Fog

Harvesting

by Joh Henschel

The relentless morning sun entices the warm mass of the open Atlantic Ocean to expel a molecule of fresh water into the thirsty air where it is joined by numerous similar molecules that eventually saturate the air. Meanwhile the same relentless sun heats up the parched land of the Namib, causing its air to warm up and rise, drawing in cooler air from the ocean to replace it. This brings the moist host of our water molecule into landward motion, until it travels across the cold Benguela Current that hugs the Namibian coast and saps warmth from the air. When it becomes too cold for our molecule, it clings onto a dust particle where it is soon joined by several companions that together form a tiny droplet. Innumerable droplets form a cloud, which reaches the land as fog by evening.

The momentum of this massive motion takes our droplet 45 km inland to Klipneus along the Kuiseb river. At 3 in the morning, it collides with the mesh of a one meter square screen that gathers fog droplets and unites them into drops that drip into a gutter, forming a small stream that runs into a 5ml spoon-shaped bucket. When the bucket is full, it automatically tips to pour out its contents into a large canister and passes this information on to a data logger.

By sunrise, our molecule has been joined by so many others that the 25 liter canister is a quarter full. When the heat of the day has dissipated the remaining fog, Alois Narib arrives by bicycle from the nearby village. He pours the water into a measuring cylinder, notes down the volume and fills his water bottle. Back at home, he heats the water over the fire and prepares a nice pot of tea for the family. Vilho "Snake" Muteleni, the DRFN research assistant, arrives with a landrover from Gobabeb just in time for a cuppa and drinks our Atlantic molecule of advective fog. Tasty!

South American Experiences

Snake tells Alois of his recent experience in Chile, where he and Joh Henschel learnt how to build a large fog collector of 50m^2, called Atrapaniebla, which connects to 80 similar screens that collect enough fog water from the Camanchaca (colloquial for fog in Chile) to supply a village of 400 people. The people themselves operate the plant.

In an intensive course by six Chilean lecturers, Snake and I were tutored on climatological engineering, economic, environmental, sociological and practical aspects of fog collection. We also learnt how advective fog originates, when and where to expect it to intercept the land, and how to apply this knowledge to efficiently and effectively harvest water.

Can this method work in Namibia too? Head-standing and trench-building beetles and plants with shallow roots and fog-absorbing leaves seem to indicate that fog is, indeed, as reliable a source of water in the Namib Desert as it is for the Peruvian flora and fauna in the Lomas area of the Atacama Desert that I visited after Chile.

Canadian expertise and funding have been most important in evaluating the potential for collecting potable water in Chile and four other developing countries, and have also enabled the DRFN to initiate an evaluation in Namibia in collaboration with the Department of Water Affairs (DWA). People of the Topnaar villages living beyond the coastal bulk-water supply system of the lower Kuiseb River were interested in participating in the evaluation. Fog water may be a more reliable and easier source of water to tap than their current deep, labour-intensive temporary wells and non-functional pumps. The Chilean-designed collector is expressly tailored to be easily managed and low-priced and may thus suit the Topnaars' needs if it proves to yield enough good water.

Focus on the Namib

After the visits to Namibia of international fog experts, Bob Schemenauer from Canada and Pilar Cereceda and Derek Webb from Chile, it was decided to focus the study on an area around the villages of Swartbank, Klipneus and Sout River. Eight Standard Fog Collectors (SFCs) with 1m^2 screens, three of them with data loggers, were erected in this area.

Snake and friends at a fog collector on Klipneus

Alois Narib and Daniel Cloete declared themselves willing to manually measure the volume of collected water on a daily basis, while Snake and I go periodically to collect these data and those from the electronic recorders. Initial analyses of the first three months of data indicate that with each fog event, an average of 1.6 – 6.1 liters of water per m^2 of screen (range 0.1 – 24.5) is collected, varying with time and location. Fog occurs for 10 – 16 days per month, yielding an average daily volume of 0.7 – 2.5 liters/m^2. This looks promising, but a full year of continuous monitoring is required and the water quality needs to be tested by the DWA before any concrete conclusions can be made.

In addition, a more complete understanding of Namib fog is required to place the current evaluation in the appropriate context and to see if wider application is feasible. While Roland Roeis of DWA designed a network of SFCs from north to south along the Namib coast, the DRFN extended its study area in the central Namib from west to east near inhabited areas along the Kuiseb River and at the established sites of a network of long-term weather stations. SFCs at Gobabeb and Utuseb school fulfill the additional roles of demonstrating the concept to potential users and future planners, as well as testing materials under Namibian conditions. True to its commitment to use research not only to gain knowledge but also to further training and environmental awareness, the DRFN demonstrates with this fog project how it integrates the interests of communities and trainees with planners and donors – in this case with Canadian funding via the International Development Research Centre and other agencies, as well as a network of enthusiastic volunteers, into state of the art research concerning sustainable resource management.

As Snake and Alois drain their cups of fog-water tea, they notice how the desert heats up once more. Tonight there will be more fog. They need no convincing that harnessing this process will allow people to harvest a sustainable source of precious water in this parched land.

Spiders as Parents

Most people have an inborn fear of spiders and certainly these creatures do not have a reputation for altruism and fond parental care. However, *Susanne Kürpick* of Wurzberg University has a close association with them while investigating whether altruistic interactions and cooperative breeding exists in colonies of Community Nest Spiders (*Stegodyphus dumicola*).

Spiders are usually solitary and aggressive towards other animals and even towards other spiders of the same species. However, species of social spiders have developed in five different spider families (Agelenidae, Dictynidae, Eresidae, Theridiidae and Thomisidae). These occur on five continents in habitats ranging from thornbrush savannah in southern Africa, like the study species *Stegodyphus dumicola*, to tropical rainforest – the family Theridiidae.

Despite obvious differences in morphology and behaviour, these species exhibit striking similarities in their social systems: members of the same generation cooperate in building and maintaining their communal nest; they catch prey and feed communally and they share in the care of their offspring.

The genus *Stegodyphus* of the Eresid family includes both social and single, gregarious species, making it a most interesting spider genus in respect of social evolution. The social behaviour of *Stegodyphus* seems to have evolved from earlier sub-social species through the brood care of juveniles which develop into colonies of adults. Parental care seems to be the most important factor which has contributed to the development of sociality in this species.

Parental care in Eresids can be divided into two categories:

a. Cocoon care; and
b. Care for the young.

There are several references in the literature to cooperative brood care among permanent social species of *Stegodyphus*. This seems at odds with some suggestions that spider societies are open systems. If there is no kin recognition found in spider societies, no cooperative activities could be expected because of the greater risk of social parasitism in this behaviour.

Discrimination against unrelated animals of the same species is a general phenomenon of real societies as pointed out in the concept of "inclusive fitness and kin selection" by Hamilton 1964*.

The project attempts to determine whether the spiders living in these huge colonies are all related and whether, in fact, they do help one another with the daily business of breeding, feeding and building. This study is being carried out in the central Khomas region in cooperation with the DRFN.

The Community Nest Spiders (*Stegodyphus dumicola*) make large, untidy nests mainly in *acacia* trees, in which a large number of males, females and juveniles live.

*Hamilton, WD. "The Genetical Evolution of Social Behaviour,", 1964, in *Journal of Theoretical Biology*, Vol. 7, pp.1 – 16, 1964.