Gary Skinner

Numbers from nature

Key words
ecology
fieldwork
collecting data
interpreting data

The usual image of a scientist many people have is of someone in a white coat in a rather comfortable laboratory. Not so the field ecologist. Their work goes on outside, in all weathers and often in some very challenging environments. In addition, to wrest information from the natural world in such places can take a very long time and be very dependent on the time of year. Despite these major difficulties, ecologists have learnt a lot about how living organisms live in the wild, and how they interact with each other and their environment. In this article ***Gary Skinner*** *tells the stories of two pieces of field ecology, one his own and the other from a Mexican botanist.*

Ants in my pants!

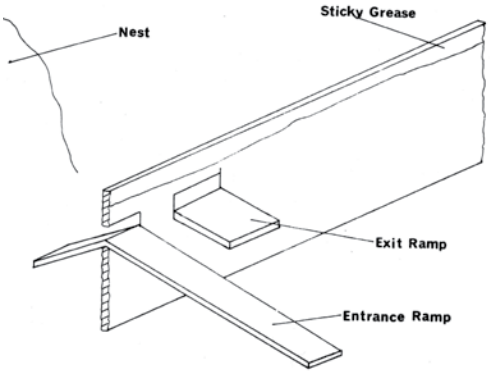
I must admit my first reaction when I finally got out to the woodland in which I was going to study the wood-ant *Formica rufa* for three years was one of horror. These centimetre-long creatures were there in their thousands and ran everywhere, including all over me! Although they do not sting, they have strong jaws which they nip with, and they spray pungent formic acid. I felt I could just about tolerate all this as long as they did not crawl up the inside of my trousers, so I spent the first few weeks wearing cycle clips.

A wood-ant (main picture), Formica rufa*, and the nest it shares with many other wood-ants (above).*

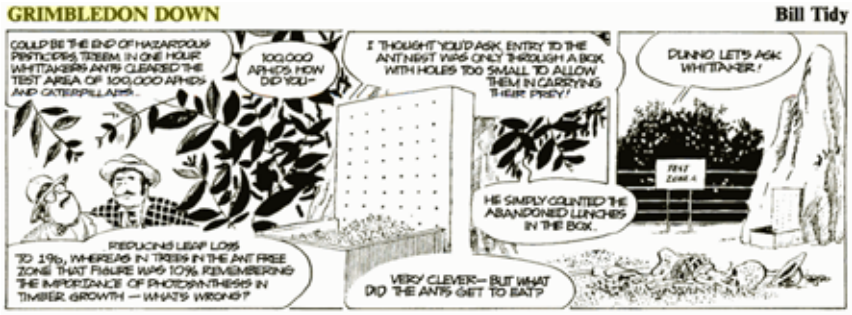
The original brief was to find out what effect these innumerable workers were having on the ecosystem and the route I decided to take was first to see what they were eating by watching what they brought back to the nest. Hours were spent sitting by one of their trails looking at the workers jaws, and occasionally taking what was there away from them. This, however, caused disturbance as a worker which had its prey taken away from it would spray formic acid, which is an alarm pheromone in these ants. So, the next frustration of studying animals in the field – the observer effect. The ants were behaving differently because I was watching them.

The solution was to put in place a permanent food collection device, which the ants became used to so that they settled down to normal activity. This device consisted of a sheet metal fence, smeared with grease which confined the ants to the nest, or to its outside. Holes were then cut in the fence

to give the ants a way in and out and equipment was set in place to collect their food from them. The way this works is perhaps best understood by looking at the cartoon strip that was drawn by Bill Tidy in *New Scientist* in 1984, just after the final paper on my work was published.



