

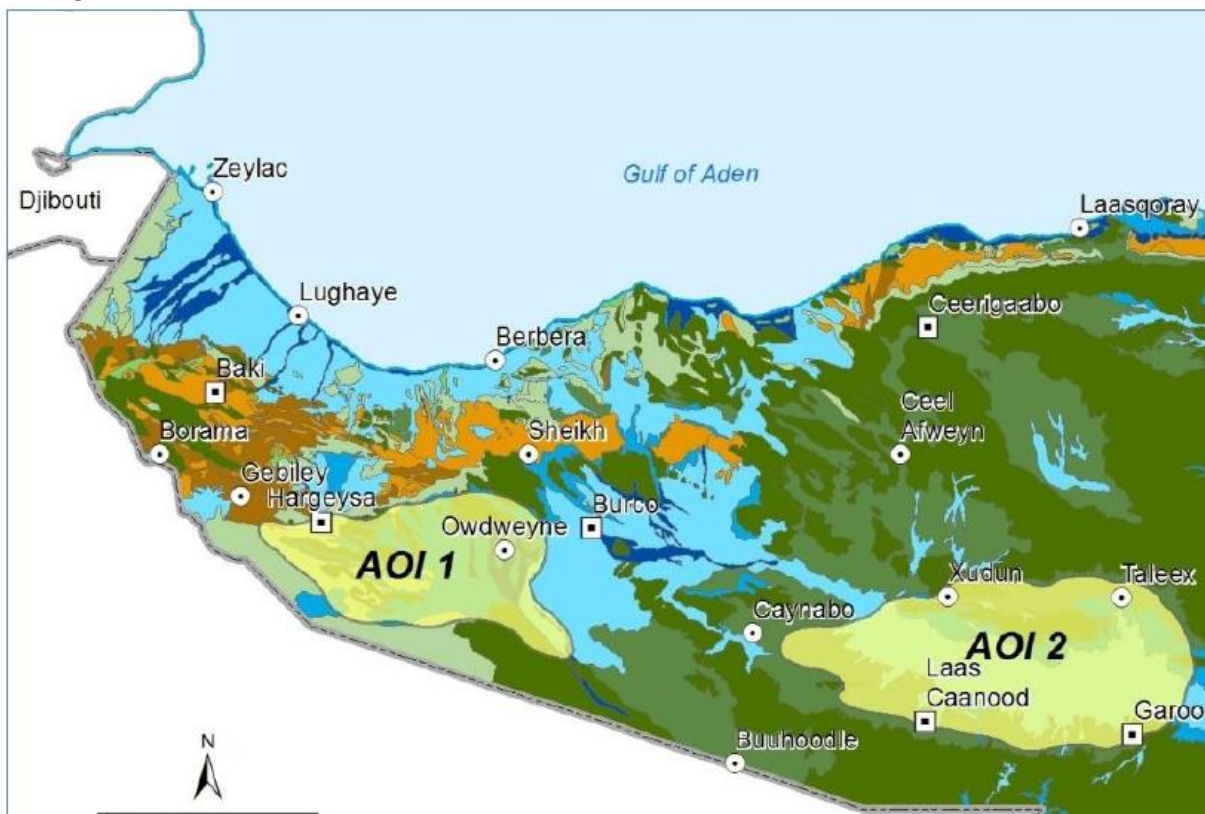
Somaliland Weather

Somaliland's have divers temperature generally ranges from 35-24°C in Summer to 15-10°C Winter in different regions, providing an average annual temperature of 22°C.. In Somaliland, they recognise four seasons but call them...

April to June (Needed to prevent drought) Rain Gu	July to September 26 – 32°C Sunny Hagga	October to November Rain Da'y	December to March 15 – 26°C Sunny Jiilaal
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Water Accessibility Selected Areas in Somaliland

Despite groundwater being the main source of water for humans, agriculture and livestock, there is neither a hydrogeological map nor a sound policy for groundwater management and exploration in Somaliland. The state of knowledge about hydrogeology, quality and quantity of groundwater resources is very poor. Information on hydrogeology to facilitate drilling and development of strategic water sources is limited, scattered and in some cases non-existent



