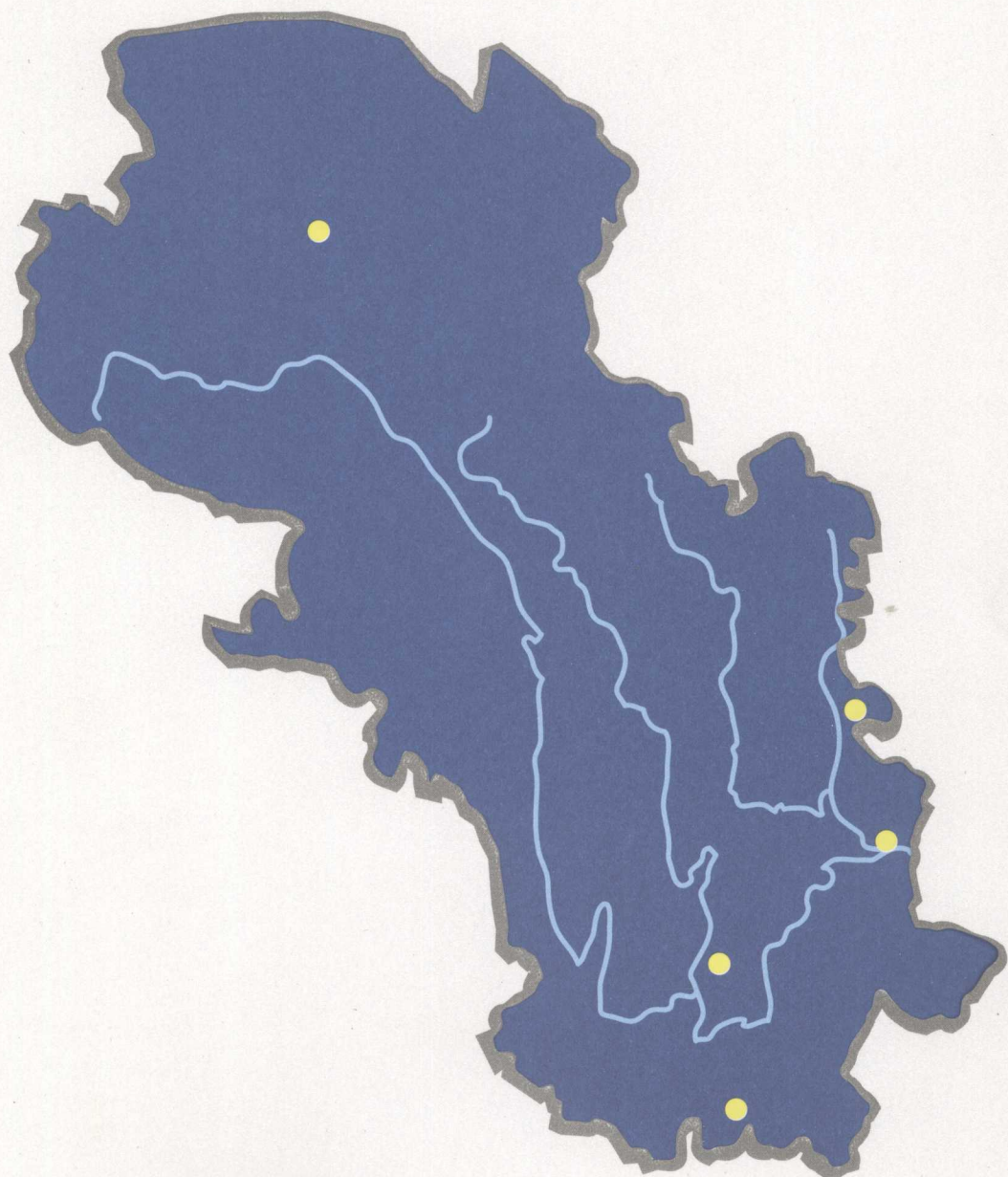


长江上游地区 生态与环境问题

ECOLOGICAL AND ENVIRONMENTAL PROBLEMS IN
THE UPPER YANGTZE RIVER

孙鸿烈·主编



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《长江上游地区生态与环境问题》编委会

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前 言

长江上游地区自然地理条件复杂多样,生物多样性丰富,水系发达,是长江流域重要的水源区和生态屏障。该区是我国水电资源最集中的地区,也是我国重要的工矿业基地之一。

近年来,长江上游地区在河流开发和区域发展的同时,生态破坏与环境恶化加剧,给自然环境带来了沉重的压力。随着今后经济建设的快速发展,该地区将面临更加严峻的生态与环境形势。因此,充分揭示长江上游地区当前和未来面临的问题,深入探讨合理保护生态和环境,减少自然灾害和环境变化的影响,具有重要的意义。

为此,中国科学院学部设立了“长江上游地区生态和环境问题再评估”咨询项目,由孙鸿烈院士主持并组织相关领域专家,在原有长期工作的基础上,通过进一步实地调研和资料分析,对长江上游地区生态与环境问题进行了系统分析和综合评估,并提出对策建议。经过近两年的辛勤工作,于2007年7月完成了专题报告和总报告,以期为长江上游地区开发与生态保护提供科学依据。

本书是在咨询报告的基础上,针对长江上游地区存在的关键性问题,补充了有关资料,并进一步分析提炼编写而成。全书共分5章,第1章阐述了长江上游地区的战略地位、生态建设的主要成就和面临的生态与环境问题;第2章分析了长江源区气候、冰川冻土和湿地与高寒生态系统的变化及其水文效应和发展趋势;第3章从水环境、空气质量和环境健康三方面对长江上游地区的环境问题进行了论述;第4章重点探讨了长江上游地区生态退化的原因;第5章介绍长江上游梯级水电开发的概况并分析了水电开发对生态与环境的影响。每章都针对长江上游地区生态与环境的相关问题提出了对策与建议。

