

# 维持人类 **21** 世纪生命 保障系统的科学共识

为决策者提供的信息

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## 为决策者提供的要点

# 维持人类 21 世纪生命保障系统的科学共识

地球正在迅速接近一个临界点。人类活动对地球的负面影响已经达到警戒线。科学家通过各种途径研究人类与生物圈的相互作用，我们共同认为，证明人类对生态生命保障系统的破坏的证据是压倒性的。

*基于现有的最权威的科学信息，我们进一步达成共识，如果人类坚持现在的发展方式，2050年后人类的生活质量将会大幅度下降。*

科学明确表明以下几方面关键的人类活动影响：

- **气候破坏**—人类有史以来更频繁、更快的气候变化。
- **物种灭绝**—自从恐龙灭绝以来，无论是在陆地还是海洋，更多的物种以更快的速度灭绝。
- **多样生态系统大规模消失**—地球 40% 以上的非冰雪覆盖土地被人类以耕种，铺路及其他方式改造，几乎在所有的陆地和海洋面积上都有人类直接或间接的影响。
- **污染**—空气、水和土壤中的污染物浓度不断增高并刷新历史记录，以不可预见的方式严重危害人类和野生动物。
- **人口增长和消费模式**—目前地球上生活着 70 亿人口，预计 2050 年达到 95 亿人口，中产阶级和富裕阶级对物质消费的需求所带来的压力与日俱增。



插图 Cheng (Lily) Li

除非我们立即采取实际行动来确保可持续的高品质未来，否则当现在的孩子们达到中年的时候，人类生存和繁荣所依赖的地球生命保障系统极有可能在全球范围内，在人类活动导致的环境压力下，遭受无可挽回的破坏。

*作为科学界积极从事全球变化生态和社会影响评估的成员，我们向全世界拉响警报。为了人类的持续健康和繁荣，我们所有的——一个人，企业，政治领袖，宗教领袖，科学家和各行各业的从业人员——必须从今天开始努力解决以下五项全球性问题：*

1. 气候破坏
2. 物种灭绝
3. 生态系统多样性消失
4. 污染
5. 人口增长和资源消费

## 问题综述和简要解决方案

### 气候破坏

通过减少温室气体排放来降低气候破坏的影响，通过执行气候适应战略来应对正在发生的气候变化。可行的方法包括加速发展和部署碳中和能源技术替代化石燃料使用；提高建筑、交通、制造业、聚落形态能源利用效率；保护森林，规范土地流转形式，最大限度地发挥碳汇作用。适应气候变化带来的不可避免的影响，对于经历海平面上升的沿海地区而言显得至关重要；确保主要的人口中心有充足的水供应；维持农业生产能力；管理生物多样性和生态系统保留地。

### 物种灭绝

减缓导致全球生物多样性丧失的快速的物种灭绝速度。可行的方法包括赋予为人类福祉作出贡献的自然生态系统经济价值；管理所有生态系统，无论是人类主导的地区还是远离人类直接影响的地区，维持并增强生态多样性和生态系统服务。通过开展跨行政辖区的合作来识别和缓解全球压力（例如，气候变化和海洋酸化）以及地方压力（土地流转、过度捕鱼、濒危物种偷猎等等）至关重要。

### 污染

遏制生产和释放有毒物质到环境中。可行的方法包括应用现代科学关于毒性的分子机制和预防原则（验证无害影响）来规范现有化学品使用，并指导新的设计。我们拥有知识和能力去开发新一代的材料，使它们的环境安全性远远超过现在使用的材料。

*总之，我们呼吁利用现有的最佳科学知识来预测未来 50 年最可能发生的，最坏的和最好的情景，便于制定政策指导长期环境健康和适应眼前危机。*

### 生态系统转型

最小化将地球剩下的自然生态系统转变成农场、郊区和其他人造建筑的转变。可行的农业方法包括提高现有粮食产地生产力；改善食品分配系统；减少浪费。可行的发展方式包括增强城市景观以适应人口增长，而不是鼓励郊区蔓延；基础设施选址尽可能减少对自然生态系统影响；投资绿色基础设施，例如重建湿地、珊瑚礁和森林以确保水质，防洪并取得休闲效益。

### 人口增长和消费

世界人口增长尽早结束，人口数量开始逐渐下降。一个可实现的目标是到 2050 年人口总量不超过 85 亿，峰值人口规模不超过 9 亿，通过自然人口过程到 2100 年降低到 7 亿以下。可行的方法包括确保每个人都能获得教育权利，经济机会，医疗卫生，包括计划生育服务尤其是妇女权利。

降低人均资源使用量，特别是在发达国家。可行的方法包括提高生产、收购、贸易和使用商品的效率，促进环境友好型消费行为的转变。

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DATE: May 18 2013

NAME: Sebsebe Demissew, Prof.  
POSITION: Professor of Systematic Botany and Angiosperm Phylogeny, Leader of the Ethiopian Flora Project (completed in 2009)  
INSTITUTION: Department of Plant Biology and Biodiversity Management, College of Natural Sciences, Addis Ababa University, Addis Ababa, Ethiopia  
DATE: 17 May 2013

NAME: Jared Diamond

POSITION: Professor  
INSTITUTION: University of California Los Angeles  
DATE: May 19, 2013

NAME: Mario D'Áz  
POSITION: Senior Researcher  
INSTITUTION: Dep. Biogeography and Global Change (BGC-MNCN), Museo Nacional de Ciencias Naturales, CSIC, Spain  
DATE: 26-4-2013

NAME: Sandra Diaz  
POSITION: Full Professor and Senior Principal Investigator  
INSTITUTION: Instituto Multidisciplinario de Biología Vegetal, CONICET and Universidad Nacional de Córdoba, Argentina.  
DATE: 20 May 2013

NAME: Christopher R. Dickman  
POSITION: Professor in Terrestrial Ecology  
INSTITUTION: The University of Sydney, Australia  
DATE: 18 May 2013

NAME: Rodolfo Dirzo,  
POSITION: Professor, Department of Biology and Director, Center for Latin American Studies  
INSTITUTION: Stanford University  
DATE: April 23, 2013

NAME: Diane Dodd  
POSITION: Assistant Professor  
INSTITUTION: University of North Carolina Wilmington  
DATE: 4/25/13

NAME: C. Josh Donlan MA PhD  
POSITION: Director, Advanced Conservation Strategies; Visiting Professor, Laboratoire Ecologie, Systématique & Evolution, Université Paris-Sud 11; Fellow, Cornell University  
INSTITUTION: Université Paris-Sud 11; Cornell University  
DATE: April 26, 2012

NAME: Michael J. Donoghue  
POSITION: Sterling Professor of Ecology and Evolutionary Biology  
INSTITUTION: Yale University  
DATE: April 25, 2013

NAME: Peter Doran  
POSITION: Distinguished Professor  
INSTITUTION: University of Illinois at Chicago  
DATE: April 25, 2013



NAME: Don Driscoll  
POSITION: Associate Professor  
INSTITUTION: Fenner School of  
Environment and Society, Australian  
National University  
DATE: 29/4/13

NAME: Robert Dudley  
POSITION: Professor  
INSTITUTION: University of California,  
Berkeley  
DATE: 29 April 2013

NAME: Ivo Duijnste  
POSITION: Assistant Adjunct Professor  
INSTITUTION: Dep. of Integrative  
Biology, University of California,  
Berkeley/University of California  
Museum of Paleontology / Dep. of  
Earth Sciences, Utrecht University  
DATE: April 30, 2013

NAME: John P. Dumbacher  
POSITION: Associate Curator of  
Ornithology and Mammalogy  
INSTITUTION: California Academy of  
Sciences, San Francisco, CA  
DATE: 13 May 2013

NAME: Robert B. Dunbar  
POSITION: W.M. Keck Professor of  
Earth Sciences  
INSTITUTION: Stanford University  
DATE: 4/25/13

## E

NAME: William E. Easterling  
POSITION: Dean, College of Earth and  
Mineral Sciences  
INSTITUTION: The Pennsylvania State  
University  
DATE: 1 May 2013

NAME: Alasdair Edwards  
POSITION: Emeritus Professor of Coral  
Reef Ecology  
INSTITUTION: Newcastle University,  
UK  
DATE: 17/05/2013

NAME: Bob Edwards  
POSITION: Professor of Sociology  
INSTITUTION: East Carolina  
University  
DATE: April 26, 2013

NAME: Mary Edwards  
POSITION: Professor  
INSTITUTION: University of  
Southampton, Geography and  
Environment  
DATE: 7<sup>th</sup> May 2013

NAME: Emilie EGEA  
POSITION: Technician staff (PhD)  
INSTITUTION: Mediterranean Institute  
for Biodiversity and Ecology, Centre  
National de la Recherche Scientifique,  
France  
DATE: April 30th 2013

NAME: Anne H. Ehrlich  
POSITION: Policy Coordinator and  
Senior Research Assistant  
INSTITUTION: Center for Conservation  
Biology, Stanford University  
DATE: April 23, 2013

NAME: Paul R. Ehrlich  
POSITION: Professor, Department of  
Biology and Center for Conservation  
Biology  
INSTITUTION: Stanford University  
DATE: April 23, 2013

NAME: STEVEN D. EMSLIE  
POSITION: PROFESSOR  
INSTITUTION: UNIVERSITY OF  
NORTH CAROLINA WILMINGTON  
DATE: 6 MAY 2013

NAME: Professor Matthew England  
POSITION: ARC Laureate Fellow  
Climate Change Research Centre  
(CCRC) and ARC Centre of  
Excellence for Climate System Science  
INSTITUTION: The University of New  
South Wales  
DATE: 29 April 2013

NAME: Barend Erasmus  
POSITION: Associate professor and  
Director: Centre for African Ecology  
INSTITUTION: University of the  
Witwatersrand  
DATE: 9 May 2013

NAME: Jussi T. Eronen  
POSITION: Postdoctoral Researcher  
INSTITUTION: Department of  
Geosciences and Geography,  
University of Helsinki  
DATE: April 23, 2013

NAME: Gilles ESCARGUEL  
POSITION: Associate-Professor  
INSTITUTION: Dpt. of Earth Sciences,  
University Lyon 1 (France)  
DATE: April, 30th, 2013

NAME: James A. Estes  
POSITION: Professor  
INSTITUTION: University of California,  
Santa Cruz  
DATE: 25 April 2013

## F

NAME: Juan A. Fargallo  
POSITION: Researcher  
INSTITUTION: Consejo Superior de  
Investigaciones Cientificas (CSIC)  
DATE: 13-05-2013

NAME: ALEJANDRO G. FARJI-  
BRENER  
POSITION: INVESTIGADOR ,  
PROFESOR  
INSTITUTION: CONICET-  
ARGENTINA, CENTRO  
REGIONAL UNIVERSITARIO

BARILOCHE, UNIVERSIDAD  
NACIONAL DEL COMAHUE,  
ARGENTINA  
DATE: 20 DE MAYO 2013

NAME: Marcus W. Feldman, MS, PhD  
POSITION: Burnet C. and Mildred  
Finley Wohlford Professor of  
Biological Sciences; Director of the  
Morrison Institute for Population and  
Resource Studies and Stanford Health  
Policy Associate  
INSTITUTION: Stanford University  
DATE: May 19, 2013

NAME: Scott Fendorf  
POSITION: Professor  
INSTITUTION: Stanford University  
DATE: 5/19/2013

NAME: Pablo Ferreras  
POSITION: Senior Scientist Research,  
Spanish Research Council (CSIC)  
INSTITUTION: Spanish Game  
Research Institute (IREC), Ciudad Real,  
Spain  
DATE: May 7<sup>th</sup>, 2013

NAME: Seth Finnegan  
POSITION: Assistant Professor  
INSTITUTION: UC Berkeley, Dept. of  
Integrative Biology  
DATE: April 28, 2013

NAME: JON FJELDSÅ  
POSITION: PROFESSOR  
INSTITUTION: NATURAL HISTORY  
MUSEUM OF DENMARK,  
University of Copenhagen, Denmark  
DATE: 21. May 2013

NAME: Joern Fischer  
POSITION: Professor  
INSTITUTION: Leuphana University  
Lueneburg, Germany  
DATE: 18 May 2013

NAME: Matthew Forrest  
POSITION: Post-doctoral researcher  
INSTITUTION: Biodiversity and  
Climate Research Centre, Frankfurt am  
Main, Germany  
DATE: 16th May 2013

NAME: Mikael Fortelius  
POSITION: Professor, Department of  
Geosciences and Geography  
INSTITUTION: Finnish Museum of  
Natural History and University of  
Helsinki  
DATE: April 23, 2013

NAME: Carolin Frank  
POSITION: Assistant Professor  
INSTITUTION: UC Merced  
DATE: 4/26/13

NAME: Peter Frumhoff

POSITION: Director of Science and Policy, Chief Scientist, Climate Campaign  
INSTITUTION: Union of Concerned Scientists  
DATE: 30 April 2013

NAME: Tadashi Fukami  
POSITION: Assistant Professor of Biology  
INSTITUTION: Stanford University  
DATE: May 21, 2013

NAME: Dr Richard Fuller  
POSITION: Senior Lecturer  
INSTITUTION: University of Queensland  
DATE: 27<sup>th</sup> April 2013

## G

NAME: Eric Galbraith  
POSITION: Assistant Professor  
INSTITUTION: Department of Earth and Planetary Science, McGill University  
DATE: April 29, 2013

NAME: Candace Galen  
POSITION: Professor  
INSTITUTION: University of Missouri  
DATE: April 26, 2013

NAME: Amiran Gamkrelidze MD, PhD, Professor  
POSITION: Director General  
INSTITUTION: National Center for Disease Control and Public Health, Tbilisi  
DATE: 18 May 2013

NAME: Laura Gangoso  
POSITION: Post doc researcher  
INSTITUTION: Department of Wetland Ecology, Estaci3n Biol3gica de Doñana, CSIC, Spain.  
DATE: 25/04/2013

NAME: Francisco Garcia-Gonzalez  
POSITION: Ramon y Cajal Research Fellow  
INSTITUTION: Donana Biological Station-Spanish Research Council, Seville, Spain  
DATE: 25th April 2013

NAME: Christopher Gardner, PhD  
POSITION: Associate Professor of Medicine (Research)  
INSTITUTION: Stanford Prevention Research Center, Stanford University  
DATE: May 20, 2013

NAME: Stephen Garnett  
POSITION: Professor of Conservation and Sustainable Livelihoods  
INSTITUTION: Charles Darwin University  
DATE: 25 April 2013

NAME: Dan Gavin

POSITION: Associate Professor, Department of Geography  
INSTITUTION: University of Oregon  
DATE: May 6, 2013

NAME: Leah Gerber  
POSITION: Associate Professor  
INSTITUTION: School of Life Sciences, Arizona State University  
DATE: April 25, 2013

NAME: Anne E. Giblin  
POSITION: Senior Scientist  
INSTITUTION: Marine Biological Laboratory  
DATE: 4/29/2013

NAME: Diego Gil  
POSITION: Senior Scientist  
INSTITUTION: MNCN (CSIC, Spain)  
DATE: 25-4-13

NAME: Michael Gillings  
POSITION: Professor of Molecular Evolution  
INSTITUTION: Biological Sciences, Macquarie University, Sydney, Australia  
DATE: 28/04/2013

NAME: Dr. Peter Gleick  
POSITION: Pacific Institute, President Member, US National Academy of Sciences  
INSTITUTION: Pacific Institute  
DATE: May 8, 2013

NAME: Deborah M. Gordon  
POSITION: Professor  
INSTITUTION: Stanford University  
DATE: 5-16-13

NAME: Lisa J. Graumlich  
POSITION: Dean, College of the Environment  
Virginia and Prentice Bloedel Professor  
INSTITUTION: University of Washington  
DATE: April 26, 2012

NAME: ANDREW GREEN  
POSITION: RESEARCH PROFESSOR  
INSTITUTION: DOÑANA BIOLOGICAL STATION  
DATE: 30 APRIL 2013

NAME: Charles H. Greene  
POSITION: Professor, Department of Wrath & Atmospheric Sciences  
INSTITUTION: Cornell University  
DATE: 4/30/13

NAME: Harry W. Greene  
POSITION: Professor of Ecology and Evolutionary Biology  
INSTITUTION: Cornell University  
DATE: April 28, 2013

NAME: Dr Marilyn J Grey  
POSITION: Honorary Research Fellow

INSTITUTION: Department of Zoology, La Trobe University, Melbourne, Australia  
DATE: 20 May 2013

NAME: Marianna Grossman  
POSITION: President and Executive Director  
INSTITUTION: Sustainable Silicon Valley  
DATE: MAY 3, 2013

NAME: Mats Gyllenberg  
POSITION: Professor, Head of Department  
INSTITUTION: Department of Mathematics and Statistics, University of Helsinki  
DATE: May 7, 2013

## H

NAME: Elizabeth A. Hadly  
POSITION: Professor, Department of Biology and Senior Fellow, Woods Institute  
INSTITUTION: Stanford University  
DATE: April 23, 2013

NAME: Joan Stephens Hadly  
POSITION: Sr Vice President, Advancement  
INSTITUTION: Museum of Science Boston  
DATE: May 8, 2013

NAME: Yohannes Haile-Selassie  
POSITION: Curator  
INSTITUTION: Cleveland Museum of Natural History  
DATE: May 12, 2013

NAME: Sharon J. Hall  
POSITION: Associate Professor  
INSTITUTION: Arizona State University  
DATE: May 18, 2013

NAME: Olivier Hamant  
POSITION: Researcher  
INSTITUTION: INRA, France  
DATE: 26 April 2013

NAME: Philip C. Hanawalt  
POSITION: Morris Herzstein Professor of Biology  
INSTITUTION: Stanford University  
DATE: May 16, 2013

NAME: Catherine HÄNNI  
POSITION: CNRS Director  
INSTITUTION: CNRS/ENS Lyon  
DATE: April 30, 2013

