Proceedings of the Indian National Science Academy (2026) 92:726–732
https://doi.org/10.1007/s43538-025-00450-x

REVIEW ARTICLE

Building a bioeconomy through non-timber forest produce in Jammu and Kashmir

Ashutosh Sharma[1] · Akhilesh Gupta[1] · Jyotesna Maurya[1] · Famida Khan[1] · Veda Krishnan[1,2]

Received: 19 December 2024 / Accepted: 30 April 2025 / Published online: 19 May 2025
© Indian National Science Academy 2025

Abstract
Jammu and Kashmir (J&K), a Union Territory (UT) shaped by complex geographical, economic, and political challenges, offers unique potential for economic growth through its rich biodiversity. The region holds promise in leveraging Non-Timber Forest Products (NTFPs) to build a sustainable bio-economy. This paper examines the economic significance of NTFPs, highlighting their potential to promote growth, reduce economic disparities, and promote ecological preservation. It also analyses the role of innovation, entrepreneurship and policy in addressing key barriers such as poor market access, dependence on intermediaries, and governance challenges. Policy recommendations are provided to enhance market linkages, promote sustainable harvesting, and support local innovations.

Keywords Bio-economy · NTFP · Policy · Entrepreneurship · Innovation

Introduction

Jammu and Kashmir (J&K), a region now designated as a Union Territory (UT) after the bifurcation of the erstwhile state in 2019, alongside the creation of the UT of Ladakh, presents a unique case of economic and environmental opportunities enmeshed with substantial socio-economic challenges. The region is home to a rich variety of endemic flora and fauna, sustained by its diverse ecological zones that range from alpine meadows to temperate forests. In comparison to other Himalayan states, J&K has the potential to utilize its high-value niche products like saffron and other unique forest-based products like honey, mushroom and medicines to contribute towards the goal of reaching $300 billion value for Indian Bio-economy by 2030 (Peerzada et al. 2021).

This biodiversity, however, remains underutilized in terms of its economic potential, especially regarding Non-Timber Forest Products (NTFPs). These products, derived from the region's vast forest resources, include a wide range of materials such as medicinal plants, resins, wild fruits, and essential oils, all of which have significant market potential, both nationally and internationally (Manzoor et al. 2023). In this context, this review article aims to explore how J&K could build a robust bio-economy by making the most of its non-timber forest resources. The first section of the paper provides an overview of the economic and geographical challenges that the region faces, to identify the context and background in which NTFPs can play a role. This is followed by an evaluation of the potential of NTFPs to drive economic growth, contribute to poverty alleviation and prevent ecological damage in the region. The article then gives the role of policy, innovation and entrepreneurship in supporting NTFP based Bio-economy in the state. It then concludes by offering policy recommendations, focusing on governance, innovation, and entrepreneurship and the way forward for further research to unlock the full potential of NTFPs in contributing towards the UT's bio-economy.

Challenges faced by Jammu and Kashmir

Economic challenges

J&K's economic situation reflects the complexities of a region striving to balance traditional livelihoods with modern aspirations. According to the Economic Survey

✉ Jyotesna Maurya
science.policy@insa.nic.in

[1] Indian National Science Academy, New Delhi, Delhi, India

[2] Division of Biochemistry, ICAR-Indian Agricultural Research Institute, Delhi, India

of India (2024–2025), the UT has a Gross State Domestic Product (GSDP) of Rs. 2.65 lakh crore at current prices (J&K Govt. 2025), positioning it 21st among the states and UTs of India. While this may be considered a decent achievement for a region grappling with significant challenges, the per capita income of Rs. 1,32,806 (MoSPI 2023) places J&K at the 27th rank in the country, highlighting its struggle to provide equitable economic opportunities for its population. Additionally, as can be seen from Table 1, the contribution of crops in agriculture sector is the third highest in Gross State Value Added (GSVA), following the GSVA of public administration and real estate.

