

Bristol Conservation and Science Foundation

SPECIES CONSERVATION in a changing climate



3rd Annual Symposium – 25th November 2010



**Bristol Conservation
& Science Foundation**

INTRODUCTION

The Bristol Conservation and Science Foundation was launched in 2008 as a separate operating unit of the Bristol, Clifton & West of England Zoological Society Ltd that is charged with running the Society's wildlife conservation and research programmes at Bristol Zoo Gardens and in the field.

The amount of land around the world that is protected for wildlife, as national parks or wildlife reserves, is very small. In most parts of the world, the 'wild' is no longer an unspoilt wilderness. Many species are threatened and becoming rare due to human activities.

The roles of good Zoos are to provide visitors with amazing experiences for learning about wildlife and biodiversity, to apply our specialist skills to investigate threats to biodiversity, and to support communities in tackling specific pressures that give rise to conservation need.

The Bristol Conservation and Science Foundation, staffed by international conservationists, scientists and enablers of conservation, undertakes original research to provide the critical insights that help fulfill our conservation goals.

Species Conservation in a Changing Climate

25th November 2010

09:45- 10:15 *Arrival and coffee*

Symposium session 1

10:15-10:25	Bryan Carroll	Welcome and scene setting
10:25- 10:40	Sue Dow	Biodiversity and Climate change: views from Inverness meeting 5 th November 2010
10:40-11:20	Simon Stuart	Species vulnerability change - some recent findings
11:20-11:40	Pete Convey	Antarctic biodiversity in a changing world
11:40-12:00	Stephen Widdicombe	Predicting the impact of ocean acidification on marine biodiversity
12:00-12:20	Suzanne Sharrock	The role of botanic gardens in addressing the impacts of climate change on plant diversity
12:20- 12:40	Paul Pearce-Kelly	The need for clear and authoritative position statements on the state of climate change science and its implications for policy

12:40-13:40 *Lunch*

Symposium session 2

13:40-14:00	Aylin McNamara	Climate change and migratory species: a convention on migratory species case study
14:00-14:20	Andrew Hartley	Ecosystems, biodiversity and climate change: What we can and can't say
14:20-14:40	Oliver Watts	Adaptation for wildlife at the RSPB
14:40-15:00	Matthew Hatchwell	Making the link between REDD and biodiversity conservation in Central Africa

15:00-15:30 *Tea*

Symposium session 3

15:30-15:40	Oliver Watts	Introduction to climate change adaptation/mitigation
15:40-16:30		Workshops on adaptation/mitigation Enthusing support for climate change & nature Zoos and <i>ex situ</i> conservation and adaptation Conservation - flexible and rigorous? How should nature help mitigation? Achieving the landscape scale
16:30-17:00	Facilitators	Report back from workshops
17:00-17:30	Oliver Watts Katie Breach	Discussion and summing up

Christoph Schwitzer

Bristol Conservation and Science Foundation: Our Team

Dr Bryan Carroll - Director



Dr Bryan Carroll joined Bristol Zoo in August 1995, having come from the Jersey Wildlife Preservation Trust (now Durrell Wildlife Conservation Trust) where he was Curator of Mammals at Jersey Zoo. This background in an establishment that pioneered the idea of the zoo as a conservation organisation has enabled the development of Bristol Zoo's conservation and scientific programmes.

Bryan is a member of the Council of the European Association of Zoos and Aquaria (EAZA) as well as being a member of the EAZA EEP Committee (which oversees all European co-operatively managed species programmes) and the EAZA Conservation Committee. Bryan is also a member of the World Conservation Union's Primate Specialist Group, Bat Specialist Group and the Conservation Breeding Specialist Group. He became Director of BCSF and Bristol Zoo Gardens in September 2010.

Dr Christoph Schwitzer - Head of Research



A biologist by training, Dr Christoph Schwitzer received his PhD in Zoology from the University of Cologne, Germany, for his work on the nutritional ecology of lemurs, which he conducted in several European zoos. He worked as part of the primatological research group at Cologne Zoo for several years and also coordinated the European Endangered Species Programme for Ruffed lemurs. In 2003 he took on a position as Programme Coordinator for the European Association for the Study and Conservation of Lemurs (AEECL) in northwest Madagascar, where he directed a field research and conservation programme that has recently led to the creation of a new national park. Since August 2006, Christoph has been Head of Research at Bristol Zoo Gardens, and was appointed Executive Secretary of AEECL in May 2007. He is on the Steering Committee of the IUCN/SSC Primate Specialist Group as the Regional Coordinator for Madagascar and editor of *Lemur News*.