NAME: James Hansen  
POSITION: Director of Hansen Climate Science Program  
INSTITUTION: Columbia University Earth Institute  
DATE: 21 May 2013

NAME: Ilkka Hanski  
POSITION: Research professor  
INSTITUTION: University of Helsinki  
DATE: April 25, 2013

NAME: David D. Hart  
POSITION: Director, Senator George J.  
Mitchell Center for Sustainability  
Solutions  
INSTITUTION: University of Maine,  
Orono  
DATE: 4/30/2013

NAME: John Harte  
POSITION: Professor of Ecosystem  
Sciences  
INSTITUTION: UC Berkeley  
DATE: April 25, 2013

NAME: Celia A. Harvey  
POSITION: Vice President, Ecosystem  
Services,  
INSTITUTION: Conservation  
International  
DATE: May 21, 2013

NAME: PAUL HARVEY CBE FRS  
POSITION: Professor  
INSTITUTION: Department of Zoology,  
University of Oxford, UK  
DATE: 7 May 2013

NAME: Angie Haslem  
POSITION: Research Fellow  
INSTITUTION: La Trobe University  
DATE: 20 May 2013

NAME: AHMED HASSANALI  
POSITION: Professor of Chemistry  
(Chemical Ecology & Bioprospecting)  
INSTITUTION: Kenyatta University,  
Nairobi, KENYA  
DATE: May 20, 2013

DATE: 20th May, 2013  
NAME: Alan Hastings  
POSITION: Distinguished Professor  
INSTITUTION: University of California,  
Davis  
DATE: May 17, 2013

NAME: MARK HAY  
POSITION: PROFESSOR OF  
BIOLOGY  
INSTITUTION: GEORGIA  
INSTITUTE OF TECHNOLOGY  
DATE: 4/25/13

NAME: Harold Heatwole  
POSITION: Professor of Biology  
INSTITUTION: North Carolina State  
University  
DATE: 25 April 2013

NAME: H. Craig Heller  
POSITION: Professor of Biology and  
Human Biology  
INSTITUTION: Stanford University  
DATE: May 16, 2013

NAME: Jessica J. Hellmann  
POSITION: Associate Professor of  
Biological Sciences  
INSTITUTION: University of Notre  
Dame  
DATE: May 15, 2013

NAME: Martin Hellman  
POSITION: Professor Emeritus of  
Electrical Engineering  
INSTITUTION: Stanford University  
DATE: 26 APRIL 2013

NAME: Hans R Herren  
POSITION: President  
INSTITUTION: Millennium Institute,  
Washington, DC and Biovision  
Foundation, Zurich  
DATE: May 10, 2013

NAME: Josiah Heyman  
POSITION: Professor of Anthropology  
and Chair, Sociology and  
Anthropology  
INSTITUTION: University of Texas at  
El Paso  
DATE: April 29, 2013

NAME: Thomas Hickler  
POSITION: Professor for Quantitative  
Biogeography  
INSTITUTION: Biodiversity and  
Climate Research Centre (BiK-F),  
Frankfurt/Main, Germany  
DATE: 17.5.2013

NAME: Larry D. Hinzman  
POSITION: Director and Professor  
INSTITUTION: University of Alaska  
Fairbanks  
DATE: 20 May 2013

NAME: Mark Hixon  
POSITION: Hsiao Endowed Chair of  
Marine Biology  
INSTITUTION: University of Hawai'i  
at Manoa  
DATE: 25 April 2013

NAME: Leslea J. Hlusko  
POSITION: Associate Professor  
Integrative Biology  
INSTITUTION: University of California  
Berkeley  
DATE: 13 May 2013

NAME: Prof Richard J Hobbs  
POSITION: Australian Laureate Fellow  
School of Plant Biology  
INSTITUTION: The University of  
Western Australia  
DATE: 20 May 2013

NAME: Dr. Karen E. Hodges  
POSITION: Associate Professor,  
Conservation Biology  
INSTITUTION: University of British  
Columbia Okanagan, Kelowna, BC,  
Canada  
DATE: 25 April 2013

NAME: Hopi E. Hoekstra  
POSITION: Alexander Agassiz  
Professor of Zoology  
INSTITUTION: Harvard University  
DATE: April 25, 2013

NAME: Christian Hof  
POSITION: Postdoctoral Researcher  
INSTITUTION: Biodiversity and  
Climate Research Centre (BiK-F) &  
Senckenberg Gesellschaft für  
Naturforschung, Frankfurt, Germany  
DATE: 17 May 2013

NAME: Andrew J. Hoffman  
POSITION: School of Natural  
Resources & Environment/Ross School  
of Business  
INSTITUTION: University of Michigan  
DATE: April 25, 2013

NAME: Karen D. Holl  
POSITION: Professor of Environmental  
Studies  
INSTITUTION: University of California,  
Santa Cruz  
DATE: 25 April 2013

NAME: C.S. Holling  
POSITION: Emeritus Professor  
INSTITUTION: University of Florida  
DATE: May 20, 2003

NAME: Professor Joseph A M Holtum  
POSITION: Coordinator of Plant  
Sciences and Tropical Agriculture  
INSTITUTION: James Cook University  
DATE: Monday 20th May 2013

NAME: David Hooper  
POSITION: Professor of Biology  
INSTITUTION: Western Washington  
University, Bellingham, WA  
DATE: 5/19/13

NAME: Professor Stephen D. Hopper  
AC FLS FTSE  
POSITION: Professor of Biodiversity  
INSTITUTION: The University of  
Western Australia  
DATE: 26<sup>th</sup> April 2013

NAME: Joaquín Hortal  
POSITION: RyC Research Fellow  
INSTITUTION: Museo Nacional de  
Ciencias Naturales (CSIC), Madrid,  
Spain  
DATE: 13 May 2013

NAME: Øystein Hov  
POSITION: Director of Research and  
Professor  
INSTITUTION: Norwegian  
Meteorological Institute and University  
of Oslo  
DATE: 20 May 2013

NAME: Alex Hubbe  
POSITION: Postdoctoral Fellow

INSTITUTION: Instituto de Biociências,  
Universidade de São Paulo, Brazil  
DATE: 05/09/2013

NAME: Prof. Lesley Hughes  
POSITION: Dept of Biological Sciences  
INSTITUTION: Macquarie University  
NSW, Australia  
DATE: 28 April 2013

NAME: Jeffrey A. Hutchings  
POSITION: Professor  
INSTITUTION: Department of Biology,  
Dalhousie University, CANADA, and  
Centre for Ecological and Evolutionary  
Synthesis, University of Oslo,  
NORWAY  
DATE: April 25, 2013

## I

NAME: Rolf A. Ims  
POSITION: Professor of Ecology  
INSTITUTION: Department of Arctic  
and Marine Biology, University of  
Tromsø, Norway  
DATE: May 3, 2013

NAME: Brian Inouye  
POSITION: Associate Professor  
INSTITUTION: Florida State University  
DATE: April 25, 2013

NAME: David W. Inouye  
POSITION: Professor  
INSTITUTION: University of Maryland  
DATE: 25 April 2013

## J

NAME: Nina G. Jablonski  
POSITION: Distinguished Professor of  
Anthropology  
INSTITUTION: The Pennsylvania State  
University  
DATE: May 4, 2013

NAME: Wes Jackson  
POSITION: President  
INSTITUTION: The Land Institute  
DATE: April 30, 2013

NAME: A. Hope Jahren  
POSITION: Professor of Geobiology  
INSTITUTION: University of Hawaii at  
Manoa  
DATE: April 29, 2013

NAME: Fabian M Jaksic  
POSITION: Professor  
INSTITUTION: Universidad Catolica de  
Chile  
DATE: April 28, 2013

NAME: Marco A. Janssen  
POSITION: Associate Professor  
INSTITUTION: School of Human  
Evolution and Social Change, Arizona  
State University  
DATE: April 25, 2013

NAME: Ivan Janssens  
POSITION: Professor  
INSTITUTION: Biology Department,  
University Of Antwerp, Belgium  
DATE: 19/05/13

NAME: Daniel H. Janzen  
POSITION: Professor of Conservation  
Biology  
INSTITUTION: University of  
Pennsylvania  
DATE: 26 April 2013

NAME: Dr. Christopher B Jones  
POSITION: Faculty  
INSTITUTION: School of Public Policy  
and Administration, Walden University  
DATE: Apr 26, 2013

NAME: James Holland Jones  
POSITION: Associate Professor of  
Anthropology and Senior Fellow,  
Woods Institute for the Environment  
INSTITUTION: Stanford University  
DATE: 18 May 2013

NAME: Jeremy B. Jones  
POSITION: Professor of Biology  
INSTITUTION: University of Alaska  
Fairbanks  
DATE: May 19, 2013

NAME: Patricia P. Jones, Ph.D.  
POSITION: Professor of Biology  
INSTITUTION: Stanford University  
DATE: May 17, 2013

NAME: William Jury  
POSITION: Emeritus Distinguished  
Professor of Soil Physics  
INSTITUTION: UC Riverside  
DATE: 4/25/2013

## K

NAME: Dr Jules Kajtar  
POSITION: Research Associate  
INSTITUTION: Climate Change  
Research Centre, University of New  
South Wales, Australia  
DATE: 29/04/13

NAME: Dibesh Karmacharya  
POSITION: International Director  
INSTITUTION: Center for Molecular  
Dynamics Nepal  
DATE: May 8, 2013

NAME: David Karoly  
POSITION: Professor of Climate  
Science  
INSTITUTION: University of  
Melbourne  
DATE: April 29, 2013

NAME: Daniel Karp  
POSITION: Postdoctoral Scholar  
INSTITUTION: University of California,  
Berkeley and The Nature Conservancy  
DATE: 4/25/2013

NAME: Shakkie Kativu  
POSITION: Professor  
INSTITUTION: University of  
Zimbabwe  
DATE: 17 May 2013

NAME: LILIANA KATINAS  
POSITION: PROFESSOR OF PLANT  
MORPHOLOGY  
INSTITUTION: UNIVERSIDAD  
NACIONAL DE LA PLATA,  
ARGENTINA  
DATE: MAY 19, 2013

NAME: Donald Kennedy  
POSITION: President Emeritus and  
Bing Professor of Environmental  
Science, Emeritus; Editor-in-Chief,  
Science, 2000 to 2008  
INSTITUTION: Stanford University  
DATE: April 25, 2013

NAME: Julie Kennedy  
POSITION: Professor (Teaching),  
Environmental Earth System Science  
INSTITUTION: Stanford University  
DATE: May 21, 2013

NAME: Thomas Kiørboe  
POSITION: Professor, Centre Leader  
INSTITUTION: Centre for Ocean Life,  
National Institute of Aquatic Resources,  
Technical University of Denmark  
DATE: May 15, 2013

NAME: Patrick V. Kirch  
POSITION: Class of 1954 Professor of  
Anthropology and  
Integrative Biology  
INSTITUTION: University of California,  
Berkeley  
DATE: 29 April 2013

NAME: James Barrie Kirkpatrick  
POSITION: Distinguished Professor of  
Geography and Environmental  
Studies  
INSTITUTION: University of  
Tasmania  
DATE: 26/4/2013

NAME: Professor Roger Kitching AM  
POSITION: Chair of Ecology  
INSTITUTION: Griffith University,  
Brisbane  
DATE: 26.4.2010

NAME: Alan K. Knapp  
POSITION: Professor of Biology  
INSTITUTION: Colorado State  
University  
DATE: April 25, 2013

NAME: Andrew H. Knoll  
POSITION: Fisher Professor of Natural  
History  
INSTITUTION: Harvard University  
DATE: April 30, 2013

NAME: Matthew L. Knope

POSITION: Post-doctoral research fellow  
INSTITUTION: Dept. of Geological and Environmental Sciences, Stanford University  
DATE: April 25, 2013

NAME: Jacob Koella  
POSITION: Professor  
INSTITUTION: University of Neuchatel  
DATE: 4/30/2013

NAME: Jeffrey R Koseff  
POSITION: William A Campbell and Martha Campbell Professor of Engineering  
INSTITUTION: Stanford University  
DATE: May 16 2013

NAME: Dr Tineke Kraaij  
POSITION: Scientist: Fynbos Ecology  
INSTITUTION: South African National Parks  
DATE: 10 May 2013

NAME: Nathan Kraft  
POSITION: Assistant Professor  
INSTITUTION: Department of Biology, University of Maryland College Park  
DATE: 5/7/2013

NAME: Holger Kreft  
POSITION: Professor  
INSTITUTION: Faculty of Forest Sciences and Forest Ecology, University of Gottingen  
DATE: May 17 2013

NAME: Claire Kremen  
POSITION: Professor  
INSTITUTION: University of California, Berkeley  
DATE: 4/25/13

NAME: Andrew Krockenberger  
POSITION: Professor and Dean of Research  
INSTITUTION: James Cook University  
DATE: 20th May 2013

NAME: Markku Kulmala  
POSITION: Academy Professor  
INSTITUTION: University of Helsinki, Department of Physics  
DATE: 2.5. 2013

NAME: Juri Kurhinen  
POSITION: researcher, Helsinki University  
INSTITUTION: coordinator of the international project  
DATE: 02.05.2013

NAME: Thomas A. Kursar  
POSITION: Professor  
INSTITUTION: University of Utah (Dept of Biology)  
DATE: 27 April, 2013

NAME: Eric Lambin  
POSITION: Professor  
INSTITUTION: Stanford University and Universit  catholique de Louvain  
DATE: May 18, 2013

NAME: Dr. Tom   Landete-Castillejos  
POSITION: Vice-director of IREC (Spain's national game institute); Vicepresident of FEDFA (European Federation of Deer Farmers Associations; [www.fedfa.es](http://www.fedfa.es)); founder of science-based companies: European Meeting on Antlers and Deer International Scientific Training S.L. ([www.emad.es](http://www.emad.es)); Venadogen ([www.venadogen.com](http://www.venadogen.com)).  
INSTITUTION: University of Castilla-La Mancha  
DATE: May 7th 2013

NAME: John Largier  
POSITION: Professor of Oceanography  
INSTITUTION: University of California Davis  
DATE: 5 May 2013

NAME: William F. Laurance  
POSITION: Distinguished Research Professor & Australian Laureate  
INSTITUTION: James Cook University, Cairns, Queensland, Australia  
DATE: 20 May 2013

NAME: Beverly E. Law  
POSITION: Professor Global Change Biology & Terrestrial Systems Science  
INSTITUTION: Department of Forest Ecosystems & Society, Oregon State University  
DATE: May 10, 2013

NAME: Prof. Mike Lawes  
POSITION: Professor, Savanna Management and Wildlife Conservation, Research Institute For The Environment And Livelihoods  
INSTITUTION: Charles Darwin University  
Darwin, Northern Territory 0909, AUSTRALIA  
DATE: 26 April 3013

NAME: Dr Susan Lawler  
POSITION: Head of Department of Environmental Management and Ecology  
INSTITUTION: La Trobe University, Wodonga, Victoria, Australia  
DATE: 20 May 2013

NAME: Stephanie Lawson  
POSITION: Professor of Politics and International Relations  
INSTITUTION: Macquarie University, Sydney, NSW, Australia  
DATE: 1 May 2013

NAME: Raphael Leblois  
POSITION: researcher

INSTITUTION: INRA (French National Institute for Agronomic Research), Lab "Center for Biology and Population Management", CBGP, Montpellier, France  
DATE: 4th of May, 2013

NAME: Herwig Leirs  
POSITION: Professor, Evolutionary Ecology Group and Dean, Faculty of Sciences  
INSTITUTION: University of Antwerp, Belgium  
DATE: 17 may 2013

NAME: Yuri L. R. Leite  
POSITION: Associate Professor  
INSTITUTION: Universidade Federal do Espirito Santo, Brazil  
DATE: 17 May 2013

NAME: Jennifer Leonard  
POSITION: permanent researcher  
INSTITUTION: Estaci  n Biol  gica de Do  ana, Consejo Superior de Investigaciones Cient  ficas  
DATE: April 25, 2013

NAME: Estella B. Leopold  
POSITION: Professor Emeritus, Department of Biology  
INSTITUTION: University of Washington  
DATE: April 23, 2013

NAME: Simon Levin  
POSITION: Professor  
INSTITUTION: Princeton University  
DATE: April 25, 2013

NAME: William Z. Lidicker, Jr.  
POSITION: Professor of Integrative Biology Emeritus  
INSTITUTION: University of California, Berkeley  
DATE: 29 April 2013

NAME: Kent Lightfoot  
POSITION: Professor, Department of Anthropology  
INSTITUTION: UC Berkeley  
DATE: May 8, 2013

NAME: MAURICIO LIMA  
POSITION: FULL PROFESSOR  
INSTITUTION: DEPARTAMENTO DE ECOLOG  A, FACULTAD DE CIENCIAS BIOL  GICAS, PONTIFICIA UNIVERSIDAD CATOLICA DE CHILE  
DATE: 25/04/2013

NAME: Ken Lindeman  
POSITION: Professor, Sustainability Program Chair  
INSTITUTION: Florida Institute of Technology  
DATE: April 27, 2013

NAME: Richard L. Lindroth

POSITION: Professor and Associate  
Dean for Research  
INSTITUTION: University of  
Wisconsin-Madison  
DATE: April 29, 2013

NAME: Lee Hsiang Liow  
POSITION: Researcher  
INSTITUTION: Centre for Ecological  
and Evolutionary Synthesis,  
Department of Biosciences, University  
of Oslo, Oslo, Norway  
DATE: 25 April 2013

NAME: Jere H. Lipps  
POSITION: Professor Emeritus  
INSTITUTION: University of  
California, Berkeley  
DATE: April 29, 2013

NAME: Professor Adrian M Lister  
POSITION: Research Leader  
INSTITUTION: The Natural History  
Museum, London  
DATE: 13th May 2013

