

RANGE AND ANIMAL SCIENCES AND RESOURCES MANAGEMENT

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Summary

Rangelands comprise over forty percent of the earth's land surface and, as one of the most prevalent land systems on the planet, rangelands are critical habitats for myriad plant and animal species and form many of the world's major watersheds e.g. the three major rivers that arise in the Tibet plateau (Mekong, [Langcan], Yellow River and the Yangtze), the Orange River that arises in Lesotho and runs across South Africa and Namibia, the Amu-Daria and Syr-Daria rivers that flow across the Southern Kazakh steppe, the Kyzyl-Kum and Karakum desert in Central Asia, as well as the Euphrates and the Tigris that flow through rangelands in southern Turkey, Syria and Iraq.

Rangelands are categorized in two distinct ways: (a) as a type of land or (b) a type of (land) use. For many years the literature and the “science” of range management was centered on the type of use (mainly livestock grazing) but of more recent times the definition has been amended to be more inclusive. Rangelands are those parts of the world where pastoral people graze native and domestic herbivores on native vegetation. Here the natural and fossil resources are utilized by other people for a host of purposes, including: water, fossil fuels, mineral ores and other saleable commodities as well as “invisible” ecosystem services such as watersheds, carbon sequestration, and tourism,

For the purposes of this essay rangelands are defined as “*uncultivated land that will provide the necessities of life for grazing and browsing animals and the herder families that depend on them. Therefore it includes deserts, forests and natural grasslands and shrublands.*” Rangelands have a key role as grazing lands for pastoral uses, as wildlife habitat and as biosphere reserves and this will be the focus of this volume. Appropriate management is essential for all these uses if we are to prevent degradation of the resources that provide the base for all the activities that occur now on rangelands or may occur in the future.

The development of thinking that underpins the science and management of rangelands in both North America and elsewhere is outlined and new paradigms are explained.

Rangelands are mostly thought of as being in the drier regions (drylands) and this is certainly the case for most of them but upland areas and some cold lowlands (notably in Iceland and the tundra region above 60° N latitude) are also classified as rangelands.

Drylands, as defined by the United Nations Convention to Combat Desertification (UNCCD), include the arid, semi-arid, and dry sub-humid zones and cover almost 54 million km² of the globe. The definition is based on the length of the growing season. The zones falling between 1-74 and 75-119 growing days represent the arid and semi-arid drylands respectively. Many of the world’s drylands are grazed rangelands. Semi-arid areas are most extensive, followed by arid areas and then dry sub-humid lands. These drylands are spread across all continents, but are found most predominantly in Asia and Africa where the principal land use is as rangeland used for herding and opportunistic agro-pastoralism.

Rangelands are the home to millions of people, most of whom rely solely on the ecological services that rangelands provide. The significance of rangelands as a resource base falls into several broad categories: for grazing animals, livestock and wildlife; for biodiversity conservation: as a source of medicinal plants and foods; for carbon sequestration; as a reservoir of irreplaceable biodiversity and as a bastion of customs and tradition that have endured for centuries.

Regionally, Asia has the largest population living in drylands, both in terms of numbers and percent: over 1.4 billion people, or 42 percent of the region’s population. Africa has nearly the same percentage of people living in drylands— 41 percent— although the total number is less than Asia’s: nearly 270 million. South America has 30 percent of its population in drylands or approximately 87 million people. Of the three aridity zones defining drylands, semi-arid and dry sub-humid lands are the most populated by people.

Some of the highest population densities in the world are found in the semi-arid and dry sub-humid zones of India. Other pockets of high population densities occur in the dry sub-humid zones of eastern China, the Middle East, and West Africa.

Livestock production from rangelands is quite important both in terms of the volume of the output and in respect to the number of people dependent on livestock for their livelihood. Rangelands produce the full spectrum of production systems from commercial ranching in Australia, southern Africa, western USA, Canada, Mexico and Argentina through various gradations of crop-livestock systems in Africa and north and Central Asia to traditional nomadic and semi-nomadic subsistence systems.

The availability of land either for grazing or for producing animal feed, is a major determinant of the animal production systems in a specific area. Basically there are two broad categories of livestock raising (a) commercial ranching (industrialized) and (b) non-commercial (traditional) livestock raising.

Pastoralists (herders) have different management objectives. The aim of pastoralists is to maintain a large herd as insurance against extreme drought or hardship. The goal of the rancher is to maximize money profit. Pastoralists try to reduce their work load as much as possible; ranchers try to maximize productivity of labor.

