

antibiotic resistance genes and clinically relevant pathogens are distributed worldwide within very short periods of time (Bengtsson-Palme et al. 2015).

Efforts are made to build and maintain low-cost, low-energy, low-maintenance, decentralized wastewater treatment systems in developing countries. Ponds and retention soil filters/constructed wetlands seem promising and could be suitable for this purpose (Kivaisi 2001). The retention of *Escherichia coli* by passing a retention soil filter can even be comparable with that of a wastewater treatment plant equipped with a tertiary treatment step (mean retention of 2.7 log units; Scheurer et al. 2015). However, it has to be taken into account that many of these studies were carried out in the temperate zone and that the transferability of the results due to different climatic and edaphic conditions has to be proven.

24.4 Agriculture

24.4.1 Intensive, Large-Scale Animal Husbandry

In supermarkets, meat and other animal products such as eggs and milk are sold at very low prices. In order to be able to produce these products profitably, farmers breed many animals on very little space (Welfare of Livestock Regulations 1994: not less than 450 cm² for each laying hen where four or more hens are kept in the cage; each calve of 150 kg or more live weight must have at least 1.5 m²; pigs with more than 110 kg live weight must have at least 1 m²). Keeping animals close together increases the risk of disease spreading in case of infection of individual animals. To minimize this threat, antibiotics are applied as food additives. In addition, drugs are fed to promote growth (officially banned in the European Union [EU] since 2006) and to treat infectious diseases. For these purposes, mainly tetracyclines (32%), penicillins (26%), and sulfonamides are currently used (European Medicines Agency 2018). In 2014, an average of 152 mg antibiotics per kilogram biomass was consumed European in animal husbandry. In human medicine, the consumption was slightly lower with 124 mg kg⁻¹ biomass (ECDC, EFSA, and EMA 2017). The problem in this context is not only the high consumption, but that in veterinary and human medicine, antibiotics with the same mode of action – or sometimes even the same substances – are used. For example, in Australia and the EU, avoparcin has been used for years, mainly in poultry farming. Avoparcin acts in the same way as vancomycin. In human medicine, vancomycin is considered as last-line antibiotic to treat infections caused by multidrug-resistant enterococci. Since avoparcin was banned in the EU in 1997, the prevalence of vancomycin-resistant enterococci (VRE) has dropped significantly (e.g. van den Bogaard et al. 2000; Aarestrup et al. 2001). For instance, in 1997 in the Netherlands, 80% of the *Enterococcus* isolates obtained from chickens were resistant to vancomycin