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## Executive summary

D 6.3 provides a summary of the state-of-research as regards the production of non-wood forest products in Europe. It summarises the advances, existing knowledge, data availability and gaps in order to highlight the potential lanes for progress in further research. The paper is structured along the lines of primary production, marketing and trade, institutional aspects, and innovation needs for the development of production lines and markets. The deliverable shows that – in contrast to other regions in the world – systematic knowledge on NWFP is still fragmented as well as data for NWFP are scarce and incomplete. An integrated approach is needed to provide a better systematics of NWFP in Europe alongside national case-studies to explore the national and regional dimensions of NWFP, a goal, StarTree is instrumental in implementing. Both the micro- and macro-environment for the production and marketing of NWFP are to be addressed when highlighting the contribution of NWFP to sustainable forest management and their economic and socio-cultural dimension in European societies.



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# 1 Introduction

European forests (35% of the EU's landmass) provide multiple goods (wood and non-wood) and services (capturing 10% of EU's CO<sub>2</sub> emissions, being the main host for biodiversity, providing high-quality water) to rural communities and society in general. The forest-based sector in Europe delivers a wide variety of bio-based products which represent 8% of the EU's manufacturing and provides income for about 16 million forest owners while creating 3 to 4 million jobs, many of them in rural areas. In this context, European forests and the forest-based sector play an increasingly important role in fostering smart, sustainable and inclusive growth in Europe based on the production of eco-services and eco-efficient products from wood and non-wood-based products.

Up to now the forest-based sector has been mainly built around wood based products, this is due to the significant relative economic importance of wood and the well-structured and competitive value chains based on such raw material (wood products, pulp and paper, bio-energy). However, the full potential of non-wood forest products (NWFP) (e.g., forest fruits, mushroom, cork, pine kernels, acorns, medicinal herbs, essential oils, chestnuts etc.) which are defined as "*products of biological origin other than wood derived from forests, other wooded land and trees outside forests*" (FAO 1999) needs to be unlocked, especially in regions where wood is not the most profitable product or in order to increase the socio-economic opportunities and competitiveness of rural economies. Nevertheless, unlocking the full potential of NWFP requires (i) new knowledge and tools to optimise the sustainable provision and profitability of NWFP and services from multipurpose trees (MPT), (ii) better understanding on the potentials of markets for NWFP and of the role of innovation processes for new products and services.

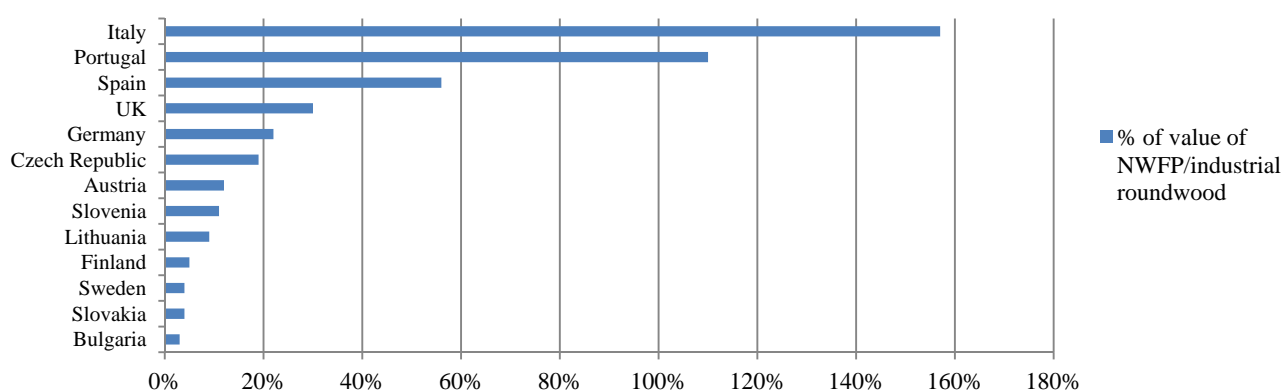


Figure 1: Annual value of NWFP as % of the annual value of industrial roundwood in selected EU countries (source: FAO 2005 and 2010)

According to the Millennium Ecosystem Assessment report (Schvidenko 2005) more than 150 NWFP are of importance within international trade. The latest report on the state of Europe's forests (Forest Europe, UNECE and FAO 2011), reported that the total value of NWFP in the Forest Europe region reached 2,763 million EURO, of which 83% was generated by plant products. This value represents around 10% of the value of roundwood, which is quite important considering the existing gaps in data collection and unaccounted NWFP. In addition, there are significant differences in the access, utilisation and importance that are ascribed to the production of NWFP. In particular in the Mediterranean region, where an immense diversity of NWFP exists, and the profitability of wood is lower, the value of NWFP is representing a considerable part of the total forest production (Figure 1)

To ensure a sustainable and optimal provision of relevant forest products and services, forest management requires tools to quantify the joint production of wood and NWFP and the impacts of forest management and environmental conditions (including climate change and emerging biotic and abiotic threats) in their provision as well as the trade-offs between them. This means a shift from wood-based to multi-product forest management, which maximises the profitability of relevant products and services rather than only wood production or timber profitability. This also implies developing specific silvicultural guidelines to operationalise the concept of multipurpose trees, which means that the same tree is managed and used for more than only one purpose (for example chestnut trees can be used for production of wood, tannins and chestnut fruits).

The objective of this article is to provide a fundamental state-of-the art review of the fragmented information and literature base, and to review the state of research along the key lines of (i) Forest management and production of NWFP, (ii) markets and marketing of NWFP, (iii) policies and institutional framework related to NWFP, (iv) innovation needs for producing and marketing NWFP.