NAME: Jianguo (Jack) Liu  
POSITION: Rachel Carson Chair in  
Sustainability and Director  
INSTITUTION: Center for Systems  
Integration and Sustainability,  
Michigan State University  
DATE: 4/26/13

NAME: Dr John Llewelyn  
POSITION: Postdoctoral research fellow  
INSTITUTION: James Cook University,  
Australia  
DATE: 20/5/2013

NAME: Jorge Miguel Lobo  
POSITION: Research professor of the  
Museo Nacional de Ciencias Naturales  
(CSIC)  
INSTITUTION: Museo Nacional de  
Ciencias Naturales (CSIC). C/ Jose  
Gutiérrez Abascal 2. Madrid  
DATE: 13 May 2013

NAME: Michael E. Loik  
POSITION: Associate Professor,  
Department of Environmental Studies  
INSTITUTION: University of California,  
Santa Cruz  
DATE: April 25, 2013

NAME: Adam Lomnicki  
POSITION: Professor Emeritus of  
Biology  
INSTITUTION: Institute of  
Environmental Sciences, Jagiellonian  
University, Krakow, Poland  
DATE: 18th of May 2013

NAME: John Longino  
POSITION: Professor  
INSTITUTION: Department of Biology,  
University of Utah  
DATE: 26 April 2013

NAME: Cindy V. Looy  
POSITION: Assistant Professor  
INSTITUTION: UC Berkeley and UC  
Museum of Paleontology  
DATE: April 29, 2013

NAME: Celia López-González  
POSITION: Profesor Titular  
CIIDIR Unidad Durango  
INSTITUTION: Instituto Politécnico  
Nacional  
May 10 2013

NAME: Jonathan Losos  
POSITION: Professor and Curator  
INSTITUTION: Dept of Organismic and  
Evolutionary Biology and Museum of  
Comparative Zoology, Harvard  
University  
DATE: April 28, 2013

NAME: Thomas E. Lovejoy  
POSITION: University  
Professor  
INSTITUTION: George Mason  
University  
DATE: April 25, 2013

NAME: Richard Loyn  
POSITION: Ecologist; Director, Eco  
Insights, and recently Principal  
Scientist, Arthur Rylah Institute for  
Environmental Research (Victorian  
Government)  
INSTITUTION: Eco Insights (also  
research fellow at La Trobe  
University; honorary senior Fellow at  
University of Melbourne & Charles  
Sturt University)  
DATE: 8 May 2013

NAME: Stephen Luby  
POSITION: Professor of Medicine  
INSTITUTION: Stanford University  
DATE: April 29, 2013

NAME: Gary Luck  
POSITION: Professor in Ecology and  
Interdisciplinary Science  
INSTITUTION: Charles Sturt  
University, Institute for Land, Water  
and Society  
DATE: 19th May 2013

NAME: Per Lundberg  
POSITION: Professor  
INSTITUTION: Dept. Biology, Lund  
University, Lund, Sweden  
DATE: 30 April, 2013

NAME: Ian D. Lunt  
POSITION: Associate Professor in  
Vegetation Ecology & Management  
INSTITUTION: Institute for Land,  
Water & Society, Charles Sturt  
University, Australia  
DATE: 20 May 2013

## M

NAME: Manuel Maass  
POSITION: Research Scientist  
INSTITUTION: Centro de  
Investigaciones en Ecosistemas  
(CIEco), Universidad Nacional  
Autónoma de México (UNAM)  
DATE: April 27, 2013

NAME: Georgina Mace  
POSITION: Professor of Biodiversity  
and Ecosystems  
INSTITUTION: University College  
London  
DATE: 10 May 2013

NAME: James A. MacMahon  
POSITION: Dean, College of Science  
INSTITUTION: Utah State University  
DATE: 25 April 2013

NAME: Adjunct Prof Jonathan Majer  
POSITION: Recently retired as  
Professor of Invertebrate  
Conservation  
INSTITUTION: Curtin University, Perth,  
Western Australia  
DATE: 26/Apr/13

NAME: Stephanie A. Malin, Ph.D.  
POSITION: Mellon Foundation  
Postdoctoral Fellow with Center for  
Environmental Studies and Superfund  
Research Program  
INSTITUTION: Brown University  
DATE: 26 April 2013

NAME: Michael A. Mallin  
POSITION: Research Professor  
INSTITUTION: Center for Marine  
Science, University of North Carolina  
Wilmington  
DATE: April 25, 2013

NAME: Michael E. Mann  
POSITION: Distinguished Professor of  
Meteorology; Director of Penn State  
Earth System Science Center  
INSTITUTION: Pennsylvania State  
University  
DATE: May 18, 2013

NAME: W. Andrew Marcus  
POSITION: Professor of Geography &  
Associate Dean, Social Sciences  
INSTITUTION: University of Oregon  
DATE: April 29, 2013

NAME: Dr Martine Maron  
POSITION: Senior Lecturer in  
Environmental Management  
INSTITUTION: The University of  
Queensland  
DATE: 10 May 2013

NAME: Pablo Marquet  
POSITION: Full Professor of Ecology  
INSTITUTION: Pontificia Universidad  
Católica de Chile  
DATE: April 28, 2013

NAME: Jason P. Marshal  
POSITION: Senior Lecturer of Ecology  
INSTITUTION: University of the  
Witwatersrand  
DATE: 9 May 2013

NAME: Richard A. Marston  
POSITION: University Distinguished  
Professor  
INSTITUTION: Kansas State University  
DATE: 30 April 2013

NAME: Airam Rodríguez Martínez  
POSITION: Postdoctoral Researcher  
INSTITUTION: Estación Biológica de  
Doñana CSIC  
DATE: 25 April 2013

NAME: Jean-Noël Martinez  
POSITION: Professor of Geology and  
Director of the Paleontological Institute  
at the National University of Piura  
INSTITUTION: National University of  
Piura - Peru  
DATE: 17th May 2013

NAME: Enrique Martínez-Meyer  
POSITION: Researcher  
INSTITUTION: Instituto de Biología,  
Universidad Nacional Autónoma de  
México  
DATE: May 10, 2013

NAME: Gil Masters  
POSITION: Professor (Emeritus)  
INSTITUTION: Civil and  
Environmental Engineering  
Department, Stanford University  
DATE: May 20, 2013

NAME: Damon Matthews  
POSITION: Associate Professor  
INSTITUTION: Concordia University,  
Montreal, Canada  
DATE: April 29, 2013

NAME: Erik Matthysen  
POSITION: Professor, Evolutionary  
Ecology Group  
INSTITUTION: University of Antwerp,  
Belgium  
DATE: 17 May 2013

NAME: Kevin McCann  
POSITION: Canadian Research Chair in  
Biodiversity  
INSTITUTION: University of Guelph  
DATE: May 13, 2013

NAME: Perry L. McCarty  
POSITION: Silas H. Palmer Professor  
Emeritus, Environmental Engineering  
INSTITUTION: Stanford University  
DATE: May 20, 2013

NAME: Susan K. McConnell, Ph.D.  
POSITION: Susan B. Ford Professor  
INSTITUTION: Stanford University  
DATE: May 16, 2013

NAME: Michael McGehee  
POSITION: Associate Professor of  
Materials Science and Engineering  
INSTITUTION: Stanford University  
DATE: May 20, 2013

NAME: Dr. Peter B. McIntyre  
POSITION: Assistant Professor  
INSTITUTION: University of  
Wisconsin  
DATE: 26 April 2013

NAME: Galen A. McKinley  
POSITION: Associate Professor of  
Atmospheric and Oceanic Sciences;  
Faculty Affiliate, Center for Climatic  
Research, Nelson Institute for  
Environmental Studies  
INSTITUTION: University of  
Wisconsin - Madison  
DATE: May 1, 2013

NAME: Sarah McMenamin  
POSITION: Postdoctoral Researcher  
INSTITUTION: University of  
Washington  
DATE: April 25, 2013

NAME: Rodrigo A. Medellín  
POSITION: Senior Professor of Ecology  
INSTITUTION: National Autonomous  
University of Mexico  
DATE: April 25, 2013

NAME: Timothy D. Meehan  
POSITION: Associate Scientist  
INSTITUTION: Wisconsin Energy  
Institute, University of Wisconsin-  
Madison  
DATE: 29 May 2013

NAME: Katrin Meissner  
POSITION: Associate Professor  
INSTITUTION: University of New  
South Wales  
DATE: 29.04.2013

NAME: Natalia Gañán Mejías  
POSITION: Postdoctoral researcher  
INSTITUTION: Unaffiliated  
DATE: 26/04/2013

NAME: David J. Meltzer  
POSITION: Henderson-Morrison  
Professor of Prehistory  
INSTITUTION: Southern Methodist  
University  
DATE: May 13, 2013

NAME: Sarah Keene Meltzoff  
POSITION: Associate Professor  
INSTITUTION: Rosenstiel School of  
Marine and Atmospheric Science,  
University of Miami  
DATE: 28 April 2013

NAME: Santiago Merino  
POSITION: Professor of Research  
INSTITUTION: Higher Council for

Scientific Research (CSIC-SPAIN)  
DATE: 25-04-2013

NAME: Laura A. Meyerson  
POSITION: Associate Professor  
INSTITUTION: University of Rhode  
Island  
DATE: May 2, 2013

NAME: Fiorenza Micheli  
POSITION: Professor  
INSTITUTION: Stanford University,  
Hopkins Marine Station  
DATE: 25 April 2013

NAME: Edward L. Miles  
POSITION: Professor Emeritus of  
Marine Studies and Public Affairs,  
School of Marine Studies and  
Environmental Affairs  
INSTITUTION: University of  
Washington  
DATE: May 3, 2013

NAME: Brian Miller, Ph.D.  
POSITION: Senior Scientist  
INSTITUTION: Wind River Ranch  
Foundation, PO Box 27, Watrous NM  
87753  
DATE: April 25, 2013

NAME: L. Scott Mills  
POSITION: Professor  
INSTITUTION: Department of  
Ecosystem and Conservation Sciences,  
University of Montana  
DATE: May 3, 2013

NAME: Professor Bruce Milthorpe  
POSITION: Dean of Science  
INSTITUTION: University of  
Technology Sydney  
DATE: 1 May 2013

NAME: David P. Mindell  
POSITION: Visiting Professor  
INSTITUTION: University of California,  
San Francisco  
DATE: 25 April 2013

NAME: Brent D. Mishler  
POSITION: Professor of Integrative  
Biology, Director of the University and  
Jepson Herbaria  
INSTITUTION: University of California,  
Berkeley  
DATE: April 29, 2013

NAME: Cary J. Mock  
POSITION: Professor of Geography  
INSTITUTION: University of South  
Carolina, Columbia  
DATE: 5/13/2013

NAME: Atte Moilanen  
POSITION: Professor, Conservation  
Decision Analysis  
INSTITUTION: University of Helsinki,  
Dept. Biosciences  
DATE: April 25, 2013

N

NAME: David R. Montgomery  
 POSITION: Professor (Geomorphology)  
 INSTITUTION: University of  
 Washington  
 DATE: 5/7/13

NAME: Arne O. Mooers  
 POSITION: Professor of Biodiversity  
 INSTITUTION: Simon Fraser  
 University, Canada  
 DATE: April 25, 2013

NAME: Harold A. Mooney  
 POSITION: Professor Emeritus,  
 Department of Biology, and Senior  
 Fellow, Woods Institute  
 INSTITUTION: Stanford University  
 DATE: April 23, 2013

NAME: MORAND Serge  
 POSITION: DR CNRS, Université de  
 Montpellier 2  
 INSTITUTION: CNRS (Centre National  
 de la Recherche, France)  
 DATE: 02/06/2013

NAME: Juan Moreno  
 POSITION: Research Professor CSIC  
 (Spanish Council for Scientific  
 Research)  
 INSTITUTION: Department of  
 Evolutionary Ecology, National  
 Museum  
 of Natural Sciences (CSIC), Madrid,  
 Spain  
 DATE: 26 April 2013

NAME: Christopher Moy  
 POSITION: Lecturer  
 INSTITUTION: University of Otago,  
 New Zealand  
 DATE: May 19, 2013

NAME: Prof. Dr. Andreas Mulch  
 POSITION: Vice Director Biodiversity  
 and Climate Research Centre Frankfurt  
 INSTITUTION: Biodiversity and  
 Climate Research Centre Frankfurt  
 DATE: [17.05.2013](#)

NAME: Geoffrey Mwachala  
 POSITION: Director of Collections and  
 Research  
 INSTITUTION: National Museums of  
 Kenya  
 DATE: 20 June 2013

NAME: John Peterson Myers  
 POSITION: CEO and Chief Scientist  
 INSTITUTION: Environmental Health  
 Sciences, Charlottesville, Virginia  
 DATE: April 23, 2013

NAME: Atle Mysterud  
 POSITION: Professor  
 INSTITUTION: University of Oslo,  
 Norway  
 DATE: 25. April 2013

NAME: Nalini Nadkarni  
 POSITION: Full Professor, Dept of  
 Biology, and Director,  
 Center for Science and Mathematics  
 Education  
 INSTITUTION: University of Utah  
 DATE: April 26, 2013

NAME: Shahid Naeem  
 POSITION: Professor of Ecology  
 INSTITUTION: Columbia University  
 DATE: 25 April 2013

NAME: Tohru Nakashizuka  
 POSITION: Professor  
 INSTITUTION: Graduate School of Life  
 Sciences, Tohoku University  
 DATE: May 7, 2013.

NAME: Rosamond L. Naylor  
 POSITION: Director, Program on Food  
 Security and the Environment and  
 Professor, Department of  
 Environmental Earth System Science  
 INSTITUTION: Stanford University  
 DATE: April 23, 2013

NAME: Ioan Negrutiu  
 POSITION: Professor biology  
 INSTITUTION: ENS Lyon, Michel  
 Serres Institute  
 DATE: April 25, 2013

NAME: Tarique Niazi  
 POSITION: Associate Professor of  
 Environmental Sociology  
 INSTITUTION: University of  
 Wisconsin-Eau Claire  
 DATE: May 2, 2013

NAME: GRACIELA G. NICOLA  
 POSITION: FULL PROFESSOR  
 INSTITUTION: UNIVERSITY OF  
 CASTILLA-LA MANCHA (UCLM),  
 SPAIN  
 DATE: 29/04/2013

NAME: Prof. Dr. Manfred Niekisch  
 POSITION: University Professor and  
 Zoo Director  
 INSTITUTION: Goethe University and  
 Frankfurt Zoo  
 DATE: 17. May 2013

NAME: Rasmus Nielsen  
 POSITION: Professor  
 INSTITUTION: University of California  
 - Berkeley  
 DATE: April 29 2013

NAME: Dale G. Nimmo  
 POSITION: Research Fellow  
 INSTITUTION: Deakin University,  
 Australia  
 DATE: 20-05-2012

NAME: DAVID NOGUÉS-BRAVO  
 POSITION: ASSOCIATE  
 PROFESSOR

INSTITUTION: UNIVERSITY OF  
 COPENHAGEN  
 DATE: 25-APRIL-2013

NAME: NORET Nausicaa  
 POSITION: ASSISTANT PROFESSOR  
 INSTITUTION: UNIVERSITE LIBRE  
 DE BRUXELLES  
 DATE: 30 04 2013

NAME: Christopher M. Nyamai  
 POSITION: Senior Lecturer, Chair,  
 Department of Geology  
 INSTITUTION: University of  
 Nairobi DATE: 15<sup>th</sup> May 2013

O

NAME: Karen Oberhauser  
 POSITION: Professor  
 INSTITUTION: University of  
 Minnesota  
 DATE: 4/29/2013

NAME: Timothy G. O'Connor  
 POSITION: Observation Scientist (plus  
 Honorary Professor, School of Animal,  
 Plant and Environmental Sciences)  
 INSTITUTION: South African  
 Environmental Observation Network,  
 PO Box 2600, Pretoria 0001, South  
 Africa (University of the  
 Witwatersrand, Johannesburg, South  
 Africa)  
 DATE: 20 May 2013

NAME: John C. Ogden  
 POSITION: Emeritus Professor  
 INSTITUTION: University of South  
 Florida (USF)  
 DATE: April 30, 2013

NAME: Onesmo K. ole-Moi Yoi MD,  
 DSc (hc), EBS (Kenya)  
 POSITION: Chair Board of  
 Management  
 INSTITUTION: Kenya Agricultural  
 Research Institute  
 DATE: 14 May 2013

NAME: Gordon H. Orians  
 POSITION: Professor Emeritus of  
 Biology  
 INSTITUTION: University of  
 Washington, Seattle, WA 98195  
 DATE: April 25, 2013

NAME: Dr. Jamie F Orr  
 POSITION: Adjunct Faculty, Physics &  
 Engineering, Foothill College &  
 Faculty Researcher, NASA Ames  
 Research Center  
 INSTITUTION: Foothill College and  
 NASA Ames Research Center  
 DATE: May 15, 2013

NAME: John Orrock  
 POSITION: Assistant Professor  
 INSTITUTION: Department of Zoology,  
 University of Wisconsin-Madison  
 DATE: April 30, 2013



NAME: Otso Ovaskainen  
POSITION: Professor  
INSTITUTION: University of Helsinki,  
Finland  
DATE: April 25th 2013

NAME: Norman Owen-Smith  
POSITION: Emeritus Research  
Professor  
INSTITUTION: University of the  
Witwatersrand, Johannesburg  
DATE: May 9, 2013

## P

NAME: LUIS F. PACHECO  
POSITION: PROFESSOR AND  
RESEARCHER  
INSTITUTION: INSTITUTO DE  
ECOLOGÍA, UNIVERSIDAD  
MAYOR DE SAN ANDRÉS, LA PAZ,  
BOLIVIA  
DATE: 24 APRIL, 2013

NAME: Kevin Padian  
POSITION: Professor and Curator  
INSTITUTION: University of  
California, Berkeley  
DATE: 4/29/2013

