Royal Entomological Society

Data Special Interest Group
Ecology Special Interest Group
Electronics and Computing Special Interest Group

Virtual meeting on e-Ecology

19th October 2020

Convenors

Mark O'Neill – Tumbling Dice
Ashley Lyons – Liverpool Hope University
James Gilbert – University of Hull

PROGRAMME, ABSTRACTS & DELEGATE LIST

PROGRAMME

Speakers' names only. Full authorship with abstracts. All times BST/UTC+1.

10:00	**Richard Harrington** (RES SIG Coordinator) Introduction to the Royal Entomological Society
CHAIR	**ASHLEY LYONS**
10:10	**Helen Roy** (Centre for Ecology and Hydrology, RES President) The urgent need for transformative change to address biodiversity loss and ecosystem deterioration
10:40	**Chris Hassall** (University of Leeds) KEYNOTE: Weather radar networks for abundance and diversity monitoring in insects
11:10	Break
CHAIR	**JAMES GILBERT**
11:30	**Sarah Barlow** (University of Utah) Technologies for pollinator surveillance in field studies and intelligent image recognition: RFID, Rana and DAISY-II
12:00	**Sarah Barlow** (University of Utah) Ecological applications of automated video monitoring (Rana) to study plant–pollinator interactions in Utah: Conservation management of rare Penstemons
12:30	**Luca Pegoraro** (Royal Botanic Gardens, Kew; Queen Mary University London) Automated pollinators monitoring on sympatric cytotypes of *Senecio doronicum*
13:00	Break
CHAIR	**MARK O'NEILL**
14:00	**Justin Sparks** (The Merian Project Limited) The Merian Project
14:30	**Colin Hawes** (Royal Holloway, University of London) Flight capacity and dispersal of the stag beetle *Lucanus cervus* (LINNAEUS, 1758), (Coleoptera: Lucanidae) in south-east England
15.00	**James Bell** (Rothamsted Research) Technological advances: a useful servant or a cause of bias?
15.30	Q & A
16.00	Close

ABSTRACTS

In programme order

The urgent need for transformative change to address biodiversity loss and ecosystem deterioration

Helen E. Roy
President, Royal Entomology Society

Centre for Ecology & Hydrology, Benson Lane, Crowmarsh Gifford, OX10 8BB

hele@ceh.ac.uk

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) released the much-awaited Global Assessment in 2019 and the headline message was, perhaps unsurprisingly, stark: *Biodiversity – the diversity within species, between species, and of ecosystems – is declining faster than at any time in human history.* Despite the bleak headlines, there is a role for us to play in *maintaining a life-sustaining and life-fulfilling planet for humans and other species*, recognising the *rich array of approaches and instruments* that are available to achieve sustainability. I will highlight some of the innovative studies that are documenting the ways in which our world is changing. The role of human-associated drivers of change is unquestionable. The extent and magnitude of change has led to declarations of a global climate emergency. Perhaps this alone is, strangely, cause for optimism as awareness is increasing and the call for transformative change is being heard. I will present some of the studies that have led to ecological and technological insights underpinning much needed action with benefits for people, policy and ultimately our planet.

Text in italics from: Díaz, S., Settele, J., Brondízio, E.S., Ngo, H.T., Agard, J., Arneth, A., Balvanera, P., Brauman, K.A., Butchart, S.H., Chan, K.M. and Garibaldi, L.A. (2019) Pervasive human-driven decline of life on Earth points to the need for transformative change. *Science*, *366*(6471).

