

# Spreading the word

## Can the goal of open access to research be supported financially?

**A**chieving growth and demonstrating transparency are two major ambitions espoused by the coalition Government. In recent speeches, Universities and Science Minister David Willetts has said both can be achieved by extending public access to publicly-funded research.

Extending access is, of course, a welcome aim. The difficulty is how to bring this about in a world where complex systems have evolved around the publication of research articles: from the peer-review process to their printing, distribution and curation in both libraries and online.

Many elements of these systems are provided on a commercial basis, and some on a not-for-profit basis, but all incur some costs. I have yet to encounter any members of the Society who are not in favour of opening up access, but all recognise that this must be funded from somewhere in the system and a new business model will be needed.

The Government recently welcomed the recommendations made in the Finch report on 'Extending Access to Research', published in June. In the report the Finch Group, chaired by Dame Janet Finch of Manchester University, recommended 'a clear policy direction' towards open access as the main vehicle for publishing publicly-funded research, using 'article publication charges' for authors, rather than journal subscriptions.

Many of our learned society Member Organisations have charitable objectives to disseminate research reports from their specialisms and have publishing enterprises to achieve this. They reinvest financial surpluses, earned in the broader support of their science, into fellowships, grants, educational and career support and public engagement activities. Indeed surveys have shown that they invest approximately twice as much in the UK higher education sector as they earn from it in library subscriptions.

Much of their ability to do this relies on revenues earned from journal

sales overseas, demonstrating the national value of this export industry. Of course earnings from running meetings, charging membership subscriptions and through investments and grants also play their part. Organisations that publish, on average, rely on it for half of their revenue (in some cases up to 95%).

Many of the Society's individual members are authors, readers, peer-reviewers and editors of journals and articles. As such they largely produce, quality-control and consume these research reports without directly paying or earning. Behind all this lies a complex world of university and library subscriptions to publishers, and the funding for academic time and resources. Many members outside the academic library sector would welcome the facility to read original research reports, as would many involved in commercial R&D or with an interest in health, environmental, cultural and political debates.

Open access, however, will not confer accessibility as popularly understood. The majority of reports are written for specialist readerships. Even for those specialists the volume of research currently being published is so large that automated reading and computer-aided searching are considered to be tools of increasing importance. 'Readability' and the ease of discovery of articles may in fact be the emerging challenges. Policy development is ongoing here also. The Royal Society tackles this in its report 'Science as an Open Enterprise', with practical measures to ensure that data is made available in useable and durable formats high on its lists of recommendations.

Both of these recent reports will receive plenty of attention in the coming months and the Society will continue to be involved in discussions. Our Research Dissemination Committee has already published a position statement on journal content mining and the Society has written to the Government in response to the Finch Report.

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Laura Bellingan FSB  
Head of  
Science Policy

## Ensuring access for all



The Society of Biology is now a core member of the STEM Disability Committee – a grouping

of learned societies and academies with a commitment to improving policies, practices and provision for disabled people in STEM disciplines. The Committee was established last year following the Barriers to Disabled Students conference, held by the Institute of Physics, which highlighted a number of common problems encountered by disabled students entering lab or field environments.

The Committee aims to identify areas of joint working that could improve provision for disabled students in the sciences. Its remit includes people aspiring to a STEM career as well as those already employed, and takes into consideration both physical and mental disabilities.

The Committee has a number of practical projects underway – most recently working with the Scottish Sensory Centre to launch 116 new British Sign Language signs for physics and engineering terms. The new terms add to existing chemistry and biology signs developed by the team in a project that began in 2007. The signs ensure students with hearing difficulties are not deterred from engaging in science, for which complex terms can act as a barrier.

The STEM Disability Committee is also working on projects to support dyslexic students with maths and to support disability assessors of STEM students, ensuring assessors understand the unique requirements a STEM degree demands.

If you recognise any specific problems with disabled access to biology degrees, have ideas for potential STEM disability committee projects or have expertise with disabled STEM workers and students, please get in touch with Jackie Caine at [jackiecaine@societyofbiology.org](mailto:jackiecaine@societyofbiology.org)

More information on these projects and a portal to further resources can be found on the website [www.stemdisability.org.uk](http://www.stemdisability.org.uk)

Video clips of the Scottish Sensory Centre's British Sign Language signs can be found at [www.ssc.education.ed.ac.uk](http://www.ssc.education.ed.ac.uk)



# Ecologists & economists join forces at summit

## London workshop tackles the big ecological questions facing UK agriculture

**H**ow can public policy tackle the need to create sustainable agriculture in the UK, given such complex issues surround the issue, such as food security, volatile food commodity markets and global climate change?

