Fire management in China: Application and Development of Fuelbreaks

Cui Yong-huan [1]

Abstract

The paper summaries the achievement of fuelbreaks in China and introduces the status of the fuelbreaks in China. It describes the silvicultural technique of fuelbreaks and its application in fire management. Fire experiments in wildland confirmed that the fuelbreaks can prevent surface fire and some crown fire on some scale. The fuelbraks also can be used as fire control line and transportation chunnel for fire resources. The fuelbreaks also have other functions benefiting the forest ecosystem and environment. In China, *Schima superba*, *Camellia oleifera* and *Myria rubra* are main tree species in existent fuelbreaks.

Introduction

Fuelbreaks has been building in south forest region of China since 1950s. In 1980s it is application rapidly in southern China. Lot fire lines are replaced by fuelbreaks in some provinces. Those play an important role in fire management. At present, the fuelbreak has already been built 339,541 kilometers, about 635,565 ha (Ma Fu, 2000). Great development has been achieved in the construction of fuelbreakss along with the strengthening of basic facilities construction of forest fire control in southern China. In 1998 the People's congress Council of Guangdong province passed an act about the construction of fuelbreaks in the province. From 1999 to 2008, the province will invest 688,390 thousand Yuan to build fuelbraks 83,209 km, 94,624 ha. Fujian province has built 55,811 km and average density of fuelbreaks 15.02 m per hectare forestland. They plan to build another 50,000 km in 2006-2030 on base of current 110,000 km. Anhui province made a plan to build 47,000 km fuelbreaks during 2006-2030. Zhejiang province set the fuelbreaks construction as the important forestry project in the eleventh five-year plan. They plan to build fuelbreaks more than 2,000 km/yr. by the end of 2010 China will have fuelbreaks 170,530 thousand km, about 527,560 thousand ha according to China's Plan of fuelbreaks construction(Du 2004.).

1 Effectiveness of Fuelbreaks

With the development of the fuelbreak in China, it plays an important role in fire prevention. According to the statistics, in Guangdong province there are average 285 forest fires per year in the period of 1988-1998. Every year there are average 2,100 ha destroyed forest. Compared with the period of 1977-1987, the number and area of forest fires have decreased about 73% and 93% respectively. The forest cover rate is 76.7% in Sanming city, Fijian province, but there is only one big forest fire during 1990s. The forest fire occurrence rate is 2.16 per ten million hectares. The reasons of forest fire decline are that the government gave more attention, the fire prevention education is strengthened, the basic facilities construction is improved and the fuelbreaks was built extensively.

Fuelbreak can separate the large area conifer forest into smell parts combined with natural firebreaks. Fuelbreaks can prevent or postpone the fire crossing. In fact, there are lot examples in south China. In 1996, Huaiji County occurred a forest fire. Because the strong wind and number of combustible fuel, the forest fire is so strong that 4,000 people couldn't control it. But when the fire met an eight kilometer long

[1] Fire management office, State Administration of Forestry 100714 Beijing

fuelbreakss (made of Schima superba), it stopped and the fire was push out after burning 20 hours.

In China, the researchers have done several experiments to test the fire resistant ability of the fuelbreak. Ruan Chuancheng (1995) led a research group to do two burning fuelbreak outdoor experiments in the base of Youxi science research in October 15 and October 27, 1995. They built fires, which the fire intensity was up to 97MJ/(m·s) and 125 MJ/(m·s), the average fire height 5.07m and 5.86m respectively, and the tallest fire height 10m and 12m. Consequently, the fuelbreak have stood the fire test, and just in the first row some trees had 1.5 to 2.0 m fire scar. The rest trees of the fuelbreak have not been destroyed. The fuelbreak can prevent fire successfully. After one year of the test, they investigated the fuelbreak and found the wounded trees had cured and had two or three sprouts. The sprouts grew well and had five to six meters long. Tian et al. (2003) studied on fuelbreaks effectiveness of Schima superba and its combustibility through cone calorimeter and wildland fire experiment. Experiments show that the fuelbreak can block spread of surface fire and crown fire. Crown story of the fuelbreak can prevent short distance spot fire. In addition, Wu Deyou and Guo Huiru had done some similar experiments, and the result was that the fuelbreak could prevent surface fire and crown fire effetely.

Compared with fire line, fuelbreak have ecological and economical benefits (Tian Xiaorui et al. 2000; Yao Shuren & Tian Xiaorui, 2001) It can effectively prevent soil erosion, forest insects and disease spread, and it also contributes to the improvement of the forest structure.

2 Planting techniques of the fuelbreak

2.1 Tree species of the fuelbreak

Fuelbreaks are often located in the ridges of the hill or the forest fringe (Tian Xiaorui et al. 2001). The site is poor and grid. So the suitable tree species should be used. Its must suit for the site condition and have less flammable characteristics. In south China, we often use native tree species. At present, most fuelbreak is established with Schima wallichii. The following tree species are commonly used in south China for fuelbreak (Tian Xiaorui & Liu Tao, 1997; Chen Cunji et al. 1988; Gu Fengqi & Wang Shijiang. 1995; Shu Lifu et al., 1999; Shu Lifu et al., 1999). Hamamelidaceae: *Exbucklandia popunea, Mytilaria laosensis, Altingia chinensis, Altingia gracilipes* ; Magnoliaceae: *Michelia macclurei* ; Theaceaed: *Schima superba, Schima wallichii, Camellia oleifera, Camellia sinensia* ; Myricaceae: *Myria rubra, Myria esculenta* ; Minosaceae: *Acacia auriculiformis.*

