The Relationship of Landscape Fragmentation Fundamental Process and Species Protection

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Abstract

Landscape fragmentation is one of the main causes of biodiversity decline. The impact of landscape fragmentation on species diversity is mainly manifested in species, genetics and ecosystem diversity. Landscape fragmentation caused by corridor and edge effect has dual effects on biodiversity. According to the reasons of biodiversity reduction caused by landscape fragmentation, conservation measures are proposed.

Keywords

Landscape fragmentation; biodiversity; corridor; edge effect.

1. Introduction

Habitat loss and habitat degradation caused by landscape fragmentation is one of the main reasons of biodiversity loss [1,2]. Landscape fragmentation causes habitat loss and fragmentation of species by reducing the area of original habitats and increasing the degree of spatial isolation, which affects the reproduction and migration of species populations, changes the normal ecological pattern and process, and has a great impact on biodiversity [3]. Due to the intense interference of human beings, many species and ecosystems on the earth are endangered at present, and the loss of biodiversity in tropical rainforest is the most serious [4]. One of the effective ways to protect biodiversity is to understand the causes of landscape fragmentation and reduce the degree of landscape fragmentation fundamentally.

2. The definition of landscape fragmentation and its causes

Landscape fragmentation refers to the process in which the landscape changes from simple to complex due to the interference of natural or human factors, that is, the landscape changes from a single, homogeneous and continuous whole to a complex, heterogeneous and discontinuous patchwork or mosaic. The process of embedding is a kind of landscape dynamics [5]. Simply put, it is a process in which habitats continue to become fragments. The main manifestations are as follows: the number of patches increases and the area shrinks; the shape of the patches tends to be irregular; the area of the internal habitat is reduced; the corridors are cut off and the patches are isolated from each other.

Landscape fragmentation is the comprehensive result of natural conditions and human activities. However, human activities are the main cause of landscape fragmentation. It is generally believed that the intensity of human activities is directly proportional to the degree of landscape fragmentation. In the past century, with the rapid development of agriculture, urbanization and transportation,

deforestation, agricultural reclamation, overgrazing, lake reclamation, road transportation and other man-made damage to nature have become increasingly serious. Coupled with the impact of global climate change, the problem of landscape fragmentation has become increasingly prominent around the world [6]. Understanding the impact of landscape fragmentation on species and ecological processes is a prerequisite for exploring ways and methods of species conservation.

3. Effects of landscape fragmentation on biodiversity

Landscape fragmentation will have a series of impacts on species living in it, such as population size and extinction rate, diffusion and migration, population inheritance and variation, population survival vitality, etc. Changing a number of important relationships in ecosystems also makes patches more vulnerable to external disturbances, threatening their existence and the maintenance of species diversity.

3.1 Section Headings

Landscape fragmentation leads to genetic isolation, which leads to inbreeding within species and impedes gene exchange between populations. As isolated and lost types of genetic variation cannot be compensated by transferring new alleles from other populations, genetic differences between different populations are increased and population structure tends to be simplified. These genetic consequences have a profound impact on the genetic diversity, adaptability and population differentiation of the population, leading to population degradation [7].

3.2 Impact of landscape fragmentation on species diversity

The survival of species requires a certain area suitable, because fragmentation of the landscape reduces the total area of a certain type of habitat and the area of each patch. Large patches become less and less, and smaller patches are isolated from each other. More and more, the living space of organisms is divided and shrunk, and the possibility of species survival in these patches becomes less and less, which affects the size of the population and the rate of extinction. The results of the study showed that the number of species in the bird community increased with the increase in the patch area of the secondary forest [8]. In addition, landscape fragmentation affects the rate of species dispersion and migration. When the population density is at the same level, the spreading ability between patches in the broken landscape is significantly lower.

3.3 Impact of landscape fragmentation on ecosystem diversity

Make landscape china-africa suitable habitat types of landscape fragmentation and area is increasing, the interaction of various patches increased, eventually change within the ecosystem, the relationship between species richness and species of community structure and ecological processes of ecosystem, changing ecosystem structure leads to the degradation of ecosystem function and types of disappear. The main results are as follows: (1) The energy balance of fragmented habitat is obviously different from that of the landscape covered by dense vegetation; (2) Habitat fragmentation leads to turbulence effect, which enhances the influence of wind and changes the ecosystem water cycle. (3) Fragmentation affects the immigration rate and extinction rate of biological population. Habitat fragmentation tends to extinction of "in-forest species" or "area-sensitive species" that require larger habitat patches, while increasing the abundance of exotic and common species adapted to human-disturbed environments [8].

