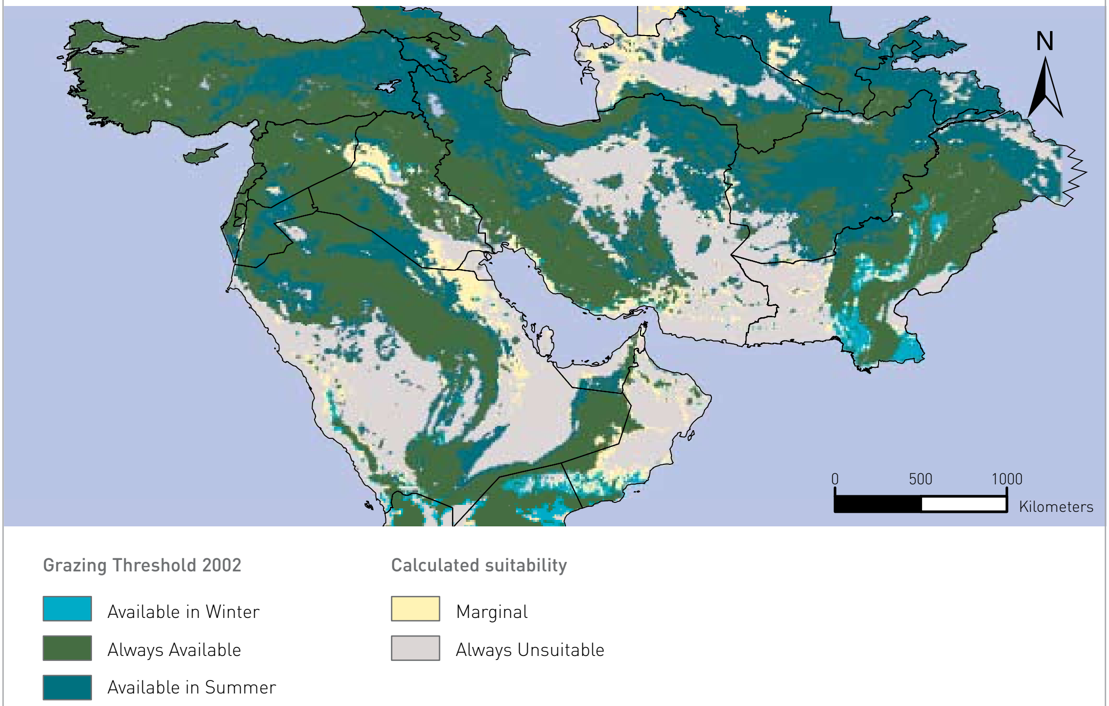
**7.19 SEASONAL PASTURE AVAILABILITY IN THE NEAR EAST FOR THE YEAR 2002**




*Source:* Adapted from Wint, 2003.