Agriculture continues to dominate the economic landscape, with J&K ranking 5th in the country in terms of household income derived from agriculture (J&K Govt. 2023). This reliance on agriculture underscores the limited diversification of the region's economy, where income from other sectors remains relatively low. With limited industrialization and the absence of robust manufacturing or service sectors, the economic base remains fragile, leaving the region vulnerable to external shocks, particularly related to climate change, political unrest, and market fluctuations (Mushtaq et al. 2024).

Geographical challenges

Geography plays a critical role in the challenges faced by J&K, particularly concerning infrastructure development and economic integration. The region's difficult terrain, characterized by mountainous landscapes, valleys and other land forms along with specifically harsh winters, among other seasons, presents significant obstacles to connectivity. The inadequate road and railway networks hinder both internal and external trade, making the cost of doing business in the region disproportionately high. This lack of infrastructure has particularly affected small and medium enterprises, which struggle to compete due to the high cost of transportation and logistical challenges (Hamid 2017). Currently, the railway network extends only up to Jammu, necessitating further travel to Srinagar by local trains or road transport.

Climate change

J&K is situated in one of the world's most ecologically fragile regions. According to the Intergovernmental Panel on Climate Change (IPCC), the Himalayan ecosystem is particularly vulnerable to the impacts of climate change. This vulnerability is further confirmed by Ishtiyak et al. (2016), who documented climate variability in terms of rainfall

Table 1 Sectoral share in J&K towards GSVA (current prices)

	2021–22	2022–23 (3RE)	2023–24 (1RE)	2024–25 (AE)
Crops	10.4%	10.5%	11.1%	11.5%
Livestock	5.3%	5.7%	5.5%	5.4%
Forestry & logging	1.5%	2.3%	2.4%	2.3%
Fishing & aquaculture	0.4%	0.4%	0.4%	0.3%
Agriculture & allied sector	**31,935 (17.5%)**	**37,825 (19.2%)**	**42,887 (19.7%)**	**47,850 (20.0%)**
Mining & quarrying	0.3%	0.4%	0.5%	0.5%
Manufacturing	6.6%	6.1%	5.9%	5.7%
Utility services	5.4%	5.1%	4.9%	4.8%
Construction	5%	8.1%	7.9%	7.8%
Industry	**35,909 (19.7%)**	**37,934 (19.2%)**	**40,693 (18.7%)**	**43,799 (18.3%)**
Trade, repair, hotels & restaurants	10.6%	10.7%	10.9%	11.2%
Transport & storage services	6.3%	7.2%	7.1%	7.1%
Financial services	3.6%	3.6%	3.6%	3.6%
Real estate	11.6%	11.9%	11.9%	12.0%
Public administration	21.2%	18.4%	17.9%	17.5%
Other services	9.5%	9.8%	10.2%	10.3%
Service	**1,14,413 (62.8%)**	**1,21,672 (61.6%)**	**1,33,955 (61.6%)**	**1,47,657 (61.7%)**
GSVA	**1,82,257**	**1,97,432**	**2,17,535**	**2,39,307**

Source Economic Survey of Jammu and Kashmir, 2024–25

The bold implies total of sub-sectors within the sector. And the last bold implies the total of all GSVA for the state

and temperature in Kashmir. Their study emphasizes the far-reaching impacts of these climatic changes on natural resources, biodiversity, and food production, along with water scarcity and the increased occurrence of natural disasters. They forecast that, unless addressed, these trends will severely affect the region. By 2030, it is projected that there will be a 60% food deficit, a significant increase from the 23% shortage recorded in 1980–1981 (Ishtiyak et al. 2016). Additionally, the region will likely face more frequent and severe disasters, including heavy snowfalls, snowstorms, and flash floods, exacerbating soil erosion and further contributing to deforestation and loss of biodiversity (Ishtiyak et al. 2016).

