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A Comparative Review of the Socio-Economic and Agro-Ecological Impacts of Jhum Cultivation and Settled Agriculture

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Abstract
Jhum cultivation, a traditional form of shifting agriculture practiced in tropical mountainous regions, and settled cultivation represent two distinct approaches to agriculture with significant socio-economic and agro-ecological implications. This study provides a comprehensive review comparing these two agricultural systems. Jhum cultivation, integral to the livelihoods of tribal communities, involves periodic land clearing and burning, leading to soil degradation, reduced crop yields, and increased vulnerability to food insecurity. Despite its deep cultural roots, the sustainability of Jhum cultivation is compromised by environmental degradation and limited economic returns. Conversely, settled cultivation, characterized by permanent land use and the application of modern agricultural practices, generally offers higher and more stable crop yields, greater economic benefits, and improved socio-economic conditions. However, it also poses environmental challenges if not managed properly. This review underscores the need for sustainable practices that integrate the benefits of both systems while addressing their respective challenges to promote long-term agricultural viability and socio-economic well-being.

Keywords: *Jhum cultivation, settled agriculture, shifting cultivation, socio-economic impacts, agro-ecological effects, soil degradation, crop yields, sustainability, tribal communities*

INTRODUCTION
Jhum cultivation, also known as shifting agriculture, is an ancient farming practice widely followed by indigenous communities, particularly in the hilly regions of Northeast India and Southeast Asia [1]. This traditional method involves the clearing of forested land through slash-and-burn techniques, followed by short-term crop production before allowing the land to regenerate. While Jhum cultivation plays a vital role in sustaining the livelihoods of tribal populations, it also brings significant changes to both the socio-economic and agro-ecological systems. Over time, the increasing pressures of population growth, environmental degradation, and modern agricultural practices have raised concerns about the sustainability and long-term effects of Jhum [2].

The practice has both positive and negative effects on the socio-economic well-being of communities and the agro-ecological balance of mountain regions. On one hand, Jhum provides a means of survival and cultural identity for many tribal groups; on the other hand, it can lead to soil erosion, loss of biodiversity, and fluctuating crop yields. In contrast, settled agriculture, which involves permanent farming on the same piece of land, is often viewed as more sustainable and productive, though it requires more resources and infrastructure [3]. The primary objective of this review is to analyze the socio-economic and agro-ecological impacts of Jhum cultivation and compare them with settled agricultural practices. By examining both systems, the study aims to provide insights into their respective contributions to tribal livelihoods, environmental sustainability, and economic development.

Impact of Jhum Cultivation

The land degradation and deforestation caused by shifting cultivation pose serious challenges to the people. Among the major concerns is the invasion of exotic weed species, which is closely tied to the ecological characteristics of the area [4]. The effects of Jhum cultivation on soil and water resources, forest productivity, biodiversity, and the socio-economic conditions of the cultivators are outlined below:

1. Over the past decade, crop productivity has declined by 50%, even with the use of fertilizers and pesticides. For instance, rice yield dropped from 303 kg/ha in 1900 to 96 kg/ha in 1960, while other study observed better growth of ginger under zero tillage and mulch conditions in Bangladesh's hilly areas.
2. Jhum cultivation results in the depletion of 100 to 250 metric tons of topsoil per hectare annually in hilly region in India, significantly reducing soil nutrient levels.
3. Farmers face food shortages lasting between 2 to 6 months each year.
4. To sustain livelihoods, many farmers have turned to alternate occupations such as wage labor, animal husbandry, monoculture, and forest product extraction.
5. Hill cutting during Jhum has exacerbated landslides and caused siltation and flooding in nearby lakes.
6. Large financial investments are needed for repairing drainage basins and conserving water resources.
7. Frequent shifting of cultivation sites has severely impacted local ecology, creating forest canopy gaps and allowing invasive weed species to flourish.
8. Forest areas decreased from 1,215,636 hectares in 1980 to 828,745 hectares by 2010.
9. Repeated slashing and burning replaced native forests with secondary vegetation, including shrubs, exotic weeds, and hardy grasses, leading to the disappearance of several native species.
10. The shift from communal land ownership to private property has caused landlessness and poverty.
11. Many tribal communities have migrated within the hill areas or to other countries.
12. Jhum cultivation has disrupted habitats for forest birds, arboreal mammals, and plant species, leaving only a fraction of these species in the secondary growth areas created by the practice.

