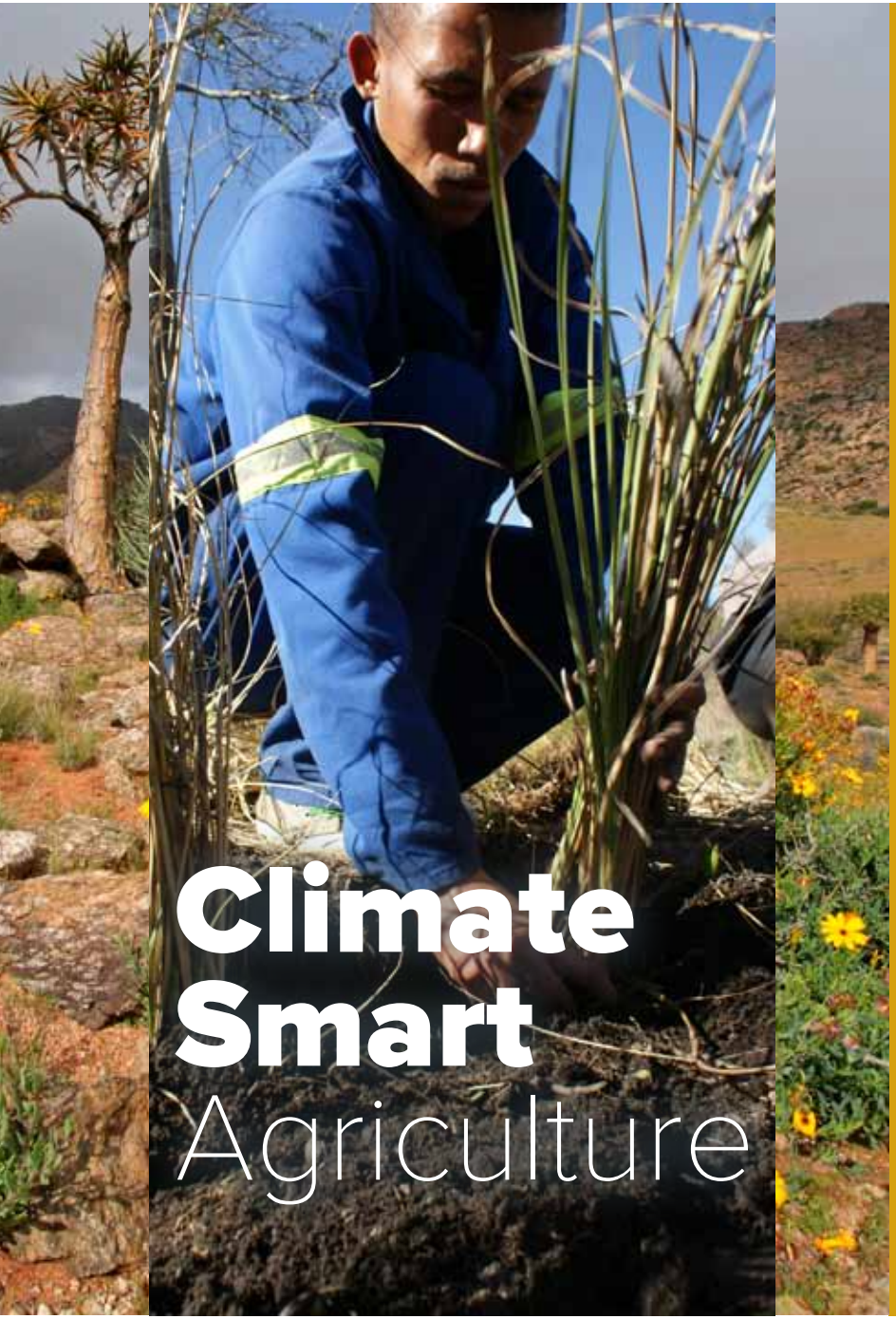

Climate Smart Agriculture

Livestock Production in a Changing Climate

Global change in climate is affecting vulnerable farmers worldwide. Rangeland ecosystem health is declining under pressure from many drivers in the face of an estimated global population rise of 38% by 2050 that will mean farmers must feed an additional 158,000 people per day. While nature must thrive to sustain production, farmers in all corners of the globe have to adapt how they manage their lands if there is any hope of keeping their landscapes healthy and productive. In some cases, transformative strategies will be needed, depending on the specific climate impacts they are likely to face in their regions.

Significant changes in physical and biological systems have been observed globally, some of which can be attributed to changes in climate due to rising temperatures. According to the IPCC Fourth Report Assessment, temperatures are expected to increase in the range 1.8 - 4 ^{0}C by 2090-2099[1]. Changes in climate and climate variability are expected to have an impact on global food production. An increase in food production is likely to occur at a lower temperature range (1 - 3 ^{0}C), but food production is likely to decrease above this range, increasing global food insecurity[2]. In addition, changes in climate variability are expected to have an impact on livestock systems in all parts of the world[3]. These impacts are likely to surpass the current coping mechanisms of commercial farmers, and even more so the estimated 600 million poor people, smallholder farmers, subsistence farmers, and pastoralists who depend on livestock production for subsistence (decreased job security + increased poverty + decreased food security)[1, 3].

