DAY 1: Monday 13 July

08:00	**Registration**	
09:00	**Conference opening** Dr Mark O'Connell, Director of ERT Conservation	
09:10	**Conference welcome address** Professor Jane Memmott, Head of Biological Science, Bristol University	
	SYMPOSIUM 1 **HELP!! Is our conservation land management actually working?**	**SYMPOSIUM 2** **Where are we with spatial statistics? A comparative review of core methods and future directions**
09:30	**Keynote presentation by session Leader** **Kathy Meakin,** Gloucestershire Wildlife Trust In the face of growing environmental pressures, conservation organisations need to measure and report their successes in terms of 'wildlife gain' i.e. provide *evidence* that their conservation actions are really working for wildlife. Protected area staff and reserve managers are often required to answer three key questions: (1) is the conservation status of your nature reserves changing, (2) are changes at our nature reserves the result of your land management or driven by external factors, and (3) what are the priorities for your future actions – which species, habitats, sites are changing the most (numbers, diversity, extent)? Many organisations collect huge amounts of monitoring data from their reserves, but relatively few analyse these data and harness them to address these questions. This symposium will identify the barriers driving this situation, suggest a range of spatial analysis solutions, and discuss an 'in	**Keynote presentation by session Leader** **Marie-Josée Fortin,** University of Toronto It is now widely accepted that ecological processes can only be fully understood if the underlying spatial patterns and relationships within a system are analytically accounted for. With many researchers and students now exploring spatial effects in their data (including a growing use of spatial tools in statistical packages such as 'R'), this symposium will provide a timely comparative overview of the range of 'core' spatial statistics methodologies available (e.g. spatial auto-correlation, wavelets, dispersion indices, fractal analysis, variance:mean ratios, neighbour networks, cluster detection, Mantel test, *etc*). It will then explore potential future directions and tools that could be usefully employed by ecologist to underpin conservation.

	progress' example of an initiative at the Gloucestershire Wildlife Trust (UK) to evaluate their land management.	
10:00	**How successful are African protected areas in conserving tree cover?** D. Gross 1, M. Holmgren 1, G. Dubois 2, C. Rondinini 3, L. Boitani 3, Z. Szantoi 2, J. Martínez-López 2, H.H.T. Prins 1 1 Resource Ecology Group, Wageningen University, P.O. Box 47, 6700 AA, Wageningen, The Netherlands. 2 Land Resource Management Unit, Institute for Environment and Sustainability, Joint Research, Centre of the European Commission, 21027 Ispra (VA), Italy 3 Department of Biology and Biotechnologies, University of Rome "La Sapienza", Viale dell'Università 32, 00185 Rome, Italy Protected areas are of vital importance for biodiversity conservation worldwide but they are vulnerable to increasing pressures. Assessing these threats and their effects has been conducted mostly at small spatial scales and for particular groups of species. In a continental study, we evaluated the changes of tree cover within protected areas distributed throughout all African biomes during the last decade and related them to ecological and socio-economic factors. Our study is based on freely available medium to low resolution satellite products to measure tree cover changes, environmental conditions and pressures in and around protected areas. The data is complemented by a list of demographic indicators. Our results identify sites that are changing most as well as those where the conservation of trees seems to be most successful. We will give a continental view on the effectiveness of protected areas in maintaining tree covered habitats and factors strengthening or impairing the success. It might help conservation and donor institutions to direct future actions.	**A novel technique for detecting missing aspects in complex ecological models** Dr. Jonathan Potts University of Sheffield Conservation decisions are increasingly informed by detailed, spatially explicit models of the abundance, movements, and interactions of organisms. Though many techniques exist for determining which of a set of competing models fits data best (e.g. information criteria), there are few tools for determining which factors might be missing from a model. However, such knowledge is crucial for assessing a model's validity in an absolute, rather than relative, sense, as well as determining its predictive capabilities. Here, I will explain a new method for uncovering missing features in ecological models. It makes use of the "Earth Mover's distance", well-known to the world of computer vision, but hitherto used little in an ecological setting. The focus will be on models of animal movement through complex environments. However, the methods are quite general, so have the potential to be extended to population abundance models and beyond. As a concrete example of the techniques, I will show how they have shed light on the behaviour of bird flocks living in fragmented areas of Amazonia.
10:15	**The evolution of digital mapping – can 3D representations of vegetation and landscape help us to detect change?** Lars Hansen & Katharina Child CDT3	**Spatial analysis of species sensitivity to edge effects** Véronique Lefebvre, Marion Pfeifer, Robert M. Ewers Forest Ecology and Conservation Lab, Imperial College London, London, UK Edge effects are central to understanding landscape processes. Evaluating

	Spatial analysis starts with maps. At CDT3 we make software tools for the map makers. This gives us an opportunity to investigate spatial data in new ways, how to manipulate and structure data. We would like to demonstrate some of these approaches, showing the combined use of traditional orthophotos, oblique images, digital elevation models and as the latest development, massive 3D point clouds. Point cloud data can either be obtained directly from laser scanners or it can be constructed from imagery by utilizing image matching algorithms. With our presentation we would like to start a discussion about how these data types and visualization methods might take over from how we today work with image data and how ecology might find ways to exploit this.	their influence over species abundance requires the use of spatial methods. Typically, the distance to the nearest edge is used as a proxy for edge influence and the edge defined as the interface between zones of suitable versus unsuitable habitat. In practice, this method has limitations as it ignores: (1) the influence of multiple edges (i.e. the shape and size of landscape elements), (2) the continuous variations in land cover (i.e. patch contrast). We developed a simple methodology, lifting these constraints, to assess species edge sensitivity. The central idea is to study abundance variations with respect to the combination of point land cover (value of one map pixel) and local land cover (average cover within a radius equal to the estimated distance of edge influence). Point and local covers are equal in zones exempt from edge effects, and different in edge zones, with edge influence increasing with the difference. Species responses to the pair point/local cover thus describe their edge and land cover sensitivities. As this method does not require spatial constraints we suggest that it will allow for more reliable predictions of habitat preferences of species within complex, fragmented landscapes.
10:30	**Symposium 1: Plenary workshop** Discussion of key issues, needs, trends and future directions	**Application of spatial statistical models to spatial planning in Amboseli ecosystem, Kenya** Victor N. Mose [1*], David Western[1] [1]African Conservation Centre (ACC), 15289-00509 Nairobi, Kenya Spatial compression had been on the increase in the recent times across many African ecosystems. We present an application of spatial statistical models on long-term data sampled from the Amboseli ecosystem in southern Kenya. The data, spanning over four decades includes estimates of wildlife and livestock populations, vegetation biomass, rainfall and human settlement patterns. We apply selected spatial time series regression models in order to estimate minimum viable spatial needs for wildlife, livestock and people. We present and compare different model scenarios teasing out the effects of extreme events such as drought on the spatial spread of the three main variables sampled. These scenarios are necessary in informing the physical planning of the ecosystem for sustainable development.

