Science as colle

Increasingly, members of the public are doing their bit towards scientific research by sending in observations or carrying out small-scale studies. Fun to do, but for policymakers this 'citizen science' is also a way of democratizing research and gearing it more to society's problems. It is hard to get funding for it, though.

TEXT ARNO VAN 'T HOOG **PHOTO** HH/MARCEL VAN DEN BERGH

ctive action

> ‘We didn’t have the resources to send out researchers’

In the past few years webshops and supermarkets have started selling cheap camera traps equipped with a movement sensor so they automatically take a series of photos when something walks in front of the lens. These are simple variants of the instruments with which Patrick Jansen of the Wageningen Resource Ecology chair group does research, both in the tropics and in Europe, on populations of shy animals which are difficult to observe.

‘People buy one of those cameras for fun. They think it’s a nice gadget, but after a while it ends up in the cupboard,’ says Jansen. Imagine if you could get those people enthusiastic about setting up the camera in their gardens, or lending it to their neighbour, and sending in the pictures they get. ‘Then you could get a better idea of how mammals use the urban environment, ranging from big gardens on the edge of the city to tiny green patches in the city centre. All the evidence suggests that many woodland animals are gradually shifting towards the cities, but we don’t actually know exactly how that is progressing.’

Jansen has been able to try out a citizen science project of this kind together with the Mammal Association, in a project called Hopping Cameras. In this project, cameras are moved from garden to garden for a year in cities including Amersfoort, Deventer and Nijmegen. A volunteer installs them 20 centimetres above the ground, half a metre away from a tin of sardines with holes in it, from which fish oil leaks. The idea is that most mammals – mice, rats, hedgehogs, martens or cats – find this smell interesting enough to be worth checking out.

STANDARDIZATION

The setup with the tin of sardines solves a scientific problem: standardization. ‘Some people have a high-tech camera trap with high resolution, and others have a toy. In order to overcome that difference in sensitivity, you need to lure the animals as close to the lens as possible so that even the least sensitive camera picks them up,’ says Jansen. ‘The disadvantage of using bait is that we can’t then conclude anything about numbers, because the same animal might come snuffling around three times in one night. Domestic cats are an exception because you can tell them apart by their markings.’

If you want to involve a broad segment of the public, you have to make compromises, says Jansen. ‘Above all, the system needs to be fool-proof. With professional researchers we would go for a different setup in a project using camera traps.’ But some degree of compromise on data quality is not disastrous, says Jansen, because there is something to be said for quantity too. Researchers are expensive and they cannot be everywhere at the same time, whereas you need a large number of observations to get a reliable picture of the distribution of mammals. Besides, there are other good reasons for doing a citizen science project. ‘The Mammal Association wants to get people enthusiastic and aware that their garden can be a little habitat for wild animals. For our students too, it is very handy that they can get some experience with citizen science.’

If a lot of people take part, thousands of

TICK RADAR

Purpose Up-to-date information about ticks and Lyme’s disease; offers a ten-day forecast on tick activity levels.
Name Arnold van Vliet
Year Since 2012

ALLERGY RADAR

Purpose Overview of symptoms being experienced by hay fever sufferers. The Pollen Planner provides info on the expected pollen count.
Name Arnold van Vliet
Year Since 2009

GROWAPP

Purpose See for yourself how nature reacts to a warmer climate. Makes it possible to compare photos from different seasons.
Name Arnold van Vliet
Year Since 2017

WILDCAMERA
Purpose Doing research with camera traps to monitor how wild mammals use gardens.
Name Patrick Jansen
Year Since 2016

images come in. Jansen also wants to enable the public to help with identifying the animals in the photos through Agouti, a platform he built himself. This works in a similar way to the successful website Zoonoverse. There, thousands of volunteers receive a short training course and then help classify millions of photos from hundreds of camera traps on the Serengeti plains in Tanzania, for instance, or in the rain forest in Peru. To avoid mistakes, several people classify the same photo.
Jansen hopes to launch his camera trap project before the summer. The only thing lacking is funding for the software development and supervision once the project has started. A lot of automatization will be needed for gathering and storing the research data: where and when was the photo taken, and what does the garden look like? 'Our photo processing system was made for researchers and I don't think it is user-friendly enough yet. Nor do we have a good helpdesk yet for questions and problems. Involving the public like this will only succeed if everything works properly from the start.'

