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# Biopiracy & Ethics: Balancing Interest of Indigenous Communities and Developed Nations

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**Abstract**

Biopiracy is a pressing issue that highlights the unfair exploitation of natural resources and traditional knowledge, often taken from Indigenous communities without their consent or fair compensation. Many of these communities, located in resource-rich but economically disadvantaged regions of the Global South, have spent centuries cultivating a deep understanding of the plants, animals, and ecosystems around them. However, their contributions are frequently overlooked, as corporations and researchers from wealthier, developed nations in the Global North patent these resources and profit from them. This paper explores the ethical and practical challenges of biopiracy, including issues like informed consent, fair sharing of benefits, and the preservation of cultural identity. It also examines the power imbalance between nations with advanced technology and economic leverage and those that possess the natural wealth being exploited. Case studies, such as the commercial use of neem, turmeric, and quinoa, show how biopiracy exacerbates global inequalities, stripping communities of their heritage while others profit. To address this imbalance, the paper highlights solutions like strengthening international agreements, promoting ethical research, and giving Indigenous communities a stronger voice in decision-making. Protecting biodiversity and respecting the rights of these communities isn't just about fairness—it's about ensuring a more just and sustainable future for everyone.

**Keywords:** Biopiracy, Indigenous community, Traditional knowledge, Biodiversity

## Introduction

The term biopiracy connotes the unauthorised access to biological resources with the intent to accumulate commercial gain out of it. This term was first coined in the early 1990s, emphasising the misappropriation of these biological or genetic resources by the giant corporations in the name of research and development.[1] This is not a new phenomenon; one can trace its history back to the colonial past. The exploitation of biological resources in British colonies by neglecting the interests of local and indigenous communities is the prime example of biopiracy. Though this practice is not new, it has gained the centre of attention in the contemporary era of technological advancement and the intellectual property rights regime. This has posed a threat to the sustainable use of these natural resources, which has a greater impact on the environment and human lives.

The modern scientific temperament, research, and innovation have resulted in easy access to these biological resources by the developed nations. Ironically, most of these biological resources are found in developing nations such as Brazil, which is famous for its Amazon forest, constituting 10% of the world's known species.[2] Eventually, these natural or biological resources are often an integral part of local or

[1] Rachel Wynberg, "Biopiracy: Crying Wolf or a Lever for Equity and Conservation" 52 Elsevier 1 (2023).
[2] The Amazon Rian forest: Understanding its Ecological Importance and Current Threats. https://decodingbiosphere.com/2024/07/29/the-amazon-rainforest/

indigenous communities residing in that particular region. These communities believe in preserving their resources or culture, which are part of their 'Traditional Knowledge'. The 'Traditional Knowledge' is orally transmitted from generation to generation. It has a wider scope, ranging from the field of biodiversity (plants, animals, and micro-organisms) to agriculture, health treatment, folklore, etc. There are innumerable examples such as Inuit communities in the Arctic, which have extensive knowledge about sea ice dynamics useful for travelling, fishing, or hunting, practice of terraced agriculture by indigenous people of Andean highlands; the medicinal values of plants and herbs are not unknown, it includes usage of turmeric as wound healer, Rauwolfia serpentina (Sarpa Gandha) & Allium sativum (Garlic) have been used in relieving hypertension and anxiety, Withania somnifera (Ashwa Gandha) have been used in curing insomnia, diabetes and other conditions etc.[3] This paper also includes case studies related to Bt. Brinjal, Red Sage, Nigella Sativa, and Enola Beans to get a deep understanding of the protection of traditional knowledge and natural resources.

This paper primarily focuses on the present challenges associated with biopiracy and bioprospecting. The scope is to examine the political power dynamics between giant corporations and indigenous communities, revolving around Access Benefit Sharing (ABS) and equitable distribution. The unethical exploitation of traditional knowledge and acquiring a monopoly through patent protection are undermining the interests of local or indigenous communities. This paper encapsulates the legal aspects of the Convention on Biological Diversity (CBD), Nagoya Protocol, and TRIPS to determine the ethical and sustainable usage of traditional knowledge simultaneously acknowledging the sovereign rights of indigenous communities over their natural resources and sharing of benefits through technology transfer. This paper tries to bridge the gap between developed and developing nations, creating fair dynamics by ensuring the co-existence of biopiracy with ethical dimensions.

**Research Methodology**

This paper adopts doctrinal and analytical research methodology, focuses on analysis of secondary sources, and consists of the legal framework surrounding biodiversity protection and IP laws in India and the international framework provided by TRIPS, the Convention on Biological Diversity, and the Nagoya Protocol. The spectrum of other sources consists of data gathered through blogs, articles, journals, case studies, and official documents.