The decline in biodiversity in J&K is also evident from research conducted by Ganie et al. (2019), which focused on the Overall Threat Impact (OTI) assessment of 94 medicinal plant species in the Kashmir Himalayas. Their findings underscore the critical threats posed to the region's unique flora, with 28% of medicinal plant species categorized as facing high to very high impacts from human activities. Twenty-one of these species are endemic to the Himalayan region, making their preservation vital. The study identifies over-exploitation for commercial purposes (63%) as the most significant threat, followed by habitat loss caused by landslides and soil erosion (54%). Additionally, overgrazing by livestock (52%) and the construction of roads and buildings in natural areas (34%) further endanger these valuable species (Ganie et al. 2019).

The cumulative effects of these environmental and anthropogenic pressures could have long-lasting consequences for J&K. As biodiversity declines, the region's ecosystem services—including those vital for food production, water regulation, and medicinal resources—are compromised. The potential loss of biodiversity due to climate change and over-exploitation can be addressed by focusing on utilizing NTFPs instead within sustainable limits, which need to be scientifically calculated. In light of these challenges, there is an urgent need for sustainable development strategies that prioritize ecological preservation, climate adaptation, and community resilience.

Potential of NTFPs in Jammu & Kashmir

Economic activities based on NTFPs emphasize the use of natural resources from forests without cutting down trees. NTFPs include fuel wood, medicinal plants, mushrooms, fruit and nuts, honey, bamboo, fodder, and more. The website of Forest Department of J & K shares the list of permissible NTFPs for collection in 14 out of 20 districts in the UT. Five out of the 14 districts also provide the potential commercial application of each NTFP, whereas one district provides the distribution of each NTFP. An assessment of the botanical names from each of these district list gives a total of 241 unique species permitted to be collected as NTFP in the 14 out of 20 district of the UT (J&K Forest Department 2025). While there is no official record or estimate of population depended on NTFP collection in J & K (to the best of authors' knowledge), a study by Forest Survey of India has brought out an estimation of people residing in Forest Fringe Villages (FFV), which are villages within 5 km of the forest area (FSI 2020). Assuming that people residing in FFV usually are depended on NTFP collection, an estimated guess can be made about the magnitude of people depended on this activity. According to this study, the population residing in FFVs of the erstwhile state of J & K, including Leh and Ladakh is 3.50 million. Assuming that there is a similar distribution of population in FFVs in the two UTS, the population depended on NTFP collection comes out to be around 3.4 million in the UT of J & K, which is 27.7% of the population based on data of 2011 Census.

Hence, the UT of J & K has numerous species which can be collected as NTFPs as well as a significant population which is depended on the collection of NTFPs to support their livelihoods. This potential is also reflected in the UT's export of NTFPs. It has witnessed substantial production and export of NTFPs in recent years. In 2021–22, the UT reported a total export trade of 2852 quintals of various NTFPs (J&K Forest Department 2021), which amounted to a total value of 2,581 million INR (MoSPI 2023). While data is available for NTFP as an aggregate category, a breakdown of major NTFP species which are exported and to which countries would help in the specialised policy making for the UT to address the local challenges.

As per published academic literature on J & K, there is record of indigenous medicinal plants, mushrooms and bee varieties scattered across specific regions of the state in different studies.

A study by Manzoor et al. (2023) documented the indigenous plant species used by local residents for medicinal purposes in the Kashmir region, identifying 110 medicinal plants (31 of which are endemic to the Western Himalayan region are used for 166 human remedies and 9 for animal diseases. Additionally, research has been conducted to identify edible mushroom species in the district of Jammu, which had 14 new species of mushrooms used for culinary and medicinal purposes (Sharma et al. 2022) and identification of medicinal properties of local mushroom species scattered across J & K, with most of the species having anticancer properties (Verma et al. 2023). Moreover, the UT has the potential to explore migratory beekeeping, which could enhance the honey production by a factor of 2 times, compared to stationary beekeeping, as the region has a long pollen season and migratory bee-keeping requires low investment (Sharma et al. 2013). However, Thakur and Bali (2022) in their primary study of 300 beekeepers from Doda, Kishtwar and Rambar district highlight that majority

of the beekeepers in the region, face the challenge of disease outbreak and branding of their product for sale in market.