KEYNOTE

Weather radar networks for abundance and diversity monitoring in insects

Chris Hassall

School of Biology, University of Leeds

c.hassall@leeds.ac.uk

The current insect decline involves considerable unknowns around the spatial and temporal drivers of change. Weather radars scan the entire country at 100-1000m resolution every 5 minutes to detect meteorological particles ("hydrometeors" such as rain, hail, and snow) but also record "biometeors", which include animals and plant material within the air column. In this talk, I will describe the early stages of the BioDAR Project – a collaboration between biodiversity and radar researchers to try to unlock the wealth of biological data that sit in archived weather datasets. I will start with a primer on radar science and then describe three complementary studies. The first is a hierarchical clustering method designed to classify biometeors based on their radar characteristics. I will demonstrate clear differences in cluster structure between diurnal and nocturnal insects, and link those radar signals to a time series of light-trap moth data. Second, I will discuss the link between particular radar properties and the detection of insect abundance and diversity. Third, I will show how we are using electromagnetic modelling to predict how insects will appear in radar data. Taken together the work is a preliminary but exciting opportunity to solve a contemporary issue through interdisciplinary methods

Technologies for pollinator surveillance in field studies and intelligent image recognition: RFID, Rana and DAISY-II

Sarah E. Barlow[1], Mark A. O'Neill[2]

[1]Conservation Dept., Red Butte Garden, University of Utah, USA; and Associate Faculty, School of Natural and Environmental Sciences, Newcastle University, UK;
[2]Tumbling Dice Ltd, Newcastle upon Tyne, UK

sarah.barlow@redbutte.utah.edu

Ecologists and beekeepers need technology-based solutions, or e-ecology tools, for acquiring, sharing and understanding data on pollinators to address urgent knowledge gaps. We will present our work on developing and applying three novel technologies for studying pollinators. These are 1) prototype long-range RFID tags for tracking bumblebees in the field; 2) an automated video monitoring system based on active motion vision, called Rana; and 3) a deep learning intelligent image recognition system based on plastic self-organising maps, called DAISY-II.

We envisage an integrated e-ecology platform that leverages these tools. Developing the next generation of e-ecology tools will require cross-disciplinary collaborations between ecologists, engineers, informaticians and beekeepers, and significant investment from academia and industry.

Ecological applications of automated video monitoring (Rana) to study plant-pollinator interactions in Utah: Conservation management of rare Penstemons

Sarah E. Barlow

Conservation Dept, Red Butte Garden, University of Utah, USA; and School of Natural and Environmental Sciences, Newcastle University, UK

sarah.barlow@redbutte.utah.edu

Penstemon scariosus var. *albifluvis* (White River beardtongue) and *P. grahamii* (Uintah Basin beardtongue) are endemic to the oil-shale desert region of the Uintah Basin, north-eastern Utah. The species are threatened by factors relating to oil and gas development, including habitat loss and fragmentation, road construction and maintenance, and indirect disturbance to the species and their pollinators from fugitive dust and invasive plant species.

Field, lab and GIS studies, undertaken over two years, resulted in extensive multi-faceted datasets on pollinator visitation, plant performance and reproductive fitness, population size, density and distribution, plant community composition, and roads as a proxy for disturbance. Our pollinator data sets are the result of using novel automated video monitoring technology (Rana), deployed at multiple sites throughout the flowering periods. In total, we recorded 24,470 insect foraging visits to flowers of 50 *P. albifluvis* plants during 1373 h of automated video monitoring on 12 days; and 2,771 insect and 6 hummingbird visits to 49 *P. grahamii* plants during 2300 h of monitoring on 18 days. The principal pollinators of both species were *Osmia* bees which sonicate flowers. *Penstem scariosus* var. *albifluvis* was also frequently visited by the pollen specialist Masarid wasp, *Pseudomasaris vespoides*.

We used Structural Equation Modelling (SEM) to investigate causal pathways and resolve the direct and indirect relationships between the variables. Our results strongly suggest that the net effect of road-related disturbance on pollinator visitation rates and conditions favourable to plant growth (probably associated with water availability) depend on the spatial scale operating within the approximate realms of *Osmia* foraging ranges.

The findings will be used to make scientifically underpinned recommendations about the species conservation management to inform the Penstemon Conservation Agreement (PCA).

