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**Innovative tools for encouraging cooperation in
forestry: the case of LIFE VAIA agroforestry
project**

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1. INTRODUCTION

Today, the reasons that limit normal practices of managing the forest heritage and inhibit entrepreneurial initiatives include inadequate service roads, high labor costs, fragmentation of land ownership, the complexity of national and regional regulations and constraints, poor organization of the supply chain, and inadequate product compensation from markets. Forestry and primary transformation businesses, whether individual or associated, are often small, family-run, inadequately equipped, and combine logging and commercialization of lumber with other activities. The situation of the forestry sector in Italy makes companies more fragile, and climate change worsens the situation.

Italian forests have historically been one of the main economic components of our country. The Carabinieri Forestali on their website (www.carabinieri.it) state that the total forest area in Italy has tripled in the last 80 years, and from 2005 to 2015 it expanded by about 53,000 hectares per year. However, this expansion and reclaiming of space by the forest is not the result of a forward-thinking policy for protecting the territory, but rather the result of the gradual depopulation and abandonment of agricultural and management practices in rural, mountainous, and inland areas of the country.

The Vaia storm is a demonstration of the danger that forests and forest enterprises are facing. The storm had a strong economic and social impact on the local population. A part of the population used the forest as a source of income, and also a source of food like mushrooms, nuts, and meat. Additionally, as they are typically neglected topics, ecosystem services and the value of naturalistic qualities must be taken into account (Lasen, 2019). The biodiversity and the provision of ecosystem services are significantly damaged due to the storm, and the restoration of those losses is a critical aspect to be considered. The destruction of the forest causes additional environmental problems in the area; the exposed soil is subject to erosion, which causes the reactivation of existing sediment sources as well as the formation of new ones (G. Beretto et al., 2021). Furthermore, even if nature can restore itself to the destroyed ecosystem by the storm, governments may help with the restoration process of the forest ecosystem and all its positive effects on the local community and environment. Action and strategy must be taken to speed up and address the process of restoration of the storm-damaged area, and have to take into consideration the effects of climate change in the future. For the restoration of the area destroyed by the storm, in 2018 the LIFE VAIA project started. Above this, it is important to create a strong collaboration among forest enterprises,

the local population, and other companies that depend on local forests and the environment. In this context, this thesis aims to propose a plan for evaluating the possibility to use a new type of Italian contract called “Accordo di Foresta”(AdF) in the interested area. The AdF could be used to unify the efforts of more people and companies to solve problems and to create a stronger and more competitive collaboration. In this new type of contract, management is reframed with a new social value; it now represents the owner's responsibility in dealing with the business and society, whether they are public or private owners. In the contract, the management decision is defined in accordance with the laws in force while taking into account the pace and the natural changes occurring in the forest. It is then put into practice through the use of a planner, a tool that expresses the assumption of responsibility by the owners or title holders of forestlands, in the public interest. The objective of the "Accordo di Foresta" is to satisfy the need to create a new contractual figure that represents the territories, communities, and socioeconomic realities of the country's mountainous and interior regions while also including local populations as consumers and beneficiaries of forest products and ecological services. Thus, the AdF becomes a tool helpful in the development of concrete actions aimed at carrying out joint interventions for the preservation, protection, and valuing of local forest heritage. It stands out for being a flexible tool that identifies and defines goals, demands, and lines of communication for a specific local development. The “Accordo di Foresta” is not only useful for the success of the LIFE VAIA project, through the possibility for other companies and associations to join the contract. It can be used also to help neighboring forest owners solve problems in their land that are in common with the area covered by the LIFE VAIA project. As already known by local foresters, the storm weakened the forest, which was further tested by the subsequent very snowy winter, causing a collapse in the natural defenses of the forest. The consequences of this series of events manifested themselves in the uncontrolled propagation of bark beetles, which are becoming the main problem for the forests in the region.

Extreme events like Vaia storm, but also wildfires, and landslides are a natural control system, because they allow the renovation of natural areas, favoring the growth of new and young vegetation. Unfortunately, human-induced climate change has led to an increase in the frequency and intensity of extreme meteorological events (Alexander et al., 2013 and Xuebin Zhang et al., 2013). Therefore, a large number of habitats, ecosystems, and, in particular, forests are being destroyed more often and with a stronger impact. To guarantee the wellness of forest and local economies in the area interested by LIFE VAIA in the future, the

“Accordo di Foresta” define agroforestry as sustainable forest management that must be used to prevent and adapt the forest to possible future hazards.

The agroforestry system is adopted in the LIFE VAIA project because it can aid in the protection of biodiversity and the adaptation and mitigation of climate change if they are correctly planned and managed. However, if they are used improperly, crop and tree competition could result in productivity declines. The majority of agroforestry systems work to diversify production by using two different layers in the same area, the tree layer or other woody perennial plants mixed with a cropped layer composed of shrubs or herbaceous plants. The aims of agroforestry are to produce wood and non-wood forest products from the two different layers, as well as to boost or maintain the production and productivity of farming and forestry systems. Small-scale forest-based businesses may find potential thanks to agroforestry systems. By improving household income, on-farm output, and employment opportunities, agroforestry can help to reduce rural poverty. When wood, fodder, and other tree products are produced on-site rather than having to be procured from off-site sources, it can save time, labor, and money that they would otherwise have to be purchased. It can also lower the chance of economic failure by increasing the diversity of production within farming systems. Agroforestry provides choices for maximizing output per labor input when the labor supply changes at the household or community level. The continuation of conventional agroforestry methods can contribute to the preservation of the social ties created by mutual aid agreements. Furthermore, a variety of environmental services can be offered by agroforestry systems. They can, for instance, increase soil fertility, shield animals and crops from the wind, repair damaged fields, enhance water conservation, control pests, and stop soil erosion. In order to achieve the objectives of an agroforestry system and maximize the positive effects, it is necessary to implement the system in the right way. A thorough grasp of agroforestry systems and a method for expanding knowledge to the people that are going to use it are prerequisites for their adoption and effective implementation. The effective adoption of agroforestry depends on the dissemination of agroforestry practices and the provision of support for farmers like also for product value chains and coordination among the various sectors.

The project aims to strengthen the body of knowledge on the application of novel agroforestry techniques in forest farming, evaluate the efficacy of the approach, and promote its usage in European forests. LIFE VAIA is trying to create an innovative ecosystem-based approach that emphasizes the quick response to the negative effects of extreme weather

events, accelerates natural regeneration processes with high biodiversity levels, and generates economic benefits to temporarily replace the loss of income from timber exploitation. By defending forests against climate change and fostering biodiversity, LIFE VAIA's management is also attempting to advance the execution of the EU forest plan. The project is a test to determine the impact of innovative management systems and apply the VAIA approach in several areas characterized by different conditions in order to define fast response models that can be applied in sites affected by extreme events exacerbated by climate change.

This thesis first discusses what is agroforestry through a literature review of the definition. Also, it investigates the possibility of implementing the production of honey, mushrooms, wild berries, and medicinal plants in a forest ecosystem. Furthermore, an analysis of the "Accordo di Foresta" was done. The aim of this analysis is to explain to the association involved in the project what this new type of contract is. After the explanation of what the AdF is, a possible questionnaire submitted to participants to an Accordo di Foresta within the project is proposed, aiming at understanding the opinion of respondents about the Accordo di Foresta and to get information about how respondents perceive its implementation in the LIFE VAIA project, highlighting the pros and cons.

2. STATE OF THE ART

The aims of this chapter are to define, from different perspectives, the concept of agroforestry and its benefit to the environment and community. Furthermore, it collects information about the production of non-wood forest products in an agroforestry system and provides examples of culture already settled and, where it is possible, the information is accompanied by the result. The “Accordo di Foresta” (AdF) is another topic analysed with this method by searching information in the dedicated legislation and in the literature.

It is possible to notice a lack of information about some aspects of agroforestry and the AdF. Indeed, the AdF, is a new legal instrument adopted by the Italian government and the few examples found are without results yet. In addition, for agroforestry, it is difficult to find examples and results in climatic regions compatible with the study area.

2.1. AGROFORESTRY

2.1.1. DEFINITION

Humans have utilized trees in conjunction with crops and cattle since the start of agriculture, many previous lands use systems are originated beneath trees or in savannas, with the tree component undergoing dramatic alteration (PKR Nair et al 1993). Subsequently, the research found out that agriculture and forestry could improve their productivity by separating crops and trees, doing so it was possible to eliminate competition among different species, also the machinery and agrochemical used to become more and more specialized increasing the efficiency of their use. Humans, by seeing the positive effects in the short term of monoculture schemes, start to increasingly use this method abandoning agroforestry. This land use change led to a total alteration of the rural landscape, which led to numerous problems to this day.

The agroforestry system consists of two different layers, one composed of trees and/or hedgerows (forest system) and the second layer composed of other production systems

different from the first layer (agricultural system), this second layer usually consists for example of crop, mushrooms, meadows for pasture and plants for the production of little fruits. Even if this technique is already present in human society, it is only since the seventies that the word agroforestry began to appear in the scientific community. This word is used to define ancient practices that, were replaced in time by modern systems more focused only on production like monoculture farming. In a relatively short period of time, the word and notion achieved a good amount of acceptance in international land-use jargon, although not without some difficulties. Undoubtedly, there were a lot of misunderstandings and uncertainties in the beginning about what agroforestry was. Even those who claimed to be competent and experienced in agroforestry in the late 1970s and early 1980s were unable to describe it precisely. Most of the literature on agroforestry, during this time period, had at least one description of the topic. All these definitions create a scenario where agroforestry is not clearly defined creating bias in the scientific community, this situation motivated researchers to find a common definition. The first significant step taken in the reconsideration of the agroforestry system was the establishment of the “International Council for Research in Agroforestry” (ICRAF) in 1977 (Reinhold Muschler et al 2016).

ICRAF is one of the firsts associations that try to fill this lack in the definition of agroforestry. The topic was examined by ICRAF in an editorial, headed "What is Agroforestry," in the first issue of *Agroforestry Systems* (Vol. 1, No. 1, pp. 7–12; 1982). The editorial includes a variety of definitions of agroforestry, put forth by different writers, these concepts were further developed, and the following definition was proposed:

“Agroforestry is a collective name for land-use systems and technologies where woody perennials (trees, shrubs, palms, bamboos, etc.) are deliberately used on the same land-management units as agricultural crops and/or animals, in some form of spatial arrangement or temporal sequence. In agroforestry systems, there are both ecological and economical interactions between the different components.”

(Lundgren and Raintree, 1982)

Despite the creation of this definition, the discussion on what agroforestry is continuing until these years (20’s) as example the study led by Somarriba in 1997 titled “Revisiting the past: an essay on agroforestry definition” and also all the paperwork and documents that different organizations publish trying to define what is agroforestry. However, the scientific community eventually come to the conclusion that the discussion was ultimately not

worthwhile. They accept the fact that even disciplines like agriculture and forestry which have been present in our culture for centuries, do not have entirely satisfactory definitions, and more importantly, that the development of those disciplines has not been predicated on the existence of a definition that is universally accepted.

Even with the difficulties in finding a common definition, it is essential for an organization or a government that deals with agroforestry systems to have one. A definition is important to avoid problems and misunderstanding with authority and stakeholders, for example, FAO creates its own definition: 'Agroforestry is a collective name for land-use systems and technologies where woody perennials (trees, shrubs, palms, bamboos, etc.) are deliberately used on the same land-management units as crops and/or animals, in some form of spatial arrangement or temporal sequence. [...] Agroforestry can also be defined as a dynamic, ecologically based, natural resource management system that, through the integration of trees on farms and in the agricultural landscape, diversifies and sustains production for increased social, economic and environmental benefits for land users at all levels.'

Also, the European Commission, in its explanatory fiche on the rural development sub-measure 'Establishment of agroforestry systems, provides a precise definition for the purpose of granting support to European farmers practicing agroforestry:

'Agroforestry means land-use systems and practices where woody perennials are deliberately integrated with crops and/or animals on the same parcel, or land management unit without the intention to establish a remaining forest stand. The trees may be arranged as single stems, in rows, or in groups, while grazing may also take place inside parcels (silvoarable agroforestry, silvopastoral, grazed or intercropped orchards) or on the limits between parcels (hedges, tree lines).'