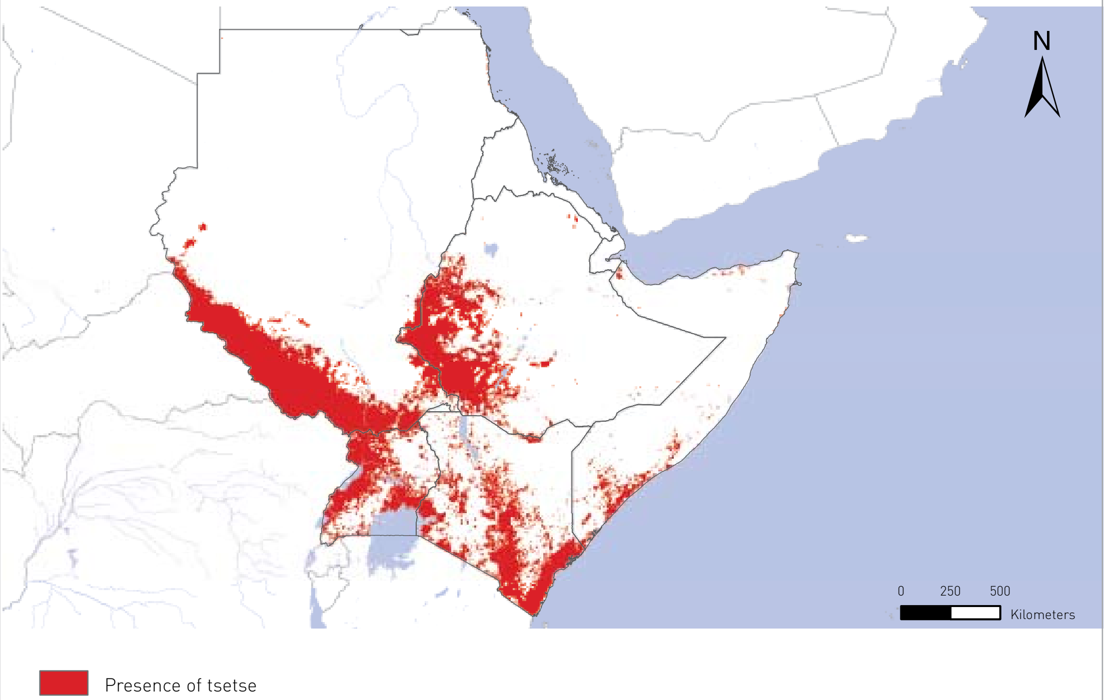
are indicative of transhumant pastoral production. Figure 7.17, for example, shows the distribution of African farming systems (defined in Wint *et al.*, 1999) that satisfy these criteria and are thus likely to support significant cattle movements.

Another way to infer movement, particularly for transhumant animals, is to evaluate the seasonal distribution of pasture for grazing.

Monthly integrated NDVI values are directly related to primary production (Tucker and Sellers, 1986). It therefore follows that an appropriate NDVI threshold could be identified, below which no pasture is available for grazing. Figure 7.18, for example, adapted from Wint, 2003, shows the monthly suitability of pasture for grazing in the Near East, estimated from monthly NDVI data derived from satellite imagery. Areas where the NDVI falls below a specified threshold are masked as unsuitable for grazing during the month in question. Figure 7.19 summarizes this, showing which areas support grazing only during the winter, which support grazing only during the summer, and those areas where pastures are suitable for grazing throughout the year.

It may be possible also to reinterpret the legends of these maps in terms of seasonal stock movements. Areas where pasture is available only during the winter or summer are less likely to support permanent animal populations. Thus, seasonal movements of animals are likely to occur in the autumn into areas where pasture is available only during the winter, and in the spring into areas where pasture is available only during the summer, with return migrations at the end of those seasons. Animals remaining in marginal areas when there is no pasture available are likely to be fed on stored or imported feed.

7.20 DISTRIBUTION OF TSETSE IN THE HORN OF AFRICA




*Source:* PAAT information system (www.fao.org/ag/againfo/programmes/en/paat/infosys.html).

## LIVESTOCK DISEASE ASSESSMENT

Livestock distribution maps are an essential component of any spatial evaluation of the impact of livestock disease, and therefore of livestock disease interventions.