10:45	**TEA/COFFEE BREAK**		
11:05	Workshop discussions continued….		**Species distribution modelling based on intra-specific gene-c variation in the light of global climate change** Arnald Marcer 1,2, Marie-Josée Fortin 3 and F. Xavier Picó 4 1 CREAF, Cerdanyola del Vallès 08193, Spain 2 Univ. Autònoma de Barcelona, Cerdanyola del Vallès 08193, Spain 3 Department of Ecology and EvoluHonary Biology, University of Toronto, Toronto, ON, Canada 4 Departamento de Ecología IntegraHva, Estación Biológica de Doñana (EBD), Consejo Superior deInvesHgaciones CienTficas (CSIC), Sevilla, Spain Genetic diversity is the underlying property that enables species to adapt to varying environmental conditions. It determines how they will be able to cope with global climate change (GCC). Hence, to understand and predict how species are affected by GCC it becomes necessary to base our studies on intra-specific genetic diversity rather than with the species as a whole. Genetic diversity is usually measured as multi-locus genotype data which is then used to structure the species in population clusters. Species distribution modelling techniques are powerful tools to analyse species spatial patterns but they require to threshold cluster membership percentages to binary form, loosing information along the process. This work attempts to directly model percentages of cluster membership by using parametric and non-parametric statistical tools. Environmental variables are complemented with Moran eigenvector maps to account for residual spatial autocorrelation and to improve prediction power. We used a dataset of 274 accessions of *Arabidopsis thaliana* in the Iberian peninsula for which two levels of intra-specific variation have been measured: population cluster membership derived from SNPs and vernalisation requirement. We then use different GCC models and scenarios to measure genetic impoverishment and map future distributions of intra-specific diversity.
			Symposium 2: Plenary workshop Discussion of key issues, needs, trends and future directions

13:00	**LUNCH** **Poster session 1** **Exhibition stands**	
	SYMPOSIUM 3 **Small Unmanned Aerial Systems: bringing high resolution, low cost remote sensing to field ecologists and conservation practitioners**	**SYMPOSIUM 4** **Big data for big ecology: what do we need to understand about ecological patterns and processes at continental scales?**
14:15	**Keynote presentation by session Leader** **Andrew Fletcher,** University of Queensland Ecology and conservation often struggle to quantify habitat degradation sizes and extents. Many areas of conservation significance are large, widely distributed or ecologically complex. This causes traditional ground based techniques to be arduous while variability and small sample sizes limit confidence in conclusions. To further complicate this matter, many sources of impact and degradation are spatially and temporally fragmented, filamentous or diffuse. In most cases development is considered on a case by case basis rather than cumulatively giving rise to death by a thousand cuts. For conservation practitioners and field ecologists, context for field observation is critical to effective interpretation of ecological data. While remote sensing and mapping are not modern technologies, budgets often limit access to current remote sensing and other spatial data to those with the means to purchase these products. Humans are now capable of rapid regional and global impact requiring access to relevant, accurate and timely information regarding fundamental changes to their environment for effective social and ecological decision making. This symposium explores the potential of small unmanned aerial vehicles to democratise remote sensing and geospatial data as well as methods for delivering actionable products to site and community practitioners.	**Keynote presentation by session Leader** **Holger Kreft,** University of Göttingen Many environmental problems and phenomena occur over large spatial extents (e.g. habitat loss, pollution, invasives, climate change). And whilst policy makers and planning authorities frequently require ecological information and understanding at a continental [macro] scale, most ecological studies of patterns and process are understood only at local or medium scales. Ecologists then attempt to scale up understanding gleaned from meso- and micro-scale studies. Advances in remote sensing, computer processing, and spatial analytical techniques, means that it is now becoming possible to put together large datasets (buzz word 'big data') to study macro-scale phenomena (buzz word 'big ecology'), although issues remain with the availability, ownership and analysis of such data. This symposium will discuss this issues associated with this growing area of spatial ecology and conservation, provide examples of current research initiatives and identify future needs.

