中国北方草原火灾风险评价、预警及管理研究

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内 容 简 介

　　本书针对草原火灾这一经典论题，从宏观的时空视野、多学科交叉的角度，以多源数据融合的方法，用翔实的数据、先进的技术和缜密的逻辑研究了草原火灾风险评价、预警和管理，系统地论述了草原火灾的成灾机理与致灾过程、风险内涵与形成机制、风险评价、预警和管理的基本理论、内容框架、通用程式与实用的数量化方法，给出了大量的应用实例，并尽可能地反映草原火灾风险评价、预警和管理研究的最新发展。最后，介绍了草原火灾综合风险管理的理念，探讨了草原火灾综合风险管理的对策及其实施过程和实施战略，并且提出了我国实施草原火灾综合风险管理的建议。本书可供从事草原灾害的管理人员、研究人员、业务人员阅读和参考，还可供政府减灾管理部门的管理人员、保险工程技术人员参考使用，也可作为高等院校相关专业研究生的教学参考书。

Introduction

This book talks about the classic topic of grassland fire disaster, and studies on the risk assessment, early warning and management of grassland fire disaster from a macro perspective of time and space, and interdisciplinary perspective, with multi-source data fusion method, detailed data, advanced technology and meticulous logics. Systematically discusses the basic theories, research framework, common program and practical quantitative method of disaster mechanism and hazard-formation of grassland fire disaster, content and formation mechanism of risk, risk assessment, early warning and management. Large numbers of application examples are given to reflect the latest development of grassland fire risk assessment, early warning and management study. Finally, this book describes the idea of integrated risk management for grassland fire disaster, and discusses the integrated risk management countermeasure, implementation process and implementation strategy of grassland fire disaster, and proposes a suggestion on the implementation of integrated risk management for grassland fire disaster in our country. This book is available for the managers, researchers and business people who are engaged in grassland disaster for read and reference, and it also for the technical officers in government disaster management department and technical

person in insurance to be used and referred, and it can be also used as the teaching material for higher institution's post-graduates.

第 一 著 者 简 介

张继权，男，1965 年 2 月出生，吉林九台人，日本鸟取大学联合农学研究科生物环境农学博士、日本学术振兴会外国人特别研究员、日本京都大学防灾研究所博士后。现任东北师范大学城市与环境科学学院自然灾害研究所所长、教授、博士生导师，兼任中国草学会草原火专业委员会常务副理事长兼秘书长、中国灾害防御协会风险分析专业委员会理事和副秘书长、中国自然资源学会资源持续利用与减灾专业委员会委员、农业部草原防火专家组专家。

长期致力于综合灾害风险研究，首次提出了基于致灾机理的综合自然灾害风险评价与管理理论，并初步建立起了比较完整和实用的自然灾害风险评价与管理理论、程式与技术方法体系、数量模型及相应软件系统。近年来，先后主持各种科研课题 40 多项，其中国家自然科学基金 2 项、国家公益性行业（农业）科研专项 1 项、973 计划前期研究专项 1 项、全球变化研究国家重大科学研究专题 1 项、国家"十二五"农村领域科技支撑 1 项、国家"十一五"科技支撑 4 项、高等学校博士学科点专项科研基金 1 项、农业部草原防火专项 1 项。起草了农业行业标准《草原火灾损失评估规程》1 项。发表学术论文 130 多篇，其中 SCI 检索 10 篇，EI 5 篇，ISTP 30 篇，出版学术著作 5 部。

Biography of First Author

Jiquan Zhang, male, was born in February 1965 from Jiutai, Jilin Province. He is the agricultural doctor of biological environment of Tottori University in Japan. He is the special fellows of foreigners in Japan society for the promotion of science, and the post-doctor in Disaster Prevention Research Institution of Kyoto University in Japan. Now, he is the head of the natural disaster research institution, professor and Ph. D. supervisor in Northeast Normal University, and also he is the First Deputy Director General and secretary of professional committee of grassland fire in Chinese society of grass, director and assistant secretary of Risk Committee of China Association for Disaster Prevention, member of Sustainable Use of Resource and Professional Committee of Disaster Mitigation of China Society of Natural Resources, and expert of fire prevention group of agricultural department.

Long term commitment to integrated disaster risk assessment, he proposed the integrated disaster risk assessment and management theory based on information mechanism at first time, and initially established more completed and practical theory, program, technique methodology, quantitative model and related system of natural disaster risk assessment and management. In recent years, he hosted more than 50 projects of various research, in which 2 projects of the National Natural Science Foundation of China, 1 project of the National Scientific Research Special Project of Public sectors (Agriculture) of China, 2 project of the National Grand Fundamental Research 973 Program of China, 1 project of the National Key Technology R&D

Program of China，4 projects of the National Key Technology R&D Program of China in the eleventh "five-year" plan，1 project of specialized research fund of doctoral program in universities. He established the agricultural standard for "grassland fire disaster damage assessment procedure". He published more than 130 academic papers，in which 10 papers are embodied by SCI，5 papers are embodied by EI，25 papers are embodied by ISTP，and published 5 academic works.

