

■ 主编 / 王得楷 胡杰

地质灾害 **预** **防**



DIZHI ZAIHAI YUFANG

- ☆ 监测
- ☆ 预警
- ☆ 避险
- ☆ 减灾



兰州大学出版社

地质灾害预防



100
兰州大学出版社



图书在版编目(CIP)数据

地质灾害预防/王得楷,胡杰主编. —兰州:兰州
大学出版社,2010.5

ISBN 978-7-311-03558-7

I. ①地… II. ①王… ②胡… III. ①地质灾害—
预防 IV. ①P694

中国版本图书馆 CIP 数据核字(2010)第 086341 号

责任编辑 魏春玲

封面设计 管军伟

书 名 地质灾害预防
主 编 王得楷 胡 杰
出版发行 兰州大学出版社 (地址:兰州市天水南路222号 730000)
电 话 0931-8912613(总编办公室) 0931-8617156(营销中心)
0931-8914298(读者服务部)
网 址 <http://www.onbook.com.cn>
电子信箱 press@onbook.com.cn
印 刷 兰州人民印刷厂
开 本 787×1092 1/16
印 张 12.25
字 数 159千
版 次 2010年6月第1版
印 次 2010年6月第1次印刷
印 数 1~10100册
书 号 ISBN 978-7-311-03558-7
定 价 46.00元

(图书若有破损、缺页、掉页可随时与本社联系)

是全社会
预防地质
灾害的
责任
和
义务
汪民

二〇〇九年十二月二十八日

国土资源部副部长 汪民题

防患于未然是地质灾
害防治的第一要务

汤中立

二〇一〇年四月二十六日

中国工程院院士 汤中立题

序言

灾害是由自然因素或人为因素，或二者综合作用影响下对人类的生命财产及人类赖以生存和发展的资源及环境造成危害和破坏的不幸事件或过程，其作为大自然与人类关系的一种动态演化过程，与人类认识自然、改造自然、相处自然是息息相关的。自然灾害与人类社会的进步、经济的发展和文明程度的提升等就如同一对孪生兄妹，始终存在于人类历史的进程中。地质灾害作为自然灾害的主要类型之一，在历史上曾给人类带来了无尽的伤痛，留下了许多不堪回首的记忆。

地质环境是人类赖以生存的基础，决定着人居环境的安全可靠性。大到城镇、农村、水电枢纽、矿山、铁路和公路干线，小到每一处高楼大厦、居民住宅和工程设施，都离不开地质环境所提供的安全保障。一旦这种保障不能实现，就会出现或发生地质灾害，导致人员伤亡和财产损失。从这个意义上讲，地质灾害是地质环境发生变化或破坏，造成人员伤亡、财产损失的事件，也可以理解为是地球环境恶化的直接后果。

“地质灾害”一词萌生于上世纪七八十年代。而对于地质灾害的防治却由来已久，应该与人类寻求安全的生活环境同时产生、同时发展。因此，人们对“地质灾害”的认识经历了一个十分漫长的过程，生命和财产的代价是认识过程中最为昂贵的成本。随着当今社会开发、建设和开采(矿山)能力的

跨越式、超强水平发展，人类对地质环境的作用与影响在某些方面已超过了自然地质作用的速度和强度，在全球地质环境变化中起着巨大作用，成为影响全球环境的重要力量，其影响结果最直接的表现之一就是地质灾害发生的频度和强度增大。据估计，全球发展中国家每年由地质环境恶化和地质灾害所造成的损失，达到国民生产总值的5%以上。在我国，地质灾害造成的损失约占各类自然灾害损失的35%。崩、滑、流等灾害的一次性规模虽小于地震，但其发生频度和广度却远高于和大于地震，近年来的年平均直接损失约20多亿元(2001—2008年)。