14:45	**Using UAVs in the high altitude Eastern Tibetan plateau: linking bird surveys with UAV data** Andreas Fritz[1], Li Li[2], Barbara Koch[1], Ilse Storch[2] [1] University of Freiburg, Remote Sensing and Landscape Information Systems, Tennenbacherstraße 4, 79104 Freiburg, Germany, phone: ++49 761 203 8645, andreas.fritz@felis.uni-freiburg.de and barbara.koch@felis.uni-freiburg.de [2] University of Freiburg, Wildlife Ecology and Management, Tennenbacherstraße 4, 79104 Freiburg, Germany, phone: ++49 761 203 3664, li.li@wildlife.uni-freiburg.de and ilse.storch@wildlife.uni-freiburg.de The Tibetan plateau is the world's largest alpine landscape which harbours a large number of endemic flora and fauna. However, ecological knowledge regarding those native species is scarce due to difficult access to the area and insufficient baseline data. In our study in the Eastern Tibetan Plateau we used two different data sets: 1) a bird survey conducted over 2 years during summer and b) remote sensing data gathered from three fixed wing UAVs equipped with a consumer digital camera. The data sets covering 142 sample plots on an altitude ranging from 3700-4200m ALS. In total we accomplished 38 flights covering 45.8km² based on 5559 individual images taken by the UAVs. Digital ortho-mosaics and photogrammetric elevation models were derived from the data. For the first time we were able to make a wall-to-wall classification of land cover types based on an average ground sampling distance of 13cm. Furthermore we derived terrain parameters beyond slope and aspect. The high resolution 3-dimensional data enables us to investigate morphological structures such small ravines, rocks and man-made objects. The two comprehensive data sets give us the basis for sound statements regarding key species habitat preferences and their potential influence of anthropogenic land use patterns.	**Big data processing to monitor plant phenology, snow cover and fires at global scale by remote sensing** Florent Hawotte1,2, Corentin Rousseau1, Julien Radoux1, Thomas De Maet1, Céline Lamarche1, Sophie Bontemps1, Pierre Defourny1 1 Université catholique de Louvain, Earth and Life Institute, Environmental Sciences. Croix du Sud, 02, bte L7.05.16, 1348 Louvain-la-Neuve, Belgium. 2 Corresponding author, Florent.Hawotte@uclouvain.be Remote sensing provides precise information about ecosystem dynamics at global scale. In this study, we present ready to use information derived from the full archive of MODIS and SPOT-VGT products. Recently, a global data set has been produced in the framework of the ESA Climate Change Initiative – Land Cover (CCI-LC) project in order to provide information about plant phenology (greenness), snow cover and burned areas occurrences (http://maps.elie.ucl.ac.be/CCI/viewer/). Typical mean and standard deviations have been computed on a weekly temporal resolution, thanks to 13 years of data. Based on this data set, metrics and anomalies are derived over Europe to further characterize ecosystem dynamics. The goal of the LifeWatch project is to provide information about biodiversity to researchers. In this frame, the previous data sets have been further processed to derive metrics and near real-time anomalies in Europe and Northern Africa. The records of anomalies highlight exceptional climatic events which occurred during the last few years. Those events had strongly impacted plant phenology and animal behavior, and they have been linked to changes in geographical distribution of animal species over time. Some scientific publications claim that such events will be more frequent in the future. Remote sensing data will certainly play a significant role in understanding their effects on animal populations.
15:00	**UAV's (aka drones), in pursuit of plant conservation and science. Real world experiences** Justin Moat, Susana Baena, Tim Wilkinson, Steve Bachman, Jenny Williams, Alfonso Orellana García, Amanda Cooper and Oliver Whaley	**Combining remote sensing and ancillary data to improve species distribution models** J. Delangre 1, J. Radoux 2, F. Jacquemin 1, M. Dufrêne 1 1 University of Liège – Gembloux Agro-Bio Tech – BIOSE department, Biodiversity and Landscape Unit

	Royal Botanic Gardens Kew, Richmond Surrey, TW9 3AB Small Unmanned Aerial Vehicles (UAV's more commonly known as drones) can expedite our understanding and management of the environment. There has been much media coverage on the use of UAVs in the recent years, much of it negative, and they are often viewed with suspicion. Here I will present our experience of using an off-the-shelf fixed wing UAV in plant conservation projects from Peru's hyper-arid vegetation to the dry forests of the Caribbean and finally to the humid woodlands of South Africa. I will present our findings from over four successful (but also our unsuccessful) field work campaigns flying over 1500 km. I will show how the technology is being used for discovery, conservation and restoration, but I'll also review the real world issues of using a UAV in both the remote areas of the world and the more congested areas of the world. Finally I'll review the spatial analysis and processing used with the data derived from the UAV to inform conservation planning.	2 Catholic University of Louvain, Earth and Life Institute, Environmental Science Correlative distribution models are increasingly used in biological conservation. They often require the compilation of various environmental attributes (climate, topography, land cover,…), which can be very time-consuming. In the Lifewatch project, a database combining segmentation in homogeneous landscape units ("ecotopes") and environmental attributes derived from regularly updated remote sensing data (land cover, potential solar energy,…) and other data sources (climate, topography,…) has been designed. Our aim was to assess the usefulness of this database for species distribution modelling and to propose further improvements. The distribution of ten species (four butterflies, three birds, two reptiles and one mammal) was modelled across Wallonia and model performance was assessed by Area Under the ROC Curve using the subsample approach. The models derived from ecotope segmentation and quantitative land cover attributes were compared to those obtained with a corresponding grid and a qualitative land cover database. The usefulness of ancillary data (soil properties, contextual attributes) was assessed to decide which variables should be integrated in the ecotope database. The results allowed us to assess and improve the relevance and accuracy of our database, which is a promising tool for species distribution modellers at the European scale.
15:15	**Geospatial analysis of degraded peat bog habitats utilising high resolution datasets captured using Unmanned Aerial Vehicle (UAV) Technology** Mark Brown Yorkshire Peat Partnership The Yorkshire Peat Partnership is an umbrella organisation comprising the Yorkshire Wildlife Trust, Yorkshire Dales National Park Authority, Natural England, North York Moors National Park Authority, Yorkshire Water and the Environment Agency. The aim of the partnership is to restore and conserve upland peat resources in order to ensure the long term future of these unique and valuable habitats. The Yorkshire Peat Partnership has carried out surveys using Unmanned Aerial Vehicle (UAV) technology to capture high resolution aerial imagery of degraded peat bog habitats in	**Old data, new data and complex models to quantify structure and biodiversity responses to tropical forest degradation** Marion Pfeifer[1], Veronique Lefebvre[1], Platts P[2], BIOFRAG network[3], Rob Ewers[1] [1] Ecology and Evolution, Silwood Park Campus, Imperial College London, UK [2] Environment Department, University of York, UK [3] Database contributors named as co-authors in Pfeifer et al. 2014 Ecology and Evolution Tropical forests are displaying significant changes in structure and biodiversity in response to land use change. Forest fragmentation and selective logging, can cut deep into forest interiors. They affect more than a third of the world's tropical humid forests, acting, non-additively, in concert with climate changes to reduce tropical forest resilience. Studies on ecological responses to tropical deforestation and forest degradation have produced results that are challenging to synthesize. Studies are inconsistent in experimental design and methods used to measure either, biodiversity responses (e.g. abundance, density, species richness, and diversity indices)

