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Wild Energy Plant Resources, Conservation and Sustainable Use of Sanqingshan in Eastern China

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Abstract

Accompany with the energy crisis and pollution, came the energy plant, the biomass energy relying mainly on energy plant should be developed. Energy plants are vital strategic resource to secure the state energy supply and to respond possible energy crisis at present and in the future. Sanqingshan has a wide variety of the wild energy plant resources, having an estimate of more than 100 species. This paper studies on the species diversity status, protection and sustainable use of the wild energy plant resources in Sanqingshan. Some energy plants are characterized by fast growth, high yield, high oil content, good burning quality, and potential exploitable worth, including Lauraceae, Magnoliaceae, Theaceae, Sapindaceae, *Prunus* of Rosaceae and *Carya* of Juglandaceae and *Jatropha curcas*, *Sloanea hemsleyana*, *Sloanea sinensis*, and so on. Besides to biodiesel, the development of energy plants can bring various resources such as wood, fragrance materials, fruits, medicine materials and rubber, for seeds are the main oil containers in these plants, in the same time. Some suggestions on the sustainable use and development of energy industry in the region were put forward.

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Key words: Energy plant, Wild Resources, Environmental conservation, Sustainable use, Sanqingshan

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1. Introduction

Accompany with the energy crisis and pollution, came the energy plant, the biomass energy relying mainly on energy plant should be developed. Energy plants are vital strategic resource to secure the state energy supply and to respond possible energy crisis at present and in the future (Ragauskas *et al*, 2006; Wen, 2007). Development biomass energy and selection energy plant to alternative fossil fuels is an important way to ease the energy crisis and reduce greenhouse gas emissions. Energy Plant with its rich resources, renewable, zero emissions of carbon dioxide and other advantages will become an important alternative energy sources (Liu *et al*, 2010; Wan and Fang, 2008; Ramos *et al*, 2009).

Sanqingshan is located on east north of Jiangxi province, Eastern China, it has a wide variety of wild energy plants, many of them has not been used, Therefore, the development and utilization of wild energy plant resources is of great potential. By developing and utilizing the wild energy plant resources, we can form some advantages as new industries, in order to avoid loss of wild energy plant resources when use plant resources, protection should be taken, and the protection is a long-term use for wild energy plants.

2. Species diversity status of wild energy plant resources in Sanqingshan

Sanqingshan has diverse biodiversity, based on the investigation mentioned (Peng *et al*, 2008), there are 2373 species higher plants(including culture species)from 984 genera belonging to 253 families, Among them, there are 368 species of Bryophyta from 165 genera belonging to 65 families, 179 species of Pteridophyta from 71 genera belonging to 34 families, 24 species of Gymnopermae from 22 genera belonging to 6 families, and 1802 species of Angiospermae from 726 genera belonging to 148 families.

Energy plants are plant resources of edible oil, industrial oil and paint raw materials, and there are about 100 species of energy plants, account for an estimated 5% of wild plant resources in Sanqingshan region.

In this area, the *Camellia oleifera*, *C. japonica* and *C. chekiang-oleosa* of Camelliaceae are rich and have high oil content, and can be used for human consumption. Tea seed oil of *C. sinensis* can be used as lubricants of precision machinery and lubricants. *Lindera megaphylla* of Lauraceae is evergreen tree, common in evergreen broadleaved forest and brush land, and its kernel of seed is non-drying oil, which is used for soap raw material, and its seed oil can be also used for soap raw material. *Litsea cubab* is common, born in hillsides, hillsides, shrub, woodland or on-street and other places, and its seed oil is used for industrial oil. *Mallotus apelta* of Euphorbiaceae is a shrub or small tree, common, born in shrubs or the sides of villages and its seed oil is used for soap and so on. *Celtis sinensis* of Ulmaceae is deciduous tree, born on forest edge, village, street, and its wood is light and hard that can be made of made of furniture. Its seed oils can be used for lubricating oil. *Ailanthus altissima* of Simaroubaceae is deciduous tree, common in the region and born in hillside, limes of villages, and seeds can be extracted to oil. Moreover, energy plants have *Pinus massniana* of Pinaceae, *Cunninghamia lanceolata* of Taxodiaceae, *Taxus wallichiana* var. *mairei* of Taxaceae, *Cinnamomum camphora*, *C. micranthum*, *C. porrectum*, *C. sudauenium*, *Lindera aggregata*, *Lindera communis*, *Lindera glauca*, *Litsea cubeba*, *L. rotundifolia* var. *oblongifolia*, *Machilus grijsii*, *Machilus velutina*, *Machilus thunbergii*, *Phoede sheareri* of Lauraceae, *Capsella bursapastoris*, *Cardamine hirsuta* and *Lepidium virginicum* of Cruciferae, *Celosia argentea* of Amarantaceae, *Idesia polycarpa* and *Xylosma congesta* of Flacourtiaceae, *Camellia breuistyla*, *C. cuspidate* and *Ternstroemia gymnanthera* of Camelliaceae, *Firmiana simplex* of Sterculiaceae, *Urena lobata* of Malvaceae, *Glochidion puberum*, *Mallotus lianus*, *Sapium discolor*, *Sapium japonicum* and *Sapium sebiferum* of Euphorbiaceae, *Lauroceasus phaeosticta* of Rosaceae, *Aeschynomne indica*, *Daldergia*, *Millettia* and *Sophora flauescen* of Papilionaceae. *Lithocarpus glaber* of Fagaceae, *Broussonetia papyrifera* and *Ficus pumila* of Moraceae, *Boehmeria niuea* of Urticaceae, *Paliurus ramosissimus* of Rhamnaceae, *Melia azedarach* of Meliaceae, *Euscaphia japonica* of Staphyleaceae,

