is of potable quality. I consumed a large amount of it during my recent four-day study-trip to the forest and there was no health upset. Tribal people do tap the water to quench their summer thirst. *Caraka Samhita* mentions the use of *T. tomentosa* bark decoction in rheumatism, fever and urinary diseases. However, medicinal uses, if any, of the water stored in the stem are not known.

Plants/trees can transport water to great heights through xylem, much like a pump or heart[1,2]. Coconut palm trees fill their heavy fruit with cocoa water at considerable heights[2]. But it is totally unknown how plants/trees like *T. tomentosa* can actually store large amount of 'free' water in the stem. Many woody scandent shrubs like *Calicopteris floribunda* and *Hippocratea arnottiana* trickle cool, potable water when the stem is cut at the base. However, this water must be a backflow from the xylem vessel.

Only a small section of the population (roughly 5–10%, probably old trees) is observed to have stored water in the stem. It would be interesting to know how the water is stored in the stem and why only a small percentage of *T. tomentosa* trees store water.

1. Tyree, M. T., *Nature*, 2003, **426**, 923.
2. Kundt, W., *Curr Sci.*, 1998, **75**, 98–102.

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Secondary succession in the buffer zone of Corbett Tiger Reserve, Uttaranchal

The Corbett Tiger Reserve (CTR) established in 1936 is the oldest national park in the Indian subcontinent. Spread over 1318.54 km^2 in the foothills of Uttaranchal Himalaya, it occupies the Siwalik-terai biotic zone abutting the Himalaya. The reserve is adorned with a unique assemblage of Himalayan flora and fauna.

With the passage of time and increase in animal population, an urgency to expand the protected area was perceived by the forest authorities. With this aim two villages, namely Dhara and Jhirna, which were situated on the southern boundary of the reserve (Dhara ca. 5 km from Kalagarh and Jhirna ca. 7 km from Kalagarh), were relocated to Firozpur–Manpur area situated on Ramnagar–Kashipur highway (Figure 1) during 1990–93. There were about 25 families in Dhara and 30 in Jhirna, which were mostly dependent on the forest products. These inhabitants were rehabilitated on the Ramnagar to Kashipur road in the village Ampokhra. The areas thus vacated were designated as CTR buffer zones.

As time passed, nature began its secondary succession arising from the destruction of previous ecosystems or the abandonment of cultivated land[1], on the abandoned fields and soon they began to show signs of ecological recovery. During this process a tangle of vines, herbs, grasses and small trees arose initially. Such a situation is the primary stage of secondary succession[2]. These were subsequently supported by herbaceous flora, eventually leading to natural forest type. In the CTR, it was noticed that the vacated agricultural fields were soon taken over by grass and the adjoining forest areas started recuperating.

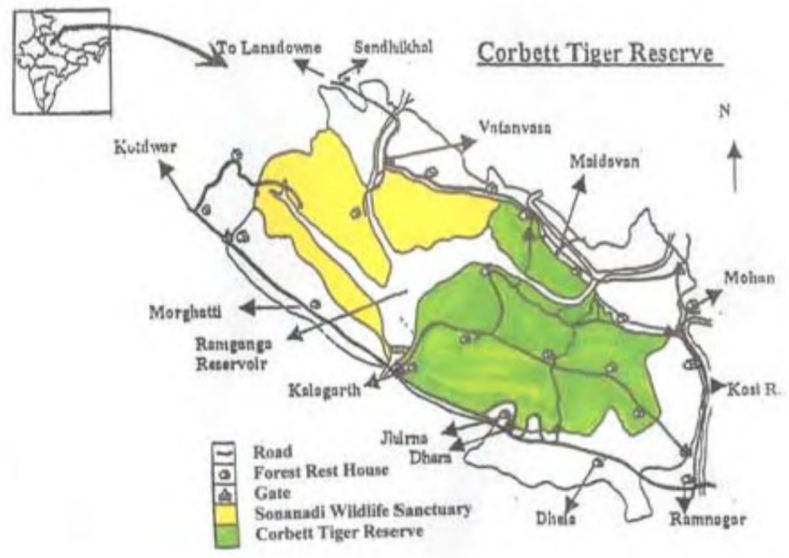

Figure 1. Map of study area.

By 1999–2002 several plant species, namely *Abelmoschus crinitus* Wall., *Acacia pennata* (L.) Willd., *Ailanthus excelsa* Roxb., *Albizia lebbeck* (L.) Benth., *Alternanthera sessilis* (L.) DC., *Cyperus nutans* Vahl., *C. rotundus* L., *Galium apariane* L., *Heliotropium strigosum* Willd., *Indigofera glandulosa* Willd., *Ipomoea nil* (L.) Roth., *Limonia acidissima* L., *Melochia corchorifolia* L., *Mucuna capitata* Wt. & Arn., *M. nigricans* (Lour.) Steud., *Perotis hordeiformis* Nees ex Hook. & Arn., *Saccharum spontaneum* L. and *Thevetia peruviana* (Pers.) Merr., had already emerged in these buffer zones. It was therefore clear that secondary succession was fast progressing and was on way to acquire a climax.

