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◆本期提及的主要地点均已标示
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KFBG
Kadoorie Farm & Botanic Garden
嘉道理農場暨植物園

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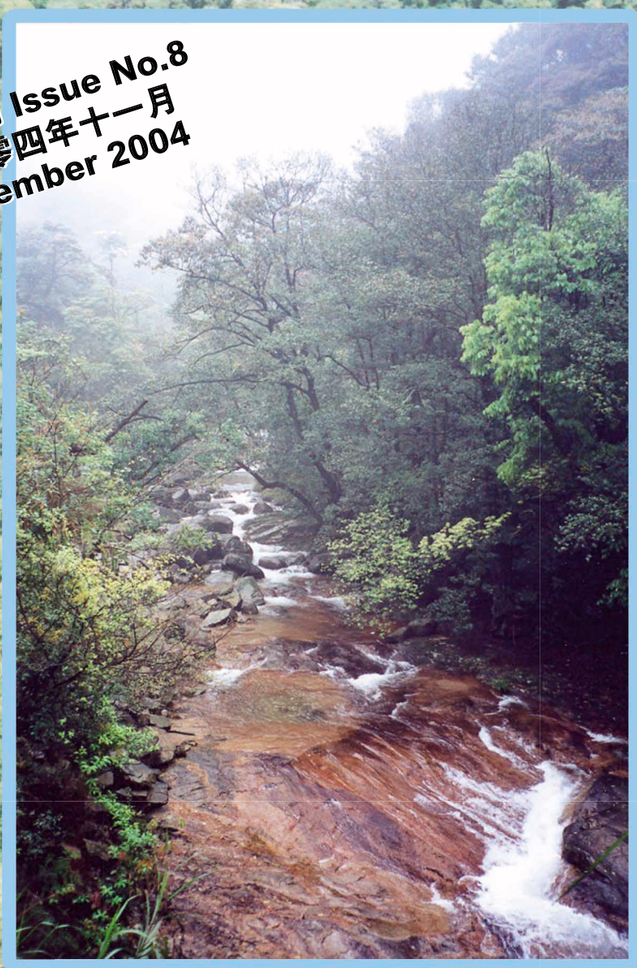

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KFBG
Kadoorie Farm & Botanic Garden
嘉道理農場暨植物園

嘉道理农场暨植物园简介

Introduction to Kadoorie Farm & Botanic Garden (KFBG)

嘉道理农场暨植物园是香港的一所慈善机构，早在1951年，嘉道理家族的两兄弟，罗兰士与贺理士，创办本园以推行农业辅助计划，帮助从大陆移民来的贫困农户自力更生。该计划帮助了超过三十万名香港农民改善生活。两兄弟于九十年代先后辞世，但其家族的慈善活动仍延续下来。嘉道理慈善基金会为中国境内及东南亚地区服务贫困社群的计划提供资助，而嘉道理农场暨植物园则因应香港社会的转型，现已建成为一所自然教育与保育中心，并根据1995年通过的香港法例成为一家公益事业公司。我们的任务是「提高大众对人与环境关系的的认识，透过保育与教育，积极改善世界」。本园现推行的计划有野生动植物保育、可持续农业和环境教育等等。

Kadoorie Farm & Botanic Garden (KFBG) is a charity based in Hong Kong, with a tradition of agricultural aid dating back to 1951, when the two brothers Lawrence and Horace Kadoorie began a self-help scheme for poor immigrant farmers from China. This scheme was to help over 300,000 Hong Kong farmers to achieve a good standard of living. Both brothers died in 1990s, but the family's philanthropic activities continue. The Kadoorie Charities fund projects throughout China and the South East Asia region. KFBG, in response to changing priorities in Hong Kong, has become a centre for environmental education and conservation, enshrined by a Government Ordinance in 1995 as a public corporation. The Mission Statement of KFBG is " TO INCREASE THE AWARENESS OF OUR RELATIONSHIP WITH THE ENVIRONMENT AND BRING ABOUT POSITIVE CHANGE IN THE WORLD THROUGH CONSERVATION AND EDUCATION". KFBG now has thriving programmes in wild plant and animal conservation, sustainable agriculture, environmental education and other areas.

广东大稠顶自然保护区

Dachouding Nature Reserve in Guangdong

封面及背景照由李国诚摄

Front cover and background photos by Lee Kwok Shing

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「物种保育」每每让人联想到对破坏环境活动的积极干预——如打击偷猎、遏止野生动植物贸易、或是救助个别受危种走出野外困境，进入圈养的生活环境当中——鲜有人会质疑保育在生态系统层面上是较有效或较具成本效益的方法。然而，「生态系统保育」似乎是颇为被动的，即让生境及人类以外的生物独善其身。这正好反映在「保护区」概念中，即是人类禁足之地、一片净土。

诚然，生态系统并非如此简单。纵观人类侵略性的影响，即使是最天然的生态系统也开始逐步退化——不论参天大树或旗舰种是否逐渐消失，大自然是不息在变动，在如斯情况下，我们并不能假定本质已改变的森林及溪流已回复至长久平衡状态。如维持人类健康一样，我们只能在这些蕴酿的转变尚未恶化及堕进万劫不复的深渊前，从种种失衡的徵兆中找出端倪。相对我国医学人才辈出，能救活生态系统的专家却著实不多。

我们在本期探讨了维持生态系统完整性的若干层面，首先阐述导致森林及溪流环境恶化的因素及现时人类活动造成的影响。在考虑生态系统的其中一种威胁—大肆兴建水坝发电后—我们又谈到保护区管理人员及其合作伙伴能如何实践生态系统监测，并确保其整全性。当然，我们并不能把上述提问一一解答，但希望藉此激励从事这方面的保育人士热烈讨论及作出创新的行动。

While "species conservation" conjures up images of active intervention - intercepting poachers, controlling trade, perhaps taking individual threatened organisms into captivity to be rescued from adversity - few would doubt that conservation is more effective, and more cost-effective, at the ecosystem level. But "ecosystem conservation" sounds a rather passive affair - leaving habitats and their non-human residents alone. The idea of a "protected area" sums this up: an area off-limits to the usual range of human impacts; an area of inactivity.

Of course, it's not as simple as that. In view of the pervasive influence of people, even the most natural ecosystems are at risk of being steadily degraded - whether or not the biggest trees or flagship species disappear - and nature itself is ceaselessly dynamic, such that our modified forests and streams can never be assumed to have settled into lasting equilibrium. As with maintaining human health we can only look for symptoms of imbalance before they lead to serious and even irreversible decline. But in contrast with China's unparalleled expertise in human health, there are not many ecosystem doctors around.

In this issue we consider some of the aspects of keeping natural ecosystems intact, beginning with some illustrations of what can and does go wrong in the forests and streams of the region. After considering one particular ecosystem threat - the spread of dams for hydroelectricity - we move on to what managers and their partners can realistically do to monitor their ecosystems, and ensure they stay intact. Of course we do not have all the answers, but hope to provoke discussion, and creative action, from those involved in ecosystem conservation.

读者反馈资讯・完善报导范畴

为确保《森林脉搏》能好好发挥提供森林保育资讯、促进夥伴交流及启发灵感的功能，相信读者仍记得们我们曾于2003年进行的读者调查。共有98人回覆，另有约190位读者透过回执表示希望继续收取本刊。填妥问卷的人士约有一半来自学术界，另有百分之三十为内地政府官员。

反馈尽是鼓励的字句，不少读者对本刊资讯内容均深感兴趣，每五位当中便有四位认为报导内容与他们的工作息息相关。政府官员普遍把资讯应用在保育管理上，而科研人员则用于学术研究及意识提升；其他主要应用范围包括保育状况评估、教学及政策发展。野生动植物纪录、特稿及新闻被选为最具参阅价值的栏目。 最为人津津乐道的启发性文章又花落谁家呢？读者首推候智恒博士于第五期撰写的「生态旅游与环境教育」。大多数的意见均认为本刊内容显浅易懂、准确可靠、取材开放、独树一帜。

我们对本刊的不足之处尤为关注，就内容的平衡与完整性及原创性与洞察力这两方面，读者给予的评价仅属一般，有指我们应多留意内地与香港在表达语法与用词上的差异，而这确是我们要多下工夫的地方。读者们且多多包涵，我们正积极装备，使本刊更臻完美！

就徵询应否增删报导元素一题， 读者属意增加动植物分布与威胁、物种的积极保护及森林保护与复修为题的资讯。他们对研究、项目资助、人员培训、资源管理及公众教育等指引亦渴求甚殷。读者期望本刊能以更大的篇幅来积极提倡科学的观点与视野。简单而言，便是希望藉本刊获取更多技术支援，以应付森林及生物多样性保育的艰巨挑战。

编者衷心感谢各位的宝贵意见，这一切对本刊工作都有莫大帮助，我们会尽力采纳当中建议。您的鼓励使我们更有信心继续把杂志办好，并推广给更多相关人士。由于「资讯速递」及「近期刊印的出版物」的受欢迎程度较低，从今期开始，我们会把这两栏合并为「资讯及新闻」，报导近期消息，但沟通大门并没有关上 —— 我们乐于听取不同声音，并随时候教。

费乐思和吴狄姬

(嘉道理农场暨植物园)

Readers help define our niche

As many of you will know, since 2003 we have conducted a readership survey to help us ensure *Living Forests* is performing its intended function - informing, serving and inspiring partners engaged in forest conservation. We received 98 completed questionnaires, and about 190 others sent reply slips confirming their desire to receive the publication. About half our questionnaire respondents described themselves as academics, while about one-third are government officials in China.

The strongest message was encouragement; most readers report strong interest in the contents, and four in five say it is often relevant to their work. Most officials apply the information in conservation management, while academics use it in research and enhancing awareness; other important uses were in assessing conservation status, teaching and developing policy. Most valued components included records of threatened species, in-depth articles and news. Many also cite examples of inspiring or uplifting articles - a clear favourite was a piece on ecotourism and environmental education by Dr Billy Hau in issue number 5. Most readers find the material easy to read, accurate, reliable and open-minded; they also feel the magazine does not overlap with other publications.

We particularly wanted to know areas where the magazine could do better. Ratings for balance/completeness and originality/insight of content were modest - we see room for improvement here. We also had a few comments on Chinese expression - "Chinese with Hong Kong characteristics", you might say. Bear with us - we're learning!

When asked which elements readers would like changed, the strongest message was for more coverage of animal and plant distribution and threats, active species protection, and forest protection and restoration. Readers seek more guidance on research, funding, staff training, resource management and education. They also want a boosted scientific perspective, with greater detail. In short the demand is for technical help with the complex challenge of conserving forests and their biodiversity.

This survey has been of great help to us and we thank all who responded; we will do our best to take your views on board. The overall encouragement gives us confidence to continue, and improve our distribution to other potential users. In view of the lower enthusiasm for short notices and recent publications, we have altered the format to combine these under a notices and news section, beginning with the present issue. Meanwhile the channels are still open - please share your thoughts and suggestions with us at any time.

John FELLOWES and Norris NG

(KFBG)

嘉道理生物多样性奖学金消息

2004年度嘉道理生物多样性奖学金面试已于八月十七至十八日假广州举行。评审团在芸芸28位申请者中甄选出4名研究生。他们的生物多样性研究课题见下表：

KFBG Biodiversity Studentship news

The interviews for the 2004 KFBG Biodiversity Studentships were held in Guangzhou on 17-18 August 2004. This year we have awarded studentships to four postgraduate students out of 28 applicants. Their research topics cover varied areas in the field of biodiversity conservation as follows:

姓名 Name	程度 Degree	学院 Institution	研究课题 Project title
汪继超 Wang Jichao	硕士研究生 M.Phil.	海南师范大学生物系 Department of Biology, Hainan Normal University	黄额盒龟的生态学及其保护生物学研究 Study on ecology and conservation biology of Indochinese Box Turtle *Cuora galbinifrons*
蒋爱伍 Jiang Aiwu	硕士研究生 M.Phil.	广西大学动物科技学院 College of Animal Science and Technology, Guangxi University	桂西南喀斯特森林鸟类调查和比较研究 Comparison of bird communities in karst forests in southwest Guangxi
张明霞 Zhang Mingxia	博士研究生 Ph.D.	中国科学院昆明动物研究所 Kunming Institute of Zoology, Chinese Academy of Science	海南黑冠长臂猿的栖息地选择和潜在分布分析 Analysis of habitat selection and potential distribution of Hainan Gibbon
林家怡 Lin Jiayi	博士研究生 Ph.D.	华南农业大学林学院 College of Forestry, South China Agricultural University	海南黑冠长臂猿主要采食植物之物候学与生态学研究 Phenology and ecology of the main feeding plants of Hainan Gibbon

我们谨此向诸位出席八月十六日的简报会并就研究课题给予宝贵意见的人士致以由衷谢意，他们包括广东林业局的廖庆祥主任、何克军副主任及林术科长；海南林业局的苏文拔先生、广西林业局的谭学锋先生以及中国科学院植物研究所的张宪春教授。

We sincerely express our gratitude to Director Liao Qingxiang, Deputy Director He Kejun and Mr. Lin Su of Guangdong Forestry Department, Mr. Su Wenba of Hainan Forestry Department and Mr. Tan Xuefeng of Guangxi Forestry Department, as well as Professor Zhang Xianchun of the Institute of Botany, Chinese Academy of Sciences, who kindly agreed to attend the presentations on 16 August and gave valuable inputs to the research projects.

与此同时，我们亦恭贺两位于本年毕业的2001年奖学金得主——董仕勇先生(博士生)及张兵兰小姐(硕士生)。他们俩今后均会继续从事保育研究，前者将以华南植物园为基地，进一步研究华南地区的蕨类植物，后者则于中山大学研究中国的细蟌科分类学。

Meanwhile, we would also like to congratulate two 2001-awarded studentship-holders, Mr. Dong Shiyong (Ph.D.) and Miss Zhang Binglan (M.Phil.) who have graduated this year. Both will continue their research on, respectively, the Pteridophytes of South China (at South China Botanic Garden) and Taxonomy of the Coenagrionidiae of China (at Zhongshan University).

奖学金得主在完成学业后可获发证书，以表扬他们的努力成果。

In recognition of studentship-holders' efforts, we will henceforth issue a certificate to those who successfully complete their studies.

吴狄姬
(嘉道理农场暨植物园)

Norris NG
(KFBG)

悼念庞雄飞院士(1929-2004)

中国著名昆虫学家、生态学家、高等农业教育家、中国科学院院士、华南农业大学资源环境学院导师庞雄飞教授因病于2004年3月25日在广州逝世。

庞院士于1983至1989年曾任华南农业大学副校长，他长期从事昆虫学、生态学和害虫防治理论与实践的教学和科研工作，在害虫生态控制和天敌物种多样性及其利用方面作出了重要而开拓性的贡献。他创立了昆虫生态研究室，把系统科学的理论和方法引进昆虫种群生态学的研究领域，并提出害虫种群控制系统理论和研究技术的新思路。他整理了分布于中国及其邻近地区的瓢虫分类系统近700种，另描述瓢虫科昆虫新种近100个及赤眼蜂属和缨小蜂属新种12个。他专业基础扎实，学术思想活跃，积极开展国际间的学术合作与交流。他又创办了集教学、科研和科技示范于一体的深圳龙岗生态农业示范基地，为华南农业大学昆虫学科成为国家级重点学科及农业部昆虫生态、毒理重点实验室的建设作出重要贡献。

相片由作者提供 Photo by author

庞教授 1998 年 6 月到深圳龙岗时摄
Prof. Pang visiting Longgang, Shenzhen in June 1998

他十分关心广东自然保护区的建设和环境保护教育工作，为大学本科生开设了旨在普及生态环保知识的《生态环境教育》序列讲座和通识性课程《生物多样性保护》专题。庞教授热心于森林保护工作，他生前任广东省自然保护区评审专家组组长，曾多次赴广东南岭、车八岭、英德石门台自然保护区考察，

A tribute to Professor Pang Xiongfei (1929 - 2004)

Professor Pang Xiongfei, renowned entomologist, ecologist and educator in advanced agriculture, died on 25 March 2004 in Guangzhou. Professor Pang was an academician of Chinese Academy of Sciences and valued teacher of many students in the Faculty of Resources and Environment of South China Agricultural University (SCAU).