Add to that concern over the beneficial processes and resources that farmland ecosystems provide – known as ecosystem services – and you have an extremely complex problem. Yet this was the issue of the day for over 60 experts in both ecology and economics at a May workshop in London hosted by the Natural Capital Initiative (in partnership with York Environmental Sustainability Institute, UK Network of Environmental Economists, Valuing Nature Network and GardnerLoboAssociates).

In his keynote speech, Professor Bill Sutherland (Department of Zoology, University of Cambridge) outlined principles for an effective

sustainable agricultural policy from the perspective of an ecologist. He emphasised that the UK must be considered in a global context, taking into account trends in markets, production capacities, population growth and changing diets. Agri-environment policy interventions should be focused and incentives well-targeted to ensure that they are effective to local or regional land management priorities – be they biodiversity, tourism, crop production or flood defence.

Professor Ian Bateman (Centre for Social and Economic Research on the Global Environment, University of East Anglia) followed this with the viewpoint of an economist. Ecosystem services are often neglected in economic discussions, he said, stressing the importance of incorporating strong natural science evidence when analysing the potential impact of land management changes. (For example, the effects on water quality and biodiversity as well as production outputs and earnings.)

Professor Bateman said where robust information is not available, constraints must be applied to ensure that natural resources are used sustainably. The need to



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determine what these constraints are provide an opportunity for dialogue between ecologists and economists.

The keynote speakers joined Professor Tim Benton (University of Leeds), Professor Charles Godfray (University of Oxford), Dr Paul Morling (RSPB) and Dr Salvatore Di Falco (London School of Economics) in a panel discussion to identify the most pressing issues around sustainable agriculture. The panel agreed that policy must ensure that we do not export environmental, social or economic degradation when we import food from elsewhere. At the same time, issues of scale and heterogeneity of land use here in the UK mean that blanket policies will be unlikely to achieve their goals, whereas targeted incentives to farmers, to ensure the effective provision of ecosystem services, might be successful.

The panel also considered how patterns of food consumption, particularly with rising food prices, will be an important issue to tackle and policies may be required to encourage sustainable consumer behaviour. Later, break-out groups considered how farmers could be incentivised to manage farmland to enable optimal provision of ecosystem services.

In closing, Chair Peter Costigan (Department for Food, Environment and Rural Affairs) concluded that great progress has been made in the dialogue between ecologists and economists in recent years. “Discussions from the event showed a much greater familiarity with each other’s disciplines and an increasingly common language,” he said.

Costigan expressed hope that the workshop might have sparked ideas to be carried forward in both research and policy. In light of a major review of the EU Common Agricultural Policy in 2014, participants agreed that it is essential for ecologists and economists to work together to ensure that agricultural production is delivered sustainably.

To facilitate further dialogue, the National Capital Initiative and the supporting partners of this workshop are organising a further session at the British Ecological Society’s Annual Meeting in December.

**A full report from the workshop is available at [www.naturalcapitalinitiative.org.uk](http://www.naturalcapitalinitiative.org.uk)**



# PET HATE

Exotic pet-keeping is on the rise despite decades of initiatives aimed at reducing the trade of exotic and rare animals. Three experts argue that urgent action is needed to protect both animals and ecosystems.

Several decades ago, alligators could occasionally be seen walking through the streets of London accompanied by their proud owners.

Amid a culture of curiosity, animal keepers housed almost anything that would physically fit into their homes: crocodiles, giant tortoises, big cats, primates, piranhas, salamanders and owls.

The introduction of the Dangerous Wild Animals Act (1976) in Britain controlled some of these excesses, especially where large and venomous species were concerned. Also in the UK, a 1983 amendment to the Pet Animals Act (1951) banned the selling of pets from market stalls on welfare grounds.

Conservation issues began to gain recognition in the 1960s and 70s, resulting in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 1975.

Trade bans on certain key species were also successful in reducing trade volume and wildlife collection (see box on page 16). But bans on commercial importation and trading have not resolved all problems associated with exotic pet-keeping, as many surviving animals continue to experience captivity-related stressors, morbidity (incidence of disease) and mortality (deaths due to trade and keeping).

