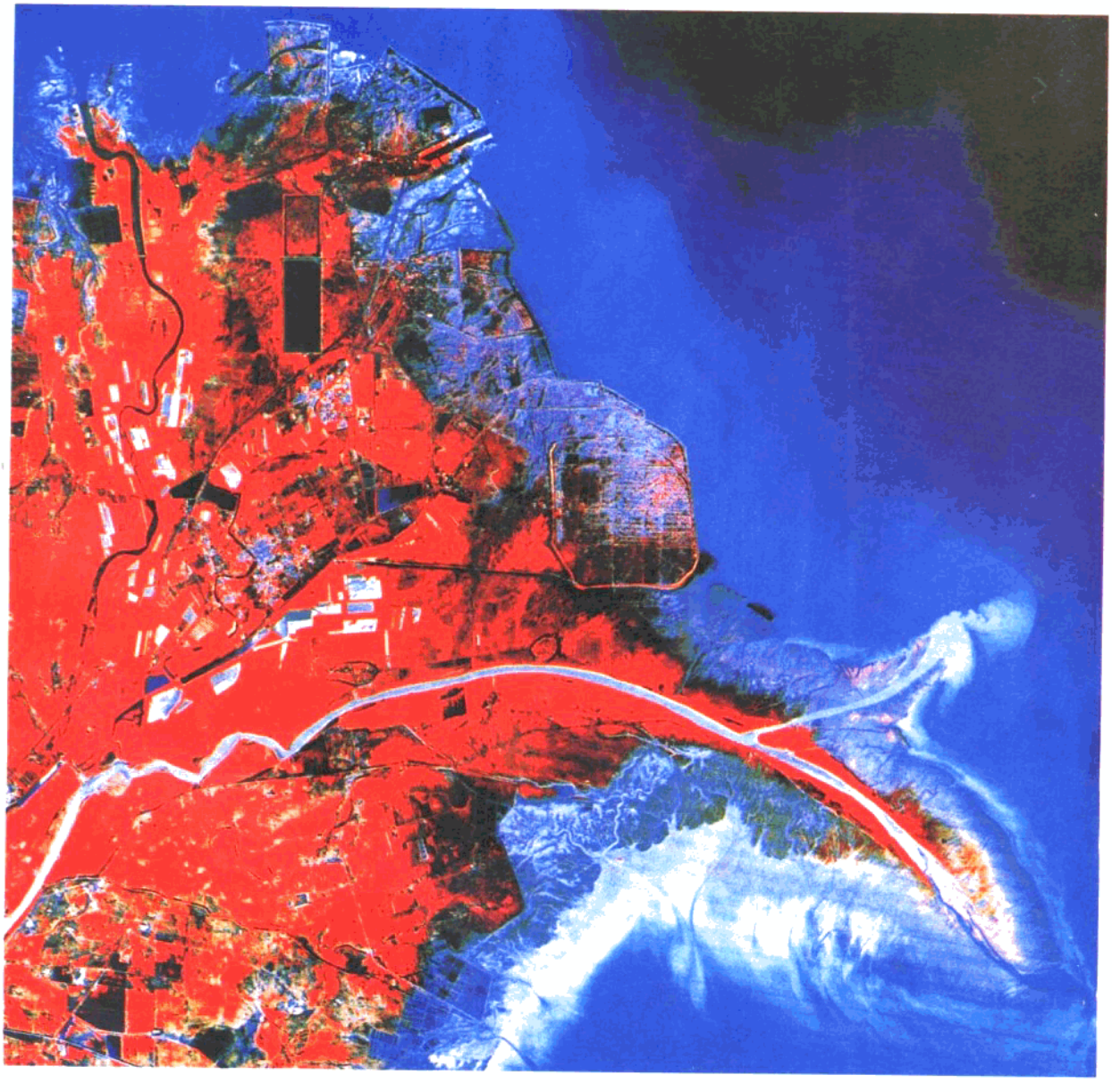
Chinese Academy of Sciences
State Key Lab. of Resources and
Environment Information System LREIS
中国科学院
资源与环境信息系统国家重点实验室

Ministry of Transport, Public Works and
Water Management of the Netherlands
Research Institute for Inland Water Management
and Waste Water Treatment RIZA
荷兰交通，公共工程与水管理部
内陆水管理与废水处理研究所

ATLAS OF THE YELLOW RIVER DELTA

黄河三角洲可持续发展图集



The Publishing House of Surveying and Mapping
测绘出版社

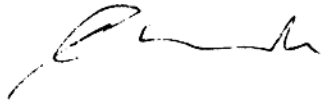
PREFACE 1

The UNDP project "Support for the sustainable development of the Yellow River Delta" (1995—1997) was co—funded by the Chinese government, UNDP and the Netherlands Government through its Ministry for Transport, Public Works and Water Management. The project brought experts together from various Netherlands institutes, from Chinese national institutes and from Chinese regional/local institutes in Dong Ying municipality, Yellow River Delta, Shandong Province.

Planning of sustainable regional development requires a very good knowledge of the key processes that determine environmental and economical developments. Not only the region itself has to be studied, but also its major relations with its surroundings. For the Yellow River Delta, for example, developments along the upstream part of the Yellow River determine the future availability of fresh water and the future risks of flooding with river water, the global sea level rise determines the future risk of storm surges from the sea and national and provincial investment policies determine the priorities for economic development. The experts in the UNDP project payed attention to both the Yellow River Delta itself and to its major relations with its surroundings.

This Atlas of the Yellow River Delta summarizes the geographical information about the Yellow River Delta itself that was collected during the UNDP project. The Atlas was compiled by experts from the Research Institute for Inland Water Management and Waste Water Treatment RIZA in the Netherlands, experts from the state key Laboratory of Resources and Environment Information Systems(LREIS) of the Chinese Academy of Sciences, with information from many local experts in Dong Ying.

It was not an easy task to compile this Atlas, because the authors working for it were separated by a distance of 9000 km and had to communicate with each other about texts, maps and lay—out mainly by e—mail and by fax. So I am very satisfied by the fact that this Atlas has become available in a relatively short period and that the common effort is visible in the completeness of (Chinese) data, made accessible now to a modern international public. I hope that this Atlas will turn out to be one of the milestones in a continued cooperation between Chinese and Netherlands experts, aiming to achieve a wise use of the resources in our world.



ir C. D. van der Wildt

Chairman of the Steering Committee for Sino—Dutch Cooperation in the Ministry of Transport, Public Works and Water Management.

