荒漠生态系统功能评估与服务价值研究

（第二版）

荒漠生态系统服务功能监测与评估技术研究项目组　著

科学出版社

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内 容 简 介

本书以我国荒漠生态系统为研究对象，采用集成创新方法，首次构建了荒漠生态系统服务评估指标体系，创建了荒漠生态系统服务综合评估模型，全面核算出我国荒漠生态系统防风固沙、土壤保育、水文调控、植被和土壤固碳、生物多样性保育、沙尘生物地球化学循环、景观游憩等主要服务的实物量和价值量。本书资料翔实、内容丰富，是我国荒漠生态系统服务评估成果的集中展示，也是国内外第一部关于荒漠生态系统服务评估研究的专著。

本书可供从事干旱区生态经济学和荒漠生态学等领域研究的科技工作者和高等院校相关专业师生参考。

图书在版编目（CIP）数据

荒漠生态系统功能评估与服务价值研究/荒漠生态系统服务功能监测与评估技术研究项目组著. —2 版. —北京：科学出版社, 2016.11
ISBN 978-7-03-050808-9

Ⅰ.①荒… Ⅱ.①荒… Ⅲ. ①荒漠–生态系–环境生态评价–研究–中国
Ⅳ.①P942.073

中国版本图书馆 CIP 数据核字(2016)第 280445 号

责任编辑：杨帅英　张力群 / 责任校对：何艳萍
责任印制：肖　兴 / 封面设计：图阅社

科学出版社 出版
北京东黄城根北街 16 号
邮政编码：100717
http://www.sciencep.com

中国科学院印刷厂 印刷

科学出版社发行　各地新华书店经销
*
2014 年 7 月第　一　版　开本：787×1092　1/16
2016 年 11 月第　二　版　印张：14 1/4
2017 年 3 月第二次印刷　字数：310 000

定价：139.00 元

(如有印装质量问题，我社负责调换)

Functions Assessment and Services Valuation of Desert Ecosystem in China

(Second Edition)

By China Desert Ecosystem Functions and Services Research Team

Science Press

Beijing

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序　一

近年来，生态系统服务作为生态学研究的一个国际热点，并逐渐被纳入到生态学、生态经济学等学科领域，其中生态系统的功能、产品和服务的价值核算成为研究焦点。由于人们长期对生态系统服务及其重要性缺乏了解，对自然资源进行掠夺性开发，加之生态系统受人类活动的影响和干扰日益加剧，致使全球性的生态系统严重退化、生态系统功能大大降低，如出现土地荒漠化、水土流失、物种减少、干旱缺水等一系列生态环境问题。生态系统服务是指人类从生态系统的各项功能所获得的各种收益。因此，人们逐渐认识到生态系统的服务是人类生存发展与现代文明的基础，生态系统服务不仅为人类的生产和生活提供必需的生态产品，而且创造与维持了地球生命支持系统，形成了人类生存所必需的环境条件。

荒漠生态系统是发育在降水稀少、蒸发强烈、极端干旱环境下，植物群落稀有的生态系统类型，是陆地生态系统的重要组成部分，也是我国西北干旱区代表性的生态系统类型，具有独特的结构和功能，亦是沙尘暴的主要发源地。

多年来，人们对荒漠生态系统服务的认识还处于初始阶段，只要一提到荒漠，多数人马上想到的就是沙尘暴，即扬沙浮尘漫天、出门睁不开眼、满身是土的情景。老百姓都熟知老子那句话，“福兮祸所伏，祸兮福所倚”。沙尘暴除了造成严重的大气环境污染，对农业、工业和交通造成巨大损失外，还具有一系列的正效应。例如，土壤形成，即当沙尘落到陆地，经过多年发育形成可满足植物生长的肥沃土壤；沙尘中和酸雨效应，即沙尘所携带的碳酸盐和可溶盐与大气中酸性离子发生中和；沙尘的“阳伞效应”，即降低太阳辐射从而减缓气候变暖；沙尘的“冰核效应”，即沙尘气溶胶可作为云的凝结核或冰核，从而增加降水等；沙尘的“铁肥效应”，即沙尘气溶胶中含有大量的铁元素，这些粒子随着气溶胶的沉降，为海洋生物提供所需的营养元素。另外，荒漠生态系统具有较强的水文调控服务，如形成凝结水、地下储水、净化水质等。荒漠中还有独特的动植物，譬如肉质植物仙人掌、胡杨、藏羚羊、野骆驼、野牦牛等，且生物资源中蕴藏了大量可供人类利用的药用资源。尽管荒漠地区植被稀疏，但由于面积巨大，除了有防风固沙之功效以外，其固碳能力也非常可观。而且，沙漠作为荒漠生态系统分布最广的一种类型，有众所周知的沙漠奇观，譬如有“上帝画下的曲线”之称的巴丹吉林沙漠，沙山绵连起伏，如同波浪，有雄浑苍凉之美，唐代诗人岑参则吟唱沙漠“黄沙西海际，百草北连天”。而荒漠地区中的绿洲，盛产水果，以汁多味甜而著称。

