As the world unites behind the new Sustainable Development Goals and Paris Agreement to mitigate climate change, it will need to tap an underexploited but widely available natural resource: livestock, or the world’s domesticated food-producing animals.

Livestock are a critical part of our global food, health, economic and environmental systems. Widely known for the food, nutrition and draft power they provide, farm animals underpin human progress in a multitude of ways all over the globe and also serve as cultural assets. Some 12 millennia after livestock domestication helped usher in an agricultural revolution, they remain a potent force for achieving the bulk of the 17 Sustainable Development Goals (SDGs). By addressing livestock issues frontally, the international community has a better chance to address foundational issues and support the underlying drivers of sustainable development.

Now is the time to harness the many opportunities offered by the diversity of animal production systems and to bring livestock to the forefront of developing solutions to global development challenges.

**Achieving the Sustainable Development Goals**

**Growth and development**

The livestock sector is an engine of global economic growth and source for inclusive development (SDGs #1, 5, 8, 10). More than 18 percent of the world’s population is engaged in animal husbandry and/or the processing and marketing of animal-based foods. Livestock is the fastest growing agricultural sub-sector today, making up five of the six highest value commodities in the world and 40 percent of agricultural Gross Domestic Product (GDP) in developing nations. But animals, their products and by-products are also key assets in combating extreme poverty. Some one billion smallholder food producers across sub-Saharan Africa and South Asia today rely on livestock for their liveli-
hoods, food and income, for insuring themselves against crop losses and other calamities and for building their capital and cultural assets for a better future.

**Nutrition and health**

Milk, meat and eggs are important sources of nutrition and health (SDGs #2, 3). Today, livestock supply 26 percent of the protein and 13 percent of the calories in human diets. The six micronutrients found in energy-dense animal-sourced foods (vitamin A, vitamin B12, riboflavin, calcium, iron and zinc) are critical in maintaining the health of women of child-bearing age and in the cognitive and physical development of children. Contribution to human health goes beyond nutrition: with more than 6 out of 10 infectious diseases in humans originating in animals, maintaining animal health is a major factor in preventing outbreaks of diseases among human populations and controlling epidemics. Livestock that are well taken care of and in good health are also less likely to introduce pathogens to humans through contaminated milk, eggs and meat.

**Livestock production systems vary vastly within and among countries and regions of the world. Each kind of production system makes specific contributions and requires tailored interventions.**

Improving livestock diets can not only greatly increase meat and milk yields but also greatly reduce greenhouse gas emissions per unit of product. Livestock waste can be a source of renewable energy and organic fertilizer, complementing or replacing fossil-fuel-based inputs. And while the livestock sector is a major user of diminishing land and water resources, most of the environmental degradation attributed to the sector has resulted from deficient public policies, inadequate regulations and poor management practices along livestock value chains. Such problems can be remedied through more efficient production practices, incentives, investments and stakeholder engagement.

**Environment and climate change**

Properly managed, cattle, buffalo, sheep, goats, camels, poultry, pigs and other domesticated livestock can benefit the environment and reduce greenhouse gas emissions (SDGs #6, 7, 12, 13, 14, 15). The potential of livestock systems to mitigate—and adapt to—climate change is being seized by 54 countries that have included livestock in their Intended Nationally Determined Contributions to global mitigation efforts. Improving livestock diets can not only greatly increase meat and milk yields but also greatly reduce greenhouse gas emissions per unit of product. Livestock waste can be a source of renewable energy and organic fertilizer, complementing or replacing fossil-fuel-based inputs. And while the livestock sector is a major user of diminishing land and water resources, most of the environmental degradation attributed to the sector has resulted from deficient public policies, inadequate regulations and poor management practices along livestock value chains. Such problems can be remedied through more efficient production practices, incentives, investments and stakeholder engagement.

**Grasping the diversity of livestock systems**

In on-going discussions and debates about the livestock sector today, from its benefits (e.g. energy-dense nutrition and better health for malnourished people) to its harms (e.g. contribution to anti-microbial resistance or to obesity and ill health), the vast diversity of livestock production systems, both among and within countries and regions of the world, is overlooked, or worse still, ignored.