序 言 1

UNDP 项目“支持黄河三角洲可持续发展”得到了中国政府，UNDP 和荷兰政府的交通、公共工程及水管理部的共同资助。参与该项目的专家分别来自荷兰各有关研究所以及中国中央和地方的有关研究所与政府机构。

区域可持续发展计划的制定，需要对决定区域环境和经济发展的关键过程有一个很好的了解，不仅要研究区域内的情况，还要研究区域内外的联系。对于黄河三角洲而言，它的来水和洪灾风险均受黄河上游发展的影响；全球海平面的上升增加了该区域未来风暴潮的风险；区域经济发展的战略也受中央和省内投资政策的宏观调控。在该项目进行过程中，专家们对于黄河三角洲自身及其与邻近地区的联系都给予了高度的重视。

在该项目中，收集了大量的关于黄河三角洲的地理信息，现将它们编纂成图集。这本图集的主要完成单位有：荷兰内陆水管理与废水处理研究所（RIZA），中国科学院资源与环境信息系统国家重点实验室（LREIS）和山东东营市政府。

编辑这本图集很不简单。由于编辑人员之间相距九千公里，他们之间只能通过电子邮件和传真来传递文字说明和图稿。虽然时间紧迫，该图集还是在相对较短的时间内完成了，值得庆贺。更值得一提的是，原先的纯中文资料，现在制成了一本全新的国际出版物。我衷心希望本图集将成为中、荷专家继续合作谋求全球资源有效利用的里程碑。

冯·德尔·威尔德特

中荷合作委员会主席
荷兰交通、公共工程与水管理部

PREFACE 2

In 1855, the Yellow River was broken at Tong Waxiang. The flood water of the Yellow River captured the course of Daqing River to the Bohai Sea, where it created a new delta rapidly.

Taking the advantage of its geographical location(neighboring Beijing and Tianjin, facing Bohai Sea in the north), and of its vast land resources, the Yellow River Delta will be developed to be a national cotton and grain production base. With the exploitation of the abundant oil and gas resources, a second largest petrochemical industry center in China was founded here. In addition, agriculture, cattle-breeding, salt industry and aquaculture are also thriving in this area.

Three factors should be considered in the development of the Yellow River Delta. First of all, the Yellow River becomes dry usually. In 1996, the Yellow River dried out since February 13 and it lasted for 136 days and the dry out position reaches Luokou in Jinan. As long as 295 kilometers of the river channel was affected by stream dry. Although several plain reservoirs have been built in advance, it still causes a great amount of losses. Secondly, the Xiao Qing river is heavily polluted and has not been fully harnessed. Red tide in the sea occurs repeatedly. And thirdly, in the northern part of the Yellow River Delta, the coast is eroded and regresses backward. Land in the south is influenced by the sea water intruding. All of these factors will damage in a great extent the sustainable development of the Yellow River Delta. With the increase of population and booming of economy, the contradiction between resources and environment accrues. Under this background, it is the very time to compile an Atlas of the Yellow River Delta aiming to documenting the investigation and research results of the Yellow River Delta.

Experts form the Institute of Geography, Chinese Academy of Sciences have been studying this newly-formed Yellow River Delta since 1980's. Multi-temporal satellite data have been applied to monitor the Yellow River channel shifting and a high resolution Digital Elevation Model (DEM) of this area has been constructed. The research results have been used in the allocation of storm surge barriers and plain reservoirs, and in controlling the river channel shifting. These previous work form the basis of this atlas.

I am very appreciated to many experts and officers from the Netherlands side, particularly Mr. C. D. van der Wildt and H. J. Drost, the Ministry for Transport, Public Works and Water Management. They introduced us their work experiences in water management, land reclamation and in building modern monitoring and management system in the lower reaches of the Rhine River. In addition, they also bring us their research results in various types of delta such as the Danube River Delta, the Yenisey River Delta and the Nile River Delta.

This Atlas is a result of mutual cooperation and is also a very good memento of three years' cooperation. It is a precious quintessence of the scientific and friendly cooperation of experts from the Netherlands and Chinese sides, a gift to the social and economic sustainable development of the Yellow River Delta, and a special case of the global coast change research.

Sincere thanks to our Netherlands friends and great congratulations to my Chinese colleagues!

Earth Day, 1997, Beijing

序 言 2

1855 年黄河在铜瓦厢决口，返回山东，夺大清河流路经利律注入渤海，开始以很快的速度，建造它的新三角洲。从多期卫星影像分析中清楚地看到，黄河尾闾按照科氏力定律，出现三个弧段的转折；同时河口也依次由向北、向东转向东南。年轻的黄河三角洲，成为举世瞩目的、快速淤长的复式三角洲发育的典型。

由于邻近京津，滨临内海的地理区位优势，在中国经济腾飞的浪潮中，黄河三角洲广袤的土地，很快成为国家开发棉、粮基地之一。特别是发现海洋和地下蕴蓄着巨大的油气资源，迅速地建设起国家第二个大型石油产业中心。加上农牧业、乡镇企业、盐业与水产也有可观的发展，黄河三角洲于是赢得了"绿洲"加"油洲"的美誉。

但是 90 年代以来，黄河新三角洲的发育与发展，面临着三方面的严峻制约：一是黄河断流，1996 年从 2 月 13 日开始，延续 136 天，长达 295km，上溯到济南附近的泺口。虽然未雨绸缪，早已建成广南等一系列平原水库，但胜利油田当年少注水 260 万 m^3，减少原油 30 万吨；东营市工业缺水 3200 万 m^3，经济损失 9.6 亿元人民币。二是小清河污染远未完全处理，海上赤潮频发。三是三角洲北部海岸侵蚀后退，南部海水内侵，对黄河三角洲持续发展，构成严重威胁。在人口不断增长-经济高速发展之中，资源与环境的矛盾日益突出，提到《中国 21 世纪议程》上来了。规范和系统地整理黄河三角洲的调查研究成果，编制与出版图集及其电子版，就应运而生，并且迫在眉睫了。

中国科学院地理研究所及其资源与环境信息系统国家重点实验室，早在 80 年代初，即曾布署力量，对黄河新三角洲的发育和发展，进行过多时相的卫星遥感监测，并建立了高精度的地形数字模型。利用中国回收型科学实验卫星摄影，结合美国陆地卫星影像，进行综合分析，对黄河尾闾改道，对复合三角洲的地貌发育过程，对土地利用与旱涝灾害等，进行过仿真模拟与地面实况调查。所取得的一批丰硕成果，对填海造陆、海岸工程、平原水库选址、控制河口尾闾摆动，作出了切实的贡献，荣获国家及航天工业部科技进步奖，也为图集的编制，提供了一部分可靠的素材。

