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Thoughts of a travelling ecologist 17.

One biosecurity

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The still-untamed SARS-CoV-2 pandemic underlined, again, two important facts that have been known for a long while but conveniently forgotten by humankind. One is that we are profoundly linked to other organisms and nature, and the other is that human-driven distribution chains are global and fast. Neither should be a surprise, yet it seems that both caught people at individual and organisational levels unprepared and unaware. It is a no-brainer that if someone can arrive at literally the opposite part of our globe in about 24 hours, she can also bring back anything from there in the same time span.

Dispersal is a basic feature of living species. However, the dispersal abilities of various species are drastically different, both in space and time. In space, an organism can move a few cm or circumnavigate the globe in one year, as some seabirds do (Egevang *et al.*, 2010). Movement can be active or passive, intentional or accidental. Humans are one species that became cosmopolitan through dispersal, and today the global movement of humans has become incredibly intense, some individuals circling the globe several times a year (or used to, although I am afraid this will start happening again once the pandemic subsides). No wonder that we became a major agent of assisted dispersal even if this role has not always been conscious. The end result is that we have been helping and continue to help various organisms to reach locations that they would not be able to reach on their own. Very frequently, they are not there only for a second good reason: the conditions at that location do not allow their survival. For example, people accidentally transported a considerable number of weed seeds to the Antarctic (Lee & Chown, 2009), and probably do so repeatedly every year, but due to the harsh conditions, most of them have no chance to establish a self-sustaining population there.

In too many occasions, however, the newcomer can not only arrive, but can survive, grow and reproduce, and becomes an invader, generating various and often unfavourable impacts on natural habitats, cultivated habitats, animals or people. Invasions today are a legitimate part of human-generated global change (Vitousek *et al.*, 1997) and such invasive organisms cause serious problems and damage in their new environment.

Human primacy is a deeply entrenched principle in our thinking, and most people would be taken aback by anyone challenging this. Consequently, human health is globally seen as the most desirable thing to uphold, and we have ample evidence that new pathogens and diseases can have devastating effects of human health. After the European "discovery" of the Americas, the biggest impact has been through the in-

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troduction of various pathogens that decimated the native human population (Koch *et al.*, 2019). Many of the human diseases have a probable animal origin, yet the concept of "One Health" was formulated only around 2007 (Monath *et al.*, 2010). Behind One Health is the recognition that questions and problems of human and animal health are interrelated, and by necessity, they are best treated together. Traditionally, however, they have not been, and human and animal health in many countries remain to be dealt with by different departments, administrative structures and legislation even today. There is no logical reason for that division, as zoonoses are not uncommon. Several evolutionary biologists called attention to the fact that the zoonosis question is never an "if" but a "when" — several animal pathogens are able to switch hosts and with our increasing numbers and mobility, we are becoming more and more promising hosts. The so-called DAMA protocol (documentation-assessment-monitoring-action, Brooks *et al.*, 2014) is trying to find these potential pathogens "before they find us" — recognising the need to look beyond strict disciplinary boundaries. This, however, is still only a first step — bigger hurdles exist.

I recall my experience as an expert at the Plant Health Panel of the then-newly established European Food Safety Authority (EFSA) in 2006: our task was to evaluate the impact of the weed *Ambrosia artemisifolia*. During the work, we had to realise that this species is not a major weed but its pollen is a major allergen. In the resulting evaluation (Baker *et al.*, 2007), we had to specify that these health impacts are serious but the mandate of EFSA did not extend to evaluate impacts on human health.

Such a situation is precisely the starting point for Philip Hulme, an eminent invasion ecologist, who suggested a wider concept (Hulme, 2020). Hulme argues that our scope of evaluating invasive species should not be sectorial but complex. One Health is a useful but limited concept and needs to be extended. He suggests that the overarching term should be biosecurity, and that it is best framed as one concept: One Biosecurity. There is only one biosecurity, he argues, because impacts can be complex and multi-faceted, and effective defensive action cannot be mounted if the various impacts are registered and handled by different departments or organisations.

Biosecurity, Hulme (2020) reminds us, "commonly refers to the research, procedures, and policies that cover the exclusion, eradication, or effective management of the risks posed by the introduction of alien plant pests, animal pests and diseases, animal diseases capable of transmission to humans (zoonoses), the release of genetically modified organisms and their products, and the management of invasive alien species and genotypes". The key connection among these seemingly disparate phenomena is the appearance of a genotype, or organism, in places or situations where it has not been present before. This may be an organism with a "normal" geno- and phenotype, arriving to a new location (i.e. a biotic invasion), one with a natural mutation in host range (like an animal pathogen host-jumping, see SARS-CoV-2), or an intentionally generated one (such as a genetically modified organism that has a changed its tolerance limits, like a herbicide-tolerant crop plant). Yet these fall under different (and too often not cooperating) national and international organisations, from the World Health Organisation to the Convention on Biological Diversity. If we insist on continuing to deal with such organisms and phenomena on a sectorial basis, we do the invasive species a favour, but to ourselves a disservice. I find it difficult to disagree with this argument.

If there is anything to deplore in the idea, it is the sequence (ranking?) of the components. Hulme's title lists "human, animal, plant and environmental health" (Hulme, 2020). Well, when you announce the need for a revolution, you should not pussyfoot around. Humans have been put at the top of the creation for much too long. The correct sequence is: "environmental, plant, animal and human health". This is also the appropriate evolutionary timeline. I happen to believe that ranking these connected fields this way will help us recognise that without a "healthy" environment, human health may be a wish, but will never become a reality. (下转第 28 页)

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