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BIODIVERSITY POTENTIAL TO ENHANCE ENVIRONMENTAL RESILIENCE

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Abstract: *At the global scale, ecosystems are changing at an extraordinary rate mainly due to anthropogenic influences, like; global warming and climate change, land-use change and conversion, pollutant dispersion and biodiversity reduction. Biodiversity governance directly affects ecosystem structural characteristics including its resilience capacity, which in turn shape provision of ecosystem goods and services to humanity. Biodiversity substantially contributes to ecosystem resilience. To identify environmental resilience on biodiversity potential, population trend and intraspecific and interspecific diversity using ecosystems structural characteristics is a rational approach. This research paper indicates, securing ecosystem resilience require a comprehensive and interconnected approach to biodiversity conservation. Any shift in biodiversity abundance and distribution affect ecosystem productivity and substantially challenge our ability to care for ecosystem health as well as human well-being. Addressing the data gaps is decisive for finding variations in socio-ecological arrangements, and providing better information to policy- makers to achieve better resiliency programs. The result clearly indicates, the biodiversity potential, enhances ecosystem services, hence would promote the resilience capacity of the environment.*

Key words: Biodiversity Potential, Resilience Capacity, Adaptation, Environmental Resilience

Introduction

Biodiversity contributes a remarkable role in sustaining ecosystem resilience capacity (Chapin, F. S., et al. 2000; Loreau, M., et al. 2001; Diaz, S. and Cabido, M., 2001; Kinzig, A.P., et al. 2002). Ecosystem resilience is the extent of shock or disturbances that an ecosystem can tolerate, while continue its shape and composition, fundamental activity and justification, for purposes. At the global scale, ecosystems are changing at an extraordinary rate mainly due to anthropogenic influences, like; global warming and climate change, land-use change and conversion, pollutant dispersion and biodiversity reduction. At the same time, the growing urbanisation significantly alters the ecological systems in landscapes. The consequences comprise alteration of habitats (Wood, B.C. and Pullin, A.S., 2000); the change of natural assets process (Donovan, et al., 2005; Bonan, G.B., 2000); the change in species composition and biodiversity (Hardy, P.B. and Dennis, R.L.H., 1999; McKinney, M.L., 2002). Furthermore, change itself keep changing, as well; sometimes it is slow and bit by bit, while some other times it is unexpected and trouble making. That is why the idea of ecosystem resilience come into picture. Ecosystem resilience evolve from diversity of species, the genetic constitution of an individual organism and ecosystems on a landscape. Recently the biodiversity potential has received special attention in ecosystems adaptation and their resilience capacity to climate change and any other disturbances. It is highly significant that the genetic variation secures compatibility of communities under various environmental circumstances, which truly influences the potency of species to retrieve after perturbations (Barton, N. and Keightley, P.D., 2002).

The resilience of forest ecosystems to climate change to a great degree depends on genetic versatility of tree species building these ecosystems (Millar, C.I., et al., 2007). Ecosystem features and processes are the main constituents in scanning of common resilience and can comprise, land cover of vegetation categories, productivity indicators, species useful attributes, and patterned ecosystem operations, like; soil temperature and moisture pattern, and eco-physiological flows (Levine, N.M., et al., 2016). The importance of intraspecific variation can be more understood when investigated with further aspects of biodiversity, like pollinator populations (Gotts, N. 2007). Pollinator populations fall due to loss of genetic diversity and as such, the pollinators' species are the key species in ecosystems, their extinction reduces ecosystem services, which we are most concerned about (Potts, et al. 2010). The ecosystem services values besides being an economic and technical issues, the most importantly it is a societal issue. Societal development relies on ecosystem support; for instance, agricultural production requires visits by a variety of pollinators like; bees, wasps, flies, birds, etc. (Nabhan, G.P. and Buchman, S.L., 1997). Such diversity brings fundamental functional capacity in sustaining ecosystem services. Also species carrying out identical ecological functions but act at various spatial and temporal scales, though declining intraspecific competition yet accepting coexistence of species from same functional associations (Peterson, et al., 1998). Species spatial diffusions and respective profusions are nearly connected to common ecological and spatial elasticity. Common and ecological elasticity are connected to climatic aspects that regulate species diffusions, i.e., the bioclimatic scope, and ecosystem features and flows that ascertain habitat compatibility, such as access of food, minerals and nourishment essentials, and water.

