



# IUCN's Science Bulletin

# October 2011

## SCIENCE FOR IUCN'S PROGRAMMES



### Application of the IUCN Red Listing system to setting species targets for conservation planning purposes [\[abstract\]](#)

Biodiversity targets are fundamental to systematic conservation planning and the authors propose using the IUCN Red List quantitative thresholds for the Vulnerable category as a guide in setting those targets. Examples of this approach are presented for case studies from South Africa, including threatened taxa listed under the IUCN Red List criteria of A to D, a species listed as Near Threatened, a species of conservation concern due to its rarity, and one species in need of recovery. The method gives rise to multiple representation targets, an improvement on the often used single representation targets that are inadequate for long term maintenance of biodiversity or the arbitrary multiple representation and percentage targets that are sometimes adopted. The positive attributes ascribed to the IUCN Red List system, and therefore to the targets arising from this approach, are important when justifying decisions that limit land uses known to be detrimental to biodiversity. Pfab MF, Victor JE, and Armstrong AJ. (2011). *Biodiversity and Conservation* 20:1001–1012

### Trophic Downgrading of Planet Earth [\[abstract\]](#)

The authors review the impacts of the loss of formerly ubiquitous, large apex consumers on ecosystems. They note that although such losses are widely viewed as an ethical and aesthetic problem, recent research reveals extensive cascading effects of their disappearance in marine, terrestrial, and freshwater ecosystems worldwide. This review supports long-standing theory about the role of top-down forcing in ecosystems but also highlights the unanticipated impacts of trophic cascades on processes as diverse as the dynamics of disease, wildfire, carbon sequestration, invasive species, and biogeochemical cycles. The authors emphasize the urgent need for interdisciplinary research to forecast the effects of trophic downgrading on process, function, and resilience in global ecosystems. Estes JA, Terborgh J, Brashares JS, et al (2011). *Science* 333 : 301-307.

### Early Warnings of Regime Shifts: A Whole-Ecosystem Experiment [\[abstract\]](#)

Catastrophic ecological regime shifts may be announced in advance by statistical early warning signals such as slowing return rates from perturbation and rising variance. The authors test the theoretical background for these early warning indicators in an experimentally induced regime shift in an aquatic food web. They gradually added top predators to a lake over 3 years to destabilize its food web. An adjacent lake was monitored simultaneously as a reference ecosystem. Warning signals of a regime shift were evident in the manipulated lake during reorganization of the food web more than a year before the food web transition was complete, corroborating theory for leading indicators of ecological regime shifts. Carpenter SR, Cole JJ, Pace ML, et al (2011). *Science* 1079-1082

### Extinction risk assessment of the world's seagrass species [\[abstract\]](#)

Seagrasses, a functional group of marine flowering plants rooted in the world's coastal oceans, support marine food webs and provide essential habitat for many coastal species, playing a critical role in the equilibrium of coastal ecosystems and human livelihoods. This report documents the risk of extinction for individual seagrass species using the IUCN Red List process. Ten seagrass species are at elevated risk of extinction (14% of all seagrass species), with three species qualifying as Endangered. Seagrass species and degradation of seagrass biodiversity will have serious repercussions for marine biodiversity and the human populations that depend upon the resources and ecosystem services that seagrasses provide. Short FT, Polidoro B, Livingstone SR et al (2011) *Biological Conservation* 144: 1961-1971

## Fun to Know

### Even malaria parasites have parasites! [\[article\]](#)

Hughes GL, Koga R, Xue P, et al (2011) Wolbachia Infections Are Virulent and Inhibit the Human Malaria Parasite *Plasmodium falciparum* in *Anopheles gambiae*. *PLoS Pathog* 7(5): e1002043

### Climate change affects Nemo's hearing [\[abstract\]](#)

Simpson SD, Munday PL, Wittenrich ML et al. (2011) Ocean acidification erodes crucial auditory behaviour in a marine fish. *Biology Letters*

### Crows and parrots are real problem solvers [\[article\]](#)

Auersperg AMI, von Bayern AMP, Gajdon GK, et al. (2011) Flexibility in Problem Solving and Tool Use of Kea and New Caledonian Crows in a Multi Access Box Paradigm. *PLoS ONE* 6(6): e20231.

### Drink wine, save cork oaks, store carbon! [\[abstract\]](#)

Bugalho MN, Caldeira MC, Pereira JS, et al (2011) Mediterranean cork oak savannas require human use to sustain biodiversity and ecosystem services. *Frontiers in Ecology and Environment* 9:278–286.

