

国家重点基础研究发展计划（973计划）2003CB415100研究项目资助

# 云南

## 生物多样性及其保护研究

STUDIES ON THE BIODIVERSITY AND  
ITS CONSERVATION IN YUNNAN, CHINA

杨宇明 王娟 王建皓 裴盛基 © 编著



科学出版社  
[www.sciencep.com](http://www.sciencep.com)

国家重点基础研究发展计划（973计划）2003CB415100研究项目资助

云南

# 生物多样性及其保护研究

STUDIES ON THE BIODIVERSITY AND  
ITS CONSERVATION IN YUNNAN, CHINA

杨宇明 王娟 王建皓 裴盛基 © 编著

科学出版社

北京

## 内 容 简 介

本书内容主要包括云南生物多样性形成的地理背景,景观多样性、生态系统多样性主要类型和空间分布格局,以及物种多样性系统构成与分布和动植物区系组成特征;云南生物地理分区、各分区的特征及其分异的规律性;云南鸟类保护与环志站、云南生物多样性保护信息系统的建设。除此之外,本书还对云南生物多样性与生态环境问题进行了分析,阐述了传统文化与生物多样性的关系,传统知识在保护生物多样性中的地位和作用,云南生物多样性优先重点保护的区域和重点保护的对象、保护的策略与方法。

本书是一部对云南生物多样性现状及其保护策略较为系统全面的研究专著,有较高的学术价值,可供从事生物学、地理学、动物学、植物学、生态学、保护生物学、生物多样性与自然保护的科研工作者和自然保护区工作人员参考;同时可作为综合性大学生物、地理、旅游专业和农林院校相关专业的教学参考书。

### 图书在版编目(CIP)数据

云南生物多样性及其保护研究/杨宇明等编著. —北京:科学出版社, 2008

ISBN 978-7-03-019599-9

I. 云… II. ①杨… III. ①生物多样性-特征-研究-云南省②生物多样性-保护-研究-云南省 IV. Q16

中国版本图书馆 CIP 数据核字 (2007) 第 083102 号

责任编辑:杨震朱丽 王国华/责任校对:陈丽珠

责任印制:钱玉芬/封面设计:耕者设计工作室

科学出版社 出版

北京东黄城根北街 16 号

邮政编码:100717

http://www.sciencep.com

中国科学院印刷厂印刷

科学出版社发行 各地新华书店经销

\*

2008 年 7 月第 一 版 开本: B5 (720×1000)

2008 年 7 月第一次印刷 印张: 19 插页: 6

印数: 1—1 500 字数: 373 000

定价: 60.00 元

(如有印装质量问题, 我社负责调换〈科印〉)

## 序

地处中国西南部的云南，因“植物王国”、“动物王国”、“有色金属王国”和多姿多彩民族文化而闻名于世。在这片神奇的土地上，澄江动物化石群被誉为古生物圣地，是研究地球生命起源的宝库；禄丰恐龙动物群是古脊椎动物最完整、最丰富的动物群之一；中国人类历史的帷幕在这里由元谋猿人的双手拉开。奇特的自然地理环境，使云南具有得天独厚的自然资源。自 20 世纪以来，国内外的科学家对云南的考察研究成果，充分显示了云南不仅生物资源丰富程度独冠全国，并且还是世界公认的全球生态系统、生物类群和遗传种质资源极为丰富而重要的分布区域。《中国国家地理》云南专辑以“云南——如此多样”为主题，扉页中这样写着：“这里是中国植物的基因库，中国最大的热带雨林在这儿。这里的动物种类位居全国之冠。中国的大山大河基本上是东西走向，这里的大山大河竟然拐了一个直角弯！从北向南纵贯排列。中国 56 个民族这里就有 26 个……”