荷兰交通、公共工程与水资源管理部的威尔德特先生和汉斯先生等科学家和管理官员们，不仅为我们提供有关莱茵河下游水资源与土地开发利用，建立先进的监测与管理技术体系的丰富经验，而且向我们介绍在多瑙河、叶尼塞河和尼罗河等不同类型的三角洲所取得的一批丰硕研究成果。在互相切磋琢磨、交流学习中，共同编制《黄河三角洲可持续发展图集》，为三年来的密切合作，留下了愉快、美好的回忆。它是中、荷科学家们非常珍贵的科学与友谊的结晶，也是对黄河三角洲社会经济可持续发展能力建设奉献的一份厚礼，对于全球海岸带变化研究，也提供了一个具有特殊意义的东方案例。

谨此对荷兰的朋友们表示衷心的感谢；对中国同行们表示热烈的祝贺。

陈述彭

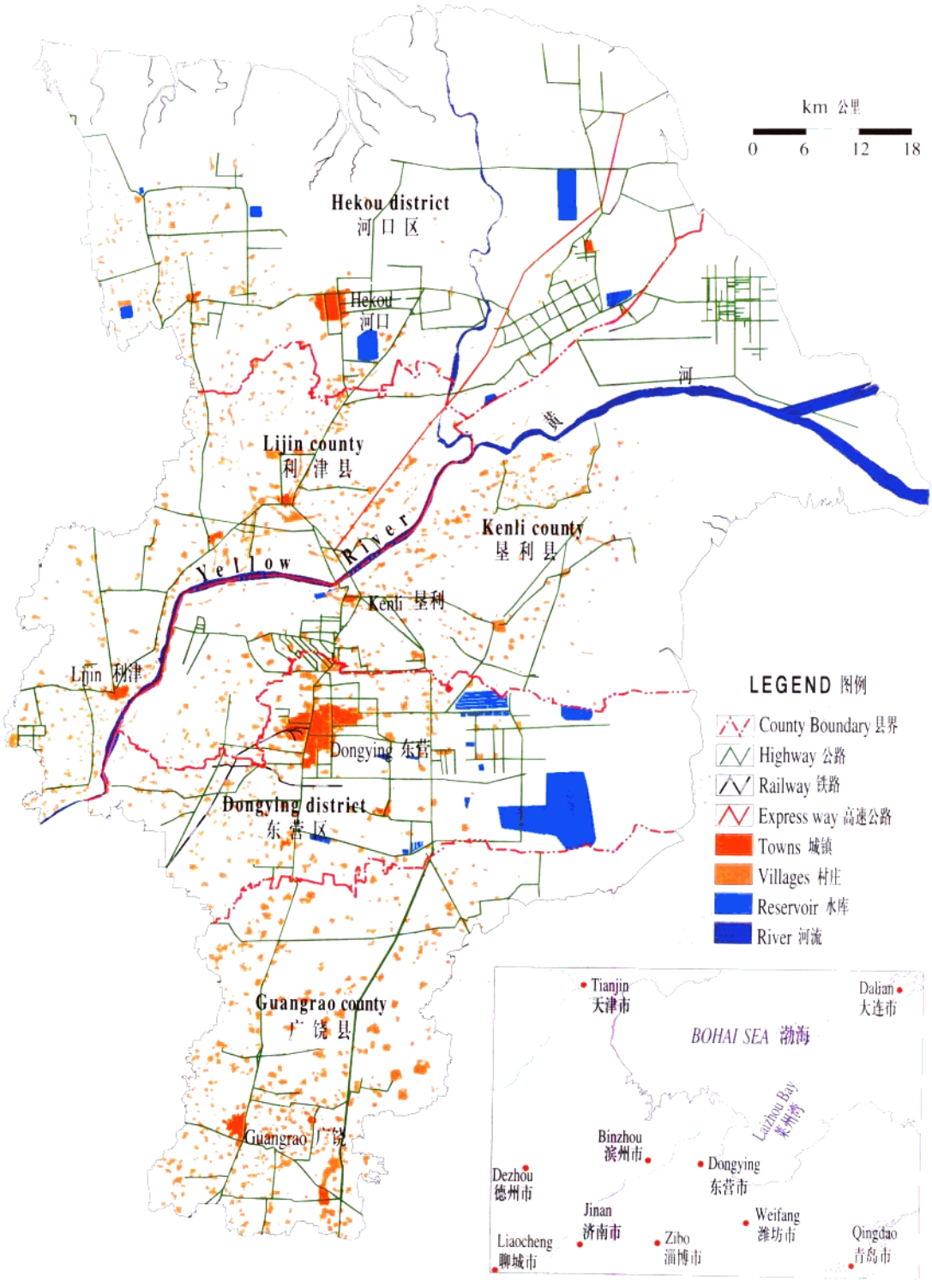
陈述彭

1997 年地球日于北京

CONTENTS

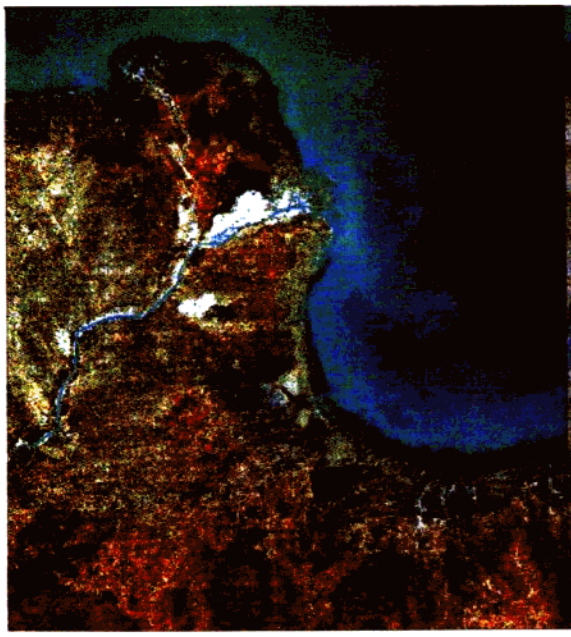
目 录

RESIDENTS AND ADMINISTRATION 居民点与行政

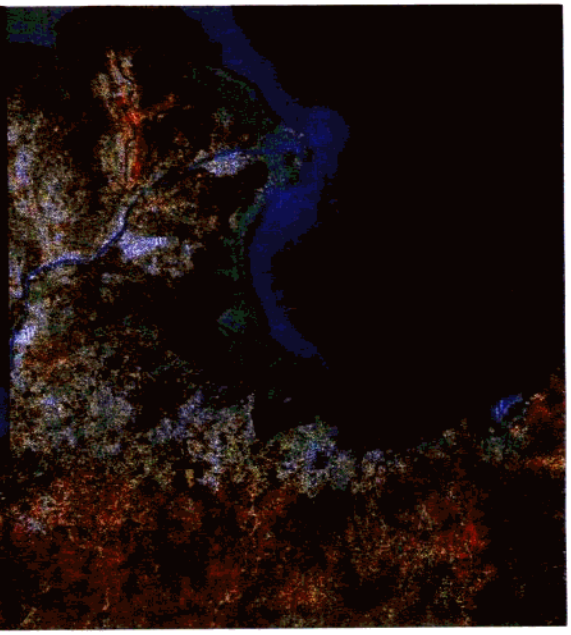


DELTA EVOLUTION 黄河三角洲演变

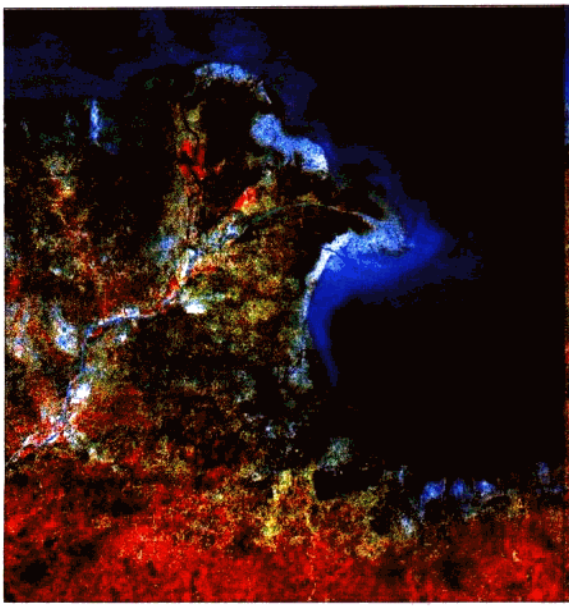
