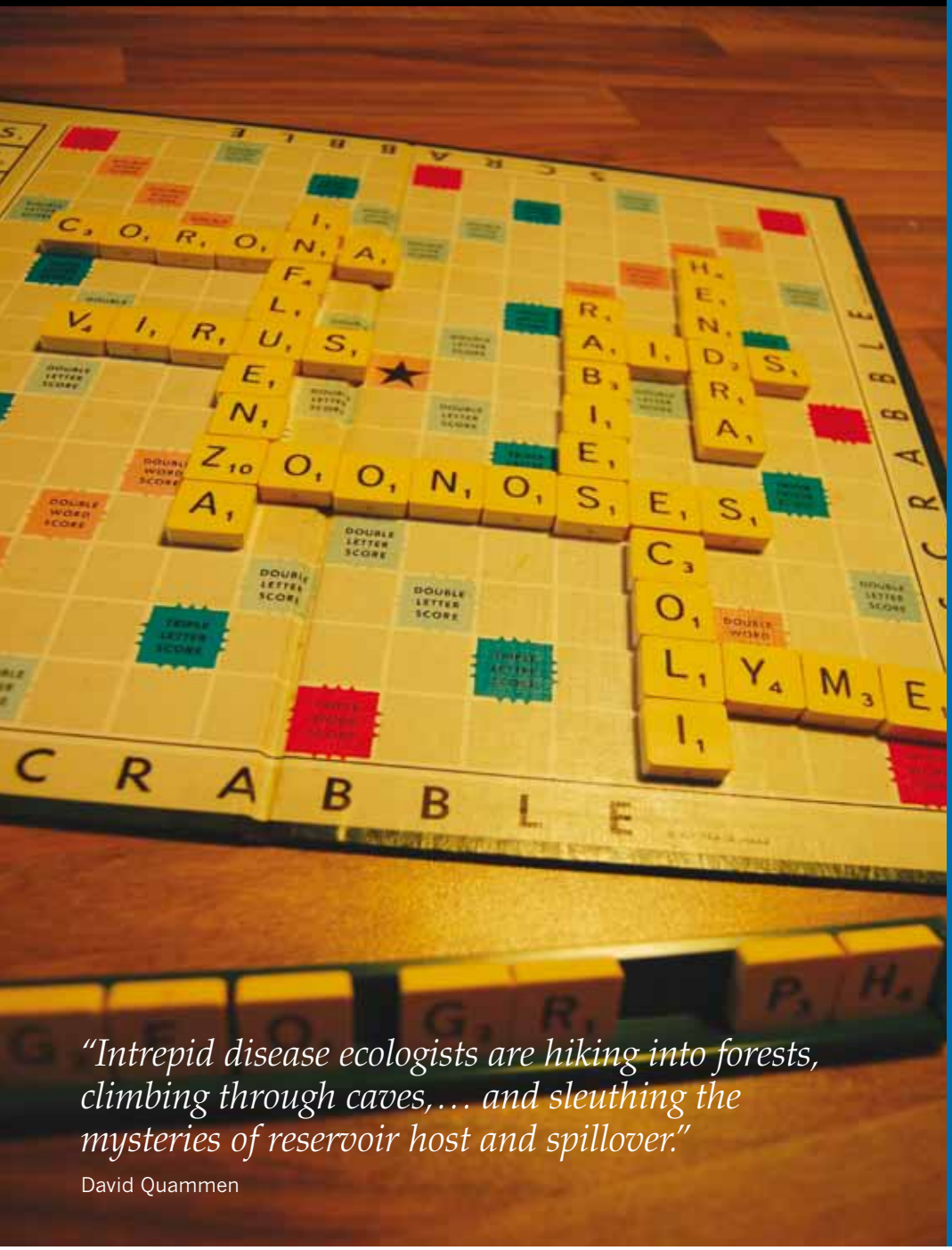
WINTER 2013–14

The Geographer

The newsletter of the Royal Scottish Geographical Society

Zoonoses

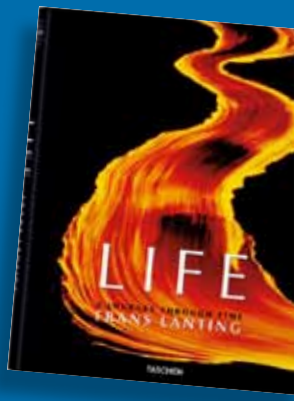
Reservoirs, reasons and the role of viruses



"Intrepid disease ecologists are hiking into forests, climbing through caves,… and sleuthing the mysteries of reservoir host and spillover."

David Quammen

IN THIS EDITION...



PLUS OTHER NEWS, COMMENTS, BOOKS...

RSGS: helping to make the connections between people, places & the planet

The Geographer

zoonoses

Zoonoses are much more than just a good word in Scrabble: the term derives from *'zoo'* meaning 'of animals', and the Greek *'nosos'* meaning 'disease', and refers to those diseases which can be passed from animals to humans. Many people anticipate that if there is to be a major outbreak of a new disease, it will most likely be a zoonosis.

About 60% of current infectious diseases are thought to be zoonotic in origin. For example, all influenza stems from diseases of water birds such as ducks; even swine flu comes from birds, but its appearance in pigs simply increased the likelihood of 'spillover' into humans. Many readers will remember the 'bird flu' (or H5N1) scare in Scotland back in 2006, and the consequent concerns it generated. Flu is a particular worry, in part because of its incredible adaptability – there are 18 known types of haemagglutinin (H) and ten known types of neuraminidase (N), so, in theory, 180 different combinations of these proteins are possible.

Zoonotic diseases lurk in some of our more ancient species, such as bats, rodents and birds, and other hosts who have developed immunity but carry the virus. In fact, these viruses have almost certainly influenced the evolution of these animals in the process. But with a growing human population, increased deforestation and encroachment into natural areas, more travel, more urbanisation, and an indiscriminate demand for meat, the opportunity for spillover to humans is greater than ever. It is a classic geographical conundrum – a multi-faceted combination of environmental change, lifestyle change, and changing patterns of connectivity.

There are thousands of people on the front line of zoonotic exploration. Where do these diseases come from? Where have they been hiding? Why are they appearing? How do they spread? And what do we need to know to prevent them spreading? In this edition of *The Geographer*, we aim to shed some light on this fascinating area of research, with the help of veterinarians and virologists, journalists and geographers.

I am grateful to Professor Jo Sharp, Dr Jo Halliday and Professor Sarah Cleaveland from the University of Glasgow for their help in producing this magazine.

Mike Robinson, Chief Executive

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Tivy Education Medal

RSGS President Prof Iain Stewart presents the Medal to Alan Parkinson.

Alan Parkinson was awarded the Tivy Education Medal, together with Fellowship of the RSGS, at the Scottish Association of Geography Teachers conference in Perth in October. The award was given in recognition of his work developing online educational resources for schoolteachers.

In 2001, Alan developed the then-revolutionary Geography Pages website. He went on to become a prolific blogger, better known to some for his online persona 'GeoBlogs', and he now runs eight blogs on various aspects of geographical education. He previously worked for the Geographical Association, and is a founder member of the Geography Collective / Explorer HQ, creators of the *Mission:Explore* books and website. He now works part-time as a geography teacher at King's Ely.

Delighted to have received the Medal, Alan remarked, "What was equally important to me was to read and hear the comments of others who were there, who appreciated the work that I've created and shared over the years."

John Rae Bicentenary Conference

Dr Andrew Cook, a member of the RSGS's Collections Team, visited Orkney to speak on behalf of the RSGS at the John Rae Bicentenary Conference in September. Dr Cook presented on the Goodsir Papers, a record of correspondence between members of the Goodsir family, which forms part of the RSGS's archive.

Harry Goodsir was surgeon on the ill-fated Franklin Arctic Expedition. A young naturalist in Edinburgh, he realised his ambition for Arctic exploration when he was appointed Acting Assistant Surgeon, *HMS Erebus*, in March 1845.

RSGS Perth Group

please help

Our Perth local group is keen to hear from anyone who would be able to assist with some of the basic but critical tasks associated with running our public talks. If you feel you could help, please contact RSGS HQ.

Train trip no more

Sadly, we have not been able to develop our plans for a 130th anniversary train trip, due to a lack of sufficient interest. Thank you to those members who did express enthusiasm, but unfortunately the costs of train hire are too prohibitive to allow us to proceed without a much higher take-up than has been evident. We will keep trying other ideas in future editions.

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RSGS AGM

Monday 24th March 2014 will see the next RSGS AGM, in Perth Concert Hall, which we plan to follow with a public talk given by our President, Professor Iain Stewart. More details will be sent to members in February.

Amongst other items on the agenda for the AGM, we will be seeking to introduce a new constitution (tidying up the 2009 constitution which is now somewhat dated in places), and to appoint new members of Board (Trustees). Two members of Board have recently stepped down, including the longest-standing member, Stuart Frame, who had served as Treasurer for more than 20 years. We are grateful to Stuart for all his efforts over the past two decades, and to Trustee Keith Griffiths for his more recent input, in particular to the new constitution.

To replace them, the Board would particularly welcome people with good financial skills, and those with the time to commit to help move the Society further along in the months and years ahead. Board roles are normally held for a maximum of two terms each of three years, and there are five half-day Board meetings a year, usually in Perth, plus the AGM. Anyone wishing to put themselves forward for nomination as a potential Board member must be an RSGS member, and will need a Proposer and a Seconder (also both RSGS members). If you are interested, then please send a short biography, detailing the experience you would bring to Board and how you can help, to RSGS HQ, addressed 'Board nomination'. Please contact RSGS HQ if you would like further details.

RSGS Chairman


Barrie Brown

After six years as Chairman of the RSGS, Barrie Brown announced in November that he would step down in the New Year. Keen to ensure that there would be a smooth transition, he invited the Board to nominate a successor, and Professor Rogers Crofts CBE was duly unanimously elected.


Professor Crofts

Professor Crofts is a geographer by training, profession and inclination. He has used his geographical skills in many senior roles in government, and has been a Board member of international, UK and Scottish bodies. He has a particular interest in Scotland's Earth history, Iceland's environmental protection, energy, and the world's natural wonders. He said, "On behalf of all members of the Board and of the Society, I express sincere thanks to Barrie Brown who has given sterling service as Chair. The award of a Fellowship was a fitting tribute to his many contributions. I wish him well for the future.

"It is a rare privilege to be appointed as the Chair of the RSGS. Now we are fully established in the Fair City, I hope we can become a beacon for new ways of looking at our world and be a formative influence in resolving the issues of the day. Like all charities, we have our challenges. I know that the Board and the staff will address these jointly with rigour and creativity. I relish the prospect of chairing the organisation through its next phase."

Chairman's thoughts

Barrie Brown

As I approach the end of my term as Chair, I hope you will indulge me for sharing these thoughts with you all.

In any charity, faith in what you exist for is essential. In this context, I am happy to assure you all that the members, and staff, of the Society are at least as convinced of the rights of what we are doing as our founder members would have been in 1884. And that assurance is strengthened by our ability to communicate more effectively through our exhibition centre in the Fair Maid's House, and in particular through the use of our collections.

I was told some years ago that the Society could not exist without its volunteers and I completely endorse that statement. Our CEO has regularly calculated the total contribution made by all our volunteers and it totals the equivalent of several staff years. It would be impossible to keep open the Fair Maid's House without the dedicated team of volunteers, and our collections, too, have benefited from the work of a team of volunteers, most of whom have a background in that type of work. It would be impossible to run our local groups without the commitment of the local committees who are often the first point of contact with our members, visitors, and potential members.

All charities need benefactors, and by that I mean people who support their work by gifts of money. We have effected many economies in our running costs in the past few years, but despite that, we still have great difficulty in making ends meet. I read recently that some large charities benefit by receiving "millions of pounds in legacies each year, often from people who are not even members". These people simply approve of what the organisation is doing and may even use legacies to make sure that nothing goes to the taxman when the final tally is made. Despite our longevity as a vibrant Scottish charity, we have only occasional support of this type, and I would ask you to please consider helping the Society in this way if you can.

I conclude by sharing with you one of my 'straws in the wind'. I was at the launch of the Society's Stories in the Land exhibition, and one of the young participants told me that she had changed schools so that she could study geography and that she hopes to work as a volunteer guide in the Fair Maid's House in a gap year before university. I was delighted to assure her that she would be most welcome.

With best regards,

Barrie

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Fairtrade Pioneers Presented with Shackleton Medal

Husband and wife team Craig Sams and Jo Fairley were presented with the RSGS's Shackleton Medal after their talk in Perth in December. Craig and Jo were the brains behind Green & Black's chocolate, the pioneering brand which paved the way for mainstream Fairtrade products.

Green & Black's was launched in 1991 by the ex-hippy organic wholefood pioneer and his journalist wife, with virtually no cash. From those tentative beginnings, it has grown into an internationally renowned $100 million brand, now owned by Cadbury, where Jo still works as a brand ambassador, alongside her day jobs as a marketing consultant and journalist.

The RSGS's Shackleton Medal, which recognises leadership and citizenship in a geographical field, was awarded to Craig and Jo for their work on developing sustainable, ethical, fair trade practices. Due to Green & Black's fair trade policy, cacao growing communities in Belize have been strengthened both socially and economically, improving the status of women, increasing education, and uniting the community in a common business.

Shakespeare's Scotland

In September, to coincide with Perth Theatre's production of *Macbeth*, an informal display of maps from Shakespeare's time was exhibited in the Fair Maid's House. Collections Convenor Margaret Wilkes, volunteer Tony Simpson, and Education Officer Joyce Gilbert selected items from the RSGS's extensive collections of splendid early maps of Scotland.

Members of the cast with a map of Cawdor.

The display also formed the basis of a Continuing Professional Development evening for teachers. Before the evening, three members of the *Macbeth* cast visited the Fair Maid's House to hatch their murder plot!

Professor Charles McKean FRSGS

Professor Charles McKean, Emeritus Professor of Scottish Architectural History at the University of Dundee, died in September, some time after being diagnosed with cancer. A passionate advocate of preserving Dundee's architectural history, he led hundreds of walking tours of the city, and was recognised by several royal societies and academic bodies for his achievements in engaging the public with his research in Scottish architectural history.

Hats off to Iain Stewart

Midway through his run of popular *Inspiring People* talks for the Society, RSGS President Professor Iain Stewart travelled to London to receive an Honorary Doctorate from Kingston University. The University's Faculty of Science, Engineering and Computing was pleased to honour Professor Stewart with the award of Doctor of Science *honoris causa*, in recognition of his outstanding contribution to geoscience communication to the public.

Stories in the Land

on tour

After a well-received run at Edinburgh's Scottish Storytelling Centre in October, where it was seen by an estimated 2,000 visitors, the RSGS's *Stories in the Land* exhibition will carry on its journey to Stirling in 2014. The exhibition will be hosted in the Crush Hall of the University of Stirling's Pathfoot Building, a central hub where items from the University's art collection are put on display. The *Stories in the Land* project has involved researchers from the University's School of Education. Dr Greg Mannion recorded the reactions of both school pupils and the Duke of Edinburgh's Award group to their experiences of learning in the landscape, as a basis for research into outdoor learning. It's hoped that the exhibition will also visit the communities involved in the project later in the year.

SAGT & RSGS

Further to a successful recent meeting with representatives of SAGT about the issues regarding geography's place within the Curriculum for Excellence, we are seeking comments from teachers and practitioners on their experience of the changes, and hoping to establish the scale of their impact. If you would like to take part, please contact our Education Officer at joyce.gilbert@rsgs.org.

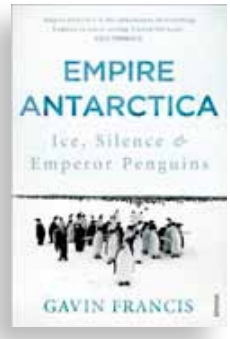
take part

SARS virus

zoonoses

Researchers have found two SARS-like coronaviruses in Chinese horseshoe bats. These viruses are around 95% genetically similar to the SARS virus in humans, and could have transferred directly from bats to humans. They could therefore be used to develop new vaccines and drugs to combat SARS, which infected more than 8,000 people and killed over 770 during the outbreak in 2002 and 2003.

