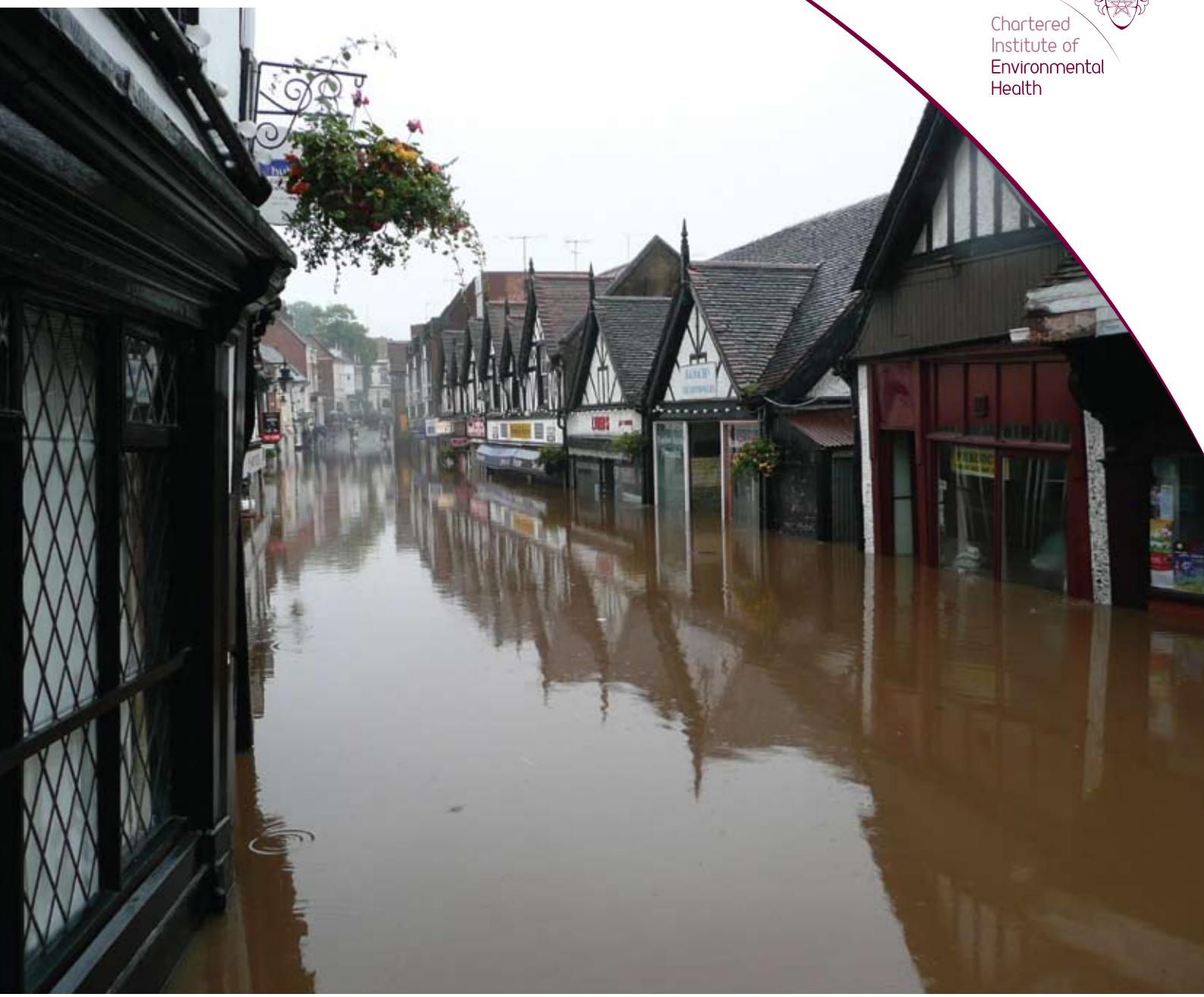
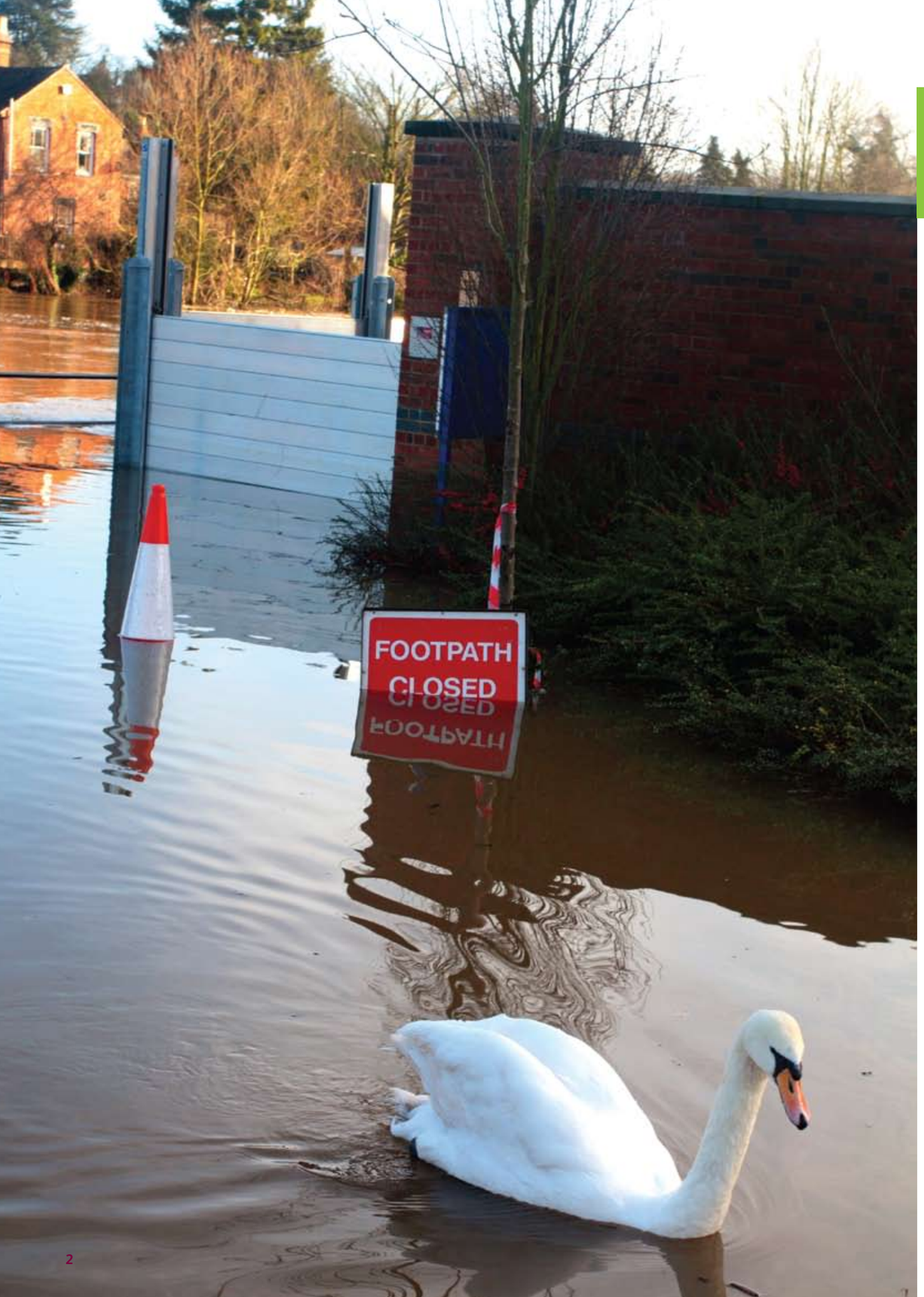
Chartered Institute of Environmental Health



