

Reducing hazards for animals from humans

PAUL-PIERRE PASTORET⁽¹⁾

ABSTRACT

If animals may be a source of hazards for humans, the reverse is equally true.

The main sources of hazards from humans to animals, are the impact of human introduction of transboundary animal diseases, climate change, globalisation, introduction of invasive species and reduction of biodiversity.

There is also a trend toward reducing genetic diversity in domestic animals, such as cattle; there are presently around 700 different breeds of cattle many of which at the verge of extinction (less than 100 reproductive females). The impact of humans is also indirect through detrimental effects on the environment. It is therefore urgent to implement the new concept of "one health".

Key words: Animals, Humans, Transboundary animal diseases, Biodiversity, Environment, One health

(1) Professor emeritus, University of Liège 7, rue de la Clissure, B-4130 FONTIN (Esneux) Belgium.

A tribute to Frank FENNER who passed away in November 2010

CORRESPONDING AUTHOR: Paul-Pierre Pastoret, Professor emeritus, University of Liège 7, rue de la Clissure, B-4130 FONTIN (Esneux) Belgium. Phone: 00-32-4-3803059, Fax: 00-32-4-3551447, GSM: 00-32-496-950287, e-mail: paul-pierre.pastoret@skynet.be

INTRODUCTION

If animals may be the source of hazards for humans, the reverse is also true. For instance the introduction of transboundary animal diseases (1) and the reduction of biodiversity either in wild or in domestic animals are often the result of a direct human intervention.

When dealing with the influence of humans on animals, the issue of biodiversity should be taken into account, especially the biodiversity of vertebrates.

The detrimental impact of humans on animals is the result of the direct influence of humans on animals and the indirect influence through environmental factors. This paper will therefore be a plea for the new concept of "One health" it is to say human health, animal health and environmental health.

BIODIVERSITY OF VERTEBRATES

One cannot deal with the influence of humans on animals without taking biodiversity into account, especially biodiversity of vertebrates, since humans are part of it.

The number of vertebrate species, is currently estimated to be 62 275 (fish, amphibians, reptiles, birds, mammals), many at the verge of extinction.

Among the identified vertebrate species, 31 564 are fish species, 6 570 are amphibian species, 9 002 are reptile species, 9 723 are bird species, 5 416 are mammal species (2).

As far as mammals are concerned, as mentioned 5 416 species have already been recognised, whereas the expected number of mammalian species is expected to be around 5 500. For mammalian species we are therefore nearly at the end of the inventory, since 99% of the species are already known (3).

The number of recognised mammalian species

has increased since their first complete listing in 1982; it seems to be in contradiction with the extinction of several species during the same period. This increase is due to the fact that molecular techniques allow to differentiate species according to their genotypes rather than their phenotypes, with increasingly detailed comparison of species limits and revision of the phylogeny.

Among mammals, there are 2 277 species of rodents pertaining to 481 genera. Rodents account therefore for 42% of recognised mammal species and rodents are the reservoir of many zoonotic diseases.

To date the number of recognised bat species reaches 1 116 pertaining to 202 genera. Bats make up therefore to more than 20% of the total number of mammalian species. Bats are flying mammals and also the source of many emerging diseases, many of it previously unknown.

There are 9 723 recognised bird species pertaining to 2 058 genera, among which mainly passerines. Wild birds are also a reservoir of zoonotic diseases, as the avian influenza viruses.

Biodiversity of domestic animals

Biodiversity of domestic animals must also be considered.

Through selection, man has created many breeds. For instance there are nowadays approximately 700 recognised breeds of cattle worldwide, but many of these are on the verge of extinction having less than 100 breeding cows left (4). There is therefore a swift erosion of genetic variability in cattle that is worrying.

On the other hand man has selected more than 300 breeds of dog. The dog's genome sequence being completed it will be a huge source of information for comparative studies on spontaneous diseases in both humans and animals.

BIODIVERSITY OF HUMAN PATHOGENS

There are 1 415 species of infectious organisms known to be pathogenic to humans, including 217 viruses and prions, 538 bacteria and rickettsia, 307 fungi, 66 protozoa and helminths (5).

Out of these, 868 (61%) are classified as zoonotic and 175 pathogenic species are considered to be associated with emerging diseases. Out of 175 emerging pathogens of this group, 132 (75%) are zoonotic, the vast majority of which coming from wildlife.

Wildlife constitutes an important potential of already unknown pathogens

for both humans and animals. For example, the number of already recognised virus species is largely an underestimate. RNAs viruses produce populations of quasi-species and are constantly evolving at a quicker step than their host.

THE LIVESTOCK REVOLUTION AND GLOBALISATION

In 2008 over 21 billion food producing animals were raised to feed a population of over 6 billion people. By 2020 this demand is expected to increase by 50%.

It should be kept in mind that food producing animals not only produce meat, but also milk, eggs, fiber and leather, work force and manure.

Human population is expected to reach 9 billion people in 2050.

The main threats for animals, both domestic and wild, and for biodiversity are globalisation and invasive species, both mainly anthropogenic factors.

As far as global changes are concerned, the recent acceleration in the volume, speed and intensity of global trade and communication has been accompanied by an unprecedented increase in the frequency of movements of animals, domestic or wild.

