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Evaluation of Non-Wood Forest Products in Food Industry

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Abstract – In this study, non-wood forest products evaluated in the food industry have been compiled. The status of non-wood forest products in Türkiye and around the world has been presented. Non-Wood Forest Products (NWFPs) have served as essential nourishment for numerous communities in both Türkiye and worldwide. This study offers a comprehensive overview of the historical importance and contemporary relevance of NWFP utilization, both within Türkiye and on a global scale. Despite their vital role, NWFPs have yet to gain widespread recognition internationally. In ancient times, forests held a central role as primary food sources, but this significance diminished as agricultural practices evolved. At present, the yield of NWFPs remains notably modest, particularly within the Turkish context. Reinvigorating the NWFP sector necessitates collaborative endeavors between the food industry and forestry enterprises. Such efforts hold the potential to not only promote the production of healthier food resources but also to enhance the economic well-being of local communities. Especially in small settlements near forests, meetings should be organized to introduce non-wood forest products to the local communities, and the residents should be supported economically. Thus, both local developments can be enhanced and environmental awareness can be cultivated among people, thereby enabling a more conscious understanding of forestry and nutrition to be passed on to future generations.

Keywords – Forest Product, Fibrous Foods, Forest Fruits, Human Health, Natural Life

I. INTRODUCTION

Non-wood forest products (NWFPs) are naturally occurring special items or services found on Earth that are distinct from timber resources. Some of these products are cultivated and produced through agricultural activities due to their high demand. Thyme consumed as tea and marigold used as an ornamental plant are examples of plants collected from both natural habitats and cultivated through agricultural practices in Türkiye. However, the majority of NWFPs are still collected from nature for consumption [1]. The products obtained from the forest are illustrated in Fig. 1.

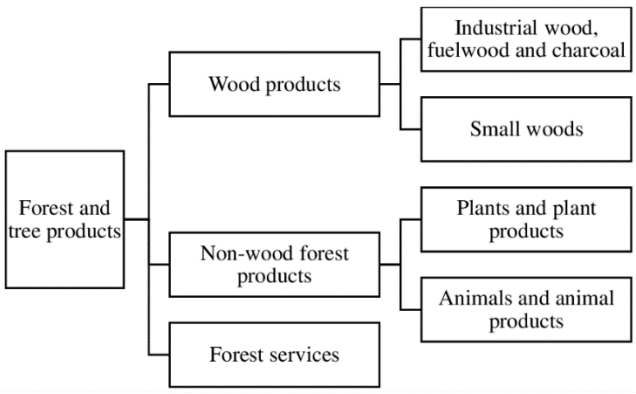

Fig. 1 Forest products %

The vast majority of forests in Türkiye are under the control and jurisdiction of the government, with the majority being managed by the General Directorate of Forestry (OGM) based on the principles of sustainability. According to Forestry Law No. 6831, "The extraction from state forests shall be carried out by the State in accordance with the principles determined by the Ministry of Agriculture and Forestry and the State's Forest Management Plans." As an implementation of this provision, the entire forested areas of the country are managed through forest management plans. These plans are developed at the level of Forest Management Units by the OGM, the Directorate of Forest Management, and the Directorate of Planning within specified periods [2]. Türkiye is one of the 22 countries that managed to increase its forest area between 1973 and 2021 [3] (Fig. 2). In 1973, when a comprehensive forest inventory was completed for the first time, Türkiye's forest area was 20,199,296 hectares . By the year 2015, the forest area had risen to 22,342,935 hectares [4]. The proportion of degraded forests in terms of wood production and forest cover, relative to the total forest area, decreased from 56 % to 42 % between 1973 and 2021. During the same period, the forest resources in Türkiye increased from 22.2 million cubic meters to 22.9 million cubic meters [2].

