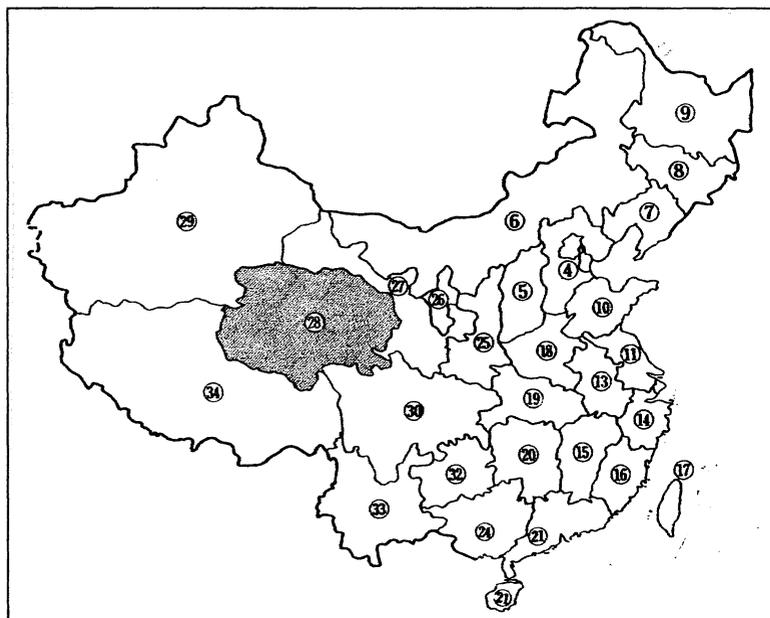


Observations on plant life in Qinghai Province, China

Mike Wilcox

From August to November 2002 I spent three months working in Qinghai Province, China as a member of a project team, sponsored by AusAID – the Australian government's development agency. The project is ongoing to 2006 and we have the task of helping the local government with land-use management, particularly with regard to prevention of soil erosion and alleviating poverty in some of the poorest villages.

(*Populus simonii*), Hebei poplar (*Populus x hopeiensis*), han willow (*Salix matsudana*), weeping willow (*Salix babylonica*), and Chinese white elm (*Ulmus pumila*). Green poplar is by far the commonest tree in villages. For a poplar it is quite drought-tolerant, and so is Chinese white elm. Conditions are mostly too cold and arid for fruit and nut trees, but some that are grown in villages are the mountain apricot (*Prunus armenaica* var. *ansu*), Russian olive (*Elaeagnus angustifolia*), and prickly ash (*Zanthoxylum bungeanum*) – a favoured, peppery condiment in Chinese cooking.



Map of China showing location of Qinghai Province (shaded)

Qinghai is a huge province, and together with Tibet forms the Qinghai-Tibet Plateau – a vast elevated plateau at 3000-4000 m in north-west China. The Plateau is sometimes called the "third pole", and has a mean annual temperature of just 0-3° C. It is also arid, with annual precipitation of only 200- 400 mm. The Tibetan people, who are traditional herders of yak and sheep on the Plateau rangelands, make up one of the biggest ethnic groups living in the province.

Our team is based in Xining, the capital city of Qinghai, which is located in a valley at 2200 m, on the far eastern edge of the Plateau, and taking in the western edge of the Loess Plateau – an enormous area of loess (wind-blown silt), where the land has been continuously cropped for 2000 years.

China has about 30 000 plant species, and Qinghai 3000 (Liu Shangwu 1999). I have so far managed to collect about 300 species, and get to know many of the significant plants in our area.

Cultivated trees and forests

As is typical in Chinese cities, Xining's streets are graced with trees, and there are also trees in villages and along river banks. The dominant trees planted are green poplar (*Populus cathayana*), Xinjiang poplar (*Populus alba* var. *pyramidalis*), small-leaved poplar

Agricultural crops

Arable cropping is the dominant land-use on the loess soils, where the villagers grow spring wheat (*Triticum aestivum*) and potatoes (*Solanum tuberosum*) as their main food crops, and rapeseed oil (*Brassica napus* var. *napus*) as the main cash crop. At higher elevations on the Plateau (3200-3500 m), highland barley (*Hordeum vulgare* var. *nudum*) is important. Other crops commonly seen in the fields are fodder oats (*Avena sativa*), fodder vetch (*Vicia sativa*), and broad beans (*Vicia faba*), whilst in villages there are small plots of hemp (*Cannabis sativa*) grown for its stem fibres, and safflower (*Carthamus tinctorius*) which yields a red dye, and

medicine.