在项目实施和本书编写过程中,得到中国科学院学部的支持,在此表示衷心感谢。

摘要

长江上游宜宾以上的区域是长江自然环境复杂、水系发达、水资源充沛、生物多样性丰富、生态屏障功能突出的区域。这个区域当前既是生态建设重点区，又是水电开发等人为干扰集中区，正向演化与负向退化相互交汇，生态系统处于激烈变动的关键时期。

1. 生态与环境安全面临巨大挑战

经过多年的努力，特别是1998年长江特大洪水之后，国家作出了一系列有关生态建设与环境保护的战略决策。长江上游地区各级政府在“十一五”规划中都将生态建设列为重要任务，把转变经济增长方式、节能减排、发展生态产业和循环经济作为努力的方向，生态环境恶化趋势有所控制，局部地区得到改善。但从全局看，长江上游生态环境面临的形势依然是严峻的，离生态安全的目标相去甚远，生态建设、环境整治依然任重道远。

1.1 生态仍然面临恶化的趋势

尽管长江上游植被覆盖的面积开始扩大，森林覆盖率有所提高，但人工林大多还处于幼林或未成林状态，加之林种单一，多样性贫乏，尚未构成乔、灌、草多层次的生态系统结构。因此，其涵养水分、保持水土、调节水文等生态功能还很有限。现在只能说，长江上游生态建设有了一个好的开端，与真正建成长江上游生态屏障的要求尚有很大差距，任务仍然十分艰巨。

更应强调的是，某些区域生态系统不仅没有改善，而且还呈恶化趋势，主要表现在以下四方面：

(1) 草原退化。长江上游草地生态系统的退化仍未遏制。2002年，四川草地（大部分在本区或与本区相邻地带）有80%以上的面积出现不同程度的退化现象，其中20%左右遭受鼠虫危害，并且沙化面积还在以每年6%的速度不断扩大；云南香格里拉大峡谷的草地过牧超载达到85%，草地载畜力普遍降低；长江源区高寒草甸牧场由20世纪70~80年代年均退化3.9%的速度上升到90年代的7.6%，高寒草原牧场退化速度由2.3%上升到4.6%。长江源区黑土滩和沙化土地还在迅速增加。

