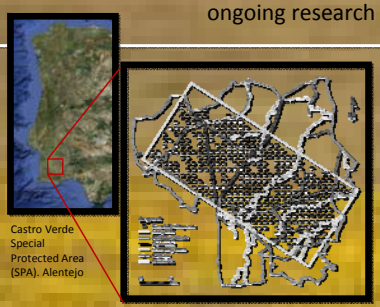
Responses of grassland birds to drought events in Portugal

Susana Dias, Francisco Moreira, Inês Catry, João Paulo Silva & Francisco Rego

Centro de Ecologia Aplicada Prof. Baeta Neves (CEABN), Instituto Superior de Agronomia, Technical University of Lisbon, Portugal

susanadias@isa.utl.pt

Under a global change scenario Portugal is likely to be affected by more frequent and intense droughts and heat waves (Santos et al., 2001), with negative repercussions on cereal production and quality (INAG 2006). Castro Verde is the main area of cereal steppes in Portugal (ca. 800000 ha), having international importance for several steppe bird species with unfavourable conservation status the like Little Bustard *Tetrax tetrax*) and Lesser Kestrel (*Falco naumanni*). When combine, drought and summer heat induce changes in the availability of food, water and cover (e.g., Catry et al. 2011, Moreira et al.2012). A better understanding on how these species respond to such changes will facilitate future monitoring and conservation actions. Examples of ongoing research on this thematic within *DROUGHT R&SPI* are presented.



Castro Verde Special Protected Area (SPA). Alentejo

1. Effect of drought events on population trends of steppe birds

Comparing breeding population estimates after dry and normal years (e.g., 2005 and 2010)

Methods: 5mn counts (with 125m distance limit) on 370 sampling points over a grid of 1km x 1km on pseudosteppe habitats(15 april-15 May of 2005 and 2010). Abundance of habitat type by visual estimation on each point. Population estimates using DISTANCE program.

Scientific name	unit	2006	2011	?(%)	Z-test
Emberiza calandra	pairs	15652-20561	20674-26803	+31.2	***
Melanocorypha calandra	pairs	9699-16895	9699-16895	+26.9	***
Galerida spp.	pairs	6450-11686	10803-17767	+59.6	***
Tetrax tetrax	males	3743-6089	4126-6583	+9.2	***
Saxicola torquatus	pairs	1691-4440	2032-5161	+18.2	***
Cisticola juncidis	pairs	2897-5669	21987-32486	+559.6	***
Alectoris rufa	birds	1396-3437	2375-5295	+61.9	***
Calandrella brachydactyla	pairs	2449-6918	1750-4938	-28.6	***
Circus pygargus	birds	613-1883	961-2902	+55.5	***
Coturnix coturnix	birds	735-1779	3254-5404	+266.5	***
Burhinus oedicnemus	birds	533-2052	437-1737	-16.6	ns
Upupa epops	birds	1021-3218	972-3104	-4.1	ns
Anthus campestris	pairs	486-1844	81-614	-76.5	***
Oenanthe hispanica	pairs	296-1268	169-899	-36.4	*

Breeding population estimates (95% confidence intervals) for each species for 2006 and 2011. ?: variation in the average estimates 2006-2011 (in %); significance of the z-test to compare years: ns= non-significant, *=p<0.1, ***=p<0.01. Units for the estimates: breeding pairs, males or total number of birds.

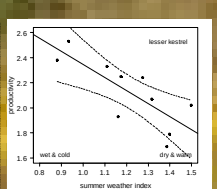
Results: Between 2006 and 2011, bird abundance increased 66% (median= 22.5%, range=-76.5% to 559.6%, n=14) suggesting that bird populations in 2006 were still suffering the impact of the 2005 drought, and that the situation in 2011 is more representative of an average climatic context. The species registering the strongest population increases were the ones associated with cereal fields (in green), in spite of the decreased availability of this habitat. This suggests that the 2005 drought was the main driver of a significant population crash and of the subsequent increasing population trend in spite of the ongoing habitat loss for this set of species. In contrast, the species registering the largest losses were the ones associated with sparse vegetation and bare ground (in yellow), and for which the 2005 drought might have caused an increase in habitat quality.