云南丰富的生物多样性为生物工作者提供了广阔的天地。作者在蔡希陶、吴征镒等老一辈植物学家的感召下，对云南生物资源进行了 20 多年的调查研究。他们先后主持和参加了云南 30 余个国家级和省级自然保护区的综合科学考察研究和总体规划编制。在积累逐步增多和认识逐渐深化的基础上，常常思考一些问题，诸如云南生物多样性为什么会比其他一些地方丰富、怎样恰当地表述与评价云南生物多样性特征及评价的内容与方法、困扰问题与胁迫因素有哪些、保护与管理的关键问题是什么和应采取的优先行动等。生物多样性保护的目的是通过对生物多样性资源的保护维护生态环境稳定，可持续利用和管理生物资源，促进经济发展、社会文明，特别是当地社区的发展，因为生物多样性丰富的地区多是边远贫困的地区，而以往恰恰没有重视这些地区原住民在利用和保护管理方面的传统知识和经验。这些经常在脑际萦绕的问题，成为完成该项研究的基本思想构架。

该书以宇明在清华大学的博士学位论文《云南生物多样性特征及其保护研究》为基础，与其他同行合作，应用生物地理学、保护生物学、民族植物学的理论和参与式快速评估的技术方法，对于组成复杂、内容丰富、区域广泛的云南生物多样性系统进行了广泛深入的调查研究，通过对该系统的调查采集、分析处理、研究归纳、综合评价，确定了云南生物多样性的关键地区、重点保护的生物类群、生态稳定的压力因素，进而将这些成果应用于生物多样性保护的目标、策略和方法的制定。该研究方法系统、完整，可操作性强，具实用性，是对生物多

样性保护研究方法的新发展。

这部专著在查明了云南生物多样性的主要组成部分的基础上，对已查明的生物类群按生物地理分区单元进行了编目，确定了具有地区或全球意义的生物多样性的主要类群或关键地区。在此基础上，对调查研究地区进行了生物地理区划，分析研究了生命系统与云南特殊的自然地理环境长期协同进化发展的关系，提出了云南生物多样性形成与演化发展的原动力源于环境因素的论断。

作者从自然环境-生物世界-人类社会三大部分相互融合、共同发展的历程，提出人类文化联系着三大部分的纽带的论断，强调了传统文化与乡土知识体系在保护自然生态环境、利用和管理生物多样性资源中所起的作用，原住民的知识是人类对自然环境和生物多样性的第一作用力。作者提出的应用传统知识保护生物多样性是对生物多样性保护理论的重要推动。

基于所建立的云南生物多样性保护信息系统和对云南生物多样性与生态环境问题的分析，突出云南生物多样性保护的策略与保护重点。作者较系统地阐述了应用传统知识文化保护生物多样性的策略与方法，突出了当地民族群众是保护生物多样性的力量。该研究提出的保护策略与方法的逻辑框架图，系统全面、层次清楚、重点突出、易于实施。

在经济建设迅猛发展的今天，生物多样性保护问题不仅在中国，乃至整个世界都突显出来，在全球气候变化、环境污染和生物多样性衰减三大环境问题中，生物多样性问题尚未引起人们足够的重视。为解决这一重大的环境保护问题，随着对环境科学认识的不断深入，人们的目光开始从最初重视环境的化学污染和物理因素的影响等，逐步转移到重视生物多样性与生物因子的影响。因为生物多样性是生物因子在环境中最重要的表现和存在形式，生物多样性变化会直接或间接导致环境的改变，而生物多样性的变化或衰减常常是不可逆转的。研究生物多样性保护，实现生物资源可持续性利用，已被认为是当今解决环境保护与资源利用最重要的方面之一。

我对宇明等作者坚持不懈的努力感到欣慰，并诚挚地向广大读者推荐这部具有保护理论研究和指导保护实践价值的专著。希望更多的朋友关心云南的环境问题和生物多样性的保护，为云南的生物多样性在得到有效保护的前提下、为促进当地经济社会的可持续发展作出贡献。文中有些倾向性观点，是作者反复思考的，有些问题、有的看法尚待讨论，还需要提高认识，以进一步形成学术见解。保护云南生物多样性，需要我们继续努力，身体力行，沿着实现云南生物多样性有效保护下得到可持续利用的发展目标走向未来。

