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"We live in a Utopia": Adapting Criteria and Indicators for Sustainable Forest Management at the Local Level in Hungary to Achieve Community Visions of Sustainable Forests

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Author's declaration

No portion of the work referred to in this thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

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ABSTRACT OF THESIS submitted by:
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Criteria and indicators (C&I) developed by the Ministerial Conference on the Protection of Forests in Europe (MCPFE) are currently in use as a monitoring and evaluation instrument at the regional European level to assess progress towards sustainable forests. This study explores to what extent these C&I apply at the local level in Hungary, questioning the appropriateness of the policy instrument for use by small-scale forestry operations and its adequacy for a community that endorses ecocentric values and an independent lifestyle. In order to relate C&I to practical issues in forest management, conceptual links between silvicultural decision-making according to a classification of forest management approaches (FMA), and environmental, economic and social sustainability, were developed.
Based on an extensive literature review, analysis of forest management plans and interviews with members of the community of Gyűrűfű in Southern Hungary, MCPFE C&I were adapted for use by the community. Conceptually, the synthesis of FMA and C&I was crucial in this regard, and should be made the subject of further research. The findings of this study suggest that with significant modifications, Forest Europe C&I can form the basis of a concrete strategy to realize a small community's forest vision. This research also suggests that sustainable development trajectories in small-scale forestry are complex and nonlinear.

Keywords: criteria and indicators, sustainable forest management, forest management approaches, social sustainability, sustainable development, small-scale forestry

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"… the utopian vision provides the indispensable fundamentalist well of inspiration from which green activists, even the most reformist and respectable, need continually to draw. Green reformers need a radically alternative picture of post-industrial society, they need deep ecological visionaries, they need the phantom studies of the sustainable society, and they need, paradoxically, occasionally, to be brought down to earth and to be reminded about limits to growth." (Dobson 2000: 202)

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List of Abbreviations

C&I: Criteria and Indicators

CCF: Continuous-cover forestry

CEE: Central and Eastern Europe

CIT: Countries in transition

CSA: Canadian Standards Association

ECOSOC: United Nations Economic and Social Council

FAO: Food and Agriculture Organization of the United Nations

FM: Forest Management

FMA: Forest Management Approach

FMU: Forest management unit

FSC: Forest Stewardship Council

IFF: Intergovernmental Forum on Forests

ILO: International Labor Organization

IPF: Intergovernmental Panel on Forests

MCPFE: Ministerial Conference on the Protection of Forests in Europe/Forest Europe

SFM: Sustainable Forest Management

SSF: Small-scale forestry

STAMP: Sustainability Assessment and Measurement Principles

UNCED: United Nations Conference on Environment and Development

UNFF: United Nations Forum on Forests

1. Introduction

Forests are an immensely important physical entity of our planet. As a resource, they provide the wood that is raw material for furniture, housing and energy production, as well as a multitude of other products from toys to musical instruments. Forest ecosystems harbor substantial agricultural production, generating commodities such as cocoa and coffee as well as foods like honey and mushrooms. They are the 'earth's lungs', providing oxygen through photosynthesis; they stabilize soils, purify water, act as carbon sinks and harbor significant biological diversity. They shelter animals that are hunted for food and sport the world over, and enable wide-ranging opportunities for recreation. Crucially for human society, all of the consumable goods and services provided by forests are structured around industries that employ millions worldwide. (FAO 2010) Forests are seen by many as possessing a spirituality and peacefulness that make them a popular refuge for those wishing to escape, temporarily or indefinitely, the fast-paced stress and dulling routines of life in contemporary capitalist consumer societies.

The UN, in the Agenda 21 'action plan' produced after the 1992 Conference on Environment and Development in Rio de Janeiro (Rio Summit), made sustainable forestry a top priority for the organization and its subsidiaries. The protection of forests and combating deforestation in particular were an integral part of the Agenda 21 report with 289 mentions of the word 'forest' alone. (United Nations 1992) European level ministerial conferences on forests began in Strasbourg in 1990 and continue to this day. The Ministerial Conference on the Protection of Forests in Europe (MCPFE/Forest Europe) is a significant player in advancing forest policy in the region, and has developed as a monitoring and adaptive management instrument a set of criteria and indicators (C&I) to guide the sustainable management of Europe's forests. Partly as a result of this degree of political commitment and partly as a result of the longstanding tradition of sustainable forest management demanded by

Europe's slow-growing forests, the ecological state of European forests is the healthiest in the world, and the forestry sectors of European countries are by and large considered relatively sustainable. (FAO 2010)

Concurrent with widespread international concern for and agreements on sustainability were political changes in Eurasia that led to the dissolution of the USSR and subsequent expansion of the reach of Western European institutions, along with the concepts and practices of the market economy and consumer culture, eastward. This began with the reunification of Germany in 1991 and continues with the possible accession to the European Union of the Balkans and other Eastern European states. Central and Eastern European countries account for almost a third of Europe's forest cover of 195,911,000 hectares. (Ibid) It is therefore highly important that these forests, like those in Scandinavia and Western Europe for example, be managed sustainably in the interest of ecology, economy and society.

The transition processes of the last decades in Central and Eastern Europe (CEE) contain some interesting challenges and pose certain questions with regard to sustainability in the forest sector. The (re-) introduction of democratic institutions brought a plurality of voices and interests into the public arena, and civil society groups and political parties with a 'green' agenda were able to operate relatively freely and started to gain support.

While support for the policies determined at a pan-European level came easily from most countries in transition (CIT), capacities for implementation were initially very limited and the economic transition from a planned economy further confounded the sustainable management of forests, and the struggles and partial collapse of the CEE agricultural and manufacturing sector served only to exacerbate the issue. (Csóka 1998; Bemmann and Grosse 2001 and Krott 1998)

Generally speaking, the state forest sectors of CEE countries can be classified midway between fully developed 'Northern' countries and developing countries in the Global South in

terms of reliance on natural resources for economic growth on the one hand, and the extent and priority of nature conservation on the other hand. (Mészáros, Jáger and Hegedűs 2005) It is thus imperative to investigate the region's future trajectory in terms of preservation of forest resources and health, the realization of social sustainability and public participation, and the continuing of nature conservation programs in CEE countries' forest sectors. Of particular interest from a bottom-up perspective is, how small communities and interest groups that embrace ecocentric values and that have significant stakes in forest resource management can realize these values, and whether Forest Europe C&I are a valuable tool in this endeavor. Therefore, the research question I seek to answer is:

> Can Forest Europe C&I be adapted at the local level to fulfill community aspirations in, and formal requirements of, SFM?

Focusing on and working with the community of Gyűrűfű, the goal is to examine how Forest Europe C&I for sustainable forest management (SFM) can be adapted and merged with forest management decision frameworks at the community level to concretize and help fulfill community aspirations with regard to forestry. This eco-village community was chosen as a case study because it already has a strong commitment to sustainable forestry, making it interesting to investigate the overlap of the community's values and practices with Forest Europe C&I (and the wider policy). In addition, this community lives in what approximates an ecological utopia, so it may be possible to derive from this research further insights on what allows communities to lead ecologically sensible lives.

The thesis is structured as follows: Chapter two will provide a brief policy background and history of the village Gyűrűfű. This will be followed by a literature review focusing on SFM more broadly speaking, the conceptual basis of C&I in SFM, a review of existing C&I

sets and an elaboration on the relationship between social sustainability and C&I for SFM. In the subsequent theoretical framework, I will draw on the previous chapter to conceptualize the approach to (and the justification behind) adapting an existing C&I set to a local case. Next, a methodological chapter will describe the process of my research. The following chapters will present the results of the study and discuss these, before closing with some concluding remarks on the most prominent themes of this thesis and recommendations for further research.

2. Background

2.1 The UN and its sustainable forestry efforts

The 1992 United Nations Conference on Environment and Development (UNCED/Rio-Summit) produced the first two UN documents on sustainable forestry: The Non-Legally Binding Authoritative Statement Of Principles For A Global Consensus On The Management, Conservation And Sustainable Development Of All Types Of Forests (Forest Principles) and chapter eleven of Agenda 21 on combating deforestation. These are not legally binding and represent a very general consensus that forests are at risk and that this problem needs to be addressed; owing to a variety of interests of the member states[1], these documents contain no tangible policies to be implemented. Subsequently, the Intergovernmental Panel on Forests (IPF) and the Intergovernmental Forum on Forests (IFF) were set up under the auspices of the UN Commission on Sustainable Development in 1995 and 1997 respectively and produced a collection of 270 recommendations towards SFM. Between 2001 and 2007, and pursuant to two UN Economic and Social Council (ECOSOC) resolutions, the United Nations Forum on Forests (UNFF) worked on the Non-Legally Binding Instrument on All types of Forests whose purpose is to "strengthen political commitment and action … to implement effectively sustainable management … of forests and to achieve the shared global objectives on forests; … to enhance the contribution of forests to the achievement of the internationally agreed development goals; … to provide a framework for national action and international cooperation" (United Nations General Assembly 2007:2)

[1] Generally speaking, states in the Global South insisted on their right to economic development and sovereignty in resource exploitation, whereas 'developed' countries showed a greater focus on nature conservation and the protection of forests from overexploitation.

The main shortcoming of these three UN-level processes is the lack of agreement on an institutional framework that is able to facilitate effective implementation of international agreements on SFM. Accordingly, the IFF, IPF and UNFF "played an advisory and facilitative role in the development of agreed upon forestry norms." (McDermott, O'Carroll und Wood 2007:7) Their greatest potential is to create a "holistic framework within which countries can develop their own forest management priorities," but this has not been widely achieved as even at the regional level, there is only one legally binding agreement focusing exclusively on forests – the Central American Forest Convention. (Ibid)

2.2 Regional sustainable forestry: Forest Europe

As mentioned in the introduction, since 1990 European countries have met regularly for Ministerial Conferences on the Protection of Forests in Europe (Forest Europe) to develop strategies for forest protection and SFM. 46 states including the EU are signatories to Forest Europe, and together with observer countries (including such forest-rich nations as the USA, Canada, China and Brazil) and observer organizations (like Friends of the Earth, the Food and Agriculture Organization of the UN and the European Forest Institute) are working on creating a legally binding policy at the pan-European level. (Forest Europe Liaison Unit 2013) The Forest Europe network may best be described as an organization that both vertically facilitates the implementation and creation of SFM policy between member states and wider relevant international frameworks, and horizontally integrates member states' efforts and fosters cooperation and collaboration between state organs such as forest authorities, research institutes, and civil society organizations. Structurally, Forest Europe is comprised of a variety of meetings at different levels (the triennial Ministerial Conferences, expert working groups, more general round-table meetings as well as workshops and working groups) and an administrative apparatus composed of one country each from Northern, Southern, Western, Central and Eastern Europe. Forest Europe has been rightly praised for its early realization

that the inclusion of CEE countries was integral to improving the management of Europe's forests. (Juszczak et al. 2004) The 1993 Helsinki conference was a landmark event that produced several resolutions on forest management and policy, two of which will be summarized here.

The first, titled "General Guidelines for the Sustainable Management of Forests in Europe" (H1) defines SFM as

> "the stewardship and use of forests and forest lands in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfil, now and in the future, relevant ecological, economic and social functions, at local, national, and global levels, and that does not cause damage to other ecosystems" (Ministerial Conference on the Protection of Forests in Europe 1993a:1)

It goes on to spell out twelve guidelines for SFM, which can be grouped into statements on the ideal state of forests and how this is to be maintained or achieved; statements on forest management and the forest industry (including tree species selection and recyclability of wood products, respectively); and on forest policy (mainly on consumption of forest products and public awareness). (Ministerial Conference on the Protection of Forests in Europe 1993a)

The third resolution of the Helsinki conference, "Forestry Cooperation with Countries with Economies in Transition," (H3) addresses the relationship between the countries that had in the five years prior to the conference left the Soviet sphere of influence and those countries that had been West of the 'Iron Curtain' in the second half of the 20th century. It addresses the European Community specifically, as well as other signatories, and spells out ways in which the H1 general guidelines were to be brought to their realization in CIT. This includes specifying areas of cooperation (technical, scientific, institutional and legal matters), partners for cooperation (universities, research institutes, individuals) as well as more general

suggestions on the transition process (the change to market economies, for example). (Ministerial Conference on the Protection of Forests in Europe 1993b)

The Helsinki conference was a milestone in the work of Forest Europe because it shifted away from a narrow focus on environmental issues and nature-conservation and focused increasingly on socio-economic aspects of forest policy as well. This reflects the general consensus of the Rio summit, namely that sustainable development must be holistic and that social, ecological and economic aspects should be balanced. (Mayer and Rametsteiner 2004; Ministerial Conference on the Protection of Forests in Europe 1993b; Ministerial Conference on the Protection of Forests in Europe 1993a)

The 1998 Lisbon conference shows Forest Europe's exemplary cooperation with organizations at a similar level but on different topics (such as the Ministerial Process "Environment for Europe") as well as with supranational organizations at a higher level (i.e. the ILO (International Labor Organization) Team of Specialists on Social Aspects of Sustainable Forest Management). Three years later in 2001, Forest Europe expressed a strong commitment to cross-sectoral cooperation to account for the multiple benefits of forestry on the one hand and the influence of many industries and sectors on forests on the other. (Mayer and Rametsteiner 2004)

Besides negotiating and lobbying for a legally binding treaty on sustainable forestry (see e.g. IISD 2011) the most important activity of Forest Europe is to monitor the implementation of SFM and the health of ecosystems in European forests. To this end, the Forest Europe Criteria and Indicators (C&I) developed in 1998 and updated in 2001 are used. Chapter three will investigate these C&I in some depths before proposing a method of adapting them at the local scale and evaluating their worth for this purpose in subsequent chapters.

