Science used to catch serial killers helps control pests and disease

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A technique designed to help criminologists catch serial killers is being used by scientists to locate sources of disease, control pests and study animal behaviour. Locating a serial killer's home is similar to finding the nests of animals or centres of disease outbreaks, explains an article in the December edition of the Society of Biology's magazine *The Biologist*.

Author of the article, Mark Stevenson, a PhD researcher at Queen Mary, University of London, explains: "What do serial killers have in common with great white sharks, invasive species and malaria-transmitting mosquitoes? It sounds like the sort of question Sherlock Holmes might ask his faithful companion. The answer to our riddle is relatively simple – dare I say elementary? They are all travelling from a central location in some kind of predictable pattern. If we can work out the pattern, it is possible to estimate where they live based on where we know they have been."

The technique is called geographic profiling (GP) and has been used in many high profile cases, and helped catch the Yorkshire Ripper. Imagine a situation where the police have found five bodies and linked the killings, and now need to locate the killer. GP uses the locations of the bodies and predictions of the killer's movement patterns to calculate where the serial killer's home is likely to be. This approach has been shown to be much more effective than starting at the centre of the kills and searching outwards.

In biology, GP was first used to study animal foraging, specifically bats,

bees and sharks. Mark Stevenson says: "We have discovered a lot about the patterns animals move in. What we're not so good at is predicting the central points they are moving from. These points might be the breeding sites of malaria-transmitting mosquitoes or the place that an invasive species (such as the harlequin ladybird or ash die back) first arrived. The efficient identification of the sources of invasive species can be used to target disease and pest-control programmes."

In epidemiology, GP has been used to re-analyse Snow's classic study of the 1854 London cholera outbreak, using the location of 321 disease sites[1]. Of the 13 neighbourhood water pumps, the Broad Street pump – the outbreak's source – ranked as the most likely culprit. The same study analysed cases of malaria in Cairo, Egypt, using 139 locations of disease cases. Scientists ranked 59 local water sources in order of how likely they were to be responsible, and of the seven which tested positive for the mosquito vector, six were ranked 1-6.

"Development of geographic profiling is by no means complete, and the two fields of biology and criminology still have much to teach each other. Ecological approaches have applications in counter-terrorism work, as terrorist cells tend to have more than one anchor point within the area in which they operate, exactly so they can avoid detection."

Dr Mark Downs, chief executive of the Society of Biology, says: "When we talk about the importance of collaboration between the sciences we might think about chemists and physicists working with biologists to discover the mechanisms within cells or to turn plants grown for bioenergy into fuel. This is a fantastic example of how much even the most unlikely collaborations can achieve. It shows how impossible it is to predict the spinout benefits from a piece of research."

More information: [1.] Le Comber, S. C. et al. Geographic profiling as a novel spatial tool for targeting infectious disease control. *International*

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