The definitions above incorporate the term 'deliberately' to emphasize that agroforestry is not a natural system but requires human intervention - 'humans' are an integrated element of the system, also points out the importance of highlighting the presence of two layers can aid in avoiding misunderstanding, concepts already resumed in the EU-sponsored AGFORWARD project (Mosquera Losada et al 2018).

EU also defines minimum characteristics needed for receiving a direct payment like the tree density, fixing the minimum value of 100 trees/ha, established by Regulation 640/2014 (Mosquera-Losada et al. 2016b). Considering the fact that the LIFE VAIA project wants to

use the agroforestry technique as a new sustainable management system, adopting only one definition of agroforestry is really important in order to avoid misunderstanding and conflicts. Furthermore, a definition is even more important for the contract “Accordo di Foresta” proposed by this thesis. Indeed, creating a contract that envisages the adoption of agroforestry, without a definition of it could create several problems.

The word agroforestry includes in its definition more different techniques and a system classification is required to offer a framework for analyzing systems and generating action plans for their development, for doing so a series of criteria and parameters are needed to classify agroforestry systems (Nair et al 1985). A 2018 study led by Mosquera Losada examining the importance of agroforestry in climate change mitigation and how it is promoted through the CAP defines six basic agroforestry practices: silvopastoral, silvoarable, forest farming, hedgerows, windbreaks, and riparian buffer strips, as well as home gardens/kitchen gardens. Another classification was developed by Dr. Antonio Rigueiro-Rodríguez, Dr. Jim McAdam, and Dr. María Rosa Mosquera-Losada in 2009, the study according to AFTA (1997) and Alavalapati and Nair (2001), recognizes six fundamental types of temperate agroforestry practices: silvoarable agroforestry, forest farming, riparian buffer strips, silvopasture, improved fallow, and multifunctional purpose trees. European farmers have a long history of involvement with forests, and this connection, together with Europe's wide diversity of temperatures and microclimates, has resulted in the emergence of many different combinations of agroforestry methods.

The reason behind the reassessment of the agroforestry method was the occurrence of issues caused by the adoption of monoculture farms. Just after a few decades, the first problems began to develop in the bigger monoculture farming system, which appeared to give almost limitless production improvements (Reinhold Muschler et al 2016). The earliest indicators of the unsustainability of the monoculture system were soil erosion by water and wind. The absence of trees and permanent vegetation reduces the soil cover, exposing the ground to the natural elements that, year after year damage the structure of the soil and reduce productivity. Furthermore, the detrimental and long-term consequences of relying on agrochemicals to manage pests and diseases start to destroy ecosystems. These products were hailed as the solution to almost all plant nutrition and protection problems. Unfortunately, until the effect of chemical products were visible, we didn't take into account the bioaccumulation and long-term toxic effects of persistent chemical products, as well as their unavoidable complications such as groundwater contamination and the destruction of beneficial organisms like insects,

birds, or symbiotic soil microbes (Bardgett and van der Putten 2014), have demonstrated that an over-reliance on agrochemicals and fossil-fuel-powered machinery is a dead end road. Indeed, while this approach has been effective in some cases (without considering its externalities) and for a short period of time, it cannot be sustained in the long run. In the face of rising external input prices and mounting evidence of their massive negative effects on the environment and human health, farmers start to adopt other strategies (Conway and Pretty 1991). The rise of these problems increases the acceptance in the scientific community that, the use of a more efficient agroecological design for integrating productive units immersed in a biodiverse and functioning environment is the only really sustainable long-term alternative (FAO 2013). Agroforestry become one of the main sustainable landscape designs (Nicholls et al. 2013; Trumper et al. 2009; Muschler and Bonnemann 1997), thanks also to its great potential for combining production with protection and for all ecosystem services provided by this technique. The importance given by the scientific community to the agroforestry system is due also to its environmental and social benefits already known. Shibu Jose et al 2009 describe agroforestry as a part of a multifunctional working landscape that provides ecosystem services, environmental benefits, and economic commodities. Protected areas are not able to counteract anthropogenic pressures that are the prime reason for the disappearing of species and habitats, so agroforestry approaches can combine production and conservation functions (Jose Shibu et al 2012). It is possible to. It is important to choose, today, the species to introduce in the forest on the base of their suitability for the climate existing in the next 50/100 years, when trees will be mature. This strategy will produce forests more adapted to the climate, then more resistant and resilient and consequently more able to offer ecosystem services in the future. The selection of species functional to climate change has lately been submitted to experimental trials in Europe. Some scientific articles are already published about the topic publications (*cedrus libani* and non-native tree) and some associations are carrying out experiments (example Forgenius project of H2020). The researcher's objectives include, among other things, assessing genetic and phenotypic variety of all genetic resources, as well as their adaptability, under changing climate. Agroforestry could play in the future a major role in conserving and even enhancing biodiversity due to its positive effect in providing new habitats and corridors and reducing the rate of conversion of the natural environment. It is important to consider among these effects other ecosystem services provided by agroforestry for example erosion control. Agroforestry has demonstrated a strong effect in enhancing soil quality and health. It has the potential to (1) enrich soil organic carbon more effectively than monocropping systems, (2) improve soil

nutrient availability and fertility owing to the presence of trees in the system, and (3) improve soil microbial dynamics, all of which would benefit soil health (Dollinger et al 2018). Indeed, the integration of trees in agriculture increases soil's organic matter from depositing litter above and below ground. The inputs from the litter increase microbial diversity and abundance, facilitating the creation of an abundant nutrient stock in the agroforestry system (Yengwe et al 2018). Agroforestry systems could also be a powerful tool against the greenhouse effects thanks to their capacity to increase carbon storage when compared to a monoculture field of agricultural plants or pasture (Sharrow and Ismail 2004). Besides all these positive environmental effects, agroforestry can also improve the social and economic aspects of the entire population.

Jie Gao and Carla Barbieri (et al 2014) already discussed the role of agroforestry in improving the quality of life in farming communities, restricting urban sprawl, providing educational opportunities, and beautifying rural landscapes from a social aspect (Burel 1996; Schultz et al. 2009). Agroforestry approaches can provide landowners and tourists with both consumptive and non-consumptive recreational options, particularly when combined with treed farm landscapes (Kenwick et al. 2009; Lovell et al. 2010). Agroforestry has the potential to cut production costs while increasing agricultural revenues. The most frequently mentioned cost savings are the reductions in manufacturing inputs such as chemicals, water, energy, labor, and the supply of natural shelters (Benayas et al. 2008). In terms of economics, agroforestry may raise the net value of production by diversifying crops and other farm outputs (for example, fuelwood) and increasing production area above and below ground (Cable 1999; Chamberlin et al. 2009). These economic benefits may be extended to local economies by offering job opportunities for citizens (Benayas et al. 2008). Despite the wide range of ecological and socioeconomic advantages associated with agroforestry, there is a dearth of knowledge of public views of such benefits.

Agroforestry is a great opportunity for the development of agriculture and also human society, as it is already explained above, this method has a lot of benefits, but the implementation of an agroforestry system is not still without challenges.

The lack of financial incentives for compensating the ecosystem service that provides, make it more difficult for this practice to expand. In Europe agroforestry system is promoted by Pillars I and II of the Common Agricultural Policy but only for establishing new agroforestry systems, so areas already managed with an agroforestry technique are not taken into account (Hernandez-Morcillo et al 2018). Moreover, Carbon Credits earned by land use and forestry system cannot be traded so farmers cannot benefit from selling them (Van Vooren et al

2016). Incentives might mitigate the financial risk and support farmers in maintaining an agroforestry system in the long term, and it is important to consider besides, the typical high prices for the adoption of innovative agricultural practices and production techniques (Long et al 2016). Agroforestry system is a labor-intensive technique, and the high cost of labor in Europe can be a significant disincentive for anyone contemplating implementing agroforestry (Eichhorn et al 2006). Costs and the higher risk to lose a part of the yield, to competition, are great obstacles to the diffusion of agroforestry systems. Furthermore, even if the production of multiple products in an agroforestry system is seen as a positive aspect by landowners, the lack of market or lack of information about the market for those products are one of the biggest concerns when considering the adoption of agroforestry techniques (Workman et al 2003; Rois-diaz et al 2018).

On-farm demonstrations and comprehensive field-based proof of agroforestry system in relevant socioeconomic contexts are required to connect local product demand with agroforestry supply. These actions must be complemented by agricultural consultants to advise farmers and policy reforms to encourage policy-making bodies to bring forth and disseminate the numerous advantages of the agroforestry system from a local to a global scale. Field demonstrations of agroforestry systems are few and far between. As a result, there is a clear need to supplement the substantial scientific data on agroforestry's various advantages with on-the-ground demonstrations. The demos may be used as a teaching platform for farmers, consulting services, and policy-making authorities, as well as to teach students about the multifunctionality of agroforestry systems in real-world settings. It is important to consider also to plan an education program to disclose to farmers the benefits of agroforestry with exchange opportunities among farmers, involving also the general public. Not only the landowner must be informed about the benefit and role that agroforestry could have, but also consumers must know the importance of agroforestry systems to incentives them to pay a premium price for agroforestry products, helping so farmers.

A lot of work must be done to fulfill these issues, but new tools are being created and agroforestry is being recognized always more by institutions and new laws and incentives are being adopted to foster and protect this traditional but innovative method.

2.1.2. NON-WOOD FOREST PRODUCTS

Bowes and Krutilla (1989) argue that forests are capable of successfully producing a range of

desired and complementary outputs (e.g. of wood, non-wood forest product (NWFP) and biodiversity). Agroforestry has various options for combining the production of NWFP with wood production and/or the provision of other goods and services of the forest. Co-production significantly depends on the intensity of management and the related management goals, for example, if a forest is managed for increasing biodiversity, the management can't be too intensive. It is indisputable that high-intensity forest management in association with wood biomass production may well achieve this particular goal but may cause a diminution in the value of other ecosystem services. The delivery of most ecosystem goods and services is likely to increase as forest management intensity for biomass increases (from passive to high intensity) up to a point, followed by a decline (Figure 1).

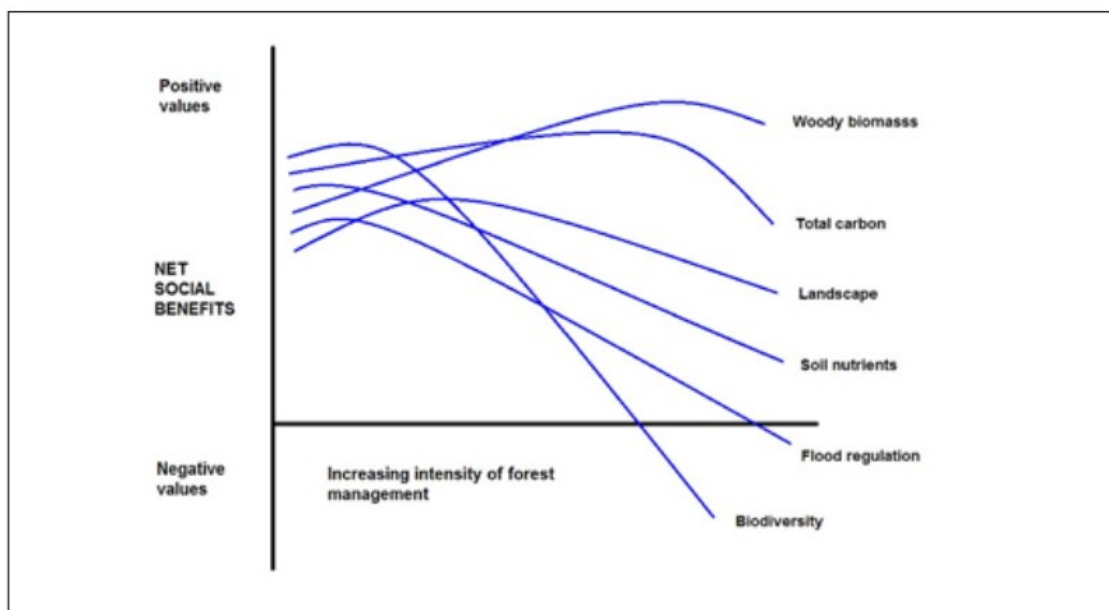


Figure 1 Relation between management intensity and ecosystem service delivery (Nijnik et al., 2016)

In relation to some services, such as landscape and biodiversity, the level of intensity at which the value starts declining may be quite low (Figure 1). This observation is along with the results of Duncker *et al.* (2012) who illustrate that maximizing the rates of biomass production (and carbon sequestration, which are synergetic) may conflict with biodiversity values.

