

Destination Nepal: the land, plants and fieldwork at the crossroads of the Himalaya by Dr. Mark Watson

(written up by Evelyn Stevens)

Mark Watson has worked on the Flora of Bhutan, then the Flora China and currently, for the last 5 years, on the Flora of Nepal, these floras being compiled by the RBGE, in collaboration with others.

His talk and PowerPoint presentation comprised several aspects: i. the topography of Nepal, ii. insight into how fieldwork to obtain the necessary material to make the floras is done and iii. overview of the diversity of ecological habitats and plants found in Nepal.

Geography and topography Nepal is not merely the land of high snowy mountains of popular perception. Instead it ranges strikingly in roughly parallel east-west bands, from flat tropical jungle lands at 60-100m above sea-level in the south, rising through a series of mountain chains of increasing height, to the highest in Everest at 8.848m (29,028ft), all this in the distance of only 50km (31 miles) from south to north. This is the crumple zone where the Indian plate collided with the Asian plate 40 million years ago and there has been a succession of mountain building events ever since. Mark showed a view of the Himalayan chain from space, showing Nepal as a long thin country, running east - west in the middle of the Himalayan chain. It is a small country and would fit easily inside the UK, but is very diverse in its culture, topography, and ecological habitats.

From south to north the bands of land are:

1. The tropical jungle area of the Terai bordering India and comprising a lot of flat savannah and wetland areas only 60-100m above sea level, very hot with steamy jungle noted for elephant safaris etc.
2. North of this is the first band of hills - the Siwalik Hills (120-1800m), made up of quite young, porous sedimentary rocks which are poor agriculturally. They are dominated by evergreen forests with clearings in amongst the trees. The climate here is cooler.
3. Then north again are the Mid-Hills (1000m-3000m). With the increasing altitude the climate is yet cooler and the dominant vegetation is mixed deciduous forests as well as evergreen trees. Magnolias still occur and rhododendrons just begin to occur. There are a lot of deep valleys in Nepal forming fingers penetrating deeply, north-south, into the mountains from the predominant east-west bands of land, the vegetation of the more southerly regions following up the valleys. The soil of the Mid-Hills is fertile. This is most heavily populated area and is where Kathmandu, the capital, is situated. *Pinus roxburghii* is a common tree and it grows into the deep valleys just mentioned. This is an intensively farmed area, with rice and further north maize is grown – it is the bread basket of Nepal. This equitable climate and fertile lands led it to be the area that early civilisations colonised and the architecture of the old buildings, both secular and religious, is incredibly rich. Tourists to-day arrive by air into Kathmandu and don't normally go south to visit the Terai, but make for the higher mountains. In the past explorers had to walk in through the Terai and Mid-Hills to reach the High Hills, which are above 3000m and so, unlike to-day's tourists, became acquainted with the full range of terrains.
4. The High Hills (Great Himalayas) are sub-divided into sub-alpine, up to the tree-line (3000-4000m) and then the alpine region, above the tree-line (4000-5000m). Around the tree-line there is a great diversity of trees and shrubs, e.g. *Malus*, *Sorbus*, *Euonymus*, *Ribes* etc. *Rhododendron arboreum* begins to peter out here. Then above the tree-line you reach an area of dwarf rhododendrons and other dwarf shrubs, then above that again pastures and rough screes. Yaks have a great effect on the upper pastures which are heavily grazed by them and can decimate what a visitor is able to see growing.

Some of the plants at high elevation Mark then mentioned and illustrated some of the plant groups which occur at these high elevations. Many primulas, *Pedicularis*, gentians, *Gaultheria*, and spectacular *Rheum nobile*, and a dwarf form of *Rhododendron lepidotum*.