From 1983 to 1989, Professor Pang was a vice-principal of SCAU. Throughout his life he was dedicated to his research in entomology and ecology, and their application in pest control, and was considered a pioneer in studying the ecological control of pests as well as biodiversity. He set up the SCAU Laboratory of Insect Ecology and brought modern scientific concepts and methods to the study of insect population ecology, as well as contributing new theory and techniques to the control of pest populations. He revised the taxonomy of nearly 700 coccinellid (ladybird) beetle species known from China and neighbouring areas, and described around 100 new ladybird species as well as 12 new species of wasps. His profound knowledge and innovative thinking prompted academic co-operation and exchange with international institutions. He founded an eco-agricultural demonstration base at Longgang, Shenzhen, with an emphasis on incorporating education, research and scientific techniques. He also made major efforts to win national recognition for the entomological work of SCAU, and established the Key Laboratory of Insect Ecology and Toxicology of the Ministry of Agriculture.

Keen to strengthen Guangdong's nature reserves and conservation education, Professor Pang established an ecological education seminar series and a general biodiversity conservation course for undergraduate students. As a one-time chair of the Guangdong Nature Reserves Assessment Working Group, Professor Pang showed great interest in forest conservation, and had conducted surveys in nature reserves such as Nanling, Chebaling, and Shimentai in Guangdong. He actively facilitated the expansion of Guangdong nature reserves, and was chief editor of the book *Biodiversity Research on Nanling National Nature Reserve in Guangdong.*

积极促进广东省自然保护区的建设和发展，并主编出版了《广东南岭国家级自然保护区生物多样性研究》。

庞教授的编著有《昆虫群落生态学》，《害虫种群系统的控制》及《中国瓢虫物种多样性及其利用》等十多本有关的学术专著、教材及150多篇论文。他的成果被广泛肯定，屡获多项国家自然科学奖及科技进步奖等。

庞雄飞院士病重期间仍念念不忘学科建设，不忘教学科研工作，不忘对年青人的培养与关怀。他的离世，是中国昆虫学界、生态学界和华南农业大学的重大损失。我们深切怀念庞雄飞院士！

华南农业大学

编者按：以往本园项目成员往广东自然保护区进行考察时，庞雄飞院士给予了很多帮助及支援，我们谨向他的亲友及学生致以深切慰问。

His research contributions included over ten academic monographs and teaching textbooks such as *Ecology of Insect Communities, Control of Pest Population Systems* and *Species Diversity and Utilization of Ladybirds in China*, along with more than 150 academic papers. His accomplishments were recognised through various awards, like the National Natural Science Awards of China and the National Scientific and Technological Progress Prize.

Though his health had been manifestly weakening in recent years, he insisted on promoting educational development and scientific research as well as extending his tireless love and care to young generations. The death of Professor Pang is a tremendous loss to Chinese entomology and ecology and to SCAU. He will live on in our minds.

South China Agricultural University

Editors' note: KFBG obtained considerable assistance and support from Professor Pang when undertaking our first surveys in Guangdong nature reserves. We would like to express our deep condolences to his family and students.

本园的人事变动

前行政总裁查敏立 (Manab Chakraborty) 先生在本园服务三载后，已于七月离职并返回印度祖家。今后他将全力推动可持续生活项目、关注环境政策议题并打理其顾问公司的业务。我们衷心感谢他对本园的贡献，在此谨祝他日后诸事顺利、称心如意。

而薄安哲 (Andy Brown) 先生亦于本年七 月十日正式接掌行政总裁的职务。薄先生在八零年代为一间庞大石油公司的管理层，事业发展正如日方中，但却怅然若失。于是，他便与自行车为伴，浪迹天涯，先后到了澳洲、非洲及南美体验当地村民及农民的生活。他更在英国筹募经费以培训非洲农民。把上述经历辑录成书后，他摇身一变成为培训顾问，常

Personnel changes at KFBG

After three years at Kadoorie Farm and Botanic Garden, our former Executive Director, Mr. Manab Chakraborty, departed for his home country, India, in July. Manab will be devoting his time to sustainable livelihood projects, policy issues concerning the environment, and running his own consultancy. We would like to thank him for his great contribution to KFBG's work and wish him all the best in his future endeavours.

Mr. Andy Brown, our new Executive Director, took over Manab's duties on 10th July 2004. Andy had a promising career as an executive with a major oil company during the 1980s but became disillusioned. He then bicycled across the three southern continents, living with villagers and farmers in Australia, Africa and South America. He raised funds in the UK to provide training for African

常拉近人与自然的距离。他在香港及内地工作了十年，累积了不少管理、领导、写作、教育、社会科学及实用环境学上的经验，过去两年更出任本园组织发展顾问。他在大小型商业机构里打滚多年，亦曾跟非营利组织共事。刻下他已准备领导本园员工，为实现我们的使命目标向前进发。

中国项目加入两名新成员

自2000年加入本园的前教育部经理王丽贤小姐，于本年七月转为负责中国项目的可持续生活范畴。主要工作包括审视主流社会经济系统，探索环境危机的根源；提倡恒久价值观，推广更具可持续性的生活方式。

本年九月中旬，周嘉旺小姐亦成为了中国项目的新成员，担任教育及意识推广主任一职。周小姐在过去五年从事环境及公众教育工作，曾参予内地保育项目，并且在上年于香港大学完成环境管理学硕士课程。

farmers. After writing a book about this experience, he then became a training consultant, often working to connect people to nature. Andy has been working in Hong Kong and the Mainland for ten years. He is an experienced manager, leader, writer, educator, social scientist and practical environmentalist. He has been working with KFBG frequently over the last two years as our organizational development consultant. Andy has led various commercial organizations large and small, and has NGO experience also. He is now ready to lead KFBG to better serve our mission.

Two new staff join China Programme

In July 2004, Miss Idy Wong, Manager of KFBG's Education Department of KFBG since 2000, joined the China Programme as coordinator of projects in the new "Sustainable Living" focal area. Our sustainable-living work aims to explore the root causes of environmental crisis including major socio-economic trends, as well as promoting lasting values and more sustainable ways of living.

It also gives us pleasure to welcome Miss Sharon Chow who joined us as Education and Public Awareness Officer from mid September. Receiving her Master's Degree in Environmental Management from The University of Hong Kong last year, she has five years' experience in environmental and public education, and has taken part in conservation projects in China.

华南野生贸易进一步损耗亚洲动物资源

一个于2000年10月至2003年3月进行为期29个月的广东重点野生动物市场调查确认了野生动物贸易

的庞大规模及深远影响。调查人员每逢10月至3月期间，每月都会到广州槎头、清平及流花市场以及深圳东门市场调查两次；而在馀下的夏季月份，则每月调查一次。是次调查共录得哺乳类39种、鸟类453种、爬行类154种及两栖类31种，其中有59个全球受危种（10个极危和19个濒危）、77个濒危野生动植物种国际贸易公约物种（9个附录I物种）及46个国家保护物种（8个国家一级保护）。和早期调查比较，食用龟的物种组成已发生了显著的变化。东南亚及缅甸淡水龟大大取代了中国及其它中印国家物种，可见贸易正蚕食区内种群。同时，鉴于一些哺乳类、鸟类及龟类的圈养数量越来越多，应进一步调查这些野生动物驯养繁殖场的可持续性、卫生与健康状况。

资料来源：嘉道理农场暨植物园，2004。*广州及深圳一些市场的野生动物贸易监测2000-2003*。嘉道理农场暨植物园专题报告：第二号。香港，36页。

国家正严格修订《野生动植物保护法》

国家林业局打算对1989年落实的《野生动植物保护法》进行修订。国家林业局野生动植物保护司副司长张德辉指，修改重点将针对受保护野生动植物的管理，明确界定野生动植物拥有权及强化自然保护区以外的野生生境管理。现时国家对重点保护野生动物行使二级管制。「国家一级重点保护动物」由国家野生动物行政主管部门保护，而「二级」则交由省级、县级或自治区政府管理。该制在法例修订后将会转为统一管理。现行的野生动植物保护法规定野生动物资源为国家所有，但因驯养繁殖动物的私营机构越来越多，应就具体动物拥有权订立明确浅易的法律条款。此外，新法例会加强自然保护区以外动物生境的管理及保护。去年的非典型肺炎（SARS）爆发已表明了野生动植物保护法有需要修改，如增设禁食野生动物的条款。

资料来源：转载自新华报 07. 06. 2004

大量香港物种未受保护区保护

香港大学生态学及生物多样性学系对本港623个具生态保育重要性的物种的分布研究指，尽管香港保护区的土地面积百分比（38%）高踞亚太区之首，但逾半数物种在保护区内的代表性不足。所有调查的类群代表性均很低，特别是蚊类（55%不在保护区之内及70%代表性不足）、接著是繁殖鸟类（分别为18%及82%）、蜻蜓（18%及59%）、蝶类（17%及79%）、珍稀植物（16%及46%）、两栖类（8%及50%）及爬行类（3%及88%）。香港的保护区偏重于发展压力较低的高海拔生境，因此代表性不足的物种多来自低地生境：包括淡水湿地、弃耕农田及风水林。由于这些局限分布的物种分布零散，不同类群的热点亦没重叠，只有扩大保护区网路才能增加物种的代表性，而其他遭人类日益破坏的亚洲地区也将面临同样的挑战。

资料来源：Yip JY, Corlett RT & Dudgeon D, 2004. A fine-scale gap analysis of the existing protected area system in Hong Kong, China. *Biodiversity and Conservation* 13, 943-957页。

数百濒危物种未予全球保护

保育国际（CI）应用生物多样性科学中心（CABS）的研究显示，全球数百个极危种仍未受到保护。研究结合了5套有关物种及保护区的全球性资料，为评估保护区在保护物种方面的成效进行分析。专家们确认了149种哺乳类、411种两栖类、232种鸟类、及12种淡水龟类已迹近灭绝，却仍没有受到任何保护。如获悉下列物种的分布或现况资料，请与本园或CABS联系，它们包括中国蛙类如*Amolops liangshanensis*, *Brachytarsophrys chuannanensis*, *Protohynobius puxiongensis*, *Scutiger brevipes*, 木里猫眼蟾 *S. muliensis* and *Xenophrys shuichengensis* 及呈贡蟾蜍 *Cynops chenggongensis*。

资料来源：ENS, 07.04.2004, http://www.ens-newswire.com/ens/apr2004/2004-04-07-01.asp. 原载自Rodrigues ASL et al., 2004. Effectiveness of the global protected area network in representing species diversity. *Nature* 428, 640-643, 08.04.2004. http://www.nature.com/cgi-taf/DynaPage.taf?file=/nature/journal/v428/n6983/abs/nature02422_fs.html

中国逮捕象牙贸易商

中国官员根据国际组织环境调查协会(EIA)提供的线报，于广州查获约300公斤象牙。目前中国在禁止象牙非法贸易上主力进行边境管制，该会形容是次行动为中国政府在国内实施有关政策的一重大突破，其行动召集人Mari Park指出，一次性销售象牙制品的决定使中国象牙进口量激增，他们反对放宽象牙贸易禁令，因此举会为中国以至其他国家的执法官员带来沈重负担。联合国濒危野生动植物种国际贸易公约(CITES)缔约国大会于1997年首度批准象牙贸易，再于2002年通过波扎那、那米比亚及南非进行第二次象牙出口贸易。

资料来源：ENS, 15.03.2004. http://www.ens-newswire.com/ens/mar2004/2004-03-15-01.asp

超额采伐使中国森林资源增长率下降

一个在全国28省进行共5次的全国森林资源普查资料分析了引致森林资源增长率下降及不能达到持续经营的因素。中央政府制定采伐限额以维持或提升森林增长率，另方面要求管理人员因应在国有林采伐的面积重新植林。由于政府林业管理部门没能力监督及强制当地管理人员的决策，林业管理人员因而缺乏推动力进行根据限额经营采伐与再植林。分析显示高采伐限额本已拖低森林资源增长率，加上管理人员较难侦测在面积较大的天然及人工林区发生的超额采伐或营林投入不足情况，都令国有林增长率不断下降。

资料来源：Xu J, Tao R & Amacher GS, 2004. An empirical analysis of China's state-owned forests. *Forest Policy and Economics* 6, 379-390页

温家宝下令搁置怒江水坝计划

国家总理温家宝对怒江十三级水坝工程的社会及环境影响尤为关注，并下令撤回计划。这是中国至今最大型的水电计划，云南一家建筑公司已著手兴建工程中首个水坝；估计共可为全国带来两千一百万千瓦的电力。除对环境造成影响外，预计五万个大部分来自彝、栗僳及苗等小数民族居民因水位上升而要迫迁。计划遭到多方巨大的阻力，国家环境保护总局反对计划并坚持怒江应受保护；而中国社会科学院亦表达了对事件的关注；怒江下游的居民，特别是泰国的民众，亦对计划作公开谴责。政府仍计划达到每年7%的经济增长目标，以致中国耗电量比上年增长了15%，高达1.8万兆千瓦。

资料来源：大纪元 http://www.epochtimes.com/b5/4/4/2/n498879.htm

生物多样性热点地区开展保护区培训课程

透过「关键生态系统合作夥伴基金」(CEPF)的拨款资助，保护国际中国项目(CI-China)近日正筹备六项培训课程，向55个县级保护区管理及技术人员提供野生动物保育的训练。首个为期18个月的培训课程已于四川开展，共80名来自新建的保护区管理及技术人员参与，提升他们管理保护区的能力。这是自政府兴建保护区5年以来，首个开办的培训课程。保育国际中国项目主任李晟之表示，眼见保护区人员踊跃参与，增强了他对课程的信心。很多参加者过去都从事伐木，眼见保育必须进行，都跑来受训。单是三天的研讨会便吸引了来自9个CEPF中国西南山区热点的新建保护区人员参加。

资料来源：CEPF E-news, 06.2004, http://www.maildogmanager.com/page.html?p=0000015Fu8vj4XAzwu0wSGI+ArSDKSGgCANS00=

新亚洲水鸟普查

湿地国际刚出版了《亚洲湿地水鸟普查报告(1997-2001)》，收录了1997-2001年每年1月于亚太区22个国家共1,392片重要湿地中录得的鸟类数量，当中包括61片拉姆萨尔湿地。作为国际水鸟普查分项之一，亚洲水鸟普查自1987年开展，与其他国际水鸟普查同步进行，它们是全球最大型及历时最长的动物监察项目。亚洲水鸟普查由千多名义务普查员协助搜集水鸟及湿地资讯，普查录得37个全球受危种，其中31种只于普查范围内分布。结果显示，调查地区严重受人类活动影响，包括捕鱼、耕作、植被过度生长、优养化、泥沙淤积及填海工程。所得资料数据引发当地及国际组织一系列相关保育活动，包括保育及调查计划、行动计划与策略、意识推广及全球评估。

资料来源：湿地国际, 04. 2004.

