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Physics Procedia 33 (2012) 1292 – 1297

Physics

Procedia

2012 International Conference on Medical Physics and Biomedical Engineering

Grassland Coverage Changes and Analysis of the Driving Forces in Maqu County

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Abstract

Vegetation coverage is an important indicator of weighting ecological environment; grassland ecosystem plays an important role in regional ecological safety and sustainable development. Statistics was used to analysis the grassland coverage changes in Maqu County. Results showed that: 1) the grassland coverage show decreasing trend overall, and has period characteristics; 2) changes in grass coverage both have positive and negative conversion, depending on using rationality of grassland resource; 3) Climate warming and drying and irrational exploitation activities are the main driving factors of ecological environment deterioration; 4) Prohibition grazing project have obvious effect on grassland restoration.

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Keywords: Maqu grassland; Vegetation coverage; ecological safety; sustainable development

1. Introduction

Vegetation as an important component of the ecosystem strongly influence the energy transfer between atmosphere and soil, and have the following ecological function: intercepting rainfall, decreasing runoff, soil conservation and other functions, which plays a decisive role on soil erosion[1]. Research on vegetation and vegetation cover is an ecological environment research hot, to some extent, which reflecting the changing trend of ecological environment [2]. Vegetation coverage is the percentage of the vegetation vertical projection area to unit area, which is an important indicator to measure ecological environmental conditions [3]. Grassland ecosystems are the planet's most important terrestrial ecosystems, grassland is an important component of terrestrial vegetation, grassland ecosystem service value is very unique, and particularly its water conservation function, witch plays an important role in ecological safety and sustainable development for the entire region. The Mid and Late 20th century, the majority of our

grassland pasture appeared increasingly serious degradation and had a major impact on the local ecological environment and social economy, as overgrazing and other unreasonable use.

Known as the "the first song of nine curve of the Yellow River," said the Maqu is located in the eastern Qinghai-Tibet Plateau, is a pure animal husbandry county concentrated with Tibetan population [4], because of the many tributaries, abundant storm water, and the snow-capped mountains, lakes and grasslands, which constitute a complete water conservation system of the Yellow River, as the Yellow River "reservoir". Grass industry is an important advantage resource of Maqu County, which mainly includes alpine meadow and alpine meadow grassland, with good grass growth and high yield, known as "Asia's first ranch," said. In recent decades by the effect of human factors and natural factors, the ecology degradation significant, aspects of deterioration as follows: grassland degradation, desertification, lakes dried up, rivers drying up and inclined of Biological Diversity [5]. Maqu special geographical location and the unique value of ecosystem services, Maqu grassland ecological and environmental protection plays an important role in ecological security of the entire Yellow River Basin.

Based on the above understanding, this article selected Maqu County as the research object, studied grassland cove change and explored its drivers factors, which have important science and practice guidance significance in regional ecological environment restoration, rebuilding and rational use of resources.

2. Materials and methods

2.1. Study area

Maqu is located in the eastern Qinghai-Tibet Plateau (33°06'-34°30'N, 100°45'-102°29'E), 3300-4806m altitude, terrain is complex, grasslands, mountains, valley and plateau lakes commonly distribution; It belongs to practical continental climate, four seasons of the year is not obvious, and the annual average temperature 1.1°C, annual precipitation is 650mm, ninety-one percentage of rainfall concentrated in May-September, the annual evaporation 1000 -1500 mm; soil belong to sub-alpine meadow soil and peat-based soil; vegetation type is various, mainly including six categories, eleven groups and twenty types, such as alpine meadow, subalpine meadow, swamp meadow, shrub meadow grassland category. As Maqu County high elevation, harsh climatic conditions, harsh ecological environment, combined with the increasing of population and livestock numbers, deterioration of the county's resources and ecological situation is worsening in recent years.