Dec 1, 1976



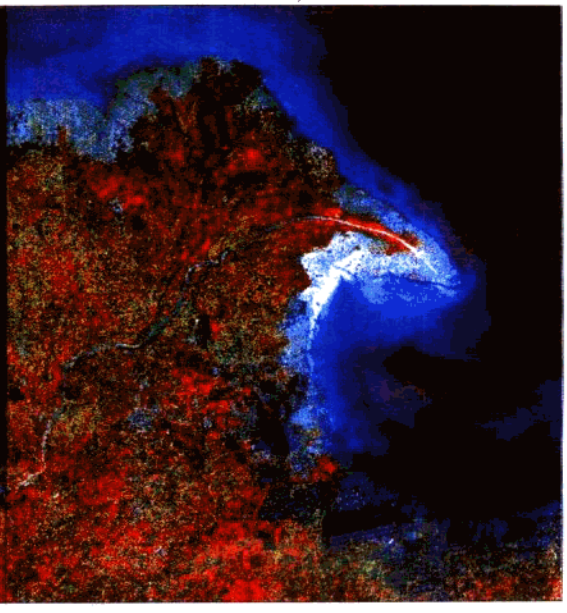
Nov 21, 1981



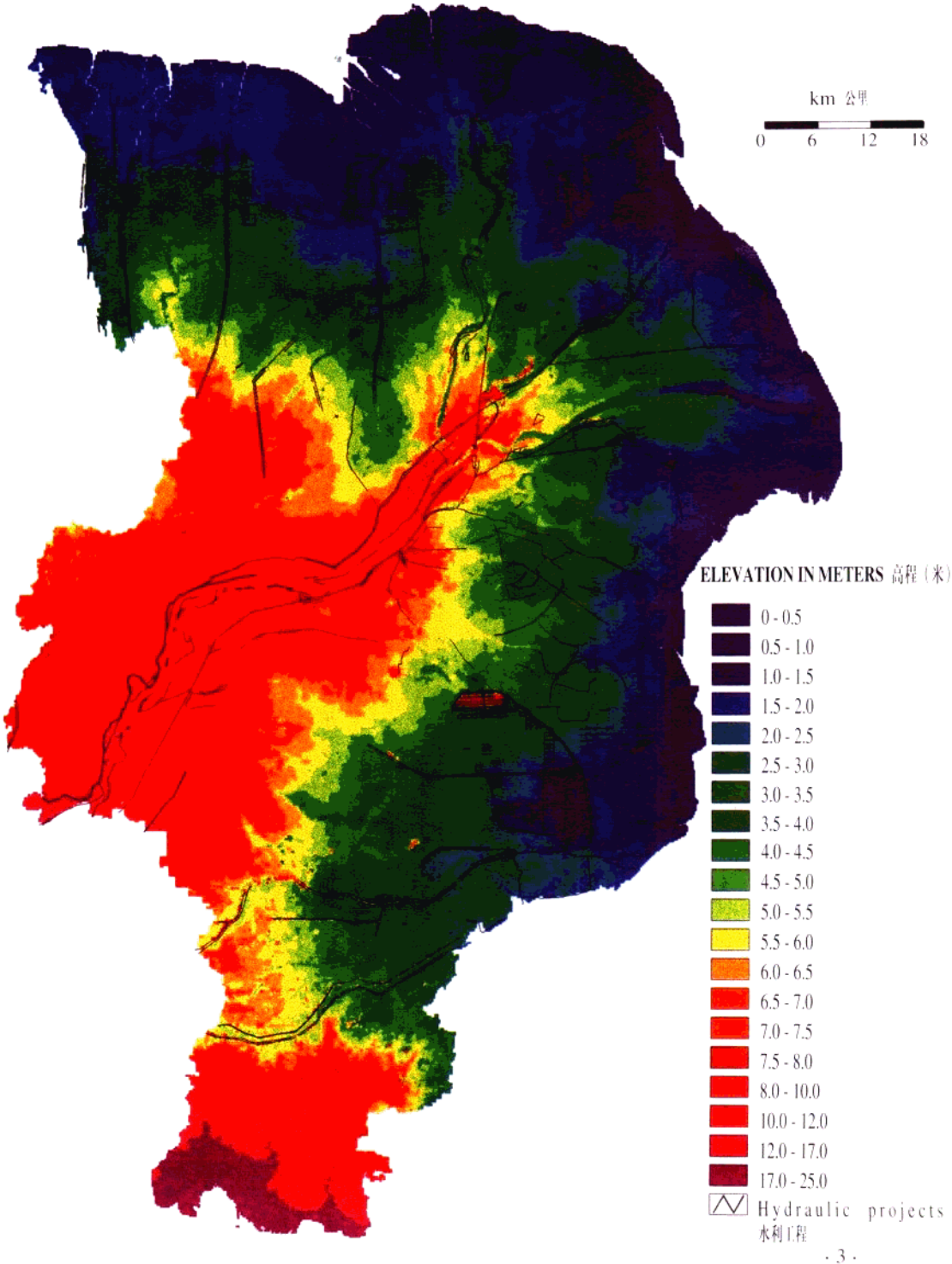
Dec 3, 1988



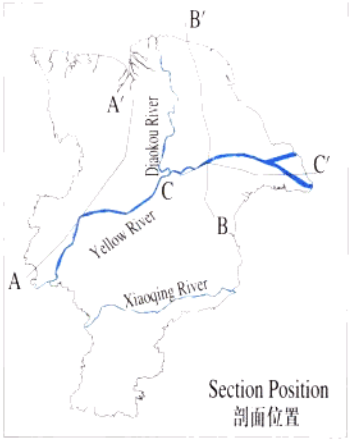
Oct 4, 1995

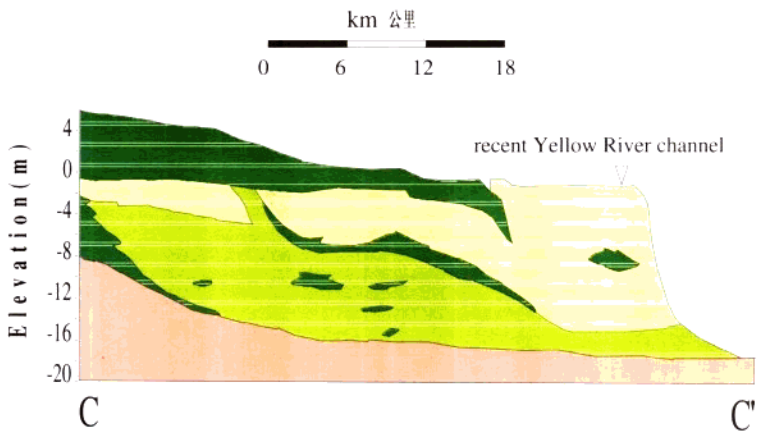


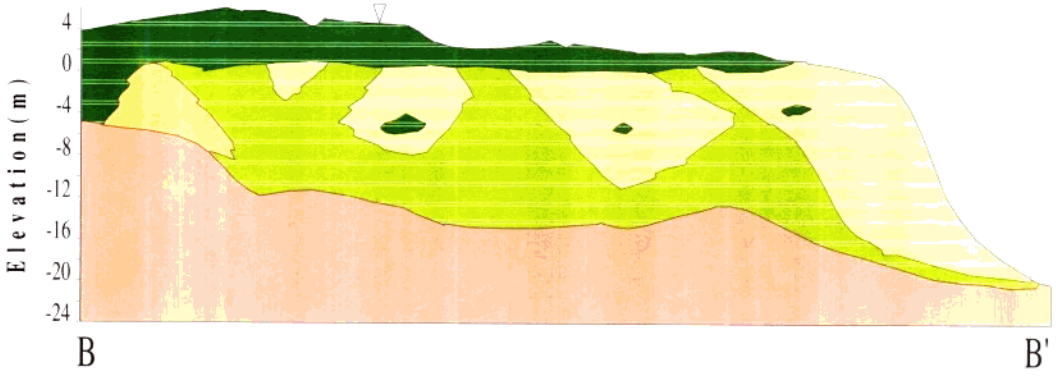
