

An Analysis of Environmental Impacts on the Conservation and Protection of Geographical Indications in India

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1. Introduction

Geographical Indications (GIs) represent a unique intersection of culture, commerce, and geography, offering legal protection to traditional knowledge and preserving invaluable cultural heritage. In India, these designations are not merely labels but are emblematic of the nation's rich biodiversity and artisanal history. The recent and considerable increase in GI registrations, with approximately 33 products being awarded the tag between April 2024 and July 2025 to bring the national total to 697, speaks to a growing recognition of their importance.¹ However, this developing system of protection faces an existential threat that legal frameworks alone cannot mitigate. Environmental degradation is damaging the essential environmental conditions, like specific soil, climate, and local ecosystems, that give these products their unique and legally recognised characteristics. The escalating climate crisis, characterised by rising temperatures, erratic rainfall, melting glaciers, and unpredictable weather patterns, directly affects the quality and distinctiveness of India's GI products. This environmental degradation extends beyond climate change, encompassing broader ecological pressures that jeopardise the longevity and legal integrity of these goods. Consequently, there are profound and growing concerns regarding the urgent necessity of integrating sustainable

¹<https://search.ipindia.gov.in/GIRPublic/>

practices and biodiversity conservation into the very fabric of GI production and governance, ensuring the long-term viability of these irreplaceable cultural and economic assets.

2. The Rationale for Protecting Geographical Indications

The fundamental rationale for the legal protection of geographical indications stems from the need to correct a significant information asymmetry that pervades the market, a condition that fosters unfair competition and ultimately harms both producers and consumers. The issue of counterfeit goods masquerading as authentic, reputed products is particularly prevalent in India. A classic and frequently cited example is the sale of cheap power-loom saris passed off as genuine Banarasi handloom saris, a practice that deceives consumers into paying inflated prices for inferior goods while simultaneously undercutting the market for the original artisans who depend on this craft for their livelihood. The GI framework acts as a powerful deterrent to such unethical and deceptive practices by establishing a clear legal recourse against infringement, thereby safeguarding the integrity of the product's name and origin.²

Beyond its role as a defensive mechanism, a GI tag functions as a crucial indication device in the marketplace. It empowers producers to differentiate their offerings from a sea of generic competitors, allowing them to build and leverage a reputation that can justifiably command a premium price. In this capacity, the GI performs several indispensable functions. It serves as an unambiguous indicator of a product's geographical origin and, by extension, acts as a guarantee of its quality and unique characteristics. Furthermore, it operates as a valuable tool for investment and advertising, concentrating marketing efforts and building collective brand equity for an entire community of producers. Significantly, the protection of GIs also serves a profound cultural purpose by incentivising the preservation of traditional production methods and the knowledge systems that underlie them³. Given that a vast number of India's GIs originate in rural and often economically marginalised areas, their protection becomes a direct instrument of rural development, enhancing the income and economic stability of producers' communities.⁴

² Datta, T. K. (n.d.). *Darjeeling tea, India* [Case study V, page 113].

³ Kalita, P. (2022). Role of Muga Silk-Gi of Assam in the Sustainable Development of Assam. *International Journal of Law Management & Humanities*, 5(6), 588-598.

⁴ Datta, T. K. (n.d.). *Darjeeling tea, India* [Case study V, page 131].

3. The International Framework for the Protection of Geographical Indications

The genesis of India's domestic legal framework for geographical indications can be traced directly to its international commitments, most notably its obligations as a signatory to the World Trade Organisation's (WTO) Agreement on Trade-Related Aspects of Intellectual Property Rights, commonly known as the TRIPS Agreement. This landmark international accord established minimum standards for the regulation and protection of various forms of intellectual property, including GIs, which all member nations were required to adopt and implement within their national legal systems. The enactment of 'The Geographical Indications of Goods (Registration and Protection) Act, 1999' was, therefore, a direct and necessary measure undertaken by India to align its domestic laws with these binding international standards and to fulfil its obligations to the global trade community⁵. This context is critical to understanding that the Indian GI regime is not an isolated legal construct but part of a larger global framework aimed at standardising intellectual property rights to facilitate fair and orderly international trade.

4. The Legal Framework for the Protection of Geographical Indications in India

The cornerstone of India's legal framework for protecting the GIs is 'The Geographical Indications of Goods (Registration and Protection) Act, 1999, which, along with the accompanying Geographical Indications of Goods (Registration and Protection) Rules of 2002, came into full effect on September 15, 2003.⁶ This comprehensive legislation was meticulously designed to provide a robust system for the registration and protection of GIs within the country. The Controller General of Patents, Designs, and Trademarks, who also serves as the Registrar of Geographical Indications, administers this Act. To centralise and streamline the registration process, the central government established the Geographical Indications Registry in Chennai, which serves as a national hub for all GI applications and registrations across India.