**Review of Literature**

Niti Pathak's "Traditional Knowledge and its role in Biodiversity Conservation" emphasizes India's rich biodiversity and traditional knowledge possessed by these indigenous communities is an invaluable asset for the nation. It is greatly responsible for the economic growth, and it forms a part of the primary healthcare system in India, also known as the traditional system of medicine or alternative system of medicine. Therefore, the authors suggested that indigenous communities should get benefits and rights for the knowledge they share with the urban class.

Mariana Javia's "Biopiracy and Intellectual Property Rights in Bioprospecting: Balancing Innovation and Ethical Concerns" highlights the debate that has been sparked by the emerging concept of bioprospecting, surrounding the issue of biopiracy. This article explores the complex relationship between bioprospecting,

[3] Subhadeep Saha, Deeparani Urolagin, et.al, "Rauwolfia serpentina: A Comprehensive Review of its Pharmacological, Phytochemical and Therapeutic Properties" 11 Journal of Emerging Technologies and Innovative Research 788 (2024).

biopiracy, and IPRs, aiming to shed light on the ethical and legal dimensions of this contentious issue. It addresses the challenges posed by biopiracy on biodiversity conservation, indigenous communities, and traditional knowledge holders, while also considering the need to strike a balance between incentivizing innovation and safeguarding collective rights.

Edward Hammond's "Biopiracy watch – a compilation of some recent cases(2013), Volume 1," highlights the Nigella Sativa and its cultural and medicinal significance. Due to its vitality, various companies like the Swiss food giant Nestle are trying to patent its usage, which undermines the traditional knowledge and the cultural roots attached to it.

Gillian N. Rattray 'The Enola Bean Patent Controversy: Biopiracy, novelty, and Fish-chips" highlights the validity of the Enola Bean patent case wherein the patent of this Mexican seed was granted to John Proctor, who brought the said bean from Mexico to the USA. This case highlights and emphasizes the importance of acknowledging the contributions and traditions of the indigenous people and their cultural heritage.

**Understanding the Interrelation between Biopiracy and Traditional Knowledge**

Biopiracy can be described as the act wherein people or institutions steal biological resources and related traditional knowledge from indigenous populations to legally acquire a patent or intellectual property monopoly control over them. The activity often involves stealing indigenous peoples' knowledge of agricultural or medicinal uses of regional flora and fauna without necessary permission or compensation. Local communities' customs, inventions, and beliefs—especially those pertaining to agriculture, medicine, and biodiversity—are all included in traditional knowledge. Numerous pharmaceutical and agricultural businesses have taken advantage of this information to create new goods, frequently patenting them without giving the original knowledge holders any of the profits. This endangers biodiversity and sustainable practices in addition to undermining the rights of indigenous peoples.

The connection between traditional knowledge and biopiracy is intricate. Bioprospecting primarily depends on traditional knowledge, which is rich in information about the utilization of local plants and animals for agricultural and medicinal purposes.[4] Biopiracy is a process in which companies appropriate this knowledge for themselves without permission, thus denying indigenous communities their intellectual property and cultural heritage.

Moreover, the loss of traditional knowledge through biopiracy can result in the loss of biodiversity. Traditional knowledge contributes to the upkeep of ecological balance, and their traditions help in the sustainable management of resources. The appropriation of this knowledge not only harms the concerned communities but also endangers the ecosystems they preserve.

Regulatory systems like the Nagoya Protocol, which aims to facilitate equitable sharing of benefits resulting from genetic resources and traditional knowledge, are put in place as part of preventing biopiracy.[5i] Empowering indigenous communities by recognizing their rights and allowing them to have a say is essential in a bid to protect their knowledge and receive their fair share from its use. As a result of this interdependence, conservation and preservation of culture require a joint effort to ensure traditional knowledge is valued and recognized.

[4] Traditional Ecological Knowledge (TEK): A Comprehensive Guide. https://sigmaearth.com/traditional-ecological-knowledge-tek-a-comprehensive-guide/

[5] Biopiracy and Legal Safeguard of Intellectual Properties. https://theamikusqriae.com/biopiracy-and-legal-safeguard-of-intellectual-properties/

As the keepers of a vast body of traditional knowledge ingrained in their cultural heritage, identity, and lifestyles, indigenous communities are essential. This information, passed down over the ages, is evidence of their extensive historical background and serves as the basis for how they engage with society and the environment.