INCREASINGLY EFFICIENT

Citizen science has the image of being casual and amateurish. Primarily, something you do for fun. But mobile technology and the internet are making communication between the general public and scientists increasingly efficient and international.
Anyone can submit online observations or data, carry out research tasks or make their computers available for calculations. There are now too many projects, both large and small, to have an overview. They range from garden bird counts through air quality measurements and calculations of protein structures, to classifying galaxies or molecular structures of cells.
For a few years now, citizen science has also been attracting serious attention from European policymakers. They see this approach as offering ways of drawing the wider community into the pursuit of science, spreading knowledge and making science more open and democratic. In this respect, citizen science is very relevant to the recent debate about open access to data and publications, and the influence of society on the scientific agenda.
In 2014, the European Commission published its *White Paper on Citizen Science*. The paper waxes lyrical about the opportunities and possibilities: 'In citizen science, a broad network of people collaborate. Participants provide experimental data and facilities for researchers, raise new questions and co-create a new scientific culture.' Seen like this, citizen science goes far beyond public assistance for the researcher. The document recommends targeted financing of citizen science projects, and proposes making this form of science a fixed component of large EU research projects, such as the 80-billion-euro Horizon 2020 programme for innovative projects. There are signs of growing enthusiasm for the concept elsewhere too. The United States has already taken it one step further: the National Science Foundation has recently started awarding grants specifically for citizen science projects.

MINIMAL RESOURCES

The new appreciation and professionalization of citizen science would seem beneficial to researchers who have been working in this field for years now with minimal resources, as funding is still very hard to find, as Arnold van Vliet knows from experience. 'You have to be constantly asking yourself what your business models are,' says the Wageningen citizen science specialist.
In 2001, Van Vliet started up Natuurkalendar.nl: a phenological observation programme which registers recurring natural phenomena such as flowering, leaf fall, bird migration and the return of insects.
Van Vliet knows how to make good use of this general knowledge. One example is the website tekenradar.nl which he started together with the National Institute for Public Health and Environment RIVM. Tick bites can be reported on this site, which provides researchers with information about the risk of Lyme's disease, as well as making it possible to warn people when ticks become active again. Van Vliet's ambitions go beyond involving the public as data providers. >

‘You know that you’ll get some unusable observations’

For him, citizen science is a combination of observation, analysis and the translation into applications, plus all the communication that entails. ‘Why get worked up about a plant that is flowering a month earlier because of climate change? Well, what about hay fever, for instance? If birches and grasses flower earlier, 10 to 15 percent of the human population are affected.’
The accumulated knowledge about weather conditions and flowering times and the reports of all sorts of allergy symptoms were used to build the ‘pollen planner’, which, with visuals like those used on weather forecasting websites, warns hay fever patients weeks ahead that they can expect symptoms. ‘Actually, we’d like to go a step further by informing the relevant people – patients, doctors and pharmacists – so that sufferers can start taking medicines before symptoms appear,’ says Van Vliet.
For Van Vliet, citizen science means making the best of the time and money available, because science funding bodies are dubious about this unconventional approach, which does not focus exclusively on publications. Moreover, the monitoring of flowering times, allergy symptoms, tick bites and mosquito bites is geared to the long term. ‘That is very tricky for project financiers. So I am constantly wondering how we can generate a reliable income. How do we maintain the networks which collect data? Because it doesn’t all come free.’

COMMON ASSUMPTION

That is a common assumption about citizen science, says Van Vliet: it’s nice and cheap. ‘That is absolutely not the case. The technical development of apps and websites, the hours of analysis and interaction with the public cost money. Building up a community is time-consuming. You need to reach people and motivate them. Will you join in? Will you stay on board? One of the ways we do it is through the stories we tell on Nature Today, showing how data provided by the public are used. That goes on 365 days a year, literally.’
The media play a key role in citizen science. Without attention you don’t get participants, as Bastiaan Meerburg can tell you. He is head of the Livestock & Environment department and an expert in rodent pests at Wageningen University & Research. In the summer of 2012, Meerburg created a bit of media hype around a project which asked people to send in rat droppings. The aim was to use DNA analysis to get the measure of resistance to rat poison.
‘We wanted observations from all over the country, but we didn’t have the resources to send researchers out to collect droppings. That makes this an interesting alternative, and we certainly got a good picture. Some of the droppings were not usable because they had crumbled, and some were mouse or hedgehog droppings. You get that with citizen science: you know that you’ll get some unusable observations.’
The results of the DNA analysis were remarkable, says Meerburg. ‘One quarter of the rats in the Netherlands were resistant to well-known types of poison. That is quite a lot.’ This knowledge has contributed to