2.3 EU forest policy: forests in the shadow of the Common Agricultural Policy

While there are a plethora of forest-related regulations and initiatives emanating from Brussels, no EU forest policy as such exists. This is attributable to the lack of legal competence for forestry of the European Union: only articles 43 (regarding the Common Agricultural Policy) and 100 (regarding the European Common Market) of the Treaty of Maastricht have direct bearing on forest-related activities. The remainder of European forest policy is an aggregate of forest-focused and forest-directed policies pieced together from various jurisdictions and predominantly left to the member states. However, "in practice and viewed from a juridical angle," Wydra (2013) sees "an existing European Forest Policy." (33) Sectors that influence forestry in the EU include agricultural and rural development, industry, trade, energy and climate change. The influence these sectors have on forest policy becomes more diffuse and incoherent as the relative importance and power of individual sectors grow and recede, and because there is little coordination and coherence between policy objectives that have an impact on forestry. (Pülzl and Hogl 2013) In an effort to remedy this inefficient disparity, the European Commission's plan for a new framework of a EU-wide forest strategy contains a priority area dedicated to cooperation, coordination and communication. The Commission further states that a new strategy is necessary to ensure sustainable and balanced management of forest multifunctional potential; satisfy growing demand for raw material for existing and new products as well as renewable energy; respond to challenges and opportunities that forest-based industries face to stimulate growth; protect forests and biodiversity from storms, fires, scarcer water resources and pests; acknowledge the EU consumption's impact on global forests; and develop an information system to follow up on these objectives. (European Commission 2013)

2.4 The Hungarian forest policy environment

Up-to-date literature on Hungarian forest policy and regulation is limited, with most available academic articles and books focusing on the period of transition after the fall of the socialist dictatorship in the 1990s (e.g. Csóka 1998). As a EU member state, Hungary by and large has to follow EU 'forest policy'. An example of the implementation of a relevant directive is the establishment of a Natura 2000 biodiversity protection network in the country, as legislated by the 1992 Habitats directive. (European Commission 2014) Here, the Ministry of Environment and Water collaborated with local NGOs as well as national parks to develop a list of suitable sites for the protection areas, and to monitor and maintain them. This process was considered effective and led to a wide coverage of Natura 2000 sites. While a scandal erupted around the illegal clear-cutting of the Sajólád forest (which led to the European Commission officially warning Hungary in 2010), forestry managers and regulators have adapted to the directive in recent years. However, there remains a principal conflict over land use for economic purposes versus nature conservation between the agricultural sector and production forest enterprises and conservation NGOs and environmental interest groups. A valid criticism leveled by the former at the latter is the burdening of forest enterprises with increased bureaucracy. (Cent, Mertens, and Niedzialkowski 2013)

Reporting on qualitative indicators for SFM,[2] the Hungarian Ministry for Rural Development reports that while much of Hungarian forest policy is in line with EU and Forest Europe stipulations regarding SFM, additional funds are needed in some areas and in others, such as forest ecosystem health and vitality, funding had been reduced with potentially detrimental effects. (Szepesi 2010) Furthermore, Hungary is currently following a National Forest Program which aims to regenerate forests and reforest barren land, 'naturalize' the

[2] These are part of Forest Europe C&I, but as they cannot be measured quantitatively they are not part of the C&I set as such.

species mix by repressing invasive species, and developing a "diverse forest structure composed of several layers." (CBD 2014:14)

A review of the development of small-scale forestry (SSF) operations in CEE countries has found that several classes of forest owners exist who experience forestry regulations and policies differently from one another, with co-operative ownerships and farmers valuing sustainable forestry but having limited access to networks and limited possibilities to develop their capacities in SFM, and private owners who do not live near their forests largely favoring clear-cutting as much as possible as quickly as possible for economic gain.[3] The authors of the study point out that while biodiversity conservation is taking place in forests in the region[4], there is little integration of forest management with conservation measures, the latter being carried out largely by specialized groups. This leads to conflicts between landowners who may not understand conservation policies and mostly have limited capacities to carry these out. The authors recommend measures for better vertical and horizontal co-operation in forestry, i.e. between forest managers, forest owners and – regulators on the one hand and between a variety of forest owners with complementary capacities on the other. These measures include developing "knowledge about SSF stakeholders and their priorities and challenges" and "linking ecological indicators of forests to forest ownership and management frameworks." (Nijnik, Nijnik, and Bizikova 2009: 171)

This research project takes up these recommendations by investigating the SSF enterprise of Gyűrűfű and adapting an indicator framework to the case. The following section will describe the community of Gyűrűfű and its vision for its forests, before the technical part

[3] The transition period has produced many such forest owners who were given forestland as part of land redistribution acts. These often live in cities far away and have extremely limited knowledge of, and interest in, sustainably using their forests. (Bemmann and Grosse; Csóka 1998; Krott 1998)

[4] According to the CBD (2014), 59% of Hungarian forests belong to categories of forests that are to some degree favorable from a biological diversity standpoint.

of the thesis (chapters three and four) deal with the topical discussion of criteria and indicators for SFM and explain my approach to the issue.

2.5 The state of Hungary's forests

Of the 9,3 million ha of Hungary's land area, just over 2 million ha are covered by forests. This has been steadily increasing over the last two decades. Of these, 122,000ha are plantations, 1,79 million ha are semi-natural forests and only 100 ha are undisturbed by man. While the total growing stock rose by 23% between 1990 and 2010, the growing stock available for wood supply has decreased by almost 20%. This indicates that indeed, forest conservation is a higher priority now than 25 years ago. However, the growth, in area, of plantation forests is higher than that of semi-natural forests. This suggests that management objectives in semi-natural forests are diversifying, whilst production forests purely for wood supply simultaneously increase. The main non-wood goods produced in Hungary's forests are game meat and animal skins. The forest area covered by introduced species has grown from 554,400 ha in 1990 to 712,300 ha in 2010; worryingly, invasive species – predominantly the *Robinia pseudoacacia* (Black locust) – have increased from dominating 261,900 ha in 1990 to 407,200 ha in 2010. Forests designated as water or soil protection areas have decreased in recent years, dropping from covering 195,000 ha in 1990 to 166,000 ha in 2010. Government spending on long-term sustainable ecological services has increased from €5,4 million (2000) to €33,5 million (2010), mainly for afforestation programs; meanwhile, spending on biospheric services (predominantly reforestation) has dropped from €9,23 million to €2,59 million and spending for the social functions of forests has dropped from €1,18 million to just €270,000 in the same period. Almost all of Hungary's forests are open to recreational use (99,8%) and 47,500 ha of forest had recreation as a main management priority; but the number of actual visitors to these forests has not been reported. (Kottek 2010)

2.6 Gyűrűfű

The community of Gyűrűfű was founded in 1991, shortly after the 1989 transition from communist dictatorship to a parliamentary republic. A number of families who felt a need to lead a more self-determined and ecologically sustainable lifestyle bought 174 hectares of land in what had in the 1970s become a completely deserted village 30 kilometers west of the Southern Hungarian city of Pécs, three hours from the capital Budapest. The site had been populated since the ice age and its first written mention by the name of Gyűrűfű dates to the early 14th century. As part of the forced collectivization programs of the Kádár regime, the village was depopulated and with this, the traditions and social institutions of centuries perished. After the political changes of the late 1980s and early 1990s, it was again possible to settle in and re-establish the village. However, while a return to some of the traditions of old was possible and continues to this day[5], the changes – and challenges – of modernity and globalization meant that institutions and values of a small rural community would have to be differently constituted and reinvented according to the new realities.

Creating an eco-village based on principles of sustainability and pragmatism/workability was the brainchild of the friends Imre Kilián and Béla Borsos, who chose the site because it lies in a natural catchment area, is sufficiently distant from Budapest to allow a degree of isolation, because the land was affordable and suitable for human settlement. The principles of the community are:

- Nature: Preserving the natural landscape and its biodiversity
- Agriculture: Producing food based on organic principles to preserve soil and water quality as well as for its health benefits
- Forest: Protecting the local forest, using it sustainably and in so doing steering the forest landscape towards its natural state

[5] For example, the village carries out education activities for children to familiarize them with the ancient Hungarian script and language. (Fridrich 2014a)

- Water: Sustainably using the local water catchment; careful utilization of rainwater and recycling of wastewater
- Energy: Generating electricity and heat using solar power and biomass
- Waste treatment: Committing to "reduce, reuse, recycle"
- Architecture: Using natural and recyclable building materials, energy-efficient design

(Gyűrűfű Műhely Kft. 2014)

In order to protect groundwater in the local catchment area from pollution, and therefore make it safe for future use, the Gyűrűfű Foundation together with the three surrounding local municipalities of Ibafa, Dinnyeberki and Nagyváty instituted the Gyűrűfű Conservation Area in 1994. (Fridrich 2014)

Of the 174 hectares of land owned by the Gyűrűfű Foundation, around 127 hectares are forest. Under the current property rights regime, effective since 1994, only the state, municipalities and natural persons can own land in Hungary. This law was introduced to prevent foreign investors buying up large swathes of cheap land. However, this means that the Gyűrűfű Foundation cannot buy and subsequently own and determine the use of the other forest areas in the Conservation Area. Therefore, a non-profit organization comprised of three members of the community leases 160 hectares of land owned by the municipality of Ibafa. As lessors of this land and furthermore as member of the organization overseeing the Conservation Area, the non-profit organization prepares forest management plans to the competent forest authority, the Pécs Board of Forestry. (Lehoczky and Fridrich 2007)

2.7 Gyűrűfű's forest vision

The intention of the Gyűrűfű community is to create a close-to-nature forest that can be utilized using eco-sensitive FM practices that have little to no visible impact on the forest ecosystem. The envisioned forest has a varied age-, diameter- and height structure, which would further increase biological diversity. This forest prevails as a prominent landscape element, covering as much of the surrounding hillside as possible. Particularly the thorn bush

forest peripheries are protected and in turn protect the forests. Rare, unique and old trees (such as the beech in figure one below) especially are protected, and deadwood not used for heating remains in the forest. (Gyűrűfű Műhely Kft. 2014; Fridrich 2014)

Currently, half of Gyűrűfű's forests are populated exclusively with the invasive *Robinia pseudoacacia*, with the rest composed of a variety of native species such as *Quercus cerris*. The majority of the stands are virtually perfectly even-aged, having been managed as rotation forests in recent times. There is little to no shrub cover in most of the forest, but the gullies and hilly relief of the area make for a pleasant environment. A more detailed description of the forests will be made in chapter six.

Figure 1: Students and faculty from Central European University on Gyűrűfű's forest education trail (photograph by the author)

Management of the idealized forest is low-input (in terms of financial capital and labor) but allows for the continuous harvesting of lumber to provide biomass for heating and building material needed by the community. This continuity is achieved by taking deadwood from the forest and removing trees in the process towards achieving the desired forest

structure, i.e. making room for chosen trees with desired properties by removing inferior trees (i.e. thinning). This is in line with the PRO SILVA approach to continuous cover forestry where thinning, felling and harvesting are determined and carried out for each individual tree, in order to achieve a mixed-age, mixed-species forest structure with a good understory and in balance with forest fauna[6]. (PRO SILVA Europe 2012) The value of wood from this forest will be higher than it is now as the quality of trees should improve, and further value will be added as individuals in the village manufacture wood products. This will make logging operations and trade in timber obsolete. Lastly, Gyűrűfű's forest remains a site of relaxation and training of mind and body, where ecologically sensible walking trails and an education and information trail stay intact and are maintained.

In summary, Gyűrűfű exists in an environment that on a regional level has a nominally strong political commitment to SFM as expressed in Forest Europe activity and the EU's current commitment to consolidating and improving its forest policy. Hungary as a transitional economy in this context is burdened by economic constraints and demands for prioritizing economic development over environmental protection, as well as by the legacy of extreme centralization. On the other hand, civil society in Hungary is by and large pro-active, with Gyűrűfű being exceptional as an eco-village but not exceptional as a citizen organization and community actively pursuing methods of environmentally friendly living.[7] Having introduced the setting of the case study, I will go on to review the scientific and technical literature on SFM, C&I and other relevant concepts and ideas.

[6] A more detailed description of continuous cover forestry and PRO SILVA can be found in the appendix.

[7] This view is based on first-hand experience in urban permaculture gardening in the country's capital.

3. Literature review

3.1 SFM

3.1.1 History and philosophy of SFM

Historically, forest cover globally has followed an S-curve trajectory mirroring the rise and fall of civilizations: Quickly developing, 'booming' civilizations decimate forests as they need timber for fuel and building material and the space cleared of wood for agricultural land and living space (the current clearing of rain forests to grow soy as cattle feed to then in turn feed a global middle class craving meat products being no exception); while on the other hand the decimation of human populations and civilizations leads to a regeneration of forests, as evidenced by e.g. Central Europe's vast afforestation efforts following the Second World War[8]. In Hungary for instance, 600,000 ha of land was reforested in the post-war decades. (Csóka 1998; Lanly 1995) While these reforestation are beneficial for soil conditions and play a vital role in carbon sequestration, and although forests generally preserve more biodiversity than agricultural landscapes, the increasing trend of single-species plantation forests has a poor record of harboring and promoting biodiversity. (Brockerhoff et al. 2008; Rudel et al. 2005)

The central characteristic of forest ecosystems and forest resources that lies at the heart of SFM is that trees grow slowly. Whereas managing agricultural resources that can be grown yearly requires thinking ahead to the next growing season, managing forests requires thinking in time frames of at least twenty years, i.e. roughly the span of what is commonly considered a human generation. This has two key implications: First, that sustainably using wood as a resource runs contrary to 'human nature' (the prime concerns implicit in our

[8] Furthermore, legend has it that the devastation of Genghis Khan's conquest of Eurasia led to a period of great increases in forest cover.

psyche are to be watered, fed and sheltered), and second and consequently that foresight must be enforced and institutionalized where it would usually be ignored.

Modern forestry was born out of Enlightenment era efforts to systematize "traditional practical knowledge … in an effort to develop a body of scientific disciplines whose main purpose was to ensure steady wood supplies through time." (Agnoletti, Dargavel, and Johann 2007:7) It found its first strong application where economic development through international trade necessitated it: first in the Venetian Republic of the middle ages and later in France, where the forest of Tronçais was set aside in the 18th century to provide oak to build ships for the French navy in the 19th century. (Ibid) Forestry science as we now know it was pioneered in Germany where Hans Carl von Carlowitz penned the first treatise on silviculture, *Sylvicultura Oeconomica*, in 1713. The management system that established itself was one of so-called 'cameralists' with a silvicultural university education in charge of administration, and 'master hunters' – a term that shows an espousal of multiple-use ideals – tasked with the monitoring of the stands. The result was a synthesis of interdisciplinary science – taught at universities' dedicated forest schools – and practical art (foresters were led by the maxim of "talking to the forest", i.e. spending considerable time wandering the stands and even living in the forest). (Ibid) While modern times have brought a host of high-tech management and administration tools to forestry, the "sustained yield" forestry model of most of Europe is still largely based on the ethos of German 18th century forestry pioneers. (Lanly 1995) It is also a German forestry lecturer that gave one of the earliest definitions of SFM. Hartig, in 1804, stated: "Every wise forest director has to have evaluated the forest stands without losing time, to utilize them to the greatest possible extent, but still in a way that future generations will have at least as much benefit as the living generation." (Quoted in Wiersum 1995:322) Having been under Habsburg rule, the forests of Hungary were managed in the tradition described here for centuries.