Wooden ramps installed to allow streams of ants in and out

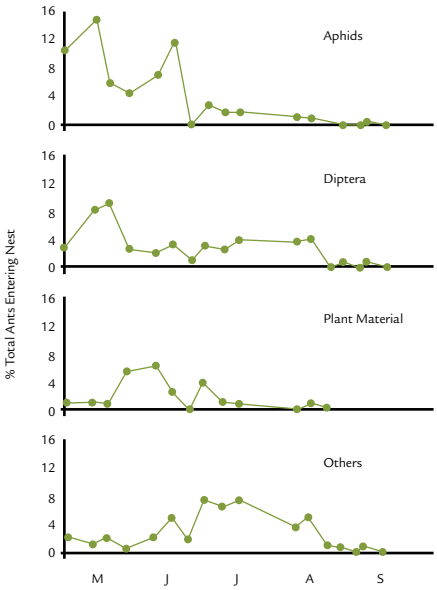


A cartoon from New Scientist*, based on Gary's work.*

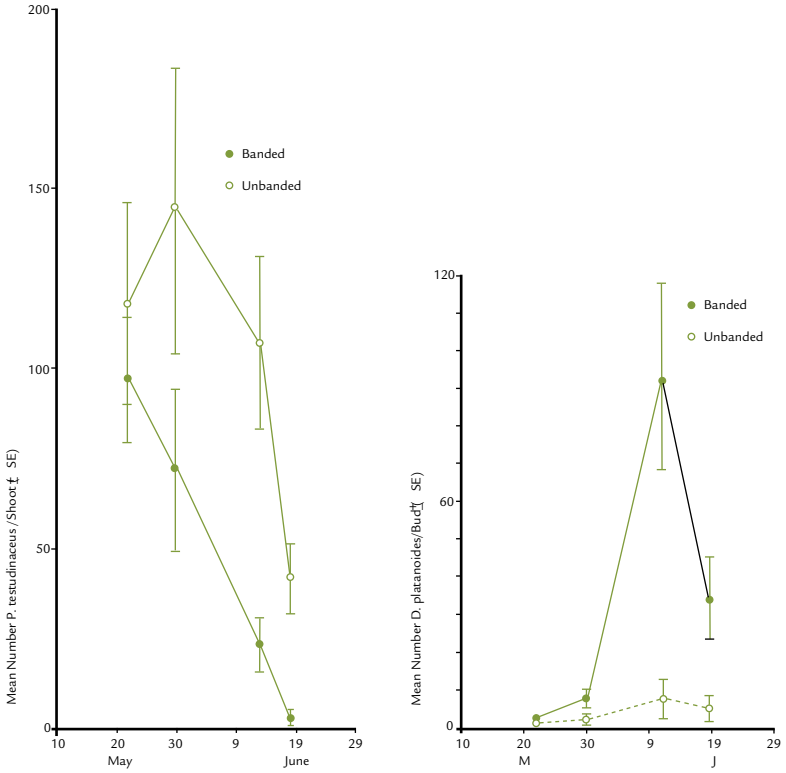
Once I had this information I was able to start thinking about the effect the ants have on the ecosystem. The data led me to focus on effects on aphids and caterpillars that live on oak trees. The results were surprising, at least for the aphids. Here I found that the ants ate one type on sycamore (the sycamore aphid, *Drepansosiphum platanoides*) but not another (called *Periphyllus testudinaceus*) from which it collects a sugary solution called honeydew. The effect of this is shown in the results of an experiment in which I excluded ants from some trees and not others by 'banding' the trees with grease. The aphids which are eaten by ants did better on banded trees where they were protected from ants; the honeydew aphids did better on unbanded trees. This put a big question mark over the practice in some other countries of using wood-ants to protect trees against caterpillar attack. This they may well do, but at the cost of encouraging some aphids which not only suck sap but transmit diseases to the trees too.

Representing data

The results were many but a flavour can be seen in the graphs which show the input of greenfly (aphids), two winged flies (diptera) and bits of plant material (which are not eaten but used to build the nest).



Numbers of prey taken into a wood ant nest over part of a year



Effect of excluding ants from colonies of aphids, one species of which is tended by ants for its honeydew (left) while the other is eaten by ants (right).