Ecological systems spatial heterogeneity may alleviate interspecific competition rising community stability and species coexistence from identical functional associations increasing ecosystem resilience capacity (Liao, J., et al. 2016; Roxbourgh, S.H., et al. 2004; Miller, A.D. and Chesson, P., 2009). In addition, landscapes with multi-diversity of ecosystems may provide spatial resilience, with unique conditions for ecosystems to rehabilitate after interferences and disturbances (Drever, C.R., et al. 2006). The ecosystem resilience to environmental change is specified; by various factors at multi-levels of biological arrangements. Ecosystem resilience because of the complex system of nested and hierarchical nature, substantially work better through multiscale procedure (Wu, J., and Loucks, O.L., 1995; Allen, C.R., et al., 2016). Biodiversity governance directly affects ecosystem structural characteristics including its resilience capacity, which in turn shape provision of ecosystem goods and services to humanity. Biodiversity substantially contributes to ecosystem resilience. To identify environmental resilience on biodiversity potential, population trend and intraspecific and interspecific diversity using ecosystems structural characteristics is a rational approach. This research paper indicates, securing environmental resilience require a comprehensive and interconnected approach to ecosystem connectivity and biodiversity conservation.

Methodology

For methodology in this research paper, the resilience notions and ideas were applied to manage biological fitness and productivity in each area. Through ecological resilience processes, we enhance management capabilities for ecosystems connectivity and biodiversity productivity. Critical elements like, landscape processes and spatial interactions is the key factors to support habitats connectivity and species productivity.

Geographical Area

The area of concern is the Zagros Mountains Forest steppe. It is a temperate broadleaf and mixed forests ecoregion in Western Asia. The ecoregion stretches from eastern Turkey and northern Iraq to southern Iran. The climate is semi-arid and temperate. Summers are hot and dry, and winters are cold. The main plant community is deciduous broadleaf trees, steppe shrubs and grasses. Oaks (Quercus Brantii) are the characteristic trees, covering over 50 percent of the Zagros Mountains in Iran. The fauna of the region include: Persian leopard (Panthera pardus tulliana), Syrian brown bear (Ursus arctos syriacus), Mouflon (Ovis orientalis orientalis), Wolf (Canis lupus), Striped hyena (Hyena hyena), Blanford's fox (Vulpes cana), Zagros Mountains mouse-like hamster (Calomyscus bailwardi) and Wild goats (Capra aegagrus).

Results and Discussion

Socio-ecological challenges to environmental resilience should generate diversity of knowledge in various fields. The concept of resilience in ecology is about consistency of ecosystem processes and return to full functionality after any disturbances. It is concerned with the capability of systems to withstand displacement and maintain its functional capacity. The point of reference for resilience measurements also differs. From one side it is the degree of external pressure that a system can tolerate, from other side it is the time that a system requires to return to its initial balance or equilibrium. The relationship between biodiversity potential and resilience capacity mainly stands through species richness and abundance (McCann, K.S., 2000). Resilience besides relying on the versatility of functional groups, it is as well depend to the number of species within a functional assembly and the overlapping functions among those assemblies (Peterson, G.D., et al., 1998). Also, species within the same functional assembly, when appear to react non- identical to environmental change, this feature is called as response diversity (Walker, B.H., 1997; Ives, A.R., et al., 1999).

Precise monitoring and evaluation of landscape would help to rule out the appropriateness of specific strategy, because environmental conditions like precipitations and species diversity, govern ecosystems conditionality (Johnstone, J.F., et al., 2016). We already know the planetary distribution of marine diversity are changing in reaction to climate change, causing local ecosystem functionality and services (Pinsky, M.L., et al. 2019; Mclean, M.J., et al, 2019). Any shift in biodiversity abundance and distribution affect ecosystem productivity and substantially challenge our ability to care for ecosystem health as well as human well-being (IPCC, 2014; Pecl, G.T., et al., 2017). A system with a feeble bed of attraction may react forcefully to disorders and shift to other state. These ecosystems considered comparatively to have slight ecological resilience (Scheffer, M., et al. 2012). On the other hand, an ecosystem with more than one bed of attraction may react to disorders by floating conditions, while shifting to a new bed of attraction, adjusting, and come back to the native condition once situations ameliorate. These ecosystems have towering adaptive magnitude to shifts in environmental situations. Adaptive capacity is the capability of a socio-ecological system to manage with unconventional conditions without failing choices for the future, and resilience is the key to raising adaptive capacity. Adaptive capacity in ecosystems is connected to genetic, species and ecosystems diversity in a landscape (Bengtsson, J., et al. 2002). Conditions that come up with feeble bed of attraction comprise less beneficial environmental circumstances, restricted species and utilitarian categories to reinstate the systems. Data on the levels and shapes of disruptions and their impacts on the ecosystems' functionality assists the type of useful management plan to be taken. The widespread resilience of landscape effectively directs its reaction to disruptions and management efforts (Chambers, J.C., et al., 2017b). Landscape with the widespread resilience capacity have the potential to go back to the earlier condition with the slightest intervention.

