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# ECOLOGICAL SUCCESSION AND SOCIAL EVOLUTION: A COMPARATIVE STUDY OF ECOSYSTEM DYNAMICS AND MARXIST STAGES OF SOCIAL DEVELOPMENT

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**Abstract:**

*Human societies and natural ecosystems both undergo long-term transformations shaped by internal dynamics, adaptations, and structural changes. This study presents a comparative analysis of Marxist social development and ecological succession as parallel frameworks for understanding evolutionary processes in social and natural systems. Marxist theory explains societal progression through stages driven by contradictions between productive forces and relations of production, while ecological succession describes community changes from colonisation to relative stability. Recent developments in both fields challenge linear models, emphasizing non-linearity, diversity, and disturbance-driven change. By examining similarities and differences, this discussion highlights the continued relevance of these frameworks in interpreting complex, evolving systems and provides a multidisciplinary perspective linking social theory with ecological science.*

**Keywords:** *Marxist Theory; Ecological Succession; Social Evolution; Historical Materialism; Non-Linear Dynamics.*

## 1. Introduction

Human societies, like natural ecosystems, evolve through long, dynamic processes shaped by internal contradictions, adaptations, and transformations. Both Marxist social theory and ecological science offer systematic frameworks to study these transformations, though from different domains—one socio-economic and historical, the other biological and ecological. Karl Marx and Friedrich Engels described the progression of human society through distinct stages, each defined by its mode of production and class relations (1). Similarly, ecologists describe ecosystems evolving through ecological succession, a sequence of community changes from initial colonisation to a relatively stable climax community (2, 3).

Recent scholarship in both traditions complicates these linear models. Marxist theorists argue that capitalist development takes divergent forms and may not follow a uniform path toward socialism (4, 5). Likewise, ecologists now emphasise non-linear, patchy, and disturbance-driven succession rather than inevitable progression to a climax (6, 7, 8). The discussion examines the parallels between Marxist social development and ecological succession, highlighting points of convergence, divergence, and ongoing relevance.

**Marxist stages of social development**

Marxist theory of history, often referred to as historical materialism, argues that the development of human society follows a dialectical process shaped by the interaction between the productive forces (tools, technology and labour) and the relations of production (social and economic structures). According to Karl Marx and Friedrich Engels, human history progresses through a series of stages, each defined by its particular mode of production. These stages are not random or accidental; rather, they emerge out of the contradictions and crises of the previous stage, pushing society forward to new and more advanced forms of organisation (9). The major stages include:

***1. Primitive communism***

Primitive communism is the earliest stage of human society, dating back to hunter-gatherer bands and tribal communities. In this stage, there was no concept of private property in the modern sense. Land, tools, and resources were commonly shared among members of the community. Economic activity was based on subsistence, with individuals hunting, gathering, and producing for the group's survival rather than for profit. Social hierarchy was minimal, and decision-making was often collective.

Marx and Engels viewed this stage as both limited and egalitarian. Although technological advancement was very rudimentary—limited to stone tools, the use of fire, and the beginnings of agriculture—the society was egalitarian because the forms of exploitation that would emerge in later social systems had not yet appeared. There were no distinct social classes, and thus no systematic oppression. However, the scarcity of resources and the inefficiency of productive forces meant that life was precarious. This stage was destined to be transcended as human beings improved their tools and developed agriculture, which led to the creation of surpluses and, with them, inequalities.

***2. Slave society***

With the development of agriculture and permanent settlements, societies began producing surpluses. This gave rise to the earliest form of class society: slavery. In slave societies such as ancient Greece and Rome, a minority of free citizens owned land and slaves, while the majority—slaves themselves—were exploited for labour. Private property emerged as a defining feature, and social stratification became entrenched.

Slave society marked a significant advancement in productive forces. Large-scale agriculture, architecture, trade, and political organisation flourished. Yet it was also a deeply unstable system, reliant on coercion and oppression. The contradiction between slaveholders and slaves created constant social tension. Over time, these contradictions weakened the slave system, paving the way for its replacement by feudalism.

***3. Feudalism***

Feudalism emerged in medieval Europe and in similar forms across Asia. In this stage, society was organised around land ownership and the relationship between lords and peasants. The feudal lord owned the land, while peasants or serfs[*1] worked it in exchange for protection and a share of the produce. Unlike slaves, peasants were not considered property, but they were bound to the land and subject to the authority of the feudal elite.

Feudalism allowed for further advances in productive forces. Agricultural innovations such as the heavy plough, crop rotation, and irrigation systems improved yields. Cities began to grow, trade networks expanded, and early forms of markets appeared. However, feudalism was also rigid and hierarchical, with limited mobility for peasants and immense power concentrated in the hands of nobles and monarchs. Over time, the contradictions between emerging merchant classes, urban populations, and the stagnant feudal order grew irreconcilable. These tensions, alongside technological and economic changes, laid the foundation for capitalism.

***4. Capitalism***

Capitalism, according to Marx, represented both the most dynamic and the most contradictory stage of social development before socialism. It arose out of the decline of feudalism, spurred by the growth of trade, the rise of industrial production, and the accumulation of capital. In capitalism, the central relation of production is between the bourgeoisie (owners of capital, factories, and means of production) and the proletariat (wage labourers who sell their labour power).