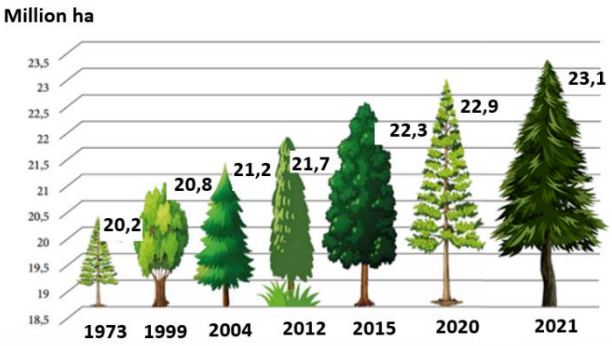

Fig. 2 Türkiye's forest assets from past to present

According to OGM, non-wood forest products are defined as "biological and mineral products of biological origin other than wood, obtained from forests and trees, as well as other products such as bark, chips, twigs, roots, logs, and cones that are produced during wood harvesting. Fungi, forest litter, and ground cover also fall within the same group" [5].

Initial exploration of NWFPs value began in the Amazon, but India pioneered economic insights. The Indian government, noting rising NWFP income alongside timber, established state-level organizations for collection, marketing, and management. NWFPs now constitute 60-70 % of India's forest-related export revenue, with sustained growth [6].

NWFPs are utilized worldwide, yet research in the field of NWFPs holds particular significance in developing countries, often referred to as the "third world." This is because NWFPs play a crucial role in the lives of a significant portion of the population in these regions. For instance, NWFPs serve as indispensable sources of sustenance for around 500 million individuals living within or in proximity to forests in India [6].

An American study reveals that NWFPs possess both economic and ecological significance, expected to grow in importance. NWFP collection and trade impact various economies, constituting a significant portion of gatherers' income, emphasizing the need for their sustainable management to balance economic gains and ecological preservation [7].

II. Historical Development of Non-Wood Forest Products

The historical practice of collecting and using various plant materials from forest ecosystems for sustenance and other purposes has evolved and become integral to cultures and national identities. NWFPs not only contribute to local and national economies but also play a crucial role in ensuring food security, preserving biodiversity, and supporting environmental objectives. This practice highlights the significant link between traditional resource utilization and sustainable development [8].

In the absence of wood technology, humans historically utilized NWFPs from forests for shelter, tools, sustenance, and medicine, forming a basis for today's herbal medicine knowledge. These resources served as a "green social security," offering low-cost materials, income, and traditional remedies [9].

European settlers migrating to the New World (USA) brought essential resources such as medicinal herbs and tools for survival. They learned from Native Americans and eventually

exported Non-Wood Forest Products (NWFPs) back to Europe. Initially importing medicinal plants, America shifted to synthetic alternatives in the early 1900s [10].

Sezik [11] identified traditional medicinal plants used across 55 provinces and 160 villages in Anatolia, Türkiye between 1986 and 1995. This study resulted in the creation of a database called "TUHIB," revealing that 1011 medicinal plants were collected or cultivated by locals for therapeutic purposes.

In developing nations, rural communities heavily depend on income from NWFPs harvested from forests. Yet, the value of medicinal plants, fruits, resins, and more is often lost in their sale. Certification can rectify this by ensuring fair income distribution, sustainability, and product quality assurance among villagers, intermediaries, and exporters [12].

Türkiye's geographical location at the juncture of Asia and Europe, combined with its Mediterranean identity and altitudinal range of 5000 meters, results in rich natural, cultural, and biological diversity. The country's diverse climates, including humid, semi-tropical, and semi-arid, contribute to its abundant ecological variety, housing over 10,000 plant species, with a significant number being endemic, primarily within its forest ecosystems [13].

Countries like Bulgaria, Hungary, and Romania foresaw the economic value of NWFPs and have gained significant positions in the European market by collecting and cultivating around 70 different species. In Türkiye, it is estimated that there are around 500 species of plants used for medicinal purposes (Önal, 1988).

