www.stemmaresearch.com ISSN (Online): Applied

STEMMA International Research Journal

(International Open Access, Peer-reviewed & Refereed Journal)

(Multidisciplinary, Bimonthly, Multilanguage)

Volume: 1 Issue: 1 September-October 2025

Economic Zoology and Biodiversity Conservation: A Theoretical Framework

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Abstract

Economic zoology and biodiversity conservation together represent an emerging interdisciplinary domain that links ecological integrity with sustainable economic development. This theoretical framework focuses on understanding how zoological resources contribute to human welfare and how economic activities, in turn, influence biodiversity patterns. It integrates the principles of ecology, economics, and environmental science to evaluate the monetary and non-monetary value of living resources. The discussion emphasizes the importance of bio economic models in assessing species conservation, ecosystem services, and long-term ecological sustainability. By connecting biodiversity management with economic incentives and policy mechanisms, the framework promotes efficient resource utilization and equitable benefit sharing. It also explores the need for institutional support, global cooperation, and adaptive governance to mitigate biodiversity loss and strengthen ecological resilience. Overall, the approach underscores that biodiversity conservation is not merely an ecological obligation but also a vital economic strategy essential for maintaining sustainable livelihoods and global environmental balance.

Keywords: Economic Zoology, Biodiversity Conservation, Ecosystem Services, Sustainability, Bio economics, Resource Management, Ecological Economics.

Introduction

Human intervention on the planet directly affects the persistence of biodiversity, the variety of life on Earth. Despite increased international efforts to conserve wildlife, ecosystems and habitat around the globe, biodiversity is lost each day. Definitions of biodiversity abound, but the Convention of Biological Diversity of United Nations (1992) states it simply as: "the variability among living organisms from all sources, including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part, this includes diversity within species, between species and of ecosystems". Academic literature distinguishes between three components of biodiversity: genetics, species and ecosystems. Insects, which account for 70% of earth diversity and play key roles in crop pollination and control of crop pest, are of major concern.

Conceptual Foundations

The degradation of the natural environment has sparked social concern for biodiversity loss and its catastrophic impact on the entire socio-economic system. The notable biodiversity loss is a result of a 99% decline of species that became extinct on islands before humans arrived and the extinction of 1,167 vertebrate species in contemporary times, including that of the passenger pigeon and the thylacine, has been witnessed. The collapse of the fishing industry in the 1960s and vanishing butterfly species in European countries also serve as reminders of biodiversity loss. Tackling biodiversity loss has become an urgent issue for both mankind and the entire ecosystem. The concept of economic zoology has emerged to incorporate the economic aspect of nature conservation into environmental theory. It is analogous to the concept of economic anthropology, which focuses on the economic aspect of social structure and anthropological observation. Economic zoology seeks to introduce the concept of economic consideration into the analysis of fauna from a zoological perspective and expand the existing concept of conservation. Biodiversity conservation, in conjunction with economic zoology, offers a broader theoretical framework in species, population, ecological, and environmental economics to incorporate the dynamic spatial-temporal interactions, inter- and intra-generational decision-making, and "equity-theoretic" consideration of biodiversity loss and species extinction into the theory of nature conservation and the long-run economic performance of an economy.

Methodological Considerations

Economic zoology comprises broad topics, including the interplay of economic and biological systems; the role of historical geography and the geographic distribution of species in understanding the development of economic systems; and the influences of physical environments on economic systems. Economic zoologists emphasize core concepts rather than methodologies and incorporate topics not detected by more conventional approaches.