Concerning non-wood forest production, its dependence on the intensity of forest management for biomass is deemed to be very case and context-specific, and be very different for different types of NWFP (e.g. for fungi, honey, and wild berries). Further, different types of the same NWFP, for instance, fungi species, may be associated with different curves. The actual shape and location of the impact curves will vary over space, and from one forest to another, the impact curve is case and context-specific, and the generalized

curve above will need to adapt to specific locations and conditions. However, the general point is that increased intensity of management towards one single aim is often associated with a diminution of multiple forest values. In practice, different elements of the mix of forest ecosystem goods and services are influenced by the preferences of the forest owner, by markets and/or policies; some forest goods and services, whilst having high public good values, may not be rewarded at all by markets or policies.

Particular attention should be given to synergies and trade-offs from a combined production in order, if possible, to find win-win solutions. Environmental conditions (including climate change and emerging biotic and abiotic threats) and management instructions enhancing NWFP production have to be taken into account. The identification of trade-offs between wood production and NWFP production is essential for sustainable forest management, which aims at optimizing the provision of multiple goods and services. Existing management concepts like agroforestry can support a combined production of NWFP and timber in various manners.

In a rational decision-making environment, the most preferred choice is generally bounded by the management, environmental and social objectives. LIFE VAIA managers decide to adopt an agroforestry system in areas damaged by the Vaia storm, their aim is to create a multipurpose forest that produces the following NWFP: mushrooms, berries, honey, and medicinal and aromatic plants (MAP). The types of products are chosen by taking into consideration the objectives of LIFE VAIA. As already explained above, the adoption of the agroforestry system increases the biodiversity in the forest thanks to the presence of more species in the forest structure. Furthermore, those species bring other environmental but also economic benefits to the area thanks to their function. The melliferous plant helps in the regeneration of more resilient and climate-adapted forests thanks to their role in the bee life cycle (Zdenko Franic et al., 2019). Instead, the production of little fruits like berries was estimated by the LIFE VAIA researcher and their partners, and a positive return on investment is expected. The project will test and demonstrate berries production in multiple different places, with the aim of demonstrating the estimation, which will contribute to attracting private investors. By the way, the literature gives little information about the economic aspect of agroforestry. It is possible to find studies about the economic aspect of the agroforestry system but few of them have the same non-wood forest product as LIFE VAIA. Furthermore, for some non-wood forest products information comes mostly from sites with different climates, for example for medicinal and aromatic plants. From the

information collected, it is possible to assume that if the production in an agroforestry system increase, also the revenue should increase. Unfortunately, a large number of factors must be considered and for the first years the revenue could not be enough to create a net income.

2.1.2.1. MEDICINAL AND AROMATIC PLANT (MAP)

Medicinal and aromatic plants (MAPs) have a vital role in global health, particularly in impoverished nations. Approximately 12.5% of the world's 422,000 plant species have medicinal potential (Schippmann et al. 2002), and these plants were used to cure human and cattle ailments prior to the development of modern medicine. Human communities all over the world have acquired a great body of indigenous knowledge on the medical benefits of plants, as well as allied purposes such as poison for fish and hunting, water purification, and pest and disease control in crops and animals. Approximately 80% of the population in most underdeveloped nations still uses traditional plant-based remedies to treat human ailments (de Silva 1997). The benefits of MAP are considered so important, in countries like China, Cuba, India, and a few other nations, to officially support the use of traditional medical systems in their healthcare programs. People in rural and isolated locations rely mostly on traditional treatments since the contemporary system is out of reach and prohibitively expensive. Many educated people in Asian and African nations utilize traditional medicines because they believe they are more effective than modern medicine for some chronic conditions, they do not have the adverse effects that certain contemporary drugs have, and/or they are cheaper. As a result, traditional and contemporary medical systems coexist in many communities.

MAPs are less used in Europe compared to Asian countries, but even here have an important role, just considering also that Germany is one of the three most important commercial centers of those products, the other two are Hong Kong and the USA. About 25% of present pharmacopeia are derived from plants, while many others are synthetic counterparts based on plant prototype compounds. Up to 60% of the drugs prescribed in Eastern Europe are unmodified or little changed to higher plant components (Rao et al 2004). Contraception, steroids, malaria drugs, heart failure drugs, and anti-cancer drugs are made up of compounds that cannot be synthesized inexpensively, therefore their production needs a steady supply of plant material (van Seters 1997). The vast quantity of commerce at the national and

international levels underscores MAP materials' global importance. During the 1990s, annual overseas imports of MAPs for pharmaceutical use were 350.000 Mg, worth more than USD 1 billion, and the total number of MAPs in international trade is projected to be around 2500 species worldwide (Schippmann et al. 2002).

Growing MAPs in forests need (or tolerate) partial shade, wet soils rich in organic matter, high relative humidity, and mild temperatures (Vyas and Nein et al.1999). Such MAPs may be grown in thinned forests and cleared forest sections, as well as intercrops in new forest plantations. Newly formed forest plantations, like agroforestry systems, can be intercropped with MAPs similar to food crops until the trees fill the ground. Light-demanding understory species (e.g., *Echinacea* sp.) may be intercropped initially to offer early returns from plantings, while shade-tolerant species such as ginseng and goldenseal can be intercropped following canopy closure (Teel and Buck et al.2002). Fungal infections are a serious problem in forest farming, yet fungicide treatment can be harmful to forest health; consequently, adequate spacing and mixed cropping are suggested (Cech et al 2002). Mechanical cultivation may not be possible in wooded areas, thus labor supply must be regarded as a constraint (Hill and Buck 2000). There are two types of intercropping systems employing MAPs:

medicinal plants and tree species used as upper-story trees that grow tall and form an open crown at the top. Tall and perennial medicinal trees, which require greater spacing, can be intercropped with annual crops in the early years until the tree canopy completely covers the land. Depending on the spacing and type of the trees, certain medicinal plants may enable intercropping for many years or permanently. Farmers earn money from intercrops at a time when the primary trees are not producing.

MAPs should be well adapted to partial shadowing as intercrops with other tree crops (Vyas and Nein 1999), allowing them to be intercropped with timber and fuel wood plantations, fruit trees, and plantation crops. Kumar and Gupta in 1991 demonstrated that many medicinal plants may be produced in agroforestry systems they intercropped 64 herbaceous medicinal plants with two-year-old poplar (*Populus deltoides*) spaced 5 m and only 10 of those plant species performed poorly and also the trees may benefit from the intercrop inputs and management. Short stature and a quick cycle MAPs and culinary herbs are ideal for short-term intercropping during the juvenile stage of trees. MAPs are profitable alternative intercrops to regularly cultivated annual crops wherever markets are developed (Maheswari et al. 1985; Zou and Sanford 1990). The number of years MAPs may be intercropped with a specific tree species is determined by the size and intensity of its canopy shadow, tree

spacing, and management, particularly branch cutting, as well as the type of MAPs. Shade-tolerant and rhizomatic MAPs may be cultivated in widely spaced plantations for a longer period of time. Many medicinal plants that are typically produced in thinned woods can also be intercropped with trees (Zhou 1993). The yields of medicinal plants and herbs in intercropping were comparable to those in solitary cropping at the first harvest, but they tended to be lower at successive harvests (Palada and Williams 2000).

MAPs are already present in agroforestry systems in Europe, Herdade de Vale Côvo in Mértola, Portugal (<https://www.herdadevalecovo.com/>) is one instance of this management. Rockrose, wild native lavenders, and rosemary are among the medicinal and aromatic herbs and shrubs that may be found on this farm amid the native holm oak woodland. The farm also has additional pine and eucalyptus plantations in addition to a rosemary planting area. The most significant problem is that the majority of the work done on the farm is vegetation management, which is done to increase the quantity and quality of the essential oils, which are the farm's main product. In France is becoming more and more common to grow lavender and trees (mainly fruit trees) together in the same field, this system called pré-verger cover about 150,000-168,000 ha, especially in Normandy, Bretagne and Pay de Loire (Eichhorn et al 2006, Bélouard and Coulon, 2002). The lavender is intercropped for the first five to fifteen years with a tree density between 50 to 100 trees per ha. Also in Spain, in the Galicia region *Melissa officinalis* L. and *Mentha x piperita* L. are established under *Prunus avium* L. *Prunus avium* L., this agroforestry system increases the production of both components (Ferreiro-Dominguez et al 2017). 2008 saw the establishment of the *Prunus avium* L. plantation. Originally a mixed stand, the plantation was maintained to establish *Prunus avium* L. at ultimate densities of 6 m x 1.25 m and 6 m x 2.5 m, or 1333 and 666 trees ha⁻¹, respectively. Following soil preparation in November 2015, *Melissa officinalis* L. and *Mentha x piperita* L. were planted between tree rows using a three-replicate randomized block design. In 1.75 m wide alleyways, 2.12 m away from the tree bases, medicinal plants were planted. 0.7 meters separated plant rows, and 0.4 meters separated plants within a row. One of the alleyways was used to grow medicinal plants, while the other was left unplanted to give machinery access for the trees' annual pruning and phytosanitary treatments. The yield of *Mentha x piperita* L. varied between 0.46-0.68 Mg DM/ha and for *Melissa officinalis* L. farmer obtained 0.31-0.42 Mg DM/ha.

Unfortunately, since there are few examples of agroforestry systems using MAP in Europe, find information about the economic aspect was not possible. Most of the studies present in

the literature are developed in Asian countries, mainly in China and India. Even if the climate change so much from the two continents, Asian studies could be used as a starting point. Indeed, the Horti-medicinal agroforestry system was a success. The economic study of MAPs integrated into agroforestry systems demonstrates that numerous medicinal plants may be planted at various ages of trees, with a higher economic income than the monoculture practice (MAP economy). In some cases, the ratio benefit/cost could be doubled or even more, for the monoculture of *Andrographis paniculate* benefit/cost ratio pass from 2.33 to 5.06 in an agroforestry system (Bari and Rahim et al 2012b). The LIFE VAIA's agroforestry system has the possibility to demonstrate if this increment of revenue is also possible in a European contest, considering the climate and the plant species utilized.

2.1.2.2. HONEY

Insect pollinators' numbers have been declining for several decades, and some have even gone extinct (Vaissière et al., 2008). Since honeybee extinction is on the rise and agriculture is particularly susceptible to such losses, future production is in danger. In this way, melliferous resources have decreased as a result of the current fallow reduction trend in the agricultural environment. Because of this, it is essential to create "new" areas with high biodiversity on the border of cultivated lands in an agricultural context, such as hedges and riverbank vegetation, or to (re)introduce trees into cropping systems by using the agroforestry technique that could maintain and even increase beekeeping (apimondia 2009). Honeybees and forests are associated in many places of the world, and this association has an extensive history, but it is rarely integrated or well explored. Honeybees graze on the blossoms of forest trees, and the trees themselves offer cover to a swarm or beehive. Therefore, planned tree plantings, such as those found in agroforestry systems, may be adjusted to promote bee prosperity and hive protection. For a variety of reasons, it may be simple to combine beekeeping and tree farming; both are feasible on terrain that is too sloping or otherwise unsuited for other agricultural applications. Both require intermittent maintenance and might be maintained while the grower or beekeeper is involved in other farming endeavors. Hives can be placed inside or next to a tree plantation and forage from the trees as well as other blooming plants in the area. Another advantage is that bees can use 4- to 5-kilometer radius of a forest, but beehives need only a little amount of space.