**The Why, What, and How of Global Biodiversity Indicators Beyond the 2010 Target** [\[abstract\]](#)

The authors considered why global biodiversity indicators are needed, what characteristics successful global indicators have, and how existing indicators perform, using 4 existing indicators (including the IUCN Red List) as examples. The authors believe indicators should be linked explicitly to monitoring objectives and decisions about which monitoring schemes deserve funding should be informed by predictions of the value of such schemes to decision making. They suggest that raising awareness among the public and policy makers, auditing management actions, and informing policy choices are the most important global monitoring objectives. They recommend that conservation professionals improve on existing indicators by eliminating spatial biases in data availability, fill gaps in information about ecosystems other than forests, and improve understanding of the way indicators respond to policy changes.

Jones JPG, Collen B, Atkinson G et al (2011). *Conservation Biology*, Volume 25, No. 3, 450–457



**Forests and Climate Change in Latin America: Linking Adaptation and Mitigation** [\[abstract\]](#)

Forest ecosystems play an important role in both adaptation and mitigation and this paper explores the linkages between these two options looking at their trade-offs and synergies. Potential trade-offs can be observed between global ecosystem services, such as the carbon sequestration relevant for mitigation, and the local ecosystem services that are relevant for adaptation. In addition, mitigation projects can facilitate or hinder the adaptation of local people to climate change, whereas adaptation projects can affect ecosystems and their potential to sequester carbon. Linkages between adaptation and mitigation can also be observed in policies, but few climate change or forest policies have addressed these linkages in the forestry sector.

Locatelli B, Evans V, Wardell A et al (2011) *Forests* 2, 431-450

**Declining body size: a third universal response to warming?** [\[abstract\]](#)

A recently documented correlate of anthropogenic climate change involves reductions in body size, the nature and scale of the pattern leading to suggestions of a third universal response to climate warming alongside phenology and distribution. Because body size affects thermoregulation and energetics, changing body size has implications for resilience in the face of climate change. This review of recent studies shows heterogeneity in the magnitude and direction of size responses and identifies the need for integrated analyses of the underlying mechanisms and physiological consequences of size shifts and, therefore, the ability to predict the sensitivities of species to climate change.

Gardner JL, Peters A, Kearney MR et al. (2011) *Trends in Ecol and Evol* 26: 285-291.

**The Effects of Natural Iron Fertilisation on Deep-Sea Ecology: The Crozet Plateau, Southern Indian Ocean.** [\[article\]](#)

Ocean iron fertilization (OIF) has been proposed as a means of mitigating anthropogenic atmospheric CO<sub>2</sub>, but its impacts on ocean ecosystems below the photic zone are unknown. Natural OIF, through the addition of iron leached from volcanic islands, has been shown to enhance primary productivity and carbon export and so can be used to study the effects of OIF on life in the ocean. This report compares two closely-located deep-sea sites in the southern Indian Ocean. Results suggest that long-term geo-engineering of surface oceanic waters via artificial OIF would lead to significant changes in deep-sea ecosystems. The authors report that the +Fe area had greater supplies of organic matter inputs to the seafloor, greater densities & biomasses of large deep-sea animals, lower levels of evenness in community structuring and very different species composition.

Wolff GA, Billett DSM, Bett BJ, et al. (2011) *PLoS ONE* 6(6): e20697

**Increased Fitness of Rice Plants to Abiotic Stress Via Habitat Adapted Symbiosis: A Strategy for Mitigating Impacts of Climate Change** [\[article\]](#)

Climate change and catastrophic events have contributed to rice shortages in several regions due to decreased water availability and soil salinization. The authors report on the impacts of colonizing two commercial rice varieties achieved tolerance to these stresses by colonizing with Class 2 fungal endophytes. Symbiosis with the fungal endophytes reduced water consumption by 20–30% and increased growth rate, reproductive yield, and biomass of greenhouse grown plants. In the absence of stress, there was no apparent cost of the endophytes to plants, however, endophyte colonization decreased from 100% at planting to 65% compared to greenhouse plants grown under continual stress (maintained 100% colonization). These findings suggest that symbiotic technology may be useful in mitigating climate change impacts and expanding production on marginal lands.

Redman RS, Kim YO, Woodward CJDA, Greer C, Espino L, et al. (2011) *PLoS One* 6(7): e14823

**Regular coffee fights Alzheimers** [\[abstract\]](#)

Cao C, Wang L, Lin X et al (2011). Caffeine Synergizes with Another Coffee Component to Increase Plasma GCSF: Linkage to Cognitive Benefits in Alzheimer's Mice. *Journal of Alzheimer's Disease* 24 (2011) 1–13

**Managing Knowledge**

**Measuring Americans' Issue Priorities: A New Version of the Most Important Problem Question Reveals More Concern About Global Warming and the Environment** [\[abstract\]](#)

Global warming and the environment have rarely been cited, in recent surveys, as key issues of interest to Americans. The authors explore the possibility the way questions are posed is influencing the responses received.