Capitalism brought unprecedented advances in productive forces. Industrialisation, mechanisation, global trade, scientific discovery, and technological innovation transformed the world. Productivity soared, and wealth was generated on a scale never seen before. Yet capitalism was also riddled with contradictions. Its competitive nature led to the exploitation of workers, economic crises, inequality, and imperialist expansion. For Marx, these internal contradictions meant that capitalism could not sustain itself indefinitely. It would eventually give way to socialism, propelled by class struggle and workers' movements (1).

***5. Socialism***

Socialism emerges as the transitional stage between capitalism and communism. In socialism, the means of production are collectively or state-owned, and wealth is distributed more equitably. Unlike capitalism, where profit maximisation dominates, socialism emphasises social welfare, economic planning, and the gradual elimination of class distinctions. Workers no longer sell their labour to private capitalists but participate in collectively organised production.

Marx and Engels envisioned socialism as the result of revolutionary struggle, where the working-class overthrows capitalist structures. Socialism is not the final stage but an intermediary one. It still bears contradictions inherited from capitalism, such as bureaucracy, inequality in distribution, or the persistence of state power. Yet it represents a significant improvement, laying the groundwork for the full realisation of communism.

***6. Communism***

Within the framework of Marxist thought, communism is viewed as the culminating stage of historical and social transformation. It is a classless, stateless society in which the means of production are communally owned, exploitation is abolished, and distribution is based on need rather than profit. In communism, contradictions that drove previous historical stages are resolved: class struggle ceases to exist, private property is eliminated, and collective human freedom is maximised.

Marx and Engels described this as the stage where human beings can truly realise their creative potential, freed from the constraints of survival-driven labour and oppressive hierarchies. Just as the climax community in ecology represents a stable and balanced ecosystem, communism represents a stable and sustainable human society. It is not simply another phase in history but the resolution of the contradictions that propelled social evolution (10).

**Ecological succession**

Ecological succession is the gradual and orderly replacement of species within an environment, eventually forming a stable community. Clements (2) proposed the classical model, suggesting that succession follows a predictable path toward a climax community. Early ecologists like Cowles and Clements (11, 2) compared this process to the development of an organism that grows and matures over time. In this way, ecosystems, much like human societies, undergo progressive stages of transformation before reaching stability.

Succession can occur in a variety of environments, but the two most widely studied forms are hydric or hydrarch succession, which begins in water-dominated habitats, and xeric or xerarch succession, which begins in dry, bare, or nutrient-poor areas. Despite differences in their starting conditions, both follow similar principles: colonisation by pioneer species, gradual environmental modification, community replacement, and eventual stabilisation.

***1. Pioneer communities: The beginning of succession***

Every succession begins with a pioneer community, composed of the first species capable of colonising a new or barren environment. These pioneers are usually hardy and resilient organisms that can withstand harsh conditions and limited resources. In xerarch succession, which starts on bare rocks or deserts, pioneers are often lichens and mosses that can survive with minimal soil, water, and nutrients. Their biological activity gradually breaks down rocks into soil, allowing the establishment of grasses and small plants. In hydrarch succession, which begins in ponds, lakes, or wetlands, the pioneers are typically small phytoplankton, algae, or aquatic plants that thrive in waterlogged conditions.

Pioneer communities are comparable to the stage of primitive communism in Marxism. They represent simplicity, resilience, and collective adaptation to survival challenges. However, pioneers do not remain dominant; their very presence modifies the environment by producing organic matter, stabilising soils, or altering water content and paving the way for new, more complex communities.

***2. Seral communities: Transitional stages***

After the pioneer stage, succession proceeds through a series of seral stages - intermediate communities that gradually replace one another as conditions change. Each seral stage is more complex, productive, and stable than the previous one. Importantly, each stage modifies the environment in a way that makes it more favourable for its successor.

In xerarch succession, lichens break down rock into soil, which allows mosses to grow. Mosses contribute more organic matter, creating a thin soil layer that supports grasses and herbs. These are eventually replaced by shrubs, then small trees, and finally large forest trees. Similarly, in hydrarch succession, phytoplankton are replaced by rooted submerged plants, then floating vegetation, then reeds and marsh plants. As organic matter accumulates and water depth decreases, the habitat becomes suitable for grasses, shrubs, and eventually terrestrial forests.

These transitional stages resemble the successive social systems in Marxist theory—slavery, feudalism, capitalism, and socialism. Each stage is unstable, temporary, and bound to be replaced by the next. Yet each contributes something valuable to the process: greater productivity, more complex relationships, and better adaptation to changing conditions.

***3. The Climax community: Stability and equilibrium***

The final stage of succession is the climax community, representing ecological maturity and balance. In a given climate and region, the climax is characterised by the highest possible level of stability, biodiversity, and

productivity. For example, in tropical regions, the climax community may be a dense rainforest, while in temperate regions it may be a deciduous forest. The climax is resilient, capable of self-regulation, and resistant to minor disturbances.