Most systems of raising livestock involve quite complex interactions of domestic livestock and the forage and water resources on which they depend. The most primitive of these systems was that of migratory herding. Somewhat more complex migratory systems are involved in nomadism and transhumance which utilize the seasonal production of grass and available water in different grazing areas. Traditional nomadism is practiced in many parts of Africa, the Middle East, central Asia and parts of South America. The more sophisticated modern equivalent of traditional; nomadism is represented by the seasonal grazing practices found in parts of western USA and the Republic of South Africa.

Ecologically sustainable development is the primary challenge currently facing the world's rangelands from the highly commercialized ranch operations in North America, Australia and elsewhere to the subsistence herders in Africa and Central Asia, north and northwest China and elsewhere. Environmental and sustainability issues have emerged during the 1990s. These days, few ecological topics evoke more emotional reaction among concerned citizens of developed countries than the prospect of a drastic transformation of natural landscapes. The concept of sustainable agriculture (including livestock systems) is in the process of evolution and its operational content remains notoriously difficult to define. In the more marginal rangelands sustainability implies that a major emphasis must be placed on reducing the vulnerability of small farmers and herds to resource fragility and natural hazards.

The pursuit of environmental sustainability in marginal rangelands (and elsewhere throughout the world's rangelands) must be seen as a dynamic process requiring that the long term balance between population and carrying capacity is addressed through measures to relieve the pressure on fragile resources. Relieving the pressure on the natural resource base requires enhanced strategic interventions. Achieving a balance

will be the challenge for rangeland managers and administrators in the decades to come.

1. What are Rangelands?

Rangelands comprise over forty percent of the earth's land surface and, as one of the most prevalent land systems on the planet, rangelands are critical habitats for myriad plant and animal species and form many of the world's major watersheds e.g. the three major rivers that arise in the Tibet plateau (Mekong,[Langcan], Yellow River and the Yangtze), the Orange River that arises in Lesotho and runs across South Africa and Namibia, the Amu-Daria and Syr-Daria rivers that flow across the Southern Kazakh steppe, the Kyzyl-Kum and Karakum desert in Central Asia, as well as the Euphrates and the Tigris that flow through rangelands in southern Turkey, Syria and Iraq.

Rangelands are categorized in two distinct ways: (a) as a type of land or (b) a type of (land) use. For many years the literature and the “science” of range management was centred on the type of use (mainly livestock grazing) but of more recent times the definition has been amended to be more inclusive. "Rangelands are those parts of the world where pastoral people graze native and domestic herbivores on native vegetation. Here the natural and fossil resources are utilized by other people for a host of purposes, including: water, fossil fuels, mineral ores and other saleable commodities as well as “invisible” ecosystem services (See:People in rangelands: their role and influence on rangeland utilization . The Society for Range Management (USA) definition reads "Land on which the native vegetation (climax or natural potential) is predominantly grasses, grass-like plants, forbs, or shrubs. Includes lands revegetated naturally or artificially when routine management of that vegetation is accomplished mainly through manipulation of grazing" Rangelands are not suitable for cultivation because of low and erratic precipitation, rough topography, poor drainage, or cold temperatures.

Box 1 is a compilation of various definitions of rangelands. Note that most relate to the use to which they are put, but that many refer to the plants communities that are supported on them and some to wildlife habitat, watershed values and other ecological services that rangelands provide.

1. (Grassland) - Biome found in regions where moderate annual average precipitation (25 to 76 centimeters, or 10 to 30 inches) is enough to support the growth of grass and small plants, but not enough to support large stands of trees. <http://www.gsu.edu/~mstnrhx/ecogloss.htm>.
2. (Grazing land) - Any area of pasture, rangeland or other grassland available for stock to graze <http://www.abs.gov.au/websitedbs/c311215.nsf/20564c23f3183fdaca25672100813ef1/b4a3c3fd558c2c7dca2569c80077855e!OpenDocument>
3. (Range) Rangelands, forests and woodlands, and riparian zones that support an understory or periodic cover of herbaceous or shrubby vegetation amenable to rangeland management principles or practices. <http://www.mtnvisions.com/Aurora/glossary.html#R>
4. A broad category of land characterized by native plant communities that are often associated with grazing. Rangelands are managed by ecological rather than agronomic methods. <http://www.for.gov.bc.ca/pab/publctns/glossary/R.htm>
5. A kind of land on which the native vegetation, climax or natural potential, consists predominately of grasses, grasslike plants, forbs, or shrubs. Rangeland

includes lands revegetated naturally or artificially to provide a plant cover that is managed like native vegetation. Rangelands may consist of natural grasslands, savannas, shrublands, most deserts, tundra, alpine communities, coastal marshes, and wet meadows <http://www.lastgreatplaces.org/glossary.html#R> and <http://www.mtnvisions.com/Aurora/glossary.html#R>