Traditional knowledge covers a wide range of topics, including medicine, agriculture, biodiversity, crafts, hunting, fishing, and even the non-technological interpretation of climate trends. These communities are proud of this wisdom, which has been passed down from their ancestors and painstakingly preserved over time. They are also eager to pass it on to future generations.

Since traditional knowledge has had a major impact on current science and technology, its value goes beyond its cultural significance. Originating in particular places like India and China, practices like Siddha Vaidya, Ayurveda, Unani, Tai Chi, and Acupuncture have served as the basis for a number of modern medical theories.[6]

These methods are now widely used and have received international recognition. Traditional knowledge's adaptability is demonstrated by its use in contemporary fields like biotechnology, which combines technology and biological processes. Indigenous populations, who are frequently disregarded for their crucial contributions to the isolation and modification of biological and genetic products, have occasionally been exploited as a result of this integration.

Unfortunately, these communities must be given the credit or payment they merit for their substantial contributions. Therefore, it is imperative to put policies in place that protect indigenous groups' rights and preserve traditional knowledge. In order to protect their cultural legacy and guarantee that they are fairly recognised for their significant contributions to modern science and technology, this step is imperative.

**Biopiracy & Ethics: A Dilemma for Developed and Developing World**

In this highly volatile capitalist world, even the exploitation of biological resources can be possible for commercial gains. The technological advancement can enhance the utility of these natural resources with an increase in their accessibility. It modifies these naturally occurring resources, which can be easily utilized by a large extent of society. At the same time, it also ensures the exclusive monopoly through patent protection over these patentable goods. This restricts their accessibility in a few hands, while creating an economic divide in society. This eventually gives rise to market competition and unfair use or trade practices in the form of Biopiracy. This unethical process of getting unauthorized access to these natural resources led to a large extent of exploitation of these resources. Biopiracy not only impacts the ecological balance but also has a devastating impact on the livelihood of indigenous or local communities. This section will highlight the impact of biopiracy and how it creates an imbalance between developed and developing nations. Further, it also emphasizes the efforts taken by various international forums to cope with and to accommodate ethics to mitigate the harmful consequences of biopiracy.

The issue of biopiracy, though not new to the world it has gained significant attention in contemporary times. In this era of advanced development in various fields, including the intellectual property regime, opened new ventures for countries at the global level. The developed nations already have strong existing IP protection, including patent and data exclusivity. This always puts them on the upper pedestal over the developing nations, which are still exploring many new possibilities in this field of IP and gradually emerging with time. Thus, it is easy for developed nations to take unfair advantage or to get a free ride

[6] Indian Traditional Medicine: Ayurveda, Siddha, and Unani. https://www.momentslog.com/culture/indian-traditional-medicine-ayurveda-siddha-and-unani

over such types of knowledge, which is an intrinsic part of the particular community or related to their indigenous tradition. This gives rise to biopiracy. This phenomenon of biopiracy is highly prevalent in present times, as many multi-national corporations of developed nations try to get access to traditional knowledge. They exploit these biological or genetic resources for commercial use by acquiring a patent for the same and restricting their usage.[7] Sometimes, they do not even give credit or proper compensation to these indigenous or local communities.

Most of these indigenous communities are located in tropical or sub-tropical regions. These regions have 90% of the world's biodiversity. These biological resources are in abundance, which also serve as the source of livelihood for these communities. This is an intrinsic part of their traditional knowledge, which has been passed on from generation to generation. On the contrary, biopiracy has posed a great threat to the utilization of traditional knowledge. It tends to compel the traditional communities to pay in order to consume the patented products that originally belong to them without any boundaries.[8] The unethical practice of biopiracy has the potential to cause to these biological resources, leading to extinction of vulnerable species, privatization of biodiversity and indigenous knowledge. This has a negative impact on ecological stability, leading to global warming and climate change. This also eradicates cultural identity and traditional knowledge of these indigenous communities. This can be evident with a 70% decline in the production of traditional plants in Asian countries.[9] Subsequently, the growth in genetically modified organisms caused a sharp decline in native species.

In order to mitigate such a crisis international community has taken several efforts to counter the unethical practice of biopiracy and to ensure the preservation of the traditional knowledge. This was the very first time they recognized it as a concerning issue at the global level. The first step to protect the traditional knowledge under the IP regime was taken under the joint initiative of WIPO and the United Nations Educational, Scientific and Cultural Organization (UNESCO) in 1978, which led to the protection of Expression of Folklore against illicit exploitation.[10] Later, this has drawn the attention of the global community towards the protection of traditional knowledge, which led to the adoption of the Convention on Biological Diversity (CBD) 1992. The scope under Article 8(j) of the CBD extended to preserve, respect, and maintain the traditional knowledge, innovation, and practices of the indigenous community or local people.[11] This convention also affirms that the State from which the traditional knowledge has originated has the sovereign right over it. This also ensures the conservation of biological diversity, simultaneously encouraging the equitable distribution and Access Benefit Sharing of traditional knowledge between developed and developing nations.

