Investigation and Protection of Ancient and Famous Trees Resources of Daxiong Mountain

Yanwu Xiao 1, Dinglong Wang 1, Yi Wu 2, *
1 West Yunnan University, Lincang 677000, Yunnan, China;
2 Central South University of Forestry & Technology, Changsha 410004, Hunan, China
*Corresponding author e-mail: wuyi3721@csuft.edu.cn

Abstract. In the paper, the authors presents current situation of ancient and famous trees resources in Daxiong Mountain; the characteristics of ancient and famous trees resources is analyzed: (1) There were a large number of trees, and most of them appear in communities. (2) There are many old and tall trees with beautiful tree shapes and different postures. (3) There are many rare and precious old trees. Third, investigated the Problems existing in protection and management of ancient and famous trees in Daxiong Mountain and the reasons. Final, protection countermeasures of ancient and famous trees in Daxiong Mountain is put forward.

Keywords: ancient and famous trees; resources; protection countermeasures; Daxiong Mountain; Xinhua County; Hunan Province.

Ancient and famous trees are the precious heritage left by nature to mankind. They are of great value in the construction of ecological civilization in modern society[1].The Daxiong Mountain National Forest Park was located in the north of Hunan Province, Xinhua County, Loudi City. The geographic coordinates was 28°04′~28°30′N,110°14′~110°22′E. Between east and west was 27.5km, between north and south was 12.5km, the total area of was 8 102.4 hm².

The Daxiong mountain national forest park belongs to the eastern subtropical monsoonal humid climate area, the monsoon is obvious. With the elevation of the mountain, the vertical change of climate is very obvious. The unique geography and climate of Daxiong mountain have bred rich plant resources and preserved a large number of ancient and famous trees, so it has been a famous cultural and tourist resort [2].

In this paper, on the basis of field investigation and reference to relevant materials, the author made a detailed investigation of the ancient and famous trees in the Daxiong Mountain, and put forward some countermeasures to protect the ancient and famous trees. [3]

1. Current situation of ancient and famous trees resources in Daxiong Mountain

According to the survey from 2015 to 2017, there are a total of 547 ancient trees in Daxiong Mountain, including 423 individual ancient trees (places), and 15,963 ancient trees in 124 ancient tree groups, 16,386 in total, belonging to 45 families, 75 genera and 110 species. Lauraceae contains the most genera,
with 7 genera; Fagaceae and Rosaceae are followed, each containing 6 genera; then Fabaceae, Juglandaceae and Hamamelidaceae, each contain 3 genera; and then Cupressaceae, Ericaceae, Magnoliaceae, Oleaceae, Anacardiaceae, Cornaceae, Pinaceae, and Araliaceae, each containing 2 genera; The rest have a single genus each. Acer contains the most species, including 6 species; the second is Castanopsis and Quercus, with 5 species; next Cyclobalanopsis and Cyclobalanopsis, each have four species; then there are 3 species in Lithocarpus and Michelia; Ilex, Rhododendron, Tilia, Daphniphyllum, Liquidambar, Castanea, Fagus, Toona, Cerasus, Crataegus, Padus, Meliosma, Schima, Acanthopanax and Machilus each contain two species; the rest contain a single species (Table 1).

Table 1. Classification and statistics of the ancient and famous trees in Daxiong Mountain