Renewed interest in exotic pet-keeping has in fact led to an expansion in both the diversity and severity of the problems associated with it. At the same time, better scientific understanding of the biological needs of animals has led to new obligations in animal welfare. Modern 'welfare' practices should no longer merely consider whether containers are overcrowded, or if animals have broken bones and occupy dirty cages, but also account for their behavioural and psychological needs.

Science has also revealed other significant new problems and challenges associated with the exotic pet trade, including ecological alteration from over-collection, the impact of invasive 'alien' species and animal-to-human diseases.

Over one thousand species are in trade (CAWC, 2003), but current concern is typically focused on reptiles. According to data from the Pet Food Manufacturers Association, the pet reptile population in UK homes has risen from 700,000 in 2009 to



Photo: PETA

Approximately 200 dead green iguanas from a shipment of about 400. Tens of millions of wild animals of several thousand species are wild-caught or captive-bred annually to supply the exotic pet trade. Many, like these lizards, do not survive their cramped transport conditions.

“Renewed interest in exotic pet-keeping has in fact led to an expansion in both the diversity and severity of the problems associated with it”



850,000 in 2010, and 800,000 in 2011 (PFMA, 2009, 2010, 2011).

#### Welfare

Unfortunately, the fundamental five freedoms for well-being – freedom from hunger and thirst; freedom from discomfort; freedom from pain, injury and disease; freedom to behave normally; and freedom from fear and distress – which are now embodied in the Animal Welfare Act 2006, are not all realistically met for exotic pets living in vivariums.

Exotic pet morbidity and premature mortality are high. A recent investigation of a major US-based dealer (a UK supplier) found that of 26,000 animals, 80% were sick, injured or dead. Approximately 3,500 dead and dying animals, mostly reptiles, were being discarded weekly. The dealer's defence was that the operation was in accordance with wholesale pet industry standards of 70% mortality (Smith, 2010).

Between 2000 and 2008, the percentage of wild caught CITES-listed reptiles imported into the EU increased by almost 79% (RSPCA, 2010). Wild collection and shipping is frequently traumatic for animals due to capture-stress, cramped conditions, injury and disease. Captive bred animals avoid some of these stressors but are still subjected to restrictive breeding facilities, shipping and so on.

A significant difference between

domestic and exotic pets is that whereas domestic animals such as dogs and cats have relatively liberal associations with their keepers, exotics are typically caged, and manifest numerous captivity-stress-related behaviours. These typically include interaction with transparent boundaries – persistent climbing of glass walls – hyperactivity, hypoactivity, co-occupant aggression, and 'pica' – habit-related consumption of non-food materials, such as bedding or paper (Warwick, Frye and Murphy, 2004).

By comparing reptile supply with the population of pets in homes, it is clear premature mortality among reptiles in the domestic environment is high.

Data from animal trade regulators indicates that, on average, around 320,000 reptiles were imported into the UK each year from 2006 to 2011 (DEFRA, 2012). According to Karesh et al. (2007), an additional 25% illegal trade should be factored-in, suggesting the annual number of reptiles imported into the UK is more like 400,000. (Some consideration should be given to the fact that not all imported reptiles are destined for the pet market, as laboratories and zoos exert a small demand for reptiles.)

Meanwhile, the Federation of British Herpetologists and the Reptile and Pet Trade Association, which represents reptile breeders in Britain, add that approximately 300,000 additional reptiles have been bred

## Trade bans: success stories

From the 1960s, several hundred thousand wild-caught Mediterranean tortoises arrived and died every year in the UK until 1984, when the trade was banned under CITES. By 2010 less than 14,500 reportedly captive-bred tortoises were either imported or sold domestically (DEFRA, 2011), conserving wild populations.

Illegal trade has also been reduced (Türkozan et al., 2008). A consequential 3,000–4,000% increase in 'unit price' has also probably minimised impulse purchases that are commonly associated with poor welfare.

In the 1980s and 90s, UK imports of red-eared terrapins (*Trachemys scripta elegans*) reached 200,000 annually, with a mortality rate of approximately 90% (Warwick, 1992) until the trade was banned in 1997 under the EU Habitats Directive.

Other North American turtles have since partially substituted red-eared terrapins in trade but are imported in considerably lower numbers and are also more expensive to purchase (Bringsøe, 2006).



in the UK in captivity for the pet trade annually since 2006 to 2011. Combined, these figures indicate that around 700,000 reptiles have entered the UK pet trade system each year since 2006.