6. A specific kind of land that produces native grasses and other plants, and its best agricultural use is for grazing livestock. It also provides habitat for many kinds of wild animals. <http://csd.unl.edu/csd/illustrations/ra5a/range.html>

7. A type of land, not a use of land. They are not urban land and they are not agricultural land. They do include some forests, some woodlands and other vegetation types not usually associated with range, but primarily, rangelands are grasslands, shrublands and savannas, and grasslands with scattered trees and shrubs. <http://ag.arizona.edu/OALS/agnic/introduction.html>

8. All land producing naturalized or native forage for animal consumption, and lands that are revegetated naturally or artificially to provide a forage cover that is managed like naturalized or native vegetation. Generally considered as land that is not cultivated. It may include forestlands that support an understory or periodic cover of herbaceous or shrubby plants suitable for grazing without impairing other forest values. <http://fwie.fw.vt.edu/rhgiles/appendices/glossr.htm>

9. All land that is not urban or farmland in Arizona. 92% of Arizona is rangeland (SRM 1994). <http://www.uni-frankfurt.de/fb11/didaktik/xprojekt/Water/glossary.htm>

10. An expanse of land suitable for livestock to wander and graze on. <http://www.dictionary.com/cgi-bin/dict.pl?term=rangeland>

11. Any land supporting grazable or browsable vegetation and managed as a natural ecosystem; can include grasslands, forestlands, shrublands, and pasture. "Range" is not a land use. <http://www.ext.colostate.edu/pubs/natres/06105.html>

12. Any land supporting vegetation suitable for wildlife or domestic livestock grazing, including grasslands, woodlands, shrublands, and forest lands. <http://www.luco.gov.bc.ca/lrmp/diamond.htm#60>

13. Land on which the native vegetation (climax or natural potential) is predominantly grasses, grass-like plants, forbes, or shrubs. Includes lands revegetated naturally or artificially when routine management of that vegetation is accomplished mainly through manipulation of grazing" (Society for Range Management 1989

14. Ecological sites are separated from forestland ecological sites based on the historic climax plant community that occupied the site before the arrival of European settlers. An Ecological Site Type of "Rangeland" is assigned where overstory tree production was not significant in the climax vegetation. Refer to the National Range and Pasture Handbook for details on rangeland ecological types. <http://www.statlab.iastate.edu/soils/nssh/622.htm#09>

15. Land on which the climax or potential plant cover is composed principally of native grasses, grasslike plants, forbs or shrubs suitable for grazing and browsing, and introduced forage species that are managed like rangeland. This would include areas where introduced hardy and persistent grasses, such as crested wheatgrass, are planted and such practices as deferred grazing, burning, chaining, and rotational grazing are used, with little or no chemicals or fertilizer being applied. Grasslands, savannas, many wetlands, some deserts, and tundra are considered to be rangeland. Certain communities low forbs and shrubs, such as mesquite, chaparral, mountain, shrub, and pinyon-juniper, are also included in rangeland. <http://www.in.gov/oca/ilrc/glossary/>

16. Land on which the climax vegetation (potential natural plant community) is predominantly grasses, grasslike plants, forbs or shrubs suitable for grazing and browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundra and certain forb and shrub communities. It also includes areas seeded to

native or adapted introduced species that are managed like native vegetation. [source: USDA-SCS 1982 NRI] (NRCS)

17. Land on which the indigenous vegetation (climax or natural potential) is predominantly grasses grass-like plants, forbs, or shrubs and is managed as a natural ecosystem. If plants are introduced, they are managed as indigenous species. Rangelands include natural grasslands, savannas, shrublands, many deserts, tundras, alpine communities, marshes and meadows. http://www.forages.css.orst.edu/Topics/Pastures/Grazing/Terminology/grazterm_body.html#Vegetation

