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RESEARCH ARTICLE

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Analysis of the change in the original *Metasequoia glyptostroboides* population and its environment in Lichuan, Hubei from 1948 to 2003

Abstract Lichuan, located at the foot of the Wuling Mountain in southwest Hubei Province of central China, is well known in the world for the discovery of the living fossil *Metasequoia glyptostroboides* Hu & Cheng in the 1940s. Its natural habitat has been well protected by the Chinese government. In order to provide a scientific foundation for the protection of the Metasequoia resource, it has become necessary to analyze the changes in the original, natural Metasequoia mother trees (ONMMT) and their environment from 1948 to 2003. The results and countermeasures are as follows: First, the distribution areas have little changed, involving four towns/farmland, 45 villages, 5,746 individual trees in 1983 and 5,388 trees in 2003, covering nearly 600 km^2, with an average density of less than 0.1 tree/hm^2. The Metasequoia distribution consists of two main types: a scattered distribution type found mainly at the foothills or near houses, roads, villages and rivers while the population distribution type is found mainly at the mountains and valleys with a minority at low elevations in the mountains and basins. The largest Metasequoia populations have 105 and 123 trees. Second, in the past, attention was only paid to the protection of individual trees while the protection of the Metasequoia population and environment was neglected. This led to a shift from the past mixed forests to pure Metasequoia forests, with a simpler structure, reduced biodiversity and conditions non-conducive for natural renewal. From 1983 to 2003, 386 original Metasequoia mother trees died. So it is vital to enhance the protection of the only original Metasequoia population in the world and its habitat. Third, modern ecological means should be taken to protect the original Metasequoia population and its habitat. Research on the restoration and rehabilitation of Metasequoia vegetation should be carried out. Restoration and rehabilitation should be put into practice in the Xiaohe Valley, where the highest concentration of Metasequoia is found. Fourth, efficient measures should be taken to stop human activities that are harmful to Metasequoia and to improve the environment of ONMMT in order to promote the protection of the ONMMT population and its ecosystem. Eco-emigration and the return of marginal agricultural land to forestry can be practiced.

Keywords *Metasequoia glyptostroboides* Hu & Cheng, original natural Metasequoia mother trees (ONMMTs), habitat change, Xiaohe of Lichuan (Lichuanhsien)

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1 Introduction

The native distribution area of Metasequoia (*Metasequoia glyptostroboides* Hu & Cheng) is limited within the extremely narrow triangle formed by Western Hubei (Lichuan, Hubei), Western Hunan (Longshan, Hunan) and Eastern Chongqing (Shizhu, Chongqing), at longitude between 108°20′E (Huangshui, Shizhu County) and 109°30′E (Luota, Longshan County) and latitude between 30°10′N (Moudaoxi, Lichun City) and 29°25′N (Luota, Longshan).

Lichuan is located in the Wuling Mountain area, in the southwestern part of Hubei, central China. It is 120 km away from the Three Gorge Reservoir and is famous all over the world for the discovery of a living fossil *M. glyptostroboides* Hu & Cheng in the 1940s. The number of original natural mother trees (ONMMTs) of Lichuan Metasequoia and their habitat has changed since the investigation by Cheng and Chu and several subsequent studies. Among others, the result of a systematical investigation in 1983 found 5,746 individual trees plus 3 individuals in Longshan County, Hunan Province. In the 1960s, 28 trees were found in Shizhu County, Sichuan Province (since 1972 this county belongs to Chongqing City). In fact, there were 5,779 ONMMTs in their native habitat in the 1980s. In 2003, the result of a systematical investigation on Lichuan ONMMTs found 4,360 individual trees. In the 1940s, the Metasequoia forests had changed from mixed forests to the current pure forests. Ever since its discovery, China has paid careful attention to the protection of its ONMMTs (Wang et al., 2004). At the same time, the international community has also shown its concern for this species (Chaney, 1948, 1951; Fulling, 1976; Farjon and Conifers, 1999; Madsen, 1999). Protection methods have changed from protection of individual trees to protecting its entire population and habitat by establishing a nature reserve. In the past 50 years, great changes have taken place in the protection of Lichuan ONMMTs and their habitat. This paper is largely a description of the contrasting results of these investigations.

