

**Effects of Meteorological Conditions on the Outbreak and Dispersal of the Desert Locust
*Schistocerca gregaria***

(サバクトビバッタの大発生と分散に及ぼす気象条件の効果)

北海道大学大学院 環境科学院

環境起学専攻 統合コース

Catherine Appiah (かとりん あびあ)

Outbreaks of the desert locust, *Schistocerca gregaria* (Förskal), have remained as a constant threat to agricultural production in Sahel region of Africa, Middle East and South-west Asia (India) for centuries. The Food and Agriculture Organization (FAO) of the United Nations reports that sixty countries in this area are threatened by swarms of the desert locust during a plague.

In this study I tried to extract meteorological and ecological factors affecting the outbreak and dispersal of the desert locusts in Mauritania based on 1985-2006 data of locust abundance well documented by FAO and concurrent meteorological data of rainfall (GPCP), winds and temperature (ECMWF) and ecological data of NDVI (NOAA) using the time series analyses with ACF (autocorrelation function) and PRCF (partial rate correlation function) and the multiple regression analysis. Main results are as follows: 1) Annual mean of locust abundance showed a large interannual variation, with peaks in 1988, 1995 and 2004. On the other hand, monthly mean of locust abundance exhibited a remarkable periodicity, with a peak in November and bottom in July. 2) Time series analysis using ACF detected statistical significance of locust abundance almost at 12 month lag. Locust abundance was then transferred into population growth rate (G_t) by $G_t = \log(A_{t+1}/A_t)$. The τ month lag effects of locust abundance index ($A_{t-\tau}$), rainfall ($R_{t-\tau}$), air temperature ($T_{t-\tau}$), westerly wind ($W_{t-\tau}$), southerly wind ($S_{t-\tau}$) and NDVI ($V_{t-\tau}$) on the locust population growth rate (G_t) were examined by time series analysis using PRCF. Accordingly, G_t was significantly correlated with A_{t-1} , R_{t-1} , R_{t-2} , R_{t-10} , T_{t-1} , T_{t-4} , T_{t-12} , W_{t-2} , S_{t-1} , S_{t-8} , V_{t-1} , V_{t-3} and V_{t-4} . 3) Stepwise regression analysis was conducted using A_{t-1} , R_{t-1} , R_{t-2} , T_{t-1} , W_{t-2} , S_{t-1} , V_{t-1} , V_{t-3} and V_{t-4} as independent variables and G_t as a dependent variable. For the best model, A_{t-1} , R_{t-1} , T_{t-1} , W_{t-2} , V_{t-1} , V_{t-3} and V_{t-4} were selected, and six of them other than W_{t-2} significantly correlated with G_t .

Since V_{t-1} negatively correlated with G_t , it was unlikely that the only one month antecedent rainfall enhanced population growth rate via rapid growth of vegetation. Instead, R_{t-1} probably contributed to the enhancement of G_t by providing the wet soil which activated the oviposition of adult females. The negative correlation between T_{t-1} and G_t suggested that too high temperature often deteriorates the population growth of locust. Compared with meteorological factors, the vegetation seemed more influential to the population growth of locust. In particular, V_{t-3} showed the highest positive significance, reflecting the period for the development of locust from egg to adult which takes about three months.