ELEVATION 高 程

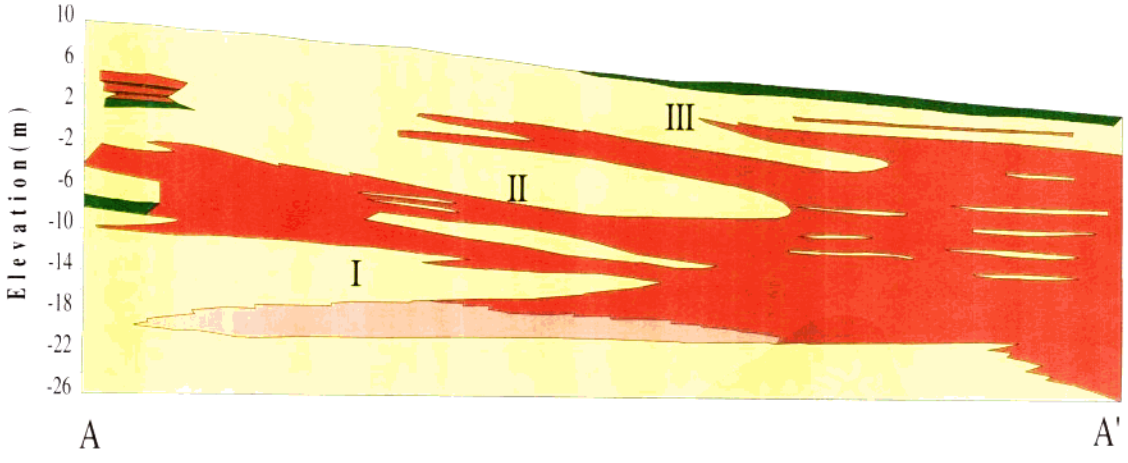


GEOLOGIC PROFILES
地质剖面



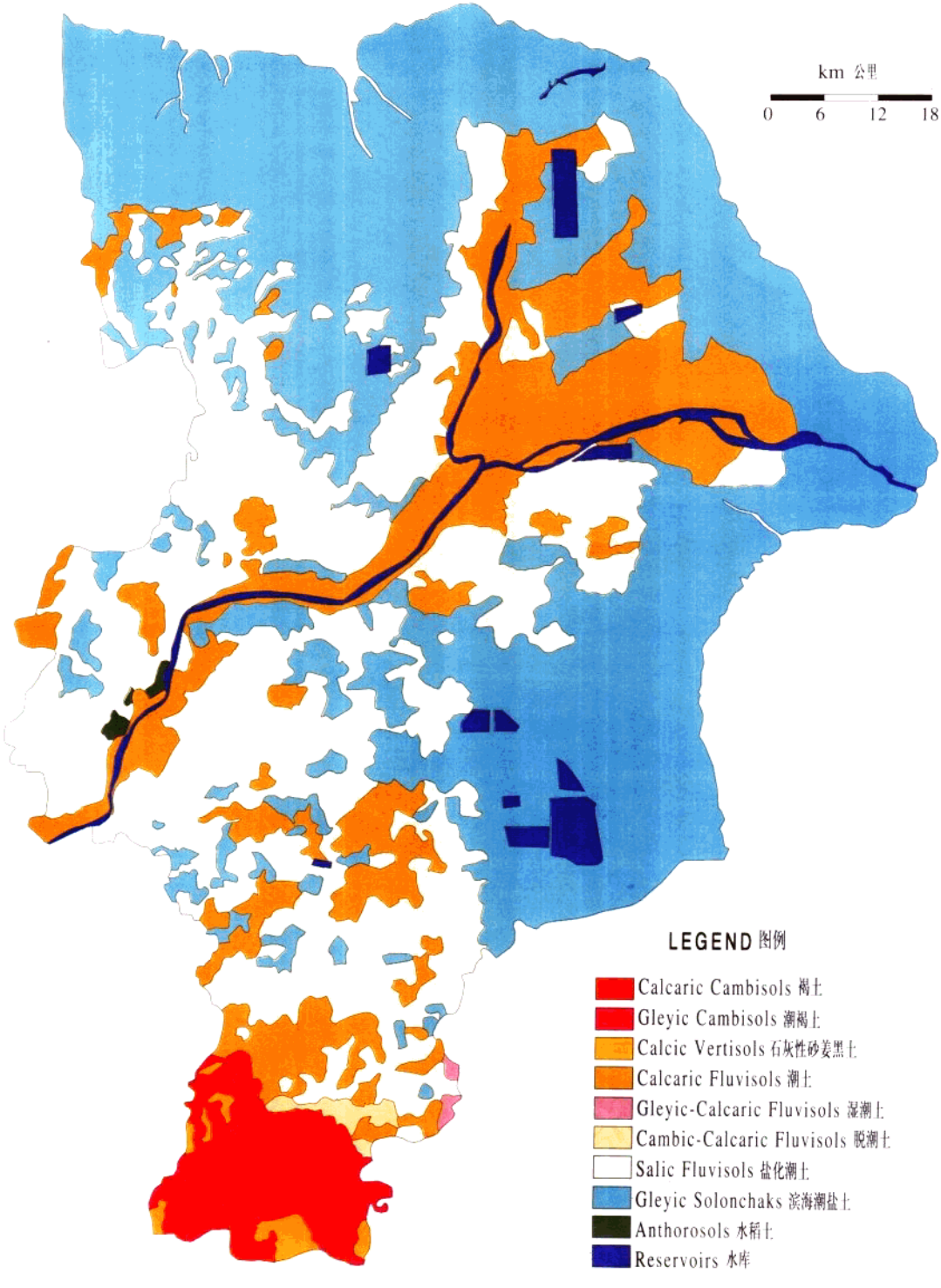




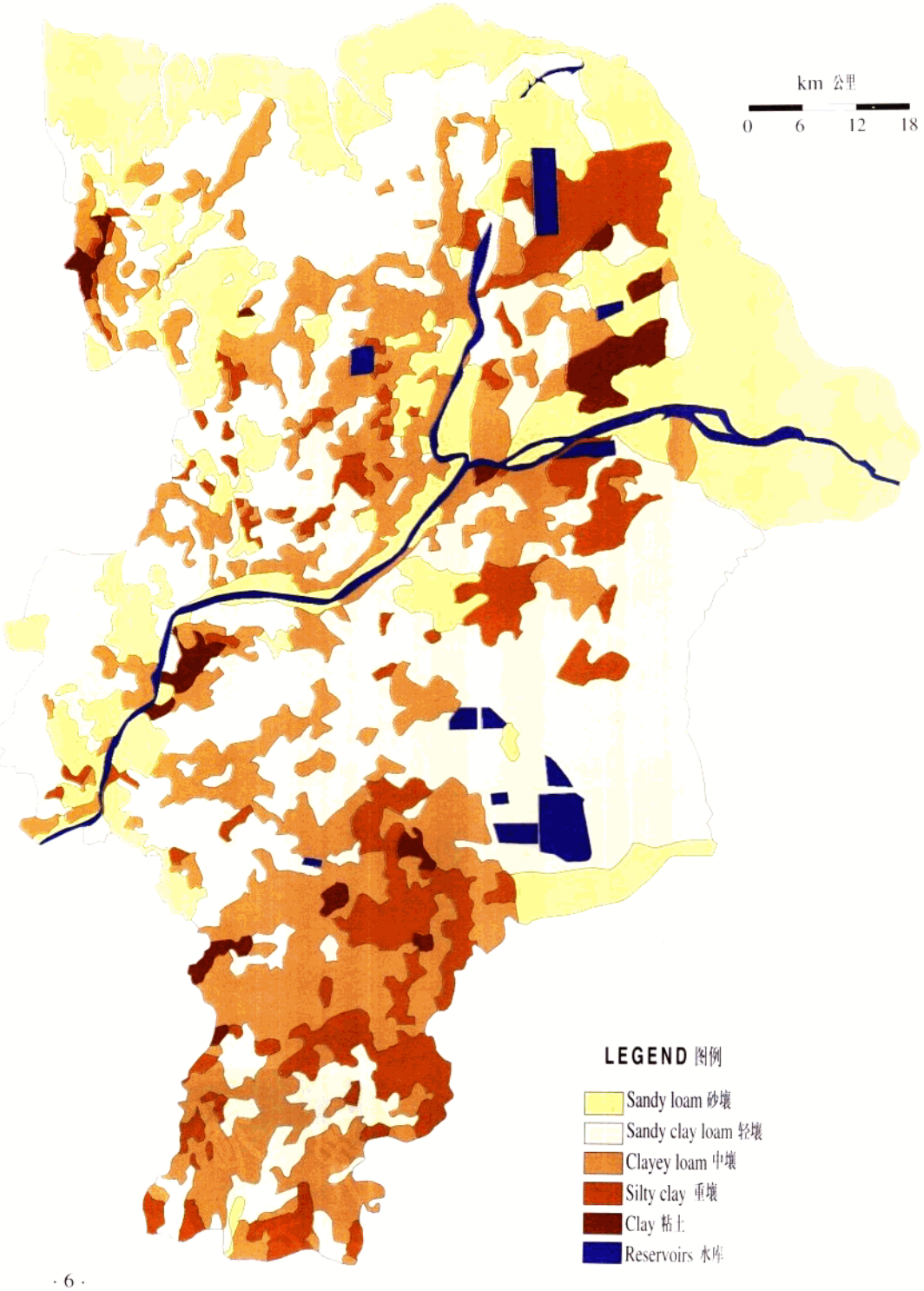


Fine sand 细砂
Silty sand 粉砂
Clayey sand 粘土质粉砂
Clayey sand or sandy clay 粘土质粉砂或粉砂质粘土
Sandy clay 粉砂质粘土
Clay 粘土