Toxicodenrom succedaneum of Anacardiaceae, *Pterocaya stenoptera* of Juglandaceae, *Alangium chinensis* of Alangiaceae, *Aralia chinensis* of Araliaceae, Umbelliferae, of Umbelliferae, *Ardisia crenata* of Myrsinaceae, *Styrax suberifolus* of Styracaceae, *Symplocos sumuntia*, *S. chinensis* of Symplocosceae, *Ligustum sinensis* of Oleaceae, *Gardenia jasmindes* of Rubiaceae, *Bidens tripartita* and *Xanthium sibiricum* of Compositae, *Lysimzchia fortunei* of Primulaceae, *Plantago asiatica* of Plantaginaceae, *Paulownia rawrarmii* of Schrophuraceae, *Vitex negundo* of Viticaceae, *Leonurus artemisia*, *Perilla frutesens* and *Salvia plebia* of Labitae, and *Commelino communis* of Commelinaceae are all energy plant resources. Besides, *Pinus massoniana* of Pinaceae, *Machilus leptophylla* and *Machilus pauhoi* of Lauraceae, *Altingia chinensis* and *A. gracilipes*, *Liquidambar formosana* of Hammeliaceae, *Toxicodendron succedaeum* of Anacardiaceae are resin and balata plant resources. Above can be show that Sanqingshan has a wide variety of the wild energy plant resources.

3. Protection of wild energy plant resources in Sanqingshan

3.1 Protection aim of wild energy plant resources

- Protects the wild energy plant resources. The plant is the production of a long-term evolution and adaptation. These energy plants are the precious germplasm resources.
- Protects the reproductive ability, In the use wild energy plant resources intensity, must consider its restoration ability and reproductive property, Must give the opportunity for energy plant resources rests and builds up, enables it to restore and develop.
- Protects the species and economic diversity. The wild energy plant resources originally are bountiful, Many kinds of energy plants gather in together, forms harmony communities, When uses some resource, can not take damage other wild plant resources, development diversified management.
- Protects the ecological habitat. When plant grows, it influence with the environment mutually, the synthesis has formed the specific ecological environment. During development use energy plant resources, must pay attention to the ecological environment which protects them to form, promotes it to restore and to develop.

3.2 Protection approach of wild energy plant resources

To conservation the wild energy plant resources in Sanqingshan, should to take following approach:

- In situ conservation. As possible as to establishes different types of nature protection area.
- Ex situ conservation. Establishes some kinds of botanical gardens and the arboretums.
- Establishes the germplasm resources storehouse. Long-term preserved seed, pollen and each kind of asexual propagules.
- Builds the raw materials base. To developed use the wild energy plant type, according to the market demand, establishes the raw materials base separately.

4. Sustainable use of wild energy plant resources in Sanqingshan

4.1 Basic rules for energy plant resources use

To sustainable use the wild energy plant resources in Sanqingshan, should follow these rules:

- Energy plant resources synthesis and highly effective use, in the wild energy plant uses process, will often waste the resources. Should use the modern new technology, to use raw material effectively.

- Resources productivity constant with energy plant resources used quantity. When development use energy plant resources, must first discover this area plant resources to be possible to pick the quantity, extracts the output with the most greatly economic efficiency combining site, can achieve the sustainable use.
- Establishes the industrial base, the use and the protection develop simultaneously. Including the establishment the base of wild sustainable use and the base of the manual planter, the introduction domesticates, provides stable and the high quality raw material for the industry.
- Develops the new resources, increase the resources marketed proportion. Regarding the quality is superior, but measures the plant resources, in enhances these resources outside the use factor, should seek for the new substitution resources, development the new commodity.

4.2 Sustainable use plan of energy plant resources

The wild energy plant resource development must achieve the protection and use develops simultaneously, the ecological benefit and the economical efficiency are unified. Both will have development the use goal in the near future, and will have the long-term development direction. The plan actual content includes:

- Direct development. To wide distribution, large amount and high economic efficiency energy plant resources, should use directly, to realize the economic efficiency as soon as possible.
- The near future development. To economic efficiency, but the reserve amount small wild plant resources, not immediately to form certain productivity.
- Forward development. To those plant resources that has not verified the use, the breadth is insufficient, the processing technological level is low, creates serious resources waste, develops not eagerly.

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