郝吉明

2007年8月于清华园

# 目 录

## 序

<b>Studies on the Biodiversity and Its Conservation in Yunnan, China</b> .....	1
1. Introduction .....	1
2. Background of Yunnan's biodiversity .....	1
2.1 Geographical features of Yunnan .....	1
2.2 The climate of the province .....	4
2.3 Biodiversity under the influence of minority culture .....	5
3. The province's biodiversity .....	5
3.1 The faunal diversity .....	6
3.2 The flora diversity .....	7
3.3 The genetic diversity .....	10
3.4 The ecosystem diversity .....	10
4. The threats to province's biodiversity .....	11
5. Yunnan's biodiversity fragility .....	11
<b>第 1 章 绪论</b> .....	13
1.1 导言 .....	13
1.1.1 生物多样性的概念 .....	13
1.1.2 认识和了解云南生物多样性的的重要意义 .....	13
1.2 研究的主要目的和意义 .....	15
1.3 云南生物多样性的有关研究概述 .....	16
1.3.1 云南生物多样性的有关调查研究 .....	16
1.3.2 云南生物多样性研究与保护的国际合作 .....	17
1.3.3 主要学术活动与成果 .....	18
1.4 本研究的背景和重点内容 .....	19
1.4.1 研究的背景 .....	19
1.4.2 研究的重点内容 .....	19
<b>第 2 章 云南生物多样性的形成背景及基本特征</b> .....	21
2.1 自然地理背景 .....	22
2.1.1 云南地形地势的基本特征 .....	22
2.1.2 云南气候的区域性特征 .....	24

2.1.3	气温的分布	26
2.1.4	降水和湿润程度的分布	28
2.2	自然景观多样性高度密集	31
2.2.1	景观的基本概念及特征	31
2.2.2	云南基本的生物地理景观类型	32
2.3	从热带到高山寒带完整的生态系统多样性系列	41
2.3.1	云南生态系统多样性地域分布的地理构成因素	42
2.3.2	云南生态系统多样性地带性分布与垂直系列	44
2.3.3	河流、湖泊淡水生态系统	52
2.3.4	云南生态系统多样性分布规律与特征	61
2.4	物种多样性特征	65
2.4.1	菌类多样性特征	67
2.4.2	藻类多样性特征	68
2.4.3	高等植物多样性特征	68
2.4.4	动物多样性特征	83
2.5	小结	97
<b>第3章</b>	<b>云南生物地理分区研究</b>	<b>100</b>
3.1	用地理学观点研究生物种的分布	100
3.2	世界动物区和植物区界的异同	101
3.3	生物地理 Udvardy (1975 年) 全球分区系统	104
3.4	我国生物地理分区方案简介	109
3.5	云南生物地理区划编制方案	112
3.5.1	方案编制的依据	112
3.5.2	分区的原则	112
3.5.3	分区的方法	113
3.5.4	分区的单位和系统	113
3.6	云南生物地理分区特征	115
3.6.1	中甸、德钦高山峡谷生物地理区域①—(23a)	115
3.6.2	独龙江高黎贡山生物地理区域②—(38e)	116
3.6.3	滇中高原生物地理区域③—(39a)	117
3.6.4	滇西北横断山脉生物地理区域④—(39b)	118
3.6.5	滇西横断山脉生物地理区域⑤—(39f)	119
3.6.6	滇东北中山切割生物地理区域⑥—(01a)	119
3.6.7	滇东南喀斯特山原热带生物地理区域⑦—(06a)	120
3.6.8	滇西中低山南热带生物地理区域⑧—(10a)	121

