ONE HEALTH ATLAS

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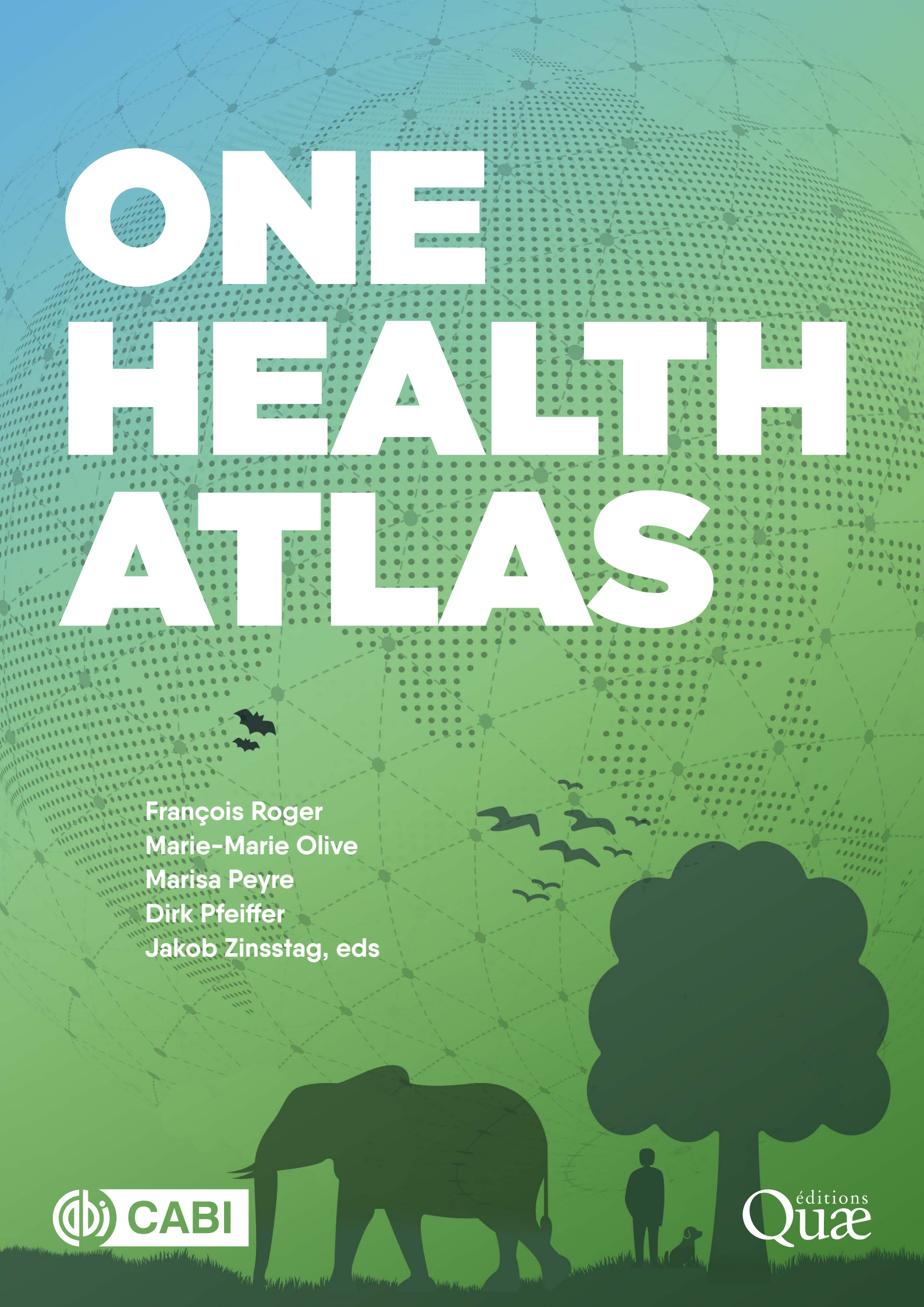

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Tuberculosis unleashed: why One Health holds the key

François Roger

Tuberculosis (TB) is an ancient disease that has afflicted humankind for thousands of years. While the disease is primarily caused by the bacterium *Mycobacterium (M.) tuberculosis, M. bovis,* another member of the *M. tuberculosis* complex (MTBC), also plays a significant role, particularly in zoonotic TB. These two species share a common ancestor and have evolved to adapt to different hosts over time. Historically, *M. bovis* was a major cause of human TB, especially before the introduction of milk pasteurization and advances in veterinary practices.