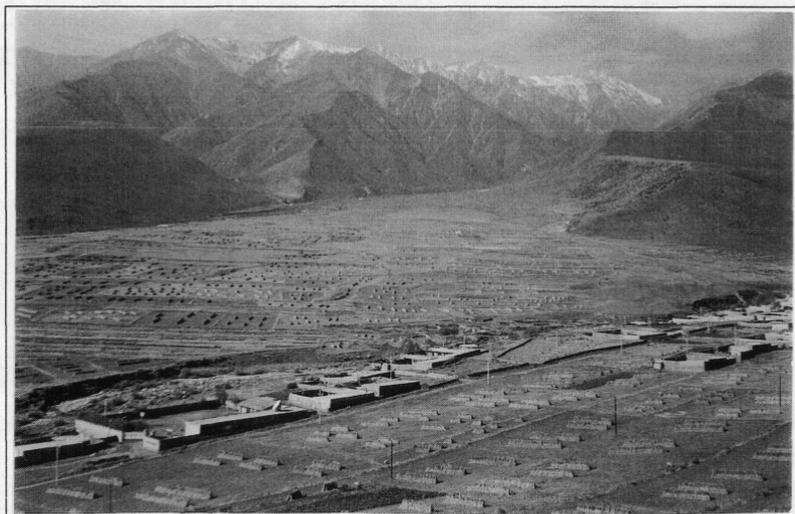
Medicinal herbs and wild vegetables

Something like 1000 plant species are used in traditional Chinese medicines. Most of these are wild plants, but there is increasing interest in cultivating some of the most valuable ones. In Qinghai, caterpillar fungus (*Cordyceps chinensis*) is the most esteemed of all local medicines, and fetches a high price. Village people collect these oddities in the mountains during spring. Medicinal plants of note are members of the Gentianaceae (e.g. *Swertia mussotii* and *Gentiana straminea*), *Potentilla anserina* (Rosaceae), *Astragalus membranaceus* (Fabaceae), and a kind of wild rhubarb (*Rheum tanguticum*), which has a large, yellow root much used in traditional medicines.

Dozens of wild plants are picked as vegetables, a particularly sought-after one being Chinese bracken fern (*Pteridium aquilinum* var. *latiusculum*). The young unfolding fronds are collected in spring.

Natural forests

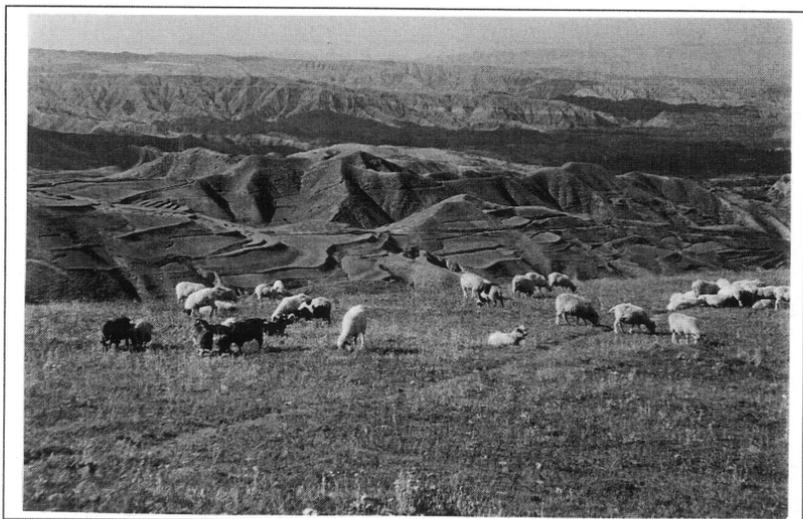
There is not much natural forest where we are working. Centuries ago there were apparently scattered trees such as Chinese white elm on the Loess Plateau, but now this area is tree-less except for small areas where some forests have been planted with the help of irrigation. In the moister mountains with rainfall >450 mm, on north-facing, shady slopes