2 General situation of the study area

Lichuan City is located in the southwestern mountain area of Hubei Province, which is one of the cities of the Enshi Tujia and Miao Municipal State, at longitude ranging between 108°21′ and 109°18′E and latitude between 29°44′ and 30°39′N. The distance from north to south of the city is 120 km, its distance from east to west is 90 km and the whole area covers 4,589 km^2, a contiguous area in the Wushan and Wuling Mountains, belonging to the western edge of the Yungui Highlands, interlaced with hills, gorges, hilly areas, mountain basins and plains between valleys. From the southwest to the northeast, it borders on Qianjiang, Pengshui, Shizhu, Wanzhou, Yunyang and Fengjie Counties of Chongqing. It is the main entrance of Sichun, entering from western Hubei by land routes, 100 km away from Enshi City, the capital city of the Enshi Autonomous Prefecture, 123 km away from Wanzhou District in the west, with national highway No.318 cutting across the whole area from west to east. The entire city consists of nine counties, nine towns and three administrative offices. The city is populated by 17 nationalities; among others, the Tujia, Miao, Han and Dong. In 1997, the entire population was 820,000. Prevailing is a subtropical and monsoon mountain climate with very obvious vertical differences and without bitter winters or sultry summers. The weather is often cloudy and foggy, with enough rainfall; the water resource is abundant with an average annual rainfall of 1,472 mm. The biotic resource is diversified with 191 families of spermatophyta, 557 genera and 1,037 species, including some rare and endangered plants, such as Metasequoia and *Davidia involucrate* Baillon, which are under protection in China.

3 Methods

The main references are as follows: the preliminary investigations in 1948 carried out by Cheng from the Agricultural Department of Nanjing Central University and Chu from Fudan University (Cheng and Chu, 1949; Cheng, 1984); the paper by Chu and Cooper (1950) on ecological reconnaissance in the native habitat of Metasequoia; the investigation by Zhang (2000) from the Enshi Prefecture Forestry Bureau (now the Enshi Tujia and Miao Autonomous Prefecture); the material of the first investigation on ONMMTs in Lichuan carried out by the Lichuan Forestry Bureau from 1972 to 1974. Also consulted was the material from systematic investigations carried out through the process of a symmetric numbered list, registration and file formation from 1982 to 1984 (Hubei Forest Editor Committee, 1991); the material of additional investigations on ONMMTs while conducting a Provincial Forest-tree Germplasm Resources Inventory Program by Wang from the Hubei Forestry Department and Xi Wenfeng from the Enshi Autonomous Prefecture Forestry Bureau from 1988 to 1991 (Hubei Forestry Department, 1993). Also consulted was the material (1988–1989) by Ban and Li from Huazhong Normal University (Li and Ban, 1989; Ban and Qi, 1995); the proposal by Yin et al. (2002) from the China Geological University in August 2002, on expanding the protection of the original, natural Metasequoia mother trees and their habitat and on recovery and scientific research, and finally the material from the systematic investigation by the Hubei Provincial Ancient and Known Trees Inventory and Restoration Program (2002–2004). The two investigations in the years 1982–1984 and 2002–2004 are systematic and comprehensive, with an interval of 20 years. The original material is complete and thus provides important evidence for the analysis of the numerical change of the original Metasequoia trees.

4 Results and analysis

4.1 The numerical changes of ONMMTs

Cheng and Qu, and others carried out preliminary investigations during August and October of 1948, with the result that Lichuan preserved 1,000 ONMMTs, while Zhang's investigation from 1960 to 1962 found more than 1,224 trees with a diameter at breast height (DBH) of more than 26 cm, about 2,200 young trees and reported the cutting of more than 100 old ONMMTs. The details of this issue on ONMMTs are unclear. Although, until the 1970s, much at-

Table 1 Distribution status and change in the population of *Metasequoia glyptostroboides* in Lichuan

