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THE YELLOW RIVER BASIN, ECOLOGICAL MIGRATION AND CULTURAL ADAPTATION

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Abstract: Contemporary Research indicates a clear convergence and exchange between ecological migration and cultural adaptation in the Yellow River Basin (YRB). The findings show that ecological restoration initiatives have effectively increased vegetation cover and improved soil stability. However, relocated communities continue to experience cultural and social disruptions. Despite these challenges, migrants have demonstrated resilience through adaptive cultural practices, interethnic cooperation and the preservation of traditional ecological knowledge. Participatory approaches appear vital, as they support both ecological success and cultural continuity, with governance emerging as the decisive factor. The study concludes

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that sustainable development in the YRB must balance ecological rehabilitation with cultural vitality, recognizing that human adaptation and environmental restoration are mutually reinforcing pillars of socio-ecological sustainability.

Keywords: Adaptation, Balance, Basin, Culture, Ecology, Environment, Governance, Migration, Nature, Restoration, Sustainability.

1. Introduction

The Yellow River Basin (YRB) is more than a geographical region; it is a living arena where ecological change, human adaptation, and cultural development continuously unfold. Situated between the Tibetan Plateau and the loess-covered hills of the North China Plain, stretching down to its expansive delta, the basin represents a unique harmony between civilization and nature. It is widely regarded as the cradle of China's early agrarian society. Despite centuries of floods, droughts, and erosion, the YRB remains central to contemporary policy agendas aimed at balancing rapid modernization with ecological protection and sustainable development (Xu and Wang, 1–8). Throughout history, the Yellow River has been both life-giving and destructive—depositing rich silt while sweeping away plateaus and entire settlements. Today, the region faces modern environmental pressures in the form of urban expansion, mining, irrigation, and deforestation. Although considered one of the world's most vulnerable ecological zones, vulnerability tends to decrease from upstream to downstream, with challenges such as water scarcity and inequality persisting across the basin (Wang et al., 915–918). These environmental stresses complicate human–nature relationships, prompting local actors to view ecological migration not merely as relocation but as an opportunity for renewal and development.

Large-scale ecological engineering and migration projects, however, have often treated environmental governance and cultural transformation as separate issues. Contemporary studies rarely examine how ecological initiatives reshape cultural

identities, traditional knowledge systems and community resilience. Liang et al. (2024) argue that this gap prevents a full understanding of how ecological migration simultaneously transforms both environments and human lives across the diverse socio-economic contexts of the YRB (535–549). Many scholars are of the opinion that ecological migration in the YRB should be viewed not simply as an environmental intervention but as a form of cultural adjustment. Ecological change and governance structures have prompted communities to renegotiate new settlements, affecting livelihoods, social relations and identities among both migrant and host populations. From this perspective, ecological migration becomes a process in which environmental transformation and cultural adaptation are intertwined with basin-level governance, land-use reconfiguration and ecological risk management.

Home to roughly 160 million people and encompassing nearly eight percent of China's landmass, the YRB contributes nearly one-fifth of the nation's food and energy production (World Bank, 2024). Yet, excessive grazing, deforestation and over-extraction of water resources have severely degraded the ecosystem. Recent studies show that human activities have had a greater impact on vegetation loss than climate change (Gao, 1–21). The Loess Plateau, in particular, suffers from extreme soil erosion, sending millions of tons of sediment into the Yellow River every year (Chen et al., 682–698). In response, the Chinese government has implemented extensive ecological migration programs, relocating people from eroded or desertified areas to more secure environments. These initiatives seek to reduce human pressure on fragile ecosystems while promoting socio-economic improvement. Xu and Wang (2020) suggest that such policies could enhance ecological restoration, poverty alleviation and cultural revitalization across the basin (1–8). Yet, relocation also brings significant socio-cultural transformation: communities rooted in pastoral and agricultural traditions are suddenly immersed in modern urban or semi-urban settings.

The ecology–culture nexus is further mediated by governance structures. National development plans for the YRB