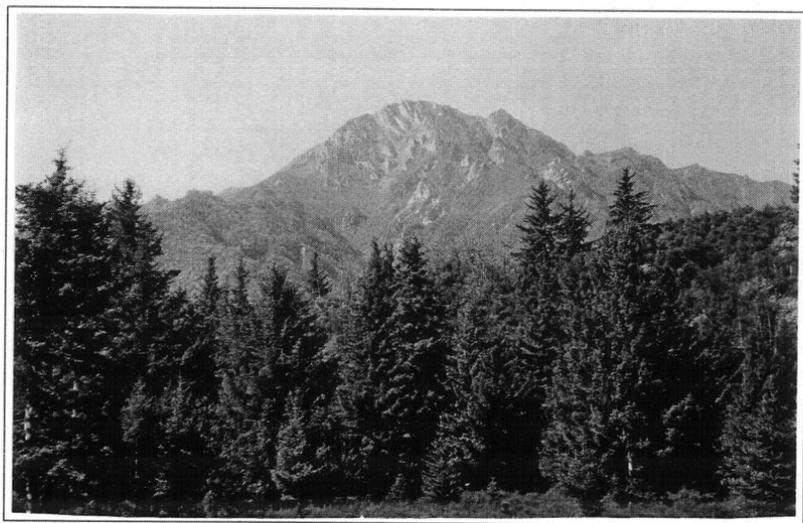
1. Fields of highland barley or qingke (*Hordeum vulgare* var. *nudum*) in mountain village, Guide County, 3500 m. 22 Sep 02



2. Ya Zha Village Committee, Ping'an County. 7 Oct 02



3. Rangeland, Ya Zha village, Ping'an County. The white-flowered plant is *Anaphalis lactea* (Asteraceae). 17 Sep 02



4. La Ji Shan Forest Park, Huangzhong. Qinghai spruce (*Picea crassifolia*). 2 Oct 02

from 2800-3200 m there are some remnants of forest dominated by Qinghai spruce (*Picea crassifolia*), Asian white birch (*Betula platyphylla*) and Chinese aspen (*Populus davidiana*), usually associated with Tibetan Buddhist monasteries. This type of forest is generally absent from south-facing, sunny slopes because centuries ago the local herders are thought to have destroyed the forests to increase the area of winter grazing land for their livestock. Treeless mountains are thus a characteristic feature of the landscape. Qinghai spruce is very cold-hardy, and comparatively drought-tolerant, and is the most important species for mountain afforestation. Logging of the remaining forests was banned in 1998.

The spruce forests are sometimes very open and park-like, but in cool valleys and slopes there is an abundant layer of shrubs and small trees, including species of *Sorbus*, *Rosa*, *Potentilla*, *Ribes*, *Berberis*, *Acanthopanax* and *Viburnum*. On stream flats, Chinese sea buckthorn (*Hippophae rhamnoides* subsp. *sinensis*) grows as a small, stout tree.

Mountain scrublands

Arable land mostly lies below 3000 m. Above this, the vegetation is scrubland and alpine meadows, forming the traditional grazing lands for sheep, goats, yak, and horses. All village are involved with livestock grazing as a major activity. The dominant mountain shrub species are members of the Rosaceae – *Potentilla fruticosa*, *Potentilla glabra*, *Spiraea mongolica*, *Spiraea alpina*, *Sibiraea angustata*, and *Rosa omeiensis*. Other important shrubs (which typically are 0.3-0.7 m tall) are *Salix oritapha*, *Salix taoensis*, *Hippophae tibetica*, *Berberis circumserrata*, *Berberis verna*, *Lonicera hispida*, *Lonicera rupicola*, *Caragana brevifolia*, and *Daphne tangutica*. These shrubs are all deciduous and form dense thickets in areas closed to grazing, but where grazing is heavy, the scrub becomes open, and in extreme cases, reduced to just one dominant woody species – *Potentilla fruticosa*. The pH of the mountain soils is quite high – 7.5 is typical, though loess soils are actually alkaline (pH c. 8.2)- and heathland typical of acidic soils is not developed. In our area, I found only one species of *Rhododendron* – *R. compactum*.