These products play a significant role in contributing to the region's bio-economy, as indicated by a study conducted by Peerzada et al. (2022) in the Kupwara area of the Kashmir region. The study found that NTFPs contributed substantially to both cash (29.38%) and subsistence (70.62%) incomes of local residents, while also reducing income inequality, as reflected in a 29.27% reduction in the Gini coefficient for the area, which is widely used indicator for income inequality. The study also highlighted that most of this income was driven by the sale of fuel wood, followed by medicinal plants (Peerzada et al. 2022). While the use of medicinal plants is beneficial, the reliance on fuel wood raises concerns about indoor air pollution in households that use it. These claims are further supported by a study by Peerzada et al. (2021), which calculated that the potential increase in revenue for local residents could be 18 times their current income if NTFPs are used sustainably and marketed under a governance framework that prioritizes indigenous rights. This claim is further substantiated by the high prices which some of the specialized NTFPs fetch in the market such as Himalayan Cedarwood Oil priced at Rs 550–850 per kg, Chilgoza Dry Fruits Pine Nuts which sell for Rs 720 per kg and Gucchi mushroom commanding a premium price of Rs 20,000–30,000 per kg.

However, in order to achieve the full potential of NTFP for the growth of UT's economy, some economical and geographical challenges need to be addressed where entrepreneurship, science and technology can play an important role. NTFP prices often fluctuate significantly due to seasonal variations, inconsistent demand, and market uncertainties (Magry et al. 2023). A study done to identify challenges faced by NTFP collectors in the forest ranges of Basantgarh, Dadu and Bani of J&K identified lack of markets, no proper weighting of material, harmful wild weeds and attack of wild animals as the most pressing issues faced by them (Bagal et al. 2023).

Another important aspect is the dependence on intermediaries who support the farmers and collectors in trade. The collectors of NTFP, particularly in remote areas, depend heavily on intermediaries for selling their products, leading to lower prices at the source (Magry et al. 2022). Middlemen often dictate prices, resulting in a large share of profits going to them rather than to the primary collectors. Lack of formal access to credit or financial support in this sector is also common (Sarin 2024). Being small scale farmers, investing without finance support gets difficult and limits their ability to expand.

The high-altitude terrain and remote location of many NTFP collection areas in J&K significantly increases transportation costs. This is especially problematic for low-value, high-bulk products, making it less economically viable to transport them to larger markets. Hence, there is a need for local value addition to the NTFP products to enhance their economic value while conserving the biodiversity of the region.

Role of different factors in supporting NTFP based bio-economy in the state

Role of science, technology and innovation

The region of J&K holds significant potential for leveraging science and innovation to drive economic growth, particularly in supporting the NTFP based economy as the region has a rich culture of grassroots and frugal innovation. While there is a lack of studies identifying grassroots innovation specifically related to NTFP or bio-economy in the UT, there are examples of frugal innovations in other fields such as traditional handicrafts like Pashmina and addressing medical equipment shortages during Covid-19.

In case of Pashmina shawls, a study done by Sheikh (2014), demonstrates that the local communities involved in the 13 steps of the shawl making have introduced several incremental innovations over the years to solve local challenges. Some of these innovations include – introduction of a steel comb-like tool to brush out the pashm (very fine goat or sheep hair) from the animals in a painless manner; a dehairing machine for cleaning of pashm (which was initially done by women and was a back breaking process) by a local inventor Shakeel Ahmad Mir who modified a cotton cleaning machine to suit his local needs; invention of *bhukhari* a local water heating device for washing of these shawls at scale during sub-zero temperatures (Sheikh 2014).