Site	Number		Diameter at breast height/m					
			>1.5		1.0–1.5		0.2–1.0	
	1982–1983	2002–2003	1982–1983	2002–2003	1982–1983	2002–2003	1982–1983	2002–2003
Total	5,779	5,393	4	8	40	159	5,735	5,226
1. Lichuan Hubei	5,746	5,360	4	8	31	150	5,711	5,202
1.1 Zhonglu County	5,255	4,994	3	7	31	150	5,221	4,837
1.1.1 Xiaohe	1,575	1,524	1	2	11	72	1,563	1,450
1.1.2 Guihua	1,819	1,754	1	2	15	56	1,803	1,696
1.1.3 Shizi	1,341	1,216		1	2	2	1,339	1,213
1.1.4 Shanmu	229	226	1	2	1	6	227	218
1.1.5 Xinhuo	257	255			2	13	255	242
1.1.6 Xilin	14	11				1	14	10
1.1.7 Longtang	14	2					14	2
1.1.8 Hujiatang	4	4					4	4
1.1.9 Yangjiang	2	2					2	2
1.2 Wangyin County	247	167					247	167
1.2.1 Baiyangtang	222	148					222	148
1.2.2 Longyu	2	2					2	2
1.2.3 Mujin	23	17					23	17
1.3 Mudao County	1	1	1	1				
1.4 Jiannan County	1	1					1	1
1.4.1 Jianzu	1	1					1	1
1.5 Fubaoshan farm	242	197					242	197
2. Longshan Hunan	5	5			3	3	2	2
2.1 Luota County	5	5			3	3	2	2
3. Shizhu Chongqing	28	28			6	6	22	22
3.1 Huangshui County	28	28			6	6	22	22

tention had been paid to *M. glyptostroboides* no systematic investigations had ever been carried out since it was found. The exhaustive investigation in Hubei Province from 1972 to 1974 on ONMMT counted 5,069 ONMMTs in Lichuan with a DBH over 20 cm. In order to know the changes that occurred in ONMMTs over a ten-year period, a systematic numbering, labelling, registration and filing system was completed during the period from 1982 to 1984. The fieldwork was finished in 1983. The result was that there were 5,746 ONMMTs, distributed over four towns, 16 management areas and 45 villages. Among these were four trees with a DBH over 1.5 m, 31 trees between 1.0 and 2.0 m while 5,711 trees had a DBH between 0.2 and 1.0 m .The average density was calculated to be less than 0.1 tree/hm^2. Xiaohe Valley (also called Shui-hsa Valley) in Zhonglu County has the highest concentration of this species with 91.45 per cent of the ONMMTs from 1983 to 2003, in Hubei Province (Chaney, 1948; Cheng and Chu, 1949; Chaney, 1951). The program of ancient and famous trees, initiated in Hubei Province, also systematically investigated and filed the original natural mother trees of Lichuan Metasequoia (the fieldwork finished in 2003) and found 4,360 ONMMTs. Over the 20-year period from 1983 to 2003, the number and growing conditions of the original natural mother trees had changed considerably, with 386 ONMMTs dead. The investigation in 1983 showed that there were 5,255 trees in the Xiaohe Valley. In 2003, 4,994 trees remained and 224 trees had died over this period. The distribution and changes in the number of ONMMTs are shown in Table1.

4.2 The change of habitat for Lichuan ONMMTs

The four investigations on the number and distribution of Metasequoia, carried out in 1948, 1982–1984, 1988–1989, 2002–2004, included an investigation into its habitat. The contrasting results show that the original, natural Metasequoia population changed from being mixed forests to pure forests. The structure became simple, biodiversity had reduced and conditions were not conducive for natural regeneration.

In 1948, after the investigation on Shuishaba in Lichuan, Chu believed that the forests in the Shuishaba Valley were mostly secondary forests, where the Metasequoia mixed-forest was the distinctive forest physiognomy of the area. The distribution of Metasequoia ranges from Fangjiapo in Hekou, down to the south of Xiaohe County, about a 25 km long valley area, which contains about 1,000 trees. Most of the Metasequoia mixed with other types of trees to form mixed forests, including 48 kinds of tall trees, 34 kinds of shrubs and 17 kinds of vines. Many Metasequoias, growing with other conifer or broad-leaved trees, were originals, while those living beside roads, houses or in fields in neat processions, were mostly planted. Wild Metasequoia mixed forests are distributed in side ditches of river valleys, and the forest physiognomy of Maoba ditches is excellent. Chu also believed that the evergreen broad-leaved mixed forest of Shuishaba evolved to the physiognomy of a secondary forest, after the evergreen broad-leaved forest was

