

## Role of Sericulture in Achieving Sustainable Development Goals

## Rola jedwabnictwa w wypełnianiu Celów zrównoważonego rozwoju

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### Abstract

The present study attempted to scenario analysis study of sericulture resource which would cover its significance and provide the entire gamut of mulberry silk in order to create appropriate planning and thereby playing a significant role in enhancing GDP of silk dominant regions of the economy. This review study analyses our present knowledge of the current scenario of sericulture sustainability, potential, growth and silk crafts of a silk producing regions with the aim of supporting the regions' sustainable growth and development. It conducts bibliometric analysis of highly cited scientific research publications on sericulture sustainability using the Scopus and web of science databases. We investigate sericulture's contribution in accomplishing UN Sustainable Development Goals, and we claim that a better knowledge of sericulture's contribution to sustainable development is critical for assuring inclusive sustainable regional development.

**Key words:** Silk farming, silk growth, silk crafts, Sustainable development goals

**Słowa kluczowe:** uprawa jedwabiu, wzrost jedwabiu, rzemiosło jedwabne, Cele zrównoważonego rozwoju

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### Introduction

By 2030, the 17 Sustainable Development Goals (SDGs) set forth by the United Nations are intended to promote a balance between environmental preservation and human well-being (UN, 2015). All of the SDGs are built on the biosphere, but maintaining biodiversity is still a worldwide issue (Arroyo-Zeledón, 2018). Examining how sericulture within the world's rich biodiversity can help the SDGs be achieved has the potential to connect sustainable development policy. In recent years, there has been a lot of attention on utilising local resources for agricultural sustainability. Proper exploitation and management of local resources, as well as the development of diverse agro-based enterprises, have the potential to create a regional balance between rural and urban sectors together with providing sustainable livelihood. The natural environment plays an integral role in the growth of sericulture resources. The mulberry crop is the foundation of sericulture resource, which is directly responsible for the creation of silk cocoons. Silk farming is the practise of cultivating silk-producing organisms. The term comes from the Greek word sericos, which means silk, and the English word culture, which means rearing. It includes interlinkage

of activities such as mulberry plant cultivation, silkworm rearing to generate silk cocoons, cocoon reeling to untwist silk filament, yarn production, weaving, and silk fabric processing (Kumaresan, 2008; Anitha, 2011). It provides income generation to farm families throughout the year (Kamili et al., 2000; Roopa et al., 2015; Lakshmanan et al., 2011).

Mulberry silk is well-known in the textile industry which represents the second largest industry after agriculture in India (Wang et al., 2010). It is a significant economic subsidy income-generating activity for rural people in mountainous areas (Misra, 2000) and offers livelihood in industries, which are a key activity in the metropolitan economy. China is the world's largest producer of silk, followed by India, Uzbekistan, Thailand, and Brazil. In Europe, the United States of America (USA) is the biggest silk consumer and importer, followed by Switzerland, the United Kingdom, and Germany. (International sericulture commission, 2019)

The main crop for the growth of sericulture is mulberry plantations. On the other hand, mulberry trees have long been grown specifically for the purpose of breeding silkworms. Its importance to ecology was disregarded. (Ghosh et al., 2017). Mulberry is used in many industries, including sericulture, to process mulberry products, which offers prospects for a sustainable way of life. It offers a variety of ecosystem services that improve human well-being while preserving the planet's life support mechanisms (Ghosh et al., 2017). The provision of ecosystem services naturally aids in achieving global sustainable development (Huang et al., 2012). The extent to which sericulture helps in achieving the entire set of SDGs has not, however, been thoroughly investigated. Through the regulation of environmental restoration, afforestation, carbon sequestration, and soil conservation, existing research has emphasised the significance of mulberry in achieving multiple SDGs (Qin et al., 2012; Singhal et al., 2010; Zhang et al., 2018). We specifically identify the actual and potential contributions of sericulture in achieving the SDGs and provide evidence to demonstrate how interconnected mulberry is with its backward and forward linkages from the viewpoint of an integrated system. (Yuan et al., 2017). We examine the SDGs as well as the potential role that sericulture could play in accomplishing specific SDG objectives. This review study analyses our present knowledge of the current scenario of sericulture sustainability, potential, growth, and silk crafts of a silk producing region with the aim of supporting the region's sustainable growth and development. The Scopus and Web of Science databases are used to conduct bibliometric evaluations of highly cited scientific research papers on sericulture sustainability.