| Family         | Genus            | Species                  | Oldest tree age (a) | Plants |
|----------------|------------------|--------------------------|---------------------|--------|
| Styracaceae    | Pterostyrax      | Pterostyrax corymbosus   | 220                 | 4      |
|                |                   | Sabina                   | 100                 | 23     |
| Cupressaceae   | Cupressus        | Cupressus funebris       | 220                 | 24     |
|                | Sabina           | Sabina chinensis         | 100                 | 23     |
| Bretschneideraceae | Bretschneidera  | Bretschneidera sinensis  | 200                 | 2      |
| Flacouriaceae  | Xylosma          | Xylosma racemosum        | 120                 | 1      |
| Euphorbiaceae  | Sapium           | Sapium sebiferum         | 200                 | 1      |
|                | Sophora          | Sophora japonica         | 300                 | 1      |
|                | Dalbergia        | Dalbergia hupeana        | 380                 | 18     |
|                | Cladrastis       | Cladrastis platycarpa    | 320                 | 1      |
| Aquifoliaceae  | Ilex             | Ilex chinensis           | 120                 | 2      |
|                |                  | Ilex cochinensis         | 120                 | 1      |
| Ericaceae      | Enkianthus       | Enkianthus chinensis     | 260                 | 2      |
|                | Rhododendron     | Rhododendron latoucheae  | 180                 | 1      |
|                |                  | Rhododendron fortunei    | 260                 | 167    |
| Elaeocarpaceae | Sloanea          | Sloanea sinensis         | 110                 | 2      |
|                | Tilia            | Tilia tuan               | 150                 | 1      |
|                |                  | Tilia oliveri            | 260                 | 1      |
| Mimosaceae     | Albizia          | Albizia julibrissin      | 100                 | 1      |
|                | Taxus            | Taxus chinensis          | 600                 | 127    |
| Juglandaceae   | Pterocarya       | Pterocarya stenoptera    | 160                 | 1      |
|                | Carya            | Carya hunanensis         | 100                 | 1      |
|                | Cyclocarya       | Cyclocarya paliurus      | 400                 | 4      |
| Daphniphyllaceae | Daphniphyllum  | Daphniphyllum oldhami    | 100                 | 1      |
|                |                  | Daphniphyllum macropodum | 100                 | 1      |
| Betulaceae     | Carpinus         | Carpinus viminea         | 240                 | 4      |
| Hamamelidaceae | Liquidambar      | Liquidambar acalyca      | 380                 | 4      |
|                |                  | Liquidambar formosana    | 420                 | 762    |
| Fagaceae       | Castanopsis      | Castanopsis fargesiti    | 400                 | 1      |
|                | Lithocarpus      | Lithocarpus harlandii    | 100                 | 1      |
|                |                  | Lithocarpus glaber       | 300                 | 1203   |
|                |                  | Lithocarpus henryi       | 140                 | 1      |
|                | Quercus          | Quercus englerianna      | 450                 | 3      |
|                |                  | Quercus fabri            | 320                 | 120    |
|                |                  | Quercus serrata          | 350                 | 5      |
|                |                  | Quercus acutissima       | 300                 | 1      |
|                |                  | Quercus variabilis       | 800                 | 307    |
| Castanea       | Castanea mollissima | Castanea mollissima     | 500                 | 2      |
|                | Castanea henryi  | Castanea henryi          | 500                 | 3980   |
| Castanopsis    | Castanopsis carlesii | Castanopsis carlesii    | 180                 | 17     |
|                | Castanopsis eyrei | Castanopsis eyrei        | 800                 | 841    |
| Family                  | Genus            | Species                        | Height  | No. |
|------------------------|------------------|--------------------------------|---------|-----|
| Castanopsis sclerophylla | Castanopsis      | Castanopsis tibetana            | 800     | 4   |
| Cyclobalanopsis         | Cyclobalanopsis  | Cyclobalanopsis gilva           | 800     | 1   |
|                        |                  | Cyclobalanopsis glauca          | 520     | 1   |
|                        |                  | Cyclobalanopsis gracilis        | 800     | 2   |
|                        |                  | Cyclobalanopsis myrсинfolia     | 300     | 3   |
| Fagus                  | Fagus longipetiolata | Fagus lucida              | 450     | 594 |
| Simaroubaceae           | Ailanthus        | Ailanthus altissima            | 120     | 1   |
| Nyssaceae               | Nyssa            | Nyssa sinensis                 | 100     | 6   |
| Cercidiphyllaceae       | Cercidiphyllum   | Cercidiphyllum japonicum       | 600     | 2   |
|                        | Toona            | Toona ciliata                  | 520     | 1   |
|                        |                  | Toona ciliata var. pubescens   | 200     | 15  |
| Verbenaceae             | Clerodendrum     | Clerodendrum mandarinorum      | 100     | 1   |
| Magnoliaceae            | Michelia         | Michelia macclurei             | 120     | 1   |
|                        |                  | Michelia maudiae               | 300     | 1   |
|                        |                  | Michelia platypetala           | 130     | 1   |
| Oleaceae                | Fraxinus         | Fraxinus chinensis             | 220     | 1   |
|                        | Ligustrum        | Ligustrum lucidum              | 100     | 7   |
| Hippocastanaceae        | Aesculus         | Aesculus wilsonii              | 160     | 3   |
| Anacardiaceae           | Choerospondias   | Choerospondias axillaris       | 240     | 219 |
|                        | Pistacia         | Pistacia chinensis             | 150     | 1   |
| Aceraceae               | Acer             | Acer flavellatum               | 150     | 4   |
|                        |                  | Acer henryi                    | 500     | 1   |
|                        |                  | Acer nayongense var. hunanense  | 120     | 603 |
|                        |                  | Acer palmatum                  | 120     | 3   |
|                        |                  | Acer mono                      | 260     | 1   |
|                        |                  | Acer lucidum                   | 500     | 2   |
| Lythraceae              | Lagerstroemia    | Lagerstroemia indica           | 240     | 2   |
| Rubiaceae               | Emmenopterys     | Emmenopterys henryi            | 200     | 2   |
| Rosaceae                | Cerasus          | Cerasus dielsiana              | 500     | 1   |
|                        |                  | Cerasus dielsiana var. abbreviata | 300     | 1   |
|                        | Crataegus        | Crataegus cuneata              | 300     | 2   |
|                        |                  | Crataegus hupehensis           | 160     | 3   |
|                        | Malus            | Malus hupehensis               | 180     | 1   |
|                        | Padus            | Padus buergeriana              | 260     | 3   |
|                        |                  | Padus obtusata                 | 200     | 5   |
|                        | Laurocerasus     | Laurocerasus phaeosticta       | 100     | 3   |
|                        | Pyrus            | Pyrus pyrifolia                | 120     | 26  |
| Sabiaceae               | Meliosma         | Meliosma veitchiorum           | 100     | 1   |
|                        |                  | Meliosma myrianthea var. discolor | 220     | 1   |
| Theaceae                | Schima           | Schima argentea                | 120     | 16  |
|                        |                  | Schima superba                 | 200     | 674 |
| Cornaceae               | Bothrocaryum     | Bothrocaryum controversum      | 180     | 7   |
| Dendrobenanthia         | Dendrobenanthia japonica var. chinensis | 100    | 7   |
| Taxodiaceae             | Cunninghamia     | Cunninghamia lanceolata        | 260     | 16  |
| Staphyleaceae           | Tapisia          | Tapisia sinensis               | 100     | 1   |
| Ebenaceae               | Diospyros        | Diospyros kaki                 | 100     | 20  |
| Rhamnaceae              | Hovenia          | Hovenia acerba                 | 300     | 2   |
| Pinaceae                | Pinus            | Pinus massoniana               | 140     | 5455|
|                        | Pseudolarix      | Pseudolarix amabilis           | 320     | 21  |
| Leguminosae             | Gleditsia        | Gleditsia sinensis             | 200     | 2   |
| Celastraceae            | Euonymus         | Euonymus myrianthus            | 240     | 2   |
| Araliaceae              | Acanthopanax     | Acanthopanax senticosus        | 320     | 1   |
|                        |                  | Acanthopanax evodiaefolius     | 120     | 1   |
Among the ancient and famous trees, the largest number was Pinus massoniana, with 5455 trees, accounting for 33.29% of the total; the second was Castanea henryi, with 3980 trees, accounting for 24.29.8%; the third is Lithocarpus glaber, with 1203 trees, accounting for 7.34%. The rest are respectively Castanopsis eyrei, Liquidambar formosana, Schima superba, Acer nayongense var. hunanense, Fagus lucida, Fagus longipetiolata, Machilus leptophylla, Quercus variabilis and Choerospondias axillaris, in total 15536 trees, accounting for 94.81%(Table 2).

