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Environmental resources and economic life in post-Mauryan India (200 BCE-300 CE)

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Abstract
The post-Mauryan period (200 BCE-300 CE) represents a crucial phase in early Indian history marked by political decentralization, the rise of regional kingdoms, and the expansion of agrarian and commercial networks across the subcontinent. A defining feature of this era was the close and dynamic interaction between environmental resources and economic life, which significantly shaped patterns of production, exchange, and settlement. This article explores how forests, rivers, fertile plains, mineral-rich zones, and climatic variations influenced agrarian expansion, pastoral activities, craft specialization, and the growth of inland and coastal trade. Drawing upon a wide range of sources including Sanskrit and Prakrit literary texts, inscriptions, numismatic evidence, and archaeological remains the study highlights the ecological foundations of economic activities and the adaptive strategies adopted by communities in diverse geographical regions such as the Gangetic plains, Deccan plateau, coastal belts, and forested hinterlands. Special attention is given to the role of forests as sources of timber, fuel, medicinal plants, and elephants, rivers as arteries of irrigation and trade, and minerals in the development of metallurgy and coinage. The article also examines the role of emerging states, land grants, and religious institutions, particularly Buddhist and Brahmanical establishments, in regulating, exploiting, and conserving natural resources through systems of taxation, donation, and patronage. By situating economic developments within their environmental context, the study argues that regional prosperity, economic diversification, and the integration of local economies into long-distance trade networks during the post-Mauryan period were deeply rooted in patterns of resource utilization and environmental adaptation, thereby laying the structural foundations for major socio-economic transformations in early historical India [1].

Keywords: Environmental resources, economic life, Post-Mauryan India, agriculture and trade

Introduction
The post-Mauryan period in Indian history represents a phase of significant transformation in political authority, social organization, and economic structures, following the gradual disintegration of Mauryan imperial centralization. In place of a unified empire, a variety of regional powers such as the Shungas and Kanvas in northern India, the Indo-Greeks and Shakas in the north-western regions, the Kushanas in the trans-regional zones of Central Asia and northern India, and the Satavahanas in the Deccan and peninsular India emerged and consolidated their authority. These political formations operated within diverse ecological and geographical environments, ranging from fertile river valleys and semi-arid plateaus to forested uplands and coastal regions, and their economic life was deeply embedded in the exploitation and management of local environmental resources [2]. Unlike the relatively uniform administrative framework of the Mauryan state, post-Mauryan economies were characterized by pronounced regional diversity, ecological adaptability, and increasing commercialization, all of which were shaped by variations in land use, water availability, forest resources, mineral wealth, and climatic conditions. Environmental history offers a crucial analytical framework for understanding the economic dynamics of this period by foregrounding the interaction between human societies and their natural surroundings. Environmental resources such as land, water systems, forests, minerals, and climate functioned not merely as passive backdrops to historical change but as active forces that influenced patterns of agricultural production, settlement expansion, craft specialization, and the development of internal as well as long-distance trade networks [3]. This article seeks to examine the reciprocal relationship between environment and economy in post-Mauryan

India by analyzing how specific ecological settings structured agrarian practices, pastoral activities, artisanal production, and commercial exchanges, while simultaneously being transformed by human intervention. It also explores the role of political authorities, land-grant practices, and religious institutions particularly Buddhist monasteries and Brahmanical establishments in mediating access to natural resources and shaping institutional responses to environmental challenges. By situating economic developments within their ecological context, the study aims to contribute to a more nuanced understanding of regional economic growth, resource management, and socio-economic change in early historical India [4].

