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Animal Genetic Resources (AnGR) for Food Security

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Demand for livestock products is increasing against a background of rapid change in the agricultural sector, genetic erosion of indigenous livestock diversity and increasing impact of climate change.

In developed countries, improved livestock genetics associated with better husbandry – better feeds, health care and housing – have resulted in significant and sustained increases in livestock productivity. New technologies, including better recording of production traits, statistical models to predict genetic merit, genetic marker information in selection programmes (Goddard *et al.*, 2007; Clark *et al.,* 2013) and new reproductive technologies that speed up genetic gains (Kasinathan *et al*., 2015) are leading to further productivity gains in the commercial sectors. This is not yet happening in developing countries (Marshall, 2014). The reasons are multiple, they include but are not limited to, a lack of understanding of the potential of indigenous livestock genetic resources for productivity improvement; investment prioritized other avenues of livestock development; heterogeneity of livestock systems and preferences of livestock keepers; lack of supportive policies, institutional arrangements and capacity to undertake genetic improvement (Kosgey and Okeyo, 2007; Rege *et al.*, 2011).

Indigenous livestock breeds have sustained human livelihoods for centuries (FAO, 2015). Today, they represent a treasure trove of diversity and adaptation that remains largely under-exploited (Okeyo *et al.,* 2015). The world faces the challenge to respond quickly yet sustainably to a rapid increase in demand for livestock products, while addressing the poverty and poor nutrition typically found in livestock-producing households. This will only be achieved rapidly through the understanding of the diversity and unique traits of the indigenous animal genetic resources and their utilisation in within breeds and crossbreeding improvement programmes as well as in breed replacements strategies.

Indigenous village chicken diversity

In this presentation, I will first put into context the diversity and adaptation of animal genetic resources (AnGR) in relation to its history of domestication and dispersion. I will present then the today on-going and expected future trajectories of the livestock sector (Smith *et al.*, 2013). In particular, I will present the three main trajectories as detailed in Smith *et al.* (2013) and their link with AnGR: (i) The "*rapid inclusive growth systems*", which address the need to develop sustainable food systems that deliver key animal-source nutrients to the poor while facilitating a structural transition in the livestock sector of developing countries. In this trajectory the productivity as well as the adaptive traits of animal genetic resources are important. (ii) The "*high growth systems with externalities*"**,** a system which rely mainly on the development and the use of new technologies and high inputs. The diversity and adaptive traits of AnGR are playing here a minor role. (iii) The "*fragile growth systems*" which recognizes that rapid, market-focused growth will not be the trajectory for all livestock keepers. Indeed, in areas where productivity is severely limited by remoteness, harsh climates or environments, and/or by poor institutions, infrastructure and market access,

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Coat colour variation in African sheep (Ethiopia) (Photo credits: ILRI – Camille Hanotte)

Women and indigenous chicken, Oromia, Ethiopia

the emphasis needs to be to enhance the important roles of AnGR diversity and adaptation in the resilience of people and communities to environmental variability.

Examples of ongoing genome wide livestock characterisation project led by ILRI and its partners will be presented, including example of diversity and/or adaptive traits of AnGR that may be utilised for the benefit of livestock productivity and food security (e.g. cattle dairy sector, small ruminant, poultry). I will end by examining the possibilities of new breeding approaches (e.g. genomics selection), new technologies (e.g. gene editing) as shortcuts to exploit the diversity and adaptive traits of AnGR for immediate improvement of productivity.

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