Neil Maddison - Head of Conservation Programmes



Neil Maddison gained his first degree in Zoology at the University of Bristol and went on to work for several conservation charities before joining the Bristol, Clifton and West of England Zoological Society in 1997, initially as Development Manager. His experience in field conservation has led him to focus on working with communities to develop sustainable solutions to wildlife conservation, looking for practical ways to support disadvantaged people in their development. This often leads to an examination of the 'business case' for conservation, and finding new sources of revenue for local communities. Neil obtained his MBA from the University of the West of England, with a specialisation in pro-poor ecotourism. He is a Trustee of Ape Action Africa, an NGO working to address the commercial bushmeat trade in Africa and was previously a Trustee of the Hawk and Owl Trust. He is also currently a member of the Conservation Specialist Breeding Group and the Association of MBAs.

Jen Nightingale - UK Conservation Officer



Jen Nightingale gained a degree in Zoology from the University of Bristol, a Masters in Wildlife Management and Conservation from Reading University and is a full member of the Institute of Ecological and Environmental Management. With extensive experience in the aquarium industry, from Vancouver Aquarium and European Sealife Centres, she became Curator of the Aquarium at Bristol Zoo Gardens in 1997 where she focused on a programme of extensive modernisation of exhibits, off show breeding facilities, infrastructure and educational themes.

During this time Jen also played a major role in two successful water vole reintroductions and extended this to establish the position of UK Conservation Officer within the BCSF. Within this current role Jen focuses on the conservation of UK species both *in-* and *ex-situ* and project manages the South West Crayfish Project, the largest white-clawed crayfish initiative in the UK. This project has established 8 ark sites for this species, is developing a captive breeding programme at the zoo and an extensive communication outreach initiative. Jen is on the Steering Committee of the BIAZA native species focus group.

Dr Sue Dow – Research Officer



Sue Dow trained as a Zoologist at the University of Oxford and carried out a PhD at the University of Exeter on foraging and learning in pigeons. She has carried out research at Bristol University on the biomechanics of bird flight in the zoology department and investigations into tendon injuries and humane treatments for horses in the anatomy department.

Sue worked part time at London Zoo setting up environmental enrichment projects and has been working at Bristol Zoo Gardens since 1992 on construction projects but has also been co-ordinator of research projects undertaken at the zoo. She works part time as Research Officer and is conducting a longitudinal study into the social dynamics of Bristol Zoo's group of gorillas. She is also the Sustainability Officer for Bristol Zoo Gardens

Katie Breach – Intern, Assistant to the Head of Research



Katie Breach studied Zoology at the University of Bristol before obtaining an MSc in Conservation Science from Imperial College London. Katie has worked on conservation projects in South Africa and Indonesia, as well as carrying out research alongside Durrell Wildlife Conservation Trust in the Caribbean. Katie assisted with research into the climate change effects on migratory species at the Zoological Society of London, before moving to Bristol firstly to work with the Bristol Natural History Consortium, then finally to Bristol Conservation and Science Foundation where she is an assistant to the Head of Research.

About the speakers

Prof. Peter Convey

Prof. Peter Convey is a terrestrial ecologist with 22 years experience of working with the British Antarctic Survey and in a wide range of polar environments (14 summers and one winter south, two Arctic seasons). He has broad and diverse research interests from ecology and life history strategies, through biogeography to molecular biology and palaeo-studies, and human impacts on polar ecosystems. He is an 'Individual Merit' senior research scientist at BAS, working within their core 'Ecosystems' Programme. He is very active in the development of international Antarctic science priorities and collaborative research programmes through the Scientific Committee on Antarctic Research (SCAR), being Co-Chair of the SCAR Science Research Programme 'Evolution and Biodiversity in Antarctica'. He has also been an Honorary Lecturer at the University of Birmingham since 2000, and is a Guest Lecturer at UNIS, Svalbard and a Visiting Professor at the University of Malaya. He has supervised seven (completed) PhD students, and three current students, and is a STEM Ambassador (educational and public outreach). He has been a member of the International Steering committee of the 3rd and 4th SCAR Open Science Conferences (>1,000 participants), and the 10th SCAR Biology Symposium (>300 participants), is a member of the editorial advisory panel or Associate Editor for the journals *Global Change Biology* and *BMC Ecology*, and a guest editor for two journal special issues and three other volumes. He is a member of the SCAR Action Group on Prediction of Changes in the Physical and Biological Environments of the Antarctic.