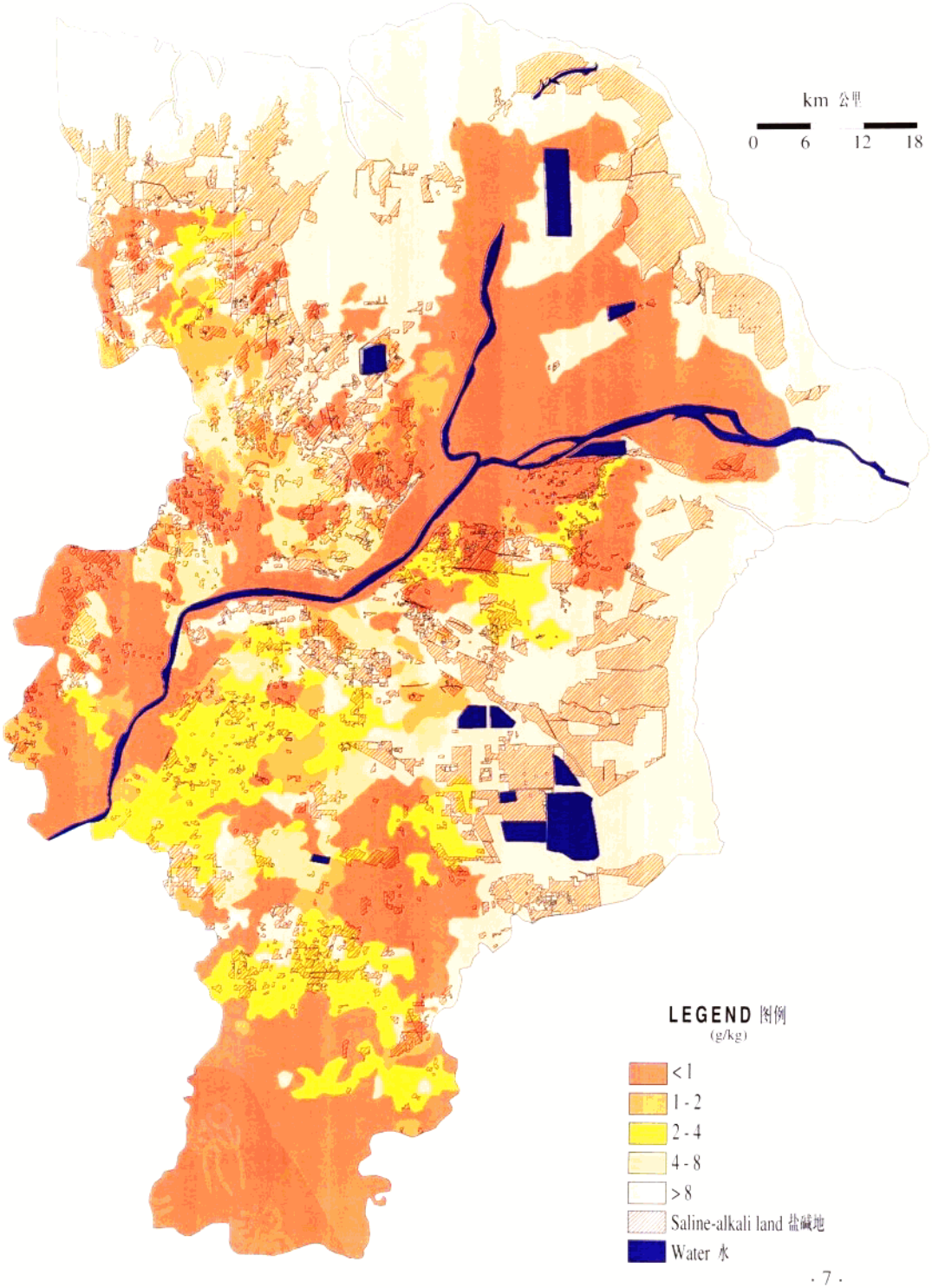
SOIL TYPES 土壤类型



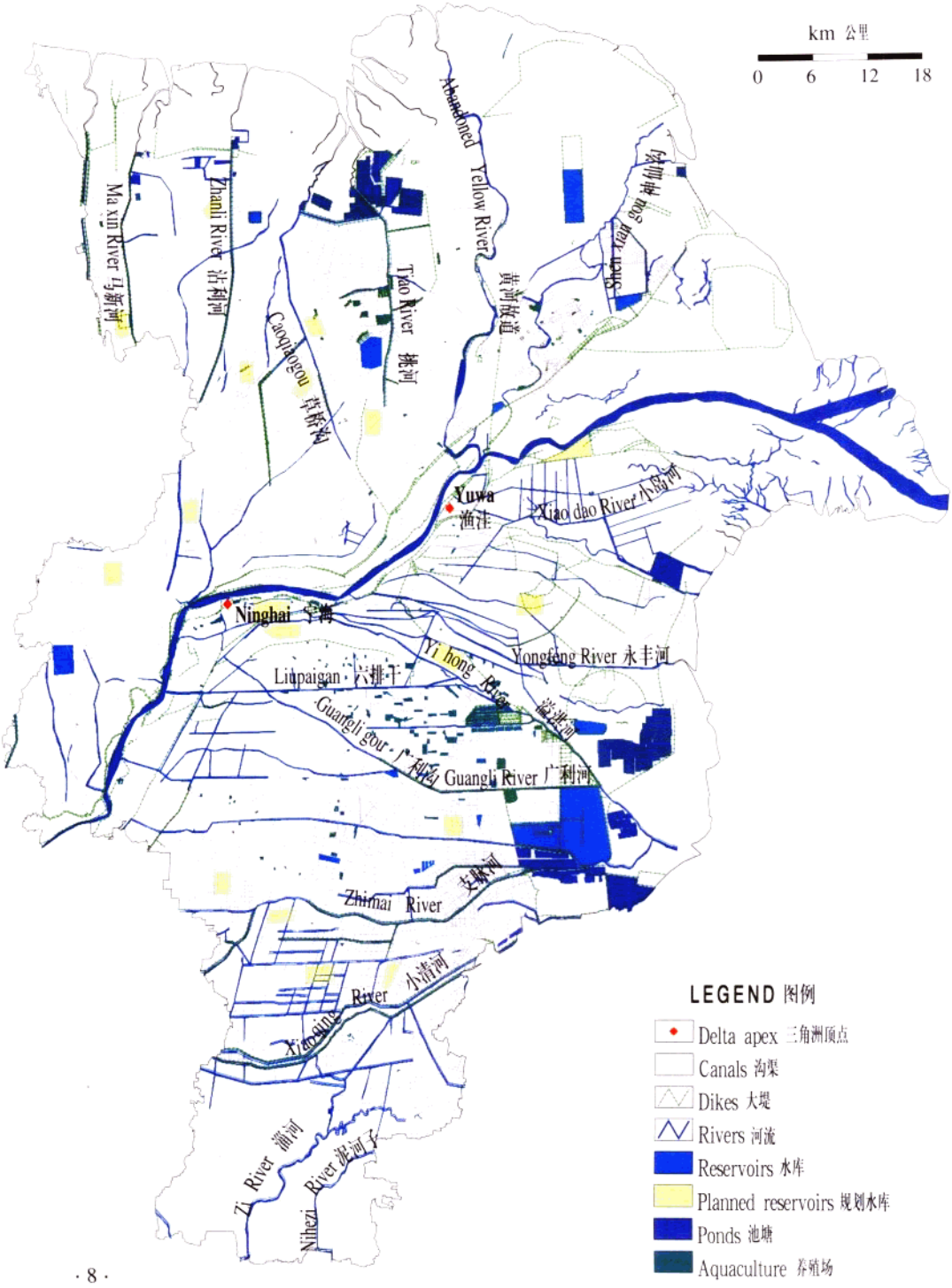
SOIL TEXTURE 土壤质地



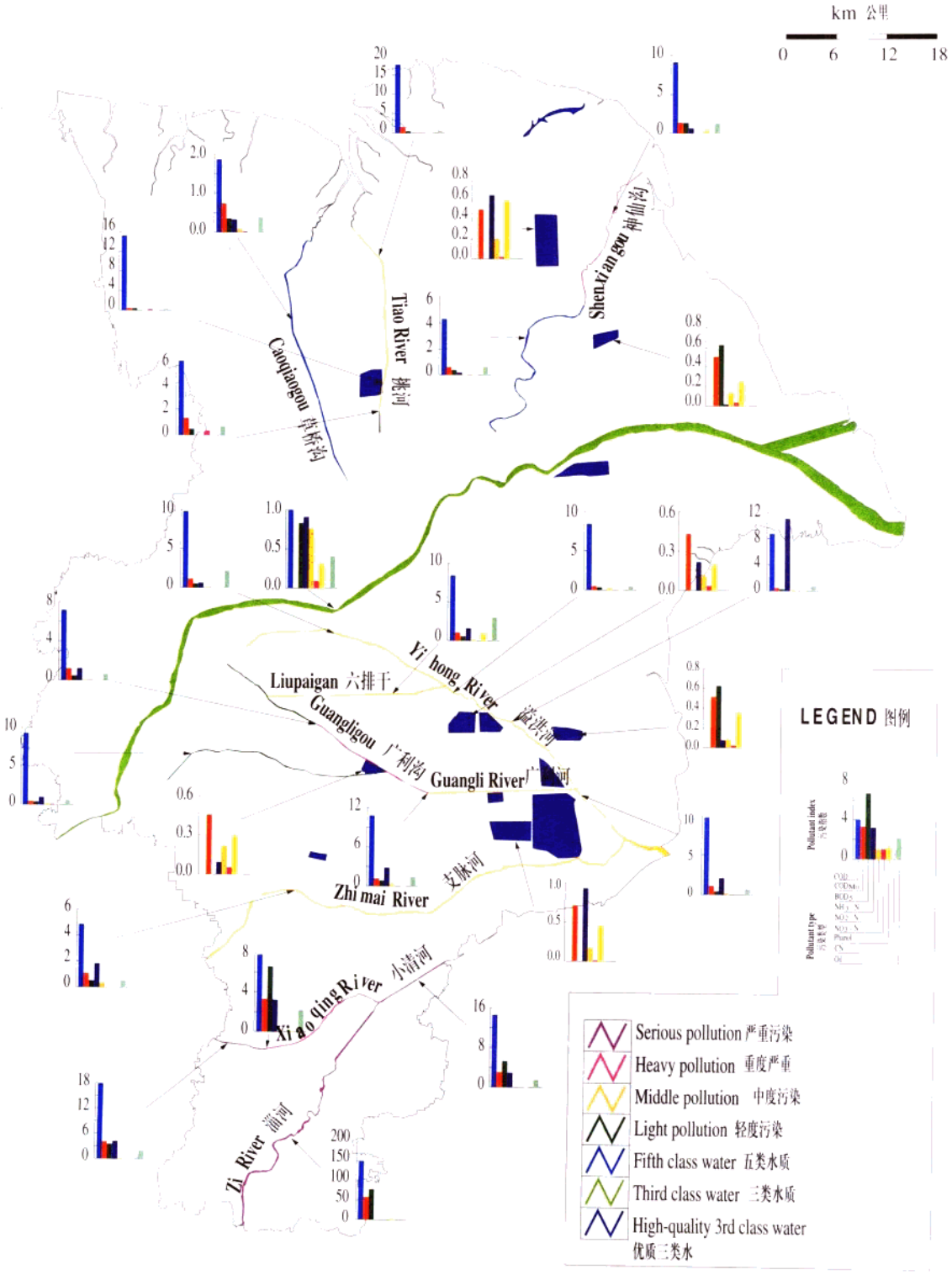
SOIL SALT CONTENT 土壤含盐量分布



WATER SYSTEM 水 系



ORGANIC POLLUTANTS IN SURFACE WATER 地表水有机污染物



HEAVY METAL POLLUTANTS IN WATER 地表水重金属污染物