The next picture showed Neil McCheyne, one of the RBGE horticultural members of staff at Benmore Botanic Garden. This was his first expedition (in 2005) collecting seed of a very dwarf form of *Rhododendron lepidotum*. The RBGE regularly have combined horticultural and scientific expeditions and often junior members of horticulture come too for fieldwork training. Neil has now gone on to lead his

own expeditions – so this illustrated one way in which staff at the Botanic Gardens may progress through the ranks.

Then in the nival zone (5000m plus) there grow plants that can just clutch onto the ground or form dense cushion forming plants like *Arenaria* and *Saxifraga* and, on the scree, plants like *Saussurea*.

Then beyond the very high mountains in Nepal there are areas of intense rain-shadow with desert-like habitats called the trans-Himalayas, with plants that can withstand such arid conditions. They often have spines, presumed to stop them being eaten.

Influence of geographical location and topography on Nepal's important and rich great floral diversity

The next slide was of a very complicated map of Nepal which showed its ecological zones. Mark used it to demonstrate that the vegetation types of Nepal are very complex. Superimposed on the simple horizontal east-west narrow bands of terrain (Terai, Siwalik Hills, Mid-hills, High Hills, and Trans-Himalayas) is a very complicated system of valleys and mountains penetrating into the horizontal bands and breaking them up in an intricate way resulting in a very complex system of ecological zones. The result can be that in places there is lowland type vegetation very near high altitude types. All this contributes to the tremendous number of ecological niches in Nepal and the great diversity of plants.

Another complex aspect of the flora of Nepal is that it is situated at the cross-roads of two Floristic Kingdoms, i.e. Holarctic and Palaeotropical vegetation types. Then at a lower level from that, Nepal is at the cross-roads of five Floristic Regions, namely the Western Himalayan, the Tibetan Plateau, the Eastern Himalayan, the SE Asiatic and the Indian, with plants coming in from each of these different areas. It is a real melting-pot of different influences from the areas all around. A French ecologist working in the 1970s recognised 118 different ecosystems. There are 6200 (maybe up to 7000 when the Flora is completed) flowering plants and ferns in Nepal. This huge diversity is reflected in Nepal being part of the Himalayan Biodiversity Hotspot and thus on a world scale the plants of Nepal are very important.

Pressures on Nepal's flora and the need for conservation measures But there is a lot of pressure on the flora. Logging, intensive agriculture and increasing amounts of road-building. There is also a problem in some areas of invasive foreign plants, e.g. in the Terai. So there are a lot of conservation pressures and the Nepalese are very aware of this. But they are restricted in what they can do as the knowledge of their plants is not very good.

Therefore as the baseline for conservation is very limited – there is urgent need for a comprehensive flora What do we know of Nepal's plant biodiversity? Mark showed some facts and figures which included:

Highest point (Mt Everest 8,848m), lowest 59m and these two areas are only 150km apart (i.e. same distance as from Edinburgh to Fort William). The number of endemic species is not great (about 250). This is because it is a political area, not a biogeographical one, so plants occur which also occur just over the border in Tibet, or India for example. At present, there are only a check-list and incomplete photographic guides to help conservationists. So a flora of Nepal is a high priority in Nepal's *National Biodiversity Strategy (2002)*. The RBGE has been invited to work with the Nepalese and other international partners on a flora of Nepal. The RBGE credentials for doing this are that it has wide Sino-Himalayan floristic experience, the Flora of Bhutan has been completed, the Flora of China is nearly completed and there are excellent plant and literature collections, so the RBGE is well-placed in taking a lead in completing the Flora of Nepal.

But the base-line information that they work from, i.e. the collections in the RBGE herbarium and in the garden are incomplete, so there is a need to maintain an active field-work programme..