序

我国是一个草原大国，拥有天然草原近 4 亿公顷，占国土总面积的 41.7%，居世界第二位。我国草原主要集中在西部欠发达地区，也是少数民族分布最集中的地区。草原是国土的主体和陆地生态系统的主体，是我国面积最大的绿色生态屏障，是维护国家生态安全的重要资源，是牧区畜牧业发展的物质基础。同时，我国也是世界上发生草原火灾比较严重的国家，在近 4 亿公顷草原中，火灾易发区占 1/3，火灾频发区占 1/6。特别是近年来，随着我国草原保护建设工程的实施，草原植被得到有效恢复，可燃物明显增多；随着全球气候变化和人类活动的增多，草原火险等级逐步攀升，草原火灾正呈现出从春秋两季多发向全年延伸的新趋势；随着牧区经济社会发展加快，草原上的设施设备不断增加，草原火灾造成的直接经济损失不断加大。草原防火工作事关农牧民群众生命和财产安全，事关草原生态安全和畜牧业发展，事关边疆民族团结和社会稳定。因此，做好草原防火工作，任务繁重，意义重大。

我国草原地广人稀，再加上草原火灾发生的原因极为复杂，涉及天气、气候、地形、植被等自然因素以及社会因素，因此其发生具有一定的随机性和不确定性。草原火灾突

发性强、发展快、蔓延迅速、破坏性大，一旦发生，处置救助较为困难，危害较为严重。因此，加强草原火灾风险评价、预警和管理研究，增强草原防火工作的主动性和预见性，实现从目前灾后被动的危机管理模式向灾前预警、灾时应急、灾后救援"三位一体"的草原火灾风险综合管理与控制模式转变，过于贯彻落实"预防为主、消防结合"的方针、提高对草原火灾的综合防控能力具有重要的现实意义。

当前灾害风险评价与管理研究是灾害学领域中研究的热点。灾害风险管理是对人类社会中存在的各种风险进行识别、估计和评价，并以此为基础优化组合各种风险管理技术，做出风险决策，从而对风险实施有效地控制。因其将灾前降低风险、灾害时的应急对应和灾后恢复三个阶段融于一体，对灾害实行系统、综合管理，因此逐渐受到国内学者和各级政府的高度关注。

近十年来，国内外广泛开展了地震、洪水、干旱等灾害的风险评价与管理研究，但对草原火灾研究很少。在草原火灾研究方面，目前多侧重于草原火行为（火灾危险性）、火险预报与区划、火管理等研究，对草原火灾风险内涵与形成机理、风险评价、预警标准和风险管理还比较薄弱。通过研究草原火灾风险孕育机制、评价方法与技术体系，对草原火灾进行风险评价，并根据风险评价结果，进行草原火灾早期预警，提出合理可行的防范和减缓措施，以便在草原火灾发生前就能采取行动降低风险，把火灾控制到最低水平，已成

为一项十分紧迫的任务。该书是作者在"十一五"国家科技支撑计划项目"草地灾害评估与治理关键技术研究（2006BAD16B04）"、公益性行业（农业）科研专项"草原火灾应急管理技术（200903041）"、国家自然科学基金项目"基于多源信息融合的草原火灾风险评价体系构建及其在应急管理中的应用研究（40871236）"资助下取得的草原火灾风险评价、预警和管理方面的最新研究成果。

该书从基本理论和研究方法入手，系统地论述了草原火灾的成灾机理与致灾过程、风险内涵与形成机制，提出了风险评价、预警的指标体系和模型，阐述了草原火灾综合风险管理的基本理论、内容框架。在此基础上，探讨了草原火灾综合风险管理的对策及其实施过程和实施战略，并且提出了我国实施草原火灾综合风险管理的建议。该书资料翔实、内容丰富、针对性强，是草原火灾研究领域不可多得的一本好书，将为各级草原防火管理部门制定草原火灾日常管理的对策、应急预案体系和减灾规划及防火救助等提供科学依据和技术支撑。同时，该书的出版将有助于推动我国草原火灾风险管理研究的进程，增加全民的草原火灾风险和防火避险意识。