Gavin Francis wins Scottish Book of the Year



Dr Gavin Francis received the Scottish Mortgage Investment Trust Book of the Year award for his non-fiction book *Empire Antarctica: Ice, Silence and Emperor Penguins*, which details his experiences as resident doctor with the British Antarctic Survey. Gavin, who spoke for the Society in Dunfermline in November, and previously took part in our World Book Day celebrations in 2012, was based at Halley, a profoundly isolated British research station on the Caird Coast of Antarctica. The research station is so remote, it is said to be easier to evacuate a casualty from the International Space Station than it is to bring someone out of Halley in winter.

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First 'Explorer-in-Residence'

We are delighted to announce the appointment of the RSGS's first ambassador for exploration, more commonly known as Explorer-in-Residence. Scottish explorer Craig Mathieson will work with the Society for the next four years, promoting our work and his, and inspiring school children all over the country.

Craig has been involved in many polar expeditions, to both the Antarctic and the Arctic. His childhood dream was to ski to the South Pole, a dream that he realised in 2004. He decided then that he wanted to share this experience with the younger generation. In 2006 he trained a 16-year-old boy, who joined him on a journey to the Geographic North Pole. This trip of a lifetime proved life-changing, and motivated Craig to replicate its success elsewhere.

Since then, Craig has established the Polar Academy charity, to take young adults from difficult backgrounds and motivate them through expeditions. Participants will learn to work together in the outdoors as a team, learning the importance of planning and leadership. The Academy will emphasise that any goal is achievable, as long as you have the right attitude. Craig will spread this message wide, by talking to school classes around the country, before taking a selection of young adults for training sessions in Scotland. A small number of these young people will then join him on an expedition to East Greenland.

Craig has given talks to thousands of school children around the country, and will now be doing so as a representative of the Society. Despite the 'in-Residence' part of his title, he will not be confined to the Explorers' Room, but will be out and about around Scotland and on expedition, encouraging understanding of exploration and the natural world.

Craig said, "To be awarded the title of the first RSGS Explorer-in-Residence is truly an honour and a privilege. As a young boy I would read of the achievements of Scott, Amundsen and Shackleton, hoping and dreaming that perhaps one day I could also experience the harsh beauty of the polar regions. Having now stood at both the North and South Poles, I feel it my duty to share the knowledge and experience gained over the years. Therefore, working with the RSGS, who have similar aspirations, allows for an ideal partnership. Over the coming months and years, I am looking forward to inspiring our younger generation and hopefully motivating them to achieve their own dreams one day."

RSGS Chief Executive Mike Robinson said, "Craig is a great guy with a gentle exterior that hides a fierce determination and an iron will. His plans for the Polar Academy are visionary and ambitious, and the RSGS is delighted to back him in this venture and, I hope, help him to achieve that vision. We hope he can 'crack on', as Craig would say."

RSGS Medals 2014

The RSGS's prestigious Medals and Awards allow us to recognise outstanding contributions to geographical exploration and learning. We are now inviting nominations for the RSGS Medals 2014, and are particularly seeking nominations for:

- Livingstone Medal, for outstanding service of a humanitarian nature with a clear geographical dimension.
- Mungo Park Medal, for an outstanding contribution to geographical knowledge through exploration or adventure in potentially hazardous physical or social environments.
- Shackleton Medal, for leadership and citizenship in a geographical field.
- Geddes Environment Medal, for an outstanding contribution to conservation of the built or natural environment and the development of sustainability.
- Tivy Education Medal, for exemplary, outstanding and inspirational teaching, educational policy or work in formal and informal educational arenas.
- Bartholomew Globe, for excellence in the assembly, delivery or application of geographical information through cartography, GIS and related techniques.

To nominate someone for an award, please send details, including a brief explanation (up to 250 words) of why your nominee(s) should be considered, by email to enquiries@rsgs.org, or by post to RSGS HQ in Perth. Nominations should be marked for the attention of the Chief Executive, and should arrive by the end of February 2014.

nominate a medallist

Sustainable Energy For All

The UN Decade of Sustainable Energy for All, 2014-24, highlights the importance of energy issues for sustainable development. The UN General Assembly has asked Member States to galvanize efforts to make universal access to sustainable modern energy services a priority, noting that 1.3 billion people are without electricity, that 2.6 billion people in developing countries rely on traditional biomass for cooking and heating, and that even when energy services are available, millions of people cannot afford them.

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Scotsman Supplement

We were delighted to publish a four-page feature in *The Scotsman* on Saturday 19th October. This supplement was designed to act as an introduction to the history of the Society, whilst also featuring our current activities and aims, and to act as a showcase for the talks programme. There has been a great positive response to the supplement, including a number of new members and some notable increases in attendance at talks.

From waste to water filtration

A quarter of Scotland's green glass bottles are to be recycled to make water filtration systems at a new plant in Midlothian. Dryden Aqua will use the glass in filters for drinking water, industrial waste water and pools. Environment Secretary Richard Lochhead said, "This is a major investment in Scotland's green credentials and places us at the forefront of the move towards a zero waste nation."

Scotland – No 3 place to visit

Scotland has been named by *Lonely Planet* as one of the top ten countries to visit, narrowly missing out to Brazil and Antarctica. Why was Scotland so high on the list? *Lonely Planet* said that events like the Commonwealth Games and the many events under the Year of Homecoming banner, plus a certain political debate, mean that Scotland is an exciting place to visit in 2014.

Deer management

We were happy to receive two pieces of feedback on an article in the Autumn 2013 edition of *The Geographer*. George J Strachan, a former geography teacher and a founder member of the first deer management unit established in Scotland (Gairloch Conservation Unit), took issue with a number of the statements made in Mike Daniel's piece *Deer Management – Getting Out of the Rut!*. Forestry Commission Scotland also gave us some key points on the article. Both responses are available at our blog at royalscottishgeographicalsociety.blogspot.com.

Doug Scott FRSGS

In November, Doug Scott (left), one of the world's most accomplished climbers, was presented with the RSGS's Honorary Fellowship by Colin Mitchell, Chair of the RSGS Dumfries Group.

Inspiring People talks

Whooper swans. © L Campbell

We were delighted to see some fantastic turn-outs for talks by RSGS President Professor Iain Stewart, and mountaineers Doug Scott and Paul Braithwaite, in November. Both played to packed halls throughout the country. The talks were so successful that some members of the public had to be denied entry, and we would like to extend our apologies to anyone who was inconvenienced.

One of the drawbacks of engaging high-profile adventurous people to come and give talks for us is that sometimes they will be offered an unmissable opportunity to go and do something more adventurous instead. And so it is with Dave MacLeod, who was invited to spend January doing some spectacular climbing in Patagonia and who is therefore unable to speak for us this year. However, we are delighted that his place in our talks programme has been taken by wildlife photographer Laurie Campbell, who will now be speaking in Inverness, Perth and Stirling in mid-January. Laurie has dedicated over 35 years to photographing Scotland's distinctive wildlife and flora, and was Scotland's first full-time professional wildlife photographer. He will speak on the results from a recent project where he worked on a commission for the North Harris Trust to photograph the wildlife, landscape and a little of the culture of a community-owned 62,000 acre estate in this wild and beautiful part of Scotland.

come to a talk

Norwegian town sees the light

The small town of Rjukan in Norway has seen its first ever winter sun. The town is nestled in a deep valley, and remained completely sheltered from the sun from late September to mid March. Now, three large solar-powered and computer-controlled mirrors have been placed on the hillside, to reflect sunlight into the town square. Locals can come to the square for a quick burst of reflected sunlight, which is almost as intense as natural light.

HIV genetic diversity

Researchers from two universities in São Paulo, Brazil, who analysed blood samples from HIV+ children and adolescents born between 1992 and 2009, observed greater genetic variability in the HIV virus than had been indicated by previous studies in adults. The results of the investigation (detailed in *Variability of HIV-1 Genomes among Children and Adolescents from São Paulo, Brazil*, available on www.plosone.org) suggest that the profile of the epidemic in Brazil is changing, with possible implications for both diagnostic tests and vaccine development.

zoonoses

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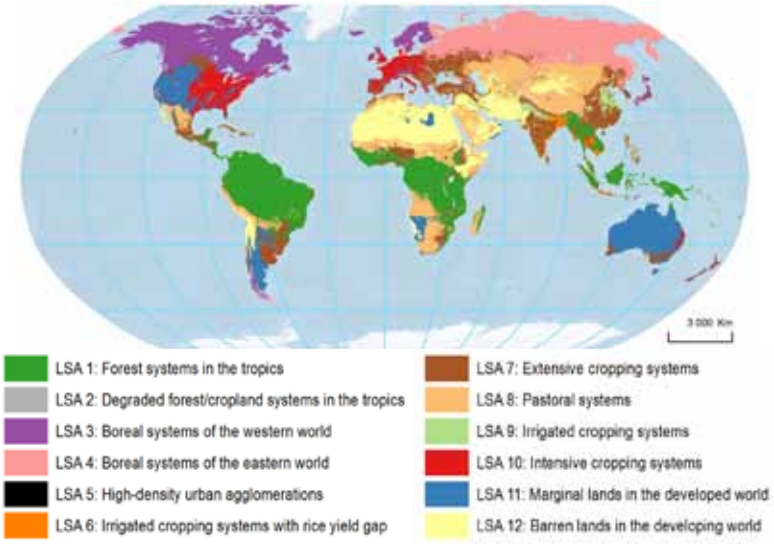
Global Land Use

In order to assess the global impacts of land use on the environment and help provide appropriate countermeasures, a group of researchers under the leadership of the Helmholtz Centre for Environmental Research (UFZ) has created a new world map of land use systems. Based on various indicators of land use intensity, climate, environmental, and socio-economic conditions, the researchers identified twelve global patterns called land system archetypes. These include barren lands in the developing world, pastoral systems, or extensive cropping systems. The results are published in the journal *Global Environmental Change*.



Global land system archetypes. The data for this classification refer to the year 2005.

Bob Scott

We were sorry to lose a good friend when Bob Scott died in October after a short illness. An enthusiastic supporter of the RSGS, Bob was determined to be the first to sign the new Fair Maid's House Visitor Book, on 21st July 2011. His words, "Excellent facility. Credit to the Society." set the trend for many more positive comments to follow.

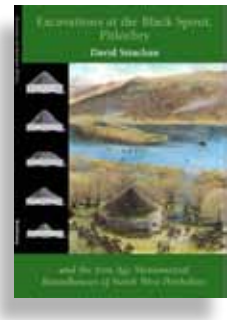
A former provost of Perth, Bob became one of the Fair Maid's House volunteer guides, a friendly and welcoming face, with a wealth of local knowledge. Later, he worked with the RSGS's collection team, thoroughly enjoying himself as he carefully cleaned layers of grime off all the Ordnance Survey 19th century 6-inch map indexes, and all superficial dirt off at least a hundred OS early 20th century 25-inch maps of Edinburgh – he loved doing these and noting the map detail on them.

Bob made a considerable, positive and practical contribution to the RSGS, in hours of work always done with a sunny smile and with absorbing interest. We will miss him.

Geoparks are rocking

The Shetland and North West Highlands (NWH) Geoparks are back on track after securing funding from the Scottish Government in July. Backed by this new funding, the NWH Geopark advertised for a new Development Manager and Information Manager in November. The NWH Geopark starts at the Summer Isles in Wester Ross and continues northwards through west Sutherland to the north coast. It extends to the east of Durness, beyond Loch Eriboll, and on to the Moine. Its eastern boundary largely follows the Moine Thrust zone, a famous and important geological structure.

Excavations at the Black Spout, Pitlochry



A new book by David Strachan, published by and available from Perth and Kinross Heritage Trust (www.pkht.org.uk), tells the story of an archaeological dig from 2005 to 2009 which uncovered remarkable broch-like architecture at an Iron Age building near Pitlochry. The book explores the contemporary culture and environment of the region, with expert contributions on place-names, ancient environments, and the array of stone, metal and glass artefacts unearthed.

Polio in Syria

In late November, the World Health Organization (WHO) confirmed 17 cases of wild poliovirus type 1 infection in three separate areas of the Syrian Arab Republic, confirming widespread circulation of the virus. A comprehensive outbreak response is being implemented across the region, with seven countries and territories holding mass polio vaccination campaigns targeting 22 million children under the age of five years.

As a result of the global effort to eradicate polio, cases decreased from 350,000 in 1988 to just 223 in 2012. In 2013, only three countries (Afghanistan, Nigeria and Pakistan) remained polio-endemic, down from more than 125 in 1988. But as long as a single child remains infected, children in all countries are at risk. Failure to eradicate polio from its last remaining strongholds could result in up to 200,000 new cases every year, within 10 years, across the world.

Matthew Smallman-Raynor, Professor of Analytical Geography at the University of Nottingham, explained, "The wartime collapse of hygiene and healthcare systems means that familiar infections rapidly re-establish themselves opportunistically in war-torn populations."

Fair Maid's Garden

Jonathan Hemelberg's design for a geology garden.

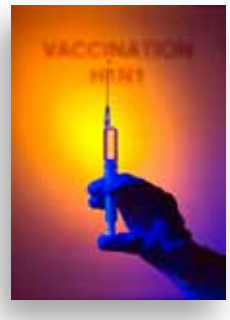
We are planning to create a 'geological garden' at the Fair Maid's House, and were delighted to welcome students from Edinburgh College of Art's *Art, Space & Nature* course to share their design ideas. The ten students took as inspiration the work of Scottish geologist James Croll, who developed a theory of climate change based on the Earth's orbit. The students produced a startling variety of designs from this shared base point, using elements including glacial stone, sculptures based on icebergs, and the planting of rare Arctic mosses, to create inspired concepts for this currently under-used space in our visitor centre. We will be in touch with members during 2014 as plans develop.

Zoonotic Geographies

Professor Jo Sharp, **Dr Jo Halliday** and **Professor Sarah Cleaveland**, University of Glasgow

"It is estimated that at least 60% of human infectious diseases are zoonotic."

A zoonosis is a pathogen (a biological agent that can cause disease in a host) that jumps species from an animal host to infect a person. It is not a commonly used word, nor is it one that has generally been considered by geographers, but the concept it describes is ubiquitous, and the causes and effects of zoonotic disease transmission are intensely geographical. We actually read about zoonoses all the time: in terrifying headlines about the discovery of a new form of bird flu or swine flu in Southeast Asia that is sweeping through local populations and threatening to go global via the intense networks of travel and trade that now connect the distant parts of the world; through debates about the necessity of badger culls to protect farmed cattle (and the consumers of their milk) from TB; in cautions given out to walkers heading to the Scottish hills to abandon the hardiness of hiking in shorts and instead to cover exposed flesh as protection from ticks and the possibility of Lyme disease.