NAME: Dianna K Padilla  
POSITION: Professor, Department of  
Ecology and Evolution  
INSTITUTION: Stony Brook University  
DATE: April 25 2013

NAME: Stephen Palumbi  
POSITION: Professor, Department of  
Biology and Director, Hopkins Marine  
Station, Stanford University  
DATE: April 23, 2013

NAME: John M. Pandolfi  
POSITION: Professor  
INSTITUTION: University of  
Queensland, Brisbane, Queensland,  
AUSTRALIA  
DATE: 26 April 2013

NAME: Mario Garcia Paris  
POSITION: Permanent Researcher  
(Investigador Científico)  
INSTITUTION: MNCN-CSIC (Museo  
Nacional de Ciencias Naturales-  
Consejo Superior de Investigaciones  
Científicas, Spain)  
DATE: 25/April/2013

NAME: James L. Patton, PhD  
POSITION: Curator and Professor  
Emeritus  
INSTITUTION: Museum of Vertebrate  
Zoology and Department of Integrative  
Biology, University of California,  
Berkeley  
DATE: 25 April 2013

NAME: Daniel Pauly  
POSITION: Professor of Fisheries

INSTITUTION: Fisheries Centre,  
University of British Columbia,  
Vancouver, Canada  
DATE: April 10, 2013

NAME: Jonathan L. Payne  
POSITION: Associate Professor  
INSTITUTION: Dept. of Geological &  
Environmental Sciences, Stanford  
University  
DATE: April 28, 2013

NAME: Richard G. Pearson  
POSITION: Emeritus Professor  
INSTITUTION: James Cook University,  
Australia  
DATE: May 20, 2013

NAME: Kabir G. Peay  
POSITION: Assistant Professor  
INSTITUTION: Stanford University  
DATE: 4/25/2013

NAME: Pablo Pelaez-Campomanes  
POSITION: Senior researcher  
INSTITUTION: National Museum of  
Natural Sciences, CSIC, Spain  
DATE: 25/04/2013

NAME: Petri Pellikka  
POSITION: Professor of Geoinformatics  
INSTITUTION: University of Helsinki  
DATE: 15.5.2013

NAME: Dr Avril Pereira  
POSITION: Research Fellow  
INSTITUTION: The Florey Institute of  
Neuroscience and Mental Health  
DATE: 20 May, 2013

NAME: Henrique Miguel Pereira  
POSITION: Invited Professor  
INSTITUTION: Faculty of Sciences of  
the University of Lisbon, Portugal  
DATE: 13 May 2013

NAME: Melissa Pespeni  
POSITION: National Science  
Foundation Postdoctoral Fellow in  
Biology  
INSTITUTION: Indiana University  
DATE: April 25, 2013

NAME: Owen Petchey  
POSITION: Professor  
INSTITUTION: University of Zurich  
DATE: 8th May 2013

NAME: Dmitri Petrov  
POSITION: Professor of Biology  
INSTITUTION: Stanford University  
DATE: 5/20/13

NAME: Ben Phillips  
POSITION: Senior Research Fellow  
INSTITUTION: Centre for Tropical  
Biodiversity and Climate Change,  
James Cook University  
DATE: 20 May 2013

NAME: Theunis Piersma  
POSITION: Professor of Global Flyway  
Ecology  
INSTITUTION: University of  
Groningen/Royal Netherlands Institute  
for Sea Research (NIOZ)  
DATE: 18 May 2013

NAME: Stuart Pimm  
POSITION: Doris Duke Chair of  
Conservation  
INSTITUTION: Duke University  
DATE: 28th April 2013

NAME: Stephanie Pincetl, PhD  
POSITION: Adjunct Professor,  
Director, Center for Sustainable  
Communities, Institute of the  
Environment and Sustainability  
INSTITUTION: UCLA  
DATE: April 26, 2013

NAME: Malin L. Pinsky  
POSITION: David H. Smith  
Conservation Research Fellow  
INSTITUTION: Princeton University  
DATE: April 24, 2013

NAME: Erica Plambeck  
POSITION: Professor of Operations,  
Information and Technology  
INSTITUTION: Stanford Graduate  
School of Business  
DATE: May 18 2013

NAME: P. David Polly  
POSITION: Professor  
INSTITUTION: Department of  
Geological Sciences, Indiana  
University  
DATE: 25 April 2013

NAME: Warren P. Porter  
POSITION: Professor of Zoology and  
Professor of Environmental Toxicology  
INSTITUTION: University of  
Wisconsin, Madison  
DATE: 25 April 2013

NAME: Hugh Possingham  
POSITION: Professor and Centre  
Director  
INSTITUTION: The University of  
Queensland  
DATE: 25 April 2013

NAME: Malcolm Potts  
POSITION: Professor, School of Public  
Health  
INSTITUTION: University of  
California-Berkeley  
DATE: April 25, 2013

NAME: Mary E. Power  
POSITION: Professor  
INSTITUTION: Univ. California,  
Berkeley  
DATE: April 25, 2013

NAME: Daniel Press

POSITION: Olga T. Griswold  
Professor, Environmental Studies  
Department and Executive Director,  
Center for Agroecology and  
Sustainable Food Systems  
INSTITUTION: University of California,  
Santa Cruz  
DATE: April 28, 2013

NAME: Aili Pyhäälä  
POSITION: Postdoctoral Researcher  
INSTITUTION: Department of  
Biosciences, University of Helsinki  
DATE: 25th April 2013

NAME: Dr Graham H. Pyke  
POSITION: Distinguished Professor  
INSTITUTION: School of the  
Environment, University of  
Technology Sydney  
DATE: 26 April 2013

## Q

## R

NAME: Nancy N. Rabalais  
POSITION: Executive Director and  
Professor  
INSTITUTION: Louisiana Universities  
Marine Consortium  
DATE: 49 April 2013

NAME: Paul A Racey  
POSITION: Co-Chair, IUCN Bat  
Specialist Group  
INSTITUTION: Regius Professor of  
Natural History (Emeritus), University  
of Aberdeen. Honorary Visiting  
Professor, University of Exeter in  
Cornwall  
DATE: 30 April 2013

NAME: Carsten Rahbek  
POSITION: Professor  
INSTITUTION: Center for  
Macroecology, Evolution and Climate,  
University of Copenhagen, Denmark  
DATE: 15 May 2013

NAME: Paul B Rainey  
POSITION: Distinguished Professor  
INSTITUTION: New Zealand Institute  
for Advanced Study & Max Planck  
Institute for Evolutionary Biology.  
DATE: 20.05.13

NAME: Uma Ramakrishnan  
POSITION: Associate Professor  
INSTITUTION: National Centre of  
Biological Sciences, Bangalore, India  
DATE: May 11, 2013

NAME: Giovanni Ramón  
POSITION: Post-graduate student  
INSTITUTION: James Cook University  
DATE: 20/05/2013

NAME: Dr. Eduardo H. Rapoport

POSTION: Professor Emeritus &  
Investigador Consejo Nacional  
Investigaciones Científicas  
INSTITUTION: Universidad Nacional  
del Comahue, Bariloche, Argentina  
DATE: MAY 20, 2013

NAME: Daniel J. Rasky  
POSITION: Senior Scientist  
INSTITUTION: Self  
DATE: 5/20/2013

NAME: Prof. Peter H. Raven  
POSITION: President Emeritus  
INSTITUTION: Missouri Botanical  
Garden  
DATE: May 9, 2013

NAME: RAVIGNÉ Virginie  
POSITION: RESEARCHER (permanent  
position)  
INSTITUTION: CIRAD  
DATE: 21/05/2013

NAME: Dr. John E. Rawlins  
POSITION: Curator of Invertebrate  
Zoology  
INSTITUTION: Carnegie Museum of  
Natural History  
DATE: 1 May 2013

NAME: Dr. Maureen E Raymo  
POSITION: Lamont Research Professor  
and Director Lamont-Doherty Core  
Repository  
INSTITUTION: Lamont-Doherty Earth  
Observatory of Columbia University  
DATE: May 11, 2013

NAME: Harry F. Recher  
POSITION: Emeritus Professor  
INSTITUTION: Edith Cowan  
University, School of Natural Sciences,  
Joondalup, Western Australia,  
Australia  
DATE: 26 April 2013

NAME: Kent H. Redford  
POSITION: Principal  
INSTITUTION: Archipelago Consulting  
DATE: May 19, 2013

NAME: William E. Rees, PhD, FRSC  
POSITION: Professor Emeritus  
INSTITUTION: University of British  
Columbia  
DATE: 26 April 2013

NAME: Jonathan Rhodes  
POSITION: Senior Lecturer  
INSTITUTION: The University of  
Queensland  
DATE: 29<sup>th</sup> April 2013

NAME: Brett R. Riddle  
POSITION: Professor  
INSTITUTION: University of Nevada  
Las Vegas  
DATE: 26 April 2013

NAME: William J. Ripple  
POSITION: Professor  
INSTITUTION: Oregon State  
University  
DATE: May 18, 2013

NAME: Euan G. Ritchie  
POSITION: Lecturer in ecology  
INSTITUTION: Deakin University,  
Australia  
DATE: 18/5/2013

NAME: Annapaola Rizzoli  
POSITION: DVM, PhD, Animal  
Ecology Research Group Leader  
INSTITUTION: Research and  
Innovation Centre, Department of  
Biodiversity and Molecular Ecology,  
Edmund Mach Foundation, San  
Michele all'Adige (TN), Italy  
DATE: 26/04/2013

NAME: Dr Lisa Roberts  
POSITION: Visiting Fellow,  
Environmental Science / Design  
INSTITUTION: University of  
Technology, Sydney  
DATE: 29 April 2013

NAME: Heyward G. Robinson  
POSITION: Senior Scientist, Applied  
Optics Laboratory  
INSTITUTION: SRI International  
DATE: 8 May 2013

NAME: John G. Robinson, Ph.D.  
POSITION: Executive Vice President,  
Conservation and Science  
INSTITUTION: Wildlife Conservation  
Society  
DATE: April 25, 2013

NAME: Johan Rockström  
POSITION: Professor, Water systems  
and Global Sustainability; Director,  
Stockholm Resilience Centre  
INSTITUTION: Stockholm University  
DATE: April 25, 2013

NAME: Antonio Gonzalez Rodriguez  
POSITION: Researcher  
INSTITUTION: Universidad Nacional  
Autonoma de Mexico  
DATE: April 27th, 2013

NAME: Klaus Rohde  
POSITION: Professor Emeritus  
INSTITUTION: University of New  
England, Armidale, Australia  
DATE: 26.4.2013

NAME: Terry L. Root  
POSITION: Senior Fellow  
INSTITUTION: Stanford University  
DATE: 8 May 2013

NAME: Helen Rowe  
POSITION: Assistant Research  
Professor

INSTITUTION: School of Life Sciences, Arizona State University  
DATE: 4-26-2013

NAME: Lasse Ruokolainen  
POSITION: Postdoctoral fellow  
INSTITUTION: University of Helsinki  
DATE: 26.4.2013

## S

NAME: Takashi Saitoh  
POSITION: Professor  
INSTITUTION: Field Science Center, Hokkaido University, Japan  
DATE: May 8, 2013

NAME: Osvaldo Sala  
POSITION: Julie A. Wrigley Professor of Life Sciences and Sustainability  
INSTITUTION: Arizona State University  
DATE: 4/25/2013

NAME: Peter F Sale  
POSITION: Assistant Director, Institute for Water, Environment and Health  
INSTITUTION: United Nations University  
DATE: April 25th 2013

NAME: Benjamin Santer  
POSITION: Atmospheric Scientist  
INSTITUTION: Lawrence Livermore National Laboratory  
DATE: May 18, 2013

NAME: Jos é Sarukhán  
POSITION: National Coordinator, and Professor Emeritus, UNAM.  
INSTITUTION: Mexican National Commission on Biodiversity (CONABIO) and Institute of Ecology, UNAM  
DATE: 19th May, 2013

NAME: Dov Sax  
POSITION: Associate Professor of Ecology and Evolutionary Biology, Director-Elect for the Center for Environmental Studies  
INSTITUTION: Brown University  
DATE: May 10, 2013

NAME: James Schaefer  
POSITION: Professor  
INSTITUTION: Trent University  
DATE: 26 April 2013

NAME: Christoph Scheidegger, Prof. Dr.  
POSITION: Senior Scientist and Chair Research Group Biodiversity  
INSTITUTION: Swiss Federal Institute for Forest, Snow and Landscape Research, WSL, Zürcherstr. 111, CH-8903 Birmensdorf, Switzerland  
DATE: April 30, 2013

NAME: William H. Schlesinger  
POSITION: President  
INSTITUTION: Cary Institute of Ecosystem Studies  
DATE: April 25, 2013

NAME: Jan Schnitzler  
POSITION: Postdoctoral Researcher  
INSTITUTION: Biodiversity and Climate Research Centre (BiK-F) & Goethe University, Frankfurt, Germany  
DATE: May 17, 2013

NAME: Cagan H. Sekercioglu, Ph.D.  
POSITION: Assistant Professor  
INSTITUTION: University of Utah Department of Biology  
DATE: May 11, 2013

NAME: Heikki Seppä  
POSITION: Professor  
INSTITUTION: Department of Geosciences and Geography, University of Helsinki, Finland  
DATE: May 14, 2013

NAME: Fabrizio Sergio  
POSITION: Researcher (permanent post)  
INSTITUTION: Estacion Biologica de Donana - Consejo Superior de Investigaciones Cientificas, Seville, Spain  
DATE: 25 April 2013

NAME: DAVID SERRANO  
POSITION: ASSOCIATE PROFESSOR  
INSTITUTION: EBD-CSIC  
DATE: 25 April 2013

NAME: ROSS D. SHACHTER  
POSITION: ASSOCIATE PROFESSOR  
INSTITUTION: STANFORD UNIVERSITY  
DATE: MAY 20, 2013

NAME: Michael Shapira  
POSITION: Adjunct assistant professor  
INSTITUTION: Department of Integrative biology, UC Berkeley  
DATE: 4/29/13

NAME: Anne Sheppard  
POSITION: Research Assistant  
INSTITUTION: School of Life Sciences, University of Warwick, UK.  
DATE: 26th April 2013

NAME: Steven Sherwood  
POSITION: Professor, Director of the Climate Change Research Centre  
INSTITUTION: University of New South Wales  
DATE: 1 May 2013

NAME: Richard Shine  
POSITION: Professor in Biology  
INSTITUTION: University of Sydney

DATE: 26 April 2013

NAME: Candida Shinn  
POSITION: post-doctoral researcher  
INSTITUTION: IMAR - Instituto do Mar  
DATE: 25.4.2013

NAME: Marisa Sicilia  
POSITION: Post-doctoral researcher  
INSTITUTION: Universidad de Castilla-La Mancha (Spain)  
DATE: 13th May 2013

NAME: Fernando Simal  
POSITION: Manager, Natural and Historic Resources Unit  
INSTITUTION: STINAPA Bonaire  
DATE: April 26<sup>th</sup>, 2013

NAME: Ellen L. Simms  
POSITION: Professor, Integrative Biology  
INSTITUTION: University of California, Berkeley  
DATE: 29 April 2013

NAME: Javier A. Simonetti  
POSITION: Professor, Facultad de Ciencias, Universidad de Chile, Chile  
INSTITUTION: Facultad de Ciencias, Universidad de Chile  
DATE: May 20th, 2013

NAME: Jasper Slingsby  
POSITION: Biodiversity Scientist  
INSTITUTION: South African Environmental Observation Network  
DATE: 10 May 2013

NAME: Adam B. Smith  
POSITION: Postdoctoral Researcher  
INSTITUTION: Center for Conservation and Sustainable Development, Missouri Botanical Garden  
DATE: April 25th, 2013

NAME: Kirk R. Smith  
POSITION: Professor of Global Environmental Health  
INSTITUTION: University of California Berkeley  
DATE: April 25, 2013

NAME: Martyn T. Smith  
POSITION: Professor and Director, Berkeley Institute of the Environment  
INSTITUTION: School of Public Health, University of California at Berkeley  
DATE: May 19, 2013

NAME: Dr. Allison A. Snow  
POSITION: Professor of Biology  
INSTITUTION: Ohio State University  
DATE: April 25, 2013

NAME: Janne Soininen  
POSITION: Assistant Professor  
INSTITUTION: Department of

Geosciences and Geography,  
University of Helsinki  
DATE: 14.5.2013

NAME: Manuel Soler  
POSITION: Full Professor  
INSTITUTION: Department of Zoology,  
Granada University, Spain  
DATE: 25 April 2013

NAME: Michael Soule  
POSITION: Emeritus Professor,  
INSTITUTION: UCSC  
DATE: 4-25-13

NAME: Wayne P. Sousa  
POSITION: Professor  
INSTITUTION: Department of  
Integrative Biology, University of  
California, Berkeley  
DATE: April 29, 2013

NAME: Donald W. Spady MD, MSc.  
POSITION: Adjunct Associate Professor  
of Pediatrics & Public Health  
INSTITUTION: Faculty of Medicine &  
Dentistry, and School of Public Health,  
University of Alberta, Edmonton,  
Canada  
DATE: April 28, 2013

NAME: Chelsea Specht  
POSITION: Associate Professor and  
Curator  
INSTITUTION: University of California,  
Berkeley  
DATE: 29 April 2013

NAME: THOMAS WIER STAFFORD,  
JR  
POSITION: RESEARCH PROFESSOR  
INSTITUTION: DEPARTMENT OF  
PHYSICS & ASTRONOMY,  
UNIVERSITY OF AARHUS,  
AARHUS, DENMARK  
DATE: MAY 9, 2013

NAME: Dr Martin J. Steinbauer  
POSITION: Senior Research  
Fellow/Entomologist  
INSTITUTION: Department of Zoology,  
La Trobe University, Melbourne,  
AUSTRALIA  
DATE: 20 May 2013

