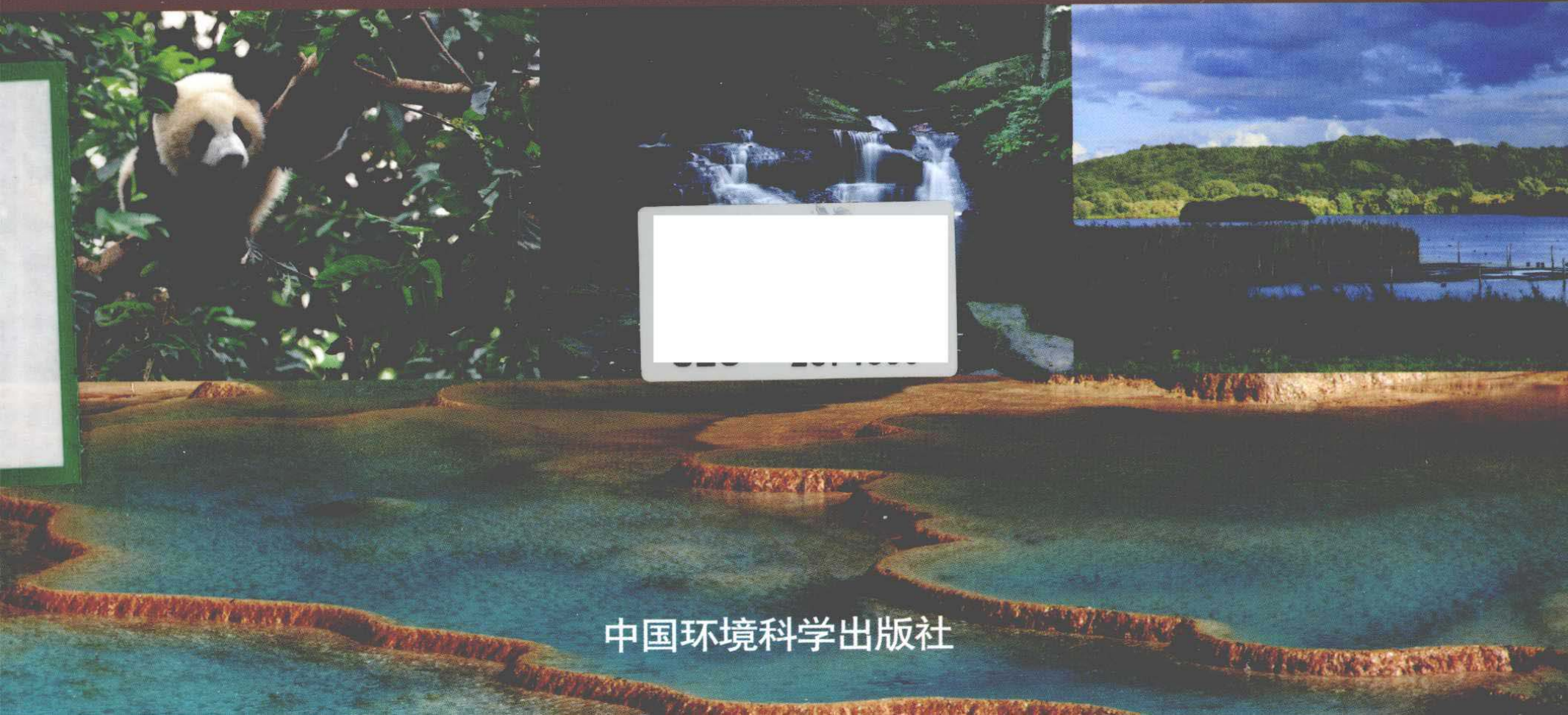


ZHONGGUO ZIRAN BAOHUQU QUHUA XITONG YANJIU

中国自然 保护区区划 系统研究

张荣祖 李炳元 张豪禧 刘林山 著



中国环境科学出版社

中国自然保护区区划系统研究

Regional System of Natural Reserves in China

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序 言

在我国广袤的国土上,南北纬度跨度 $49^{\circ}15'$,有赤道带—寒温带等六个温度带;从西到东经度跨度近 62° ,西南境内又有青藏高原的存在,自东南向西北出现湿润—干旱(荒漠)递变的自然环境地带性规律,在生态、经济、社会文化等各个方面都有相应的反映。因此各类经济建设的策略,是否能因地制宜、权衡利弊、避免偏倚,符合科学发展规律,在很大程度上取决于对各类问题地带性或地域性分异的了解和研究的深度。当代许多重大问题的解决,如人口、土地、资源、环境整治与自然保护等,都与区域(地理)的研究分不开。