Effects of Jhum Cultivation on Socio-Economic Attributes

1. Jhum cultivation has long been intertwined with the socio-economic fabric of tribal communities, particularly in hilly and forested regions. As a subsistence farming method, Jhum plays a pivotal role in sustaining livelihoods by providing food security and maintaining cultural traditions passed down through generations. However, the practice also brings about complex socio-economic changes, which have far-reaching consequences for tribal societies [5].
2. One of the most notable effects of Jhum cultivation on socio-economic attributes is its role in shaping the economic structure of tribal communities. For many Jhumias (practitioners of Jhum), the economy is primarily based on agriculture, with little reliance on formal markets or monetary systems. This form of subsistence farming fosters a self-reliant economy where the primary focus is meeting household needs rather than generating surplus for trade. While this system ensures a degree of economic independence, it also limits the income-generating opportunities available to Jhum farmers, keeping many communities in a cycle of poverty.
3. Another critical aspect is the social organization within Jhum-based communities. The labour-intensive nature of Jhum farming often requires cooperative efforts, where families or entire villages work together in clearing land, sowing crops, and harvesting. This communal approach fosters social cohesion and mutual support systems, reinforcing traditional social structures and governance. However, as land availability diminishes due to population pressure or environmental degradation, conflicts over land use and resources can arise, disrupting the social harmony that has historically characterized these communities [6].
4. In terms of education and health, Jhum cultivation often presents challenges. The remote and often isolated nature of areas where Jhum is practiced means that access to education and healthcare is limited. Children from Jhum communities may face difficulties in attending school regularly, as they are often required to assist in agricultural activities. Additionally, healthcare facilities are typically scarce in these regions, and the shifting nature of Jhum makes it difficult to establish stable infrastructure. This, in turn, impacts the overall well-being and development of the community [7].
5. The evolving socio-economic landscape also includes the pressures brought about by external forces, such as government policies aimed at discouraging Jhum and promoting settled agriculture or other forms of development. These interventions, while intended to improve the socio-economic conditions of tribal communities, often clash with traditional practices and can lead to the erosion of cultural identity. As communities transition away from Jhum cultivation, they may experience both positive and negative economic shifts, including new opportunities

for income generation through settled farming or allied activities like horticulture and livestock rearing, but also increased dependency on external markets and a loss of agricultural self-sufficiency [8].

6. Overall, Jhum cultivation has profound effects on the socio-economic attributes of tribal communities. It provides a livelihood and a way of life, fostering strong social bonds and maintaining cultural traditions. At the same time, it limits economic growth, access to education and healthcare, and leaves communities vulnerable to external pressures, environmental changes, and land scarcity. Understanding these socio-economic dynamics is crucial to addressing the challenges and opportunities faced by Jhumias as they navigate a rapidly changing world.

Impact of Jhum Cultivation on Agro-Ecology in Mountainous Regions

Jhum cultivation, or slash-and-burn agriculture, is a prevalent farming method in the hilly regions of tropical Asia. It involves clearing forest patches, burning the vegetation, and sowing seeds in sloped fields between February and April, with crops harvested from July to December. Common crops include rice, maize, millet, and vegetables like cucumber and pumpkin. This shifting cultivation system moves every 1-2 years, allowing fallow periods for land regeneration and secondary forest growth. Jhum supports food security with a diverse range of crops but faces challenges from external factors like dam construction, which disrupt traditional practices. The International Centre for Integrated Mountain Development (ICIMOD) recognizes Jhum for its benefits in farming, forestry, and conservation, though its sustainability varies with environmental and socio-economic conditions. Jhum cultivation, widely practiced in the mountainous regions of India, particularly in the northeastern states, significantly impacts agro-ecology [9]. The practice involves clearing forest land, burning biomass, and cultivating crops for one or two seasons before shifting to a new plot, which leads to deforestation, soil erosion, and loss of biodiversity. The removal of forest cover disrupts the ecosystem, causing a decline in soil fertility due to the depletion of organic matter and nutrients. The slash-and-burn process also contributes to greenhouse gas emissions, affecting local climate patterns. The 1987 'Jhum Control' policy aimed to promote settled farming in Mizoram by establishing coffee, orange, and pineapple plantations. Focused on the Aibawk Community Development Block, it involved 22 villages and 17,128 people. Beneficiaries were supervised, given financial aid, freedom to choose trades, and educated through campaigns. However, challenges like oversized land allotments and insufficient financial support led to only partial success. After the 1991 elections, a new policy was introduced, marking a shift in approach. Moreover, frequent shifting reduces the fallow period, preventing the natural regeneration of vegetation and accelerating land degradation [10]. This destabilizes the ecological balance, negatively impacting water retention, leading to increased surface runoff and risks of landslides in steep terrains. Despite its long cultural association with tribal communities, Jhum cultivation poses serious environmental challenges, calling for sustainable agricultural practices and improved land management strategies to protect the fragile ecosystems in India’s mountainous regions. In Bangladesh, Jhum is widely practiced in the Chittagong Hill Tracts (CHTs), home to several tribal communities. For many, including the Chakma and Tongchonga, the soil from Jhum fields holds sacred significance and is even used in religious ceremonies. However, land-use changes over centuries, influenced by shifting governance from pre-colonial, colonial, and post-colonial periods, have had significant impacts on Jhum cultivation practices and the socio-ecological conditions of the communities involved [11]