Andrew Hartley

Andrew Hartley is a Risk Analyst for the Impacts of Climate Change at the Met Office. He has a masters degree in Geographical Information Science and Remote Sensing from Cranfield University (UK) and 6 years experience working at the European Commission Joint Research Centre to support European environment and development policy in ACP countries. Specifically, this involved a systematic assessment of African protected areas (<http://bioval.jrc.ec.europa.eu/PA/>), using GIS and Earth Observation techniques, in order to inform the effective allocation of EU conservation funding. More recently, Andy has used his geographical and technical skills to develop indicators and new approaches to quantify the risks of climate change to biodiversity and ecosystems. This involves leading research into large scale ecosystem changes, and making climate change information more relevant for conservation planners.

Matthew Hatchwell

Matthew Hatchwell is head of the Wildlife Conservation Society in Europe. He has worked for WCS for nearly 25 years, as director of programmes in Madagascar and previously in the Republic of Congo and at WCS headquarters at the Bronx Zoo in New York. He is the co-author of books on Masoala National Park in Madagascar and on the role of zoos in supporting on-the-ground wildlife conservation, and is working now on sustainable financing mechanisms for conservation and on the links between climate change and biodiversity conservation, among other issues.

Aylin McNamara

Aylin is an environmental scientist with a keen interest on the effects of climate change on biodiversity. She began her scientific career as a primatologist, working on the conservation of a new subspecies of chimpanzee in Nigeria. During this time, it became apparent that climate change was one of the greatest emerging threats to the continued survival of specialist species. Subsequently, Aylin spent four years working at the Zoological Society of London on the impacts of climate change on migratory species, corals, amphibians, and many other taxa. In July 2009, she co-ordinated the production of a statement from many of the world's experts on coral reefs outlining how reefs are gravely threatened by ocean acidification and surface water warming due to anthropogenic greenhouse gas emissions. The statement was released at a press conference and public meeting at the Royal Society in London, and gave much-needed publicity to the possibility that tropical coral reefs will be the first ecosystem to collapse due to human-induced climate change. Aylin has worked with the UNEP Convention on Migratory Species, researching climate change for their Scientific Council. Aylin continues to work at ZSL in her current role as the Climate Change and Sustainability Officer, where her work also includes the achievement of carbon reduction and sustainability goals across the society. Aylin feels that sustainability and conservation efforts are becoming more and more entwined, demonstrated by the fact that carbon emissions will have such great impacts on the future of conservation.

Paul Pearce-Kelly

Paul Pearce-Kelly is Senior Curator of Invertebrates & Lower Vertebrates at the Zoological Society of London. Paul has been with ZSL for the last 28 years, and in addition to his senior curatorial focus, Paul coordinates the zoological department's conservation and research projects as well as the Society's Climate Change Thematic Programme. He specialises in the development and management of species conservation programmes. His conservation, research, animal welfare and education work has received over 20 awards, including the *Ulysses S. Seal Innovation in Conservation Award*.

In recent years he has focused on efforts to help clarify the climate change threats to biodiversity and associated viability thresholds and response imperatives. In this capacity he chairs the World Association of Zoos and Aquariums Climate Change Task Force.

Suzanne Sharrock

Suzanne Sharrock is Botanic Gardens Conservation International's Director of Global Programmes and manages BGCI's climate change and human well-being programmes. Suzanne is co-editor of BGCI's twice-yearly botanic garden journal (BGjournal) and oversees the production of BGCI's technical publications. Suzanne also works on policy issues connected with the Global Strategy for Plant Conservation and provides support to the European Botanic Gardens Consortium.

Before joining BGCI, Suzanne worked for the International Plant Genetics Resources Institute (now Bioversity International) and has also worked on plant genetic resource projects in Nepal, Australia, Papua New Guinea and the Caribbean.