(2) 水土流失严重。长江上游地区水土流失面积达 24.88 万 km^2 , 占该区总土地面积的 39.8%。同时由于复杂的地质条件, 加之强降雨作用, 水土流失极易诱发滑坡、泥石流等山地灾害。该区水土流失面积之大, 侵蚀强度之剧烈, 是我国最强烈的水土流失区。

(3) 冰川冻土萎缩。由于气温上升, 长江源区 2000 年的冰川面积比 1969 年减少 5.37%, 多年冻土也处于退化状态。1970 年中期以来, 冻土萎缩, 导致沼泽湿地退化, 向着干化、沙化的方向演替, 湿地水源涵养功能大大削弱。

(4) 河川径流减少。近 50 年来, 长江源区径流减少, 1990—2000 年径流均值比 1961—1989 年低 14%。岷江上游 20 世纪 50 年代平均流量为 $488\text{m}^3/\text{s}$, 年均径流总量达 161 亿 m^3 ; 1988—1999 年平均流量为 $443\text{m}^3/\text{s}$, 年均径流总量为 140 亿 m^3 。

1.2 水电无序开发影响严重

长江上游是我国水力资源富集区, 是“西电东送”的重要基地, 开发水电是该区重要的经济增长点, 也是全国能源发展战略的重要组成部分。但是, 在地区和部门利益的驱动下, 当前出现了无序开发的严重局面。几乎所有干流、大小支流都在筑坝建电站, 大至千万千瓦, 小至几十千瓦, 有些县小水电多至百余座。现在全流域在建水电站尚无确切数字, 水电开发缺乏统一的规划, 更无严格的环境影响评估。水电无序开发引发的生态环境问题是全局性、综合性、长远性的, 许多是不可逆的影响。

同时水电无序开发又带来过量的移民问题, 不仅对生态造成巨大的压力, 而且构成社会不安定的重大隐患。截至 2005 年底, 四川省仅大中型水电水利工程已经移民 93.4 万, 正在移民和将要移民的人数还有 30 万。对各库区所在地来说, 移民绝对数量虽然不是很大, 但在当地人口中所占的比重却很高。移民安置区多分布于生态环境脆弱的干旱河谷和山地陡坡地带, 更加剧了水土流失, 导致进一步的贫困。同时移民中少数民族比重大, 移民区又大多是贫困区, 社会稳定问题值得关注。

1.3 环境污染形势严峻

长江上游地区环境质量局部好转、整体恶化的趋势仍将继续, 未来若不采取有效措施, 水环境、大气环境以及重点城市环境的质量仍难以有大的改善。

(1) 长江上游的水污染形势将更严峻。宜宾以上的长江干流水质较好, 但干流的城市江段和支流的局部水体污染严重。四川省 2010 年还将增加 150 万~200 万 t 纸浆生产能力, 主要集中于上游的宜宾、乐山、雅安等市; 成都市将建 80 万 t 乙烯、1 000 万 t 炼油厂, 工业排污量将持续增加; 城市生活污水处理率很低, 2005 年攀枝花市生活污水处理率仅为 29.9%, 还有很多小城镇的工业和生活污水几乎不经处理便直排入江河。污水量大幅度增加, 但治理的投入与环境保护的目标差距巨大, 对水环境安全构成极大威胁。

(2) 长江上游的能源结构仍以高硫劣质煤为主。2002 年攀枝花的 SO_2 排放量超过大

气环境容量 1.82 万 t, PM_{10} 超过 0.72 万 t, 宜宾的 SO_2 、 NO_x 和 PM_{10} 也均已超过大气环境容量。近几年还将大量增加火电装机容量, 由于仍主要使用高硫高灰分劣质煤, 今后“超额”排放量还将增加, 宜宾、攀枝花、昭通、乐山等地的酸雨污染有继续加重的趋势, 这些城市的空气质量难以有较大改善。