广西泗涧山建立大鲵自然保护区

2004年10月12日，广西苗族自治区人民政府批准，在融水泗涧山建立大鲵自然保护区。这是华南地区第一个大鲵*Andrias davidianus*省级自然保护区，面积103.84平方公里。

资料来源：读者陈旻先生　柳州市畜牧水产局

South China wild animal trade continues to deplete Asian fauna

A 29-month survey of Guangdong's key wild animal markets has confirmed the massive scale and impacts of the trade. The survey, from October 2000 to March 2003, ran twice-monthly from October to March and monthly during the summer months, recording 39 species of mammals, 453 birds, 154 reptiles and 31 amphibians in the markets of Chatou, Qingping and Liuhua in Guangzhou, and Dongmen in Shenzhen. They included 59 globally Threatened species (ten Critically Endangered and 19 Endangered), 77 CITES-listed species (nine in Appendix I) and 46 nationally protected species (eight in Class I). A dramatic change since earlier surveys was in the composition of the turtles traded for food. Freshwater turtles from Southeast Asia and Myanmar have largely replaced species from China and other Indochinese countries, supporting the belief that the trade is extinguishing populations in the region. Meanwhile an increasing proportion of individuals of certain mammal, bird and turtle species are captive-bred; further investigation is needed into the sustainability, hygiene and welfare status of these wild animal farms.

Source: *Kadoorie Farm & Botanic Garden, 2004.* Wild Animal Trade Monitoring at Selected Markets in Guangzhou and Shenzhen, South China, 2000-2003. *Kadoorie Farm & Botanic Garden Technical Report No. 2, KFBG, Hong Kong SAR, 36 pp.*

Tougher wildlife protection law under way

According to SFA, China plans to toughen its wildlife protection laws, which came into force in 1989. The adjustments will likely focus on management of protected wildlife, the definition of ownership of wildlife and management of habitats beyond nature reserves, according to Zhang Dehui, SFA's Department of Wild Fauna and Flora Conservation. The current two-grade management system for key protected wild animals, with "first grade" (Class I) animals handled by State administrative departments and "second grade" (Class II) by provincial, municipal and autonomous-region governments, may be transformed into a unified scheme. The current State ownership of all wild animal resources may also be changed due to the increasing number of private enterprises involved in domesticating and breeding animals. In addition, the law may be revised to make stipulations on the management of animals' habitats outside nature reserves. The outbreak of SARS (severe acute respiratory syndrome) last year indicated a need to modify wildlife protection laws to ban the eating of wild animals.

Source: *Forest Conservation Portal at http://forests.org/. Original source: Xinhua, 07.06.2004, http://news.xinhuanet.com/english/2004-06/07/content_1511157.htm*

Many Hong Kong species not covered in protected areas

A study by the Department of Ecology & Biodiversity, The University of Hong Kong, examined the distribution of 623 species of conservation concern in Hong Kong Special Administrative Region (SAR), and has found that over half are under-represented in the protected areas system, despite the SAR having the highest percentage of protected area (38%) of any administrative region in the Asia Pacific region. All the taxonomic groups examined were poorly represented, particularly ants (with 55% not found at all in protected areas and 70% under-represented), followed by breeding birds (18% unrepresented and 82% under-represented), dragonflies (18% and 59%), butterflies (17% and 79%), rare plants (16% and 46%), amphibians (8% and 50%) and reptiles (3% and 88%). Hong Kong's protected areas are biased towards high-altitude habitats, where development pressure is lower, so the under-represented species are mostly associated with lowland habitats: freshwater wetlands, abandoned agricultural fields and feng shui woods. Since the restricted species are scattered, and hotspots of different taxa do not overlap, an extended protected area network would be needed to represent all species, indicating the challenge to be encountered in other parts of Asia with increasing human impact.

Source: *Yip JY, Corlett RT & Dudgeon D, 2004. A fine-scale gap analysis of the existing protected area system in Hong Kong, China.* Biodiversity and Conservation *13, 943-957.*

Hundreds of endangered species remain unprotected worldwide

Hundreds of critically endangered species remain without protection worldwide, according to a study by the Center for Applied Biodiversity Science (CABS) at Conservation International (CI). The study assessed the effectiveness of protected areas in representing species, using five global data sets combined. Scientists identified 149 mammals, 411 amphibians, 232 birds, and 12 tortoises that are threatened with extinction and enjoy no protection of any kind. Information is sought on the Chinese frogs *Amolops liangshanensis*, *Brachytarsophrys chuannanensis*, *Protohynobius puxiongensis*, *Scutiger brevipes*, *S. muliensis* and *Xenophrys shuichengensis*, and the newt *Cynops chenggongensis*. Please contact CABS or KFBG if you have information on their distribution or status.

Source: *ENS, 07.04.2004, http://www.ens-newswire.com/ens/apr2004/2004-04-07-01.asp. Original source: Rodrigues ASL et al., 2004. Effectiveness of the global protected area network in representing species diversity.* Nature *428, 640-643, 08.04.2004. http://www.nature.com/cgi-taf/DynaPage.taf?file=/nature/journal/v428/n6983/abs/nature02422_fs.html*

Illegal ivory seized in China

Chinese officials have seized nearly 300 kg of ivory in Guangzhou. The operations were conducted on the basis of information provided by an international campaign NGO, The Environmental Investigation Agency (EIA). To date China's efforts to stop the illegal ivory trade have largely concentrated on border controls and the EIA called this seizure "a major breakthrough in internal policing by Chinese authorities." EIA campaigner Mari Park noted "the one-off sale decision has led to a rise in illegal ivory heading to China. EIA opposes a relaxation of the ban on ivory trade as it will place an enormous burden on enforcement officers in China, as well as other parts of the world." The first one-off ivory sale was agreed by CITES in 1997, and a second sale of ivory from Botswana, Namibia and South Africa was approved in 2002.

Source: *ENS, 15.03.2004. http://www.ens-newswire.com/ens/mar2004/2004-03-15-01.asp*

Higher quotas implicated in forest declines

China's forests with high harvest quotas, and large state-owned forest areas, are the ones least likely to be managed sustainably, according to a recent study. Factors leading to declines in forest growth, or less sustainable forest management, were analysed using data from 28 provinces and five census periods. Central government sets harvest limits (quotas) to maintain or increase growth rates, and reforestation is required to compensate for the area harvested in state forests. Unfortunately, monitoring and enforcing local manager decisions has been difficult, which has created disincentives for state forest managers to harvest and reforest according to the quotas. The analysis shows that higher quotas have led to declines in forest growth over time. In addition, growth rates were lower where there were larger state natural forests and plantations, where state forest managers have been able to over-harvest, or under-reforest, undetected.

Source: *Xu J, Tao R & Amacher GS, 2004. An empirical analysis of China's state-owned forests. Forest Policy and Economics 6, 379-390.*

Reprieve for Nujiang

Premier Wen Jiabao has paused plans for a huge dam system in the spectacular canyon of the Nujiang (Salween). Mr. Wen cited social and environmental concerns in ordering a review of the scheme. In China's biggest hydropower scheme to date, construction firms in Yunnan were to start work this year on the first of the 13 dams that would together generate 21 million kilowatts of electricity. Besides the environmental impact it has been estimated rising water levels would force the relocation of 50,000 people, mostly from ethnic minorities such as the Yi, Lisu and Miao. The plan has met fierce resistance; the State Environment Protection Agency declared opposition to the plan and insisted that the Nujiang remain unspoiled, and the Chinese Academy of Social Sciences voiced concern. Downstream communities - particularly in Thailand - have also condemned the plan. The government still aims to achieve at least 7% growth per year; this resulted last year in a 15% surge in demand for power, to 1.8 trillion kilowatt hours.

Source: *Forest Conservation Portal at http://forests.org/. Original source: Guardian, 10.04.2004, http://www.guardian.co.uk/international/story/0,3604,1189223,00.html .*

Workshops build nature reserve capacity in CEPF hotspot

A project, led by Conservation International-China (CI-China) with support from the Critical Ecosystem Partnership Fund (CEPF), aims to provide wildlife conservation training for site managers and technical staff from 55 reserves, most of them at county or prefecture level. The workshop in Sichuan was the first of six to be held over 18 months and 80 managers and technical staff from newly established national reserves participated. The workshop provided the first training for many participants since the government established the parks five years ago. "It gave us a lot of confidence to see such a high interest in attending the sessions," said Li Shengzhi of CI-China. "Many of the people involved were formerly loggers, and all came away saying they saw the need for conservation." The three-day workshop attracted participants from nine new reserves in CEPF's "Mountains of Southwest China" hotspot.

Source: *CEPF E-news, 06. 2004, http://www.maildogmanager.com/page.html?p=0000015Fu8vj4XAzwu0wSGi+ArDKSGgCANS00=*

New Asian waterbird census

Wetlands International has published an Asian Waterbird Census (AWC) (1997-2001), summarising the results of annual January counts from 1,392 sites in 22 countries in the Asia-Pacific Region, including 61 Ramsar sites. The AWC was initiated in 1987 and runs in parallel with others under the International Waterbird Census (IWC), the world's largest and longest-running faunal monitoring programme. The AWC is carried out by over 1,000 volunteers. Of the species recorded 37 are globally Threatened; 31 of these are restricted to the region. Results revealed strong human influences through fishing, agriculture, overgrowth of vegetation, eutrophication and excessive siltation, and reclamation. The data contribute to a range of conservation activities from local to global levels, including conservation and research programmes, action plans and strategies, awareness-raising campaigns and global assessments.

Source: *Wetlands International, 04. 2004.*

Xijianshan Nature Reserve for Chinese Giant Salamanders

On the official approval of Guangxi Miao Autonomous Region on 12 Oct 2004, South China's first provincial nature reserve covering an area of 103.84km^2 was established in Xijianshan, Rongshui to protect Chinese Giant Salamanders *Andrias davidianus*.

Source: *Reader Mr Chen Min, Liuzhou Animal Husbandry and Fishery Bureau*

华南自然生态系统
放眼四周——让自然生生不息

South China's natural ecosystems — what to watch to ensure a functional future?

费乐思和陈辈乐 (嘉道理农场暨植物园)
John R. FELLOWES and Bosco P.L. CHAN (KFBG)

Natural ecosystems

残破的网

我们越来越意识到对自然生态系统内各种资源的依赖—洁净的水，清新的空气，稳定的气候，充足的食物、药品和能源。众所周知，作为重要陆地生物区系的华南森林，生态系统极为脆弱，且日益退化[1]。于是，政府正逐渐增建森林保护区[2]网路，并开展了很多植树造林活动。不过，尽管淡水生态系统长期被开发利用(肥沃的泛滥平原区变成农田，水产品捕捞，运输、灌溉、生活和工业用水)，而华南地区河流生物多样性非常丰富，人们对淡水生态系统的保护需求意识却很薄弱[3 4]。我们能否知道大自然是否具足够韧力持续运作？

大树是森林中最显著的成分
Large trees are the most obvious components of forests

生态系统因营养关系而互相紧扣：那就是自然界的生产者、消费者与分解者之间的联系。陆地和淡水的食物链形成了一个整体，而人类的未来发展便有赖于维持它们的功能完整性。因此自然生态系统中哪些成分最容易消失呢？哪些是最需要受到监测和保护行动呢？就让对来自亚洲热带地区，尤其是长

Fraying webs

There is increasing awareness of our dependence on natural ecosystems for vital needs — clean water, and air, a stable climate, food and fibre, medicine and energy. In southern China the vulnerability and decline of forests, the major terrestrial biome, is well known[1], and has sparked a growing network of forest protected areas[2] and afforestation initiatives. The needs of freshwater ecosystems have received less attention, despite their long history of utilisation (the conversion of fertile riparian floodplains to farmland, the harvesting of aquatic products, and the use of water for transport, irrigation, domestic and industrial consumption), and despite the exceptional river biodiversity of the region[3 4]. Is nature tough enough to keep on functioning? Can we tell whether it is or not??

Ecosystems are held together by trophic interactions: the links between the producers, consumers and recyclers of nature. Terrestrial and freshwater food-webs form an integrated whole, and our future development depends on keeping them functionally intact. So which components of natural ecosystems are particularly susceptible to elimination? Which are most in need of monitoring, and protective intervention? Observations from tropical Asia, and especially our East Asia region where human impact has been so protracted, tell us some of the ecological changes to look for.

Obvious targets

The most obvious components of forests are the large trees - without them, our definition of forest collapses along with its habitat attributes. The precise impacts of deforestation vary with the extent and duration of the damage[5]. Succession may lead to near-natural forest, indistinguishable in structure or composition from primary vegetation, or to greatly impoverished ecosystems lacking most of the original species and interactions; the term "secondary forest" covers a huge range of local realities[6]. The replacement of diverse natural forest stands with species-poor plantations goes, by definition,

期受人类活动影响的东亚地区的观察提示我们应当著眼的一些生态变化。

明确的保护对象

大树是森林中最显著的成分——没有了它们，森林的定义及其生境特性也将荡然无存。滥伐森林所产生的具体影响随破坏范围及时间长短而有所差异[5]。演替可能导致再生林在结构或物种组成上与原始植被难以区分，但亦能使生态系统极度退化，当中的大部分原有物种及物种间的相互关系都会丧失；「次生林」一词被大量应用，当中包含了一系列上述的情况[6]。物种单一的人工林取代了多样化的天然林，无可避免地导致生物多样性和生态功能丧失。

然而仅大树本身还不能造就一片森林，在不断退化的森林景观中，许多其他物种也可能慢慢消失。通常首先失去的是需要大面积栖息地的大型动物；由于猎杀以及栖息地的退化，象、犀牛和野牛等巨型草食性动物，早就在华南森林中绝迹。随著食物的消失和人类对自然环境的侵占，像虎、豹和狼等大型肉食动物也在逐渐失去踪影。全球的淡水生态系统中的大部分巨型肉食动物早已灭绝[7]，我们并没有曾经出没本区水域的巨型鱼类、鳄类、龟鳖和鲸豚的完整记录；也许已在本区绝迹的湾鳄*Crocodilurus porosus*和濒临灭绝的中华鲟*Acipenser sinensis*、鼋*Pelochelys cantorii*以及白鳍豚*Lipotes vexillifer*，过往不单有较多竞争者，更有生活在高地上的同类。至今，个体较大、成熟慢的捕食性物种，如湄公河大鲶鱼*Pangasianodon gigas*[8]，鲮*Luciobrama macrocephalus*和鱤*Elopichthys bambusa*[9]，水獭(水獭*Lutra lutra*、江獭*Lutrogale perspicillata*和小爪水獭*Amblonyx cinereus*)，水陆两栖的爬行动物(如圆鼻巨蜥*Varanus salvator*)，两栖动物(如大鲵*Andrias davidianus*)都是极为稀有了。所有这些案例都是因直接开发利用、食物来源不断减少和栖息地退化，最终使种群数量锐减。陆地情况也一样，即使是中型的捕食性动物已在许多地区消失——曾于香港出没的豺*Cuon alpinus*、大灵猫*Viverra zibetha*和赤狐*Vulpes vulpes*在上半世纪已告绝迹。

保育机构往往把这类比较有名气的的「景观物种」的需要看得极为重要[10]。然而并非所有此类物种都是大型动物——也有一些由于栖息地特殊稀有而变得濒危的小形物种，如距翅麦鸡*Vanellus duvaucelli*喜欢在不受干扰的沙洲和沿河的小圆石河岸上繁殖；而斑头大翠鸟*Alcedo hercules*则爱在林中石涧内栖息。

with a loss of biodiversity and ecosystem function.