Grasslands and meadows of the Plateau

Over huge areas of the Plateau there are no woody species at all, and the vegetation is entirely made up of grasses, sedges, and forbs. The grass flora of Qinghai is very rich, some of the main genera being *Agropyron*, *Leymus*, *Elymus*, *Roegneria*, *Poa*, *Festuca*, *Trisetum*, *Koeleria*, *Achnatherum*, and *Stipa*. Grasses are actually less common in the heavily grazed meadows than sedges, dominated by numerous species of *Kobresia*, and also *Carex* and *Scirpus* – highly favoured by yak. On drier sites where grazing has been intense, a depleted type of vegetation develops in which various forbs dominate, several of which are very unpalatable or toxic to livestock. Typical of these are *Oxytropis ochrocephala*

(Fabaceae) and *Stellera chamaejasme* (Thymeleaceae).

Loess steppe

The grasslands of the loess hills (2200-2600 m) are dominated by *Stipa* species, particularly *S. breviflora*, *S. krylovii* and *S. grandis*. *Festuca ovina* is also common. Two abundant grasses of loess slopes and land between fields are *Achnatherum splendens* and *Leymus secalinus*. Much of the loess country has been heavily overgrazed, and the loess mantle lost by erosion. Such degraded lands supports just scattered grasses, and characteristic semi-woody herbs such as *Artemisia vestita*, *A. frigida*, *Neopallasia pectinata*, and the common loess daisies *Heteropappus altaicus* and *Ajania fruticulosa*, and *Peganum multisectum* (Zygophyllaceae)- this latter being one of the characteristic plants on otherwise bare, eroded slopes.

Salty desert areas

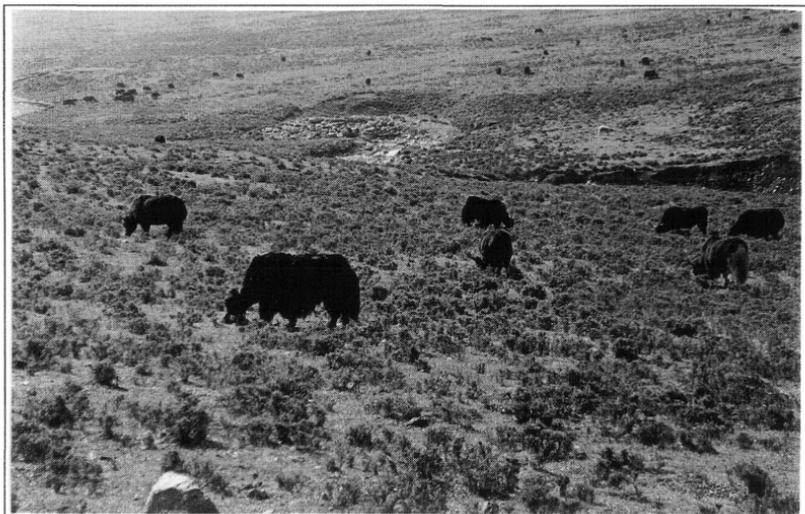
On parts of the regions are sand dunes, salty flats and near desert conditions. The Chaidamu Basin is the biggest and best known saline area, and there are other patches near Qinghai Lake. I have not yet had the chance to visit these places. However, halophytic plants develop abundantly on some heavily irrigated sites, with a high pH, with the Chenopodiaceae (*Agriophyllum*, *Anabasis*, *Atriplex*, *Ceratoides*, *Kalidium*, *Kochia*, *Salsola*, *Suaeda*, *Sympegma*) being very well represented by both herbaceous and woody species. *Nitraria* (Nitrariaceae) is also common.