Over time, the multiple uses of forestry were increasingly recognized and the concept of "sustained yield" evolved into SFM. The 1960 US Multiple-Use Sustained Yield Act for example identifies "timber, fish and wildlife, outdoor recreation, range and fodder, and watershed protection" (Wiersum 1995:322) as categories of human benefits from forests. This instrumental and predominantly economically oriented view evolved into a more inclusive one when the importance of ecosystems services like climate change mitigation and harboring biological diversity was recognized, as well as the social dimension of forest sustainability when forest-dependent communities and their reciprocal relationship with forests (both as dependent on forests and as guardians or stewards of the forest) was accepted. Thus, Wiersum identifies four norms that underlie the concept of sustainability in forestry:

Table 1: Norms underlying forest sustainability (Wiersum 1995:324)

Maintenance of forest ecological characteristics	Maintenance of the production capacity of forest soils
	Maintenance of the vegetative renewal capacity
	Maintenance of specific and unique forest components
	Maintenance of biodiversity and natural forest ecological processes
Maintenance of yields of useful forest products and services for human benefit	Maintenance of production of a dominant commercial good
	Maintenance of ecological benefits in relation to non-forest areas
	Maintenance of a production mix of diverse products and services for human benefits
	Maintenance of production of goods for those categories of population who depend on forest for their basic needs
	Maintenance of forests as an insurance or buffer against possible ecosystem disasters
Sustenance of human institutions that are forest-dependent	Maintenance of cultural integrity of tribal communities
	Maintenance of equitable distribution of forest products and services to different categories of population
	Maintenance of labor- and income-generating benefits derived from forests
Sustenance of human institutions that ensure forests are protected against negative external institutions	Maintenance of effective legal and organizational frameworks for forest protection
	Maintenance of proper socioeconomic conditions for populations living near forest areas
	Maintenance of involvement of local forest users in forest management

Finally, Wiersum makes the point that there is a fundamental contradiction in sustainable forest management: the contradiction of ecological limits of forest ecosystems,

"dominated by negative-feedback loops and homeostatic processes," and social systems "characterized by positive feedbacks and consequently time-dependent features in response to the evolving needs of mankind." (Ibid:326) This relates to the trend observed over long periods of time that forests flourish when human civilization is decimated, and vice versa. The core consequence is that if SFM is to be realized effectively and over long periods of time, social and political dynamics are at least as important as ecological, physical boundaries.

3.1.2 Definition of SFM

Table two lists a number of commonly used definitions of SFM.

Table 2: Definitions of SFM

Organization or institution	Definition	Reference
United Nations Forum on Forestry	"A dynamic and evolving concept, [aiming] to maintain and enhance the economic, social and environmental values of all types of forests, for the benefit of present and future generations"	(UN General Assembly 2007)
Canadian Standards Association (CSA)	"SFM is management to maintain and enhance the long-term health of forest ecosystems, while providing ecological, economic, social and cultural opportunities for the benefit of present and future generations"	(Duinker 2001)
Forest Europe	"The stewardship and use of forests and forest lands in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfill, now and in the future, relevant ecological, economic and social functions, at local, national, and global levels, and that does not cause damage to other ecosystems"	(Ministerial Conference on the Protection of Forests in Europe 1993a)

The most apparent common feature of all three is the application of the concept now and in the future, or for both present and future generations. This is an element shared with the definition of sustainable development by the UN and its central feature. Another common element of all three definitions is the operative subject in each: The *maintenance*, and in the case of the UNFF and CSA the *maintenance and enhancement*. Forest Europe's definition is

on the whole somewhat confounding, containing multiple verbs and verbal nouns as well as series of nested objects of these operative terms, but adds *stewardship* and *use* to *maintenance*. Forest Europe's objects of SFM include forests' *biodiversity, productivity, regenerative capacity* and *vitality*, as well as their *potential* to fulfill functions according to all three dimensions of sustainability. UNFF's definition on the other hand limits itself to the latter, while being alone in stressing explicitly that *all* types of forests are concerned – this is likely to do with the regional character of both Forest Europe's and Canada's definitions, where tropical rainforests for example are not affected. Lastly, while the UNFF uniquely states that SFM is a *dynamic and evolving* concept, Canada's definition is alone in including *cultural* values of forests among the things to be maintained and enhanced. In addition *opportunities* is used where the other definitions describe forest *functions* or *values*, suggesting a greater focus on the potential of positive social dynamics finding context in forests.

For the purpose of this research thesis, the definition of SFM will combine some features of the above. SFM is thus defined, by me, as: the stewardship and use of forests to enhance the economic benefits and sociocultural opportunities of present and future generations, while maintaining forest ecosystem health and vitality and with appropriate responsiveness to sociopolitical and physical dynamics.

3.2 C&I for SFM

The paramount question that lurks beneath these definitions of SFM and the discussion of their terminology is how SFM is to be operationalized. Wiersum states: "Although it is far easier to show ex-post what was not sustainable than to identify ex-ante what would be a sustainable activity, practical experience can significantly increase the understanding of the contextual significance of various factors when operationalizing the principle of sustainability." (Wiersum 1995:327) Operationalization of SFM should be a process based on

the social legitimization and valuation of evolving principles and practices and a technical or scientific review of their efficacy. Duinker affirms that the ideal operationalization of SFM in the face of the realities of political dynamics is adaptive management, defined by the Provincial Ministry of Forests and Range, Canada as "a systematic, rigorous approach for deliberately learning from management actions with the intent to improve subsequent management policy or practice." (Ministry of Forests and Range 2007) A mode of SFM operationalization chosen by, for example, Forest Europe, is the use of C&I. In the following pages, C&I as a SFM operationalization tool will be defined and a number of C&I sets in use at various levels discussed.

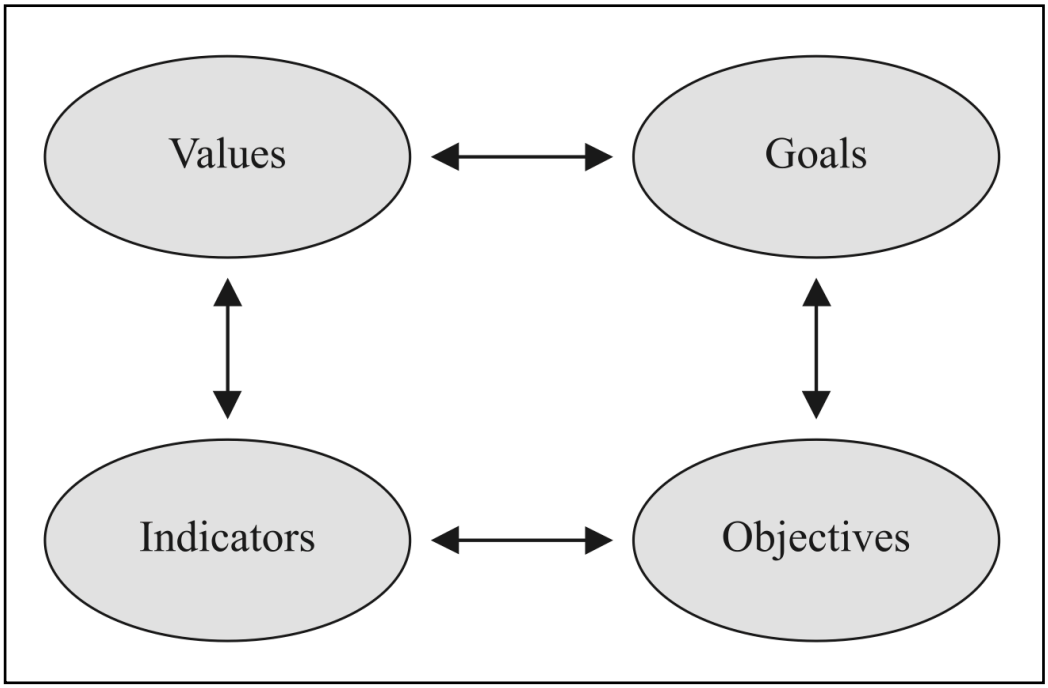
3.2.1 Theory

In order to properly understand C&I for SFM, C&I needs to be separated into *criterion* and *indicator* and these terms must be individually defined, along with a number of terms that are crucial to properly understand, evaluate and create or apply a C&I set for SFM.

To define C&I, it is necessary to first define a higher-order term than either *criterion* or *indicator*, as C&I do not exist for their own sake but rather for a higher purpose, i.e. the realization or fulfillment of a certain *principle*. A *principle* is "a fundamental truth or proposition that serves as the foundation for a system of belief or behavior or for a chain of reasoning"; alternatively it can be defined as "a general scientific theorem or law that has numerous special applications across a wide field". (Apple Inc. 2005a) In the first of these definitions, applied to our academic discipline, the fundamental proposition is that the integrity of forest ecosystems and landscapes must be preserved for future generations through careful utilization in the present. The second definition of 'principle' holds because, if one were to correctly substitute terms in the foregoing sentence, one could describe the sustainable management of aquatic resources or sustainable agriculture.

At the other end of the spectrum, systems of belief or behavior are underpinned by certain *values*, i.e. the "importance, worth, or usefulness of something" (Apple Inc. 2005b) with which one regards a thing. Each value is guided, in the context of C&I, by a *goal*, a "directional statement" (Duinker 2001:10) that need not be quantified. In order to fulfill these goals, quantitative *objectives* are set with respect to the *indicator* (a variable from which the status of a particular criterion can be derived) that relates to one or more values. Each value has a goal, and each indicator has an objective, and the meeting of an objective's quantitative target signifies reaching a goal that is set for each value. This interaction of indicators and objectives, values and goals is a dynamic one that takes place for each *criterion*. This term can be defined as a cluster of values, "a category of conditions or progresses by which SFM may be assessed." (Ibid:9) This can be understood, looking towards lower-order statements, as an aggregate of properties or characteristics of a forest for which one may consider a forest important, i.e. criteria as 'mega-values'. In relation to the higher-order statement of a *principle*, a criterion is a "second-order principle" (Ibid). The relation between these components is summarized in figure two:

Figure 2: Relationships among values, goals, objectives and indicators (Duinker 2001:10)



While major C&I frameworks follow these distinctions, some confusion arises for example when one compares C&I frameworks with other SFM operationalization approaches. The Forest Stewardship Council (FSC) for example uses a framework of 'principles and criteria', where from a hierarchical viewpoint the principles equate with criteria and the subsequent criteria are on the same level as indicators, but conceptually radically different: The FSC 'criteria' are legalistic statements along the lines of 'forest operators shall …' and thus do not display variables that pertain to the state of the criterion[9]. (Forest Stewardship Council 2014)

Duinker identifies three ways in which the determination of SFM criteria is a political endeavor. First, the values of the persons determining the criteria influence the selection of criteria. In the case of Canada's SFM for example, four out of six criteria are strictly ecological whereas the notion of sustainability built on three pillars (ecology, economics, society) suggests that a third of the criteria should be based on each pillar[10]. Secondly, C&I deliberations have a problematic dilemma of inclusiveness: While a variety of experts, stakeholders and representatives are ideally included in the process, this leads to a need to have 'something for everyone' and the inclusion of indicators that do not satisfy the criteria of indicator and data quality necessary for good C&I. Lastly, those deliberating a C&I set may be biased towards including indicators whose objectives are more easily fulfilled to showcase the success of whatever project the C&I set is designed for. This can potentially lead to important aspects being neglected if they seem too problematic for those involved. (Duinker 2001) These aspects may provide an explanation for the suitability/adequacy (or lack thereof) in applying C&I in various cases, as discussed in subsequent chapters.

[9] It should be noted that, outside the domain of forestry, criteria are often regarded as describing the indicator selection process.

[10] Unless of course the explicit purpose of a C&I framework is to provide an adaptive management tool for only one of the dimensions of sustainability.

At the basis of this political dimension of C&I development is the fact that groups of people create, discuss and implement C&I. For this reason, Rametsteiner et al. (2011) approached this topic from a social science perspective. They start by asserting that sustainability is a normative concept and as such presents a challenge: However much a team of scientists tries to limit a C&I development process 'purely scientific', the scientists must – implicitly or explicitly – agree on some definition of sustainability (whether general or specific to the subject area at hand) which they then perpetuate. Actual C&I development processes are scarcely orchestrated only by scientists, however: Many include predominantly policy-makers and civil society representatives as well as technical or scientific experts. While "science-driven sustainability indicator development initiatives … develop indicators to use them in the context of ex ante sustainability impact assessments of alternative policies or scenarios based on modeling tools," processes driven by policy-makers and administrators tend to have monitoring and evaluation of sustainability aspects of certain projects as their purpose. (Rametsteiner et al. 2011:62)

However, regardless of the composition of people tasked with developing them, or their end-goal, all C&I development processes need to integrate both scientific or technical knowledge and societal norms. Developing C&I is thus "a process of both scientific 'knowledge production' and of political 'norm creation.'" (Ibid:61) It is further stressed that an optimal C&I development process is "iterative… a continuous adjustment to emerging societal norms and priorities as well as knowledge about the physical system." (Ibid:64) This reinforces the definition of SFM as 'dynamic and evolving' by the UNFF. (UN General Assembly 2007)

In order to understand how C&I processes can better integrate these two dimensions, the authors first constructed a set of conceptual frames to distinguish between the two types of C&I processes and then drew up assessment criteria to ascertain to what extent on the one

hand ‘knowledge production’ and on the other hand ‘norm creation’ were part of a series of actual C&I processes. Comparing knowledge production and norm creation in a variety of C&I processes, the authors draw two important conclusions: First, with regard to the role of scientists in C&I development processes, they ask whether “a slightly more accurate but politically less relevant set, or a slightly less accurate but politically more relevant set” is better. (Rametsteiner et al. 2011:69) The answer they give is that it depends on the people involved and the wider context of the C&I set. Experts in “knowledge production” processes need to accurately reflect social norms when voting on indicators that are not their particular scientific domain (which means that they make their choices effectively as ‘informed citizens’), while the rules of inclusion and the choice of topical focus in ‘norm creation’ processes must be designed so that there is enough focus for the set to be relevant and potentially effective, and so that the process is legitimated through the inclusion of suitable stakeholders. Secondly, with regard to the balance of sustainability dimensions in the outcome of these processes, the authors find that overwhelmingly, the processes they studied lacked in reflection of the social dimension of sustainability, favoring ecological and economic aspects. As will be further discussed later, this may imply an underrepresentation of the interests of certain segments of societies and consequently lead to a lack of legitimacy.

None of the C&I projects under scrutiny included measures that would include a balance in the expertise of participants from the outset. While one may argue that, as mentioned above, participants make politically motivated decisions when deciding on aspects that are not their expertise and therefore are expressions of their norms and values, it seems unlikely that groups of natural scientists and economists could reflect on social sustainability (a dimension arguably in need of sociologists, anthropologists and human rights lawyers) in a balanced way. Indeed, the very notion of social sustainability rests on a just, inclusive process

as much as, and perhaps more than, on deciding what elements, forms of capital, resources etc. need to be sustained.

The Sustainability Assessment and Measurement Principles (STAMP), a revision of the Bellagio principles formulated in 1996 by experts on guidance for sustainable development, are a useful and venerated reference for formulating and evaluating sustainability assessment instruments across topical areas and geographical scales. As such, the STAMP principles apply to both C&I for SFM at a regional level – reviewed in the following section – and to the case study in particular. A short summary of the principles will be given below in table three, and further reference to them will be made when relevant throughout the rest of my thesis.