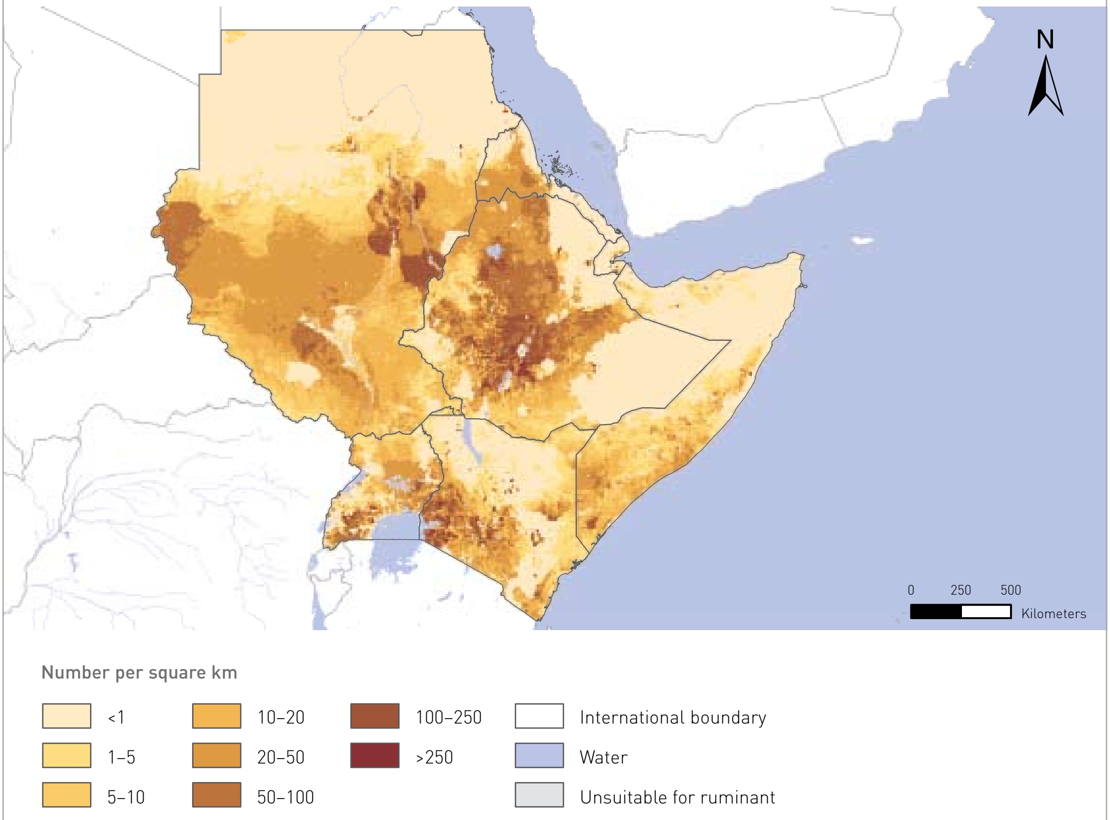
At its very simplest, one can overlay the distribution of a disease or a disease vector on the livestock distribution maps to estimate the numbers of animals that are at risk. For planning applications, such evaluations can be stratified by administrative areas, such as province or district boundaries, for example, to assist with allocations of funds, distribution of vaccines, or placement of particular livestock services. Another useful type of stratification is the production system.

Figure 7.20 provides an estimate of the distribution of tsetse in the Horn of Africa. This was produced by combining the modelled probabilities of presence of the three major groups of tsetse, available as GIS layers from the Programme Against African Trypanosomiasis (PAAT) information system[47]. These were then combined with the cattle distribution in the Horn of Africa (Figure 7.21 – but adjusted to match FAOSTAT 2005 national totals) and the Thornton *et al.*, 2002, livestock production systems (Figure 7.22) to extract the figures given in Table 7.3.

These figures would suggest that, of the approximately 100 million cattle in the Horn of Africa, some 17 percent are potentially at risk from trypanosomiasis. The greatest absolute numbers of cattle at risk (some 4 million) are in the arid/semi-arid pastoralist areas. However, these represent only 15 percent of total animals in these systems, which cover vast areas of East Africa. Large numbers of cattle, more than 3 million,