18. Land on which the native vegetation (climax or natural potential) is predominantly grasses, grasslike plants, forbs, or shrubs. It includes land that is revegetated naturally or artificially, as when routine management of the vegetation is accomplished, mainly through the management of grazing. Rangeland includes natural grassland, savannas, most deserts, tundra, alpine communities, shrub land, coastal marshes, and wet meadows. <http://www.statlab.iastate.edu/soils/nssh/622.htm#09> and <http://www.state.wy.us/~land/racfinal.htm>

19. Land on which the native vegetation is predominately grasses, grass-like plants, forbs, or shrubs suitable for grazing or browsing use. <http://www.fs.fed.us/pl/rpa/95rpa/glossary.htm> (USFS)

20. Land on which the natural potential (climax) plant cover is principally native grasses, grasslike plants, and shrubs. It includes natural grasslands, savannas, certain shrubs and grasslike lands, most deserts, tundra, alpine communities, coastal marshlands, and wet meadows. It also includes lands that are re-vegetated naturally or artificially and are managed like native vegetation.

21. Land on which the natural vegetation is predominantly native grasses, grasslike plants, forbs, or shrubs valuable for forage, not qualifying as timberland and not developed for another land use. Rangeland includes natural grassland and savanna <http://www.srs.fs.fed.us/sustain/report/appendix/glossary.htm>(USFS)

22. Land on which vegetation is predominantly grasses, forbs, or shrubs suitable for grazing or browsing. Rangeland is generally and Shrubland, but may include some Treeland and Barren land. Agricultural land is excluded. Also included are areas seeded to native or adapted introduced species that are managed like native vegetation. Resource Inventory Coordination Task Group. 1989. Interim resource inventory glossary. Washington, DC: U.S. Department of Agriculture; Forest Service; June 14, 1989. 96p <http://forestry.about.com/library/glossary/blforglr.htm>

23. Land used for grazing by domestic livestock and wildlife including grasslands and forest lands with an understory or periodic cover of herbaceous or shrubby vegetation. (Canada – British Columbia) <http://www.for.gov.bc.ca/pab/publctns/frrra/app-c.htm>

24. Land which is predominantly grasses, grasslike plants, or shrubs suitable for grazing and browsing. Rangeland includes natural grasslands, savannas, many wetlands, some deserts, tundra, and certain shrub communities. It also includes areas seeded to native or adapted and introduced species that are managed like native vegetation. <http://www.usda.gov/news/pubs/fbook97/13d.pdf>(USDA)

25. Land, a major use of which is grazing by livestock and big game animals and on which the natural potential natural vegetation of plants is dominated by native grasses, grass-like plants, forbs, and shrubs. Some rangelands have been or may be seeded to introduced or domesticated plant species. Rangelands include natural grasslands, savannas, shrublands, many deserts, tundra, alpine communities, coastal marshes, and wet meadows. <http://fwie.fw.vt.edu/rhgiles/appendices/glossr.htm>

26. Open expanses of land over which animals (such as livestock) may roam and feed (Lund 1998)

27. Rangeland ecological sites are separated from forestland ecological sites based on the historic climax plant community that occupied the site before the arrival of European settlers. An Ecological Site Type of "Rangeland" is assigned where overstory tree production was not significant in the climax vegetation. Refer to the National Range and Pasture Handbook for details on rangeland ecological types. (NRCS)- <http://www.statlab.iastate.edu/soils/nssh/622.htm>
28. Rangeland, grassland (<10% cover trees, <20% shrubs). This subdivision includes rangeland used for hayland, including bluestems, mixed midgrasses and shortgrasses. <http://www.statlab.iastate.edu/soils/nssh/622.htm#16>
29. The internationally recognised term for land where livestock are grazed extensively on native vegetation, and where the rainfall is too low or erratic for agricultural cropping or for improved pastures. www.affa.gov.au/corporate_docs/publications/pdf/oper_env/armcanz/armcanz-may28.pdf
- Source: H. Gyde Lund Forest Information Services

Box 1. Rangeland Definitions.

For the purposes of this study we define rangelands as “*uncultivated land that will provide the necessities of life for grazing and browsing animals and the herder families that depend on them. Therefore it includes deserts, forests and natural grasslands and shrublands.*” Rangelands have a key role as grazing lands for pastoral uses, as wildlife habitat and as biosphere reserves and this will be the focus of this volume. Appropriate management is essential for all these uses if we are to prevent degradation of the resources that provide the base for all the activities that occur now on rangelands or may occur in the future.