The majority of the population in Somaliland is rural. Livestock exports account for 60-65% of GDP in Somaliland, and 85% of foreign exchange earnings. Although agricultural production has seen a steady increase in Somaliland, the livestock sector still employs roughly 70% of the population. With a mean annual precipitation of 200-300 mm per year, Somaliland is characterised as semi-arid, with high levels of annual variability. Water lost to evapotranspiration in Somaliland far exceeds rainfall in all months of the year, and can be as high as 2000-3000 mm annually. Drought and inconsistent Gu and Deyr rainfalls are persistent underlying threats to agro-pastoral populations who do not possess adequate rainwater harvesting capabilities. Groundwater storage is the main source of water for humans, livestock and agriculture in Somaliland. This water is mostly accessed through shallow wells. Groundwater development and rainwater harvesting are arguably the most important sources of water in Somaliland. However, Somaliland lack a sound policy for groundwater management and exploration, while the limited capacity of water institutions have contributed to un-regulated water exploration and drilling. Large segments of the population still rely on water trucking to fulfil dry season water needs. While this service is expensive it also exerts increased pressure on existing (shallow) groundwater aquifers where the water is collected. The cost per cubic meter (1000 litres) of water sold by tanker trucks varies per region and is influenced by the distances they have to travel to purchase and sell the water. Water sold by vendors in urban areas tends to be much cheaper than water sold in rural areas.

Population pressure, increased political stability, and growing wealth through remittances have increased demand for groundwater in Somaliland. According to SWALIM (2012), there is evidence of decline in groundwater levels in large cities such as Borama due to over abstraction. While the majority of the population still lives in rural areas, urban needs tend to dominate the development agenda.

A large portion of the rural population in Somaliland has limited access to potable water, and equity and efficiency in the use of scarce water resources requires coordination at the national and sub-national levels of the sector. Donors, government agencies, and implementing partners face the challenge of administering integrated interventions that encourage community ownership, facilitate unbiased local management, and create linkages to regional and national service providers.

Figure 3: N.W Hudson's formula for estimating storage capacity of a reservoir²³

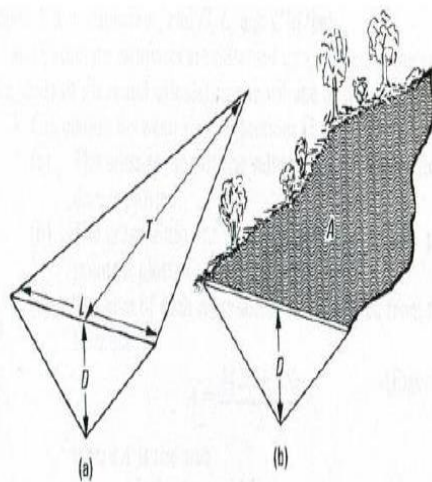


Figure 5.1. Estimating the storage capacity of a reservoir.

Storage capacity: approximate estimate is:

$$Q = \frac{L \times T \times D}{6}$$

Where²⁴:

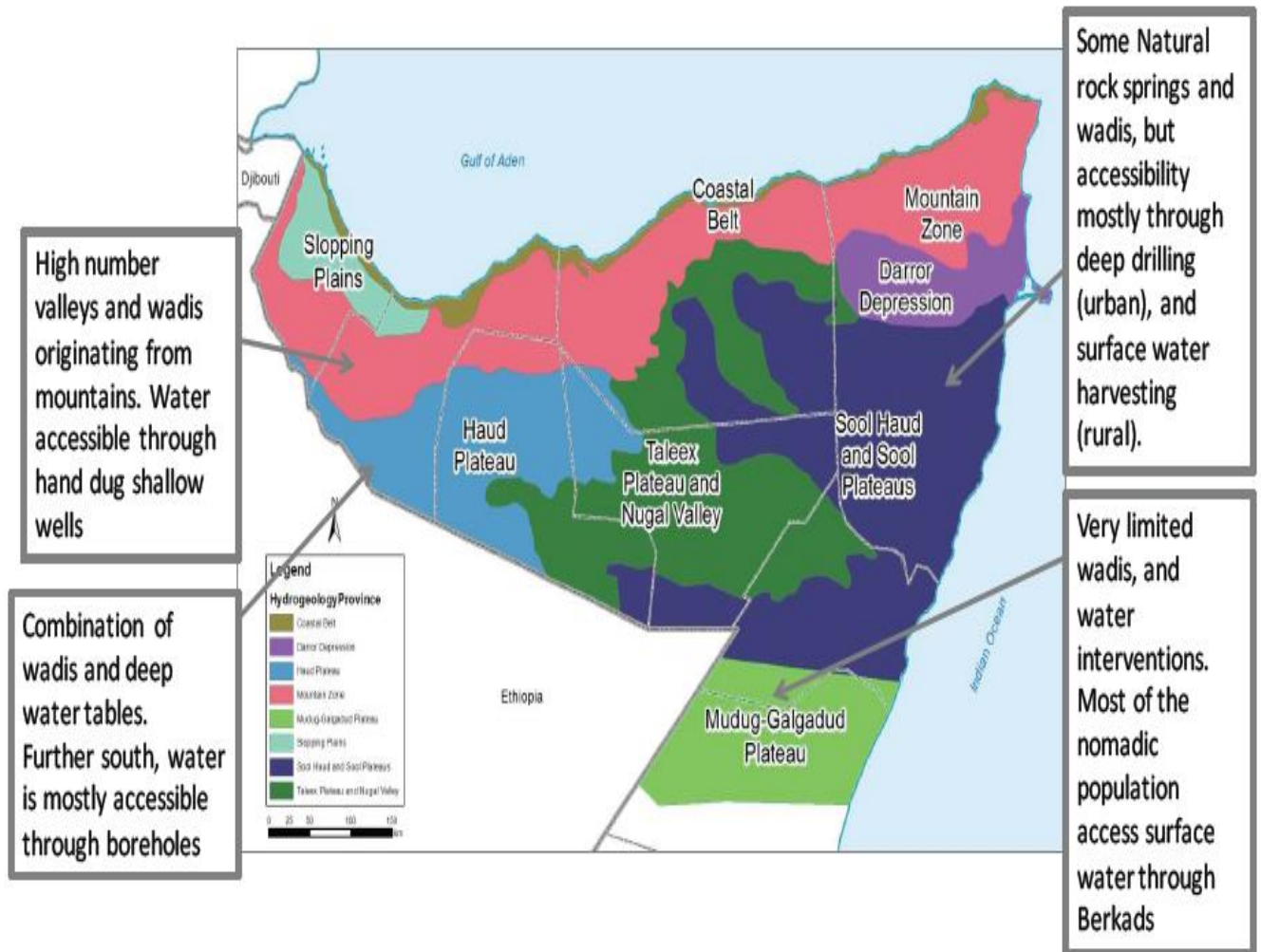
Q= capacity in cubic meters

L= length of the dam wall in meters at full supply

D= maximum depth in meters

T=Throwback in meters

Measuring the Volume of Extractable Water from a Sand Reservoir



Map of hydrogeological provinces of northern Somalia region

The location type for Somaliland: was based on Santa Fe in USA. In addition to the semi-arid climate, annual rainfall and ET in Santa Fe was very similar to Somaliland. Peak monthly precipitation in Santa Fe is 1.16 inches / per month (roughly 29.5 mm / month or 354 mm / year). In Somaliland this figure is roughly 300 mm / year. Peak evapotranspiration in Santa Fe was 7.75 inches per month (roughly 196.9 mm / month or 2,362 mm / year).

The landscape type: was determined as:

- Moderate to high water requirements for plant species
- Low density of plantings (sparsely spread out crops and vegetables)
- Intense exposure type of microclimate for the landscape (limited coverage from the sun)

Rainwater harvesting techniques

INTRODUCTION

Somaliland is located in the Horn of Africa, with an area of 137,600 km² with a population of about 3.85 million according to the Ministry of National Planning and Development (Somaliland in Figures,

2011). Somaliland is a majorly water scarce country with no perennial river flow making groundwater is the main source of water for the majority of the people in Somaliland.

In Somaliland estimates say that 55% of Somaliland communities live in rural areas but less than 20% have access to improved water supplies and nearly 88% lack access to universal sanitation. This must be addressed and this is complicated significantly by: (i) Continued conflict, (ii) The low rainfall and very complex hydrogeology of the country, (iii) The centrality of pastoralist livelihoods to the economy, (iv) Weak or absent local government institutions.