近十年来,由于各方面(包括一些国际机构)的努力,对我国自然保护区建设的调查研究有了长足的进展,特别是对国家级自然保护区,出版了许多专著。但是,将自然保护区与区域性自然、社会、经济与生态环境可持续发展联系起来的专题性调查研究,仍不多见。地理学应积极地参与这方面的工作,发挥其应有的作用。现在,我们可喜地看到本书作者在环境保护部、国家林业局、美国大自然保护协会的支持下,以“中国自然保护区区划系统——分布格局与区域差异”为主题,从宏观角度,着眼于自然保护区区域性分异,对自然保护区分布格局与区域性可持续发展进行研究,主要依据由原国家环境保护总局发布的全国自然保护区(截至2006年底为主)记录进行初步分析,供有关方面参考。

全国自然保护区已超过2300个,现仍在不断地增长。为有利于对全国自然保护事业建设的宏观调控,有必要从全国生态环境建设及可持续发展的高度,对我国自然保护区的分布格局的合理性进行分析,以避免因无序建立,而在客观上可能产生的与自然规律不相符合的情况,本书着重探讨以下几方面的内容:

(1) 按我国综合自然区划等级系统,联系自然保护区建设,阐述各自然地带及生态地理区的自然、经济和人文地理条件;

(2) 在我国自然保护区基本统计数据的基础上,分析各自然地带和生态地理区自然保护区分布格局的基本特征,探讨其缺失和不足;

(3) 从宏观角度对各自然地带和生态地理区自然保护区建设提出建议。

此书的作者主要是中国科学院地理科学与资源研究所张荣祖等一批退休科技人员,他们出于对大自然的热爱,克服了许多困难,开展了“中国自然保护区区划系统研究”,

历时近三年时间。本书是总结这一研究成果而写成的，作者系统收集分析了全国主要自然保护区主要属性、中国主要生态类型及其空间分布，在应用自然地理综合区划的理论与方法探讨中国自然保护区及其网络系统建设方面取得了较好的成果，发挥了地理学特色，在自然保护研究中实属少见。希望本书的出版，对中国自然保护与保护区建设发挥作用。

此项研究所编制的《中国自然保护区类型分布图》及建立的有关信息库，为今后从宏观上进一步对自然保护区建设、进行政策指导有重要的参考价值。

大自然保护协会北京项目主任

李典谟

2008-08-29

Foreword

The vast territory of China spans about 49.4 degrees of latitude and near 62 degrees of longitude, encompass a great variety of natural complexes including six climatic zones of equatorial tropic, tropic, sub-tropic, warm temperate, temperate and cold temperate from south to north and the world highest Tibetan Plateau with alpine climate standing up in the southwest and the vast arid land of Xinjiang-Inner Mongolia extending in the northwest. The naturally geographical features of the territory, with regular zonal distribution, have brought influence in forming of ecology, economy and social cultural with regional characteristics. For advisable strategy of socio-economic development in varied aspects, such as population, land use, resources, environmental management and natural conservation, understanding of regional geography is very important.

Recently, more than ten years, with the efforts of various aspects including international supporting, the investigation undertaken on natural reserve construction has achieved obvious progress with plentiful publications, especially for the national natural reserves. But the study specially linking with regional socio-economic problems in terms of sustainable development is inadequate. Under care of Ministry of Environmental Protection, State Forestry Administration of P.R.China and The Nature Conservancy, a study on a subject of "Regional System of Natural Reserves in China – Distribution Pattern and Regionalization" has been carried out. Mainly based on the information provided by the Ministry of Environmental Protection of P.R.China (update to 2006), the study analyzes the natural reserve distribution patterns relevant to regional ecological and socio-economic sustainable development from a macro point of view.

More than 2000 natural reserves have been established in the whole country and the number is still increasing. But the establishment of the natural reserves was in non-sequence and remaining possibly inadequacies and gaps. For further health progress of the natural reserves, following subjects have been elaborated for each of the natural zones and eco-regions of the whole country:

1. Expound the natural, economic and cultural back ground of the Eco-geographical regions base on the comprehensive physical regionalization of China and the natural reserve construction;

2. Base on the statistic of the natural reserves, analyze and discuss the fundament features, possible inadequacies and gaps of natural reserve construction;

3. Suggestions for further construction of natural reserve in general view of macro control.

A distribution map of natural reserve types in China has been compiled with basic data, which can be used for references in later study from different aspects concerning natural conservation in terms of strategic instruction from view of macro management.