	Nidderdale AONB and the Yorkshire Dales National Park. This presentation will outline the developments we have made to analyse and map peat bogs in far greater detail than we previously could before. This includes but is not limited to the automated mapping of peat bog erosion features, analysis of peat bog hydrology and geomorphology, creation of photorealistic 3D terrain models, the creation of cross sectional profiles of gully systems and the 3D modelling of subsurface peat reserves. By helping us to understand and quantify erosion the information generated from these surveys will help us to target resources and make informed decisions on how and where to carry out restoration work in order protect and enhance our peat bog habitats.	or land use change metrics (e.g. total habitat amount and its distribution within the landscape). I will showcase two of our research projects, established to develop and inform reliable measurements of forest degradation impacts. I present findings from the **BIOFRAG** project (https://biofrag.wordpress.com/), showing how the creation of forest edges through fragmentation alters abundance and diversity of taxa across continents. I visualise these responses using image analysis methods developed in our research group. I will provide evidence for non-linear responses of canopy structure on the interplay between climate, disturbance and plant functional types across tropical realms using data compiled within the Global LAI project (https://globallai.wordpress.com/). **3 minute 'SOAPBOX'** **Extinction risk of the world's timber trees: reliability and applicability of GBIF data and Species Distribution Models in applying IUCN Red List categories to widespread, little-known tree species.** Jennifer Mark [1], Prof Adrian C. Newton [1], Dr Duncan Golicher [1] and Sara Oldfield [2] [1] Faculty of Science and Technology, Bournemouth University, Poole, UK [2] Biodiversity Consultant and Chair of IUCN/SSC Global Tree Specialist Group
15:45	**TEA/COFFEE BREAK**	
16:00	**Symposium 3: Plenary workshop** Discussion of key issues, needs, trends and future directions	**Symposium 4: Plenary workshop** Discussion of key issues, needs, trends and future directions
17:00	**End of first conference day**	

19:00	**Conference meal and evening dance**

DAY 2: Tuesday 14 July

09:00	**Conference updates, news and thematic introduction to day 2** Dr Mark O'Connell, Director of ERT Conservation	
	SYMPOSIUM 5 **Is there safety in numbers? Can we be confident with our Species Distribution Models?**	**SYMPOSIUM 6** **Online mapping and decision support tools for conservation - current uses and future directions**
09:10	**Keynote presentation by session Leader** **Marcia Barbosa,** University of Evora Presence-only, presence-background and presence-absence models will be discussed, focusing on their transparency, fragilities and potential. Successful case studies will show how distribution models performed when compared to independently obtained occurrence data, either at finer resolution scales, or at different time periods: (1) the performance of coarse-scale models of Eurasian Otter and Iberian Desman distribution when re-scaled to a 10 times finer resolution, (2) the ability of an Iberian Lynx distribution model to predict routes of tentative dispersal, (3) a Betic Midwife Toad model predictions of the expansion of the species' distribution, and (4) how Spadefoot Toad and Ribbed Newt models predicted the location of their glacial refugia and genetic diversification centres. The fuzzy-logic approach to biodiversity analyses in general and to	**Keynote presentation by session Leader** **Lucy Bastin,** European Commission, Joint Research Centre There is a considerable need for spatial information systems that allow ecologists, conservation practitioners and policy makers to utilise the vast amounts of available environmental data, and to share and communicate their working processes along with their predictions and recommendations. Streamlined systems are required to manage diverse datasets - often very heterogeneous in their format and quality - and to generate high-utility outputs which are accessible and informative. To achieve this goal, it is vital that the component tools we develop, whether Web-based or stand-alone, are scalable, interoperable, and if possible 'open source'. These priorities assist in carrying out truly reproducible science, where transparent access to the data and models of an analysis allows decisions to be more robustly defended by permitting the repetition of a workflow. As better data becomes available, or as scientists learn more about the inherent

	species distribution modelling in particular will be discussed, with particular reference to making full use of the quantitative information contained in models, and avoiding arbitrary thresholds that over-simplify model predictions. Lastly, methods will be discussed to allow the evaluation of distribution models, based not only on how well they discriminate presences from absences, but also on how the continuous predictions relate to observed distribution patterns.	uncertainties in their inputs, workflows can be reused and adapted to assess the impact of real-world factors. This symposium will present information about current initiatives, future needs and important challenges in this area.
09:40	**Providing SDM based abundance predictions with confidence and prediction intervals using random and quantile regression forests** Christian Kampichler and Henk Sierdsema Sovon Dutch Centre for Field Ornithology, The Netherlands. Abundance maps produced by species distribution models (SDMs) are increasingly used by decision-makers for supporting local and regional land-use and landscape planning issues. While ecologists generally are interested in large-scale patterns and the overall quality of SDMs, decision makers and conservationists focus on the reliability of quantitative predictions relevant for specific management issues such as the designation of nature reserves or the allocation of new infrastructure (roads, business parks). Typically, they call for site-specific information on the number of individuals of a given species or on total population size in a given region, as well as information on the reliability of these model-based predictions. Here, we describe how we use the machine learning methods Random Forest and Quantile Regression Forest in order to generate confidence and prediction intervals of SDM predictions. Confidence intervals characterize the reliability of parameter estimation (e.g. the mean) whereas prediction intervals are a measure of the probability that a future observation will lie between certain limits. We apply this approach to monitoring data of Dutch breeding birds and present national abundance maps and estimates of bird population sizes including confidence and prediction intervals.	**Mapping biodiversity conservation projects: Who is doing what where?** Bowy den Braber, Luca Battistella, Bastian Bertzky & Gregoire Dubois European Commission, Joint Research Centre (JRC), Institute for Environment and Sustainability (IES), Via E. Fermi 2749, 21027 Ispra (VA), Italy International development and conservation organizations fund biodiversity related projects worth over US$ 1 billion per annum around the world. So far information on these projects has been highly scattered, difficult to access and assess, and usually not mapped. To improve decision making within the funding organizations and wider conservation community, we have created a new web service that delivers critical information on biodiversity conservation projects worldwide in an interactive mapping interface. The so-called e-Conservation service is an important module of the Digital Observatory for Protected Areas (DOPA) developed by the European Commission. It provides a means to collect, share and search information on conservation projects. So far over 5000 projects across five continents from major donors including the World Bank, Global Environment Facility and EU LIFE Programme have been included and georeferenced. The projects can be searched in an interactive mapping interface based on criteria such as location, objectives, timeframe, budget, the organizations involved, target species etc. The service allows users to see " *who is doing what where*" at various scales, helps to increase transparency in conservation funding, facilitates analyses of the effectiveness of such funding in terms of conservation outcomes, and should help to improve land management.