Similarly, during Covid-19 numerous cases of frugal innovation came to light in response to the shortage of Personal Protective Equipment in Kashmir. Sheikh et al. (2024) in their study demonstrated 13 such cases, which included local innovations for disinfection and sanitization, splash guards, face masks, digital apps for contact tracing and online consultation; and even more technically challenging equipment like ventilators and robotics.

A common characteristic of these innovations is that they are driven by local residents, motivated to solve small-scale issues directly affecting their work. Scientific support from universities and institutions is generally limited to sectors like sericulture and horticulture, where specialized expertise is required to breed new varieties and species. It is evident that frugal and grassroots innovations are well-suited to enhancing the efficiency of small-scale industries, thereby boosting income (Sheikh and Bhaduri 2021) which makes local innovators suitable for addressing the local challenges faced by NTFP collectors.

One aspect in which these grassroots innovators can play a significant role is tackling the competition from synthetic alternatives or adulterants. The availability of cheaper synthetic or cultivated alternatives to natural products (e.g., synthetic resins or cultivated medicinal herbs) can lower demand for wild-harvested NTFPs. This results in reduced market prices and pressures producers to compete on price rather than the unique qualities of their natural products. Local innovations on cheaply detecting adulteration and synthetic fibres will be able to solve this issue to some extent. However, policy intervention is also required to promote and make farmers aware about certifications such as organic or fair-trade status can significantly enhance the value of NTFPs.

Role of entrepreneurship

J&K is home to 882 Department of Industrial Policy and Promotion recognized startups, with around 24% having potential to incorporate or support NTFPs across sectors like agriculture, healthcare & life sciences, professional & commercial services, and food & beverages, according to the Ministry of Commerce and Industry (MoCI) database. Startups have an opportunity to drive value addition in the NTFPs supply chain by engaging in local processing, developing innovative packaging to preserve freshness, and branding products as organic and unique to Jammu and Kashmir. To enable this transformation, the government can create incentives to guide startups toward bio-economy initiatives, especially since construction-related activities currently dominate with having around 40% of startups.

While the UT was recognized as a top performer, overall, in the third edition of States' Startup Ranking 2022 by the Department for Promotion of Industry and Internal Trade (DPIIT) for fostering innovation and providing institutional support, significant challenges remain in areas like market access, funding, and mentorship (Startup India 2024). This gap is evident as only 5.35% of startups have reached the scaling stage, while 48.12% remain in the ideation phase (Startup India 2025). Studies by Khan and Zaffar (2018) and Jain and Anwar (2022) further highlight that despite being innovative and flexible, many entrepreneurs lack the leadership skills needed for scaling up. Providing a holistic support for commercialization and growth remains critical to bridging these gaps.

Role of policy and governance in supporting NTFPs

The government of J&K released the Policy for Sustainable Collection and Utilization of NTFP (NTFP Policy) in J&K in 2022. The main aim of the policy is to ensure sustainable collection and utilization of NTFP including medicinal plants while supporting the livelihood of people residing along the forests. This is proposed to be done through promoting sustainable extraction, value addition and development of market linkages along with promotion of in-situ conservation of NTFPs. The policy strengthens the provisions of Forests Rights Act, by discontinuing the practice of auctioning of the NTFP by the Forest Department and gives the department responsibility to maintain data on collection of NTFP and share it with public, provide authentication certificates to enhance the value of NTFPs; and facilitate value addition, value chain creation and developing market linkages in collaboration with J&K Rural Livelihood Mission, Department of Tribal Affairs and Mission Skill Development to get collectors a better income for their collection (Govt. of J&K 2022).