emphasize ecological compensation, zoning, and monitoring to align population distribution with ecological capacity (Xu and Wang, 1–8). Between 1980 and 2020, land-use patterns shifted dramatically as living spaces expanded, ecological zones were redefined and production spaces contracted in response to reforestation and restoration efforts (Jia et al., 1–15). Ecological migration policies, while aimed at environmental protection and poverty reduction, can also marginalize local knowledge and impose top-down cultural homogenization (Zhao et al., 63–72). Consequently, participatory governance becomes essential—not only to uphold cultural plurality but also to ensure the ecological success of restoration projects. The YRB Ecological Protection Project, supported by the World Bank, promotes a human-centered approach that involves all stakeholders in designing and implementing restoration strategies (World Bank, 2024). Liang et al. (2024) further advocate flexible governance systems that allow local cultural practices to coexist with ecological management requirements (535–549). Such governance shifts ecological migration from a model of relocation management to one of collaborative co-management, balancing ecological needs with cultural resilience. Taken together, the ecological vulnerabilities, migration dynamics and cultural accommodations observed throughout the basin offer valuable insights for environmental humanities and migration geography. Ultimately, ecological migration in the YRB is not an act of displacement but an ongoing negotiation among policy, culture and ecological conditions. Understanding the cultural dimensions of ecological migration is essential for achieving genuine socio-ecological sustainability in a region where the Yellow River has shaped human identity for millennia.

2. The Ecological Migration

Ecological migration has become a central concept in contemporary discussions on sustainability and development across environmental and social sciences. Broadly defined, it refers to the movement of people away from environmentally fragile or degraded regions toward areas more suitable for living

and working (McLeman and Gemenne, 2). It functions both as an adaptive response to environmental stress and as a deliberate policy instrument for ecological restoration. Scholars typically distinguish between passive ecological migration, where communities relocate voluntarily due to environmental deterioration, and active ecological migration, where resettlement is initiated or mandated by government intervention (Huang, 45–54).

In China, ecological migration emerged as a distinctive policy mechanism during the major ecological restoration initiatives of the 1990s, including the Grain for Green Program and the Western Development Strategy (Fu et al., 1–12). The Yellow River Basin, one of the country's key ecological zones, became an important site for these interventions, particularly those aimed at controlling soil erosion and restoring vegetation (Chen et al., 682–698). Yet, as Hugo and Bardsley (2014) argue, ecological migration in China extends beyond environmental management; it represents a broader socio-political project combining ecological modernization with rural restructuring (21–48). This perspective goes along with international research on climate-induced displacement, where migration is seen as simultaneously adaptive and potentially risky (Black et al., 3–11). Environmental migration theories emphasize the multi-causal nature of migration, shaped by interactions among environmental, economic, social, and political forces (Adger et al., 358–366). Within this global framework, China's experience adds a unique dimension: state-directed ecological migration that pairs large-scale ecological engineering with mass resettlement, generating complex challenges for livelihood reconstruction and cultural transition.

3. Basin Management and Ecological Governance

Ecological migration in the Yellow River Basin (YRB) must be understood within the broader framework of basin governance. River-basin governance is a territorial model that integrates environmental restoration, water security, and socio-economic development (Xu and Wang, 1–8). Scholars conceptualize the YRB

as a complex socio-ecological system in which human activities, hydrological dynamics, and policy interventions continually co-evolve (Liang et al., 535–549). Historically, governance of the Yellow River focused on hydraulic engineering—embankment construction, flood control, and water management (Chen et al., 682–698). However, since the 2010s, China has shifted toward an ecological-civilization paradigm that prioritizes harmony between human activity and nature. With the release of the 2019 *Outline of the Ecological Protection and High-Quality Development of the Yellow River Basin*, the region began to be framed not merely as a development corridor but as a crucial ecological security barrier (World Bank, 2024). Current YRB governance revolves around three major strands:

1. Ecological security and restoration, emphasizing land-use transformation and habitat recovery (Jia et al., 1–15).
2. Institutional coordination, aimed at addressing multi-provincial and multi-sectoral governance challenges (Xu & Wang, 1612–1623).
3. Socio-cultural integration, which recognizes local communities as active participants in the governance process (Liang et al., 535–549).

Studies employing systems-coupling models reveal progress in the ecological and economic domains, yet cultural coordination continues to lag behind. The evolving governance approach in the basin reflects the principles of adaptive governance, emphasizing flexible management, cross-scale coordination, stakeholder participation and continuous learning (Folke et al., 1–10). These principles have become increasingly influential in YRB restoration initiatives.

4. Ecological Resettlement Culture

Cultural adaptation lies at the crossroads of environmental anthropology and migration studies. Drawing on Julian H. Steward's (1973) cultural ecology theory, it proposes that cultural change emerges from the interplay between environmental constraints and new opportunities (Steward, 30–42). Later scholars expanded this perspective, arguing that adaptation is not

merely a passive adjustment to new conditions but a creative process in which communities reshape social practices, identities, and symbolic meanings in response to altered environments (Berkes and Turner, 479–494). Within ecological migration research, cultural adaptation concerns how displaced communities preserve, reinterpret and reconfigure their traditions, livelihoods and collective cohesion. In the YRB, for instance, traditional cave dwellings have been replaced by standardized concrete housing, disrupting spatial arrangements of kinship, ritual life and community interaction. Studies show that while migrants may initially experience cultural disorientation, over time they develop hybrid identities that blend older traditions with the rhythms of urban or semi-urban life.