### **Mulberry silk production**

Mulberry silk is produced by silkworms (*Bombyx mori*) that eat mulberry leaves and make silk cocoons in 28-30 days, following which they spin cocoons. Finally, the reelers buy the silk cocoons and turn them into silk yarn. Sericulture is an economic activity that entails the development of mulberry plants and the breeding of silkworms using agricultural labour to produce silk threads (Reddy et al., 2008). India's silk industry is world-renowned, producing Mulberry silk, Tasar silk, Eri silk, and Muga silk. It plays an integral role in the textile industry. India is the second largest producer of silk with 31906 metric tonnes (2018) and contributes 15% of the overall world raw silk production which ensures sustainable development of region (Manjunath et al., 2015).

### **Global Scenario of Silk Textiles Growth**

Geographically speaking, Asia accounts for about 95% of global output and produces the majority of the world's silk. China produces the most silk in the world, with 152005 metric tonnes produced each year in 2019. In order to raise the standard of living for women and advance gender equality while simultaneously promoting the Sustainable Development Goals, sericulture has been making substantial efforts to spread it throughout numerous parts of Africa, South Asia, and Latin America. (International sericulture commission, 2019). It is considered a lucrative industry with high employment potential (Dezmirean et al., 2013; Popescu, 2018). Increasing demand for textile products and for silk products in Asia is driving growth in the global silk market. China and India are the world's top two producers of silk, respectively (Long et al., 2006). Asia is the region rich in raw materials because it produces the most raw silk in the world. Increased demand from the textile industry helped enhance the use of silk. Technology improvements in the sericulture sector are projected to benefit the silk market. (Lakshmanan, 2011).

Brazil, on an average of 2.6 hectares, produces 610 metric tonnes of silk yarn every year, improving the standard of living for rural communities. (Porto, 2014). In 2020, China produced 153,000 metric tonnes of silk, and India produced 51,900 metric tonnes. India contributes 16.10 percent, with contributions also coming from Brazil (3.82%), Thailand (2.91%), Japan (7.31%), and Korea (1.17%). (Devaiah et al., 1999). China's average growth rate in silk production is more than 9%, compared to India's growth rate of around 5.60%. (Singh, 2011).

Mulberry silk is the most popular form of silk. The textile industry makes extensive use of mulberry silk. It is also used to enhance the qualities of base fibres in blends with other natural fibres such as cotton. (Barcelos et al., 2021) The demand for mulberry silk is likely to raise as silk quality improves, propelling the silk market forward.

Art of silk fabric decoration is one of the oldest arts in the world. Chinese were the first to begin to manufacture silk fabrics.

China, Brazil and India gained popularity for silk over time, and these three nations are credited with creating ornamental art made of silk cloth. One of the primary categories of arts and crafts in China today that is fiercely competitive in terms of talent and performance quality is silk decoration. Bratac is completely processing raw materials and reeling silk yarns in Brazil (Porto, 2014). More than 2,500 people work for the Brazilian-owned enterprise Bratac in its various sectors. The enterprise employs roughly 3,500 rural households in the production of cocoons and provides indirect employment for about 30,000 people. It was established in 1989 and chose to employ the raw materials from damaged cocoons and other standard silk industry by-products. The business purchases by-products and raw materials from Bratac and crafts them into yarns for its manufacturing. According to the World Bank's 2021 income classification, sericulture plays a critical role in subsistence options, which are typically landless and marginal.

### **Silk growth in India**

Karnataka is one of the top mulberry sericulture producing states, followed by Andhra Pradesh, Tamil Nadu, West Bengal, and Jammu & Kashmir, which together account for 98.5 percent of the country's silk production. India's raw silk requirement was roughly 27,005 metric tonnes, while the country only produced 19,696 metric tonnes and imported 8,000-9,000 metric tonnes from China (Qadri et al., 2010). Currently, there is an increase in the consumption of silk products in developed countries. It leads to high demand on the global market and plays an important role in foreign exchange earnings for developing countries around the world, resulting in the transition from sericulture to manufacturing.