While this policy is a step in the direction of shifting the forest management system from timber conservation and large-scale forest exploitation to a focus on indigenous rights to harvest NTFPs for local use and sustainable sale in the marketplace as envisaged in the Forest Rights Act, there is a need to change the perceptions and attitudes of the on-ground implementors to achieve the objectives of this policy. This was specifically highlighted by a study done by Peerzada et al. (2021), which demonstrates that despite the adoption of the Forest Rights Act in J&K, there is still a need to change the perceptions and attitudes of government officials who continue to restrict the indigenous population's use of NTFPs.

Additionally, the challenges faced due to Forest Department were brought forth by Bagal et al. (2023), where they stated that majority of the surveyed NTFP collectors claimed that the forest department did not assist them in any way during the NTFPs collection, processing, or marketing phases. It would then become necessary to assess if the situation changes in the future due to the implementation of the NTFP Policy in the UT.

Recommendations

- While it is imperative that the policy gets implemented, it is also necessary to address the societal inequities by empowering women, tribal communities and economically weaker sections of the society. This can be done by broadening the scope of current NTFP Policy to include training and skilling of sections.
- It is recommended that the provisions of NTFP Policy be implemented efficiently and effectively. The forest Department should ensure that the potential application and distribution of NTFP is shared for each district with the public. Additionally, it is important to have some data about the magnitude of people depended on NTFP collection, their revenue, type of NTFP collected, etc. to ensure that NTFP is collected in a sustainable manner.

- One of the policy interventions could be encouraging the formation of farmer-producer organizations (FPOs) and cooperatives, which could empower small-scale collectors, help in bulk marketing, and reduce dependence on middlemen. The strength of this intervention was especially demonstrated in research done by Moresello et al. (2012) where they brought forth the positive outcomes due to partnerships, for NTFPs collectors in terms of their incomes and forest conservation in Brazilian and Bolivian societies of Amazon forests.
- Initiatives to create direct linkages with urban and international markets, alongside branding efforts for unique NTFPs (like morel mushrooms and medicinal herbs), could enhance market value.
- It is also recommended that the government may establish supervised marketplaces for the sale of NTFPs, complete with a weighing system and equity counters to disseminate price data as currently collectors/farmers are often misled.
- Establishing microfinance schemes specifically for NTFP collectors could provide them with the needed capital for better processing and market access.
- Another important intervention would be creation of low-cost processing facilities for value addition of NTFPs in villages—local facilities for drying, grinding, or packaging NTFPs is currently lacking and hence sold in their raw form, which fetches lower prices. Creating such facilities will value add and provide higher returns like essential oils, herbal extracts, or packaged dried fruits.
- The government of J&K can support the creation of these facilities by nudging the startups to solve these local problems through various incentives.
- Finally, to support grassroots and frugal innovation in the region, the UT needs to move from a top-down to a bottom-up approach to enhance local innovations. Research by Sheikh and Bhaduri (2021) highlights the shortcomings of patent training and the establishment of labs by the National Innovation Foundation in J&K, which follow a top-down model of driving innovation by the government. Local innovators felt these initiatives failed to support their innovation effectively, and the pressure to scale up and commercialize their products diminished their motivation when their efforts ultimately failed. Therefore, policies focused solely on scaling up commercialization for local innovators may have a counterproductive effect, hindering innovation in the region.

Conclusion

While the harnessing of NTFPs holds significant potential in contributing towards the economy of the UT, it is important to identify the challenges and address them through innovation, entrepreneurship and effective policy-making. Further research can be undertaken to estimate the magnitude of NTFP for each district and identify the type of NTFPs which would have commercial potential. It is also necessary to undertake research in identifying the sustainable limits for the collection of these NTFPs and policy mechanisms through which these collection limits can be maintained. Moreover, it is necessary to identify the grassroots innovation happening in the UT to aid in NTFP collection and identify the challenges they face. Finally, periodic policy implementation assessment should also be undertaken to identify the gaps in the policy and feed this information for policy design in the future. This research is necessary to ensure that a robust ecosystem is created to support an NTFP based economy in Jammu & Kashmir.