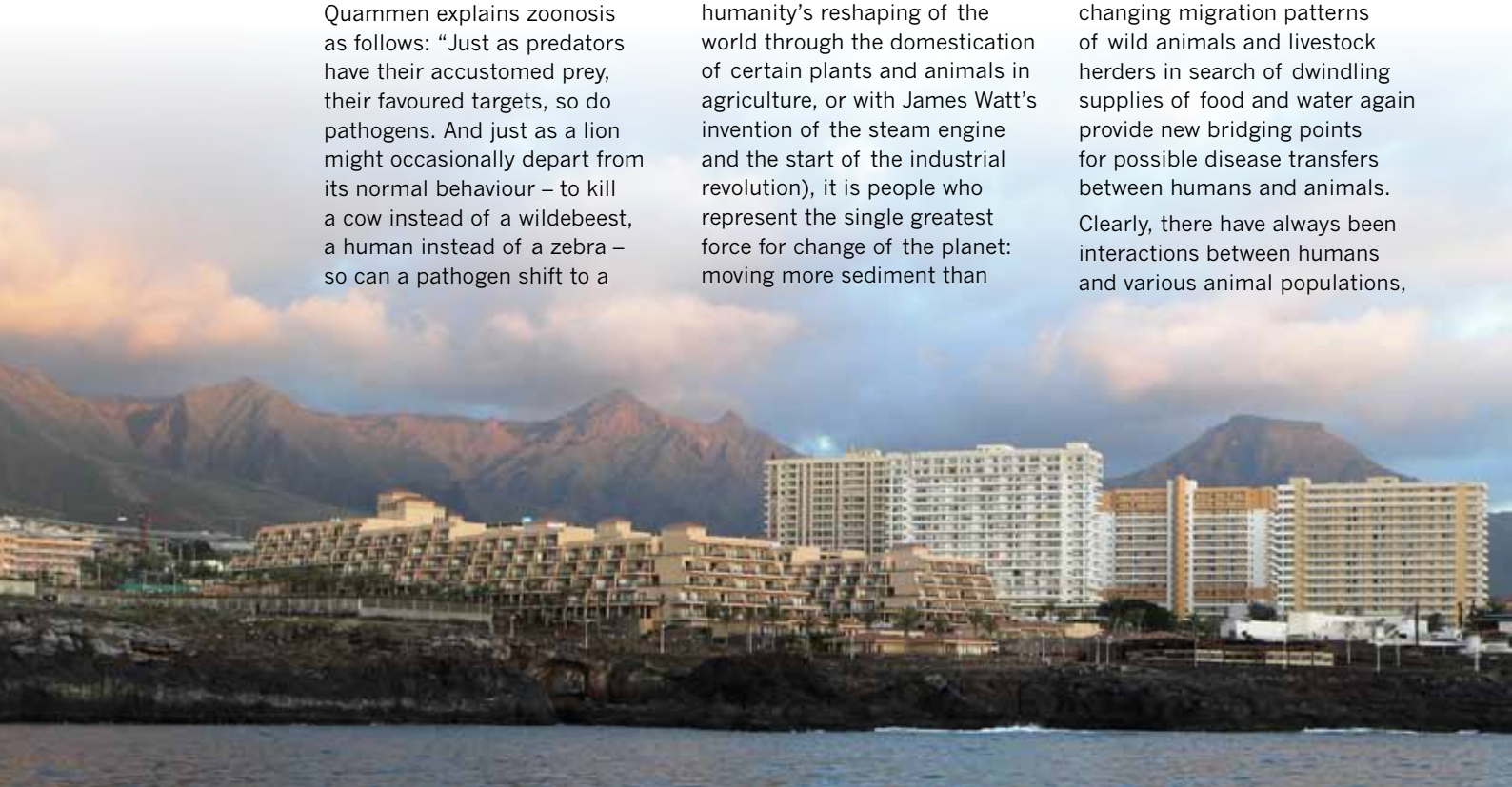


In his book *Spillover,* David Quammen explains zoonosis as follows: "Just as predators have their accustomed prey, their favoured targets, so do pathogens. And just as a lion might occasionally depart from its normal behaviour – to kill a cow instead of a wildebeest, a human instead of a zebra – so can a pathogen shift to a new target. Accidents happen. Aberrations occur. Circumstances change and, with them, exigencies and opportunities change too. When a pathogen leaps from some non-human animal into a person, and succeeds there in establishing itself as an infectious presence, sometimes causing illness or death, the result is a zoonosis."

It is estimated that at least 60% of human infectious diseases are zoonotic. We have always lived with zoonoses because we have always shared our world with other animals and their infections. However, it would appear that there are more frequent 'spillovers' of diseases from animals into the human population in recent years than has been the case in the past, and this has been linked to humanity's ever-greater influence in reworking the Earth's environments. Some have gone so far as to think of humanity now as being an Earth-shaping force akin to a geological era. In the Anthropocene, as it has been labelled (beginning either at the initiation of humanity's reshaping of the world through the domestication of certain plants and animals in agriculture, or with James Watt's invention of the steam engine and the start of the industrial revolution), it is people who represent the single greatest force for change of the planet: moving more sediment than the combined forces of natural erosion; influencing climate through the emission of huge amounts of carbon into the atmosphere; and causing the irreversible extinction of some species and the monocultural production of others.

Changes in human activities lead to the creation of novel ecosystems and alterations to existing ones, with new and changed interactions between people and other animal species. These changes lead to the release of new diseases into new animal and human populations, and the impact of these changes on the distribution of disease can be seen at a range of geographical scales. At the local scale, human alteration of the landscape can have a range of unintended effects on animal populations, wiping out some and supporting others, for instance the populations of rodents and scavengers like foxes that now thrive in cities. Consumption of 'bush meat', including various primates, in Central Africa is thought to mediate the emergence of diseases such as HIV and Ebola. At larger scales, climate change is shifting the pattern of diseases that are spread by insect vectors, and changing migration patterns of wild animals and livestock herders in search of dwindling supplies of food and water again provide new bridging points for possible disease transfers between humans and animals.

Clearly, there have always been interactions between humans and various animal populations,



and ever since the earliest forms of agriculture, which facilitated the concentration and growth of people in certain places, these relationships have been dynamic. However, the rate of this change has never been higher. The concept of the Anthropocene highlights the interconnectedness of these changes at a global scale, affecting not only the immediate environs of the intervention but also the ways in which systems operate across the whole planet. We cannot be sure of the effects of human-mediated changes when different systems (climatic, fluvial, oceanic, for instance) are interacting in such complex ways, but we can be sure that changes in our environments are likely to lead to changes in the infectious disease threats (zoonoses and non-zoonoses) that we face. Furthermore, the network of global connections between societies means it now only takes a pathogen like SARS and influenza 24 hours to cross the globe. Despite increasing governments' attention to 'biosecurity' as a part of national defence strategies, irrespective of where we live we can all now be impacted by disease transmission events in the most remote parts of the planet.

While it is undoubtedly the case that it's the potentially global reach of new flu strains or the haemorrhagic fevers like Ebola that have captured the popular imagination, whether through popular science books like *The Hot Zone* or Hollywood movies like *Outbreak* and *Contagion*, zoonoses and their impacts go far beyond these dramatic headline-grabbing scenarios. As well as these high-profile newsworthy outbreaks, endemic zoonoses also have significant burdens in countries throughout the world.

These burdens are felt most acutely in the countries of the Global South. Many of these zoonoses affect production livestock, resulting in a 'double whammy' effect – not only a greater risk of disease for people as a result of more regular and close interactions with livestock, but also a greater impact on the livelihoods of people who are dependent on farming. In such societies, there is often chronic under-funding of health services for animals and people, and this is compounded by low levels of education and difficulties in effective dissemination of information. As it is the case that many zoonoses are often difficult to diagnose, particularly in cases where they have symptoms that are very similar to other, more high-profile, diseases such as malaria, the human illness burdens of these diseases is frequently unrecognized. Moreover, this is not only a problem for rural residents: the rapidly growing informal areas of cities in the Global South represent the fastest changing environments on the planet. Such communities are poorly supported through infrastructure – city authorities and national governments simply cannot keep up with the speed of urbanization here – so people live without adequate water or sewerage services, and are often tightly packed together. These are ideal conditions for the emergence and spread of diseases that can be acquired through contact with rodents, or close proximity to livestock and poultry brought to the urban populations to meet growing demand for protein.

However, the recent emergence of the 'One Health' approach has begun to address some of these challenges. One Health recognizes the important intersections of, and interdependencies between, human and animal health, and so the need for joined-up thinking. Such approaches have seen research being designed and undertaken by teams of human health researchers and vets working together to understand where the key interactions occur, where risks of transmission might arise, and thus the points at which prevention measures can be addressed. Moreover, this more contextual approach explicitly draws in the significance of other systems too: the changing environmental conditions within which species meet; the economic constraints of livestock production; and the cultural dimensions of animal care and consumption. Thus, a variety of environmental and social science researchers, including geographers, are also getting involved in the One Health approach. In this edition of *The Geographer*, we offer an introduction to some of the research that is emerging from these new collaborations.

"One Health recognizes the important intersections of, and interdependencies between, human and animal health, and so the need for joined-up thinking."

Urban pig-keeping in Dar es Salaam.

Focus group discussion with livestock keepers about understanding of disease risk in Northern Tanzania.

The *Viruses* In Us

Dr Frank Ryan

"…the vertebrate component of our protein-coding DNA – the part we traditionally think of as human – amounts to a mere 1.5% of the total."

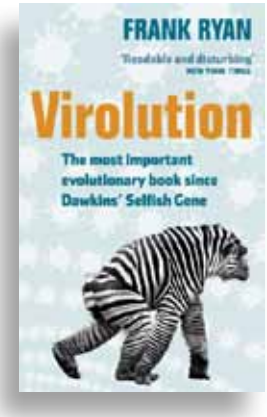
Life on Earth is essentially interactive. Biologists have been investigating these living interactions – symbioses – for more than a century. But only recently have we realized to what extent it applies to some of the most fearsome of organisms on Earth, plague viruses, and how this might apply to us, as humans.

We all know about viruses – they cause epidemics, like swine flu, smallpox and polio. But some 17 years ago, I entered epidemic zones to research a book, *Virus X*, and I came to the conclusion there was more to viruses than met the eye. I proposed that they changed the evolution of their hosts. Today we have growing evidence that this is true – indeed it seems likely that viruses have played a subtle role in the evolution of life. We also have growing evidence that they changed our human evolution.

When, on 12th February 2001, we obtained the first comprehensive analysis of our human genome, we were confronted by surprises. Where we had anticipated perhaps 100,000 or so genes, based on the prevailing notion of 'one gene, one protein', there were as few as 20,000. Today we know that these genes are made up of a series of exons, separated by non-coding introns, with proteins being coded by the splicing together of a selected cluster of exons from one or more genes, so that 20,000 genes can code for a much wider variety of proteins. A bigger surprise still was the breakdown of our human DNA, which revealed that the vertebrate component of our protein-coding DNA – the part we traditionally think of as human – amounts to a mere 1.5% of the total. This is dwarfed by DNA deriving from human endogenous retroviruses, or HERVs, which amounts to roughly 9%.

Contrary to earlier suppositions, the viral component of our genome cannot be dismissed as 'junk DNA'. Instead we are confronted by a paradox. How has this remarkable viral load come to be there? What role has it played in our human evolution? What role is it still playing in our human embryology, our day to day genetic chemistry? What role is it playing in the genetic underpinning of disease?

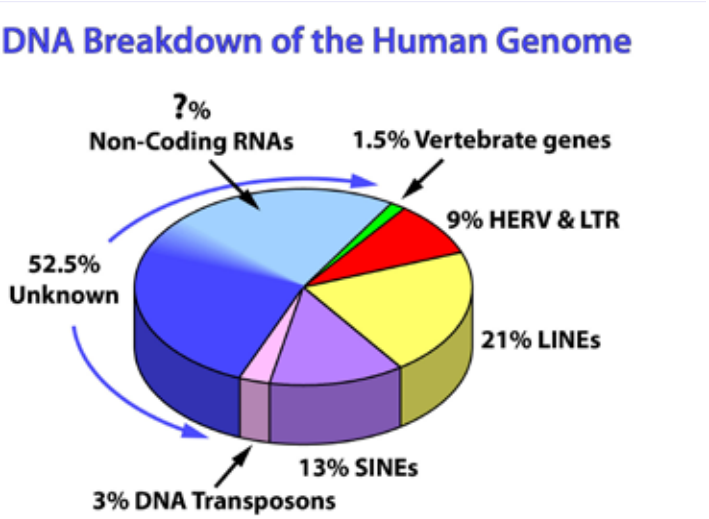
This brings me back to the concept of symbiosis. The partners in a symbiotic relationship are known as 'symbionts'. When symbiosis results in evolutionary change it is known as 'symbiogenesis'. Symbiosis is not synonymous with mutualism, since it is only necessary that one of the partners benefits from the partnership. Thus it includes parasitism, where one partner gains at the expense of another.



Symbiosis also works at different levels. For example, the root symbioses between fungi and all land-based plants, known as mycorrhizae, are metabolic, while the symbioses of the oceanic cleaner stations, where predators line up to have their skins and teeth cleaned by tiny wrasse and shrimps, are behavioural. Symbiosis also operates at genetic level, where partners share pre-evolved genes arising from different evolutionary lineages. In its most powerful form, 'genetic symbiosis' involves the union of entire pre-evolved genomes from different evolutionary lineages. For example, a single symbiosis event, long ago, enabled all animals, plants and fungi to breathe oxygen, while a series of symbiotic events enabled plants to capture the energy of sunlight through photosynthesis. In my book, *Virolution*, I explained how viruses are not only capable of being symbionts – they are the ultimate genetic symbionts.

Retroviruses, like HIV-1, the cause of AIDS, have an extraordinary evolutionary potential. They can invade the germ line cells of their hosts, the ova and sperm, to embed themselves into the chromosomes of future generations, where their viral genomes sometimes take on important genetic and physiological roles. At least 12 different HERVs play a variety of roles in human reproduction. Some help to construct the placenta, where they improve its structure by fusing together the cells lining the placental mother/foetal interface. They also help to suppress the maternal immune rejection of the foetus. But it doesn't stop there. Recent research in Sweden, where colleagues are drawing up the complete human proteome, has shown that HERV-derived proteins are involved in as-yet unknown roles in the normal physiology of a wide variety of different human cells, tissues and organs.

Dr Ryan is a consultant physician and the author of *Virolution*, in which he examines the extraordinary role of viruses in evolution and how this is revolutionising biology and medicine, including the possibility of manipulating the role of the viruses to help fight a huge range of diseases.



Pandemic *geography*

Professor Dirk Brockmann, Humboldt University & Robert Koch-Institute, Berlin

In the 14th century, the Black Death swept across the European continent in a wave that killed more than 25% of the European population in its wake. Although this event was driven by the interplay of human interactions and mobility, on large geographic scales, the process possessed a rather simple structure. With an initial outbreak in southern Europe, this historic pandemic turned into regular, large-scale wave-fronts that propagated in a matter of a few years and at a constant speed of a few kilometres per year across the entire continent.

Nowadays, matters are different. Recent large-scale epidemics, such as the 2003 worldwide spread of SARS and the 2009 global spread of 'swine flu' (H1N1 influenza), spread much faster (on average about 100-400 km/day). Because of the complexity of worldwide mobility, the patterns of modern disease spread are geographically chaotic, no longer exhibiting the spatial regularity of pandemics of the past. This comes as no surprise if we consider the complexity of modern air transportation, a network that connects more than 4,000 airports worldwide, and serves more than three billion passengers each year, who travel more than 10 billion kilometres each day.

As a consequence, it has become a daunting task to forecast the most likely spreading patterns of new, emergent infectious diseases. Whenever a novel disease emerges at scattered locations on the globe, researchers desperately try to answer the following questions: Where is the new disease going to hit next? Where did it originate? When is it going to arrive somewhere? One of the most powerful methods for addressing these questions is with highly sophisticated computer simulations that incorporate human mobility and transportation on a global scale. Although these models have been successful in the past decade, we still lack a fundamental understanding of global contagion phenomena. Also, computer simulations require detailed information on emergent infectious diseases, information that is usually not available when new pathogens surface.

In a recent study, *The hidden geometry of complex, network driven contagion phenomena*, we tackled the problem from a different angle. The key question we asked in this study was, "Are modern epidemics really that much more complex than historic events, or do they just appear to be more complex because of the global connectivity of our world?" What if only our notion of distance has to be redefined? Historically, conventional geographic distance was a good predictor for how long it would take a spreading pandemic to reach a chosen location. Nowadays, it might be better to think of distance in an effective way? For instance, from a perspective of a randomly chosen traveller in London, other 'distant' large cities such as New York City or Tokyo may effectively be closer than a small town in Sussex simply because our traveller is more likely to visit attractive hubs worldwide. This intuitive notion can be cast into a mathematical formula that maps the traffic between locations around the globe on an effective distance scale. This way, one can view the world from the perspective of any location using effective distance. Figure 1 (see page 11) illustrates this view of the world from Edinburgh according to this approach.

The key question now is, "What are the patterns of global epidemics that appear so complex on conventional longitude/latitude maps?" Figure 2 illustrates that, in the effective distance view, patterns are now simple concentric wave-fronts, very much similar to the patterns of historic diseases. This means that, in essence, these phenomena are fundamentally not much different nowadays than they were 500 years ago. It also means that, based on this new notion of effective distance, we can predict much better when an epidemic will arrive at a chosen location.

One of the interesting aspects of this work is that only from the perspective of the actual outbreak origin do the patterns behave nicely. For instance, when an outbreak occurs in London, then only from the perspective of London will one observe concentric patterns. Looking at the same hypothetical pandemic from any other location will not amount to a regular concentric wave pattern. Thus, if one only has a temporal snapshot of a contagion phenomenon (that is, a number of cases scattered here and there on a map), one can view this particular pattern from all possible locations and identify the most likely outbreak as the one from which the pattern looks more regular. This may become a powerful method for outbreak reconstruction in general, and it remains to be seen what other global contagion phenomena can be better understood by redrawing the maps of our world.

"The patterns of modern disease spread are geographically chaotic."