Around 10 million people worldwide develop TB annually, mostly due to *M. tuberculosis. M. bovis* accounts for a much smaller percentage of human cases—typically fewer than 10%, and often below 2% in countries with stringent public health measures such as milk pasteurization and bovine TB control. The disease caused about 1.25 million human deaths in 2023 (WHO). Human infection with *M. bovis* typically occurs through direct contact with infected animals or indirectly via contaminated food. Although *M. tuberculosis* is primarily a human pathogen, it can also infect animals when humans and animals live in close proximity, such as with elephants in zoos, dogs, pigs and cattle (Figure 1). This bidirectional transmission underscores the critical need for integrated surveillance and control systems. Several countries have implemented surveillance programs for zoonotic TB due to *M. bovis* at varying levels of intensity (Figure 2).

However, recent studies have shown that zoonotic TB is even more complex than previously thought. Other MTBC members, including *M. orygis, M. caprae,* and *M. pinnipedii,* also contribute to zoonotic TB transmission. For instance, *M. orygis* is responsible for most zoonotic TB cases in South Asia, while *M. caprae* often spills over from infected goats and other livestock in Europe. *M. pinnipedii,* found in pre-Columbian human populations in South America, causes infections in people who come into contact with diseased seals and sea lions. These findings suggest that the current narrow definition of zoonotic TB—primarily as *M. bovis* infection—poorly reflects the full spectrum of TB of animal origin.

Managing TB within the One Health framework is extremely important, as it promotes interdisciplinary collaboration for disease surveillance and control. Furthermore, a deeper understanding of the broader ecological context in which MTBC subspecies circulate can support the development of more effective public health policies, ensuring a comprehensive approach to TB prevention and control.