In addition to the income from long-term forest management, combining beekeeping and forest management can increase the landowner's revenue through the annual production of bee products, such as honey and bee wax (Hill & Webster 1995). Due to the variety of tree species and types present in an agroforestry system, flowering lasts longer and there is a greater supply of nectar and pollen. Additionally, unlike in more carefully maintained orchards, insecticides have no impact on bees (Herzog 1998). For these reasons, agroforestry methods are regularly integrated with apiculture, which increases the output of both fruit and honey (Herzog 1998). Agroforestry systems' combination of grassy strips, shrubs, and arboreal strata can provide more and better melliferous resources.

The phenology of trees and bees must be taken into account when designing an agroforestry system because these aspects are crucial to the relationship between them. Additionally, the types of trees present in a forest have a significant impact on bee populations and on the quality and quantity of nectar and pollen that they produce. Planning the planting strategy is the next stage after selecting the tree species. When tree planting begins, the distance between trees is essential for both foraging bees and the plants themselves. Fewer blooms per tree emerge and are accessible to pollinators when trees are near to one another and their canopies greatly overlap (Ayers et al, 1993). When trees are spaced too far apart, the land is wasted (Hill et al., 1995).

If all precautions are taken the beehives become a rich source of income. In 2018 a group of researchers, led by Simone Blanc, evaluate the beekeeper's income in a rural area. Three different types of beekeepers were considered: hobbyist mountain beekeepers, professional mountain beekeepers, and professional hill beekeepers.

Item	u.m.	Case A - Hobbyist mountain beekeeper	Case B - Professional mountain beekeeper	Case C - Professional hill beekeeper
TO	€	6010	55071	138293
O	€	1727	14691	23043
Q	€	1677	2127	4077
T	€	92	3250	5650
NP	€	2514	35003	105522
I	€	450	2858	8426
LC	€	0	800	0
WI	€	2064	31345	97097
NPu	€ hive⁻¹ yr⁻¹	126	125	301
HWI	€ h⁻¹	6.7	9.7	24.1

Table 1 Source Simone Blanc et al. 2018

The table shows the total income (TO) and the different types of costs: overheads(O), maintenance (Q), and taxes and fees (T). The net profit (NP) is different between TO and the sum of all the costs. Furthermore also the interest (I) and the labor cost (LC) are taken into account. The final result is the net profit for the single hive (NPU), and the hourly work income (HWI). For all the considered cases there is a profit, so involved in the LIFE VAIA's agroforestry system melliferous species can create a source of income to support the project and help the local economy until the restoration of the forest. In the project, the cost of starting the beekeeping activity must be considered, fortunately, hives and bees are cheap. Searching on the web is possible to find a hive for around 100 euros, also the complete equipment kit has a cost of around 100 euros. Considering the cost for the bees, the initial cost should be a maximum of 400 euros. Seeing the earnings per beehive, it is possible to have a net income since the first year, if the number of beehives is greater than four.

2.1.2.3. MUSHROOMS

Contrary to the so-called 'direct' non-wood forest products, which are obtained directly from a particular tree species (e.g., tree fruits, cork), mushrooms are typically considered as indirect wild forest products that coexist with trees and whose provision is modulated by an array of site and stand conditions. Such 'indirect' wild forest products have been usually considered as side-products of a given silvicultural regime. The agroforestry system instead tries to produce multiple products, so the management of the forest must consider also the needs of mushrooms. Since forest fungi are tightly connected to the main element that characterizes forest ecosystems (i.e., the trees), forest management and silvicultural operations are likely to influence fungal and mushroom dynamics (Egli et al., 2011). Indeed, the forest owners have to adopt silvicultural treatments and activities aimed at increasing mushroom provision. The right management allows forest owners to gain money from mushroom production to incorporate these products into multifunctional forest management plans (Harald Vacik et al 2019). Indeed, previous research has shown that mushrooms can generate a higher economic profit than timber, especially in Mediterranean areas where timber harvesting is less profitable (Palah et al. 2009). Furthermore, mushroom production can also account for a significant portion of total forest value even in regions where timber-oriented forestry is profitable (Tahvanainen et al. 2016). Forest attributes like weather and

site conditions have a strong influence on the occurrence and productivity of mushrooms in forests and agroforestry systems. In order to propose fungal-oriented management recommendations in large-scale forested landscapes those characteristics must be managed. But not all the variables can be altered through operations, only stand structure and composition are changed by management. As a result, managers and landowners may primarily influence ecological variables such as stand age, density, tree species composition, and forest cover. Useful actions that are likely to affect fungal dynamics are the changing of rotation duration, stand basal area, and tree species composition through forest management (Harald Vacik et al 2019). Similarly, whether even-aged or uneven-aged forest management strategies are used, the degree of automation and accompanying soil disturbance from wood thinning and harvesting activities may influence the number of mushrooms generated in a particular forest area.

Most of the studies are fairly local or regional, and as a result, variances in site conditions, weather, and forest structure preclude general suggestions from being made, and more in-depth investigation focused on particular fungal species is suggested. A workshop arranged by the AFINET project addresses this topic as part of the Finnish Agroforestry Innovation Network's activities (Michael Den Herder et al 2019). During the workshop, a method for mushroom cultivation was explained as an example of forest management. The mushroom species taken into consideration are *Pleurotus Ostreatus* and *Ganoderma Lucidum*, both can be grown on logs of birch, alder, oak, or poplar. The logs with a diameter of 10 centimeters are stacked in the forest and mushrooms are inoculated on them. The logs are drilled 10-12 mm deep with a drill to insert the cultured mycelium. Whether the production is carried out correctly, a log can be used for about 3-4 years and mushrooms can be harvested twice during the growing season, with an interval of 8 weeks between harvests. The management technique is particularly suitable in combination with continuous cover forest management. There is also the possibility to inoculate the mushrooms directly on those trees which will be cut anyway during the thinning operation, that would otherwise be sold for a few euros. The direct inoculation of mycelia in stand trees could be adopted with Shaga mushroom, thanks to this method trees harvested from thinning operations create an income of 100 euros for every three, instead of 2 euros for the selling of the thinned log. Mushroom farming may be thought of as a new type of forest management since it amortizes the cost of thinning operations. Because mushroom production involves minimal effort aside from the initial inoculation and harvesting phases. Its incorporation into forest products is ideally suited to circumstances when the farmer does not have a lot of time available. The few amount of

work needed for mushrooms is helpful in an agroforestry system where the owner has to work with different products. The final report of the workshop highlights the vital importance of humidity for the mushrooms. The mycelia that form on the trunks require enough moisture. Rainfall of at least once per week is required for fungal development. Mycelium can deteriorate and die if the log on which the fungus grows is excessively dry. During the summer, it is critical to have access to water to moisten the logs on which the fungus grows as necessary.

2.1.2.4. BERRIES

The literature offers more articles about berries than other non-wood forest products. Agroforestry systems with wild berries are already diffused in Europe, it is possible to find examples all over the continent. Articles from the northern part of Europe are numerous, more examples are From these articles is possible to collect a big amount of information about Bilberry (*Vaccinium myrtillus* L.) and cowberry (*Vaccinium vitis-idaea* L.). Bilberry and cowberry are common and abundant understory plants in northern European conifer-dominated forests of medium and poor fertility. Cowberry is well suited to growing under a Scots pine tree canopy, although a significant supply of light is required for optimum cowberry yields. As a result, stands at the beginning of their rotation (i.e. seed-tree and small seedling stands) had the highest cowberry yields. Cowberry yields are poor in thick and shaded thinning trees, but towards the end of the rotation, sparse pine stands are appropriate for cowberry again. As a result, even from the same stands towards the end of the cycle, good bilberry and cowberry yields can be produced (Miina et al. 2016). It is not economical to change the even-aged management schedules in Norway spruce stands to boost bilberry production. When uneven-aged spruce stands are managed, the stand basal area is always maintained at a level that allows for good bilberry yields, and hence prospective bilberry yields are larger than under the existing even-aged management technique (Pukkala et al. 2010).

In Finland berries and mushrooms are the most important NWFP. They are harvested from the wild mostly for domestic and recreational usage, but also by professional pickers. Because mushroom and berry crops in woods are not actively controlled, crop yields fluctuate substantially from year to year. Forest berries have annual values ranging from 4 to 25 million € (MMM 2009). Seeing the opportunity that agroforestry represents, the LUSTI project starts with the aim to develop innovative agroforestry measures for the production of

forest berries. The project takes into consideration the agroforestry system adopted in North America for the cultivation of *Vaccinium angustifolium* (Henri Vanhanen et al). the results were promising. Unfortunately, the annual variations in harvests combined with other local issues such as work labor availability create an unsustainable situation for the wholesale markets and the refining industry.

Others example can be found in Romania, where two agroforestry systems produce strawberries. The tree species in the agroforestry systems are *Quercus rubra*, *Acer pseudoplatanus*, *Prunus avium* in the first site and *Quercus petraea*, *Fagus sylvatica*, *Acer pseudoplatanus* and *Larix decidua* in the second site. Trees are planted 1.80m x 1.60m in the Transylvania region and in both systems strawberries were planted at 60 x 60 cm spacing creating two pure rows of strawberries in between the tree rows. Strawberries have been managed in a six-year rotation, in the first year plant didn't provide berries. Then strawberry yield increased from the second year of culture and reached its peak in the two plantations in the third and fourth years. This rotation is longer than the one (maximum three years) recommended in pure multiannual strawberry crops (Chira 2000). The maximum strawberry production in the agroforestry system was higher compared to the production of monoculture multiannual strawberry crops. Nevertheless, the production is quite big differences between the two sites due to the dry period in 2004 and the lack of a source of water for irrigation. Furthermore, the paper highlights the high cost of strawberry pickers, which amounts to 20% of the gain. Notwithstanding, alley cropping with strawberries had proven to be a viable alternative to the 'traditional' mono-cropping strategy. The two sites create an income per hectare and year between 2.270/4.450 euro (first site) and 1.710/3.550 euro (second site). Researchers point out also the high survival rate of young plants (95%) and the quick establishment of the new forest culture. Strawberries are used also by AGFORWARD in Switzerland combined with fruit trees (AGRFRWARD project 613520).

In South Bavaria, an agroforestry system is led by EURAF with the aim to investigate the feasibility of blueberry cultivation in an agroforestry system. In the EURAF website is pointed out the importance of the preparation of the soil (Ph) and also the choice of tree species. The experiment finds out in 2021 that the agroforestry system provides good yields and the financial value added is more rewarding compared to a pure forest area. Instead, the yield of berries in the agroforestry system is lower compared to the yield of traditional cultivation of blueberry bushes, but the material and input in the field like fertilizer or pesticides are several more in the traditional system.

In the LIFE VAIA project, the choice of bilberry is based on an estimation done by TESAF. In the estimation, the feasibility and cost/benefit ratio analysis has been conducted. TESAF estimate that investor will start to get a net income after 12 years of cultivation considering also the cost of forest amelioration.

2.2. ACCORDO DI FORESTA

The association Centro Oltreterra proposes the “Accordo di Foresta” in 2020, in order to promote the value of the Italian Alps and forests and to find a solution to the fragmentation of land ownership in Italy. The new instrument called “Accordo di Foresta”(AdF) was adopted by the Italian government through Article 35-bis "Measures of Simplification and Promotion of Circular Economy in Wooden Furniture" which was added to the Law of March 31, 2021, later amended into Law No. 108 of August 29, 2021.

The AdF is analogous to the “Contratto di Rete”, both encourages all parties to coordinate and direct the organization toward its maximum efficiency. The clause 4., states that AdF is compatible with the agricultural cooperative network. In fact, the AdF is described in the article as a tool for developing company networks in the forest industry. Nevertheless, "Contratto di rete" and "Accordo di offerta" are two distinct types of agreements used in the Italian legal system. A "Contratto di rete" is a type of agreement between independent companies to cooperate in a network, with the goal of improving their competitiveness in the market. In this type of agreement, the companies retain their autonomy and independence, but work together to achieve common goals. The network can be formed for a specific project or for a longer period of time, and the companies involved share resources, knowledge and information. A "Contratto di rete" is regulated by Italian law, which sets out the conditions under which these agreements can be formed and the rights and obligations of the companies involved.