The climax stage can be compared to communism in Marxist theory. It represents the resolution of contradictions and the achievement of long-term equilibrium. Just as communism abolishes class struggle and exploitation, the climax community stabilises species interactions, nutrient cycles, and energy flow. It is not static; small changes still occur, but it is stable in structure and function, maintaining itself without being replaced by another community unless a major disturbance occurs (such as fire, flood, or human interference).

**Hydrarch vs. Xerarch succession**

While both hydrarch and xerarch successions follow similar trajectories toward a climax community, their starting points are very different. Hydrarch succession begins in aquatic environments, where the main challenge is reducing water saturation. Over time, as sediment accumulates and plants grow, water bodies gradually transform into marshes, grasslands, and eventually forests. Xerarch succession, in contrast, begins in extremely dry or nutrient-poor conditions, where the challenge is the lack of soil and moisture. Through gradual soil formation and organic accumulation, the barren land evolves into a fertile habitat capable of supporting complex plant and animal life.

The contrast between hydrarch and xerarch succession highlights the adaptability of natural processes to different initial conditions. Similarly, Marxist stages of development do not unfold identically across all societies—some leap stages, others evolve differently—but the overall trajectory toward a more advanced and stable system remains consistent.

**Parallels between Marxist development and ecological succession**

***1. Primitive communism and the pioneer stage***

Primitive communism, based on communal resource-sharing and survival cooperation, parallels the pioneer stage of succession. Both represent foundational phases, built on resilience, simplicity, and collective survival strategies. Just as lichens and mosses enable future ecological complexity, early human cooperation laid the groundwork for more stratified social structures.

***2. Slave society and early competition***

The emergence of slavery resembles the introduction of early competitors in succession. In both cases, domination and displacement occur—slave societies concentrated wealth and power among elites, while stronger plant species displaced pioneer organisms. These systems were inherently unstable, giving way to more complex orders.

***3. Feudalism and intermediate communities***

Feudal systems parallel intermediate stages of succession, where diversity increases but stability remains elusive. Multiple power centres - lords, vassals[*2], clergy[*3] - resembled the competitive, layered dynamics of shrubs, grasses, and small trees. Though more developed than earlier phases, both systems were marked by fragility and frequent conflict.

***4. Capitalism and high competition***

Capitalism mirrors the height of ecological competition, where species diversity peaks and the struggle for dominance intensifies. Industrial expansion, urbanisation, and exploitation resemble the rapid growth and

competitive exclusion found in maturing ecosystems. In both cases, contradictions accumulate, destabilising the system and preparing conditions for transformation (Harvey, 2003).

***5. Socialism and transitional stabilisation***

Socialism can be compared to late-successional stages, where cooperative interactions - mutualism, resource recycling, balance - begin to dominate (Odum, 1969). Both represent systemic adjustments aimed at reducing conflict and stabilising development. However, just as late-successional communities remain vulnerable to disturbances, socialism is not fully stable and requires further evolution.

***6. Communism and the climax community***

Marx's vision of communism corresponds to the ecological climax community: an idealised endpoint of stability and harmony. In both frameworks, this represents a state of self-sufficiency, equilibrium, and absence of fundamental conflict (2, 12). Though largely theoretical and perhaps unattainable in absolute form, these stages serve as guiding ideals for systemic evolution.

In Marxist theory, social change occurs when tensions arise between productive forces and the relations of production, leading to revolution and restructuring (9, 13). Similarly, in ecological succession, processes such as competition, disturbance, and interactions between species and their environment drive continual replacement until a temporary balance emerges (7, 8). Both frameworks highlight the dialectical principle, where conflict acts as the engine of transformation.

**Conclusion**

The comparison between Marxist stages of social development and ecological succession reveals profound structural parallels. Both frameworks describe progression through stages, driven by conflict, contradiction, and adaptation, culminating in a vision of stability and balance. Primitive communism resembles pioneer communities; capitalism parallels competitive intermediate stages; and communism mirrors the idealised climax community. Yet, both social and ecological systems remain vulnerable to disruption, questioning whether any final, permanent stage is attainable. This recognition underscores the value of the analogy: it emphasises that history and ecology alike are dynamic, unstable, and open-ended. By examining society and nature through a shared dialectical lens, we gain a deeper appreciation for the interconnectedness of human and ecological evolution, and for the constant interplay of conflict, adaptation, and transformation that shapes both.

[*1] Serfs were unfree, indentured labourers in the medieval European and Russian feudal systems, legally bound to live and work on a specific lord's land. Unlike slaves, they could not be sold individually but were transferred with the land. Serfs owed labour and taxes to their lords, required permission to marry or leave, and were the lowest socioeconomic class.

[*2] Vassals were individuals in medieval Europe who pledged loyalty (fealty) and military service to a lord (suzerain) in exchange for land, known as a fief, and protection. This relationship formed the backbone of the feudal system, creating a hierarchy of personal loyalty, military obligation, and land ownership.

[*3] Clergy are leaders within established religions. Their roles and functions vary in different religious traditions, but usually involve presiding over specific rituals and teaching their religion's doctrines and practices.

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