09:55	**A (reproducible) distribution model for benthic species applied to cold water corals of Norway and Iceland** Genoveva Gonzalez-Mirelis (1), Julián M. Burgos (2), Pål Buhl-Mortensen (1) 1 Institute of Marine Research, Norway 2 Marine Research Institute, Iceland Species Distribution Models (SDM) have become a very popular method in conservation biology, particularly as applied to conservation planning, because they provide an alternative to expensive and time-consuming field data collection. In spite of the wealth of literature on SDM it remains challenging for ecologists to build on our colleagues' work, as models are often fine-tuned to suit the particularities of each case study. We have fitted identical models predicting the distribution of two cold-water corals, *Lophelia pertusa* and *Primnoa resedaeformis,* in two study areas, off Northern Norway and Eastern Iceland. Both areas were around 70 000 km^2 in size. Predictions were generated for a 200-m pixel size. We used depth, terrain class at a range of scales, bottom current speed, temperature, and salinity as predictors. The code for the model is available online. This modeling exercise allowed us to compare the importance of drivers in the two areas and find regional differences. This knowledge contributes to our understanding of (medium-scale) distribution patterns of cold-water corals. The findings also have direct applications in regional conservation planning. We demonstrate that a reproducible model better enables real progress in SDM.	**GeoAviR : an R package and web app for the computation of densities of seabird at-sea multi-species datasets** François Bolduc 1, Christian Roy 2 & Mehdi Adda 3 1 Canadian Wildlife Service, Environment Canada, 1550 Ave d'Estimauville, Quebec City, Quebec, Canada. 2 Département de Biologie, Université du Québec à Rimouski, 300 Allée des Ursulines, Rimouski, Quebec, Canada 3 Département de mathématiques, d'informatique et de génie, Université du Québec à Rimouski, 300 Allée des Ursulines, Rimouski, Quebec, Canada The Canadian Wildlife Service (CWS) collects data on seabird at-sea on the eastern coast of Canada since 2006. The CWS frequently receives requests for data and therefore new outputs presenting correct densities of multiple seabird species must be prepared. To facilitate and ensure proper data treatment, we developed the R package GeoAviR. This R package allows users to import data, and offers the option to either compute densities over a study area, predetermined spatial zones, or a spatial grid constructed via the package. Density estimates can be computed for data collected using the line-transect method and distance sampling, or the strip-transect method. GeoAviR allows subsetting the data by species to launch simultaneous analyses, and therefore facilitate the usage of multi-species datasets. From the options selected by the user, the package builds an input file that is sent to the MCDS engine of the Distance software. To facilitate the access to GeoAviR to scientists with little knowledge of R, we built a web app called GeoAviRWeb (GeoAviRWeb.ddns.net) that allows the user to perform analyses through menus and buttons. GeoAviRWeb also allows the user to map seabird densities and save estimates in a shapefile for later use.
10:10	**Species distribution modelling reveals important areas for inclusion within MPA network** Black, J.[1,2], Wilson, L.[1], Brewer, M.[2], Potts, J.[2], Kuepfer, A.[1], Win, I.[1] 1 Joint Nature Conservation Committee (JNCC) 2 Biomathematics and Statistics Scotland (BioSS) As part of a wider programme of work to identify the most suitable areas of sea to be included within a network of marine protected areas for marine birds, JNCC undertook a programme of visual	**The Condatis software for improving long-distance connectivity in ecological networks** Jenny A. Hodgson 1, David W. Wallis 1 and Paul Evans 2 1 University of Liverpool 2 Buglife Species and ecosystems have limited capacity to survive climate change, especially in industrialised landscapes where natural habitats are fragmented, populations are small, and it is difficult for species to colonise

	tracking followed by species distribution modelling for four tern species which breed in the UK. This work allowed identification of important foraging areas at sea around large breeding colonies for these species. The analysis was undertaken in two phases: Phase 1 produced colony-specific models for each colony at which visual tracking had been undertaken (interpolation). Phase 2 produced general models based on the colonies for which we had tracking data, and which could then be applied to any tern colony of interest in the UK (extrapolation). Cross-validation was part of the phase 2 model selection process to ensure the model focused on covariates which act generally across colonies (ie ignoring colony-specific patterns). This presentation will chart the process of developing species distribution models for applied conservation use within a statutory nature conservation body, and can be seen as a 'how-to' guide. The challenges of combining ecological realism with statistical rigour, producing outputs in a meaningful numerical scale, and creating phase 2 models and outputs that we could defend in the face of challenge, will be discussed.	new sites. In response to this challenge, many organisations are turning to ecosystem restoration, and aim to build a functioning ecological network which will be resilient to future shocks. Building networks may require coordinated action by a diverse body of land users and landowners on an unprecedented spatial scale. Decision support tools can be invaluable to synthesise complex, spatial data and help to prioritise limited resources to make networks "bigger, better and more joined up". We have developed a new model, Condatis, to show which habitat arrangements might maximise connectivity over very long distances. Condatis is based on novel theory on how the spatial pattern of habitat affects the speed of range expansion into fragmented landscapes. Condatis has been trialled by several UK conservation organisations, and is currently being used by Buglife to guide investment in their B-lines network, which aims to create nationwide corridors of habitat for pollinators. We show the benefits that Condatis has brought in this case study, and discuss how Condatis can complement other modelling approaches.
10:25	**Methods of Assessing Spatio-temporal Variation in Harbour Porpoise Distribution and Activity** Laura D. Williamson[1,2], Kate L. Brookes[2], Beth E. Scott[1], Paul M. Thompson[3] [1] Institute of Biological and Environmental Sciences, University of Aberdeen, Aberdeen AB24 2TZ, UK [2] Marine Scotland Science, Marine Laboratory, 375 Victoria Road, Aberdeen, AB11 9DB, UK [3] Institute of Biological and Environmental Sciences, Lighthouse Field Station, University of Aberdeen, Cromarty, IV11 8YJ, UK Habitat modelling has been used to assess the distribution of many species, often with the aim of supporting management decisions or assessing the potential impacts of anthropogenic disturbance. However, such models have often been limited to including static environmental variables. By analysing harbour porpoise detections from acoustic recorders (C-PODs), we will be able to assess the influence of fine-scale oceanographic variables on the spatial and temporal distribution and activity of harbour porpoise and dolphins.	**A decision support framework to prioritize coral reefs for conservation in the US Virgin Islands** Simon J. Pittman Biogeography Branch, US National Oceanic and Atmospheric Administration & Marine Institute, Plymouth University, UK The coral reef ecosystems of the US Virgin Islands are some of the most intensively surveyed tropical ecosystems on earth, yet managers do not currently have the data accessible in a framework that supports risk assessments and prioritization of management actions. The Biogeography Branch of the U.S. National Oceanic & Atmospheric Administration is designing a novel decision support tool that integrates data on seafloor structure, habitat connectivity and biodiversity along with local expert knowledge and threats to resilience to characterize and rank priority coral reefs. The map based tool will support investments in coastal management, coral reef conservation and marine spatial planning.