The impact of climate change on pest populations and public health

November 2008



Introduction

The World Health Organization (WHO) book, *Public health significance of urban pests*, tells us that to protect public health we must improve pest and pest-related disease management.

The second half of the 20th century and the beginning of the 21st has witnessed important changes in ecology, climate and human behaviour that favour the development of pests.

"Climate change is particularly relevant because it is expected to alter not only the natural environment as a result of flooding or drought but also the urban environment as a result of changes in land use." (Bonnefoy et al, 2008)

Warmer temperatures, changing precipitation patterns, higher sea levels and more extreme weather events such as flooding will become more frequent and will impact pest populations.

These changes make crucial the need to carefully assess the potential threat of pests to public and environmental health.

Pest management must be recognised as fundamental to the public health imperative and a proactive approach adopted by those working in the profession.

The effects of climate change on rodent populations

The current trend of a warmer and wetter climate will impact on rodents and their interaction with humans.

Data suggests that temperature is the major factor influencing the reproductive potential of rodents and that this reproductive potential is increased during the warmer months or during rainy seasons, as described by Meehan in 1984, in his book, ‘Rats and Mice’.

Researchers Brown and Singleton published work in 1999 in the Journal of Applied Ecology, showing that other climatic factors such as precipitation, can increase rodent populations.

Urban rodents can be infected with a wide range of pathogens, such as *Salmonella*, as confirmed by Hilton in 2002 in the International Journal of Environmental Health Research and *Toxoplasma gondii*, as presented by Murphy in 2008 at the 6th International Conference on Urban Pests. The transmission of pathogens to humans is also influenced by climatic factors.

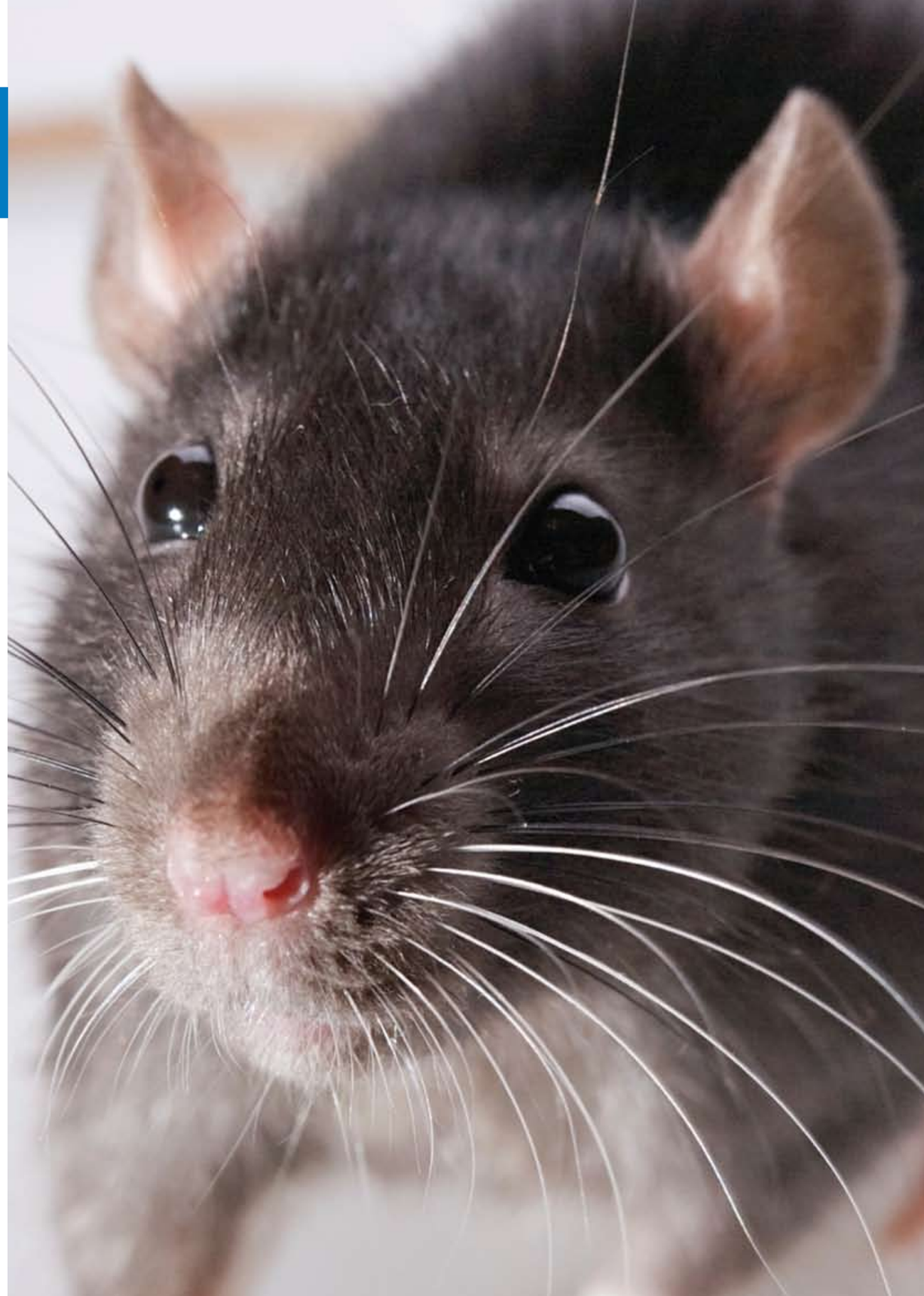
Floods may cause rodents to be displaced from their habitats and as a result, bring them into even closer contact with humans, increasing the likelihood of disease transmission. Flooding has been associated with increases in the incidence of *Leptospirosis* (also known as Weil’s disease).