To harness livestock for the greatest good for people and the planet, it is essential to grasp the huge diversity in livestock practices, livelihoods, enterprises and consumption patterns throughout the world. As outlined in the box on page 3, these vastly different forms of production and socioeconomic contexts require vastly different kinds of interventions for achieving lasting development outcomes.

**Grazing systems**

In pastoral systems, for instance, the main goal is to reduce climate and socio-economic risks while increasing production. This requires tracking the changing conditions of water and natural biomass resources and regularly moving herds to those regions with adequate supplies to water and feed them. The pastoral livestock herding communities of the developing world are by necessity highly adept at responding to changing nature and locations of the resources on which they and their animals depend. They face difficulties, however, in coping with big or rapid institutional and economic shocks and climatic alterations. External support in terms of sustaining their mobility, ensuring better access to livestock markets and related infrastructure, services, advice and information, coupled with trusted and long-lasting community engagement, could greatly enhance the enduring ecosystem management wisdom and resilience of pastoral peoples.

**Demand for livestock-based products is spiraling. By 2050, experts estimate we will need two times as much dairy and meat products as that produced in 2000.**

Mixed crop-and-livestock agriculture, the backbone of both animal and crop agriculture in developing countries, can be highly efficient in cycling nutrients and making good use of natural resources. In such closely integrated production systems, stover and other crop ‘residues’ are used to supplement feed for livestock whose manure helps to fertilize the soils that nourish the next season’s crops. And animals provide draft power where there is little mechanization. But the tiny sizes and wide dispersion of mixed farms typical in developing countries prevents smallholders from accessing livestock markets, which increasingly require traceability of products, stringent hygiene standards and large volumes. Improving smallholder access to a range of skills and resources, including microfinancing, veter-
inary and extension services, land and water resources and management expertise can achieve multiple gains, substantially improving food and nutritional security and public health while reducing poverty. Removing price distortions on agricultural inputs can further improve natural resource use efficiency—such as by encouraging the recycling of manure as fertilizer.

**Industrial systems**

Industrial livestock production can make efficient use of natural resources and effectively respond to the rising urban demand for animal products, but it needs to operate within a comprehensive policy framework supporting public goods. Regulatory and market-based instruments designed to reduce the negative ‘externalities’ of industrial types of livestock production can drive innovations all along the supply chain to improve animal welfare as well as public and environmental health performance. For government agencies, large-scale operations and vertically integrated supply chains are easier to identify and engage with than a multitude of small producers. The technical and financial capacity of industrial systems to adjust to new policies is also stronger than that of smallholders, although this greater industrial adaptability is often accompanied by greater ability to lobby against policies that threaten short-term financial gains. The affluent societies that now typically host industrial livestock operations have

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**Grazing systems**

In grazing systems, animals feed on grass and browse, often supplemented with crop residues and occasionally with grains. Pastoralism is a successful livelihood strategy for some 100 million people living in dry or harsh environments where no other livelihood is possible. Although adaptive by nature, the capacity of pastoralists to respond to environmental change has been reduced greatly in recent decades, while the pace of environmental and social changes has accelerated. In a typical pastoral community in the Sahel region of Africa, each household has an average of 6–10 animals, generally consumes little meat, but relies heavily on the milk its herds provide as a major source of micronutrients. Grazing systems also include sedentary forms of production in temperate and sub-humid climates. The productivity levels and environmental impacts of grazing systems depend chiefly on the ways grasslands are managed and on the dynamics of grazing expansion into forests and other natural habitats.

**Mixed systems**

In mixed or integrated systems, animals and crops are produced on the same area of land and are mutually and positively interdependent: the waste products of one component serve as resources for the other. For instance, animal manure is used to enhance soils and crop production, while crop residues and by-products are used to supplement feed for the animals. Mixed crop-livestock systems make up the largest category of animal production in the world and cover about 2.5 billion hectares of land. Globally, mixed farming systems produce the largest share of total beef (60 percent) and milk (90 percent) and remain the main production system practised by smallholder farmers in developing countries. By integrating several production activities on the same farm, mixed systems use and recycle natural resources efficiently and generally have low environmental impacts. Because they are labor intensive, they can also generate employment and thus contribute to shared prosperity.