The newly arisen lush green fields started attracting animal population and subsequently colonization began. The grass-eating animals, mainly deer and elephants, slowly migrated towards these areas and even preferred to stay here throughout the monsoon. These animals,

which normally migrated to the Sonanadi area during the previous years, showed no signs of movement outside the CTR.

The climax of this succession is expected to reach in the coming decades, when a persistent dynamic equilibrium between organisms and their habitat would be achieved. This would be a condition when the buffer zones become floristically rich and provide independent support to the life of animal species dependent on them and in turn, to the carnivores, mainly tigers, in order to enhance tiger management programmes. The Jhirna and Dhara regions would then be completely encompassed in the core zone of the CTR. According to the forest authorities, once these fields develop into chaurs (grasslands), the forest cover would increase and this would offer good potential for wildlife-viewing and attract more tourists. Such practices, in turn, would help fetch more revenue for wildlife protection, and support future conservation programmes in our country.

1. McNaughton, S. J. and Wolf, L. L., *General Ecology*, Holt, Rinehart and Winston, Inc., New York, USA, 1973, p. 341.
2. Golley, F. B., *Ecological Succession*, Benchmark Papers in Ecology, 5, Dowden, Hutchinson & Ross, Inc., Stroudsburg, Pennsylvania, USA, 1977.

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Where do we place the Indian cattle *Theileria mutans* of yore?

Theileriosis causes immense economic losses in the improved cattle of the tropics and subtropics. As measures to control the pathogenic *Theileria* have been evolved, attention has now shifted to the benign parasite, *Theileria mutans* described as 'rag-bag', in which were dumped all bovine benign *Theileria* strains of the world[1].

Recent researches revealed that *T. mutans* is a sub-Saharan parasite of African buffalo (*Syncerus caffer*) affecting cattle and sheep, and is transmitted by *Amblyomma* ticks[2]. Another finding that indirect fluorescent antibody test (IFAT) differentiates *Theileria* species of cattle from one another[3], stimulated research on benign *Theileria* occurring in cattle. It soon became clear that British *T. mutans* was different from *T. mutans* of Africa, but was similar to Australian *Theileria* of buffalo and cattle[4,5]. A comparative study showed that benign strains of *Theileria* isolated from cattle in Britain, Australia, Iran, Japan, USA and a more pathogenic stock of *T. sergenti* from Korea were closely related in morphology, serology (IFAT) and transmission by *Haemaphysalis* ticks, except the American stock transmission which is yet to be determined[6]. The authors described the parasites as *T. orientalis*. Some subsequent reports from Ethiopia, New Zealand and Burundi in Central Africa designated benign *Theileria* of cattle as *T. orientalis*, whereas others from Italy, Greece and Australia assigned them to *T. buffeli*.

Two *Theileria* species contending for attention are *T. sergenti*[7] and *T. orientalis*[8] described from cattle of eastern Siberia; the former as pathogenic and the latter as benign. According to the International Code of Zoological Nomenclature, the name *sergenti* is invalid as it is preoccupied by a valid species of sheep parasite. This leaves *T. orientalis* as the only valid species to designate benign *Theileria* of cattle in Eurasia 'as long as its identify with *T. buffeli* has not been established'[9]. *T. buffeli* is known to infect buffaloes in South east Asia. It is transmitted by *Haemaphysalis* ticks and is transmissible to cattle[10]; therefore, the name *T. buffeli* takes preference over *T. orientalis*. Stewart *et al.*[11] support the view that the benign parasite seen in cattle has been correctly named as *T. buffeli*.

Despite the warning on the invalidity of the nomen *T. sergenti*, Japanese authors have stuck to this name basing their assertion mainly on molecular studies reviewed by Gubbels *et al.*[12], who suggested to continue using the name *T. buffeli* for buffalo-derived parasites of cattle.

In India, the 'small piroplasms' affecting almost all cattle have been described as *T. mutans*, as they produced no ill-effects in the host even when occurring in large numbers[13]. A recent publication erroneously mentions *T. mutans* as occurring in the 'Middle-East and Far East, Russia, Africa and Australia'[14].

Some light on benign *Theileria* of cattle and buffaloes in India was shed by Shastri *et al.*[15], who identified the parasite isolated from an ox as *T. orientalis* on the basis of the characteristic 'bar' structure in the host erythrocytes in all the six calves infected by *H. bispinosa*, and positive reaction of sera of three out of six infected calves to IFAT but not to African *T. mutans*. Another study[16] showed that *Theileria* isolated from debilitated and anaemic buffaloes was transmitted by *H. bispinosa* ticks to nine buffalo-calves, but not to cow-calves. Blood smears of the buffalo-calves showed pleomorphic piroplasms and typical 'bar' or 'veil' or both in the host cell, sera of five of them reacted positive to *T. orientalis* in IFAT and not to *T. mutans* or *T. annulata*. The authors left the parasite unnamed, but Uilenberg, who provided findings on morphology and serology opined that unless the infectivity of the buffalo parasite to cattle was further examined, the name *T. orientalis* be retained 'for the moment'[6].

There is another Indian report[17] on five out of seventeen cattle reacting positive to complement fixation test using *T. mutans* antigen obtained from Germany. On the basis of this and other observations the occurrence of *T. mutans* in India was pointed out[18]. Uilenberg replied that (i)