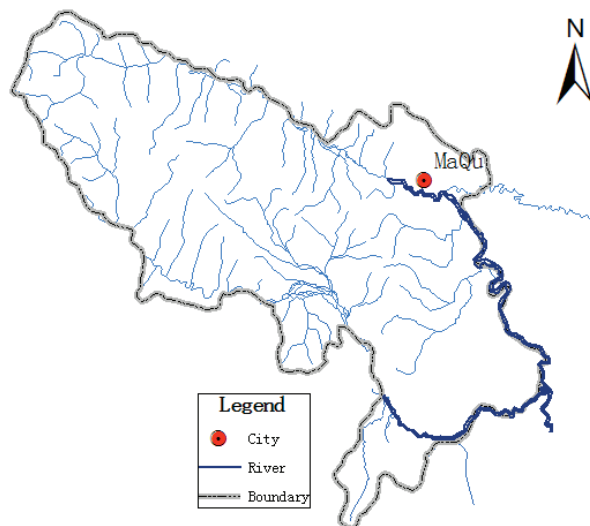


Figure 1. Map of study area

2.2.Data Preprocessing

Due to funding and other factors, data be used in study mainly come from the related research literature such as remote sensing interpret results, Maqu County Statistical Yearbook of the corresponding year. Classification system based on land resources, combined with the actual vegetation distribution of the study are, grassland in study area will be divided into five categories (Tab.1).

TABLE I. GRASSLAND USE CLASSIFICATION SYSTEMS OF MAQU COUNTY

Grassland types	Concepts
High cover	Coverage of grasslands is above 60%, such as natural grassland, refined grassland and reaping grass. water condition is good, plants grow well, include high product grassland ,shrub-tree, etc vegetation
Mid-high cover	Coverage of 30% to 60%, natural grassland and improved grassland, grassland coverage general is higher than the middle grassland, mainly composed of mid-high product grassland
Middle cover	Coverage of 30% to 60%, natural grassland and improved grassland, water condition is inadequate , grass is sparse, mainly composed of low-middle product grassland, wetland graasland
Low cover	Coverage of 30% to 60% natural grassland, the land of intense erosion and low desertification, grass is sparse than middle cover grassland, mainly including middle product grassland and low cover vegetation
Inferior	Coverage of natural grasslands is below , water is lack, vegetation is sparse, animal industrial usages condition is bad, including intensely desertification land, bald land

3.Results and Analysis

3.1.Maqu grassland coverage change trend Analysis

According to historical records, sandy grassland in Maqu County, only scattered in the fifties and sixties of last century, since the sixties grasslands’ desertification began to speed up and area expand [6]. As grassland degradation and desertification, significant changes of grassland coverage have taken place, from 2000 to 2008, grass cover of Maqu County change condition can be divided into three stages in general (Fig.2).

Phase I: 2000 to 2002, annual grass cover was slowly decrease. According to historical records, up to 2000, 90% of natural grassland in Maqu County appeared degradation in various degrees, due to the implementation of population transfer, grass coverage in some areas increased significantly, offsetting degradation in other areas; it seems that the overall trend of grass cover reducing is slow, so grasslands present recovery trend.

Phase II: 2003 to 2005, annual grass cover showed a rapid growth trend. Maqu County as the first prohibited grazing project pilot county in nationwide and in Gansu Province, and the grassland restoration project has obvious effect on the ecological environment restoration of the Maqu [7]. Maqu County’ prohibited project full implement in early 2004, and take two major construction measures: forbidden grazing and rest grazing. The concrete measures as follows: carrying out long-term enclosure mainly aimed

at sandy grassland and degradation wetlands; adopting fencing grazing 5-7a in black soil caused by rodents danger, when the vegetation restoration to some extent, began to seasonal rest grazing and rotational grazing. In serious deteriorate grassland mainly taken seasonal grazing and rest grazing ninety days in seed germination stage and fruiting pastures and seed of grazing on the 90d, to make the grass get respite opportunities. After prohibited grazing, the man created a more conducive environment for grass growth; grass takes on an obvious recovery trend [8].

The third stage: 2006 to 2008, annual grass cover presents a decline trend. Maqu County is a county of pure animal husbandry; grassland animal husbandry is the economic mainstay of Maqu, with population increases and the continuous expansion of economic scale, leading to a sharp increase in the number of livestock, making pasture carrying capacity to the limit [9]. The role of rodents and other natural disasters, to accelerate the process of grassland degradation, leading to a sharp decrease of grass cover.