Table 3: Bellagio STAMP principles (Pintér et al. 2012)

Principle	Description: "Assessment of progress toward sustainable development …
1: Guiding vision	... will be guided by the goal of delivering well-being within the capacity of the biosphere to sustain it for future generations.
2: Essential considerations	… will consider the underlying social, economic and environmental system as a whole and the interactions among its components; … dynamics and interactions between current trends and drivers of change; risks, uncertainties, and activities that can have an impact across boundaries.
3: Adequate scope	… will adopt an appropriate time horizon …; [and] an appropriate geographical scope.
4: Framework and indicators	… will be based on a conceptual framework that identifies the domains within which core indicators to assess progress are to be identified; standardized measurement methods wherever possible…; comparison of indicator values with targets, as possible.
5: Transparency	… will ensure the data, indicators and results of the assessment are accessible to the public; explain the choices, assumptions and uncertainties determining the results of the assessment; disclose data sources and methods; disclose all sources of funding and potential conflicts of interest.
6: Effective communications	… will use clear and plain language; present information in a fair and objective way that helps to build trust; use innovative visual tools and graphics to aid interpretation and tell a story; make data available in as much detail as is reliable and practicable.
7: Broad participation	… should find appropriate ways to reflect the views of the public, while providing active leadership; engage early on with users of the assessment so that it best fits their needs.
8: Continuity and capacity	… will require repeated measurement; responsiveness to change; investment to develop and maintain adequate capacity; continuous learning and improvement."

Meanwhile, as an illustration of the relevance of Bellagio STAMP, the various definitions of SFM can be reflected upon given these principles.[11] In light of principle two, all definitions

[11] While definitions of SFM are not assessment and measurement instruments for sustainability as such, they are at the heart of such instruments and thus, where applicable, these principles provide valuable insights.

reviewed above reflect on at least social, economic and environmental factors; however, only the UNFF defines SFM as a dynamic and continuously evolving concept. This partly addresses principle eight, namely the requirement for continuous learning and improvement. The Canadian Standards Association's use of the term opportunities reflects principles seven and eight – 'broad participation' and 'community and capacity'. The Forest Europe C&I will be further evaluated along the lines of Bellagio STAMP principles in the following section.

In the following part, I will review the Forest Europe C&I set as well as a forest management approach (FMA) framework developed by forest scientists.

3.3 Indicator sets

3.3.1 Forest Europe C&I

While European nations initially participated in an international, Canadian-led SFM policy debate after the Rio summit, a parallel process was started in Helsinki in 1993 at the second Ministerial Conference on the Protection of Forests in Europe (MCPFE). The six Forest Europe C&I were adopted at the 1998 Lisbon conference and further improved at the 2003 Vienna conference. The criteria and their indicators are listed in table three. Criteria one, two, four and five are of an environmental character, while criterion three and most indicators of criterion six are of an economic character. Only four of the eleven indicators of criterion 6 can be described as belonging to the social dimension of sustainability (marked with "*S" in table four). This confirms the previously mentioned potential of C&I processes to lead to an imbalance in the inclusion of all three dimensions of sustainability, and may be explained by a detailed investigation of the process of creating the C&I framework.

Table 4: Forest Europe Criteria and Indicators for SFM (Ministerial Conference on the Protection of Forests in Europe 2003)

1. Maintenance and appropriate enhancement of forest resources and their contribution to global carbon cycles	Forest area
	Growing Stock
	Age structure and/or diameter distribution
	Carbon Stock
2. Maintenance of forest ecosystems' health and vitality	Deposition of air pollutants
	Soil condition
	Defoliation
	Forest damage
3. Maintenance and encouragement of productive functions of forests (wood and non-wood)	Increment and fellings
	Roundwood
	Non-wood goods
	Services
	Forests under management plans
4. Forests Biological Diversity	Tree species composition
	Regeneration
	Naturalness
	Introduced tree species
	Deadwood
	Genetic resources
	Landscape pattern
	Threatened forest species
	Protected forests
5. Maintenance, conservation and appropriate enhancement of protective functions in forest management (notably soil and water)	Protective forests – soil, water and other ecosystem functions
	Protective forests – infrastructure and managed natural resources
6. Maintenance of other socio-economic functions and conditions	Forest holdings *S
	Contribution of forest sector to GDP
	Net revenue
	Expenditure for services
	Forest sector workforce *S
	Occupational safety and health *S
	Wood consumption
	Trade in wood
	Energy from wood resources
	Accessibility for recreation *S
	Cultural and spiritual values *S

Rametsteiner et al., whose 2011 article "Sustainability indicator development – Science or political negotiation?" was used above to highlight the policy-science nexus in play in C&I development, applied their assessment framework of C&I processes to five case studies, including the Forest Europe C&I. As the MCPFE is government-led, government representatives and stakeholders dominated over scientists who were represented mainly by

government-funded research institutes. Accordingly, norm creation and knowledge production were not evenly merged. The balance of scientific expertise was furthermore biased towards economics and environmental sciences, with little representation of experts with social science backgrounds. With a clear agenda of aiming to protect forestry and promote SFM, policy domains outside of the environment were not present and the focus was on forestry; integration with e.g. agriculture as a policy domain – a domain forestry is subordinate to in terms of EU legislation – was not identified. C&I were selected by consensus and are subject to review over time, indicating that they should be adjusted to emerging knowledge and changing social norms. However, the lack of integration with rural development and agricultural policy begs the question of how applicable and relevant these C&I are for rural communities, particularly in CEE countries where rural populations in particular are underdeveloped compared to their urban compatriots; see e.g. "Rural poverty and health systems in the WHO European Region". (World Health Organization 2010)

The aforementioned review of the process of creating Forest Europe C&I suggests a major limitation of the framework when evaluated according to Bellagio STAMP principles. While the definition of SFM for which the framework was created constitutes a suitable *guiding vision*, and *essential considerations* of keeping in mind all three dimensions of sustainability are evident. The *scope* of Europe, including non-EU states, is adequate; and the C&I constitute a comprehensive *framework and indicators*. Some degree of *transparency* is given with public availability of country reports for member states, and repeat assessments allow for *continuity* of the instrument. However, environmental indicators clearly dominate the framework, and the scope lacks a timeline that states dates for particular goals. This might mean that the Forest Europe C&I achieve an air of achievability by not specifying with what degree of urgency certain issues need to be tackled, allowing small steps to be portrayed as big achievements. Furthermore, the objectivity inherent in the framework does little to resolve

dilemmas of prioritizing one development agenda over another; i.e. where increases in plantation forests lead to greater contributions of the forest sector to GDP but also a harmonization of the landscape and detrimental effects on biodiversity, Forest Europe C&I contain no mechanism to curb development trajectories that have short-term financial benefits but may lead to potentially severe long-term sustainability problems.[12] Forest Europe C&I and country reports contain highly technical language that is poorly understood by laymen (see chapter six in this thesis), and data is presented in excel files with no visual aids. The last update of the indicators took place in 2003, and macroeconomic changes resulting from the 2008 financial crisis – which have led to a decrease in forestry workforces in Hungary and elsewhere in Europe – ought to lead to renewed discussion on the framework and its indicators. In fact, the Bellagio principle that Forest Europe C&I least fulfill is principle seven, 'broad participation'. Technical experts and policy-makers deliberated the framework, and are also its primary users. Grassroots practitioners, i.e. foresters particularly of small-scale silvicultural operations, were neither included in the process of creating the framework, and whether or not they can apply it is a key question of this research – addressed in the following chapters.

Participation is a key consideration in the domain of social sustainability, which has been found underrepresented in the framework. Section 3.4 will discuss some of the theories of social sustainability scholars; the next section however discusses a more silviculture-and practice-oriented framework of Forest Management Approaches that should have more currency with forest practitioners.

[12] Indeed, it could be argued that the very fact that contribution to GDP is an indicator in the framework is contradictory to the spirit of Bellagio STAMP that seeks alternative ways of measuring wellbeing and progress.

3.3.2 C&I for forestry practitioners: Classification of forest management approaches

Duncker et al.'s framework of forest management approaches is not a C&I set but a list of silvicultural decisions that pertain to particular SFM criteria. It serves to illustrate how various concrete forest management practices, and their degrees of intensity or disruptiveness, can impact C&I. The framework's purpose is to "serve as the foundation of any analysis wishing to explore *the effect of changing policies and silvicultural operations upon criteria and indicators of sustainability*, and upon the provision of ecosystem services." (Duncker et al. 2012:52)

The list of decision criteria, relevant silvicultural operations and affected sustainability criteria, is contained in table four.

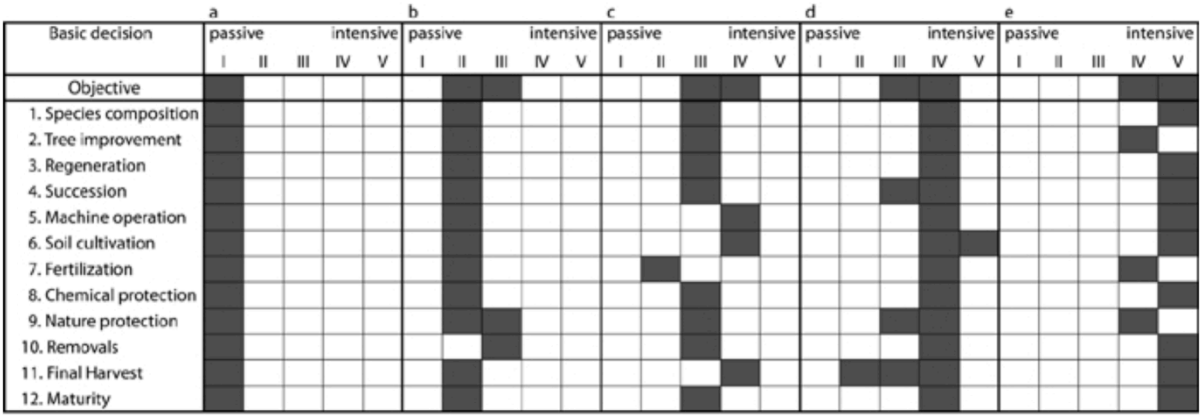
Table 5: Decisions involved in forest management, relevant silvicultural operations and affected sustainability criteria (Duncker et al. 2012:53)

Decision criteria:	*Relevant silvicultural operations:*	*Affected sustainability criteria:*
Naturalness of tree species composition	Selection of tree species	Biodiversity; tree species composition
Tree improvement	Selection of tree genotypes	Biodiversity; genetic diversity
Type of regeneration	Stand establishment	Growing stock; age structure; tree species composition
Successional elements	Stand establishment; tending; thinning	Tree species composition; density pattern
Machine operation	Fertilizing; liming; soil preparation; thinning; final harvest	Forest ecosystem health and vitality; site condition
Soil cultivation	Soil preparation; drainage	Site condition
Fertilization/Liming	Fertilization; liming	Site condition
Application of chemical agents	Pest control	Tree species composition
Integration of nature protection	Thinning; final harvest	Biological diversity; tree species composition; density pattern; age structure
Tree removals	Thinning, final harvest	Site condition; carbon stock
Final harvest system	Final harvest	Density pattern; age structure
Maturity	Final harvest	Biodiversity; age structure

These decision types are then drawn up in a roster to show which types of operations would be appropriate for forest management approaches (FMA) of varying intensity. For example in a passive, unmanaged forest nature reserve (the lowest intensity level) no silvicultural machinery is operated in the forest and no soil fertilization takes place; in intensive short rotation forestry on the other hand there is intensive machine operation, the soil is cultivated

and fertilization and chemical use are standard practice. (Ibid) Table five below indicates how the intensity of each FM decision aligns with the FM objectives of each case study: both the overall intensity of the FM objective for each case study is ranked from 'I' (passive) to 'V' (intensive) and blocked out accordingly, and the same is done for each FM decision element.

Table 6: Intensity of silvicultural operations in relation to the forestry objectives of five case study forests: a: Bialowieza National Park, Poland; b: European beech in Baden-Wuerttemberg, Germany; c: mixed forests dominated by Norway spruce in northern Sweden; d: Sitka spruce forests in Scotland; e: Eucalyptus in Portugal (Duncker et al. 2012:55)



While this pragmatic framework indeed shows potential for effectiveness in the adaptive management at a stand or forest management unit (FMU) scale, the authors perhaps went too far in declaring it fit to reflect sustainability criteria, as only environmental sustainability criteria are addressed. However, silvicultural operations have an impact on social aspects of sustainability (extensive clear-cutting for example is generally not seen as conducive to recreation and relaxation) as well as economic returns from forestry (an unmanaged forest such as Bialowieza National Park in Poland would not produce any economic returns from timber sales). Therefore, silvicultural operations have a bearing on sociocultural and economic dimensions of sustainability according to the intensity of FM; this relationship is further explored in the next chapter.

3.4 Community participation and social sustainability in SFM

A key question that serves as a useful first step in thinking about sustainability in general and the direction and aims of particular sustainability dimensions or issues is, "what is to be

sustained?" This question is easily answered with regard to environmental sustainability – "the healthy state of ecosystems" and economic sustainability – "the prosperity/livelihoods of communities". The same question, however, is not easily answered in regard to social sustainability. In other words, "it is still unclear whether the concept of social sustainability means the social preconditions for sustainable development or the need to sustain specific structures and customs in communities and societies." (Colantonio 2009:866) This section will first expand on this question, and subsequently relate it to C&I and SFM.

