thesis of a morphological flexibility responsive to changes in food availability, as suggested by Piersma and Drent. However, the relationship will certainly be more complex than was indicated by them, and will probably involve changes in both dietary quantity and quality.

References

Agriculture, transport policy and landscape heterogeneity

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In their recent review of mechanisms promoting biodiversity in farmland, Benton et al. [1] pointed to the importance of heterogeneity at a range of spatial and temporal scales, collating evidence of its value for a wide variety of farmland invertebrates and birds. They also identified the mechanisms that reduce farmland heterogeneity. Increased homogeneity at small spatial scales (within fields) is often an outcome of technological developments, such as mechanization, new agrochemicals and advances in crop breeding. Economics suggest that such developments are irreversible. Rather, reversing the trend towards within-field homogeneity might rely on agri-environment schemes, such as those currently in use in over half the countries in Europe [2].

At larger scales, the causes of reduced heterogeneity include increasing specialization and consolidation of farm units, and the simplification of crop rotations [1]. The simplification of crop rotations has been enabled by developments in agrochemicals and crop science but could well be regarded as a symptom of the drive for local specialization. We suggest that moving away from local specialization might be possible within a broader framework for agricultural reform and that such a change might be expected to have impacts not only on heterogeneity and biodiversity, but also on a range of other environmental and economic issues of current concern within the industrialized world. Specifically, we urge the promotion of local consumption of local produce [3,4], which we envisage will have benefits in the following areas.

Heterogeneity in farmland

Increased demand for local production would be expected to reduce regional emphasis on a single type of production. Producers would tend to diversify to meet the demand for a wider range of local produce, promoting spatial heterogeneity. Local economics and local patterns of supply and demand would play a greater role in dictating land-use and would favour flexible enterprises and temporal heterogeneity.

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Rural communities
In many countries worldwide, small family farms struggle to compete with larger, corporate enterprises, which benefit from economies of scale and a greater potential to negotiate with major suppliers and consumers (e.g. [3]). Bringing the consumer base that is available to any one farm from international and national to regional and local levels might promote the competitiveness of smaller enterprises, reduce the loss of small farms, and help both to conserve rural communities and bolster rural economies [5].

Pollution and infrastructure
A more local food economy would reduce the freight transport of agri-food produce on the roads. In the UK, for example, agri-food transport currently accounts for 27% of all tonne-kms traveled and tonnes of goods lifted [6], and goods carried on the roads (billion tonne-kms) have risen by 65% since 1980. These changes are matched in other industrialized countries. A shift towards the consumption of more local goods would have significant benefits for the maintenance of the physical infrastructure of a country, its public health, and its prospects for reducing emissions of greenhouse gases.

Livestock disease
Long-distance transport and nonlocalized centers for the processing of livestock (as opposed to local or even regional abattoirs, for example) have been implicated in the spread of several agricultural diseases through Europe, including foot and mouth disease, classical swine fever and BSE [7–10]. A shorter, more locally centered food supply chain might be expected to inhibit the rapid spread of such diseases.

The question of how to promote a move towards increasing consumption of local produce is complex. A recent review of agricultural policy [3] noted that local food is already becoming established in mainstream markets and suggested many local funding and advisory mechanisms for facilitating that process. Such mechanisms will be equally workable elsewhere in Europe and North America. However, for most consumers, discriminating between products on the basis of provenance rather than price remains a luxury that they cannot afford.

One obvious mechanism for promoting the competitiveness of local produce is to tax long-distance transport of goods in a realistic way, taking into account the damage caused to the environment, the economy, human health and national infrastructure. Congestion charging is now accepted in several countries in northern Europe and the Far East, suggesting that the public might be prepared to accept realistic charging of transport for the environmental costs that it incurs. In the UK, this is currently part of the Government’s plans for the real pricing of road transport. However, throughout the industrialized world, such changes must be supplemented by changes in consumer behaviour and farm practice if there are to be substantial increases in local heterogeneity [1] and the production of other public benefits from the countryside.

References
1 Benton, T.G. et al. (2003) Farmland biodiversity: is habitat heterogeneity the key? Trends Ecol. Evol. 18, 82–188
2 Kleijn, D. and Sutherland, W.J. How effective are agri-environment schemes in conserving and promoting biodiversity? J. Appl. Ecol. (in press)

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| Book Reviews |

Chaos in a bottle
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Why are oscillations of population densities often so wild and complex? The idea that simple rules might underlie complex dynamics in nature is far from trivial. Indeed, it certainly came as a surprise to most ecologists in the mid-1970s that chaos theory could be used as a powerful theoretical framework. Evidence had been accumulating from time series that epidemics were not random: looking at their internal structure revealed much more order than was expected. Against any previous intuition, ecological complexity could be explained by a few nonlinear equations [1,2]. But, in tandem with the hopes raised by nonlinear science, doubts also emerged about their relevance or even their evolutionary significance: chaos often implies that populations are close to extinction and, thus, that they should be maladaptive [3].

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