Automated pollinators monitoring on sympatric cytotypes of *Senecio doronicum*

Luca Pegoraro[1,2], Ellen C Baker[1,3], Manica Balant[4,7], Sarah Barlow[5], Ilia Leitch[1], Andrew Leitch[2], Luis Palazzesi[6], Robyn Powell[1], Daniele Sommaggio[8], Oriane Hidalgo[1,7], Jaume Pellicer[1,7]

[1]Royal Botanic Gardens, Kew; [2]Queen Mary University, London; [3]University of Oxford; [4]University of Primorska; [5]Red Butte Garden and Arboretum; [6]Museo Argentino de Ciencias Naturales; [7]Institut Botànic de Barcelona; [8]University of Bologna

l.pegoraro@kew.org

Sympatric mixed-ploidy plant populations can be used as natural experiments to investigate the early stages of speciation. We used the Rana automated system to monitor pollinators visiting a high elevation population of *Senecio doronicum* showing multiple cytotypes in SW France. Octoploid and tetraploid individuals exhibited small morphological differences, but had divergent flowering times as well as micro-habitat preferences. The main visitors to *Senecio doronicum* were flies and bees (most Asteraceae are generalists), with hoverflies *Eristalis* and *Syprhus* being the main visitors for tetraploids and octoploids respectively. Tetraploid plants attracted a higher proportion of feeding visits than octoploids, while the latter attracted more visits overall. Higher "effective" visitation rate could account for the tetraploid's higher reproductive success, although the different flower resource landscapes could also have influenced visitation. Automated pollinator monitoring techniques allow unprecedented detail in observing plant–pollinator interactions.

The Merian Project

Justin Sparks

The Merian Project Limited

justin.l.sparks@gmail.com

The value of the natural world has always been considered in both physical and metaphysical terms. Supporters of its metaphysical value, often promoted by conservationists keen to avoid the natural world becoming commoditised like iron or copper, prefer to posit the counter-question, what price would you put on the survival of the human race?

Evaluating the natural world in physical terms, as a percentage of world GDP growth, has often proved equally nebulous. Some accurate data can be drawn from calculating the dollar cost of environmental disasters, such as the price of cleaning up a river contaminated by industry, or soils contaminated by heavy metals, or harvests lost to floods. But valuations based on negative values are only part of the equation.

Europe countries that for centuries enjoyed a climate sweet spot, have been forced by drought to reassess the monetary cost of drawing irrigation water from rivers. As crop productivity threatens to go into reverse, and California's vast mono-plantations struggle to secure sufficient bee colonies to pollinate crops, calculating the true value of biodiversity has become a pressing theme. This informal talk will discuss some of the issues around why this is necessary, and how systems capable of calibrating and monitoring biodiversity in real time, are not only essential to conservation, but potentially transformative for both economics and social values.

Flight capacity and dispersal of the stag beetle *Lucanus cervus* (LINNAEUS, 1758), (Coleoptera: Lucanidae) in south-east England

Colin J. Hawes

School of Biological Sciences, Royal Holloway, University of London

The ability to disperse from natal sites is crucial for the maintenance of gene flow between neighbouring populations, and for the colonisation or re-colonisation of suitable unoccupied habitat. Dispersal distance data are also essential for providing reliable information on which to base habitat conservation strategies. Such data are vital, too, for estimating the likely effect of climate change.

Dispersal of the stag beetle *Lucanus cervus* has previously been measured by the author using mark-release-recapture (2006) and radio-telemetry (2007-2009) at two sites Suffolk (England). Results suggest that *L. cervus* has a low dispersal rate and range, especially in the case of female beetles when there is a plentiful supply of suitable decaying broad-leaved wood available at their natal site, or close to the site of their emergence.