(3) 农村面源污染增加, 将难以控制。短期内农药、化肥用量仍将增加, 农业养殖业的发展将成为重要的污染源, 上游严重的水土流失更加剧了面源污染。据初步统计, 2003 年长江上游化肥施用量达 124.2 万 t, 单位耕地施肥强度高于全国平均水平, 是世界平均水平的 3 倍。昆明、曲靖、雅安、攀枝花等地区化肥施用强度是安全施肥强度的 3~4 倍, 70% 的化肥没有得到利用而变成污染物排入江河湖泊。长江上游地区面源氮、磷排放负荷分别达 274.4 万 t 和 105.4 万 t, 占整个长江流域的 20% 以上。农村环境污染面广、分散、难以集中处理, 管理难度大, 至今尚无良策, 是一个极具挑战性的环境污染难题。

2. 保障生态与环境安全的对策建议

2.1 综合管理, 优化长江上游生态建设工程

(1) 按不同生态功能区, 规划生态经济发展方向。

- 长江源区。海拔高, 主要为藏民族分布区, 超载放牧严重, 导致草场退化、沙化, 湿地干化。应培育人工草场, 补充冬春饲草不足, 放牧与舍饲相结合, 集中建设牧民定居点。
- 横断山区。包括藏东、川西、滇西北等地区, 是我国大河流域的重要生态屏障, 是生物多样性分布中心, 也是少数民族分布集中区, 社会经济发展滞后, 生态安全的敏感性较强。应以生态旅游、水电、特色农牧业、林产业为发展方向。
- 喀斯特地区。主要分布于滇西北和川西, 不少地区发生石漠化, 区域内降水量不少, 但保水能力差, 土壤瘠薄, 历来是贫困集中区, 又是生态修复难点区。应重点抓好石漠化的预防和综合治理, 并将严重石漠化地区的农民转移集中到条件较好的地区定居。
- 以丘陵、低山为主的川西、滇北地区, 历史上是主要农业区, 人口密度较大, 也是水土流失严重区。鉴于当前大部分青壮年农民外出打工, 农村剩余劳动力不多, 建议对退耕地实行集中经营, 除部分发展生态林外, 可扩大经济林比例。

(2) 优化生态工程的项目配套和地域组合, 以小流域为单元, 加强水土流失综合治理。继续实施退耕还林、坡改梯、坡面水系及小型水利工程等的综合整治, 集中规模, 形成综合效益。扭转不同部门各项工程分散、效益单一、措施不配套的局面, 营造农业发展与生态安全“共赢”的生态综合体系。

2.2 制定水资源开发综合规划, 规范水电开发秩序

尽快建立统管全流域综合开发与管理的权威机构, 对长江上游水电开发进行综合规划。对水电开发的终极规模、数量、开发顺序、重点布局、生态保护等加以科学界定, 以此作为共同遵守的权威文本。

严禁在世界自然遗产地、文化遗产地、自然保护区、风光名胜区、生态敏感区、珍稀动植物和濒危物种栖息地、重要生物多样性集中区、少数民族文化与宗教敏感区内建水电站。

在长江上游确定鱼类保护区。每条大的支流都应划出一定的河段或支流严禁水电开发, 按鱼类生态要求, 确定保护区的范围。

2.3 坚决摒弃不具优势而污染严重的产业

应该摆脱大而全产业体系的思维 and 传统, 坚决摒弃不具优势而污染严重的产业, 构建真正有区域特色且环境友好的产业体系, 并采取有力的治理措施, 保护上游环境安全。