---

3.6.9 滇南边缘热带低山河谷生物地理区域⑨—(10b)	121
3.6.10 滇西南边缘热带低山河谷生物地理区域⑩—(10c)	122
3.7 小结	123
<b>第4章 云南鸟类保护与环志站建设</b>	<b>126</b>
4.1 云南是中国鸟类迁徙重要的通道和越冬栖息地	126
4.1.1 滇西横断山脉通道	127
4.1.2 滇东—滇中高原通道	128
4.2 云南重要的候鸟集结点和湿地越冬地	129
4.2.1 洱源鸟吊山	130
4.2.2 巍山鸟道雄关	130
4.2.3 南涧凤凰山	131
4.2.4 富宁鸟王山	131
4.2.5 丽江拉市海湿地鸟越冬地	132
4.2.6 昭通大山包湿地越冬地	133
4.2.7 昆明滇池湿地越冬地	133
4.3 鸟类保护与环志在云南生物多样性保护中的重要性	134
4.3.1 鸟类环志的意义和历史	135
4.3.2 云南鸟类环志站建设的必要性	136
4.3.3 云南鸟类环志的任务与目标	138
4.3.4 环志、科研监测的任务与目标	140
<b>第5章 云南生物多样性保护信息系统建设研究</b>	<b>142</b>
5.1 生物多样性信息系统建设的主要内容和目标	142
5.2 信息系统网络环境的建设	143
5.3 信息数据库的建设	144
5.3.1 内容	144
5.3.2 实现步骤	144
5.3.3 数据采集方法	144
5.3.4 生物多样性保护数据的初步分类	144
5.3.5 分布式网络数据库建设与应用	145
5.3.6 云南省生物多样性保护数据仓库系统建设	145
5.4 保护决策支持系统与专家系统的建设	145
5.5 云南省生物多样性保护三个层次的信息数据库	146
5.5.1 生物种群多样性层次数据库	146
5.5.2 生态系统多样性层次数据库	149
5.5.3 景观多样性层次数据库	152



---

5.6	小结	153
<b>第6章</b>	<b>云南生物多样性与生态环境问题分析</b>	<b>154</b>
6.1	保持丰富的生物多样性是云南生态环境问题的核心和关键	154
6.1.1	生物多样性与自然环境之间是相互作用协同进化的关系	154
6.1.2	生物与环境相互作用力的变化	155
6.1.3	生物多样性对云南生态环境产生的影响	155
6.1.4	生物多样性功能的不可替代性	156
6.2	生物多样性对云南生态环境稳定的重要意义	159
6.2.1	稳定性的基本概念	160
6.2.2	生物多样性与生态系统稳定性的关系	160
6.2.3	生物多样性对云南山地生态环境稳定性的重要作用	166
6.3	云南生物多样性受到威胁的主要原因	169
6.3.1	云南生物多样性的脆弱性分析	169
6.3.2	人口过度增长是造成云南资源和环境破坏的主要原因	170
6.3.3	过度放牧造成草丛草甸退化	172
6.3.4	过度利用是造成物种濒危或灭绝的主要因素	173
6.3.5	外来物种侵入与病虫害传播	174
6.3.6	大规模发展热带经济作物造成热带天然林毁坏、生境变化	177
6.3.7	栖息地改变、生境丧失是对物种多样性最严重的威胁	178
6.4	生物多样性测度与评估研究	181
6.4.1	生物多样性测度	181
6.4.2	云南生物多样性评价指标体系的研究	186
6.5	小结	196
<b>第7章</b>	<b>传统文化与生物多样性保护</b>	<b>197</b>
7.1	文化多样性	197
7.1.1	文化的概念	197
7.1.2	村寨文化——民族文化的基本单元	198
7.1.3	民族文化的性质与功能	200
7.2	生物多样性与文化多样性的关系	202
7.2.1	生物多样性是文化多样性形成和发展的基础	203
7.2.2	特定生物多样性孕育了与之相适应的特定传统文化	204
7.3	传统文化对生物多样性的影响和作用	208
7.3.1	原住居民是生物多样性的第一感知力	209
7.3.2	传统文化是人类对生物多样性的第一作用力	209
7.3.3	传统文化对生物多样性保护的影响和作用	210