3.4.1 Social sustainability as fundamental process or constitutive part of sustainable development

Sachs (quoted in Colantonio 2009:869) defines social sustainability by grounding the concept on "basic values of equity and democracy, the latter meant as the effective appropriation of all human rights – political, civil, economic, social and cultural – by all people." This 'appropriation' can be understood as the continuous building up of social, spiritual and cultural capital by various means – education, childcare, activity in civil society and the public sphere, et cetera. This development takes place in the context of on the one hand ecological dynamics that provide for, and delineate the restrictions of, vital resources; and on the other hand of the "burden of the living past," (ibid:867) that is to say, the constraints of past processes in civil society, politics, familial and community relations and so on. Social sustainability thus rests on an arrangement of human institutions that provides both for the physical requirements of societies derived from nature, and the peaceful relation within and between societies. While further components of the definitions of social sustainability diverge widely, there is substantial agreement among scholars that the fundamental pillars of the concept are the provision of basic needs and equity over time. (Ibid)

Because no society can be said to be free from inequalities and a want of basic necessities by some part of its population, social sustainability must be understood as a

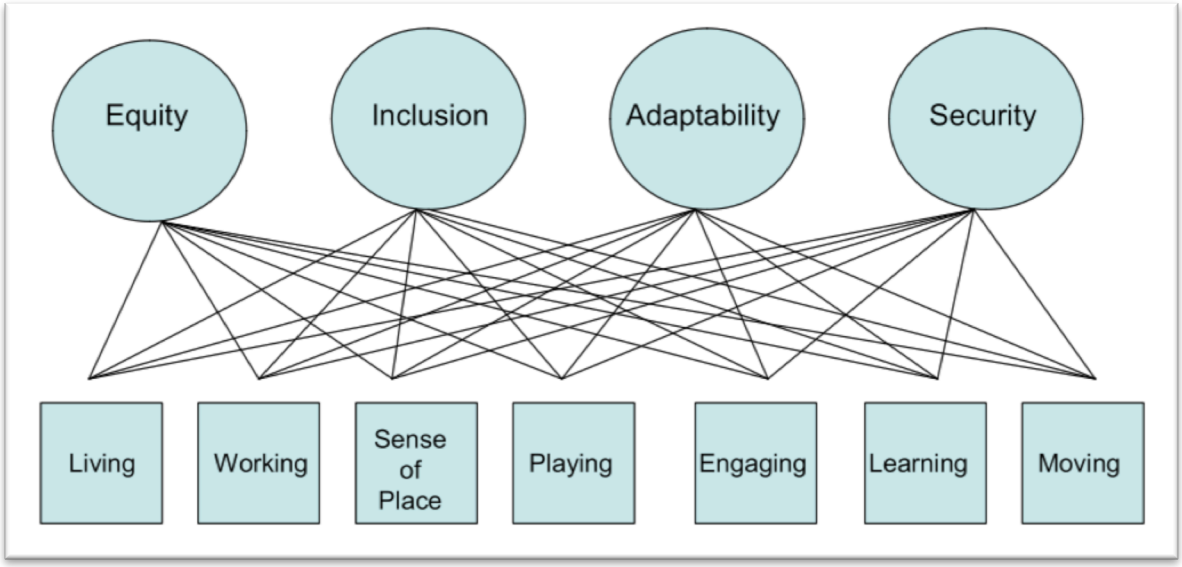
continuous process aiming to satisfy basic needs for all in an equitable fashion; and because all societies – even in the most socioeconomically developed regions of the world – exhibit unique traits, the concept must be operationalized according to the constraints of such peculiarities. As such, it can be argued that there is a 'thing to be sustained' in the dimension of social sustainability, but in terms of operationalizing the concept this fact alone is of little help as different societies are in different stages of socioeconomic development and, as hinted at above, are culturally, ethnically and politically diverse and therefore in need of different processes to equitably obtain, and then sustain, basic needs for everyone.

3.4.2 The social dimension of C&I for SFM

Social sustainability has conceptual similarities with SFM in the sense that no universal solution to the problem exists. Instead, policies and plans must be developed according to individual constraints and contexts. Recognizing the interconnectedness of social and environmental problems, adaptive management techniques for sustainability are ideally an integrated process and informed by input from interdisciplinary panels of experts as well as citizens. (Wallimann 2013)

One popular – if partial – approach to adaptive management is the development of C&I as reviewed in the preceding sections. Applied to matters of (urban) social policy, relevant criteria may be equity, inclusion, adaptability and security based on themes and values that include living, working, playing, a sense of place, engaging, learning and moving, as developed for the city of Vancouver. Relevant indicators in this case include 'long term employment,' 'education expenditures,' 'young offenders' and 'suicides.' (Colantonio 2009)

Figure 4: Framework for social sustainability assessment Vancouver (Colantonio 2009)



A general observation shared by all scholars engaging with this topic in the realm of SFM is the relative lack of focus on, and inclusion of expertise relevant to, social sustainability in C&I development processes and resulting indicator sets (see for example Robertson 2013; Rametsteiner et al. 2011.) Taking the Forest Europe C&I as an example, we can see that only five indicators qualify as belonging to the social dimension of sustainability (see section 3.3.1 above), compared with eleven from the economic dimension and the remaining 19 being environmental. The five social indicators – forest holdings, forest sector workforce, occupational safety and health, accessibility for recreation, and cultural and spiritual values – can be further classified as structures, rules and institutions that require sustaining as opposed to signifying processes that exist as preconditions to sustainable development.

However, having previously identified the lack of inclusion of social expertise and voices from civil society in the development of C&I, it is questionable whether the few social indicators included (in a category of criteria labeled 'other'!) reflect the actual needs and desires of affected societies and/or qualities of sustainable development identified by scholars specializing in social sustainability and its relevant second-order principles. This may be part of a larger problem in community inclusion in SFM: Maureen Reed (2010) found that forest

policy and planning deliberations in Canada include participants based on interests they represent, which are narrowly defined, predominantly in economic terms. Discussions center around the technical, which precludes laymen, and the gender bias against women – particularly in more remote communities – excludes a vital part of the demographic that tends to care more about the environment and possesses different knowledge of environmental issues. (Reed 2010) This exclusive character of forest policy formation is perhaps the more troubling given the fact that the least educated residents in and around forests tend to value their integrity, health (and arguably naturalness) the most. (Paletto et al. 2013) Importantly for this thesis, it is of great interest to see how such strata of society that are usually excluded from C&I deliberation processes receive C&I frameworks: How well do members of such communities understand them, and how relevant do they think they are to the circumstances they find themselves in? Chapter six will show how these questions are answered in regard to Gyűrűfű.

This matter is further complicated by the fact that social aspects of sustainability are more difficult to measure and more subject to debate than environmental and economic topics. Robertson, focusing on the Montreal Process C&I, finds that good arguments can be made for the sustainability as well as the unsustainability of various criteria, owing to the essentially qualitative approach that must be taken to research relevant data and depending on the context. He concludes, "Forest sustainability must be interpreted in a broader context subject to many contingent factors outside of the purview of … whatever … C&I framework you happen to be using." (Robertson 2013:60) However, this broader topical context should not be confused with a broader spatial context: Robertson points out that in regard to socioeconomic sustainability indicators such as recreation and employment, one community may benefit from and appreciate focus on one and not the other, and vice versa. This highlights the importance of emphasizing social sustainability as a process acting as the

foundation of SFM: Consultation and involvement of affected populations in agenda setting for forest management and policy, and in deliberating appropriate C&I, is vital as it not only involves expertise and 'connectedness' with the 'situation on the ground', but crucially legitimizes the chosen approach.

4. Theoretical Framework

The core of my approach is to integrate Duncker et al.'s silvicultural decision-making framework and his classification of FMA with C&I for SFM as laid out by Duinker (Duinker 2001; Duncker et al. 2012). The rationale behind this is to address limitations of both frameworks and to show how their synthesis can be a useful tool in small-scale, community-determined forestry operations; and furthermore I posit that the two augment each other by adding temporal elements and opportunities to learn and adjust progress towards a vision.

In "Classification of Forest Management Approaches: A New Conceptual Framework and Its Applicability to European Forestry" Duncker et al. state that their framework "can serve as the foundation of any analysis wishing to explore the effect of changing policies and silvicultural operations upon criteria and indicators of sustainability" (Duncker et al. 2012:52). However, they only engage with one dimension of sustainability: The sustainability indicators affected by the silvicultural decisions in their framework – biological diversity, genetic diversity, carbon stock – are exclusively ecological characteristics of sustainability. The authors do not point out any affected sociocultural and economic C&I.

However, there is a clear link that can be extrapolated by relating the impact of silvicultural decisions to sociocultural and economic indicators by way of the intensity of forestry operations caused by various FMAs. The achievement of objectives for particular indicators can be impeded by a greater or lesser intensity of silvicultural operations, or can benefit from greater or lesser intensity.

By and large, social and cultural indicators benefit from a lower intensity: Visitors of forests whose purpose is relaxation prefer old-growth forests or forests with a mix of conifers and broadleaved tree species as well as a mixed age structure, as reported by respondents in Paletto et al.'s 2013 study of recreational preferences in forests in Italian Alpine communities.

There is less uniformity than in even-aged production-oriented stands in forests ideal for regeneration, as well as a greater variety in light and shade that is pleasing to the senses, and they tend to exhibit a wider variety of animal species that can be observed. (Paletto et al. 2013) Likewise, spiritual places in forests tend to be ancient trees, springs or other such features that would stand in the way of intensive, short-rotation production forestry. (Fridrich 2014) Accordingly, there would be little machine operation in such forests; tree removals may be restricted to deadwood; mature trees may be left standing and processes of natural regeneration are not interfered with.

Employment in forestry is an important social indicator, which is not clearly identifiable as benefiting from a greater or lesser intensity. Forest management of the greatest intensity is usually more mechanized and operated 'efficiently' with little personnel, while close-to-nature multiple-use forestry, including the provision of services (mainly tourism) can potentially employ a relatively large number of people. The extreme case of a forest where no management whatsoever takes place and human interference is strictly prevented would also provide for minimal employment; however, since such forests are rare and since the matter of discussion here is an adaptive management tool (C&I), it may be unreasonable to presume that such an example would discredit the analysis.

Economic indicators instead would generally benefit from a greater intensity of forest operations: Steadily harvesting wood as the forest grows as well as the production of roundwood (Forest Europe indicators 3.1 and 3.2, respectively) require a fairly intensive degree of intervention with the forest ecosystem: Harvesters and trucks may be used (and the forest partly cleared to accommodate necessary infrastructure); genetically modified species may be planted; successional elements would be discouraged with the use of herbicides; and nature protection kept to a minimum. However, when this intensity eventually degrades the

ecosystem to the extent that harvestable trees become scarcer and wood quality deteriorates, the greater intensity is no longer important as an economic factor.

While in both of these domains of SFM the opposite can also be the case (preparing a forest for a motocross competition requires clearing parts of the forest; natural forests can employ many when the forest is open for ecotourism; and the production of some non-wood forest goods requires that trees are left standing and forests are kept healthy), this further supports the notion that there is in fact a link between social and economic C&I and Duncker et al.'s FMA framework. In addition, we should be acutely aware of cross-sectoral influences that outdated (yet still commonly used) indicators of progress can obscure. If economic growth is seen as a benchmark of development, increased productivity and GDP growth from heavily polluting industries may contribute to 'progress' if narrowly defined in financial terms. However, the resulting damage – as was rampant with NO2 and SO2 decimating forests in Europe in the 1970s and 1980s – can be detrimental to natural resources. Accordingly, indicators of sustainable development should establish links between sectoral indicators to assure that progress in one area is not critically damaging in another area. The Bellagio STAMP emphasis on cross-boundary effects (principle two, 'Essential considerations') is vital in this regard.

Although C&I are in use in SFM primarily as a policy tool, they are in principle instruments of adaptive management and are thus directly applicable to the management of forests at the FMU level. Foresters think about the resources they manage in time scales often spanning several human generations and often choose their career for life, in many cases managing the same forest for more than 30 years. Furthermore, uncertainties and high-risk changes of circumstances are best dealt with, if not anticipated, at lower jurisdictional levels. (Swanson et al. 2010) In their various manifestations at a (supra-) regional policy level however, C&I lack relevance to decision-making in forest operations. Forest Europe

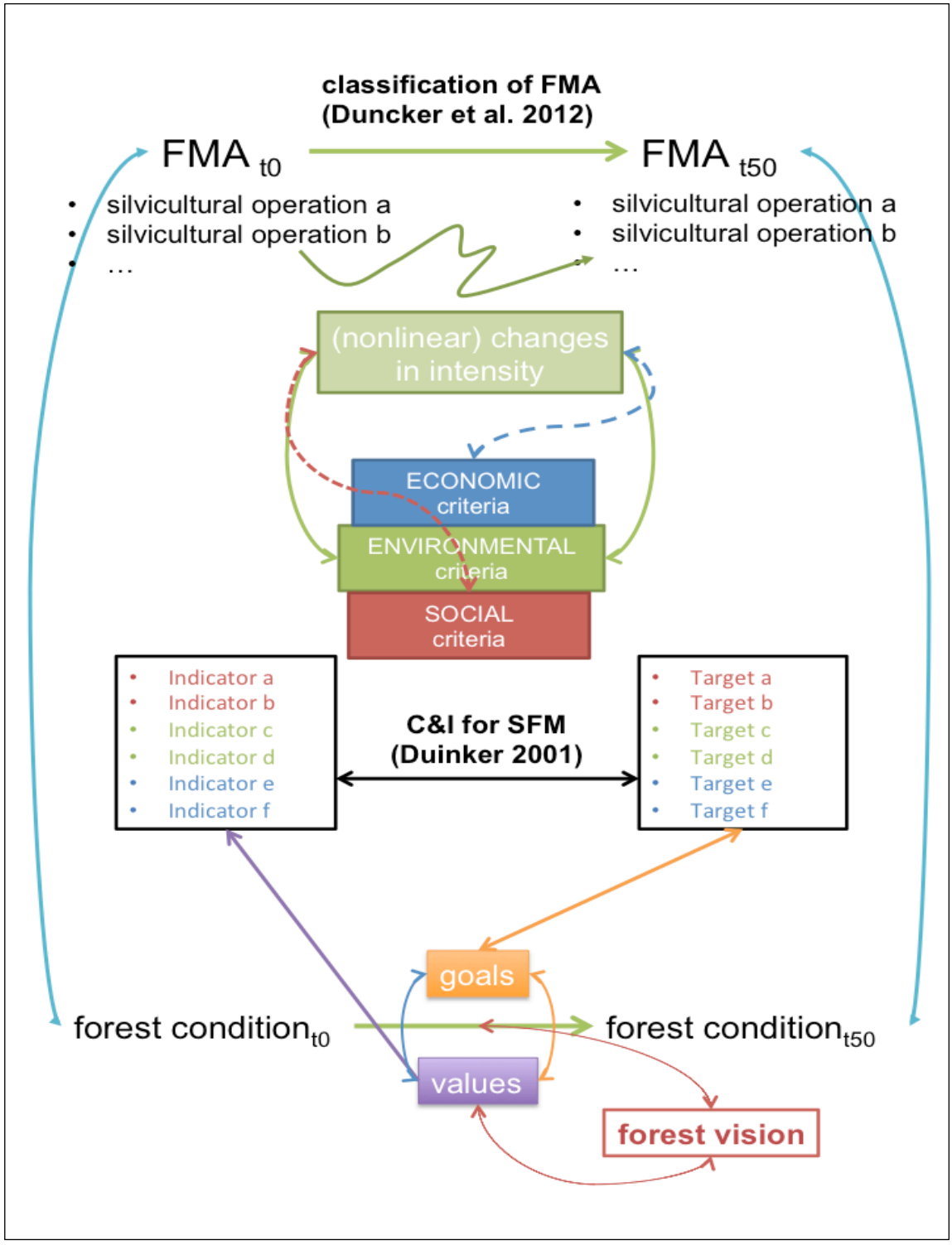
indicators include many factors that do not apply at this scale (ownership categories of forest holdings, the contribution of the forest sector to GDP, and what proportion of wooded land is governed by a forest management plan), and applicable indicators are too broad and vague to effectively guide daily forestry operations. At this scale for example, Forest Europe indicator 5.1 – "protective forests – soil, water and *other* ecosystem functions" (my emphasis) – needs to be more accurate to local circumstances and make necessary differentiations between soil, water, and other ecosystem services, as well as more specifically within soil (soil nutrient levels, compactness, etc.) and water (groundwater retention, water purification, etc.) indicators. (For a deeper discussion of the linkages between scales, see section 4.2.4 in Russillo and Pintér 2009)

While linkages between indicators are acknowledged by Forest Europe (a rationale and a list of related indicators are provided for each indicator), it is unclear how both individual indicators outside of the ecological dimension as well as the dynamics between indicators affect silvicultural operations. For example, the way forestry operations can influence the landscape pattern of forest cover (indicator 4.7) is unclear, and the impact of silvicultural decisions (such as chemical use and sol preparation) on key protective functions of forests (water and soil protection, indicator 5.1) is unexplored.

