

干旱区环境整治 与资源合理利用

(银川国际会议论文选集)

Rational Utilization of Natural
Resources and Territorial Management of
Arid Lands — Proceedings (Selected Papers)
of the Yinchuan International Symposium

中国自然资源学会干旱区研究委员会
Arid Land Committee, China Society of Natural Resources

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Rational Utilization of Natural Resources and
Territorial Management of Arid Lands

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Natural Resources

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序 言

干旱区环境整治与资源合理利用国际学术研讨会于 1993 年 9 月 1—8 日在塞上古城宁夏回族自治区首府——银川市胜利召开。由中国自然资源学会干旱区委员会和宁夏回族自治区科学技术协会共同主持,并得到宁夏党委和人民政府的关怀和支持,以及自治区外办、科委、农业厅、林业厅、水利厅、农垦局、畜牧局、气象局、环境保护局、土地管理局和宁夏农林科学院的通力合作。联合国环境总署也派负责官员莅临指导,并捐赠 2.5 万美元,作为邀请第三世界有关专家出席会议和刊印论文集的费用。

中外有关科学家 130 余人参加了这次学术讨论会,其中来自美国、德国、日本、澳大利亚、奥地利、墨西哥、叙利亚、巴基斯坦、苏丹、荷兰、蒙古等国的外宾 20 余人(见附表)。

干旱区(含半干旱区)在全球分布甚广,约占陆地总面积的 1/3。在我国分布尤为广阔,约占土地总面积的 52.5%(包括整个西北干旱区,青藏高寒区中部和西北部以及东部季风区的黄土高原西北部;后二者若不计算在内,则约占全国土地总面积的 1/3)。这片浩瀚地区蕴藏着异常丰富的土地、矿产以及太阳能、风能资源,并有不少水资源和生物资源,但也存在许多自然灾害和环境问题,例如荒漠化、干旱、盐碱、风沙、草原退化和水土流失等。如何充分合理和持续开发利用这些自然资源,同时大力进行环境整治和灾害防治,是当今全球性重大科学和生产问题之一。因此,中国自然资源学会干旱区委员会近 10 年来每四年召开一次干旱区环境整治与资源合理利用的国际学术讨论;第一次于 1985 年 9 月在乌鲁木齐与中国科学院新疆分院联合召开;第二次于 1989 年 8 月在呼和浩特与内蒙古自治区科学技术协会联合召开;本次则与宁夏回族自治区科学技术协会联合召开。这也是近 40 多年来宁夏境内首次举行的大型国际学术研讨会,得到各级政府和广大人民特别热烈的欢迎和支持。

这次研讨会于 1993 年 9 月 2 日上午正式开幕,由赵松乔教授主持会议。先由宁夏科协主席马以惇代表组织委员会致开幕词,简单介绍组织经过,接着,由宁夏回族自治区付主席任启兴讲话,简单介绍宁夏的山川人物和名胜古迹以及 40 多年来改造利用干旱区的巨大成就,并代表宁夏政府和人民热烈欢迎中外代表,预祝大会圆满成功。再由联合国环境总署控制荒漠化处付处长 T·丹霍弗博士简单阐明该处的宗旨目的以及对这次研讨会的希望。

9 月 2 日下午以及 4 号上午,为大会学术报告和交流讨论。国际著名干旱区专家 H·E 巨格尼、C·M 麦凯尔、C·R 夏佐德、R·H 施密特、D·W 弗里尔、M·A 伽度诺、M·D 埃尔·卡里发,田村三郎以及刘钟龄,汪久文、黄培祐、伍光和、梅成瑞等 18 人先后宣读论文,引起浓厚兴趣和热烈讨论。这些论文,均将在本论文集全文发表。

9 月 3 日全天和 4 日下午,分成四个专题组进行热烈交流和讨论,其中 80 多篇论文摘要已于会前中、英文对照出版并分发给出席代表。本论文集由于篇幅有限,不少优秀论文未能全文刊登,敬祈作者鉴谅。

9月5号到8号,大部分代表乘坐游览大轿车,参观访问宁夏境内干旱区改造利用典型以及许多名胜古迹。前者包括沙坡头铁路治沙工程、固海黄河扬水工程、南梁白僵土改良农场、盐池旱地沙生灌木园、盐池沙边子综合治沙试验区等等;后者包括西夏王陵、北塔、沙湖、贺兰森林保护区等等。许多代表都是第一次畅游宁夏,获得大量科学知识,并感到“见所未见,闻所未闻”的乐趣。