7.3.4 生物多样性与文化多样性是相互依存、协同共存的关系 .....	212
7.4 关于文化多样性在生物多样性保护策略中的思考 .....	214
7.5 小结 .....	216
<b>第8章 云南生物多样性保护的策略方法与重点</b> .....	<b>218</b>
8.1 当前生物多样性管理中存在的主要问题 .....	218
8.1.1 自然保护区管理体制不顺,保护效能不高 .....	218
8.1.2 保护目标与资源合理利用的矛盾未能很好解决 .....	219
8.1.3 保护区与社区的矛盾冲突,使保护措施不能发挥应有作用 .....	219
8.1.4 保护与发展之间的矛盾日益突出 .....	220
8.1.5 不适当的发展策略导致了地方文化多样性的消失 .....	220
8.2 应用传统文化保护生物多样性的策略 .....	221
8.2.1 传统文化应用于保护与发展策略的制定中 .....	221
8.2.2 把文化多样性的保护纳入生物多样性的保护范畴 .....	222
8.2.3 促进参与式管理 .....	222
8.2.4 乡土保护体系在保护生物多样性中的功能和作用 .....	223
8.2.5 从绝对保护到保护与可持续利用并举 .....	223
8.3 应用传统知识保护生物多样性的方法 .....	224
8.3.1 应用民族植物学的原理和方法进行生物多样性编目 .....	225
8.3.2 发掘弘扬传统知识中有关生物资源管理和保护的方法 .....	225
8.3.3 发挥传统信仰文化在生物多样性保护中的作用 .....	225
8.3.4 应用民族传统医药文化,发掘和保护药用植物的多样性 .....	226
8.3.5 应用混农林系统知识对农业生物多样性栖息地进行保护 .....	226
8.3.6 应用各民族采食野生植物的知识利用和保护植物多样性 .....	226
8.3.7 应用庭园种植的传统知识对经济植物进行迁地保护 .....	227
8.4 云南生物多样性保护的优先重点 .....	227
8.4.1 确定保护优先重点的重要意义 .....	227
8.4.2 确定优先重点的标准和方法 .....	228
8.4.3 云南优先重点保护区 .....	233
8.4.4 云南优先重点生态系统与自然保护区 .....	236
8.5 小结 .....	243
<b>参考文献</b> .....	<b>246</b>
<b>附录1 云南生态系统多样性的地带性垂直分布系列</b> .....	<b>252</b>
附1.1 滇西南热带山地生态系统垂直分布系列 .....	252
附1.2 滇东南热带山地生态系统垂直分布系列 .....	253
附1.3 滇南热带山地生态系统垂直分布系列 .....	254

---

附 1.4	滇东高原亚热带北部山地生态系统垂直系列 .....	254
附 1.5	滇东北亚热带东北部山地生态系统垂直系列 .....	255
附 1.6	寒温高原地带生态系统垂直系列 .....	255
附录 2	云南陆栖脊椎动物生物地理分区分布名录 .....	257
附录 3	云南优先重点保护的物种名录 .....	279

# **Studies on the Biodiversity and Its Conservation in Yunnan, China**

## **1. Introduction**

Biodiversity is the material base on which people rely for existence and development, and its potential role-affecting mankind is beyond measure. However, Yunnan's biodiversity is faced with the menace of excessive exploitation of resources and changes in environmental condition caused by the activities of an expanding human population. Now, more and more people are waking up to the need for protecting nature. Biodiversity conservation and sustainable development are being followed with great interest internationally.

China is one of 10 mega-biodiversity countries and ranks the eighth in the world and the first in Northern hemisphere (Braatz et al. , 1992). However, 4,000~5,000 high-plant species are endangered amounting to about 15%~20% of China's total (Chen et al. , 1993). Among 640 endangered species listed by EITES, China has 156 accounting for 25% of the world's total.