NAME: Nils Chr. Stenseth  
POSITION: Professor and Chair, Center  
for Ecological and Evolutionary  
Synthesis, and Chief Scientist,  
Norwegian Institute of Marine  
Research  
INSTITUTION: University of Oslo  
DATE: April 23, 2013

NAME: Jonathon Stillman  
POSITION: Associate Professor - and -  
Adjunct Assistant Professor  
INSTITUTION: San Francisco State  
University - and - University of  
California Berkeley  
DATE: April 29, 2013

NAME: Robert L. Street  
POSITION: Campbell Professor in the  
School of Engineering [Em]  
INSTITUTION: Stanford University  
DATE: 20 May 2013

NAME: Caroline A E Strömberg  
POSITION: Assistant Professor &  
Curator of Paleobotany  
INSTITUTION: University of  
Washington, Seattle  
DATE: 05/19/2013

NAME: Simon N. Stuart, PhD  
POSITION: Visiting Professor,  
Department of Biology and  
Biochemistry, University of Bath  
INSTITUTION: Chair, Species Survival  
Commission, International Union for  
Conservation of Nature; Senior  
Biodiversity Advisor, Conservation  
International; Senior Biodiversity  
Advisor, World Conservation  
Monitoring Centre  
DATE: 30 April 2013

NAME: Rashid Sumaila  
POSITION: Professor of Ocean and  
Fisheries Economics  
INSTITUTION: Fisheries Centre,  
University of British Columbia,  
Vancouver, Canada  
DATE: April 10, 2013

NAME: William Sutherland  
POSITION: Miriam Rothschild  
Professor of Conservation Biology  
INSTITUTION: University of  
Cambridge  
DATE: 18 May 2013

NAME: Dr. David Suzuki, Emeritus  
POSITION: Professor, Sustainable  
Development Research Institute  
INSTITUTION: University of British  
Columbia, Vancouver, BC, Canada  
DATE: April 29, 2013

NAME: Andrew Szasz  
POSITION: Professor of Environmental  
Studies  
INSTITUTION: University of  
California, Santa Cruz  
DATE: April 26, 2013

NAME: Alina M. Szmant  
POSITION: Professor of Marine  
Biology  
INSTITUTION: Center for Marine  
Science, University of North Carolina  
Wilmington  
DATE: April 25, 2013

## T

NAME: Gary M. Tabor  
POSITION: Executive Director  
INSTITUTION: Center for Large  
Landscape Conservation  
DATE: 25 April, 2013

NAME: Celine Teplitsky  
POSITION: Research scientist  
INSTITUTION: CNRS & French  
Natural History Museum  
DATE: 29/04/2013

NAME: John Terborgh  
POSITION: Research Professor,  
Nicholas School of the Environment  
and Earth Sciences  
INSTITUTION: Duke University  
DATE: April 29, 2013

NAME: Alexey Tesakov  
POSITION: Head of Laboratory for  
Quaternary Stratigraphy  
INSTITUTION: Geological Institute,  
Russian Academy of  
Sciences, Moscow, Russia  
DATE: May 7, 2013

NAME: John N. Thompson  
POSITION: Distinguished Professor of  
Ecology and Evolutionary Biology  
INSTITUTION: University of California,  
Santa Cruz  
DATE: 30 April 2013

NAME: Hiroshi Tomimatsu  
POSITION: Associate Professor  
INSTITUTION: Department of Biology,  
Yamagata University, Japan  
DATE: May 10, 2013

NAME: Susumu Tomiya  
POSITION: Lecturer  
INSTITUTION: University of California,  
Berkeley  
DATE: May 1, 2013

NAME: Alan Townsend  
POSITION: Professor, Dept of Ecology  
and Evolutionary Biology Fellow,  
Institute of Arctic and Alpine Research  
INSTITUTION: University of Colorado,  
Boulder  
DATE: April 25, 2013

NAME: ANNA TRAVESET  
POSITION: RESEARCH PROFESSOR  
INSTITUTION: SPANISH RESEARCH  
COUNCIL  
DATE: APRIL 26, 2013

## U

## V

NAME: James W. Valentine  
POSITION: Professor of Integrative  
Biology, Emeritus  
INSTITUTION: UC Berkeley  
DATE: April 19, 2013

NAME: Myriam VALERO  
POSITION: Researcher at the CNRS  
(Centre National de la Recherche  
Scientifique)

INSTITUTION: Station Biologique de  
Roscoff, France  
DATE: 1st May 2013

NAME: Fernando Valladares  
POSITION: Research Professor  
INSTITUTION: Spanish Council for  
Scientific Research (CSIC)  
DATE: April 24, 2013

NAME: Jan van der Made  
POSITION: Scientific researcher  
(Investigador científico)  
INSTITUTION: Consejo Superior de  
Investigaciones Científicas (CSIC),  
Museo Nacional de Ciencias Naturales  
(Madrid, Spain).  
DATE: 25-4-2013

NAME: Marcel van Tuinen  
POSITION: Associate Professor  
INSTITUTION: UNC at Wilmington  
DATE: 4/25/13

NAME: Jake Vander Zanden  
POSITION: Professor  
INSTITUTION: University of  
Wisconsin-Madison  
DATE: 4/25/2013

NAME: Ella Vázquez-Domínguez, PhD  
POSITION: Full time Researcher,  
INSTITUTION: Instituto de Ecología,  
UNAM, México  
DATE: 12 May 2013

NAME: Geerat J. Vermeij  
POSITION: Distinguished Professor of  
Geology, Department of Geology  
INSTITUTION: University of California  
at Davis  
DATE: April 25, 2013

NAME: Montserrat Vila  
POSITION: Research Professor  
INSTITUTION: estación Biológica de  
Doñana (EBD-CSIC)  
DATE: April, 25th, 2013

NAME: Peter Vitousek  
POSITION: Professor  
INSTITUTION: Stanford University  
DATE: April 26, 2013

NAME: Kristiina Vogt  
POSITION: Professor and Director of  
FSB, School of Environmental and  
Forest Sciences, College of the  
Environment  
INSTITUTION: University of  
Washington  
DATE: 6 May 2013

NAME: Henrik von Wehrden  
POSITION: Junior Professor  
INSTITUTION: Leuphana University,  
Germany, Institute of Ecology/Faculty  
of Sustainability & Center for Methods  
DATE: 18.05.2013

## W

NAME: Mathis Wackernagel, Ph.D.  
POSITION: President, Global Footprint  
Network, and Visiting Professor  
INSTITUTION: Cornell University  
DATE: 28 April 2013

NAME: David B. Wake  
POSITION: Professor of the Graduate  
School in Integrative Biology  
INSTITUTION: University of California  
at Berkeley  
DATE: April 25, 2013

NAME: Marvilee H. Wake  
POSITION: Professor of the Graduate  
School, Department of Integrative  
Biology  
INSTITUTION: University of  
California-Berkeley  
DATE: April 23, 2013

NAME: Diana H. Wall  
POSITION: University Distinguished  
Professor and School of Global  
Environmental Sustainability  
INSTITUTION: Colorado State  
University  
DATE: April 25, 2013

NAME: Don Waller  
POSITION: John T. Curtis Professor of  
Botany and Chair, Department of  
Botany, Biological Aspects of  
Conservation Major, Wisconsin  
Ecology  
INSTITUTION: University of  
Wisconsin – Madison  
DATE: April 26, 2013

NAME: Dr Haydn Washington  
POSITION: Visiting Fellow, Institute of  
Environmental Studies  
INSTITUTION: University of New  
South Wales (Australia)  
DATE: 29 April 2013

NAME: Les Watling  
POSITION: Professor  
INSTITUTION: University of Hawaii at  
Manoa  
DATE: 26 April 2013

NAME: David M Watson  
POSITION: Associate Professor in  
Ecology  
INSTITUTION: Charles Sturt  
University  
DATE: 26 April 2013

NAME: Andrew Weaver  
POSITION: Lansdowne Professor and  
Canada Research Chair  
INSTITUTION: School of Earth and  
Ocean Sciences, University of Victoria  
DATE: April 25, 2013

NAME: Anthony LeRoy Westerling

POSITION: Associate Professor,  
Geography and Environmental  
Engineering  
INSTITUTION: Sierra Nevada  
Research Institute, University of  
California, Merced  
DATE: April 26, 2013

NAME: Dr Desley Whisson  
POSITION: Lecturer in Wildlife and  
Conservation Biology  
INSTITUTION: School of Life and  
Environmental Sciences, Deakin  
University  
DATE: 18 May 2013

NAME: Tim D. White  
POSITION: Professor, Department of  
Integrative Biology  
INSTITUTION: The University of  
California at Berkeley  
DATE: May 1, 2013

NAME: Ruscena Wiederholt  
POSITION: Assistant Research Scientist  
INSTITUTION: University of Arizona  
DATE: 4/25/13

NAME: RICARDO LOPEZ WILCHIS  
POSITION: Senior Researcher and  
Professor  
INSTITUTION: Universidad Autónoma  
Metropolitana-Iztapalapa, Departamento  
de Biología  
DATE: May 11, 2013

NAME: J. Allen Williams, Jr.  
POSITION: Professor Emeritus  
INSTITUTION: University of Nebraska-  
Lincoln  
DATE: May 3, 2013

NAME: Susan L. Williams  
POSITION: Professor  
INSTITUTION: Dept. of Evolution &  
Ecology and Bodega Marine  
Laboratory, University of California at  
Davis  
DATE: 25 April 2013

NAME: Gregory P. Wilson  
POSITION: Assistant Professor of  
Biology, Adjunct Curator of Vertebrate  
Paleontology  
INSTITUTION: University of  
Washington and Burke Museum  
DATE: May 13, 2013

NAME: Ragnar Winther  
POSITION: Professor of Mathematics  
INSTITUTION: University of Oslo,  
Norway  
DATE: 10 May, 2013

NAME: Connie Woodhouse  
POSITION: Professor  
INSTITUTION: School of Geography  
and Development, University of  
Arizona  
DATE: May 16, 2013

NAME: Dawn J. Wright, Ph.D., GISP  
POSITION: Chief Scientist  
INSTITUTION: Environmental Systems  
Research Institute (Esri)  
DATE: April 26, 2013

NAME: Carl Wunsch  
POSITION: Cecil and Ida Green  
Professor of Physical Oceanography,  
emeritus, MIT and Visiting Professor  
of Physical Oceanography and Climate  
INSTITUTION: Harvard U. and MIT.  
DATE: 14 May 2013

## X

## Y

NAME: Norman Yan, PhD, FRSC  
POSITION: Professor  
INSTITUTION: York University,  
Toronto, Canada  
DATE: April 28, 2013

NAME: Ruifu Yang  
POSITION: Professor  
INSTITUTION: Beijing Inst. Microbiol.  
Epidemiol.  
DATE: 19 May, 2013

NAME: Charles Yanofsky  
POSITION: Emeritus Professor of  
Biology  
INSTITUTION: Stanford University  
DATE: May 17, 2013

NAME: Thamasak Yeemin, D.Sc.  
POSITION: D. Sc., Marine Biodiversity  
Research Group, Department of  
Biology, Faculty of Science  
INSTITUTION: Ramkhamhaeng  
University, Huamark, Bangkok 10240,  
THAILAND  
DATE: 21 May 2013

## Z

NAME: Dr Jan Zalasiewicz  
POSITION: Senior Lecturer in  
Palaeobiology  
INSTITUTION: University of Leicester  
DATE: 7 May 2013

NAME: Luis Zambrano  
POSITION: Professor / Reseracher  
INSTITUTION: Biology Insitute  
at National Autonomous Univeristy of  
Mexico  
DATE: May 3rd 2013

NAME: Hugo Tomás Zamora Meza  
POSITION: Biologist,  
INSTITUTION: Research Associate at  
the Natural History Museum of the  
National University of St Augustin of  
Arequipa, Peru - Bat Conservation  
Program in Peru  
DATE: May 2, 2013

NAME: Kelly R. Zamudio  
POSITION: Professor of Ecology &  
Evolutionary Biology  
INSTITUTION: Cornell University  
DATE: April 29, 2013

NAME: Joy B. Zedler  
POSITION: Professor of Botany and  
Aldo Leopold Chair of Restoration  
Ecology  
INSTITUTION: University of  
Wisconsin - Madison  
DATE: 4/30/2013

NAME: Liping Zhou  
POSITION: Professor, Department of  
Geography  
INSTITUTION: Peking University  
DATE: 18 May 2013



截至 2013 年 5 月 21 日，来自图中蓝色国家的 520 名科学家签署了该声明

## 该共识声明的目的

相比过去一万两千年，世界自 1950 年左右开始在更大的范围里发生着迅速的变化。如何平衡这种变化带来的积极影响和消极影响将是 21 世界的主要挑战。

积极影响包括绿色革命，从而减少世界饥荒（尽管目前全球仍然有八分之一的人口面临粮食短缺）；新的医学突破，降低婴儿和儿童死亡率，让人们可以活得更长，更富有成效的生活；获取无数的商品和服务，增加财富和舒适度；新的技术突破，例如电脑、手机和互联网，将全球数十亿人连接到一个潜在的全球大脑。

相比之下，其他变化，相互作用，正引导者人类走向危险的方向：**气候破坏，生物多样性灭绝，生态系统大规模消失，污染，日益增长的人口竞争地球有限的资源**。不幸的是，到目前为止，这些现象往往被人们视为进步的“必要之恶”，或者是不会最终影响为人类需求提供服务的附带损害。

然而，科学界最近的一些综合报告显示这种观点是错误的。气候破坏、物种灭绝、生态系统消失、污染和人口增长的加速趋势事实上正在威胁着人类维持（很多人已经享有或者向往的）高品质生活的生命保障系统。

绝大多数研究人和生物圈相互作用的科学家在主要的结论上达成一致：上述五项相互作用的危险趋势正在产生不利影响，如果继续下去，已经对人类生活质量产生的负面影响将会在未来数十年内变得更糟。支持这一结论的许多合理的科学证据已经被总结在最近的许多立场文件和共识声明里（第 28-29 页上列出了一些例子），并记录在数以千记的经同行评审的科学文献里。但是，立场文件和共识声明通常只集中在上述五个关键问题（例如，气候破坏、生物多样性消失、污染）之一，而对于非科学家而言，很难获取同行评审的文献。其结果是，当决策者面临重大决策时，发现很难从成千上万的文献中定位并消化相关信息。

我们在这里提供一个总结，目的是：

- 帮助政策制定者和其他人了解影响当地和整个地球最严重的环境健康问题。
- 清楚地阐述研究这些问题的大多数科学家的共识：
  - **气候破坏、物种灭绝、生态系统消失、污染和人口增长**是人类福祉和社会稳定的严重威胁。
  - 这五大威胁彼此不是独立运作的。

我们从科学的角度，勾勒出减轻这些威胁的简要行动。我们希望提供有用和必要的信息，帮助大众、政府和企业实现愿景，即最大限度地让我们的子孙后代至少和我们生活得一样好。

## 背景信息：我们生活保障系统的危险趋势

人们对食物、水、健康和居住有基本的需求，从而需要从自然资源里获取能源和其他产品来维持不同文化认可的生活标准。如果没有一个健康的，运作良好的全球生态系统，难以满足所有人的所有生活需求。“全球生态系统”简单来说是在地球上所有生命形态包括人类彼此间相互作用，并与所处的物理环境（水、土壤、空气等等）相互作用的复杂系统。所有这些相互作用构成了地球和我们的生活保障系统。

人类有史以来就是全球生态系统里的组成部分，现在我们成为其中的优势物种。因此，我们强烈地影响着地球生活保障系统的运行，包括积极和消极的方式。在未来数十年里，一个重大挑战是确保消极的影响不能超过积极的影响，否则世界将会变得更糟。强有力的科学证据表明五大危险相互作用产生的消极影响已经在过去几十年里出现：

- **破坏我们和其他物种赖以生存的气候。**
- **引发生物多样性的大规模灭绝。**
- **破坏多样化的生态系统，破坏我们基本的生命保障系统。**
- **有害物质污染我们的土地、水和空气，破坏基本的生物过程，极大地增加健康成本，降低我们应对其他问题的能力。**
- **快速增长的人口仍然沿用传统的生产和消费模式。**

这五大趋势相互作用，彼此加剧，总的影响比每项趋势单一影响的总和更糟糕。

为了确保让我们的子孙后代至少和我们生活得一样好，我们必须承认已经把全球生态系统推向了危险的方向，如果我们立刻采取行动，我们有知识和能力把它带回正轨。等待将会让事情变得更难，即使成功，也会为此付出更高昂的成本，包括金钱和人类所经受的苦难。

以下数页总结了造成每种危险趋势的原因，为什么它们的持续发展会对人类造成损害，它们如何彼此相互作用加剧负面影响，以及人类为了维持可持续的美好的未来必须采取的简要解决方案。





## 迎接挑战

解除以下总结的五大全球性危机并非易事，但是过去的经验表明，如果人类准备好迎接挑战，这些大规模的难题确实是可以解决的。如同人类过去成功地应对全球危机，解决方案需要具备相同的要素：个人能动性，国内和跨国合作，技术进步，以及安置新的基础设施。个人能动性从来都是供不应求，并且将持续做为强大的人力资源。成功的全球地方合作导致了第二次世界大战的结束以及战后的重建；禁止使用核武器；通过联合国倡议的绿色革命极大地增加了全球粮食产量，避免了粮食危机；极大地减少了对具有持久性毒性的化学物质（例如 DDT）的使用；扭转了平流层的臭氧损耗（“臭氧空洞”）；减少了全球性的流行疾病，例如疟疾和小儿麻痹症。

