Original Articles

Multipurpose plant utilization in ethnic areas of Guizhou, southwest China

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A B S T R A C T

In ethnic areas, plant utilization is an essential component of traditional ecological knowledge and an important intersection between biodiversity and cultural diversity. Multipurpose plants play an important role in diversity of plant utilization and can be used as an indicator of regional biocultural diversity. Different uses of the same multipurpose plant correspond to different gathering methods and have different impacts on plant resources. Although important in both daily life and scientific studies, multipurpose plants are rarely specifically studied. In this study, multipurpose plant utilization by Miao and Buyi people in Guizhou, China, was investigated using semi-structured interviews. Plant uses were classified into eight categories: food, medicine, timber, fuel, technological, recreation, ornamental and symbolic. Three indices, Joint Plant and Use (JPU), Joint Uses (JU), and Joint Index (JI), were proposed to analyze overall utilization for multipurpose plants and the relationships among their different uses. A total of 58 species of non-cultivated multipurpose plants and 140 corresponding JPUs were recorded. With the decrease in use number, the corresponding species number of multipurpose plants increased. Two-use plants were most common among multipurpose plants, and food–medicinal plants were most frequent among two-use plants. Moreover, medicinal use and food use have the highest JI value, representing the close relationship between these two uses. Multipurpose plants are essentially determined from the attributes of plants themselves. Trees tend to have more uses than herbaceous plants. Different uses of the same plant represent different cultural or economic values, which determine the importance of a specific use. Socio-economic conditions and policies also have impacts on multipurpose plant utilization. While socio-economic conditions, policies, and plant resources vary, people might choose among different uses; hence, some key multipurpose plants and their JPUs will reflect the variations. The JPU used in this study can be regarded as a basic biocultural diversity unit. Using JPU, JU or JI allows multipurpose plants and their uses to be analyzed quantitatively. Multipurpose plants should be valued in research and management and, for further research, it is important to establish a standard plant use categorization.

1. Introduction

Traditional ecological knowledge is an important intersection between biodiversity and cultural diversity, and also a promising approach to balance biodiversity conservation and social development (Hobart, 1993; Warren, 1991; WCED, 1987). In ethnic areas, plant utilization is an essential component of traditional ecological knowledge. Over many generations and through associated production practices, ethnic groups have accumulated abundant knowledge and experience about plants and their sustainable utilization (Pei and Huai, 2007). Interactions between humans and plants have large impacts on plant resource management, and thus on regional biodiversity. Plant utilization by ethnic groups is strongly influenced by local cultural practices. Co-conservation of biodiversity and cultural diversity should

provide a promising opportunity to retard the rate of biodiversity loss (Maffi, 2001; Pretty et al., 2009). Therefore, the many facets of plant utilization are important in biocultural diversity research and management.

Plant utilization can be used as an indicator of traditional ecological knowledge (Pilgrim et al., 2008), at the same time, it can be also used as an indicator of biocultural diversity. Diversification of uses is a significant characteristic of plant utilization, especially wild plant utilization. This diversification first presents in different natural environments, where available plant resources in regions differ because of differences in native species or vegetation composition (Huai et al., 2000; Ladio et al., 2007). Even in the same region, impacted by different cultures, ethnic groups have developed distinct indigenous knowledge for utilization of plants (Goodman and Hobbs, 1988; Pieroni

and Quave, 2005). Most plants have more than one use, and the parts used or processing methods for the same plant adopted by different ethnic groups will also vary. Multipurpose plant utilization is an important aspect of diversity in plant utilization. Different uses of one plant correspond to different cultural or economic values, corresponding to different importance to a specific ethnic group. Moreover, different uses equate to different gathering strategies or use patterns, which have different impacts on the plant resource. On the other hand, the abundance of plant resources leads to human trade-offs and selection among different uses of a plant, which then impacts plant resource utilization and management.

Multipurpose plants are prevalent and important in daily life, but in scarcely studied quantitatively. Generally, ethnobotany studies focus on certain uses of plants, like medicinal use for new active substance, or some important multipurpose plants for sustainable utilization (Mafole et al., 2017; Olivier et al., 2015; Tovignan et al., 2016; Zhang et al., 2018). Multipurpose plants are generally used as an index in the progress to evaluate plant importance in some regional scale studies (de Albuquerque and Hanazaki, 2009; Phillips and Gentry, 1993). In this study, we emphasized the importance of multipurpose plants as indicator of regional biocultural diversity study and proposed some relative indices to explore the influence factors on multipurpose plants utilization and try to answer the following questions. (1) What is the overall situation of the multipurpose plant use in an ethnic area? (2) What is the relationship among different uses? (3) What factors determine or impact human' choices among plant uses? (4) And what role can multipurpose plants play in regional plant resources management and regional biocultural diversity conservation? Multipurpose plants utilization of the Miao and Buyi people in Guizhou province, southwest China, was chose as a case study. This study might provide method for research on multipurpose plants and reference for regional biocultural diversity conservation.