Globalisation includes what is called the five Ts: Trade, Transport, Travel (2 billion people by air in 2008), Tourism, Terrorism.

Globalisation has a direct impact on infectious diseases since the duration of travel or transport is shorter than the duration of incubation period of most of the known or previously unknown infectious diseases such as SARS.

Globalisation has several components such as the previously described five Ts, climate change, human population growth, rapid urbanisation, changing farming systems, primary forest encroachment, opening of previously closed ecosystems and as a consequence, the next big battle: fight for water.

The standardised freight container is also a concern. Standardised freight containers are an hidden way to introduce some disease vectors and vector-borne diseases, but even some vertebrates that may become invasive species.

ALIEN INVASIVE SPECIES

The definition of an alien species can be a species not native to a region and which was

introduced to that region mainly through human activities. In this context, synonyms for “alien” include: exotic, introduced, non-indigenous, non-native, allochthonous.

The definition of an invasive species is alien species that reach the final stage of an invasion process and have the capacity to spread.

Invasive species are considered to have a highly detrimental impact in the regions concerned, not only on local biodiversity, but also on issues with socio-economic interest, such as animal production, animal health and even public health.

The invasion process is a sequence of events and processes during which an introduced species faces, and potentially overcomes, various barriers to its establishment, proliferation and spread in a new region. It must be kept in mind that the most invasive species are human beings. Human beings are responsible for most of the animal invasions from the beginning of their history (migrations, etc.).

THE DAISIE SURVEY

The DAISIE SURVEY (Delivering Alien Invasive Species Inventories for Europe (6) published in 2009 lists, altogether, around 11 000 species which have been introduced onto the European continent alone. Their degree of aggressiveness varies, but some pose real problems.

According to the International Union for the Conservation of Nature (IUCN) 625 (51%) of known endangered species are threatened because of invasive (alien) species (7).

Many of these species are also threatened by the international trade in endangered animals, plants and their products.

The lack of biodiversity can be detrimental for human and animal health as exemplified by the ecology of the infection by West Nile virus in humans and horses. It seems contradictory, but increased avian diversity is associated with lower incidence of human West Nile infection due to a dilution effect in the diverse species of the avian population (8-9).

Impact of the introduction of non-native animals on biodiversity and health

There are number of examples of detrimental effects of the introduction of non native species, domestic or wild, on biodiversity: impact of the introduction of goats on Galapagos islands on the biodiversity of native fauna; impact of the

introduction of cattle on Caribbean Islands with heart water (cowdriosis) and the appropriate ticks for the transmission; introduction of the American grey squirrel (*Sciurus carolinensis*) in United Kingdom and Italy and the progressive elimination of the native red squirrel (*Sciurus vulgaris*); introduction of the European red fox (*Vulpes vulpes*) and its detrimental effect on the native marsupials; release of the American mink (*Mustela vison*) and the progressive elimination of the native European mink (*Mustela lutreola*); introduction of European rabbit in Australia with highly detrimental effect on the environment. The examples of the introduction of diseases through foreign species are also numerous such as the introduction of African horse sickness in Spain through the importation of African zebras; the introduction of Bluetongue virus 8 in Northern Europe still unsolved (10); introduction from Australia of the brushtail possum (*Trichosurus vulpecula*) in New Zealand which is now the major reservoir of bovine tuberculosis in his new country and shows a very high population density; introduction of monkeypox in USA through African squirrels (New Companion Animal) with human contaminations; introduction of Highly Pathogenic Avian Influenza Virus H5N1 (HPAI) through smuggling of Eagles for falconry in Belgium. The introduction of animal diseases may be a direct consequence of anthropogenic interventions, for instance the introduction of foot-and-mouth disease in United Kingdom in 2001 by feeding pigs with contaminated material; the introduction of African swine fever from Spain in Belgium by feeding pigs with wasted sausages; the contamination of cattle with Bovine Spongiform Encephalopathy (BSE) by contaminated feed and the emergence of the new variant of Creutzfeldt-Jakob disease in man.

The well documented story of the introduction of rinderpest in Eastern and Southern Africa end of the nineteenth century and its impact on Maasai population and indigenous wildlife.

Rinderpest was the most dreadful disease of cattle due to a *Morbillivirus* and is nowadays officially declared to be eradicated from the world thanks to vaccination (11); only the second viral disease to be eradicated after smallpox.

There are also examples of direct contamination of wildlife by man such as the contamination of mountain gorillas with measles as a consequence of wildlife tourism and transmission of MRSA from man to companion animals (12-15).

REDUCING HAZARDS AND FUTURE CHALLENGES

To reduce the hazards there are several actions to promote: increased regulation of the transport and introduction of animals, domestic or wild; sustainable agriculture, breeding and forestry management; campaigns against new companion animals (man has already selected more than 300 dog's breeds to fulfil all his needs, from work to friendship); measures to maintain wildlife

biodiversity; reduce the erosion of genetic variability in domestic animals; reducing unnecessary contacts between man and wild animals; medical surveillance of caretakers of animals; vaccination of animals and/or men; and, last but not least, control of human population growth.

The challenges to face are also numerous: climate change; human population growth, livestock population growth; lack of water; rapid urbanisation; changing in farming systems; forest encroachment; opening of previously closed ecosystems; globalisation of trade.

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