## 2 State-of-the-Art: Non-Wood Forest Products in Europe

### 2.1 NWFP in the context of Sustainable Forest Management in Europe

In contrast to their vital role in major parts of the world, NWFP have been long assigned to traditional forms of use in Europe, back to a time when resin and charcoal production and the use of litter as a substitute for straw were part of the daily forest use. NWFP have mainly been restricted to local use and hence, systematic knowledge is limited. It may be this lack of knowledge and public perception that the role of NWFP in Europe has been heavily underestimated.

With the advent of a new and broader understanding of sustainable forest management (SFM) in the early 1990s NWFP returned to a broader agenda. The provision of forest goods and services comprises of more than a sustainable yield of wood (Peng, 2000). SFM covers explicit ecological, economic and social aspects and thus goes beyond the postulate of multi-functional effects of timber production. Against this background we see NWFP forming a potentially cornerstone, be it due to scientific, technological and societal demands as for example in Northern America (cf. Kline 2001, Donoghue et al. 2004, McLain & Jones 2005), or the importance of NWFP for sustaining livelihood for local population in tropical and arid climatic regions (Gautam & Watanabe 2002, Belcher et al. 2005).

In the European SFM process, NWFP have been addressed as aspect to maintain and strengthen the productive functions of forests. The definition, criteria and indicator, and guidelines of the Ministerial Conference on the Protection of Forests in Europe (MCPFE, now FOREST EUROPE) encourage the use of instrumented that fosters the production of marketable and non-marketable goods and services (MCPFE 1998, 2003). This broadened portfolio of forest productivity shall secure a viable forest management and development of rural areas in the long run. Alongside, forest good and services were targeted by the European scientific community in order to study their potential in the context of SFM. Mantau et al. (2001) analysed the access and development of new markets for forest enterprises, and the monetarisation of formerly non-marketable goods was in the centre of research interest (Rametsteiner et al., 2005). It was frequently observed particularly in Central Europe that non-timber forest goods and services present difficulties in finding fair market values (e.g. Kissling-Näf, 1999). The reasons maybe be found inter alia in a lack of exclusion and consumer rivalry for NWFP (Glück, 2000). A central question underlying this is how strong the social liability of forest property (e.g. free forest access, free use rights) is implemented in different parts of Europe, and which implications and potential conflicts among land users, land-use forms and other societal interests may arise. In this context, the inclusion of NWFP in SFM should also address approaches to understand the interdependencies and spillover effect of SFM practices and their implication on the product mix of forest enterprises (complementary vs. exclusive production forms), the limits to free

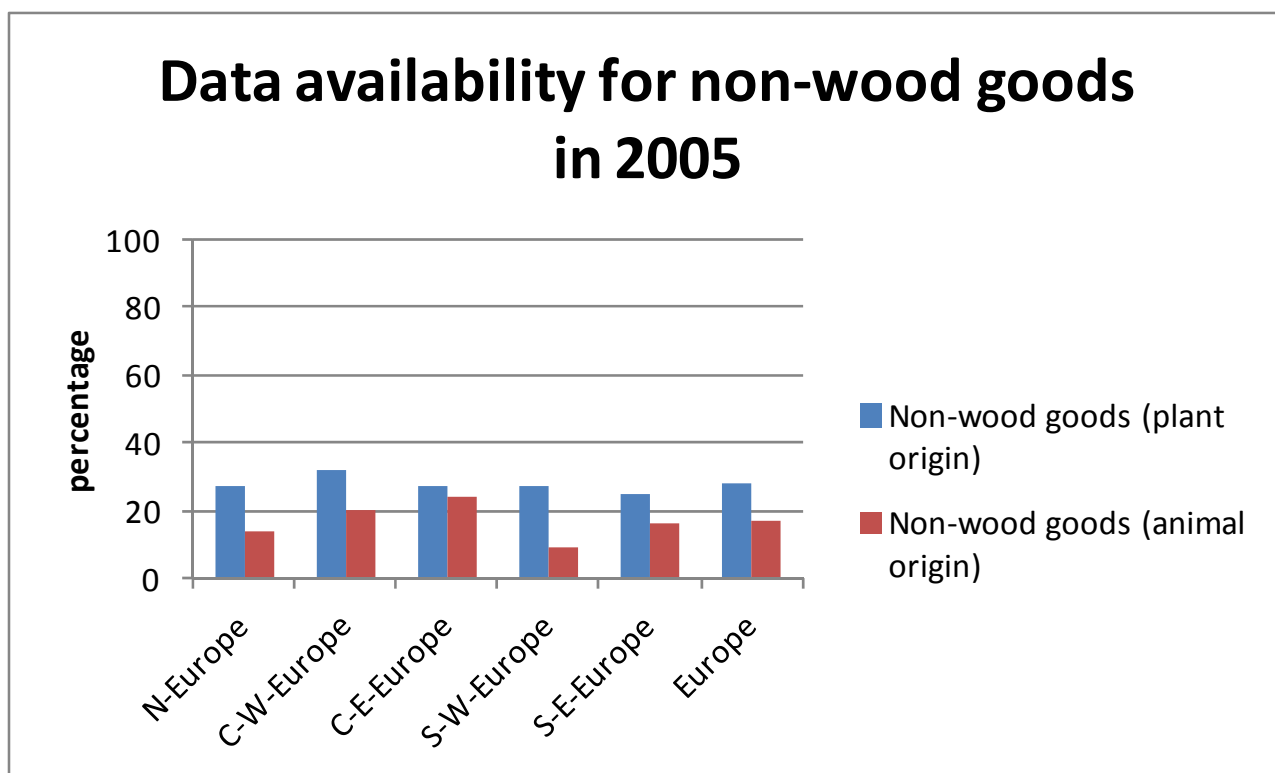


choice of production goals (e.g. by ecological constraints), or the legal compliances that provide social benefit beyond legal prescription.