This field also intersects with resilience theory, which understands culture as a dynamic resource that enables communities to absorb shocks and reorganize without losing their core identity (Adger et al., 358–366). Thus, the success of ecological migration cannot be measured solely through improved infrastructure or livelihoods; it also depends on cultural sustainability—how people rebuild their relationships with place, nature and community. Wu et al. (2024) reveal that in the YRB, communities with strong cultural cohesion and functioning local governance structures exhibit higher adaptation efficiency and better ecological outcomes (1–27). Globally, similar patterns emerge: mountain resettlement in Nepal, drought-induced mobility in the Sahel and coastal relocation in the Pacific Islands all show that cultural continuity is essential for long-term sustainability. However, the Chinese context differs significantly. Because ecological migration is often state-driven and implemented rapidly, communities have limited time to organically negotiate cultural norms or rebuild symbolic ties. This makes the integration of anthropological perspectives into ecological planning one of the most persistent—and urgent—challenges.

5. Mapping the Theoretical Terrain

To analyze ecological migration and cultural adaptation in the

YRB, scholars draw on several theoretical frameworks such as cultural ecology, resilience theory and political ecology. Cultural ecology explains how human societies adjust to environmental change through technology, social organisation and belief systems (Steward, 41–43). It makes us understand how YRB communities modify their subsistence practices and worldviews when relocated to new ecological contexts shaped by agricultural policy. Resilience theory introduces the idea of adaptive capacity—the ability of socio-ecological systems to absorb disturbances and reorganise while retaining essential functions (Gunderson & Holling, 21). In migration studies, it highlights how migrants rebuild livelihoods and identities in unfamiliar environments (Folke et al., 1–10). In the YRB, resilience is reflected in the persistence of shared rituals, informal support networks and reinterpreted heritage practices that cultivate belonging in resettlement areas.

Political ecology complements these perspectives by examining how power relations shape environmental and cultural outcomes. Scholars note that ecological migration is often embedded in state narratives of modernization and ecological civilization, which prioritize ecological targets over cultural diversity (Yin, 429–441). Thus, any study of adaptation must consider ecological limits alongside governance dynamics. Integrating these approaches, recent scholarship proposes composite socio-ecological models that illuminate feedback loops among ecosystem health, cultural vitality and governance effectiveness. These models reveal that sustainable adaptation depends on cultural inclusion and the recognition of traditional ecological knowledge as a core component of ecological governance.

6. An Interdisciplinary Approach

Despite growing research, key gaps remain. Existing studies focus on ecological indicators—vegetation recovery, soil stability, land-use efficiency—while neglecting identity, heritage and social memory. Most rely on single-site cases rather than comparisons across upstream, midstream and downstream regions, limiting

understanding of geography's mediating role. Longitudinal ethnographies are also missing, though adaptation may be economically measurable in the first generation and culturally complex in later ones, where identities become stigmatized or place-detached. Moreover, the YRB is rarely examined globally as a state-led Anthropocene migration project. To address these gaps, one needs to adopt an interdisciplinary approach combining ecological geography, migration studies and anthropology.

Ecological migration in the Yellow River Basin (YRB) is spatially uneven and shifts over time under complex environmental pressures. Severe upstream soil erosion, grassland desertification, and downstream groundwater depletion have driven significant population resettlement. NDVI data (1982–2022) show that vegetation cover in Qinghai's resettlement zones has improved, largely due to state-led restoration and grazing restrictions (Yu et al.). Likewise, the Grain for Green programme reduced erosion intensity in Shaanxi's middle reaches by about 15% (Chen et al.). To strengthen ecological protection, the World Bank approved a USD 300 million initiative for the YRB in 2024, while China has relocated roughly 3.2 million people through ecological migration programmes, particularly in the Loess Plateau and desertified regions. These movement patterns reveal deliberate state planning that channels migrants toward productive lowlands and peri-urban zones (Xu & Wang). The resulting spatial reorganisation links environmental relief with broader goals of economic modernization.

However, ecological outcomes do not always translate into human welfare gains. Studies from Qinghai show that areas fully depopulated under migration programmes experienced faster vegetation recovery than partially relocated zones, where competing land-use pressures persisted (Liang et al.). Although complete withdrawal can accelerate ecological restoration, it may also disrupt cultural continuity and weaken social networks until new community structures emerge elsewhere. Consequently, ecological migration tends to meet environmental targets more effectively than social or cultural ones—an imbalance echoed in other environment-induced mobility contexts (Adger et al., 2011).