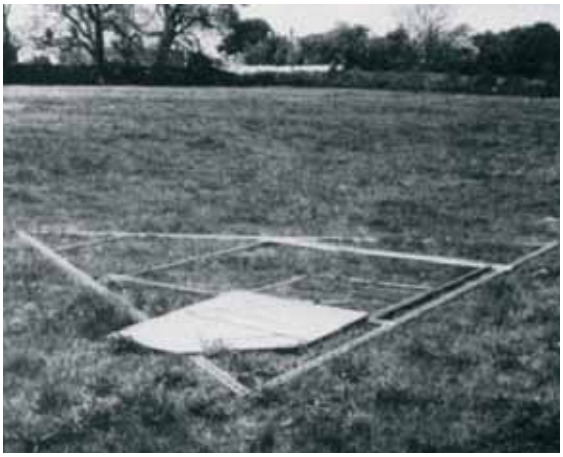
Dead interesting stuff!

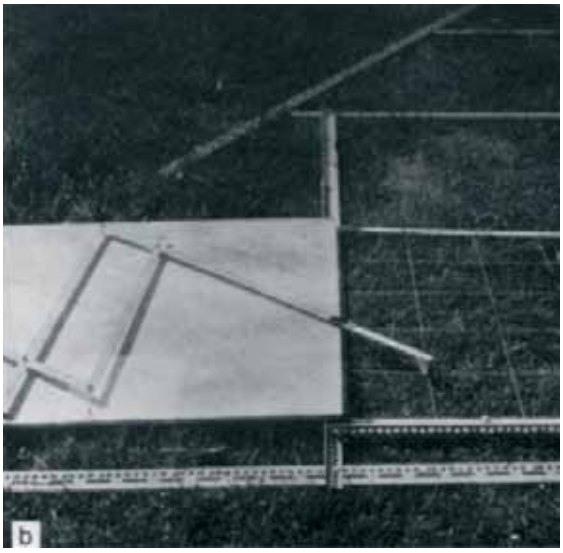
A very famous story amongst field ecologists is that of Mexican botanist Jose Sarukhan when he was doing his PhD at Bangor University in North Wales. This is how he tells it:

*My thesis research was on the population dynamics of three species of buttercups (*Ranunculus acris, R. repens *and* R. bulbosus*) which grow together in the same area but occupy different niches within it (Box 1)* – bulbosus *in the wettest spots,* acris *in the upper part of light 'humps' in the field and* repens *in intermediate conditions. They also differed in the way they reproduced:* acris *exclusively by seeds,* bulbosus *by germination of the little subterraneous bulb, and* repens *mostly by stolons, although also some seed, depending on the conditions that plants were in. They were a fantastic experimental model to make comparative studies on plant demography (population dynamics). Actually it became the first long-run comparative demographic study of plant populations.*

To do the work, I had to select populations in different places on the Henfaes field at the Aber field station of the University College of North Wales (now Bangor University), identify replicates of them and revisit these sites during three years.

The field in North Wales where Jose Sarukhan did his three year research project on buttercup populations