Deforestation and poaching are the major threats to Zagros eco-region. Zagros mountainous eco-region significant capacity lie with its potential to block sand and dust storms moving towards the central part of Iran, and 40 percent of the water reservoir in the country exist in this region. As it was observed also in Zagros eco-region, the forest biomes are responsible habitats in safeguarding any environment from climate change impacts (Mori, A.S., et al. 2021; Lewis, S.L., et al. 2019; Holl, K.D. and Brancalion, P.H.S. 2020). With extreme climatic conditions, the ecosystems' resilience usually declines. Hence, biodiversity potential has direct impact on conservation integration on species management. Conservation framework may lay out foundation to expand resilience concept and include that into management program (Brown and Williams, 2015). The result clearly indicates, in Zagros eco-region the resilience capacity keeps declining as biodiversity of the region is under various pressure. Since we know, the biodiversity potential, enhances ecosystem services, hence promotes the resilience capacity of the environment, for reversing the situation, more comprehensive and convincing conservation programs should be implemented in the region.

Recommendations

- Address the rapid change occurring in ecosystems.
- Sustain ecological connectivity and landscape resiliency.
- Generate knowledge and information on biodiversity responses to climate change.
- Create comprehensive guidance for environmental managers on maintaining landscape biodiversity.
- Recognize early notification signs of tipping points in ecological systems.

Conclusion

Global shift would decrease the resilience of ecological systems and trigger tipping points, causing reduction in ecosystems functions. Integrating resilience aspects into environmental plans and strategies is challenging because it is tough to assess and predict the exact scenario. The term resilience considers as a comprehensive system characteristic that reflect interactions between human and natural systems and their subsystems. The detection and attribution of biodiversity potential to the environmental resilience capacity is one of the major environmental science challenges of today. Strong and clear answer is needed to reverse the current weak resilience situation to a more productive one in Zagros region. The challenges can be resolved by addressing the synergies between biodiversity conservation, ecosystems connectivity, landscape planning program and the societal interactions with them in the context of restoration.

In Zagros the biodiversity across scales, from genes to species and ecosystems, and the services they generate, furnishes the fundamental roots on which socio-economic growth and success depends. Conducting biodiversity monitoring and assessment at species and ecosystem levels throughout the region in relation to the Earth's spatio-temporal resilience capacity is a big challenge. Moreover, the successful resilience capacity depends on coupling nature-based and society-based information for building comprehensive plans and strategies towards good governance interventions in biodiversity conservation. Nevertheless, there is no scientific conclusions on key components that maintain resilience capacity and how to predict and refrain from tipping points.

Despite the advancement of technology, data gaps stay as an important hindrance to realizing responses between biological diversity and environmental resiliency. These gaps stand not only for biodiversity observations, but also in realizing their shares to ecosystem services and environmental resiliency. Addressing the data gaps is decisive for finding variations in socio-ecological arrangements, and providing better information to policy- makers to achieve better resiliency programs in Zagros eco-regions. Moreover, shifts in the Earth environment must be find out and characterized on proper time periods. There is a firm relation among biodiversity, ecosystem resilience and sustainability of social-ecological systems. Realizing the trend of a system to shift to other states and the factors causing this to happen is a key element in resilience-based management in Zagros region. Resiliency initiative is effective, when it is seen in the frame of adaptive action plan. Thereby, resilience integration in landscapes provide understanding on ecosystem features and processes to respond ecosystems capacity to support species diversity and abundances. Based on Zagros landscape observations, damaged ecosystems and the ecosystems with declined biodiversity has got lesser potential to withstand environmental changes, hence ecosystems resiliency declined too.

As we know, mankind has strong interactions with environmental processes from local to global scales. Managing complicated socio-ecological systems for sustainability needs the capacity to manage the systems without losing alternatives for future growth. When huge variation exists in the environment, resilient systems possess choices for restoration. As a result, the environmental sustainability should have resilient capacity. Resilient ecosystems contain functional assemblies with a variety of species that fulfil an almost identical functions, but react in various ways to environmental modifications. Hence, there is a positive correlation between biodiversity potential and environmental resiliency capacity as it was observed in patches of undisturbed ecosystems in the Zagros eco-region.

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