The Changing Role of Shrubs in Rangeland-Based Livestock Production Systems: Can Shrubs Increase Our Forage Supply?

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Source: Rangelands, 36(2):25-31. 2014.
Published By: Society for Range Management
DOI: http://dx.doi.org/10.2111/RANGELANDS-D-13-00066.1
URL: http://www.bioone.org/doi/full/10.2111/RANGELANDS-D-13-00066.1

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On the Ground

- Loss of grasslands to shrublands continues.
- Demand for livestock products is expected to continue to grow.
- Increased demand for red meat may stimulate rangeland livestock production.
- Methods for increasing shrub use are needed to meet increasing forage demands.

Keywords: cattle, goats, grasslands, secondary plant metabolites, sheep, woody plants.

Rangelands 36(2):25–31
doi: 10.2111/RANGELANDS-D-13-00066.1

In the past 50 years, cattle, sheep, and goat numbers have increased from about 2.3 billion animals in 1961 to 3.4 billion in 2010,[1] and are projected to reach nearly 4.2 billion animals by 2030.[2] Three continents (Africa, Asia, and South America) experienced a cumulative increase of nearly a billion ruminants during the past three decades.[1] Projections suggest that by 2030, ruminant livestock numbers in developing countries will exceed those on the entire planet in 2000.[3] The world's goat population has nearly doubled in the past three decades, from ~474 million in 1981 to ~910 million in 2010, with much of this growth in Asia and Africa.[1] Increased demand for red meat is driven by population growth, urbanization, and improved economies (especially Asia), a trend projected to continue through 2030.[2,4] Rural/peri-urban small-farm growth in places such as sub-Saharan Africa has also contributed to rising numbers of small ruminants.[5,6]

Approximately one-third of the world's ruminants are in grazing-based systems.[7] Grasslands are in decline in many parts of the world.[3] Many factors (invasive species, drought tolerance, urban sprawl, climate change, differential herbivory, changing fire cycles, reduced prescribed burning, etc.) contribute to loss of native grasslands.[8–10] Two major contributing factors are 1) conversion to cropland to support increased demand for cereal and oilseed production and 2) shrub encroachment.[2] Arable land in developing countries is projected to increase by almost 300 million acres[2] (an area about the combined size of Texas, Oklahoma, and New Mexico) by 2030, and much of this will likely be native grasslands marginally suited for crop production.

Approximately 93.5 million acres of the world's rangelands are classified as "woody" compared to 31.6 million acres categorized as grassland.[3] Woody plant expansion/dominance is especially prevalent on arid/semiarid rangelands.[11] Though rangeland ecosystems are diverse and complex, most contain some proportion of woody plant species, many of which are used sparingly or avoided by livestock. Restoration of degraded rangelands is costly and slow, if not impossible in some cases[10]; yet, demand for forage to support projected increases in livestock will escalate. An estimated 3.2 billion tons of forage will be required annually to feed these extra livestock.[3] Other systems will undoubtedly absorb some of this growth (i.e., intensive systems, mixed farming).[2] Even though intensive production systems have increased in recent years, they may not be sustainable, given that intensive systems rely heavily on an inexpensive oil supply and are likely to be hardest hit by rising oil costs associated with impending peak oil.[12,13] There will likely be unprecedented pressures on rangelands, especially in developing countries, and it would behoove us to learn how to more efficiently use the forage base on these landscapes. A paradigm shift is needed to produce livestock with less grass, and development of methods