The prevailing theoretical scope in economic zoology comprises four key concepts: that economic systems consist of interrelated historical–geographical systems; that the various components of an economic system exert uneven influences over other components; that conditions affecting distinct aspects of the grouping have diverged historically, exerting cascading influences across the components; and that floods, droughts, earthquakes, temperature extremes, and tropical diseases exert systemic limitations on economic development. Biodiversity conservation prioritizes permanent survival of species, habitats, and ecosystems. Economic zoology highlights critical interdependencies among those forms of conservation and identifies several dimensions that challenge conservation efforts. One dimension relates to the direct importance of biological resources in economic systems. Modeling of long–run equilibria connects rates of consumption of biological resources to specifications of the forms of economic development. A second aspect delineates the influences of economic factors and conservation measures on interactions among biological resources. Modeling shows that the size and similarity of resource inputs within a system affect interactions and, thus, conservation along those dimensions. Interactions among variables conditional on system characteristics can change qualitative regimes and shape conditions for sustainable resource exploitation.

Biodiversity encompasses diversity among living species at levels ranging from genetic through organismal to habitat, comprising 7 to 100 million distinct species. Literature emphasizes non–economic considerations, whereas economic valuation remains foundational for economic zoology. Existence value, use value, and option value comprise three primary lifelong-but-diminishing preferences associated with biological resources. Contingent valuation, auctions, and economic-hedonic approaches represent major elicitation techniques, complemented by revealed-preference and stated-preference aggregations.

Conceptual Modeling: Biodiversity is of strategic importance for the business sector, providing raw materials and natural assets essential for many enterprises. It supports industries such as ecotourism, agriculture, forestry, fisheries, pharmaceuticals, and food processing. All economies and businesses depend, directly or indirectly, on biodiversity and its resources, which underpin all ecosystem services that support economic activity and property. Biodiversity also provides ecological, aesthetic, and ethical advantages. The concept of Business Biodiversity refers to commercial enterprises that generate profits while conserving biodiversity, using resources sustainably, and sharing benefits equitably.

Wildlife is crucial for risk management in semi-arid savanna livelihoods dependent on rainfall. Seasonal livestock value depends on market supply, demand, and rainfall, while wildlife value depends only on market demand. Investing in wildlife promotes efficient land-use diversification and insurance against drought risks. Introducing wildlife conservation as a land use diversifies operations and hedges risk. Such initiatives may improve livelihoods around them, especially in coping with drought risk, depending on the profitability of irrigated agriculture. It is imperative to control livestock and human densities surrounding parks for sustainable natural resource management. This approach contributes to the understanding of how people balance conservation and development objectives in systems with variable rainfall.

Conceptual modeling of biodiversity–economy interactions incorporates ecological and economic data to inform decision-making. Decision models estimate the optimal share of land to preserve for biodiversity and associated economic costs. They link models for ecosystem and species population dynamics, estimating land required for conservation, revenue forgone, and timing of land-use change. Several modeling frameworks for the biodiversity–economy interface have been applied to ascertain conservation priorities given limited resources as well as to examine unexpected economic shocks that staunch progress towards conservation goals. Various bioeconomic models investigate the relationship between biodiversity and economic activity through a mix of land-use activities, while additional economic-ecological interfaces highlight the preconditions for biodiversity provision by ecosystem services when pursuing further economic development.

Economic Valuation of Biodiversity: Biodiversity can represent a societal asset endowed with economic value. Economic valuation encompasses the assignment of economic benefits to biodiversity entailing the assessment of social welfare increments triggered by biodiversity changes through preference elicitation. Core distinction exists between existence values with non-use preferences and use values comprising direct, indirect, and option values. Elicitation of willingness-to-pay includes both household-ranked and collective-preference formats demanding stratification on the valuation context. Aggregation of preferred-potentials utilises both majority-rule and electoral-voting frameworks where strategy-proofness needs evaluation.

Population Dynamics and Resource Sustainability: Economic zoology and biodiversity conservation continue to attract considerable attention. Population dynamics builds upon existing principles while recognizing the significance of sustainable resource exploitation and the potential threats posed by economic growth and trade through neglect or over-exploitation of these vital resources. Sustainable Population growth has been a focal point of economic literature and research, with prior investigations addressing its correlation to economic growth through the concept of the demographic transition. However, past studies fall short of an economic analysis or a comprehensive examination of the economic-ecological connections involved, thus providing justification for the present undertaking.