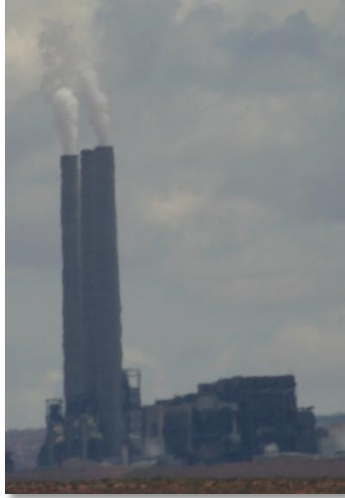
同样地，过去的技术进步和基础设施建设规模对于解决今天的问题显得富有成效。例如，为了满足第二次世界大战的需求，美国仅用了七年的时间就将飞机舰队从 3100 辆扩建到 300,000 辆。从二十世纪五十年代开始，美国不到五十年就建成了 47,000 英里（75,639 公里）的州际高速公路，足够绕地球两圈。在大约相同的时间里，60%世界上最大的河流重新探测了水坝。在大约三十年中，世界从打字机和邮票发展到手提电脑和互联网，现在连接着地球上约三分之一的人口。与此同时，从大约 3.1 亿固定电话跳跃到 60 亿 卫星联网手机，目前估计连接着 32 亿人口。

在过去成功的背景下，现在气候破坏、物种灭绝、生态系统消失、污染、人口增长和资源消费的问题也并非不能在未来三十到五十年内解决。事实上，科学的、技术的和企业的硬件已经具备，国际、国家、州和地方层面的鼓励性提议和共识也开始出现。而且，今天全球的连通性是人类历史上前所未有的，为大多数人了解全球问题，并帮助协调解决方案提供了新的机遇。

上述成功案例给出三个关键经验。首先是必须承认全球性问题，才可以得到解决。第二，解决它们是绝对有可能的。实际制定和实施解决方案的地方政府之间进行“双赢”的互动，而高层政府需要明确优先次序，并提供清晰的激励措施作为支持。第三个非常重要的经验是重大问题不可能在一夜之间得到解决。考虑到气候变化、新建基础设施、改变社会观念、延缓人口增长都存在内在的滞后性，今天采取的行动要在未来几十年后才能取得成果。举例来说，如果我们在 2035 年建立起一个碳中和的能源系统，那么气候变化要到 2100 年才能稳定下来，并且将来的气候系统和今天的气候系统仍然会存在差异。但是如果我们拖延至 2035 年才采取行动，气候破坏会持续恶化，减缓和适应气候变化的成本会急剧增加；而且到 2100 年后气候都难以稳定下来。如果这种情况发生，那时的气候状况对全社会的破坏性将远远超出我们早日采取行动的后果。类似的延迟成本在其他问题上也会产生，事实上，在其他问题上拖延行动将会导致物种、生态系统、人类健康和财富方面难以弥补的损失。因此，从今天开始减缓我们当前面临的全球性危机至关重要。

## 气候破坏

人类燃烧煤炭、石油（及其衍生品如汽油、柴油等）和天然气产生的温室气体正在改变着地球的气候<sup>1</sup>。在过去的一个世纪，尤其是过去六十年，地球的平均气温持续攀升，这种趋势还在持续。全球平均气温升高导致地方气温，降雨量和降雪量的数量和发生时间，不同季节的持续时间和特点，极端风暴、洪水、干旱和森林火灾的频率都发生了变化<sup>1,2</sup>。沿海地区海平面上升的问题尤其值得关注<sup>1-4</sup>。这些后果会破坏人们的生计、财产和健康，从而直接影响人们的福利，同时也间接增加了社会的潜在矛盾。最近的例子包括美国东海岸发生的超级风暴桑迪（Sandy）并引发水灾，美国西部和澳大利亚创记录的森林大火，席卷欧洲的热浪和干旱，巴基斯坦的水灾，所有的一切都发生在 2012 年和 2013 年。



人类活动排放的主要温室气体是二氧化碳（CO<sub>2</sub>），甲烷（CH<sub>4</sub>）和一氧化氮（NO）。其中，因为 CO<sub>2</sub> 排放数量巨大，尤其重要。人类活动产生的形成臭氧的化学物也在一定程度上导致气候变化。

## 关注原因

即使最好的排放情景（IPCC B1 情景）也预测地球到 2070 年会超过人类有史以来的最高气温，这种情况甚至可能提前发生<sup>1,5</sup>。如果目前的排放趋势持续下去<sup>6</sup>，当现在的孩子们长大并有了孙子的时候（2100 年），可能<sup>a</sup>会导致全球平均气温升高 4.3 到 11.5 华氏度（2.4 到 6.4 摄氏度），它们之间的最佳估计为 7.2 华氏度（4 摄氏度）<sup>1</sup>。上一次地球平均气温升高 7.2 华氏度发生在一千四百万年前，而上一次地球平均气温升高 11.5 华氏度发生在三千八百万年前<sup>7</sup>。

照目前温室气体排放速度持续下去，到 2100 年对人类社会的危害如下<sup>2,8-10</sup>：

- **更持久更强烈的热浪。** 二十一世纪末，二十年一遇的最热天气在大多数地区可能<sup>a</sup>变成两年一遇<sup>b,2</sup>。这样的现象在 2013 年已经出现了，澳大利亚的气温上升太快，导致天气地图上需要添加两个新的色彩来表达新的极端炎热天气。一些模型预测现在的变暖轨迹，如果持续到 2100 年，将导致一些地区太热而不适宜人类生存<sup>11</sup>。
- **更频繁发生的破坏性风暴。** 二十一世纪末，二十年一遇的平均日降雨量在大多数地区可能<sup>a</sup>变成五年一遇到十五年一遇<sup>c</sup>。气旋风速可能<sup>a</sup>会增加。城市可能会更频繁地经历像超级风暴桑迪造成的那种程度的损害。

<sup>a</sup> 在这里“可能”是只有 66%到 100%的机率会出现该情况。这里的用法是按照 IPCC 报告的定义。参见参考文献 1 和 2。

<sup>b</sup> IPCC A1B 和 A2 排放情景，参见参考文献 2。

<sup>c</sup> IPCC B1, A1B, 和 A2 排放情景，参见参考文献 2。

- **海平面上升对沿海城市造成破坏。**海平面上升的程度部分取决于冰川融化的速度。下限预测<sup>1</sup>到2100年海平面上升0.6到1.9英尺（0.18到0.59米）；上限预测海平面上升高达2.6到13.1英尺（0.8到4米）<sup>3,4,9</sup>。即使是下限预测的海平面上升幅度，也将淹没全球各大城市的大部分地区，并迫使上百万人口需要永久性的重新安置。目前大约有一亿人口生活在平均海面上不足3.3英尺（1米）的地区<sup>12</sup>。
- **世界人口稠密的地区水资源短缺。**依赖季节性积雪和缓慢春融的城市和农田，从主要河流分摊水资源的干旱地区，以及依赖冰川融化获取水资源的地区都将面临威胁<sup>12</sup>。
- **地方粮食产量减产。**新的气候模式将会改变不同地区适宜耕种的粮食类型。一些地区预计将出现粮食减产：例如，目前拥有最高人口密度和/或者最多营养不良人口的地区，尤其是非洲和印度的大部分地区，将会出现谷物作物的减产<sup>12</sup>。主要的作物种植区，如加利福尼亚州，它提供美国一半的水果、坚果和蔬菜，将会遭遇跨作物的不均衡影响，要求农民迅速适应，改变他们种植的作物<sup>13,14</sup>。
- **经济损失，社会冲突，政治动荡。**沿海地区的损害，港口淹没，水资源短缺，恶劣的天气，粮食种植区转型，新航道的开辟，以及对北极资源的竞争都将是国家和国际关系变得更加复杂，花费数亿美元<sup>9,10,14,15</sup>。例如，纽约时报报道<sup>d</sup>，2013年头几个月，美国纳税人已经支付70亿美元来补贴农民因为极端干旱遭受的损失，而这一数字预计将上升至160亿美元。
- **传染病广泛传播。**当温带变得更加温暖，花费高昂且使人虚弱的蚊虫传播疾病，如疟疾，预计在发达国家和发展中国家都会增加<sup>16</sup>。事实上，从1999年开始西尼罗河病毒已经扩张到美国。蓝舌病毒，一种蚊子传播的昂贵的牲畜疾病，在过去几十年已经向北扩展到欧洲中部和北部。除了人类的苦难，有气候变化引起的人类健康年均成本在2030年将高达20至40亿美元<sup>16</sup>。
- **害虫泛滥导致严重的生态和经济损失。**例如，在过去二十年中，北美西部数百万英亩的森林被松树甲虫杀死。松树甲虫的泛滥就是由于暖冬引起的，之前极端寒冷的冬季阻止了大量松树甲虫的存活<sup>17</sup>。甲虫泛滥不仅减少了木材的产量和销量，而且降低了发达地区的物业价值。
- **独特的生态系统遭受重大破坏。**气候变暖和海水酸化将会破坏世界上大部分珊瑚礁。它们给海洋生物多样性提供栖息地而被称为“海洋雨林”<sup>9,18</sup>。陆地上，无论在干旱还是湿润地区，全球森林都面临干旱导致的衰减<sup>19</sup>。对许多热带和亚热带地区的森林<sup>20</sup>而言，这一问题尤为严峻，因为它们是大多数陆地生物多样性的摇篮。
- **物种灭绝。**如果全球平均气温升高2.7华氏度至4.5华氏度（1.5摄氏度至2.5摄氏度），那么目前至少有20%至40%被评估的物种——大约12,000至24,000种物种——面临灭绝的风险会增高<sup>1,12</sup>。按照目前的排放趋势，到2100年全球平均气温会升高7.2华氏度（4摄氏度），这将使更多物种面临风险<sup>9</sup>。物种灭绝更糟糕的情况是，那些在生态系统里为生物多样性提供支持的基本物种具有更高的灭绝率<sup>21</sup>。

<sup>d</sup> Ron Nixon, 2013年1月15日。“纳税人支付创纪录的粮食作物保险”，《纽约时报》。

## 解决方案

为了避免人为导致的气候变化所造成的最坏影响，需要快速地<sup>22</sup>大量地<sup>6,9</sup>减少温室气体排放量。例如，如果到 2050 年大气中二氧化碳浓度稳定在 450ppm（百万分之四百五十），那么就有 50% 的机率使全球气温上升 2 摄氏度，而这需要在未来 38 年里年均排放量降低 5.1%。在过去六十年中，这一减排速度还未在任何一年中实现过，显示出减排任务的难度和紧迫性<sup>6</sup>。

但是，通过协作创新，在现有技术条件下部署新的能源系统和交通系统，有可能在未来 50 年将排放量降低到所需值<sup>23-26</sup>。这需要迅速扩大碳中和能源（太阳能、风能、水电、地热能、氢燃料电池、核能、基于微生物的生物燃料）的产量来取代依赖化石燃料的能源生产。在过渡的几十年里，化石燃料将继续被广泛使用，提高能源使用效率（更省油的小汽车和卡车，更节能的建筑等等）将是必要的，并逐步淘汰煤电厂建立气低排放的设施（天然气）。

**“世界需要再一次工业革命，让我们的能源资源可支付、可获取、可持续。能源效率和节能，以及能源资源去碳化是这场革命的关键。”**

*S. Chu and A. Majumdar, 2012, ref. 24*

虽然在过渡时期继续使用化石燃料，但是可能有必要在主要的排放设施，如水泥厂和钢铁厂，使用碳捕捉和封存技术。迅速扩大碳中和能源产量，可能需要激励创新和调整能源生产经济格局的相关立法和政府政策<sup>24,27</sup>。

气候变化的一些影响（海平面上升，更频繁的极端天气等等）已经发生了。城市和公共土地需要制定和执行规划，以适应不可避免的气候变化。为了保持农产地的产量，需要改变一些地方的种植作物，确保适宜新气候的种子储备。气候减缓和适应行动每推迟一年，其最终的经济成本都会大幅度增涨<sup>13,22</sup>。

## 物种灭绝

生物灭绝不可逆转，因而是一种极具破坏性的全球变化。即使最保守的分析表明，今天人类导致其他物种的灭绝速度是人类在地球上盛行以前发生的物种灭绝速度的 3 到 80 倍，其他的估计甚至更高<sup>29-32</sup>。如果目前物种及它们组成种群的灭绝速度没有减缓，那么在短短三百年内，地球将会损失 75% 的脊椎动物（哺乳类、鸟类、爬行类、两栖类和鱼类），以及其他许多动植物物种<sup>28</sup>。自从六千五百万年前小行星撞地球导致恐龙和其他许多物种消失以来，地球上还没有如此大规模的物种灭绝。复杂的生命形式主宰地球已经五亿四千万年，和目前物种灭绝速度导致的大规模物种灭绝可以相提并论的仅发生过五次。据估计，那些大规模的物种灭绝导致同时代的 75% 至 96% 的物种消失。

目前，可靠的科学标准证明至少有 23,000 种物种面临灭绝的危险，包括 22% 被评估的哺乳动物，14% 被评估的鸟类，29% 被评估的爬行类，43% 被评估的两栖类，29% 被评估的鱼类，26% 被评估的无脊椎动物和 23% 被评估的植物<sup>33-35</sup>。种群——在一定时间内占据一定空间的相互作用的同种生物个体，构成物种的基本单位——甚至比物种消失得更快。事实上，地方种群的灭绝代表着当代生物灭绝的最强冲击。例如，1970 年以来，大约 30% 的所有脊椎种群消失了<sup>36</sup>，大多数物种都经历了人类活动导致的栖息地分割，从而使种群间失去联系。健康的物种是由许多相互关联的种群组成的。因此，种群的迅速消失，种群间失去联系，是物种灭绝的先兆。

## 关注原因

地球上的植物、动物、真菌和微生物是地球生命保障系统的组成部分。失去它们将增加直接的经济损失，降低大自然满足人类需求的效用（见下页“生态系统服务”），并且有着高昂的情感和道德成本。

- **经济损失。**生物资源至少贡献了40%的世界经济，并且满足80%的穷人需求<sup>12</sup>。例如，在美国，商业渔业，其中一些依赖的物种中大多数种群已经灭绝，而这些物种提供了大约一百万份工作和320亿美元的年收入<sup>37</sup>。国际上，生态旅游，很大程度上受参观目前面临威胁的物种所驱动，例如大象、狮子和猎豹，提供肯尼亚14%的国内生产总值（2013年）<sup>38</sup>，坦桑尼亚13%的国内生产总值（2001年）<sup>39</sup>。在加拉帕戈群岛，1999年至2005年间国内生产总值增长78%，而生态旅游贡献了其中的68%<sup>40</sup>。美国的地方财政收入也依赖和野生动物资源紧密相连的生态旅游：例如，2010年到黄石国家公园的游客，很大一部分是为了看那里的狼和灰熊。生态旅游给当地带来3.34亿美元的收入，并为周边社区创造了超过4800份工作<sup>41</sup>。2009年到优胜美地国家公园的游客给当地创造了4,597份工作，带来了4.08亿美元的销售收入，1.3亿美元的劳动收入和2.26亿美元的附加值<sup>42</sup>。
- **许多社区的基本服务损失。**世界上，土著和农村社区依赖于超过25,000种物种，从它们那里获取食物、医药和住所<sup>43</sup>。

- **生态系统服务损失。** 物种灭绝不可逆转地导致生物多样性减少，而生物系统服务损失会直接增加社会成本<sup>44-46</sup>。“生态系统服务”（见方框）是生态系统为人类服务的属性。支持人类生活生产的生态系统服务包括：调节天气，调节水循环，稳定水供应，过滤饮用水，保护农业土壤并补充它们的营养成分，分解废弃物，为农作物和野生植物授粉，提供食物（尤其是海鲜），稳定渔业，提供药品，控制病原传播，帮助减少大气中的温室气体含量<sup>34,45</sup>。相比高生物多样性所带来的可直接量化的好处，减少生物多样性通常会降低生态系统的生产力，降低其稳定性，并使它们容易迅速发生对人类不利的变化<sup>45</sup>。例如，除了其他成本之外，森林砍伐导致热带生物多样性的损失，通常会改变局部和区域的气候，导致更频繁的洪水和干旱，降低当地农业系统的生产力。热带森林砍伐也能引起人类出现新的疾病，因为人类会更频繁地遇到和破坏动物病媒<sup>47,48</sup>。

世界生态系统是提供所谓的**生态系统服务**的**自然资源**：

**生产商品**（粮食、木材、海鲜）

**生命保障系统**（供给和净化水资源，为风暴、洪水和干旱提供缓冲）

**美化充实生活**（美观，提供休闲机会，以及相应的身体和心理健康好处）

**选择**（未来农业、能源、医药和其他行业所需要的遗传多样性）

Modified from G. Daily et al., 2000, ref. 46

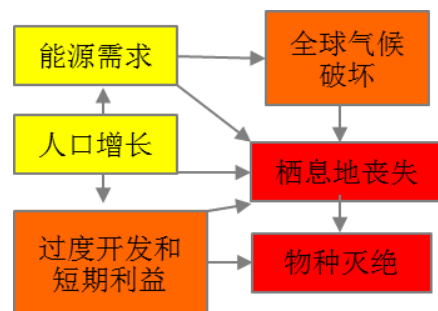
- **无形价值。** 数以百万计的人们在自然栖息地的标志性物种那里找到情感和审美价值，按照目前的速度持续灭绝，将极大地降低人们的生活品质。在这个意义上，物种是无价的，因为它们无限宝贵。一个恰当的比喻是，一件伦勃朗或者其他独一无二的艺术品，能够唤起人类的特殊情感，它们的损失通常会被视为人文财富的损失。

## 物种灭绝的主要原因

人类导致物种灭绝<sup>28,30-32,35,49</sup>的主要原因是：

- **生态系统转型引起的栖息地破坏。** 这些行为包括不可持续地将森林转换为农用地，郊区蔓延和道路，导致栖息地的破坏和分割。尤其是，大规模的砍伐热带雨林用于放牧和农业永久地破坏了广大物种的栖息地。这些地区是陆地生物多样性最重要的储备地，为成千上万种独一无二的物种和动植物功能群（生态位）提供了栖息地<sup>43</sup>。在海洋，污染、捕鱼、航运交通以及航运噪音（声纳等）导致了栖息地破坏和分割。
- **环境污染。** 人类制造的化学品导致环境污染，通过破坏栖息地（例如，矿山排土场、石油泄漏和农业径流），污染物的直接毒性作用，以及对动物免疫和生殖系统潜移默化地影响，增加了物种灭绝的压力。