但是长期以来，由于对荒漠生态系统服务及其在维持干旱区社会经济发展和减贫方面的重要性缺乏研究，加之荒漠生态系统服务研究一直处于定性描述的初级阶段，而未能进行量化，致使荒漠生态系统持续处于过度开发利用的状态，已经开始由结构性破坏向功能性紊乱的方向发展，由此引起区域性的水资源短缺、风蚀沙化、生物多样性丧失

等，对我国干旱区的社会稳定和生态安全造成严重威胁。因此，对荒漠生态系统服务进行科学、量化的评价，对生态产品价值进行量化，是一项紧迫而又必须完成的任务。

该书基于全国 17 个荒漠生态站长期、连续的大量观测数据，以及国家林业局第四次（2009 年）全国荒漠化和沙化监测结果，采用典型案例、问卷调查、尺度转换、遥感解析、综合评估模型等多学科交叉的集成创新方法，对不同地域、不同类型的荒漠生态系统的结构、功能及过程进行深入的研究，并有效克服了以往评估的局限性及不足，从而完成了荒漠生态系统防风固沙、土壤保育、水文调控、固碳、生物多样性保育和景观游憩六个主要生态服务的实物量和价值量的定量估算。譬如，估算我国荒漠地区植被每年固沙量 378.35 亿 t、沙尘搬运可形成土壤 151.98 亿 m^3、沙漠和沙地每年产生凝结水 70.14 亿 m^3、植被每年固定 CO_2 6.11 亿 t 等实物量评估结果。同时以 2009 年为基准年份，得到我国荒漠地区当年产生的生态服务价值高达 3.08 万亿元，约占当年我国 GDP 的 9.05%的价值量评估结果。

我国是世界上受荒漠化影响最严重的国家之一，也是亚洲沙尘的最重要源区之一。该书对荒漠生态系统服务功能的系统研究和定量评估，不仅可以扭转人们对沙尘功能和作用的认知，重新认识沙尘所带来的正效应，而且有助于加深决策者、管理者和使用者对我国荒漠生态系统服务的特征、空间格局及影响因素，以及荒漠生态系统与人类福祉之间相互关系的科学认识和理解，特别是我国荒漠生态系统碳储量估算，可以增进荒漠地区固碳功能对减缓气候变化重要性的认知。

该书研究和评估结果具有科学性、准确性，不仅标志着我国荒漠生态系统服务进入了量化研究的新阶段，而且填补了我国在荒漠生态系统服务定量评估方面的空白，也为生态系统服务及其价值评估奠定了可靠的生态学基础。为此，我愿意将此书推荐给我国的广大公众、生态经济学和荒漠生态学等相关专业的科研人员，以及相关政府部门的决策管理人员，希望此书对他们有所裨益。

蒋有绪

2014 年 3 月

Foreword I

In recent years, the ecosystem services are prioritized as one of worldwide hotspot in international ecology research, and are gradually integrated into the scientific disciplines of ecology, ecological economics, in which the value costs of ecosystem functions, products and services are targeted as main concerns of scientific research sector.