ENVIRONMENTAL AND SOCIAL BASELINE INFORMATION

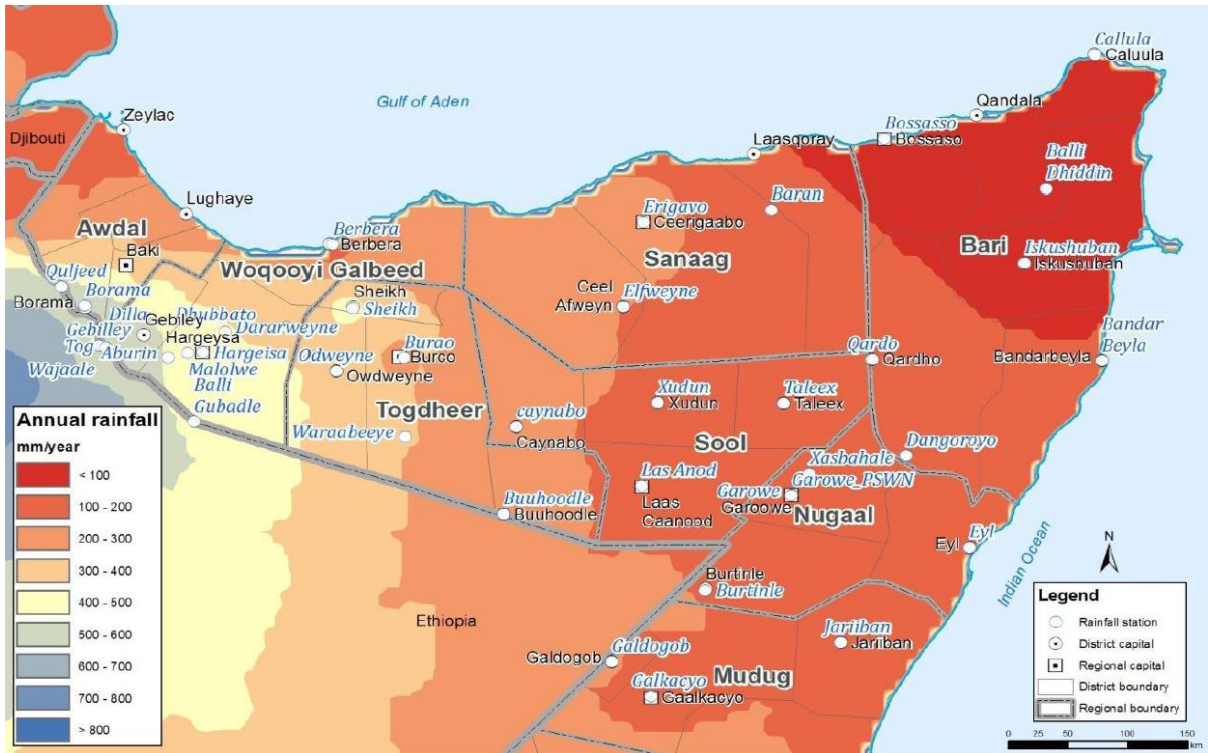
Somaliland is located in the Horn of Africa, with an area of 137,600 km² and a biophysical environment consisting of a variety of ecosystems, limited biodiversity and water resources. The altitude ranges from 2,100 meters above sea level at the highest peak, to sea level. A large portion of the country consists of high plateaus and mountains but has no rivers or lakes.

Climate: The Somali climate is hot, arid to semi-arid. There are two wet seasons (Gu April to June, and Deyr October to November) with approximately 500 mm rainfall annually in the northern highlands, 50-150mm along coast, and 300-500 mm in the southwest. With the impact of climate change extreme weather patterns such as droughts and floods (see also natural disasters) are likely to increase in frequency and magnitude

The Gu' (Spring) rainy season – late March to end of May followed by warm and relatively dry summer and rainy autumn that ends though the end of September in far West but ending through November in the East and dry season, which starts in December and ends in mid-March with hardly any rains.

Temperature: The mean air temperatures are generally high, in the range of about 25oC to more than 35oC in the northern coastal regions (e.g. Berbera and Boosaaso) while it is cooler in the north-western mountain region (e.g. Shiekh) where it varies from about 15oC to about 23oC. In the inland areas of the Darror and Nugal basins, it varies between 22oC and about 33oC. The mean temperature is highest from June to August in the Gulf of Aden basin areas whereas the peak temperature occurs from May to September in the inland areas.