Agriculture constituted the backbone of the post-Mauryan economy and was fundamentally sustained by the availability of fertile land, monsoon-dependent rainfall, and extensive river systems that supported expanding cultivation zones across the subcontinent. Major agrarian regions such as the Gangetic plains, the Krishna-Godavari delta, the Narmada and Tapi valleys, and the north-western plains benefited from rich alluvial soils and perennial or seasonal rivers, which facilitated stable agricultural production. These ecological advantages enabled multiple cropping patterns and supported the large-scale cultivation of staple crops such as rice and wheat, along with barley, millets, pulses, oilseeds, and cash crops suited to regional climatic conditions. Variations in rainfall and soil composition across regions encouraged diversified agrarian practices, reflecting a close adaptation of agricultural strategies to local environmental settings [5]. The post-Mauryan period also witnessed a gradual but significant expansion of agrarian frontiers through the clearance of forests and the settlement of previously uncultivated lands. Literary sources, inscriptions, and archaeological evidence suggest the transformation of forest tracts into arable fields, often involving the participation of tribal groups and Shudra communities as cultivators, laborers, and settlers. This process not only altered the ecological landscape but also reshaped social relations by integrating marginal communities into the agrarian economy. To cope with environmental constraints and uneven rainfall, irrigation practices became increasingly sophisticated, particularly in semi-arid regions of the Deccan, western India, and parts of central India [6]. The construction and maintenance of canals, tanks, wells, reservoirs, and embankments enhanced agricultural productivity, reduced dependence on monsoon variability, and ensured the generation of surplus essential for sustaining urban centers and trade networks. Land revenue emerged as a principal source of income for regional polities, making the effective management of environmental resources a matter of political and administrative significance. Rulers and local authorities actively promoted agricultural expansion by offering tax concessions, facilitating irrigation works, and granting land to individuals and institutions. Land grants to Brahmanas and religious establishments especially Buddhist monasteries played a crucial role in the colonization of new areas and the stabilization of agrarian production, while simultaneously linking ecological resources with emerging social hierarchies and ideological frameworks. Thus, the agrarian economy of post-Mauryan India was deeply embedded in environmental conditions, and its growth reflected a complex interaction between natural resources, technological adaptation, state policies, and social organization [7].

Forests constituted one of the most extensive and strategically important environmental resources in post-Mauryan India, deeply influencing patterns of subsistence, production, and socio-economic organization. Vast forest zones spread across central India, the Deccan plateau, eastern India, and the Himalayan foothills supplied a wide range of essential materials that sustained both rural and urban economies. Timber from forests was indispensable for the construction of houses, palaces, fortifications, carts, boats, and irrigation devices, while firewood remained the primary source of energy for domestic use, pottery, metallurgy, and other crafts. In addition, forests provided medicinal plants, edible fruits, roots, tubers, honey, wax, and resins, which were integral to local consumption, traditional healing practices, and ritual activities [8]. These forest resources ensured the survival of communities living in ecologically marginal regions and formed the economic base of a large section of the population outside the agrarian heartlands. Closely linked with forest ecology was the pastoral economy, which played a crucial role in sustaining subsistence life during the post-Mauryan period. Forest fringes, grasslands, and upland zones served as grazing grounds for cattle, sheep, goats, and other domesticated animals. Pastoral communities engaged in cattle rearing and animal husbandry contributed significantly to dairy production, supply of draught animals for agriculture and transport, and the availability of animal products such as milk, ghee, hides, wool, and meat. In regions where agricultural productivity was limited due to poor soil quality, uneven rainfall, or rugged terrain, pastoralism and forest-based livelihoods offered economic stability and ecological adaptability. These communities often practiced seasonal mobility, adjusting their subsistence strategies to climatic variations and resource availability, thereby maintaining a balance between human needs and environmental sustainability [9].

The economic importance of forests and pastoral resources is well attested in contemporary literary, epigraphic, and archaeological sources. Texts such as the *Arthashastra*, Buddhist and Jaina canonical literature, and later Puranic traditions refer to forest officials, hunting reserves, and regulated extraction of forest produce, indicating state awareness of the economic potential of these regions. Archaeological evidence further reveals the widespread use of forest products such as teak, sandalwood, bamboo, ivory, lac, and aromatic substances in craft production and trade. These commodities were exchanged in local markets and also formed part of long-distance trade networks connecting inland forest regions with urban centers and coastal ports [10]. Control over forested areas, therefore, implied access to valuable resources and revenue, encouraging regional states to gradually integrate forest zones into their administrative and economic systems. Despite increasing state intervention, forests continued to function as spaces of relative autonomy and cultural distinctiveness, particularly for tribal groups and marginal communities. These groups relied on hunting, gathering, shifting cultivation, and pastoral activities rather than intensive surplus-oriented agriculture. Their subsistence practices were closely attuned to ecological rhythms and emphasized collective access to resources rather than private ownership. However, the gradual expansion of agrarian settlements, land grants to Brahmanas and religious institutions, and the extension of