The need to stimulate rapid economic growth to improve human welfare is often counter-terrorism is countered by the recognition that growth can pose serious threats to species' survival. Yet, neither of these considerations sufficiently tackles the question of sustainable resource extraction when economic growth is a stated or implied objective. Characterising a resource as potentially common-property resource, the challenge of economic growth arises in situations where human societies and institutions are currently unable to establish property rights over a growing number of species and ecosystem functions that must remain intact for future generations. Rather, the current focus is on exploring models of resource dynamics that underline the nature and implications of environmental interactions within a theoretical framework.

Policy Analysis and Scenario Planning: A critical first step in addressing the biodiversity crisis is to frame a suitable theoretical lens for examining the research problem. Such a framing needs to clarify the specific research visions guiding the overall inquiry, the principal concepts denoting those visions, the secondary topics recast through economic-ecological lenses, and the emerging stylised facts generating theoretical propositions capable of aiding the understanding and resolution of the research problem.

The principal analytical focus concerns the economic-ecological interfaces between economic activity and biodiversity conservation. Policy decisions often attract individual and collective attention because they can significantly influence population- and ecosystem-level dynamics in the longer run and have important ramifications for many other conservation activities. Furthermore, policy development bears directly upon theoretical research—specifically, theory development can contribute to knowledge about these interfaces without necessarily becoming entangled in the broader question of optimality. The analysis of policy and scenario characterises their future evolution, propagation, and uncertainties through the use of simplified conceptual and quantitative representations of changing ecological, financial, and institutional conditions. Counterfactuals track critically differing assumptions. When large uncertainties pervade concern for the long-term fate of economic-ecological interfaces, a careful distinction between time discounting of current and future welfare and effective propagation of partial uncertainties affecting factor-product, input-output, output-target, and stock-flow relationships becomes paramount. One policy-relevant question investigates how biological, economic, and institutional aspects change over time and whether those trends are positively, negatively, or neutrally correlated. A second illustrates the extent to which the biological foundation is expected to chart distinct trajectories within the same geographical space.

Economic-Ecological Interfaces

The work ultimately translates biodiversity interaction into economic and societal outcomes through theory and modelling. Three theoretical dimensions of biodiversity, ecosystem service provision, and conservation or degradation are connected to highlight interactions that fall within economics, termed 'economic-ecological interfaces'. Three economic-ecological interfaces are identified:

(a) The interaction of ecosystem services with biodiversity affects collection and supply when the ecosystem is monetized, providing the basis for economic geography that links economic-societal features to biodiversity.

(b) The connection of biodiversity to economic policy and the ability to model species richness generates a theory that links economic-societal outcomes to biodiversity.

(c) The link of species extinction to policy without conservation measures and the population dynamics condition for conservation hairs the still wider condition that economic growth or welfare converges to a level derived only from a policy-respecting resource implies further population requirement.

Goods and services from ecosystems are referred to as ecosystem services. Ecosystem services can be conveyed to society through markets or non-markets. According to the United Nations (2005), it is estimated that ecosystems provide goods and services worth between 16 and 54 trillion US dollars globally, although efforts to monetize ecosystem services often underestimate rather than overestimate their value, these figures nevertheless indicate the substantial economic value of ecosystems; hence, societies that regard them as an externality rather than an internality may not exhibit a long-term resource-optimizing equilibrium. For ecosystems to be included in education, they must be displayed on the balance-sheet of a society, therefore, initial efforts are naturally directed to examine whether a convex and positive price can be observed on some good emanating from an ecosystem. According to the World Resources Institute (2008), about 50% of the goods provided by ecosystems remain outside formal economic mechanisms.

There is a potential for monetizing ecosystems via non-markets, which can be permitted through stated preferences or revealed preferences, often experimental in approach. A preliminary approach is to determine a minimal or non-monetizable ecosystem that possesses no substitute available in the market, in this case, it is necessary to show that no such a minimal ecosystem condition is satisfied in any viable circumstances for examining the general form of ecosystem modeling.