Yeager DS, Larsen SB, Krosnick JA, et al (2011) *Public Opin Quarterly* 75(1): 125-138

**Mobilizing metaphors: the popular use of keystone, flagship and umbrella species concepts** [\[abstract\]](#)

Misrepresentation of terminology is a major impediment for attempts at enhancing public conservation literacy. This paper examines how keystone, flagship and umbrella species concepts are used and represented in 557 news articles containing these terms. Mammals featured most often in articles using any of these terms and the meaning of keystones was the most misrepresented term. The findings highlight the fact that conservation biologists need to engage with issues of language if public conservation literacy is to be improved.

Barua M (2011) *Biodivers Conserv* 20:1427–1440



### Biofuels and biodiversity [\[abstract\]](#)

Current biofuel production in the US occurs largely on croplands that have long been in agricultural production but meeting expected increases in demand requires additional land area that can be met in part by reclaiming reserve or abandoned croplands and by extending cropping into lands formerly deemed marginal for agriculture. In the US, many such marginal lands have been enrolled in the Conservation Reserve Program (CRP), providing important habitat for grassland species. The demand for corn ethanol has already contributed to loss of CRP lands as contracts expire and lands are returned to agricultural production. Nevertheless, biofuels can be developed to enhance their coexistence with biodiversity through promoting interspersed land uses and development of biofuel feedstocks that do not require additional land for production, such as residues and wastes.

Wiens J, Fargione J, And Hill J (2011) *Ecological Applications*, 21;1085–1095

### Energy and water use related to the cultivation of energy crops: a case study in the Tuscany region. [\[article\]](#)

Biomass from agriculture represents one potential sustainable replacement for fossil fuels, mainly for transport purposes. In this study, the processes related to the cultivation of two energy crops (maize and sunflower) were analyzed from an energy and water cost perspective. A 50-year climatic series of meteorological data was used to feed the crop model CropSyst for the simulation of crop production, water requirement, and cultivation techniques. Obtained results were analyzed to define the real costs of energy crop cultivation, depending on energy and water balances. The authors report that the only positive energy balance was obtained with maize and the more efficient system of irrigation. Concerning water, the results demonstrated that more than 1.000 liters of water are required for producing 1 liter of bioethanol. As a result, cultivation of energy crops could almost double the actual water requirement of the Tuscan agricultural sector.

Dalla Marta, A., F. Natali, M., Mancini, R., et al (2011). *Ecology and Society* 16(2): 2.

### Managing Ecosystems for human well-being



### Cost-effectiveness of dryland forest restoration evaluated by spatial analysis of ecosystem services [\[abstract\]](#)

The authors examine the potential cost effectiveness of various types of forest restoration on the value of multiple ecosystem services across four dryland areas in Latin America. The values of selected ecosystem services were mapped under three restoration scenarios and results show that passive restoration is cost-effective for all study areas on the basis of the services analyzed, whereas the benefits from active restoration are generally outweighed by the relatively high costs involved. These findings were found to be relatively insensitive to discount rate but were sensitive to the market value of carbon. Substantial variation in values was recorded between study areas, demonstrating that ecosystem service values are strongly context specific.

Birch JC, Newton AC, Aquino, CA et al (2010) *Proc. Nat Acad Sci*, 107: 21925–21930

### Ecosystem Management: Tomorrow's Approach to Enhancing Food Security under a Changing Climate [\[article\]](#)

This paper argues that feeding the world at a time of climate change, environmental degradation, increasing human population and demand for finite resources requires sustainable ecosystem management and equitable governance. The authors highlight that healthy ecosystems provide a diverse range of food sources and support entire agricultural systems, but their value to food security and sustainable livelihoods is often undervalued or ignored. They urge for increased financial investment for integrating ecosystem management with food security and poverty alleviation priorities, and for increased political commitment at the highest level to raise the profile of ecosystems on the global food agenda.

Munang RT, Thiauw I and Rivington M. (2011) *Sustainability* 3, 937-954

### Fish and Cetaceans inspire underwater vehicle design [\[abstract\]](#)

Autonomous underwater vehicles (AUVs) are playing an ever-growing role in modern subocean operations, generating a demand for faster, more manoeuvrable designs capable of deployments of increasingly longer durations. In order to meet these demands, vehicle developers have been looking to biological aquatic animals for inspiration.

Roper DT, Sharma S, Sutton R et al (2011). A review of developments towards biologically inspired propulsion systems for autonomous underwater vehicles. *J. Engineering Maritime Environment* 225: 77-96.