The most recent development, in order to protect traditional knowledge in plant genetic resources, was the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRA).[12] This treaty was adopted in 2001 with the aim of enhancing food security through conservation, exchange, and sustainable

[7] Biopiracy. https://www.vedantu.com/biology/biopiracy
[8] Avantika Gupta, Vinil Tripathi, et.al., "Biopiracy in India: A Decline in Cultural Values" 4(9) International Research Journal of Environment Sciences 81 (2015).
[9] Id. at 1
[10] R.Alagu Mani, R.Dinesh Kumar, "An Analysis of the Issues and Challenges in the Protection of Indigenous Knowledge from Bio-Piracy in India" 4 Indian Journal of Integrated Research in Law 744 (2022).
[11] The Convention on Biological Diversity. https://www.cbd.int/convention/wg8j.shtml
[12] R.Alagu Mani, R.Dinesh Kumar, "An Analysis of the Issues and Challenges in the Protection of Indigenous Knowledge from Bio-Piracy in India" 4 Indian Journal of Integrated Research in Law 745 (2022).

use of the world's plant genetic resources for food and agriculture. It also encourages fair and equitable sharing of benefits arising from its use. It recognizes the right of the farmers and local communities, who are the epicenter of origin and diversity, in conserving, improving, and making available these resources. It is in harmony with CBD. Under Article 9.2, the treaty highlights the need to protect traditional knowledge associated with plant genetic resources for food and agriculture.[13] The other international agency, like the World Health Organization (WHO), also indulges in the preservation of traditional knowledge in the field of traditional medicine. It is associated with the study of traditional plants having medicinal properties. It also encourages fair and equitable benefit sharing derived from the utilization of the resource.

On the other hand, WIPO has also taken initiative to enhance the documentation of traditional knowledge in the minimum documentation of the Patent Cooperation Treaty (PCT). This will eventually give accurate information on relevant traditional knowledge during the patent examination process. Later in the year 2010 Nagoya Protocol was adopted, with the aim is to strengthen the framework of Access Benefit Sharing in association with traditional knowledge and genetic resources.[14] This also led to the emergence of the Access and Benefit Sharing Clearing House (ABS clearing house), as a tool for the implementation of the Nagoya Protocol.

These are some of the ethical practices that are adopted at international forums to counter the unethical notion of biopiracy. This somehow sensitizes the nations about the gravity of the issue and also compels developed and developing nations to balance their interests in consonance with the welfare of society at large. The idea to condemn the unethical practice of biopiracy and to ensure the preservation of traditional knowledge has many threads attached to it. There is a need to conserve the indigenous knowledge, firstly, in order to protect the identity and culture of the holders. Secondly, it not only protects the rights of holders of traditional knowledge but also benefits society at large, including research institutes and firms that are potential partners. Lastly, it also leads to socio-economic upliftment of indigenous people or communities by alleviating their poverty and sustaining their livelihood. This is the reason developing nations like India demand IP protection for the traditional knowledge, which will provide the exclusive rights in the hands of the indigenous community, and further they can commercialize their valuable knowledge on their terms and conditions while restricting its misappropriation by powerful corporations of developed nations.

**Biopiracy in the Indian Context: BT Brinjal Case Study**

India is the hub of biological diversity and traditional knowledge associated with it. As a developing nation, it is a challenge for India to make a conducive environment for innovation, flourishing business, and IP protection, simultaneously, while also balancing the rights of indigenous or local communities, conservation of biodiversity, and preservation of traditional knowledge. The backlash that India faced in the case of Neem, Turmeric, and Basmati Rice later transformed into a success story in the form of the Traditional Knowledge Digital Library (TKDL) in India.[15] This section provides an insight into the Indian perspective of biopiracy and the need for preservation of traditional knowledge. It consists of the case

[13] Ibid.
[14] The Nagoya Protocol on Access and Benefit-sharing. https://www.cbd.int/abs
[15] Anurag Singh, "Recognition and Protection of Indian Traditional Knowledge: Issues and Challenges" 1 Institute of Legal Education 77 (2023).

study of BT Brinjal, which gives a deep understanding of the unethical practice of biopiracy and how it impacts the interests of local or indigenous communities.