But big trees alone don't make a forest, and many other elements can be whittled away in a degrading forest landscape. Often the first to go are the largest animals, requiring the greatest expanses of habitat; the great herbivores, such as elephants, rhinoceroses and forest cattle are all long gone from South China's forests through hunting and habitat degradation. With the loss of large prey, and the intrusion of human settlements in the landscape, large predators like Tiger *Panthera tigris*, Leopard *Panthera pardus* and Wolf *Canis lupus* are also apt to disappear. Throughout the world, most of the largest predators in freshwater ecosystems disappeared centuries ago[7], and we have an incomplete record of the largest fish, crocodilians, turtles and cetaceans that must once have hunted the region's waterways; perhaps the vanished Estuarine Crocodile *Crocodilurus porosus* and the vanishing Chinese Sturgeon *Acipenser sinensis*, Asian Giant Softshell Turtle *Pelochelys cantorii* and Yangtze River Dolphin (Baiji) *Lipotes vexillifer* once had more rivals and upland counterparts. Today larger, slower-maturing predatory species, such as Mekong Giant Catfish *Pangasianodon gigas*[8], the carps *Luciobrama macrocephalus* and *Elopichthys bambusa*[9], otters (*Lutra lutra*, *Lutrogale perspicillata*, and *Amblonyx cinereus*), amphibious reptiles (e.g. Water Monitor *Varanus salvator*), and amphibians (e.g. Chinese Giant Salamander *Andrias davidianus*) are all scarce, and in all these cases direct exploitation has worked with reduced prey supply and habitat degradation to deplete populations below viable levels. On land too even moderate-sized predators have been eliminated in many areas - Hong Kong has lost its Dhole *Cuon alpinus*, Large Indian Civet *Viverra zibetha* and Red Fox *Vulpes vulpes* in the last half-century.

Conservation organisations often consider the needs of such high-profile 'landscape species' paramount[10]. Not all are large-bodied - some smaller species appear vulnerable because of the restricted nature of their habitat, like the River Lapwing *Vanellus duvaucelli*, which breeds on undisturbed sandbars and shingle banks along large rivers, and Blyth's Kingfisher *Alcedo hercules*, which needs forested rocky streams.

Structural changes to forest also affect fauna. Hong Kong has no truly arboreal forest frogs of the family Rhacophoridae[11], perhaps due to the loss of dense canopy. Confined to more natural forest areas in South China are some woodpeckers, pigeons and babblers - presumably limited by nest sites and/or food supplies.

森林结构的变化也会对动物构成影响。香港没有真正的树栖树蛙科Rhacophoridae物种[11]，也许这是因为浓密树冠层已不复存在，鸟类如啄木鸟、鸠鸽类和鹛类可能是因营巢地点及食物的限制而只活跃于华南较天然的森林。

那些被人类视为食物、贸易对象的类群容易受到影响，特别是那些相对容易被找到的物种。例如穿山甲的痕迹现已极难碰上，附生兰花亦已在某些林子里绝迹。龟鳖整个类群尤其令人担忧，长期的滥捕乱猎使栖息于华南地区的全球极危种，如山瑞鳖*Palea steindachneri*，本区特有的黑颈乌龟*Chinemys nigricans*、百色闭壳龟*Cuora mccordi*等岌岌可危；溪流大型蛙类，如棘蛙属*Paa*等的数量亦在锐减[12]。

相互助长的威胁

侯智恒摄 Photo by Billy HAU/KFBG

那些被人类视为食物或贸易对象的类群情况令人担忧
Taxa targeted by people for food or trade are of concern

水生生物减少及生态系统整全性受破坏不单是捕捞所致，乃是建坝、过度捕鱼、水污染、栖息地退化和外来生物入侵所共同酿成的影响。值得注意的是水利工程——包括蓄水建坝和修建渠道直接改变天然河道的面貌(参阅第20页韦敬辉的文章)。这些工程都能改变河水的化学、物理及生物属性，引起栖息地复杂性以及洪水调节和分解废物等自然机制丧失。受影响最深的莫过于大型、长寿的物种，及那些喜作纵向和横向回游、或需要广阔且不受干扰的特殊栖息地来进行繁殖的物种。流域土地利用方式的改变，诸如大规模伐林，农业化与城市化深深影响了鱼类群落的结构，尤其是降低食虫鱼类的丰富度，并助长外来入侵种的扩散[13]。从1950年代起珠江上游的森林退化已影响了有机物的投入，河岸水土流失日渐加剧导致河水浑浊，水温和水流改变。富养化和化学污染是严重的威胁——我国80%的主要河流因严重污染而不能发展渔业[14]，其中5%的河道更鱼迹罕见。一些水生植物，如水菜花*Ottelia cordata*和海菜花*Ottelia acuminata*亦变得濒危[15]。长江特有的扬子鳄*Alligator sinensis*和许多华南水生物种更因为水质恶化，数量正在下降[16 17]。几乎所有泛滥平原区的和河谷都被开发成耕地，农地直扩展到河岸，如此一来，一些依赖水滨植被的鱼类[18]和无脊椎物种将会消失。由于河流

Other taxa targeted by people for food or trade are susceptible, especially those which are relatively easy to locate. Signs of Chinese Pangolin *Manis pentadactyla*, for example, are now extremely rare, while some forests have been stripped of epiphytic orchids. The turtles as a group are of particular concern, and southern China supports some of the most critically endangered species in the world, such as Wattle-necked Softshell Turtle *Palea steindachneri*, Asian Giant Softshell, and the endemic Red-necked Pond Turtle *Chinemys nigricans* and McCord's Box Turtle *Cuora mccordi*. Stream frogs, such as the 'spiny frogs' in the genus *Paa*, have experienced drastic declines following intense collection for decades[12].

Synergistic threats

Harvesting does not act alone to deplete river wildlife and impair ecosystem integrity, but in concert with the impacts of dams, overfishing, water pollution, habitat degradation and introduced species. A particular concern is river regulation, including impoundment (dam building) and channelisation (direct modification of a river course) (see also article by Keith Wilson, pp. 20). These can change the chemical, physical and biological characteristics of rivers, and cause the loss of both habitat complexity and natural mechanisms for flood regulation and waste-assimilation. Among the most affected are large, long-lived species, those that perform longitudinal and lateral migration, and those that require extensive, undisturbed, specific habitats to breed.

Changing land-use patterns in the water catchment, such as large-scale deforestation, conversion to agriculture and urbanisation profoundly impact fish community structure, particularly reducing species richness among insectivores and encouraging the spread of invasive alien species[13]. Deforestation of the Zhujiang's headwaters since the 1950s has affected organic inputs, increased bank erosion leading to turbidity, and altered temperature and flow regimes. Eutrophication and chemical pollution are severe threats; 80% of China's major rivers are too polluted to support commercial fisheries[14], and fishes are absent from 5% of their length. Some aquatic flora, such as *Ottelia cordata* and *O. acuminata*, have become endangered[15]. In southeast China the decline of the endemic Chinese Alligator *Alligator sinensis*, among many other aquatic species, has been attributed to deteriorating water quality[16 17]. Almost all floodplains and stream valleys have been converted to arable land right to the water's edge, causing extirpation of some fish[18] and (doubtless) invertebrate species dependent on ri-

生态系统退化，泛滥平原区的脊椎动物，如獐 *Hydropotes inermis*、海南坡鹿 *Ruservus eldii hainanus*[19] 和许多水禽[20]的数量已骤减。毫无疑问，还有很多不计其数、我们鲜有认识的类群可能已饱受河流生态系统退化所带来的连锁反应的冲击。

食物链瓶颈

有一类别的生物在监测中常被视为「关键种」，即其对食物链有较重要的影响。在一些相对简单的生态系统中可找到明显的例子：如北极熊*Ursus maritimus* 或南极海域的磷虾 *Euphausia superba*。然而在生物多样性丰富的系统中，却很难确定单一个关键种——如一些大树的命运可因某些小型授粉昆虫能否存活而决定。

森林中的一个瓶颈是果实的物候变化。大型食果动物特别需要大片完整的森林以维持它们全年的食物来源。在亚洲热带地区，随著无花果属（*Ficus*）的消失[21]，犀鸟Bucerotidae的数量也在减少。以果实为食的大型树栖动物—如长臂猿和犀鸟，几乎已在华南绝迹；许多体型较大的松鼠、猴子及鸽子也渐见稀少；在香港，许多种子较大的树木已失去了主要的传播媒介[22]。

食物链紊乱

除人类开发的直接影响外，受干扰的森林还受到多方面和不同程度的改变，这与生长在内的动植物息息相关。这些改变可能发生在光线、温度和水分，也可能表现在不同的生态过程（如火烧和物理性干扰，分解、捕食、寄生和竞争，种子散播和授粉）的速率、频率和强度中。砍伐打断了树冠层，不利喜荫、喜湿、喜于凉爽环境下生长的植物生长，这包括许多苔藓、兰花和顶级树木的幼苗，并对在光亮、通风条件下快速生长的物种有利。与那些适应于较稳定环境下生存的物种（K - 选择）相比，繁殖及传播均迅速的动植物（*r* - 选择）和真菌可能更适应这种情况[23]。

森林干扰能助长如长足捷蚁等广生性物种的入侵
Forest disturbance may favour generalists, such as the invasive *Anoplolepis gracilipes* "crazy ants"

在采集木头和落叶作为燃

parian vegetation. Ranges of floodplain vertebrates, such as Chinese Water Deer *Hydropotes inermis*, Hainan Eld's Deer *Cervus eldi hainanus*[19] and many waterbirds[20] are also greatly reduced due to degradation of river ecosystems. It is likely that innumerable less well-known taxa have suffered from the combined impacts of river ecosystem degradation.

Food-web bottlenecks

A category of organisms often considered in monitoring is "keystone species", with a disproportionate influence on the food-web as a whole. Some relatively simple ecosystems have obvious examples: the Arctic Polar Bear *Ursus maritimus*, or the Krill *Euphausia superba* of southern oceans. In more diverse systems key species are harder to single out - the fate of some big trees may rest with survival of some small insect pollinators, for instance.

One bottleneck in forests is the seasonal availability of suitable fruit. Populations of large-bodied frugivores typically need large tracts of intact forest to sustain them round the year. In parts of tropical Asia the decline of hornbills (Bucerotidae) has been linked to the loss of strangler figs *Ficus* spp.[21]. Large canopy-level frugivores such as gibbons and hornbills have almost disappeared from South China, and many of the larger squirrels, monkeys and pigeons have become scarce; many Hong Kong trees with larger seed sizes have hence lost their main dispersal agents[22].

Web disruptions

Besides bearing the direct impacts of exploitation, forests subject to disturbance tend to change, to varying degrees, in many dimensions important to their constituent plants and animals. Changes can occur in the patterns of light, temperature and water, and the rate, frequency or intensity of different processes, such as fire and physical disturbance, decomposition, predation, parasitism and competition, seed dispersal and pollination. Opening of the canopy by logging makes life harder for shade-, damp- and cool-adapted plants, including many mosses, liverworts, orchids and climax tree seedlings, and favours species that grow fast in light, airy conditions. Fast-breeding, fast-dispersing ruderal (*r*-selected) species of animal, plant and fungus may be favoured over those adapted to conditions of constant stress or competition (K-selected)[23].

Where wood and leaf litter are collected for fuel, or where most trees are removed before reaching old age and senescence, abundances of saproxylic (wood-eating/dwelling) species are reduced. KFBG's surveys indicate that over half of South China's ant species are strongly forest-

料、或砍伐大量未成年或衰老树木的地方，以枯木为生的物种(以木头为食/栖居)的丰富度就会降低。本园的考察显示：过半在华南发现的蚁类与森林都有密切关联，其中大部分为专化捕食者，大部分以等足目isopods和弹尾目collembola等腐屑食性动物为食。出没于栖息地退化较严重的蚁类倾向于具有广泛的食性，它们的食物包括花蜜、蜜露以及草食性昆虫。森林被严重干扰后，林地的食物链将由以腐屑食性为主的群落让位与靠活植物组织为生的食植性食物链。如此转变，很可能对整体的生物多样性都造成影响，就像被破坏的水生生态系统一样。

生态系统直接变化牵涉的影响既多种多样且变幻莫测。失去了大型捕食动物，大型草食性动物的数量可能会上升，并可能会耗尽其喜食物种，尽管实际上它们也有被过度猎杀的可能。通过影响食物、基质、光线、微气候以及营养回圈和干扰等过程，树冠层物种组成的改变可以影响到其他物种类群[24]。大部分植食性昆虫对它们采食植物的科均很挑剔[25]；因此树木组成的变化也就意味著无脊椎动物的变化。这反过来便影响了大多以无脊椎动物为食的脊椎动物[26]。东南亚的砍伐活动，使某些雀鸟类群不断减少，以地栖的食虫鸟类(如鹟鹛和八色鸫)，采食树皮昆虫的鸟类(啄木鸟)以及地栖的食果/食虫鸟类(如雉类)最受影响；然而食蜜/食虫鸟类(如啄花鸟、太阳鸟)和树栖性食果/食虫鸟类(如鹎)数量却趋于攀升[27]。改变的微气候显然会影响无脊椎类群[28]以及鸟类的行为，而过度放牧可能会影响在地面和近地面筑巢的鸟类[29]。在香港，过去的森林消失使林下层鸟类消声匿迹，如灰眶雀鹛、红头穗鹛、小鳞鹟鹛、八色鸫科和雉类[30]。

河道治理影响著无脊椎动物类群。在香港，底栖大型无脊椎动物(特别是蜉蝣目 Ephemeroptera和毛翅目Trichoptera)的数目和种类随著截流造霸而明显下降[31]。北美也有报道环境退化使大型无脊椎动物和鱼类数量减少的类似发现[32]。

外来种入侵是生态系统退化的表徵[33]。迄今为止，虽然外来哺乳动物、鸟类、两栖爬行类在本地区的天然林中建立种群的例子不多，但外来亚种以及疑似的外来种已开始在当地建立种群[34]。人们对无脊椎动物的情况了解甚少，长足捷蚁*Anoplolepis gracilipes*是其中一种生活在较开阔生境且数量较多的蚁类，严重入侵海洋岛屿，亚洲大陆的种群亦可能是外地入侵，但天然分布区并不为人所知。也许水生生态系统可算是被外来种入侵最为肆虐之处，引入鲤鱼和其他外来物种被广泛用于满足日益增长的食鱼需求，以及弥补捞量下降的损失，但这样却使本土物种骤降，特别在湖泊生态系统[35]。

associated, and most of these appear to be specialist predators which feed, to a large extent, on detritivores such as isopods and collembola. Ant species common in more degraded habitats tend to have more generalised feeding habits, including nectar and honeydew from plants and their herbivorous insects. Following severe disturbance a forest floor dominated by a detritus food web may thus give way to a "grazing" food web based on living plant tissue. Such a shift, like that in a disturbed aquatic ecosystem (p.17), is likely to have wholesale biodiversity impacts.

Knock-on effects of direct ecosystem changes are varied, and difficult to predict. With no large predators, larger herbivores may increase, and risk exhausting their food supply, though in practice they too may be over-exploited. Changes to canopy tree composition can influence the rest of the community by affecting food, substrate, light, microclimate and processes such as nutrient cycling and disturbances[24]. Most plant-feeding insect species are very selective in the plant families they feed on[25]; thus changes in tree composition mean changes in the invertebrate fauna. This in turn affects vertebrates, many of which are themselves specific in their invertebrate prey[26]. The bird guilds most consistently depleted by logging in Southeast Asia seem to be terrestrial insectivores (such as wren-babblers and pittas), bark-gleaning insectivores (woodpeckers) and terrestrial frugivore/insectivores (e.g. pheasants), while nectarivore/insectivores (e.g. flowerpeckers and sunbirds) and arboreal frugivore/insectivores (e.g. bulbuls) tend to increase[27]. Altered microclimates evidently influence both invertebrate assemblages[28] and bird behaviour, while cover for ground- and near-ground-nesting birds may be affected by over-grazing[29]. In Hong Kong past deforestation apparently eliminated the insectivorous understorey forest birds, such as Grey-cheeked Fulvetta *Alcippe morrisonia*, Rufous-capped Babbler *Stachyris ruficeps*, Pygmy Wren Babbler *Pnoepyga pusilla*, pittas (Pittidae) and pheasants (Phasianidae)[30].