An "Accordo di offerta", on the other hand, is a type of agreement between a company and its suppliers or customers. The purpose of this agreement is to define the terms and conditions of the commercial relationship between the parties, such as the price, quality and

delivery of goods or services. An "Accordo di offerta" is not regulated by Italian law, but rather is a private agreement between the parties involved.

In summary, the main difference between a "Contratto di rete" and an "Accordo di offerta" is that the former is a type of agreement between companies to cooperate in a network, while the latter is an agreement between a company and its suppliers or customers to define the terms of their commercial relationship. This sentence defines the contract's economic and social purpose:

4-quinquies.3. “Gli accordi di foresta, allo scopo di valorizzare superfici privati e pubbliche a vocazione agro-silvo-pastorale nonché di asserire la conservazione & l'erogazione dei servizi ecosistemici, nel rispetto della biodiversità e dei paesaggi forestali...”

“Accordo di Foresta have the aim of enhancing private and public agro-sylvo-pastoral areas as well as asserting the conservation and provision of ecosystem services, respecting biodiversity and forest landscapes...”

(according to Article 3 of Law No. 5 of 2009, amended by Law No. 9 of April 2009, Section 33)

Therefore, in contrast to the “Contratto di Rete”, the AdF is specialized in agricultural and pastoral areas. Additionally, AdF must consider the biodiversity and ecosystem services provided in the contract region. The collaboration promoted by AdF allows entrepreneurs to establish cooperation networks that promote economic growth while enhancing public and private agro-silvo-pastoral lands and maintaining the production of ecosystem services. In accordance with the contract, the parties involved establish mechanisms for common coordination and control phases of their activities, while maintaining their formal autonomy and developing interdependent relationships (Perone, 2008). The consequences of the Vaia storm highlight the importance of the forest, not only for the timber industries but also for the entire local community. So, management takes on a new social meaning and becomes the owner's responsibility towards the forest and society.

Storm Vaia spread awareness among the local population of the importance of forests and forestry industries. Indeed, more industries from different sectors are affected by the consequences of the storm. These industries must begin to take an interest in the

management of the forest in order to develop and provide benefits and services to the current and future population of the area.

The idea for the *Accordo di Foresta* was born from the need to develop a new contractual figure that represents the land, communities, and socioeconomic realities of mountainous and inland areas. In the LIFE VAIA project, this modern legal instrument could be used for creating synergies that benefit forest areas and the multifunctionality that characterizes the forestry sector. This thesis takes it into account because the AdF includes both public and private forest owners, as well as producers of goods and services, processors, market segments, local populations, and consumers of non-wood forest products.

Based on this premise, the "*Accordo di Foresta*" is an instrument for the development of a cooperative association system aimed at preserving, protecting and enhancing local forest resources. The creation of a network between the participants in the contract helps in the realization of a productive forestry supply chain and in the promotion of environmental and socio-cultural enhancement in the local area in which they operate. The term "network" refers to an organizational structure with the aim of coordinating and directing the activities of several entities, usually companies, in order to achieve greater overall efficiency. This is achieved by establishing cooperative or collaborative relationships between participants in order to achieve their own benefits, such as the creation of new jobs for the community and the prevention of threats to the territory. It is clear that the local forestry sector must participate in and collaborate with other local realities to define management standards to meet current and future needs while integrating with regional socioeconomic development standards. This is done by laying the foundations for the development of sustainable industries (productive, environmental and socio-cultural), creating jobs, promoting innovation, and taking control of major projects such as the adoption of new sustainable management systems like agroforestry.

It is important to remember that there are no laws specifically designed to regulate the relationships between the parties to the AdF. In other words, there are no rules for resolving any particular conflict that might arise between the parties. Against this background, it becomes important for the success of the AdF that the partners develop a unified vision and a common language. Defining in the contract the objectives, the role of the participant, the resources needed, and the effort to reach the goals is fundamental for avoiding misunderstanding and preventing problems from arising. To overcome this obstacle,

techniques such as a path of confrontation and accompaniment between the parties and the exchange of information must be adopted. The presence of an expert mediator in this phase could increase the awareness of the importance of collaboration among participants.

2.2.1. *CONTENTS OF THE "ACCORDO DI FORESTA"*

The AdF, which is a contract, provides that "two or more participant shall establish, regulate or create a relationship between themselves". The first paragraph of the AdF is the list of the participant involved in the contract. The entities involved must agree on their respective duties and rights and act with respect for other members and good faith. They must also act honorably and honestly and cooperate to prevent the policyholders from suffering excessive or unnecessary damage as a result of the compensation. The contract will have participants both from the public and private sector

In addition, it is necessary to appoint a person within the contract - or someone outside the contract - as coordinator and guarantor of the contract. This person must be recognized as the mandated authority for the execution of one or more parts or phases of the contract.

Then the contract specifies the purpose of the AdF that unites and represents the specific interest of the contracting parties for the territorial and socio-economic context in which the AdF itself is proposed. The purpose must be developed in a joint action plan that outlines clear and common strategic objectives. The participants must pursue together the action plan respecting the term set out in the AdF. In the contract all the objectives have an expected result, that must be measurable and quantifiable, identified within the agreed term and defined time intervals. Of course, the text must define the modalities agreed upon by the signatories to implement the pursuit of the expected results of the contract.

The AdF is a contract that shall last enough time to see effects of the collaboration proposed by the contract, by doing so it is possible to evaluate the success or the failure of the contract. In this regard, it may happen that in the course of time, the initial AdF may need maintenance, due to changes in the scenario, or unknown events could occur. In the face of such an eventuality, it is important to specify in the contract a series of rules and conditions for the possibility of amending the contractual clauses by majority vote, specifying the manner in which the amendment itself is to be undertaken, without prejudice to the right of withdrawal of the contracting party that has not consented to the amendment, to be exercised within fifteen days of the notification of the amending act.

The AdF also provides the possibility of adding new members in the contract, a very useful tool for the contract proposed in the study area. The contract must specify in a dedicated paragraph the rules and conditions to add new members, and every participant can evaluate and express their willingness to add a new participant. Indeed, the AdF proposed want to include all the stakeholders present in the area subjected to the LIFE VAIA project, but not only. The Vaia storm had destroyed other forests not involved in the project, furthermore, other issues are spreading around which are affecting both the forests involved in the project and other areas. Some hazards were already present in the forest, but after the Vaia storm became uncontrollable due to the compromised defense strategies of the forest by the damage suffered. An example is the uncontrolled spread of bark beetles that usually are managed by the forest itself. Moreover, the strong winter which follow the storm made the situation even worse. So, allowing new members to join the contract become a great possibility for other stakeholders not initially involved. Indeed, other companies could decide to join the contract in the future due to the difficult situation of the forests in the region. New member in the contract could bring new resource to be use for the wellbeing of all the participants and so, it makes stronger the collaboration in the contract.

The contract may also contain clauses for the exclusion of members, so participants no more interested in the contract or are no longer useful for reach the objectives can be excluded.

With the AdF, the legislator has given entrepreneurs an adaptable contractual instrument that is open to a variety of commercial solutions depending on the state of filings in the industry. This allows entrepreneurs to learn how to work together and eventually evolve into more complex organizational structures. The success of this contract could alleviate the difficult situation of the forestry sector and communities affected by the Vaia storm. It would also create a stronger and more resilient production system that would be more competitive in the market and at the same time maintain the production of ecosystem services.

It is possible to notice a lack of information about some aspects of agroforestry and the AdF. Indeed, the AdF, is a new legal instrument adopted by the Italian government and the few examples found are without results yet. In addition, for agroforestry, it is difficult to find examples and results in climatic regions compatible with the study area.

3. METHODOLOGY

3.1. STUDY AREA

The area destroyed by the Vaia storm is taken into consideration in this study. The Vaia storm was a natural disaster that occurred in the European Alps in October 2018. It was characterized by extremely strong winds and heavy rainfall that caused widespread damage across a large area. The hardest hit regions in Italy were the Veneto and Trentino-Alto Adige/Südtirol, where the wind gusts reached up to 220 km/h. The storm caused significant damage to infrastructure, homes, and forests. In particular, the forestry sector was severely impacted, with an estimated loss of around 8,5 million cubic meters of wood (Chirici et al 2019). The AdF proposed by this study aims to involve the area in the destroyed region involved in the LIFE VAIA project. Furthermore the contract allow the possibility to include new members. The AdF proposed will adopt this tool in order to expand its influence in the nearby area damaged by hazard also present in the study area.

3.1.1. LIFE VAIA PROJECT

The EU Strategy on adaptation to climate change aims to improve the preparedness of the EU for the impacts of climate change through promoting action by member states, better informed decision-making, and strengthening the EU's resilience through sustainable policies. The 2018 review of the strategy found it to be highly relevant and effective, although more work needs to be done to implement it. Examples of adaptation measures include choosing tree species and forestry practices that are less vulnerable to climate change impacts. The EU Green Deal, which is the roadmap for a sustainable economy, recognizes the importance of forests in contributing to the EU's climate efforts. The LIFE VAIA project is a pilot project aimed at improving the knowledge for effective climate change adaptation measures, supporting capacity building, and bridging the knowledge gap. The LIFE VAIA project aims to promote the adaptation of forest areas to extreme meteorological events, such as storms, fires, and climate change. The project will use innovative transitional agroforestry concepts to regenerate damaged forests, provide fast responses to the negative effects

produced by extreme events, and generate economic benefits for the local communities. The objectives of the project are to consolidate knowledge, develop an ecosystem-based innovative approach, and test the approach in different conditions. The project will be implemented in 16 pilot sites in Italy, France, and Spain and will be managed by a team of 5 beneficiaries who will share their knowledge and skills in reforestation, forest management, and agroforestry. The results of the project will be disseminated through replication, networking, training, and communication activities. The project is fully coherent with the priority area of "Adaptation" of the LIFE call and the objective of art. 15 of the LIFE regulation, which supports ecosystem-based approaches as a strategy for adapting to climate change.

The implementation of the VAIA approach in European forests is expected to have significant impacts on a larger scale. The approach aims to improve the resilience of forests and their capability of producing ecosystem services by planting a variety of selected species that are better suited to respond to future extreme climate events. The improvement in biodiversity is also expected as a result of the ecosystem-based approach adopted for forest restoration. The choice of species and varieties will take into consideration the expected climate changes and aim to maximize genetic variability.

In conclusion, the implementation of the VAIA approach in European forests is expected to result in an improvement in the resilience of forests, an increase in biodiversity, and a revival of the local economy. The two scientific documents, one conducted by Gardiner in 2010 and titled "Destructive Storms in European Forests: Past and Forthcoming Impacts" and the second conducted by H. Gregow in 2017 and titled "Increasing large scale windstorm damage in Western, Central and Northern European forests, 1951–2010," describe the climate problems affecting European forests and the impact of meteorological events on these forests. The first document reports that the increase in growing stock and average forest age in Europe over the last 60 years has contributed to the increase of observed damage and that the damage levels are expected to at least double, and possibly quadruple, by the end of the century if the current trend of increasing growing stock and average age continues. The second document reports that there has been a statistically significant change in storm intensity in Western, Central and Northern Europe since 1990 and that the impact of climate change on North Atlantic storms hitting Europe has started in the last two and a half decades. LIFE VAIA aims to address these problems by exploiting agroforestry as a "temporary" strategy for promoting the economic and environmental resilience of forests. Indeed, LIFE

VAIA project is interested not only in the environmental aspect, but also in the economic and social aspects.