2. Global Distribution of Rangelands

Rangelands are mostly thought of as being in the drier regions (drylands) and this is certainly the case for most of them (Figure 1) but upland areas and some cold lowlands (notably in Iceland and the tundra region above 60 ° N latitude) are also classified as rangelands.

Drylands, as defined by the United Nations Convention to Combat Desertification (UNCCD), include the arid, semi-arid, and dry sub-humid zones and cover almost 54 million km² of the globe. The definition is based on the length of the growing season. The zones falling between 1-74 and 75-119 growing days represent the arid and semi-arid drylands respectively. Many of the world’s drylands are grazed rangelands. Semi-arid areas are most extensive, followed by arid areas and then dry sub-humid lands. These drylands are spread across all continents, but are found most predominantly in Asia and Africa where the principal land use is as rangeland used for herding and opportunistic agropastoralism.

Rangelands are the home to millions of people, most of whom rely solely on the ecological services that rangelands provide.. The significance of rangelands as a resource base falls into several broad categories: for grazing animals, livestock and wildlife; for biodiversity conservation: as a source of medicinal plants and foods; for carbon sequestration; as a reservoir of irreplaceable biodiversity and as a bastion of

customs and tradition that cover millennia.

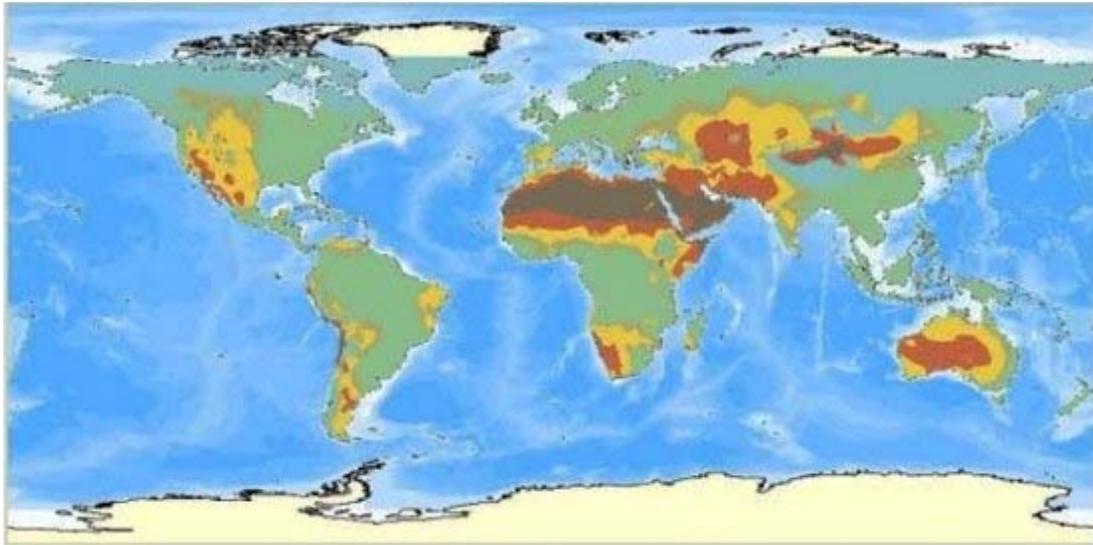


Figure 1. Distribution of the world's drylands, as defined by UN

Regionally, Asia has the largest population living in drylands, both in terms of numbers and percent: over 1.4 billion people, or 42 percent of the region's population. Africa has nearly the same percentage of people living in drylands— 41 percent— although the total number is less than Asia's: nearly 270 million. South America has 30 percent of its population in drylands or approximately 87 million people. Of the three aridity zones defining drylands, semi-arid and dry sub-humid lands are the most populated by people. Some of the highest population densities in the world are found in the semi-arid and dry sub-humid zones of India. Other pockets of high population densities occur in the dry sub-humid zones of eastern China, the Middle East, and West Africa.

Human population density is often related to the population of livestock in a specific area. In any event, livestock density is variable across the globe but pockets of high density occur.