In practical terms, operationalizing these linkages may be done by means of a "red-flag" method: Certain C&I, or even certain values on which these are based, could rule out certain aspects of more intensive FMA (such as pesticide use or heavy machinery use). Conversely, for economic C&I, felling particular volumes of wood annually over a ten-year period (where for example the use of biomass in a local power station demands a predictable supply) may require a FMA that aims to provide the required volume whether or not trees are mature. This relationship can be characterized as guided by the idiom, "as much as necessary; as little as possible".

The graphic below displays this relationship, and shows how changes in forest management can impact social, environmental as well as economic C&I; and also how indicators belonging to all three categories can conceivably dictate the degree of intensity in forest management and, consequently, a set of suitable silvicultural decisions.

Figure 5: Integrating FMA frameworks and C&I for SFM



The diagram further relates forest management and C&I to the underlying forest vision (defined as the desired condition of the forest by community stakeholders): The process of turning the current forest condition into the forest envisioned is on the one hand subject to changes in forest management (top part of the diagram), and on the other hand guided by values of the community that can be expressed in forest principles, an unwritten shared vision, the wish to return to a condition that existed in times of old (folklore plays a large role here) – or in C&I for SFM. The temporal element of this conceptualization is to an extent informed by the theory of reflexivity, as the acts of changing the forest feed back into the vision and adjust it over time. A corollary of this is a learning process, both in terms of learning of forestry practices and techniques (e.g. applying monitoring technology, or thinning trees to achieve a particular shape in maturity) and in terms of 'social learning', as these processes cover long time spans of at least twenty to fifty years and the people involved thus necessarily change and are influenced by shifts in societal values, market forces and culture (this ties in with the definition of SFM given at the beginning of the chapter).

In addition, the scaling down to FMU level implied by the above effectively deals with the reporting and progress evaluation problem reported by Robertson (2013). Due to the wide-ranging definitions of SFM and consequently diverging practices of SFM across countries and regions, it is hard to gauge whether or not overall progress is being made once the reported C&I data is upscaled to regional or national levels. Sociocultural indicators are particularly affected here, as they may play very large roles in forest management (in and around national parks and areas managed by indigenous people in North America, for instance) or marginal roles (for example in short-rotation production forests of Scandinavia).

Finally, despite the holistic nature of C&I, where usually no hierarchy of criteria or indicators is created, it may be useful to rank indicators according to urgency and importance by measuring the current state against the desired state of the particular indicator and

prioritizing those indicators where the distance between status quo and the objective is greatest. This can be done for each criterion's indicator set and subsequent incompatibilities or clashes between indicators, both within criteria and between them, can be resolved by in turn prioritizing attention to resolving those discrepancies between indicators where most progress is needed.

The following chapter describes how the proposed synthesis of FMA and C&I for SFM was applied to the case study of Gyűrűfű. The scale of a community autonomously managing a forest of around 150 hectares is sensible because at such a level it is more likely that a unified vision of how the forest should be constituted exists. Working with the instruments discussed in chapter three and attempting their synthesis as described in this chapter, is less likely to result in the progress evaluation problems resulting from up-scaling relevant data as reported by Robertson.

5. Methodology

In order to apply the theoretical framework developed in the previous chapter and based on a review of the literature in chapter three, the forest management of the community of Gyűrűfű was used as a case study. This chapter will describe the methods employed to collect relevant data and organize it for the purpose of using the approach put forward here.

The research of this thesis is, "How can Forest Europe C&I be adapted at the local level to fulfill community aspirations in, and formal requirements of, SFM?" A variety of methods were used in the research to answer this question, including a literature review (chapter three), forest management data analysis, semi-structured and unstructured interviews and participant observation.

Istvan Fridrich, the main contact person in my research and operator of a guesthouse in the village[13], provided Gyűrűfű's forest management data. This consisted of a 2007 plan detailing ways of managing the various tree species, and data contained in excel-spreadsheets from 2001-2008 that included information on average tree group age, height, diameter, annual increment, growing stock, as well as the proportions of different tree species in mixed stands. As Mr. Fridrich co-authored the forest management plans and carries out forestry operations in Gyűrűfű (mainly harvesting and processing of deadwood), he was also the main subject of my semi-structured and unstructured interviews. After initial e-mail correspondence to introduce the topic of my research, a second visit took place in May, and a follow-up visit in early July.

The main mode of communication was through semi-structured interviews, where I introduced a topic of discussion regarding particular aspects of the project and the

[13] Visiting this guest house and participating in educational activities were the first contact I had with Gyűrűfű, in late March 2014.

conversation then continued without much guidance to explore Mr. Fridrich's interpretation of general circumstances relating to regulatory and market context, principles of forest management, and actual practices in forestry in Gyűrűfű. Initial questions included general ones such as:

- "How would you like to manage the forest in the future?"
- "What are the most important forest ecosystem services the community benefits from?"

These questions became more focused on particular aspects of forest management in the follow-up visit where questions included, for example:

- "To what extent should vehicles be operated in the forest in the future?"
- "Do you intend to use any chemicals in future forest operations?"

These more focused questions loosely followed Duncker et al.'s classification of forest management approaches. Where a particular silvicultural decision – e.g. decision twelve, tree maturity – needed to be expanded upon based on relevance to local circumstances and the context of a transition to continuous cover forestry, this led to further narrowing of the questions. Information derived from observations during my visits was first written up as field notes and then included in data reported in the following section, for example with regard to the forest workforce of the village.

Based on our conversations, forest visits and a thorough review of forest management plans, a description of the forest's current state and condition (in terms of age distribution and species composition primarily) was made and contrasted with the envisioned ideal forest state and condition. Both the status quo and the vision are presented briefly in chapter two and described in more detail in chapter six. Consequently, a framework of Gyűrűfű's FMA to achieve this vision was created, following the categories put forward by Duncker et al. Here, particular attention was paid to areas that require the most drastic changes or the most

progress to achieve the desired forest condition. These were identified with reference to PRO SILVA principles and manuals, as well as methods of continuous-cover forestry (CCF) described in the forest science literature. An overview of the principles of CCF can be found in the appendix.

Subsequently, Forest Europe indicators were adapted to the case of Gyűrűfű: First, indicators applicable only to a national/regional scale were eliminated. Subsequently, the remaining indicators were reviewed according to site conditions and community needs and aspirations expressed in interviews and in the community's forest principles as found on the village's website. Indicators were selected based on:

- Understandability: How easily was the indicator name, and Forest Europe's full text description of each indicator, understood by the respondent?
- Relevance to the context: Does the indicator generally apply to the management of Gyűrűfű's forests, and does it align with forest principles of the community?
- Relevance to priority areas: What is the currency of the indicator for achieving the change in forest structure specifically and forest condition generally?

Throughout this process, areas that demanded more attention in a suitable C&I framework were discussed and subsequently added. Concrete objectives for a selection of key indicators were made where applicable and where the combined insights and expertise of Istvan Fridrich and myself allowed it; some indicators lack a specific objective as none could be articulated. This is due to the speculative and visionary character of some aspects of Gyűrűfű's forestry that will become more tangible in the future. Where applicable, measurement units for quantitative indicators were taken from Forest Europe reports.

Finally, the observed intensity of the current FMA and foreseeable changes were related to the chosen C&I and the underlying vision. These relationships are discussed as they surface in the results chapter and are discussed more broadly in chapter seven.

It should be noted that data collection for each indicator was beyond the scope of this project; I merely propose suitable indicators for the case of Gyűrűfű. Some available data from forest management plans will be reported where relevant. Furthermore, the language barrier between the main respondent and myself made discussions of more technical and intricate issues extremely difficult. This barrier was only partly overcome with rather crude translation websites; however, bilingual Hungarian/English-speaking students at Central European University helped translate written documents from Gyűrűfű's website and the FM plans. Apart from Mr. Fridrich, his wife Ágnes was also interviewed (in German). The focus on a small group of respondents was a result of time constraints on behalf of the respondents and limited access to other members of the community, as well as further language barriers. However, as Istvan Fridrich has great responsibility in carrying out and planning the village's FM, and as his wife Ágnes is very familiar with recreational and educational activities in the community forest, these respondents can be regarded as local 'experts', justifying the attention given to them.

6. Results and discussion

6.1 The state of Gyűrűfű's forest

While a distinction between two types of forest within Gyűrűfű's forested land is necessary (roughly half of the stands are populated exclusively by *Robinia pseudoacacia*, whereas the other half are stands of a mix of various native species), some shared characteristics can first be reported.

6.1.1 Shared characteristics

- General characteristics: Altitude 300m above sea level; main forest functions are nature protection (municipal nature protection rules apply) and timber production; good and in some cases medium long-term productivity of stands; shrub cover is moderate in three stands, sporadic in one, and nonexistent in the remaining stands.
- Soil: The main soil type is compact, brown clay soil of a medium topsoil depth, with most of the remaining stands growing on compact brown forest soil and one small (1,8ha) stand of sandy brown forest soil.
- Climate: The local climate is ideal for the growth of hornbeam and oak species.
- Relief and gradient: The local topography is largely hilly with gradients between 10 and 20 degrees, with some areas of steep gullies where the gradient exceeds 20 degrees.
- Stand size: The average stand size is 6ha, with some very small stands (0,7ha) and several stands exceeding 10ha.
- Forest structure: All stands were reforested after clear-cutting. Accordingly, the trees within stands are mostly of the same age, diameter and height.

6.1.2 Characteristics of *Robinia pseudoacacia* stands (shaded light blue in figure six)

There are ten stands where only the *Robinia pseudoacacia* (Black locust) grows. The Black locust is a fast growing deciduous tree that can reach maturity after only 20 years. It has a high heating capacity and a relatively long service life as construction and furniture material. As the wood typically requires no treatment for utilization, the Black locust makes for relatively environmentally friendly products. Its main utilization is as firewood, followed by poles, woodchips and sawlogs.

The Black locust is considered a problem for two reasons. First, its abundant seed dispersion leads to a weed-like colonization, and its fast growth marginalizes other tree species that cannot compete for nutrients and light. It is thus considered a pest in its native South-Eastern USA and considered invasive in Europe. (Sabo 2000) Second, its nitrogen-fixing capabilities have a negative impact on forest soils, leading to higher pH values and potentially leading to detrimental effects on groundwater. (Berthold 2005)

6.1.3 Characteristics of mixed stands (shaded light brown in figure six)

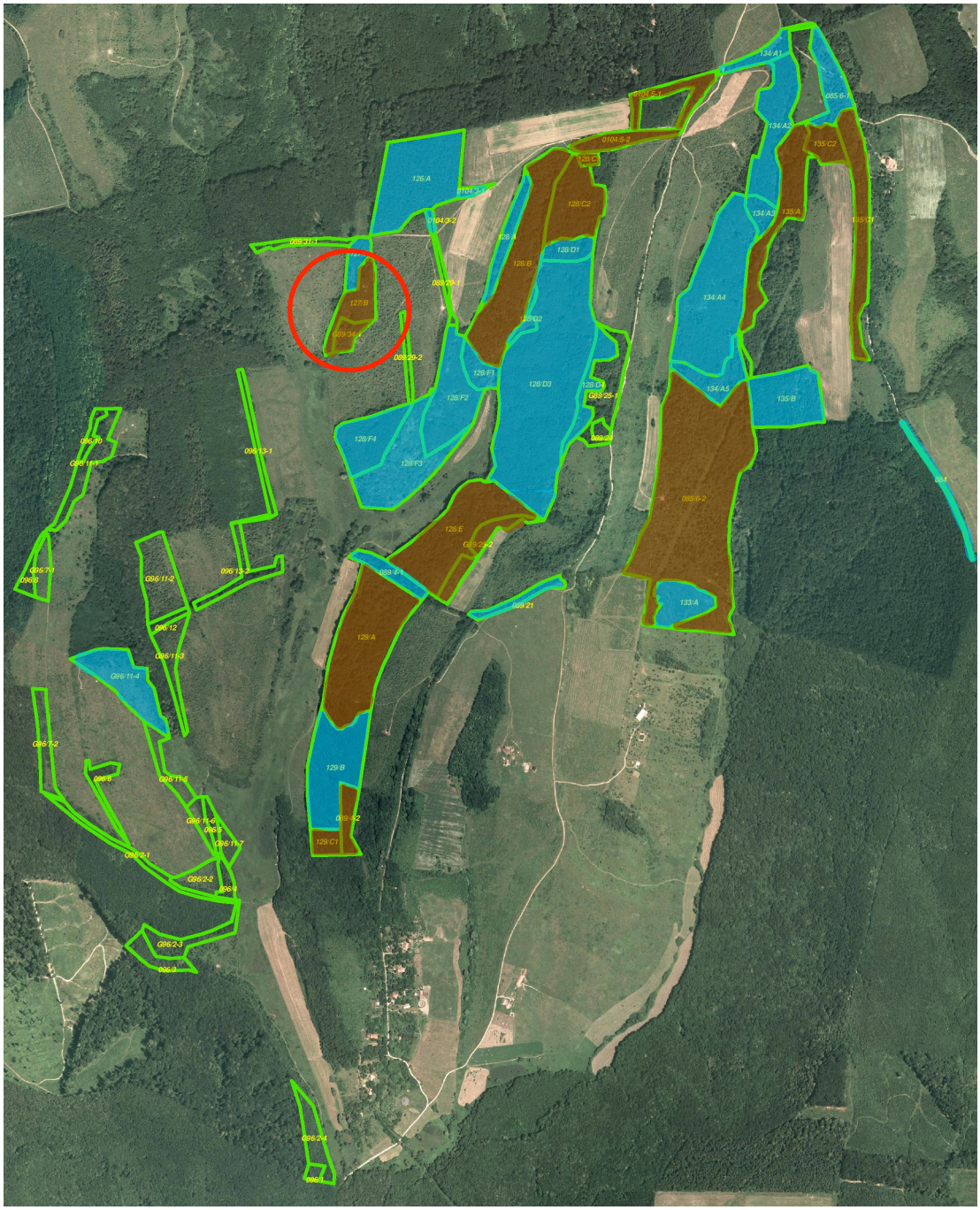
There are eight mixed stands where *Quercus petraea* (sessile oak), *Carpinus betulus* (hornbeam), *Quercus cerris* (turkey oak), *Fagus sylvatica* (beech), *Morus alba* (white mulberry), *Acer campestre* (maple) as well as Black locust grow. The local climate is most suitable for hornbeam and oak species, but beech, mulberry and maple species fare well too.

