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THE INFLUENCE OF AQUATIC INSECT IMAGOES ON THE PREDATOR-PREY RELATIONSHIPS OF RIVER SHORE SPIDERS TOWARDS TERRESTRIAL INSECTS

Trophic relationships among arthropods were investigated along the Main River in southern Germany. We compared the abundance and biomass of arthropods living in the herb layer along the shore compared to a similar habitat some distance away from the river. This enabled us to elucidate the effect of an allochthonous resource, namely flying imagoes of aquatic insects, towards the spider community, and, in turn, on the spiders' autochthonous prey of terrestrial insects. We found that at the shore: (a) flying imagoes of aquatic insects (mainly Nematocera) were most abundant; (b) spider abundance and biomass were highest; (c) herbivorous, terrestrial insects, particularly Homoptera, were less abundant; and (d) spiders regularly captured aquatic as well as terrestrial insects. A causal link of (a) on (b) on (c) because of (d) was demonstrated by removing spiders from 18 plots of 1 x 2 m and comparing the insects found in these with those found in control plots. Spider removal caused Homoptera abundance and biomass to increase at the shore, whereas their population did not change significantly at spider-removal sites away from the shore. This indicates that the shore spider population, enriched by allochthonous Nematocera, were depressing the terrestrial Homoptera population. We interpret this in terms of the subsidisation effect, where a reliable allochthonous resource that is of little cost to the recipient habitat, has a bottom-up effect on its consumer, enabling it to exert a top-down effect on the autochthonous resources. This study contributes to the understanding of resource economics in food web dynamics.

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CREATING AND FURTHERING AWARENESS AND UNDERSTANDING OF ARID ENVIRONMENTS WITH THE DESERT RESEARCH FOUNDATION OF NAMIBIA (DRFN) INCORPORATING THE DESERT ECOLOGICAL RESEARCH UNIT (DERU)

Based at the Gobabeb Centre in the Namib Desert, the Desert Ecological Research Unit (DERU) is a centre of the DRFN for arid-land studies that conducts and facilitates basic and applied, short- and long-term research and training. Ecologists have worked here for the last 35 years, providing insights into the functioning of hyper-arid ecosystems, which are described in over 800 publications. DERU promotes the DRFN commitment to research and training in support of the Rio'92 agendas on global natural resources by helping to develop the capacity, skills and knowledge to manage arid environments appropriately. DERU's programmes include long-term ecological research (LTER), ecophysiology, community ecology, biodiversity, conservation and supporting national programmes of the DRFN, such as desertification, water management and sustainable land use. These programmes involve scientists, students, decision-makers, and the participation of local communities. Ecologists are invited to visit Gobabeb and to participate in the DRFN's programmes, or to enrich Namibia with their own projects under the auspices of DERU (P.O.Box 1592, Swakopmund, Namibia).

Introduction

A worldwide programme to combat desertification was initiated as a result of the Rio Conference in 1992. Namibia's National programme to Combat Desertification (NAPCOD) was initiated in 1994 as a joint effort between the DRFN, Ministry of Environment and Tourism and Ministry of Agriculture, Water and Rural Development.
The objectives of the programme are shortly:

- to raise national awareness of desertification,
- to conduct a preliminary assessment on desertification, and
- to prepare a proposal for a long-term programme to combat desertification.

Approximately 80% of Namibia is classified as arid and to meet the above objectives, Napcod required information on the extent, rate, causes and costs of land degradation, if in fact this was occurring at all.

In line with this requirement, Napcod commissioned the National Remote Sensing Centre (NRSC) to conduct a study on land degradation in the communal areas of the Huab catchment because most inhabitants are communal subsistence farmers farming with livestock and using management practices that are generally believed to be unsustainable.

The objective of the project was to assess the present land cover and study the possible occurrence of land degradation by:

1. developing appropriate techniques for quick but accurate assessment of land cover;
2. investigating signs of land degradation/desertification in the Huab catchment;
3. creating an opportunity for the development of staff at the NRSC in the fields of Remote Sensing, Global Information Systems and natural resource assessments.

Map 1 gives an overview of the study area.
The study area is broadly defined as the entire catchment of the Huab river.
Situated in the north western part of Namibia, the Huab catchment lies within the southern Kunene region. According to calculations, the catchment comprises an area of about 14, 153 km^2. Jacobson et al, 1995, estimated that about 62% lies within the communal farming areas, thus 8, 749.22 km^2.

Vegetation cover

According to the classification done for the whole country by Geiss (1971), most of the Huab catchment falls in the *mopane* savanna. More detailed study revealed that there is a high prominence of *mopane*, but other associations and species are more prominent in parts of the catchment.
The catchment vegetation structure and distribution is largely determined by the distribution of rainfall and the availability of water. However, soil types and geology also appear to have an effect on vegetation structure and distribution. Woodlands are limited to riverine areas with isolated pockets outside river courses. The upper catchment is characterized by more woody vegetation compared to the lower catchment which is

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LONG TERM POPULATION DYNAMICS OF TENEBRIONID BEETLES IN THE NAMIB DESERT

