

Community-Based Forest Fire Management in Wenyime Village, Sanchahe Township, Dayao County, Chuxiong Yi Autonomous Prefecture, Yunnan Province, China

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EXECUTIVE SUMMARY

China had an average of 15 619 forest fire events each year since the establishment of the People's Republic of China in 1949 until 1990. Yunnan is one of the country's key national forest areas. It is rich in forest resources, but also very prone to fire. Every year, more than 2 700 forest fire events occur, destroying 1.7 million ha of forest. Of the many natural disasters in Yunnan, fire has had the most pronounced influence on forest cover. Although forest fires are difficult to prevent altogether, proper management and control can reduce their occurrence and spread, or at least minimize the damage that they cause.

The Chinese Communist Party and Government in Dayao county have paid great attention to forest fire management, especially after the Daxinganling forest fire in 1987. A collaborative effort between government and communities in the county has led to significant achievements, culminating in Dayao county being awarded a prize for advanced forest fire management by Yunnan Provincial Government in 1992.

This case study investigates the village of Wenyime in Dayao county, Chuxiong Yi Autonomous Prefecture, where villagers have shown a profound understanding of fire prevention and control and have participated voluntarily in fire management. The effect of such community-based fire management (CBFiM) has been beneficial to both villagers and government.

Forest fire management has a close and direct relationship with forest tenure. The existing Responsibility Mountain policy has provided benefits and income to the people of Wenyime village, thereby encouraging their participation in CBFiM in order to protect the forest resources from which such benefits are derived. To date, the effects have been positive, with no incidence of uncontrolled fire in the past 35 years. The most effective forest fire prevention regulations are not necessarily those of the government or outside agents. In Wenyime village, the community has discussed and formulated very effective regulations of its own. These experiences are worth publicizing within the county, the province and the whole country.

Gestion A Base Communautaire des Incendies de Forêt dans le Village de Wenyime, Municipalite de Sanchahe, Canton de Dayao, Prefecture Autonome de Chuxiong Yi, Province de Yunnan, Chine

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RÉSUMÉ

La Chine a enregistré en moyenne 15 619 incendies de forêt par an entre 1949, date de création de la République populaire, et 1990. Le Yunnan est une des zones forestières les plus importantes du pays: il est riche en ressources forestières mais très exposé aux incendies. Chaque année, plus de 2 700 incendies ont lieu et détruisent 1,7 million d'hectares de forêt. Parmi les nombreuses catastrophes naturelles qui frappent la province, c'est le feu qui a l'incidence la plus forte sur le couvert forestier. Bien qu'il soit difficile de prévenir totalement les incendies de forêt, une gestion et une lutte bien organisées permettent de réduire leur fréquence et leur ampleur, ou tout au moins de limiter au minimum les dégâts qu'ils causent.

Le Parti communiste et les pouvoirs publics du canton de Dayao ont porté un grand intérêt à la gestion des feux de forêt, notamment après l'incendie de Daxinganling en 1987. La collaboration entre les pouvoirs publics et les communautés du canton a donné des résultats si remarquables que le canton a reçu du gouvernement provincial un prix pour sa gestion avancée des incendies de forêt en 1992.

Cette étude porte sur le village de Wenyime du canton de Dayao, (préfecture autonome de Chuxiong Yi) où les villageois connaissent bien la prévention et la lutte contre les incendies et ont participé à titre volontaire à la gestion des incendies. La gestion à base communautaire des incendies a été bénéfique pour les villageois comme pour les pouvoirs publics.

Il existe un rapport étroit et direct entre la gestion des incendies et le régime foncier des forêts. La politique de responsabilité dans les zones de montagne actuellement appliquée a apporté divers avantages et fourni des revenus aux villageois de Wenyime, et les a ainsi encouragés à participer à la gestion communautaire des incendies de forêt afin de protéger les ressources forestières si précieuses pour eux. Jusqu'ici cette politique a eu des effets positifs et aucun incendie non maîtrisé n'a eu lieu depuis 35 ans. Ce ne sont pas nécessairement les règlements des pouvoirs publics ou d'agents extérieurs qui sont les plus efficaces pour prévenir les incendies de forêt. Au village de Wenyime, la communauté a étudié et établi elle-même une réglementation très efficace. Ces réalisations méritent d'être largement connues au niveau du canton, de la province et de tout le pays.