Like the Black locust stands, these mixed stands were established after clear-cutting took place, albeit at earlier times: All but two of the mixed stands were planted before World War Two, whereas only one of the Black locust stands was established in that period.

The oldest stand, circled in red in figure six, is a stand planted in 1896, and its turkey oaks and beeches stand taller than 25 meters and have diameters approaching 50 centimeters. Even though this part of the forest can be considered ‘old’ compared to the younger Black locust plantations, it is not an ‘old-growth’ or ‘natural’ forest as such, because it has no shrub

cover and there is no variation in the age structure of trees. Regeneration of tree species in these mixed stands is very limited due to the feeding practices of local herbivores (mainly *Cervus elaphus* – red deer). (Fridrich 2014)

Figure 6: Forest stands of Gyűrűfű; Black locust stands are shaded light blue, mixed stands are shaded light brown. Oldest mixed stand circled red. (Aerial photograph provided by Istvan Fridrich)



6.2 Gyűrűfű's FMA

Reporting a single overarching FMA for Gyűrűfű, despite the small scale, is impossible owing to the dual nature of its forests. Furthermore, it is necessary to distinguish between the FMA practiced once the forest vision is achieved (i.e. an ideal FMA) and the FMA/transition strategy necessary to achieve it. Each of the following sections will address the relevant aspects of Duncker et al.'s classification of FMAs, with a focus on areas that are of particular interest to the case of Gyűrűfű given the conditions and vision detailed in chapter two.

6.2.1 FMA for Black locust stands

The community of Gyűrűfű considers the Black locust the most serious problem of its forest resources, for reasons stated above and because this species has no place in the vision of a natural forest. (Gyűrűfű Műhely Kft. 2014) Accordingly, the aim is to gradually reduce Black locust stands and establish in their place continuous cover forests of tree species that are native to the area, such as sessile oak and hornbeam. As around half of all stands in Gyűrűfű's forests are exclusive Black locust stands, this process needs to be relatively radical: The removal of large numbers of trees is necessarily an intensive operation covering large areas, and a more sensitive approach would not effectively deal with the 'weediness' of the species[14]. However, this process must also be gradual because on the one hand regulatory restrictions on the extent of clear-cutting apply, and on the other because the removal of entire Black locust stands would expose neighboring mixed stands to wind damage.

Given the intent to eliminate Black locust from Gyűrűfű's forests, FM decisions related to the establishment of stands or their regeneration do not apply here. *Machine operation* will be extensive, including the use of harvesters and trucks to harvest large volumes of wood (>200m^3 per year in the foreseeable future). Post-harvest *liming* may be

[14] For an overview of methods of Black locust control, see "*Robinia pseudoacacia* Invasions and Control in North America and Europe" (Sabo 2000). Methods include burning, bulldozing and spraying of glyphosate.

necessary where soils are particularly negatively affected by nitrification. *Chemical agents* will not be used, as it is prohibited by the local watershed protection rules. *Tree removals* will be most intensive, as reestablishment of Black locusts is not desired – the whole tree as well as residues will be removed.[15] The *final harvest system* is clear-cutting of plots sized 1-2ha in order to yield at least 200m^3 per year for at least the coming ten years. Stands where the trees have reached or exceeded their age of *maturity* (i.e. 30 years and older) will be prioritized. (Fridrich 2014)

6.2.2 FMA for mixed stands in the transition towards continuous cover forestry

The intended *naturalness of tree species composition* for stands where continuous cover forestry is to be established is comprised only of species naturally characteristic to the area. *Tree improvement* includes no genetically improved or modified materials or organisms; seedlings and saplings planted to initiate continuous cover forest stands will be taken from available genetic material or other natural sources. The *type of regeneration* used will be natural regeneration supplemented by planting of saplings to enrich and change the species composition.[16] *Successional elements* are encouraged insofar as the natural succession of an understory is desired, but may be affected by thinning to allow a certain pattern of certain tree species to emerge. *Machine operation* is limited to the use of chainsaws in felling of mature trees to provide room for younger trees, and the use of powered auger drills to fence in stands where saplings are vulnerable to browsing. *Soil cultivation* is limited to mechanical cultivation to introduce natural regeneration as well as the weeding out of saplings of Black locust, and *fertilization and liming* are not carried out. Likewise, *Chemical agents* are not applied. A high standard of *nature protection* is implied in the overall approach, and special

[15] The local biomass-firing power station makes use of shredded tree residue, so all parts of the tree will be used.

[16] For an overview of possible methods see for example Vítková and Dhubháin 2011

measures to protect particularly rare, vulnerable, unique and old trees and other flora will be taken. Large herbivores (mainly red deer) will be denied access to stands in transition for five to 20 years, but the small size of plots should not affect their behavior or wellbeing in any way. Large-scale silvicultural operations will take breeding seasons of birds into account. *Tree removals* will be limited to the stem. The *final harvest system* as well as the *maturity* of harvested trees is addressed in the next section. (Vítková and Dhubháin 2011)

6.2.3 FMA for mixed stands under PRO SILVA principles

Silvicultural operations in stands where the forest vision has been achieved include primarily tending, thinning and final harvest. Accordingly, there is some overlap between the final envisioned FMA and that employed in the transition process: the same degree of tolerance and encouragement of *successional elements* is evident, with priority given to careful thinning of stands to continuously encourage irregular shelterwood – i.e., part of the overstory may be removed; no greater degree of *machinery operation* will take place; once natural regeneration functions, *soil cultivation* is not practiced; *fertilization and liming* as well as the use of *chemical agents* will not occur; *nature protection* is at its highest especially as standing and fallen deadwood is maintained at a suitable spatial distribution and in sufficient quantities. The silvicultural *(harvest)* system is centered on the attention of the forest manager to each individual tree, or a small group of trees. This "selective logging" approach entails choosing trees to be cut based on a target diameter previously determined, on conservation needs and community needs for firewood or money from the sale of the timber. The age at which a tree, or small group of trees, is cut often exceeds the tree species' average *maturity* in terms annual increment, and the notion of rotational age does not apply as a guide in determining the harvest. (Pommerening and Murphy 2001)

6.3 Adapted Forest Europe C&I for Gyűrűfű

This section first reports the outcome of individual questions on indicator understandability and relevance, before describing the selected, adapted and improved indicators for Gyűrűfű.

6.3.1 Indicator understandability and relevance

Table 7: Forest Europe indicator relevance and understandability (based on Forest Europe C&I)

Criteria	Indicators and measurement units	Understandability	Contextual relevance	Relevance to priority areas
1: Maintenance and Appropriate Enhancement of Forest Resources and their Contribution to Global Carbon Cycles	i. Forest area (ha)	Good	Marginal	None
	ii. Growing Stock (m^3)	Good	High	Some
	iii. Age structure and/or diameter distribution (area by age class per 1000 ha, or volume by diameter class in m^3)	Good	High	High
	iv. Carbon Stock (tons)	Good	Marginal	Marginal
2: Maintenance of Forest Ecosystem Health and Vitality	i. Deposition of air pollutants (kg per ha per year for various pollutants)	Poor	Marginal	None
	ii. Soil condition (variety of measurements of carbon stock, macronutrient content, compactness, water retention)	Good	High	High
	iii. Defoliation (% of trees damaged by defoliation)	Poor	Marginal	None
	iv. Forest damage (area damaged, in ha, by cause of damage)	Good	High	High
3: Maintenance and Encouragement of Productive Functions of Forests (Wood and Non-Wood)	i. Increment and fellings (m^3)	Good	High	High
	ii. Roundwood (m^3)	Good	High	High
	iii. Non-wood goods (EUR)	Good	Marginal	None
	iv. Services (EUR)	Good	Some	None
	v. Forests under management plans (%)	Good	High	High
4: Maintenance, Conservation and Appropriate Enhancement of Biological Diversity in Forest Ecosystems	i. Tree species composition (area with different numbers of tree species occurring in ha)	Good	High	High
	ii. Regeneration (area in ha by regeneration type)	Good	High	High
	iii. Naturalness (area in ha of forests undisturbed by man, semi-natural forests, and plantation forests)	Good	High	High
	iv. Introduced tree species (area dominated by introduced and invasive species, in ha)	Good	High	High

	v. Deadwood (m^3/ha)	Good	High	High
	vi. Genetic resources (area of primary forest in ha)	Poor	High	Some
	vii. Landscape pattern (mapped index showing landscape composition, morphological forest shape, mosaic pattern, forest edge interfaces, forest landscape connectivity)	Good	High	High
	viii. Threatened forest species (no. of species per category by IUCN ranking)	Good	Marginal	None
	ix. Protected forests (area classified as protected in ha)	Good	Marginal	None
5: Maintenance and Appropriate Enhancement of Protective Functions in Forest Management (notably soil and water)	i. Protective forests – soil, water and other ecosystem functions (area classified as soil, water and other ecosystem function protection area, in ha)	Good	High	Some
	ii. Protective forests – infrastructure and managed natural resources (area classified as protecting infrastructure and managed natural resources, in ha)	Poor	High	Some
6: Maintenance of other socio- economic functions and conditions	i. Net revenue (EUR)	Good	Some	High
	ii. Expenditure for services (EUR)	Poor	Moderate	High
	iii. Forest sector workforce (number of employees)	Good	Some	High
	iv. Occupational safety and health (number of accidents per year)	Good	Some	Some
	v. Wood consumption (m^3)	Good	Some	None
	vi. Trade in wood (EUR and m^3)	Good	Some	High
	vii. Energy from wood resources (TJ/year)	Good	High	High
	viii.Accessibility for recreation (area in ha)	Good	Some	Some
	ix. Cultural and spiritual values (number of sites)	Good	Some	Some

The respondent easily understood most indicators, particularly in criteria one, three and four. Criterion four is overall most relevant to the context of Gyűrűfű and its specific priorities of establishing continuous cover forestry and meeting the needs of the community. Criterion two was not well understood overall, primarily because of the considerable language barrier but also because the criterion theme (forest ecosystem health and vitality) is seen by the respondent as implied by the attainment of objectives in criterion four (biodiversity in forest ecosystems).

6.3.2 Adapted C&I for Gyűrűfű

This section reports indicators and concrete targets for Gyűrűfű's forest management. These are broadly divided into three classes – environmental, economic and sociocultural. Where expedient, indicators have been combined; indicators developed specifically for this case study are marked with an asterisk (*). Each indicator has a goal, and specific objectives are given where possible/applicable. Where available data could give an indication, the status quo is reported. Due to limitations in expertise, as well as a considerable language barrier, objectives are not always given in terms of the ideal unit of measurement and rather expressed descriptively.

Table 8: Environmental indicators, their goals, objectives and current status

Indicator and measurement unit	*Goal*	*Objective*	*Status quo*
Age structure (graphically represented with an age class/number per ha diagram)	Achieve an uneven-aged, continuous-cover forest structure.	Approximate, within each stand, the 'inverse J-curve' age distribution.	Five stands with two age classes, one stand with three age classes. Remaining stands are perfectly even-aged.
Tree species composition (number of different species per ha)	Achieve a forest composed of native tree species.	Establish mixed stands of at least three native species in the local area.	Only three stands are comprised of mixed native species without Black locust interspersion.
Soil condition (g/kg of macronutrients; water retention; compactness)	Maintain a soil condition that enables a healthy forest ecosystem, maintains its biological carrying capacity, and its productive functions.	Restore soils negatively affected by lack of natural regeneration and nitrification in Black locust stands to healthy levels.	No information available
Forest damage (% of trees affected per 10 ha)	Maintain as little as possible forest damage.	Achieve varied forest height structure to protect from windthrow. Protect saplings from browsing with fences around continuous cover forest stands in transition.	No information available
Regeneration (area in ha by regeneration type)	Mimic natural regeneration as well as possible, i.e. natural regeneration in the whole forest area.	Enable natural regeneration processes to function in one 0,5ha parcel in a native- and mixed species stand in the coming year.	Natural regeneration is extremely limited overall, and regeneration behavior of invasive species dominant.
Introduced tree species (area in ha dominated by introduced species)	Restore the tree species composition and forest landscape to natural conditions.	Eliminate, in the next fifty years, the Black locust.	61 ha dominated by Black locust.

Table 9: Economic indicators, their goals, objectives and current status

Indicator and measurement unit	*Goal*	*Objective*	*Status quo*
Increment and fellings (m^3 per year)	Achieve a balance between increment and fellings for each stand.	Harvest 100-200m^3 of Black locust in 2014 Harvest 200-500m^3 of Black locust annually in the following ten years	Total annual increment approximately 600m^3, of which approximately 400m^3 in Black locust stands. No fellings; harvesting restricted to collection of deadwood
Roundwood – trade in logs (m^3 per year)	Rely on the sale of stems only in exceptional cases	Sell the annually harvested Black locust lumber to local buyers.	No trade in logs.
Trade in processed wood* (HUF/year)	Derive income from the sale of wood processed into higher-value products (such as toys and furniture) by members of the community.	Begin selling some wood products with value added in the village by 2018.	No carpentry etc. in the community.
Management plans (% of stands covered my plans)	Produce sound management plans for each stand as required by law.	Produce management plans for the Black locust stands to be cleared in the near future, and for the mixed stands to be converted to continuous cover forestry.	FM plans are outdated, but cover the entire forest.
Net revenue (HUF)	Generate enough revenue to sustain forestry operations and improve village infrastructure.	Generate at least HUF1.5 million per year in the near future to initiate the transformations to continuous cover forestry in selected stands.	No information available.

Table 10: Sociocultural indicators, their goals, objectives and current status

Indicator and measurement unit	*Goal*	*Objective*	*Status quo*
Education and training – forest work* (number of people)	Possess the human resources to independently manage the forest according to community needs.	In the next five years, train and educate at least four more members of the community in forest operations (including a chainsaw operator's license).	Only Istvan Fridrich is trained to carry out forest work; his teenage son and another adult member of the community are in training.
Education and training – wood processing* (number of people)	Possess the human resources to independently process wood harvested in the community forest to generate added value.	In the next five years, train and educate at least one person who can add value to the forestry operations by processing wood into products like toys and furniture.	Nobody in the community can process wood in the desired fashion.

6.4 Discussion

To answer the research question, "How can Forest Europe C&I be adapted at the local level to fulfill community aspirations in, and formal requirements of, SFM?" I will break down this question according to some key themes and discuss these before formulating an answer.

First, with reference to the element of community aspirations in the RQ (and in line with the first Bellagio STAMP principle, 'guiding vision') it can be argued that adapting Forest Europe C&I to this case study provides a framework in which these aspirations can be spelled out and concretized compared with the existing, more loosely defined vision. While a vision for Gyűrűfű's forests can be inferred from its forest principles (stated on the community website), the process of articulating it in a C&I framework drew out issue areas which are of particular importance to the community. Furthermore, the adapted indicators have specific objectives for the immediate and mid-term future, enabling the community to plan steps to achieve these objectives. Here, the combination of C&I with Duncker et al.'s framework of FMA enables practically oriented forest managers such as the main respondent to foresee what steps need to be taken in the local silvicultural operations in order to achieve objectives.