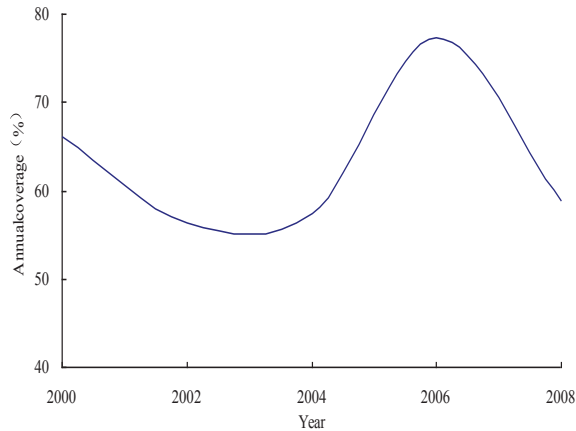


Figure 2. Annual grassland cover change trend

3.2. Grass area change at all levels

The classification and area statistics of the various coverage grassland in Table 2 is based on Table 1. It can be seen from Tab.2, Maqu County high coverage grassland generally shows a decreasing trend, low cover grassland shows a increasing trend. Prohibited grazing project began to implement in early 2004, making the effective restoration in Maqu; 2006 high-cover grassland area is up to 817339.32 km²; 2000-2008, the mid-high coverage grassland area reduced 91011.18 km², an increase of low-cover grassland 82699.9 km².

TABLE II. MAQU LEVELS COVERAGE OF VEGETATION AREA CHANGE (2000-2008)

Type	area (km ²)				
	2000	2002	2004	2006	2008
High cover	662244.5	447105.6	444078.7	817339.32	654647.7
Mid-high cover	247715	427619.4	448959.8	90541.08	164300.6
Middle cover	22929.48	48757.14	30648.15	18613.09	30663.72
Low cover	7036.74	15211.8	8488.62	9726.66	7634.07
Inferior cover	6365.09	7612.2	14135.76	10096.47	89064.99

*Source based on reference [10]

3.3. Driving factors analysis of grassland coverage changes

- *Climatic factors.*

The growth of natural vegetation not only depends on the light, heat, water resource, but also closely related to their degree of match [11]. Due to the impact of global warming, the Yellow River wetlands convert from dry and cold climate, large wind dry to warm type. According to historical records [12], Maqu sunshine duration annual variation tended to increase; but Maqu County Weather Bureau shows that in the past 20 years rainfall is still low, $\geq 0\text{ }^{\circ}\text{C}$, $\geq 5\text{ }^{\circ}\text{C}$ accumulated temperature values lower than the average accumulated value; Heat is inadequate, hot and water is not match, which increase grasslands' evaporation, impels grass continuously to arid, vegetation coverage decrease.

- *Rodent and pest disaster factors.*

Rodent and pest disasters is one of the important affect factors of coverage changes, the region's main rodents including Zokor plateau, plateau pika, Himalayan otter, etc; insect pests mainly including locusts, caterpillars, etc[13]; Effects of rodent and pest disasters mainly including two aspects: on the one hand, pests and mice largely fed grass lead to the loss of growth capacity of grass; on the other hand, rodents dig around point, destroyed the original structure of the soil, reducing soil fertility, resulting in the further deterioration of grass ecological environment, reduce grass productivity.

- *The impact of human activities.*

Humans' over-exploitation on natural resources, beyond the limits of the natural environment' buffer and balance, which is bound to pose a threat to the ecological environment. Maqu County is rich in gold resources [14], is also a rich land of herbal material, known as the "the town medicine of." The disorder exploit and mining lead to the deterioration of ecological environment. The illegal digging herbs medicine seriously undermined the integrity of grassland vegetation, which, to some extent, is an important factor of vegetation cover changes in the region.

- *Social and economic factors.*

Scientific and cultural quality is low of the Large herdsmen, ecological construction and management talent is lack, tools and equipment is inadequate, implementation means is backward all that are important factors of leading to serious degradation[15]. Maqu County is the important grassland ecological zone of Gannan county, is also a pastoral county, so the number of cattle and sheep directly affect herders' income, from 1982, the livestock were contracted to home, herder attach importance to the development of livestock [16], driven by economic interests, the number of cattle and sheep is increasing year by year, the load of grass sharply increased, resulting in the vegetation damage and vegetation cover reduce.

4. Conclusion and discussion

Maqu County grassland coverage decreased year by year. we can see from the total area of vegetation data that, low cover grassland showed an increasing trend, changes in grass cover both have positive and negative conversion, high coverage grassland are mainly converted form mid-high coverage grassland, and the increase of inferior coverage grassland mainly come from middle coverage vegetation. The main driving factors of grass cover changes: light, heat, water and other natural factors; overgrazing, and socio-economic factors; and climate warming and drying and irrational exploitation activities are the important reasons leading to the ecological environment deterioration.

Acknowledgment

This research was supported by the National Nature Science Foundation of China (No.40971039) and National 11th five-year technology support projects (2007BAD46B07).

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