Due to the weakness of the awareness of the importance of ecosystem service, natural resources were exploited in unsustainable way. In addition, the ecosystem was negatively affected and increasingly disrupted by human intervention and economic activities, the global ecosystem is seriously degraded and the function of ecosystem is rapidly declined, such as the occurrence and spread of land desertification, soil erosions, loss of species, drought and aridization and other series of eco-environmental issues.

Ecosystem service refers to a various benefits the human derived from the ecosystem functions. Consequently, human being recognizes gradually that ecosystem service is the base of human existence, development of modern civilization. Ecosystem service does not only provide the necessary ecological products for human economic production and daily life, but also create and maintain guarantee systems of the earth life, which consists of necessary environmental conditions for human existence.

Desert ecosystem is an ecosystem pattern with sparse plant community that developed in the extreme arid environment with scarce rainfall, high evaporation, and it is an important component of terrestrial ecosystems. It is also specific ecosystem pattern of arid zone and is characterized by unique landscapes and functions in Northwest China and also the main sand sources areas of dust and sand storm.

Over decades, people are lack of awareness of the desert ecosystem services, and the majourity of people will immediately think of the images of dust and sandstorm when talking about the desert, namely, blowing dusts and shifting sands suspend in sky and people could not open eyes and citizens are affected by floating dusts in open field. People are well acknowledged the ancient proverb of Lao Tzu (4^{th} Century BC) "From disaster forture comes, in forture lurks disaster".

Dust and sandstorm do not only cause serious atmosphere environmental pollution and huge losses of agriculture, industry and communication, but also brings about some of direct effects. For instance, dusts and sands flown and deposited on terrestrial surface will be transformed into fertile soil for plant growth after a certain of years of development.

Dusts can neutralize acid rain effects. Namely, the carbonate and soluble salt contained in dust-sands can be neutralized with the acidic particles in the atmosphere. The "umbrella effect" of dust can reduce solar radiation and consequently slow down the global warming; The "ice nuclei effect" of dust namely the dust aerosols, as cloud condensation nuclei or ice nuclei, can consequently increase precipitation. The "iron fertilizer effect" of dust, namely

rich iron particles contained in the dust aerosols, can provide necessary nutrient elements to the marine organism along with the sedimentation of these dust aerosols.

In addition, the desert ecosystem is characterized by its strong hydrological regulation services, such as the formation of condensation water, underground water storage, water purification and so on. There is a unique desert flora and fauna, such as succulent cactus, Populus, Tibetan antelope, wild camels, wild yak, etc., and rich of herb medicines in these botanic resources which can be edible and used for human being.

Although vegetation coverage is sparse in desertification-prone areas, it covers huge areas, and can sequestrate carbon in large quantity except its high effectiveness to reduce wind and control shifting sands. Moreover, sand desert is one of widely distributed landscape pattern in desert ecosystems and is characterized by unique and well-known desert scene, such as the Baidan Jilin Sand Desert, which is named as the "curve drawn by God." Undulating sand dunes extend wildly on sand sea with forceful momentum and desolate nature beauty. Cen Shen, an ancient Poet in the Tang Dynasty chanted and wrote "yellow sands stretch westward to the ocean and luxuriant grasses connect northward to the heaven". However, oasis in desert region is well known due to rich produce of juicy and sweet fruits.

Over a long period of time, due to less concern and insufficient studies on desert ecosystem service and its importance in maintaining socioeconomic development and poverty alleviation in arid regions, the research on desert ecosystem service was at the position of primary qualitative description stage and it is not appropriately quantized. Desert ecosystem thus is continuously over exploited and over-utilized. Consequently, it develops from compositional destruction to functional disturbance. As a result, lack of water resources at regional level is caused, wind erosion and sand encroachment occurred and loss of biodiversity was brought about. This negative consequence brings about serious threat to social stability and ecology security in arid regions of China. For this reason, a scientific and quantitative assessment of desert ecosystem service, and a quantization of value of ecology products are essential and urgent targets that must be completed.