III. NWFPs USED IN THE FOOD INDUSTRY

The global food system is falling short in providing adequate and nutritious food while exerting negative environmental impacts. Trees and forests play a crucial role in addressing these challenges. Trees and forests offer nutrient-rich foods, income opportunities, ecosystem services, and climate mitigation, necessitating the scaling up of tree-based food production, realigning agricultural investments, promoting nutrient-dense foods, and integrating nutrition objectives into forest conservation for a holistic approach to achieving healthy and sustainable food systems [14].

Over 2 billion individuals face food insecurity [15], and nearly 700 million suffer from undernourishment. Concurrently, there is a growing global trend of overconsumption, with 39 % of adults classified as overweight or obese [16].

The global food system falls short in providing the necessary variety of foods for promoting healthy diets. A mere 15 crops contribute to 90 % of the global energy intake [17], with rice, maize, and wheat alone constituting 48 % of daily calories worldwide [18]. The production of nutrient-rich foods is insufficient to ensure adequate healthy diets for all [19], and only 40 countries, encompassing 26 % of the global population, possess a satisfactory supply of fruits and vegetables in line with dietary guidelines [20]. While even small amounts of animal-derived foods can alleviate malnutrition in areas with high stunting and micronutrient deficiencies, these foods often remain inaccessible or unaffordable for the most disadvantaged populations [21]. Simultaneously, the overconsumption of animal-derived foods in other regions adversely affects both population health and environmental sustainability [14].

In a study conducted in the Aegean region of Türkiye, it was reported that Non-Wood Forest Products (NWFPs) are utilized by the local community primarily as food, in the form of both edible items and beverages. The second most common usage is for medicinal purposes, involving the leaves, seeds, fruits, or roots of certain plants [22].

Studies have established a positive link between tree cover and improved dietary diversity, leading to higher consumption of fruits and vegetables. Trees contribute significantly to the cultivation of nuts and over half of human-consumed fruits, which often boast high nutritional content. Agroforestry systems integrating trees in farmland have been shown to support diverse food production and enhance food security and nutrition [23]–[27].

Forests are vital for nourishing approximately 1.6 billion people residing within close proximity to them [28]. Forests directly provide wild foods, substantially improving dietary adequacy, with

studies showing that even in tropical countries, half of surveyed individuals in forested areas consume forest-derived foods, with the top quartile of users obtaining nearly 15 % of their recommended fruits and vegetables intake from forests [29]–[31].

Rowland et al. [31] posit that alterations in land use and deforestation could yield unanticipated effects on the nutritional profiles of indigenous communities. A deeper comprehension of the role played by forest-derived sustenance in local diets is imperative to fully grasp the potential repercussions of forest diminution in the wake of agricultural expansion, potentially leading to unforeseen adverse nutritional outcomes for the local populace, particularly if forests indeed wield substantial influence over dietary quality in specific regions.

The world's biodiversity finds its primary refuge in forests, particularly tropical ones, where they flourish. These ecosystems not only provide an array of wild edibles but also render vital ecosystem services that underpin sustainable agricultural productivity [32]–[36]. A research endeavor undertaken by Ickowitz et al. [25] analyzed dietary data extracted from the Demographic and Health Survey encompassing 21 African nations, revealing a positive correlation between tree cover and the dietary diversity of children, as measured by the consumption of ten food groups in a single day's recall. The study further observed an ascending trend in fruit and vegetable consumption in correspondence with increased tree cover, peaking at 45 % tree cover, followed by a decline. However, the relationship between tree cover and animal-source food consumption did not attain statistical significance [37].

IV. CONCLUSION

Non-Wood Forest Products (NWFPs) are used as a source of sustenance by numerous communities in both Türkiye and around the world. This study provides a compilation on the historical significance and relevance of NWFP utilization in Türkiye and globally. Despite its inherent importance, NWFPs are not duly recognized on a global scale. In prehistoric times, forests served as vital sources of nutrition, but their significance waned as agricultural practices developed. Presently, NWFP yield remains notably low, particularly in Türkiye. Collaborative efforts between the food industry and forestry enterprises are needed to revitalize the NWFP sector. This would not only foster the production of healthier food sources but also elevate local income levels.

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