	The data for this study have been collected between 2009 and 2015 at over 100 locations in the Moray Firth, Scotland. Advanced hydrodynamic model data (e.g. FVCOM) and statistical techniques such as spatial point processes and joint species distribution modelling will be used to assess the fine-scale spatio-temporal drivers of harbour porpoise distribution and activity. This will result in improved understanding of how harbour porpoises make use of specific environmental variables and how interspecific competition with dolphins may influences their distribution. One of the applied outcomes of these results will be to underpin investigations of the influence of habitat quality on harbour porpoise responses to disturbance from offshore wind farm developments.	
10:40	**Symposium 5: Plenary workshop** Discussion of key issues, needs, trends and future directions	**Symposium 6: Plenary workshop** Discussion of key issues, needs, trends and future directions
10:55	**TEA/COFFEE BREAK**	
11:25	**Symposium 5: Plenary workshop** Discussion continued….	**Symposium 6: Plenary workshop** Discussion continued….
13:00	**LUNCH** **Poster session 2** **Exhibition stands**	
14:15	• **Opportunity for networking** • **Training and demonstration workshops:** 1. **Unmanned Aerial Vehicles (UAVs)** *Andrew Fletcher, University of Queensland* A field trip to a local Bristol site to demonstrate the collection of imagery of local habitats using a UAV.	

2. **Should we focus on biodiversity hotspots or biodiversity coldspots?**

Richard J. Smithers (1) and Kevin Watts (2,3)

(1) Ricardo-AEA Ltd, (2) Forest Research,(3) University of Stirling

Global 'biodiversity hotspots' have been defined as places supporting exceptional numbers of endemic species threatened by exceptional rates of habitat loss. The idea of focusing on such hotspots was first put forward in 2000 as a strategy for conserving the greatest number of species at least cost. However, from an ecological perspective, the concept is contentious for a variety of reasons. For example: biodiversity value cannot simply be measured by species-richness; the credentials of hotspots has only been judged by the presence of species groups for which data is most readily available, ie vertebrates, macro-invertebrates and flowering plants; and biodiversity faces many other threats in addition to habitat loss. Nevertheless, the idea of biodiversity hotspots has also since been transposed from a global level to national and local levels confounding its original intentions. Furthermore, the prospect of rapid climate change this century brings into question whether the strategy of focusing on biodiversity hotspots is tenable or whether effort should also be invested in 'biodiversity coldspots' in order to enable species to move between hotspots. We will review from an ecological perspective the pros and cons of focusing on biodiversity hotspots versus focusing on biodiversity coldspots, highlighting intuitive and counterintuitive concepts.

3. **Using microclimate to adapt conservation to climate change**

Robert Wilson, Ilya Maclean, Andrew Suggitt

University of Exeter

The University of Exeter has been running a knowledge exchange project about the use of microclimate to adapt conservation to climate change. We have developed a set of guidance and a freely available GIS dataset of topographic features of the microclimate to be used by conservation organisations. We will demonstrate the 5 m resolution dataset including measures of solar radiation and topographic wetness for South-West England, and are keen to discuss with conference attendees how this information can be incorporated usefully in conservation planning and practice in a changing climate.

4. **CONDATIS: a tool for planning habitat restoration to improve the connectivity of habitat networks on large spatial scales in the context of climate change**

David Wallis and Jenny Hodgson

University of Liverpool

Condatis is a user-friendly software application developed by David Wallis and Jenny Hodgson at the University of Liverpool under a partnership project funded by NERC and with the involvement and support of the UK devolved conservation agencies, Forest Research, RSPB, Buglife and Wildlife Trusts. The aim of the project is to help with planning habitat restoration to improve the connectivity of habitat networks on large spatial scales in the context of climate change. The model works by calculating range shifting speed: that is how quickly a species could spread through and populate the landscape, over multiple generations, from one end to the other or between defined source and target locations. The speed takes into account the relationship between distance and dispersal probability, and also the fact that when there is more habitat, there are larger populations producing a greater number of dispersers overall. In this introductory workshop we will explain how Condatis works, and run through a few exercises with demo data that will be provided. We will cover the import and export of data, choosing source and target locations, and viewing and interpreting the results of the flow calculations. We will then show two ways in which restoration planning can be optimised: firstly by viewing the most serious bottlenecks in the landscape and editing the habitat manually to relieve these, and secondly by loading a map of potential restoration areas and ranking them in terms of their ability to

	enhance the existing habitat network. 5. **Full circle: closing the loop between biological recorders and data analysts** *Thomas Starnes, Amphibian and Reptile Conservation* Biological recording, famously prolific in Victorian times, is undergoing a renaissance largely driven by the development of mobile technology and online recording. Biological recording in itself is an educational and rewarding pastime, but what happens to these records once they have been submitted? Innovative methods in spatial analysis are putting these data repositories to use in the name of conservation, but it doesn't end there. We need more data and we can tell you where we need it! There needs to be a conversation here. Amateur naturalists, data analysts and anyone with an interest in the relationship between recording and investigating biological data is welcome to attend this workshop. We hope to see you all there for a vibrant and productive interactive workshop.
15:45	TEA/COFFEE BREAK
15:40	Networking, training & demonstrations continued…..
17:00	**End of second conference day**