本研讨会共收到学术论文120余篇,本论文集选载其中37篇,英文和中文并用(英文全文,附中文摘要28篇;中文全文,附英文摘要9篇),分成下列四个组:

- I 干旱区环境和国土整治,共16篇,其中英文全文14篇;
 - II 干旱区水土资源合理利用,共9篇,其中英文全文4篇;
 - III 干旱区生物资源合理利用与农业建设,共7篇,其中英文全文5篇;
 - IV 干旱区区域开发问题和战略,共5篇,其中英文全文4篇。
- 最后感谢各位论文作者的密切合作。

赵松乔
1994年春节

Preface

The International Symposium on the Rational Utilization of Natural Resources and Territorial Management of Arid Lands, sponsored jointly by the Arid Land Committee, China Society of Natural Resources and the Ningxia Association for Science and Technology, was held from September 1—9, 1993 in Yinchuan, capital of the Ningxia Hui Autonomous Region. The UNEP kindly contributed US \$ 25,000 defraying the expenses for inviting five scientists from the developing countries as well as for publishing the proceedings.

Chinese and foreign scientists actively attended the Symposium, of which, were distinguished guests from the foreign countries (please see List of Participants).

The arid lands are widely distributed in the world, occupying about one—third of total land area. They account for even a larger proportion in China, as high as 52.5 per cent (including the whole Northwest Arid China, the middle and northwestern Tibetan Frigid Plateau, and northwestern Loess Plateau of Eastern Monsoon China). In these extensive areas, there exist rich land, mineral, solar energy and wind energy resources, as well as a considerable amount of water and biological resources; yet, natural hazards and environmental problems such as desertification, drought, salinization, shifting sand, grassland degradation and soil erosion are also quite serious. How to make a better and sustainable use of these natural resources and how to meliorate and control these environmental problems are certainly one of the most significant and urgent challenges in modern world. Therefore, the Arid Land Committee, China Society of Natural Resources, has recently sponsored international symposia on rational utilization of natural resources and territorial management of arid lands once every four years. The first one, jointly sponsored by the Xinjiang Branch, Chinese Academy of Sciences, was held in Urumqi, capital of the Xinjiang Uygur Autonomous Region (September, 1985). The second one, jointly sponsored by Inner Mongolia Association for Science and Technology, was held in Hohhot, capital of the Inner Mongolia Autonomous Region (August, 1989). This is the third one; it is also the first large—scale international symposium to be held in Ningxia, and thus, so very welcome and supported by all the Ningxia people.

The Yinchuan Symposium was opened in the morning of September 2, 1993; Professor Zhao Songqiao in chair. First, president Ma Yi—dun of Ningxia Association for Science and Technology, representing the Organizing Committee of the Symposium, made a short report. Then, Deputy Governor Ren Chixin of Ningxia welcomed all participants (especially foreign guests) visiting Ningxia. The last speaker was Dr. T. Darnhofer, Deputy Director, DC/PAC, UNEP, who gave a brief account of the UNEP's current major tasks.

In the afternoon of September 2 and the morning of September 4, two plenary sessions were held. 18 distinguished scientists including H. E. Dregne, C. M. McKell, C. R. Jastzold, R. H. Schmidt, D. W. Fryrear, M. A. Garduno, M. D. ElKhalifa, Saburo Tamuro, etc. presented their interesting papers. All these papers will be published in the Proceedings.

In September 3 whole day and the afternoon of September 4, papers were presented and discussed in four different sessions. Previously, the abstracts of more than 80 papers, both in Chinese and in English, had been printed together in one volume and distributed to each participant. Yet, owing to the limited space in the Proceedings, only a part of these papers can be included and published in full pages. I must apologize for such an omission.

From September 5-7, most of the participants made a delightful trip around the Ningxia Hui Autonomous Region. They visited several successful desertification—control and oasis—making experimental areas, such as the Sapotou Railway Sand—Control Experimental Area, the Guyuan—Haiyuan Irrigation Project (the Yellow River), the Yanchi Desert—Transformation Experimental Area, etc. They also enjoyed many scenic and cultural sites, such as the Xi Xia Imperial Tombs, the North Pagoda, the Sand Lake, the Helan Montane Forest Reserve, etc.