2. Local weather conditions and nest-site microclimate effects on the breeding performance of lesser kestrels

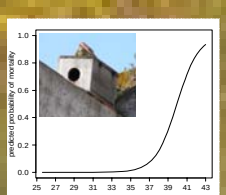
Methods: Long-term monitoring (2003-2012) of breeding parameters; weather variables were sumarized with PCA to obtain a proxy of the weather conditions along a "cold and wet"-"warm and dry" gradient.

Nest-site microclimate along the breeding season was assessed in different nest-types using temperature data-loggers

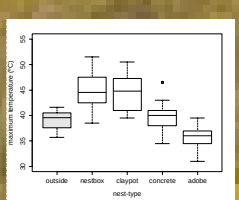
First Results:



Productivity (number of fledglings per breeding pair) of lesser kestrels in relation to summer (16 May to 1 July) weather. Lower values are associated with drier and hotter years. Black dots represent annual productivities from 2003 to 2012. The solid line represents the regression fitted to the dataset ($P < 0.01$) and the dotted line the 95% CI.



Increased probability of chick mortality within wooden nest-boxes as the maximum daily temperature experienced by nestlings becomes higher. Mortality is defined as either 0 (no nestlings dying) or 1 (at least one nestling dying). The regression line was fitted using a logistic regression.



Maximum daily temperatures recorded in different nest-types during the nestling period in 2012. Air temperature in the exterior (white box), is shown for comparison. Only days with maximum temperatures > 35 ºC were included. Median, upper and low quartiles (box) and the range (whiskers) are represented.

Further analyses:

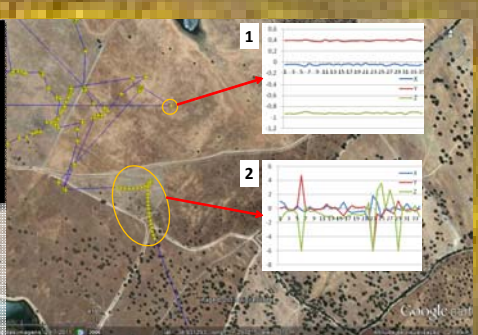
Relating body condition with nest-site microclimate;

Comparing bird body condition and stress levels between dry and normal years (e.g., 2012 and 2011).

3. Drought effects on little bustard behavior and habitat use during breeding and post-breeding seasons

Methods: Little Bustard habitat quality was assessed by NDVI (Normalized Difference Vegetation Index) data (images from 1983 to 2005). Six males were captured, tagged and tracked with GPS/3D accelerometer loggers (April –July 2012);

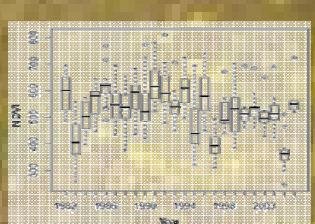
First Results:



Little Bustard movement pattern and behaviour (GPS fixes and 3D acceleration readings, at a rate of 1 reading per second) at different times of the day illustrating:1 – inactive behaviour that tends to occur during heat hours and night; 2 – flight activity that occurs during the beginning and end of the day.

Temporal variation of the NDVI (1982-2005) at the sites where the Little Bustard's occur in Portugal. Severe drought events in southern Portugal were reported for 1983, 1995, 1997 and 2005.

NDVI can be used as a proxy for bird habitat quality in cereal steppes.The Little Bustards subsist in areas of extensive agriculture, in less productive soils, presenting a lower NDVI, thus less resilient to drought episodes.



Further analyses:

Modelling bird activity with temperature and with habitat quality

Comparing daily behaviours and movements between dry and normal years (e.g., 2012 and 2011).

References:

Catry I., Franco A. Sutherland W. J., (2011). Adapting conservation efforts to face climate change: Modifying nest-site provisioning for lesser kestrels. *Biological Conservation*, **144**: 1111–1119

INAG (2005). *Seca 2005. Relatório de balanço*. Instituto da Água, Lisboa

Moreira et al., (2013). Population trends in the steppe birds of Castro Verde in the period 2006-2011: consequences of a drought event and land use changes? *Airo*, **22**: 79-89

Santos, F.D., Forbes, K., Moita, R. (Eds.), 2001. Climate Change in Portugal. Scenarios, Impacts and Adaptation Measures. Executive Summary and Conclusions. SIAM,Gradiva, Lisbon.