Introduction

FAO (2006) showed how the spatial pattern of household expenditure in Uganda could be described in terms of environmental data derived from satellites. This approach to poverty mapping escapes from the somewhat circular approach adopted by the small area estimation technique (Hentschel *et al.,* 2000; Elbers and Lanjouw, 2000; World Bank, 2000) that exploits the internal correlations within socio-economic data sets. Poorer, in contrast to richer, people cannot afford bicycles or radios, and are unlikely to have access to clean drinking water. One might therefore use the possession of such assets, or lack thereof, to describe any chosen single index of poverty, such as household expenditure. Linking the same index of poverty to environmental data begins to break out of this circularity and looks for causes of poverty rather than the consequences of it. The underlying assumption in this approach is that people in rural settings are poor because their environments fail to provide the goods and services available to richer people. Soil fertility, good health, access to fuel and water all have environmental correlates for which satellite data may act as proxies: people are often poor because of an inadequate supply of these vital resources. By incorporating the driving factors that are associated with the different levels of poverty, the modelling approach allows not only for a description, but potentially also for an explanation and, ultimately, a prediction of the distribution of poverty.

It is obvious that a strict environmental approach to poverty mapping will apply best to subsistence agricultural systems, where external inputs in the form of soil improvements (e.g. fertilisers), carbon subsidies (e.g. oil for tractors) or cash subsidies (e.g. tariffs) are minimal or lacking. It cannot apply also to urban communities, which are variously connected to external cash economies, and so less dependent on the immediate environment.

The vast majority of rural people in less developed countries, and especially in sub-Saharan Africa, still practice subsistence agriculture, where environmental constraints are likely to be critical and limiting to welfare. This assumption appeared to be borne out by the Uganda analysis that used a set of socio-economic data from the Uganda Bureau of Statistics and a set of environmental variables, including satellite data derived from the National Oceanic and Atmospheric Administration (NOAA) satellites' Advance Very High Resolution Radiometer (AVHRR). This satellite series provides a more or less uninterrupted sequence of monthly global imagery from the early 1980's to the late 1990's. Such imagery, when appropriately processed, captures habitat seasonality associated with the growing seasons for crops, or transmission seasons for vector-borne and other diseases, and these seasonal signals were used within a discriminant analytical framework (that naturally allows for any non-linearity in the relationship between the index of poverty and the environmental data) to describe the different levels of household expenditure. The analysis showed how the correlations between satellite data and household expenditure increased in strength from finer to coarser spatial resolutions (a common feature of all poverty mapping exercises) and were equivalent to, or better than the small area mapping results at a spatial resolution of *c.* 20 to 30 km (FAO, 2006; Robinson *et al.,* 2007).

Following on from the Uganda study, the Inter-Governmental Authority on Development (IGAD) supported an initiative that sought to extend this approach to the Horn of Africa, including Sudan, Eritrea[1], Ethiopia, Djibouti, Somalia, Kenya and Uganda. This working paper describes the results of this new study undertaken to support the EC funded IGAD Livestock Policy Initiative (LPI). All data and results are archived in digital format (compatible with ESRI GIS software) on the IGAD Livestock Information Portal: http://www.igad-data.org/.

The next section discusses the analytical methodology and the data used. This includes a description of the DHS Wealth Index (WI) and the steps required to construct a Regional WI. The predictor variables are then described as is the modelling approach, which involves non-linear discriminant analysis applied to the socioeconomic and environmental data. The following section presents the results of the analyses – exploring issues of data aggregation by comparing the analysis of clusters of household data against that based on individual households. In the final section we draw some conclusions from our analyses and discuss some ways in which the environmental approach to regional poverty mapping may be taken forward in the future.

[1] Eritrea has currently suspended its membership of IGAD.