This book is based on the long-term and running observation data from 17 desert ecology stations and the final monitoring results of the Fourth Nationwide Desertification Monitoring and Desertization (sand movement) conducted by the State Forestry Administration in 2009. New methods, including case studies, questionnaires, scale convertibility, remote sensing and interpretation, integrated evaluation model and other multi-disciplinary cross-cutting creation and innovation are used to conduct deep studies on structure, function and process of different desert ecosystem in different regions. The insufficiency and limitation on evaluation in past were effectively overcame. Thus, the quantitative estimation of the physical quantity and moneraty value of desert ecosystem service were completed, including the following seven key targets of desert ecosystem service, wind-sand control, soil conservation, hydrological regulation, carbon sequestration, biodiversity conservation, and landscape recreation. For example, it is estimated that vegetation coverage in deserts of China stabilizes annually 37.835 billion tonnes of shifting sands, 15.198 billion m^3 of soil is transformed from dust-sand deposits per year, about 7.014 billion m^3 of condensation water is formed in a year, and 611 million tonnes of CO_2 is sequestrated every year. Meanwhile, taking 2009 as the datum year, the annual value of desert ecosystem services in China is estimated as high as 3084 billion

Chinese Yuan, accounting for 9.05 percent of China's GDP of the value assessment in the very year.

China is one of the seriously affected countries by desertification in the world and one of the main sand source originating areas in Asia. The book is focused on systematic studies and quantitative evaluation of desert ecosystem service will not only help people understand the function and significance of dust-sands and re-cognize correctly the direct effects of dust-sands, but also will benefit decision makers, land managers and land-users to recognize and understand correctly the scientific characteristics of desert ecosystem service, spatial patterns, affecting elements and the relationship between desert ecosystem and human well-being. Particularly, the accurate estimation of carbon reserves of desert ecosystem will raise our recognition of the importance of carbon sequestration function to slow down climate change.

The studies and evaluation results of this book are science-based and accurate and they indicate that desert ecosystem service in China comes into new stage of quantitative study. At the same time, they fill in the gap in quantitative evaluation aspect of desert ecosystem service and lay a reliable ecologic base for evaluating desert ecosystem service and its value. Therefore, I would like to recommend this valuable book to public society, academia in ecologic economics, desert ecology and other professional fields, technicians and development personnel, decision makers, planners, and governmental officers and hope all of the readers will benefits from this book.

Jiang youxu
March, 2014

序　二

20 世纪 60 年代以来，世界上人口、资源和环境以及社会经济的不协调发展造成的全球性问题日益激化。荒漠化扩展、生态系统退化、生物多样性丧失、气候变暖、自然灾害等带来的负面效应不断加剧，且具有全球性的特点，并日益严重地威胁着人类的生存与发展。如何保证地球生态系统成为适于人类生存与可持续发展的生命支持系统，以及各国政府如何对生态系统管理、自然资源保护以及应对全球变化等进行宏观决策，已经成为当前最紧迫的重大任务。

1935 年，英国生态学家 Tansley 提出了生态系统（ecosystem）的概念，随即得到广泛传播和普遍应用。20 世纪 50 年代以来，随着生态学理论和方法的不断发展，人们对生态系统的结构和功能的认知日益加深，并逐步认识到生态系统的重要性。生态系统不仅在维持生命支持系统和环境动态平衡方面起着不可替代的重要作用，同时还为人类提供各种生态产品和服务。随着人类活动对生态系统的影响日益加剧，生态产品和生态服务日趋稀缺，人们对生态系统服务的研究也逐步由定性向定量发展。

从 20 世纪 90 年代开始，生态系统服务价值评估，不仅为越来越多的学者所关注，而且得到众多国际组织的高度重视。2005 年，联合国《千年生态系统评估》（*Millennium Ecosystem Assessment*）提出了生态系统评估框架，至 2010 年，TEEB（The Economics of Ecosystems and Biodiversity）又提出了构建生态系统与生物多样性评估构架的方法，以及评价生态系统服务价值的经济工具，从而极大地推进了生态系统服务研究在世界范围内的开展，表现出向生态系统服务机理和区域集成方法两大方向发展的趋势，并逐渐成为当今生态科学、环境科学以及生态经济学等多学科交叉研究前沿热点。