[47] http://www.fao.org/ag/againfo/programmes/en/paat/infosys.html

**7.21 MODELLED CATTLE DENSITY IN THE HORN OF AFRICA**



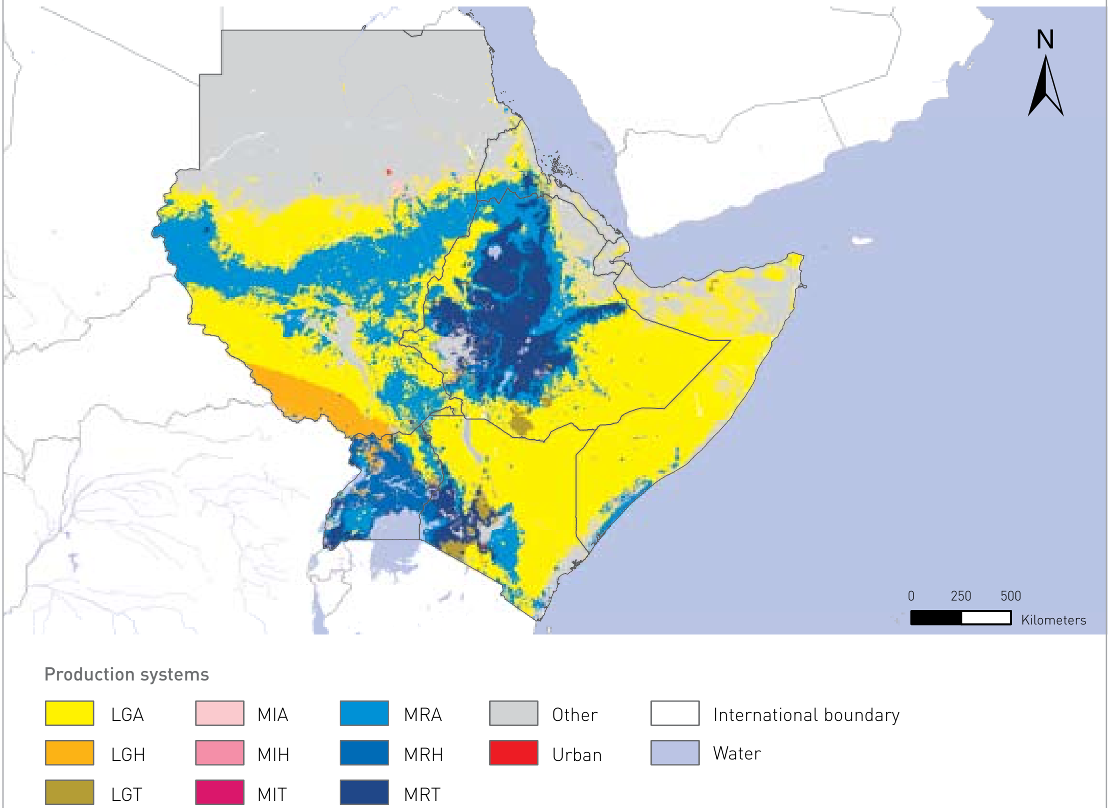

are also at risk in the rainfed mixed (arable and livestock) farming areas in the humid/sub-humid zones. In this latter production system, however, they represent three-quarters of the total number of cattle, and therefore interventions might be more appropriately targeted here.

More sophisticated approaches exist to livestock disease-risk or impact assessment. For example, in sub-Saharan Africa, the average sero-prevalence of brucellosis is estimated at 16.2 percent; elimination of the disease would improve fertility rates and calf mortality rates. FAO, 2002a, used the LDPS-2 model described in Section 7.4, stratified by agro-ecological zones, to estimate the potential increase in milk and meat off-take that would result from brucellosis control (on the assumption that cattle population growth rates would remain unchanged). By using estimates of the value of milk and beef, US$ 0.20/l and US$ 2.00/kg, respectively, they were able to map the estimated financial benefits of brucellosis control. Shaw *et al.*, 2006, have further advanced this approach by incorporating the livestock movement models described in Section 7.2 to map the potential benefits of trypanosomiasis control interventions in West Africa over a 20-year period.

