Institution: University of Gloucestershire

Unit of Assessment: C-17 Geography, Environmental Studies and Archaeology

Title of case study: Ants: Life inside the colony

1. Summary of the impact

This case study focuses on the impact of work underpinned by Professor Hart's entomological research and includes the major BBC and Discovery/Science Channel documentary, *Planet Ant: Life inside the Colony*, a children's version, *Living on Planet Ant* (both presented by Hart) and subsequent secondary impact through two Citizen Science projects. Together these projects have considerably raised public awareness and understanding of ants and their importance. *Planet Ant* has reached a domestic audience in excess of one million via TV, a large international TV audience, more than 0.6 million via YouTube and was widely and positively reviewed in the national press.

Activities arising from the programme included a debate session on the importance of ants at the Cheltenham Science Festival, 10 weeks of public viewing and guide-led interpretation of the ant colony at the Glasgow Science Centre and national and international magazine articles. *Planet Ant* led to Hart's central involvement with two large citizen science projects run jointly between him and the UK's Society of Biology. Widely featured in the national press and radio, these have actively engaged more than 20,000 members of the public in primary scientific research, including some 3,500 "super engagers" who have sent on more detailed records and samples. Indeed, one of these projects has been selected by the RCUK for their Concordat anniversary publication as a case study to demonstrate the impact of public engagement.

2. Underpinning research

Research underpinning this case study was undertaken by Hart at the University of Gloucestershire and takes the form of published papers in international peer-reviewed journals. Hart has published more than 30 peer-reviewed publications on social insects (ants, termites, and some bees and wasps), using laboratory and field colonies as well as theoretical approaches to study how insect colonies are organised. He has a particular interest in leafcutting ants and his research into this group, and the publicity that arose from some of these studies, led directly to Hart's involvement in *Planet Ant*. His research also underpinned set design and a number of key sequences within the documentary[1].

Whilst a member of the submitting unit (from 2005 to present), Hart has carried out research directly relating to the case study in two areas:

1) Pheromone trail organisation The public is fascinated with ant colony behaviour and chemical pheromone trails hold a particular interest (indeed, Hart has personally communicated his research findings on this topic to more than 10,000 people to date)[7]. Hart's research focused on the influence of a small number of individual ants on the development and maintenance of pheromone foraging trails. In some ants, "u-turning" behaviour is carried out by ants on the foraging trail and Hart's research demonstrated that this behaviour is crucially involved in the maintenance of the pheromone trail.

U-turning ants were revealed to be specialist "trail layers" and in leafcutting ants they are members of the smallest caste of ants, the minims. The *Planet Ant* set design and programme structure had pheromone trails as a central theme and, as well as demonstrating Hart's research, the set was designed with his findings in mind to ensure that full and natural trail behaviour could be filmed[1].

2) Sanitation and hygiene How ants and other social insects keep their colony clean through the careful handling of waste and dead ants has been a key theme in Hart's research for 12 years and, prior to the REF date, his research in this area featured in *The Independent* and the *New Scientist*. The complex set design required to accommodate the ant colony used for *Planet Ant* was based directly on his research on waste handling in this group[1]. Key sequences in the final documentary are directly based on his research into the importance of waste management and social hygiene[1].

3. References to the research

1. Jackson DJ & Hart AG (2009) Sanitation and Sociality. *Animal Behaviour* 77:e1-e5
2. Evison S., Hart AG and Jackson DJ (2008) Minor workers have a major role in the maintenance of leafcutter ant foraging trails. *Animal Behaviour* 75: 963-969
3. Elliot SL and Hart AG (2010) Density dependent prophylactic immunity reconsidered in the light of host group-living and social behaviour *Ecology* 91: 65-72
4. Hart AG & Jackson DJ (2006) U-turns on ant pheromone trails. *Current Biology* 16: R42-R43
5. Hart AG (2013) Task Partitioning: Is it a useful concept? In: *Cooperation and its Evolution* Sterelny K, Joyce R, Calcott B and Fraser B (Eds) MIT Press, Cambridge Mass: Chapter 11

4. Details of the impact

Hart was contacted by the BBC following the publication of Jackson and Hart 2009 (above) and subsequent publicity (http://dsc.discovery.com/news/2008/12/19/animals-feces-cleanliness.html). Together with a BBC researcher, Hart developed a documentary focussing on the social life of ants. Research carried out by Hart, particularly on sanitation and foraging trails, was used to develop several unique demonstrations and short pieces for the documentary pitching process.