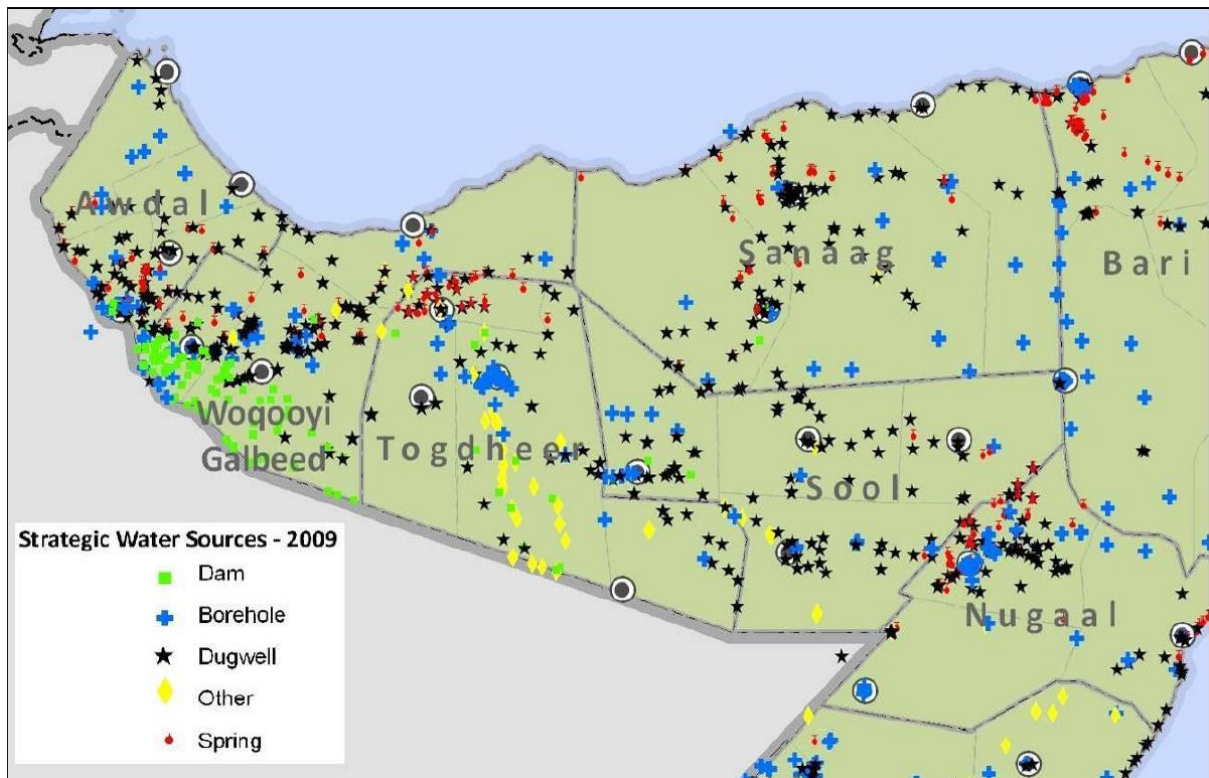
Potential Evapotranspiration: The annual Potential Evapotranspiration (PET) exceeds 2,000 mm in the Somaliland and Puntland, and is even as high as 3,000 mm in the Gulf of Aden. In most locations, PET exceeds rainfall in all months of the year. Except in a few locations in the extreme northwest regions, even 0.5 PET exceeds rainfall in all months, giving zero values for the longest vegetation growing period in most of the areas. This is why most areas in the northern basins are not suitable for agriculture (Basnyat, 2007).



Operational monitoring network and rainfall distribution map of the study area

Water Resources: Water resources are generally scarce in Somaliland and there is no river with perennial flows in Somaliland. Groundwater is the main source of water for the majority of the people in Somaliland to meet their water needs, groundwater from dug wells, bore holes and springs are the primary sources of water for the population in the most of the country. Groundwater is harnessed by the rural and urban population to meet domestic and livestock water needs as well as for small scale irrigation.