## LIVESTOCK DISEASE-RISK MAPPING

Knowledge of livestock distributions is an essential component of livestock disease-risk mapping. Two examples that incorporate livestock densities directly into disease-risk maps are given here: the first relates to bovine tuberculosis (BTB) in the United Kingdom and demonstrates the use of

**7.22** LIVESTOCK PRODUCTION SYSTEMS IN THE HORN OF AFRICA




*Source:* Reproduced from Thornton *et al.*, 2002.

livestock densities in determining disease distribution; the second concerns global risk assessments of FMD. A third example, the global spread of bird 'flu, whilst not using livestock distributions directly to model risk, illustrates how powerful such maps can be in helping to understand disease spread and to present information to the general public in an accessible and appealing way.

### BTB in the United Kingdom

Since the mid-1980s, BTB has been spreading in England and Wales and, by 2004, was found throughout southwest and central England, and in eastern and southern Wales. Attempts to model distribution of the disease have highlighted a range of factors that are reliable predictors of the presence or absence of the disease, of which seasonal climatic factors (Wint *et al.*, 2002) and animal movement-related parameters (Gilbert *et al.*, 2005) are the most effective. Animal densities must also be incorporated into the models, both as a mask to delimit areas where the disease may occur (and thus where it is necessary to monitor it), but also as one of the main determinants of disease presence within its range. Figure 7.23 for example, shows the predicted distribution of BTB in the United Kingdom for 2003, with the actual distribution inset, adapted from Wint *et al.*, 2002.

### FMD status

Animal density distributions can be used more directly to assess disease risk in areas where

**TABLE 7.3** NUMBERS OF CATTLE WITHIN THE DISTRIBUTION OF TSETSE AND THEREFORE POTENTIALLY AT RISK FROM TRYPANOSOMIASIS IN THE HORN OF AFRICA, BY COUNTRY AND LIVESTOCK PRODUCTION SYSTEM, ADJUSTED TO FAOSTAT 2005 NATIONAL TOTALS

| Production System | Djibouti | Ethiopia | Eritrea | Kenya | Somalia | Sudan | Uganda | System Total |
|---|---|---|---|---|---|---|---|---|
| LGA | 0 | 425 545 | 0 | 865 345 | 344 500 | 2 694 820 | 39 280 | 4 369 490 |
| | | 11% | | 30% | 8% | 16% | 15% | 15% |
| LGH | n.a. | 42 770 | n.a. | n.a. | n.a. | 958 060 | 75 300 | 1 076 130 |
| | | 98% | | | | 99% | 36% | 88% |
| LGT | n.a. | 16 190 | 0 | 130 830 | 0 | 6 210 | 4 700 | 157 930 |
| | | 7% | | 25% | | 98% | 44% | 20% |
| MIA | n.a. | 0 | 0 | n.a. | 53 030 | 0 | n.a. | 53 030 |
| | | | | | 40% | | | 11% |
| MRA | 0 | 1 277 160 | 0 | 1 582 800 | 146 440 | 622 200 | 449 810 | 4 078 410 |
| | | 15% | | 77% | 39% | 4% | 29% | 13% |
| MRH | n.a. | 1 280 250 | n.a. | 889 965 | n.a. | 8 230 | 1 635 930 | 3 814 375 |
| | | 100% | | 88% | | 100% | 59% | 75% |
| MRT | n.a. | 2 209 075 | 0 | 784 360 | n.a. | 18 930 | 251 650 | 3 264 015 |
| | | 10% | | 20% | | 95% | 30% | 12% |
| Other | 0 | 327 430 | 0 | 531 800 | 128 230 | 93 910 | 187 230 | 1 268 600 |
| | | 26% | | 36% | 20% | 3% | 43% | 18% |
| Country Total | 0 | 5 578 420 | 0 | 4 785 110 | 672 200 | 4 402 360 | 2 643 900 | 18 081 990 |
| | | 15% | | 40 % | 13% | 11% | 43% | 17% |

*Notes:* Livestock production system data were taken from Thornton *et al.*, 2002. The percentages indicate the number of animals at risk as a proportion of the total number of cattle occurring in that stratum (from Table 7.2).
'n.a.' indicates that system does not occur in a country.