 (Dianmo Li)

Beijing Program Director, TNC

2008-08-29

前 言

我国历代帝王所建立的苑囿（供饲养珍禽、异兽和培植名果、奇葩）、围场（供狩猎）、少数民族设立的“龙山”或“神山”，以及因宗教和皇家宗祠而围禁起来的圣地和陵地，实际上都是原有生态环境保存良好，又受到不同程度保护的地方，均可以看做是自然保护区的原始类型。近代自然保护区的发展，自从 1872 年世界上第一个自然保护区——美国黄石公园建立以来，已有 100 多年的历史。除“国家公园”、“森林公园”、“风景名胜区”，自然保护区还包括科学保护区、自然纪念地、自然遗产地等。自然保护区的基本条件是被保护的环境必须代表自然或接近自然的生态系统。生物物种，特别是珍稀濒危物种及其栖息地，也就是代表性生物群落的整体，是绝大多数自然保护区的主要保护对象，单纯以地质遗迹和古生物化石产地为保护对象的，所占比例不高。

我国的自然保护区建设已经历时半个世纪，大规模建设主要在最近 20 年，目前我国已建立 2 000 多个自然保护区，总面积位列美国之后，居世界第二位，相当于世界自然保护区总面积的 1/5，超过欧洲国家自然保护区面积的总和。然而，我国建设自然保护区的整个过程是无序的，存在先天不足的问题。我国不同时期自然保护区的设置主要以抢救和应急为主，难免缺乏系统性；有的地方为了促进旅游业发展、争取国家的资助而设置保护区，这样的保护区设置带有盲目性。从自然保护区的情况来看，我国的保护区面积在不断增加，但实际上保护区是不是得到有效保护、是不是可行，我们并不十分清楚。因而，系统研究现有保护区空间设置的合理性，就变得很重要。

中国国土辽阔，自然条件复杂，南北纬度跨度 $49^{\circ}15'$ ，东西经度跨度近 62° ，从南向北包括赤道热带、热带、亚热带、暖温带、中温带、寒温带六个温度带，自东南向西北出现从湿润到干旱（荒漠）的递变，西南境内又有青藏高原的存在，地理环境地带性差异明显。有许多值得保护的区域，我国建立的多种类型的自然保护区不仅是我国的自然财富，也是全人类的财富。我们要珍惜大自然留下的宝贵遗产，并进行科学分析和管理工作。

近十年来，由于各方面（包括一些国际机构）的努力，对我国自然保护区建设的调查研究有了长足的进展，特别是在对国家级自然保护区的研究方面出版了许多专著。有关的自然保护区文献资料是大量的，其中绝大多数是针对自然保护区本身。自然保护区建设必须“因地制宜”的指导思想，在国家的政策性文件中是很明确的，并要求以统一的“生物地理区划”布局自然保护区。生物学界朱靖、王献溥（1982）首先提出应用“中国综合自然区划”，李文华（1983）提出再结合“中国植被区划”。但是，将自然保护区与区域性自然、社会、经济与生态环境可持续发展联系起来的专题性调查研究的文献仍不多见。国外在保护区的分类方面提出了可资借鉴的系统。但他们的分类系统是从全世界范围考虑的，与中国的情况不尽符合。作为地理学工作者，我们认为地理学应积极地参与这方面的工作，要根据自己的情况，不断创新，要有自己的主动权和发言权，发挥

其应有的作用。这一设想得到中国科学院地理科学与资源研究所领导的赞同,并立项开展以“中国自然保护区区划系统——分布格局与区域差异”为主题的研究。从宏观角度,着眼于自然保护区域性分异,探讨自然保护区分布格局与区域性环境保护及可持续发展问题。本书包括以下几方面的内容:

(1) 充分研究了中科院地理科学与资源研究所在全国综合自然区划方面的丰富积累以及国内的相关成果,联系自然保护区建设研究,深入分析了综合自然区划等级系统,各自然地带及生态地理区与自然保护相关的自然、经济和人文地理条件。

(2) 全面系统收集、整理和分析全国自然保护区及其地理背景信息(保护区的类型、等级、规模及其所处的环境等),以较扎实的数据为基础,开展“自然保护与地理区划系统研究”。阐明各自然地带和生态地理区中自然保护区分布格局的基本特征,指出中国自然保护区的空缺和不足。

(3) 从宏观角度对各自然地带和生态地理区自然保护区建设提出建议。

自然保护区数据的收集与处理对中国自然保护区区划系统研究至关重要,数据的正确、全面与系统更是关键。同时,也是作为“战略地图”的《中国自然保护区类型分布图》编绘的基础。