Desert animals are believed to have highly variable, unpredictable populations, that are mainly influenced by episodic events, especially precipitation, rather than by community processes. We tested this for darkling beetles (Coleoptera: Tenebrionidae) in the hyper-arid Central Namib. The sources of surface water in this desert are frequent advective fog along the Atlantic coast (CV=43%), highly sporadic summer rain from Indian Ocean monsoons (11.3mm per annum; CV=250%), winter rain from the Atlantic Ocean (4.0mm; CV=217%), and runoff in ephemeral rivers (18 days annually; CV=150%). We monitored tenebrionid populations by pit trapping in five habitats continuously for 21 years (1976-1997), beginning with a heavy monsoon rain (>100mm) and ending with the next heavy monsoon. There were gradual changes in species richness (22-31 per habitat; CV=14-37%) and total abundance (72-5280 individuals per trap; CV=34-108%), increasing for several years and declining thereafter. Different species had different abundance patterns in response to various water sources. These responses are grouped into five models, namely, long-lived species using fog water and responding gradually to heavy monsoons, irruptive species linked to all monsoons, seasonal species tied to winter rains, species responding to general precipitation, and those that depend on river floods. Our analyses confirm the hypothesis that rain is fundamental to population processes for most tenebrionid species in this desert. This study is contributing to our understanding of the ecological processes that may be affected by climate change, resource availability and desertification in southern Africa.

So2Cm-Hi - Open *Commiphora* dominated bushland on hilly terrain

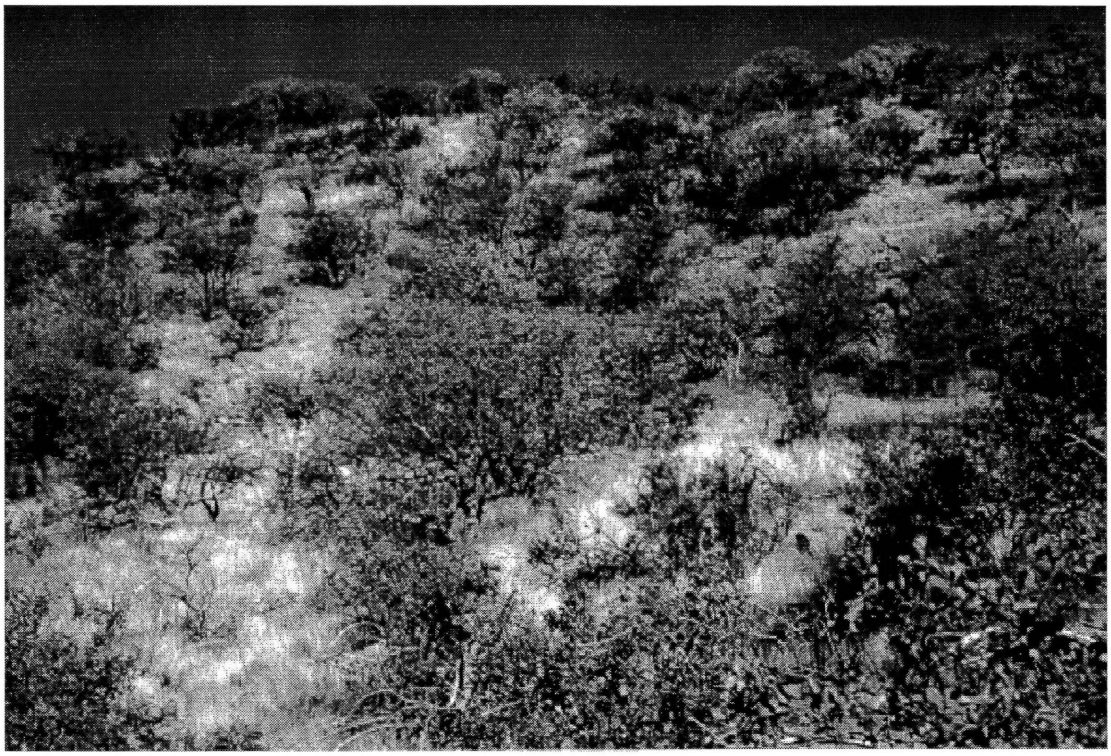

PLATE 1 - *So2Cm-Hi*

The list of species and percentage cover found in this unit are:
Colophospermum mopane [!oenis, omutati] (10);
Terminalia prunioides [#nob, omuhama] (7);
Combretum apiculatum [#o-b, omumbuti] (4);
Catophractus alexandri [!gawab-s, omukaraviza] (4);
Acacia fleckii [omungondo] (2);
Boscia albitrunca [|hunib, omunguindi](2);
Boscia foetida [xaubes, otjinautoni](1);
Acacia reficiens [!gu, omungondo] (1);
Acacia senegal [du^s, omuryangava](1);
Acacia mellifera [!noes, omusaona] (1);
Commiphora multijuga [omuzumba] (1);
Sesamothamnus guerichii [omgumbati](1);
Dichrostachys cinerea [|gowes, omutjette](1);
Acacia erioloba [||ganab, omumbonde] (<1);
Parkinsonia africana |kha^b, omuyumbamenye] (<1).
Grasses include:
Stipagrostis uniplumis var uniplumis, Stipagrostis obtusa, Stipagrostis ciliata, Stipagrostis hochostetterana, [sawi, otji-ngatjira] *Aristida meridionalis* [otji-kuendjanda] and *Aristida adscensionis* [ohoke]