4. Analysis of the impact of two types of landscape fragmentation on biodiversity

4.1 Corridors and biodiversity

Corridors are thought to reduce or even offset the negative effects of landscape fragmentation on biodiversity. Corridor can not only provide some species with specific habitat or respite, and adjustable landscape structure, promote and maintain the isolated habitat connection between habitat patches, im make species, can through the corridor in the broken condition between free proliferation,

migration, increase species gene exchange, prevent population isolation, to maintain the minimum population and protect biodiversity [10]. In addition, because corridors facilitate the movement of species, changes in climate in a patch or landscape can greatly reduce the threat to species. By promoting the dispersal of species between patches, corridors can promote population growth and the invasion of alien populations after the extinction of a population in the patch, thus playing a positive role in maintaining species numbers and enhancing the survival of fragmented populations on a larger scale.

However, some scholars say that corridors can fragment habitat patches, block gene or species flow, cause habitat fragmentation, or guide the invasion of alien species and natural enemies, threatening the survival of native species.

4.2 Edge effects and biodiversity

An edge is a narrow area formed by the intersection of two different ecosystems. Because the environmental conditions at the edge of the patch are very different from those inside the patch, differences in the composition and abundance of species between the edge and the inside of the patch are caused, which is commonly known as edge effect. The edge effect is the most important reason for ecological differences in patches of different shapes, and landscape fragmentation can cause drastic changes in the environment at the edge of patches, leading to the edge effect [2].

Some scholars believe that edge effects are beneficial to the maintenance and conservation of biodiversity. The environmental conditions in the marginal areas are often relatively complex, and the plant species are more abundant, thus providing more living and feeding conditions for animals, and the species and number of animals are also more abundant. In many marginal areas, biodiversity is significantly higher than that inside the patch [11]. For example, species richness of frogs and butterflies remained stable or even increased after forest patches were isolated, and populations of various insects increased in marginal habitats.

But most agree that the main reason for the loss of species is the "edge effect" of forest fragmentation. Studies on Amazon forest fragmentation have shown that species richness is positively correlated with patch size, primary forest has more species than fragmented forest, and some highly area-sensitive species are lost in fragmented forest habitats. Moreover, the impact of edge effect can reach 100 m or even further into the forest, which further reduces the area of suitable habitat in the fragmented landscape and causes a large number of external species invasion. Edge effects also involve many aspects such as microclimate, air quality, noise environment, soil physical and chemical properties and other ecosystem processes. For example, local hydrological cycle, nutrient cycle, carbon interception capacity and species composition are affected, resulting in degradation of ecosystem services [2]. The rapid spread of sandstorms in northern China is a good example of landscape fragmentation.

5. Species protection measures

The objective existence of human disturbance makes scientific landscape planning inevitable. The following approaches can be adopted to reduce the degree of fragmentation and effectively protect species.

5.1 Establish nature reserves

The most traditional strategy in nature conservation is to establish a core area of habitat for absolute protection. The basic idea is to preserve the protected object (remnant patches or habitats of endangered species) as completely as possible, and to exclude human activities from the buffer zone around the core area.

However, the current pattern of biodiversity conservation based on a single, isolated nature reserve is far from enough. Instead, a regional and continent-wide biodiversity conservation network, namely an ecological network, should be developed. Ecological networks should cover most of the earth’s land surface with biodiversity value and potential value, connect nature reserves in different regions,

and connect with urban greening system and farmland forest network. Thus, a multi-level (nature reserve biodiversity, farmland biodiversity, countryside biodiversity, urban ecological garden biodiversity), multi-scale (single reserve, region, continent) complete biodiversity protection system, so as to maximize the protection of land biodiversity resources [12]. The ecological significance of biodiversity conservation networks at regional and continental scales is to maximize the connectivity of fragmented habitat patches by establishing ecological networks, so that biodiversity resources can be restored from terrestrial landscape patches to substrates and become the dominant part of terrestrial ecosystems.

5.2 Building corridors

Proper design and use of corridors is a useful and effective tool for species management in fragmented landscapes. Corridors can reduce the damage of habitat fragmentation and establish corridors between habitats. The connection and radiation function of corridors make them important landscape structures promoting the evolution of biodiversity in the future. In line with this function, corridors should be designed to fit the trajectory of biological evolution, connecting important sources of species to protect the continuous communication and radiation of species.

The effectiveness of corridors depends on many factors, including habitat structure, corridor width and length, and biological habits of target species. The corridor should be natural or a restoration of the original natural corridor, and any man-made corridor must be adapted to the natural landscape pattern (such as the drainage pattern). It is also effective to introduce or restore native landscape patches in key locations, transform the texture between habitat patches, and reduce the frequency of hard boundary in landscape to reduce the resistance of organisms crossing the boundary. At the same time, the corridor should have a certain width. If the corridor does not reach a certain width, it will not only fail to play the role of protected objects, but also create conditions for the invasion of alien species[13]. For example, in order to avoid the fragmentation and extinction of species populations caused by corridor segmentation, underground channels can be designed to allow animals to pass through roads through underground pipelines, and it is suggested that roads should not be built on the preferred habitat and natural passage of these animals.

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