River regulation is known to affect invertebrate guilds. In Hong Kong, the diversity and abundance of benthic macroinvertebrates (especially Ephemeroptera and Trichoptera) declined markedly following stream impoundment[31]. Similar findings relating environmental degradation to declines of macroinvertebrate and fish assemblages have been reported in North America[32].

An obvious indication of reduced ecosystem health is the spread of exotic species[33]. To date few exotic mammals, birds, reptiles or amphibians have become established in the region's natural forests, though some exotic subspecies and possibly exotic species have become established locally[34]. For invertebrates the situation is not so well known - one of the more abundant ants in more open habitats is *Anoplolepis gracilipes*, a

更广阔的视野

要保存华南天然生态系统在一个原始状态已为时过晚——我们无法得知何类物种已绝迹；也无法了解过去数千年间当生物群进化到现在的境地究竟发生了怎样的变化——我们要应付的挑战是维持现今得以幸存的物种。这就意味著我们需努力重建天然森林特有的结构和机能，包括天然的干扰格局[36]。在绝大多数情况下，这意味将人为干扰减至最低；透过充分的监测来探测限制森林恢复的因素；采取措施缓解生态系统的威胁。

恢复生态连通性是一项主要的挑战。现时一些物种被视为「景观物种」，长远来看，被隔离的小片状生态系统很可能导致生物多样性的大幅丧失，尤其是随气候变化的来临。因此对于一个完整的生物群而言，保持栖息地间景观水平的空间连通性是很重要的。每个流域都需要全面的管理方法，平衡考虑经济、环境及生态的需要。为了维护生态系统的完整性，我们需要维持充足的水量和优良的水质，并在河道内及其周围提供多样的天然栖息地。这需要有关于多种河流物种的生态学知识，才能了解它们的需求，评估水生栖息地和生物多样性的完整性，并改善河流治理方法以保障河流生态系统的完整性。（参阅第20页韦敬辉的文章）

恢复生态连通性是对保护华南天然生态系统一项主要挑战
Retaining ecological connections is a major challenge to keep South China's natural ecosystems functioning.

当用物种总数来表示时，华南地区仍拥有很丰富的生物多样性，但存在的危机是该地区的生态系统将无法保持足够的完整性以维持和恢复其生态功能。我们必须要作出很多努力探测生态系统退化的徵兆，并采取补救行动。

对症下药

要确保最天然生态系统的完整性都得以保留，我们应该监测些什么呢？监测植被高度和树冠覆盖率，以及地面物理状况等的变化是有用的；甚至通过监测枯木和落叶数量可以用来确保这些重要的微生境的存在。如上所述，有理由去监测一些明显的「景观物种」，处于营养级高的物种，处于食物链瓶颈

severe invasive in ocean islands and possibly invasive in mainland Asia too, though its original range is unknown. Perhaps again the most extreme impacts of exotics are in aquatic ecosystems. Stocking of carp and other alien species has been widely practised to meet the escalating food fish demand and compensate for declining natural fisheries. This has caused severe declines in native species, especially in lake systems[35].

Bigger picture

While it is too late to keep South China's natural ecosystems fully intact - we will never know what species have been lost, and what changes have been made over the millennia to the conditions in which the native biota evolved - we can respond to the challenge to retain what survives. This will mean striving to recreate the structural and functional characteristics of natural forests, including natural patterns of disturbance[36]. In most cases this means keeping human-caused disturbance to a minimum, conducting sufficient monitoring to detect the limits to forest recovery, and responding to threats with ingenuity and resolve.

Reviving ecological connections will be a major challenge. While some particular species are typically highlighted as "landscape species", in the long term the existence of small, isolated ecosystems is likely to lead to biodiversity loss on a much larger scale, particularly with the advent of climate change. Thus maintaining the landscape-scale spatial connections between habitats will be important for the biota as a whole. Each river basin will need holistic management, giving equal priority to economic, environmental and ecological concerns. To sustain ecological integrity we will need to maintain adequate water flow and quality, and a diverse physical habitat within and around river channels. This will require knowledge of the ecology of many river species to understand their needs, methods to assess the integrity of aquatic habitats and biodiversity, and amendment of river regulation to address the ecological integrity of river ecosystems (see Keith Wilson, pp. 20).

Although South China still has very high biodiversity when expressed in terms of total number of species, there is a substantial risk that the region's ecosystems will not retain sufficient integrity to retain and recover their ecological function. We will need to get a good deal better at detecting signs of degradation, and taking remedial action.

Attuning to symptoms

What, then, should be monitored in our most natural ecosystems to ensure they remain intact? Changes in

的物种(估计是关键种或依赖关键种的物种)，以及狩猎者/采集人的目标物种。但只是监测这些还不够，我们还需要监测所有类型的群落、微生境、类群和种类的典型代表，它们每一个都面临著一些相同的和相异的威胁。时至今日，我们对华南地区的食物链的了解依然匮乏；虽然我们不太了解物种的食性，但这些广大的物种类群中发生的变化已可揭示生态系统健康的重要趋势。

实际上，许多地区所能提供用于生态监测的资源非常有限，而监测方法又需要适当反映对当地自然资源的压力。本期的其他文章会论及其他可行的方法。然而，实施这些方法都必须符合「我们必须允许自然界靠其自身的力量来运转、成长及耗损」[37]的原则。纵使大自然如何运转永远是个谜，但我们却不能掩耳盗铃，无视对它的破坏，并假定它仍能如常运转。

vegetation height and canopy cover, and in physical conditions underneath, can be instructive; even amounts of dead wood and litter can be monitored to ensure these important microhabitats are maintained. As we have seen there is an argument to monitor some obvious 'landscape' species, species of upper trophic levels, species at food-web bottlenecks (suspected keystone species or species dependent on them), and any species specifically and effectively targeted by hunters/collectors. But monitoring these may not be enough; representation is needed of all communities, microhabitats, guilds and taxa, each of which faces some common and distinct threats. South China's food webs are poorly understood even today, but even where diets are not fully known, changes in broad guilds may reveal important trends in ecosystem health.

In practice, resources for ecological monitoring will be limited in most areas, and monitoring will often need to be tailored to reflect local pressures. Some pragmatic approaches are discussed elsewhere in this issue. They should be conducted with the constant recollection that "we must allow nature space to be itself, to function, to build and tear down."[37] We may never understand how it all works, but we cannot assume it will work regardless of how it is treated.

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反思中国西南及南部水力发电的环境状况
Hydroelectric power production in Southwest and South China - Environmental considerations

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现时全球有五分之一的电力是由水电站供应的。与最大的电力生产来源—火电（燃烧化石燃料）相比，政府及财经人士均视水电为低消费低污染的理想可再生能源。

自1990年起，中国经济逐步起飞，发展却受能源供应短绌的约束。1995年，估计全国每年须至少增加17,000千瓦的装机容量方能避免缺电情况进一步加剧。虽然兴建了许多大型发电设施，但电力至今仍然供不应求，国内大部分地方因而需要缩短本年度的工作周期。大型水电厂于是被视作应付电力需求飙升的重要手段。


吴欢姬摄 Photo by Norris NG
中国西南部开发了很多水坝工程
Many large-scale dam projects are developed in Southwest China

国内西南及南部地区地势高，年降雨量多，再加上从滇蜀部份的青藏高原汇入的冰雪融水，水利资源非常丰富，尤其合适开发水电。许多在滇、蜀川、桂及黔兴建的大型水电站已相继落成及动工，或在规划当中。然而这些工程的影响却多不胜数。此举令数以千计居民面临逼迁，反映当地文化历史的古迹文物也被上升水位淹没。上游流域及蓄水区的沙泥淤积往往大幅削减工程的预期运作寿命及下游的生产力。随著洪水暴发（因雨季时库区排洪）、渔业、水生生物多样性及流域生产力下降等危机增加，这些影响都对湄公河（我国江段称澜沧江）下游国家包括缅甸、柬埔寨、老挝、泰国和越南构成潜在危险。

除大型水力发电工程外，国内亦加速开发中小型水电站。与规模相若的烧煤发电站相比，一般人相信这些工程对环境的影响较小；而水电站与终端使用者相邻，周边老百姓有机会在修建过程中作很大程度的参与。但很多这些水电站位于保护区内，如缺乏周详规划、兴建及管理，会使保护区及风景区溪流内的动植物备受严重冲击。

Hydroelectric plants currently produce about one-fifth of the world's electricity. Compared to the combustion of fossil fuels, the largest current source of electricity production, hydroelectric power plants are generally considered by Governments and financiers as desirable, cheap, clean and renewable sources of energy.

China's booming economy since 1990 has suffered continuously from shortages of power production. In 1995 it was estimated electricity capacity had to increase by at least 17,000 MW a year in order to avoid exacerbation of the serious power shortages that already existed. Despite the construction of many large facilities production has not kept pace with demand, and during 2004 short working weeks have been imposed across much of China, due to severe power shortages. Large hydroelectric plants are envisaged as an important means of helping China meet its soaring demands.

Southwest and South China are particularly suited to hydroelectric production due to elevated positions in mountainous locations receiving high annual rainfall, along with melt water from the Tibetan plateau in parts of Yunnan and Sichuan. Many large hydroelectric dam schemes have already been completed, begun or planned in Yunnan, Sichuan, Guangxi and Guizhou. The impacts are numerous. Many thousands of people must be relocated and often cultural antiquities are lost beneath rising river and reservoir water levels. Siltation of the impounded reservoirs and upstream watercourses often severely reduces the planned working life of hydroelectric schemes and reduces downstream fertility. For countries downstream of the Mekong (Lancangjiang) reservoirs, including Myanmar, Cambodia, Laos, Thailand and Vietnam, the impacts are potentially serious with increased risk of flooding (due to full reservoir releases during high river flow periods), loss of fertility and deleterious impacts to fisheries and aquatic biodiversity.

In addition to the large-scale dam projects China has a policy of speeding up the development of small and medium-scale sources of hydroelectric power. These are considered to have far less impact on the environment than small coal-fired power stations and are conveniently located close to end-users, who can also be heavily involved in the construction process. But many of these smaller projects are located in (officially) protected areas and without sympathetic planning, construction and management can have serious impacts on the stream fauna and flora of these nature reserves and scenic areas.

主要环境影响包括在施工期间溪流严重淤塞及受影响河溪流程流量的显著改变。很多情况下，溪流被堤坝截流，而坝下的河道便会出现间歇断流的情况。此外，附近的集水区往往也被截流引水，透过管道输水到库区，以增加发电量。而截流结构通常也没有考虑保持下游流量的设计。

广东北部南岭的一个小型水电站
A small-scale hydroelectric scheme in Nanling, north Guangdong

除断流外，堤坝下的河道也会受淤沙沉积及温度变化的影响。下游生态亦出现彻底转变，有机物的主要组成将由如枯枝落叶等外来碎屑物转为发源自库区水中的藻类及浮游动物。

中国西南及南部河系蕴藏一些全球生物多样性最丰富的鱼类群落，而湄公河更是公认的亚洲水生物多样性热点。当地鱼类以鲤科为主，包括在大江河生活的鲤科鱼类也常会回游到支流的砂砾上产卵。只有配合适当建霸设计及有效管理，筑堤截流才不致对鱼类种群造成严重影响。

为提高整体发电量，中国将继续加大水力发电的发展。而环境工作者便得要肩负起游说工作，向规划师及工程师分析采用有效缓冲措施对保护溪流动植物的重要性。这些措施早在设计初期便应纳入规划考虑，并在整个施工过程期间配以适当管理策略，同时保证水电站在建筑及运作时能排放一定的基流量 (Base flow) 。理想的基流是从库区上游输送到水坝下游，并与鱼道设施相互配合。此外，施工时应在坝内建设水闸，以便洪峰时从坝底排走淤沙。这样，不但可以避免淤积泥沙，亦可减少在枯水期时沙泥冲刷造成缺氧及淤塞等潜在负面影响。发电时不应让鱼类误进水轮机，以免它们因强大水流而送命。

因建坝修水电带来的惨痛教训在世上比比皆是，当想起国内之河溪生态是何等重要时，我们在建坝问题上更应小心谨慎，免得因重蹈覆辙而付上沈重代价。

即使是江西一个自然保护区内的小水坝，也可产生巨大的影响
Small dams, such as this one in a Jiangxi nature reserve, can have huge ecological impacts

The main environmental impacts involve heavy sedimentation of streams during the construction process and dramatic changes in the flow regime of dammed and intercepted streams. In many cases the normal stream flow is arrested by the creation of a dam with periods when no discharge occurs, leaving long stretches of the main river immediately downstream of the dam periodically dry. In addition neighbouring stream catchments are often intercepted to convey water into the reservoir through conduits to increase the capacity for electricity generation. The structures used to intercept stream flows usually have no mechanism to maintain a residual flow downstream of the intercept.

In addition to intermittent flows the main stream, below the dam facility, will be impacted by altered sediment load and temperature regimes. Downstream ecology will also be fundamentally changed from a system with organic inputs dominated by allochthonous detrital matter, such as leaf litter, to one with organic inputs principally derived from algae and zooplankton, growing in reservoirs.

The river systems in Southwest China and South China contain some of the most biodiverse fish communities in the world with the Mekong considered the richest in Asia. Most of these fish species belong to the Cyprinidae family. Even cyprinids found in relatively slow-flowing rivers often migrate upstream to small tributaries to spawn over gravel areas. The widespread damming and interception of streams will have serious impacts on local fish populations unless appropriately designed and managed effectively.

China will continue to strive to increase the contribution from hydroelectric power sources to the overall electricity production capacity. It is left to environmentalists to convince planners and construction engineers that effective mitigation measures are necessary to protect, as far as practicable, stream fauna and flora. These measures must be incorporated into schemes early in the design phase with appropriate management strategies in place upon completion. Such measures include the need to ensure 'base flows' are discharged from the hydroelectric facility at all times during construction and operation. Ideally the base flow discharge should be conveyed from upstream of the reservoir to downstream of the dam and should incorporate fish pass facilities. In addition a penstock facility should be incorporated into the dam during construction, designed to permit the discharge of accumulated sediments, from the bottom of the dam, during periods of spate flow. In this way excessive sediment accumulation can be avoided whilst minimizing the potential negative impacts such as oxygen depletion and sediment smothering that would arise from sediment discharges during low flow periods. Fish should also be prevented from entering the turbines during electricity generation since they cannot survive the trauma involved.

Many problems of dams have been learned by painful experience around the world. There is no need for China to repeat the expensive mistakes made elsewhere, especially given the outstanding importance of its stream ecosystems.

监测自然保护区的生物多样性
Monitoring biodiversity in the nature reserve

解焱和肖峻峰　译

我们都知道保护区内生物多样性备受威胁。那么，保护区管理人员如何能获得应对这些威胁的所需资讯呢？要诀正在监测。然而，监测生物多样性可以是耗资费时且又困难重重的工作。在此，我们基于在亚洲其他热带地区的经验，对监测在自然保护区管理的作用和实践提出一些看法。

We have heard about threats to biodiversity inside protected areas; how, then, can reserve managers acquire the information necessary to respond? The answer is monitoring. But monitoring biodiversity can be expensive, time-consuming and difficult. Here we present some views on the role and practice of monitoring in nature reserve management, based on experiences gained elsewhere in tropical Asia.