taxation into forest regions often disrupted these traditional systems [11]. As a result, forests became arenas of interaction, negotiation, and sometimes conflict between state authorities, agrarian settlers, and forest-dwelling populations. Thus, forests and pastoral resources in post-Mauryan India were not peripheral to economic life but formed a critical foundation of the subsistence economy and regional exchange systems. They supported diverse livelihood strategies, supplied raw materials for crafts and trade, and shaped social relations between settled and mobile communities. By examining forests as ecological, economic, and cultural spaces, this section underscores the central role of environmental resources in shaping the complexity and resilience of the post-Mauryan economy [12].

Mineral resources constituted a vital foundation of the craft-based and urban economy of the post-Mauryan period, significantly influencing technological development, production systems, and commercial expansion. Rich deposits of iron ore, copper, gold, silver, lead, zinc, and various semi-precious and precious stones were available in regions such as the Chotanagpur plateau, Rajasthan and the Aravalli range, the Deccan plateau, eastern India, and the Himalayan foothills. The systematic exploitation of these mineral-rich zones enabled the growth of metallurgy and stimulated the emergence of specialized craft traditions. Access to mineral resources not only enhanced regional economic potential but also shaped patterns of settlement and political control, as states sought to secure and regulate these strategically important areas. Iron, in particular, played a transformative role in the post-Mauryan economy. The widespread use of iron tools such as ploughshares, axes, sickles, and hoes contributed to agricultural expansion by facilitating forest clearance, improving tillage, and increasing productivity [13]. At the same time, advances in iron metallurgy supported the manufacture of weapons and military equipment, strengthening the coercive power of emerging regional states. Copper, bronze, silver, and gold were extensively used in the production of household utensils, ornaments, ritual objects, and prestige goods, reflecting both functional and symbolic dimensions of metal use. The availability of metals also underpinned the development of coinage systems, as evidenced by the proliferation of punch-marked, cast, and die-struck coins during this period. Numismatic evidence indicates an expansion of monetized exchange, market transactions, and long-distance trade, all closely linked to the circulation of mineral resources. The growth of mineral exploitation and metallurgical techniques fostered the rise of craft centers in urban and semi-urban settlements across the subcontinent. Cities and towns became hubs of artisanal activity, producing a wide range of goods including pottery, textiles, beads, metal implements, jewelry, glassware, and luxury items intended for elite consumption and export [14]. Craft production was deeply embedded in the environmental context, as artisans depended on locally available raw materials such as clay for pottery, fibers for textiles, natural dyes and mordants, wood and charcoal for furnaces, and metals and stones for specialized crafts. This close relationship between environment and craftsmanship highlights the ecological basis of urban economies in post-Mauryan India. Moreover, craft production was organized through occupational groups and guilds, which played an important role in regulating skills, training artisans, and facilitating trade. These guilds often received patronage from rulers, merchants, and religious institutions, further integrating craft activities into broader economic and ideological networks. Thus, mineral resources were not merely extractive assets but key drivers of technological innovation, craft specialization, urbanization, and commercial growth. By linking natural resource availability with artisanal production and market expansion, this section underscores the centrality of mineral wealth in shaping the complex and diversified economy of post-Mauryan India [15].