Dr Simon Stuart

Simon Stuart has been associated with the IUCN Species Survival Commission since the early 1980s, when he started work on the African Bird Red Data Book. He joined the IUCN Secretariat in 1986, and was Head of the Species Programme (1990-2000), Acting Director General (2000-2001), Head of the Biodiversity Assessment Unit (2001-2005), and Senior Species Scientist (2005-2008). Simon recalls “My interest in conservation started as a child, earlier than I can remember. A fascination for wild animals and plants has always been in my blood. A career in conservation was the only option for me. I have been privileged to have been closely associated with IUCN and the Species Survival Commission (SSC) for 25 years, most of that time as a member of the IUCN Secretariat. The SSC is in many senses my home.”

Before becoming Chair of the SSC, Simon coordinated the IUCN/SSC biodiversity assessments, including those on mammals, reptiles, amphibians and marine species. He says: “This has brought home to me how seriously the status of very many species is deteriorating, despite our best conservation efforts. There are some notable exceptions, but overall we are not keeping pace with the ever growing threats. This is leading to not only the loss of species, but is also jeopardising the livelihoods of millions of people who depend on wild species. The SSC has made, and is continuing to make, huge strides in the delivery of species-related data. This is excellent. However, conservation delivery does not just happen as a result of making the data available. I want to see the SSC be proactive in working with countries and regions, and with a larger array of partners, to help stimulate the conservation actions needed to stem the rising tide of extinctions.”

Dr Olly Watts

Dr Olly Watts is the Royal Society for the Protection of Birds' Senior Climate Change Policy Officer. He has been working on climate change for ten years, with the main focus on developing adaptation policy for nature conservation. Olly has been developing carbon reduction and greening across the RSPB's activities. He also works on the protection of peatlands from industrial extraction and the replacement of peat in horticulture. Olly joined the RSPB in 1992, having previously worked on the species policy team and on regional office public affairs.

Dr Steve Widdicombe

Dr Steve Widdicombe leads the Plymouth Marine Laboratory's strategic science area Marine Life Support Systems. The research he oversees aims to develop novel approaches for measuring and describing biodiversity across a range of biological scales, investigate the relationships between biodiversity and the provision of key biogeochemical processes, and thus develop the understanding necessary to predict the impact of biodiversity change on the structure and function of marine ecosystems.

Steve is a marine ecologist with 20 years experience in using field observations and manipulative experiments to address issues relating to benthic ecology, biodiversity and ecosystem function. He is particularly interested in quantifying the effects of disturbance on the structure, diversity and function of marine benthic communities. Much of his recent research has concentrated on the ecological impacts of ocean acidification and elevated temperatures. As a result he currently leads a large (£2m) consortium project examining the impacts of ocean acidification on key benthic ecosystems, communities, habitats, species and life cycles. He is also involved in a number of UK- and EU-funded projects studying the ecological risks associated with the release of CO₂ from geological storage sites. He regularly provides advice to UK government departments (e.g. Defra, DECC), environmental NGOs (e.g. Natural England) and has provided evidence on the ecological implications associated with geological storage of CO₂ to the London Convention. He has published over 50 peer-reviewed papers and book chapters.

Abstracts

Biodiversity and climate change: views from Inverness meeting 5th November 2010

Sue Dow

Bristol Conservation Science Foundation, Bristol Zoo Gardens, Clifton, Bristol BS8 3HA

Biodiversity and climate change and the implications for Scotland were discussed at the meeting held on 5th November. The aims of the meeting were:-

- to enhance public awareness** of the importance of safeguarding biodiversity and of the underlying threats to biodiversity which climate change may accelerate,
- to showcase** biodiversity projects led by Highlands and Islands communities and develop further strategies for future projects and networking,
- to investigate** gaps in knowledge, generate ideas and promote innovative solutions to reduce the threats to biodiversity from climate change, and
- to encourage** main stakeholders to take the immediate steps needed to halt the loss of biodiversity.