destroyed by harvesting and burning and he indicated that another demolition would result in a deciduous broad-leaved and mixed forest, because in Metasequoia mixed forests, there are few opportunities for Metasequoia seeds to shoot up, and the seedlings grow weakly (Cheng, 1984). Chu and Cooper (1950) investigated ten sample plots of 10 m×10 m in Shuishanba where they found abundant biodiversity, with 30 kinds of tall trees species and 47 kinds of shrub and vine species within 2 m × 8 m sample plots. They also found plenty of Metasequoia seedlings and young trees and, therefore, concluded that seedlings and young trees obtained the characteristics of shade-tolerant trees and that the original, natural Metasequoia population was steady and advanced. They also believed that, although the two sides of the Shuishan Valley were quite wet, there was little evidence of swamps. But later research proved that the Xiaohe Valley used to be a wetland. Since the 1950s, buried timber and old tree stumps from Metasequoia trees were often found in the paddy fields of the Xiaohe Valley. In the 40-year period since the first discovery in the Capital Rehabilitation Project on the Farmland of Zhonglu, till 1990, the amount of buried timber and old tree stumps amounted to over 20 m^3. Among others, in 1989, in a 600 m^2 paddy field near Xiangyang Village, Xiaohe, ten old Metasequoia tree stumps were found, with diameters at ground level of 2 m. The biggest diameter at ground level was 6.3 m, while the smallest was still 2.5 m. Their colour was a dark purple grey, half charred. Apparently, the Xiaohe Valley used to be a wetland with flourishing Metasequoia forests. The buried timbers of various diameter classes also revealed that this population had, at one point, a thriving original, natural Metasequoia population. Farming of the Xiaohe Valley led to the disappearance of virgin forests. With the increase in human population, the place turned into an important grain production base. All this proves that Metasequoia used to grow in a wet environment and thus provides the essential scientific evidence for the South Shelter Belt for Crop and Stock Farms in China to use Metasequoia as a protection plantation species and this also assures the success of plantation in wetlands.

However, in the late 1950s, during the period of Steel-Making Iron Movement in China，a large number of Metasequoia trees and their companion species were harvested and the composition and structure of the Metasequoia community had been damaged irreparably. While more than 100 old Metasequoia trees were cut, other trees were also harvested, under seriously uncontrolled conditions. Later, after clearing of forest lands for farming, where medicinal material and crops like *Coptis chinensis* and *Zea mays* were grown, more destruction followed by decreasing the amount of lower forest and grass layers. After the original environment had been altered, the conditions made it impossible for the original, natural Metasequoia population to regenerate naturally. From 1988 to 1989, Ban Jide and Li Jianhua carried out their investigation and indicated that the native habitat of the Xiaohe Metasequoias belonged to the middle and subtropical evergreen broad-leaved forest zone. The well-preserved Metasequoia community, concentrated in the side valleys of the Xiaohe Valley, divided the Metasequoia community into three typical associations: 1) Association *Metasequoia glyptostrobodies-Camellia cuspidata-Parathelypteris nipponica*, located in Gangchangwan Maoba at Xiaohe; 2) Association *Metasequoia glyptostrobodies-Camellia cuspidate-Begonia* sp.+ *Pilea* sp., located in Dengziwan Maoba; 3) Association *Metasequoia glyptostrobodies-Eurya hebeclados-Iirs japonica + Parathelypteris nipponica*, located in Youjiawan. The structures of these Metasequoia associations were simple and apparently they constitute three layers of tall trees, shrubs and grasses. Altogether, there were nine species, with IV and V class Metasequoia trees dominant. There were 18 kinds of plants in the shrub layer, with *Camellia cuspidata* as the dominant species. The grass layer was not evenly distributed, but the coverage was quite high. The Metasequoia population that was investigated is near a random distribution in structure, with the Metasequoia community in a reverse succession.

