

Forest Resources Beyond Timber: From Animal Products to Value-Added Goods

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When we think about forests, timber, firewood and bamboo are often the first resources that come to mind. However, forests provide a much wider range of products that support human life and rural economies. Among these are non-timber forest products (NTFPs)—biological materials obtained from forests and trees outside forests for food, medicine, fibres, cultural uses and other purposes. Not all forest wealth comes directly from trees. Several economically important products are obtained through interactions between forests, wildlife, insects and local communities. Honey, lac and silk are excellent examples. These products connect biodiversity with livelihoods and markets, and their value can increase substantially when they are properly processed, packaged, branded and marketed. Value addition is therefore an important step in transforming a relatively low-value raw product into a range of higher-value goods. Processing, grading, storage, product diversification and improved marketing can increase income, extend shelf life and create opportunities for rural communities.

From Raw Resources to Valuable Products

The real economic potential of a forest product is often revealed only after it undergoes some form of processing. A raw material may have limited market value, while the same material, after cleaning, grading, extraction or conversion into a finished product, can reach a much wider market. For example, honey can be marketed not only as a natural sweetener but also as flavoured honey, organic honey, honey-based beverages and cosmetic products. Lac can be processed into shellac, lac dye and other specialized products. Similarly, silk can be transformed into high-quality fabrics, garments, carpets and other textile products. Such value addition also provides scope for small-scale enterprises, self-help groups, cooperatives and forest-dependent communities. Better processing and branding can help producers move beyond selling raw materials and participate in more profitable stages of the value chain.

Lac: A Tiny Insect with a Big Economic Role

One of the most fascinating forest-linked products is lac, a natural resin secreted by the lac insect *Kerria lacca*. The insect is cultivated on host plants such as palas, ber, kusum and *Flemingia semialata*. The insects settle on young branches and produce resinous encrustations, which are harvested and processed. India is an important producer and exporter of lac. Major producing regions include Jharkhand, Chhattisgarh, Madhya Pradesh, West Bengal, Maharashtra, Odisha, Uttar Pradesh and Andhra Pradesh. Lac has applications in several industries, including food, pharmaceuticals, textiles, cosmetics and surface coatings. The journey from lac insect to finished product involves several stages. After harvesting, the

resin-bearing material is processed to obtain stick lac and seed lac. Further processing can produce shellac, while specialized processing can yield dewaxed lac, lac dye and other useful compounds. The versatility of lac makes it particularly valuable. Shellac can be used for wood finishes, furniture polishes, coatings and certain industrial applications. Lac-derived materials also have uses in food and pharmaceutical products, while lac dye has applications as a natural colourant. The export market demonstrates the economic significance of this small insect. According to the report, India exported about 7,659.95 tonnes of lac in 2021–22, generating approximately US\$84.44 million in export revenue. The United States, Bangladesh, China and Germany were among the major destinations. Thus, lac represents a remarkable example of how forest vegetation, insects, traditional knowledge and processing industries can come together to create economic value.

Honey: Sweetness with an Ecological Connection

Honey is perhaps the most familiar animal-derived forest product. Produced by honey bees from flower nectar, honey contains carbohydrates, enzymes, amino acids, vitamins and minerals. But the importance of bees extends far beyond honey production. Honey bees are social insects belonging to the genus *Apis*. A colony consists of a queen, workers and drones, each performing specialized functions. Worker bees collect nectar, construct the hive and care for developing young, while the queen is responsible for egg laying. The relationship between forests and bees is particularly important because flowering trees and other plants provide nectar and pollen, while bees contribute to pollination and biodiversity. Therefore, apiculture can simultaneously provide an economic product and support ecological functions. Raw honey can be converted into a variety of value-added products. Flavoured honey, made using herbs, spices or fruits, can appeal to specialized markets. Organic honey can target consumers seeking products produced without prohibited chemical inputs. Honey can also be blended with ingredients such as nuts, turmeric or aloe vera. Its use does not end with the food industry. Honey-based beverages, honey powder and honey-containing skin-care and hair-care products provide additional avenues for value addition. India has also developed a significant export market for honey. The report records exports of nearly 60,000 tonnes in 2020–21, valued at approximately ₹721.13 crore. The United States accounted for the largest share of India's honey exports, followed by countries including Saudi Arabia and the United Arab Emirates. For forest-fringe communities, beekeeping can therefore offer an income source that is closely linked with the conservation of flowering vegetation.

Silk: Where Forest Plants Become Fine Fibre

Silk is another remarkable product associated with insects and vegetation. It is a natural protein fibre produced primarily by silkworms and is valued for its softness, lustre and strength. Different silkworm species depend on different host plants. The familiar mulberry silkworm, *Bombyx mori*, feeds on mulberry. Tasar silkworms utilize trees such as *Terminalia arjuna* and *T. tomentosa*, while oak tasar is associated with *Quercus serrata*. Eri silkworms feed on plants including castor, while muga silkworms depend on host plants such as *Persea bombycina* and *Litsea polyantha*. This diversity illustrates an important feature of sericulture: the production of silk is inseparable from plant resources. Maintaining suitable host plants is therefore fundamental to sustaining different silk-producing systems. Value addition significantly increases the usefulness of silk. Raw silk can be transformed into high-quality fabrics, designer textiles and ready-made garments. Silk waste can also be utilized for yarn production and other applications. Traditional craftsmanship further enhances the value of silk. Dyeing, printing, embroidery and zari work can transform a simple fabric into a premium cultural and fashion product. Blending silk with other fibres and applying finishing treatments can also produce fabrics suited to changing consumer preferences. India exported silk and silk products worth approximately ₹1,848.96 crore in 2021–22, demonstrating the continued economic importance of the sector.