Plants useful for erosion control

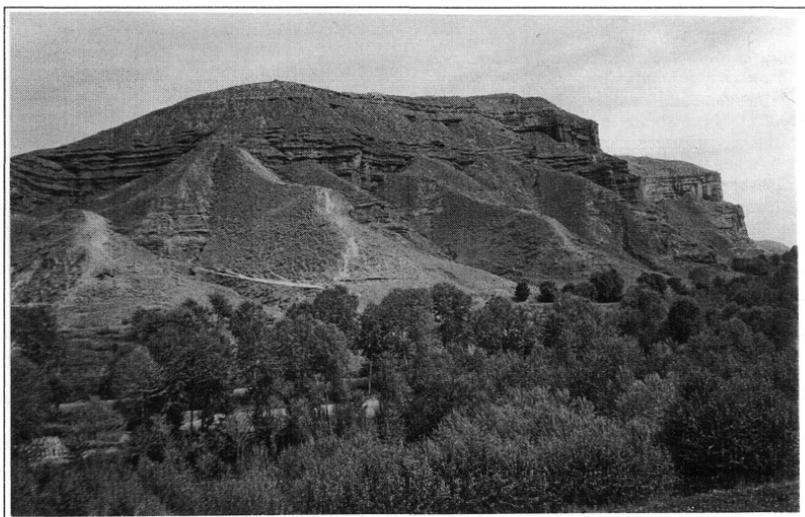
The Chinese government has a number of schemes to combat soil erosion, prevent flooding, and arrest the advance of deserts in northern China. The most famous of these programmes is called the "Three Norths", aimed at stabilising the land in the north-east, north, and north-west. In Qinghai, this programme can be seen commonly on the eroded mountain slopes in the Huangshui catchment (a tributary of the Yellow River). The most successful of revegetation technique on dry slopes is the direct-sowing of seeds of short, thorny woody legumes, *Caragana korshinskii* and *C. microphylla*. Another technique is called "fish-scale" planting, in which deep pits are dug on the steep slopes in an alternating pattern. These pits have channels to guide in water run-off, and so maximise the capture of rain water. Trees such as elm, mountain apricot, sea buckthorn, and sometimes conifers (*Pinus tabuliformis*, *Picea crassifolia*) are planted in the pits in an attempt to a deep-rooted form a woody vegetation which can eventually stabilise the slopes. The tamarisks (e.g., *Tamarix ramosissima* and *T. chinensis*) are also widely used for revegetation work.

Some outstanding features of the flora

So far I have experienced only late summer and autumn conditions, so have not yet seen the marvellous spring flowers of the alpine meadows.



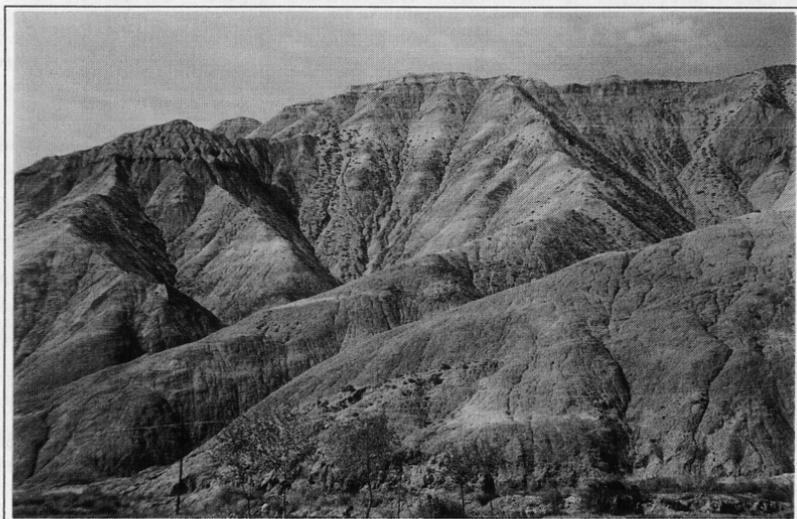
5. Rangeland dominated by the shrub *Potentilla fruticosa* (Rosaceae), Guide County, 3700 m. Yaks grazing. 22 Sep 02



6. Ping'an County. Typical red sandstone buttes, with the loess mantle long since eroded away. Note the remnant vegetation still clinging to the north-aspect slopes. The valley floors in the county are everywhere planted up with qing poplar (*Populus cathayana*). 8 Aug 02



**7. The Ping'an Demonstration Area with snow cover.
23 Oct 02**



8. Advanced soil erosion, Guide County. 22 Sep 02

Autumn is a time for fruiting of the shrubs, and many colourful red or orange fruits were evident, especially on *Berberis*, *Cotoneaster*, *Rosa*, and *Lonicera*. Many Gentianaceae were in flower, and two species of great beauty were *Swertia dichotoma* and *Gentiana lawrencei* var. *farreri*. Gentianaceae is an important family here (*Comastoma*, *Gentiana*, *Gentianopsis*, *Halenia*, *Lomatogonium*, *Swertia*), and I met Dr Chen Shilong of the Northwest Plateau Institute of Biology, who with his colleagues is "doing" the Gentianaceae for the new Flora of China series in English (Missouri

Botanical Gardens).

