Introduction

The recently published flagship publication of the Food and Agriculture Organisation (FAO): '*Livestock in the balance*' (FAO, 2010a) points to continuing growth of the livestock sector, stating that: '*Decisive action is required if increasing demand is to be met in ways that are environmentally sustainable and contribute to poverty alleviation and improved human health*'.

Driven by population growth and increasing incomes, the demand for animal-source foods in developing countries is growing rapidly, while urbanisation leads to demand becoming highly concentrated. Up to a point of saturation, a more affluent population uses a proportional, or even increasing proportion of its growing income on animal-source foods. Economists describe this in terms of income elasticity. In China, for example, income elasticity for meat is about 1 percent and that for milk is about 1.2 percent. This means that for every percentage point increase in income, expenditure on meat and milk will increase by 1 and 1.2 percent, respectively (World Bank, 2005).

Livestock is one of the fastest-growing sectors in agriculture, presenting potential opportunities for economic growth and poverty reduction in rural areas. Current estimates (Robinson *et al.*, in press) are that 766 million poor people (< US$ 2 per day) keep livestock. Livestock sector growth could directly benefit these, and others who are less immediately linked to the livestock sector. The social and economic benefits of this increase in demand include the sector's potential contribution to economic growth, especially in economies where agriculture contributes significantly to Gross Domestic Product (GDP), possibly creating market opportunities for the livestock-dependent poor, and improvements in food security and nutrition.

But positive social outcomes of sector growth may not be ubiquitous. There is also a risk that smallholders dependent on livestock for their livelihoods may be squeezed out of the sector as production intensifies and becomes geographically concentrated. Beyond possible social problems are environmental and public health issues that are likely to be associated with rapid, poorly regulated sector growth. There has been considerable debate of late about the contribution that livestock make to greenhouse gas (GHG) emissions. Published estimates range from 18 percent of annual worldwide GHG emissions (FAO, 2006a) to 51 percent (Goodland and Anhang, 2009). These estimates include the effect of deforestation and other negative land use changes that can arise as a result of increasing livestock production. Other negative environmental effects include land degradation (e.g. from overgrazing), loss of biodiversity and pollution from effluents (FAO, 2006a).

Regularly making the news headlines are some of the public health consequences of rapidly increasing livestock production. The spread of infectious zoonotic and non-zoonotic diseases, typified by the recent and ongoing H5N1 avian influenza panzootic and the pandemic (H1N1) influenza A crisis, demonstrates the magnitude of such problems. Dealing with the staggering human and animal disease burden that persists in the developing world and the continual emergence of novel diseases at the animal-human-ecosystems interface require solutions that embrace the way in which the livestock sector grows to meet increasing demand.

Understanding where growth in demand for specific livestock commodities is likely to occur, and where production will rise to meet this increasing demand, are

therefore important for a number of reasons.

In 2003 the Global Perspective Studies Unit of the Food and Agriculture Organisation (FAO) published the report '*World Agriculture: Towards 2015/2030*' (Bruinsma, 2003). The study presented prospective developments in food demand and consumption and possible implications for nutrition and under-nourishment. Since the publication of that study, estimates of population growth have been revised considerably and the world energy markets have become increasingly tight. High energy prices affect the food and agriculture sectors in many ways, with, for example, direct increases in the costs of inputs and of transporting agricultural products, and the more complex interactions that result from an increased use of agricultural land to produce biofuels. For these and other reasons FAO has revised and extended the 2015/2030 estimates to 2030/2050 (FAO, 2006b).

These new estimates present the possibility of mapping changing demand for livestock products, and possibly the associated changes in production that will be required to meet that demand growth.

In this paper we first provide an overview of demographic and economic changes in the world that are influencing the livestock sector. The following section describes the methodological approaches to mapping human and livestock populations, provides a summary of how the FAO projections are made (focussing on livestock commodities), and describes how these can be combined to map projected demand for and supply of livestock commodities. The results section presents some examples of the outputs of the analysis and the concluding section mentions some ways in which the methodology might further be developed in the future, and discusses some implications and potential uses of the results.

Detailed maps and tables of projected change in supply and demand for animal-source food, disaggregated in a number of ways, are provided in the Annexes.