



The Study of the Ecological Problems of Eucalyptus Plantation and Sustainable Development in Maoming Xiaoliang

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Abstract

In recent years, the eucalyptus plantation industry develops rapidly in Xiaoliang Soil and Water Conservation Station of Maoming city, Guangdong Province. It has brought enormous economic benefits for regional economic development, and also brings many ecological problems. Based on the analysis about the advantages and disadvantages of the eucalyptus plantation industry development, the researches about the laws of its development and characteristics, and the exploration about good strategies for its sustainable development, this paper has important realistic significance to promote the healthy and steady development of regional economy.

Keywords: Maoming Xiaoliang, Eucalyptus plantation, Ecological problem, Sustainable development

Introduction

Eucalyptus is the general name of the Myrtaceae Eucalyptus species, originated in Australia and nearby islands. Because of its fast-growing, short rotation, desiccation-tolerant, drought-tolerant, adaptable, use of broad, high economic benefits, eucalyptus is known as one of the world's three major fast-growing tree species, which widespread in tropical and subtropical regions. China introduced in eucalyptus since 1989, it has gone through a journey of 100 years from planting before the founding of the People's Republic to its current scale development. Today, the total area of eucalyptus plantations in China have exceeded to 170 million hectares, ranking the second in the world. Eucalyptus has become the fast-growing, high yield, commercial forest tree species in South China (Zhang Junhua., 2006).

In recent years, eucalyptus plantations of Xiaoliang Soil and Water Conservation Station have developed rapidly and achieved significant economic benefits, while there is also a serious ecological problem. Under the guidance of scientific concept of development, combined with the practical production of Xiaoliang, how to carefully analyze the advantages and disadvantages of the development of eucalyptus plantations, study the laws of its development and characteristics, and explore the best methods for their sustainable development, in order to achieve the sustainable development of eucalyptus plantations is an urgent problem should be solved at present.

1. The development status of Xiaoliang ducalyptus plantation (Yang Liu Chun et al, 2003; Fang Daiyou, 2005)

1.1 The development of eucalyptus plantations in the study area

Xiaoliang Soil and Water Conservation Station, located at north $21^{\circ} 27'49''$, east $110^{\circ} 54'18''$, it belongs to subtropical maritime monsoon climate zone, with the annual average temperature of 23° , the annual average rainfall of 1400 to 1700 millimeter, and a noticeable change in wet and dry seasons. Xiaoliang has topography for coastal platform, soil zones for red and laterite, and Natural vegetation is subtropical monsoon forest. Due to human destruction of vegetation and serious soil erosion, Xiaoliang has become to a veritable barren land (Yang Liu Chun et al, 2003).

Zhanjiang Water Conservancy Bureau founded the Maoming, Xiaoliang Soil and Water Conservation in 1957, began to do ecological restoration experiments on this infertile barren land. Using a combination of engineering and biological methods, they planted 266.67 hectares of drought-tolerance, barren-tolerance, fast-growing eucalyptus and pine as a "pioneer forest" which adapted to local conditions, made the initial success of soil erosion. However, single forest form, strong absorption and fat absorption capacity of the eucalyptus, lack of surface litter to contain moisture, thus grass never grow and soil erosion is still very serious. Later, they created an ecological mixed forest and fruit forest, which has basically controlled the soil erosion and partly restored the ecology in Xiaoliang. In recent years, due to poor soil

and poor economic benefits for fruit trees, yet another large-scale cultivation of eucalyptus commences in Xiaoliang Soil and Water Conservation Station. In order to obtain better economic benefits, they cut down the original "pioneer forest" for sale, while expanded the cultivation area of fast-growing Eucalyptus. Now except for retaining some small piece of the ecological forest and a small number of fruit trees, most of the land is planted with fast-growing commercial eucalyptus such as eucalyptus number 5 and number 6. Harvesting period of commercial forest shorten to 3-5 years, and limited artificial fertilizer impoverishes the original low fertilized erosion soil, in which rare plant can grow. Currently eucalyptus cultivation area is accounting for more than 70 percents of the total area, and this number continues to rise, probably reach to more than 90 percents in 3 to 5 years. Then there will be almost entirely eucalyptus plantations except for an ecological protection forest (26.67 hectares). Therefore how to manage the eucalyptus plantations scientifically, is the key point to solve the sustainability development problem of Xiaoliang water and soil conservation station.