The results of the investigation on the distribution of the original, natural Metasequoia trees and community are shown in Table 2. There are two types of ONMMT distributions. First is a scattered distribution of 895 individual trees, mainly at the foot of the mountains and trees outside the forest, representing a randomly scattered distribution (Ban and Qi, 1995; Li and Ban, 1989). In the second type of distribution, there are 273 original, natural Metasequoia populations with 4,465 individual trees. The largest one contains 123 individuals, located in Heiwan, Chatai, Zhonglu, with an average age of 80 years, an average height of 30.0 m and an average DBH of 59.0 cm. These trees are linearly distributed in the valley at an elevation of 1,230 m covering an area of 2,600 m^2. The 1984 investigation found 131 individual trees here, with an average height of 16.6 m, an average DBH of 29 cm. Another population of 105 trees was discovered in Yujiaba, Gongqiao, with an average tree age of 122 years, an average height of 34.0 m and an average DBH of 61.5 cm, distributed along the valley at an elevation of 1,260 m within a 3,600 m^2 area. A third population of 95 trees is in Yangjiayuanzi, Guihua, with an average tree age of 129 years, an average height of 33.0 m and an average DBH of 79.6 cm, distributed in the valley and its two sides at an elevation of 1,230 m, covering an area of 5,000 m^2. The result of the investigation of 237 other communities, each of which includes more than 3 individual Metasequoia trees, shows that these communities have formed pure Metasequoia forests, with 7 other tall tree species. There is little information available on the number and characteristics of individual trees. Their stand crown closure lies between 0.1 and 0.3. Twelve kinds of lower layers of forest-like species, such as *Euonymus* sp. are present, with a coverage between 20% and 30% and grass-like *Pilea* sp., with coverage between 60% and 80%. Because the Metasequoia community has lost its natural advantage, recovery and growth by natural regeneration is difficult. The existing communities should be strictly protected. Harm to the ONMMTs caused

by human activity should be mitigated and we should try to restore the environment to its natural condition. If we do not pay greater attention to the natural Metasequoia population, it will become extinct one day. The reasons why no naturally regenerated seedlings and young trees occur in the community have been investigated by Xin et al. (2004). They indicated that the seeds may be of low quality under natural conditions, for 90% of the seeds abort. Also, the temperature of the native habitat in the spring is not conducive for the seeds to sprout. Actually, there are two reasons for this condition. One is that, since the 1970s, the percentage of seed bearing of Metasequoias has been 65%, with an apparent low seed production in off years. In 1984, the seed output was 10 kg, while in 1986, a mast year, the highest seed production was 2,100 kg. From 1979 to 2003, the seeds were in great demand. With an extremely high market price, the cones had been picked before they became ripe and, therefore, few seeds fell to the ground for natural regeneration. The second reason is that the environment for natural regeneration of Metasequoia has been destroyed by frequent human activity in the Metasequoia forests and the forest lands have lost the conditions favourable for Metasequoia seedlings to grow. Before the 1970s, growing Metasequoia locally was achieved through transplanting naturally regenerated Metasequoia seedlings and young trees. The Metasequoia trees, introduced since the 1970s, have begun to produce seeds normally, but still cannot regenerate naturally. This problem should be considered seriously, and it highlights the importance of protecting the original population.

5 Discussion and suggestions

The various research and sample plot investigations indicate that the original, natural Metasequoia population is declining as is the ecological system that typically supports it. The reasons that caused this phenomenon are as follows:

1. Throughout the long-term landform changes in geological eras and particularly during the Quarternary Period Glacier Movement, Metasequoia has undergone a process ranging from a wide flourishing distribution era to the present time that encompasses narrow natural distribution, and has become a rare and endangered species.

2. The incursion of human immigration into the Metasequoia habitat and the natural increase in the population during the past half century is another cause; the population in the Xiaohe Valley is eight times as large as that of 50 years ago. At the same time, several social and economic factors also peaked in the valley and aided and abetted in the destruction of the Metasequoia habitat. In the late 1950s, during the period of Steel-Making Iron Movement in China, large numbers of Metasequoia trees and their companion species were cut down. The destruction of the Metasequoia companion species, through the use of their timber as firewood, destroyed the original vegetation through backward production modes, damaging the forests and clearing wasteland. All these activities have purified the structure of Metasequoia communities and destroyed the community structure of the original Metasequoia population as a whole.

3. Protection methods are inappropriate. Since the 1950s, forestry departments paid much attention to the protection of individual Metasequoia trees, but neglected the protection of entire Metasequoia communities and their living environment. All this led to the damage of the original habitat.

4. Given a continuous expansion of human activities, the impact on the Metasequoia community and its habitat becomes more and more obvious and various disasters have taken place. Beside the direct damage caused by human activities, some indirect events also inflict serious damage to the Metasequoia habitat, such as insect pests, air pollution and lightning strikes.