Livestock densities range from less than 50 head to well over 100 head of livestock per square kilometer (Figure 2). In areas where the intensity of livestock production is low, especially in developing regions of Africa and parts of Asia, ranchers presumably rely on native grassland for grazing without many external inputs. Livestock can help maintain soil fertility, increase nutrient retention and water-holding capacity, and create a better climate for micro-flora and fauna. If overgrazing does occur, soil compaction and erosion may follow with a decrease in soil fertility, organic matter, and water-holding capacity. In areas where the intensity of livestock production is low, especially in developing regions of Africa and parts of Asia, ranchers presumably rely on native grassland for grazing without many external inputs.

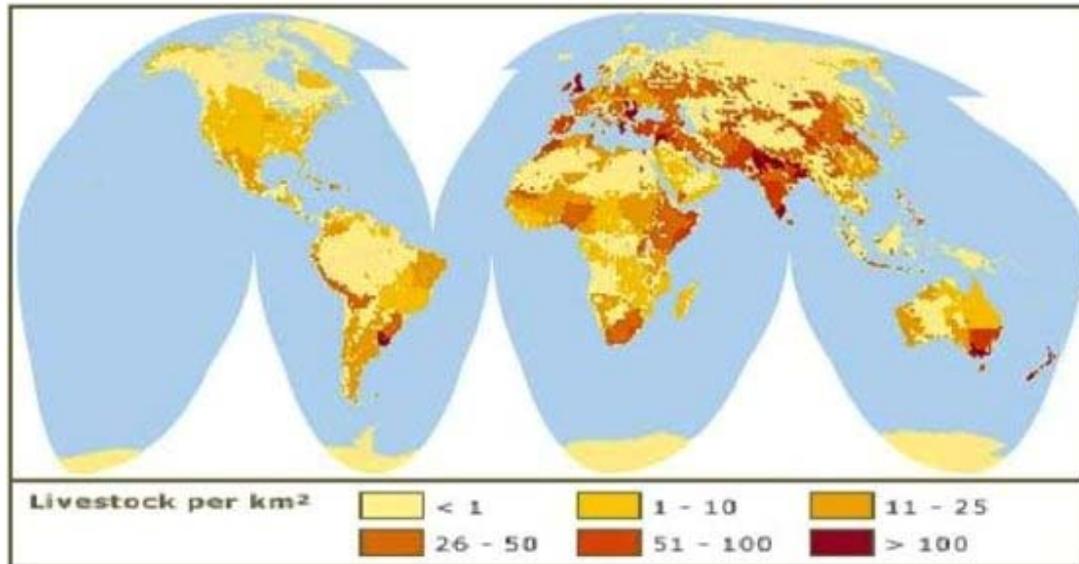


Figure 2. Global livestock densities

There is no rangeland prototype because there are many different types. Rangelands include natural grasslands consisting of either tall, short, medium, annual or desert species; savannahs both wet and dry; shrublands of various characteristics; alpine communities; coastal marshes; wet meadows and most deserts. The commonalities between these are: (1) they produce a kind of vegetation that only animals can consume and convert into products beneficial to man; and (2) they are not suitable for sustained cultivation and they are incapable of supporting arborescent forests. However, many forests can be grazed without damage to the trees within the multiple-use concept and these are often called "woodland ranges". The objective is not to destroy the forest, but instead to use its resources for more than one product.

Rangelands are those parts of the world where pastoral people graze native and domestic animals on native vegetation. But rangelands resources are also utilized by people who harvest products including water, fossil fuels, mineral ores and other saleable commodities as well as "invisible" ecosystem services (See: People in rangelands: their role and influence on rangeland utilization). The principal focus of this entire volume is on rangelands that are used for pastoral purposes and on the animal grazing systems that they support.

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Biographical Sketch

Dr Victor Squires is an Australian. His undergraduate studies in Australia were in Botany and Ecology and he has a PhD in Range Science from Utah State University, USA

He is a former foundation Dean of the Faculty of Natural Resources at Adelaide University and the Foundation Director of the National Key Centre for Dryland agriculture and Land Use Systems. He is currently an Adjunct Professor in the University of Arizona, USA.

He has a background in teaching and applied research. As an educator he taught graduate and post

graduate students in Australia, and conducted applied research and training programs for institutions and government agencies over the world.

Dr. Squires is an internationally well known dryland management expert. He has worked in many developing countries e.g. China, Mongolia, Thailand, Algeria, Ethiopia, Iraq, rural Australia and Italy. He has conducted many projects in multiple sectors of environment protection, natural resource and biodiversity conservation, land degradation and desertification control, livestock and rangeland management.

He is the author of over 100 scientific papers, numerous invited book chapters and several books.

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