Hart's interest and expertise in leafcutting ants, together with his 12 years of research on these ants, gave a focus to the developing programme[1]. A 90-minute documentary, framed around a very large captive colony of leafcutting ants, was commissioned and Hart's research into foraging trails and waste handling was used directly to guide the design of the complex studio nest that would be used for filming[1]. As a consequence of Hart winning the Society of Biology's Science Communicator of the Year (2010), appearing on BBC1's Wallace and Gromit's World of Inventions and The One Show, and writing and presenting programmes for BBC Radio 4 and World Service, he was asked to co-present the programme with established TV entomologist Dr George McGavin.

Planet Ant (and related activities) mostly achieved impact through raising awareness and improving public understanding[8,9]. *Planet Ant: Life Inside the Colony* first aired on March 12th 2013 on BBC4 in the UK (with several repeats), on April 28th 2013 on Discovery Channel in the USA and worldwide through BBC World network on numerous subsequent dates. The 90-minute BBC programme featured a captive leafcutting ant nest (the largest in Europe) in a studio. The complex and unique set design was directly based on this research to ensure that waste management and trail laying behaviour could be filmed (for the first time)[1]. A variety of breakout films documenting its collection as well as other features of ant social life was also included. As well as being crucial to the development and commissioning of the programmes[1], Hart's research featured in both the studio and breakout sections[1].

Independent viewing figures indicate that 1.16 million people watched the BBC4 broadcast in the first week[2]. This compares to an expected number of viewers in the show's slot of 400,000. The programme was "Pick of the Day" and "Pick of the Week" in most major UK newspapers and was reviewed positively by several national papers following the broadcast [e.g. *it was impossible not to be impressed (*Metro*)*; *Fascinating* (The Independent); *Ingenious programme – quality natural history* (The Observer)][3]. It spent two days as the 5th most downloaded programme on iPlayer (exceptional for a BBC4 documentary) and to the submission date has recorded more than 600,000 views on YouTube[1,2,4]. It was also nominated in the Factual category for the 2013 Broadcast Digital Awards and for a Royal Television Society Craft Award[5].

As well as the main programme, *Planet Ant* gave rise to a 30-minute BBC Learning programme *Living on Planet Ant* that was written and presented by Professor Hart. This aired on BBC2 and is permanently available to schools through the BBC's website. Aimed at 11–13 year olds (KS2) this programme took concepts presented in *Planet Ant* and re-presented them for a younger audience, producing a programme that was "an excellent resource" [9].

The programmes are not just for biologists. The *Times Educational Supplement* described the programme as "excellent" and heralded its role in demonstrating aspects of mathematics to students[6]. The programme, and the research of Hart's that features within it, also underpins a talk developed by Hart that introduces children to pheromones and pheromone chemistry. This presentation has featured as the Bristol University ChemLabs Christmas Lecture (three times), the Royal Society of Chemistry schools lecture, a major event at the Cheltenham Science Festival and as a centre-piece for the National Science Federation of Malta's annual schools science event[7].

The programme generated considerable secondary impact. This included a four-page article, written by Hart, in *BBC Focus* Magazine and an article in the magazine of the Royal Entomological Society's National Insect Week 2012, a nationwide event co-organised by Hart. The latter article documented the collection of the nest from a field location in Trinidad and was circulated to 3,000+ schools[8]. Further impact came from the studio colony that was housed in the Glasgow Science Centre and was on full public view

over the summer of 2012[1].

Planet Ant was featured as BBC event at the 2013 Cheltenham Science Festival, where Hart and others involved in the programme debated with the audience on the role of ants and insects in the ecosystem. Hart also co-hosted an event called Hidden Worlds that featured *Planet Ant* for the Big Bang festival in Glasgow with 650 children attending.

Arising from his involvement with *Planet Ant*, Hart has developed two Citizen Science projects with the Society of Biology – *The Flying Ant Survey* (that has now run for two years) and *Spider in da House* – a web and phone based app for recording house spider emergence in autumn. These projects, which will result in peer-reviewed publications, have engaged nearly 20,000 members of the pubic in scientific research. This secondary impact would not have occurred without the primary impact of *Planet Ant* and will result in peer-reviewed publications that complement Hart's entomological work[9].

5. Sources to corroborate the impact

1 Testimonial evidence held on file from Series Producer BBC
2 Viewing figures collected by BARB and issued by the BBC, held on file and available via Publicity Department at the BBC
3 An indicative collection of reviews held on file
4 http://www.youtube.com/watch?v=8n0SkIGARuo and held on file
5 http://heirloommedia.co.uk/project/planet-ant/ and held on file
6 http://www.tes.co.uk/article.aspx?storycode=6329995 held on file
7 Testimonial from Director of Outreach, Bristol ChemLabs, held on file
8 Testimonial from Royal Entomological Society Head of Outreach and Insect Week Coordinator held on file
9 Testimonial from Society of Biology Press Officer held on file