Secondly, the expression of a forest management strategy for the various parts of the forest (stands dominated by the invasive Black locust, mixed native-species stands now, and mixed native-species stands in the future) according to Duncker et al.'s framework supports my claim that not only environmental indicators are affected by silvicultural operations. My findings suggest that the increased intensity in Black locust stands have positive effects on economic indicators (deriving income from the sale of wood); and that the transition towards PRO SILVA forestry requires methods in forest management that are currently not known by the forest managers of the community, which in turn led to the inclusion of social indicators on education and training (discussed below).

Third, there remains an imbalance between the domains of sustainability in the adapted indicator framework, with only two social indicators and five and six economic and environmental indicators respectively. As discussed in chapter three, social sustainability is seen by some as predominantly a process, where participation, equality and transparency are

paramount; and by others as the nurturing and developing of structures necessary for true, holistic, sustainable development. As the respondents reported that the community's forest principles and the overall vision are shared by all members of the village, we can assume – with some caution – that this vision was co-determined by members of the community, and indeed that it is a feature which means a lot to those who have chosen to live in Gyűrűfű. Accordingly, much of the prerequisites for a socially just and sustainable process are given, though it should be stressed that on a larger scale, relevant indicators on e.g. participation should be included. This could take the form of annual conferences or meetings where not only policy-makers and NGOs, but also a rotation of foresters (especially small-scale foresters not represented by major unions) and forest community representatives are present to deliberate on progress towards SFM goals and to share ideas.

In contrast with Forest Europe C&I, the indicators chosen for social sustainability in the adapted C&I set describe specific human capital – i.e. acquiring skills to manage the forest sustainably and independently, and processing wood to make higher value goods than just sawlogs or firewood. There is an important link here between desiring lower-intensity forest operations while still deriving income from the forest resources, as the gentle management of mixed, close-to-nature forests can produce higher quality trees which, with the right input of skill, can yield more money from sales than a single tree would generate as part of a clear-cutting operation. Particularly due to decreases in employment in traditional forestry sectors (partly as a result of the post-2008 financial turndown) and partly to contribute to efforts for rural development, Forest Europe should consider including indicators relevant to creating structures that can sustain human capital for forest-dependent communities.

An important point to note is that the objectives and goals of some indicators seem to contradict each other. While the overall goal for the trade in roundwood is to rely on

it in exceptional cases only, the objective for the immediate future is to sell a lot of roundwood. Likewise, while the goal for increment and fellings is to achieve a balance (in line with PRO SILVA principles) between the two, and while furthermore the overall vision is for forests to dominate the landscape, the immediate clear-cutting of Black locust stands will in some cases exceed their mean annual increment and make for a rather unattractive and in some cases even bleak landscape. These steps however are necessary to reach a situation where the envisioned ideal forest management and forest condition are realized. This points to an implicit conceptual incoherence in the approach of integrating FMA with C&I that may best be explained as a result of the different ways that the two concepts deal with time. Whereas FMA taken by themselves have no inherent trajectory in time, and gain this element only if particular scenarios of how a forest should be constituted are stated and relevant FMA components formulated, C&I have a deep-seated future orientation based on the desire to improve social, ecological, economic and other parameters. Therefore, sustainability indicator frameworks have a forward trajectory that, while not necessarily linear, usually makes no plan for backward steps;[17] backward in this case meaning carrying out activities that (for a time) regress on the trajectory towards the ultimate goal. Again, this may in and of itself not be particularly noteworthy – after all, a ramshackle building may need to be torn down to erect a new house; but considering the timescales in forestry, it is striking that a community is willing to initiate a process of converting its forests' structure and species composition that necessitates radical landscape transformations which will only begin to reach the envisioned state of the forest when those currently planning and carrying out the transformation will be dead.

One aspect of my theoretical framework which could not be tested due to the time limitations of the study, and thus can only be speculatively addressed at this point, is the

[17] This should not be confused with actual trajectories of development, which often include significant setbacks.

element of learning and readjustment. While this is present in the social indicators that focus on education and training (i.e. the learning of skills necessary for a change in forest management and introducing wood processing as a form of income in the community), and while this may well be a result of a realization that these skills are necessary after living with the forest as it is now for two decades, it is impossible at this point to ascertain whether social learning – the dynamic between social values and institutions and the natural environment – is actually taking place, what role C&I play in this, and to what extent the community's forest vision changes according to this dynamic. Long-term studies that revisit select communities over the course of at least one generation would be necessary to properly investigate this theory.

In conclusion, despite the limitations of time, focusing on just one case study, and significant communication difficulties between the respondents and myself, the research question could be answered satisfactorily. Forest Europe C&I as they are currently used to report on the state of Europe's forests are inadequate for use in small-scale community forestry and by practitioners with limited scientific and technical education. They are partly too complicated and partly too vague, especially where forest protective functions are concerned; and their lack of indicators in the domain of social sustainability and the focus on GDP and productivity in economic indicators suggest that Forest Europe operates on principles of well-being, progress and development that are outdated. However, the addition of more appropriate indicators, the elimination of inadequate and inapplicable indicators and the amendment of other indicators – in other words, a stripping-down and reorientation of Forest Europe C&I – produced a useful framework that is adjusted to the situation of the community and that will continue to be useful in the next ten to twenty years, especially if it is periodically fine-tuned according to changing circumstances.

For further research on this topic, I would recommend the following. First, more 'ordinary' communities should be investigated: Gyűrűfű is a small eco-village which, as far as values of ecological sustainability are concerned, is rather homogeneous. Investigations in larger communities that live neither as remotely nor as independently from the remainder of society as Gyűrűfű could reveal to a greater extent how instruments and policies for SFM affect small rural communities, and give further insights as to how such policies and instruments should be adjusted. In addition, data collection should also be broader in scope, on the one hand using surveys to gain the viewpoints of more community members (albeit at the loss of detailed insights from more extensive semi-structured interviews), and on the other hand collecting metadata on e.g. soil condition, forest health and biodiversity, and wood sales. Both should ideally be assessed continuously over a period of at least ten years in two-year intervals.

7. Conclusion

The two main concepts this thesis deals with are Duncker et al.'s (2012) classification of forest management approaches, and criteria and indicators for sustainable forest management as conceptualized by Duinker (2001) and 'put into practice' by the Ministerial Conference on the Protection of Forests in Europe. I have demonstrated that for the purpose of realizing a community's forest vision, and based on the principles underlying this vision, some useful links can be drawn between these major concepts and that they can potentially complement each other. There is tangible evidence of a relation between sustainability indicators that are not directly affected by forestry operations' interventions in forest ecosystems, most prominently of an economic but also of a sociocultural nature. The results show that under consideration of the aims of the community, as expressed in an adapted Forest Europe C&I set, concrete plans for the management of particular parts of the forest can be made, relating to both short-term objectives for timber sales as well as long-term goals of envisioning a close-to-nature, continuous-cover forest. Conversely, the FMA in place under the desired scenario demand progress in particular socioeconomic areas, namely education and training for independent forest management, and securing livelihoods from processing trees into higher-value wood products.

One unexpected but crucial finding of this study was the inconsistency between intermediate objectives and long-term or overarching goals for certain indicators, and the fact that therefore the development trajectory of Gyűrűfű's forests is not direct and forward, but rather complex and temporarily requiring steps that contradict underlying principles and overall goals. While one could disregard this as a unique characteristic of just this case study, it echoes voices in the wider sustainability discourse calling for restraint and moderation rather than a fixation on continuous 'progress' in the form of technological development and

capital accumulation. If things must get worse/deteriorate before they get better, then it is in the interest of societies to steer this process with conviction and purpose. For this, Western liberal societies are currently at a crossroads, where certain segments of society express their agency through actively changing their lifestyles while the majority is stuck in the 'work-life treadmill,' (Skidelsky and Skidelsky 2012) and are victims to, as well as perpetuators of, consumer culture. While leading the life of an eco-village community is not an option for many, and while the relocation of large numbers to rural forest landscapes is neither socially, economically nor ecologically a sensible proposal, the values underlying a change to more eco-sensible lifestyles need to be investigated further. Methods of cross-fertilizing civil society by means of exchanges between e.g. urban sustainability groups, schools, and rural eco-villages or similar organizations need to be developed.

In present times, the political mainstream and many scholars see utopias as fanciful dreams or, worse, dangerous ideas that in the past have only led to state terror and abysmal outcomes for society, nature and the economy. This view rests on a misunderstanding that sees a utopia as a blueprint, a strict plan, rather than a compass and source of creative ideas for the future. (de Geus 2003) This latter interpretation can allow us to learn from those willing to deviate from the mainstream and realize their imagination, and borrow from their practices to "rebuild the ship while at sea." (de Geus 2003:89) In this respect, the way that the community of Gyűrűfű boldly manages its forest and other resources according to a sound vision of sustainability is awe-inspiring; hopefully, it will continue to inspire scientists, students and members of civil society alike.

Appendix 1: Continuous cover forestry and PRO SILVA

Continuous cover forestry (CCF) is an approach to silviculture that is even less precisely defined than SFM but has the essential feature of avoiding clear-cutting. The practice was pioneered by French, German and other Central European forest scientists in the 19th century and was highly popular in the 1920s to 1940s. (Pommerening and Murphy 2001) Lately, interest in CCF has had a revival as a response to the Rio summit and the organization that has promoted the use of CCF is PRO SILVA Europe (Pro Silva).

Pro Silva Europe is a network of national or federal state level societies whose members endorse CCF as detailed in the Pro Silva Principles. Pro Silva has little to no coverage in academic publishing, only appearing as a side note in articles on CCF and with no explicit coverage as an organization.

The Pro Silva association has four forestry principles that guide the silvicultural operations of members:

1. "Conservation of ecosystems
2. Protection of soil and climate
3. Production of timber and other products
4. Recreation, amenity and cultural aspects." (PRO SILVA Europe 2012:7)

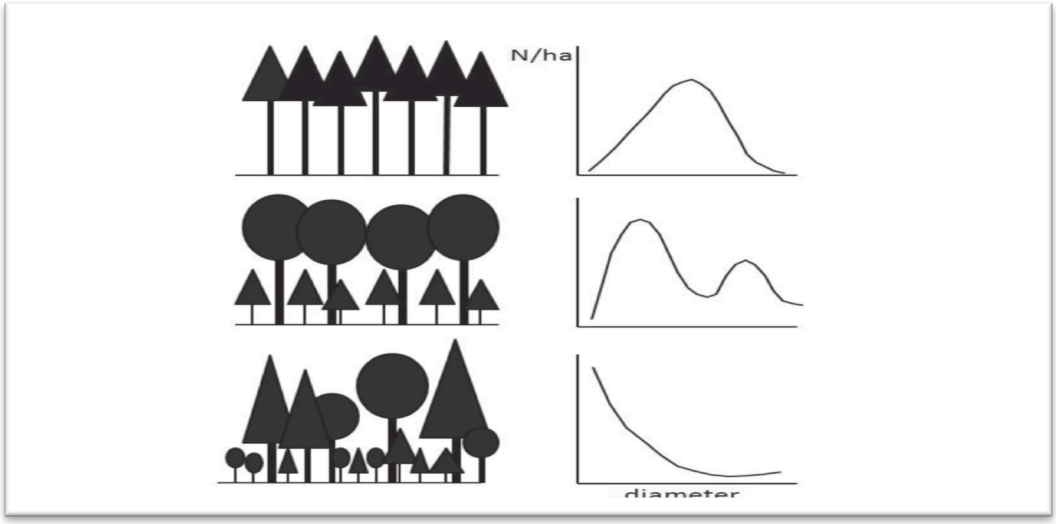
The main difference from other SFM principles is that Pro Silva, unlike Forest Europe, explicitly states that this is a hierarchy of principles rather than a set of interrelated and complementary components: "The preservation, and if necessary the restoration, of the ecosystem is … the first priority" and the foundation for other functions of forest ecosystems. (Ibid)

Pommerening and Murphy (2004) identify ten characteristics of CCF: Continuity of woodland conditions; emphasis on vertical and horizontal structure; mixed age classes and tree species; attention to site limitations; selective individual tree silviculture; conservation of

old trees, deadwood and protection of rare and endangered plant and animal species; promotion of native tree species/provenances and broadleaves; ecologically sensitive forest protection, thinning and harvesting operations; ecologically sensitive wildlife management; the establishment of forest margins and a network of protected forests.

The key to finding a workable approach to CCF based on these principles or characteristics is the attention to local requirements and limitations, and taking into account the fact that some of these characteristics may be irreconcilable or contradictory. Transformations to native-species forests from plantations of even-aged exotic or even invasive species, for example, may require harsh interference with ground vegetation to prevent the propagation of such invasive species. In a review of methods to control *Robinia pseudoacacia* – black locust – populations in North America and Europe, Sabo (2000) states that the most viable mechanical methods of eradicating black locust are bulldozing and burning, while the most viable chemical methods involve the use of glyphosate – an aggressive, nonselective herbicide – and diesel fuel. (Sabo 2000) It is evident that such methods would run contrary to notions of protecting forest landscapes, ecologically sensitive management practices and the maintenance of forests as watershed protection systems.

Figure 3: "Forest stand structure with appropriate diameter distribution showing an even-aged structure on the top … uneven-aged with two ages in the middle … and uneven-aged with numerous ages on the bottom" X-axis: number of trees per ha; Y-axis: tree diameter in cm. (Vítková and Dhubháin 2011)



The ‘reversed-J curve’ distribution (figure three) is a key characteristic of CCF, and has numerous benefits:

- It is a useful harvesting guide for CCF practitioners, as actual diameter distributions in each stand can be compared with this ideal and harvested accordingly
- It is easy to understand and therefore beneficial to implementation of CCF, especially given that few forest managers are trained in implementing, transforming other stands to, and maintaining CCF forests
- The uneven forest structure is more resistant to wind damage as the force of wind is softened by dense canopies at virtually all heights in the stand
- The availability of a greater multitude of timber products means that forest enterprises managing a CCF forest have more opportunities to adjust to changing demand in the market
- CCF stands are potentially continuously profitable, as some form of wood product can be harvested almost every year (as opposed to clear-felling which occurs once every 30-100 years depending on tree species)
- CCF forest ecosystems have a higher recreational value and offer biodiversity as well as climate change mitigation benefits.

(Vítková and Dhubháin 2011)

CCF can be established ‘from scratch’ on bare land, which involves the careful utilization of nurse and pioneer species, or by transformation from a uniform or coppice forest structure. Both apply for this case study, and chapter six explores how a differentiated FMA strategy can be effective in planning the establishment/transition.

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