Fieldwork to help with the preparation of a flora for Nepal and the part of RBGE in this So the next part of the talk was to explain what the field work is all about. The RBGE has an intensive training programme in Nepal funded by the Darwin Initiative, working with Nepalese botanists getting them out in the field. Although they have been mainly concentrating on the training element, they also wanted to collect new material for their own work. In 3 expeditions they collected 1,727 specimens, over 833 species, an incredible 30 new records for Nepal, including 4 new genera and there were 106 extensions to geographical ranges and 93 extensions to altitudinal ranges. In order to study the flora in greater

detail, they made 2 three-week expeditions to the Everest National Park and collected several hundred specimens and added over 300 species to the National Park list. This is quite amazing and demonstrates dramatically how little is actually known of the flora of Nepal even in their protected areas. So field work does need to continue.

Organising field work expeditions Mark then described something of how expeditions are organised and carried out. First you need to get to where the trail starts. Normally in Nepal the expeditions are trek-based, i.e. walking. They travel around the monsoon time, so it is very wet and land-slides on the roads are frequent. Porters or animals (yaks) carry the luggage. The teams are quite big. For example, on the one to Manaslu last year, they had a team of 8 botanists, 10 sherpa guides, 6 or 7 in the cook team and 65 porters to carry the luggage. i.e. it is a big operation, with quite complex logistics. Each person gets a tent and Mark showed a picture of tents up at high elevation at 5000m. But you need to get up to these heights, and to do so you need to pass through lower lying areas and have to walk for two or three weeks until you reach the high elevations. This means having to go through areas of tropical or subtropical vegetation with lots of cultivation, so you plod through rice paddies and it is very hot and uncomfortable - nevertheless it is important to collect here as well as high up for the Flora. You sometimes have to pass along the side of steep ravines and the tracks can be quite treacherous and can be very wet and flooded. Most of the time in the Monsoon it is raining, although photographs in slide talks often don't give this impression, but this is because cameras only come out of rucksacs to take the pictures when it stops raining! Some of the bridges over the rivers are well built, but others look very precarious. Sometimes there are large rock-falls onto the tracks and one is fortunate not to be passing as they fall! Mud-slides are another hazard. Mark said that he finds great interest and pleasure in the ethnic aspects of the journeys through the country and also the views of the landscape. But eventually you reach the high elevations where the *Meconopsis* and other plants of interest to alpine enthusiasts, grow.

At high elevation where *Meconopsis* are to be found The first picture Mark showed at this point of high elevation plants was a *Saussurea*. For brevity, in what follows, I am just selecting Mark's *Meconopsis* finds. Mark admitted he does not know *Meconopsis* very well and would be seeking some guidance. His first picture was of what he calls *M. horridula* (at least, part of the *horridula* complex – this was scapose, with purple spots on the spiny leaves) – on Manaslu – the commonest one he comes across. He showed several others of this or closely related species, including a plant prominent in a rocky defile on steep cliff, amongst cushion plants in a very harsh environment and also another growing in a crevice on a steep cliff. He also showed a picture of *M. horridula* taken using one of the techniques they use, i.e. pictured *in situ* against a black velvet background.

The next species were slides of deep purple *Meconopsis pinnatifolia*, a close relative of *M. discigera* (in subgenus *Discogyne*) – and this was an exciting new record for Nepal.

The next pictures were of *M. paniculata* - identification confirmed by Paul Egan and others.

Mark then returned to more details on expedition organisation and logistics. He first showed his gear spread around in his hotel room in Kathmandu at 2am before leaving for the field early the next day. Then he showed the camp site. Everyone has their own small tent. There are also larger canvas work tents, one is a cook tent, one for drying specimens with kerosene heaters etc., and a mess/work tent for eating and working up the collections. During the day one is given a packed lunch in a tiffin tin. It is important to keep fluids up and drink plenty on treks. Mark found a nice natural rock pool to have a bath in – picture shown – not a frequent occurrence, but not to be missed! You are given a small bowl of hot water in the morning for washing and need to make use of opportunities during the day for more extensive ablutions!