从上世纪50年代开始，从两次世界大战中解脱出来的各国政体，从文明发达和经济社会发展水平较高的国家开始，着手进行大规模的经济振兴发展计划，突发性地质灾害捉摸不定的发生时间、地点和方式，不断地对建设方案、工程和生命财产安全提出挑战。迫使各国从工程治理的“硬”措施，逐步向土地利用规划的“软”措施转变，与之相配套的是把地质灾害的防治战略上升到国家法律的高度——制定强有力的法律制度，“硬”性规定并约束个人和社会行为。同时还严格制订了土地利用规划和土地审批政策，为法律手段的贯彻执行提供了重要的保证。这也是国际防灾减灾战略重要转折的标志。

在制定和完善法律法规的同时，法国在上世纪50年代及时实行了滑坡灾害风险规划，日本也于上世纪80年代开始制定并实施了滑坡泥石流等地质灾害的相关法律法规。其它欧美发达国家在上世纪末的联合国“国际减灾10年”活动期间到本世纪初，也相继修编完善出台了有关规定和办法，意大利1998年的1998/180号法令，法国1995年的1995/101号法令，瑞士1991年的森林和洪水保护法和1997年的《滑坡灾害管理与土地规划指南》等，一系列法律法规和与之相配套的一整套土地利用规划和政策，均取得了十分良好的正面效果。

联合国组织在2000年指出：“城市规划和开发中迫切需要可靠的地质灾害危险性和风险区划，以致力于减轻地质灾害造成的人员伤亡和经济困难。”世界上大多数国家，尤其是发展中国家要达到这一步还需要相当长的道路。

也正因为如此，我国对防治地质灾害十分重视，先后出台了一系列相关的法规、政策，来指导与规范政府、社会及个人与地质环境“打交道”的行

为，明确了相应责任和义务。1998年国土资源部成立后，进一步加强了对地质灾害的防治工作，尤其是2004年3月起施行的国务院《地质灾害防治条例》，使我国的地质灾害防治和地质环境保护与管理工.作上升到了一个更高的平台和层面。与此同时，各省(市、区)也相应地出台了相关法规和管理规定，使地质灾害防治和地质环境保护工作逐步法制化、规范化。

地质灾害防治既是地质环境保护工作中最重要的内容，也是防灾减灾工作的重要环节，其所涉及的头绪十分纷繁，概括起来可包括预防、治理、救灾和灾后恢复重建四大方面。其中，以防为主是我国长期以来防灾减灾的基本国策。这是由我国的基本国情、经济发展水平和灾害自身的风险水平所决定的。对于地质灾害的防治也不例外。因此，预防在现实减灾工作中具有先决性和主导性的位置。

不同类型的灾害，其形成、发生、发展变化的规律各不相同。但在社会管理方面，对于各类灾害的预防管理的原则基本类同，而技术方法和措施上则差别较大，因而对从事专门工作的人员的素质要求很高。

灾害的防治是一项公益性、社会化和公众参与性很强的活动。灾害的预防是在灾害规律认识的基础上，通过政府的主导和倡导，以唤醒或提高大众及全社会的防灾意识和水平，从而达到将灾害损失降低到最低程度为目的的社会行为过程。生活在地质灾害易发区的广大群众，尽管具有长期以来与自然抗争的某些心理素质，但由于受防灾知识传播不够和知识水平及知识结构的限制，防灾意识普遍比较淡薄，在灾害面前仍然是手足无措，不知道该干什么、如何去干？5·12特大地震灾害及其引发的大规模、大面积次生地质灾害及抢险救灾的实践充分证明，提高全社会的防灾意识和灾害预防水平已刻不容缓。

本书以图文并茂的形式、浅显易懂的文字和形象直观的图表，采用略深于科普读物的形式，参考近年来国土资源部门宣传地质灾害防治知识的有关资料和科技文献，并结合编者多年来的工作经验，从我国地质环境保护和地质灾害防治管理的相关方面和预防地质灾害的角度，对我国境内分布、发育较为严重的崩塌、滑坡、泥石流、地面塌陷、地裂缝及地面沉降等6种地质灾害，在对各自概念、类型、危害、诱因、前兆及预防等内容总结叙述的基础上，重点对地质灾害预防领域内的相关知识进行了归纳和梳理，进而对预防地质灾害的若干方面，分门别类地进行了文字叙述和图片、图表展示，图片