Manejo Comunitario de los Incendios en la Aldea de Wenyime, de la Alcaldía de Sanchahe, Condado de Dayao, Prefectura Autónoma de Chuxiong Yi, Provincia de Yunnan, China

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RESUMEN DE ORIENTACION

China alcanzó un promedio de 15 619 incendios al año entre 1949, fecha de la fundación de la República Popular de China, y 1990. Yunnan es una de las áreas forestales más importantes del país. Esta provincia es extremadamente rica en recursos forestales, pero también es muy propensa a los incendios. Cada año ocurren más de 2 700 casos de incendio que destruyen cerca de 1.7 millones de ha de bosque. El fuego es uno de las numerosas causas de desastres naturales que ocurren en Yunnan, en efecto, los incendios han tenido un fuerte impacto en la cubierta forestal. Aunque los incendios forestales son difíciles de prevenir, el manejo y control apropiados pueden reducir la ocurrencia y propagación de los incendios, o al menos, reducir al mínimo los prejuicios que estos provocan.

El Partido Comunista Chino y el Gobierno del condado de Dayao han dado mucho relieve al tema del manejo de incendios forestales, especialmente después de que ocurrieran los incendios del bosque de Daxinganling, en 1987. Un esfuerzo de colaboración, realizado entre el gobierno y las comunidades del condado, tuvo grandes logros que fueron coronados en 1992 con el premio otorgado al gobierno de la provincia de Yunnan, por el manejo avanzado de los incendios forestales.

Para realizar este estudio de caso, se condujo una investigación en la aldea de Wenyime en el condado de Dayao, de la Prefectura Autónoma de Chuxiong Yi, en donde la población mostró un profundo conocimiento sobre la prevención y el control de incendios, habiendo participado de manera voluntaria en el manejo de incendios. El efecto producido por este manejo comunitario de los incendios forestales ha sido beneficioso tanto para la población, como para el gobierno.

El manejo de los incendios forestales tiene una íntima y directa relación con la tenencia del bosque. La política de Responsabilidad de las Montañas que existe actualmente en China, produjo beneficios e ingresos para la población de la aldea de Wenyime, fomentando así su participación en el manejo comunitario de incendios a fin de proteger los recursos forestales de los cuales provienen tales beneficios. Hasta la fecha, los efectos de esta participación han sido positivos y han evitado la incidencia de fuegos incontrolados durante los últimos 35 años. La reglamentación más eficaz de prevención de incendios forestales no es necesariamente de índole gubernamental o la producida por agentes externos. En la aldea de Wenyime, la comunidad ha debatido y elaborado una reglamentación propia muy eficaz. Vale la pena divulgar estas experiencias en el ámbito del condado, de la provincia y de todo el país.

BACKGROUND AND OBJECTIVES

Many environmental problems, such as global warming, greenhouse effects, soil erosion, desertification, water resource degradation, loss of biodiversity and excessive flooding, have been linked directly or indirectly to the decrease in forest cover. One cause of the rapid decrease in forest cover is the effects of various natural disasters. Among non-natural events, excessive logging can be blamed for much of the loss. Of the many natural disasters, fire has had a pronounced influence on forest cover. Although forest fires are difficult to prevent altogether, proper management and control can reduce their occurrence and spread, or at least minimize the damage that they may cause. Prevention and control of forest fire has always been an important part of disaster prevention and relief. Appropriate forest fire management has not only important repercussions for human well-being, but also a profound significance for forest resource protection, restoration effects and sustainable economic development.

This study investigates community involvement in fire management as a way to strengthen forest development, fire prevention and the management of forests and woodlands in Yunnan Province. The objectives of the study are to:

- provide background information on fire management in China;
- collect primary data and statistics from a village, analyse these and provide recommendations to improve forest policy;
- itemize traditional uses of fire in forests and surrounding areas, and document community relationships with forest fire;
- gain an understanding of indigenous methods, rules and regulations used for community-based fire management (CBFiM);
- study how the community has been involved in fire prevention, control, management and remedial measures of restoration after fire; and
- assess the level of local people's awareness about fire management.

The strategies used to reach these objectives were: collection of primary data and statistics on forest fire management, and evaluation of local people's awareness about fire management. There was an emphasis on traditional sources of fire, methods of using fire and managing fire for productive and non-productive uses. These include the causes of forest fires, prevention methods and village rules and regulations. The study also provides background information on China's fire management policies and includes recommendations for the further development of such policies.