Ecosystem Services and Market Mechanisms: The ecosystem services concept links ecological systems with the economy. Ecosystems provide a range of services, from clean water to carbon sequestration. Promoting these services through market mechanisms offers the potential for greater availability of goods and, with appropriate management, increased sustainability. The concept has gained prominence among both practitioners and researchers, with calls for greater attention to the interplay between market mechanisms and the provision of ecosystem service. Benefits include a clearer understanding of the causal linkages between ecosystem changes and human well-being, increased attention to valuation, an improved understanding of the role of ecosystem service regulation, and an opportunity to spot synergies with long-term economic growth and poverty reduction. The economic discourse around market-based instruments and ecosystem services continues to evolve. Initially framed as methods to promote sustainable development through economic growth, it has broadened to encompass market failures, the operation of governance structures, and the potential for adverse ecological side-effects. Nevertheless, significant limitations constrain policy design and implementation.

Incentive Structures for Conservation: Conserving habitats and species is fundamental for sustaining nature's wealth and fulfilling humanity's global survival and prosperity aspirations. Economic zoology—addressing the economic dimensions of animal existence—constitutes an approach to biodiversity conservation that seeks to overcome the recurring failure to address the issue successfully and efficiently. The economic-ecological interface clarifies prominent economic-ecological feedback loops that degrade ecosystems. Focusing explicitly on the theoretical rationale behind the various incentives provides clarity and aids the effective selection and substantial adaptation of the most suitable mechanisms for the situation at hand. Adopting payment arrangements, rights-based approaches, and market-based instruments appears to constitute a beneficial theoretical foundation for preserving biodiversity.

Fishery quotas and tradable fishing rights represent an economic mechanism extensively employed in resource conservation and sustainability. Numerous economic instruments or incentives, grouped as (1) payments or (2) rights-based approaches, can bolster conservation endeavors. Payments manifest as cash compensations for undertaking actions that, although essential for preserving biodiversity, hamper other productive activities, thereby generating implicit external costs. Rights-based measures comprise three instruments: (1) the allotment of property rights over resources (e.g., transfer of fish stocks to individual fishers); (2) scenario-independent catch-removal quotas (like CO2 emissions); and (3) the introduction of individual rights-separated accumulation allowances. Market-based apparatuses stimulate conservation constraints without depending on funding provisions. These methodologies and arrangements possess widespread applicability across diverse ecosystems beyond the aquatic sphere, including forestry and farmlands.

Cost-Benefit and Risk Assessment in Biodiversity Projects: In the 21st century, wildlife populations, ecosystems, and the essential biodiversity they provide have dramatically declined due to anthropogenic threats, such as climate change, natural habitat destruction, and over-exploitation of resources. These pressures indicate that biodiversity loss is one of the major global threats of the century. Biodiversity loss enhances the potential extinctions of many small populations, reduces the recovery potential of severely depleted ecosystems, and diminishes the productivity and stability of ecological systems. Biodiversity is not just the number of species (species richness), but also includes functional (species traits) and phylogenetic (evolutionary divergence) components of diversity. Biodiversity matters to understanding and analyzing whether it has positive, negative, or ambiguous socio-economic impacts on economic growth and development at the local, regional, and global levels. The simple structure of the theoretical framework includes the economic and ecological systems. The ecological system includes biodiversity, population dynamics, resource sustainability, and ecosystem services. It drives biophysical processes affecting the economy. Population dynamics looks at the interplay between natural (resource) growth rates and population growth rates. The balance between the two determines the opening and the closing of economy–eco feedback loops. Resource sustainability explores the conditions under which the system is sustainable and resource base would deplete, balance recovery, or non-local collapse. The economic system captures the economy decisions and actions that either positively or negatively affect the ecological system. In turn, it expresses the economic outcomes generated by the ecological system. The feedback loops between the two systems link the external economic shocks with changes in biodiversity economy. The temporary economic shocks lead to permanent dynamic path change in economic growth.