DAY 3: Wednesday 15 July

09:00	**Conference updates, news and thematic introduction to day 3** Dr Mark O'Connell, Director of ERT Conservation	
	SYMPOSIUM 7 **Spatial planning for sustainable landscapes: a key**	**SYMPOSIUM 8** **Seeing the wood for the trees: Object-based Image**

	role for spatial ecology?	Analysis to measure habitat condition and change
09:10	**Keynote presentation by session Leader** **Mark Steer,** University of West of England Balancing the economic pressures associated urban, agricultural and industrial development, with biodiversity conservation is a difficult task for planning authorities. The use of 'ecological networks' as planning units is now enshrined in a variety of policy statements and legislation. But what do we mean by 'ecological networks', how do we map them, and how can we communicate them to local decision makers and planning authorities. This symposium will examine specific roles for ecologists and practitioners in spatial planning, and identify key methodological needs in this area.	**Keynote presentation by session Leader** **Dirk Tiede,** University of Salzburg Object Based Image Analysis (OBIA) provides a range of tools and methods for the advanced and automated classification of remotely sensed data into maps with enormous utility for conservation. The integrated analysis of (high-resolution) data from different sources and the promised (maybe not redeemed) provision of GIS-ready information predestines OBIA to be used in conservation (monitoring) workflows. This talk will provide an overview about different applications conducted at the Department of Geoinformatics – Z_GIS, University of Salzburg, during the last years, varying in terms of data usage and scale as well as information complexity and integration of different degrees of expert knowledge. Open challenges of transferability (parameterisation of expert rule-sets, data pre-processing) and automation (including large-scale processing issues) will be discussed.
09:40	**Ecological networks in practice: providing evidence for spatial planning and habitat management decisions with informative and intuitive indicators** Shelley Barbour, Chloe Bellamy, Vanessa Burton, Darren Moseley, Kevin Watts Forest Research, UK Planning Authorities and developers have a duty of care to species and their habitats under UK law, and are encouraged to develop ecological networks to map and protect them. Ecological network analysis can provide valuable quantitative, spatial information on habitat connectivity, but it is often unclear how the networks should be used. Furthermore, the outputs must often be further interrogated in order to translate the data into action 'on the ground'. We provide examples of the tools and frameworks we have developed with practitioners to aid understanding and to derive more detailed information from ecological networks, in order to facilitate better targeted, evidence based decision making. These	**Prototype of an object-based reference database for biodiversity studies in Wallonia** Radoux, Julien 1; Coos, William 2 ; Jacquemin, Floriane 2; Delangre, Jessica 2; Hawotte, Florent 1; Dufrêne, Marc 2; Defourny, Pierre 1 1 Université catholique de Louvain, Earth and Life Institute, Environmental Sciences, B-1348 Louvain-la-Neuve, Belgium 2 Université de Liège, Gembloux Agro-Bio Tech, Biodiversité et Paysage, B-5030 Gembloux, Belgium Lifewatch-WB is a Belgian contribution to build a European Research Infrastructure Consortium for biodiversity research. In this framework, we aim to distribute a geographic database tuned for the biodiversity research community. In this study, a prototype of object-based geographic database is presented. This database has been produced based on ortho-photos (2009-2010 and 2012-2013) and LIDAR data (2013) resampled at a spatial resolution of 2m for the Walloon region (South of Belgium, approximately 17000 km²). Image-objects are extracted from the images based on the multiresolution segmentation algorithms in order to capture consistent landscape units: ecotopes. The ecotopes are not classified using a

	include a GIS tool for measuring the impacts of landcover change on priority habitat connectivity across a Nature Improvement Area, a framework for assessing the 'ecological potential' of vacant/derelict land sites in a development zone, and a tool for scoring habitat patches and networks according to their ecological coherence, resilience, and potential for improvement via explicit actions.	categorical classification system, but they are characterised based on the proportion of land cover elements that they contain. A large set of ancillary data is then provided for each polygon, including land use, contextual information, abiotic factors and metrics representing the land cover dynamic. This combination of quantitative attributes creates a flexible database that is difficult to represent, but is easy to import into the majority of the statistical models used for habitat modelling and biotope characterisation. It can also be used for monitoring the ecotopes status based on the changes of attribute values.
09:55	**Putting Landscape Science into Strategy: the experience of the Warwickshire, Coventry and Solihull Green Infrastructure Strategy** David Lowe[1] and Chris Talbot[2] 1 Principal Ecologist, Ecological Services, Warwickshire County Council. 2 Habitat Biodiversity Manager, Habitat Biodiversity Audit (HBA) Partnership, Warwickshire Wildlife Trust The Warwickshire sub-region Green Infrastructure Strategy is a planning driven policy document that combines the strands of Landscape, Biodiversity and Accessibility to '*Create a Connected Landscape for People and Wildlife'*, based on Landscape Character, Landscape Ecology and Accessible Green Space practices. The ecological aspects of the GI Strategy is evidenced on the HBA Phase 1 habitat data, and modelled by the using the incidence function model (IFM) measure of inter-patch distance. The model uses average dispersal distances to give each polygon an estimate of the functional connectivity. These parameters are applied to woodland, grassland and wetland habitat categories. The connectivity maps evidence the 'Lawtonian' Biodiversity Priorities of: (1) Connect individual sub-regional GI Biodiversity assets to create large functional clusters, (2) Connect the large functional clusters. The data are also used to identify the strategic areas for Biodiversity Offsetting: (1) Strategic Areas, where habitat enhancement or creation will connect habitats, (2) Semi-Strategic Areas –where habitat enhancement or creation will expand existing habitats, and (3) Non-Strategic Areas - where habitat enhancement or creation	**Mapping and identifying species from the air: the very high resolution challenge for plant conservation** Susana Baena, Justin Moat, Oliver Whaley, Ana Maria Juarez Chunga and Amanda Cooper Royal Botanic Garden, Kew, UK The Pacific Equatorial dry forest of Northern Peru is recognised for its unique endemic biodiversity. Although highly threatened the forest provides livelihoods and ecosystem services to local communities. As agro-industrial expansion and climatic variation transform the region, close ecosystem monitoring is essential for viable adaptation strategies. UAVs offer an affordable alternative to satellites in obtaining both colour and near infrared imagery to meet the specific requirements of spatial and temporal resolution of a monitoring system. Combining this with their capacity to produce three dimensional models of the environment provides an invaluable tool for species level monitoring. Here we apply object-based image analysis to very high resolution UAV images in order to identify and map the keystone tree species and their health across the landscape. Multispectral, contextual and textural information along with UAV-derived tree height information was used to differentiate the species. Results demonstrate that object-based image analysis is an effective image processing technique to analyse very high resolution images allowing for the identification of individual tree species and composition across wide heterogeneous landscapes. The analysis exposes the state of the vegetation and serves as a baseline for monitoring and adaptive implementation of community based conservation and restoration in the area.