The main areas of discussion included:

- marine and coastal biodiversity and what adaptation measures can be adopted to increase resilience to the unavoidable impacts of climate change;
- forest conservation and sustainable use and what lessons can be learned as the practice of balancing economics and sustainability alongside the challenges of climate change is developed;
- engaging with communities and how a robust network of community based, climate change driven biodiversity projects can be developed;
- biodiversity enhancing land management and what steps can be taken to ensure sustainable management of mountain and upland areas, while enabling the creation of new habitats to help northward migrating species adapt to climate change.

The main discussion points and outcomes will be outlined.

We are working with CIFAL Findhorn who organised the conference to combine the outputs from the Inverness and Bristol meetings.

Species vulnerability change - some recent findings

Simon Stuart

*IUCN Species Survival Commission, The Innovation Centre, University of Bath,
Carpenter House, First Floor, Broad Quay, Bath, BA1 1UD, UK*

Since 2006, the IUCN Species Survival Commission has developed a traits-based approach to assessing species' vulnerability to climate change, and this has now been applied to all species of amphibians, birds and reef-building corals. The results show that the species most at risk from climate change are not always those that have been assessed to be most at risk of extinction due to other causes. The preliminary results of this work will be presented, together with a preliminary identification of flagship species that are being, or will be, impacted negatively by climate change. The implications of this work for conservation will be discussed.

Antarctic biodiversity in a changing world

Prof Pete Convey

British Antarctic Survey, High Cross, Madingley Road, Cambridge, CB3 0ET, UK

Even today the terrestrial biota of Antarctica is often overlooked and is surprisingly poorly described in detail. However, through compilation of existing biodiversity data, in combination with the application of techniques of molecular biological analysis, new evidence has been obtained indicating that long-term persistence and regional isolation are general features of most of the major groups of both Antarctic terrestrial and marine biota. This opens important new cross-disciplinary linkages in the field of understanding the geological and glaciological history of the continent itself. Superimposed on this emerging historical template of Antarctic biogeography, this biota now faces the twin challenges of responding to the complex processes of climate change facing some parts of the continent, and the direct impacts associated with human occupation and travel to and between the spatially very limited areas of terrestrial habitat. In many instances (although there are exceptions), the terrestrial biota is likely to benefit from environmental changes which increase available energy and make liquid water available to organisms, and there is an expectation of increased production, biomass, population size, community complexity, and colonisation. In the marine environment, very low tolerance to temperature variation may lead to the reverse consequences. However, the impacts of climate change may themselves be outweighed by other, direct, impacts of human activities, and in particular the introduction of non-indigenous organisms from which until now the ecosystems of the continent have been uniquely protected.

Predicting the impact of ocean acidification on marine biodiversity

Dr Steve Widdicombe

Plymouth Marine Laboratory, Prospect Place, The Hoe, Plymouth, PL1 3DH, UK

For the past 200 years, the oceans have been absorbing carbon dioxide (CO₂) at an unprecedented rate. It is now evident that this ongoing process has already significantly altered seawater carbon chemistry at a global scale and will continue to do so for hundreds of years to come; a phenomenon termed "ocean acidification". The challenge currently facing scientists is to predict the long term implications of ocean acidification for the diversity of marine organisms and for the ecosystem functions this diversity supports. This challenge is all the more difficult considering that empirical data which specifically address the impact of ocean acidification on marine biodiversity are currently lacking. In the face of growing political and public pressure to provide answers, what predictions can be made and how reliable are the assumptions on which those predictions depend? Here we review the extent to which the few existing data, and understanding gained from previous physiological studies, can be used to make predictions on the future for marine biodiversity in a high CO₂ world.

The role of botanic gardens in addressing the impacts of climate change on plant diversity

Suzanne Sharrock

Botanic Gardens Conservation International, Descano House, 199 Kew Road, Richmond, Surrey TW9 3BW, UK

The talk will include an overview of the impact climate change is having on plant diversity and provide examples of the work being done by botanic gardens to address these impacts. The talk will also discuss how the work of botanic gardens fits into the broader plant conservation agenda and will conclude with some recommendations for future actions to ensure the conservation of plant diversity for the future.

The need for clear and authoritative position statements on the state of climate change science and its implications for policy

Paul Pearce-Kelly

Climate Change Task Force, Zoological Society of London, Regent's Park, London, NW4 4RY

To help ensure an adequate engagement with the many and diverse climate change issues influencing biodiversity conservation, the World Association of Zoos and Aquariums (WAZA) in association with IUCN's Conservation Breeding Specialist Group (CBSG) established a Climate Change Task Force to review the latest available information on these threat and response considerations. The resultant WAZA position statement on climate change was agreed, together with a supporting resolution, at the October 2010 annual WAZA conference (see <http://www.waza.org/en/site/conservation/climate-change/position-statement>).