Outbreaks of rodent-borne Hantavirus have been associated with increases in mouse populations, driven by food supply as a result of prolonged precipitation, as reviewed by Epstein in his 2001 paper ‘climate change and emerging infectious diseases’.

Rats can also damage electrical cables, gas and water pipes by gnawing on them and this has been known to cause fires and floods. In addition there could be an increased economic expense as rodents consume and contaminate scarce foodstuffs.

Changes in the climate may also result in changes in human lifestyles, such as an increase in outdoor activities. This in turn affects rodent populations more where discarded food is available.

The increased availability of alternative food sources may impact the effectiveness of treatments, such as rodenticide bait acceptance, the type of bait and baiting techniques used.



The effects of climate change on tick populations

According to WHO, ticks are responsible for transmission of more cases of human disease than any other arthropod vectors in North America and Europe. Ticks transmit the most common vector-borne diseases, for example Lyme Disease.

Regional studies show that tick populations are increasing. Climate change may increase tick numbers and cases of tick-borne diseases. Milder winter temperatures in particular have important effects on tick distribution, fostering shifts to higher altitudes.

Ticks dwell predominantly in woodlands and meadows with hosts such as deer, small mammals, rodents and birds. Most ticks that can impact human health are rare in urbanised environments but increasingly they occur closer to home where a moist microhabitat is provided by high grass, gardens and rough forest edges.

Seasonal patterns of plants are changing. Studies indicate that flowering periods and leaf unfurling are occurring earlier, while autumn leaf fall is increasingly delayed. Since the early 1960s the overall growing season has extended by 10.5 days and, according to predictions by the National Farmer's Union (NFU), it will have extended by 45-50 days by 2080.

The early and prolonged abundance of plants may aid earlier births, better birth weights, increased juvenile survival, and lower adult mortality of host animals. This in turn would support higher numbers of ticks.

Milder winters aid ticks to actively feed and continue their life cycles. A lack of harsh winters also reduces the mortality rate among host species.

Milder weather all year round is likely to encourage people to enjoy outdoors more frequently and for longer periods, increasing public exposure to ticks.

The effects of climate change on mosquito populations

Increases in international travel and trade allow accidental importation of mosquito vectors and hosts. As our climate and environment change, mosquitoes will spread to new areas, bringing emerging and resurging vector-borne diseases.

Mosquitoes are highly responsive to changes in climate and increased temperature is associated with increased abundance, assuming there are sufficient numbers of water-filled sites as habitat.

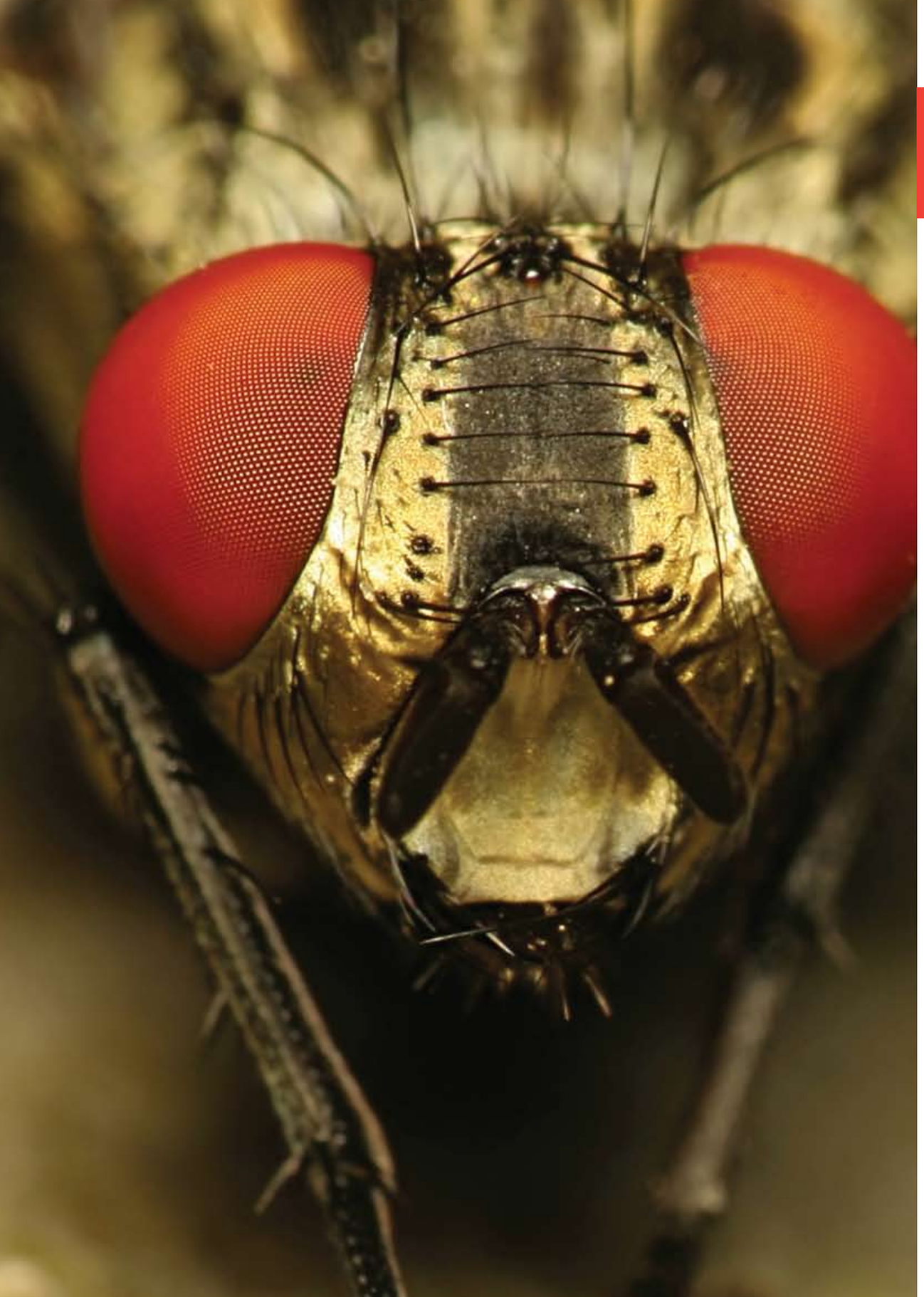
The predicted warmer summers and milder winter temperatures will favour mosquito development and extend the biting season of some species.