The criteria for site selection included: frequent fire occurrences; degraded landscape; fire management challenges; the government's interest in collaborating; community involvement; and significant achievements with CBFiM. With collaboration from the headquarters of Yunnan Provincial Forest Fire Management Office, the Wenyime natural village in Dayao county, Chuxiong Yi Autonomous Prefecture was selected as the site for studying CBFiM in Yunnan Province. The reasons for selecting Wenyime were as follows:

- Wenyime village is located in the river valley of Sanchahe township. The weather tends to be dry and hot in spring and winter, with prevalent windy conditions. It is one of the most fire-prone areas in Dayao county, with fires occurring often. Bordered by Bingchuan county and Xiangyun county of Dali Bai Autonomous Prefecture, Dayao county has signed a joint protection agreement with these neighbouring townships for forest conservation and fire management.

- In recent years, Wenyime villagers have participated in fire fighting in a nationally owned forest managed by the township. Villagers have a profound understanding of fire prevention and control and have also participated voluntarily in fire management. The effect of this CBFiM has been beneficial for both villagers and government agencies.
- Wenyime village is multiethnic. People of Yi and Han nationalities have been living there in harmony for more than a century.
- Leaders at the county, township and village levels recommended this village and supported the work there.

CASE STUDY METHODOLOGY

A total of 18 days were spent in Wenyime village. In the first stage, the research team spent four days listening to the introductions of the township and village leaders and discussed forest resources, forest fire management organizations and forest fire disaster time lines. In the second stage, the members of the research team stayed in the village for 11 days to hold group discussions with the following groups of villagers:

- present and past leaders;
- women;
- elders;
- joint defence fire control volunteer team;
- key households reliant on forest resources; and
- shepherds.

A workshop was held for household heads. Semi-structured interviews, forest resources stakeholder analysis, questionnaires and ranking were used to obtain primary data and relevant information. Key informant interviews were also carried out; key informants included elementary school teachers, the former party secretary, elders, neighbouring villagers, and people who had been punished for starting fires. In the third stage, the research team spent three days completing the collection of secondary data, cross-checking primary data and giving feedback of the study results to the township and village leaders.

FOREST FIRE STATISTICS AND FOREST FIRE MANAGEMENT IN CHINA

From the establishment of the People's Republic of China in 1949 until 1990, China had an average of 15 619 forest fire events each year (1996 inspection tour, National People's Congress). The average forest area damaged by fires was 930 000 ha per year. The forest fire incidence rate was 11.1 occurrences per 100 000 ha of forest area. Every year, the forest fire damage rate was 0.706 percent (the area of fire-damaged forest divided by the country's total forest area). On average, 103 people were killed and 643 injured by fires each year.

Since the 1987 forest fire in Daxinganling, each level of government has strengthened its leadership on forest fire management and adopted more effective measures. In the past ten years, forest fires have decreased significantly. Between 1990 and 1995, the number of forest fire events decreased to 5 768 per year and the average forest fire incidence rate to 4.4 occurrences per 100 000 ha per year. Compared with values from 1990, the number of forest fires in 1995 had decreased by 63.1 percent, and the incidence rate by 58.5 percent. The area of forest damaged by fire was reduced to 38 800 ha per year, amounting to a forest damage rate of 0.029 percent

between 1990 and 1995. Compared with figures from 1990, the damaged forest area had decreased by 95.3 percent, to become lower than the world average of 0.1 percent of forest area burnt. The number of deaths resulting from forest fires also decreased from 1990 to 1995: 49 people died and 203 were injured in fires every year. The number of deaths and injuries had therefore decreased by 53.4 and 68.4 percent, respectively.

In 1996, about 4 948 fires took place in China, and forest fire alarms were sounded on 2 156 occasions. Fire occurrences included categories of ordinary forest fires (2 779), major forest fires (ten) and extraordinary forest fires (three). The damaged forest area was 148 985 ha. The forest fire incidence rate was 3.8 occurrences per 100 000 ha, and the damage rate was 1.13. In 1996, 105 people were injured and 75 killed. Compared with 1995, the number of fire occurrences decreased by 4.8 percent; the damaged forest area increased by 155.9 percent; the number of injuries decreased by 36.7 percent; and the number of deaths increased by 82.9 percent. Three extraordinary forest fires in Mongolian forests increased the damaged area significantly. Regarding the causes of forest fires in 1996, productive uses of fire such as prescribed burning or wasteland burning caused 2 355 fires, comprising 47.6 percent of the total ignitions; non-productive uses of fire, such as smoking or burning paper when visiting graves, caused 2 474 fires, accounting for 50 percent of known ignitions; arson caused 54 fires, making up 1.1 percent of known causes; lightning caused 16 fires; and fires from other countries caused five forest fires.¹