(1) 压缩以劣质煤炭为主要能源的火电, 可考虑购买邻区的电用于水电的调峰。昭通、宜宾等煤炭应严格洗选。对节能减排的产业给予补贴。

(2) 以天然气资源优势弥补石油劣势, 适当减少天然气外输, 大力发展天然气化工, 不宜强求发展石油化工。大力普及天然气作民用能源, 取代燃煤, 减少污染。

(3) 严格控制有色金属制造业等高耗能、环境污染严重的产业。

(4) 加快城市生活污水和生活垃圾处理工程的有效运行。

2.4 构建生态“三农”系统, 改变山区村落模式

当前山区村落模式不仅不能让山区人民享受工业化、城镇化快速发展的成果, 而且对生态环境带来严重破坏, 亟待改变。

(1) 村落空间重构。山区村落应逐步向生态条件较好、环境容量大、交通方便、有发展潜力和条件的山间平原、沿江、沿路、靠城的区域集中, 改变分散、无序, 靠陡坡垦殖或靠天然草场低水平生产的局面, 让大面积天然草地、荒地、森林自然休养生息。

(2) 组织重构。山区村落应变分散为集中, 变小村为大村, 减少乡、村、聚落数量, 向聚集社区方向发展。减少农村基层管理层次, 降低管理成本, 减少农民负担。建设使山区居民能享受到现代社会发展成果的社区或乡镇。

(3) 产业重构。坚持农业规模化、专业化、产业化的发展方向, 以提高单位面积产量, 提高农业效益和增加农业加工链为中心, 减少对生态的大面积破坏。大力发展二、三产业, 改变农业自给自足为市场经济、商品农业。在牧区建设高产优质人工草场和饲草料基地, 实现舍饲与放牧结合。

Abstract

The area above Yibin of the upper Yangtze River is a place with complicated natural environment, well developed drainage system, abundant water resources, rich biodiversities and marked eco-functional barrier of the Yangtze River. This area is either a key ecological restored area or an anthropogenic highly disturbed area due to hydroelectric development. It is experiencing a critical period having evolution intersected negative degeneration and ecosystems in drastic changes.

1. Great Challenges Confronting Ecological and Environmental Security

Through years' efforts, particularly after the catastrophic floods of the Yangtze River in 1998, the central government made a series of strategic decisions relevant to the ecological restoration and environmental protection. Specifically, the local governments at various levels in the upper Yangtze River should take ecological restoration as a key task during the 11th Five-Year Plan and strive to follow the direction of changing the mode of economic growth, saving energy and reducing carbon dioxide emissions and developing ecological industry and circular economy for the sake of controlling the tendency of eco-environmental deterioration and improving environment locally. In view of the overall situation, the present eco-environmental condition in the upper Yangtze River is still serious, far from meeting the goal of ecological and environmental security, hence there is still a long way to go before fulfilling the tough work of ecological restoration and environmental pollution control and reduction.

1.1 Ecology still confronted with a worsening trend

Although the vegetated area begins to expand and forest coverage increases in the upper Yangtze River, the multi-layered ecosystem structure constituting of trees, shrubs and grass has not yet been formed because most of the artificial forests are still young growths or non-matured woods, in addition the tree species are single and lack of diversity. Hence their ecological functions in conserving water supply, water and soil conservancy and hydro-regime regulation are very limited. It can be said that there is a good beginning in ecological restoration in the upper Yangtze River, however, there is still a big gap in satisfying the needs of constructing a real ecological barrier of the region, and the task ahead is yet arduous.

What should be emphasized is that in some areas the ecosystem has not only been improved but presented a degenerating trend, reflecting mainly in the following four aspects:

(1) Grassland degradation. The degradation of grassland ecosystem in the upper Yangtze River

has yet not been controlled. In 2002, over 80% of the grassland degraded to different degrees in Sichuan grassland (mostly in the concerned region or the neighbouring areas), of which around 20% were damaged by rats and insects, and desertified area has been constantly increasing at a rate of 6% per year; grassland overgrazing reached 85% for the grassland in the Shangri-la valley in Yunnan with grassland carrying capacity lowering generally; and the degraded frigid meadow pasture land increased from 3.9% in the 1970s — 1980s to 7.6% in the 1990s in the source region of the Yangtze River and the degraded rate of frigid pasture land increased from 2.3% to 4.6%. The area of black earth flat and desertified land is still increasing rapidly in the source region of the Yangtze River.