Wetter winters will provide more temporary and underground aquatic sites for some species during winter and spring. Drier summers could however reduce possible aquatic sites for other species.

Mosquitoes change behaviour, adapting to new breeding habitats, such as slurry pits and rainwater pools in used tyres. In the warmer climate, the increased use of water butts by households is likely to increase the number of biting and non-human biting species around homes. Intense summer rainfall resulting in localised flooding could also increase the abundance of flood-water species.

Rises in sea levels and increased storm surges, particularly on the east coast, could eliminate some mosquito sites for example saltmarshes, but create new sites where there is inundation of salt-water.

There are more than 25 common species of mosquito in the UK and each will respond slightly differently to climate change. Climate change is likely to increase the abundance of mosquitoes in the UK but may also increase the abundance of their predators.



The effects of climate change on fly populations

The public health significance of flies is well established. For example the housefly, *Musca domestica*, has been implicated in the spread of many diseases by researchers such as Greenberg, in his 1973 book, 'flies and disease'.

The nuisance value of such flies can be considerable and legislation already exists to tackle this nuisance under the Clean Neighbourhoods and Environment Act 2005. The potential increases in fly populations due to climate change are of concern, in terms of both the risk to public health and the considerable nuisance value.

Goulson and colleagues developed predictive models to forecast fly populations, published in the Journal of Applied Ecology in 2005. Models were produced for the housefly, *Musca domestica*, and blowflies, *Calliphora* spp. Predictions based on climatic factors only were strongly correlated with observed data. This observation suggests that fly population changes are largely driven by the weather rather than biotic factors.

The models predict that under likely scenarios of UK climate change, fly populations could increase substantially, with increases of up to 244 percent by 2080 compared with current levels.

If these predictions hold true, it is possible increases in fly-borne diseases will occur.

The effect on other fly populations is less clear. The influence of climate change on the stable fly, *Stomoxys calcitrans*, a blood-feeding, biting pest of livestock and humans, was examined in an international study by Gilles and colleagues in the journal Medical and Veterinary Entomology in 2008. The main conclusion is that stable fly infestations are unlikely to worsen in response to global warming.

The study noted that although infestations are unlikely to worsen a shift in the infestation period could occur, which is still of importance. Stable flies breed in livestock manure and rotting vegetation. Sanitation/husbandry practices can have a major impact on populations and are likely to compensate for the effects of climate change on these flies.

Studies such as these are essential. They enable the forecasting of fly population levels ensuring that control measures can be focussed as part of an integrated pest management programme, reducing public health risk and fly nuisance.

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