热带地区的自然保育和生物多样性监测：现实、优先次序与困难

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学术界和援助机构往往忽视在热带地区实施自然保育的现实问题，导致本已严重不足的基本管理经费被挪用来开展「自然保育」活动。即使在保护区内，热带森林生物多样性也要面对栖息地丧失、无序开发和导致环境退化的各种因素，如火灾和入侵种等主要威胁。一般而言，在野外确定这些威胁并没多大困难。若这些问题得以即时处理，而不是把有限的国际资源花在研究这些问题，保护管理就能立刻得到改善。所以，与其说自然保育是学术性的挑战，不如说是如何有效运用普通常识及资源。

用来捕猎森林动物的捕兽夹
A leg-trap used to catch forest mammals

要确保以最低成本找出和解决威胁，监测和评估是至关重要的。举例说，在保护区的监测是通过一般的巡护来发现侵占、火灾风险、猎人雇棚、开发迹象、捕猎陷阱等问题。管理部门可以对这些资讯作出适当反应，比如，寻求与当地社区的协作，必要时采取法律行动，建立防火带以及拆除陷阱。

国际援助和发展活动对自然保育的参与越来越直接，或在项目中加入「生物多样性」的成份。不同领域的保育专家都担当著顾问、协调和评估的角色；这些人对决定资金使用以及活动批核有相当的影响力。大多数捐助人主导的项目都要求当地机构人力物力

Conservation and biodiversity monitoring in the tropics: realities, priorities and distractions

Douglas SHEIL,
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Academics and aid agencies often overlook the practical realities of achieving conservation in the tropics. As a result, many "conservation" initiatives divert scarce resources away from fundamental management priorities. The main threats to tropical forest biodiversity, even in protected areas, are habitat loss, unregulated exploitation and various agents of environmental degradation, such as fire and invasive species. There is generally little difficulty in identifying these threats in the field. If these problems are addressed, improved conservation management can be promoted immediately without researching the questions that preoccupy so much of the international research community. The most immediate challenge is less one of science than of common sense and the effective allocation of resources.

Monitoring and evaluation are essential to ensure that threats are identified and addressed with minimal cost. An example of such monitoring in the context of protected areas is the general patrolling needed to identify encroachment, fire risk, illegal camps, signs of exploitation, snares, and other problems. Managers can respond to the resulting information as appropriate. This may, for example, require collaborating with local communities, taking legal action when necessary, building fire breaks, and collecting snares.

International aid and development activities increasingly address conservation directly or include some "biodiversity" component. Conservation experts of many kinds act as advisors, coordinators, and assessors; these individuals have considerable influence in determining how funds are used and what activities are endorsed. Most donor-led projects require a commitment of staff and resources by local agencies, yet donors appear blind to the opportunity costs that can be incurred by diverting scarce staff from activities that may have a higher immediate priority.

的支援，但捐助人却似乎没意识到从那些更具迫切性的活动中抽调原本已寥寥可数的工作人员所增加的机会成本。

我熟悉几个资金充裕的自然保护项目，它们都会包含外国和当地科研人员对各种生物参数的详细评估，并编写五花八门有关当地动植物的书刊和资料库。但几年下来，当地护林员仍未到过「保护区」的许多地方，也没有接受过如何阅读地图或操作指南针的培训。名义上负责巡护的工作人员通常没有适合野外工作的鞋履。即使是资金充足的项目，工作人员连续几个月得不到薪水也是司空见惯的事。在这种情况下，当地工作人员只好各施各法张罗食物和收入；比如把他们的交通工具(如果有的话)变成计程车，捕猎保护区的野生动物为肉食，「许可」他人非法伐木，或甚至由他们亲自操刀。尽管有这些破坏性活动，这些项目的监测工作仍可以很成功。这些项目的目标并没有反映当地自然保育的需求，成功也不是由恰当的方式制定的。不幸的是，一般的资助评估对未来保育工作的支援每每依据已有的成功例子而不是从失败中汲取教训，妨碍了开诚布公的讨论。

我们必须开始更公开、更诚实地讨论如何满足自然保育的需求，认识刻下存在的问题，找到导致目前状况的根源并寻求解决方法。我们现在面对的难题不单是人们对保育状况的无知与缺乏交流，还牵涉很多问题。对于生物多样性的定义及监测的原因存在困惑；《生物多样性公约》(CBD)的签署国虽然同意评估和监测生物多样性，但却没有相关标准。常见的生物多样性资料收集活动与当地的自然保育需求并不相关；例如，物种记录如何转化成管理部门的对策？现在许多科研重点是观察问题的发展，而不是尽力加以阻止。对管理天然资源的部门来说，更重要的工作是尽早确定问题、威胁和防护策略，并确保采取适当的管理干预措施。

要取得自然保育的成功，必须有效分配资源。尤其需要当地投入时，必须根据当地的优先行动次序和限制条件，谨慎调配科研和监测活动。科研人员如要作某地方的自然保育顾问，必须先熟悉当地的管理问题。

保护区管理的目的是保护它们包含的价值，而不是提供统计资料。许多科学研究可能最终是有价值的，但如果这些研究不能阻止自然保护区所面临的众多威胁，就不应该优先开展。世界许多地方的自然保育需要更多资源，但是短期内，如果能够谨慎分配已有的资源已可以取得更大的成绩。

*节选自*Conservation Biology *(参阅第30页推荐阅读材料)*

I am familiar with several well-funded conservation projects that have included detailed assessments of all kinds of biological parameters by both foreign and post-graduate local staff and that have produced some impressive publications and databases on local flora and fauna. Yet after several years, local ranger staff had never visited many parts of the "protected area" and remained untrained in how to use a map or compass. Staff nominally responsible for patrolling often lacked appropriate footwear for field activities. It is commonplace even in well-funded projects for field staff to go without payment for months at a time. Under such conditions local staff must improvise food and income to survive; examples include using their transport (if they have any) as a taxi, taking wildlife from the protected areas for meat, "licensing" illegal pit sawyers, or cutting timber themselves. Despite such destructive activities these projects still have been successful in their monitoring efforts. Projects goals do not reflect local conservation requirements, and success is not defined in a relevant manner. Unfortunately, regular funding reviews, in which future financial backing is contingent on perceived success rather than on learning from failures, discourage open discussion.

We must begin a more open and honest debate about how to meet conservation needs and recognize that problems exist, identify what has led to this present situation, and seek remedies. The situation involves more than ignorance and poor communication. There is confusion surrounding what biodiversity is and why it should be monitored; signatories to the Convention for Biological Diversity (CBD) agreed to assess and monitor biological diversity, but standards do not exist. Popular biodiversity data-collection activities are not relevant to local conservation requirements; how does counting species, for example, translate into a management response? Much of the current scientific emphasis is on watching problems proceed rather than trying to halt them. For good resource managers it is far more valuable to identify problems, threats, and prevention strategies early, and ensure that adequate management interventions can be taken.

If conservation is going to succeed, resources must be allocated effectively. Research and monitoring activities must also be allocated with sensitivity to local priorities and limitations, especially when local resources are involved. Researchers should ensure that they are familiar with local management issues before they become general advisors on local conservation needs.

Protected areas must be managed to protect the values they contain, not to provide statistics. Research of many kinds may ultimately be valuable, but should not be conducted at the cost of failing to halt the overwhelming threats now facing many conservation areas. Conservation in many parts of the world needs more resources, but in the short term more can be achieved by careful allocation of the resources already available.

Abridged from an article originally appearing in Conservation Biology *(see Further Reading p.30.).*

保护区生物多样性监测简易系统

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过去已有不少文献描述了生物多样性量化记录所依据的基本假定，亦列出了更广义的生物多样性监测概念，但处于资料标准化以及资料收集和分析难度的矛盾状况下，却鲜有建议提出如何把这些概念有意义地转化为适用于用于发展中国家的建议。现今初步倾向跟从西方国家的标准，但由于发展中国家的人力和财力均非常有限，以及要应付贫穷农村人口的生存需要，这似乎并非适合的作法。热带森林系统监测通常都会建立永久植被样地，定期鉴定及测量所有超过一定大小的植物物种，但这类监测结果却对管理部门帮助不大。要达到自然保育的目的，保护区监测系统必需是切实可行及能起指导作用。

我们的监测系统是1996至1998年间在菲律宾的三个保护区建立起来的。工作组成员包括菲律宾和丹麦的专家；系统建立在文献资料、实地考察管理实况以及与保护区工作人员、非营利组织、当地社区和国家/海外管理人员和科学家的讨论等基础上。研究中的三个保护区的面积界乎237到3,595 平方公里，有24至36名工作人员，保护区内及周边人口为3,000到43,000人。最具破坏性的人类活动包括伐木、公路、楼宇和工厂的建设、种植经济林和大型农场的建立、轮耕，以及以土地投机为目的之森林竭伐。

为达到保护区的法定目标：「向菲律宾人保证……所有当地动植物的永久生存」，进行的监测是为了弄清：(1) 栖息地和生态系统是否在退化？(2) 受威胁的动植物数量是否正在下降？(3) 原因是什么？(4) 管理部门的干预是否已对生态系统产生了预期的影响？(5) 可持续自然资源的利用能否带给当地人民更多利益？

三个保护区的原住民过去沿用的都是对资源作有限利用的传统制度体系；社区定期讨论自然资源的可利用性和质量。护林员几乎没有受过什么教育和培训，监测工作的时间亦不足，而管理部门也没有什么维护资金。因此，为使监测结果可用来提高保护区的管理水平(即使是短期性的)，也要选择简单的监测方法。监测系统的重点在于解决最具迫切性的问题，和为保护区管理部门提供全面资讯。

A simple system for monitoring biodiversity in protected areas

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Basic assumptions for quantitative recording of biodiversity have been described in the literature, and the broader concepts of biodiversity monitoring have also been outlined, but few suggestions have been made as to how these may be meaningfully translated into a developing country context, given the tensions between standardisation of data, and ease of collection and analysis. Initial efforts have tended to follow standards used in Western countries - unlikely to be suitable given the very limited human capacity and financial resources, and the subsistence requirements of the rural poor, in developing countries. Monitoring systems in tropical forests have often included establishment of permanent vegetation plots where all plants above a certain size are identified to species and measured at intervals, but results rarely provide input to management. For conservation purposes, protected areas need monitoring that is realistic and useful for guidance.

Our system was developed from 1996 to 1998 in three protected areas of the Philippines. The team included Filipino and Danish professionals; the system was based on literature search, field surveys of management practices, and discussions with park staff, NGOs, local communities, and national/overseas managers and scientists. The three parks in the study varied from 237 to 3,595 km^2 in area, had 24-36 staff and human populations of 3,000 to 43,000 in and around them. The most damaging human activities included logging, construction of roads, buildings and factories, establishment of commercial crop plantations and large farms, swiddening, and forest clearing for land speculation.

In order to fulfil the protected areas' statutory objective, "to secure for the Filipino people....the perpetual existence of all native plants and animals", monitoring was intended to say: (1) Are habitats and ecosystems being degraded? (2) Are the populations of threatened plants and animals declining? (3) What are the causes? (4) Has management intervention had the intended impact on the ecosystem? And (5) are there increased benefits to local people from sustainable natural resource use?

Traditional systems for controlling access to resources were used by indigenous people in all three parks; communities regularly discussed the availability and quality of natural resources. Forest guards, meanwhile, had little education and training, and very limited time for monitoring work. Also there was little funding available. It was thus important to choose simple monitoring procedures, though ones from which results could be used - even in the short-term - for improving park management. The monitoring system was designed to focus on addressing priority issues and providing general input to protected-area management.

监测指标是以简单的方法量度复杂的现象，促进对复杂关系的了解。生物多样性指标应显示正冒起的自然保育问题，引起对管理政策和行动有效性的关注。理想的指标是(1)容易采集、分析和报告，合乎成本效益；(2)对当地群众有意义；(3)直接指示生物多样性和资源利用的变化；(4)适用于连续性地评估当地面临的各种压力或威胁；(5)能够区分自然周期或趋势(天气、气候等)和人类引起的变化；(6)相对的不受样本大小所影响；(7)高敏感度以提供变化的早期警报；(8)并能应用于多种生态系统。

我们不能全面监测一个保护区内数以千计的物种，也无法预知某些特别熟悉的类群，如鸟类或大型哺乳动物，是如何反映整体生物多样性状况；我们甚至不知道物种丰富度的估计意味些什么，例如对森林的干扰通常会增加物种丰富度，却令森林专化种相对减少。菲律宾保护区的生物多样性受到的主要威胁是大范围的栖息地变化；因此，监测重点应放在关键的栖息地和保护区利用上。我们选择了一些物种(如食蟹猴*Macaca fascicularis*, 菲律宾疣猪 *Sus philippensis*, 菲律宾食猴鹰*Pithecophaga jefferyi*)和资源利用迹象(打猎、采蛋、伐木、拾藤等)来提供有代表性的资讯。任何比所选物种更敏感或更受威胁的物种一般不易鉴定，监测调查也容易受调查者个人能力偏差影响。

在研讨会讨论的基础上，我们选择了4个指标：(1)指定物种的观察记录数目和当地资源利用之变化；(2)优先地区植被类型样地的大小和土地利用之变化；(3)沿特定样带上某些指定动物的出现踪迹的频率变化及当地资源利用的变化；(4)在指定的时段里可观察到的人均收获量以及从事特定的影响生物多样性活动的人数变化。我们使用了4种相应的方法：(1)野外日记法，包括在定期巡护过程中系统地观测野生动物和资源利用，鼓励保护区员工观测当地资源利用和物种丰富度的变化；(2)照片记录法，在选定的山坡的定点作定期拍摄，提供不受观测者和鉴定技巧影响的图片资料；(3)样带法，在许可的情况下利用部分现有的巡护路线，记录几种选定的野生动物的观察记录和痕迹以及资源利用；(4)重点小组讨论法，由社区中的志愿者组成监测

Indicators measure complex phenomena in a simplified way, thereby promoting communication about complex relationships. Biodiversity indicators should highlight emerging conservation problems and draw attention to the effectiveness of management policies and actions. Ideal indicators are (1) easy and cost-effective to collect, analyse and report; (2) meaningful to local people; (3)directly indicative of changes in biodiversity and resource use; (4) suited to providing a continuous assessment over a wide range of stress (threats); (5) able to differentiate between natural cycles or trends (weather, climate etc.) and man-made changes; (6) relatively independent of sample size; (7) sufficiently sensitive to provide an early warning of change; and (8) applicable over the range of ecosystems.

It is impossible to monitor all the thousands of species in a park, and there is no *a priori* way to assess how specific well-known groups, such as birds or larger mammals, reflect overall biodiversity; we do not even know what a species-richness estimate will tell us, as forest disturbance often leads to an increase in species richness even though forest specialists decline. The main threat to biodiversity in a Philippine park is large-scale habitat changes; we thus found it reasonable to focus monitoring mainly on key habitats and uses in the parks. We identified species (e.g. Long-tailed Macaque *Macaca fascicularis*, Philippine Warty Pig *Sus philippensis*, Philippine Eagle *Pithecophaga jefferyi*, and signs of resource use (hunting, egg-collecting, logging, rattan-gathering) to provide useful proxy information. Any species more sensitive or threatened than those selected would not be easily identified, and surveys would be subject to observer bias.

Based on workshop discussions we selected four indicators: (1) changes in number of sightings of designated species and local resource uses; (2) changes in size of vegetation type blocks and in land-use of priority areas; (3) changes in frequency of detection of specified signs of presence of designated fauna species and local resource uses along established transects; and (4) changes in perceived harvest volume per effort, and in number of people engaged in specific biodiversity-impacting activities, within a given time period. We used four corresponding methods: (1) a Field Diary method, comprising systematic observations of wildlife and resource use during regular patrols, encouraging protected-area staff to be observant of changes in the use of park resources and the abundance of species; (2) a Photo Documentation method, with on-the-ground fixed-point photography of selected hillsides, providing data independent of observer and identification skills; (3) a Transect Walk Method, using parts of existing patrol routes when possible, and recording observations, signs and spoor marks of a few pre-selected wildlife species and resource uses; and (4) a Focus Group Discussion method with volunteer community monitoring groups, drawing upon Participatory Rural Appraisal (PRA) techniques.

