

China's pig relocation in balance

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China's pig relocation will protect water quality in the south, where people suffered from severe water pollution. However, such relocation may transfer the pollution to regions with large areas of forests and fragile natural grasslands.

In 2015, the Chinese government banned livestock production in some regions (called non-livestock production regions, NLPRs) to control surface water pollution near vulnerable water bodies. In total, 90,000 NLPRs had been established by 2017, covering a land area of 0.82 million km² and shutting down 0.26 million pig farms¹. As a consequence, the number of slaughtered pigs decreased by 46 million head yr⁻¹ between 2014 and 2017².

The NLPRs policy is globally unprecedented in terms of the geographical area and number of farms affected, as well as its implementation speed. The NLPRs policy has reduced pork self-sufficiency in some provinces by up to 40% (ref. ²). However, it is unclear which farms and regions may take over the market share. This question is crucial because the consumption of pork in China is forecasted to increase from 690 to 1,000 million head yr⁻¹ between 2018 and 2050³. Pig production is expected to be transferred from watercourse-intensive southern regions to southwest and northeast provinces — areas that the Chinese government designated as potential development regions⁴. The main reasons to select these provinces are the current low pig population density and the large land area available for the application of pig manure, relative to other areas. This policy seems attractive at first: total nutrient losses to watercourses may decrease by up to 27% for nitrogen and up to 48% for phosphorus in southeast China⁵, and more businesses and subsidies will arrive to economically less-developed regions, promoting local economies.

However, the pollution burden associated with pig production may also be transferred. This is concerning because the potential development regions in the southwest and northeast have large areas of forests and fragile natural grasslands, respectively². Besides, technology to manage manure and minimize ammonia emission does not appear to follow new production technology, due to a lack of appropriate investments and incentives⁶. Some recently established industrial-scale livestock farms in the northeast have simple manure or slurry lagoons that emit gaseous pollutants directly into the air. Estimated health costs of air pollution to citizens are comparable to the profits of pig production (€1.3 to 11 head⁻¹ and approximately €4.2 head⁻¹, respectively)^{7–9}. This suggests that the development regions may not benefit, on balance, when all of the costs are considered.

Overall, the NLPRs and pig-relocation policies risk decreasing surface water pollution in the southeast at the expense of increasing air emission and groundwater pollution in the southwest and northeast, regions that already have high nitrogen losses¹⁰. However, these trade-offs could be minimized through: (1) holistic spatial planning of livestock production that considers all economic, environmental and social constraints in an integrated manner; (2) adopting strategies to properly allocate manure to local cropping systems at

sustainable nutrient loading rates; and (3) promoting the use of pollution mitigation technologies. In identifying non-livestock production regions and potential development regions, we must consider the multiple risks to the environment, including surface water pollution, air pollution, soil degradation and threats to human health, but crucially, also the risks associated with long-distance transport of livestock, including the spreading of animal diseases.