In 2018 a Coordination workshop for the First National Report on the State of Forests in Italy, find out that Forests play a crucial role in providing multiple benefits to society. They occupy 34.7% of the Italian heart surface and the forestry and forest-based industries sector employ over 350.000 people in Italy. Furthermore, forests serve social and recreational functions, such as providing protective functions, promoting tourism, and preserving cultural heritage. The importance of forests has been recognized also by the European Council, which adopted a new forest strategy in 2021 titled “Forestry Strategy for 2030”. It aims to make Europe's forests more adaptable to the new conditions, extreme weather events, and high uncertainty brought on by climate change. The strategy sets a vision and outlines concrete actions to improve the quantity and quality of EU forests and enhance their protection, restoration, and resilience. This is necessary to ensure that forests continue to provide socio-economic benefits and to maintain vibrant rural areas with thriving populations. However, windstorms are increasingly affecting European forests, causing significant economic, ecological, and social damage. In regions with extensive wind damage, it can result in disruptions to infrastructure and change the landscape dramatically. The adoption of the LIFE VAIA approach becomes even more important, a post-storm management approach that takes into account the preservation of biodiversity and ecological resilience can minimize the long-lasting effects of windstorms on forests on the local economy.

3.1.2. PILOT SITES

As explained before, the LIFE VAIA project conducts experiments to develop and valorize sustainable products and services in forest areas destroyed by extreme events, increasing the ecological, economic and social resilience of forest ecosystems. The European Union-funded project has 16 pilot sites of about 2.5 hectares each, distributed in Italy, Spain and France. The thesis proposes an AdF that takes into consideration only the Veneto and Trentino Alto Adige regions.

The destruction brought by the Vaia storm completely destroyed the forest in certain areas of the two regions. The damaged areas are a perfect situation for the purpose of the LIFE VAIA project and these areas will be dedicated to adopting new management systems, like

agroforestry. Indeed, the heavy damage completely destroyed the natural environment, giving the possibility to create a new strongest forest adapted to climate change. In addition, the project seeks to raise awareness among the local population about the importance of environmental conservation and the need for sustainable development. Through a variety of activities, such as conferences and educational initiatives, LIFE VAIA hopes to encourage the local population to become active in conserving the natural heritage.

The LIFE VAIA project has 5 different areas in Italy, two of them are in the Cansiglio forest, one is in the Asiago municipality and another one in the Callio municipality, the last one is situated outside Veneto region, in the Baselga di Pine municipality in Trentino region.

Each area is 100 hectares except for the one in Trentino of 191 ha. In every area, two pilot sites are present, in the Asiago municipality the site has 4 pilot sites. The pilot sites for every area are about 2.5ha large and are fenced to prevent damage from the local fauna. There will be two cultivated areas of 2000 square meters each in every pilot site and small reservoirs are created to guarantee the supply of water. Furthermore, in every pilot area, only one beekeeping area is arranged. Outside the pilot site melliferous tree species are planted and two restoration models are implemented in different areas. All five Italian case-study areas are publicly owned except one in Trentino.

3.1.3. CREATION OF THE “ACCORDO DI FORESTA”

The research on agroforestry systems is useful also for the creation of the AdF. Indeed, persons to whom the contract will be offered, must also be informed about the type of management in the interested area, and provide a definition to avoid bias and conflicts. So, after the agroforestry review in the literature, it was possible to start research about the AdF. Firstly, normative are analyzed, highlighting the differences between AdF and the “Accordo di Rete”, two similar types of contract. Indeed, even if they are different, they are attached to one another, since both contracts are used to promote collaboration between different stakeholders. For further research articles are analyzed about the topics, the most useful one is the in-depth report promoted by “Programma Rete Rurale Nazionale 2014-2020”. The report provides all the information needed to develop an AdF providing also an example. The essential components of the contract are identified and explained helping the creation of the AdF proposed. The contract provides the list of participants, the purpose and the

commitments. The participants are chosen based on the role they can play in the contract. When it is possible the role is assigned to members of the LIFE VAIA project, to ensure the pursuit of the project's objectives. The purpose and the commitments of AdF aim to include the interest of the participants, considering also the objectives of the LIFE VAIA project. Since the AdF is a sort of “agreement” between participants, the contract in this thesis is only a proposal. The AdF is a legally binding agreement between two or more parties that outlines the terms and conditions of a transaction or relationship. The importance of a contract lies in its ability to protect the interests of all parties involved by clearly defining their rights and obligations. A well-drafted contract helps to reduce the risk of misunderstandings, disputes, and litigation, as it provides a clear and concise understanding of the expectations and responsibilities of each party. Additionally, contracts provide a reference point for resolving conflicts, providing a framework for resolving disputes in a fair and equitable manner. Overall, contracts play a crucial role in ensuring that business and personal transactions are carried out smoothly and efficiently. The main aim of this thesis is to propose a contract that promotes collaboration among the signatories and meanwhile integrates LIFE VAIA’s objectives. The contract must outline the terms and conditions of a transaction or relationship between multiple parties. The contract is designed to promote collaboration among the signatories and integrate the objectives of the LIFE VAIA project. The participants in the contract include the company Rigoni di Asiago srl, the public sector such as the municipality of Asiago and Gallio, and the Veneto region, as well as other organizations like the TESAF department of the University of Padova, Venetian Cluster srl, and non-profit organizations. The purpose of the contract is to create an efficient agroforestry system in the area affected by the Vaia storm and to maintain and improve biodiversity and ecosystem services while creating income for the local economy. The contract also promotes the development of local production chains and tourism in the area. The AdF has 11 proposed commitments, such as promoting forest certification, restoring lost ecosystem services, and enhancing non-wood forest products. Rigoni di Asiago srl is the administrator of the contract and is responsible for organizing the assemblies and representing all participants.

3.1.4. QUESTIONNAIRE

After the idea of the AdF has been conceived, it would be advisable to test its feasibility through questionnaire to participants (ANNEX 2). The questionnaire has multiple choice questions, giving to the respondents the possibility to express their views on the components of the contract.

The choice of using multiple choice questions is due to its advantages. The advantages of using multiple choice questions is a topic already explored by the literature, some examples of relevant textbooks include "Survey Research Methods" by Floyd J. Fowler Jr., "Handbook of Survey Research" edited by Peter H. Rossi, James D. Wright, and Andre Bouwhuis, and "Questionnaire Design, Interviewing and Attitude Measurement" by A.N. Oppenheim. Multiple choice questions offer a number of benefits in terms of ease of administration, reliability, standardization, response burden reduction, and reduction of response biases. Multiple-choice questions are easy to administer and score, as participants only need to choose one option from a list of alternatives. This makes data collection and analysis more efficient and time-effective. The use of a fixed set of response options also ensures that all participants are answering the same question in the same way, helping to standardize the data collected and enable comparability between participants. Additionally, multiple-choice questions are less susceptible to errors caused by misinterpretation or subjectivity compared to open-ended questions, increasing the reliability of the data collected. Participants are also less likely to become fatigued or disengaged when answering multiple-choice questions, reducing the response burden, and increasing the chances of obtaining complete and accurate data. Finally, multiple-choice questions can help to reduce response biases, such as social desirability bias, as participants are less likely to provide answers that are not representative of their true beliefs or attitudes. The questionnaire also contains some open-ended questions to give the respondent the opportunity to propose changes or new components in the contract. The proposed AdF need to be sent to the respondent before submitting them to the questionnaire, with a few sentences' explanations of what AdF is. The conduct of the questionnaire requires the presence of an interviewer prepared on the questionnaire topic, to explain and help the respondents, avoiding errors and bias.

The firsts two questions aim to investigate the respondent's knowledge of the topic. If the respondent answers "NO" to both or even only to the second question the interviewer must explain what the AdF is, and why its adoption is taken into consideration in the study case. The second part of the questionnaire is focused on the contract's participants and its duration. Question number three asks respondents to assign a number from one to five to the different roles included in the contract, based on their importance for the success of the contract. The

open-ended question number 4 gives to respondents the possibility to suggest other roles to consider in the contract in order to increase the effectiveness and efficiency of the contract. The last question of section B is about the duration time of the project, the minimum value is 5 years which should be the duration of the Vaia project, and because less years couldn't be enough to reach the goals of the contract.

Section C starts with respondents rating how suitable the purpose of the contract is. The answer is based on their personal opinion and interests, and there is the possibility to suggest changes and improvement of the purpose in question number seven. The eighth question is about the eleven commitments, they are listed and specified in the question. Respondents can represent the importance they give to each commitment by marking a number from one to five. Marking the number one means that the commitment is unnecessary, and therefore eliminable. The last question allows the respondents to express opinions and suggestions even about this last topic.

After all participants have taken part in the questionnaire, the answers collected to the multiple-choice questions are analyzed. Considering the low quantity of data, not all statistical analyses are appropriate. The descriptive analysis is appropriate for a questionnaire with few respondents, it provides information about the number of responses for each option or the percentage of responses for each option. By seeing the distribution of the respondents it is possible to identify the components of the contract where the members have the same opinion or components where the answers vary from member to member. This last case means that respondents give different importance to the subject of the questions, favoring the emergence of conflicts.

For the open-ended question instead, the answers could be used in the assemblies during the stipulation of the final AdF, so all the opinions and suggestion of the different respondents are taken into account.

4. CONCLUSION

The first aim of the paper is to analyze the “Accordo di Foresta” and propose a research plan to evaluate the possible implementation of an “Accordo di Foresta” in the areas involved in the LIFE VAIA project. Thanks to the report promoted by “Rete Rurale Nazionale” and MIPAAF, it was possible to analyze the AdF and create a contract (ANNEX 1) that can be proposed in the study area. The first step for stipulating the contract is to define the participants. It is important to involve who can perform the necessary roles, all the members of the LIFE VAIA project are taken into account, since they are directly involved in the management of the area. Firstly, the company Rigoni di Asiago srl is considered due to its main role in the LIFE VAIA project, where it is the coordinating beneficiary. Like in the LIFE VAIA project, Rigoni srl will have the right to use the products of the agroforestry system, and will transform the products in order to sell them. Then, also the owners of the interested land must be involved. The study areas are mainly owned by the public sector, specifically by the municipality of Asiago and Gallio which are the landowners of the two study areas in their boundaries. Furthermore, the Veneto region owns the two sites in the Cansiglio forest. The only site owned by the private sector is the one in Trentino, which is owned by an ASUC (Separate administration of fractional assets for civic use). Other participants chosen from the LIFE VAIA project are the TESAF department of the University of Padova. It is directly involved in the planification of the agroforestry system and in the evaluation of environmental and economic results of the management. Also, other members like Venetian Cluster srl and Veneto agency for primary sector innovation could have an interest in participating in the AdF. Even without a fundamental role, they can provide useful tools and resources to improve collaboration among participants and increase the probability of success. Venetian Cluster could be a great resource for the success of the contract, since it was created with the goal of promoting partnerships between companies and institutions. Furthermore, it incentivizes the growth of the whole sector of cultural and environmental heritage and supports corporations working in these areas. Outside the LIFE VAIA project, other candidates are taken into consideration, an example is tourism organizations like Asiago Guide, the Consorzio Turistico Alpago Cansiglio and nonprofit organizations in the region. The tourism organization has the role of sponsoring the contract and effort, organizing in collaboration with the municipality field trips, conferences, and other activities to involve the local population and tourists, giving a touristic value to the

study area. The Forestry Service of the autonomous province of Trento is also a candidate for the contract, it can collaborate in the realization of the contract's objectives and adopt the same forest management in other areas destroyed by the Vaia storm. Rigoni of Asiago srl is designed as the administrator of the contract. The administrator of the contract must represent all the participants in the contract both individually and collectively. Rigoni has the role to organize the assemblies and invite the representatives of the members of the contract. In the assemblies, decisions are taken democratically, but the administrator does not have the right to vote.