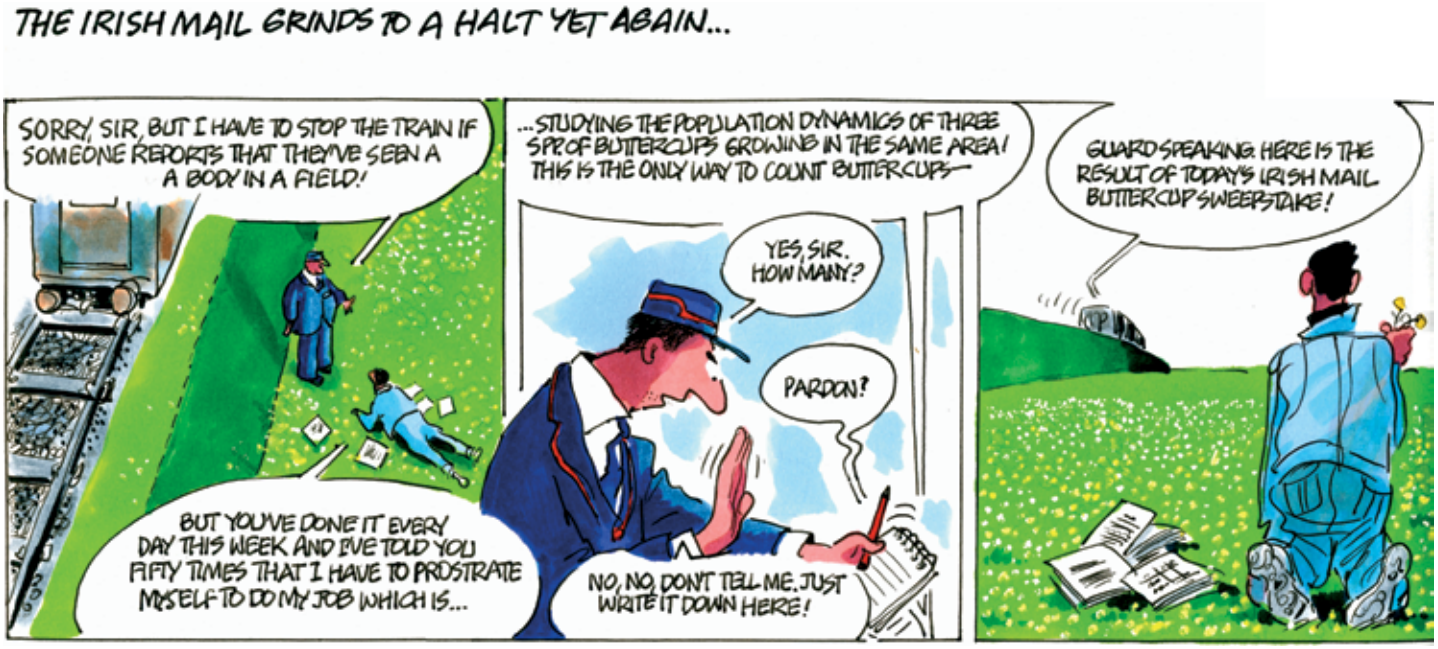


Jose Sarukhan's mapping device (a pantograph) which he used, often in the pouring rain under a greenhouse on wheels, to count all the buttercups in selected sites in the field

I had to adapt a pantograph mapping device for use on a low table that I used as a basis to record all the individuals every time I visited each site. I also had to design and build a portable 'greenhouse' (2×3 m) made of dexion, acrylic sheets and old pram wheels so I could roll it all over the field.

I then had to lie on the ground for long periods to check if every single plant I had recorded was still there, whether it was flowering, fruiting etc. I worked in the field mostly in late spring, summer and early autumn, which were the only relatively decent weather periods without gale force winds and rain.

Adjacent to the field ran the railway that connected Bangor to Holyhead and through which ran many local trains. On one of those occasions of field work, on a nice sunny day which did not require using the rollable greenhouse, during the late afternoon I was startled by someone who had carefully approached the site I was working in so I did not notice him until he was virtually on top of me. I almost jumped due to the surprise, and noticed a look of relief on the face of the person who was looking at me. He asked me what was I doing there on the ground. I said, "Counting buttercups." He questioned me as to what I was doing this for so I explained that I was



Bill Tidy's take on Jose Sarukhan's tale.