The extensive reference review (see <http://www.bioclimate.org/references/3382>) conducted for the development of the WAZA position statement highlights a serious disconnect between what the best available science is telling us and what most of the currently available position statements are saying. If policy is to be best informed then this situation needs to be urgently addressed.

Climate change and migratory species: a Convention on Migratory Species case study

Aylin McNamara

Climate Change and Sustainability Officer, Science to Government and Industry Unit, Zoological Society of London, Regent's Park, London, NW4 4RY

We have a small window of opportunity for conservation organisations to build capacity both institutionally and politically to deal with the impacts of climate change. Preparation is essential as the predictions become more severe and greenhouse gas emissions rise. This talk will give a brief overview of the issues we have to face and the complexity involved in understanding how species will respond to these changes. Climate change is an emerging threat to species. Although the science is not complete, due to the urgency of the situation it is necessary for us to rapidly develop processes to help inform what actions we can take to minimise negative impacts on species. The Convention on Migratory Species (CMS) is one such body taking steps to build its capacity to deal with climate change and communicate this threat to party members. This talk looks in depth at a study carried out by the Zoological Society of London for CMS on the climate change vulnerability of migratory species. A number of species have been identified as highly vulnerable to climate change and several key findings will be discussed. Various processes for species' climate change assessments, vulnerability and threat evaluations are under development. Each study carried out will help take us forward in our understanding of how we can maximise useful outputs and reduce limitations of these assessments.

Ecosystems, biodiversity and climate change: what we can and can't say

Andrew Hartley

Met Office Hadley Office, Fitzroy Road, Exeter, EX2 8BA, UK

In this talk I will address some of the main issues related to assessments of the impact of climate change on terrestrial ecosystems and biodiversity. I will briefly review some of the key scientific questions in this field, and discuss the main sources of uncertainty in impact projections. Given these uncertainties, conservation planners need relevant climate change information for producing long-term adaptation strategies. I will present the results of a new study designed to assess such uncertainties in large scale ecosystem projections, and discuss how this information can be used for making practical conservation decisions.

Adaptation for wildlife at the RSPB

Dr Oliver Watts

Royal Society for the Protection of Birds, The Lodge, Sandy, Bedfordshire, SG19 2DL

Climate change will bring a profound change to biodiversity and challenge to nature conservation. Adaptation should follow two broad, parallel tracks: of building resilience against climate change, and developing to accommodate the inevitable changes it will bring to biodiversity in the UK. Species, as the building blocks of ecosystems, remain an important focus for conservation, comprising a practicable, measurable and fundamentally important delivery route. Nature reserves and protected areas will continue to provide an essential core resource for biodiversity, and RSPB reserves management is addressing climate change in a number of ways. Yet nature conservation effort needs to spread out from our protected havens, to embrace the wider countryside, and be better integrated into a range of land uses.

The RSPB's Futurescapes programme is one such development of landscape scale conservation, our contribution not just to wildlife conservation, but to the continuing provision of ecological services which underpin human society, including food to fibre production, water quality and flood control, and human health and wealth.

Making the link between REDD and biodiversity conservation in Central Africa

Matthew Hatchwell

Wildlife Conservation Society, Zoological Society of London, Regent's Park, London, NW4 4RY

I will start by talking very briefly about the general principles of REDD, the context for the development of REDD projects in Central Africa and some of the difficulties that that entails, and then talk in more detail about a couple of pilot REDD projects that WCS is starting up in SW Cameroon (associated with the conservation of the Critically Endangered Cross River gorilla) and in eastern DRC in and around the Virungas National Park.