- **气候变化。**当现居地气候变得不适宜生存，物种不能及时找到气候避难区；当气候变化超出物种的生理、发育或进化耐受性；或者当关键物种的相互作用（一种物质依赖于另一种）被破坏时，都会导致物种灭绝<sup>50</sup>。陆地上，模型预测，到 2100 年，地球表面 12% 至 39% 的气候类型将是现有物种从未经历过的，同时，现有的气候类型将会消失 10% 至 48%<sup>51</sup>。这些变化在目前世界上拥有最多生物多样性的地区将最为显著。海洋酸化，一种破坏海洋生物生长和发育的气候变化副产品，尤其值得关注。因为它会阻止海洋贝壳动物，如蛤蜊和牡蛎的贝壳生长，并且导致大多数海洋物种依赖的珊瑚礁瓦解。



目前物种灭绝率已经过高，以往模式的自然资源利用已经不可持续。供给 70 亿人口（到 2050 年 95 亿人口）享有高品质的生活需要对自然资本进行投资，而不是挥霍殆尽。

- **受利益驱使对野生物种的过度掠夺。**一些标志性的物种，如大象、犀牛和老虎被人类猎杀殆尽，是为了出售象牙、牛角或者它们身体的其他部位被制作成古玩或者保健品。



如果目前大象偷猎率持续下去，在未来 20 至 30 年内，地球上将没有野生大象\*。犯罪组织和恐怖组织获得大部分的短期利益。相比之下，生态旅游的财政收入是可持续的，并且直接促进当地经济的发展。

例如，对象牙的需求，主要来自亚洲市场，拉高了市场价格，使得偷猎大象成为国际犯罪团伙和恐怖组织一项利润丰厚的收入来源。其他物种被过度开发成适销食品——尤其是许多海洋鱼类，例如蓝鳍金枪鱼和大西洋鳕鱼。这些物种供不应求——因为目前地球上的人类数量是野生鲑鱼（三文鱼）的七倍<sup>54</sup>。同样地，人类大规模快速地砍伐热带雨林也是受到眼前经济利益的驱使。在所有这些情况下，同自然资本的损失相比，一次性获利（相对少数人受益）是微不足道的。因为自然资本给当地和全球提供长期的重要的利益。从经济角度来看，这类似于花费掉投资资本，而且不是用资本来生利息。

\*这是基于 2011 年 25,000 头大象的年死亡率持续下去的假设。世界大象种群包括 420,000 至 650,000 头非洲象<sup>52</sup>和 50,000 头亚洲象<sup>53</sup>。

## 解决方案

因为物种损失来源于全球压力，物种和生态系统分布跨越政治界限，解决物种灭绝的危机需要协调地方行动，国家法律，国际协定以及严格执行政策<sup>35,55</sup>。这种跨行政辖区的做法是必要的，以防止非法贩运野生动物制品，加强公共储备地的物种保护，并制定有效的政策确保可持续渔业<sup>35</sup>。单一物种，公共土地和海洋保护区的管理规划需要包括气候变化适应措施<sup>5,9,28,35,56</sup>。需要加速发展物种风险评估<sup>33</sup>，尤其是对无脊椎动物<sup>34</sup>和鱼类。

此外，需要解决造成气候变化和不必要生态系统转型的根本原因（参见本共识声明的相关部分，第四和十一页）。解决方案的一个重要部分是赋予自然资本和生态系统服务经济价值，让全球、区域和地方经济体意识到长期储蓄自然资本的好处，而不是为了短期经济利益将有限的物种资源挥霍殆尽<sup>44,57</sup>。可行的例子已经存在，在中国，120万农民不仅获得农作物和木材生产的收益，同时获得防洪固坡，维持生物多样性的经济奖励<sup>44</sup>。在哥斯达尼加<sup>46</sup>，针对生态系统服务的国家支付系统已经帮助其从世界上最高森林砍伐率的国家之一变成最低森林砍伐率的国家一员。在纽约市，保持自然景观帮助水过滤比建立过滤厂更经济<sup>57</sup>。

*许多支持生物多样性的行动已经在特定区域和目标物种及生态系统间产生了重大的可衡量的影响。这表明，只要有足够的资源和政治意愿，已有的帮助减缓生物多样性损失的工具可以在更大的尺度发挥作用。”*

*Global Biodiversity Outlook 3, ref. 35*



## 生态系统转型

当人类数量开始增加，我们逐渐改变了地球表面的大部分地区，将它们从人类出现以前的“自然”状态改造成完全不同的陆地和海洋景观<sup>58</sup>。其中一些改造是必要的，用于满足人类的基本需求，还有一些是无意的和出乎预料的。

截至 2012 年，超过 41% 的地球表面非冰雪覆盖的土地（陆地总面积的 36%）被改造成农场、牧场、伐木场、城市、郊区、道路和其他人为建造物<sup>59-61</sup>。这相当于地球上每个人都参与改造了将近两亩的土地。大部分景观的变化是农用地改造造成的，农作物约占非冰雪覆盖土地面积的 12%，牧场约占 26%（对地球上所有土地而言，这一比例约为 10% 和 22%）。城市土地约占 3%。广阔道路网络几乎分割了占据整个陆地表面 50% 的生物栖息地，水坝改造了超过 60% 的世界大型河流和许多小河流的水流<sup>62</sup>，而在过去 16 年里，平均森林砍伐速度约为 30,000 平方公里（11,000 平方英里）<sup>63</sup>。每年的损失大约等同于一年内皆伐整个比利时或者美国马萨诸塞州或者夏威夷的树木。



几乎一半的地球表面非冰雪覆盖土地已经完全被人类活动改造。无论陆地或是海洋都没有完全不受人类影响的地方。

衡量海洋改造的百分比更具有挑战性，但是显然污染、拖网捕鱼、航运交通和噪声已经导致世界上大多数海岸线发生重大改变<sup>64,65</sup>。例如，据估计海底拖网捕鱼每年破坏海底面积相当于美国大陆面积的两倍<sup>66</sup>。人工残骸，尤其是塑料，在海域里无处不在，甚至出现在深海区域<sup>67</sup>。

人类足迹甚至延伸到被全盘改造的生态系统之外。几乎世界上每一个陆地生态系统都遭受了由于人类活动导致的物种入侵<sup>68-70</sup>，有时生态系统服务损失惨重<sup>71</sup>，在主要的海港入侵物种达到数百种<sup>72,73</sup>，而在各大洲入侵物种达到数千种<sup>70,74,75</sup>。总而言之，整个陆地面积的 83% 呈现出受人类影响，即至少受到一种以下因素的影响：人口密度超过每平方公里 1 人（人均 0.4 平方英里或者 247 英亩），农业活动，建成区或居住区，道路或海岸线 15 公里（9.3 英里）以内，夜间灯光亮度足以被卫星探测到<sup>76,77</sup>。增加气候变化的影响，那么地球上每一寸土地都受到人类影响，即使是最偏远的陆地和海洋地区<sup>78</sup>。

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## 关注原因

生态系统改造有两方面互相冲突的担忧。

- **需要最小化人类足迹，阻止其他物种的灭绝，和必要的生态系统服务的退化。**生态“临界点”，指整个生态系统突然发生变化，生物多样性减少，在大多数情况下生产力下降<sup>79</sup>，这是由改造面积百分比达到临界值而引发的。许多研究表明当景观内 50% 至 90% 的斑块被干扰，余下的不受干扰的斑块也会经历迅速的不可逆转的变化<sup>5,80-83</sup>。因此，当一半以上的地球生态系统被人类直接影响改造，将会引发那些不受人类直接影响的生态系统发生难以预料的，不可逆转的退化。这些变化已经越来越明显地表现在偏远北极湖泊里的氮沉降<sup>84</sup>，某些自然保护区的普通物种种群数量减少<sup>85</sup>，数以百万英亩被甲虫杀死的森林<sup>17</sup>，和斑马贝这样的入侵物种<sup>70,71</sup>。
- 满足给地球上生活的 70 亿人口（未来三十年可能还会增加 25 亿人口<sup>86,87</sup>）**食物、住房和高品质生活的需求**，意味着对土地利用的需求会加剧（详情参见第十五页人口增长部分）。大约 70% 未被转为农用地的可耕作土地位于热带草原和森林，其中包括一些世界上最重要的生物多样性储备地和迄今为止受人类影响最小的土地<sup>66</sup>。耕种不适宜耕作的土地意味着人均耕作土地面积高于现有水平，因为它们每亩地的生产力较低<sup>88</sup>。

*“不能在低生态足迹基础上提供高品质生活的城市、区域或者国家将在资源有限的未来处于劣势。”*

*B. Ewing et al., 2010, ref. 77*

## 解决方案

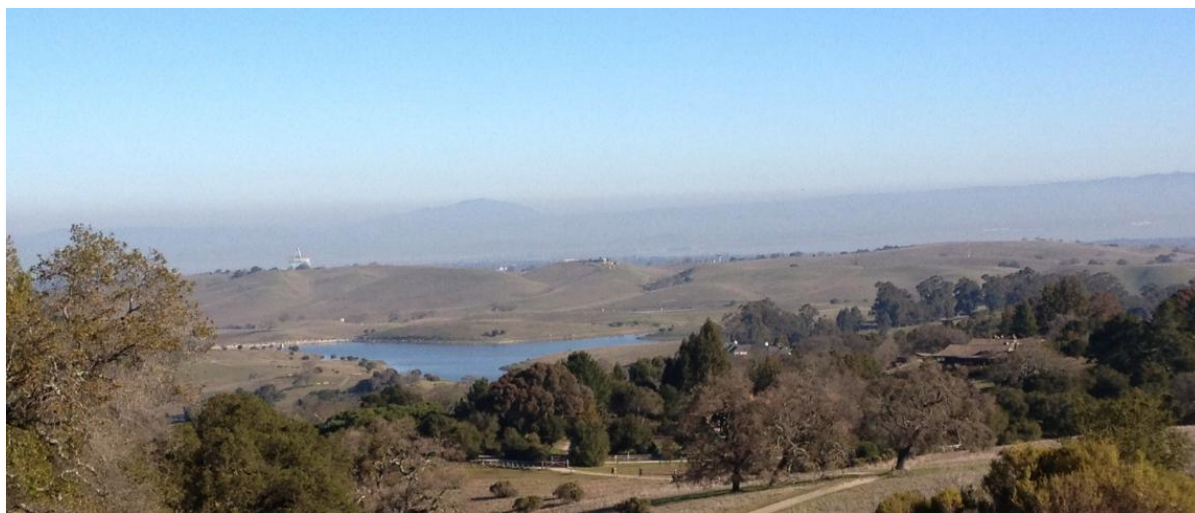
因为食物生产是导致自然生态系统转型的主要原因，一项重大的挑战是如果养活更多的人口而不显著增加现有的农业和渔业生态足迹。赋予自然资本经济价值（参见第七页物种灭绝部分的解释）是一个明智的方法，这样做能够显著提高生物多样性和粮食产量的收益。例如，在哥斯达尼加，将咖啡农场和自然景观结合起来，正说明了这一点<sup>89</sup>。减缓并最终停止农用地侵占目前未开垦的地区（尤其是所剩不多的热带雨林和热带稀树草原）可能需要有关保护的法规政策和激励措施。近来的研究表明即使不增加农业生态足迹，以一种对环境无害的方式来增加粮食产量也是可行的<sup>60,90</sup>：(a) 提高目前世界上生产力较弱的农田产量；(b) 更有效地使用水、能源和肥料来增加产量；(c) 少吃肉；(d) 通过更好的基础设施，分配和更有效的消费模式减少食物浪费——现在生产食物大约有 30% 被丢弃或者变质。同时还需要调整作物品种以适应气候变化，从而增加粮食产量<sup>91,92</sup>。在海洋，解决方案在于增强渔业管理，可持续的水产养殖，尤其侧重那些养殖消耗的蛋白质低于产出的物种，减少（尤其是海岸的）污染<sup>93,94</sup>。

为了避免郊区蔓延导致更多的土地流失，现有的建成区规划必须强调高密度住宅和更有效的基础设施，而不是在郊区土地上新建社区。

气候变化会影响地球上每一个角落——包括那些目前几乎不受人影响的地区，和那些目前被用作农用地或城镇的地区——随着气候变暖这些影响会更加显著。因此，避免全球生态系统转型需要气候变化保持在最低限度。

## 污染

地球上几乎所有地方都有人类产生并沉积下来的环境污染物。我们总是在世界上几乎任何森林的土壤样本或者树皮样本中，在鲸鱼的脂肪中，在北极熊身体组织中，在大多数河流和海洋鱼类中，在新生婴儿的脐带里<sup>66,95</sup>，发现农药和工业污染物的踪影。许多城市的烟雾等级被认为是远远高于安全水平的<sup>96</sup>。在最坏的情况下，比如 2013 年 1 月的北京，空气污染甚至可以从太空中直接看到。其他空气污染物，例如温室气体和臭氧，尽管看不见，但是能造成非常严重的全球问题，尤其是气候破坏。石油泄漏常常污染海洋，海岸线，内陆水域和陆地。核废料，尤其是在核电厂事故导致的放射性污染，已经成为一个日益严重的问题。因为它会产生无处不在的会影响激素分泌或者致癌的化学物质，例如双酚-A（通常称为 BPA）<sup>97</sup>。



在许多城市周围的棕色阴霾的空气污染是有害的，每年导致高达六百万人口的死亡。图中所示在一个凉爽的冬日，加利福尼亚州旧金山南部的烟雾沉积。

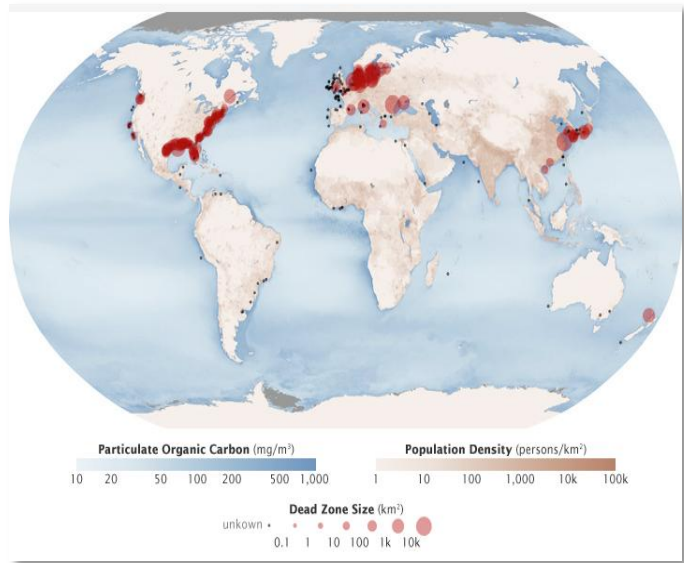
人类活动诸如采矿，制造和电子设备回收，不仅会导致当地危险污染物(尤其是有害物质如铅，铬，汞和石棉)的浓度增高，而且还会把它们传播到世界其他区域<sup>98,99</sup>。

## 关注原因

- **健康影响。** 污染的健康成本是巨大的。目前至少有 1.25 亿人身处采矿业和制造业产生的有毒废物的直接风险中<sup>98</sup>。截至 2010 年，空气污染每年造成 600 万人过早死亡<sup>96,100</sup>。环境暴露被认为引起全世界 19% 的癌症发病率<sup>98</sup>。被致癌的砷或有毒微生物污染的地下水正被数以百万计的人饮用<sup>101</sup>。由于疾病，失能或者过早死亡导致的寿命减少被统称为失能调整生命年。截至 2010 年的统计，环境危害带来的失能调整生命年可能要大于由于疟疾，肺结核，艾滋病带来的失能调整生命年的总和<sup>100</sup>。一个新兴的关注热点是模拟激素的化学物质的效果，例如内分泌干扰物，可能会大规模地影响人体生长、发育和健康。另外，内分泌干扰物和青春期的较早出现以及肥胖有相关性<sup>97</sup>。肥胖还将导致心脏疾病和 II 型糖尿病的发病率增加<sup>102</sup>。

- **死区。** 来自农药、污水处理厂、牲畜圈舍和煤电厂的过度氮最终随着水道进入大海，刺激了藻类的疯狂生长。死亡藻类的腐烂过程消耗水中大量的氧气<sup>66,95</sup>。结果是海洋生命逐渐减少，变成死区。目前世界上大多数海岸呈现出氮浓度升高，主要人口中心附近出现大片死区<sup>103,104</sup>。

- **环境破坏。** 温室气体污染，主要是人为产生的二氧化碳（CO<sub>2</sub>），一氧化氮（NO）和甲烷（CH<sub>4</sub>），是最大的环境问题之一，气候破坏的主要原因<sup>1</sup>。除草剂、杀虫剂和塑料生产过程中使用的各种化学品直接污染了许多水道，又通过食物链被有机体吸收。地球上几乎所有的人类都携带一定程度的这类永久性化学品，而它们许多是内分泌干扰物。人类或牲畜使用的药物，随着下水道或其他途径进入河流和湖泊，破坏了两栖类和鱼类的生长和发育。污水和过量的农药破坏了世界一半以上的珊瑚礁，而在一些生态区，这一比例高达 90%<sup>66,95</sup>。