India is among the 17 mega biodiversity countries identified by the United Nations Environment Program.[16] These indigenous species of plants and animals are an integral part of the traditional knowledge of India. These can be utilized for medicinal purposes in the fields of Ayurveda, Unani, and Siddha. Apart from it, there are tribal culture and practices, which is an indispensable part of India's Indigenous Knowledge. As these tribes are close to nature and usually sustain their livelihood from these natural resources, hence, they also take initiative for the conservation of the same. This traditional knowledge, due to its immense economic value often subjected to exploitation to the extent of its extinction. Due to the absence of IP protection for this traditional knowledge often led to discrimination and exploitation of the holders of this knowledge, as they didn't get equitable benefit, or their identity has been neglected. This happened in the case of Turmeric, Neem, and Basmati Rice, when a developed country like the United States got the patent protection on the aforementioned traditional knowledge of India. This was the time India changed its approach through strengthening the IP regime, led to the introduction of the GI Tag, and also it advocates for the rights of the indigenous community and demanded the amendment in TRIPS to bring traditional knowledge within the ambit of the IP protection regime.

To regulate the usage of traditional knowledge and to provide a safety wall, India has taken certain structural and legislative reforms over the period of time. At first, India adopted the Biodiversity Act 2002, in conformity with the Convention on Biological Diversity (CBD) 1992. Later, India adopted the Protection of Plant Variety and Farmers' Rights Act 2001 and the Patent (Amendment) Act 2005. This is to adapt to the international framework, such as the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) and TRIPS, respectively. Subsequently, India also started the collection of village-wise community data related to traditional knowledge, innovations, and practices, which were undertaken by various States. This was the first step in the direction of making computerized databases traditional knowledge, which is used in medicinal and other beneficial purposes. This system of computerized documentation resulted in the formation of the Traditional Knowledge Digital Library (TKDL). Such a digital database would enable Patent Offices all over the world to search and examine any prevalent use or prior art, and thereby prevent the grant of patents and biopiracy.[17]

Despite such robust efforts to detect biopiracy and to preserve traditional knowledge, India still faces the challenge of protecting the interests of indigenous communities due to the advent of biotechnology. One such case of biopiracy highlights this loophole. In the year 2011 National Biodiversity Authority (NBA) of India adopted a resolution to proceed legally against Monsanto and its Indian partner, Maharashtra Hybrid Seed Company (Mahyco), in which Monsanto and its Indian collaborators, the University of Agriculture Sciences (UAS) at Dharwad and Sathguru Management Consultant Pvt. Ltd., have 26% stakes. This case of biopiracy is related to the material and spiritual interests of local communities and farmers, who are the holders of traditional knowledge on biological resources.[18] Brinjal, which is an integral part of Indian cuisine and has religious significance in some parts of India. It is named as eggplant and cultivated by millions of farmers who have developed 2500 varieties. NBA alleged that the

[16] Traditional Knowledge and Biopiracy in India. https://sprf.in/wp-content/uploads/2021/02/16.6.2020_Traditional-Knowledge-and-Bio-Piracy-in-India.pdf
[17] Ibid.
[18] Walid Abdelgawad, "The Bt Brinjal Case: The First Legal Action Against Monsanto and Its Indian Collaborators for Biopiracy" 31 Biotechnology Law Report 136 (2012).

aforementioned three entities have violated the provisions of the Biological Diversity Act. They have access to the local brinjal variety to genetically modify it without the prior consent from the competent authority. This case originated from the complaint of the Karnataka Biodiversity Board, which alleged that in the year 2011 six indigenous varieties of eggplant, such as malpur, majarigota, kudachi, udupi, 112 GO and rabkavi were accessed by two companies without prior approval for the development of BT Brinjal.[19] It was contended that these aforementioned three entities entered into a sublicense agreement. This tripartite agreement has the common objective for the development and delivery of a "pro-poor variety of insect-tolerant eggplant. For this purpose, Mahyco has transferred the Cry1AC gene technology, which has integrated the soil Bacterium Bacillus thuringiensis into Brinjal.[20] This led to the violation of Sections 3 & 4 of the Biological Diversity Act, which obligates foreign companies or citizens who seek access to biological resources to acquire prior approval from the NBA. Though an exception was inserted under Section 5(1) of the said Act, which states there is no need for prior approval from the NBA in case of a collaborative research project which got approved by the Central Government, but in this case, it was stated that these entities do not fall under the ambit of said exception. Later in 2012 Environment Support Group (ESG) also filed the PIL in the Karnataka High Court. The High Court transferred the petition to the National Green Tribunal. After a decade Supreme Court has restored the PIL in the Karnataka High Court.