The Act defines a geographical indication as an indication that identifies agricultural, natural, or manufactured goods as originating from a specific territory, where a particular quality,

⁵ Datta, T. K. (n.d.). *Darjeeling tea, India* [Case study V, page 113, source 7 and page 114].

⁶ Datta, T. K. (n.d.). *Darjeeling tea, India* [Case study V, page 114, source 30, 31].

reputation, or other defining characteristic of the product is essentially and fundamentally attributable to its geographical origin.⁷ While the registration of a GI is not mandatory under the law, it is strongly advised and incentivised, as registration confers significantly enhanced legal protection. The registration certificate itself functions as primary proof of the GI's legitimacy in legal proceedings, thereby streamlining the enforcement process. The registration grants the registered proprietor and authorised users the exclusive right to use the GI and, critically, the right to institute legal proceedings and obtain relief in cases of infringement. In contrast, an unregistered GI can only be protected through the more cumbersome and complex common law action of "passing off", which requires proving reputation and misrepresentation. The protection afforded by registration is granted for an initial period of ten years, with the provision for renewal for subsequent ten-year periods indefinitely. The Act also prescribes stringent penalties for infringement, including imprisonment for a term ranging from six months to three years and a fine between ₹50,000 and ₹200,000, underscoring the seriousness with which such violations are treated. A noteworthy and progressive feature of the Indian law is that, unlike the TRIPS agreement which mandates a higher level of protection primarily for wines and spirits, the Indian Act empowers the government to grant this elevated level of protection to any product it deems deserving, offering a more equitable framework for the nation's diverse range of valuable goods.⁸

5. The Impact of Environmental Changes on Geographical Indications

The profound and intrinsic connection between a geographical indication and its specific environment serves as both its greatest asset and its most significant vulnerability. These products' unique qualities are not arbitrary but rather emerge from a delicate symbiosis with their native ecosystems. This deep-rooted dependency means that GIs are facing unprecedented environmental challenges that threaten their very existence. These evolving threats are not abstract; they directly compromise the quality and market value of GI goods, undermine the preservation of the rich cultural heritage they represent, and endanger the livelihoods of the communities that have cultivated them for generations. While the narrative is often one of threat, it is also important to analyse the dual nature of the relationship, wherein the GI system

⁷ Datta, T. K. (n.d.). *Darjeeling tea, India* [Case study V, page 113, source 9 and page 120, source 176].

⁸ Datta, T. K. (n.d.). *Darjeeling tea, India* [Case study V, page 114].

itself can exert both positive and negative pressures on the environment, a dynamic heavily influenced by its governance and implementation.⁹

A well-governed GI system can become a powerful force for environmental conservation. The certification process often involves establishing specific production standards that prioritise and mandate environmentally sustainable practices. For instance, the GI for Prosciutto di Parma in Italy requires producers to use natural curing techniques with limited additives, while the French GI for Roquefort cheese is contingent on the preservation of particular pastures and limestone caves that are essential to its flavour profile¹⁰. In these cases, the GI acts as an incentive for conservation, directly linking the economic value of the product to the health of the local ecosystem. GIs can serve as a bulwark against the homogenising pressures of industrial agriculture, helping to preserve traditional landscapes, maintain local genetic resources, and reduce dependence on chemical inputs.

On the contrary, when a GI system is poorly designed or managed, particularly when it prioritises commercial success over ecological integrity, it can trigger a cascade of negative environmental consequences. The allure of a premium price can lead to productive intensification, where traditional, sustainable methods are abandoned in favour of mechanised, input-heavy practices aimed at maximising yield. This can result in the overuse of chemical fertilisers and pesticides, the degradation of soil and water resources, and a dangerous decrease in genetic variability as local varieties are replaced with more productive but less resilient monocultures. A stark example of this negative feedback loop is the Tequila GI in Mexico. It's phenomenal economic success failed to protect its terroir, leading to a significant loss of agave genetic diversity, a shift towards intensive production reliant on pesticides, and a power imbalance that marginalised traditional small-scale producers.¹¹ This illustrates a critical analytical point that the GI label itself is not inherently sustainable; its environmental outcome is a direct function of the rules, policies, and social governance structures that shape its operation.

⁹ Milano, M. Z., & Cazella, A. A. (2021). Environmental effects of geographical indications and their influential factors: A review of the empirical evidence. *Current Research in Environmental Sustainability*, 3

¹⁰ Milano, M. Z., & Cazella, A. A. (2021). Environmental effects of geographical indications and their influential factors: A review of the empirical evidence. *Current Research in Environmental Sustainability*, 3

¹¹ Milano, M. Z., & Cazella, A. A. (2021). Environmental effects of geographical indications and their influential factors: A review of the empirical evidence. *Current Research in Environmental Sustainability*.