Acknowledgements The authors would like to acknowledge Prof. Nazir Ahmad Ganai, Vice Chancellor, SKAUST Kashmir and Dr. Syed Mudasir Andrabi, SKAUST Kashmir for organizing the brainstorming session and their valuable inputs, which helped in shaping some of the key ideas in this paper. We would also like to thank Mr. Pranav Sharma, Consultant at INSA-CSTP for his comments on the first draft of the manuscript.

Declarations

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

References

Bagal, Y.S., Anand, M., Kumar, N., Haobijam, J.W.: Opinions and problems regarding various aspects of non-timber forest products (NTFP): A study on NTFP collectors of Shivalik range of Jammu region. Int. J. Ferment. Foods **68**(3), (2023). https://doi.org/10.46852/0424-2513.3.2023.8

Forest Survey of India (2020) Study on Forest Fire Vulnerability in India. Ministry of Environment, Forest and Climate Change, Government of India. https://fsi.nic.in/uploads/documents/ffv-study-2020-by-fsi-searchable.pdf

Ganie, A.H., Tali, B.A., Khuroo, A.A., Reshi, Z.A., Nawchoo, I.A.: Impact assessment of anthropogenic threats to high-valued medicinal plants of Kashmir Himalaya, India. J. Nat. Conserv. **50**, 125715 (2019)

Govt. of J&K: Policy for sustainable collection and utilization of Non-Timber Forest Produce (NTFP) in J&K. Forest, Ecology & Environment Department, Civil Secretriat, J&K, Jammu (2022)

Hamid, W.: Growth, challenges and issues related to micro, small and medium enterprises (MSMEs) in Jammu and Kashmir. Bus. Econ. J. **8**(328), 2 (2017)

Ishtiyak, P., Reddy, M., Panse, S., Wani, I., Peer, Q.J.A.: Impact of climate change and anthropogenic interventions on natural vis-à-vis human resources in Kashmir, India—an overview. J. Appl. Nat. Sci. **8**(1), 489–493 (2016)

Jammu & Kashmir Forest Department: Pamphlet at a glance: 2020–21 (2021). https://jkforest.gov.in/assets/pdf/publications/Pamplet_AtAGlance_2020-21.pdf

J&K Govt: Economic Survey 2023 (2023). https://ecostatjk.nic.in/pdf/publications/ecosurvey/Economic%20Survey-2023f.pdf

Jammu and Kashmir Forest Department: Division-wise/District-wise lists of minor forest produce (MFPs)/non-timber forest produce (NTFPs) (2025). https://jkforest.gov.in/mfp.html

Jain, S., Anwar, A.: Strategic entrepreneurship in light of entrepreneurial and strategic orientations: a case of women entrepreneurs of Jammu and Kashmir in India. J. Public Aff. **22**(4), e2612 (2022)

Khan, A., Zaffar, S.: Opportunities and Challenges for Women Entrepreneurship a Case Study of Kashmir Province. International Journal of Enhanced Research in Management & Computer Applications. ISSN 2319-7471 (2018)

Magry, M.A., Cahill, D., Rookes, J., et al.: An integrated value chain analysis of non-timber forest products: a case of Jharkhand State of India. Small-Scale for. **21**, 621–645 (2022). https://doi.org/10.1007/s11842-022-09520-0

Magry, M.A., Cahill, D., Rookes, J., Narula, S.A.: Marketing constraints of non-timber forest products: evidence from Jharkhand, India. In: Narula, S.A., Raj, S.P. (eds) Sustainable food value chain development. Springer, Singapore (2023). https://doi.org/10.1007/978-981-19-6454-1_11

Manzoor, M., Ahmad, M., Zafar, M., Gillani, S.W., Shaheen, H., Pieroni, A., Al-Ghamdi, A.A., Elshikh, M.S., Saqib, S., Makhkamov, T., Khaydarov, K.: The local medicinal plant knowledge in Kashmir Western Himalaya: a way to foster ecological transition via community-centred health seeking strategies. J. Ethnobiol. Ethnomed. **19**(1), 56 (2023)