本项目收集自然保护区基本数据过程中得到原国家环境保护总局自然生态保护司大自然保护处的支持,提供了《全国自然保护区名录(2003)》、《全国自然保护区名录(2004)》和《全国自然保护区名录(2005)》、《全国自然保护区名录(2006)》,国家林业局提供了林业系统自然保护区名录数据(截至2004年)。这些名录包括保护区名称、行政区域、类型、主要保护对象、总面积、保护级别和主管部门,这是我国自然保护区主管部门发布的数据,也是我们工作的基础。本项研究所要的各保护区类型、规模、保护等级、面积等基本信息可从中取得,但研究地理区划研究必需的保护区所在的具体空间分布的数据,在名录中有的只到县,有的甚至到地、市,显然不能满足本项研究要求,无法进行保护区空间格局分布状况的研究。为此,我们又参考了《中国生物多样性综述》(马敬能等,1998)、《中国自然保护区》(刘东来等,1996)、《中国的保护地》(解焱等,2004)、《中国生物多样性保护行动计划》(国家环保局,1994)、《云南自然保护区》(云南省林业调查规划院主编,1987)、《广西自然保护区》(广西壮族自治区林业厅主编,1991)等文献,以及相关的保护区网站的附图或相关空间位置的说明的分析来确定保护区的具体位置。

中国台湾地区数据主要从“台湾大学生物多样性研究中心”的《台湾的自然资源与生态资料库①·生物多样性》(2005)中收集的。中国台湾地区的自然保护区又称“自然保留区”和“自然资源保护区”。其保护区的类型,按原国家环保总局所分的森林生态、草原草甸、荒漠生态、内陆湿地、海洋海岸、野生动物、野生植物、地质遗迹和古生物遗迹9类,分别给予定性。

2006—2008年1月新增的60个国家级自然保护区是根据国务院办公厅关于新建国家级自然保护区名单的通知确定的。

因此,本书收集的保护区数据截止的时间,国家级保护区为2008年1月,省级及其以下的保护区为2003—2005年。可以确定空间位置的保护区全国共收集了1935个,占全国各级自然保护区总数(2349个)的82.4%。其中国家级自然保护区2006年以前为243

个(原国家环境保护总局自然生态保护司, 2006), 2006年至2008年1月国务院新发布了3批60个, 共计总数为303个, 做到国家级自然保护区一个不漏; 省级自然保护区625个, 占全国省级自然保护区总数(773个)的81%; 地、县级自然保护区1007个, 占全国地、县级自然保护区总数(1333个)的75.5%(注: 省、地、县级自然保护区总数, 源于国家环境保护总局自然生态保护司的名录, 2006)。上述这些差额, 主要是由于在以往的资料中不足, 如已公布的名录中往往未注明具体范围, 或有矛盾, 虽我们从相关文献、网站资料予以对比, 仍未能补足, 但我们的分析包括了全部的国家级自然保护区和近八成的省、市、县级自然保护区, 因而可以反映自然保护区与地理区划系统关系的规律性。

分析各个自然保护区规模和类型数据, 均依据原国家环境保护总局自然生态保护司编制的《全国自然保护区名录(2005)》, 其中有关规模的分级仍依据《全国自然保护区名录(2003)》, 即小、中、大、特大型四级。在统计自然区中保护区数量时, 部分特大型自然保护区有时跨自然区, 按图中所占的保护区面积比例进行分解, 因而保护区数量分省(或地区)的统计中出现小数。

本书所附的“中国自然保护区类型分布图(1:5 000 000)”反映自然保护区数据收集与处理主要成果, 是本书文字叙述的重要补充, 图中表示了全国1935个自然保护区的空间分布, 全部国家级自然保护区和625个省级自然保护区的类型、等级和规模; 中国主要生态类型(本图以植被类型及其相关的气候环境划分了34个类型)及其空间分布; 中国综合自然(生态地理)区划。较全面地表示了中国主要自然保护区及其主要属性、中国主要生态类型和综合自然区划等主要生态环境背景。书末尾还附有全国各自然区内自然保护区等级、规模、类型的数量和面积, 生态系统类型及其面积的统计表, 以供读者进一步分析研究。对今后从宏观上进一步开展自然保护区建设及政策指导有重要的参考价值。

本书初稿完成后, 在中国科学院地理科学与资源研究所时任副所长李秀彬主持下, 举行了“中国自然保护区区划系统”课题学术研讨会, 中国科学院李文华院士、大自然保护协会(The Nature Conservancy)李典谟, 国家林业局李忠, 环境保护部陶思明, 国家自然科学基金委陈领, 中国科学院植物研究所王献溥、陈灵芝、谢宗强, 中国科学院动物研究所宋延龄、蒋志刚、解焱, 中国科学院生态中心陈利顶、《科学时报》王卉以及中国科学院地理科学与资源研究所的李国胜、吴绍洪等参加了会议, 提出了许多宝贵意见, 对本书的充实和提高有重要的价值。本书完成的过程中得到了环境保护部、国家林业局、大自然保护协会的大力支持, 以及中国科学院郑度院士、葛全胜副所长、中国科学院老科学工作者协会(地理分会)毛汉英、张懿铨以及朱澈、刘继荣、姚永惠、舒晓明、赵东升等的支持和帮助, 中国环境科学出版社李恩军编审为本书的出版做了精细周到的工作, 大自然保护协会中国项目(China Program)还为本书的出版提供了部分资助, 作者在此一并表示深切的感谢。