This case emphasizes two major issues. Firstly, it highlights the plight of farmers or indigenous communities who are the holders of these indigenous varieties of brinjal. As they couldn't afford genetically modified seeds of BT Brinjal because it leads to an increase in production cost, and they cannot restore it for another cycle. There are health concerns related to it, as pointed out by the medical experts, doctors, and experts, including that of the Doctors for Food and Safety, that GM foods have not been properly tested for human consumption and pose serious health risks.[21] Hence, the Government of India imposed a moratorium on BT Brinjals.

**Biopiracy in Red Sage: A Chinese Saga**

Biopiracy refers to the practice where indigenous knowledge of plants, animals, or traditional medicine is used without permission or compensation by outside entities, typically corporations or foreign researchers. One of the most prominent examples of biopiracy involves red sage (Salvia miltiorrhiza), a traditional Chinese herb used for centuries in Chinese medicine.[22] In the late 20th century, the controversial case of biopiracy surrounding red sage drew the attention towards the misuse of indigenous knowledge and resources. Red sage, also known as Danshen, has been used in traditional Chinese medicine (TCM) for thousands of years to treat a variety of health issues, related to cardiovascular diseases, blood circulation problems, and inflammation. The roots of this plant has commercial value due to the presence of an active compound, known as tanshinone, which is believed to have medicinal properties.

[19] India Cannot Ignore Moratorium and Risks to Bring Back Bt Brinjal. https://www.newsclick.in/India-Cannot-Ignore-Moratorium-and-Risks-to-Bring-Back-Bt-Brinjal

[20] Bt Brinjal biopiracy case: Apex court restores PIL in Karnataka HC after nearly a decade. https://www.downtoearth.org.in/wildlife-biodiversity/bt-brinjal-biopiracy-case-apex-court-restores-pil-in-karnataka-hc-after-nearly-a-decade-86439

[21] Bharat Dogra, "India cannot Ignore Moratorium and Risks to Bring Back Bt Brinjal", News Click, September 8, 2020. <https://www.newsclick.in/India-Cannot-Ignore-Moratorium-and-Risks-to-Bring-Back-Bt-Brinjal>

[22] Lili Wang, Rufeng Ma, et.al., "Salvia miltiorrhiza: A Potential Red Light to the Development of Cardiovascular Diseases" 7 National Centre for Biotechnology Information 1078 (2017).

The saga of red sage came into the limelight in 1990s when the researchers and pharmaceutical companies from United States started exploring the medicinal benefits of Chinese herbs. In 1993, the patent was granted to the team of researchers from the University of Mississippi for an extract of tanshinone (one of the active compounds in red sage) and its potential use in treating heart disease, from the red sage plant. At that point of time, the Chinese government and its people had no idea that their traditional knowledge was being commercially exploited, without giving them any compensation. The University of Mississippi and various pharmaceutical companies claimed intellectual property over tanshinone extraction and its use for medicinal purposes.[23] The grant of the patent meant that the commercial value and monopoly related to the medicinal uses of red sage was taken from the hands of Chinese people without compensation. As the herb gained the global attention in the market, the pharmaceutical companies began profiting from the sale of products which were derived from red sage, but China did not receive any royalties or economic benefits.

This case raised prominent questions related to the ethical issues surrounding biopiracy, where the indigenous knowledge of traditional healing and medicinal practices has been commercially exploited without the permission or acknowledgment to the local or indigenous communities associated with it. Many argued that this was a direct violation of the cultural heritage and intellectual property rights of the people who had cultivated and used the plant for centuries. Moreover, as the plant has gained prominent importance in the global market it, further put enormous pressure on the plant's natural habitat. As a result, this led to over-harvesting of the plant, threatening its sustainability in China. Additionally, the commercialization of the herb led to monoculture farming practices, which can undermine biodiversity.