## 2.2 The dimension of NWFP in Europe: state of research

To come to grips with dimensions of NWFP at the pan-European level two major sources of information are available, the Global Forest Resources Assessment (FRA) provided by the Food and Agriculture Organization (FAO) and the State of Europe's Forest (SoEF) report compiled by the United Nations Economic Commission for Europe (UNECE), FAO and Forest Europe (former Ministerial Conference on the Protection of Forests in Europe). Both efforts rely on well-established data collection processes, ensuring the state-of-the-art of knowledge incorporated in the assessments. While FRA covers information on total harvested quantities and values, SoEF includes marketed products (Turtiainen and Nuutinen 2011). However, it needs to be pointed out that the records for NWFPs are far away from being a complete, consistent and reliable dataset due to a substantial lack of information for most of the reporting countries as well as a high level of uncertainty, taking into account knowledge gaps on potentially huge quantities traded on grey markets and an unknown share of self-consumption for some NWFP. In a quantitative analysis on the information gathered for the SoEF 2011 report, both data availability and data quality for the entire set of indicators on sustainable forest management as defined by UNECE, FAO and Forest Europe were investigated (European Forest Institute 2013). Results for indicator 3.3 (non-wood goods) are shown in Figure 1.





**Figure 1: Data availability for indicators on non-wood goods clustered in regions used for SoEf 2011 (UNECE 2014)**

Less than one third of Forest Europe member countries provide data on NWFP. The reasons therefore can be manifold: i) lacking information on one/several NWFP categories, ii) minor (economic) relevance of specific NWFP, iii) difficulties in the transformation of national data to SoEF indicators, and iv) data collection terminology and definitions (European Forest Institute 2013).

Harmonisation efforts with regard to existing data collection approaches, as initiated via the Collaborative Forest Resources Questionnaire, strive to minimize reporting efforts by national correspondents, hence increasing data availability and improving data consistency as well as data comparability in the future.

#### 2.2.1 *Managing forests for NWFP*

The ecology of NWFPs is diverse as they represent a wide range of products from not only non-woody parts of trees (e.g. resins, fruit) and understory plants but also from other taxonomic kingdoms such as fungi. Due to this large diversity, lack of systematically collected data and, the traditional timber production dominated approach in forest management, their production possibilities are poorly known. A recent review outlined by Calama et al. (2010) shows that there are actually very few models for NWFPs in Europe (see also the results of the COST action FP0603: <http://www.isa.utl.pt/def/fp0603forestmodels/>). Some models are available for cork, pine nuts, berries, mushrooms and resins, but often the models are region-



specific and their utilization in practice has been limited. Difficulties related to creation of yield models result from high annual variability (masting), spatial variability, large and small-scale spatial variability, non-normality, lack of correlation with traditional forest characteristics, poorly understood autecology and lack of systematic data on production. NWFPs from tree origin are produced from multipurpose trees and within the European context oak (*Quercus* spp.), pine (*Pinus* spp.) and chestnut (*Castanea sativa*) are particularly interesting. European multipurpose utilization of trees might be regarded as less common than in the tropics (Boland 1989; Hines and Eckman 1993) and knowledge on silvicultural management, which is aiming for the production of both, timber and NWFPs, is lacking. Current research in Europe on multipurpose land-use systems has been carried out particularly on agroforestry systems in the temperate (Dupraz et al. 2005; Spiecker 2010; Morhart et al. 2014) and Mediterranean regions (Borges et al. 2009; Bugalho et al. 2009) but does not focus on multipurpose single-tree utilization possibilities. While there is not even enough profound knowledge about specific growth parameter relations for all valuable European species, management tools, built up on growth models, considering both, timber and NWFP production, would represent an absolute novelty to achieve an innovative and efficient tree use management, which is economically viable and ecologically friendly at the same time.

Silvicultural guidelines rarely exist solely for the management of NWFPs rather for the forest production systems within which they are found. The majority of established prescriptions are employed with the aim of controlling both branchiness and stem dimensions for pre-defined timber production goals (Oosterbann et al. 2009). This is with exception for orchard production systems where species such as walnut (*Juglans* spp.) or chestnut or in the case of an indirect NWFP, truffles (*Tuber* spp.) associated with oak species are utilised. However, these are solitary management goals, managed on a high intensity basis. Large discrepancies can be observed between timber and tree fruit/ nut production, the formative shaping and pruning regimes applied are a main management difference. When producing high quality timber it is desirable to attain stem with a length of at least 2.5 m (or a multiple thereof) of knot free timber (Mohni et al. 2009). To achieve this objective, pruning is of absolute necessity (Balandier 1997). For the sole production of fruits or nuts formative pruning should be carried out early after establishment to correct structural problems such as steeply angled branches or multiple central leaders and to initiate a strong branch scaffold and a well-balanced crown that can support the crop while facilitating simplified harvest operations. Co-production is however not impossible (for example see: Dupraz 1994; Mary et al. 1998; Titus et al. 2004), and can be achieved through the management of trees creating larger crowns and shorter boles than those managed for valuable timber production goals, to allow the additional production of NWFPs.