Being rich in wild species and ecosystem types, among which many rare, ancient and endemic species, Yunnan is acknowledged as a vital distribution region for important species and a globally significant region with its biodiversity. The study of biodiversity, biodiversity conservation and its sustainable utilization is significant not only for China's programs of "Western Exploration" and "Yunnan's Green Economy Construction" but is also of a practical or immediate value for global biodiversity conservation.

## **2. Background of Yunnan's biodiversity**

### **2.1 Geographical features of Yunnan**

Yunnan, an inland province at a low latitude and high elevation, lies between 21°09'~29°15' N and 97°32'~106°12'E in southwestern China. With its 4,060km-boundary line, Yunnan is bordered by Sichuan in the north, Guizhou and Guangxi in the east, Tibet in the northwest, Myanmar in the west and the southwest and Laos and Vietnam in the south and the southeast. Occupying a

land of area 390,000km<sup>2</sup>, Yunnan is a vast territory with diversified and unique nature resources. From the point of view of geographic location, Yunnan is situated at the meeting point of three geographic regions: the eastern Asia monsoon region, the Tibet plateau region and the tropical monsoon region of southern Asia and Indo-China, each with significantly different natural conditions. In the east, in the south and the west, and in the northwest, Yunnan adjoins the eastern Asia monsoon region, the Tibet plateau region and the tropical monsoon region of southern Asia and the Indo-China, respectively. The province's elevation is higher in the northwest with its highest point at the summit of Kagebo peak (6,740 m) of Meili Snow Mountain while the land gradually lowers towards the east, the south and the west. The lowest point in the province is only 76.4 m above the water line of the Honghe River. Thus, the height difference is 6,663m. Because of the "synergistic effect" of vertical zonality, the province that spans only 8° in latitude holds all climate zones and land ecosystem types that can be found in the 35° range of latitudes from Sanya in Hainan to Mohe in Heilongjiang (WWF, 1996).

In western Yunnan, as the Hengduan Mountain Range stretches from the north to the south, the cold-enduring animal and plant species in the center of Tibet plateau are able to distribute to the south forming the cold-enduring plateau biogeocoenosis in the region. This is the lowest latitude where representatives of the Palaearctic and Holarctic realms may be found in the Northern Hemisphere. Thus, the shift to the South of the north-south boundary line of wildlife makes the province a region with both Palaearctic and Oriental realms.

The southern Yunnan, for example Xishuangbanna, adjoining to the tropical low-height mountains of Indo-China forms a main access way for Southeastern Asia's tropical animals and plants to China. The southwestern part, for instance Dehong (the southern sector of Gaoligong Mountain) neighboring southern Asia subcontinent through Tanbang Mountain of Myanma is the piedmont low land, which is exposed to the tropical ocean flow coming from the Bay of Bengal of Indian Ocean. It is the region where the Indian tropical biota converges in China.

In generally, the province's features are high mountains and deep gorges in the north, middle-height mountain plateau in its center and the low-height mountains and broad-valley basins in its south. From the west to the east the mountain ridges sequentially are: Gaoligong Mountain, Nushan Mountain, Wuliang Mountain, Yunling Mountain and Ailao Mountain, etc., occupying 94% of

the province's total area. The Nushan Mountain begins at the Qing-Tibet plateau and stretches to Myanmar and Thailand by crossing western Yunnan to the south. Within the province's borders, Nushan Mountain ridge is a dividing crest between the Pacific water system and the Indian water system. To the east of the Nushan Mountain there is the Lancang River, which is called Mekong River after crossing the border, which flows past Myanmar, Laos, Thailand, Cambodia and Vietnam and empties into the South China Sea. To the west of the Nushan Mountain there is the Nujiang River, which is called Salween River beyond the province, and which flows past eastern Myanmar and western Thailand and empties into the Andaman Sea of Indian Ocean. Thus, the Nushan Mountain is very important for the distribution of wildlife from Yunnan to the Indo-China, and it is a significant boundary line for the fish fauna, also one of the factors of forming Yunnan's rich biodiversity.