A laboratory-based study, described here, examined the flight capacity of *L. cervus* using a flight mill. Tethered-flight experiments were conducted on 50 stag beetles (25 males and 25 females) under controlled conditions. Non-stop flight was timed up to a maximum of one hour. Eight sets of data were recorded: (i) body mass, (ii) elytrum length, (iii) maximum flight speed, (iv) mean flight speed, (v) maximum distance travelled, (vi) mean distance travelled, (vii) weight loss per kilometre flown, (viii) mean weight loss per kilometre flown. Non-stop flight for one hour was achieved by both sexes. Males showed a greater propensity for flight than females, which confirmed observations made in the field. Flight distances achieved were considerably greater than dispersal distances shown by radio-telemetry, and greater than telemetrically measured dispersal distances for beetles in Germany and Switzerland.

Continuous non-stop flight for one hour has not been previously demonstrated for *L. cervus*, as far as is known. Results suggest that long-distance dispersal of several kilometres may be possible for some individuals of both sexes in this species. If this is confirmed, we may need to reconsider our conservation strategy for this beetle.

Technological advances: a useful servant or a cause of bias?

James Bell

Rothamsted Research, Harpenden, AL5 2JQ

james.bell@rothamsted.ac.uk

For those beginning a new research program, the options to include technology to help to solve complex or practical problems are endless. Recently, I reviewed the possibilities for the second edition of our book *Practical Field Ecology*. I found that in every discipline from aquatic ecology to aeroecology, new ways of doing science were enabling great things, some unachievable with human input alone. However, there is an issue for research programs that have inherited a standardised sampling protocol. Here, sampling protocols have purposely remained unchanged, sometimes for decades, and the concern is that technological upgrades could bias results. The source of bias is likely felt either though a change in sampling efficiency or through an entirely new measurement. In this talk I address those concerns with reference to the Rothamsted Insect Survey (RIS) and associated activities. I dipped my toe into the increasing pool of technological opportunity when trying to combat the fall armyworm (*Spodoptera frugiperda*) in Kenya, a project funded by the Bill & Melinda Gates Foundation. Using image recognition (IR), we created an app (Nondo Africa – Google Play) that could identify moths including both adults and larval forms of the 20 moth maize pests in the region. We also leased TrapView's IR camera traps to detect migrating male *Spodoptera,* drawn to the trap using a pheromone lure. In my view, these activities are unable to cross-pollinate the core activities of the RIS because they currently have restricted identification capabilities. The RIS has recorded more than two thousand species and many insects are so small that the 'graph cut routine' in the IR process cannot accurately capture miniscule taxonomic features to distinguish between species, unless a compound microscope is used. As such this defeats the purpose as the process of slide mounting incurs much more time relative to the standard binocular microscope approach with an enthusiastic expert entomologist. Further, science has not progressed such that lures can be combined without interference, restricting these 'smart' traps to single species targets. Instead, for the RIS the digital transformation is being felt in other areas with complementary technologies that derive new data including: i) acoustic sensors that record the soundscape in the audible and ultrasonic range, helping to make the trophic links between predator and prey; ii) opto-acoustic sensors that derive new field data autonomously to validate our trap infrastructure at height; and iii) sensors that enable the estimation of trap performance, including changes in pressure and light penetration, alongside meteorological measures made in real-time. Lastly, we are close to delivering a new data warehouse that will see more than 55 million records visible, searchable and downloadable within the next year, a massive undertaking and one that we are keen to deliver to the entomological community.