**Industrial systems**

Today, over 60 percent of pork and 85 percent of chicken meat and eggs are produced in industrial production systems. Surging urban demand, infrastructure development, and decreasing production costs in larger operations drive the development of industrial production. Whether it is for cattle, pig or poultry, feed generally consists of more than 80 percent grains, fodder crops and by-products from the food and energy sectors. By closely controlling production parameters, these systems can achieve moderate environmental impacts per unit of product (globally, GHG emissions per kg of chicken meat are about 20 percent lower for industrial production than they are for backyard systems) but high in absolute terms, given their size and geographical concentrations. Cages, manure management and the misuse of antibiotics raise animal welfare as well as public health concerns. Furthermore, the demand for cereals to feed animals can compete with food demand and increases pressure on resources.
generally already achieved widespread food security and are in the best position to focus their interventions on improving public and environmental health and animal welfare.

The conventional categories and descriptions above of the three major livestock production systems of the world mark a simplification of the real-world diversity of livestock today. Furthermore, the future trajectory of each livestock production system and sub-system will be ‘localized’ by different societal expectations, practices, cultures and political economies; by different natural resource endowments; by different technologies available; by different innovation capacities of livestock producers, processors, marketers; and by consumers. Marshaling sustainable livestock development to achieve the SDGs requires interventions tailored for, and responsive to, this great diversity.

The time to act is now

The livestock sector holds powerful examples of development successes. The global eradication of rinderpest; the reversal of deforestation in Costa Rica; the central role played by livestock along with cash transfers and training, in so-called “graduating programs” that helped people escape extreme poverty in Asia, Africa and Latin America; and the rehabilitation of China’s Loess Plateau illustrate how economic, environmental and social needs can be met through sustainable livestock development. As the world faces unprecedented global challenges, no options can be wasted. Solutions are readily available to make the global livestock sector more efficient, sustainable and healthy as well as more equitable worldwide. Now is the time to harness the many opportunities afforded by the diversity of animal production systems and to bring livestock to the forefront of work to achieve balanced development that benefits all.

Five global public institutions mandated to help create a sustainable livestock sector have come together in a Livestock Global Alliance serving a common livestock development agenda. They work closely together and with others to advance solutions to help meet the world’s 17 SDGs.

Visit: www.livestockglobalalliance.org      Contact:  LGA-Secretariat@worldbank.org

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**Little-known livestock facts**

1. **Meat and milk divides**
   - National averages of per capita consumption between countries consuming the most and least amounts of meat and milk differ 30- and 100-fold, respectively.

2. **Where the action is**
   - Thirty years ago, developing countries produced one-third of the world’s meat and one-fourth of its milk; today, they account for two-thirds of our meat and more than half of total meat production and more than half of global milk output—and those percentages are growing.

3. **Carbon hoofprint**
   - Greenhouse gas emissions from livestock supply chains in many regions could be reduced by 20–30 percent by implementing best practices already in use by neighboring producers under similar conditions.

4. **Where’s the beef?**
   - Globally, 60 percent of beef is produced in mixed systems, with feedlots accounting for just 7 percent of production.

5. **Green water**
   - The often cited statement that producing 1kg of beef requires 15,000 liters of water, far more than is required for pig and poultry, does not clarify that nearly 90 percent of that water is “green” water—meaning it comes from rain falling on crops and pastures, with marginal environmental impacts. Moreover, the great variability in livestock production systems globally is not captured by this crude average.

6. **Case for boosting investment in livestock sector**
   - Although the livestock sector contributes 40 percent of the agricultural GDP in non-industrialized countries, it directly receives just 1–3 percent of official development assistance provided by country members of the Organization for Economic Cooperation and Development (OECD).

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Sources: (1–2) FAOSTAT, 2015; (3–4) FAO, 2013; (5) Mekonnen and Hoekstra, 2012; (6) ILRI, 2016 and Pradère, 2014.