Forests are the material basis for subsistence and precious wealth resources of the mankind, and the earliest means of production which exploited by human. With the increase in population, acceleration in urbanization and development in industrial and agricultural production, the human society demand for forest resources is also growing. In order to protect the ecological functions of forests, we should promote the development of fast-growing forests and timber stands. Meanwhile, under the guidance of the sustainable development view, the concept of sustainable use of forest resources has been put forward. Sustainable development of forest resources refers to under a specific period of time and geographical condition, the forest resources should be rational developed, utilized, improved and protected, coordinated the relationship with human beings, in order to meet the needs of the sustainable development of mankind. The sustainable development of Eucalyptus forest is characterized as follows: the ecological performance of non-degradation on the eucalyptus quality, which can be a steady supply of socio-economic development and ecological protection, and the need to maintain a high production capacity; the economic performance of Eucalyptus forest resources for sustained and efficient use, which means receiving high-quality, high-volume products and efficient cost-effective in a limited area, while maintaining eucalyptus forest resources sustainability with high output function; the social performance of fairness between contemporary people and generations on the utilization, improvement and profits of eucalyptus forest resources, namely, the use of eucalyptus forest resources should meet the needs of contemporary people, as well as ensure the future generations' survival and development demand on forest resources(Lin Yihui.,2001). Using the above standards to measure the sustainable development of the eucalyptus plantations production in Xiaoliang study area, the problem is the low sustainability. Xiaoliang sustainable development of production, there is a big problem, the sustainability of current production is very low. Therefore, in order to promote the harmonious development of regional ecological economy, correct understanding and scientific research on the sustainable development problems of Xiaoliang eucalyptus plantation is an instant task.(Wu Qionghui,2006).

2. Strength and weakness analysis of eucalyptus production in the study area

2.1 strength analysis (Yang Minsheng et al, 2006)

Xiaoliang Town is predominant in developing eucalyptus plantations, which has lots of advantages, such as superior natural conditions, increasingly mature cultivation technique and broad market prospects, which provides favorable conditions for the development of eucalyptus.

(1) Superior natural conditions for eucalyptus plantations production

Xiaoliang Town of Maoming city is located on the transition zone between the tropical and subtropical, and is strongly influenced by monsoon climate, with the climate feature of the north tropical - south subtropical. The climate here is resource-rich of heat, and abundant rainfall. The annual average temperature is 23 . Annual mean precipitation is 1442mm. It is one of the richest natural resource of water,heat and light area in China.

The climate conditions here is similar to the origin of eucalyptus, suitable for wide development enjoys exceptional climate conditions advantages. At present, eucalyptus planting area in Maoming city is only 38000 hm², which is an area lesser. It means there is great potential for further development of eucalyptus.

(2) Eucalyptus plantations produce sophisticated cultivation techniques

Guangdong is not only one of the earliest provinces introduction of Eucalyptus in China, but also the cultivation of an area of eucalyptus plantations. The one-century cultivation history has accumulated rich experiences and has laid a good foundation for the rapid development of Eucalyptus. Maoming is close to the Guangdong province's largest eucalyptus plantation production areas - Zhanjiang, which provides sophisticated cultivation techniques and experiences for the development of xiaoliang eucalyptus plantations. And at the same time lays the base for xiaoliang became the basis of eucalyptus plantations

In recent years, through the researches about eucalyptus' determination of optimal rotation, techniques of eucalyptus' high-yielding, techniques of forest's fertilization etc., Guangdong Province is gradually adopting techniques of afforestation, such as asexual breeding, reasonable site preparation, scientific fertilization, in-time tending etc., making

the development of eucalyptus plantation toward to the scientific, intensive management progressively.

The vast market prospect of eucalypt-plantation

With the rapid growth of the national economy and improving quality of people's life, the consumption of lignum has leaped sharply. To protect the forestry ecological efficiency, the commercial eucalypt-plantation has developed fast in Guangdong province. There are more than twenty thousand forestry corporations where employees amount to over three million, annual production value is nearly three hundred billion and the annual consumption of lignum has increased by 19.6 fold from 1978 to 2004. However, the autochthonic one is only three million cubic metres to supply the market in Guangdong, and the more depend on other provinces and overseas. The imported lignum up to five million metres every year, and the imported wood pulp and waste paper exceed four million ton. Owing to the large supplying gap of lignum in Guangdong, eucalypt which is the excellent trees to make paper and man-made board has brilliant and broad prospect.

2.2 Weakness Analysis (Xie Zhixing, Yan Daibi., 2006; Xie Yaojian, 2003)

Eucalyptus has many advantages and it is popular, but the problem of artificial eucalypt forest also outstanding. Like other artificial forests, artificial eucalypt forest has their faults in common, at the same time it has its own characteristics

(1) the artificial eucalypt forest eucalypt forest soil fertility declination

From the beginning of the 19th century, people have noticed the artificial eucalypt forest soil fertility declination is a common phenomenon, and its reason is various.

Firstly, eucalyptus is a fast growing tree. It absorbs a lot of nutrition and water from the soil in a unit of time, which cause nutrients and water continuous loss.

Second, the reason of soil fertility declination is artificial forest measures or site management. The major reasons are burning, destroying the soil nutrient; complete-tree utilization and shortening rotation length; the production of sod mud; land preparation, water loss and soil erosion.

The main reasons of soil fertility declination in XiaoLiang are land preparation, water loss and soil erosion; complete-tree utilization and shortening rotation length. It makes the land poorer and poorer, that other plants cannot live in this zone.

(2) bio-diversity decrease

Eucalyptus plantations bio-diversity decrease is a common phenomenon, which is mainly embodied in the reduction in the genetic diversity, species diversity, ecosystem diversity. The consequences of eucalyptus bio-diversity decrease is aggravated soil erosion and land degradation, forestland productivity decline, ecological environment deterioration, ecological poor stability and so on. Eucalyptus plantations bio-diversity decrease is not only due to natural environment factors, but even more to the effect of human factors.