2. Material and methods

2.1. Study area

Guizhou province is in southwest China, between 24°37′–29°13′N and 103°36′–109°35′E. Plant resources are abundant and ethnic groups are widely distributed here. Over many generations these ethnic groups have accumulated abundant knowledge and experience about native plant utilization. Miao and Buyi are the two most important minority ethnic groups in Guizhou province and generally live near each other. In this study, plant utilization of four ethnic groups, Miao (Group 1, also known as Balang Miao People) and Buyi (Group 2) people in Niujiaojin Village, Ziyun County, and Miao (Group 3) and Buyi (Group 4) people in Liyuba Village, Xingren County were studied. Vegetation in Ziyun is mainly evergreen oak forest, being mixed evergreen and deciduous forest, and main dominant species include *Cyclobalanopsis glauca*, *C. glauca* var. *gracilia*, *Cinnamomum camphora*, *Ligustrum lucidum*, *Liquidambar formosana*, and *Betula luminifera*. Vegetation in Xingren is mainly evergreen broadleaved forest with main dominant species of *C. glauca*, *C. glauca* var. *gracilia*, *C. camphora*, *Celtis sinensis*, and *L. lucidum* (Huang and Tu, 1983). Currently, vegetation in both counties is mainly secondary conifer and broadleaf mixed forest and shrubs because of human disturbance.

2.2. Semi-structured interview

Semi-structured interviews and field investigations were adopted for this study. Village chiefs, important villagers, herbalists (people who collect roots and herbs to make medicines), housewives and ordinary villagers were selected as interviewees in each ethnic group. The total interviewees in each of the four groups amounted to seven, five, six, and five, respectively. They were interviewed about plant utilization, including plant name, stem morphology, major plant habitats, useful

parts, uses, abundance and personal information (with their permission). Species with folk names were identified to species from photographs or from field identification accompanied by knowledgeable voluntary interviewees. To avoid language barriers, we invited village chiefs and local forestry bureau staff to translate during interviews and field investigations.

2.3. Plant use categorization

There is no uniform standard of plant use categorization in ethnobotany. Based on previous literature (Phillips and Gentry, 1993; de Albuquerque et al., 2008; Tardio and Pardo-De-Santayana, 2008; Melian et al., 2017) and our investigation results, we classified plant uses into eight categories: food, medicinal, timber, fuel, technological, recreational, ornamental and symbolic. In the food use category, vegetables, fruits, grains, edible oil, and food colorants were included; timber use is plants used for house and furniture construction; technological use refers to making objects for daily life that are not relevant to symbolic use; recreational use refers to plants used for making cigarettes, tobacco, tea or alcohol; ornamental use is those species planted around houses or streets for beauty; symbolic use is plants used in festivities, rituals, religious events or other symbolic aspects of culture, including holy trees and sacred forests.

2.4. Some indices for multipurpose plants research

Although lacking unified naming conventions, one use of one plant, and sometimes one plant use of one informant, is commonly used as quantitative analytical units in ethnobotany (Phillips and Gentry, 1993; Thomas, 2012). In our study, one concurrent use of one plant (P_i) and a single use of that plant (U_i) were defined as one Joint Plant and Use (JPU), for example, *Aster subulatus* is used as food, and was thus regarded as a basic research unit as *A. subulatus*-food. JPU is not only a plant and its one use, but also a concurrent biocultural unit.

With multiple uses, one plant would constitute several JPUs. For example, in this research, *Aster subulatus* is associated with both food and medicinal uses and thus constitutes two JPUs: *A. subulatus*-food and *A. subulatus*-medicinal. At the same time, there exists one Joint Uses (JU) between food and medicinal use; here *A. subulatus* is called a two-use plant. Similarly, there are single-use plants, three-use plants, etc. For single-use plants, there is no JU, while one three-use plant constitutes three JUs.

For one use category, its JPU equals the plant species number within this category. If the corresponding JPU number of two uses is JPU_1 and JPU_2, the JPU amount of these two uses would be ($JPU_1 + JPU_2$). However, because joint uses (JU_{12}) exists, plant species number in these two use categories is ($JPU_1 + JPU_2 - JU_{12}$). Similar to the Jaccard Index, the Joint Index (JI) is constructed to depict the association degree of use i and use j.

$$JI_{ij} = \frac{JU_{ij}}{(JPU_i + JPU_j - JU_{ij})} \tag{1}$$

Data was processed with Microsoft Excel, except for multi-dimensional scaling (MDS) analysis, which was based on JI, and processed using SPSS v.19 (IBM, 2010).

3. Results

3.1. Overall situation of plant use in study area

First, JPU amounts and plant species compositions of the four groups were statistically analyzed, and no significant differences were found. This might be because the four groups have similar biodiversity conditions, and have existed close together for a long time, leading to similar plant utilization by both the Miao and Buyi people. In sum, 265