1987 was a turning point in China's forest fire management activities. Since 1987, China's forest fire management has made great progress through joint efforts on the part of government and civil society. The following steps were taken:

- *Establishment of forest fire management organization and system.* Forest fire management command and administrative bodies were set up at the provincial, prefecture and county levels. This created a forest fire management command system from top to bottom. Now there are 2 900 forest fire management command headquarters and 3 000 administrative bodies at and above the county level. Meanwhile, each forestry bureau (state forest farm) has also set up forest fire management command institutions. This has formed the basis of a provincial forest fire management network.
- *Reform of the legal system to carry out forest protection and fire management.* The State Council issued Forest Fire Management Regulations in 1988. Each provincial, prefecture and local government formulated its own enforcement with detailed rules and regulations legalizing forest fire management work.
- *Reinforcement and reiteration of administrative leaders' responsibility for administering the forest fire management system.* According to the Forest Fire Management Regulations, each provincial-, prefecture-, county- and township-level government is to establish a system in which administrative leaders are held responsible for fire management. This system identifies responsibilities and jurisdictions at each level.
- *Strengthening of public awareness of forest fire management issues.* By increasing education activities on forest fire management and emphasizing the Everybody Has a Responsibility for Forest Fire Management policy, fire management consciousness has been strengthened.
- *Strengthening of the forest fire management infrastructure.* Since 1987, the state has given 50 million yuan renminbi a year for improving forest fire management infrastructure. In

¹ Data on fire management from 1997 to 2001 are not available.

recent years, this investment has reached 70 to 80 million yuan. The State Fiscal Ministry contributed 5 million yuan per year for construction of fire lines in the northeast and Inner Mongolia. In 1997 these funds were increased to 10 million yuan. Another 16.5 million yuan was invested in aviation measures. Each province, prefecture and local fiscal unit has arranged matching funds (according to certain proportions) to strengthen the efficacy of this infrastructure investment. Forest fire management infrastructure has been upgraded by the building and maintenance of more than 7 000 watchtowers and 700 000 km of fire lines and by the acquisition of 16 000 fire engines, 89 000 radio base stations and 56 000 wind-blower fire extinguishers.

- *Establishment and training of forest fire teams.* There are some 9 300 professional or semi-professional fire fighting teams supported by 328 000 staff and 146 000 volunteer fire fighting teams. There are also 5.29 million volunteer firefighters. Heilongjiang, Jilin, Inner Mongolia and Yunnan provinces have four forest police teams and 18 aviation stations from which to carry out aerial surveillance in the northeast, Inner Mongolia and southwest forest areas.
- *Increased scientific research on forest fire management.* China has used and experimented with helicopter drop buckets, chemical applications and fixed wing aerial drops. To monitor fire, ground patrols, watchtowers and aeroplane patrols have been used, as well as satellite data for monitoring and discovering hot spots. Local weather broadcast departments have been strengthened by including fire weather broadcasts. A risk rating system is used to increase awareness, foresight and collective action.

Since 1987, leaders at all levels of government have paid greater attention to forest fire management issues. Consciousness has been strengthened, and forest fire management has made three fundamental shifts: forest fire management work has changed from depending solely on forestry departments to giving greater responsibility to multiple departments working collaboratively with civil society; work has changed from arousing the masses on fire management passively (after the fact) to more proactive measures of pre-fire management and fire control – professional teams now realize the goal of fire control at early stages, i.e. when fires are small and of low intensity and where the communities' collaboration allows for quick and effective control; and previously simple administrative management has evolved into integrated control in which combined administrative methods are used with economic and legal incentives.

Forest fire situation in Yunnan Province

Yunnan is one of China's key national forest areas. It is rich in forest resources but also very prone to fire. Every year, more than 2 700 forest fire events occur, in which 1.7 million ha of forest is consumed by fire. From 1951 to 1999, 130 000 occurrences of fire burnt 8 622 million ha of forests. Over the same period, 658 people died and 1 944 were injured by fire. The losses to the economy were estimated at 4 billion yuan. The latest statistics show that in 1999, 964 forest fire events occurred, burning 10 469 ha, killing 12 people and injuring 185.