Yunnan is situated in the second of China's three terraces. Four rivers, the Dulong, Nujiang, Lancang and Jinsha rivers are coming from the first terrace, the Qing-Tibet plateau in the northern part of the province. Outside the country these are called the Irawaddi, Salween, Mekong and Changhong rivers, respectively. These four rivers run hundreds of kilometers side by side from the north to the south at lateral distances of less than 20 km. At the narrowest, where they are separated by only 72 m, they form the province's "three river parallel flows". Two other rivers, the Honghe and the Nanpan originate in the province itself. Flowing across the province, the water system distributes in a broom-like shape of which the first four rivers compose the "broom stick" in the western part. Before pouring into the Pacific and Indian Oceans, all six rivers fan out to the south, the east and the southwest, forming the "broom". The running direction and the location of the mouth of the rivers are beneficial to various species entering the watershed along the valley, which makes the province the most complicated watershed biogeocoenosis in China.

Also characteristic of Yunnan are the plentiful plateau lakes. There are more than 37 lakes of more than 1 km<sup>2</sup> with a total area of 1,067 km<sup>2</sup>, a catchment area of 9,000 km<sup>2</sup> and total storage capacity about 290 billion m<sup>3</sup>. Distributed at a high altitude, most of the lakes are sag pond formed by faultage sinking and have no connecting channels. In the alpine region, there are morainal lakes and glacial erosion lakes with clear water and abundant hydrobíos. Because of their unique development and formation, and as almost all are relatively isolated, each

has its own endemic species.

## 2.2 The climate of the province

The province's climate is affected by geographic location, atmospheric environment and geopotential. The west-wind circulation and the southwestern monsoon seasonal replacement influence the regional climate characters of the province. When the westerlies move to the south in October each year, the province's climate is controlled by a southern branch jet stream of west wind which comes from the dry region of tropics and subtropics of northern part of India and western Asia. By moving eastward, this warm and dry continental tropical air mass controls the climate of Yunnan plateau and forms the province's warm and arid winter climate. Except for the high mountain areas in the northwestern Yunnan, the warm winter provides for most parts of Yunnan the overwintering conditions for tropical animals and plants that originated from the Indo-China. After entering into May, as the air mass of westerlies moves northward, the southern branch jet stream of west wind disappears and the dry season ends. Instead, the southwestern monsoon coming from the Bay of Bengal and the southeastern monsoon coming from the South China Sea are advancing to Yunnan plateau. Coming from the ocean at low latitude with high moisture, these two marine air masses become the source of summer rainfall and form the province's humid and hot summer season climate. As these two monsoons extend southwestward and southeastward to higher latitude region along the valley openings respectively, some of the tropical animals and plants that originated from the south are able to distribute to the valleys of the central and northwestern parts of Yunnan. The southern tropical bio composition proceeds northward along the valley and the northern high cold wildlife extends south along the mountain ridges and formed a "finger-like crisscross distribution" within the same latitudes, each "finger" with different flora and fauna composition. Thus, Yunnan becomes a distribution limit region, where the lowest latitude for the northern composition extends southward and is met by the highest latitude for southern tropical composition.

The main factor of forming such a varied microclimate is the vertical height range in the province. Therefore, a massif with more than four climate zones within similar latitudes can be found everywhere in the province. This unique climate creates varied habitats and brings up diversified bios for the province.

### 2.3 Biodiversity under the influence of minority culture

While studying the province's biodiversity we have noticed that there is a connection between biodiversity and minority cultures. Where there is high biodiversity, we find where a wide variety of minority cultures. Although biodiversity represents nature, in fact, biodiversity results from the interaction of nature with social systems (Long et al. , 1995) . Biodiversity is a living material base for locals and provides varied environmental conditions and spaces for the development of minority peoples. In the process of using biodiversity, the locals became dependent on it. As they acknowledged the importance of biodiversity, traditional societies enhanced it and created an interdependence between biodiversity and their cultures. With the locals' traditional life and farming, unique methods of recognizing, classifying, using and protecting biodiversity were formed and preserved. Compromising the traditional cultures proves to be one of main social factors adversely affecting biodiversity.