The first such problem is caused by insect pests. The situation is serious. Given the simple structure of Metasequoia forests and deliberate human interference, some pests like *Choristoneura metasequoiacola* have done great harm to the growth and fruiting of Metasequoia trees ever since the 1970s. In 1992, the investigation on the harm in Xiaohe showed that before the 1960s, except for some scattered ancient trees, Metasequoia forests were mostly mixed forests. Since then, in order, to emphasize the protection of Metasequoia trees, other trees were mostly cut down and the mixed forests changed to pure Metasequoia forests. The number of original *Choristoneura metasequoiacola* increased so much in the 1970s that the pests can devour all the leaves of a Metasequoia tree.

Table 2 Distribution on individuals and population of *Metasequoia glyptostroboides* in Lichuan

Number of trees	Number of populations	Total number of trees	Average number of trees	Standard deviation
Total		5,360		
1–2		895		
3–10	105	681	6.45	3.03
11–20	67	994	14.84	2.40
21–30	24	598	24.80	2.70
31–40	17	593	35.18	2.89
41–50	7	314	44.86	2.69
51–60	6	330	55.00	2.67
61–70	2	130	65.00	2.00
71–80	2	148	74.00	2.00
81–90	2	168	84.00	0
91–100	3	281	93.67	1.11
>100	2	228	114	9.00

The second problem is pollution. With the increase of population in the Metasequoia distribution areas, in most places, people and trees cohabited, but human activity obviously and increasingly affected the growth of Metasequoia. Since the 1980s, coal has replaced the use of firewood and coal smoke has polluted the habitat of the Metasequoia environment. It has also seriously harmed ONMMTs. Those growing beside residential areas appear to be late in budding, show early leaf fall, have low fruiting quantity and some, under severe strain, have died.

A third problem is posed by lightning strikes. A lightning strike is one of the disasters damaging ONMMTs. According to local people, lightning has struck the old Metasequoia community for ages and the trees under attack were mostly high ancient trees. For example, in 1948, while Chaney, an American paleobotanist, was on an inspection tour in Wangying, Hubei Province, he found a big Metasequoia with a DBH of 3.8 m, a height of 50 m, under branch height of 12 m and a crown diameter of 13.3 m (Chaney, 1948). In the first half year of 1951, it was struck into four pieces by lightning and died. This kind of disaster should be taken seriously. In order to protect these easily damaged big old trees in open areas, some fast-growing conifer and tall broad-leaved trees, such as *Liquidambar formosana*, should be planted. Lighting conductors should be installed for those first-class protected ancient trees.

5. The infrastructure and the management base of the original, natural Lichuan Xiaohe Metasequoia mother trees is backward with timeworn equipment. The distribution of Metasequoia trees is quite scattered. All these factors lead to the loss of ONMMT resources employed and results in incomplete management and supervision.

The Xindoushan National Class Nature Reserve should focus on the original, natural Metasequoia population in the Xiaohe Valley and solve the problems with long-term and developing tactics. First, focus should be on the protection of the Metasequoia community and its native habitat, with the Xiaohe Valley as the central area, carrying out the establishment of conservation forests, based on the protection of the original Metasequoia gene. Second, the protection of the original Metasequoia population and the environment of its native habitat should be enhanced, through providing a sense of participation in the local population in protecting the Metasequoia. Third, the Xiaohe Valley is also the location of Qingjiangyuan and Longtougou, less than 6 km from Qingjiangyuan. Qingjiang is the main branch of the Yangtse River, running across ten counties of Hubei Province from west to east, providing the main water source for more than 5 million people. The main Qingjiang River is 423 km long and its drainage area 17 thousand km^2. The effective protection of the original Metasequoia and its habitat is also important for the environment of the upper reaches of the Three Gorges Dam and the source of the Qingjiang River. The Xindoushan National Class Nature Reserve should steer away from the protection of individual Metasequoia trees to the protection of the original Metasequoia population and its habitat. According to the statute concerning rehabilitation projects, nature reserves should protect the original, natural Metasequoia population and its native habitat through scientifically responsible ecological recovery measures. During the initial stages of the nature reserve establishment, the relationship between the Nature Reserve and the former Metasequoia Management Station should be clarified. A long-term agency should be established for research into and the protection of the original Metasequoia population. This agency should strive for sponsorship and cooperation from the international community and domestic organizations and funds. It should carry out scientific research, enhance academic communication and promote the protection of the original Metasequoia community, if not all of China's natural resources.

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