Figure 2



Prevention and control of forest fire in Dayao County

The Chinese Communist Party and Government in Dayao county have paid great attention to forest fire management, especially after the Daxinganling forest fire in 1987. Under the attention and appropriate leadership of these institutions, with the collaborative effort of each level's government and the communities, forest fire management has made significant progress. In 1992, Dayao received the prize for the most advanced forest fire management unit in Yunnan Provincial Government for the following reasons:

- Command and administrative bodies were coordinated for forest fire management at the county, township and village levels. Fourteen townships have command stations for forest fire management, within which 150 village committees have command groups for forest fire management. Within Sanchahe township, there are ten command groups with 175 firefighters.
- Dayao county has made infrastructure improvements by building two watchtowers and 256 km of fire prevention lines and by purchasing four fire engines, 80 radios with eight base stations, 23 wind-driven fire extinguishers, eight fire water guns, 70 sets of fireproof clothing, 300 No. 2 fire fighting tools, and 500 fire extinguishing bombs.
- Forest protection and fire management are carried out according to law. One month before the dry season, the county uses various media to publicize the Forest Fire Management Regulation of the State and the Forest Fire Management Regulation of Yunnan Province. Each township and village formulates its own rules and regulations legalizing its own form of CBFiM.
- Based on the Forest Fire Management Regulation, government at the provincial, prefecture, county and township levels has established a system whereby administrative leaders are responsible for fire management. This system identifies responsibilities and jurisdictions at each level.
- Education and public awareness on forest fire management have been improved. By using newspapers, radio, cable TV, posters, billboards, leaflets and children's storybooks, the

government has increased awareness by advertising the policy of Everybody Has a Responsibility for Forest Fire Management.

- Networking and joint protection bodies for forest fire management have been set up in accordance with the policy of Reliance on Preventive Measures, Collectively Unite and Help Each Other Protect Forest. Dayao county has established a collaborating network for fire management with 18 townships in six counties. A joint protection regulation for the prevention and control of forest fires was made with six neighbouring counties, and was formulated at the township and village levels.
- Three county-level forest fire control teams have been established: one team has 30 members and is organized by the county forestry bureau; one has 20 members and is organized by the natural forest protection centre; and the third has 30 members and is organized by the county public security bureau and armed force squadron. There are therefore a total of 80 county-level firefighters. Each township has a team of at least 30 members and each village committee has a team of at least 15. Each villager group has organized a volunteer fire control team with at least ten people. Institutions and personnel working in forested areas must sign a fire-safe responsibility document of forest fire management. Dayao county has 19 semi-professional armed forces fire control emergency teams with a total of 754 members. At the village level, there are 735 armed forces fire control emergency teams with 14 700 members. Sanchahe township has 12 teams with 208 members and has also set up 47 fire control joint defence teams with a total of 709 members – one team for each village of more than 30 households.

FIELD STUDY IN WENYIME VILLAGE

Wenyime is one of 14 villages participating in the village committee of Sanchahe township, Dayao county. Wenyime village is situated on the Datianling plateau, eight km from Sanchahe administrative village. Han and Yi nationalities have been living together here for more than a century. The village's 42 households have a total population of 186 people, 90 of them male and 96 female (fifth census, November 2000). The Han nationality makes up 60 percent of the total population. The cultivated land area covers 202 mu (1 ha = 15 mu), of which 25 mu are paddy fields and the remaining 177 mu irrigated fields. The average farming land area is 1.08 mu per capita. The yearly grain output is 51 600 kg. The average grain output is 276 kg per capita. The main crops are maize, rice, broad bean and some other coarse foodgrains. Tobacco is the main cash crop with a yearly planting area of 118 mu and a total output of 18 762 kg. There are 95 cattle, 39 mules and horses, 85 goats and 134 pigs. In 2000, the total income of the group was 284 700 yuan per year, of which, 51 600 yuan was from agriculture, 93 800 yuan from tobacco, 74 600 yuan from animal husbandry, 49 700 yuan from forestry, and 5 000 yuan from other sources. The average annual income is 1 530 yuan per capita. Most households live in tiled houses surrounded by walls on three sides. The village is reached by road, and electricity was connected in 1997. Some households have TV, video, and grain and fodder processing machines.