Later, when the government realized what had happened, it took certain steps to protect its resources. In 1997, the State Intellectual Property Office (SIPO) filed a counterclaim in the U.S., arguing that the knowledge of red sage's medicinal uses had existed for centuries in Chinese tradition, and thus the patent wasn't valid. By 2002, the U.S. Patent Office revoked the patent, acknowledging that the medicinal properties of red sage were indeed part of a long-standing Chinese tradition. This was a major victory for China in its fight against biopiracy. The red sage case caught the attention of international organizations. The Convention on Biological Diversity (CBD), adopted in 1992, includes provisions to protect traditional knowledge and ensure that the benefits from these genetic resources can be shared with the countries and communities that provide them. Groups like the Third World Network (TWN) and the World Trade Organization (WTO) also pushed for stronger regulations to prevent the exploitation of indigenous knowledge without fair compensation.[24] As a result this debatable issue became the epicentre and as consequence brought various legal developments in China which aimed at improving the protection of traditional knowledge and preventing biopiracy. Several preventive measures were taken by China to protect its traditional medicinal resources by strengthening its patent laws and requirements for more detailed documentation of the origins of biological resources. Ratifying international agreements like the Convention on Biological Diversity (CBD), which aims to ensure that the benefits of genetic resources are shared fairly with the countries of origin. Emphasizing the importance of prior informed consent and benefit-sharing in any research or commercialization efforts involving traditional knowledge.

[23] Xuan Zhou, Zhi-Cheng Zhang, et.al., "Conservation Genomics of Wild Red Sage (Salvia miltiorrhiza) and Its Endangered Relatives in China: Population Structure and Interspecific Relationships Revealed From 2b-RAD Data" 12 National Centre for Biotechnology Information (2021).

[24] R.Alagu Mani, R.Dinesh Kumar, "An Analysis of the Issues and Challenges in the Protection of Indigenous Knowledge from Bio-Piracy in India" 4 Indian Journal of Integrated Research in Law 745 (2022).

The red sage biopiracy case is a strong reminder of how difficult it can be for many countries, especially those in the Global South, to protect their natural resources and cultural heritage from being exploited. It shows why the world needs a fair system that respects the rights of indigenous communities while allowing scientific progress and economic growth to happen in a balanced and sustainable way. Even though China eventually won the red sage case, it shed light on the bigger, ongoing struggle faced by indigenous communities everywhere—to safeguard their traditional knowledge and resources from being taken without proper recognition or benefit-sharing.

**Biopiracy in the Nigella Sativa (Habbat al-Barakah) Case**

The flowering plant Nigella sativa, sometimes called Habbat al-Barakah or black seed, is indigenous to South and South-west Asia. Many civilisations have long utilised their seeds for their therapeutic qualities, which include acting as an immune-stimulating, anti-inflammatory, and antioxidant.[25] The plant has great religious and cultural significance, especially in Islamic culture, where it is frequently used as a cure for a variety of illnesses.

The widespread interest in Nigella sativa in recent years has prompted a great deal of research and commercialisation, frequently without giving the people who have traditionally used the plant any credit or acknowledgement. Concerns regarding biopiracy have been raised by companies' attempts to patent different Nigella sativa extracts and compositions.

In the case of Nigella sativa, the main issue is the infringement of traditional knowledge. The applications of the plant are well known to many indigenous and local groups, but this information is often not recorded in ways that conform to traditional intellectual property frameworks. Because of this, businesses that patent Nigella sativa formulations or uses do so without acknowledging or paying the original knowledge holders.

Nestlé, the biggest food corporation in the world, is attempting to obtain a patent for the use of Nigella sativa to prevent food allergies. The business claims the plant's seed and extract when it is used as a medication or food ingredient. Nigella sativa is an ancient food and medicinal crop that is commonly referred to as habbat al-barakah in Arabic and commonly dubbed "black seed," "black cumin," or "fennel flower" in English. The Swiss behemoth's claims seem baseless because Nestlé's patent application is obviously anticipated by the traditional uses of Nigella sativa, and research from developing nations has already confirmed these traditional uses and further explained, in terms of modern science, the very medicinal qualities of black seed that Nestlé is attempting to claim as its own "invention."

**Biopiracy in the Enola Bean Patent Controversy**

A yellow variant of the common black bean (Phaseolus vulgaris), the Enola bean has its roots in Mexico. It became a mainstay in many culinary traditions due to its distinctive flavour and colour. John Proctor of PODS-NERS LLC was given a patent for the Enola bean by the U.S. Patent and Trademark Office in 1999, which caused a great deal of controversy.[26]

[25] Edward Hammond, I Biopiracy Watch: A Compilation of some recent cases 2013 23 (The Third World Network, Penang, Malaysia, 2013).

[26] Gillian N. Rattray, "The Enola Bean Patent Controversy: Biopiracy, Novelty and Fish and Chips" 1 *Duke Law & Technology Review* 1 (2002).

Mexican farmers have been growing the Enola bean for decades; therefore, the main focus of the issue was the claim of biopiracy. Without the permission of the indigenous tribes who had created and preserved the traditional agricultural variety, the patent, according to critics, effectively appropriated it. Concerns about the rights of local farmers and their contributions to agricultural biodiversity were brought up by this appropriation.