资料的选用尽可能突出新颖和经典。同时，为了使广大读者能更加系统地了解、掌握国家在地质灾害防治、地质环境保护方面的相关政策和法律法规，书中专门对当前国内相关的主要法规条文进行了搜集汇总；也为了使基层国土资源部门在编制“应急预案”、“防治规划”和“年度防治方案”文本时有所学习和参考，书的最后还编印了相关的参考样板，并附有国务院《地质灾害防治条例》全部内容。其目的是以科技读物的形式，使生活在山区和地质灾害易发区的广大群众干部和相关人员，对地质灾害有更加深入的认识，在了解掌握国家方针政策的基础上，初步地掌握一些相关的预防知识、预防手段和方法，较快地普及或提高地质灾害预防科学技术知识。让灾害易发区群众在与自然相处的过程中，能更科学有效地保护自己的生命和财产；使管理人员和想了解掌握这方面知识的人员，有一个全面系统认识地质灾害预防科学技术的通俗读本；同时也有利于政府部门进行相关法律法规和政策的实施和推行。

这本书既是编者学习理解《地质灾害防治条例》的体会，也是长期以来从事地质灾害防治和地质环境保护的一些认识。同时也想表达一种愿望，这就是让广大山区的群众和干部，能够以快速、直观、通俗的方式掌握预防地质灾害的必要知识，以便能够自如地应对突发性地质灾害事件，并能够简要地了解政府相关的法规和政策，主动积极地配合政府做好防灾减灾工作。

本书在编写过程中得到了国土资源部、甘肃省国土资源厅和甘肃省科学院的领导及甘肃省科学院地质自然灾害防治研究所诸多科技人员的大力支持，在此一并表示感谢。在编写中还参考了诸多同行的文献和图片资料，因受篇幅限制，未能一一列出，我们在此衷心地感谢他们。

本书整体结构的构思和把握、科技内容和资料的准确性主要由王得楷负责，行政管理和政策法规部分由胡杰负责。

由于编写人员的水平有限，书中难免存在错漏和不足之处，恳请读者批评指正，以便在今后的研究与实践中不断完善和提高。

编者

2010年5月

Preface

The disaster is caused either by natural, artificial factors, or by both integratedly. It is a disastrous incident or a process, which often endangers people's lives and property, as well as destroys the indispensable resources and environment for human development. As a dynamic evolution process of the relationship between nature and human beings, it is closely bound up with human cognition, transformation and harmony with of nature. Natural disasters and human social evolvement, the development of economy and the improvement of civilization, and other such kind of things have always been coexisting in human historical process. In human history, geological disasters as one main type of natural disasters have left endless damages and unbearable memories to human beings.

Geological environment is the base for human beings to live in, which decides the safety and reliability of human living environment. From towns, countries, hydraulic power pivots, mines, railways and highways main stems to every skyscraper, a resident's dwelling house and engineering facilities, all these things can not be without the protection of geological environment. Once the protection can not be assured, geological disasters will come into being, and lead to casualties and property losses.

The word 'geological disaster' first came out in the seventies or eighties of the last century. But the protection and control of geological disasters has already existed for a long time. It came into being simultaneously together with human beings' search for the safe living environment and developed all together. Therefore, people's cognition of 'geological disasters' has experienced a long process, during which both lives and property are the high prices human being have to pay. With the super-conventional and leaping development,

the speed and intensity that human beings have acted on nature have greatly exceeded those of nature itself, which also plays a big part in the global geological changes and has become one essential factor to influence the environment. One of the direct consequences is the increase in the frequency and intensity of geological disasters. It is estimated that the damages caused by geological environmental deterioration and geological disasters in developing countries throughout the world cover more than 5 percent of their countries' GNP. In China, the damages caused by geological disasters cover about 35 percent of various natural damages. Although the direct size of the disasters of collapse, landslides, debris flow and other things like these is less serious than that of earthquakes, its frequency and scope are much larger than the later. In recent years, the direct damages average to more 2 billion Yuan.

