



**Figure 2.** Decline in Kashmir saffron area, production and productivity from 1997–2009.

effective both in terms of implementation and re-examining some of its provisions, in light of the Expert Group recommendations<sup>13</sup>. (vi) Invent kits for easy detection of adulterated material and spread awareness among consumers to demand conducting such tests before buying saffron from local unorganized and uncertified agencies. Moreover, there is lesser chance in getting cheated while buying laccha-type (stigma with short style) saffron, because to fabricate artificial saffron (synthetic material) resembling the laccha-type is cumbersome compared to the higher priced mongra-type (only stigma) saffron.

The good news however is that recently, the Government of India initiated a National Saffron Mission with a financial outlay of Rs 3.74 billion for resolving the saffron crisis in Kashmir through different programmes, which include rejuvenating saffron farms by corm

re-planting, digging bore wells for irrigation, and setting up of a modern Saffron Park with quality control laboratory for providing adequate marketing cover to saffron growers, thus eliminating exploitation by middle-men. There are mixed reactions from saffron farmers about the approach followed in Saffron Mission, and therefore the net results of this massive initiative remain to be seen!

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## Is Ladakh a ‘cold desert’?

Delimited by the Eastern Karakorum Range in the north and the Western Himalaya Range in the south, Ladakh lies in the bio-geographic zone 1 (Trans Himalaya) among 10 such zones into which the whole of India is divided. The region is further divided into two bio-geographic provinces, namely Ladakh Mountains and Tibetan Plateau (1A and 1B)<sup>1</sup>. The Ladakh Mountains is spread

through Kargil, Zaskar, Leh and Nubra. These areas are mostly rugged mountains and valleys and have a large altitudinal range from 2650 m in Kargil region to over 7000 m in the Karakorum Range. The ‘Tibetan Plateau’ includes Changthang characterized by vast plains, rolling mountains and some large, high-altitude brackish water lakes. Most of this region lies above an elevation of 4200 m.

As the region is situated in the rain shadow of Western Himalaya, it does not receive moisture from the northwest monsoon. Climate of the region is characterized by extremely low temperatures (25°C below freezing point), meagre precipitation (<250 mm annual), diurnal pattern of temperature fluctuations and abridged growing season with insignificant growing season precipitation<sup>2</sup>. Most



Figure 1. Cattles grazing in the steppes of Zanskar valley in Ladakh.

Indian authors<sup>3-6</sup> have described the climate of this high-altitude region as 'cold desert', the term originally used to describe tundra and arctic climate prevailing in the Arctic margins of North America and Eurasia and the Antarctic continent.

This ersatz nomenclature is due to the commonality of the cold and arid environments and hence prevalence of xerophytes in both these regions. The xerophytes of cold deserts, however, arise differently from those of high altitudes<sup>7</sup>. The former arise as a reaction to inadequate atmospheric moisture and frozen soil. The high-altitude xerophytes, on the other hand, have enough soil moisture but the atmosphere is dry. Frozen soil of cold desert sanctions shallow roots and lowly plants. In the high-altitude ecosystem, penetrating root system is precluded because of scanty soil and abundance of melt-water on the surface rather than permafrost. Besides, other climatic parameters such as photoperiodism (light duration and its annual distribution), diurnal temperature variation, contrasting Sun and shade temperatures and inclination of sunrays prevailing in the two regions differ greatly.

Moreover, the precipitation data reported from Ladakh do not present the true picture. According to the existing records, the region receives very little precipitation, which decreases eastward from approximately 250 mm annually in Zanskar and Kargil to less than 100 mm in Indus valley and Changthang<sup>2,8</sup>. These figures, however, are recorded at one or two observatories located at the valley bases (Leh and Drass). There is a considerably greater amount of precipitation on the mountain tops and the passes in the form of snow and mostly at night. These high reaches continue to receive moisture, to some extent, even in summer while the valley bases are generally

dry. This is the reason that up to a certain altitude, beyond which temperature becomes a limiting factor, the number of species tends to increase. Even the passes like Fotula and Namikala that are not near-perpetual snow have more plants near the summit than at the bottom<sup>9</sup>. At higher elevation precipitation tends to exceed even evapotranspiration<sup>8</sup>.

Another characteristic which differentiates the high-altitude region of Ladakh from cold deserts is the vertical zonation of vegetation. At lower elevation much of the area is covered by desert and semi-desert plants. Steppe vegetation is found at middle elevation up to ca. 5000–5400 m. Alpine grasslands form a narrow belt above the steppe vegetation and extend as narrow strips near glaciers<sup>10</sup>.

The flora of Ladakh includes almost the entire spectrum of life and growth forms<sup>11</sup>. Vegetation changes gradually from alpine meadows (*Kobresia*, *Cares*, *Potentilla*, *Nepeta*, etc.) to steppe vegetation (*Caragana*, *Artemisia*, *Stachys*, *Ephedra*, *Stipa*, etc.) with shrub land (*Hippophae*, *Myricaria*, *Salix*) along river courses<sup>12</sup>. Even the diversity of woody plant species is fairly high and more than 75 species of trees and shrubs have been reported from the region<sup>13</sup>.

Considering the availability of precipitation data only for the valley bottom, which represents a smaller and drier part of the vast expanse and a general observation of increasing precipitation with elevation, it seems that Ladakh is not dry enough to be called a desert. This premise can be further substantiated by the fact that a wide spectrum of life-form exists in Ladakh. An analysis of the vegetation of Ladakh<sup>14</sup> found a life-form spectrum typical of semi-desert environment. Taking cue from the similarity of climatic conditions and dominance of steppe genus, Humbert-Droz and Dawa<sup>2</sup> designated Ladakh as a high-altitude

desert-steppe. In a recent study, Dvorský *et al.*<sup>10</sup> concluded that the life-form spectrum is closer to desert-steppes and steppes (e.g. a high proportion of hemicryptophytes, a high number of turf grasses and a low proportion of therophytes) rather than to deserts or cold deserts as the vegetation of Ladakh is often referred to by local authors. If true, this may have implications for conservation strategy and planning decisions for Ladakh.

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