The Enola bean case brought to light important legal loopholes pertaining to traditional knowledge in intellectual property rules. The Enola bean is one of many native crop types that lack official documentation that would allow for patent protection. Because of this, businesses can claim ownership of what is really a community resource when they patent these kinds, so compromising the rights of the original growers.

The Enola bean patent dispute serves as an example of the difficulties in striking a balance between the preservation of traditional knowledge and intellectual property rights. It emphasises how crucial it is to value and acknowledge the contributions made by indigenous tribes to agricultural biodiversity. To ensure that traditional knowledge is honoured and safeguarded, the case emphasises the continued need for ethical bioprospecting and patenting procedures as well as legal reforms.

**Conclusion & Recommendation**

The correlation between biopiracy, ethics, and traditional knowledge is significantly complex. It has various dynamics attached to it. There are certain reforms that took place over the period of time in the field of Intellectual property. This field is constantly evolving, especially in developing nations, to match the pace of the international regime of IPR. Despite this, there are certain loopholes that creates the gap between the developing and developed economies. This paper provides a critical analysis of these drawbacks to ensure the protection of traditional knowledge while simultaneously focusing on strengthening the IP regime in developing nations. The IP protection of these natural resources and traditional knowledge will encourage the local and indigenous communities to regulate the usage of these indigenous resources according to their terms and conditions. This will also prevent biodiversity degradation and environmental damage. This also ensures the development of the nation through financial benefits and technological advancement.

The significance of IP protection can only be ensured through its utilization. Though all Intellectual Property rights are exclusive in nature and only focus on individual interest but one cannot negate the notion of public welfare. If people don't get access to their own natural resources in the guise of patent protection, it leads to the violation of their livelihood and the degradation of the environment. In order to create balance between the developed and developing world for preventing biopiracy and ethically utilising traditional knowledge, there are certain recommendations as follows:

1. Strengthen Legal Frameworks – there is a requirement for robust international and national legal frameworks to protect indigenous knowledge and biodiversity. The adoption of Nagoya Protocol to ensure Access Benefit Sharing (ABS), but there is a need for research to explore the effectiveness of these frameworks in preventing biopiracy and ensuring the fair and equitable sharing of benefits from genetic resources.
2. Enhance Community Rights - there is a need to reform TRIPS to make it in consonance with the provisions of CBD to provide protection to biodiversity. This will ensure the recognition of indigenous rights and empower the communities in decision-making processes regarding the use of their resources.

3. Practical Implementation of Informed Consent - Obtain Free, Prior, and Informed Consent (FPIC), which ensures that researchers obtain consent from local communities before accessing biological resources. This area remains unexplored as there are various developing and least developed countries that lack proper documentation of traditional knowledge. How can indigenous communities ensure they are not exploited or misrepresented when sharing their knowledge with external entities? We need proper implementation mechanism at global as well as national level to ensure this.
4. Transparent Practices & Power Dynamics - Encourage transparency in research and bioprospecting activities. Research is needed to better understand the power imbalances between multinational corporations, research institutions, and indigenous communities or developing countries.
5. Ethical Dimensions of Bioprospecting - While there is significant work on the ethical concerns surrounding biopiracy, there is still limited research on how ethical guidelines can be universally applied to diverse cultural contexts. What is deemed "ethical" can vary greatly depending on local traditions, knowledge, and values, making it difficult to create universal standards.
6. Increase Awareness and Education - Training Programs can be organised to educate researchers, policymakers, and communities about biopiracy and their rights. Public Awareness Campaigns can be held to spread awareness about the importance of biodiversity and the risks of biopiracy.
7. Support Sustainable Practices - Encourage sustainable use to promote practices that ensure the sustainable use of biological resources while protecting biodiversity. There is a need for funding to conserve and allocate resources for initiatives that involve local communities.
8. Establish Monitoring Systems - Develop databases to track the use of biological resources and associated traditional knowledge. Need to implement systems to monitor compliance with laws and agreements related to biopiracy.
9. Technological Advancements and Intellectual Property - Advances in biotechnology and genomics have made bioprospecting more complex, leading to challenges in intellectual property rights, patenting, and the commercialization of genetic resources. More research is needed on how intellectual property law can adapt to ensure fairness without stifling innovation, particularly in the context of biodiversity.
10. Foster International Cooperation – Need for effective global cooperation among international organizations to share best practices and resources. Engagement in the Multilateral Dialogues mechanism to participate in dialogues focused on biodiversity and biopiracy at international forums.