The application of a silvicultural treatment will alter forest floor conditions in terms of light, temperature and moisture, these variables are affected by the degree of canopy cover, harvest intensity, slash disposal approach and timber extraction method and can be influenced by the rate of consequent understory growth. The modification of currently applied silvicultural practice may provide the opportunity for increased NWFP production. Current research suggests that silvicultural practices can be applied for the increase in indirect NWFPs providing managerial synergies. The application of a thinning treatment is applied to increase the rate of growth (dimensions) and quality of the timber crop and often to stimulate natural regeneration. It has been suggested that ectomycorrhizal fruiting body production is linked to the growth and health of associated host trees. In research carried out by Egli *et al.* (2010) an increase of beech (*Fagus sylvatica*) associated ectomycorrhizal fungi was observed coupled with the rapid growth of released individuals. A similar outcome was reported by Bonet *et al.* (2004), there the use of silvicultural thinning treatments is advocated to decrease the density of older stands in order to enhance saffron milk cap (*Lactarius group deliciosus*) production. Moreover, by means of a deviation in usual thinning practice for an optimisation in mushroom production in Spain, the removal of a basal area of greater than  $10\text{m}^2\text{ha}^{-1}$  was found to provide an immediate increase in productivity of *L. Group° deliciosus* in maritime pine (*Pinus pinaster*) stands (Bonet *et al.*, 2012). Martín-Pinto *et al.* (2006) concluded that the total dry fungal weight decreased after a forest fire in *P. pinaster* stands with common gum cistus (*Cistus ladanifer*) in Spain, reducing diversity and the proportion of associated edible ectomycorrhizal fungi species. Conversely, *Vaccinium* spp. can be observed to benefit from both wild and prescribed fires, productivity increases after fire disturbance until a point where the forest canopy shades out the plant (Titus *et al.* 2004). This suggests that a level of disturbance resulting in removal of the overstory can be beneficial to the NWFP. Prescribed thinning regimes will also sufficiently alter the light regime at the forest floor boosting the opportunity for ground flora such as berry NWFPs (Miina *et al.* 2010), both the growth and reproduction of bilberry (*Vaccinium myrtillus*) are limited by light within dense forests, especially in dense spruce forests (Miina *et al.* 2009). Meanwhile, excessive cutting (for example during tree harvesting operations) may result in a reduction of bilberry cover (Atlegrim and Sjöberg, 1996; Bergstedt and Milberg 2001).

Often a trade-off must be sought when considering NWFP production in combination with a timber goal. In a recent publication de-Miguel *et al.* (2014) suggests a modification of rotation time as a factor of site quality and NWFP yield. In *Pinus brutia* stands in eastern Mediterranean regions pine honey can be produced where bees feed on the secretions from a scale insect (*Marchalina hellenica*). The presence of this insect is greater in older stands where damage to timber trees can occur, thus reducing the quality of the timber product. It was suggested that on good quality sites a timber production goal should be retained



cultivating trees on shorter rotations to limit insect damage. Meanwhile, on medium to poor sites longer rotations should be implemented with a co-production goal of producing both timber and pine honey.

### 2.2.2 Markets and Trade

Although awareness of the importance of NWFPs emerged in recent years, only little progress has been achieved in relation to NWFP statistics (cf. European Forest Institute 2013; Turtiainen and Nuutinen 2011; Vantomme 2003). Hence aggregated data on a European level is still scarce (cf. UNECE 2014; Forest Europe, UNECE and FAO 2011). Nevertheless, the role of NWFPs for European societies and their contribution to income generation is well recognized nowadays (i.a. Keca et al 2013; Turtiainen and Nuutinen 2011; Voces et al 2011; Stryamets et al 2011; Janse and Ottitsch 2005). The latest State of Europe's Forest report stated that Christmas trees, fruits and berries and cork are the most important NWFPs from an economic point of view (Forest Europe, UNECE and FAO 2011). Further details are highlighted in Table 1.

**Table 1: Quantities and values for the three most important NWFP categories, clustered in Forest Europe regions (UNECE 2014)**

Product	Region	Quantity (1.000 pcs / t)	Value (in 1.000 €)
Christmas trees	N-Europe	13.258	132.104
	C-W-Europe	39.050	733.900
	C-E-Europe	891	2.830
	S-W-Europe	0	0
	S-E-Europe	583	389
	Russian Federation	6	4
Fruits, berries and edible nuts	N-Europe	13.316	15.107
	C-W-Europe	139	503
	C-E-Europe	25.892	28.235
	S-W-Europe	240.211	280.735
	S-E-Europe	5.055	11.308
	Russian Federation	49.052	105.500
Cork	N-Europe	0	0
	C-W-Europe	1.550	775
	C-E-Europe	0	0
	S-W-Europe	167.665	323.850
	S-E-Europe	0	0
	Russian Federation	0	0



Nearly 64 million Christmas trees with a total value of around 870 million € where marketed all over Europe in 2005. Fruits, berries and edible nuts (285.000 tonnes, 336 million €) and cork (168.000 tonnes, 323 million €) where reported as important sources of income in addition, particularly in South-West-European countries. The market value for edible mushrooms and truffles (390.122 tonnes) was assessed to reach approximately 186 million € (UNECE 2014).

During the last three decades NWFP trade has increased both at domestic and international level (FAO 2007). In different cases, singular NWFP uses have changed gradually into copious businesses scaling up from local to national or even international level (Marshall et al. 2006, Sills et al. 2011), reaching 116 commercialized products at international level already in the late 90s (Simula 1999). Indeed, Peintner et al. (2013) report even that currently existing legislation allows the commercialization of 268 mushroom species, which gives an indication on a better categorisation of NWFP in the past two decades.