Rivers functioned as the primary lifelines of economic activity in post-Mauryan India, shaping patterns of settlement, communication, and commercial exchange across diverse regions. Major river systems such as the Ganga-Yamuna basin, the Indus and its tributaries, and the rivers of peninsular India including the Narmada, Godavari, Krishna, and Kaveri provided fertile alluvial plains that supported dense agrarian populations and generated agricultural surpluses essential for trade [16]. These rivers also served as natural highways, enabling the movement of goods, people, and ideas between rural hinterlands and emerging urban centers. Riverine transport was comparatively cheaper and more efficient than overland travel, thereby facilitating the circulation of bulk commodities such as grain, salt, timber, and raw materials, as well as high-value items including textiles, metals, and luxury goods [17]. Riverine routes were closely integrated with an expanding network of overland trade corridors that connected different ecological zones within the subcontinent and linked India to regions beyond its borders. Caravan routes traversed the north-western passes, the Gangetic plains, the Deccan plateau, and the eastern and western coastal regions, connecting inland production centers with ports and frontier markets. Through these routes, post-Mauryan India became an integral part of trans-regional exchange networks linking Central Asia, West Asia, the Mediterranean world, Southeast Asia, and the Indian Ocean trading system. Environmental geography played a decisive role in determining the alignment of these routes, as traders followed river valleys, mountain passes, forest corridors, and plateau edges that offered access to water, pasture, and shelter [18].

Coastal ecology and monsoon wind patterns were equally crucial in shaping maritime trade and commercial prosperity. Ports along the western coast, such as Bharuch (Barygaza) and Sopara, and those on the eastern coast, including Arikamedu and Tamralipti, flourished due to their strategic locations near river mouths, natural harbors, and hinterlands rich in agricultural and craft production. The predictable rhythm of seasonal monsoons enabled long-distance sea voyages across the Arabian Sea and the Bay of Bengal, allowing Indian merchants to establish regular commercial contacts with Roman, West Asian, and Southeast Asian markets [19]. Archaeological finds, including Roman coins, amphorae, and ceramics, testify to the intensity of maritime exchange during this period. India's exports during the post-Mauryan age consisted largely of commodities derived from its environmental resources, such as agricultural produce, spices, textiles, minerals, precious stones, and forest products like ivory, sandalwood, and aromatics. In return, Indian markets received gold, silver, wine, glassware, and luxury goods, further stimulating urban growth and craft specialization. Thus, rivers, trade routes, and commercial networks were deeply embedded in

the environmental landscape, and their expansion reflected the effective utilization of natural resources and ecological knowledge. By facilitating regional integration and long-distance exchange, these networks played a crucial role in transforming the economic life of post-Mauryan India and connecting it to the wider ancient world [20].

Urbanization in the post-Mauryan period was closely intertwined with ecological conditions and economic transformations, reflecting a dynamic relationship between natural resources, production systems, and settlement patterns. Urban centers developed primarily in regions endowed with fertile agricultural land, reliable water sources, access to mineral wealth, and strategic positions along inland and coastal trade routes. Cities such as Pataliputra, Mathura, Taxila, Ujjain, and Amaravati functioned as key nodes of administration, craft production, religious activity, and commercial exchange. These urban settlements depended heavily on surrounding rural hinterlands for food supplies, raw materials, labor, and revenue, thereby creating a mutually reinforcing relationship between urban and rural economies [21]. The ecological richness of these regions enabled sustained urban growth by supporting surplus generation and facilitating regional and long-distance trade. At the same time, the expansion of urban centers exerted increasing pressure on local ecological systems. The growing demand for timber, fuel, building materials, water, and food led to deforestation, overexploitation of natural resources, and stress on riverine and groundwater systems. Urban consumption patterns intensified resource extraction from forests and agricultural zones, often extending the ecological footprint of cities far beyond their immediate surroundings. The need to manage waste, water supply, and food distribution further complicated the ecological balance of expanding towns and cities [22]. These environmental challenges highlight the complex and often fragile relationship between urban growth and ecological sustainability in post-Mauryan India. Religious institutions, particularly Buddhist monasteries and Brahmanical temples, played a significant role in mediating the ecological and economic challenges associated with urbanization. Through land grants, donations, and endowments from rulers, merchants, and local elites, these institutions became major landholders and managers of natural resources. They supervised agricultural production, maintained irrigation works, managed forest resources, and facilitated the redistribution of surplus within local economies. While such institutional involvement contributed to economic stability, social welfare, and infrastructural development, it also reinforced existing social hierarchies and cultural norms by legitimizing patterns of land ownership and resource control. Thus, urbanization in the post-Mauryan period was not merely an economic phenomenon but a complex process shaped by ecological constraints, institutional interventions, and evolving social relations, underscoring the central role of environment in shaping economic change [23].