荒漠生态系统是整个生物圈中分布较广的一个系统，也是陆地生态系统中一个重要的子系统，在我国主要分布于北方干旱和半干旱区，是北方重要的生态系统类型。荒漠生态系统生境的特点是降水稀少、气候干燥、风大沙多、植被稀疏，也是陆表过程中最为脆弱的一种生态系统。由于荒漠生态系统蕴藏着大量珍稀、特有、孑遗物种和珍贵的野生动植物基因资源，因而具有独特的结构和功能。这些功能不仅为生活在干旱区的人们提供着赖以生存和发展的物质基础，也为维持社会稳定、经济发展和区域乃至全球生态安全提供了重要保障。因此，开展荒漠生态系统功能和服务价值的科学、定量评估，对加深荒漠生态系统重要性的认知，建立荒漠生态系统功能恢复和持续改善的技术支持模式，以及实现干旱区荒漠生态系统功能的修复保育，以满足人们日益增长的生态系统服务需求，均具有重要的现实意义。

该书以我国旱地生态系统（包括干旱亚湿润区、半干旱区、干旱区和极端干旱区四个气候类型区）作为控制区域，总面积约 452 万 km^2；其中评估的荒漠生态系统面积约 165 万 km^2（涵盖八大沙漠，四大沙地及戈壁）。依托中国荒漠生态系统定位观测研究网

络 17 个台站长期定位观测研究的基础数据，结合国家林业局第四次（2009 年）全国荒漠化和沙化监测结果，点面结合、多源多维集成，综合运用生态学、植物学、气象学、水土保持学、经济学、旅游学、统计学、遥感等多学科交叉的理论和技术方法，对沙漠、沙地、戈壁等主要荒漠类型提供的六大生态服务的实物量和价值量进行了较为全面、系统的定量分析和评估。

该书针对以往荒漠生态系统服务评估研究存在的局限性及不足，首次提出了适用于荒漠生态系统服务的综合评估方法。在荒漠地区的防风固沙、水文调控、生物多样性保育等多维效益的定量评估方面，不仅丰富了学科内涵，而且填补了相关领域空白。特别是在干旱区大尺度碳汇估测方面，取得了关键性的技术突破，提出了荒漠生态系统碳汇计算方法，估算出荒漠生态系统 2009 年固定 CO_2 44.48 亿 t，这个评估结果显示我国荒漠生态系统在减缓气候变化方面具有重要功用，对我国今后参与气候变化国际谈判和国际履约具有重要意义。另外，值得一提的是，沙尘作为荒漠生态系统的特有循环物质，其生物地球化学循环的全球增益是荒漠生态系统提供的、最为独特的生态服务。尽管目前对一些沙尘生物地球化学循环机制尚不清楚，而且生态服务评估难度极大，但该书在东北亚沙尘气溶胶遥感解析，以及生物地球化学循环的全球增益方面做出了诸多有意义的探索，从而增进了我国荒漠生态系统沙尘对全球海洋可能影响的认知。

该书的编撰工作称得上是荒漠生态服务研究的延伸和升华，对于荒漠生态系统功能评估和服务价值核算，不仅是一次有益的尝试和探索，而且有助于加深对荒漠生态系统功能和作用的理解，对推动干旱区生态效益补偿机制的建立，以及为荒漠地区生态系统管理、生物多样性保护、应对气候变化乃至土地荒漠化的防控等方面提供科学依据，具有重要意义。该书的出版将对我国荒漠生态系统功能和服务的量化评估起到积极的促进作用，也必将大大推进荒漠生态学的长足发展。

是以为序，与读者共飨。

李文华

2014 年 6 月

Foreword II

Since the 1960s, global unsustainable development issues caused by population growth, resource management, environment degradation and socio-economy instability in the world are being increasingly intensified. The worldwide negative effects caused by expansion of desertification, ecosystems degradation, loss of biodiversity, climate change and natural disasters d, being growingly threat to the survival and development of human being. How the planet's ecosystems can serve as the life-supporting systems and adapt to human survival and sustainable development, and how governments make holistic and strategic decisions on ecosystem management, natural resource protection, and response to global climate change, have become the primary tasks at the moment.