Livestock systems vary and global trends may be overshadowed by local differences. Impacts are likely to be spatially variable. Nonetheless, we can expect that, in general, the following aspects of livestock systems will be most vulnerable to climate change impacts:

Animal feed quality and quantity: changes in rainfall, temperature, and atmospheric CO2 concentrations may trigger changes in rangeland and fodder crop productivity and composition (e.g. ratio of legumes to grasses);

Heat stress: hot environments impair production (growth, meat, milk quality, egg yield, weight and quality) and reproductive performance (metabolic and health statues, immune response); decreased water availability may impair forage production and availability; Diseases and disease vectors: higher temperatures may increase the rate of development of some livestock parasites and pathogens, particularly those that are sensitive to environmental change and spend part of their life cycle outside of the host animal; [3]

Biodiversity: there is great potential for loss of genetic diversity as a result of extinctions driven by rising temperatures interacting with other pressures [1,3,4].

Impacts of Climate Variability on Rangelands

Livestock systems can be categorised according to the length of the growing period in the rangeland and the extent to which livestock are dependent on extensive grazing of natural vegetation[5] . In arid and semiarid rangelands such as in Sub-Saharan Africa, farmers rely almost entirely on extensive grazing. Climate change impacts in the arid zone include projected increases in the frequency, severity, and duration of droughts, increased temperatures, and reduced rainfall. These impacts are expected to be associated with direct negative impacts on the productivity of rangeland vegetation and on water availability for livestock consumption. Historically, drought and heat wave events have demonstrated a strong relationship between drought and animal death[6,7,8].

Impacts of Climate Variability on Livestock

The main impacts that can be expected for livestock farmers in these areas are heat stress – resulting in reduced livestock performance and productivity due to reduced intake of fodder[1], stress as a result of poor quality grazing or reduced water availability, and the potential promotion of livestock diseases and parasites.

The good news for small livestock farmers is that, in general, small livestock such as sheep and goats are more resilient to heat and water stress than large livestock such as cattle. They are also generally better adapted to arid and semiarid rangeland conditions, with indigenous and mixed breed animals faring better than their pedigree cousins.

Livestock Farmers in Namaqualand, Northern Cape, **South Africa**

Livestock farmers in a sub-Saharan semiarid system in the Namakwa District of the Northern Cape Province of South Africa have raised their sheep and goats under extreme weather conditions for many centuries. Livestock farming is one of the major land-uses and livelihood strategies in the District. Water scarcity and a sufficiency of adequate grazing are the two main environmental factors that limit or promote successful livestock farming in this region. Variability in the climate, including droughts and very high and very low temperatures which are expected to be exacerbated under climate change, can affect the quality of grazing and therefore the access to nutrients required for livestock health and productivity.

Farmers here are used to farming under highly variable conditions and have developed some strategies to deal with extreme weather conditions, such as moving livestock to higher altitudes in the hot summer months, and farming with adaptive breeds. However, some farmers perceive that conditions have become hotter and drier, and that rainfall seasons have shifted. Some additional adaptation actions suited to this particular environment and others like it are recommended below.

Adaptation Response 1: Conserving the natural resource base for livestock: Always come back to the veld. By adjusting stocking densities, using responsible grazing management such as rotational grazing, and focusing on the restoration of key resource areas, land users protect and maintain their valuable grazing resources.

Adaptation Response 2: Building Resilient systems by strengthening animal capacity to cope with a changing environment. Resilient systems are those that can withstand climate shocks and changes. In Namakwa, having good genetic diversity and farming with indigenous lamb breeds such as Meatmasters or Damaras can help to reduce heat stress in livestock.

Adaptation Response 3: Enhancing the capacity of stakeholders to build resilience to climate change. Farmers can build resilience through diversification of livelihoods – taking up more activities and jobs that do not rely entirely on farming. Those with an entrepreneurial spirit can look into value-add for their stock, for example selling the skins of their animals, or butchering themselves before private sale into a niche market.

- A coordinated approach on climate change, adaptation and food security is essential if we want to see climate change integrated into the decision making process at national, regional and local level.
- In order to have a strong enabling environment, we need to see a strengthening of local institutions to support resilience through information flow, capacity building, training and technology transfer. Sharing information such as weather reports, seasonal forecasts and warnings can be of great value to farmers so they can plan ahead – but importantly, that information must be communicated in an accessible way.
- National programmes on disaster risk reduction can aid farmers to make informed decisions to avoid climate shocks such as drought.
- Trying new ideas and technologies in our changing climate can yield valuable results. For example, consider the use of flexible access to credit, fodder banks, or the formation of local savings groups, to allow farmers access to finances for fodder in times of drought.

Allow change and innovation to be guided by good information. Focus on measuring change over time, setting up strong monitoring protocols that can allow people to see what worked, what didn't, and what needs to change. This will enable the most flexible, adaptive and resilient farming system.

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