5.1. The Corrosive Impact on Quality and Authenticity

The core value proposition of a Geographical Indication lies in its unwavering guarantee of authenticity and quality, attributes that are directly and inextricably linked to its geographical origin. Environmental change, particularly the relentless march of climate change, threatens to erode this very foundation by altering the unique characteristics that define these products. This change is not merely a matter of slightly diminished quality but a fundamental challenge to the integrity of the GI itself. Since the unique identity of these products is predicated on the specific climate and terrain of their production region, any significant alteration to these environmental parameters directly impacts and risks erasing their defining qualities.

This assault on authenticity is vividly illustrated across India. The beloved Bengal Nolen Gur, a date palm jaggery, owes its exquisite, caramel-like richness to the cool winter temperatures that concentrate the sweetness of the sap. The current climate crisis, bringing warmer and shorter winters, disrupts this delicate process. Even a small amount of warmth can cause the sap to ferment, turning it into toddy and rendering the raw material entirely unsuitable for producing high-quality Nolen gur. Similarly, Kashmiri Saffron, the "Red Gold of Kashmir," derives its superior quality and high market value from an exceptionally high concentration of crocin, which gives it a deep colour and potent medicinal value. This quality is a direct result of the unique Karewa soils and the region's traditional reliance on winter snow and timely rains. Climate change-induced drought and scarce rainfall are making the soil dry and unsuitable for cultivation, directly threatening the chemical composition that underpins its premium status. In Nagaland, the formidable Naga King Chilli, once one of the world's hottest, owes its powerful pungency and captivating aroma to a specific combination of monsoon humidity and fertile, organic-rich soil¹². Unfavourable environmental shifts like prolonged droughts are diminishing these very qualities, undermining the basis of its GI registration and tarnishing its global reputation. These examples reveal a disturbing trend where environmental degradation is not just harming agriculture but is actively rewriting the very identity of India's most cherished products.

¹² Singh, R. K., Kanaujia, S. P., Jamir, S., & Ananda, A. (2024, January). A Short Review on India's Hottest Chilli: Naga King Chilli. *Just Agriculture*, 4(5).

5.2. The Crippling Impact on Production

Beyond degrading quality, environmental changes pose a direct and severe threat to the sheer volume and viability of GI production. The organisms and plants that yield these valuable goods are often highly sensitive to their environment, making them exceptionally vulnerable to climatic shifts. The Muga silkworms of Assam, for example, require a precise temperature range of 25–27°C and humidity of 75–85% to thrive.¹³ As they are raised outdoors in a semi-domesticated state, even slight variations beyond their tolerable range can lead to disastrous crop losses and high mortality rates. In a typical year, microbial illnesses may kill 30-35% of the worms, but this figure can soar to a staggering 80% during unusually hot and muggy seasons exacerbated by climate change.

This trend of declining production is echoed across other flagship GI products. Darjeeling tea, an iconic Indian export, has seen its production plummet, with output having declined steadily over the past three decades.¹⁴ Erratic rainfall patterns cause frequent landslides that damage the estates.¹⁵ In the Konkan region, the famed Alphonso mango, or "Hapus," is facing a production crisis, with yields projected to fall to just 35% of normal levels, the lowest in two decades. Excessive heat and a lack of wind have led to the widespread failure of the mango blossoms, drastically shortening the season and reducing the fruit set. Likewise, Kashmiri Saffron production has declined by 65% over the 22 years leading up to 2018, a result of decreased precipitation and untimely snowfall that damage the delicate flowers. This widespread decline in yield is not a series of isolated agricultural problems but a systemic crisis driven by environmental change, threatening the very supply of these culturally and economically significant goods.

5.3. The Devastating Impact on Market Value and Livelihoods

The cascading impacts of diminished quality and reduced production translate directly to severe economic consequences, threatening the market value of GI products and jeopardising the livelihoods of the millions who depend on them. The economic model of a GI is predicated

¹³ *Golden Threads in a Changing Climate: Path towards Sustainable Geographical Indication Frameworks to Preserve the Heritage of Muga Silk.*

¹⁴ Datta, T. K. (n.d.). *Darjeeling tea, India* [Case study V, page 131].

¹⁵ Datta, T. K. (n.d.). *Darjeeling tea, India* [Case study V, page 121, source 198].

on its ability to command a premium price for a unique, high-quality product, which in turn encourages producers to invest in traditional and sustainable farming methods. Climate change systematically undermines this model by attacking both the quantity and quality of the output, potentially leading to the economic extinction of certain crops due to low efficiency and prohibitively high production costs.