Biodiversity, Species Richness, and Economic Outcomes

Biodiversity—defined as the variety of life on Earth encompasses three main components: genetic diversity, species richness, and ecosystem variability. Species biodiversity, the focus of much conservation debate, is critical for ecosystem productivity in both natural and agricultural systems. It enables valuable biotechnological research and promotes ecosystem stabilisation. Certain species—a concept denoted as keystones—play a pivotal role; their removal may trigger irreversible ecological cascades that undermine functional integrity. Biodiversity directly underpins watershed protection, carbon sequestration, soil fertility, and pollination. Economic theory, combined with ecological insights that link biodiversity to productiveness, resilience, and long-term welfare, provides a robust foundation for analysing the biodiversity–economic outcome nexus. Species productivity influences value creation; within focused boxes, theoretical illustrations demonstrate expected relationships and boundary conditions. Furthermore, trade-offs and optimisation challenges under uncertainty are explored. Comparative statics situate those findings within wider economic–ecological dynamics, while accompanying policy iterations highlight assumptions.

Trade-offs and Optimization under Uncertainty: The analysis of trade-offs under uncertainty seeks to clarify conditions under which certain comparative statics results regarding the optimal level of biodiversity, species richness, biological capital, and growth are robust. These results have previous, generalized forms in economic theory. In particular, conservation biologists and economists have raised questions about how the presence or absence of environmental risk, and how uncertainty in general influences the economic allocation of resources to species conservation policies. Such questions additionally tie into the broader issue of optimal income distribution under risk where the distribution of scarce resources across recipients and societies is regarded. Bioeconomics studies the harvesting and conservation of species subject to uncertainty.

Different conservation regimes influence the long-term prospects for biological resource use, restoration, and extinction, and these regimes are determined by available species protection strategies. Reservation-scale control, the influence of settlement growth, species interaction among land-use scenarios, and the remaining viable time of the macroecological process have been identified as key considerations, as the most crucial strategy typically differs depending the local, patchwise-scale or larger-sized ecological processes. The ranking variant of biodiversity policy types under uncertain population-growth parameters from knowledge of a geographic region has also received consideration.

Governance, Institutions, and Compliance

Environmental concerns, including the increase in biodiversity loss worldwide, have stimulated a plethora of innovative notions of cooperation which have been described through game-theoretic approaches. Although innovative formulations of cooperation include a wide variety of scientific literature, these contributions are usually surveyed and hence the existence of a primer has been felt. Monitoring efforts for ecosystem preservation and restoration have been endowed with the consideration that various monetary and non-monetary flows, labelled resources G, are taken from Nature to promote Human activities. The free extraction of resources is assumed to be subject to sanctions which depend on the locality and which obey general laws outlined by private and public Governors. All these components identify Nature as a Public good, leading to the scientific inclusion of resources G in order to contribute to local rule-making and monitoring.

Most environmental concerns have been broadly surveyed and same rationale has been applied to biodiversity loss. Although data exist supporting habitats where maximum species richness has been accrued, the formal biological theory of Biodiversity has emerged lately and has only recently travelled to Economic Literature. Beyond theory, rich Economic and Ecological data around the planet have been made available, hoping to gather preliminary insights using scientific materials already accessible. It is proposed a simple, descriptive framework where Population contains differential equations for the generic, or experimental-typical, Species State. When only resource-extent variables are included, it is found a number of mathematically-expected relationships between the Paradigm species number and Biodiversity data for Land, Fresh-Water and Marine-Aqua have been compared with an initial exertion in functional simulation using the Base-State approach at global scale.

Governance, Institutions, and Compliance. Rules, norms, and laws constitute the overarching umbrella for human societies. Without some commonly accepted rules for interacting, whether formal or informal, it is difficult for groups of individuals to realize their full potential. Watershed councils, water-users' associations, and other organizations representing a variety of interests across sectors and jurisdictions will find it difficult to perform collective action related to the management of shared bio-physical watershed goods without some commonly defined rules for the management of those watershed goods. The tendency to act in the interest of the self over the interest of the whole will almost always operate unless mechanisms have been established to at least partially internalize the welfare costs.