Development of Agriculture and Allied Sectors in Jhum Cultivation

1. Jhum cultivation, also known as shifting cultivation, has been a central agricultural practice for many indigenous communities, especially in hilly and forested regions. Despite its significance to the cultural and livelihood systems of these communities, the sustainability of Jhum farming has been increasingly questioned due to its environmental impacts, such as deforestation, soil erosion, and loss of biodiversity. In response to these challenges, there has been a growing focus on developing agriculture and allied sectors within the framework of Jhum cultivation to improve productivity and promote sustainable practices [12].
2. Efforts to develop agriculture in Jhum cultivation areas often emphasize introducing more sustainable agricultural techniques. Another focus of agricultural development in Jhum areas is improving livestock management and animal husbandry. For instance, in India, the area under food grains increased from 2.62 lakh hectares in 2005-06 to 3.03 lakh hectares in 2015-16, reflecting a compound annual growth rate (CAGR) of 1.19%. During the same period, food grain production saw a significant increase of 1.95 lakh metric tons (MT), registering a CAGR of 2.50%. The yield also showed improvement, rising from 2400 kg/ha in 2005-06 to 2720 kg/ha in 2015-16, with a CAGR of 1.52%. This data indicates positive growth in terms of both area and productivity, underscoring the value of trend analysis in understanding these shifts [13].
3. Similarly, rice production in India, a staple food grown across both plains and hilly terrains (such as Jhum rice), experienced notable changes over the same period. The area under rice cultivation expanded by 2.24 lakh hectares between 2005-06 and 2015-16, although the CAGR was relatively modest at 0.38%. However, rice production rose by 1.89 lakh MT, achieving a higher CAGR of 2.50%, while the yield improved from 2172 kg/ha in 2005-

06 to 2937 kg/ha in 2015-16, with a CAGR of 2.40%. This analysis highlights how variations in rice cultivation,

especially in Jhum rice areas, are often influenced by rainfall, contributing to fluctuations in the total rice production area each year [14].

4. Furthermore, India favourable agro-climatic conditions present considerable potential for horticulture, particularly in fruit cultivation. Crops like pineapple, which is highly regarded nationwide, thrive in the region. However, despite the significant increase in the area under major fruits, from 33.18 thousand hectares in 2005-06 to 75.69 thousand hectares in 2015-16 (CAGR of 9.61%), production growth has not kept pace. Production increased from 5.23 lakh MT to 8.58 lakh MT (CAGR of 5.87%), yet productivity declined from 15.76 MT/ha to 11.33 MT/ha, registering a negative CAGR of 3.41%. The decrease in productivity, particularly in hilly areas, can likely be attributed to the erosion of fertile topsoil and farmers' inability to afford sufficient nutrients [12]. This trend emphasizes the need for targeted interventions to address the challenges faced in improving agricultural output. Livestock plays a crucial role in the livelihoods of Jhum cultivators, providing meat, milk, and manure, which is valuable for both nutrition and agriculture. Integrating animal husbandry with Jhum farming can create a more diversified and resilient agricultural system. Furthermore, livestock can serve as a financial buffer for Jhum farmers during periods of food scarcity or crop failure. Fisheries and aquaculture have also emerged as allied sectors with the potential to improve the livelihoods of Jhum farmers. In many regions, Jhum cultivation is practiced near water bodies, making it possible to integrate fish farming with traditional agricultural practices. Developing small-scale fisheries can contribute to food security and diversify income sources for Jhum farming communities.
5. The introduction of modern technologies, such as rainwater harvesting, terracing, and improved irrigation systems, also supports the development of agriculture in Jhum regions. These practices help reduce soil erosion, conserve water, and improve land productivity, making agriculture more sustainable in areas with fragile ecosystems. Furthermore, the promotion of organic farming methods, which reduce the need for chemical fertilizers and pesticides, aligns with the ecological sensitivities of Jhum cultivation regions.

Comparative Study: Socio-Economic Culture of Jhum vs. Settled Cultivation

Jhum cultivation, and settled cultivation, like terrace farming, represent two distinct agricultural practices that reflect the socio-economic and cultural characteristics of the communities practicing them. While Jhum cultivation has been a traditional method primarily practiced by indigenous tribes in hilly regions, settled cultivation is generally seen as a more modern and permanent method of farming. A comparative study of these systems offers insight into their respective costs, returns, and overall socio-economic impacts on the communities involved [9,10].