According to FAO-SWALIM, 2012 a total of 1,037 water sources are found in Somaliland (see figure below). More than half of the water sources are shallow wells. Dams are restricted basically to the region west and south of Hargeisa, while springs are found in the mountainous regions, particularly in Awdal, between Hargeisa and Berbera and around Erigavo.



Water resources in Somaliland

Flora: The vegetation in Somaliland is predominantly dry deciduous bushland and thicket dominated by species of Acacia thorn trees, commiphora, aloes, baobab, and candelabra trees are native to the semiarid regions, with semi-desert grasslands and deciduous shrub land in the western parts neighbouring Ethiopia. Trees that provide frankincense and myrrh are native to the region as well. Mangrove trees are found in the western part of Somaliland namely from Zeila to Lowyacada along the Red Sea coast. Kapok, and papaya grow along the rivers. Coconut, dune palm, pine, juniper, cactus, and flowering trees such as the flamboyant were imported and have become widespread in populated areas.

Fauna: Along with its large livestock herd, Somalia has one of the most abundant and varied stocks of wildlife in Africa. Animal life includes elephants, lions, wildcats, giraffes, zebras, hyenas, hippopotamus, waterbucks, gazelles and other mammals, although many of them are on the verge of extinction or are already extinct. A large variety of birds inhabits the different geographical zones, among these several species endemic to the Somali Region, e.g. Somali Pigeon (*Columba oliviae*), Somali Thrush (*Turdus ludoviciae*) and Warsangli Linnet (*Carduelis johannis*). For whole Somalia a total of 171 species of mammals, 655 species of birds, and over 3,000 species of plants have been reported.

Environmental Degradation: According to Ibrahim, M.O. (2010), fauna and flora in Somaliland is affected by environmental degradation due to several factors such as: (i) clearing of vegetation and deforestation (average deforestation rate of 0.97% per annum); (ii) illegal charcoal production, trade and export; (iii) over-fishing and illegal fishing by foreign companies in coastal waters; (iv) indiscriminate shooting and hunting of wildlife; (v) uncontrolled overgrazing by livestock; (vi) Erosion and desertification. No official natural reserve or national park has been established in Somaliland so far.

Geomorphology: Somaliland can be divided into three major physiographic provinces: (i) The coastal belt and sloping plain; (ii) The mountainous zone incised by numerous toggas (rivers); (iii) The plateaus and valleys which include the large undulated Hawd and Sool plateaus and the Nugal and Darror valleys. The highest elevations occur in the Golis Mountains near the Gulf of Aden. Coastal belt and plateaus have mainly an undulating topography.

Geology: The following major geological units can be distinguished in Somaliland: (i) Precambrian / early Cambrian basement complex: Volcanic and metamorphic rocks; (ii) Jurassic: Limestone, shale and sandstone; (iii) Cretaceous: Nubian sandstones (sandstones and limestones); (iv) Tertiary (Eocene): Limestone, evaporitic rocks (Auradu Fm., Taleex Fm., Karkar Fm.); (v) Tertiary (Oligocene to Miocene): Thick series of sedimentary rocks; (vi) Pleistocene to Recent: Basaltic rocks.

An isolated uplifted Neoproterozoic and early Cambrian complex occurs in western Somaliland paralleling the Gulf of Aden. The outcropping volcanic and metamorphic rocks are part of an early Paleozoic fold belt. Clastic and marine Jurassic sediments overlie the Basement complex. Cretaceous to Tertiary sediments with clastic sequences, limestones, evaporites and marine successions cover large parts of Somaliland. Small areas with young basaltic to liparitic volcanics are exposed close to Djibouti and in the Gulf of Aden area.

Land Use: The main land use in Somaliland is extensive grazing (pastoralism). Other land uses include rainfed agriculture practiced in the higher lying areas (plateau) of maroodi Jeex, Gabiley and Awdal regions in combination with pastoralism and wood collection. Most of the cultivated crops are rainfed. Minimal irrigated agriculture especially for orchards along alluvial plains is also practiced mainly fruit trees such as citrus, guava, papaya, mango and vegetables. Water for supplemental irrigating of the crops is often obtained from wells, dams, and rivers. The eastern part of the country (Togdheer, Sool, Sanaag) is almost exclusively relying on livestock raising.