- (2) Serious soil and water loss. The eroded area in the upper Yangtze River reaches 248,800 km², accounting for 39.8% of the region's total area. Because of the complicated geological conditions and the effect of intense rainfall, it is extremely liable to induce erosion related mountain hazards such as landslides, debris flows, etc. The eroded area is so large and the erosion intensity is so acute in the upper Yangtze River that it has become a region suffering from most intense soil and water loss in China.
- (3) Glacial retreat and frozen ground shrinkage. Because of temperature rise, glacier area in the source region of the Yangtze River decreased by 5.37% in 2000 compared with that of 1969 and permafrost was also in a degradation state. Since the mid 1970s, the shrinking frozen ground has induced degeneration of swamps and wetlands which are developing towards desiccation and desertification, and water conserving function of wetlands has reduced substantially.
- (4) Reduction of river run-off. In recent 50 years runoff has decreased in the sources region of the Yangtze River with a reduction of 14% averagely from 1961 — 1989 to 1990 — 2000. The mean runoff volume was 488 m³/s in the upper Minjiang River in the 1950s and the annual mean volume reached 16.1 billion m³ while that of 1988—1999 was 443 m³/s and the annual mean volume 14 billion m³.

1.2 Serious impact caused by disordered hydroelectric development

The upper Yangtze River abounds in water power resources, an essential base for transmitting electricity from the West to the East, hence the development of hydroelectricity serves as an important economic point of growth and also an important component for the national energy development strategy. However, the serious situation of disordered development has occurred driven by the regional and sectoral interests. Dams and power stations with installed capacities ranging from ten million kilowatts to dozens of kilowatts were built on almost all the trunk streams and tributaries, big and small. In some counties the number of the small hydro-power stations has reached as much as over one hundred. There is still no accurate number of the hydro-power stations under construction in the drainage basin, no unified planning in hydroelectric development, and even no strict environment impact assessment. The disordered hydroelectric development induced eco-environmental problems are universal, comprehensive and permanent, and many of the impacts are irreversible.

Meanwhile, the disordered hydroelectric development also caused excessive resettlement problems, which bring about not only huge pressure to ecology but also cause major hidden trouble to the security of the society. Up to the end of 2005, the large and middle-scale hydraulic and hydroelectric projects in Sichuan alone had resulted in a resettlement of 934,000 people, and ongoing as well as

future resettlements will total another 300,000 people. As for the area where an individual reservoir is located, though the absolute number of migrants is not very big, yet the proportion to the local population is very high. As resettlement areas are mostly located in the eco-environment vulnerably dry valley and steep sloping areas, the even more aggravated soil erosion furthered the poverty locally. The problem of social stability is worthy to be deeply concerned because the proportion of minority nationalities to the immigrants is high and the resettlement areas are mostly poverty-stricken.

1.3 Grave situation of environmental pollution

The trend of locally improved and generally deteriorated environmental quality in the upper Yangtze River will continue, if no effective measures are taken, it is still difficult to improve more apparently the environmental quality of water, atmosphere and key cities.