Further Reading

Brockmann D, Helbing D (2013), *The hidden geometry of complex, network driven contagion phenomena* (*Science*, 442 1337 (2013))

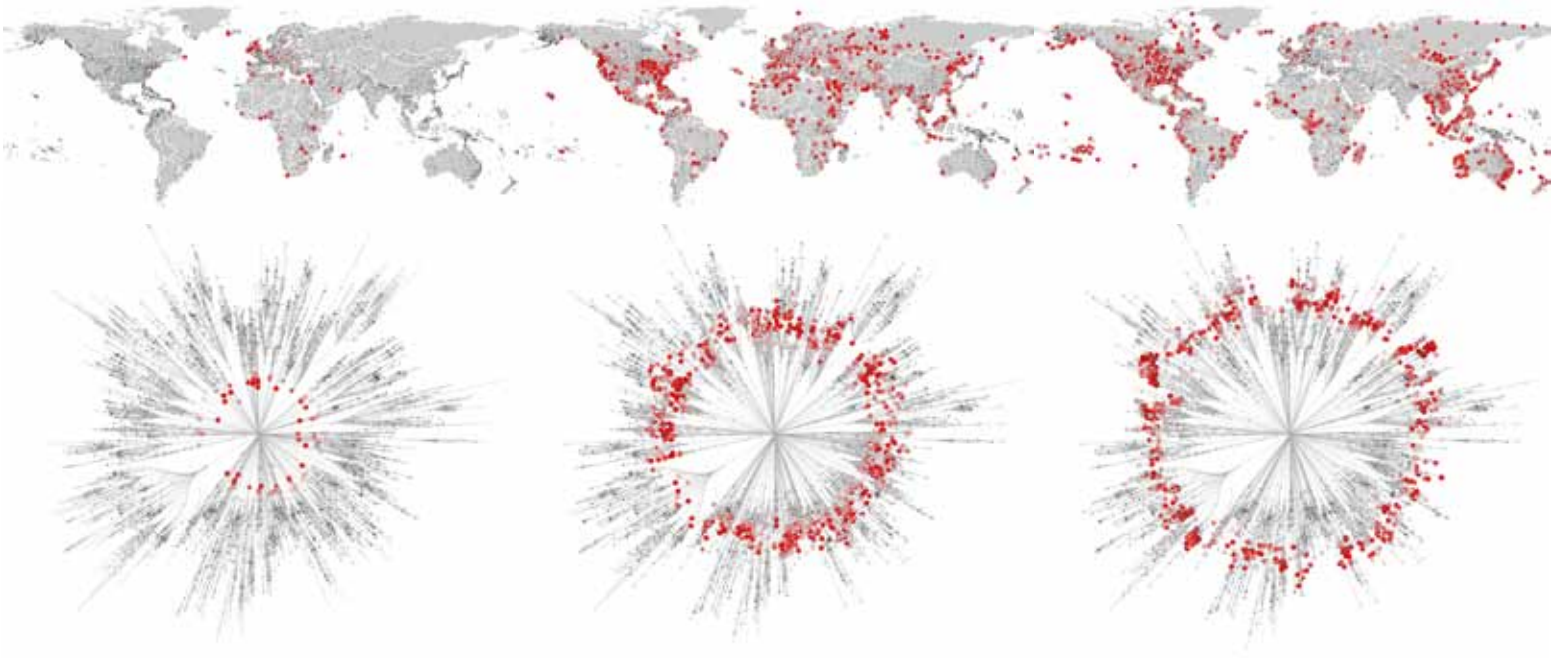


Figure 2: Each panel depicts a temporal snapshot of a hypothetical, computer simulated pandemic with its origin in London. A pattern that appears very complex on the conventional map is simple in the effective distance perspective from London. © Dirk Brockmann, Humboldt University & Robert Koch-Institute, Berlin, rocs.hu.berlin.de

Disease - the next **big** one

David Quammen

"The worst new diseases of the future, like those of the recent past, will be zoonotic."

Grim prognostications of pestilence are as old as the Book of Revelation, but they have not gone out of style or been rendered moot. Plague is a tribulation that science, technology and social engineering haven't fixed. In the mid-1960s, some public health officials imagined that antibiotics and other modern therapies would enable us to 'close the book' on infectious diseases and so make it possible to focus on non-communicable afflictions, like heart attack, diabetes and stroke. But that optimism was mistaken.

By one account, published in *Nature* in 2008, more than 300 instances of emerging infectious diseases occurred between 1940 and 2004. These included both the first appearance of scary new viral diseases (like SARS), with the potential to cause global pandemics, and the re-emergence of older bacterial infections in new forms (like antibiotic-resistant tuberculosis and *Staphylococcus aureus*), which are less dramatic but also capable of causing illness and death on a large scale. The authors of that study warned that global resources to counter disease emergence were poorly allocated, with most new outbreaks occurring in tropical countries, and most scientific and surveillance efforts concentrated elsewhere.

Ancient species like bats can harbour viruses to which they have become immune, but when they are eaten, or their habitat is encroached upon, the virus can leap to other animals, including people.

The most gruesome emergent diseases – like those caused by Ebola virus in Africa or Nipah virus in Asia – affect relatively few. The most devastating, AIDS, is caused by a devious, patient virus that wages slow-motion war against the human body, with mortal consequences for millions. The most explosive – SARS in 2002, or some recent strains of influenza – had the potential, but for prompt action and good luck, to claim many more victims than they did.

AIDS, SARS, Ebola virus, and many other new diseases have one thing in common: they are zoonotic. This means they came from non-human animals and made the leap to humans. The infectious agent might be a virus, or a bacterium, or another sort of parasitic microbe, or a worm; the animal in which it resides inconspicuously, before spilling over into humans, is known as its reservoir host. The reservoir host might be a bat (as with the SARS virus), or a rodent (the various hantaviruses), or a chimpanzee (HIV-1). The reservoir host of Ebola virus is still unidentified, a lingering mystery, though bats again are suspected. And all of our influenzas (even the so-called swine flu's) originate in wild aquatic birds.

We now know from molecular evidence (published by Beatrice H Hahn, Michael Worobey and their collaborators) that the pandemic strain of HIV went from a single chimpanzee into a single person (presumably by blood-to-blood contact when the chimp was slaughtered for food) around 1908 or earlier, in south-eastern Cameroon. The virus then must have passed slowly downriver, human to human, into the large population centres of the Congo basin before spreading worldwide.

Sixty percent of human infectious diseases, including the worst of the old ones and the scariest of the new, are zoonotic. Now disease experts wonder about the 'next big one:' when will it come, what will it look like, from which reservoir host will it spill over, and how many people will it kill?

Prediction is difficult. But we can be reasonably confident on a few points. The worst new diseases of the future, like those of the recent past, will be zoonotic. Unfamiliar pathogens come to people from wildlife or livestock. The scariest of the new bugs will probably be viruses. Formidable, hardy, opportunistic, and impervious to antibiotics, viruses replicate and evolve quickly. They exist in extraordinary diversity and seem ever ready to colonize new hosts.

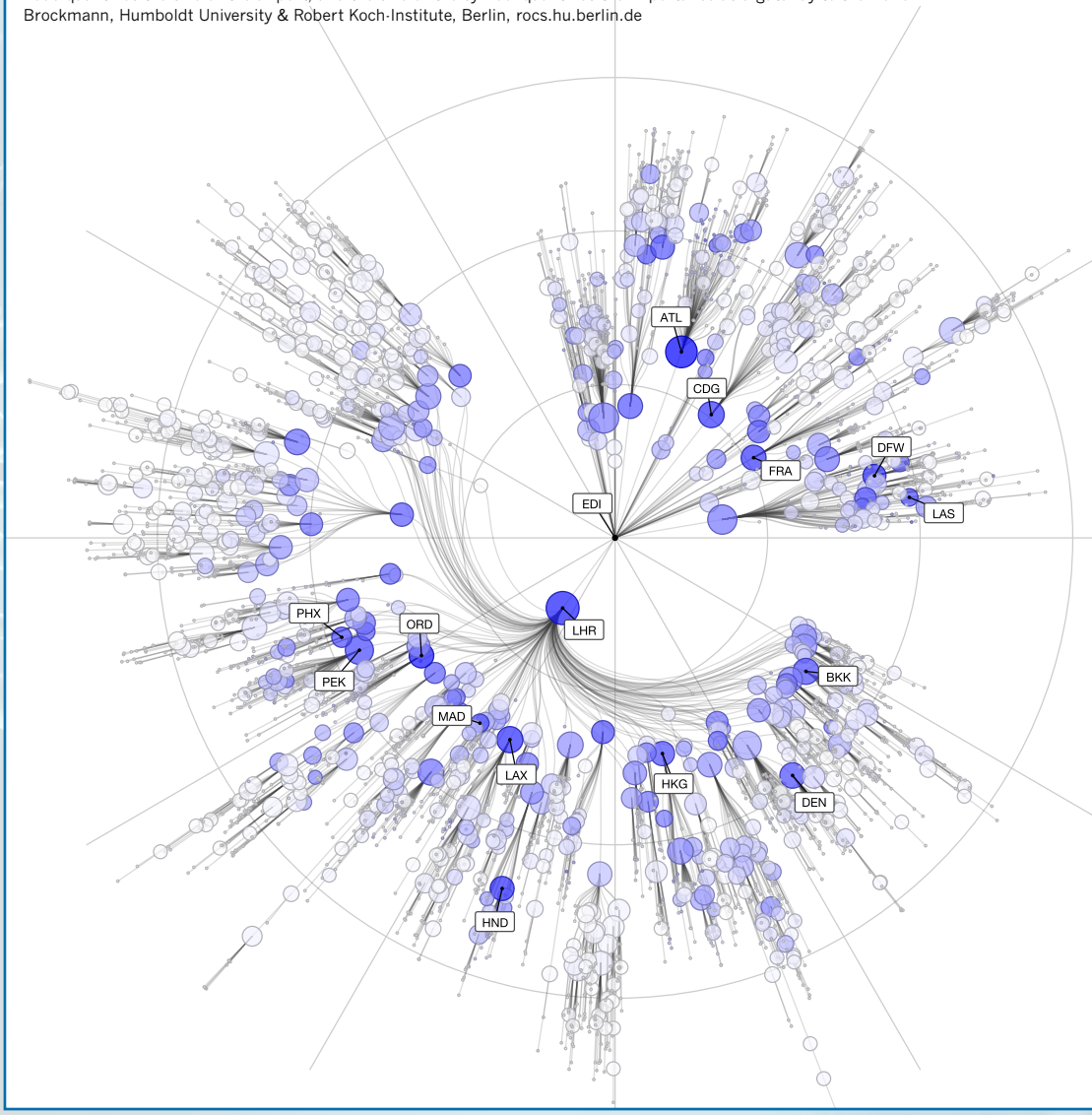
Experts believe that the next global pandemic is likely to be caused by a virus with high 'intrinsic evolvability', meaning that it mutates especially quickly or recombines elements of its genetic material during the process of replication. It crackles and snaps with accidental variation. Darwin told us that variation is the raw material of adaptive change; and adaptive change is what enables an organism to thrive in unfamiliar conditions – including human hosts.

In 1997, Dr Donald S Burke cautioned that the watch list of candidate viruses for the next global pandemic – the ones with high intrinsic evolvability – should include the influenzas, the retroviruses (like HIV-1 and HIV-2), and the coronavirus family (including SARS). His warning was validated when SARS emerged.

Precise prediction may not be possible, but informed vigilance is. Intrepid disease ecologists are hiking into forests, climbing through caves, visiting remote communities to investigate small outbreaks, gathering evidence of

This article was first published in the *New York Times*.

Figure 1: The world as seen from Edinburgh. The radial separation from the central node reflects the effective distance. The tree structure represents the effectively shortest routes from the root node to other nodes in the network. The colour of each node quantifies the size of the airport, and the size of the symbol quantifies the importance as a gateway to the world. © Dirk Brockmann, Humboldt University & Robert Koch-Institute, Berlin, rocs.hu.berlin.de



novel infections, and sleuthing the mysteries of reservoir host and spillover. In labs, other scientists are developing sophisticated new molecular tools for quickly identifying and characterizing new viruses. Private, governmental and international health institutions support scientific efforts and public-health planning to limit the scope of coming pandemics.

There are issues of civil liberties and privacy, as well as issues of public health, to be faced as we prepare for the 'next big one'. Consider the matter of travel. When Dr Burke issued his warning, you could get on an airplane just about anywhere carrying a pocket-knife. You can't do that anymore. But you can still board a plane carrying a virus. This may change. Soon, it will be possible to identify quickly who is or is not infected with a dangerous new virus, and the carriers may be excluded from certain activities – or worse. During smallpox outbreaks of the late 19th and early 20th centuries, some American communities instituted compulsory vaccination and forcible confinement in pest-houses. A 21st century version, based on similar fears about a new zoonotic virus, might involve cheek-swabbing and speedy molecular diagnostics at airport security checkpoints, followed by... who knows what sort of quarantine for those carrying the bug.

We'll need to balance between individual liberties and the health of the human herd. Field research in areas of high biological diversity, careful scrutiny of the interactions of humans and wildlife, control of the killing and transport of wild animals for food, attention to the disease threats inherent in factory-scale livestock husbandry, efficient sampling and diagnostic tools, global monitoring networks, better vaccines, better antiviral drugs, and contingency plans for confining and controlling outbreaks – these represent our best defences against the 'next big one'. We can't prevent another malign bug from entering the human population. But will it kill a few thousand people, or tens of millions?

The answer may depend not just on the nature of the virus, and on the density and abundance of *Homo sapiens* on this planet, but also on the particulars of how we respond. Viruses are adaptable and heedless. Humans are adaptable and smart.

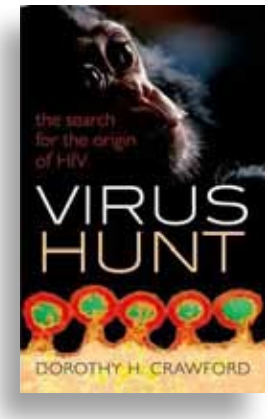
David Quammen is the author of *Spillover: Animal Infections and the Next Human Pandemic*. He tracks the animal origins of emerging human diseases, recounting adventures in the field – netting bats in China, trapping monkeys in Bangladesh, stalking gorillas in the Congo – with the world's leading disease scientists, taking the reader along on this astonishing quest to learn how, from where, and why these diseases emerge, and asking the question, what might the next big one be?

In the book, Quammen quotes William H McNeill: "If you look at the world from the point of view of a hungry virus... we offer a magnificent feeding ground with all our billions of human bodies... in some 25... years we have doubled in number – a marvellous target for any organism that can adapt itself to invading us."

Tracing *HIV* to its Roots

Professor Dorothy H Crawford, Emeritus Professor of Medical Microbiology, University of Edinburgh

"The results were spectacular – better than anyone could have hoped for."



AIDS was first described in 1981, and just under three years later the Human Immunodeficiency Virus (HIV) was discovered. Confirming that HIV causes AIDS, now accepted by virtually all scientists, took rather longer. In *Virus Hunt*, Professor Crawford gives us a scientific detective story – the search for the origin of HIV. She tells a gripping story of brilliant scientific sleuthing, breakthrough discoveries, tragic errors, stubborn intractable mysteries, generous collaborations, and bitter disputes. She conveys a wealth of interesting observations about viruses, DNA, disease, immune systems, and the latest research methods.

Where did the AIDS virus, pandemic HIV, come from? This was the question uppermost in the minds of virus evolution experts when HIV was discovered in 1983. Most of our so-called 'new' viruses actually jump to us from other animals, but the question always is: where to start looking?

By the time HIV was identified, it had been spreading in the US and Europe for several years, mainly among sexually active gay men and intravenous drug users. But when a taskforce of doctors went to Africa, they found a much older and more widespread AIDS epidemic affecting heterosexuals in cities in Central Africa. Early reports from Kinshasa in Zaire (now the Democratic Republic of Congo), and Kigali in Rwanda, showed alarmingly high infection rates among female sex workers, with rapid spread from there to the general population.

These findings suggested that the epicentre of the pandemic lay in west central Africa, and so the search for the direct ancestor of HIV pinpointed wildlife in this area. And when, in 1985, a virus from the same retrovirus family as HIV was isolated from captive monkeys with a fatal immunodeficiency similar to AIDS, the finger was firmly pointed at African primates as the source of HIV.