The increment of NWFP market dimension has shown gradual and constant enterprises movements from high to low labour cost regions, wherever a given NWFP was available in terms of volumes, out of the demanding region (Sitta and Floriani 2008, Cunningham 2011, Voces et al. 2011). Whether several scholars have explored NWFP market progress in developing countries (Kusters and Belcher 2004, Sunderland and Ndoye 2004), few has been done in Europe, especially within the EU27 countries (Turtiainen and Nuutinen 2011, Voces et al. 2011). A general overview was prepared by (Croitoru 2007) to assess the potential value of whole NWFP in the European forest, but scarce attention has been put to analyse the NWFP market dimension at different levels, focusing mostly on local and regional NWFP market dimension and structure (Secco et al. 2009, Cai et al. 2011, Voces et al. 2011, Weiss et al. 2011). Due to the lack of information, linked to the huge variety of NWFPs and the limited economic dimension, NWFP data reporting is quite weak compared to other market sectors (Vantomme 2003). Moreover, the introduction of common agreement on intra-European statistics<sup>1</sup> has introduce threshold limits on data reporting (Eurostat 2006) with a clear reduction of accuracy of the economic and quantitative volume of trade (Alexander et al. 2011).

Even so, international data reporting is an indispensable source of information relevant for a) political decision making (multilateral or bilateral negotiation, EU integration progress), b) economic and fiscal balance (payment statistics, accounting) c) and marketing strategies at enterprise, regional, national or international level (Eurostat 2008). Therefore, the understanding of international NWFP market structure and its evolution is fundamental information for several players involved in the NWFP supply as well as

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<sup>1</sup> Reg. 638/04/EC, Reg. 1982/04/EC, Reg1915/05/EC.



policy makers, both local and international. An example reported by (Sitta and Floriani 2008) described the effects of changes in the international trade policy on a NWFP traded locally in the Italian market. Basically, the need to reduce the production NWFP costs, let several Italian companies relocate in Eastern European countries, where labour cost was cheaper and the NWFP import procedure was much more convenient, especially with the entrance of new EU member states such as Hungary. Even if the publication was referred to a single NWFP (mushrooms), without using standardized methodologies, it showed the potential information stock inside the international database, often used by small-medium enterprises.

### 2.2.3 Institutional and governance frameworks

Despite the recognition that NWFP play an important role in the livelihood of rural populations and local economies, the scientific analysis of institutions - that is, policies, regulations, policy instruments, property rights, cultural norms and traditions - and governance frameworks related to NWFP provision and consumption is somewhat scarce (e.g. Laird et al. 2010, Wiersum et al 2013). Yet, institutions are of paramount importance for NWFP provision, as demonstrated by Janse and Ottitsch (2005) who list property rights, forest policy goals, financial instruments as well as legislation on land use and nature protection as influential factors in this respect.

In Europe, a major effort has been dedicated to the study of ownership and property rights producing abundant literature during the past decades (e.g. Saastamoinen 1999; Niskanen et al. 2007, Aizpurua and Galilea, 2000; Cesaro et al., 1998; Glück, 2002; Bouriaud, 2002; Indufor/Eco, 2001; Kissling-Näf et al., 2002; Kissling-Näf and Bisang, 2001; Rekola, 2004, Schmithüsen, 2000; Schmithüsen, 2004; Bauer et al, 2004; IUFRO R.G.6.13, several years). Property and ownership rights comprise of rights to access, withdrawal, management, exclusion and alienation (Schlager and Ostrom 1992). Property rights play a prominent role for NWFP market development and innovation, as they establish the base for the access to forest resources for NWFP harvesting (Bouriaud, 2007). In many countries, by law, NWFP may not be included in the content of the private property rights over forests, e.g. right to collect berries and mushroom remain in the public domain (everyman's right - Finland, Sweden, Bulgaria, Romania, Norway and Lithuania) (FAO, 2004). In other cases, such as for example in Italy, market demand for chestnuts, hazelnuts, mushrooms, truffles and berries is so high that almost all the regional administrations introduced property rights to control their harvesting (Petennella et al. 2005). The nature of property and access rights to NWFPs determines how they are managed and what institutions (formal and informal) emerge for that purpose (Wiersum et al. 2013).



Going beyond property rights, there are few direct policies, regulations or policy instruments specifically targeting NWFP, however, many policies and regulations from other related sectors (e.g., trade, transport, infrastructure, food, agriculture, and industry) have indirect impact on NWFPs. A systematic identification and assessment of policies and approaches toward strengthening the role of NWFP sector through coherent policies has been largely absent from the literature (e.g. FAO 1995). In addition, informal institutions such as cultural traditions and norms play an important role in NWFP sector (e.g. Laird et al. 2010), yet they have hardly been studied in the European context (Wiersum et al. 2013).

Due to their variety and to the large range of uses in which NWFP are employed, many actors - individual pickers, enterprises, policymakers, certification and rural development organizations, etc. - are involved in the NWFP value chain from the provision and harvesting stage, to the stage of final consumption. These actors play an important role in resolving problems affecting access to and use of resources, technology assessment and transfer, and organization of the environment in which NWFP sector activities take place. Since the NWFP governance frameworks emerge from partially overlapping formal regulations and informal norms, they typically involve many centers of authority (Laird et al. 2010). Yet, the roles and responsibilities of different actors specifically concerning NWFP sector, as well as the interactions between them leading to changes in institutional setup have received very little attention from researchers (e.g. FAO 1995). Notable exceptions are the increasing number of studies predominantly in developing countries focusing on the analysis of governance structures, either in the context of managing rural communities livelihoods (e.g. Ineichen 2010, Rista et al., in press), improving commercialization of NWFPs (e.g. Lacuna-Richman 2007, Belcher and Schreckenberg 2007), or NWFP value chains (e.g. te Velde et al. 2006).

#### 2.2.4 Innovation research

Forest related research has had a dominating focus on timber production. While the booming bio-energy sector has received strong attention recently, other non-wood forest goods and services are still quite neglected. This is true for practice and policy as well as for research and education. Within research it is true for the fields of forest management as well as policy and economics.