After having identified possible participants, the next step is to decide the purpose of the contract. The purpose of the AdF is a statement that brings together and represents the interests of the parties in the geographical and socioeconomic context in which AdF is proposed. The contract's purpose should promote the creation of an agroforestry system trying to find the most efficient management to adopt in the area destroyed by the Vaia storm and other hazards like pests and adverse climatic events. Biodiversity and ecosystem service must be maintained and improved, and at the same time, it is important to guarantee a multiproduction from the agroforestry system. The products create an income in order to sustain the local economy and make the supply chain economically sustainable. It is also important to promote the development of local production chains, taking into account the environmental and socio-cultural aspects of the agroforestry areas. The contract considers also tourism, the agroforestry system is able also to restore the local landscape destroyed by the Vaia storm. Tourism is an important aspect to consider since it is a fundamental service in the region.

The purpose of the contract must be developed in a common program of commitments, and therefore delineated in clear and shared strategic objectives that the parties must comply with the time frame specified in the AdF. The members of the contract are stimulated to cooperate by helping each other, increasing the efficiency of the measures taken. The commitments could be individual or for a group of participants. Eleven commitments are proposed in the AdF:

- 1) Promoting forest certification of management and production processes;
- 2) Re-establish and maintain the provision of ecosystem services lost (e.g. ... carbon, biodiversity, water) due to problems in the area (VAIA storm, bark beetle, snow damage...) for the benefit of members and local community;

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- 3) Promote non-wood forest products by enhancing local specificities (e.g. ... small fruits, mushrooms, medicinal herbs, etc.) and develop the local supply chain for the production and processing of products from the agroforestry system with actions aimed at achieving valuable economic benefits for its members;
 - 4) Developing the local forest-wood sector with particular reference to local processing and transformation, with interventions aimed at achieving a profitable economic performance for its members;
 - 5) Enhance and develop the cultural and social potential of the natural and landscape resources of the agroforestry system, through specific and shared actions, events and projects (e.g. ... educational events, concerts, excursions, etc.) creating a widespread network for promoting the area;
 - 6) Carrying out projects aimed at maintaining the health and resilience of the forest ecosystem, recovering the protective functions of forests, preventing of hydro-geological instability, contrasting the degradation of water and forest resources, promoting extensive forest hydraulics and naturalistic engineering action and the maintenance of minor works (terracing, gullies, etc.), forest fire prevention and phytopathology spreading, and improving the area's roads and paths giving greater attention to preventing damage from possible future extreme weather events;
 - 7) Carrying out information and communication aimed at the cultural promotion of the role and functions of the forest;
 - 8) Set up a portal for presenting the AdF (with details of objectives and actions, presentation of the signatories, photo gallery, videos, news, etc.);

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- 9) Promote studies, research and technological and process innovation in the agroforestry sector in collaboration with universities and public and private research centers;
 - 10) Promoting the AdF, the participation of the local population and/or other external stakeholders to enhance the role of the AdF;
 - 11) Create a forest plan to manage the forest after the agroforestry system is decommissioned, maintaining the integrity of the landscape and the provision of ecosystem services;

In the first assembly, the participant can decide together which commitments to adopt. It is also possible to propose new commitments in the AdF, since it is coherent with the purpose of the contract. The commitment proposed in the assembly is taken into consideration and a vote among all members will decide which ones will be included in the AdF. For every commitment an expected result must be assigned, defining the time and manner of realization. Results and deadlines are defined by the contract members, which define their role in every commitment and the resource they will make available to reach the results. For the commitments with the aim to promote and sponsor the project (like numbers 10, 7, 8 and 5), members like the municipality involved and the association Asiago Guide are ideal for reaching the expected result. Examples of expected results could be the organization and planification of a certain number in a year of seminars, field trips and other activities. The landowner and the manager of the forest should define measurable expected results of the management. Fixing a number of projects and infrastructure to develop to avoid hazards in the forest like hydrogeological instability or soil erosion could be one of the results of the sixth commitment. Instead for the second commitment the result could be completed by the realization of tot projects for PES recognition, and for the first is possible to define the percentage of the area under certification at the moment of the deadline. Those are the only examples from which one can take inspiration. Other parts of the contract will then have to be decided between all members, from the deadline and result to the conditions for including new members in the contract or for expelling them. The proposed contract is only a starting point with the aim to introduce the local stakeholders to the AdF topic and make them consider the option. The purpose of the contract and the eleven commitments can be adopted as a guideline to develop the final AdF. Since the study area and the designated participants

are Italian, both the questionnaire and the AdF are written in Italian, in order to avoid misunderstandings and misunderstandings. The component of the contract like the result and resources employed aren't specified, since they are completely dependent on the willingness of the participants.

The definition of agroforestry is the second main objective. The thesis try to define what is an agroforestry system thanks to a review of the state of the art. The importance of this step cannot be overstated in order to reach the goals of the thesis. With the literary review, the concept of agroforestry is analyzed, providing a comprehensive overview of the current knowledge and understanding. In order to understand why LIFE VAIA managers choose this technique and how they are going to reforest the study area, define what is the agroforestry system, its characteristics, and its potential became fundamental. Firstly, the definition of agroforestry must be defined. It was possible to find a vast number of articles about the topic, but most of them proposed their own definition. One reason for the difficulty in defining agroforestry is its multidisciplinary nature. As it is pointed out in the state of the art, agroforestry combines elements of agriculture, forestry, and ecology, which makes it difficult to fit into a single definition. Additionally, agroforestry practices can vary widely depending on the location, climate, and cultural context, further complicating the definition. Some definitions of agroforestry focus on the ecological benefits of the practice, while others define agroforestry in terms of its economic or social benefits. Even if those definitions are similar, they are not the same, creating discussion among the international scientific community on how to define the agroforestry system. Seeing that no solution was reached, the scientific community accept the fact that agroforestry could not have an absolute definition. They acknowledge that disciplines such as agriculture and forestry, which have existed in our culture for centuries, do not have entirely satisfactory definitions. Therefore, the associations and organizations which deal with agroforestry adopt their own definition, in order to distinguish what is agroforestry and what is not. Even if there isn't a common definition, everyone agrees that agroforestry is a management technique where different cultivations are adopted in the same area. This thesis, accept the fact that there is no absolute definition. The absence of a definition allows the members of the contract to experience new management techniques, trying to find new methods for increasing the benefit and income of the agroforestry system. To help them the literary review also find examples of agroforestry management in Europe. Those examples can help the forest managers in the decision process, increasing the possibility to find successful management.

The examples are about non-wood forest products. Four different types of NWFP are considered: MAP, honey, mushroom and berries. For berries and mushrooms, it was possible to find a lot of information about studies cases in Europe. Examples are situated all around Europe, but Finland proposes the highest amount of initiative and examples, making it the most advanced country in the topic. Berries and mushrooms are suitable for an agroforestry system. Unfortunately, data collected during the state of the art highlight the reduction of berries harvest with the growth of the forest. This issue is not a problem for the LIFE VAIA project, since the agroforestry system is not permanent. So, berries are suitable for the study case since providing initial income until the complete regeneration of the forest. Instead mushrooms are perfect for increase revenue from thinning operation. For honey and map instead, it was possible to find information, but unfortunately mainly outside Europe. The adoption of beehive in the management of the study area, is a convenient choice. The state of the art already explain the benefit of beekeeping to the vegetation. The implementation of beekeeping is cheap and it is possible to imitate other beekeeping strategies in Europe increasing the probability of success. Nevertheless, the quantity of information available on non-wood forest products (NWFPs) in agroforestry is extensive and growing every day. Research is being conducted on a wide range of NWFPs, including fruits, nuts, spices, resins, and fibers, among others. This research covers topics such as species selection, site preparation, planting and management, harvesting and processing, and marketing, among others. In addition to academic research, there are also several organizations and government agencies that are actively promoting NWFP production in agroforestry in Europe. These organizations provide technical assistance, training, and support to farmers and communities, and they also publish a wide range of materials, including case studies, best practices guides, and training manuals. Overall, the quantity of information available on NWFP production in agroforestry in Europe is significant, but it is still limited compared to other regions of the world. The LIFE VAIA project can provide useful information about the production of NWFP, helping to fulfill the lack of information. The success of the project could become an example for all European countries, providing environmental, economic and social results.

Ain the end, the thesis proposes a questionnaire to submit to the participants in order to allow them to express their views. The first section aims to investigate the local knowledge about the AdF, and the interviewer has to fill gaps of knowledge where needed. Multiple choice questions collect participants' opinions about the components of the proposed contract. Instead, open-ended questions give the possibility to respondents to express their suggestions

and changes. Data collected will be analyzed and considered to make changes in the proposed AdF.

If the candidate members find out that the AdF could be a useful contract to implement in the area, the results of the questionnaire will become a very useful tool during the assembly for involving stakeholders in contract drafting. The results represent the opinions of the respondents and their interests, giving an idea about their personal objectives and their priorities. Data collected can be used by a mediator during the assembly to find an agreement between participants to define the characteristic of the contract.

5. ANNEXES

5.1. ANNEX 1:

ACCORDO DI FORESTA

SHEDA INFORMATIVA

Titolo: Accordo di Foresta “LIFE VAIA”

MEMBRI COINVOLTI NEL CONTRATTO:

PROPRIETARI:

- comune di Asiago, proprietario terriero delle seguenti aree : (allegare foglio catastale)
- comune di Gallio, proprietario terriero delle seguenti aree: (allegare foglio catastale)
- Regione Veneto, proprietario terriero delle seguenti aree: (allegare foglio catastale)
- ASUC di Tressilla, proprietario terriero delle seguenti aree: (allegare foglio catastale)
- Azienda RIGONI, titolare del diritto di godimento delle superfici (allegare foglio catastale) per la raccolta e gestione della produzione di NFWP
- Veneto Agricoltura, titolare del diritto di godimento delle superfici (allegare foglio catastale) per la gestione e la raccolta di legname nella foresta

ALTRI SOGGETTI

- Venetian Cluster, company for the promotion and development of project
- Asiago Guide, associazione turistica di accompagnamento ed escursionismo nel comune di asiago
- Consorzio Turistico Alpage Consiglio, associazione turistica per la promozione del territorio
- Associazioni ambientali no profit.

I soggetti sottoscrittori convengono di stipulare un Accordo di Foresta al fine di raggiungere obiettivi condivisi, attraverso l’attuazione di un programma definito da impegni e attività volto al fine di creare nuove sinergie imprenditoriali, valorizzando le capacità multifunzionali che possono essere perseguite da una gestione sostenibile e diffusa delle proprietà agro-silvo-pastorali, promuovendo anche l’economia circolare della filiera foresta legno e lo sviluppo locale. Di avere una produzione di beni non legnosi dalle aree interessate fino al ristabilimento dell’ ecosistema foresta. L’ obiettivo, inoltre, dovrà essere raggiunto promuovendo la crescita e lo sviluppo unitario, partecipato e sostenibile del territorio coinvolto nel progetto LIFE VAIA e di altre aree con caratteristiche e problematiche simili.

Area geografica dell'Accordo di Foresta: L'Accordo in oggetto è stipulato dai soggetti sottoscrittori e ricade come proprio territorio di competenza nell'area dei comuni di Asiago, Alpage, Tambre e Gallio e delle aree nella regione Trentino-Alto Adige colpite dalla tempesta Vaia o con problematiche e caratteristiche simili alle aree coinvolte dal progetto LIFE VAIA. Si allega: Cartografia di riferimento; Parcelle catastali coinvolte.

Termine e durata dell'Accordo di Foresta: Il presente Accordo si configura come rapporto giuridico tra i contraenti sottoscrittori ed ha una durata di XX anni dalla registrazione del presente atto sottoscritto da parte dei contraenti.

CONTENUTI DELL' ACCORDO DI FORESTA

I sottoscrittori dell'Accordo convengono e dichiarano di perseguire, tramite il presente contratto, alla luce delle caratteristiche del territorio coinvolto, delle esigenze dei singoli soci e nell'interesse del territorio e della comunità coinvolte, i seguenti paragrafi che seguono.