| species                              | number | accounted for/% |
|--------------------------------------|--------|-----------------|
| Pinus massoniana                     | 5455   | 33.29%          |
| Castanea henryi                      | 3980   | 24.29%          |
| Lithocarpus glaber                   | 1203   | 7.34%           |
| Castanopsis eyrei                    | 841    | 5.13%           |
| Liquidambar formosana                | 762    | 4.65%           |
| Schima superba                       | 674    | 4.11%           |
| Acer nayongense var. hunanense       | 603    | 3.68%           |
| Fagus lucida                         | 594    | 3.63%           |
| Fagus longipetiolata                 | 544    | 3.32%           |
| Machilus leptophylla                 | 354    | 2.16%           |
| Quercus variabilis                   | 307    | 1.87%           |
| Choerospondias axillaris             | 219    | 1.34%           |
| Total                                | 15536  | 94.81%          |

Taking the ancient trees growing in groups of more than 3 trees as an ancient tree group, there are 124 ancient tree groups in Daxiong mountain, forming communities’ area of 475.6 hm². Lizhong work area has the largest communities area of 180.1 hm², and its number of ancient and famous trees is 6,025, which is related to the large number of secondary forests. The second is the Daxiong work area, with the communities’ area of 104.2hm² and 3090 ancient and famous trees (Table 3).