### 3. The province's biodiversity

The province's special geographic location and complicated geographic environment form the diverse ecosystems and habitats are responsible for the abundant biotic resources (Table 1). There are more than 18,000 high plant species (51.6% of China's total), 1,800 vertebrate species (54.8% of China's total) and 15,000 seed plant species (50% of China's total) in Yunnan where the land of area is 394,000km<sup>2</sup> which is only 4.1% of China's total. In the list of China's rare and endangered plant species, of all the 352 species, 151 species (42.6% China's protected plants) are distributed in the province. Among 335 China priority protected wild animals, Yunnan has 199 species (59.4% of China's total). Of all 335 species, about 15% are endemic species to Yunnan or can not be found outside of Yunnan(Yang et al. , 1998). The province's rich value in biodiversity ( $R_v$ ), the endemic value ( $E_v$ ) and the endemic rate ( $E_r$ ) all occupy the first place in China (WWF, 1996). The animal's  $R_v$ ( $R_v=300$ ),  $E_v$ ( $E_v=741$ ) and  $E_r$ ( $E_r=2.61$ ), as well as bird's ( $R_v=816$ ,  $E_v=2581$ ,  $E_r=3.54$ ) occupy the first place in China too(Yang et al. , 1999). Therefore, Yunnan is famous throughout the world as a "Wildlife Kingdom".



Table 1 Known species number in Yunnan, China and the world\*

Taxa	No. in Yunnan	No. in China	%(Yunnan/China)	No. in the World	%(China/World)
Mammalia	300	581	60.1	4,181	13.9
Aves	810	12,400	65.3	9,040	13.8
Reptilia	170	376	45.2	6,300	6.0
Amphibia	120	284	43.0	4,010	7.1
Pisces	400(FW)	3862(800 FW)	50.0 (FW)	21,400	18.1
Insect	10,000	51,000	19.6	920,000	5.5
Angiospermae	15,000	30,000	50.0	260,000	11.5
Gymnospermae	92	250	36.8	850	29.4
Pteridophyte	1,500	2,600	57.7	12,000	21.7
Bryophytes	1,500	2,200	68.1	23,000	12.6
Fresh Algae	800	9,000	16.0	25,000	36.0
Fungus	6,500	8,000	81.3	69,000	11.6
Bacterium	300	500	60.0	3,000	16.7

\* Species number in China and the world originated from "China's Biodiversity: a country study, State Environmental Protection Administration, 1998" (Mittermeier, 1988) and FW means fresh water.

### 3.1 The faunal diversity

Among 15 nationally protected primates, 10 species distribute in Yunnan and all are of the First Grade. The Yunnan snub-nosed monkey (*Rhinopithecus bieti*), like the Giant panda is one of the most endangered animal species endemic to China, which can only be found in the virgin fir (*Picea* sp. and *Abies* sp.) forest at elevations above 3,500m in the Baima Snow Mountain of northwestern Yunnan. There are 8 gibbon species in the world, of which Yunnan has 4 species (*Hylobates concolor*, *H. Hoolock*, *H. Leucogenys* and *H. lar*). They all distribute in the southeastern, southern to southwestern tropical forest region and can only be found in Yunnan except the species of *Hylobates concolor* that distributes in Hainan also (McNeely et al., 1990). There are many First Grade Nationally Protected Animals distributing only in Yunnan, such as *Macaca nemestrina*, *Nycticebus intermedius*, *Tragulus javanicus*, *Bos gaurus*, *Arctictis binturong*, *Helarctos malayanus*, *Panthera tigris corbeti*, *P. t. tigris* and *Elephas maximus* etc. There are also 112 bird species distributing only in Yunnan among 1,226 nationally recorded birds, and *Pavo muticus*, *Polyplectron bicalcaratum*,