In total, the Symposium received more than 120 high—quality academic papers, of which, 37 are selected and will be published in the Proceedings. 28 papers are in English, with Chinese abstract; while other 9 papers in Chinese with English abstract. They are grouped into four sessions:

I Environmental problems and territorial management of arid lands, 16 papers (14 in English);

II Rational utilization of water and land resources in arid lands, 9 papers (5 in English);

III Rational utilization of biological resources and agricultural construction in arid lands, 7 papers (5 in English);

IV Regional development problems and strategies in arid lands, 5 papers (4 in English). Finally, I wish to express my deep gratitude to all these authors for their close co-operation.

Zhao Songqiao
Spring Festival, 1994

在干旱区环境整治与资源合理利用国际学术研讨会开幕式上的讲话

任启兴

(宁夏回族自治区副主席)

女士们,先生们,朋友们:

干旱区环境整治与资源合理利用国际学术研讨会,经过一年多紧张的筹备,今天,在塞上古城——银川市胜利召开了。首先,请允许我代表宁夏回族自治区人民政府和宁夏各族各界人士,向不远万里而来的各位外国专家表示热烈的欢迎,向组织和参加这次学术盛会的全国各地和我区的专家、学者表示诚挚的感谢和衷心的祝贺。

我们宁夏回族自治区,地处中华民族古老的发源地黄河中游地带,也是黄土高原与腾格里沙漠、毛乌素沙地接壤的过渡地区。在中国的自然区划中,它跨东部季风区域与西北干旱区域,西南靠近青藏高寒区域,处于中国三大自然区域的交汇地带。距今 2000 年以前,宁夏地区的先民们就开创了引黄河灌溉的农业,经过历代劳动人民的开发,宁夏平原已成为西北干旱区内一块美丽富饶的绿洲,从这个意义上讲,宁夏的经济与社会是唯黄河而产生,依黄河而发展的。今天,随着中国现代化的进程,宁夏人民已向着科技、经济、教育和社会的现代化目标奋进。

宁夏自然条件的过渡性质,使其自然地理要素表现出明显的纬向变化,由此而形成三个不同的自然区域:南部黄土丘陵区、中部风沙干旱区和北部引黄灌溉区。这种特殊的自然环境,为自然科学各个学科的研究以及综合研究提供了丰富的内容和广阔的领域,甚至可以说,它是一处研究自然的理想实验场所。许多科学家在这里取得了举世瞩目的成就:包兰铁路沙坡头地段铁路防护林体系的应用技术,盐池县万亩治沙样板林、杨树深栽试验以及沙地旱生灌木园建设,引黄灌区以稻麦为主的粮食单产水平等,均已达到先进水准。40 多年来,宁夏相继建立了一批科学研究机构,拥有一批学有专长、经验丰富的科学家和工程师,他们在荒漠化土地治理、干旱区环境与资源利用、盐碱土改良、绿洲农业、干旱区供水、干旱区气候、干旱区造林技术和干旱区草原与牧草种植等各个领域进行了卓有成效的工作,取得了丰硕的成果,为宁夏经济与社会的全发展做出了贡献。如今,成为这支队伍带头人的,大多是 1958 年自治区成立以后从全国各地支援宁夏建设的科技工作者,他们为宁夏这块土地的开发、为宁夏的现代化事业辛勤耕耘、无私奉献。我想借此机会,向他们、向宁夏科技界的同志们,表示崇高的敬意。

遗憾的是,宁夏偏于中国西北一隅,交通、通讯不发达等因素,制约着开发的速度和广度。我们的很多科学技术往往鲜为人知,外部的世界还不了解宁夏。这次国际学术研讨会

作为宁夏科技界对外交流的一次盛会,将为我们之间的接触和交流提供一个契机,并为今后的合作创造一个良好的开端。把宁夏介绍给世界,让世界了解宁夏。各位朋友们将会在这次会议和考察中看到,宁夏人民正在中国共产党和人民政府领导下,按照建设有中国特色的社会主义的理论,加快改革,扩大开放,在工业、农业、科学技术、文化教育等各个方面取得的成就,这会使我们大家都感到鼓舞。当然,开放的宁夏更加期待着外部世界的理解、合作与支持。在建设社会主义市场经济的进程中,我们愿意以科学技术为起点,不断扩大彼此合作的领域。

在会议和考察中,你们也必将被宁夏独特而丰富的自然与人文景观所感染。自然的造化和人为的努力,绘成今天色彩斑斓的宁夏山川、社会、人物的画卷:雄浑的大漠风光和秀丽的水乡景色镶嵌在一起,有巧夺天工之妙;贺兰山下宏伟壮观的西夏王陵,会使你想起埃及金字塔;中国“穆斯林省”的回族风情,蕴含着丰富的民族、宗教、民俗、文化等内容,会使你对宁夏的久远历史发生浓厚的兴趣。我相信,宁夏之行必会给各位留下一段极其美好的回忆。

最后,预祝大会圆满成功,祝国内外朋友在宁夏生活愉快。

谢谢!