| Work areas | communities’ area(hm²) | (Plants) |
|------------|------------------------|----------|
| Lizhong    | 180.1                  | 6205     |
| Daxiong    | 104.2                  | 3090     |
| Jinping    | 54.15                  | 1866     |
| Taotang    | 51.65                  | 1780     |
| Jiulong    | 33.8                   | 1665     |
| Xixi       | 31                     | 1045     |
| Gaofeng    | 20.2                   | 696      |
| Xiongshan  | 0.5                    | 39       |
| Total      | 475.6                  | 16386    |

2. The characteristics of ancient and famous trees resources in Daxiong Mountain.
2.1. There were a large number of trees, and most of them appear in communities.

The ancient and famous trees of Daxiong Mountain are scattered all over the mountains and fields. At the foot of the mountain, tall old trees are obvious. And they can be seen everywhere in the mountain. In each work area of the Daxiong mountain, Crataegus hupehensis, with DBH more than 20cm and height over 6m can be seen everywhere. Some largest Crataegus hupehensis, whose DBH were more than 50cm, can be said to be unique in Hunan province. On A hillside of mountaintop, there are patches of Cornus controversa, with DBH above 35cm, branches low and branches above 20cm in diameter, which are relatively rare. However, in the montane elfin forest and secondary forests, some small trees are hundreds of years old.

2.2. There are many old and tall trees with beautiful tree shapes and different postures.

At the foot of the mountain, the Pine king, with DBH 115cm, height 45m, age more than 320 years, is tall and straight, natural and unrestrained. There are two large ginkgo trees from Xiongshan Temple and Xiquan Temple with DBH more than 300cm. The base of the two tree is densely sprouted, unique even stalactic adventitious roots formed. The roots are really rare. In the old-growth forest of Lizhong, the Cercidiphyllum japonicum’s DBH is 173 cm and its height is 14m. It is more than 600 years old and has a very beautiful shape (Table 4).

2.3. There are many rare and precious old trees

According to Fu Liguo “List of Rare and Endangered Protected Plants of China", "Red Data Book of Chinese Plants (Volume I)” [4], and “List of Key State Protected Wild Plants (the First Batch)” [5-6] officially approved by the State Council and published by State Forestry Administration and Ministry of Agriculture on August 4th, 1999, there are 10 kinds of rare and ancient trees in Daxiong Mountain (Table 4).

| species                        | Rank in the Red Book | Rank in the List |
|--------------------------------|----------------------|------------------|
| Ginkgo biloba                  | II                   | I                |
| Pseudolarix amabilis           | II                   | II               |
| Taxus wallichiana var. mairei  | I                    | I                |
| Cercidiphyllum japonicum       | II                   | II               |
| Cinnamomum camphora            | II                   | II               |
| Zelkova Schneideriana          | II                   | II               |
| Toona ciliata var. pubescens   | II                   | II               |
| Bretschneidera sinensis        | II                   | I                |
| Tapiscia sinensis              | III                  | -                |
| Emmenopterys henryi            | II                   | II               |

3. Problems existing in protection and management of ancient and famous trees in Daxiong Mountain and the reasons.

The statistical analysis showed that among the 423 scattered ancient and famous trees in Daxiong Mountain [7], 113 were in average growth and 21 were in poor growth condition or even dying. The situation was not optimistic. Damage to ancient trees can sometimes be seen. Such as a maple of Shiliping was eroded by termites; By the Xiongshan Temple, one of Carpinus viminea and one of Castanea henryii were in the dying state, and Another Carpinus viminea had badly broken branches. There is a dying of Lauraceae obtusiloba by the tourist trail on the mountaintop. In Baxianyan scenic spot the leaves of a maple were eaten up by insects. In Jinping work area, one of Castanopsis eyrei and one of Schima argentea were seriously hollow, and one of Castanopsis eyrei, had broken tip.

We investigated the reasons for these things. One was the physiological function decline of the ancient trees. Ancient trees were basically older and overmature trees, which had weakened their absorption and regeneration ability and were difficult to meet the needs of growth. Second, the pests and
diseases affected them. Most of the ancient trees had not been effectively protected and managed, and some were weak and vulnerable to pests and diseases. Third, natural disasters affect them. Some ancient trees have not been managed for a long time and suffer from natural disasters, such as lightning strikes and other natural disasters. The phenomenon of broken branches and broken trunks often occurs. Fourth, environmental factors affect them.