Furthermore, these data do not include the private and commercial buyers that legally purchase (often multiple) animals abroad – in particular from Germany and the Netherlands – and transport these to the UK in private vehicles. This steady movement of unaccounted-for reptiles into the UK is known by the authors to be particularly prevalent before and after exotic animal fairs. This component may be significant, suggesting that the supply figure above may be conservative.

Notwithstanding the 'mortality bottleneck' (see page 17) in both the pre-UK and UK commercial systems, the data appear to suggest that the annual mortality rate in the home is very high – we found at least 75%.

### Species conservation

At the moment, wildlife traders can freely exploit an unprotected animal until enough scientific and politically acceptable evidence emerges to demonstrate that continuation of trade threatens that species' survival. Gaining recognition for a species to be 'CITES-listed' as, for instance, Appendix I (endangered, and prohibited) or II (threatened, and restricted or monitored) is often burdensome.

Firstly, the process requires the discovery of a species' decline, often by chance observations; secondly, it involves species and environmental impact studies, which are often poorly-funded and limited, and frequently rejected by the regulatory authorities as 'insufficient'; and thirdly, where more substantial data are provided,

**RIGHT**  
**Prairie dogs**  
**grossly**  
**overcrowded**  
**and starving at**  
**a supply house**  
**in the USA.**

Government-processing, commercial obstruction and political inertia must be overcome.

Tens of millions of wild animals of more than a thousand species are caught in the wild or captive bred annually to supply the exotic pet trade. This is in addition to those harvested for medicine, food and their skins. If a species is granted protection, enforcement is often poor, enabling many traders to continue regardless. Alternatively, traders may transfer to another target species of unknown status – effectively commencing a new cycle.

It is impossible for scientists and administrators to keep step with those who exploit species for the pet trade. Unlike other industries, there is no burden of proof on wildlife traders to establish that their proposed market is sustainable for nature or safe for the public (or for that matter, the living product itself).

What's more, it is predicted that by 2032 more than 70% of the land surface globally will have been damaged or disturbed by the human population (UNEP, 2002). Habitat loss has been identified as a major threat to 85% of all species described in the IUCN's Red List – those species classified as threatened or endangered (WWF, 2011).

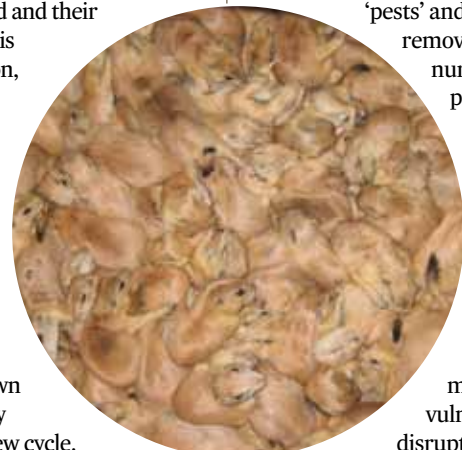
In short, there is simply less wildlife out there, making human-wildlife impacts now greater than ever. It is not difficult to argue that the impacts of the exotic pet industry are additional burdens the world does not need.

### Ecological alteration

Some ecological concerns associated with the exotic pet trade are well known: removal of significant numbers of predator-animals may result in explosive numbers of prey species, which in turn may lead to an increase in agricultural 'pests' and epidemics; removal of significant numbers of prey-animals may result in predators shifting to more sensitive species. Many other ecological relationships may be vulnerable to disruption when animals are harvested for the pet trade: for example, tortoises dig burrows which many vertebrates and invertebrates dependently share.

However, over-collection is not the only factor that can affect a population and its ecosystem. Many populations contain key individuals, such as 'transient' males, that differ behaviourally from others in the group and wander from one population to another – enhancing genetic diversity. Removing these individuals may affect population dynamics and fitness, and physically 'higher profile' individuals, such as transients, may be more easily collected than secretive individuals. Such subtleties may prove critical to population integrity even with low-level collection.

The release of pets into the wild can also cause problems. Invasive 'alien' species from incidental pet releases show varying degrees of establishment, such as in Florida,



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where Burmese pythons (*Python molurus*) have become second only to the indigenous alligator (*Alligator mississippiensis*) in predatory status, and Germany and France where American bullfrogs (*Lithobates catesbeianus*) are well established.

In the UK, the same bullfrog has been joined by ring-necked parakeets (*Psittacula krameri*) and monk parakeets (*Myiopsitta monachus*). A recent survey indicates that approximately 51 types of non-native amphibian and reptile live wild in the London area (Langton et al., 2011).