Researchers scoured primate centres, zoos, wildlife parks and animal sanctuaries around the world for primates to test. Several retroviruses were isolated from African primates, but few closely resembled HIV. We now know that most primate species carry their own particular strain of retrovirus, called simian immunodeficiency virus, SIV, which has co-evolved with them for thousands of years and generally causes them no harm.

The SIV that was most similar to HIV came from chimpanzees of the subspecies *Pan troglodytes troglodytes*. Initially only four of over 200 chimpanzees tested positive for the virus, and these were all captive animals that had at some stage been housed with other primates. This led to the suspicion that chimpanzees may not be the natural carrier of HIV's direct ancestor in the wild. The SIV they carried could have jumped to them from its as yet unidentified natural host while both species were housed together in captivity. The only way to get to the root of the matter was to look at retroviruses carried by wild chimpanzees.

Studying chimpanzees in the wild, and particularly obtaining the appropriate specimens from them, is no easy task. These animals live in remote areas in the rainforest, are large, and can be aggressive if approached. What's more, they are an endangered species, and so sedating them to obtain blood samples was not an option. The scientists needed a non-invasive method of virus detection, and in the end they opted to use faeces that could be collected from the forest floor.

It took two years of intense laboratory work before researchers could reliably detect HIV antibodies and virus-genetic material in faecal samples. They could also determine the sex, species and subspecies of animals, and even identify the individual animal that had produced the sample.

For their initial field study, researchers chose ten sites in Cameroon where they knew that individual chimpanzee communities lived. They employed local trackers who scooped up around 600 faecal samples from the forest floor. These were then airlifted to the US for analysis.

The results were spectacular – better than anyone could have hoped for. Five chimpanzee communities contained SIV-carrying animals, and at two of these sites they found a virus that was very similar to HIV. In fact, this virus was so closely related to HIV that the scientists were left in no doubt that they had found what they were looking for – the direct ancestor of pandemic HIV.

The two chimpanzee communities in the spotlight both lived in the extreme south-east corner of Cameroon, a very remote, densely forested area with few links to the outside world. The implication is that pandemic HIV emerged in humans in this unlikely place. From there it travelled to virtually every country in the world, eventually infecting 65-85 million people and killing 25 million.

As often happens in science, while answering one question this amazing piece of detective work posed several more. When and how did the virus jump to humans? How did it get from this isolated region of Cameroon to cities like Kinshasa, a journey of some 700km? And how did it then manage to spread globally? These questions are still subjects of debate and the answers are eagerly awaited.

A ray of hope: socio-geographical aspects of the HIV/AIDS pandemic in Kenya

Bob Thomson, RSGS Member

No pandemic has struck the world in such a frightening way as HIV/AIDS, and sub-Saharan Africa is one of the hardest hit areas. Over 13 million African children have been orphaned already through AIDS, and this number is predicted to increase as high as 40 million by 2020.

Children pose outside a clinic in one of the slum areas.

In Kenya, there are huge areas where a significant proportion of the child-bearing-aged population has been wiped out by the scourge of HIV/AIDS, leaving many communities populated only by orphaned children and elders. Poverty, illiteracy and social deprivation have resulted in many children being abandoned or living in destitution on the streets of what the Kenyan government terms 'informal settlement catchments areas' – slums.

In *A Geographical Study on the HIV/AIDS Pandemic in Kenya* (2007), Moses Murimi Ngigi found that the spread of HIV/AIDS has been heterogeneous geographically and has affected some communities more aggressively than others. He cited poverty, population density, migration, education and sexual mores as key factors in the varying rates and levels of infection. However, on a positive note, the Kenya National AIDS Strategic Plan is beginning to slow and reverse the incidence of both HIV and AIDS, particularly in the most deprived communities.

Against this background, in February 2013 I joined a volunteer working party from Rotary Clubs in the north-east of Scotland to help in the COGRI (Children of God Relief Institute) in Nairobi, the 11th year in which such a group has made the journey. COGRI was established by a Roman Catholic priest in 1996, and goes under the name 'Nyumbani' (Kaswahili for 'Home'). It has four separate, but linked, facilities related to those infected, or affected, by HIV/AIDS.

- The **orphanage** has 130 children who stay in same-age 'families' of a dozen boys and girls cared for by a 'Mama', usually a widow who is responsible for their domestic care year-round. It is encouraging that the use of anti-retroviral (ARV) drugs has ensured that no child has died for a number of years, and many are progressing well in their education.
- An impressive state-of-the-art **diagnostic laboratory** speeds the assessment of children within all of the COGRI programmes, and offers the opportunity to generate funds by analysing samples from hospitals and clinics which are also attentive to the incidence of TB and pneumonia.
- **Nyumbani Village** is home to some 1,200 children from the Kamba tribe which has been worst affected by the pandemic. In clusters of modest cottages holding 12 children, each with a 'Mama', this community benefits from an on-campus clinic, school, polytechnic, and psycho-social counselling services which prepare children for their reintegration into the wider world. The community is developing a sand-dam and varied cash-crops, with the aim of becoming self-sustaining within a decade.
- The **Lea Toto** ('raising the child') programme provides six clinics in slum areas; it tests, counsels and provides ARV drugs to some 8,500 children and 40,000 family members who survive in near-destitute circumstances.

Before returning to cope with the challenges of refurbishing the orphanage, I joined five volunteers and headed for Nyumbani Village, c120 miles east of Nairobi, where we spent a week erecting cooking shelters adjacent to 16 cottages. Despite the searing afternoon heat and frustrating delays in supplies and transport, the task was completed. Over several years, Rotarians have constructed 70-odd such shelters, leaving just over 20 cottages to be provided with this essential part of daily life for 'Mamas'. These ladies are issued with weekly rations of maize, rice and beans to feed their charges, and each keeps chickens or rabbits as well as a small cottage garden to supplement the diet. In this essentially cash-free society, 'Mamas' often weave baskets or produce craft items which can be sold to provide cash for the most modest of treats for the children.

Kenyan elections were taking place at the time of our trip, and regrettably our movements to and around the slum areas were severely constrained due to concern for our safety. Certain in the knowledge there was no way we could 'blend into the scenery', we had to be content with a couple of carefully managed brief visits to selected sites. It was truly humbling but inspiring to see the work being carried out in these communities. Protus Lumiti, general manager of COGRI Nyumbani, told me he was optimistic for the future of his children, despite their need to take ARVs for the rest of their life and the challenges of often being orphans.

The HIV/AIDS pandemic is extensive and well-entrenched in the fabric of Kenyan and African societies. The modest work undertaken by our working party faded into insignificance compared to the scale of the effort required, and the evident need within this society. However, each of us was heartened that we had helped in some small way, and we were rewarded by the warm smiles and expressions of gratitude of those we helped.

"It was truly humbling but inspiring to see the work being carried out in these communities."


The purpose of our mission: to replace the often dangerous and decrepit cooking shelters with new, secure, structures.


'Mamas' Grace and Agnes take a break fro pounding maize.


The author with Hamish, who was found abandoned on a bus last year and named by the Scottish working party when he was adopted by the orphanage.

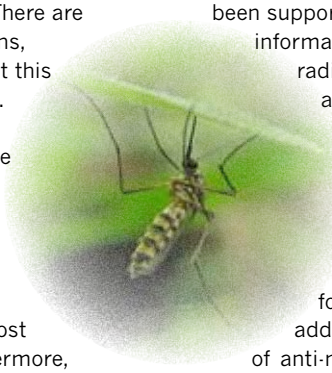
Misdiagnosis of *Zoonoses*

Professor Jo Sharp (University of Glasgow), **Professor Rudovik R Kazwala** (Sokoine University of Agriculture, Tanzania), **Professor Moshi K Ntabaye** (Kilimanjaro Christian Medical Centre, Tanzania), **Professor Sarah Cleaveland** (University of Glasgow) and **Professor John A Crump** (Dunedin School of Medicine, New Zealand)

"…more than 60% were clinically diagnosed and treated for malaria on admission, whereas less than 2% actually had malaria."

One of the major challenges in addressing the burden of diseases that are transmitted from animals to people is accurate diagnosis. This is often the result of the difficulties of detecting pathogens, but can also result from misdiagnosis. In Tanzania, the term for fever, *homa*, is often used interchangeably for malaria. In a study of patients admitted to hospital with fever at the Kilimanjaro Christian Medical Centre in northern Tanzania, it was discovered that more than 60% were clinically diagnosed and treated for malaria on admission, whereas less than 2% actually had malaria when tested in the laboratory. This means that the vast majority of severe fever illness in this area is not malaria, and that these other fever-causing diseases are going untreated.

Around a third of those tested in the Kilimanjaro study had one of four zoonotic diseases that we believe are endemic to the region: brucellosis, Q-fever, spotted fever group rickettsioses, and leptospirosis. These infections are transmitted variously by interactions with animals: during birthing; contact with animal waste; bites from ticks that have fed on animals; and the consumption of poorly cooked meat or unpasteurized milk. In the communities served by the hospital, ownership of animals such as cattle, sheep and goats is common and the consumption of raw and cooked animal products is widespread. The zoonotic diseases identified in the study have substantial impacts on human health in these communities. All cause fevers that can be severe and may be fatal. These diseases therefore pose an important development challenge in the Global South where increased food security is ever more pressing as a result of climate change and the increasing urban population.



So why do these diseases go undiagnosed? There are various explanations, demonstrating that this is a complex issue. The symptoms of these infections are very common and can indicate many different diseases, so a diagnosis based on clinical signs alone is almost impossible. Furthermore, these symptoms – fever, headaches, tiredness – are the same as those presented by someone with malaria. Malaria continues to pose a major threat to human health globally, but in many areas, including northern Tanzania, the number of cases of malaria has declined substantially. However, many patients equate fever with malaria and seek care with an expectation that anti-malarials will be prescribed, and from a healthcare worker's perspective, overlooking as deadly and common a disease as malaria they view as tantamount to professional failure.

There are highly accurate rapid tests for malaria diagnosis now, but there is a lack of quick and reliable tests for other causes of fever, so doctors have few tools to diagnose anything other than malaria. In this situation, we have anecdotal evidence that doctors do not like the new rapid tests and that they do not trust the results (as they, of course, will often give negative results for malaria). The combined effect of the doctors' mistrust of the rapid tests, availability, patient expectations, and the lack of tests for alternative conditions, leads to the prescription of malaria drugs in most cases, even though a growing body of evidence indicates that this treatment is inappropriate (and ineffective) for an increasing proportion of patients.

In recent years, there has been concerted effort by global aid agencies and other institutions to combat malaria. There has been support for everything from information campaigns (on the radio and TV) to bed-nets and malaria drugs, but the relative availability of effective malaria drugs, the success of information campaigns, and the pressure from patients for clinicians to act can add to the over-prescription of anti-malaria drugs. Many people, however, do not even go to doctors when they think they have malaria, but will instead go to purchase these drugs as soon as they feel the return of symptoms that they attribute to malaria.

One of the key responses to this situation is to ensure that medical practitioners and patients alike learn of the problems associated with the failure to effectively treat non-malaria infections. Highlighting the causes of the transmission of zoonoses is important too, but perhaps more important is the challenge of offering solutions that work in the context of everyday life. For instance, in the focus groups we have held with livestock keepers around the Kilimanjaro Region, almost everyone we spoke with knew that milk should be boiled, and meat cooked well, to avoid disease transmission. However, this was not always done for a variety of reasons: lack of time or fuel to boil large quantities of milk; a belief that boiling milk changes its taste or makes the production of yoghurt impossible; and a preference for traditional foods that involve blood products, have all being mentioned. Moreover, each community offered examples of cases where people had consumed uncooked products and had been fine; 'evidence' that such diseases were not a threat.

Further Reading

Crump JA et al (2013), *Etiology of severe non-malarial febrile illness in Northern Tanzania* (*PLOS Neglected Tropical Diseases* 7(7): e2324)

Hertz J et al (2013), *Comparing actual and perceived causes of fever among community members in a low malaria transmission setting in northern Tanzania* (*Tropical Medicine and International Health* 18(11): 1406-1415)

Kilimanjaro. © Mike Robinson

Ingredients of *Potential* Pandemics

Scott H Newman and **Ken Inui**, Emergency Centre for Transboundary Animal Diseases (ECTAD) - Viet Nam, Food and Agriculture Organization of the United Nations

Approximately 60% of emerging infectious diseases of humans are zoonotic, and since the 1940s approximately 70% originate from wildlife. Recently, zoonotic pathogens (primarily viruses) and diseases such as HIV/AIDS, Henipah viruses, SARS, *Streptococcus suis*, Rift Valley Fever, and pandemic influenza A (H1N1) have invaded human populations. Concurrently, livestock-wildlife interface diseases (foot-and-mouth disease, African and classical swine fever, bovine tuberculosis, *peste des petits ruminants*) can affect production, food security, and livelihoods, while having negative wildlife conservation implications. Most recently, public and animal health emergencies have focused around the emergence of Middle East Respiratory Syndrome (MERS)-CoV and influenza viruses, including highly pathogenic avian influenza HPAI (H5N1) and avian influenza A (H7N9).

Whether a zoonotic pathogen comes from livestock or wildlife, global factors drive pathogen evolution to take place in two major systems: 1) human-modified natural ecosystems where natural resources are being consumed, biodiversity is being lost, and ecological services are not being sustained; and 2) agro-ecological systems where the need to meet increasing global demands for livestock-based protein leads to expansion or intensification of farming systems.

In developing countries, a combination of poverty and food insecurity often leads to people sharing their living quarters with livestock without proper bio-security or hygiene, and subsistence-associated wildlife consumption. In developed countries, cultural preferences and wealth enable consumers to purchase exotic pets and food items from anywhere in the world creating an opportunity for pathogens (and the animals they travel within) to travel across the globe in less than 24 hours through globalized value chains and market trade. Ultimately, the characteristics of developed and developing countries lead to higher contact rates between people, livestock and wildlife, creating opportunities for pathogens to jump the 'host bridge' from the original hosts, where many pathogens do not cause sickness, into new human hosts, where they can be deadly.

On 31st March 2013, China notified the World Health Organization of the first human cases of avian influenza A (H7N9), an influenza virus that had never been detected in humans before. More than three-quarters of the initial 77 human cases had recent exposure to animals. Of these, 76% either had direct contact with chickens or had visited live bird markets, with poultry exposure considered as the most likely source of infection as there was no sustained person-to-person transmission at the time.

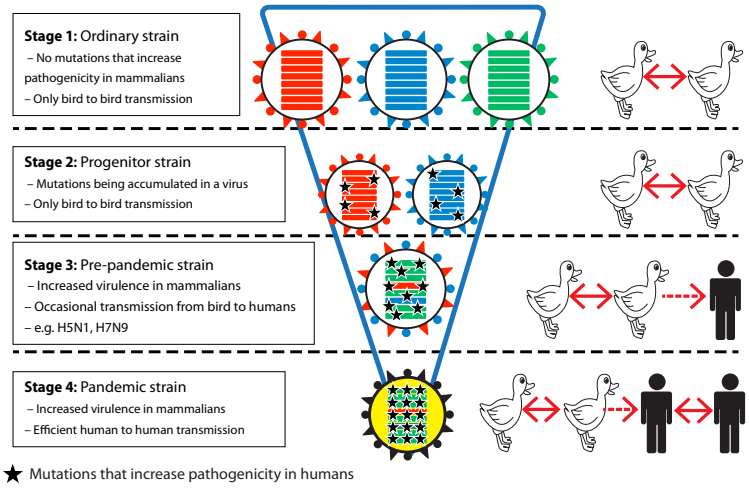
Influenza viruses are sub-typed on the basis of haemagglutinin (HA) and neuraminidase (NA) glycoproteins present on the outer surface of the virus. Ordinary strains of virus routinely circulate in wild birds (mostly waterfowl) and poultry. What makes H7N9 unique is that over time it has undergone a series of genetic re-assortments and mutations, leading to increased replication and pathogenicity in people. As with pandemic influenza A (H1N1) which emerged in 2009, H7N9 is a combination of progenitor viruses: H1N1 consisted of viruses derived from pigs, birds and people; H7N9 results from at least three different domestic and wild bird viruses. It is important to recognize that intensification, replication and co-circulation of multiple progenitor viruses in the same geographical area increases the risk of generating next stage viruses closer to pandemic strains. If mutations happened in viruses located in separate geographic places, it is unlikely that re-combinations would ever take place and become a public health threat.