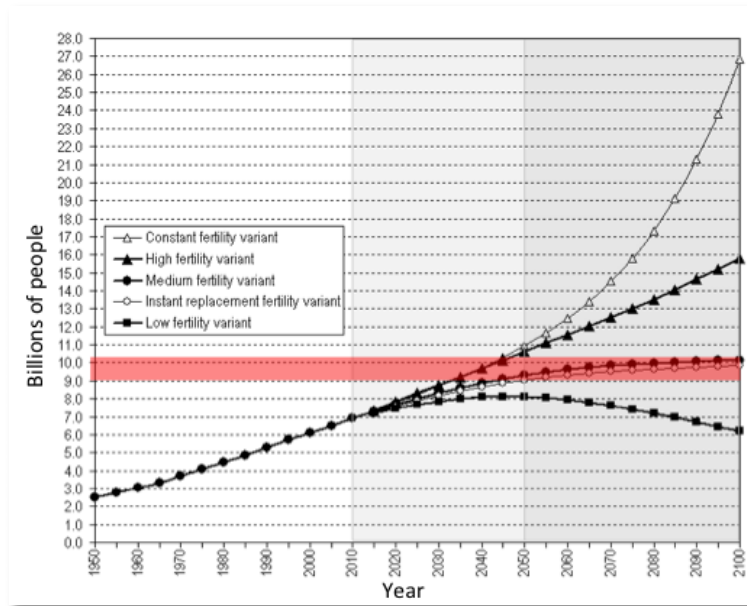
氮污染导致的海洋死区的世界分布。图片来自 NASA，见参考文献 104。

## 解决方案

污染问题不是一个新的问题。环境污染源一般是众所周知的，尤其是那些最坏的来源，例如铅电池回收，铅冶炼，采矿及矿石加工，制革，市政和工业垃圾场，产品制造，化学品制造，石油化工，电子废物，农用化肥和杀虫剂以及温室气体<sup>66,95,98</sup>。对大多数污染物而言，已经具备可行的预防和清理解决方案，但是因为成本原因往往不被采用。可以通过以下方式显著减少制造业排放的污染物：更好地规范和监督工业使用和生产有害废物，更好的控制有害废物，教育当地社区和危险工业关于污染物的危害性，提高污染物管理和处理的技术，最大限度地减少潜在的危险工业选址在人口中心附近。减少空气污染（包括温室气体）需要立即淘汰煤电厂和高排放车辆，并随着时间的推移，用清洁能源替代化石燃料。最大限度地减少农业污染需要化肥，农药和抗生素的使用效率最大化。

比这些传统方法更有效的途径是利用我们目前对毒性机制的科学认识指导合成化学生成更安全的新一代材料。今天这是显著可行的，并且肯定会奖励那些在市场上采纳这些绿色化学途径的企业家<sup>105</sup>。

## 人口增长和资源消费



如果所有国家的生育率快速变化，而使平均每个家庭都有一个女儿，那么到 2050 年，人口将达到峰值，然后稳定在大约 101 亿人的水平。图中红线表明人口在 90 亿到 101 亿的水平。图片来自 UNDESA，2011 年，见参考文献 87。

人口问题有两个方面。一方面是世界上有多少人。另一方面是不同国家和社会部门的“生态足迹”有显著差异，相对较小比例的人群无效地使用并影响着非常大比例的生态资源。

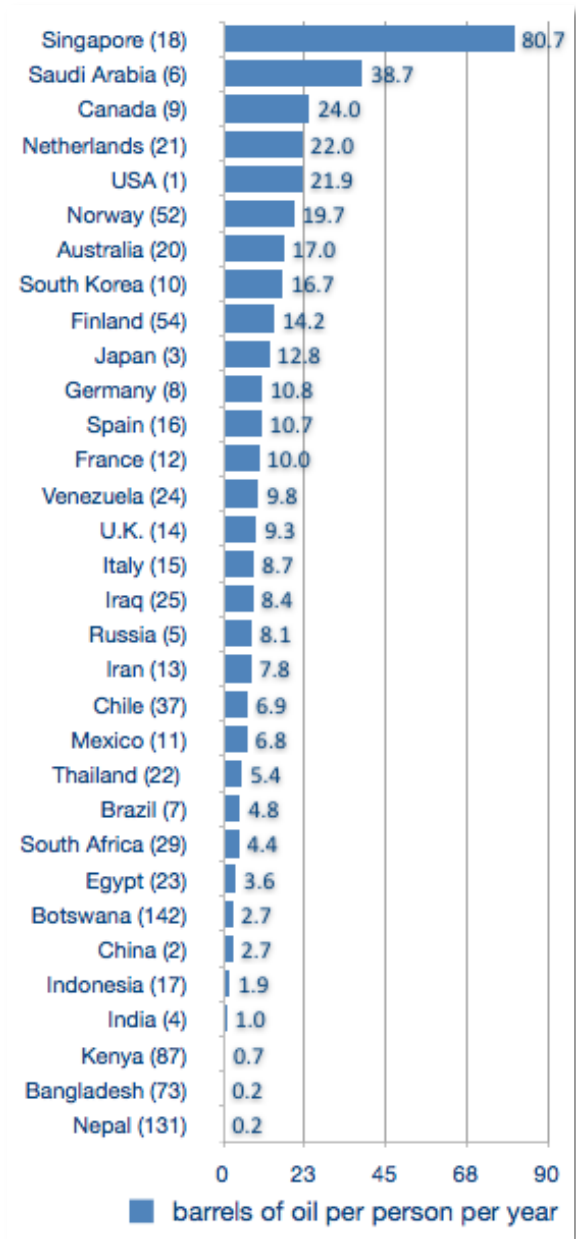
今天，有超过 70 亿人口生活在地球上。人口增长预测表明到 2050 年，当今天的孩子们步入中年，世界人口会新增大约 25 亿<sup>86,87</sup>（参见左边的人口增长图）。

人口在未来几十年的变化，很大程度上取决于生育率（育龄妇女生育子女的平均数量）和死亡率。如果全球平均生育率保持现有水平，到 2100 年地球上将有 270 亿人口，但这显然是不可能的。如果世界各地的生育率变成“替代率”（父母在下一代只是“替代”他们自己，大约每名妇女生育 2.1

个孩子），而死亡率是那些典型发达国家的水平，那么到 2100 年将有 101 亿人口。如果全球平均生育率比替代率高出 0.5 个孩子，那么 2100 年世界人口将达到 158 亿。如果全球平均生育率比替代率低 0.5 个孩子，会导致更早出现人口高峰，并且 2100 年世界人口下降为 62 亿。

今天不同国家的生育率有显著差异。在一些发达国家，如拉脱维亚、葡萄牙、韩国和新加坡，生育率低至 1.2 或者 1.3。一些生育率略高的国家，如俄罗斯、德国和日本，现在也在降低。实际上所有的发达国家和一些发展中国家，包括中国、巴西和泰国，今天的生育率已经低于替代率，他们的人口最多在未来几十年将停止增长。相对地，许多非常贫穷的发展中国家，例如赞比亚、索马里、布隆迪和阿富汗，他们每个家庭的孩子多达 6 个及以上。正是这些地区的高生育率可能使世界人口持续增长一个世纪以上，除非人口政策尽早降低他们的生育率。

不同国家间消费差异很大，如图所示，那些最大的石油消费国每人每年石油消费量远远高于其他国家。括号里的数字代表世界石油消费排名。右边的数字代表每人每年石油消费量（桶）（数据来源于 CIA Fact Book, 2013 年，见参考文献 115）。目前的挑战是降低人均消费率过高的国家，同时允许低消费率的发展中国家有所增长。对于化石燃料而言，需要扩大可再生能源和新技术创新来解决这个问题。



每人每年石油消耗量（桶）

## 关注原因

地球上每一个人都在一定程度上导致了气候破坏，物种灭绝，生态系统转型和污染。不同地区，不同国家，以及穷人和富人的实际贡献肯定存在很大差异（参见十六页的图表）。整体趋势是高度工业化更富裕的国家人均足迹高，而发展中的贫穷的国家人均足迹低。尽管每一个人对全球变化足迹的贡献微不足道，但是当乘以数十亿倍，效果将会变得十分巨大。人口增长导致的主要的全球问题如下：

- **气候破坏。** 2011年地球上平均每人每年约生产 4.9 吨二氧化碳<sup>106</sup>。因此，随着人口增长，温室气体排放总量和随之而来的气候破坏将会相应地增长。
- **物种灭绝。** 新增数十亿人口占据和使用地球资源，将导致物种灭绝的主要原因（栖息地破坏，过度开发）日益严重<sup>66</sup>。气候变化可能导致进一步的物种灭绝。此外，还有严重的间接影响，尤其是人类消耗或者新增的净初级生产力总量（NPP<sup>e</sup>）。净初级生产力是衡量供应全球生态系统“自然能源”的指标。人类现在占用大约 28% 的所有净初级生产力（也有估计是从 23% 至 40%）<sup>58,61,107-109</sup>。地球能生产的净初级生产力是有上限的，所以人类使用越多的净初级生产力，其他物种享有的就会越少。这意味着，在有限的全球能源约束下，随着人类人口增长，其他物种种群不可避免的走向灭绝（除非有专门的保护措施来减少这种损失）。假设人类消费模式维持不变，今天的生育率持续下去，到 2085 年全球人口达到 200 亿，那时人类需要的净初级生产力将会导致地球上大多数其他物种灭绝<sup>110</sup>。显然，这样的人口规模是不能持续的。
- **生态系统转型。** 地球上人均转型的土地已经达到将近 2 英亩<sup>5,58,60</sup>。如果人均土地转型率持续下去，2050 年地球上新增 25 亿人口意味着地球上大多数土地——超过 50%——将会变成农场、牧场、城镇和道路。如果人口规模达到 150 亿，人均 2 英亩的土地转型量意味着地球上 85% 的土地被人类使用，包括不宜居的地方如沙漠、北极和南极。该情景表明，如果人类不降低自身生态足迹，人口的大规模增长是不可持续的。
- **污染。** 所有的危险污染源都来自人均商品和服务需求，鉴于目前的情况，污染源将和人口数量成比例增长。此外，需要处理的人类废弃物（污水和垃圾）也大致和人口数量成比例增长。

一个重要的考虑因素是满足今天 70 亿人口的基本需求（居住、食物、水和充足的医疗保健）已经十分困难。尽管国际项目已经取得重大的成果，使更多的人和地方能获得这些基本需求，约 80% 的世界人口仍然生活在贫困线以下（即低于 10 美元每天；14 亿人口每天生活在低于 1.25 美元的水平之下）<sup>111</sup>；26 亿人口（约全球人口的三分之一）缺乏基本的公共卫生服务；11 亿人口缺水<sup>111</sup>；8.7 亿人口（每八个人就有一个）缺乏足够的食物<sup>112</sup>；10 亿人口缺乏基本的医疗保健系统<sup>113</sup>。2050 年世界新增 25 亿或者更多的人口，将会使现在已有的挑战变得更加严峻，尤其是目前最贫穷的国家有最高的生育率。例如，从 1990 年至 2011 年，尽管世界营养不良的儿童数量有所减少，但是在大多数国家相对贫穷而人口数量增长迅速的非洲，过去二十年间营养不良的儿童从 4600 万增长到 5600 万<sup>114</sup>。

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<sup>e</sup> 净初级生产力是植物通过光合作用将太阳能转化为植物有机质的净含量（即有机质总量扣除自养呼吸后的剩余部分）。

## 解决方案

为了避免人口增长的最坏影响，需要采取两项战略。首先是认识到在维持现的生活质量的同时增加数十亿人口需要降低人均生态足迹。例如，开发和采用碳中和能源技术，更有效地生产食物和商品，减少消费和浪费。这意味着在经济发达的国家减少人均资源消费量，同时允许发展中国家提高生活质量。例如，2011 年美国人均每年石油消费量是 22 桶，而中国和印度的人均每年石油消费量分别是 3 桶和 1 桶（参见第十六页图表）<sup>115</sup>。平衡这样的差距，而又能维持现有的生活质量，需要富裕的国家和贫穷的国家在能源和资源消费领域都进行转型，并在某些领域有重大的技术突破。尤其是在能源部门，需要改变政策确保发展中国家能够“跨越”过时的技术，就像在手机行业里发生的那样。总体而言，使用最先进的科学设计、开发并商业化数十亿人口使用的材料能够降低人均资源消费量。



即使在今天，数十亿人口的基本需求，如食物、水和医疗保健仍未得到满足。

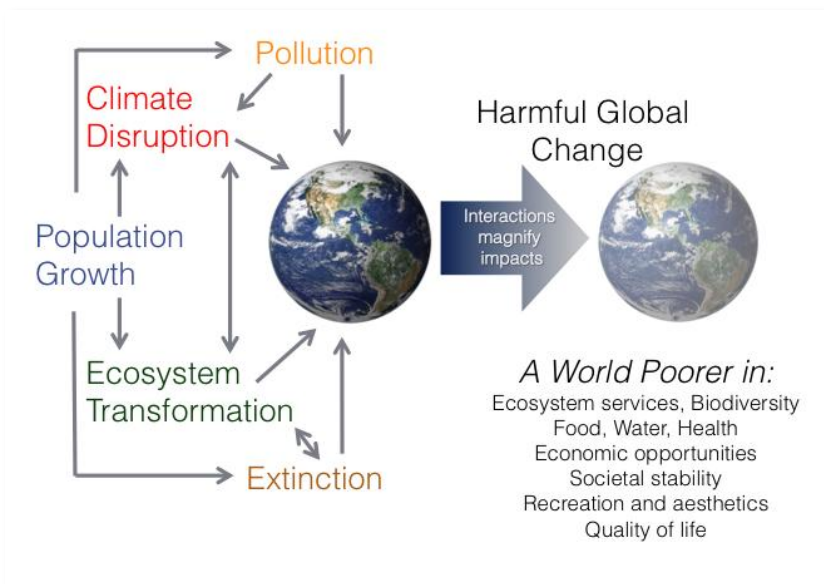
其次是确保人口增长按照低速预测模式发展<sup>44,116</sup>。全球中等生育率（每个家庭一个女儿）将使世界人口稳定在 100 亿；这实际上意味着所有发达国家以及中国和许多其他发展中国家的生育率大幅度增加。因此这个 100 亿人口的基准显然还可以改善。今天，约 40% 人口生活的国家生育率已经接近替代率，另外 42% 人口生活的国家生育率显著下降。

“低速”预测模式（参见第十五页）是可以达到的，并且应该作为目标。将世界人口稳定在 80 亿，需要降低 18% 人口<sup>87</sup>生活的大多数贫穷国家的生育率，这些国家的人口仍然缺乏基本的教育和医疗保健。提高（尤其是妇女的）受教育程度，提供安全有效的避孕措施给那些需要的人，能够显著降低生育率<sup>44,117</sup>。



## 相互作用

虽然气候破坏、物种灭绝、生态系统转型、污染和人口增长本身都是严重的问题，但是它们之间相互作用使得它们的总体影响比单一影响的总和更加棘手。例如，污染会导致地方生物多样性的损失，随后又导致主要的生态变化。砍伐多年生的热带雨林将永久地改变当地的气候，使其变得更加干旱，同时也永久地将地方生态系统从森林转型为草原。与此同时，碳汇资源的消失将使全球气候破坏更加严重。当全球气候到达变化的临界值，可能会出现整个生物群落的快速消失，如寒带森林的消失<sup>118</sup>。一些压力和另一些紧密联系，例如，增长的人口规模，尤其是增长的人均消费量，会把其余四项问题的后果扩大化。



气候破坏、人口增长和消费、生态系统转型、污染和物种灭绝的相互作用极大地放大了全球气候变化的不利影响。

## 关注原因

相互作用的效果极大地增加超出气候临界点将导致不可逆转的变化的概率<sup>79,119</sup>。这意味着多重全球压力相结合将导致出乎意料不良变化，比考虑单一压力的预测结果发生更快、更强烈<sup>120-124</sup>。这些发生在必要资源（如食物、水、气候的可预测性和生物多样性）上意料之外的变化可能导致社会动荡。

如果一切照旧，每种危险趋势自身的压力，结合它们的乘数效应，使得未来几十年内很有可能发生破坏性的社会变化<sup>5,120,122</sup>。即使单独考虑每种因素影响，目前的气候变化、物种灭绝、生态系统转型、污染和人口增长轨迹比过去行星压力引发的“行星状态改变”更快、更大<sup>5</sup>。从本质上讲，当地球系统到达“临界点”，即突然切换到一个新的状况，发生突然的、重大的和永久的改变，包括物种消失、影响地球上每一个角落的生态结构和生态服务变化。上次发生这种变化是 12,000 年以前，即上次冰川季结束的时候。在一般情况下，“临界点”描述了生态系统应对持续压力的特点，它们在很大的时间和空间尺度上都有所记录<sup>79,125</sup>。

## 解决方案

最大限度地降低由于相互作用导致的意料之外的全球变化，需要五种危险趋势达到扁平的轨迹<sup>126</sup>。解决方案一个重要的部分在于减轻具有最强烈互动效应的全球压力，即人口增长，人均资源消费和温室气体排放。这些作用影响着地球上所有的状况，因为随着人口增长，生态系统转型、物种灭绝和污染的程度必然增加，当人们从化石燃料获取更多的能源来满足消费需求，气候变化和气候破坏就会更加显著。



科学清楚地表明，气候破坏、物种灭绝、污染、人口增长和人均消费增长的负面效果会危害人类社会，而解决这些问题需要所有人和所有层面的政府机构意识到它们的紧迫性。我们已经拥有能减轻大多数负面影响的技术知识，但是最终科学和技术知识只是提供工具，需要社会来决定是否需要使用这些工具。因此，关键的下一步是让更社会认识到这些问题的紧迫性，并且愿意承诺利用人类的智慧和资源来解决这些问题<sup>88</sup>。这将需要在所有层面加强有关这些问题的教育，包括学校、企业、媒体和政府，并承认人类的福祉取决于地球的福祉这一可持续发展目标<sup>126</sup>。

开始这一全球范围的努力的时间窗口是短暂的。科学表明，如果我们不做任何改变，每过一年，问题不但变得更糟糕，而且会变得更加昂贵，更加难以解决，同时我们避免最坏结果的可能性也会降低。换句话说，从现在开始行动，我们有很大的成功机会，如果拖延十年可能为时已晚。



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