British ecologist Arthur Tansley proposed the concept of ecosystem in 1935. This concept has been widely disseminated and adopted ever since. From the 1950s, with the development of ecology theory and methodology, the perception of the structures and functions of ecosystem has increasingly deepened, and the importance of ecosystems has been gradually recognized. Ecosystem does not only play an irreplaceable role in maintaining life-supporting systems and the dynamic balance of environment, but also provide mankind with a variety of ecological goods and services. As eco-products and eco-services become increasingly scarce under the impact of human activities on ecosystems, the research on ecosystem services has gradually evolved from qualitative to quantitative.

From the 1990s, the evaluation of ecosystem services did not only attract interest from a growing number of scholars, but also received notable attention from many international organizations. In 2005, the United Nations' Millennium Ecosystem Assessment proposed a framework for assessing ecosystems. In 2010, TEEB (The Economics of Ecosystems and Biodiversity) proposed methodologies and economic tools to build an evaluation framework for not only ecosystems and biodiversity, but also for ecosystem services, which significantly promoted research on ecosystem services carrying out at global scale, promoting development trends towards dimensions on ecosystem service mechanism and regional integration approach. Those trends have gradually become research hotspots of ecology, environment science and ecology economics as well as their interdisciplinary studies at present.

As important sub-systems under terrestrial ecosystems, desert ecosystems are widely distributed throughout the biosphere. In China, they are mainly distributed in arid and semi-arid regions in the northern part of China, and belong to one of the most important ecosystem types. Characterized by scarce rainfall, dry climate, blowing strong wind and wide sand area, as well as sparse vegetation, desert ecosystem habitat is one of the most fragile ecosystems under land surface process. Desert ecosystems possess unique structures and functions as they bear large number of rare, endemic, relic species and precious wildlife genetic resource. These features do not only provide the material basis for the survival and development of the people living in the arid region, but also serve as essential safeguard to

maintain social stability, economic growth and regional and global ecology security. Therefore, carrying out scientific and quantitative assessment for functions and services of desert ecosystems has important practical significance for 1) deepening awareness of desert ecosystems; 2) establishing technical support model for recovery of desert ecosystem functions and improvement on a continuous basis; 3) realizing repair conservation of desert ecosystem functions in arid regions; and 4) supporting the growing demand for ecosystem services.

This book takes dryland ecosystems (consisting of dry sub-humid, semi-arid, arid and extreme arid areas) as rehabilitative areas , covering a total area of about 4.52×10^6 km^2. The total area of desert ecosystems assessed, including 8 main sandy deserts, 4 main sandy lands and the Gobi is about 1.65×10^6 km^2. Based on the long-term, location-specific observation data on the desert ecosystems gathered from 17 observation and research stations in Chinese Desert Ecosystem Research Network, and the results from the Fourth China National Desertification and Sandification (Sand Encroachment) Monitoring released by the State Forestry Administration in 2009, an integrated approach is adopted to apply the theories and methodologies of ecology, botany, meteorology, soil and water conservation, economics, statistics, and other essential fields for assessing and analyzing the physical quantities and the economic value of the desert ecosystem in China in a systematic, comprehensive and quantitative manner, focusing on six main aspects of ecological services.

For the limitations and deficiencies in the existing desert ecosystem services assessment studies, the book for the first time proposed a comprehensive evaluation methodology that is suitable for desert ecosystem services. Quantitative assessment on multidimensional benefits such as windbreak and sand fixation, hydrological regulation and biodiversity conservation and maintenance do not only enrich academic background, but also fill the gaps in relavant sectors. Particularly, key technical breakthrough has been achieved in terms of large-scale carbon sequestration estimate in arid area. A calculation method is proposed to amount the annual desert ecosystem carbon sequestration in 2009, the total of which is about 4.448 billion tonnes CO_2 (including 3.795 billion tonnes deposited in the ocean in form of dust and sand particles). This evaluation result shows an important function of desert ecosystems in China in terms of climate change mitigation. In addition, it is worth mentioning that dust and sandstorm, which is an exclusive circulating substance from desert ecosystems, provides the most unique ecoservices and global benefits as it cycles in a biogeochemical manner. Although some of the dust-sand biogeochemical cycling mechanisms remain unclear and the assessment of ecosystem services is extremely difficult, the book makes a number of meaningful attempts and explorations on both dust aerosol remote sensing and analysis in the Northeast Asia, and global biogeochemical cycling benefits, thus enhancing awareness that dust-sand from desert ecosystems may have positive effects on global ocean systems.