Post-Mauryan states increasingly recognized that control over environmental resources was central to economic stability, political authority, and territorial expansion. With the decline of Mauryan centralization, regional polities such as the Shungas, Kushanas, Satavahanas, and others developed administrative mechanisms to regulate land, water, forests, and mineral resources within their domains. Epigraphic evidence from this period reflects royal concern for agricultural productivity, irrigation infrastructure, and land revenue, indicating the emergence of early forms of environmental governance [24]. Rulers actively supported the construction and maintenance of canals, tanks, wells, embankments, and reservoirs to stabilize agrarian production and reduce dependence on uncertain monsoon rainfall. Land grants issued to individuals and institutions not only facilitated agricultural expansion but also served as instruments for integrating new ecological zones such as forest fringes, river valleys, and semi-arid tracts into the revenue system of the state. While the exploitation of natural resources increased in response to expanding agrarian, urban, and commercial demands, this process was often mediated by religious, ethical, and ideological frameworks that emphasized balance and harmony with nature. Buddhist traditions, with their emphasis on *ahimsa* (non-violence), moderation, and compassion for all living beings, encouraged restrained use of resources and respect for ecological life. Similarly, Brahmanical thought articulated concepts of *dharma* that linked righteous kingship with the protection of land, water sources, forests, and social order [25]. Religious institutions particularly Buddhist monasteries and Brahmanical temples played a crucial role in environmental management through land grants, donations, and endowments. As major landholders, these institutions supervised agricultural production, managed irrigation facilities, and regulated access to forests and water resources, thereby acting as intermediaries between the state, society, and the natural environment. Different social groups interacted with environmental resources in diverse and often unequal ways, shaping economic relations and cultural practices in post-Mauryan India. Peasants formed the backbone of agrarian production and were directly dependent on land quality, water availability, and climatic conditions [26]. Artisans relied on specific environmental resources such as metals, clay, wood, fibers, and natural dyes for craft production, while traders transformed rivers, mountain passes, forest corridors, and coastal routes into networks of commercial exchange. Shudras and tribal communities, often residing in forested and marginal ecological zones, played a vital role in cultivation, pastoralism, and resource extraction [25]. However, as these regions were gradually incorporated into expanding agrarian and state systems, such communities frequently experienced social subordination, loss of autonomy, and transformation of traditional subsistence practices [27]. The integration of marginal ecological zones into the mainstream economy led to profound changes in both society and landscape. Forest clearance, expansion of cultivation, and extension of revenue administration altered ecological patterns, while new forms of land ownership and social hierarchy reshaped community relations. These processes contributed to long-term historical change by strengthening state structures, expanding economic networks, and redefining human-environment relationships. Thus, environmental management in the post-Mauryan period emerged from a complex interaction between state policies, religious ideologies, and social practices, highlighting the central role of environmental resources in shaping the political economy and social transformation of early historical India [28].

The economic life of post-Mauryan India was inseparably embedded in its environmental context, where land, water, forests, minerals, and climate functioned as active forces

shaping patterns of production, exchange, and settlement. Agricultural expansion and surplus generation depended on fertile river valleys, monsoon rhythms, and irrigation systems; craft specialization and technological advancement were rooted in access to mineral and forest resources; and the growth of trade networks and urban centers was facilitated by rivers, coastal ecology, and monsoon-driven maritime routes. These processes produced marked regional diversity while simultaneously encouraging increasing commercialization and long-distance trade integration. The interaction between ecology and economy was further mediated by state policies, land grants, and religious institutions, which regulated resource use and linked environmental management with political authority and social hierarchy. Different social groups peasants, artisans, traders, Shudras, and tribal communities engaged with the environment in diverse and unequal ways, transforming both landscapes and social relations as marginal ecological zones were gradually incorporated into the mainstream economy. By foregrounding environmental resources as central determinants of economic life, this study demonstrates that post-Mauryan economic growth, urbanization, and social transformation cannot be understood without recognizing the ecological foundations of early Indian history, offering enduring insights into the long-term relationship between environment, economy, and society in the Indian subcontinent.

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