Poster Abstracts

The effects of future climatic and vegetation changes to the distribution and diversity of Southeast Asian bats

Alice C Hughes ¹, Chutamas Satasook ², Paul JJ Bates ³, Sara Bumungsri ² and Gareth Jones ¹

¹ *School of Biological Sciences, University of Bristol, Woodland Road, Bristol, BS8 1UG, UK*

² *Department of Biology, Faculty of Science, Prince of Songkla University, 15 Karnjanavanit Road, Hat Yai, Songkhla 90112, Thailand*

³ *Harrison Institute, Centre for Systematics and Biodiversity Research, Bowerwood House, 15 St Botolph's Road, Sevenoaks, Kent, TN13 3AQ, UK*

Southeast Asia represents a global hotspot of diversity and endemism, however it also suffers from the highest deforestation rates. Bats make up a large proportion of this biodiversity and also provide ideal indicators of overall biodiversity. This study examines the impact of future climatic changes at 2100 under four scenarios, and additionally incorporates both climatic and vegetation changes at 2050 on both the distribution, and diversity of Southeast Asian bats.

Known current species distributions of 171 species were paired with an array of climatic, physical and anthropogenic factors using Maxent. Projections show that each species is affected differently by a complex array of factors, and that the inputs selected for each projection have a dramatic effect on results. Three groups of projections were produced, which must only be compared with other groups whilst considering inputs.

Projections using climatic predictions produced by CSIRO were used for two scenarios (A2, B1) at 2050 and 2080. Bat species distribution predictions produced using these projections consider a range of bioclimatic factors and physical factors but do not include vegetation cover. The four scenarios (IPPC, a2, ab, b1, b2) used at 2100 do not include seasonality variables, and thus produce more generalized projections. Changes in vegetation (J. Fox) in addition to climate were however considered for a large portion of mainland Southeast Asia at 2050 under both a2 and b1 scenarios.

Biodiversity levels reflect both inputs chosen and scenarios. Projections for 2050 and 2080 all show losses in the highest levels of biodiversity, in addition to reductions in areas of highest diversity. This is particularly high in 2050 A2, which dramatically

reduces the diversity of all areas currently showing greatest diversity. This is due to loss of original suitable areas prior to range expansion. At 2100 less change is reflected except in diversity losses in areas of medial diversity. This highlights the importance of seasonality factors in distributions, thus projected losses are more probable than projected expansions. When considering both climatic and vegetative projections, diversity losses are dramatic in the areas currently showing greatest diversity. These projections are from a minimal impact projection, whereas the current level of deforestation is considerably greater.

When considering distribution changes of species when regarding original range, the 2050a2 scenario projects only 1-2 species showing no losses to current range, and up to 9 total extirpations from original range. Ab2100 shows 10 species projected to lose all original suitable habitat. These trends are very concerning; especially in the 2100 generalised trends which show dramatic loss even before considering seasonality or land cover variables. Decreases in original range are more likely to be realised as due to landscape connectivity expansions projected may show suitable niches which cannot be reached. Thus all expansions shown here may in reality be impeded by land cover variables, and therefore are often improbable.

Even generalised scenarios show the total loss of 4-8% of species in 2100. All scenarios show decreases in overall distribution in at least 30% of species. Furthermore between 4 and 16% of species are projected to lose between 50-99% of their range size, and between 19 and 51% of species are projected to lose 1 to 50%. Few species are projected to retain current range sizes and whilst many expansions are projected, these may not be ecologically possible.

Projections here show a baseline estimate, in reality human population growth and habitat fragmentation mean that declines will be greater. Few species showed no reductions to original range, and if species cannot reach newly suitable areas then this may ultimately lead to species extinctions. Therefore the losses projected here present a grave warning of potential species loss; conservation is urgently required to protect existing areas. If range expansions are to have any chance of realisation then landscape connectivity may also need to be addressed.

Climate associated dynamics of a tropical seagrass meadow: implications for the future

Richard K.F. Unsworth¹ and Michael A. Rasheed²

¹*Biological Sciences Research Unit, Glyntaf Campus, University of Glamorgan, Pontypridd, Wales, CF37 1DL, UK*

²*Marine Ecology Group, Northern Fisheries Centre, Fisheries Queensland, Department of Employment Economic Development and Innovation, PO Box 5396, Cairns, Qld 4870, Australia*