Innovation and entrepreneurship research in forestry is a relatively new field in Europe. It has strongly been advanced by the work of the European Forest Institute Project Centre INNOFORCE since 2001 (Rametsteiner et al. 2005) and by the COST Actions E30 "Economic integration of urban consumers' demand and rural forestry production" (Niskanen 2006) and E51 "Integrating Innovation and Development



Policies for the Forest Sector” (Weiss et al. 2011). Within these three European research networks, innovation has been conceived in a broad understanding, in such as innovation was understood in a systemic way and the studies covered innovations in timber but also non-wood forest goods and services. This work is therefore highly relevant for the study of innovation in non-wood goods and services of forests. At the same time, the previous research also showed that still much more research is carried out in the timber and bio-energy sector. Regarding other forest products the innovation and entrepreneurship related knowledge is still in an initial state. The knowledge which exists so far indicates that innovation processes in the non-wood sector differ quite strongly in many aspects: The sector relies on different knowledge sources; there are different policies that influence the innovation processes, and partly different actors active and relevant for the support of the innovations. Furthermore, the traditional forest sectoral innovation system hardly supports innovations in non-wood products, and there are strong barriers that specifically exist in this sector (Buttoud et al. 2011; Kubeczko et al. 2006; Mavsar et al. 2008).

On the example of CEE countries it can be said that forest holdings only marginally invest into research, development and innovation in the field of NWFP. A representative survey of forest holdings which was conducted in 2002 in the framework of INNOFORCE in six CEE countries shows dominating foci on timber-related organisational and technical innovation and on service innovations in forest management. NWFPs account for 7% of innovations in total, but most of them being in the field of bio-energy (Rametsteiner et al. 2005: 49).

A qualitative European-wide study among forest innovation experts shows that currently important innovation areas in the 18 countries covered cluster around new products and services and new form of marketing, both referring to wood and non-wood products and services (Weiss et al. 2011: 51-53). Similar to the INNOFORCE study, the COST Action E51 study indicates that bio-energy and forest-related services such as recreation, education and environmental services by far dominate the product innovations. NTFPs are only mentioned in two countries as “innovation frontiers”. In the field of territorial goods and services, institutional innovations and the coordination of actors seem to be a specific issue (Weiss et al. 2011: 53). In how far this refers to NWFP – and which of those in particular – has not been studied yet. In most European countries, it seems, these products have hardly been taken up by more than very few pioneers (Rametsteiner et al. 2005: 103) and/or have not been recognised in the forestry sectoral policy makers.

There is a strong need to advance methods of innovation research in the sector and to understand in detail the innovation processes in non-wood forest goods and services and land-related resources. In addition to the limited existing scientific knowledge about innovation in the non-wood sector, such research may rely



on general innovation research, particularly in the fields of traditional sectors, ecosystem services and regional innovation systems. Hypotheses and insights from innovation systems and regional governance research (Asheim and Gertler 2005; Boschma and Frenken 2011; Braczyk, Cooke and Heidenreich 1998; Breschi and Malerba 1997; Edquist 1997; Hirsch-Kreinsen and Jacobson 2008; Böcher 2008) were proven to be relevant in the field of innovations in territorial goods and services (Weiss et al. 2011).

## 3 Key challenges for NWFP in Europe

### 3.1 Forest Resource Management of NWFP: Modelling and management planning

To determine and assess silvicultural requirements for both timber production and the production of NWFP there is a need for resource inventory within a forest production system, linked to product demand. Forest type should be acknowledged with an inference of management intensity. It is possible to consider such as a continuum of management intensity ranging from an unmanaged reserve, close-to-nature, combined objective, intensive even aged plantation to short rotation forestry (Duncker *et al.* 2012). Furthermore, distinctions should be established between stand level management and individual tree management, the later to be further examined to assess the productivity of applied silvicultural prescription.

Silvicultural guidance for timber production must as a minimum deliver quantitative information on target diameter, rotation length, clear bole requirement and density per hectare (Hein et al., 2009), similar quantitative information about a stand must be sought for a non-wood goal. It must be noted however, that prescriptions that are employed to achieve specific objectives are also site specific, this must be acknowledged within a European standpoint.

Assessment of silvicultural prescription should be carried out from a product-based perspective this can constitute NWFP or timber production or a combination of the two. Moreover, it should be determined which NWFPs or timber assortments are required or even possible to produce given environmental, ecological and cultural constraints. Such choices ultimately influence all further decisions during the planning phase and stand establishment. Often the realisation of maximised production rate of a specified product within managing forested ecosystems is attained by employing the best combination of site condition, genetic potential and stocking density (Tomé, 2001).

In forest resource management and planning, predictive models (growth, mortality etc.) at tree and stand levels play an important role in planning and decision making due to the long time horizons needed. These





models need to be accompanied with new growth models of NWFPs and products from multipurpose trees. As a result, traditional forest planning tools such as yield tables and simple timber focused growth simulators are not able to meet the information demands of contemporary forest management. The models and tools need to be multi-objective by nature and they need to consider all future incomes and costs from the forest (Pukkala 2009), i.e. timber-cutting income from intermediate and final cutting as well as yearly income from certain NWFP. Additional difficulty in increasing the production of NWFPs is that in some areas they can be freely collected (common rights) both for own use and to markets. As a result, if the management of the stand is focused towards production of NWFPs, the forest owner will bear possible losses in timber production, while the benefits and additional income may go to other parties.