Since the fifties of the 20th century, the states released from the two world wars, especially those highly civilized developed ones launched into large scope of economic stimulation and development projects. Meanwhile, casual geological disasters, together with unpredictable occurrence time, location and ways, constantly endanger the safety of construction plans, projects and lives and property. All these have compelled states to change their 'hard' measures of engineering control into 'soft' measures of land usage layout. The strategy of prevention and control of geological disasters have been accordingly put into our national legislation, which offers a forceful legal system to scientifically guide and strictly control personal or social behaviors of using lands. Meanwhile, the policy to plan, examine and approve the usage of land has also been established, ensuring the relevant legislation to be carried out effectively. All of the above illustrate the important transition in the global strategy of preventing and controlling of disasters.

Laws are being constituted and perfected throughout the world, but in the fifties of the 20th century France had put laws on prevention

and control of landslides and debris flow into practice, and Japan also carried out the relevant laws in the early eighties of the last century. From the end of last century, when the UN held the activities of 'International Decade for Natural Disaster Reduction', to the 21st century, other developed European countries have also set up and matured the interrelated laws gradually, such as Italian 1998/180 Decree in 1998, French 1995/101 Decree in 1995, Swiss Decree on the protection of forests and prevention of floods in 1991 and the manual of landslide disaster management and land layout in 1997 and other laws like these. These series of laws and policies on land usage planning have brought great positive efforts.

In 2000 the UN pointed out 'it is urgent to classify the dangers of geological disasters truly in city planning to reduce the casualties and economic difficulties caused by the disasters.' For most countries, especially the developing countries in the world, there is still a long way to go.

Out of the above reasons, China has always been paying great attention to the prevention and control of geological disasters, and successively implemented a series of interrelated laws and policies, which define duties and obligations, to guide and regulate governmental, social and personal behaviors concerning geological environment. Since the Ministry of Land and Resources P.R.C was established in 1998, the prevention and control of geological disasters have been greatly reinforced. The Regulations on Geological Disasters Prevention and Control issued by the State Council in March, 2004 have highly improved the geological disasters prevention and geological environmental protection in China. Meanwhile, the provincial, civic and local governments also put relevant laws and policies into practice, which gradually regulates the work in geological disasters prevention and environmental protection.

Geological disasters prevention is not only the foremost part of geological environmental protection but also the significant segment

of disasters prevention and relief. Therefore, it covers wide scope of complex work, which can be generally divided into four aspects: disasters prevention, disasters control, disasters relief and post-quake restoration and reconstruction. The policy that prevention goes first has always been our country's basic state policy in disasters prevention and relief, which is determined by our country's fundamental realities, economic development, and the dangerous levels of disasters. Out of question, in geological disasters prevention, we should also consider prevention first.

For various types of disasters, the rules of the formation, occurrence and development of disasters are different. So, although the preventions of various disasters are basically the same in the view of social management, the methods and measures are radically different, which highly demands the specialists in their professional qualities. Disasters prevention is also a public welfare, and social activity with high public participation. Disasters prevention is also a social behavioral process that governments often base on the rules of disasters to guide and direct the common people, in order to arouse or enhance the public and social awareness of disasters prevention and prevention levels, so as to reduce the damages to the lowest level. Although people living in the areas with frequent geological disasters have got good psychology in the long time of fighting with nature, their awareness of disasters prevention is not strong enough, or even indifferent for their limitation of knowledge and lack of disasters prevention knowledge spreading. So when they are facing disasters, they are always at a loss. '5·12 Earthquake' and its large-scale secondary geological disasters illustrate that it is greatly urgent to improve social disasters prevention awareness and disasters prevention levels.