The artificial over-stepping and the laying of cement or other hard impermeable floor tiles around ancient trees made the soil around ancient trees rigid, air permeability and water permeability decrease, which affected the water absorption and gas exchange of the trees, therefore the nutrients needed by trees could not be replenished in time. Fifth, human damage. With the gradual acceleration of tourism development in Daxiongshan, tree damage, root system destruction, artificial logging and other phenomena had occurred from time to time in the construction process. In villages and courtyards, people randomly piled up wastes and waste materials near ancient trees, dumping sewage and waste water, which changed the physical and chemical properties of the surrounding soil and further damaged the ancient trees. Sixth, insufficient investment in protection funds. At present, there is basically no fund for the protection of ancient and famous trees at all levels, and the people responsible for the protection of ancient and famous trees are generally the district heads and branch secretaries of the work areas. The owners of ancient trees next to houses are the protectors, and there is almost no fund for the custodians. Therefore, many ancient and famous trees are basically left to die by themselves and have not been effectively protected. Seventh, protection and management measures are backward, and effective modern management means have not been established, resulting in inadequate management.

4. Protection countermeasures of ancient and famous trees in Daxiong Mountain
First, we should broaden financing channels and increase capital input. We should establish a diversified investment mechanism and encourage all sectors of the society to donate money for the adoption of ancient and famous trees. Second, we should strengthen the management of the ancient and famous trees. We should make clear who is responsible for the care of ancient and famous trees. For old trees with long age and weak growth potential, it is necessary to timely take rescue treatment and protection measures, and carry out related research to restore the tree potential [8-12].

Third, establish the digital information platform of ancient and famous trees. The information database of species, quantity, distribution and growth status of ancient and famous trees should be established comprehensively and systematically. Fourth, make full use of various media to publicize the knowledge of ancient tree protection. Fifth, strengthen publicity and law enforcement efforts to effectively protect ancient and famous trees. We should crack down on the man-made destruction of ancient and famous trees.

Acknowledgments
The Science and Technology Development Fund Project of Department of Transportation of Hunan Province (201706).

References
[1] Guo Xingjun, Xu Ting, Ding Ping. Status quo and protection strategy of ancient and famous trees in Liaocheng City [J]. Anhui Agricultural Science Bulletin, 2020, 26(17): 67-69.
[2] Chen Daiyong. A treasure of ecotourism: Daxiong Mountain[M]. Beijing: China Meteorological Press, 2006.
[3] Zhang Yutong. Census of ancient and precious trees and evaluation of landscape in Daxiong Mountain National Forest Park, Hunan Province [D]. Changsha: Central South University of Forestry and Technology, 2018.
[4] Ligu Fu. Red book of chinese plants: volume 1 [M]. Beijing: Science Press, 1991.
[5] State Forestry Administration and Ministry of Agriculture. List of key state protected wild plants (the first batch) [R]. Beijing: Bulletin of the State Council of the People's Republic of China, 1999.
[6] Li Danqi, Hu Wan, Han Caixia. Prediction of potential suitable distribution of Fokienia hodginsii (Dunn) Henry et Thomas based on Max Ent model [J]. Plant Science Journal, 2020, 38(6): 743-750.

[7] Shi Xiaozhong. Investigation on status of ancient and famous trees in Xunhua County and suggestions on protection and restoration [J]. Modern Agricultural Science And Technology, 2020(22): 131-132.

[8] Fang Qingchuan. Investigation and protection of ancient and famous trees in Hefei [J]. Anhui Agricultural Science Bulletin, 2020, 26(17): 72-73.

[9] Zhang Wei, Feng Xiaoran, Shang Lichen. Analysis of current situation and studying of protection measures of old and famous trees of Hebei Province [J]. Hebei Forestry Science and Technology, 2020(6): 46-49.

[10] Li Zhihui, Li Bohai, Qi Chengjing, et al. Studies on importance of valuable wood species resources and its development strategy [J]. Journal of Central South University of Forestry & Technology, 2012, 32(11): 1-8.

[11] Wu Yi, Cao Jiwu, Zhou Guoying, et al. Study on dominant population of Pseudolarix amabilis community in Hengshan mountain, Hunan province [J]. Journal of Central South University of Forestry & Technology, 2012, 32(11): 85-88.

[12] Li Jiaojie, Peng Jiqing, Wu Yi, et al. Genetic diversity among the species of Michelia in China using ISSR [J]. International Journal of Agriculture & Biology, 2020, 24: 413-419.