The main mountain is Hongjia, which forms a tower-shaped landscape with Datianling plateau at its peak. Soils are fertile and suitable for tree growing. The forest land area is 5 600 mu. Vegetation is subtropical green broadleaf trees and the Yunnan pine belt. The main tree species are Yunnan pine (*Pinus yunnanensis*), Chinese fir (*Keteleeria evelyniana*) and sawtooth oak (*Quercus acutissima*). The forest cover rate is 40.7 percent and the average forest area per capita is 30.1 mu. The village has cash trees such as walnut, chestnut, peach, plum, pear, bamboo and

apple. Walnut has an annual output of 3 091 kg and chestnut output is 362 kg which, together with wild mushrooms and fuelwood, generated an income of 49 700 yuan in 1999. Income from NTFP makes up 17.5 percent of the total income.

Landownership and use rights for forest resources are related to the development, prosperity and subsequent decline of forestry in China. Stable forest tenure is essential for effective protection of forest resources. Since the People's Republic of China was established, forest ownership had gone through six distinct policy changes.² The most recent experimental Responsibility Mountain policy was first implemented in 1985. Under this policy, 2 100 mu was allocated to the Wenyime village community, with ownership belonging to the collective and individual households owning the forests and trees. This has provided the incentive for households to manage forest and to control fire. The Responsibility Mountain certificate that was issued allocated 37.5 percent of the village collective mountain area. Each household has an average area of 50 mu of mountain forest, with a maximum of 109 mu and a minimum of 20 mu. Now that each household has its own mountain forest, they have invested in, benefited from and managed the forest by themselves. The confirmation of rights, responsibility and benefits of this Household Running Hills policy improved forest fire management initiatives, as well as forestry development for the collective and households. This type of community-based approach is further explored in this case study.

Forest fire and its impacts

Historically, Wenyime village has used slash-and-burn cultivation for agricultural production and other fires for improving pastoral lands. This practice is based on indigenous knowledge that “the soil would not be rich without fire burning the hills”, and “the grass would not grow, so the goats would not be strong, without fire burning the hills”. Such knowledge was handed down, so forest fires took place frequently. During discussions, elders stated that there had been more than ten occurrences of forest fire since the establishment of the People's Republic of China, the largest of which took place in March 1965. This fire was caused by a neighbouring village shepherd making a fire to warm himself. The fire continued for more than one month. The following facts emerged during investigation of this fire:

- It died out after four or five attempts to control it.
- All of the trees were destroyed in this crown fire.
- After the fire, no pasture was left for the animals and they had to be sold.
- After the fire, it was impossible to collect pine needles, grass or tree leaves. No manure fertilizer was collected so grain production decreased. The farmers had to rely on grain from government relief programmes.
- After the fire, flooding in May and June had detrimental effects on the watershed and agriculture, i.e. the water ditches and fields.
- Spring water was limited for several years; leaving little drinking-water.
- Walnut and chestnut trees did not bloom for many years.
- Wild mushroom harvesting ceased for some time owing to lack of production.
- No wildlife (barking deer, leopard, monkey and hare) was seen on the mountain.
- There was no wood for the construction of new houses for some 20 years.

² The Land Reform, the Rural Cooperative, the Four Fixes and the Three Formulations of Forestry, the Two Hills and Responsibility Mountain.

These are only a few of the effects of the 1965 fire. The former village leader claimed that the fire had a positive impact because it encouraged the next generation to remember the potential effects of fire. The memory of this fire would be handed down from generation to generation, reminding people that “Forest fire can be merciless. Forest fire management is necessary to minimize its effects on the community”.

TRADITIONAL USES OF FIRE AND ITS RELATIONSHIP WITH FOREST FIRE

In order to evaluate the sources of ignition and the cultural uses of fire within the village, 37 surveys were taken from different stakeholder groups (elders, women, main forest households, shepherds, young people and village leader groups). The main topic of the survey was “do you know the productive and non-productive uses/sources of fire in Wenyime village”. Thirty-six of the surveys were returned. The following are the productive uses of fire in Wenyime village:

- post-harvest burning to prepare seedbeds;
- burning field banks and using the burnt soil as fertilizer;
- burning tree branches and leaves on shifting cultivation plots to increase the fertility of buckwheat and/or tobacco;
- burning melon delve by using leaves and grass;³
- burning withered grass on the meadow in winter to promote the sprouting of new grass; and
- for reforestation efforts fire is used to reduce shrubs, reduce stocking by scattering trees and remove less desirable tree species.

The non-productive sources are:

- cooking when herding animals;
- smoking and throwing cigarette butts away;
- using fire for hunting (such as catching squirrels);
- burning wild bees to get their larvae as food;
- pine torches for lighting at night;
- burning incense, paper and firecrackers when visiting grave sites;
- children playing with fire; and
- tobacco drying.