- (1) The graver situation of water pollution in the upper Yangtze River. The water quality of the trunk stream of the Yangtze River above Yibin is relatively good but water pollution of the urban sections of the trunk stream and part of the tributaries is serious. Up to 2010, 1.5 million to 2 million tons of paper pulp production capacity will be added in Sichuan, concentrating mainly in cities of Yibin, Leshan and Ya'an along the main stream; an ethylene plant with a production capacity of 0.8 million tons and an oil refinery with a capacity of 10 million tons will be built in Chengdu which will lead to a constant increase in discharge capacity of industrial effluent; the urban domestic sewage treatment rate is very low, in 2005 the domestic sewage treatment rate was only 29.9% in Panzhihua. What is more, there are many small towns with industrial and domestic effluent directly discharging into the rivers without any treatment, leading to substantial increase in sewage. The big gap between the input to the treatment and the objective of environmental protection poses a great threat to the water environment security.
- (2) Grizzle dominated energy structure in the upper Yangtze River. In 2002 the sulfur dioxide (SO_2) emissions exceeded the atmospheric environmental capacity by 18,200 tons and PM_{10} by 7,200 tons in Panzhihua, and SO_2 , NO_x and PM_{10} also exceeded the atmospheric environmental capacity in Yibin. The heat power installation capacity will be increased by a big margin in recent years. Since the high-ash grizzle will still be used as a main fuel, the "excess" emission will be increased in the future and acid rain pollution tends to be aggravated in Yibin, Panzhihua, Zhaotong, Leshan, etc., where the air quality is hard to be improved to a greater extent.
- (3) The aggravated area source pollution in rural areas will be hard to control. The applications of pesticides and chemical fertilizers will still be increased in a short period, the development of agriculture related stock breeding will become a major source of pollution, and the serious soil erosion at upstreams even aggravated area source pollution. According to preliminary statistics the amount of chemical fertilizers applied in the upper Yangtze River in 2003 reached 1.242 million tons and the intensity of fertilizer applied per unit area is higher than the nation's average level, being three times that of the world average level. The application intensity of chemical fertilizers in Kunming, Qujing, Ya'an, Panzhihua, etc., are three to four times that of the safe application intensity and 70% of the chemical fertilizers became pollutants flowing into the rivers and lakes rather than fully utilized. The discharge loadings of nitrogen and phosphorus in the area of the upper Yangtze River are 2.744 million and 1.054 million tons respectively, accounting for over 20% of the total Yangtze River basin. The scope of

environmental pollution affected area in rural is extensive and scattered, hard to be handled in a concentrated way. The extremely difficult problem of management without an available sound strategy poses a very challenging problem in environmental protection.

2. Countermeasures and Suggestions for Guaranteeing Ecological and Environmental Security

2.1 Comprehensive management and optimization of ecological restoration project in the upper Yangtze River

(1) Planning ecological economic development direction according to different eco-functional zones

- Source region of the Yangtze River. It is mainly a Tibetans distributed high altitude region which witnessed grassland degradation, desertification and wetland desiccation due to serious overgrazing. Hence artificial grassland should be developed to supplement forage deficiency in spring and winter, and grazing should be combined with raising in pens to establish concentrated herdsman's settlements.
- Hengduan Mountain region. It consists of eastern Tibet, western Sichuan and northwestern Yunnan and is an important ecological barrier of the major drainage basins in China, a distribution center of biodiversities and also an ethnic groups distributed area where the socio-economic development lags behind with relatively high sensitivity to ecological security. Hence eco-tourism, hydroelectric development, characteristic agriculture, animal husbandry, and forestry should be taken as objectives of development.
- Karstic region. It is mainly distributed in northwestern Yunnan and western Sichuan where rocky desertification occurred in many localities. It has always been a poverty-stricken area where it is difficult to have ecology restored although precipitation is abundant, yet soil water holding capacity is poor and soil is infertile. Hence the foci should be prevention and comprehensive management, and movement of local farmers away from serious rocky desertified areas to settle down in areas where conditions are better.
- Hills and low mountains dominated western Sichuan and northern Yunnan region, a principal agricultural area with high population density and serious soil erosion. Since most of the young and middle-aged farmers have gone out doing a temporary job and not many rural surplus labour force left, it is suggested that defarmed land should be managed concentratedly, in addition to develop ecological forest partly, the proportion of economic forest should be increased properly.