Property Rights, Access, and Exclusion: A focus on property and access promotes a sequential order in the analysis of economic allocation and institutional governance. The initial rationale for the allocation of a biological resource emerges from the existence of entrepreneurial opportunities that inherently entail property rights, access, and exclusion considerations not captured by equilibrium resource pricing. Economic allocations are governed by rule systems that gain legitimacy through global democratic processes. The eligibility of a biological resource for property rights reflects the area's strategic advantage at all governance levels, formally regrouping the research problem as a quest to understand the mechanism underlying the emergence, determination, stability, and change of institutional arrangements regulating the biota—an agenda of enormous theoretical and societal relevance. Alternative arrangements already differ within domestic jurisdictions.

In an environment characterized by transaction cost uncertainties and high-risk profiles, such resource-specific rules remain open to question. Transaction costs accumulate in the strategy of accessing a biological resource through exclusive property rights, ownership, or appropriative regimes. The choice of governmental arrangements between access rules and public goods provision for biota naturally falls within the initial considerations of property rights, access, and exclusion. The emphasis then shifts towards regime specifications permitting accessibility free of charge without reallocation of the initial resource-endowment vector; typical examples include the political-contribution mechanism or the keystate mechanism.

International Cooperation and Safeguard Mechanisms: International cooperation and safeguard mechanisms are essential for harmonizing economic growth with wildlife conservation. The sources of species endangerment reveal crucial interdependencies that trigger welfare losses. Macroeconomic principles pertinent to tropics guide ecologists in improving the equilibrium between development and conservation. Formulating rules for sustainable fisheries and the protection of endangered species requires collaboration among a multitude of nations and organizations. Sound economic valuation methods and accurate population indices underpin effective safeguard mechanisms. Addressing biodiversity conservation within an economic-growth framework necessitates international agreements and policies.

Enforcement, Monitoring, and Adaptive Management: Economic management of natural resources rests upon principles of valuation, production, and externality correction. Popular limiting assumptions include separability, homogeneity, and monotonicity. Currency and spatial metrics are ignored. Within conservation, human-wildlife interactions arise directly alongside economic activity and indirectly through market-driven expansion of habitat loss, regime-switch and ecological destruction.

Feedback loops occur not only within the system but across scales—for example, monetary incentives to exploit biodiversity-trigger wildlife-habitat compression, cascading effects, and declines in technologically accessible species—contributing to accumulating both ecological and economic capital.

Action and biodiversity-management strategies are governed through established policy processes based on markets, regulations, and covenants. Property rights, access, and the associated liberty to exclude form the economic basis of an efficient governing structure. Rule adoption emphasizes allowance and entitlement regimes, security tenure, and transaction costs, with well-defined ownership facilitating the design of incentives structures and mutual adherence to commitments. Global biodiversity and biopiracy concerns highlight the operationalization of international accords and collaboration, incorporating property-rights appropriability, conservation-transfer equities, and the significance of equity and compliance. At the country level, institutions transitioning from marginal to predominant roles remain influential signals for compliance and concern policy design. Issues of empowerment and the sovereignty of communal actorsit is a widely acknowledged global challenge ably possessing requisite engagement capacities remain.

Theoretical Gaps and Future Research Directions

Conservation research has concentrated on the functionality of various management schemes in isolated systems. Important adaptations could enrich the existing research agenda. A dominant model class scrutinizes biodiversity in relation to economic performance, tracking high-level, differentiated variables, such as species richness, natural-capital stocks, or access to natural resources. These primitive variables are instrumental in a governmental choice problem shaped by needed economic dynamics and conservation-related orders, such as resilience, adaptive capacity, or live-capital outflows. Conjectures concerning the expected outcomes sought by policymakers introduce further diverse variables. Since major aspects of the governing quest remain outside the models, opportunities emerge to formalize some of these dimensions (Lin & Goeschl, 1970). Efforts are currently focusing on characterizing viable solutions and the stabilization conditions ensuring the conservation of specific dimensions.