**Contribution of Pollinator-Mediated Crops to Nutrients in the Human Food Supply [article]**

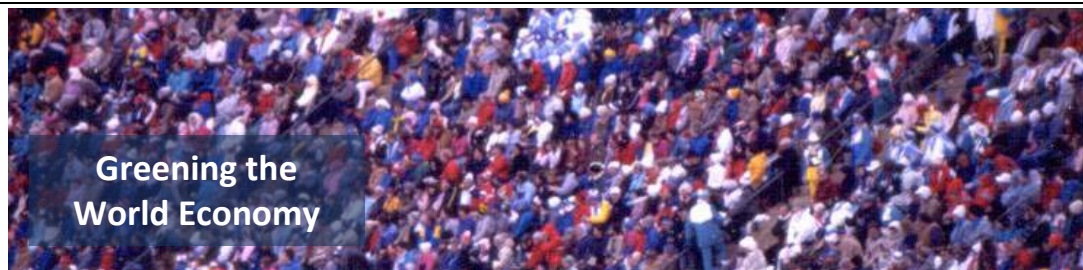
The contribution of nutrients from animal pollinated world crops has not previously been evaluated as a measure for the value of pollination services. In this paper, the authors calculated pollinator dependent and independent proportions of different nutrients of world crops, employing FAO data for crop production, USDA data for nutritional composition, and pollinator dependency data. Crop plants that depend fully or partially on animal pollinators contain more than 90% of vitamin C, the whole quantity of Lycopene and almost the full quantity of the antioxidants b-cryptoxanthin and b-tocopherol, the majority of the lipid, vitamin A and related carotenoids, calcium and fluoride, and a large portion of folic acid. Therefore, ongoing pollinator decline could exacerbate current difficulties of providing a nutritionally adequate diet for the global human population.

Eilers EJ, Kremen C, Smith Greenleaf S, et al. (2011). *PLoS ONE* 6(6): e21363

**China's grassland contract policy and its impacts on herder ability to benefit in Inner Mongolia: tragic feedbacks [article]**

Northern China's grasslands have been losing productivity since the 1980s, when a policy known as the "grassland contracting policy" allocated commonly used grazing lands to individual herder households. Using a gacha (village) in Inner Mongolia as a case study the authors find that the privatization of grassland use rights weakened pastoralist ability to benefit from rangelands and led to a community failure that engenders feedbacks of increased impoverishment and environmental deterioration. The inflexible boundaries of quasi-private household property rights have caused the pastoral system to lose capacity to respond to drought and weather events, increasing vulnerability to environmental change.

Li, W., and L. Huntsinger. (2011). *Ecology and Society* 16(2): 1.



**Combining Landscape-Level Conservation Planning and Biodiversity Offset Programs: A Case Study [article]**

One potential strategy to balance continued habitat loss and biodiversity conservation is that of biodiversity offsets. While merging offset policies and landscape-level conservation planning is thought to provide advantages over a traditional disconnected approach, few such landscape-level conservation- offset plans have been designed and implemented, so the effectiveness of such a strategy remains uncertain. In this study, the authors quantitatively assess the conservation impact of combining landscape-level conservation planning and biodiversity offset programs by comparing regions of San Diego County, USA with the combined approach to regions with only an offset program. We found that adoption of the combined approach has increased conservation for many rare species, often 5–10 times more than in the comparison area, and that conservation has been focused in the areas most important for these species. The key to this increase in conservation seems related to public and private sector commitment for the combined approach. The level of conservation achieved reduces uncertainty that these species will persist in the region into the future.

Underwood JG (2011). *Environmental Management* 47:121–129

**Comparing tourists' behavior and valuation of land use changes: A focus on ranchland open space in Colorado. [abstract]**

Scenic landscapes demonstrate public good attributes and will be undervalued in the market. This paper reports on research comparing estimates of tourists' non-consumptive use values of ranch land open space in Routt County, Colorado. The authors report that if ranch lands are converted to urban uses, the decrease in value of trips estimated is 75% or \$108 per trip day. The predicted decrease of three trip days per visitor represents a 32% reduction in visitor days. Therefore, a substantial loss in value could result from the conversion of ranch lands to urban uses .

Ellingson, L., Seidl, A. and Loomis, J.B. (2011). *Journal of Environmental Policy and Management* 54 (1): 55-69.

**IUCN Science Bulletin**

This Bulletin provides a quick overview of the recent peer-reviewed literature relevant to IUCN's programme. It is not intended as an exhaustive reflection of current conservation science but rather to stimulate further exploration of science relevant to IUCN's Programme.

Many thanks to contributors for this issue including:  
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**Feedback welcome!**

Any comments on the bulletin format and content? Send your thoughts to [iucnscience@iucn.org](mailto:iucnscience@iucn.org).

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