As an alien species, eucalyptus is difficult to form a more complete eco-system with the local native trees; the consequence of anthropogenic interference is even more serious, multigenerational trees planted causes a serious decline in soil fertility. With increase of planting and times, floor vegetation of eucalyptus plantations and species diversity will decrease with each generation.

On the other hand, a considerable portion of forest used for planting eucalyptus is hilly, hills, plateaus, seaside in Guangdong province, where forest vegetation scarce, the composition of community is simple. What's more, power farming and opening up too much forest lead to the further destruction of vegetation. After the trees have been planted, it is hard to have a luxuriant growth of weeds under the forest.

(3) single structure of community

Due to the community between the composition of community and bio-diversity, so a decline in community biodiversity will inevitably lead to a single community level, vertical structure trend. Community structure is formed by a certain species, species in terms of quantity, the advantages of extent, distribution uniformity, etc. directly regulate the complexity and diversity of the community structure.

In the origin, under the first dominant layer of eucalyptus sclerophyll, there is a complete nanophanerophyte, grass, ground-litter. The area where has humid climate even has a sub-layer, showing the appearance of various kinds of complex ecological system, which is completely different from the several kinds of species of plantation communities in the origin, and the monotonous level.

3. Eucalyptus Plantations Sustainable Development countermeasure (Qi. Shuxiong., 1989)

Chen Shaoxiong, 2005)

3.1 Reasonable zoning and introduction of afforestation Zoning is to identify regional afforestation direction and planning purposes, to determine the proportion of the main forest tree species, to take corresponding measures for

afforestation technology is conducive to regional guidance, the progressive realization of regionalization, industrialization, production-oriented in order to adjust the layout of forestry to play a local The natural advantages, to improve forest productivity.

Introduced eucalyptus tree species selection need highly technical. Firstly, we should investigate the origin and the introduction to the similarity of rainfall conditions and analyze the introduction to the potential ecological limiting factor, and then we should consider ways to cultivate it with the purpose of use. Now as to the number 5 and 6 Eucalyptus that Xiao Liang planted, which were in the absence of research, they grown slow and ecological and economic benefits are not high, In our opinion, it should be rational planning, correct introduction under the guidance of scientific concept of development.

3.2 change the traditional site preparation methods and predatory business

Guangdong have serious damaged the soil structure for they use too much mechanized farming full-cultivated soil preparation methods, which is the right reason resulting in the loss of a large number of surface soil, and thus difficult to restore understory vegetation, so that within the eucalypt plantation surface runoff can not be effectively inhibited, prone to soil erosion and nutrient loss. Therefore, mechanized farming methods with site are better than the former methods, whether from an economic point of view or an ecological point of view.

The main way to change predatory business is to protect the eucalyptus plantation the litter layer and to prohibit the use of the whole tree. Post-harvest rotting tree stump to take the way to retain the stump of the nutrient elements. All of the branches, leaves and bark should remain in the woodland to add nutrients to the forest after a process of water-moisture and rot after some time.

3.3 Implementation of the mixed, crop rotation or interplanting

Xiaoliang eucalyptus due to many generations, even in pure forest, leading to soil fertility obviously retreat, become an obstacle to their development of the main problems or potential problems. It is proved that eucalyptus plantations mixed, may form a good stand structure, improve forest productivity and achieve sustainable business results.

Species of resistant barren, shallow root depth, preferably with a nitrogen-fixing function, full of falling objects and nutrient can be selected as the mixed species. It is found that Acacia is a good mix of eucalyptus tree species after a long trial. Mixed Eucalyptus and Acacia, in particular, between the lines mixed with the best results, it can improve soil, improve soil fertility and eucalyptus forest's productivity. Also, people were studying on crop rotation or interplanting of eucalyptus forests and crops (watermelon, peppers, etc.), to restore soil fertility, increase economic efficiency, achieve sustainable development.

3.4 Rational fertilization and correct planting

Eucalyptus is a fast-growing species, fast growth, per unit time consumption of soil water, fertilizer excessively is inevitable. Therefore, Fertilization becomes the key of eucalyptus plantations' fast-growing and high yield. In the fertilization, we should pay attention to the use of several elements and balanced fertilization, eucalyptus is the early fast-growing trees, it's important to fertilizer, preferably use controlled-release which suitable to the growth of Eucalyptus.

Proper cultivation of eucalyptus is very important. From the ecological and economic point of view, eucalyptus planting density should not be too dense (up to 400 / mu), too dense will cause not only can not harvest but also soil fertility decline, undermining the balance of the natural environment.

To sum up, eucalyptus as an important industrial timber species, which has three main benefits - eco-efficiency, economic and social benefits. Ecological needs has become the first needs of the community forestry. So Xiaoliang in the Eucalyptus plantation development should follow the "people-oriented, eco-first" principle, Take the scientific concept of development as guidance, go to the priority of forest ecological construction, ecological and economic sustainable development's road.

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