The compilation of this book can be regarded as an extension and improvement of desert ecosystem services research. The assessment of desert ecosystem functions and the evaluation of its services is a useful attempt, contributing not only to a better awareness of the functions, status and roles of desert ecosystems, but also to the provision of a scientific basis for promoting the establishment of a desert ecology benefits compensation mechanism. This

book is of important significance in providing scientific evidence for aspects such as desert ecosystem management, biodiversity conservation, climate change response and desertification mitigation. The publishing of the book will facilitate quantitative assessment for desert ecosystem functions and services in China, and greatly promote the further development of desert ecology.

So shall the above preface be written and shared with readers.

Li wenhua
June, 2014

前　言

荒漠生态系统是我国陆地生态系统的主要组成部分，更是我国西北地区最为重要的生态系统类型；其中蕴藏着大量珍稀、濒危、特有物种和珍贵的野生动植物基因资源，具有独特的结构和功能。这些功能不仅为生活在干旱区的人们提供着赖以生存和发展的基本物质，也为推动经济发展、维持社会稳定和区域乃至全球生态安全提供了重要保障。

生态系统服务是近年来国际上新兴的一个研究领域。荒漠生态系统功能评估与服务价值研究对于全面认识荒漠生态系统服务及功能的空间格局、演变特征及其对全球气候变化的响应具有重要意义，可以促进决策者、管理者和使用者对荒漠生态系统与人类福祉之间相互关系的科学认识和理解，进而通过改善生态系统管理建立荒漠生态系统功能恢复和持续改善的技术支持模式，实现干旱区生态脆弱的荒漠生态系统功能的恢复重建，以满足人们日益增长的生态系统服务需求。因此，对荒漠生态系统服务进行科学、量化的评价，对其生态产品价值进行量化，进而体现林业在和谐社会建设、生态文明建设和促进全面小康社会建设中的地位与作用，反映林业建设成就，服务宏观决策，是一项紧迫而又必须完成的任务。

2010 年，“荒漠生态系统服务功能监测与评估技术研究”作为国家林业公益性行业科研专项重大项目正式立项并启动，标志着我国荒漠生态系统服务进入了量化研究的新阶段。该项目由中国林业科学研究院荒漠化研究所牵头组织，会同中国林业科学研究院森林生态环境与保护研究所、沙漠林业实验中心，北京林业大学，中国科学院寒区旱区环境与工程研究所，北京联合大学旅游学院等 17 家产学研机构共同参与实施。项目根据研究任务和主要内容，分解设置了 8 个课题，由课题承担单位和各协作单位分头组建研究团队开展调查、观测和研究工作。经过三年多协同攻关，项目首次以我国荒漠生态系统为研究对象，基于全国 17 个荒漠生态站长期、连续的海量观测数据及对不同区域、不同类型荒漠生态系统结构、格局与过程的长期研究积累，采用集成创新方法，有效地克服了以往评估的时空局限性，初步建立了荒漠生态系统服务评估指标体系，颁布实施了林业行业标准《荒漠生态系统服务评估规范》（LY/T 2006—2012），基本建成荒漠生态系统基础数据库和 8 个研究试验基地；初步完成了荒漠生态系统防风固沙、土壤保育、水文调控、固碳、生物多样性保育、景观游憩等服务评估指标框架构建和实物量评估及价值量核算，特别是在东北亚沙尘气溶胶遥感解析与生物地球化学循环的全球增益及干旱区大尺度碳汇估测技术研究方面取得了关键性突破，研究和评估结果更具有科学性、准确性，能够提供当前我国荒漠生态系统的真实状况，填补了我国在荒漠生态系统服务定量评估方面的空白，为生态系统服务评估及其价值核算奠定了可靠的生态学基础。

《荒漠生态系统功能评估与服务价值研究》一书，是对项目研究成果的系统总结，是项目承担单位与协作单位通力合作的成果，也是全体参研人员集体智慧的结晶。本书编写人员分工如下：第一章，卢琦、崔向慧、郭浩、程磊磊、吴波；第二章，王兵、郭