Integrated modelling attempts addressing these problems have been successful mainly at stand scale (see Pukkala (2002) for forestry applications and Pukkala (2009) for optimization techniques comparison). However, land use planning for multiple objectives at FMU or landscape scale (management units in the order of a few 10s up to 1000s of hectares) still provides challenges. Decision Support Systems (DSS) have proved to be suitable platforms for the integration of information, models and methods required to support the above outlined complex forest management problems (e.g. Borges et al. 2003; Reynolds 2005). There is also an ongoing COST action (FP0804, <http://fp0804.emu.ee/>) related to Forest Management Decision Support Systems (FORSYS) related to forest DSSs (FP0804, <http://fp0804.emu.ee/>), which directly relates to identify the success factors for DSS development in this field. The benefit of the DSS approach is that the user can focus on identifying the decision problem, exploring the decision space and on searching for suitable courses of action instead of handling a set of individual models and tools. With increasing complexity of planning tools the ability of decision makers to operate a DSS themselves is decreasing and assistance of an expert user is required.

### 3.2 Challenges for producing and marketing NWFP

As outlined earlier, the environment for NWFP still suffers from traceability and transparency of the real dimension of marketing and trade. Among the major issues is the fact that no information about European/international market structures exists. NWFPs are well analyzed in the context of subsistence economies, developing countries and sustainable natural resource management, but are lacking consistent analysis in the European landscape. As well, the market structure has been deeply explored in the forestry sector with regard to wood-based material, but only few large-scale studies have been carried out related



to NWFPs. Only at regional or local level good examples do exist (Kangas and Markkanen, 2001, De Romàn and Boa, 2006). Nonetheless, understanding the fluxes between supply and demand areas helps to fill the knowledge gap, for a sector conditioned by asymmetry of information.

As well, there are few studies exploring the actors relation in the regional market, only few works have explore the role of territorial marketing in NWFP promotion, and means used to increase the stakeholder awareness to enhance the use of NWFP at local or regional level. Hence, understanding the NWFP characteristics is essential to promote different products on the market. Further, there are few studies exploring the actors' relation in the regional market, while no studies address the forest owner as first economic actor of the supply chain. In total, this means that challenges do exist on both NWFP market macro- and micro-environment levels; the macro-environment with regard to the main driving factors, such as demography, technology, political, cultural and natural resources; the micro-environment both at regional and enterprise level, considering the economic nature of the product (i.e., private, club, common or public goods; product's structural aspects of managing excludability and rivalry via product design), involved supply chain actors (special reference to forest managers), added value creation, employment effects and distribution; co-benefits and costs (market and non-market) associated to the NWFPs value chain, the general market structure (i.e. the level of concentration and horizontal and vertical integration), and the main elements of marketing strategies (e.g., market segmentation and consumer behaviour, product development, pricing and contracting, distribution and networks, product and enterprise communication).

### *3.3 Challenges for governance: analyzing the frame conditions for future NWFP commercialization*

The lack of institutional capacity – that is, the capacity of policies, regulations, policy instruments and informal norms to address relevant NWFP issues – has been recognized as a major constraint in NWFPs market development (e.g. FAO 1995; Niskanen et al. 2007). At the same time, we evidence several major trends in NWFP governance: (a) increasing formalization of informal norms and practices; (b) the emergence of new formal standards for NWFP production, harvesting, consumption and trade, and (3) the increasing hybridization of governance forms (Wiersum et al. 2013, Arts and Visseren-Hamakers, 2012) In this respect, scientific research aiming to identify the barriers and opportunities for NWFP sector needs to be advanced on several avenues:

- Firstly, there is a need to explore the influence of a large spectrum of policies - national, international, sectoral and cross-sectoral - on different stages of NWFP value chain, and critically assess their capacity for advancing the potential of NWFP sector. A systematic analysis of polices will



advance the knowledge of institutional constraints and opportunities for NWFP sector development and provide suggestions on whether, how and which institutional adjustments can be made in order to overcome constraints and realize opportunities that would lead to the enhanced competitiveness of the sector. The conceptual framework of institutional interplay, elaborated by Young (2002), Flanagan et al. (2010) and Rosendahl (2001) may provide a good methodological base for such analysis.

- Secondly, a systematic assessment of the implementation measures of policies and regulations addressed at promoting the development of NWFP sector need to be performed in order to identify the gaps in their performance and establish the successful patterns with the potential to be replicated in other similar contexts (both across geographical areas and across different NWFPs). This avenue calls for the use of methodologies for the assessment of policy instrument performance (e.g. Prokofieva and Gorris 2013), combined with the methodologies proper for governance systems (e.g. Arts and Visseren-Hamakers, 2012).
- Thirdly, the role of different actors in the promotion of NWFP sector needs to be identified and their role as drivers of institutional change needs to be explored. In this respect, an institutional analysis and development framework provides a means to study the behaviour of multiple participants, including those who are directly involved in the policy situation and have an interest in policy outcomes (Ostrom 1999). Institutional analysis has already proven fruitful when dealing with such complex issues as for example, climate change, deforestation, local common goods and international environmental conventions (e.g. Ostrom 1990; Ostrom et al. 1994; Gibson et al. 2000; Young 2002; Young et al. 2005; Young et al. 2008; Dolsak and Ostrom 2003). It has also been identified as a key for understanding the regimes of forest resource utilisation (Kissling-Naf and Bisang, 2001).

### 3.4 Innovation as key requirement to foster NWFP: systems and processes

New forest goods and services are often created in intersectoral networks, which are backed neither by specific sectoral nor regional innovation systems; they rather emerge – so to speak – “in between sectors”. This points to three key requirements for improving the extremely weak institutional support: i) explicit support of innovations within forest sectoral and rural development policies; ii) better integration of sectoral with innovation and development policies; and iii) stronger interaction among sectors and institutions to develop and market new non-wood products (Rametsteiner et al. 2005; Weiss et al. 2011).