Livelihood transition is one of the most visible consequences of ecological migration, as confirmed through field interviews and direct observation. In Qinghai, Shaanxi and Henan, many households shifted from subsistence farming or herding to mixed non-agricultural work. Greenhouse agriculture and ecotourism developed around wetland reserves, while in Shaanxi, migrants commonly entered small trading, construction and transport-related occupations. Survey data from 2023 indicate that nearly 72% of relocated families experienced improved income security, with household earnings rising by about 30% within three years (Zhu & Pan). Yet disparities remain. Older migrants—particularly those over fifty—struggled to adapt to non-agricultural labour markets, whereas younger migrants benefited more from government-supported vocational training (Huang).

These patterns bring forth the significance of resilience theory, which highlights adaptive capacity—the ability of individuals or systems to reorganize without losing core functions (Folke et al.). In the YRB, resilience appears economically through diversified livelihoods and institutionally through state investment in infrastructure and skills development (Xu). However, cultural resilience often diminishes as economic resilience strengthens. As one respondent noted: "We now live in better houses, but we no longer sing the mountain songs." Such reflections underscore that adaptation cannot be measured solely in material terms. International research similarly shows that migration as an adaptive strategy may reduce socio-cultural attachment even as it mitigates environmental risks (Black et al.). Thus, livelihood recovery after ecological migration should be understood not as a complete solution but as one element in a broader adaptive process that includes emotional, social and cultural dimensions.

Ecological migration in China brings together cultural adjustment, governance and sustainability. Spatial reconstruction often replaces traditional *yaodong* cave dwellings with uniform concrete houses, improving hygiene but weakening kinship bonds and shared social spaces (Jia & Zhang). Migrants maintain

spiritual continuity through ritual recontextualization—transporting soil and stones from their original homes to build shrines—reflecting the idea of culture as an adaptive ecological system (Steward). Through ongoing identity negotiation, resettled communities in Henan frame themselves as ecological contributors rather than refugees (Fan), though stigmas such as the label *Yimin* persist (Zhu & Pan). Over time, resilience emerges through hybrid identities, intercultural learning (Berkes & Turner), and the integration of traditional ecological knowledge into reforestation initiatives, which makes migrants active partners in restoration (Liang et al.).

Governance across the Yellow River Basin remains highly centralized and focused on measurable ecological outputs. Yet, Qinghai shows that involving residents in ecological councils improves compliance and vegetation recovery. In contrast, Henan's top-down approach fosters alienation, while Shaanxi's participatory, feedback-based model demonstrates the strengths of adaptive governance. Nonetheless, state priorities continue to privilege ecological reporting over cultural well-being. Regional comparisons show distinct trajectories: Qinghai–Gansu achieves ecological success but faces cultural loss; Shaanxi maintains a better balance by incorporating ecological heritage; and Henan's rapid urbanization leads to the erosion of rural culture. These findings affirm insights from cultural ecology (Steward), resilience theory (Adger et al.), and political ecology (Fan).

4. Conclusion

Ecological migration in the Yellow River Basin (YRB) represents both a major environmental success and a profound social transformation. The findings show that while migration policies have significantly improved vegetation cover, soil stability, and water balance, the human dimension is equally crucial. Experiences of relocated communities reveal that sustainability cannot be reduced to ecological recovery alone. True resilience depends on policies that also protect cultural identity, strengthen social cohesion, and ensure community participation in decision-making. The transformation of basin communities illustrates that

adaptation is both a creative renewal and a survival strategy. Migrants forge new relationships with the land and cultivate emerging identities and traditions suited to their ecological surroundings. This reflects a resilience rooted in transformation rather than mere preservation, embracing cultural learning, innovation, and hybrid practices. Yet the findings also caution against social costs: ecological gains can be undermined when cultural integration is overlooked, producing artificial landscapes devoid of human continuity.

For ecological migration to be genuinely sustainable, it must evolve into an integrated socio-ecological programme that places ecological restoration and cultural vitality on equal footing. This shift requires moving beyond quantitative ecological indicators toward qualitative assessments of community well-being, cultural continuity, and participatory governance. Adaptive management offers a pathway by giving local residents a voice and embedding traditional ecological knowledge within contemporary restoration efforts. Cross-regional learning across the YRB should also be encouraged to generate solutions responsive to diverse environmental and cultural contexts. As the YRB experience shows, the future of ecological migration lies not simply in relocating people, but in harmonizing environmental renewal with human meaning. Enduring cultural heritage must be able to flourish within sustainable landscapes—communities capable of thriving ecologically, socially, and spiritually while contributing to the healing of nature.

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