Costs Involved: Jhum cultivation is often perceived as a low-input agricultural system. It requires minimal investment in terms of monetary costs, as most of the labour is provided by family members, and the primary tools used are simple, such as machetes for slashing vegetation and sticks for planting seeds. However, Jhum cultivation demands a significant amount of manual labour for clearing forest patches, burning vegetation, and preparing the land for sowing. Moreover, the fallow periods required for soil regeneration after a few years of cultivation can lead to temporary land abandonment, which may create long-term opportunity costs in terms of reduced productivity [10]. In contrast, settled cultivation, particularly on terraced land, demands substantial initial investments in land preparation, irrigation infrastructure, and often fertilizers and pesticides. The cost of maintaining these terraces, including the construction of retaining walls to prevent soil erosion, is also high. However, settled cultivation tends to produce higher and more consistent yields over time, which offsets the initial setup costs through a more predictable and sustainable form of agriculture.

Returns on Investment: The economic returns from Jhum cultivation can be inconsistent due to its reliance on natural factors such as rainfall and soil fertility, both of which are variable in hilly terrains. The yields from Jhum cultivation tend to decrease over time as soil fertility diminishes. While Jhum farmers typically grow a diverse range of crops—such as rice, maize, millet, and vegetables—this diversity is often geared towards subsistence, with limited surplus for sale in markets. As a result, the financial returns from Jhum are generally lower compared to settled farming systems [13]. Settled cultivation, on the other hand, tends to be more commercially oriented. The yields are usually higher and more reliable, especially when combined with the use of fertilizers and irrigation systems. Farmers practicing settled cultivation are more likely to produce marketable surplus, enabling them to generate higher income. Cash crops, such as tea, coffee, and horticultural products, are often integrated into settled farming systems, further increasing economic returns and improving the financial security of the farming community.

Socio-Economic Impact: The socio-economic impact of Jhum cultivation is deeply rooted in the cultural practices of indigenous communities. Jhum is not only an agricultural practice but also a way of life that reflects the social, spiritual, and economic dimensions of tribal societies. It fosters communal labor and shared resources, as land is often considered a common property resource. This system reinforces social cohesion, interdependence, and a deep connection to the land and

the environment. However, as pressure on land resources increases and Jhum cycles shorten, the socio-economic

viability of this practice has been challenged, leading to issues such as food insecurity, poverty, and migration to urban areas [13]. Settled cultivation, on the other hand, tends to promote individual ownership of land and a more commercial approach to agriculture. This shift from communal to private land tenure systems can lead to increased land fragmentation but also fosters entrepreneurial activities among farmers. The potential for higher incomes through cash crop production or market-oriented farming enables communities practicing settled cultivation to invest in education, healthcare, and other socio-economic improvements. As a result, settled farming communities often experience higher standards of living and better access to services [11].

Environmental and Sustainability Aspects: One of the most significant differences between Jhum and settled cultivation lies in their environmental sustainability. Jhum cultivation, due to its cyclical nature, can lead to deforestation, soil erosion, and biodiversity loss, particularly when fallow periods are shortened. The environmental degradation associated with Jhum can also exacerbate socio-economic issues, as declining soil fertility leads to reduced crop yields and greater reliance on forest products for sustenance [10]. Settled cultivation, especially with modern agricultural techniques, can be more sustainable if practices such as terracing, crop rotation, and agroforestry are implemented. However, if not managed properly, settled cultivation can also contribute to soil degradation through overuse of chemical inputs and monoculture practices. Therefore, sustainability in settled cultivation depends heavily on the adoption of appropriate land management strategies [11].

CONCLUSION

This review highlights the distinct socio-economic and agro-ecological impacts of Jhum cultivation compared to settled agriculture. Jhum cultivation, deeply rooted in tribal traditions, provides cultural and subsistence benefits but faces challenges such as soil degradation, reduced crop yields, and limited economic returns. In contrast, settled agriculture, while requiring higher initial investment, offers more stable yields and greater economic returns, fostering improved living standards and socio-economic development. However, both systems face sustainability issues, emphasizing the need for adaptive management practices to balance cultural heritage with environmental and economic sustainability.

Future Consideration: Future research should focus on exploring sustainable alternatives to traditional practices like Jhum cultivation, integrating modern agricultural techniques with indigenous knowledge to enhance productivity while minimizing environmental impact. Additionally, more in-depth studies on the socio-economic outcomes of transitioning to settled agriculture, including the long-term effects on livelihoods and ecosystems, will provide valuable insights. Advancements in agroecological practices tailored to specific regions and climates, alongside policy support, can guide the development of more resilient and productive agricultural systems.

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