India is the second largest producer of raw silk and the largest consumer of raw silk and silk fabrics in the world. In India, the silk business is fuelled by both exports and strong domestic demand. Silk fabrics are widely used in the domestic market for ceremonies, religious rituals, weddings, festivals, and other events. Silk is utilised as a raw material for both clothes, as well as furnishings. Although silk is now viewed as a luxury item in India, with a price that is much higher than other fabrics, we foresee a growth in the consumption of silk fabrics in the country as disposable incomes continue to rise.

### **Performance of Silk Growth in Jammu and Kashmir**

Practically speaking, silk is manufactured in every part of the Kashmir valley. The silk industry, which was first established by Emperor Zain-ul-Abidin, is a small and medium-scale industry that plays a significant role. It is critical for the long-term survival of small and marginalised households. Mulberry silk cocoons are well-known in the Kashmir valley and they produce a very fine fibre that can be compared to the best in the world (Global Investor Summit 2020).

Jammu and Kashmir is a bivoltine sericulture union territory of India with a variety of agro-climatic zones and different mulberry genetic resources that are known around the world for generating superb and attractive silken products (Trag et. al., 2011; Bhat et.al., 2014) It has huge potential for sericulture development (Annual Report Statistics, Central Silk Board 2018). Mulberry is grown on 9,066 hectares in Jammu and Kashmir, producing 939 metric tonnes of cocoons and 212 metric tonnes of raw silk in 2018-19. (Economic Survey Jammu and Kashmir 2018-19). Sericulture plays a significant role in the economy of J&K, involving more than 25,000 raising households and generating an annual income of Rs 7.28 crores. (Annual Plan 2010-11, Planning and Development Department, Jammu and Kashmir). In Kashmir valley, Trend of silk cocoons production has seen annual compound growth rate of 1.59% which shows positive growth rate from 1990-91 to 2019-20 as compared to reducing trend of mulberry plantation which is -1.14% (Mushtaq et.al., 2021; Mir et al 2018; Ganaie et.al., 2012).

Jammu and Kashmir has enormous potential to manufacture and use raw silk locally, establishing a strong backward and forward connection that can revitalise our industrial sector, enhance the sericulture industry for cocoon growers, and create sustainable growth that coordinate cocoon silk production and marketing (Jammu and Kashmir Trade and Export Policy report 2018; Khan et. al., 2015).

Silk products have a ready market in Kashmir, both nationally and internationally; nevertheless, the government must pay quick attention to this business in order to enhance the socioeconomic status of weavers (Yousuf et. al., 2013). The Government of India's Central Silk Board introduced Silk Samagra for sericulture development in the country, including Jammu and Kashmir (J&K), with the goal of improving quality and production. (Press Information Bureau 2019). Sericulture is an agricultural allied sector that generates income through backward and forward linkages that supply various value added goods (Barcelos, 2021). It promotes Kashmir's crafts and cultural industry. (Bhat et. al., 2020; Chauhan et. al., 2016; Trag et. al., 2011). Sericulture is currently seeing resurgence; thanks to the World Bank's assistance for the Kashmir valley in reviving the glory of silk industry, which encourages farmers and stakeholders to participate in this sector. It leads to the sustainable development of sericulture. (Global Investor Summit 2020).

### **Silk Crafts in Kashmir Valley**

Kashmir is famous for its silk carpets, which are constructed of silk yarn and wool (Tazima, 1978). Weavers of silk carpets create Kashmir silk carpets of exceptional quality and creativity that have influenced countries throughout Central Asia. It resulted in a strong demand from the international market, providing a significant source of income for the people of Jammu and Kashmir. The carpet weaving industry was centred on Srinagar. Because of their beauty, strength, and longevity, Kashmiri carpets have acquired international recognition and made a niche for themselves. Unlike the regularly available tufted carpets, they are hand woven, unmatched, and hand knotted. Handmade and hand knotted carpets have a lengthy life expectancy due to the delicate and intricate knots tied by hand. As a result of the indelible impression they create on the beholder, these find customers in both national and international marketplaces. One of the valley's most important sources of livelihood is the craft, which is combined with tourism and adventure tourism. It also provides an additional source of income and sustainable livelihood.