Only basic equipment is needed in these methods: note-

小组，使用参与式农村评估(PRA)技巧。

这些方法只需要基本设备：笔记本、铅笔、望远镜、手表、指南针、照相机、油性笔、纸张、储存资料用的扣眼档夹、图片资料表格、样带资料表和食物。在开始的时候，海拔仪和GPS(全球定位仪)也是非常有用的。可能的话，保护区应委任不同的员工负责生物多样性监测与执法，这才有利监测者与群众坦诚交流。收集的资讯由保护区办公室负责人分析，结果可供保护区管理委员会以及当地居民使用。对资料的分析必须要考虑偶然的变化、天气或季节的影响以及观测者或记录者的转变。

在超过两年半的时间里，8个保护区基于这些监测方法采取了至少156项管理行动。尤其是重点小组讨论法和野外日记法被证实对发动保护行动是非常有效的。

虽然这个系统还不能包括一个监测计划中所有的有利元素，但它确是一个切实可行的起点，随著时间进一步发展，相信可以有更多的资源和技术人员来管理和监测生物多样性。

有传统社区居住的保护区内可以考虑推行的保育方式是：通过加强非破坏性的自然资源管理体系，局部地排除非传统资源利用者和外来利用者，以巩固现有的生物多样性价值。在菲律宾的保护区，这个生物多样性监测体系便有助加强这种策略。

*节选自*Biodiversity and Conservation*和*Oryx *(参阅第30页推荐阅读材料)；这两篇文章都在网站www.nordeco.dk上载。*

book and pencils, binoculars, watch, compass, camera with batteries and film, markers, large sheets of paper, ring binders for data storage, Photo Documentation forms, Transect Walk field data sheet, and food. It is also useful to have an altimeter and a GPS (Global Positioning System receiver), at least at the outset. Where possible the park staff responsible for biodiversity monitoring are different from those involved in enforcement, in order to encourage open discussion with local people. The information gathered is analysed by the head of the Protected Area Office, and the results used by the Protected Area Management Board, as well as by local residents. Interpretation has to take into account chance variations, influence of weather or seasons, and changes in the observers or recorders.

At least 156 management actions have been undertaken in eight protected areas over $2^1/_2$ years on the basis of these monitoring methods. In particular, the focus group discussion and field diary methods have proved very effective in generating conservation action.

While the system has been unable to include all the desirable elements of a monitoring programme, it is a feasible starting point, which can evolve further over time as more resources and skilled people become available to manage and monitor biodiversity.

The way forward in protected areas with long-established local communities probably lies in the consolidation of existing livelihoods through strengthening non-destructive natural resource management systems and supporting partial exclusion of non-traditional resource users and users of external origin. The biodiversity monitoring system helps reinforce this strategy in Philippine protected areas.

Abridged from papers originally published in Biodiversity and Conservation *and* Oryx *(see Further Reading p.30.); both will be available shortly at www.nordeco.dk <http://www.nordeco.dk>.*

参与式生物多样性评估

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参与式评估、监测和评价生物多样性(PAMEB)使科学的门外汉都能参与观测、测量或评估生物多样性。让当地居民参与评估和监测生物多样性是非常有意义的，因为：(1) 他们多个世代以来累积了很多利用资源的经验和知识；(2) 当地资源的利用对规划可持续资源利用是有很大影响；(3) 使居民参与规划和管理可以提高他们对保育的意识和积极力；(4) 居民对收集和分析资料的参与加强了决策的透

Conducting a participatory biodiversity assessment

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Participatory assessment, monitoring and evaluation of biodiversity (PAMEB) involves non-scientists in observing, measuring or assessing biodiversity. Involving local people in assessing and monitoring biodiversity is valuable because: (1) they may have knowledge based on generations of use; (2) local resource use is crucial to planning sustainable harvesting; (3) involving people in planning and management is known to increase their awareness and motivation for conservation; (4) involving them in gathering and analysing data enhances the transparency of decision-making; (5) interactive partici-

明度；(5) 互动式参与能促进社区和保护区工作人员之间的关系，解决他们之间的冲突；(6) 由于这个方法运用当地现有的人力及资源，体现了可持续性。 PAMEB需要确认利益相关者、他们的目标、资讯需求、代表利益的方式、预算、参与的利益和障碍、监测目标、指标和方法；如何分析、验证和使用、记录和宣传这些结果；及如何利用经验来改善整个系统。

千万别低估促进参与式过程所需的时间。在进行之前，负责人员应先预备所有二手资讯(地图、报告、航片)，并充分利用现有的非正式监测体系。必须有利好的政策和建制环境。必须缔造利益相关者建立相互理解的机会；因为他们对为何要监测和管理的想法可以是不同的。

正如利益相关者群体之间和群体内的价值观会有差异一样，他们对资讯的需求也是不同的。如果需求可以相容，利益相关者就可以作为一个跨范畴的团队来工作；否则，他们可以发展平行的系统。云南省的中荷森林保护与社区发展项目(FCCDP)中，监测是由三个平行系统展开的：(1) 科学家们进行详细的生物编目和永久监测样地来探究生态系统的变化；(2) 保护区护林员在他们常规巡护中记录「优先」野生动物的观测；(3) 在保护区人员的帮助下，社区通过指标(如采集难度)来监测土地利用、野生动物造成的农作物损失及选定的资源和野生生物。我们预计日后会把三个系统所得的结果交换。由社区和工作人员开展的参与式监测可以引导利益相关者改变他们对资源丰富度和生态系统状况的认识，并促使保护区员工进一步学习生态学知识来回答社区成员的提问(见下)。

在选择建立合适的监测团队前，应了解当地社区(或其他利益相关者群体)不同的利益和知识。团队可能包括不同的资源利用者(如农民、采药者和猎人)，或者以年龄、性别和收入组合的团体。团队应当包括被选定群体的代表，当地野生动植物鉴定专家、当地相关官员和有效的驱动者。同时亦应在项目早期制定预算(包括会议、交通、宣传、传播、培训、

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利用图画照片可传递生物多样性的讯息
Pictures can help reveal local knowledge of biodiversity

pation can improve relations and resolve conflict between communities and reserve staff; and (6) it is sustainable as it uses locally available capacity and resources. PAMEB requires identifying the stakeholders, their objectives, their information needs, and how they can be represented; the budget; benefits and obstacles to participation; the targets to monitor, indicators and methods; how to analyse, validate and use, document and disseminate the results; and how to use experiences to improve the system.

The time to facilitate a participatory process must not be underestimated. All secondary information (maps, reports, aerial photos) should first be compiled, and existing informal monitoring systems recognised. The policy and institutional environment must be favourable. Stakeholders must be allowed the opportunity to build mutual understanding; objectives of monitoring and management may be different for each.

Just as values differ between and within stakeholder groups, so their information needs vary. If the needs are compatible, stakeholders can work as a multi-disciplinary team; if not, they may develop parallel systems. In Yunnan's Sino-Dutch Forest Conservation and Community Development Project (FCCDP) monitoring was conducted by three parallel systems: (1) scientists conducted a detailed biological inventory and permanent monitoring plots to explore changes in the ecosystem; (2) park wardens recorded observations of 'priority' wildlife on their routine patrols; and (3) communities, with the support of management staff, monitored land use, crop damage by wildlife and selected resources and wildlife through indicators (e.g. collecting effort required). It is anticipated that in the future results will be exchanged between the three systems. The participatory monitoring by communities and staff led stakeholders to change their perceptions of resource abundance and ecological health, and prompted reserve staff to seek further training in ecology, to answer community members' questions (see below).

Differences in interest and knowledge within a local community (or other stakeholder group) should be understood before selecting a team of appropriate monitoring partners. Partner groups might include different resource users (e.g. farmers, herbalists and hunters), or groups based on age, gender and income. Teams should include representatives of selected groups, recognised local experts on identifying wildlife, relevant local officials, and an effective motivator. Budgeting should also be done at an early stage (including costs of meetings, transport, publicity, dissemination, training, specimen preparation and storage, data analysis and photography, and fees of participants), to ensure the

样本制备和储存、资料分析和图片及参与者的费用），以确保建议的监测是可行的。

团队必须决定需要测量哪些生物多样性组分，以及它们意味著什么，并应当在利益相关者的关注层面基础上选择监测目标(如科学家关注全球受威胁的物种或栖息地、保护区人员关注受保护物种和植被，当地社区关注资源)。例如，云南的村民选择不仅监测资源，也监测损坏庄稼的野生动物以及他们认为在生态系统中有重要作用的动物。这些选择的目标种类应通过简单的指标来进行监测(参阅第24页Danielsen的文章)。

监测的方法可分为定量和定性两种。环境变化的定量测量在更广阔的尺度和对当地规划往往更有意义。生物学家可以引入重要的抽样概念，当地居民可以记录相当复杂的资料，但是简化的方法通常更加适合。例如在云南，便采用了市场调查和访问合作村民的方法来量化资源的采集及售卖。在对资源有限且受严重威胁的地区，定性方法，如资源丰富度，可能就足够了。云南的贫穷农民和采猎者是主要的监测夥伴，森林巡察和访问合作村民等方法都用于评估物种是否易于看到，或生境、野果、人工林等的质量是高还是低。地图是结合物种和景观价值的重要开始；即使在资讯提供者不常到的偏远地区，当地绘制的地图与科学资料之间通常有密切的相关性(参阅第30页推荐阅读材料：Stockdale & Ambrose, 1996, Sheil *et al.*, 2002)。

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天然药材是自然生态系统的珍贵资源的农民
Medicines are valued resources in natural ecosystems

理想的情况是，PAMEB的结果都能对提供和分析资料者的工作有所帮助。当地居民通常对易被忽略的事情另有一番见解，因而制定的解决方法会更加切合实际及较易调整以适应当地情况。这些结果可从更科学化的监测和巡护得到的反馈资讯得到证实。监测和评价整个过程和结果是非常重要的；若能对PAMEB产生的影响多加记录，将有助科学家和决策者找出他们能够贡献的地方以及从中得到的益处。

*节选与改编自*Biodiversity Assessment and Monitoring—Guidance for practitioners。*UNEP-World Conservation and Monitoring Centre的一章，英国康桥(参阅第30页推荐阅读材料)。*

proposed monitoring is feasible.

Decisions must be made about which components of biodiversity are to be measured, and what they tell us about the whole. Monitoring targets should be selected on the basis of stakeholders' interests (e.g. scientists might be interested in globally threatened species or habitats, nature reserve staff in protected species and vegetation, and local communities in resources). Villagers in Yunnan, for example, chose to monitor not only resources but also wild animals that damaged their crops and those they considered had important function in the ecosystem. The chosen targets are monitored through simple indicators (see Danielsen pp. 24).

Methods can be quantitative and qualitative. Quantitative measures of change are often more meaningful at the wider scale, and for planning. Biologists can introduce important sampling concepts, and local people are capable of recording quite complex data, but simplified methods may often be more appropriate. In Yunnan market surveys and interviews with co-villagers were used to quantify resources collected and sold. Qualitative methods, e.g. for resource abundance, may be sufficient where human resources are limited and threats are high. Again, in Yunnan, where poor farmers and hunter-gatherers were the main monitoring partners, forest walks and interviews with co-villagers were used to assess whether species were easy or hard to see, or whether habitats, fruits, plantations etc. were of high or low quality. Maps are a valuable start to combining species and landscape values; there is often a strong correlation between detail on locally-made maps and scientific data - even in distant sites visited infrequently by local informants (see Further Reading p.30: Stockdale & Ambrose, 1996, Sheil *et al.*, 2002).

Ideally, the results of PAMEB are used by those who provided and analysed the data. Local people often provide interpretations and insights that otherwise may have been missed, and the resulting solutions will be more practical and adjusted to local conditions. Results can be validated through feedback from more scientific monitoring and patrolling. Monitoring and evaluation of the process and results are very important; increased attention to documenting the impact of PAMEB will help scientists and decision-makers see where they can contribute to and benefit from such an approach.

Abridged and revised from a chapter in Biodiversity Assessment and Monitoring. Guidance for practitioners. *UNEP-World Conservation and Monitoring Centre, Cambridge, UK. (see Further Reading p.30.).*

云南参与式监测快速分析结果

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2001年7月起，一项参与式资源监测项目在云南小黑山和铜壁关自然保护区周边的12个村庄展开。主要方法有三：(1) 林间步行观察；(2) 村民采访；(3) 市场调查。一年后，村民与保护区员工一同在村民会议上分析监测结果，对较早前发现的问题亦提出了管理措施的建议。

保护区附近的村落
Village near nature reserve

由于监测时间太短，不足以判断物种实际丰富度的变化是否就如观察所见，但是两个保护区的村民都察觉到大多数药用植物、野果、木材、薪柴、鱼、蛙等的数量正在降低。他们将此归因于过度采集和栖息地的破坏。在铜壁关，甘蔗人工林威胁到如药用植物、薪柴和木材等资源；同时，大多数村民认为，野果数量的下降与传播种子的野生动物数量减少有关。两个保护区的村民相信，鱼和青蛙的数量减少与他们使用杀虫剂耕作有关。大家认为野菜、野菌、竹笋和鸟类的数量仍旧丰富，部分源于村民在自家菜地里栽种了「野」蔬菜和竹笋，而采集野菌亦是一项非常耗时的工作。在实行了没收枪支等轻武器的措施后，村民认为鸟类的数量确实有所增长。造成野生动物破坏农产品的事件上升，是因为多数村庄旁的生境经已退化，动物唯有到村民的农地里觅食，如玉米或甘蔗等。小黑山保护区的村民还认为像野猪这样的动物数量增加，是基于食肉动物(如豹)的数量减少所致。

基于大家亲眼目睹的环境变化和解释，村民建议在管理上采取一些干预手段和具体行动措施。铜壁关村民建议要规范草药商的买卖活动。监测使两个保护区的药用兰花采集受到严格控制，所有村民已经开始培育药用兰花石斛*Dendrobium nobile*。村里的规章制度也作出了相应调整，严禁伐木采果。铜壁关所有村民都建议保护能传播种子的野生动物。

两个保护区的村民都支持云南政府大力提倡的使用

Rapid results from participatory monitoring in Yunnan

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A participatory resource monitoring scheme was implemented in 12 villages in and around Xiaoheishan and Tongbiguan Nature Reserves in Yunnan from July 2001. The main methods were: (1) Observation through forest walks, (2) Village interviews, and (3) Market surveys. Villagers and reserve staff analysed the monitoring findings after one year during a village meeting, and suggested management interventions to address the perceived problems.

While the monitoring period was insufficient to determine whether actual abundance was changing in the way it was perceived, villagers in both nature reserves perceived a reduction in abundance of most species of medicinal plants, wild fruits, timber and fuel wood, fish and frogs. They attributed this to unsustainable collection and habitat destruction. At Tongbiguan the establishment of sugarcane plantations was seen as a threat to several resources, such as medicinal plants, fuelwood and timber, while most villages believed there were fewer wild fruits because the fauna dispersing them had become rare. Half the respondents in both nature reserves attributed the perceived decline in fish and frogs to their use of pesticides in agriculture. Wild vegetables, fungi, bamboo and birds were believed to be still abundant; this was attributed in part to the planting of "wild" vegetables and bamboos in home-gardens, while collection of fungi is very time-consuming. Bird populations were believed to have increased following the confiscation of firearms. A perceived increase in damage by wildlife was attributed in most villages to habitat degradation, causing animals to go for more easily obtainable food such as corn and sugarcane in the villagers' fields; villages in Xiaoheishan also believed that populations of animals such as Wild Boar *Sus scrofa* had increased due to declines in populations of predators (such as Leopard).