(2) Optimizing project coordination and areal combination of the ecological engineering and strengthening integrated control of soil and water loess by taking small watershed as a unit.

Efforts should be made to continue implementing integrated management of converting farmland to forest, slopeland to terraces and slope water system as well as to small-scale hydraulic projects so as to form concentrated scale and gain overall benefits. The current situation of project scattering under different departments, single efficiency and non-coordinated measures should be reversed and a win-win ecological comprehensive system for agricultural development and ecological security should be established.

2.2 Formulating integrated development planning of water resources and putting hydroelectric development in good order

Efforts should be made to set up an authoritative agency responsible for the overall governance of the integrated development and management of the whole basin as soon as possible and work out integrated planning of the hydroelectric development of the upper Yangtze River. A scientific definition of the ultimate scale, number, order of development, allocation of the key sites and ecological conservation of the hydroelectric development should be done and followed commonly as authorized text.

No hydropower stations are allowed to be built in the natural heritage site, cultural heritage site, nature protected area, scenic spots, eco-sensitive area, rare plant and animal and endangered species inhabitat area, key biodiversity concentrated area, and ethnic culture and religion sensitive area.

Fish protected area should be established in the upper Yangtze River. Hydroelectric development is prohibited on certain reaches of a major tributary or entire tributaries and scope of protected area is identified in accordance with ecological requirements of fishes.

2.3 Firm abandonment of industries without superiority but heavy-pollution related

Efforts should be made to get rid of the thought and tradition of big and complete industrial system, firmly abandon industries without superiority but causing serious pollutions, establish environment friendly industrial system with true regional characteristics and adopt effective control measures to protect environmental safety of the upstreams.

- (1) To reduce heat power stations using coal of inferior quality as main energy source by considering to purchase electricity of the neighbouring areas for hydroelectric peak demand regulation. Strict washing should be done to coals from Zhaotong and Yibin and subsidies should be given to industries practicing energy saving and emission reduction.
- (2) To compensate oil disadvantage with advantage of natural gas resources, reduce natural gas export properly, develop natural gas chemical industry energetically but inadvisable to force to develop petrochemical industry. To promote use of natural gas as civilian energy to replace coal for pollution reduction.
- (3) To control strictly high energy consumption and serious pollution induced industries such as nonferrous metal industry.
- (4) To quicken the pace of construction and effective operation of urban domestic sewage and household refuse treatment projects.

2.4 Establishment of ecological "sannong" (rural area, farmer and agriculture) system for the change of mountain village pattern

The present mountain village pattern can not only make local people fail to enjoy the achievements of rapid industrialization and urbanization development but also cause serious damage to eco-environment, hence it is urgently needed to change the existing situation.

- (1) Reconstruction of village space. Mountain villages should move gradually to intermontane plains, areas along rivers, by roadside and close to cities, where the ecological conditions are

better with large environmental capacities, convenient transportation and development potentials and conditions so as to change the scattered and disordered situation which depends on steep slope reclamation or on natural grassland low level production, making vast expanse of natural grassland, wasteland and forest restore naturally.

- (2) Reorganization. Mountain villages should be changed from scattered into concentrated, from small sizes into big ones, the number of the township and village settlements should be cut down and develop towards agglomerated communities. The grassroots management hierarchies in rural areas should be decreased, management costs lowered down and burdens on farmers alleviated. Communities of townships that enable mountain people to enjoy modern socialist development achievements should be established.
- (3) Industrial restructuring. To persist in the development objectives of scale, specialized and industrialized agriculture with the foci of raising per unit area yield, improving agricultural efficiency, increasing agricultural processing chain and reducing large area damage to ecology. To develop energetically secondary and tertiary industries and change agricultural sufficiency into market economy and commodity agriculture. To establish high yield fine quality artificial grazing ground and forage producing base and realize combination of raising in pens with grazing.

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