	will not expand existing habitats. Ultimately, connectivity modelling enables practitioners to put "*the right habitat in the right place*" and create a functioning Ecological Landscape.	
10:10	**Ecological networks: nice idea but do we actually know enough?** Kevin Watts[1,2], Elisa Fuentes-Montemayor[2], Nicholas Macgregor[3] & Kirsty Park[2] [1]Forest Research, [2]University of Stirling, [3]Natural England The concept of ecological networks has been widely embraced, by the conservation policy and practitioner communities, as an effective response to biodiversity conservation in fragmented landscapes. It is hoped that these networks will ameliorate the impacts of fragmentation by allowing the movement of species, propagules and genes between isolated fragments. Although this approach is appealing and based on sound scientific principles, the empirical evidence is equivocal and there is much debate on the relative merit of, and balance between, alternative conservation actions. We review the existing evidence for six factors, which underpin ecological network thinking, and assess their relative impacts on different species groups. We consider three site-level factors (i) patch size, (ii) patch characteristics/quality and (iii) ecological continuity/age; and three at the landscape-level, (iv) amount of surrounding habitat, (v) degree of spatial isolation and (vi) nature of the surrounding matrix. We also present preliminary results from a long-term, large-scale natural experiment (WrEN – **W**oodland C**r**eation and **E**cological **N**etworks) specifically designed to unpick the relative merit of local and landscape-scale actions through the systematic study of past woodland creation. This evidence will improve our understanding of ecological networks and inform the effective design and implementation of future conservation landscapes.	**Habitat mapping in Hong Kong's country parks using object-based image analysis and spectral un-mixing** Janet Nichol, Charles Wong Department of Land Surveying and Geo-Informatics, The Hong Kong Polytechnic University, Hunghom, Kowloon, Hong Kong Due to the high time and cost requirements of traditional mapping techniques, accurate and detailed habitat maps for large areas are uncommon. This study investigates the application of IKONOS Very High Resolution (VHR) images to habitat mapping in the rugged terrain of Hong Kong's country parks. A required mapping scale of 1:10,000, a minimum map object size of 150m² on the ground and a minimum accuracy level of 80% were set as the mapping standards. Very high quality aerial photographs and digital topographic maps provided accurate reference data for the image processing and habitat classification. A comparison between manual stereoscopic aerial photographic interpretation and image classification using pixel based and object based classifiers was carried out. Image segmentation using spectral, textural and scale parameters was used to create objects for subsequent classification along with ancillary data, using a multi-level decision tree approach. To determine objective thresholds between mixed habitats such as shrubby grassland, a method of fuzzy boundary delineation was devised by spectral unmixing of segment endmembers. Manual mapping from air photos combined with fieldwork obtained the best result, with 95% overall accuracy, but both this and the object-based method, with 94%, easily met the 80% specified accuracy standard. The method was able to achieve similar accuracy to aerial photographs, but at only one third of the cost.

10:25	**Can habitat connectivity be increased by closing roads? Results from a coupling of ecological networks and human networks** Maarten J. van Strien & Adrienne Grêt-Regamey Planning of Landscape and Urban Systems PLUS, Institute for Spatial and Landscape Development, ETH Zurich, Switzerland Habitat connectivity is important for species' survival. Therefore, the integrity of ecological networks (i.e. habitat patches connected by animal movement) should be maintained. However, this integrity is often threatened by human networks consisting of settlements connected by roads and traffic. Spatial ecological and human networks are thus interdependent, meaning that changes in one network can bring about unexpected changes in the other network. For instance, road closures in the human network can alter traffic flows, which could have both positive and negative effects on overall habitat connectivity. To better understand such interactions, we have performed simulations with coupled ecological and human networks. For several species (tree frog, hedgehog and badger), we determined the effect of road closures on habitat connectivity. For different settlement configurations, we compared habitat connectivity in dense road networks to that in sparse networks. Surprisingly, we found that in landscapes with relatively low settlement density, random closure of roads reduced habitat connectivity. However, we also found that if road closures are planned taking the total human network into account, reduction of habitat connectivity can be prevented. We emphasize the importance of considering complete ecological and human networks and their interactions when planning measures to increase habitat connectivity.	**Symposium 8: Plenary workshop** Discussion of key issues, needs, trends and future directions
10:40	**Rearranging agricultural landscapes towards habitat quality optimisation: ecological engineering applied to pest regulation** Nicolas Parisey, Yoann Bourhis and Sylvain Poggi	

	INRA, UMR1349 IGEPP, Domaine de la Motte, 35653 Le Rheu, France Modern agriculture suffers from its dependence on chemical inputs and subsequent impact on health and environment. An alternative strategy for a sustainable agriculture lies in the reinforcement of ecological processes to protect crops against pest. Our work propounds a data-driven methodological framework to derive relevant agricultural landscape rearrangements enhancing populations of beneficial organisms regulating pest. Building on spatialized entomological and geographic data, we developed a parsimonious reaction-diffusion model describing the population dynamics of beneficial organisms. Parameter estimation took advantage of a Bayesian framework accounting for uncertainty measure. Starting from a real landscape, a set of new landscapes was generated under agronomic specifications dealt with as a constraint satisfaction problem. The population was simulated on each landscape and a metric of abundances allowed their ranking regarding the investigated ecosystem service. This ranking was compared to another resulting from the analytical mean field solution based on land-cover proportions. Our framework was applied to the case study of ground beetles regulating weeds. Most remarkably, our findings highlighted differences between rankings, thus confirming that relevant landscape spatial rearrangements improved pest regulation. Minor adaptation of our integrated data-driven approach would suit numerous situations ranging from the provision of enhanced ecosystem services to land management for conservation.		
10:55	**TEA/COFFEE BREAK**		
11:25	**Symposium 7: Plenary workshop** Discussion of key issues, needs, trends and future directions		**Symposium 8: Plenary workshop** Discussion of key issues, needs, trends and future directions
13:00	**LUNCH** **Exhibition stands**		

14:15	**Concluding plenary** **Scanning the horizon: core future needs and developments for spatial ecology and conservation** What next for spatial ecology and its use to underpin conservation? **Session Leader:** Mark O'Connell, ERT Conservation
15:30	**End of final conference day** **TEA/COFFEE and farewells**