一九九三年九月二日

WELCOME SPEECH AT THE OPENING CEREMONY OF THE INTERNATIONAL CONFERENCE ON RATION —AL UTILIZATION OF NATURAL RESOURCES AND ENVIRONMENTAL MANAGEMENT IN ARID AREAS

Ren Qixing

(Vice Chairman, People's Government of the Ningxia Hui Autonomous Region)

—A Brief—

Ladies, gentlemen and friends,

For more than one year's hard working on preparation, the international conference on rational utilization of natural resources and environmental management in arid areas opens today in Yinchuan, an ancient city beyond the Great Wall. First, please allow me to represent the government and the people of Ningxia to extend our warmly welcome to you, experts who come from places all over the country, and especially come from other countries.

At the middle reaches of the Yellow River, Ningxia is one of the birth places of the Chinese nation. About 2,000 years ago, people in Ningxia started to divert water from the Yellow River to irrigate their farmlands. For generations of development, the Ningxia Plain becomes a beautiful and richly endowed oasis in the northwestern arid areas of China.

Ningxia is also located in the transitional area among the three realms of the country, namely, the Eastern Monsoon, the Northwestern Arid and the Frigid Tibetan Plateau. The transitional characteristics of the physical environment make Ningxia a unique region in the world. It can be said that Ningxia is an ideal experimental area for scientists in resources, environment, agriculture, and many other fields. As a matter of fact, many scientific achievements have been made in the region. These include research projects on desertification management, water and land resources utilization, saline soil amelioration, oasis agriculture, climate, afforestation technology and grassland management.

It is a pity that transportation and communication infrastructure in Ningxia are very limited due to its remote location. For this reason, Ningxia is not well known by the outside world. This conference is a great chance for the science and technology circles in Ningxia to exchange their views on resource utilization and environmental management with foreign colleagues. Ningxia is enlarging its door opening to outside world and deepening its reform practices. I hope that this conference will enhance the international

cooperation on scientific researches.

As the "Muslim Province" of China, Ningxia has its unique culture, religion and custom. I have the confidence that you will be deeply impressed by the beautiful landscape and the unique culture of Ningxia, and I also hope that your trip to Ningxia leave you a happy memory.

I wish the conference be a very successful one and all the participants enjoy your life in Ningxia.

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1、干旱区环境问题与国土整治
Environmental Problems and Territorial
Management of Arid Lands

LAND DEGRADATION IN THE ARID REGIONS

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1. Introduction

Development of arid lands became the focus of global scientific concern in 1951 when the United Nations Educational, Scientific, and Cultural Organization (Unesco) established an arid lands committee. By 1956, the committee's efforts had led to the initiation by Unesco of its Major Project on Scientific Research on Arid Lands. The project ended in 1965 after publishing an outstanding series of reports on the physical and biological resources of drylands and the environmental impacts of human activities.

Results of the Unesco project demonstrated clearly that arid regions of the world had suffered extensive human-induced degradation. It also was obvious that degradation would become worse unless actions were taken to reverse the process (White, 1956). While technical solutions to the problem could be found, implementing the solutions turned out to be difficult. Conservation of natural resources is not a high priority item to people who are fighting for survival in a hostile environment.

2. Land degradation processes

Globally, the principal land degradation processes in the drylands are vegetation degradation, water erosion, wind erosion, and salinization (Dregne, 1983). Important but less extensive are soil compaction and crusting, heavy metal pollution, and damage resulting from mismanagement of industrial chemicals such as pesticides. The major land uses which will be discussed here are irrigation, rainfed cropping (dryland farming), and grazing.

Salinization, frequently accompanied by waterlogging, is the dominant degradation threat on irrigated cropland. Water erosion, in particular, and wind erosion are the main problems affecting productivity of rainfed croplands although dryland salinity does much local damage to croplands in Australia, Canada, and the United States. On rangelands, vegetation degradation is, by far, the principal human-induced problem. After the vegetative cover had been reduced, water and wind erosion can become important. Vegetation degradation does not always mean a reduction in vegetative cover. Overgrazing can lead to establishment or expansion of undesirable shrubs, such as mesquite (*Prosopis spp.*), which may increase the total biomass while reducing production of desirable species.

Soil compaction and crusting most commonly are associated with a loss of organic