The Kashmir valley's temperate environment is ideal for Bivoltine silk cocoon development, and it is known for creating excellent, attractive silk fabric and silk items of high quality. Sericulture is the backbone of the Kashmir economy, contributing to the region's social and economic prosperity. The silk arts and craftsmanship of the Kashmir Valley reflect the region's rich cultural legacy and play an important role in the creation of new artistic trends in the Union territory of Jammu and Kashmir. Kashmir offers a wide range of internationally recognised hand-knotted floor coverings, including silk carpets and rugs. The Kashmir Valley's Himalayan geography is socioeconomically conducive to sericulture's growth and development, allowing rearers to achieve silk farming sustainability. (Revive Silk Industry in Jammu & Kashmir, 2021).

### **Broad significance of Sericulture to Sustainable Development Goals**

The framework for achieving a better, more sustainable future for everybody is found in the Sustainable Development Goals. They deal with the issues that the entire world is facing, such as poverty, inequality, climate change, environmental degradation, peace, and justice. By gradually altering the methods we create and use technologies, sustainable development constantly motivates us to protect and improve our natural resources. Harmonizing three key factors – economic growth, social inclusion, and environmental protection is essential for sustainable development. All of these factors are important for the welfare of people and societies and are interrelated. Before being distributed to other parties in the supply chain for the intended product, silk is first grown through three preliminary stages. The first phases involve growing mulberry leaves, raising silkworms, and transporting and packing cocoons. Depending on the producer, these steps can be improved to reduce their negative environmental effects and accomplish sustainability goals. Sericulture offers opportunities for income diversity with low start-up costs through a range of products and services. Sericulture promotion programmes in China, Brazil, and India have improved the lives of smallholder farmers by boosting farm output and providing them with a new source of income. Sericulture has the ability to contribute to a sustainable, circular economy and may even help reduce carbon emissions if supply chain management is done carefully. However, in other parts of Africa, difficulties in enhancing livelihoods through sericulture have been linked to a lack of training, expertise, and access to tools. Sericulture vocational training could increase indigenous communities' access to employment prospects, entrepreneurship, and economic diversification opportunities, as well as empower women in traditionally patriarchal societies to advance gender equality. (Babu, 2015; Kasi, 2013; Roy et.al. 2020).

Sericulture is a viable option for livelihood diversification that can immediately raise household and per capita income while also providing better financial prospects (Giacomin et.al., 2017; Gangopadhyay, 2008) and sustained income increase for residents in rural areas, irrespective of social and economic status. An initiative for environmentally friendly travel that supports the growth of the silk industry and tourism in China, Brazil, and Mysore. It promotes the arts and crafts sector and innovative high-quality products (Armito et al 2014; Barcelos et.al., 2020 Khan et.al., 2015; Zhang et.al., 2018) According to research studies (Singhal et. al., 2010, Wang et.al., 2013, Yuan and Zhao, 2017, Grzekowiak et.al., 2022), mulberries contain bioactive qualities that point to the presence of substances with antibacterial, anti-inflammatory, antioxidant, antitumor, and anticancer actions. Therefore, it is appropriate to describe it as a plant that is most suited for meeting current requirements without endangering those of future generations. According to the International Sericulture Commission 2019, these initiatives support local economies and, in the case of Africa, South Asia, and Latin America, aid in promoting the region's natural features while generating more prospects for employment through greater tourism activity. Currently, UNESCO has designated sericulture as an Intangible Cultural Heritage. The primary benefit of the silk industry is that the majority of its consumers are high earners from other areas and industrialised countries, while the majority of its producers are small-scale weavers, reelers, and growers (Wang et.al., 2010; Rana et.al., 2015; karthik et. al., 2012). The marginal farmers would have economic options as a result.