It is impossible to determine the extent to which human-modified natural and agricultural systems contribute to changes in influenza viruses that make them of greater risk to human health, but we can be confident that wild migratory waterfowl, farmed domestic ducks, and farmed wild waterfowl have no choice but to utilize human-modified wetland systems, especially in Southeast Asia where millions of domestic waterfowl are farmed. Furthermore, with the recent growth in poultry production in this region and elsewhere, farming system expansion and intensification is a dominant trend that will persist into the foreseeable future to meet food security demands of a growing population. Finally, poverty remains a major global issue and results in high-risk behaviours that enable transmission of pathogens across species.

Unravelling the complexity of these pathogen-host relationships, defining the epidemiology of transmission among livestock, wildlife and people within an ecological context, and identifying the drivers of disease emergence, are the foundations of the 'One Health' approach needed. If we are only able to detect emerging viruses when they cross the 'host bridge', we can only react to these emergency events, and this often requires significant financial commitment and results in loss of lives and impacts to livelihoods and food security. If we are able to move further upstream, to determine which progenitor viruses are present in the modified natural and agro-ecological systems, we can move towards predicting and preventing new threats to global health security. Not only is this a much more cost-effective approach, it will prevent loss of human life, safeguard livelihoods, and protect food security.

"If mutations happened in viruses located in separate geographic places, it is unlikely that re-combinations would ever take place and become a public health threat."

The views expressed in this article are those of the authors and do not necessarily reflect the views of FAO. Image created by C Y Gopinath, Regional Communication Co-ordinator, FAO ECTAD-RAP.



Stages of virus evolution depicting how pandemic influenza strains can emerge.

Rodents *and Human Disease Risks* in Urban Slums

Dr Jo Halliday and **Professor Jo Sharp**, University of Glasgow

"Many rodent species are highly opportunistic and resilient to ecological change… providing opportunities for disease transmission."

Historically the majority of the global human population has lived in rural environments, but this balance shifted in 2008 and more than half of the world's human population now lives in cities. By 2050 the proportion of humankind living urban lives will increase to an estimated 69%, when the global urban population is expected to reach 6.3 billion. Almost all of this urbanization and population growth will be in low-income regions, and most of this rapidly expanding urban population is expected to be housed in unplanned, informal settlements – slums. The number of urban residents living in informal settlements in developing countries is expected to double to almost 2 billion by 2030.

Humans interact with other animal species in all settings, and these interactions and their implications for zoonotic disease risks vary across different environments. Although we think of urban environments as uniquely human, interactions between animals and people occur even in these thoroughly 'man-made' settings. Urbanization is often associated with a reduction in species diversity overall, but also with increases in the abundance of opportunistic, urban-adapted species. We have seen this with the growth of urban fox populations in the UK, and in the ubiquitous presence of rats and mice which thrive in urban environments and are found across the planet. The presence of these different animal species can impact upon the disease threats that urban residents face.

Many rodent species are highly opportunistic and resilient to ecological change, facilitating frequent contacts between people and rodents and providing opportunities for disease transmission. Different rodent-borne zoonoses have different transmission routes, including inhalation of infected aerosols (eg, hanta- and arenaviruses), contact with rodent excreta (eg, leptospirosis), rodent bites (eg, hantaviruses), and via ectoparasites such as fleas (eg, plague), biting flies (eg, leishmaniasis) or ticks (eg, Lyme disease). Rodents also act as hosts in the lifecycle of pathogens that humans acquire through other indirect routes such as environmental exposure to Toxoplasma oocysts. In all cases, close spatial and temporal association of human and rodent populations contributes to opportunities for disease transmission.

Associations between rodents and human disease in urban settings are not new. The story of the Pied Piper of Hamelin dates from the Middle Ages. In this tale, the piper first lures the rodents away from the town of Hamelin and then, when he is not paid for his services, he also leads the children away; the story is considered by many to be a representation of the death of the town's children from bubonic plague, which killed an estimated 25 million people across Europe. More recently, the International Red Cross has warned of the potential for an outbreak of plague amongst prisoners in Madagascar, living in overcrowded rodent-infested jails.

Many of the defining attributes of today's urban slums, such as overcrowding, limited sanitation, and waste disposal infrastructure, are conducive to the proliferation of rodent species adapted to man-made environments. As the global population becomes increasingly urban, the relative importance and relevance of rodent-associated zoonoses is likely to increase. To tackle these threats we first need to better understand their importance and impacts, so that steps can then be taken to implement disease control efforts. We know that measures of the frequency of interaction between people and rodents in their homes are a good proxy for assessing the risk of exposure to several rodent-associated diseases. In the Kibera slum in Nairobi, more than half of household respondents reported seeing groups of five or more rodents in their house on a daily basis. However, the impact of rodent-associated diseases on this population is largely unknown.

What we can do to control rodent populations in urban slums is not a simple issue though. Telling people in a slum that contact with rodents is hazardous and should be avoided is not perhaps the most useful piece of advice, as there is little that an individual householder can do to rodent-proof their home. The factors that contribute to increased risk of rodent-borne diseases – poor sanitation and limited access to healthcare services – also contribute to a wide range of other infectious and non-infectious threats to health. As the global human population becomes more urban, our systems and approaches for understanding and tackling these diseases need to adapt too and to become more holistic. As well as understanding the processes of disease transmission, we need to understand the economic and social factors that govern the development of urban slums so that we can learn from past experiences and try to mitigate the changing disease threats that our increasingly urban lifestyles will generate in future.

One Health: Why we should be vaccinating cattle against *E coli* O157

Dr Louise Matthews, University of Glasgow

Identifying the major sources of risk in disease spread is key to designing effective means of control. However, understanding of how disease spreads across species boundaries is typically poor, making the design and evaluation of control methods especially challenging for zoonotic pathogens.

E coli O157 is one such widespread zoonotic pathogen, which causes serious gastrointestinal illness in people. Infection can lead to death or lifelong kidney damage and is a major cause of acute renal failure in children. Cattle are the main reservoir for *E coli* O157, and harbour the pathogen in their gastrointestinal tract without suffering clinical disease. Although it can spread between people, the usual routes of infection are either by consuming contaminated food and water, or by contact with livestock faeces in the environment.

Vaccines for cattle have been developed, but their adoption is being hampered by delays in their licensing. These delays highlight the particular challenges to control planning that are posed by zoonotic infections. First, the medical and veterinary agencies have conflicting responsibilities. The bodies responsible for licensing vaccines in animals must typically show that a new control is not just safe, but that it improves the health of animals receiving it; this poses a problem for zoonotic pathogens that are benign in their reservoir hosts, and demands greater co-ordination from medical and veterinary agencies. Second, it is not easy to test a control measure used in animals against the key outcome – the reduction in human illnesses – and this lack of data on impact hampers effective decision-making for policy change.

Our focus is on the understanding of disease ecology and cross-species transmission dynamics needed to predict how *E coli* O157 cases in people could be prevented by vaccinating cattle. In the absence of direct data, mathematical models of transmission between animals and people provide a tool to predict the success of interventions. However, because of the difficulty in mapping the distribution of infection in the animal reservoir onto disease incidence in the human population, few such models for zoonotic infections exist. Because of variation in factors such as the infectiousness of cattle, pathogen strains, and infection routes, simple measures of the presence and degree of infection in animals may not always be a good predictor of risk to humans. Epidemiological models need to be able to (or 'can be used to') represent the range of possible outcomes arising from these sources of variation.

For *E coli* O157 the role of variation in transmission from cattle is a key issue. 'Supershedding' is the rare but epidemiologically important situation where some individuals are responsible for much more onwards disease transmission than most others. In the case of *E coli* O157, some cattle shed the pathogen in faeces at unusually high concentrations. This is important because, despite being relatively rare, supershedders appear to be the major source of deposition of pathogens into the environment, from where other animals and humans can become infected.

A recent study (see Further Reading) looked at the links between supershedding in cattle and transmission risk to humans, and showed that only the relatively rare supershedding events (rather than the more common low-level shedding seen in most infected animals) contribute significantly to human risk. This new understanding of animal to human transmission of this pathogen has important consequences for our assessment of the potential impact of cattle vaccines, which not only reduce the frequency of bacterial shedding by cattle, but also reduce the number of bacteria shed by infected animals when this occurs. Consequently, the benefit to people of cattle vaccination should be substantially greater than previously anticipated based on the impact on the frequency of shedding alone. The recent study indicates that vaccines producing a 50% reduction in shedding frequency in cattle could reduce human cases by nearly 85%, and concludes that vaccination of cattle, the major reservoir for *E coli* O157, could be an especially effective public health control against a serious disease.

For zoonoses such as *E coli* O157, where controls are available in the animal reservoir but the benefit is to the human population, the challenges to the design, evaluation and delivery of effective interventions for humans can be added to by conflicting responsibilities of veterinary and public health agencies. What this example has highlighted is the need for a One Health approach to policy that understands animal and human health to be fundamentally integrated, rather than treated as discrete issues to be dealt with by separate organisations with their own policy goals.

"The bodies responsible for licensing vaccines in animals must typically show that a new control is not just safe, but that it improves the health of animals receiving it."

Further Reading

Matthews L, Reeve R, Gally DL, Low JC, Woolhouse MEJ, McAteer SP, et al (2013), *Predicting the public health benefit of vaccinating cattle against Escherichia coli O157* (*Proceedings of the National Academy of Sciences of the USA*, 2013, 110 (40))

Lyme *disease*

Dr Lucy Gilbert, The James Hutton Institute

"Lyme disease… is the most prevalent of all vector-borne diseases in Europe."

The tick, *Ixodes ricinus*, is a fascinating and unusual parasite because it is a true generalist, sucking the blood of almost every type of terrestrial vertebrate, including sheep, deer, mice, birds, dogs and humans. Like other generalists – gulls and crows come to mind – this tick species is highly successful and widely distributed around most of Europe and into Asia. One result of their catholic diet, unfortunately, is that they can be infected with a wide range of pathogens that can cause disease in humans, livestock, companion animals and wildlife. In fact they are the most important vector of zoonotic diseases (such as tick-borne encephalitis and Lyme disease) in Europe.

Each stage of *Ixodes ricinus* – larvae, nymphs, adult female. Nymphs cause most cases of Lyme disease in people.

Lyme disease (or more correctly Lyme borreliosis) is the most prevalent of all vector-borne diseases in Europe. It is caused by spirochaete bacteria called *Borrelia burgdorferi* sensulato, which have similarities to the syphilis spirochaete. The disease is named after the towns of Lyme and Old Lyme in Connecticut, where there was a spate of illnesses in the 1970s, but it wasn't until 1982 that the spirochaete was identified as the cause by Willy Burgdorfer and Alan Barbour. However, it is not a new disease: *Borrelia* originated in Europe before the Ice Age, and symptoms were officially described in 1883 in Germany. The disease often starts with a diagnostic bulls-eye rash, followed by flu-like symptoms. There is no vaccine, but it is usually treatable with antibiotics, although chronic and debilitating illness can occasionally develop if not treated soon enough. There are several different strains of *Borrelia*, each transmitted by a different host type (eg, one is transmitted only by birds, one only by rodents), each differing in ecology and distribution, and each causing different symptoms.

'Bullseye' Lyme disease rash.

Ticks are increasing in abundance and distribution in much of Europe, as are cases of Lyme borreliosis. Data published on the Health Protection Scotland website suggest an enormous increase, from only a handful in Scotland in the late 1990s to 285 in 2008. Since then, reported cases have fluctuated around 230-300. This may not seem a lot, but the majority go undiagnosed or unreported, so this is only the tip of the iceberg. The increase may be due in part to improved awareness, but environmental changes are certainly also impacting on ticks and Lyme borreliosis.

Ixodes ricinus ticks suck blood from their hosts for only a few days each year, so spend most of their lives in the ground vegetation exposed to ambient conditions. Like most invertebrates, ticks are increasingly more active as temperatures increase but are not active when it is cold: we rarely see them in a Scottish winter. However, climate change projections estimate that Scotland will warm by 3°C by 2080 – how will this affect ticks? You can mirror 3°C of climate warming by walking down a Munro into a Cairngorm glen at 450m in summer. Currently there are no ticks on the Munro tops; in fact almost no ticks until below 500-550m, at which point they increase dramatically as you descend into the relative warmth of the glen. Therefore, in 2080, we may have to watch out for ticks while eating lunch on a Munro summit, and I shudder to think of the increase in tick numbers in the glens by then! Recent studies predict that ticks will be not only more common at higher altitudes but also active for one to two months longer in the year.

As a carbon sink to mitigate climate change and to enhance biodiversity, the Scottish Government aims to increase woodland cover to 25% over the next 15 or so years (current land cover is around 17% woodland). Woodlands provide a mild, humid micro-climate that improves tick survival and activity, and mixed/deciduous woodlands in particular are great for deer, small mammals and birds. Deer are the most important tick host, while small mammals and birds are reservoirs for *Borrelia* spirochaetes. Recent Scottish research showed that unfenced semi-natural mixed/deciduous woodlands generally had more ticks and *Borrelia* than other habitats.

In Scottish woods, 1-14% of ticks contain *Borrelia*, but in warmer continental Europe this percentage is much higher. As climate warming, woodland expansion and spreading roe deer increase ticks and *Borrelia* in Scotland, and as rising population growth and outdoor activities bring more people into contact with ticks, how can Lyme borreliosis risk be controlled? Research shows that controlling deer numbers or excluding deer from target areas (such as certain woodlands) using fencing can reduce ticks by up to 90%, which should greatly reduce disease risk. At a personal level, people can reduce disease risk by being tick-aware, checking themselves for ticks frequently and thoroughly, removing them as soon as possible with tweezers or a 'tick tool' and seeking treatment if symptoms develop.

Walking through prime tick habitat.

Globalization, pet dogs, and rabies

Professor Sarah Cleaveland, University of Glasgow

Globalization has brought huge benefits and opportunities. We now expect to be able to eat tropical fruit every day of the year, even in the depths of a European winter. We assume that we can travel to almost any corner of the world for both leisure and work. And, increasingly, we expect that this right to travel will extend to travel for our pets. These expectations have invariably led to demand for greater freedom of movement of dogs and cats and, over the past 13 years, this has resulted in major changes to the regulations concerning the importation of dogs and cats to the UK. These regulations are concerned principally with reducing the risk of rabies coming into the UK.

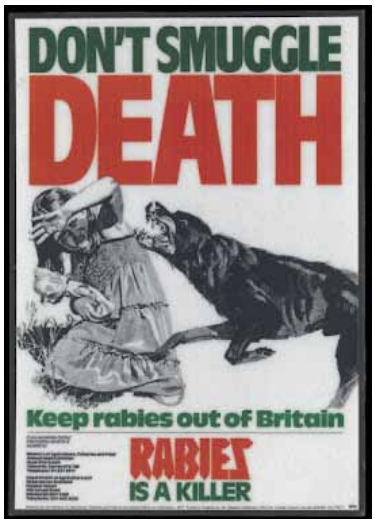
Rabies is a deadly and terrifying disease, and the UK is currently free of the rabies virus (although some types of viruses causing rabies do circulate in British bats). Not surprisingly, rabies is far from the thoughts of most people in the UK – some of us may remember the posters of snarling dogs warning about the risks of rabies – but most people are probably not aware that rabies still occurs widely across the world. It is estimated that more than 60,000 people die from rabies each year, mostly in Asia and Africa; this translates to more than 150 people dying each day, mostly children from the most disadvantaged communities in the world. This is a horrifying statistic. But the disease is not only a humanitarian concern, it is also of direct relevance to the UK because of the risk of rabies to us as travellers, and the risk of the disease being introduced to the UK through travelling pets. This is no imaginary threat: the disease is already very close to our borders, with recent cases of rabies confirmed in puppies that have been imported into the Netherlands, and a kitten recently imported into France.

While the UK still has a greater degree of protection due to its island geography, the consequences of rabies introduction could be devastating in a country where very few pets are currently vaccinated, and where we have a huge population of foxes. Most of our towns and cities currently harbour very high densities of foxes, and we know that foxes are highly susceptible to rabies and can easily spread the disease. We are also used to the freedom of being able to walk our dogs in public places and to move our dogs freely around the UK, freedoms that are likely to be severely constrained were rabies to appear in the UK. The economic consequences could also be enormous. People coming into contact with suspected rabid animals are likely to require a course of vaccinations and treatment, and while these treatments are very effective at preventing rabies, they are extremely expensive and also in limited supply. There is no doubt that widespread exposure of people to rabid animals would stretch the resources of our health service.