3.2 Structure of the fuelbreaks

Most fuelbreaks is the one-story and pure forest. In some areas, there are one-story mixed forests. But to establish a mixed forest belt is difficulty owing to the complex techniques. Forest density is usually bigger than that of the timber forest. That will speed the fuelbreaks canopy close earlier. The closed fuelbreak will restrain the heliophilous weeds. For example, the planting density of Schima wallichii is 1m×1m, and four years later the fuelbreak canopy will be closed. In the sixth year, we will make the first intermediate felling and in tenth year the second intermediate felling. The last retained trees will be 2,500 per hectare.

The width of the fuelbreak is usually not less than the average height of the protected forest. In south China, the fuelbreak is often 12-15 meters wide, and the widest is

20m. If the fuelbreaks are locate in the edge of the hill or at the edge of farmland, it can use the economic tree species.

2.3 Silvicultural techniques

Before afforestation, it must be to prepare the site and clear the weed and conifer trees. We usually use one-year or two-year seedling for planting the fuelbreak in order to make the belt close earlier. The fuelbreak need silvicultural management. Meanwhile the flammable fuels under the belt need to be cleared timely.

2.4 Regeneration

When the fuelbreak become old and the canopy open, weeds will grow under the trees. The fire resistant ability of the fuelbreak will decrease. So the fuelbreak need regeneration timely. In south China, the fuelbreak will be felled at the age of 50 to 60 years. The method of harvesting may be clear-felling or successive thinning. The regeneration can use sprout or seedling.

3 The development of fuelbreaks in China

The State Forestry Bureau has made a document to strengthen the project of fuelbreakss in order to prevent forest fire actively and improve the environment (State Forest Bureau, 2000). Now in south China some provinces have built up the network of fuelbreaks. In subtropical area, some province will pay more attention to apply fuel breaks to prevent forest fires. In the coming years, China will do some works on the fuelbreak as following.

The construct of the forest project should company with the establishments of the fire belts (Shu Lifu et al. 2000). In south China, the fire belts will mainly be the fuelbreakss and the natural belts as supplement. The construct of the fuelbreak project will be included the general forestry planning and yearly budget. We will speed up to build the fuelbreak and make the length of the fuelbreak get 15 ~ 25m per hectare in key forest regions and 10 ~ 15m per hectare in common forest regions. The fuelbreaks will combine with other fire belts to be the network.

All new afforestation sites must build the fuelbreaks according to the demand of the technological standard of afforestation. The fuelbreaks and forest will be designed and planted in the same time. In the forest area without or lack fuelbreaks, the belts will be built companying with silvicultural management. The soil belt will change into the fuelbreaks gradually.

The government will increase the investment in the project of fuelbreaks construct.

China will strengthen the research on choosing the good tree species and improving fuelbreak structure. In the south China the fuelbreaks will be extended in the future.

References

Chen Cunji, Shi Xiaofang, Hu Huang *et al*. 1988. Research on fuelbreaks tree species selection. Journal of Fijian Forestry College 8(1):1-12.

Du Yongsheng. 2004. Construction of fuelbreaks in China. Beijing: Chinese Forestry Press.

Gu Fengqi, Wang Shijiang. 1995. Order of combustibility and burning characters of main tree species in Daxing'anling by using Fuzzy. Fire Prevention (2):17-20.

Ma Fu. 2000: The report of forest fire prevention, 2000. Fire Prevention (3):2-12.

Ruan Chuancheng, Li Zhenwen, Chen Chenghe, *et al.* 1995: The mechanism and application of Schima superba fuelbreaks. Xi'an: Press of Electronic Science and Technology University, 106 p.

Shu Lifu, Tian Xiaorui, Kou Jilie . 1999. Study on the selection of fire-resistance tree species in Daguishan region, Guangxi Zhuang Autonomous Region. Scintia Silvae Sinicae 35(1):69-76.

Shu Lifu, Tian Xiaorui, Li Huikai. 1999. The development of fuelbreak research. Scintia Silvae Sinicae 35(4): 80-85 .

Shu Lifu, Tian Xiaorui, Su Kaijun. 2000. The theory and application of fuelbreaks. Haerbin: Northeast Forestry University Press. 166 p.

State Forest Bureau. 2000. To strengthen the project of fuelbreakss building. Fire Prevention (2):2-12.

Tian Xiaorui, Gao Chengde, Shu Lifu, Wang Mingyu. 2003. Study on the Effectiveness of Schima superba Fuelbreak. Journal of Safety and Environment 3(6):21-25.

Tian Xiaorui, Liu Tao. 1997. The study and application of biological fire prevention. World Forestry Research 10(1): 22-29.

Tian Xiaorui, Shu lifu, Qiao Qiyu, He Qingtang. 2001. Study on the selection of fire-resistance tree species in South China . Journal of Beijing Forestry University, 23(5):43-47.

Tian Xiaorui, Shu lifu. 2000. The application and research on fuelbreak. World Forest Research 13(1):20-26.

Yao Shuren, Tian Xiaorui. 2001. Study on the techniques of fuelbreaks establishment in Guangdong province. Fire Prevention (4): 41-42.