Table 1. Sericulture's contribution to pertinent SDGs

Sustainable Development Goals	Examples of supporting literature	Sericulture contribution towards achieving SDGs
No poverty (SDG 1)	Giacomin et.al., 2017; Prakasam et.al., 2014 ; Gangopadhyay, 2008	Sericulture offers economic diversity as income generation resilient livelihood for poor and vulnerable communities
Good Health and Well being (SDG 3)	Chen et.al., 2016; Zhang et al 2018 ; Yang et.al., 2010	Mulberry provides nutritional and medicinal properties which includes strong bio-active compounds
Quality Education (SDG 4)	Rajeshwar et.al., 2019 ; Popescu, 2018	Vocational training in sericulture provides equal opportunities for employment, training and entrepreneurship
Gender Equality (SDG 5)	Kasi et.al., 2013; Roy et.al., 2020; Babu, 2015	Sericulture provided equal access to economic and natural resources for both men and women
Economic growth (SDG 8)	Armito et.al., 2014; Barcelos, 2020 ; Grześkowiak et. al., 2022	Silk farming contributes to GDP of nations & diversify livelihood opportunities
Industry, innovation and infrastructure ((SDG 9)	Wang et.al., 2013; Yuan et.al., 2017 ; Khan et.al., 2015; Singh et.al., 2010	Silk farming promotes silk tourism and textiles which supports art and crafts industry and new value products
Climate action ((SDG 13)	Huang et.al., 2012; Ghosh et.al., 2017	Mulberry plantations improve air quality which leads to sustainable cities and communities.
Reduced inequality (SDG 10)	Reddy et.al., 2008; Popescu, 2018; Barcelos et.al., 2021	Improved Livelihoods from sericulture supports sustainable income and contributes to inclusive social and economic development

Sericulture is an agro-based industry where the food plants for silkworms must be grown in order to care for the animals. The majority of the food plants are perennial, thus the agricultural area has a lot of greenery. Sericulture is a labor-intensive industry, and very little carbon is produced throughout the manufacturing process. (Qin et.al., 2012; Ghosh et.al., 2017; Astidillo et.al., 2014).

The main goal of a sustainable sericultural development strategy for developing nations should be to increase the productivity of land that is already being farmed while reducing costs and improving input efficiency with little to no negative effects on people and the environment. In order to reduce input misuse and land degradation, a healthy soil, plant, and environment system must be established. Modifying current farming methods in the area of soil nutrient restoration to encourage the adoption of mulberry, sericulture is a creative way to promote eco-friendly farming.

## Conclusion

Given the current demand for silk in the world, sericulture appears to have the potential to become a successful sector. In nutshell, it could be pointed out that sericulture plays a sustainable role as it brings in additional areas under cultivation, generates more income, provides greater employment opportunities, and helps in the overall development of the region. The expansion of sericulture in developing countries appears to have a favourable growth rate in the formation and efficiency of silk cocoons, thanks to the cultivation of enhanced types of mulberry trees which plays an important role as far as ecological balance is concerned.

With all the above mentioned attributes of the silk industry, it is appropriate to call sericulture an ideal industry for a sustainable future. In developing countries, sericulture is built on the adoption of technology breakthroughs from various sericulture institutes, as well as tree type mulberry plantings that aid farmers in growing silk cocoon and producing silk thread more efficiently. There is need of a comprehensive and holistic strategy, as well as human resource development and effective supply chain management in pre-cocoon (Mulberry plantation, silkworm rearing) and post-cocoon sectors ( reeling, weaving and yarn) all of which must be handled simultaneously. Sericulture, with its sectoral parts of production, provides livelihood security to many population segments specialised in cultivation, rearing, reeling, and weaving which ensures sustainable growth and inclusive development of a region.

Sericulture contributes to the expansion of the rural economy and the creation of a balanced economic sector. As a result, developing countries has been able to enhance its output of silk cocoons and yarn due to the geo-economic feasibility of sericulture. The future growth plan should concentrate on Sustainable sericulture regional expansion in developing countries of economically viable regions. Furthermore, since, the women participation rate in sericulture sector is very high, we need to extend this sector to large areas. Accordingly, more women are able to draw their income from this sector. It can be an ideal tool not only for eco-friendly environment but for gender equality and women empowerment as well.

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