Programma comune di impegno

È il programma che definisce l' operato e le modalità con cui i firmatari dovranno raggiungere gli obiettivi fissati. Il programma è formato da tre punti principali:

1) OBIETTIVO STRATEGICO

Favorire la creazione di un sistema agroforestale in aree idonee al progetto come le aree danneggiate dalla tempesta VAIA o dal bostrico, per garantire una multifunzionalità dell' ecosistema foresta creando una produzione di piccoli frutti, miele, piante medicinali e funghi. La multifunzionalità del bosco e la sua gestione dovranno inoltre tener conto della produzione di servizi ecosistemici del bosco nel rispetto della biodiversità e dei paesaggi locali promuovendo il turismo che è sempre stato un fondamentale servizio nelle aree interessate. Le risorse e il territorio dovranno essere gestiti in maniera sostenibile e unitaria, promuovendo lo sviluppo di filiere produttive locali, considerando l' aspetto ambientale e socioculturale delle superfici a vocazione agroforestale nelle aree interessate dal contratto. L' obiettivo dovrà essere raggiunto seguendo il "Programma esecutivo di impegno" già redatto al momento della stipula del contratto.

2) IMPEGNI

Il Programma redatto individua nell'ambito dei suddetti **Obiettivi**, gli **Impegni** e ne definisce i tempi e i modi di realizzazione.

IMPEGNO	RISULTATO
promuovere la certificazione forestale della gestione e dei processi produttivi	

<p>Ristabilire e mantenere l'erogazione di servizi ecosistemici persi (es. ... carbonio, biodiversità, acqua) a causa delle problematiche presenti sul territorio (tempesta VAIA, bostrico, danni causati dalla neve...) a favore degli associati e di tutta la collettività</p>	
<p>promuovere i prodotti non legnosi del bosco valorizzando le specificità locali (es. ... piccolo frutti, funghi, erbe medicinali, altro...) e sviluppare la filiera locale, per la produzione e lavorazione dei prodotti provenienti dal sistema agroforestale con interventi volti al conseguimento di valide prestazioni economiche per i propri associati;</p>	
<p>Sviluppare la filiera foresta-legno locale con particolare riferimento alla lavorazione e trasformazione locale, con interventi volti al conseguimento di valide prestazioni economiche per i propri associati</p>	
<p>Valorizzare e sviluppare le potenzialità culturali e sociali delle risorse naturalistiche e paesaggistiche del sistema agroforestale, attraverso azioni eventi e progetti specifici e condivisi (es. ... eventi didattici, concerti, escursioni, altro...) creando una rete diffusa di promozione dell'Area.</p>	
<p>realizzare progetti volti a mantenere la salute e la resilienza dell'ecosistema forestale, recuperando le funzioni protettive delle foreste, la prevenzione dal dissesto idro-geologico, il degrado delle risorse idriche e forestali, promuovendo interventi estensivi di idraulica forestale, ingegneria naturalistica e manutenzione delle opere minori (terrazzamenti, canalette, ecc.), interventi di prevenzione dagli incendi boschivi e alla diffusione di fitopatologie, interventi di miglioramento della viabilità e della sentieristica dell'Area; dando maggior interesse alla prevenzione da</p>	

danni di possibili futuri eventi metereologici estremi	
realizzare attività di informazione, divulgazione e comunicazione volta alla promozione culturale del ruolo e delle funzioni del bosco;	
realizzare un portale di presentazione dell'Accordo di Foresta (con dettagli su obiettivi e azioni, presentazione dei soggetti sottoscrittori, fotogallery, video, news ecc...)	
promuovere studi, ricerche e innovazione tecnologica e di processo nel settore agroforestale in collaborazione con università e centri di ricerca pubblici e privati	
Incentivare promuovere l' accordo di foresta, la partecipazione della popolazione locale e/o di altri soggetti esterni per accrescere il ruolo dell' Accordo di Foresta	
Creare un piano forestale volto a gestire la foresta dopo la dismissione del Sistema agroforestale, mantenendo l' integrità del ecosistema e dell' approvvigionamento dei servizi ecosistemici	

Le diverse parti dovranno attuare il programma esecutivo per ogni singolo impegno condiviso e riportato nell' accordo. Dovranno inoltre concordarsi tra di loro ed esprimere i loro interessi a proposito degli impegni elencati specificando: le risorse messe a disposizione, le attività e le azioni che si andranno a svolgere per il raggiungimento degli obiettivi, specificando i tempi richiesti per l' attuazione e mantenimento dell'impegno preso in considerazione.

Le parti quindi si impegnano, in base alle loro capacità, ad attuare il programma esecutivo di impegni condiviso, scambiandosi informazioni e prestazioni favorendo così il nascere di collaborazioni e sinergie tra tutti o alcuni dei sottoscrittori. Per favorire il successo economico del progetto, è inoltre consigliato l' impegno dei sottoscritti nel diffondere il nome dell' Accordo di Foresta LIFE VAIA e del suo marchio al fine di favorire lo sviluppo di relazioni commerciali e non.

La costituzione dell'Accordo di Foresta promuove un interesse collettivo alla collaborazione che integra gli interessi individuali dei singoli partecipanti e costituisce oggetto di promozione e tutela da parte degli organi dell'Accordo di Foresta. Ai fini

della realizzazione dell'Obiettivo strategico, i soggetti sottoscrittori dell'Accordo di Foresta reciprocamente si danno atto di possedere i requisiti richiesti dalla normativa vigente.

GESTORE DELL' ACCORDO DI FORESTA

L'attuazione del Programma è affidata al Soggetto Gestore, coincidente con la compagnia Rigoni srl, la cui ho il compito di mantenere e controllare le relazioni tra i diversi partner inseriti nel contratto. Al gestore dell'Accordo di Foresta è espressamente conferito il mandato ad agire per conto delle parti partecipanti al contratto, per il compimento su mandato dell'Assemblea delle parti, di qualsiasi atto sia necessario per l'attuazione del Programma, nel rispetto degli obiettivi sopra convenuti, e per dare esecuzione al presente contratto.

5.2. ANNEX 2

QUESTIONARIO RIGUARDANTE LE CARATTERISTICHE DEL CONTRATTO DI FORESTA			
CODICE	INTERVISTATORE _____	DATA _____	CODICE INTERVISTATO _____
A) INFORMAZIONI GENERALI			
1) ERA GIA' A CONOSCENZA DELL' ESISTENZA DELLO STRUMENTO CONTRATTUALE DENOMINATO "ACCORDO DI FORESTA"? (INDICA CON UNA X LA RISPOSTA CORRETTA)			
		SÌ	NO
2) SE SÌ, NE CONOSCEVA GIA' LE CARATTERISTICHE ED I FUNZIONAMENTI?			
		SÌ	NO
SE LA RISPOSTA ALLA DOMANDA 2 O 1 È NO ALLORA PROCEDERE CON LA SPIEGAZIONE DELL' "ACCORDO DI FORESTA"			
3)			
B) INFORMAZIONI PRIMARIE DEL CONTRATTO			

4) DEFINISCI PER OGNI RUOLO ELENCATO DI SEGUITO L' IMPORTANZA DELLA LORO INCLUSIONE NEL CONTRATTO SEGNANDO CON UNA X UN NUMERO DA 1 A 5 (1= INUTILE, 5=MOLTO IMPORTANTE)

A) PROPRIETARIO FORESTALE	1	2	3	4	5
B) GESTORE FORESTALE	1	2	3	4	5
C) UFFICI PROMOZIONI TURISTICHE	1	2	3	4	5
D) TRASFORMATORE DEI PRODOTTI	1	2	3	4	5
E) POPOLAZIONE LOCALE	1	2	3	4	5
F) ASSOCIAZIONI NO-PROFIT LOCALI	1	2	3	4	5
G) ENTE CERTIFICATORE	1	2	3	4	5

5) HAI SUGGERIMENTI SU ALTRI RUOLI DA COMPRENDERE ALL' INTERNO DEL CONTRATTO?(
SCRIVI QUI SOTTO EVENTUALI SUGGERIMENTI)

6) CONSIDERANDO LA DURATA DEL PROGETTO LIFE VAIA DI 5 ANNI E IL TEMPO PREVISTO PER IL RISTABILIRSI DEL' ECOSISTEMA FORESTA (INTORNO AI 15/20 ANNI). INDICA QUALE DELLE SEGUENTI OPZIONI CONSIDERI LA DURATA (IN ANNI) PIU' ADATTA AL CONTRATTO:

5 10 15 20 30

C) DOMANDE RELATIVE AL PARAGRAFO: CONTENUTI DELL' ACCORDO DI FORESTA

7) RITIENI CHE L' OBIETTIVO STRATEGICO SIA COMPLETO E ADATTO? (1=PER NIENTE ADATTO
10=MOLTO ADATTO)

1 2 3 4 5 6 7 8 9 10

8) HAI CONSIGLI E/O SUGGERIMENTI DA DARE DI SEGUITO PER MIGLIORARE L' OBIETTIVO STRATEGICO?

9) PER OGNI IMPEGNO ELENCATO DI SEGUITO DEFINISCI L' IMPORTANZA CHE LI ATTRIBUISCI ALL' INTERNO DEL CONTRATTO SEGNANDO CON UNA X UN NUMERO DA 1 A 5 (1=ELIMINABILE, 5= INDISPENSABILE)

IMPEGNO	RISPOSTA
A) Promuovere la certificazione forestale della gestione e dei processi produttivi	1 2 3 4 5
B) Ristabilire e mantenere l'erogazione di servizi ecosistemici persi a causa della tempesta VAIA a favore degli associati e di tutta la collettività (es. carbonio, biodiversità, acqua...)	1 2 3 4 5
C) Promuovere i prodotti non legnosi del bosco valorizzando le specificità locali (es. ... piccoli frutti, funghi, erbe medicinali, altro...) e sviluppare la filiera locale, per la produzione e lavorazione dei prodotti non legnosi provenienti dal sistema agroforestale con interventi volti al conseguimento di valide prestazioni economiche per i propri associati;	1 2 3 4 5
D) Sviluppare la filiera foresta-legno locale con particolare riferimento alla lavorazione e trasformazione locale del, con interventi volti al conseguimento di valide prestazioni economiche per i propri associati	1 2 3 4 5
E) Valorizzare e sviluppare le potenzialità ambientali, culturali e sociali delle risorse naturalistiche e paesaggistiche del sistema agroforestale, attraverso azioni eventi e progetti specifici e condivisi (es. ... eventi didattici, concerti, escursioni, altro...) creando una rete diffusa di promozione dell'Area.	1 2 3 4 5
F) Realizzare progetti volti a mantenere la salute e la resilienza dell'ecosistema forestale, recuperando le funzioni protettive delle foreste, la prevenzione dal dissesto idro-geologico, il degrado delle risorse idriche e forestali, promuovendo interventi estensivi di idraulica forestale, ingegneria naturalistica e manutenzione delle opere minori (terrazzamenti, canalette, ecc.), interventi di prevenzione dagli incendi boschivi e alla diffusione di fitopatologie, interventi di miglioramento della viabilità e della sentieristica dell' area dando maggior interesse alla prevenzione da danni di possibili futuri eventi metereologici estremi	1 2 3 4 5
G) realizzare attività di informazione, divulgazione e comunicazione volta alla promozione culturale del ruolo e delle funzioni del bosco;	1 2 3 4 5

H) realizzare un portale di presentazione dell'Accordo di Foresta (con dettagli su obiettivi e azioni, presentazione dei soggetti sottoscrittori, fotogallery, video, news ecc...)	1 2 3 4 5
I) promuovere studi, ricerche e innovazione tecnologica e di processo nel settore agroforestale in collaborazione con università e centri di ricerca pubblici e privati	1 2 3 4 5
J) Incentivare la partecipazione della popolazione locale e/o di altri soggetti esterni per accrescere il ruolo dell'Accordo di Foresta	1 2 3 4 5
K) Creare un piano forestale volto a gestire la foresta dopo la dismissione del Sistema agroforestale, volto a mantenere l'integrità dell'ecosistema forestale e dell'approvvigionamento dei servizi ecosistemici.	1 2 3 4 5

10) SE HA SUGGERIMENTI A PROPOSITO DI ALTRI IMPEGNI NON CONSIDERATI DA AGGIUNGERE O DI CAMBIAMENTI DA APPORTARE LI SCRIVA DI SEGUITO:

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