Other particularly prominent families are Asteraceae, Rosaceae and Fabaceae. *Artemisia* is exceptionally common on the Loess Plateau, and in ruderal vegetation. There are dozens of species, all of which are highly aromatic (wormwood or sagebush). *Potentilla* abounds, with shrubby as well as creeping herbaceous species (e.g. *P. anserina*) in the steppe and meadow vegetation. Of the legumes, *Astragalus*, *Caragana*, *Hedysarum*, *Oxytropis*, and *Thermopsis* widely occur.

Acknowledgements

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Clear felling atop Auckland's highest peak: the destruction of submontane shrubland on Kohukohunui, Hunua Range

T. J. Martin

Kohukohunui is the highest point on the Hunua Range at 688 m altitude. The summit supports a diverse community of submontane shrubland not found elsewhere on the Auckland mainland. Above 600 m altitude, lowland forest gives way to low vegetation dominated by species such as *Quintinia serrata*, *Cyathea smithii*, *Olearia rani*, *Melicytus ramiflorus*, and *Dicksonia squarrosa*. The submontane shrubland at the summit is characterised by the presence of species either scarce or absent at lower altitudes, for example *Griselinia littoralis* (herbarium voucher: AK 208604), *Pseudowintera colorata* (AK 208822), and the abundant *Ascarina lucida* (AK 158503). Kohukohunui is the only confirmed site for *Ascarina lucida* on the Auckland mainland, and is listed as being naturally uncommon and sparse in the Auckland ecological region (de Lange et al. 1999). Bellbird are frequently observed feeding in the summit area, and kokako, kaka, North Island robin and Hochstetter's frog are found in the surrounding forest (pers. obs.)

A rainfall gauge is sited a short distance to the north of Kohukohunui trig, and until recently this was situated in a small clearing c. 10 m in diameter. On visiting the summit in September 2002 it was discovered that an area c. 25 m x 35 m had been clear-felled around the rain gauge (Fig. 1). The species felled included *Quintinia serrata*, *Hebe macrocarpa* var. *latisejala*, *Melicytus ramiflorus*, *Olearia rani*, *Pseudopanax crassifolius*, *Beilschmiedia tawa*, *Pseudowintera axillaris*, *Myrsine salicina*, *Cyathea*

smithii, *Dicksonia squarrosa*, *Hedycarya arborea*, and at least seven *Ascarina lucida*. The tallest trees felled were c. 5 m in height, including a *Quintinia serrata* with a stem diameter of c. 20 cm (at ground level), an *Ascarina lucida* at c. 21 cm diameter, and a *Pseudowintera axillaris* at c. 10 cm diameter. Age estimates for *Ascarina lucida* of this size at Kohukohunui are in the vicinity of 130 years (Martin 2001). The vegetation cleared had been chain sawed close to the ground level from the rainfall gauge to the outer edge of the cleared area, an action not necessary to gain the required line of sight from the gauge to the nearest clear sky. This included the felling of groundcover species such as mature stands of *Blechnum discolor*. Possible wind-throw, due to the strong edge effects at this exposed site, is likely to increase the size of the clearing.

Enquires were made to the Auckland Regional Council regarding this forest clearance. Permission had been granted to clear fell around the gauge, the damage being regarded as a "necessary evil". It was also claimed that the area clear-felled had been previously cleared c. 20 years ago. This failed to explain the seemingly excessive size of the area cleared, and the nature of the clearing, which involved the removal of groundcover species. The size and estimated age of the largest trees felled, would also indicate that the latest clear felling involved a much greater area than the previous clearance.