Currently, we see missing or underdeveloped innovation policies in the forest sector. Innovation support measures are often too specific and focus on diffusion of popular topics, but general innovation investment



and funding of risky projects with outstanding ideas are scarce. Sectoral policies need to foster in a more systematic way the early stages of innovations as well as new and risky projects. They need to give more room for bottom-up ideas and initiatives.

Second, there is little interaction of forestry actors with actors of innovation policy. There is little activity of forest actors to go beyond the boundaries of traditional funding instruments (e.g. rural development), and little knowledge on how forest goods and services could be promoted and positioned outside these traditional lanes. A better policy integration could possibly advance from both ends: a better recognition of the primary sector in innovation and development policies, but also a more cross-sectoral design and implementation of rural development measures such as the European Union LEADER instrument.

Third, there is still a lack of communication between sectors. Initial examples of cooperation between forestry and environment and tourism sectors show high potential for innovation in marketing and product development. New forms of cooperation should actively be strived for with potential new users such as from tourism, and from the food, pharmaceutical, chemical or other industries with a high potential for bio-based products.

Provision of information on market potential and strategies, intersectoral integration and financial assets for investments into real innovation in forest goods and service are hence key for a further development of NWFP. Against this background and the focus on innovation in NWFP, the following points require particular attention:

- innovation potentials and trends in new non-wood products
- understanding of the formulation and implementation of policies aiming at the support of innovations and start-ups in the non-wood sector, including the effect of innovation support instruments
- understanding of the role of different public and private actors, including the land-owners, rural companies, service providers, interest groups, policy makers, research, training and education organisations, etc.
- understanding the role of the institutional frameworks for the development and implementation of innovations
- understanding the role of innovation system functions such as information provision, coordination of actors as well as financing and other incentives
- practical recommendations, guidelines and tools for innovation support, for companies and institutional actors



## 4 The way forward

The state-of-research overview showed clearly the evidence of importance of NWFP and MPT, but also the gaps and challenges we are facing when studying the topic. We see a multi-disciplinary conglomerate that reaches out from primary production to marketing aspects, from eco-physiological characteristics to the social dimension, from traditional knowledge towards product and process innovation.

The StarTree concept hence is to respond at the different levels of concern, but also as an integrated endeavor to bring components of the NWFP value chains in a logical sequence.

For a sound progress in research on NWFP and MPT we identify the following key issues:

- 1) The data situation has to be improved significantly. Currently, the gaps in available knowledge on NWFP and MPT are gravid in terms of depth, representativeness, and completeness. This situation varies among countries, but can be generalized in terms that the relevance of NWFP along the value chain is not displayed in official statistics, and hence their role for national economies tends to be chronically underestimated. The StarTree concept addresses this issue by conducting national-based reviews and compiling a European state-of-the-sector report that will convey the most up-to-date synthesis of NWFP and MPT in Europe.
- 2) Information on NWFP and MPT is scattered, and has to be substantially reviewed. Very frequently, NWFP are handled as a side-product of conventional timber production, and consequently often unspecific and non- operational. On the other hand, few existing models and tools are very case-specific and not to be used for extrapolation. StarTree approaches to respond to this diagnosis by developing new systematics on NWFP modelling, and further develop model-based tools for forest management support in NWFP and MPT. Applying new models (based on better data) and decision-support systems shall support generating optimal stand forest management strategies to maximise the profitability derived by the joint production of wood and different NWFP. This allows for better identification of production opportunities of NWFP and MPT as well as the trade-offs to other utilization in forests.
- 3) A better understanding of markets for NWFP and MPT is essential for further exploring their economic potentials. Understanding the market structure and dynamics is one of the preconditions for improved NWFP commoditisation and the development of successful market strategies. Since official market and trade data are scarce, a method-mix of traditional market analysis, network analysis of actors, and participatory methods are key to get access to new information. A study-



approach is supportive in mirroring the heterogeneity of NWFP markets, and helps tackling but national and international market aspects and trade-patterns.

- 4) The institutional aspect of NWFP and MPT production and marketing has to be better understood in order to develop mechanisms of governance that take more explicitly respect of economic pillar. The environment of policies, regulations, policy instruments, property rights, cultural norms and traditions is of paramount importance for NWFP sector development, and hence needs increased scrutiny when formulating reform needs and recommendations for the development of the sector. The StarTree concept addresses this need by elaborating a comprehensive suite of policy and governance aspects that are relevant for the national cases and the European policy domain.
- 5) NWFP and MPT dwell in an interesting array between traditional management and use forms and modern aspects of novel use of natural resources. The issue of innovation is crucial when we look into development potentials, into new products that comply with the bio-economy paradigm, into resource-efficient processes and technologies, and into substitution of non-renewable resources, but also into new forms of cooperation and organization of producers and markets. The StarTree innovation approach is to identify innovation potentials and trends in new non-wood products and MPT by gathering innovation cases (e.g. new products, start-ups in the non-wood sector) from all over Europe and processing them in an innovation data-base that shall grant access to NWFP actors for knowledge sharing and information provision. This will improve understanding of the formulation and implementation of policies aiming at the support of innovations and of different public and private actors.
- 6) Finally, it gets evident from the analyses and concepts that the role of people, i.e. producers, traders, stakeholders, etc., is key to understand when working in a field of tacit knowledge and fuzzy data. The StarTree concept is designed to work with people and for people. A strong stakeholder interaction (incl. action research) is to unravel the mechanisms of NWFP and MPT production and marketing, understand motivation and skills, and unveil the value chains that are often below the official, statistical perception. On the other hand StarTree aims at producing tangible products that shall partially feed back to the NWFP stakeholders: guideline documents building on the advancement in state-of-art, communication platform, new market and trade data, databases, and training and education material. Creating operational tools to support management and decision-making in the NWFP sector is needed to support advancement in the value chains for a better recognition of NWFP in Europe.



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