最后, 由于我们水平有限, 书中谬误尚不能尽免, 恳请读者批评指正。

Summary

A “perfect” biogeographic classification of the terrestrial world is an unattainable ideal due to different persuasions in different field of floras or faunas (Pielou 1979, Takhtajan 1988). The subject has hardly reached compromise and been used at national or regional levels (Udvardy 1967, Scott 1984, Li Wenhua 1984, Wang Xianpu 1989).

Comprehensive physical regionalization is an effort to identify differentiation among different areas on the earth's surface and document the similarities of all the physical elements and, hence, might serve as a guideline for land-use planning within these areas. Due to comprehensive connotation of the system, it will be served more suitably for planning of nature protection establishment which should be not concerned biological aspect only. Biologists Zhu Jing and Wang Xianpu (1982) had been first using the system for evaluation of nature reserve establishment in China. The authors would like follow the same way to go further focusing on following three subjects at view of macro adjustment:

1. Discussion on the application of the principle of the system to practice of natural conservation;
2. Analyses of distribution patterns of nature reserves of natural zones and eco-regions;
3. Mapping of “distribution of natural reserve types in China” with relevant data base (GIS).

This report may represent an early exploration of the issues and options for further establishment of nature reserve with respect to biophysical and socio-economic background and future possible development of environmental management in different nature zones and eco-regions of the country.

The results of this study elucidates the basic features of the nature reserves in the whole country and brings to light that the arrangement of nature reserves established is appropriate or not to geographical and ecological condition in generally, nevertheless, certain gaps existing, and then makes suggestions for the future establishment:

1. Generalization

(1) By 2006, the numbers of nature reserves increased to more than 2000 in the whole country. Nature reserve coverage had been sited in each eco-region with an average numbers of 42.1. In the East Monsoon Region, there are more than 50 nature reserves in most eco-regions, of which the Min-Yue-Gui hill-plain region reaches to 200, being the most in the whole country. In the west of the country, there are less than 10~25 in the most eco-regions. There is one only in Ali-mountain, the least of the whole country.

(2) The area of the nature reserves in the eco-regions against the total area of the whole eco-regions is 14% in the highest one is in Tibet, up to 76.82% (Kunlun Mountain, class supper A). To the north of the line of Qinglin - Huaihe, in Northwest and Huabei, there is 3.1% (class D) average, in Northerst and inner Mongolia 10% average (class C-D); to the south of the lower reaches of Changjian river, less than 10% average (class C-E).

(3) Near 75% of the natural reserves are in middle size. The average area of the natural reserves is 30 000 hm² except the super big one in Tibetan Plateau (class A). The spatial variation of them is in inverse ratio of the numbers of the nature reverses in each eco-region. The sizes of almost all the nature reserves in the West China are more than 100 000 hm², in class A. Among them, the size of Qiangtan natural reserve is more than 20 000 000 hm², in class supper A. Along eastern coast of the East Monsoon area and eastern part of Huabei, the sizes of the nature reserves mostly are less than 10 000 hm², in class E. While in the other part of China the area of the natural reserves are about 30 000 hm² or less in class C or E.

(4) The average density of nature reserves in the eco-regions of the whole country is 2.02 per ten thousand square kilometers. The highest density occurs in the coast area, except Huang-Hai Plain which is 1.37 per ten thousand square kilometers in class C. In the other part of the coast area, it is more than 2.0 per ten thousand square kilometers in class B. Especially, in the south part of Hainan and Taiwan, the density is 38.98 and 18.53 respectively, much higher than that of class A. Over vast western part of the country, from the east to west, the density changes from class C to class D. In Tibetan Plateau, it is in class E, but the lower density loses its significance due to the huge size of the natural reserves in it.

(5) More than 1 000 forest ecosystem protect reserves have been established and it is more than half of the total nature reserves in the whole country. The area of them is 21.44% of the total area of nature reserves. They concentrate in East Monsoon Region, except the Northeast Plane, Huabei Plain and Sichuan Basin with lower ratio of class C or B, the others are in class A. In west China, most ecoregions belong to class C or B except the north mountain area of Xinjiang.