农业部草原监理中心主任

Prodrome

China is a big grassland country, having 400 million hm² natural grasslands, occupied 41.7% of the total land area, just behind the Australia, ranking the second in the world. China's grasslands mainly concentrate in remote backward area in the west, is also the most concentrated areas of minority nationality and the key and difficult areas focusing on building a well-off society. Grassland is the main land and main part of terrestrial eco-systems, and is the largest green barrier in China which is an important resource of safeguarding national eco-safety; and it is the important material basis for livestock development in agriculture and pastoral area. Meanwhile, China is the most serious state of grassland fire disaster in the world. In the nearly 400 million hm² grasslands, fire-prone area account for 1/3, frequently-happen area account for 1/6. Especially in recent years, with the implementation of the protected construction for grassland in China, grassland vegetation get effective restoration, grassland fuel increased significantly; with the enhancement of global climate and human activity, the grassland fire danger is gradually rising, grassland fire is showing the new trend that is extending from high incidence in spring and autumn to the whole year, grassland fire threaten is increasing; with the development acceleration of economy and society in pastoral area, the facilities in grassland are increasing constantly, the direct economic losses caused by grassland fire are increasing constantly. The grassland

fire prevention is related to the safety of life and property of people in pastoral area, ecological security of grassland and development of animal husbandry, national unity and social stability in minority nationality area in china's border. Therefore, we face arduous tasks in grassland fire prevention, and it is very important.

China's grasslands are almost the areas which have very big land and sparse people, and the factors causing grassland fire disaster include climatic and meteorological factors, natural factors related to the earth surface condition and socioeconomic factors in connection with conditions of human being and society etc. Therefore, grassland fire disaster occurs randomly and uncertainly. Because grassland fire has characteristics with suddenly happening, and rapidly developing and spreading, once it happens, it is rather difficult in relief and disposal, and causes serious damages. And therefore, reinforcing the study on risk assessment, early warning and management for grassland fire, and enhancing the initiative and foreseeability of grassland fire prevention, realizing the change from passive mode of post-disaster crisis management to trinity grassland fire integrated risk management and control mode that contains pre-disaster warning, emergency during disaster and post-disaster relief have an important practical significance for carrying out the policy of "prevention first, combining with the firefighting", and enhancing comprehensive prevention and control ability of grassland fire disaster.

Currently, the study of disaster risk assessment and management has become to the hot spot in the research field of disaster. Disaster risk management is to identify, estimate and assess

all kinds of risk existing in human society, to optimize and combine the risk management technology, and to make risk decision, and then so it can implement effective control of risk. It integrates the pre-disaster risk reduction, the emergency corresponding during disaster and the post-disaster recovery so as to make systematic and integrated management for disaster, and so it was valued for domestic and foreign scholars and government at all levels.

In recent years, an increasing number of studies on natural disaster risk assessment and management are focusing to flood disaster, earthquake disaster, and drought disaster etc. , whereas less attention has been focused on grassland fire disaster. Grassland fire disaster is inevitable and it is impossible to fully recoup the damages caused by it. But to some extent it is possible to minimize the potential risk by assessing and comparing risk to raise risk awareness, developing early warning strategies for grassland fire disaster. The occurrence of grassland fire disasters is due to natural factors or human factors or their interaction. But traditional grassland fire disaster is often limited to the studies on the fire behavior model, fire hazard, and fire hazard forecast model, but less attention has been focused on formation principle, risk assessment, early-warning and risk management of grassland fire disaster. It has become a very emergency task to assess grassland fire disaster fire by researching formation principle, assessment method and technology of grassland fire disaster, and then to make early-warning for grassland fire disaster on the basis of risk assessment result, and propose reasonable and practical preventing strategy and mitigation measures so as to have implementation to reduce the risk danger be-

fore grassland fire disaster happening, and to control grassland fire disaster to the lowest level. This book is written by the authors based on new research results on risk assessment, early-warning and management of grassland fire disaster supported by the 15th National Key Scientific and Technological Project: study on key technology for assessment and governance of grassland disasters under Grant No. 2006BAD16B0422, the National Scientific Research Special Project of Public sectors (Agriculture) of China: study on emergency management technology of grassland fire disaster under Grant No. 200903041, the National Natural Science Foundation of China: The construction of grassland fire disaster risk assessment system and its application of emergency management based on multiple sources information fusion under Grant Nos. 40871236.

The book is started from basic theories and research methods, systematically discussed the disaster-caused mechanism and damage process, risk formation principle of grassland fire disaster, and then proposed the index system and model of risk assessment and early warning, described the basic theory and content framework of integrated grassland fire disaster risk management. On this basis, the countermeasures of integrated grassland fire disaster management and its measurement process and measurement strategy were discussed, and also the suggestions about how to measure the integrated weather disaster risk management in China were put forward. This book is a rare good book in the field of grassland fire disaster with informative data, abundant contents and well-targeted, and it will provide scientific basis and technique support for grassland fire prevention department at all levels in formulating the countermeasure of daily manage-