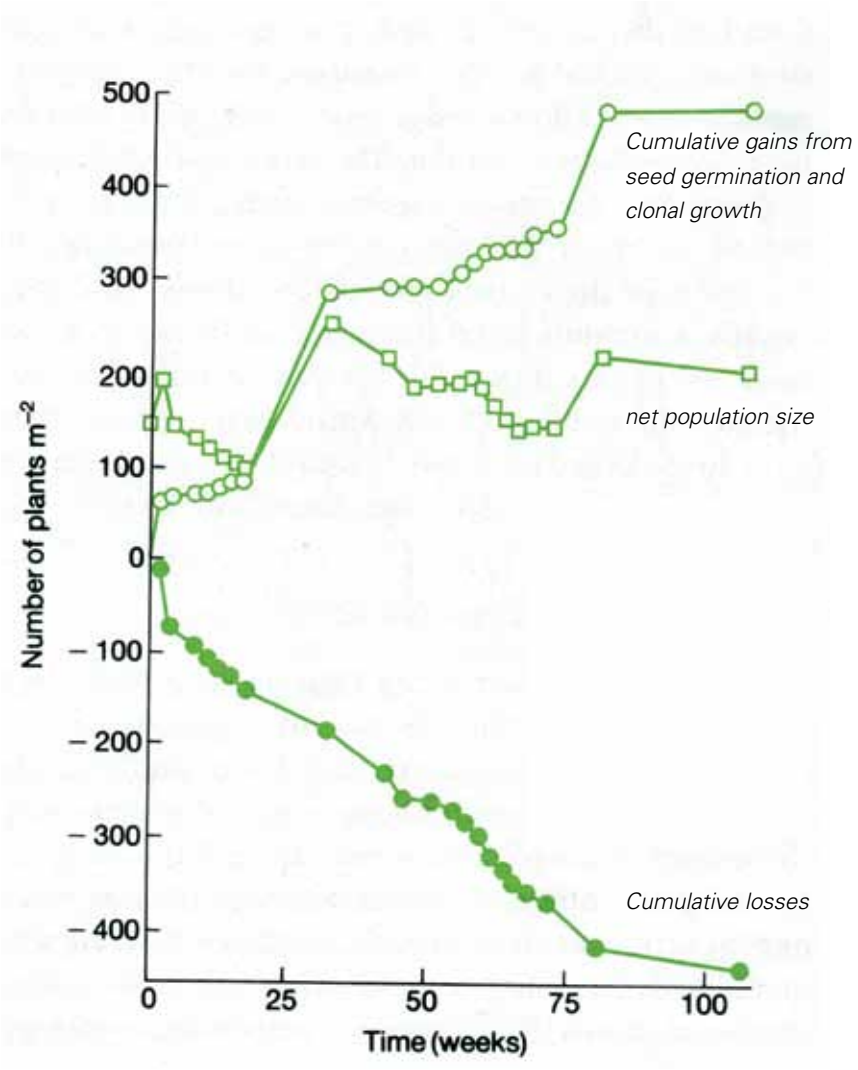
a graduate student, told him my research topic, etc. He then explained that he was the guard on the Irish Mail train. They had passed several hours before going towards Holyhead and they saw a body lying on the ground but did not think much of it; however on their return towards Bangor, they again saw the body and decided to stop the train. He jumped the fence and came to check what was happening. I did not know what to say, whether to apologize for having caused a disruption to the train's schedules or what. He was relieved that all was OK, shook my hand and left. In a small town like Bangor the story started running, reached the School of Plant Biology, and from there, it seems, to many parts of the world.

Jose Sarukhan's study was the first in which changes in populations in plants had been followed over time. As had been found in animals, the populations remain remarkably constant despite much reproduction and death.

Dr Sarukhan went on to be a professor of Ecology, and has worked in a range of institutions in his native Mexico and beyond. On his return to Mexico in 1972 he carried on work on demography, this time of tropical trees, work described by David Ackerly a professor at Stanford University as 'extraordinary and pioneering'. He then went on to found the Institute of Ecology at the National Autonomous University of Mexico (UNAM), described as one of the top five such institutes in the world. He is now president of UNAM with 28 000 staff and 260 000 students! During this time he founded the Mexican National Commission on Biodiversity.

So it was good for the world, ecology and the environment that he really was not dead in that field all those years ago!

Gary Skinner is Biology editor of Catalyst.



Some of Jose Sarukhan's results, showing changes in the population of the creeping buttercup, Ranunculus repens.