PHOTO JEROEN JUMELET

SPLASH COUNTER

Purpose Counting the number of insects splattered on number plates to get an idea of changes in insect density.
Name Arnold van Vliet
Year 2011

RAT DROPPINGS

Purpose Sending in droppings to find out where brown rats are resistant to rat poison
Name Bastiaan Meerburg
Year 2012/2013

EVOCA

Purpose Sharing information about diseases and pests in order to solve problems in Africa.
Name Cees Leeuwis
Year Since 2016

more targeted pest control methods, with pest controllers first checking which poison is effective.
An important lesson, says Meerburg, is that sharing results is good for the participation levels. 'It gives people the feeling that something really is done with what they send in. We asked participants to give their postcode; then they could look at the results on the website within a few days. Commitment increased tremendously, and neighbours started getting each other interested. Asking each other: what's living in your garden?'
The researchers chose a strategic moment: around the time of the Olympic Games, in a period when there wasn't much other news. Meerburg: 'Because of that the subject really caught on. I was interviewed for endless radio shows and newspapers. That was good for the research and led to us getting a lot of material sent in. Somebody even sent in a dead rat; they are still talking about that in the post room.'

FIGHTING MALARIA

The digital revolution and the availability of telephones could mean citizen science could be used to address serious problems related to diseases and food security in Africa. Finding out whether that can work in practice is one of the aims of the EVOCA project run by Cees Leeuwis, professor of Knowledge, Technology and Innovation at Wageningen University & Research. In the next few years, 12 PhD candidates will be studying whether mobile information systems can be built using elements from citizen science for purposes such as setting up regional collaboration among farmers.
Leeuwis: 'For us, citizen science is not an end in itself. The main priority is the problems, such as diseases and pests in potato farming, water shortages, or fighting malaria. Maybe we could use some citizen science-like elements in addressing these problems but we are nowhere near ready to develop specific ways of using it, or apps. You shouldn't dream up solutions before the problem is totally clear at the local level. That is what the PhD candidates are researching in the field at the moment.'
ICT and telecommunications offer new scope for connecting people, says Leeuwis. In countries such as Tanzania, Kenya and Ethiopia, most people have access to a mobile phone by now. 'That makes it possible to collect data in a decentralized fashion, and to link it to scientific models. Farmers might send in observations on their mobile phones, giving you a picture of the incidence of diseases and plagues in an area. In turn, that provides information about how farmers could respond to the situation.' It is not for nothing that the terms observation and action feature in the acronym EVOCA: Environmental Virtual Observatories for Connective Action.

IN TOUCH

For Leeuwis, citizen science is primarily a means of mobilizing people and stimulating collective decision-making. 'Diseases and pests are collective problems. A farmer cannot fight potato blight alone; you need a community of farmers for that. It is precisely new communication technology that can put people in touch with each other and promote collective action. So we are not interested in citizen science as a matter of collecting data and giving individual advice; we want to see if it can help a community deal with diseases more effectively.'
Citizen science originally grew out of the idea that citizens could help scientists collect data, says Leeuwis. 'Subsequently, projects have grown up in which the citizen becomes a bit of a scientist, with the focus still on the science. We take it a step further, by focussing on an actual problem. What we do is very action-oriented. Science plays a role, but the pursuit of science is no longer the main objective. That is a bit different to the idea with which citizen science was started.' ■

www.wur.eu/citizenscience

MOSQUITO RADAR

Purpose National monitoring network for nuisance caused by mosquitoes. Offers a five-day forecast of mosquito activity, in collaboration with weather forecast site *Buienradar*.
Name Arnold van Vliet
Year Since 2016
In 2017 muggenradar.nl joined the international Global Mosquito Alert