Villagers' habits and consciousness in managing fire

Except for one fire alarm caused by a child playing with fire in February 1982, there has been no significant fire since that of March 1965. The 1965 fire was the first forest fire in Sanchahe township and the last significant forest fire in Wenyime village, which had no forest fires in the 35 years from 1966 to 2000. During discussions with elders, women, forest households, shepherds and young people, the following components of CBFiM in Wenyime village were identified:

- Responsibilities and jurisdictions have been set up, with each villager group responsible for different parts of the pasture, forest land, etc.
- The source of fire is strictly controlled.
- Forest fire management bodies, such as a leadership group of forest fire management and a voluntary joint defence team for fire control, have been set up.

³ Melon delve grows mostly near the forest and has higher yields after low-intensity fire.

- People in all households know the Everybody is Responsible for Forest Fire Management policy.
- Fire lines have been cut around areas of high concern.
- Pine needles and branches have been cleared to prevent and control forest fire.
- Children have been taught not to play with matches and cigarette lighters.
- The burning of paper, cooking and the setting off of firecrackers when visiting a relatives' graves have been stopped.
- Instead of pine torches, flashlights are used for lighting.
- People have stopped throwing away lit cigarette butts, cooking food while herding, burning wild bees and using fire to trap animals.
- They have stopped burning field banks, tobacco cultivation plots or melon delve.
- Villagers now obey village rules and regulations conscientiously.
- Herding times have been changed from once to twice a day, so that shepherds can eat lunch at home instead of cooking or heating lunch on the hills.
- Hay is stored for the winter feeding of livestock, instead of the traditional practice of burning pasture to promote grass growth.
- The period from 20 December to 30 May has been identified as the dry period for fire prevention, and a meeting is held a month earlier for planning control measures.
- Forest guards have been employed to enforce laws and regulations.
- The "four contracts" of responsibility are carried out: village leaders oversee the masses, teachers oversee students, shepherds oversee pastures, and forest guards oversee forest land.
- The "six responsibilities" are carried out: the group head is responsible for group members starting fire; the leader is responsible for the masses starting fire; the family head is responsible for children starting fire; the teacher is responsible for students starting fire; the guardian is responsible for disabled people starting fire; and the individual is responsible for him/herself.
- Forest fire is controlled as quickly as possible. When it breaks out, the volunteer joint defence fire team controls it at the early stage of its development.

Villagers' role in preventing and controlling forest fire

Based on this study, the farmers are the main body in forest fire prevention and control. The farmers in Wenyime village joint action depend on two factors: they have had clear forest tenure since 1982 and now obtain such forest products as timber for house construction, leaves for animal stables and fertilizer, fodder, fuelwood, fruits and a comfortable living environment, all of which influence their behaviour; and the government has formulated requirements and strict regulations. The punishment for causing a forest fire or not actively participating in its control is severe, and everyone is deterred by it. The role of the villagers in forest fire prevention and control are as follows:

- collecting falling leaves to use for animal stables, to provide fertilizer for crops and to clear the ground under trees so as to decrease the risk of forest fire;
- obeying the regulation that prohibits the starting of fire in the forest, especially between the months of November and May;
- teaching children not to play with fire;
- collecting the sources of fire (e.g. lighters, matches) and putting them out of children's reach;

- never using fire for heating or cooking food during grazing activities (e.g. not putting potatoes into the fire for lunch);
- sending at least one family member to join fire control activities as soon as forest fire breaks out; and
- providing information to the forestry office on the causes and perpetrators of any forest fire that has occurred.

Villagers' indigenous methods and regulations for fire management

The main indigenous regulations are as follows:

- Village rules and regulations for forest fire management, such as the Three No's, the Four Contracts, the Five No Burnings and the Six Responsibilities are formulated: the Three No's are no smoking on mountains, no opening up wasteland by destroying forest and no burning fire to catch wild bees and animals; the Four Contracts are as mentioned in the section on the Six Responsibilities; the Five No Burnings are no burning without permission, no burning without opening fire lines, no burning without fire control tool, no burning under heavy winds and dry conditions, and no burning without supervision; and the Six Responsibilities are as already mentioned.
- Formulate a forest fire management period from 1 December to 31 May and a high-risk period from 1 March to 31 May.
- Establish forest management responsibilities that are separate from those for pasture management, and guardian responsibilities for each of the groups involved.
- Identify 1 000 mu of forest as a watershed protection area in which to carry out special protection and management.
- Establish the protection and management of the watershed area and 2 500 mu of collective forest as the main focus. One person is selected as a full-time coordinator to manage these and is paid 180 yuan per month for doing so.
- Implement public awareness campaigns and education in forest fire management. Request the township film team to visit the village regularly to show slides and films on fire management.
- Formulate village rules and regulations for forest fire management at meetings of household heads. These meetings are also the forum at which village cadres allocate CBFiM responsibilities to village members.
- Set up CBFiM organizations, institutions and teams. Village leadership groups for forest fire management consist of the village group cadre (as the head), the Party Secretary (as the deputy head), the former villager head, and the armed forces team (as the group members). A regular household head meeting is held once a month to monitor, evaluate and reallocate forest fire management work. At the same time, a village volunteer fire control team is established and a full-time forest guard is hired.

ROLE OF CBFiM IN COMMUNITY FOREST RESOURCE MANAGEMENT

Forest fire can potentially harm forest resources. After 35 years, the effects of having villagers cultivate, manage and protect the 5 600 mu of forest are clear. The following are some of the effects of CBFiM on forest resources protection:

- Mountains in Wenyime Village become greener every year.
- Forests have become mature timber because of good conservation and management.

- Pines and firs are straight and evenly spaced because of intermediate thinning and lack of fire.
- Many herbs and shrubs are present in the understory. Watershed and soil resources are protected.
- Many rare wild animals, such as barking deer, monkey and pheasant, have returned since the fire disaster of 1965.
- The mushroom harvest is, once again, one of the main sources of income.
- The forest resembles a virgin forest. Water yields have increased and provide enough water for drinking and crop production. Flooding has been tempered and water flow is now regulated.
- Chestnut, walnut, peach, plum, pear and apple are, once again, cash crops for most households.
- Good living conditions and the ecological environment have been maintained so that future generations will benefit from resources.

CONCLUSION

In China, forest fire prevention and control is more of a top-down than a bottom-up process. Planning, regulations, cost and management all come from the government; the local community thus has a limited role in decision-making. Experiences from Wenyime village have the potential to provide recommendations for forest fire prevention policy that emphasize the local community's ability to manage fire. They also demonstrate how to encourage and build on the local community's interest in protecting forests. Forest fire management has a tight and direct relationship with forest tenure. The Responsibility Mountain policy has given benefits and income to the villagers so that they have the incentive to participate in fire management, and the effects of this have been positive. The most effective forest fire prevention regulations are not necessarily those of the government or outsiders. In Wenyime village, the community discussed and formulated regulations of its own, which are very effective. Awareness building about forest fire management is a long but important process. The attitude and behaviour of Wenyime villagers are the result of 35 years of capacity building, awareness raising and the benefits derived from CBFiM practices.

RECOMMENDATIONS

It is necessary to find CBFiM models that supplement the current top-down and government-dominated forest fire management approach. The Chinese saying that "A single spark can start a prairie fire" is quite true. It is necessary to perform more studies on CBFiM and to summarize some key elements that may foster the formulation of more CBFiM models that are appropriate to China. For example:

- Local communities should be the main managers of forest fire, especially in collectively owned forests. Several elements need to be considered if the model of CBFiM from Wenyime village is to be extended to other areas.
- Local communities should have the right to decide the use of forest resources so that they may increase the benefits that they derive from the forest. Full, stable and secure rights to resources are the key for CBFiM, as well as for sustainable forest management. The government should do more to ensure that local communities have clear and secure forest tenure, especially secure use rights to forest products.

- This requires open, equal regulation formulation processes and effective supervision from the community itself during the implementation of regulations. For this, the Everybody has a Responsibility for Forest Fire Management policy means clear and equal rights and access to forest resources and benefits. The local community may derive counterpart benefits from forests and relevant activities, but every community member should have equal access.
- Government agencies should transfer certain roles to communities so that they may generate income from forest resources and create linkages between prevention of forest fire and livelihood security. In southwest China, CBFiM must be combined with efforts on poverty alleviation and livelihood improvement. Increasing farmers' income sources and level should be the fundamental base for CBFiM.
- The rules and regulations for forest fire management, as well as for other village affairs, should come mainly from the community itself. Wenyime village has not experienced any forest fires for 35 years. One of the key reasons for this is that the villagers established, revised and followed village rules and regulations. These experiences are worth publicizing in the county, the province and the whole country.