On the basis of the perceived environmental changes and their explanations, villagers suggested several management interventions and took some concrete actions. Villages in Tongbiguan suggested regulating the trade by herb dealers. The collection of medicinal orchids in both nature reserves has been restricted as a result of the monitoring, and all villages have started to cultivate the medicinal orchid *Dendrobium nobile*. Village regulations have been adapted to prohibit tree felling to collect fruits. All villagers at Tongbiguan suggested protecting seed-dispersing wildlife.

Villages in both nature reserves suggested using more energy-saving stoves to limit fuel wood use, as advocated by the Yunnan government. Half the villages in Xiaoheishan suggested establishing fish ponds, and half

节能灶，以限制柴薪的耗用。半数小黑山保护区的村民提议修建鱼塘，而铜壁关半数村民提议禁止电鱼，以保护鱼类资源。又两个保护区半数的村民都提议使用有机肥料。

村民建议对数量日益增长或丰富的野菌及野菜，应可进行可持续的野外采集，并建立由村寨或乡镇为本的绿色食品加工厂，对野生植物进行加工。这些来自天然林的绿色食物经过加工后可以销往城市，以满足日益增长的有机食物需求。

*摘自并节选于投给*Biodiversity and Conservation *的一篇论文。(见下推荐阅读材料)*

参与式策略、方法与工具

(2004年5月)农粮组织(FAO)发行的光碟收录了由FAO或其他机构发展及应用的参与式农业的策略、方法及野外工具。另附精选了Participation Website的图书馆资料库部分文件。如欲索取，请联系Bernd.Seiffert@fao.org。

those at Tongbiguan suggested prohibiting electro-fishing, to conserve fish stocks. Half the villages in both nature reserves suggested using organic fertilisers on their fields.

For those resources perceived to be increasing or abundant, such as fungi and wild vegetables, half the villages suggested allowing sustainable collection from the wild, and establishing a green food factory - a village- or township-based factory processing wild vegetables, collected from natural forests, to be sold to urban markets in response to growing demand for organic food.

Abridged and adapted from a paper submitted to Biodiversity and Conservation *(see Further Reading below).*

PARTICIPATORY APPROACHES, METHODS AND TOOLS <http://www.fao.org/sd/dim_pe2/pe2_040502_en.htm>

(May 2004, FAO) This resource CD was produced by the FAO Participation Website Team and includes a field tools database of participatory approaches, methods and field tools, developed or applied by FAO and other organizations. It also includes a selection of FAO documents taken from the Participation Website's annotated library database. To receive the CD-ROM contact Bernd.Seiffert@fao.org <mailto:Bernd.Seiffert@fao.org>.

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广东大雾岭自然保护区的蟌

An investigation into the damselflies (Zygoptera) of Dawuling Nature Reserve, Guangdong

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大雾岭位于广东省西南部，毗邻广西，地跨信宜、高州两市，于1996年升为省级自然保护区。其地理座标为东经111º8´~111º15´，北纬22º14´~22º17´。主峰海拔1,704米，为广东第二高峰。保护区总面积35.2平方公里，有林地26.1平方公里，森林覆盖率81%，其中保存完整的天然次生林有16.7平方公里。大雾岭受到海洋气候及南亚热带季风气候的影响，月平均温度17-18℃，年降雨量2,300-2,600毫米。由于地理位置独特，动植物物种丰富，珍稀特有种类繁多，区系复杂，初步调查有野生维管植物1,210种，估计植物种类可超过2,000种[1]。

图一：透翅绿色蟌 *Mnais andersoni*, 摄于 2002 年 6 月大雾岭 (海拔 1,001 米)
Fig 1. *Mnais andersoni*, taken at Dawuling, in June 2002 (1,001m asl)

1988年7月、2002年5至6月及9月、2003年2及8月，中山大学昆虫学研究所师生先后4次在广东大雾岭省级自然保护区进行昆虫资源调查，采集了大量昆虫标本。初步鉴定结果有蟌类7科16属25种，其中赭腹丽扇蟌*Calicnemia erythromelas*，紫闪溪蟌*Caliphaea consimilis*，蕾尾丝蟌*Lestes nodalis*及黄腹绿综蟌*Megalestes heros*。有关详细名录请与作者联系（由于鉴定资料缺乏，部分种类未定）。

经过对大雾岭自然保护区分别于2002及2003年的野外考察工作，笔者发现在冬深春初期间，蟌类没有

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Dawuling in Southwest Guangdong is in Xinyi and Gaozhou near the Guangxi border. Upgraded to a provincial nature reserve in 1996, Dawuling is at 111º8'-111º15'E and 22º14'-22º17'N. The highest peak, Datianding, the second-highest mountain in Guangdong, is 1,704m above sea level. Dawuling Nature Reserve is 35.2 km^2 in size with reported forest cover of 26.1 km^2 (81%), of which 16.7 km^2 is considered well-preserved natural secondary forest. Dawuling has a maritime- and monsoon-influenced climate, with mean monthly temperature and annual precipitation respectively 17-18ºC and 2,300-2,600 mm. Preliminary botanical investigations have found 1,210 vascular plant species, and Dawuling is expected to have more than 2,000 plant species in all[1].

During the periods of July 1988, May to June 2002, September 2002, February 2003 and August 2003, Zhongshan University conducted four insect surveys in Dawuling Nature Reserve, collecting a substantial number of insect specimens. Twenty-five damselfly (Zygoptera) species in sixteen genera and seven families were identified after preliminary investigation, of which *Calicnemia erythromelas*, *Caliphaea consimilis, Lestes nodalis*, and *Megalestes heros* are new to Guangdong. A full list is available from the authors (some species have not been identified due to lack of information).

The field investigations in 2002-2003 found no active damselflies in midwinter or early spring. Of the 25 damselfly species collected, *Mnais andersoni* (Fig. 1) and *Matrona basilaris* (Fig. 2) occurred in the largest numbers, during summer and autumn respectively. The former inhabited either small streams with luxuriant herbaceous vegetation or tussocks beside mountain paths, while the latter was commonly found in larger streams or rivers shaded by trees.

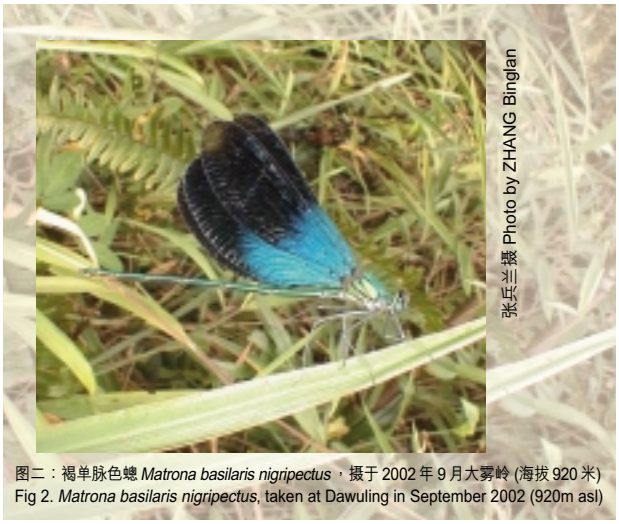
In view of the lack of reports on Zygoptera in South China, Chinese and overseas scholars have recently initiated investigations on Zygoptera in the region. Dawuling has an abundant water supply with clean and clear rivers and little human disturbance, and good riparian

出现。在所采获的25种蟌中，透翅绿色蟌 *Mnais andersoni*（图一）和褐单脉色蟌*Matrona basilaris*（图二）分别为夏季和秋季调查所获数量最多的两种蟌。前者栖息于草本植物茂盛的小溪，也活动于山道山壁上的矮草丛中，后者则在有乔木荫蔽的较大溪流甚至河流中均有栖息。

对华南大区域的蟌类资源，现在尚无系统报道，但国内外部分学者开始进行相关研究。大雾岭作为粤西的重要自然保护区之一，人为破坏少，水源充足，溪流甚多，且大多溪流水质清净，阳光充足，溪边植物种类丰富，海拔落差大，非常适合蟌生活，种类应比现在调查所得更丰富。其次，蟌科Coenagrionidae种类繁多，分布较广，目前在该地区却仅见异痣蟌属，因此有待进一步的调查。

致谢：广东大雾岭省级自然保护区工作人员容坚先生、李友余先生等参与向导和采集工作，韦敬辉先生审阅文稿，在此一并表示衷心感谢。

vegetation. Since this natural environment is a favourable habitat for damselflies, the actual species richness is expected to be higher than the current figure. Further investigations are planned.



图二：褐单脉色蟌 *Matrona basilaris nigripectus*，摄于 2002 年 9 月大雾岭 (海拔 920 米)
Fig 2. *Matrona basilaris nigripectus*, taken at Dawuling in September 2002 (920m asl)

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大雾岭溪流环境（2002 年 9 月）(海拔 990 米)
Stream environment of Dawuling in Septembert 2002 (990m asl)
张兵兰摄 Photo by ZHANG Binglan

节录 Excerpt

生 态 系 统 的 世 界
The creation of ecosystems

“……试想从湿地食物网中把棕榈林莺歼灭。食物链虽是断了，生态系统大抵仍旧完整无缺。原因在于链中每个物种都与别的食物链相连。湿地中依然活著的其他鸟类会捕食更多蜘蛛，湿地鹰会不动声色地转往捕食更多其他鸟类、啮齿动物、蛇和其他生物。仅见那些在棕榈林莺身上发现的羽螨、鸟虱以及其他共生生物，虽然它们本身是也是其他食物链的组成部分，却会随著寄主体一起消失，然而它们的消失对整个群落的影响却是微不足道。

再天马行空一点，先除掉两种莺，继而是所有莺类，最终是群落中的所有鸣禽。随著刃口加深，造成的影响也就日益严重并在群落中扩散，影响到难以确定的物种数目。如把蚂蚁—主要针对昆虫以及其他小动物的捕食者及食腐者也抽掉，影响便更形加剧，具体细节则更难预测。大多数鸟类、蚂蚁和其他动植物在食物网中都与多重食物链相连。很难估计哪种幸存者会取代被消灭的物种，以及它们对这新任务有多胜任。物理学家可以缯出单粒子的活动；可以信心十足地预测两个粒子的相互作用；但出现三个或以上的粒子时，物理学家便开始技穷。要注意的是生态学是比物理学还要复杂得多的一门学科。

灭绝过程的相对面就是物种堆迭。生态学家在大部分情况下无法预测那些物种可入侵群落并增加其多样性。随机选择一片栖

"... I magine that you excise the palm warblers from the marsh food web. That food chain is broken, but the ecosystem remains intact, more or less. The reason is that each species in the chain is linked to additional chains. Other species of birds still present in the marsh will eat more spiders, and the marsh hawks will turn, almost imperceptibly, to a larger number of birds, rodents, snakes, and other creatures. Feather mites, bird lice, and other symbionts found only on palm warblers, part of yet other chains, disappear with their host, but their loss has a negligible effect on the community at large.

Expand the thought experiment to extirpate two warbler species, then all warbler species, and finally all the songbirds in the community. As the knife cuts deeper, its effects will spread with increasing severity through a large but indeterminate part of the community. Take out the ants, the principal predators and scavengers of insects and other small animals, and the effects will intensify - yet the details are even less predictable. Most species of birds, ants, and other plants and animals are linked to multiple chains in the food web. It is very difficult to assess which survivors will fill in for the extinguished species and how competently they will perform in that role. Physicists can chart the behavior of a single particle; they can predict with confidence the interaction of two particles; they begin to lose it at three and above. Keep in mind that ecology is a far more complex subject than physics.

The reverse of the extinction process is species packing. Ecologists are unable for the most part to predict which species can still invade the community and add to its diversity. Select a habitat at random. How tightly packed are the species? What is the upper limit of stable

息地，物种堆迭有多紧密？如果人类不插手干涉，那么稳定的多样性上限是什么，可以维持的最高物种数量又是多少？人工引入越来越多的物种，便能轻易增加本土多样性，如把兰花植于树干上，将动物园繁殖的老虎放归森林，但是大部分引入的物种最终还是会消失。如果没有持续的人工干扰控制，群落的物种数目一旦过多，其多样性大都会回复到较低的水平，或可能恢复原状，又或不受影响。

在传统食物链以外的物种，它们相互间亦有其他联系，这些联系因无固定的规律或法则可循，也就加强了群落结构的不确定性。竞争—尤其是物种间相互排斥的竞争—便不易确定。除去食腐动物和共生生物造成的影响亦同样难以确定。最难评估的是，多年来改变实质环境的物种所造成的影响，优势树种盖过并改变了其他动植物赖以生存的水热环境。筑土墩的白蚁翻土，增加土壤的养分；它们改变化学元素的成分，影响地道附近生长的植物物种。当螨和跳虫繁殖旺盛，真菌孢子和腐殖质相应减少，处处存在不确定程度的相互影响。

……生物学家肩负著新的使命重投自然历史的怀抱。他们不能指望由上而下地从生态系统的特徵(能量流、养分回圈、生物量)中了解许多有关群落和物种的特徵资讯。只有详细了解大量重要组成物种的生命周期与生物学，才能有望找到能准确描绘在人类冲击下生态系统前途的原则和方法。

diversity, the highest number of species that can be maintained without human intervention? It is easy to enhance local diversity by the artificial introduction of more and more species - orchids affixed to tree trunks, zoo-bred tigers released into the jungle - but most would eventually perish. Without constant and intrusive manipulation, most overloaded communities will revert to a lower state of diversity, perhaps resembling the original, perhaps not.

The indeterminacy of community structure is increased by the existence of connections between species lying beyond the conventional food webs, and for which few reliable laws or rules exist. Competition - especially that resulting in the exclusion of one species by another - is especially difficult to call. So are the effects of removing scavengers and symbionts. Most difficult of all to assess is the impact of species that alter the physical environment over many years. Dominant tree species overgrow and change the temperature and humidity regimes in which other plants and animals must live. Mound-building termites turn and enrich the soil; they alter the composition of chemical elements and determine the species of plants that can grow near their underground tunnels. Populations of mites and springtails bloom, and fungus spores and humus correspondingly decline - all to indeterminate degree.

... Biologists are returning to natural history with a new sense of mission. They cannot expect to learn much more from the top down, from the properties of ecosystems (energy flow, nutrient cycles, biomass) interpolated to the properties of communities and species. Only with a detailed knowledge of the life cycles and biology of large numbers of constituent species will it be possible to create principles and methods that can precisely chart the future of ecosystems in the face of the human onslaught."

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《森林脉搏》投稿须知

范畴

《森林脉搏》由嘉道理农场暨植物园中国项目出版，每年两期，为致力从事华南地区自然保育人士报导环保资讯，提供讨论及交流渠道，藉以启发读者。《森林脉搏》的内容题材包罗森林和生物多样性各个保育范畴，尤以改善资源管理与减少威胁为报导主题。凡从事相关保育的工作者、森林管理人员、科研人员及顾问等都欢迎投稿。

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Scope

Living Forests magazine is published twice a year by the China Programme, Kadoorie Farm and Botanic Garden. It aims to inform, inspire and serve those dedicated to nature conservation in the South China region, providing a platform for discussion and information exchange. *Living Forests* publishes material on all aspects of forest and biodiversity conservation, particularly with the potential to improve management and reduce threats. We welcome submissions by forest managers, researchers, advisers and practitioners with related objectives.

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1. **Articles**
   Feature articles (1,000-1,200 words) and short articles (500 words), with photographs, are invited on topics relevant to the magazine's focus in South China.
2. **Letters**
   Contributions (generally <500 words) in response to material published in previous issues of the magazine.
3. **Notices and news**
   Items (generally <500 words) concerning recent developments in conservation or important announcements, other than from published sources. Other items of interest include news of the availability of grants or funding opportunities, and announcements of relevant meetings, workshops and conferences.
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