The human cost of this crisis is immense. In Assam, the Muga silk industry is not a niche craft but a cornerstone of the regional economy, with nearly 185,000 families depending on its various operations for their primary income¹⁶. The environmental threats to the silkworm thus represent a direct threat to the economic stability of a vast rural population. In Nagaland, the plummeting production of the Naga King Chilli has had a tangible financial impact, with revenue in the village of Seiyhama declining to ₹40 lakhs by 2024 from its 2022 levels, a devastating blow to the local farming community. Similarly, the climatic trends threatening the Alphonso mango endanger the entire economic ecosystem of the Konkan region, from the farmers and orchard managers to the traders, processors, and exporters who form the supply chain. As the environmental foundation of their economic security crumbles beneath them, the livelihoods of numerous farmers, artisans, and traders are at risk. As more consumers care about sustainability, GI products that harm the environment, like those causing soil erosion from increased production, may become less popular, making the economy even more unstable.¹⁷

6. Strategies to Enhance the Sustainability of GI-Tagged Products

Addressing the complex and interconnected challenges facing India's Geographical Indications requires a proactive, multi-pronged strategy that moves beyond mere legal protection to actively build resilience and foster long-term sustainability. This approach must integrate scientific innovation, robust policy frameworks, practical on-the-ground adaptations, and market-based incentives to safeguard these invaluable assets for future generations.

¹⁶*Golden Threads in a Changing Climate: Path towards Sustainable Geographical Indication Frameworks to Preserve the Heritage of Muga Silk*; Kalita, P. (2022). Role of Muga Silk-Gi of Assam in the Sustainable Development of Assam. *International Journal of Law Management & Humanities*, 5(6), 588-598

¹⁷*Golden Threads in a Changing Climate: Path towards Sustainable Geographical Indication Frameworks to Preserve the Heritage of Muga Silk*.

A primary and urgent strategy lies in harnessing scientific and technological innovations to help these climate-sensitive products adapt. This includes a dedicated focus on climate-resilient breeding programmes, such as developing new strains of Muga silkworms that exhibit greater tolerance to temperature variations and resistance to diseases that thrive in warmer, more humid conditions. Modern science offers powerful tools like genome sequencing, which can decode a species' genetic makeup to identify traits for thermogenesis or disease resistance, allowing scientists to accelerate adaptation in a way that complements, rather than replaces, indigenous knowledge. Furthermore, research into advanced agricultural inputs, such as nutrient-supplemented sprays for host plants, can improve food quality and bolster the health of organisms like silkworms, making them more resilient to environmental stressors.

These scientific efforts must be supported by a progressive evolution in policy and governance. The existing GI framework must be reimaged to embed environmental sustainability requirements directly into the specifications for registration and protection.¹⁸ This means moving beyond simply defining a geographical area to mandating specific sustainable production methods, such as organic or agroecological techniques, the preservation of local landscapes, and the protection of biodiversity through the use of indigenous crop varieties. Policymakers can draw inspiration from international models, such as the European Union's use of data-driven bioclimatic indices to evaluate the suitability of wine-growing regions, to create a more dynamic and adaptive management system for GIs in the face of climate change. This requires a holistic policy vision that views GIs not just as intellectual property but as powerful tools for achieving broader goals of sustainable rural development, heritage preservation, and consumer protection.

On the ground, these policies must translate into practical agricultural and management adaptations. For highly vulnerable products like Muga silk, which are traditionally reared outdoors, a critical adaptation is the adoption of indoor rearing techniques, especially during the fragile early larval stages. This provides a controlled environment that can significantly reduce mortality from extreme weather events like heatwaves and heavy rains, while also allowing for better disease prevention and management. We must make a concerted effort in conservation and habitat management alongside these cultivation changes. This includes

¹⁸*Golden Threads in a Changing Climate: Path towards Sustainable Geographical Indication Frameworks to Preserve the Heritage of Muga Silk*; Kalita, P. (2022). Role of Muga Silk-Gi of Assam in the Sustainable Development of Assam. *International Journal of Law Management & Humanities*, 5(6), 588-598.

establishing in situ conservation sites to protect the genetic resources of GI-producing organisms within their native environments and, in some cases, exploring the establishment of sanctuaries in cooler climates to ensure a species' long-term survival.¹⁹

Finally, these strategies must be underpinned by economic and market-based mechanisms that make sustainability a viable and attractive choice for producers. This involves providing financial and technical support, especially for smallholders who may lack the resources to transition to more sustainable practices.²⁰ Government policies should include assistance for investments in organic farming, subsidies for certification fees, and robust capacity-building programmes. Simultaneously, a concerted effort must be made to educate consumers about the crucial link between GIs, environmental stewardship, and climate resilience.²¹ By fostering market demand for sustainably produced GI goods, perhaps through official labelling, it is possible to create a virtuous cycle where consumer choices support the conservation of the very ecosystems upon which these unique products depend, ensuring the long-term viability of India's precious geographical heritage.

¹⁹ Ibid at 13

²⁰ Ibid at 13

²¹ Ibid at 13