References

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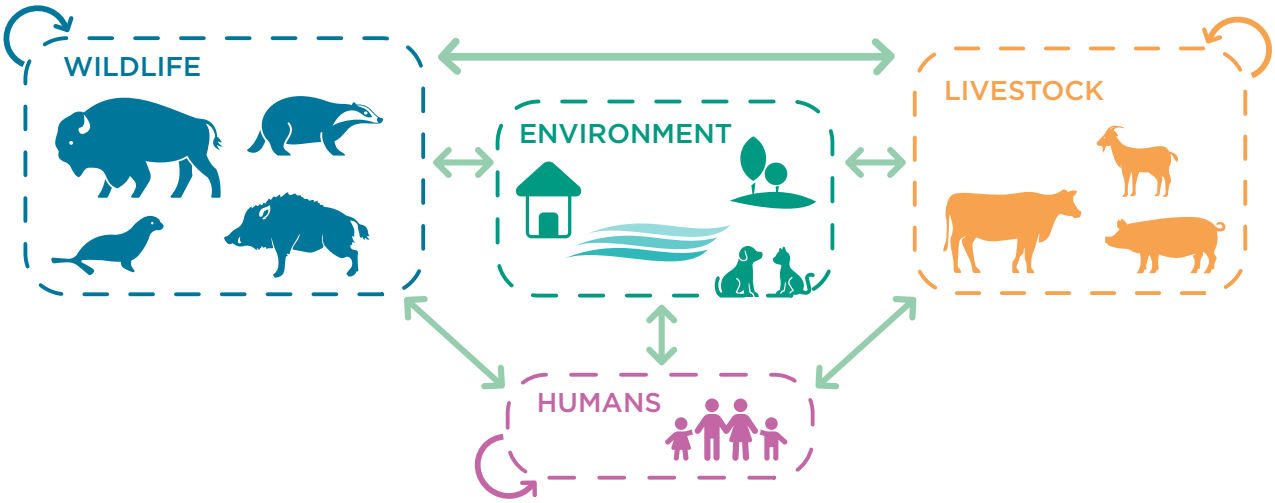
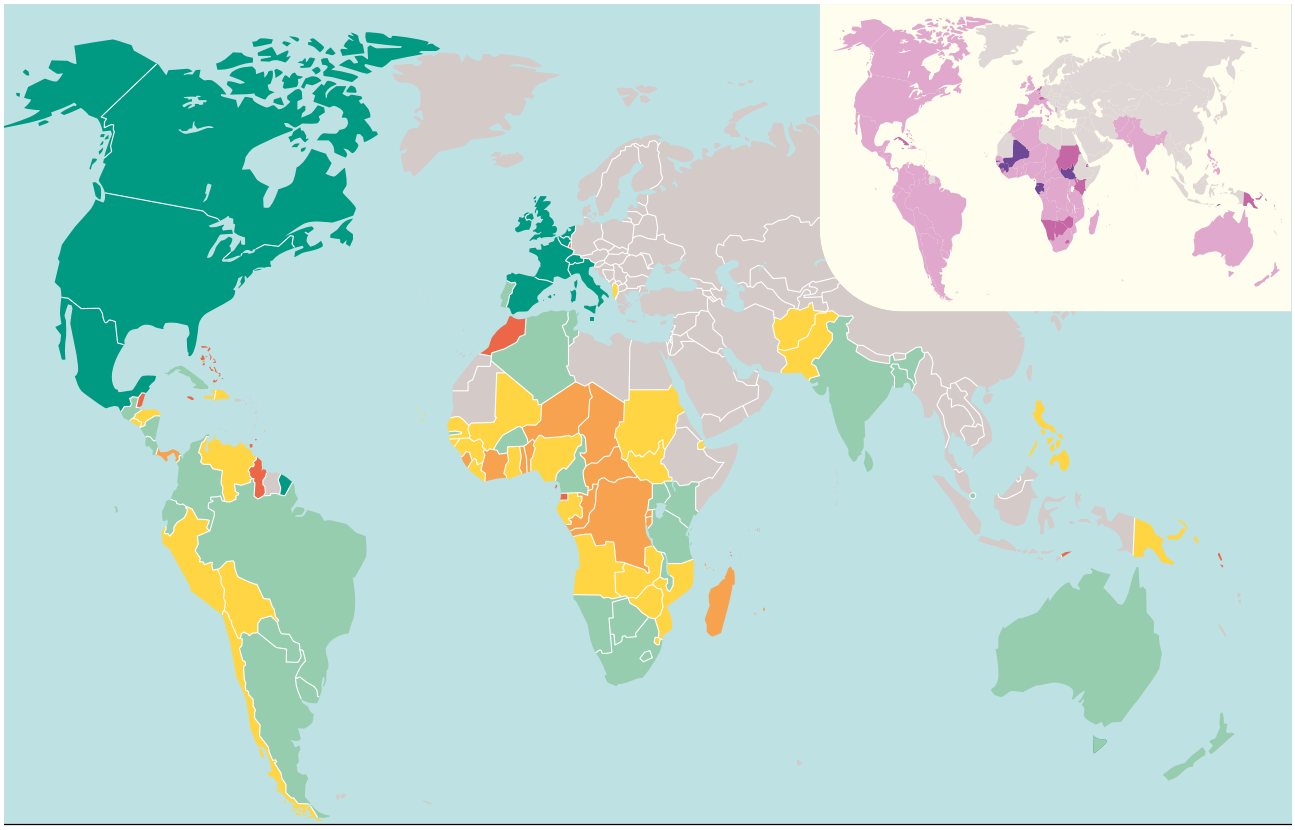


Figure 1. The spread of bovine tuberculosis between animals and humans illustrates the importance of the current One Health approach.



Comprehensive TB surveillance, including specific surveillance for zoonotic TB. Countries actively collect data, analyze it regularly, and widely share the results.

These countries conduct TB surveillance but lack dedicated zoonotic TB monitoring.

TB surveillance is conducted, but no zoonotic TB information is available

Lack clear references to any TB surveillance or control programs, including zoonotic TB.

Similar to Group D, with no clear TB surveillance programs or zoonotic TB references; however, these countries have specific factors (e.g. being islands, city-states, or having small populations) that could influence zoonotic TB epidemiology.

Animal TB notification

Present

Absent

No information

Not documented in the paper

Figure 2. Global map of human tuberculosis (TB) surveillance data related to cases caused by *Mycobacterium bovis* and animal TB. From de Macedo Couto *et al*. 2022.