(6) Nature reserves established mainly for particular endanger species hold about 1/4 of the total numbers of the reserves in the whole country, distributed in every eco-region. The area of them is 26.97% of the total area. In East Monsoon Region, they are combined with function of forest protection. They concentrated in Qinglin Mountains and Changjian Middle Lower reaches of the north sub-tropic zone, one of the hot pots of biodiversity, in class A. In the west, especially in Tailimu Basin and Zhungeer Basin, the area of this type of nature reserves is of highest in the whole country, mainly for protecting of wild ungulates.

(7) The numbers of wetland protect nature reserves are near 1/10, holding an area of 18.14% of the total in the whole country. In well known wetlands, Sanjiang Plane and Songnen Plain, the area of them is in class A. In the other regions, the ratios of the areas of this type of nature reserves are mostly lower, in class C or D except Huainan and Mid-lower reaches Plain of Changjiang River which is in class B.

(8) The numbers of natural reserves for meadows and steppes are less than 40; the total area of them is 2.72% of the total natural reserves in the whole country. Because of the need of anti-desertification of steppe, they are distributed mainly in the transitional zone of the boreal forest-steppes and steppes from Northeast Plain to the eastern part of inner Mongolia and Loess Plateau. The highest area ratio is in the east part of inner Mongolia Plateau which is in class B. For the other parts, most belong to class C or D though there is a huge size of grassland in China.

(9) There are more than 20 reserves sited for protection of desert ecosystem. The area of them is 28.63% of the total natural reserves in the whole country. In Alashan and Chaidamu, the area of this type of nature reserves is of the highest, in class A, while in Tailimu and Zhungeer it is rather lower, nevertheless, in which there are biggest desert ecosystem of the country, in class C and D. Now, in the eastern part of inner Mongolia and Loess Plateau, in the coverage of desert nature reserves are actually secondary desertification landscape, which will be developing toward steppe or forest-steppe.

(10) On imperfect statistic, there are more than 50 Ocean-Seacoast natural reserves, of which the number and area both hold more than 1/5 respectively of that in terrestrial ones of the country.

(11) There are more than 110 geological and palaeontological nature reserves, being about 5.74% of the total in the whole country, while the area of them hold 1.18% of the total. The average area of them mostly is low, mostly in class D or E. They are distributed along the first and second topographic tiers relating to important geological structure lines.

(12) Among the nature reserves in the country, there are more than half established in county level, more than 1/3 in province level and more than 1/7 in national level. And the areas of them are 11.07%, 23.69% and 65.24% of the total. More than 20 nature reserves of national level are distributed in the mountains of Nanling and Minyue due to favorable ecological condition of tropic and subtropic, with great significance in biodiversity protection.

2. Feature of distribution patterns and suggestion for future establishment in eco-regions

(1) East Monsoon Region

—North Daxinganling: It is of cold-temperature forest ecosystem, key area of biodiversity. Nature reserves sited in the eastern flank of the mountains are less, on which it is advisable to add nature reserves covering forest, water sources and wetlands for enhancing corridor effectiveness between exist reserves.

—Sanjiang Plain: It is of wetlands ecosystem, key area of biodiversity. Enhancing protection in terms of integrated protection and bring into play of the network effective is needed.

—Northeast Eastern Mountains: It is of middle-temperature forest ecosystem, key area of biodiversity. A gap in geographic coverage exists between Changbai Mountains and Xiaoxinganling, in which forest protect reserves covering watershed should be added.

—Northeast Eastern Pediment Plain: It is of forest-steppe ecotone with agriculture and husbandry mixed land, a fragile ecosystem exposed to soil erosion. A gap existing in river terraces zone, in which nature reserves need to be established incorporating tasks of farmland protection.

—Middle Songliao Plain: It is of wetlands ecosystem. The areas of the nature reserves are less. Merging and/or expanding the reserve sites incorporating with environmental management for industrial and agricultural constructions are needed.

—Middle Daxinganling: It is a fragile ecosystem of forest-steppe transition. A gap exists in upper reaches of tributary of Songhua River and nature reserves need to be established for wetlands and water resources protection.

—Jiaodong-Liaodong Mountain - hills: It is of an ecosystem of sea and terrestrial confluence, key area of biodiversity protection. Enhancing establishment of marine-coast nature reserve networks is needed.

—Luzhong Mountain-hills: It is of warm-temperate forest ecosystem. The numbers and area coverage both are less. It should add and/or expand the reserve coverage with enhancing buffer effect in surrounding areas.

—Huabei Plain: It is of alluvial plain-estuary-coast ecosystem. Benefiting to agriculture, wild protect nature reserve among farmland is needed to form a kind of farm-forest complex ecosystem.

