industrial private forestry

Table 12. Average stumpage rates by product, 2015 (cubic metres)

Product	Stumpage Price by Treatment (e/m3) Regeneration felling	Second Thinning	First thinning
Pine logs	56.01	47.33	38.58
Spruce logs	55.31	46.89	39.24
Birch logs	43.44	36.90	33.35
Pine pulpwood	17.30	14.76	11.55
Spruce pulpwood	18.17	15.02	11.05
Birch pulpwood	17.17	14.31	11.47
Small-sized logs, pine	24.96	20.55	17.17
Small-sized logs, spruce	24.83	20.23	

Source: Natural Resources Institute Finland, Volumes and prices in industrial roundwood trade

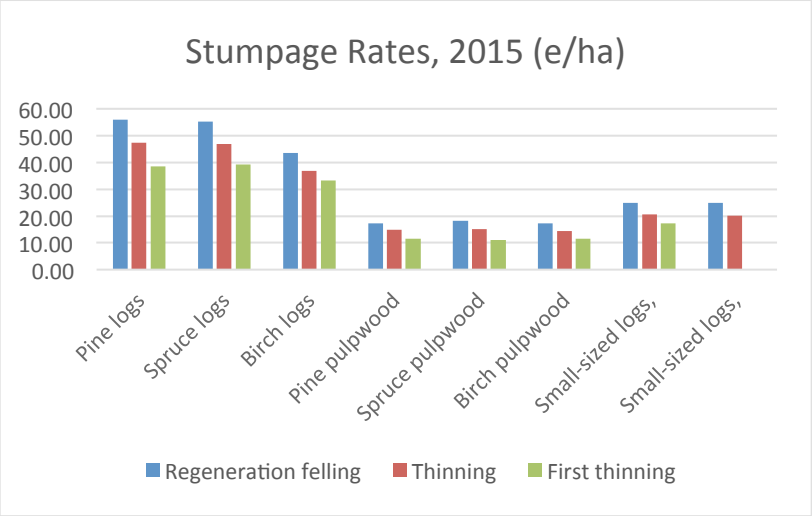

Figure 10. Average stumpage rates paid in Finland by product, 2015. (Source: Natural Resources Institute Finland, Volumes and prices in industrial roundwood trade.)

6.0 References

1. Nova Scotia Commission on Building our Economy, ***Now or Never: An Urgent Call to Action for Nova Scotians***, 2014, page vi
2. Forestry Lab, Summary Report, 2017 (http://www.theforestrylab.ca/about.html), page 3
3. *ibid.*
4. Multi-Source National Forest Inventory of Finland, METLA.
http://www.metla.fi/ohjelma/vm1/infoen.htm
5. Finnish Forest Research Institute National Forest Inventory (NFI).
http://www.metla.fi/ohjelma/vmi/vmimonien.htm
6. National Forest Strategy 2025 – Government Resolution of 12 February 2015. Ministry of Agriculture and Forestry of Finland. May 2015
7. Sustainable Forestry in Finland: ENVI Delegation, May 2016
8. Karppinen, Heimo, Maria Hänninen & Lauri Valsta, "Forest ownership changes in Europe: trends, issues and needs for action." Conference: Forest ownership changes in Europe: trends, issues and needs for action. 7-9 September 2016, Vienna, Austria
http://facesmap.boku.ac.at/library/Final_conference_Presentations/Parallel_session_8/Karppinen%20et%20al_Forest%20owners%20views%20on%20storing%20carbon.pdf
9. C02e: Unit of Carbon dioxide equivalent. This is the standard unit for greenhouse gas equivalency ratios. Carbon offset markets report in C02e.
10. North Savo Forest Management Association presentation, Kuopio, Finland, September 28, 2016
11. http://www.borealforest.org/world/world_finland.htm