Initially, in 2000, the Pet Travel Scheme (PETS) was introduced to allow dogs and cats from specified countries (either free from rabies, or considered very low risk) to enter the UK without the six-month quarantine period that had previously been required. This six-month period was considered necessary to detect rabies in animals that may be incubating the disease, as rabies can develop up to six months after an animal is bitten, but the animal appears entirely healthy during this incubation period. While removing the requirement for physical quarantine, the original PETS regulations incorporated a six-month waiting period after vaccination, which achieved a similar outcome – dogs incubating rabies would be detected before entering the UK. Furthermore, these regulations included mandatory blood testing to ensure that the dog had sufficient immunity from vaccination prior to the six-month waiting period.

However, these regulations were demanding, time-consuming and expensive, and not in line with our growing expectations and demands for freedom to travel at short notice with our pets. As a result, since 2012, the regulations have changed, with travel within the EU no longer requiring a blood test, and with a waiting period reduced to 21 days. For pets travelling from other countries, including the highly endemic countries of Asia and Africa, there is no longer need for a quarantine period, and although vaccination and blood testing are required, the waiting time is now only three months after a positive blood test (www.defra.gov.uk/ahvla-en/imports-exports/pets).

These changes have profound implications for disease risk, not only the direct risks associated with dogs coming in to the UK from much higher-risk areas, but the indirect consequences of changing movement patterns. Now that it is relatively simple and cheap to bring dogs and cats into the UK, the dynamics of the pet trade have changed dramatically, with massive expansion of a commercial trade in dogs from rabies-endemic areas, particularly pedigree dogs, for sale in the UK. The ease of dog movements has also led to an upsurge in the number of street dogs or shelter dogs that are being adopted and re-homed in the UK, often from high-risk areas of the world where people travel on holiday. And while the risks are still small if the regulations are followed correctly, ensuring compliance with regulations is increasingly dependent on the legitimacy of paperwork, and there are concerns that the huge commercial opportunities now opening up may be spawning unscrupulous practices.



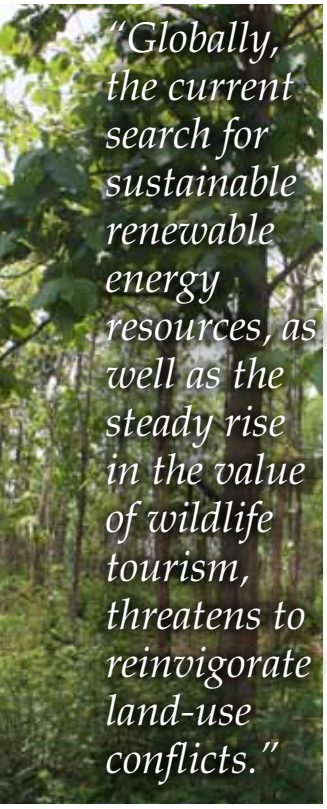
Rabies: a rabid dog attacking a young girl. Colour lithograph, 1977. © Wellcome Library, London

"Now that it is relatively simple and cheap to bring dogs and cats into the UK, the dynamics of the pet trade have changed dramatically."

The global connectivity between supply and demand has created new markets, which apply as much to supply of cheap puppies as to cheap clothing. These clearly present us with new challenges, and we need to be alert and vigilant to disease threats that may arise as a result. Our island situation and animal movement restrictions have protected us from rabies in the past. If we consider that the freedom of cheaper, simpler and more flexible movement of pets is worth the loss of this protection, we should at least do so with our eyes open.

Jungle jitters – *Thailand's efforts to protect its forest heritage*

Dr Brian J D'Arcy



Teak plantation as a buffer zone between farmland and protected forest reserve.

White-handed gibbon, Khao Yai National Park.

Dr D'Arcy is leading an International Water Association project to develop best practice concepts for eco-business parks, and is working with officials in Thailand to develop more sustainable means to protect natural resources and promote environmentally sound ecotourism projects.

The *Jungle Book* is a compelling read. Not the Rudyard Kipling classic, but a compilation of essays first published in the *Bangkok Post* which reflect on politics and a range of recent issues in Thailand. Hydro-dams or forests? Electricity and irrigation, or sustainable local economies dependent on the natural forests? Tourism and recreational development, or pristine forest reserves? Thailand has experienced all of those debates and has examples of each type of development.

Sign at Phu Khieo Wildlife Sanctuary, making clear the connection between protected forests and water resources.

The westernisation of Thailand's forestry economy over the past 150 years was initially a process of unsustainable resource exploitation, primarily focused on teak extraction for European demand. Forest cover declined rapidly, from c75% in 1900, to 53% by 1961, to only 28% by 1989, when the government introduced a ban on logging. That was followed, however, by a focus on commercial forestry practices exemplified by monoculture planting of even-aged exotic timber species, grown on a clear-fell harvesting strategy. Sadly, there are real parallels with Scottish forestry. In Thailand, the selected tree species for commercial planting were pine and eucalyptus, although only the latter proved economic. If a shift from forests with up to 20 tree species to just one or two seems regrettable in Europe, such a move in a tropical forest where there would naturally be 160+ tree species was probably the intellectual abyss of single purpose forestry philosophy. Globally, the current search for sustainable renewable energy resources, as well as the steady rise in the value of wildlife tourism, threatens to reinvigorate land-use conflicts, driven also by efforts to escape from economic slow-down.

The jungles of tropical Thailand are remarkable places, where lianas that would sustain dozens of Tarzan movies hang down from towering trees, where gibbons sing and swing high up in the canopy, and giant squirrels the size of pussy-cats chatter from the security of forest foliage. The birdlife is amazingly rich, and deer, wild boar and elephants create and maintain paths through the undergrowth below. Butterflies flit between trees and flowers, and epiphytic plants growing on the trees include remarkable orchids. A tropical forest in Thailand is still wonderful.

Thailand has two UNESCO World Heritage Sites gazetted for natural history importance and landscape. The larger site has the Huai Kha Khaeng Wildlife Sanctuary at the heart of the most extensive continuous area of protected forest in mainland Southeast Asia: the Western Forest Complex. There, an estimated 100 tigers still live in the wild, one of the largest continuous populations on Earth. There are three species of wild cattle – gaur (the world's largest wild ox), banteng, and water buffalo (one of only four wild populations in the world). Malayan tapir maintain a population, and rumours continue of rhinos. The regional fauna includes a host of other wild animals, from elephants and primates to the world's smallest bat and longest venomous snake. Several different forest types are present, including dry deciduous dipterocarp forest in the rain shadow of the mountains. The region drains southwards, feeding reservoirs that flooded tropical forests when created, amid considerable controversy. But government policy prohibits further encroachment, underpinning the UNESCO designation, so the dams (damage done) now provide a compatible protected land-use as downstream neighbours of the forest reserves.

North-east Thailand, the country's poorest region, has featured in many land-use conflicts over large projects seeking to clear-fell forest and either flood with a dam or replace with eucalyptus. But it still has some excellent large and biologically diverse forest areas, including the Dong Phayayen Forest Complex, the other World Heritage Site. Based upon the Khao Yai-Thap Lan National Parks, the UNESCO designation is however under threat, following the upgrading of a strategic highway connecting the north-east with Bangkok and the mainstream economy of the central region. The government is looking at ways to mitigate wildlife impacts of the dual carriageway that bisects the designated area.

The establishment of community forests was enabled by new legislation in 2007. It is heartening to see an excellent example established by local communities at the north-eastern end of Khao Yai, protecting some old forest and healthy naturally-regenerating forest too, stabilising hill slopes and protecting water resources, and encouraging income from wildlife tourism. The pressure for forest timber is still an economic consideration, but in other parts of north-east Thailand, teak plantations are being encouraged on a far smaller scale than would be usual for industrial forestry, as part of securing more economic diversity for farming incomes, using funds for carbon sequestration planting to create small stands of teak. One novel application of teak plantations has created a buffer zone between farmland and the forest reserve at Phu Kradueng National Park, an example of 'contiguous compatible investment'. Local community action and creative green enterprise can work well alongside government initiatives. The difficulties and the achievements in Thailand deserve greater recognition and offer interesting ideas for wider consideration.

Wild elephant at salt-lick, Khao Yai National Park.

FURTHER READING

Jungle Book, by Chang Noi (2009).

Thai Forestry, by Ann Danaiya Usher (2009).

Wildlife in the Kingdom of Thailand, by Bruce Kekule (2009), and www.brucekekule.com.

The Geographer 20–21
Winter 2013-14

Emergency Mapping *in Al Za'atari Camp*

Robert Trigwell, REACH Initiative

Introduction

Al Za'atari Camp, located 15km south of the Jordan-Syria border, is the second-largest refugee camp in the world and the fifth-largest city in Jordan, despite only having its first anniversary last July. At one point it was home to 120,000 people; however, these numbers have steadily decreased, with more and more people finding refuge in the larger cities of Jordan, as well as in Lebanon, Turkey and Iraq. The REACH Initiative has been applying novel ways to make data from the 'field' in Al Za'atari Camp accessible to the international aid community, to support humanitarian planning and to meet information gaps in order to improve the lives of people living in Al Za'atari.

Setting the context

Al Za'atari is a chaotic environment, not through mismanagement but through the ever changing situations and contexts in the camp, which are largely dependent on what is going on north of the border in Syria. Population influxes are extremely dependent on locations of hostilities within areas of Syria for instance, and with every new person into the camp, the context changes. Therefore, with the population of Al Za'atari refugee camp changing over time, humanitarian actors are constantly challenged to plan and implement life-saving services. The purpose of REACH (implementing partner of UNHCR) is to ensure evidence-based programming and to make data accessible to all on open data platforms, so that when interventions are happening, the decision-makers are not doing them 'data-blind' but instead are using reliable information to make a real difference to the residents of the camp.

What we have been doing

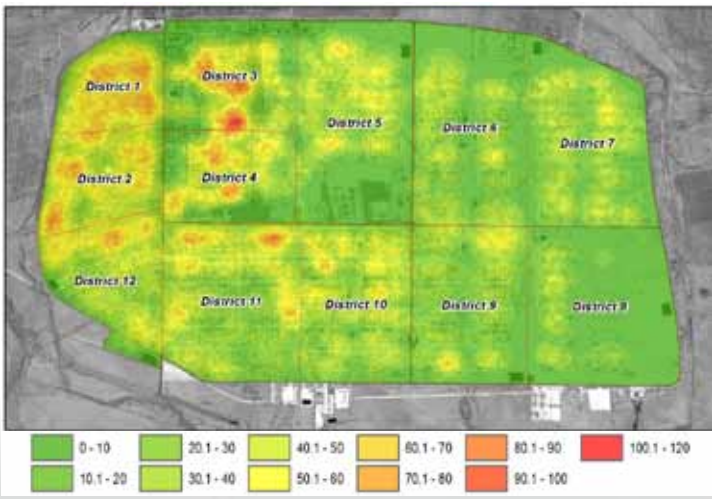
Since November 2012, REACH has been conducting regular assessments regarding camp infrastructures and assessments at the household level. All data is collected on an open source mobile application called ODK (Open Data Kit) so all data collected can be available the same day. In an emergency environment, regular and up-to-date information is pivotal to effective aid implementation, and therefore exploring new technologies in order to implement this is a key point of the work done by REACH. Some of the work REACH has been doing over the past year has been the following: weekly assessments of the communal bathrooms to ensure regular maintenance; household-level assessments for equality of living standards; the mapping of street leader boundaries; the mapping of the infrastructure in the camp; as well as the start-up of the first ever cadastral system in the camp and all the corresponding data analysis.

The focal point for REACH's activities in Jordanian camps

Al Za'atari is not an easy place to work, but it is a rewarding one. People from all the UN agencies and the NGO community are doing a fantastic job to try and help the Syrian people at this terrible time for them. The camp is dynamic, and as a result there isn't really an '8-5'. Of course we try and keep to our work plan for the week, but you never know what is going to come up that day. Being on top of the security situation is a good way to ensure my staff are safe and can work effectively.

Each day I am in awe of the resourcefulness and kindness of the Syrian people. The residents alone have built a bustling market street, coined the the 'Champs-Élysées', with at least 600-800 different shops and businesses. The falafel is out of this world. This market provides many items to the camp that aren't available through official distributions, so people are using their initiative to serve their own community and provide comfort at this difficult time. Each household composition is slightly different from the other, despite having access to the same resources, another sign of the resourcefulness and initiative of the residents. It is hard to make your way down one of the 227 streets in the camp, each with a self-appointed street leader (street mayor) without being invited for chai tea somewhere. The self-resilience of the Za'atari residents gives me hope for Syria, despite what may be waiting for them when they return.

"It is hard to make your way down one of the 227 streets in the camp… without being invited for chai tea somewhere."



Population density (individuals per hectare) of Al Za'atari Camp.

A Year of Success!

"We all really enjoyed our visit to the Fair Maid's House. Many of the children were enthusiastic to make a return visit and do more work with you in the future. A fantastic resource, thank you so much."
Primary School Teacher

Travelling with the reindeer at a *Stories in the Land* public event.

Primary school pupil taking part in a mapping exercise.

Stories in the Land exhibition at the Scottish Storytelling Centre, Edinburgh.

Storymaking workshop with Claire Hewitt.

"I just wanted to say thanks very much for organising the geology conference, *Scotland Rocks*. It was a fantastic experience for [my son] and it is the most enthusiastic I have seen him for a long time! He talked non-stop all the way home from Perth yesterday about how much he had enjoyed it and how much he had learned."
Parent

Over the past year, the RSGS's Education Officer, Dr Joyce Gilbert, has been developing, managing and promoting a broad-ranging and imaginative service, working with teachers and outdoor learning practitioners, developing resources and activities with partner organisations, offering a range of professional development opportunities, hosting visits to our education centre at the Fair Maid's House, running outreach programmes for primary and secondary schools, promoting the use of playground maps in school grounds, creating the engaging and much-admired *Stories in the Land* project, managing several public community events, organising the *Scotland Rocks* geology conference, working with two universities to support their action research projects, and representing geographical interests in several policy forums.

Climate Change Story Mat for early years.

Over the next year, we plan to consolidate and develop our educational work at both practical and policy levels. We will continue to develop educational materials and resources, to run CPD sessions for teachers, to invite school groups to visit the Fair Maid's House, and to encourage schools to join in the *Playground Map Project*. We are now providing *Stories in the Land* project materials to schools in Aberdeen, Edinburgh, Falkirk and Oban, and will support them in adapting the resources to suit their own local areas. We will continue to work with universities on action research projects. We are continuing to press for the retention of Geology as a taught and examinable subject in secondary schools; we are also planning to run a second *Scotland Rocks* geology conference in March 2014, and hope that this will become an annual event. And we hope to start work on some creative new ways of engaging young people with geography.

"Through the *Stories in the Land* project there is a great opportunity to encourage people, especially young people, to develop their awareness of their culture and heritage..."
Principal Museum Officer, Highlife Highland

The key achievements of the year are:

- 2 academic research projects, which will be published
- 3 case studies developed
- 6 projects underway or near completion
- 6 sets of educational materials produced or being developed
- 6 events to inspire young people (primary & secondary age)
- 9 CPD sessions for primary and secondary teachers
- 9 conferences and workshop sessions to share good practice
- 17 key partner organisations involved (not counting participating schools and funders)
- 25 schools (primary & secondary) with playground maps
- 30 school visits (primary & secondary) to the Fair Maid's House
- 35 schools (primary & secondary) involved in projects, CPD sessions and attending RSGS talks
- 120 teachers involved in projects and CPD sessions
- 220 hours contributed by volunteers
- 1,200 children engaged face-to-face, through projects and visits to the Fair Maid's House
- 6,000 children engaged through broader activities and resources

University News

University of Edinburgh

Greenland's tidewater glaciers

A new project will investigate how variations in ice sheet runoff perturb fjord circulation and thus the submarine melt rate and dynamic behaviour of tidewater glaciers in Greenland. This research, led by Prof Pete Nienow, is important because

observations suggest that the delivery of warmer ocean waters to the margins of the Ice Sheet may be the major driver for the recently observed acceleration in marginal ice sheet thinning.

Forest pests and diseases

Susan Davies is being seconded to the Forestry Commission for six months from December 2013, as a NERC PURE Associate developing a better model for assessing pest and disease risk to forests. The model will have its initial application in determining the size of buffers for the Woodland Carbon Code, but is expected to have wider application in the NERC-sponsored Forest Finance Risk Network.