Released pets have the capacity to introduce novel and harmful pathogens to indigenous wildlife (Warwick, Frye and Murphy, 2004). For example, in the USA, the release of pet tortoises is what most likely led to widespread introduction of 'upper respiratory tract disease syndrome' (URDS) which killed 79% of free-living tortoises (Jacobson, 1992).

#### Public health and safety

Approximately 200 recognised human diseases are linked to animals. Known as 'zoonoses', about 40 of these pathologies are associated with amphibians and reptiles alone (Warwick, 2006). A survey of 1,410

human diseases, however, found that 61% may have a zoonotic origin (Brown, 2004). Wildlife markets have been highlighted as an especially high-risk infection hub due to species diversity, poor hygiene and stressful and cramped conditions that facilitate microbial transfer.

Many cases of zoonotic disease superficially resemble common illnesses, such as gastrointestinal disturbances and 'flu-like' conditions, and thus may be misdiagnosed. Although important and of rapidly growing concern, the prevalence of zoonotic disease in the human population is at present challenging to quantify.

**The Burmese python is an invasive alien species that has been introduced to Florida by pet releases.**

In the USA, the keeping of hatchling turtles was historically popular until epidemiological studies revealed that 14-18% (approximately 280,000) cases of reptile-related human salmonellosis (RRS) annually were turtle-associated.

In 1975 the import and domestic trade of turtles less than four inches in length was banned. The ban prevents the import and sale of small animals (not all animals) and export is still permitted. The year following the ban saw a 77% reduction in RRS infections (Mermin et al., 2004). Extrapolating from current US figures, we consider there may be around 5,600 RRS cases in the UK annually. In addition to zoonotic disease, there are growing safety issues arising from exotic pet-related human injuries and venom bites (De Haro and Pommier, 2003; Schaper et al., 2009).

The exotic pet trade also enables remote potential pathogens access into the UK via air travel – the use of only minimal or no quarantine (in the case of fishes, amphibians and reptiles) only adds to this issue.



Photo: www.prowildlife.de



**Pet reptiles (like these veiled chameleons) can exhibit behaviours related to captivity-stress compared with such creatures in their natural habitats.**

**We calculated that in the six years from 2006 to 2011, over 4.2 million reptiles probably entered the UK trade system. At least 3.2 million of these are likely to have survived to reach households, and just 800,000 will currently be surviving in homes.**

### Future approaches

The exotic pet trade has been subject to some governmental regulation for at least four decades. However, despite the long history of theoretical control the problems associated with the exotic pet trade remain – regulation and enforcement is laden with inertia, and the pet industry has manifestly failed to self-moderate.

While trade bans on certain species have not solved the problem of exotic pet trading, the authors do feel they are important and more are urgently required.

Following bans, surviving animals become a ‘finite’ and arguably more ‘precious’ population. Owners are more likely to seek specialist veterinary care, improving welfare, and the release of unwanted animals into the wild becomes less likely.

Despite our best efforts, the number of individual animals and species in trade is unknown; the proportion of legal versus illegal trade is unknown; the number of animals caught in the wild versus captive bred is unknown; the number of people suffering injury or zoonoses is unknown; and the conservation and threat of extinction status for the vast majority of species in trade is unknown or unclear. This lack of information is lamentable but unsurprising, given the apparent laxities of the pet industry.

Some new measures of monitoring and control are emerging: the EU has declared biodiversity protection

a major environmental priority for Europe; an EU strategy is in preparation to address invasive alien species; an EU Animal Health Strategy has been developed to help protect livestock from invasive disease; and a new EU strategy for animal welfare is in progress.

The authors are not proposing a ban on the keeping of exotic pet animals. Rather, we feel there is justification for a ban on the importation of and domestic trading in both exotics caught in the wild and those that are captive bred – thus a prohibition on any commercial trade activity. This would result in a rapid improvement in species conservation, ecological problems, and welfare concerns linked to transport, storage and captivity in general.

Based on historical precedents, such a ban would cease most entries into the trade and domestic pipeline, thus allowing the remaining problems of public health and safety, release of alien species and animal welfare in private ownership to reduce in line with a reduction in the captive animal population.

A strong education programme is also needed: not just with regards to animal welfare issues, but to responsibility to the indigenous ecology from invasive species, and the introduction of novel pathogens to free-living wildlife. Plus, of course, the risks of pet-linked disease to human and animal health.

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Ring-necked parakeets, now regularly found in the UK after release into the wild, are another invasive species.