DELEGATE LIST

Freya	Addison	University of Leeds	freya.addison@ncas.ac.uk
Maryam	AlHaddad	N/A	maryam.s.al.haddad@gmail.com
Tom	August	UKCEH	tomaug@ceh.ac.uk
Devshuvam	Banerji	Ashoka University	devshuvam@gmail.com
Sarah	Barlow	Red Butte Garden, University of Utah	sarah.barlow@redbutte.utah.edu
James	Bell	Rothamsted Research	james.bell@rothamsted.ac.uk
Apithanny	Bourne	Edinburgh University	apithanny@hotmail.co.uk
Victoria	Burton	Natural History Museum	vburton@outlook.com
Thomas	Dally	University of Leeds	fbstmd@leeds.ac.uk
William	Evans	The University of Leeds	bs17wle@leeds.ac.uk
Julie	Ewald	Game & Wildlife Conservation Trust	jewald@gwct.org.uk
Stanislaw	Galas	HiProMine	stanislaw.galas@gmail.com
Steve	Garland	Lancashire Wildlife Trust	steve@stevegarland.co.uk
Jenna	Grier	Liverpool Hope University	18005215@hope.ac.uk
Quentin	Groom	Meise Botanic Garden	quentin.groom@plantentuinmeise.be
Richard	Harrington	RES	richard@royensoc.co.uk
Martin	Harvey	UKCEH Biological Records Centre	marharv@ceh.ac.uk
Christopher	Hassall	University of Leeds	c.hassall@leeds.ac.uk
Mike	Hassett	Edge Hill University	20596588@edgehill.ac.uk
Dave	Hubble	OU	d.s.hubble@open.ac.uk
Somala	Karthik	Dr Rajendra Prasad Central Agricultural University	somalakarthik1995@gmail.com
Harrison	Lambert	Natural Resources Institute	harrison.lambert@greenwich.ac.uk
Daniel	Leybourne	ADAS	daniel.leybourne@adas.co.uk
Daniel	Leybourne	ADAS	daniel.leybourne@adas.co.uk
Ashley	Lyons	Liverpool Hope University	lyonsa@hope.ac.uk
Emma	Manning	Headscape	emma.manning@headscape.co.uk
Abadi	Mashlawi	UOM	amashlawi@hotmail.com
Morag	McCracken	UK Centre for Ecology and Hyrology	memcc@ceh.ac.uk
Sofie	Meeus	Meise Botanic Garden	sofie.meeus@plantentuinmeise.be
Ellen	Moss	Newcastle University	ellen.moss@ncl.ac.uk
Hadyn	Murray	University of West Scotland	hadynreism96@gmail.com
David	Nash	University of Copenhagen	DRNash@bio.ku.dk
Redell	Olsen	Royal Holloway	redell.olsen@rhul.ac.uk
Mark	O'Neill	Tumbling Dice	mao@tumblingdice.co.uk
Mir	Owais	Skuast-K' Shalimar Srinagar	mirowais150@gmail.com
Anne	Oxbrough	Edge Hill University	anne.oxbrough@edgehill.ac.uk
S	Pavithran	Tamil Nadu Agricultural University	sspavithranmsd@gmail.com
Luca	Pegoraro	Royal Botanic Gardens, Kew	l.pegoraro@kew.org
Lars	Pettersson	Lund University, Sweden	lars.pettersson@biol.lu.se
Domonic	Phillips	Southampton University	djophillips@yahoo.co.uk
Glen	Powell	NIAB EMR	glen.powell@niab.com
Gabor	Pozsgai	Fujian Agriculture and Forestry University	pozsgaig@coleoptera.hu
Dalila	Rendon	BioDatarium	dalila.rendon@biodatarium.com

Molly	Rogers	University of Bristol	m.rogers@bristol.ac.uk
Helen	Roy	UK Centre for Ecology & Hydrology	hele@ceh.ac.uk
Samuel	Rund	VectorBase	srund@nd.edu
Renate	Smallegange	Wageningen Academic Publishers	smallegange@wagenigenacademic.com
Douglas	Sponsler	University of Wuerzburg	sponslerdb@gmail.com
Joanna	Staley	UK Centre for Ecology and Hydrology	jnasta@ceh.ac.uk
Jenni	Stockan	James Hutton Institite	jenni.stockan@hutton.ac.uk
Jen	Thomas	Harper Adams University	jen@falciot.net
Jessica	Wooden	Edge Hill University	jesswuf@gmail.com
Sharon	Zytynska	University of Liverpool	sharon.zytynska@liverpool.ac.uk