Plants and Fire

Caroline Lehmann, with Sally Archibald from the University of Witwatersrand, is organising a five-day catalysis meeting in February 2014 in Durham, North Carolina, to examine the co-evolution of plants and fire. They seek to bring together a diverse group, from phylogeneticists to remote sensors and Earth system scientists, to develop a unique understanding of how fire varies across the globe both now and in the past, the processes that have generated these changes, and consequences for the Earth system.

University of St Andrews

Q-Step Quantitative Methods Programme

Prof Stewart Fotheringham and Dr Urska Demsar, of the Centre for GeoInformatics, have been selected for an award under the £19.5m Q-Step Quantitative Methods Programme, which is designed to promote a step-change in quantitative social science training, with expertise and resources shared across the higher education sector, and links forged with schools and employers. The award will enable the appointment of two permanent lecturers, and will extend the teaching of Quantitative Methods and Geographic Information Science (GISc), building upon significant investment in this area by the university.

Laurel Award

Prof Allan Findlay has been awarded an honorary doctorate (signified by a laurel crown and a gold ring) by Sweden's University of Umeå, for his contribution to population geography and demographic research. Prof Findlay has served for seven years on the international board of Sweden's research council that guides work on ageing and wellbeing; the University of Umeå is home to the Linnaeus Demographic Database that underpins much of this research.

Erskine Fellowship

Prof Colin Ballantyne was awarded an Erskine Fellowship by the University of Canterbury in New Zealand, enabling him to spend seven weeks working in Christchurch, teaching a summer school course in applied geomorphology, and developing a new research project designed to establish the links between earthquakes, climate change and large landslides in the Southern Alps.

Entrepreneurship in Homes and Businesses

A new seminar series, starting in January in Glasgow, aims to advance knowledge on entrepreneurship, space and place. International researchers will come together to gain a better understanding of the roles of homes and neighbourhoods for firm formation and entrepreneurship, and to inform enterprise and housing policy and practice. See www.st-andrews.ac.uk/homebusiness or contact Dr Darja Reuschke (dr35@st-andrews.ac.uk) for more information.

PhD Studentship Opportunities

See www.st-andrews.ac.uk/gsd/news/title,231018,en.php for details of ESRC-funded PhD studentship opportunities for 2014 commencement, and www.st-andrews.ac.uk/gsd/opportunities/pg/ for topics that staff would be interested in supervising. Interested candidates should get in touch with Dr Louise Reid (lar9@st-andrews.ac.uk).

University of Stirling

Buddha's birthplace

Stirling geoarchaeologists Ian Simpson and Krista Gilliland joined an international team led by Durham University and the Pashupati Area Development Trust in Nepal, to uncover evidence of a sixth century BC structure at the birthplace of the Buddha. Pioneering excavations within the Maya Devi Temple at Lumbini uncovered a timber structure under a series of brick temples; further geoarchaeological tests confirmed the presence of ancient tree roots. The findings, the first to link the life of the Buddha to a specific century and to the nativity story, are reported in the December 2013 issue of *Antiquity*; a documentary, *Buried Secrets of the Buddha*, will premiere in February on the National Geographic Channel.

Super-Typhoon *Haiyan*

"...an extremely powerful 'super-typhoon',

Super-Typhoon Haiyan moving over the central Philippines at 05:10 UTC on 8th November 2013, as seen from the MODIS instrument aboard NASA's Aqua satellite. © NASA Goddard MODIS Rapid Response Team

Data from the Met Office and NASA

A tropical cyclone is the generic term for a low pressure system over tropical or sub-tropical waters, with organised convection (ie, thunderstorm activity) and winds at low levels circulating either anti-clockwise (in the northern hemisphere) or clockwise (in the southern hemisphere). The whole storm system may be five to six miles high and 300 to 400 miles wide, although sometimes it can be even bigger. It typically moves forward at speeds of 10-15mph, but can travel as fast as 40mph. At its very early and weak stages it is called a 'tropical depression'. When the winds reach 39mph it is called a 'tropical storm'. If the wind should reach 74mph or more, the tropical storm is called a 'hurricane' in the Atlantic and the north-east Pacific, or a 'typhoon' in the north-west Pacific, or a 'cyclone' or 'tropical cyclone' in other parts of the world such as the Indian Ocean and South Pacific. Around 80 to 100 typhoons develop globally each year; many of them form and dissipate over the ocean, but those that make landfall can cause considerable damage and loss of life.

Early in the morning of 8th November 2013, Typhoon Haiyan struck the central Philippines municipality of Guiuan at the southern tip of the province of Eastern Samar. Haiyan made landfall as an extremely powerful 'super-typhoon', perhaps the strongest ever recorded at landfall, with sustained winds estimated at 195mph by the Joint Typhoon Warning Center. (Previously, Hurricane Camille, which struck the northern Gulf Coast in 1969, held the record with 190mph sustained winds at landfall.) After striking Samar, Haiyan quickly crossed Leyte Gulf and the island of Leyte as it cut through the central Philippines. As it weakened from a typhoon to a tropical storm, Haiyan made a second landfall in north-eastern Vietnam on 11th November, with maximum sustained winds of 75mph, and then continued moving north-east through southern China, with heavy rain causing extensive flooding.

An insight into the life of a working geographer

ADRIAN TEAR holds a BA (Hons) in Geography from the University of Durham and an MSc in Geographical Information Systems from the University of Edinburgh. He is conducting research for a PhD in Geography at the University of Portsmouth, and is an Honorary Fellow in the University of Edinburgh's School of GeoSciences.

Geography and its meaning to me has changed over time. At A-level it meant learning classics of the subject; central place theory or plate tectonics. For my BA thesis it meant taking soil cores from Romney Marsh to conduct pollen analysis and interpret paleoclimatic conditions. At MSc level it meant using GIS software to manipulate data, make maps or perform analyses. At O-level I did not know how much it would all come to mean! But my children's work for their GCSEs shows there is still a lot more to the subject than simply knowing what is where.

My geographical education has provided me with theory, skills and tools which have helped me address a variety of questions. At Pinpoint Analysis in the 1990s, I used geography for market research; plotting stores, profiling customers, planning territories and producing thematic maps. When Pinpoint was taken over, geography meant learning to run my own company; making sales, delivering jobs, installing software and manipulating data. At Business Geographics, we worked with clients such as the *Financial Times* and *Daily Mirror* to refine their wholesale distribution networks, Camelot to plan for the national lottery re-bid, and MORI and NOP to define sample frames for face-to-face interviewing. We also did a lot of work on the Web.

After selling Business Geographics in the late 1990s, geography came to mean postcodes and proximity, as my co-founders and I stumbled into developing a series of online dating sites at Allegran. In online dating, knowing that a prospective partner is nearby is one of the key components of search. Our five sites grew rapidly to serve over 25% of the UK market, generating multi-million pound revenues. The company was sold some five years ago.

I am still using geography today. My family owns Ascog Farm on Bute, and we use GIS to manage the farmland. We have also worked with Community Energy Scotland on plans to build three mid-size wind turbines at the site. Map-based analysis and visualisation have been used together with a range of ecological, archaeological and built environment studies, all of which have a geographical component. Away from the farm, I am working part-time towards a PhD in Geography, researching use of geo-located social media posts during the 2012 US presidential election campaign.

As computer hardware, software and the Web have developed, geographical applications that appeared left-field in the early 1990s are now mainstream. Many people worldwide are now better connected to the concept of place through online maps, web applications, satellite navigation and smartphone apps. More importantly, there is a growing realisation, through mash-ups and mobile media, that geography really can tie many aspects of life together.

perhaps the strongest ever recorded at landfall."

No single weather event can be definitively attributed to climate change. However, all climate models do anticipate more intense storms. Typhoon Haiyan hit the Philippines just before a major UN climate summit convened in Warsaw. Yeb Saño, lead negotiator for the Philippines, addressed the opening session of the summit with an impassioned speech in which he called for urgent action to prevent a repeat of the devastating storm.

The following is extracted from his speech.

"It was barely 11 months ago in Doha when my delegation appealed to the world… to open our eyes to the stark reality that we face… as then we confronted a catastrophic storm that resulted in the costliest disaster in Philippine history. Less than a year hence, we cannot imagine that a disaster much bigger would come... Even as a nation familiar with storms, Super-Typhoon Haiyan was nothing we have ever experienced before, or perhaps nothing that any country has every experienced before.

"The picture in the aftermath is ever so slowly coming into clearer focus. The devastation is colossal. And as if this is not enough, another storm is brewing again in the warm waters of the western Pacific. I shudder at the thought of another typhoon hitting the same places where people have not yet even managed to begin standing up…

"We have entered a new era that demands global solidarity in order to fight climate change and ensure that pursuit of sustainable human development remains at the fore of the global community's efforts…

"I speak for my delegation. But more than that, I speak for the countless people who will no longer be able to speak for themselves after perishing from the storm. I also speak for those who have been orphaned by this tragedy. I also speak for the people now racing against time to save survivors and alleviate the suffering of the people affected by the disaster.

"We can take drastic action now to ensure that we prevent a future where super-typhoons are a way of life. Because we refuse, as a nation, to accept a future where super-typhoons like Haiyan become a fact of life. We refuse to accept that running away from storms, evacuating our families, suffering the devastation and misery, having to count our dead, become a way of life. We simply refuse to.

"We must stop calling events like these as natural disasters. It is not natural when people continue to struggle to eradicate poverty and pursue development, and get battered by the onslaught of a monster storm now considered as the strongest storm ever to hit land. It is not natural when science already tells us that global warming will induce more intense storms. It is not natural when the human species has already profoundly changed the climate.

"Disasters are never natural. They are the intersection of factors other than physical. They are the accumulation of the constant breach of economic, social, and environmental thresholds. Most of the time disasters are a result of inequity, and the poorest people of the world are at greatest risk because of their vulnerability and decades of maldevelopment, which I must assert is connected to the kind of pursuit of economic growth that dominates the world; the same kind of pursuit of so-called economic growth and unsustainable consumption that has altered the climate system.

"Now, if you will allow me, to speak on a more personal note.

"Super-Typhoon Haiyan made landfall in my family's hometown and the devastation is staggering. I struggle to find words even for the images that we see from the news coverage. I struggle to find words to describe how I feel about the losses and damages we have suffered from this cataclysm.

"Up to this hour, I agonize while waiting for word as to the fate of my very own relatives. What gives me renewed strength and great relief was when my brother succeeded in communicating with us that he has survived the onslaught. In the last two days, he has been gathering bodies of the dead with his own two hands. He is hungry and weary as food supplies find it difficult to arrive in the hardest hit areas…

"We can fix this. We can stop this madness. Right now… Let Poland be forever known as the place we truly cared to stop this madness. Can humanity rise to the occasion? I still believe we can."

"Disasters are never natural. They are the intersection of factors other than physical."

Karen L Nyberg, an astronaut aboard the International Space Station, captured this photo of Super-Typhoon Haiyan from space on 9th November 2013. © NASA/ISS/Karen Nyberg

The Falling Sky

Words of a Yanomami Shaman

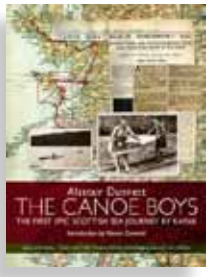
Davi Kopenawa, with Bruce Albert (*Harvard University Press, November 2013*)

In the first book ever written by a Yanomami Indian, Davi Kopenawa, shaman and leading spokesman for his people, describes the rich culture, history and ways of life of the Yanomami of the Amazon rainforest. Davi recounts his initiation as a shaman and his first encounters with outsiders – including the gold miners who flooded Yanomami land during the 1980s and caused the death of one in five Yanomami through disease and violence. He vividly describes his impressions of western culture on trips abroad, such as his first journey outside Brazil when he visited Europe at the invitation of Survival International. Davi's book, written in collaboration with French anthropologist Bruce Albert, Research Director at France's Institut de recherche pour le développement (IRD), is an impassioned plea to respect his people's rights and preserve the Amazon rainforest.

The Canoe Boys

The First Epic Scottish Sea Journey by Kayak

Alastair Dunnett (*In Pinn, May 2007*)

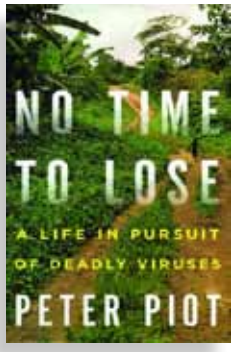


"It's too late in the year!" they were advised, but they still did it. By canoe from Bowling to Kyle of Lochalsh with numerous stops along the way, Alastair Dunnett and Seamas Adam spent a heady autumn in 1934 meandering up the glorious west coast of Scotland. Their account, first published in 1950 as *Quest by Canoe*, later republished as *It's Too Late in the Year* and again as *The Canoe Boys*, makes fascinating reading and is one of the classics of sea kayaking literature. Varied escapades, from running the infamous tide-rush of the Dorus Mhor to a balmy harvest working on Calve Island off Mull, are related in superb, lyrical style. Fully illustrated with archival material and contemporary press cuttings, this is an adventure story of youthful exuberance and of how life once was lived before the war changed everything for ever.

No Time to Lose

A Life in Pursuit of Deadly Viruses

Dr Peter Piot (*W W Norton & Company, July 2012*)

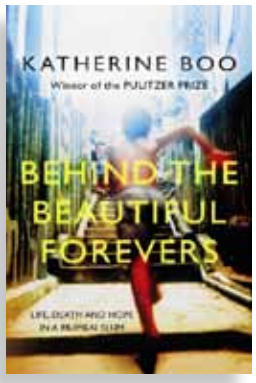


The story begins in a laboratory in Belgium in 1976, where the newly qualified Dr Piot and his colleagues receive mysterious blood samples from victims of a lethal new disease in the equatorial forest of Zaire. Having identified a new virus later named Ebola, Piot is dispatched to the quarantine zone to track the outbreak to its source and discover its transmission mechanisms. Living and working among dying villagers and terrified missionaries deep in the rainforest, Piot repeatedly risked his life to collect blood samples and understand the spread of the Ebola epidemic. Back in Europe, he set out to work with vulnerable communities from Antwerp to Nairobi. As one of the few researchers in sexually-transmitted diseases with knowledge of Africa, he was among the first to understand and respond to the burgeoning AIDS epidemic there.

Behind the Beautiful Forevers

Life, Death and Hope in a Mumbai Slum

Katherine Boo (*Portobello Books, June 2012*)

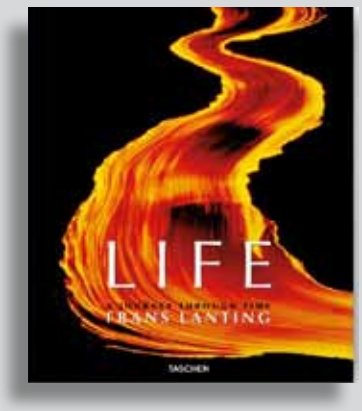


Annawadi is a slum at the edge of Mumbai Airport, in the shadow of shining new luxury hotels. Its residents are garbage recyclers, construction workers and economic migrants, all of them living in the hope that a small part of India's booming future will eventually be theirs. But when a crime rocks the slum community, and global recession and terrorism shock the city, tensions over religion, caste, sex, power, and economic envy begin to turn brutal. Boo spent three years with the residents of Annawadi, documenting the dreams, disappointments and inspired improvisations of the families who call the place home. Getting to know those who dwell at Mumbai's margins, she evokes an extraordinarily vivid and vigorous group of individuals flourishing against the odds amid the complications, corruptions and gross inequalities of the new India.

Life

A Journey Through Time

Frans Lanting (*Taschen, June 2012*)



In 2000, world-renowned wildlife photographer Frans Lanting set out on a personal journey to photograph the evolution of life on Earth. He made pilgrimages to true time capsules like a remote lagoon in Western Australia, spent time in research collections photographing forms of microscopic life, and even found ways to create visual parallels between the growth of organs in the human body and the patterns seen on the surface of the Earth. The result is a glorious picture-book depicting the amazing biodiversity that surrounds us all. Lanting's true gift, beyond his technical mastery, is his eye for geometry in the beautiful chaos of nature that allows him to show us the world as never before. From crabs to jellyfish, diatoms to vast geological formations, jungles to flowers, monkeys to human embryos, this book is a testament to the magical beauty of life in all its forms.