Musk: High Value, but a Conservation Challenge

Not every animal-derived forest product can be viewed simply as an economic opportunity. Musk provides an important example of the need to balance economic interests with wildlife conservation. Musk deer belong to the family Moschidae and occur in mountainous parts of Asia, including the Himalayan region. Male musk deer possess a musk gland or pod containing a strongly scented substance. The compound muscone contributes to the characteristic fragrance of natural musk. Historically, musk has been highly valued in perfumery because of its distinctive and long-lasting scent. It has also been used in traditional medicine. However, the commercial value of natural musk has created serious conservation pressures. The report highlights illegal trade and the role of hunting in the decline of musk deer populations. Because obtaining natural musk traditionally involved killing the animal, uncontrolled exploitation poses a major threat to wild populations. This makes musk fundamentally different from products such as honey and lac. Sustainable value addition cannot mean simply increasing exploitation. Instead, wildlife protection, regulation, alternative sources and conservation-oriented approaches must remain central. The musk story reminds us that the economic value of a forest product must never be measured only in terms of its market price. The ecological value of the species producing it may be far greater.

Ivory: When Value Becomes a Threat

Ivory presents an even stronger example of the conflict between commercial demand and wildlife conservation. Ivory is a hard, dense material obtained primarily from the tusks and teeth of animals such as elephants. Its smooth texture, durability and suitability for carving made it highly desirable for centuries. Historically, ivory was used for decorative objects, sculptures, jewellery, piano keys and other luxury products. However, commercial demand contributed to large-scale killing of elephants and illegal wildlife trade. The international response to this problem has resulted in strong restrictions and bans on ivory trade. The report describes how ivory prices changed following major trade restrictions, including China's domestic ivory sales ban in 2017. It also identifies continuing illegal trade routes and consumer markets. The lesson from ivory is particularly important: value addition is not automatically synonymous with sustainable development. A product may have enormous commercial value but still be unacceptable when its production threatens endangered wildlife. Today, conservation must take precedence over commercial exploitation. Alternatives such as synthetic materials, plant-based substitutes and legally obtained sustainable materials can help meet artistic and industrial needs without harming wild populations.

Linking Forest Biodiversity with Rural Livelihoods

Lac, honey and silk demonstrate how closely forests are connected with livelihoods. Trees provide host plants and flowers; insects transform these biological resources into economically useful products; and people add further value through harvesting, processing, craftsmanship and marketing. This creates opportunities particularly in rural and forest-fringe areas. Instead of depending exclusively on timber, communities can develop diversified income sources through beekeeping, lac cultivation, sericulture, processing, packaging and handicrafts. Value addition can also encourage local entrepreneurship. A producer who sells raw honey receives income from the primary product, while processing, branding and packaging can create additional economic opportunities. Similarly, lac producers can benefit when raw lac enters organized processing chains, and silk producers can obtain greater returns when traditional weaving and design are incorporated into finished products. However, such development must be accompanied by appropriate training, market access, quality control and sustainable resource management.

The Need for Sustainable Marketing

The future of forest-based animal products depends not only on production but also on how they are marketed. Consumers increasingly look for products that are natural, responsibly produced, traceable and environmentally friendly. This creates an opportunity for forest-

linked products to develop distinctive identities. Organic honey, sustainably produced silk and responsibly processed lac can occupy specialized markets when their quality and origin are clearly communicated. At the same time, products associated with wildlife exploitation require strict regulation. Musk and ivory demonstrate that commercial demand can become destructive when it exceeds ecological limits.

Therefore, a sustainable marketing strategy should consider three dimensions:

- Economic value – ensuring fair returns to producers and communities.
- Ecological value – maintaining biodiversity and resource regeneration.
- Social value – strengthening rural livelihoods and traditional skills.

A successful forest-product enterprise is one that creates income without destroying the resource on which that income depends.

Conclusion

Forests offer much more than timber. Their biological diversity supports a remarkable range of products and livelihoods, many of which remain underappreciated. Lac, honey and silk demonstrate how insects, plants and people can be linked through sustainable production and value addition. Processing, product diversification, quality improvement and better marketing can transform forest-based raw materials into products with greater economic value. Such activities can generate employment, strengthen rural economies and encourage communities to recognize the importance of biological resources. At the same time, musk and ivory provide important warnings. Not every valuable natural product can be harvested sustainably, particularly when exploitation threatens wildlife populations. In such cases, conservation and legal protection must take priority over commercial interests. The future of forest-based enterprises therefore lies not simply in extracting more from nature, but in adding more value while taking less from nature. With appropriate policies, scientific research, community participation and responsible markets, forest resources beyond timber can contribute meaningfully to both rural prosperity and biodiversity conservation.