The long-term changes of tropical intertidal seagrass meadows and their relationship to climate are poorly documented. Developing a greater understanding of the effects of climate on seagrass meadows is critical for estimating the impacts of future climate change scenarios. Here we document the temporal dynamics of coastal intertidal seagrass in tropical north east Australia over 16 years of detailed monitoring. This study is the first to directly relate such change to long-term climate variability in the Indo-Pacific and southern hemisphere. Regression modelling was used to relate seagrass biomass and meadow area measurements to climate data. The above ground biomass and area of the meadow was correlated with the interacting factors of air temperature, precipitation, day-time tidal exposure and freshwater runoff from nearby rivers. Elevated temperature and reduced river-flow resulted in lower seagrass biomass. Increased daylight hours of tidal exposure resulted in increased meadow area. Results of this study have important implications for the long-term viability of seagrasses in the face of climate change scenarios. Modelling of our findings indicate that future higher temperatures could be detrimental to Indo-Pacific intertidal coastal and estuarine seagrass meadows.

Managing wildlife and protected areas under a changing climate

Ian Redmond¹ and Edgar Kaeslin²

¹ *FAO wildlife officer & GRASP Envoy, c/o RSPCA Building, Lansdown, STROUD Glos. GL5 1BG, UK*

² *Food and Agriculture Organization of the United Nations, Vialle delle Terme di Caracalla, 00100 Rome, Italy*

Food and Agriculture Organization of the United Nations (FAO's) Wildlife and Protected Area Management Programme has identified the impacts of climate change as a priority area of work. It seeks to strengthen countries' capacities to adapt to climate change through actions that sustain conservation and sustainable management, and helps them improve the mitigation potential of wildlife conservation. To achieve this goal, it works with national, regional and international partners, including other FAO programmes, UN bodies, international organizations, research institutions and NGOs.

Major climate-induced changes and possible solutions for protected areas are outlined along with what is happening in different areas, priority measures and what this may include in practical terms

A request is made for interesting examples and case studies.

Species conservation in a changing climate – results from the field in Equador, Mongolia and Australia

Ellie Gilvin and James Burton

Earthwatch Institute, Mayfield House, 256 Banbury Road, Oxford, OX2 7DE, UK

Earthwatch is a charitable organisation which exists to further scientific research and education for a sustainable environment, through providing funding and engaging citizen scientists in the environmental research process across the globe. A number of Earthwatch's projects are specifically investigating the conservation of species in a changing climate, and cutting-edge developments are being made across the globe.

Interaction diversity as a metric for determining climatic impacts on ecosystems:

Following extensive field research on caterpillars, parasitoids and host plants, Prof. Lee Dyer is using the concept of interaction diversity to draw new insights about ecosystem response in the face of environmental change. By assessing the number of "plant-herbivore-enemy" trophic chains as an example, the team are able to assess traditional diversity measures using links rather than species as the basic unit. This metric allows much clearer conclusions to be drawn concerning diversity, stability, productivity and ecosystem services. Models based on existing data suggest that interaction diversity is much more sensitive to climate change than species diversity, and that interaction diversity is a much stronger indication of ecosystem function and productivity. This raises important implications for the future of ecosystem services in the face of environmental change.

Conservation of wildlife in the threatened Mongolian steppe: Dr Richard Reading and his team of ecologists are working in the little-studied ecosystems of the Mongolian steppe to better understand the status, ecology and factors threatening certain species. Results from their long-term data collection have been used to determine the importance of certain areas with the right environmental characteristics to certain species such as the Siberian ibex, whose range is very much restricted to steep cliffs and rocky outcrops. The team's results are heavily employed in management of the Ikh Nart Nature Reserve. Radio tracking results have also highlighted the need for international collaboration in conservation, after South Korea was found to be an important wintering ground for juvenile vultures. The area is threatened by the growing challenges of industrialisation, poaching, and mineral exploitation – and the

demands of resource competition in a changing climate will surely add to the pressure on this valuable ecosystem.

Tropical mountain habitats in a changing climate: Prof. Steve Williams is working in the wet tropical rainforest of North Queensland, Australia to gather data that provides an understanding of the complex impacts associated with climate change in this environment. Using long term monitoring sites and baseline field data, the researchers are assessing the relationships between topographic weather patterns (such as orographic cloud layer and rainfall) and the wet tropical fauna. Altitudinal gradients are thought to be at particular risk of severest temperature changes in a changing climate, so predictions made by research project will be of key importance in forming appropriate mitigation policies and plans.

Selected References:

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