Recent academic literature has pursued other data-driven routes that might complement the previously established theoretical constructions. Agent-based territorial models investigate how agents' awareness of their consumption levels, territory quality, and other natural-capital dimensions shapes local-biodiversity outcomes. For low awareness, biodiversity is predicted to diminish; whereas, above a threshold of acknowledgment, the patterns become diversified. Such avenues, however, have not yet converged towards contemplation on the digital economy. Moreover, contrary to the established practice on micro foundations, account remains un-taken of the delicate distinction between mixed, multicasting, and conventional forms of interactions. The absence of suretypical heterogenities afflicted by symmetric transitions responses keeps reinforcing the segregation into particular sub-specialties.

Limitations of Current Models: Despite many theoretical and applied studies about the role of biodiversity in economic processes, they have scarcely examined which model structures or assumptions about the interaction between biota and the economy apply under which circumstances. Hardly any analyses explore the validity of the equilibrium assumption in the economic-ecological interface, e.g. over uncertain time horizons. The literature does not comment on the relatively recent focus on alien species, urban dimensions of biodiversity in affluent societies, interactions between pollution and land-use change, and other frontiers. Efforts to grasp ecological dimensions in economic growth and adaptation models have yet to embark on systematic investigations that track bio-diversity as an explicitly defined variable. Economic growth models examining the impact of land, climate, or nature have not applied their insights to plan biodiversity-attuned strategies.

Emerging Approaches and Interdisciplinary Pathways: Emerging approaches to economic zoology and biodiversity conservation shift focus away from the ongoing crisis of large-scale biological impoverishment to the desire for enhancement and recovery of ecological fitness and resilience. Rather than combat crises through increased knowledge and control, more recent efforts seek ways to expedite positive and benign ecological processes by applying relevant concepts from technology, engineering, and economics. Numerous disciplines now share a common concern for the designs and strategies that enhance and maintain wellness, an area of significant public interest and funding. These endeavors can be construed as proactive and optimistic rather than reactive and apocalyptic. Never before have such highly selective, targeted, and effective approaches been available. Some anthropogenic processes can operate entirely independently of destructive elements. The field of economic zoology has entered an advanced stage, focusing on emerging mechanisms, designs, and models that encourage and sustain healthy biodiversity and biological evolution (quality, quantity, and complexity) on local, regional, and global scales. This phase is conceptually linked to activity in wide-ranging applied fields such as biotechnology, agriculture, and other areas where directed action is sought to produce optimal outcomes.

Conclusion

Biodiversity loss and ecological degradation continue to accelerate, increasingly affecting the economy and societal well-being. Underestimating the essential contribution of ecosystems to human livelihoods sustains the incessant decline of ecosystems and their associated functions and services. Understanding the interrelationship between economic systems and biological systems represents a critical challenge for societies globally. Achieving both economic development and biodiversity preservation under growing socio-economic pressures poses a significant challenge for policymakers worldwide. Theoretical contributions that illuminate the interconnections between the economy and ecosystems and foster cross-fertilization among scholars and policymakers constitute a necessary but unfulfilled requirement.

Economic zoology and biodiversity conservation emerge as unifying acolytes of these theoretical contributions. The conceptual and analytical territories established between economics and biology reveal complex relationships, yet remain sparsely explored within classical economics or its encompassing theoretical framework. Addressing this gap opens pathways to conserve biodiversity while achieving economic growth and human development. Economic zoology represents a neglected, underappreciated, and undiscovered branch or sub-branch of economic science, yet possesses potential to observe, render visible, and conceptualize the underlying condition for both economic zoology and biodiversity conservation to prevail collaboratively. Economics, ecology, conservation, population, governance, and ethics constitute the conceptual material necessary to contribute meaningfully to economy-biodiversity interdependence.

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