Morsello, C., Ruiz-Mallén, I., Diaz, M.D.M., Reyes-García, V.: The effects of processing non-timber forest products and trade partnerships on people's well-being and forest conservation in Amazonian Societies. PLoS ONE **7**(8), e43055 (2012). https://doi.org/10.1371/journal.pone.0043055

MoSPI: (2023). https://pib.gov.in/PressReleasePage.aspx?PRID=1942055

Ministry of Statistics and Programme Implementation: Forestry output value: non-timber forest products: Jammu and Kashmir (2012–2023) (2023). CEIC. https://www.ceicdata.com/en/india/forestry-output-value-20112012p-current-price-non-timber-forest-products/forestry-output-value-non-timber-forest-products-jammu-and-kashmir

Mushtaq, S.O., Khan, J.I., Majeed, M.: Poverty and Inequality in Jammu and Kashmir: a sensitivity analysis. Indian Econ. J. 00194662241265467 (2024)

Peerzada, I.A., Chamberlain, J., Reddy, M., Dhyani, S., Saha, S.: Policy and governance implications for transition to NTFP-based bioeconomy in Kashmir Himalayas. Sustainability **13**(21), 11811 (2021)

Peerzada, I.A., Islam, M.A., Chamberlain, J., Dhyani, S., Reddy, M., Saha, S.: Potential of NTFP based bioeconomy in livelihood security and income inequality mitigation in Kashmir Himalayas. Sustainability **14**(4), 2281 (2022)

Sarin, R.: India urgently needs to streamline multi-billion rupees worth NTFP market. Mongabay-India (2024). https://india.mongabay.com. Accessed 16 Dec 2024

Sheikh, F.A.: Community innovations in the informal sector: study of Kashmiri Pashmina shawls. In: Delhi Workshop on Grassroots Innovation Movement. Centre for Studies in Science Policy, Jawaharlal Nehru University, New Delhi (2014)

Sheikh, F.A., Bhaduri, S.: Policy space for informal sector grassroots innovations: towards a 'bottom-up'narrative. Int. Dev. Plan. Rev. **43**(1), 115–137 (2021)

Sheikh, F.A., Pugh, R., Wu, X., Sarkar, S.: Regional studies and frugal innovation: a missing link? Reg. Stud. **58**(4), 893–905 (2024)

Sharma, D., Abrol, D.P., Ahmad, H., Srivastva, K., Vir, V.: Migratory beekeeping in Jammu and Kashmir, India. Bee World **90**(2), 44–47 (2013)

Sharma, R., Sharma, Y.P., Hashmi, S.A.J., Kumar, S., Manhas, R.K.: Ethnomycological study of wild edible and medicinal mushrooms in district Jammu, J&K (UT), India. J. Ethnobiol. Ethnomed. **18**(1), 23 (2022)

Startup India: States' Startup Ranking 2022: Jammu & Kashmir (2024). https://www.startupindia.gov.in/srf/portal/SRF_2022_Result_page/Jammu_And_Kashmir_15th_Jan_2024.pdf

Startup India: Jammu & Kashmir Startup Policy 2024–2027 (2025). https://www.startupindia.gov.in/content/sih/en/state-startup-policies/Jammu-and-Kashmir-state-policy.html

Thakur, J., Bali, R.K.: Innovations for reviving sericulture in Jammu and Kashmir. Pharma Innov. J. **11**(7), 1126–1131 (2022)

Verma, K., Mehmood, T., Kumar, S., Altaf, U., Sharma, Y.P.: Wild medicinal mushrooms of the Northwest Himalayas of Jammu and Kashmir, India and their traditional and modern applications. In: Wild Mushrooms and Health, pp. 23–50. CRC Press (2023)

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Springer Nature or its licensor (e.g. a society or other partner) holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.