How herbariums specimens are prepared

The methodology has changed over the years. In 2001, they collected madly into polythene bags as they went along during the day. The polythene bags were then put into a bigger bag. Then at the end of the day, the specimens were sorted out and pressed and notes made. But this way, the plants had suffered and wilted during the day in their bags and the pressed specimens were not as good as they could have been. It was also very time-consuming to do it this way, plus writing the notes, at the end of a tiring day.

Mark said they have now moved on from this methodology. Now they press everything they can into newspapers during the day as they collect the specimens and make all notes in their field books at the time of collecting. Each specimen receives a field number as it is collected. As a result they collect less material but much better information on each collection. The results and the use that can be made of them is a big improvement. Mark showed a number of pictures of the work in progress

Other modern improvements include: Having a satellite phone as a useful safety feature. They now use computers in the field for recording data rather than a main collection book. A generator is needed, but they are quite small – 13 kg and which run for 3 hours on 1l of fuel – which is the cost per day for using computers for data recording, recharging camera and mobile phone batteries and also for lighting (instead of Tilley lamps). A trekking porter will carry 30-40kg, so this is a good investment. Some things never change – Mark showed a picture of the local village children crowding around to see what is happening!

How the plants are pressed Mark then showed further how the plant specimens are dealt with. The plants pressed into newspapers during the day are then put into drying frames and sandwiched between corrugated aluminium sheets and surrounded by a heat reflector or heavy canvas skirt, and then paraffin heaters put underneath the frames. You check the specimens next morning – if they are warm and stiff they are dry, if not they need further drying. Most specimens dry within one or two evenings. The specimens are then put in crates for the porters to carry – and compared with some loads they are very light.

The Japanese press specimens in a rather similar way, but use Primus stoves and give a blast for 2 hours, then turn the presses over, and another 2 hour blast. Their specimens are as a result more crispy.

Seed collection This has not changed at all whilst Mark has been on expeditions. Dry seeds are dealt with as normal and put into packets. Fleshy seeds are put into cotton bags, squeezed to get the juice out and hung up in the top of the tent to dry slowly and can then be put out to dry further on rocks at camp. Some cleaning may then be done in the field, some left till later.

Photography This has changed a lot over the last few years with advances in digital cameras and the flexibility they offer. For example, with some of the little compact cameras you can get very good close ups 1cm away. Photographs are now being able to take over from herbarium records as vouchers of occurrences, when longitude and latitude are also embedded in the image. Mark showed a composite slide with a number of images giving a record of a plant (*Arisaema*) in its habitat, a whole plant closer up, and then details at increasing magnification down to details of the female parts and the stamens of the flower. These pictures can then be used in guide books with more information than given by the use of words and much cheaper than botanical illustrators.

Post expedition processing At the end of the expedition there is a lot of work still to be done. This includes final drying of seeds and herbarium specimens, if needed, sorting and distribution of specimens between intended recipients, lists to be compiled, and plant locations can be entered on Google Earth maps with the data collected by GPS.

Then back in the UK the data is immediately uploaded into the main Flora of Nepal data base and then onto the website of the Flora of Nepal. in the Botanical Locator for Nepal part of the site. Mark illustrated use of the latter with data and images of several *Meconopsis* with which he finished his talk. One unidentified *Meconopsis* collected in far west Nepal in 2009 was identified by Paul Egan from the Botanical Locator as *M. pinnatifolia*. Members of the audience then identified the next that he showed again from the far west of Nepal which was probably *M. robusta*. Then he showed pictures of *M. grandis* growing in Jumla, north-west Nepal in quite a degraded habitat and the last plant was *M. simikotensis* collected in 2008 near Simikot in the far west of Nepal.

Mark's talk was followed by questions and discussion which mainly centred on photographic topics. James Cobb suggested that a protocol should be developed for a check-list for the details needed when plants are photographed in the wild. Mark said that this might well differ for different groups of plants. Other interesting questions and suggestions (on sorts of cameras, use of tripods or not, how to get accurate colours in photographs etc) were made but it was difficult to follow up on the tape, so they will not be elaborated on here.