In order to be easily understood by readers, the book is written in simple language and illustrated with many pictures and graphs, which is a bit more difficult than those popular science reading

materials. In the book, the author also refers to the current interrelated publicized materials and scientific and technological documents of the departments of land and resources in China, which are mainly about geological disasters prevention and control. At the same time, basing on his working experience of many years, the author, from the view of our country's geological disasters prevention and control management, generalizes and collates the relevant knowledge concerning geological disasters prevention, which touches upon the wide-spread and serious geological disasters of collapse, landslide, debris flow, ground collapse, ground crevasse and ground subsidence, meanwhile the author generally sums up the definitions, types, dangers, inducements, auspices and prevention of those disasters. Furthermore, in classification the author narrates several fields of geological disasters, illustrating with pictures and graphs which are often the typical and latest ones.

In order to help readers to roundly understand the policies and laws on geological disasters prevention and control in our country, the author gathers the current interrelated legal items; the author also offers some legal document samples, together with the Regulations on Geological Disasters Prevention and Control issued by the State Council, to help departments of land and resources at ground roots to compile 'Contingency Plan', 'Prevention Programs', 'Annual Prevention Projects' and other such texts. In a style of somewhat popular reading materials of science and technology, this book is very useful in helping people and cadres living in the mountains and some areas with frequent geological disasters to know geological disasters deeply and to master some knowledge of prevention measures and ways, which will popularize and improve geological knowledge spreading, as well as helps people to protect their own lives and property, offers governors wanting to know something in this aspect to get a popular book, and makes it easy for governmental departments to carry out some relevant laws or regulations.

This book is the reflections that the author got when he studied Regulations on Geological Disasters Prevention and Control, as well as the generalization of his working experience in his field work of preventing geological disasters and protecting the geological environment. In the book, the author also hopes that relying on the book common people and cadres in mountains can easily, directly and quickly to know the knowledge of unexpected geological disasters and relevant local regulations and policies, then to cooperate with the government to do the work of disasters relief better.

While the book is being compiled, the author receives a lot of help from the leaders of Department of Geological Environment affiliated to Ministry of Land and Resources, Gansu Provincial Land and Resources Office, Gansu Academy of Sciences, and Geological Hazards Prevention Institute, appreciations are due to them. Appreciations are also due to Mr. Zhang Manyin, who has helped the author to surf the internet to get and collate relevant materials, edit and adjust the words and illustrations, and proofread the drafts. In compiling the book, the author also refers to some scholars' documents, illustrations and other materials, for the content limitation, the author cannot appreciate one after another here, but whole-hearted appreciations are due to them as well .

The general structure, scientific and technological content and materials veracity of the book is in the charge of Wang Dekai; the part of administrative management, regulations, policies, and laws is in the charge of Hu Jie. As for the scope of the author's knowledge, some misunderstandings or shortcomings cannot be avoided, welcome readers to help the author to correct them, thus to improve the research and practice in the future.

Author

May 2010, Lanzhou

目 录

概论 / 1	崩塌 / 21
滑坡 / 32	泥石流 / 50
地面塌陷 / 66	地裂缝 / 75
地面沉降 / 82	群测群防 / 90
应急预案 / 103	防治规划 / 109
年度方案 / 113	法规条文 / 116
附件 / 121	
附件一 / 122	附件二 / 136
附件三 / 152	附件四 / 161
参考资料 / 173	编后语 / 176

概 论

- 1.1 地质灾害的概念及其内涵
- 1.2 我国地质灾害分布、发育概况
- 1.3 我国地质灾害防治的管理
- 1.4 地质灾害险情、灾情及其等级划分
- 1.5 地质灾害防灾减灾体系的构成
- 1.6 防灾减灾工作的主要原则、制度和措施
- 1.7 地质灾害预防的必要性及意义
- 1.8 地质灾害预防工作的基本要求
- 1.9 地质灾害预防工作体系的构成
- 1.10 地质灾害监测、预警、评估及调查