—Huabei Mountains: It is of warm-temperature forest ecosystem. More attention should be paid to establish nature reserve for secondary forest-shrubs protection to bring role of conservation effects.

—Jinnan-Hanzhong Basin: It is of warm-temperate forest-steppe ecosystem in loess plateau. Secondary forest-shrubs ecosystem is in very important position for erosion management. Protection of this system should be enhanced.

—Jinzhong-Shanbei-Gandongnan Plateau hills: It is of warm-temperature forest-steppe mountain ecosystem. The nature reserves are distributed unevenly. A gap existing in the loess terraces, in which nature reserve cooperating with agriculture -forest complex ecosystem should be established.

—Huainan and Changjiang Middle Lower Reaches: It is of north sub-tropic marine-river wetlands ecosystem. Nature reserves should be enhancing to alleviate the impact of intensive economic activities on the endanger species conservation. It is advisable to establish wetlands nature reserves incorporating with management of river-lakes system in coast zone.

—Hanzhong Basin: It is of north sub-tropic montane ecosystem, key area of biodiversity (Qingling). In ongoing construction, the issue of improving hydrological effect must be taken into consideration.

—Jiangnan Hills-basin: It is of middle sub-tropic forest-wetlands ecosystem, key area of biodiversity. Existing nature reserves are unitary in forest, less attention on endanger species. In Funiu - Dabai monatan area and Poyang-Dongting wetlands, nature reserves should be added.

—Nanling and Ming-Zhe Hills: It is of middle sub-tropic forest ecosystem, key area of biodiversity. Frequently suffer from natural hazard in over exploitation hills. For reinforcing capacity of anti-nature hazard to merge and/or add nature reserves and site "corridors" incorporating with watershed management should be priority in environment conservation plan.

—Guizhou Plateau: It is of middle sub-tropic forest ecosystem. Existing area of nature reserves are rather less. The numbers of nature reserves are smaller in central area. Establishing nature reserves combining with anti-desertification in rocky landform should be considered.

—Sichuan Basin: It is of middle sub-tropic forest-wetlands - water ecosystem. The nature reserves in middle and west of the basin are less. It is advisable to enhance nature reserves establishment combining with ecological construction in Changjiang Middle Reaches.

—Yunnan Plateau: It is of middle sub-tropic forest and montane ecosystem. Existing nature reserves network is inadequate to meet wetlands and water ecosystem conservation. Watershed management should be enhanced in comprehensive mountain management plan.

—East Himalaya South Flank: It is of middle sub-tropic alpine-plateau ecosystem, key area of biodiversity. Existing nature reserves are inadequate for the huge montane coverage and should be increased including international.

—North-Middle Taiwan Hills-Plain: It is of south sub-tropic montane ecosystem. In the eastern part nature reserves are less. It is advisable to establish nature reserve incorporating with water resource utilization.

—Ming-Yue-Gui Hills-Plain: It is of south sub-tropic forest ecosystem, key area of biodiversity. The nature reserves are smaller and scattered. It should merge and expand them linking with small watershed management.

—South Yunnan Mountains-Hills: It is of south sub-tropic forest ecosystem. The nature reserves for endanger species protection are much inadequate. The reserves in the province border area of Yunnan and Guangxi is not enough. Awareness of the importance of biodiversity conservation in tropical bio-resources exploitation should be enhanced.

—South Taiwan Lower Hills: It is of margin tropic forest-coast -marine ecosystem. It is having highly potential for establishing marine nature reserves. It is advisable to expanding nature reserves for coast-marine conservation.

—South Yunnan Border Valleys-Hills: It is of margin tropic forest ecosystem, key area of biodiversity. Nature reserves are too scattered and should be merged or linked with corridors incorporating with small watershed and forestry management.

—South Hainan Lowland and Dongsha-Zongsha-Xisha Archipelago: It is of middle tropic marine forest ecosystem. The area of territorial nature reserves is small. It is advisable to expand reserves coverage in combination with establishment of coast protect forest system.

—Nansha Archipelago: It is of equator tropic marine ecosystem. As a unique geographical location of the archipelago, enhancing awareness of nature conservation in terms of integrate point of view is needed.

(2) Northwest Arid China

—West Liaohe Plain: It is of middle temperature forest-steppe-wetlands ecosystem. A gap is existing in ecological fragile zone of agricultural-husbandry transition. It is important to add steppe protected nature reserves incorporating with anti- desertification.

—South Daxingnanling: It is of middle temperature montane forest- steppe-wetlands eco-

system. Nature reserves are deficient in the north and the wetlands. Nature reserves network establishment at the west flank of the mountains should be enhanced.

—East inner Mongol Plateau: It is of middle temperature forest-steppe and steppe ecosystem. To the northwest of the eco-region, nature reserves are deficient and needed to be sited incorporating with the end for anti-desertification.

—West inner Mongol Plateau: It is of middle temperature montane forest-steppe, semi-desert and desert ecosystem. Steppe nature reserves are deficient and needed to be sited especially in the agriculture – husbandry transitional zone.

—Alaskan -Hexi corridor: It is of middle temperature montane forest-steppe and steppe ecosystem, key area of biodiversity. A gap in wetlands-water protection exists in lower reaches of ruoshui. To improve existing nature reserves network, it should be distributed in series from desert oasis to sub-alpine forest –meadow ecosystem.

—Zunger Basin: It is of desert ecosystem. It is deficient in protection for the represent ecosystem of shrubs *Haloxylon*. It should improve existing nature reserves network from basin to montane forest –meadow ecosystem.

—Altay Mts. and Erchishe-Taihe Basin: It is of middle temperature desert ecosystem, key area of biodiversity. It is deficient in meadow-wetlands protection and arid land protection incorporating with management of montane husbandry should be enhanced.

—Ili Basin: It is of middle temperature montane forest-steppe-desert and semi-desert ecosystem, key area of biodiversity. Based on better establishment of nature reserves, improving existing nature reserves network from valleys to alpine ecosystem is needed.

—Talimu Basin and Tulufan Basin: It is of middle temperature desert ecosystem. A gap exist in the southwest, where wetlands and montane ecosystem nature reserves should be sited bring into regional environment management and sustainable development plan of the whole basin.

(3) Qinghai - Xizang Plateau

—Kunlun Mts: It is of plateau subfrigid desert ecosystem. In the west Kunlun Mts, a nature reserve should be established and linked with corridor build to existing Qiangtang nature reserve.

—Aba- Naqu Plateau: It is of plateau sub-cold forest-shrubs-meadows and steppe ecosystem. Protection particular on oriental species and wetlands is deficient and should be enforced.

—South Qinghai Plateau: It is of plateau sub-cold shrubs-meadows and steppe ecosystem. Protection particular on oriental species and wetlands is deficient and should be enforced. In the existing huge wild antelopes nature reserve, integrate conservation including river sources, swamps and wetlands should be enhanced to prevent existing ecological degradation (desertification) tendency.

—Qiangtang Plateau: It is of plateau sub-cold steppe, semi-desert and desert ecosystem. Enhance awareness that the ecologically fragile feature of the plateau ecosystem with limit existing factors and eliminating impact of negative human activities on the heart land of the plateau

should be strengthen.

—West Sichuan and East Xizang Alpine Gorges: It is of temperate alpine-gorges shrubs-meadows- forest ecosystem, key area of biodiversity. There is gap in protection of montane shrubs meadows in the west part of the eco-region with pasture management.

—East Qinghai Plateau Mts.: It is of plateau temperate forest-shrubs-meadows and steppe ecosystem. It is lack of protection of steppe- meadows. Establishing nature reserves combining with watershed management is needed especially in the agriculture – husbandry transitional zone.

—South Xizang Mts.: It is of plateau temperate forest-shrubs-meadows and steppe ecosystem. Protection on the main ecosystem, which is being a tendency of ecological degradation, is deficient and should be enhanced incorporating with watershed management. It is having highly potential of establishing geological nature reserves as its particular geological position of earth plate movement.

—Chaidamu Basin: It is of plateau temperate semi-desert and desert ecosystem. According to geo-ecological transition from the basin centre to mountains, adding nature reserves to complete the network of the protected system is needed. And, it is advisable to incorporate with the exploitation resources of salt-swamp and tourism landscape for regional development.

—Xizang Ali Mts. It is of plateau temperate and desert ecosystem. A gap in protection of plateau representative steppe existing in the eco-region should be sited combining with highland pasture management.

3. Thematic maps and relevant data base (GIS)

It is including: (1) Comprehensive map of Nature Reserve Types in China (scale 1: 5 000 000) with the overlapping contents of the nature reserves, nature (eco-) regions and ecosystem types; (2) Single element map (scale $\leq 1: 5\,000\,000$): Nature Reserves; Nature Regions; (3) Map of nature reserve types (scale $\leq 1: 5\,000\,000$); (4) Comprehensive physical regionalization with ecosystem of China (in adjustable scale $\leq 1: 5\,000\,000$); (5) Comprehensive physical regionalization with provincial administrations of China (in adjustable scale $\leq 1: 5\,000\,000$); (6) Ecosystem types in China.

The relevant data are including: (1) Geographical basic data; (2) Areas of the nature (eco-) regions; (3) Areas of the ecosystem types; (4) The relevant data of the nature reser.