

The Birch beyond the steppes

Studying the little-known birch of Mongolia

Authors: Paul Bartlett, Marcin Kowalczyk, Prof. Oyuntsetseg Batlai,
Dr. Baasanmunkh Shukherdorj and Choinom Chingis-Od.

A Plant Study expedition to Mongolia in August 2024 to study the native shrub and tree birches of the vast region of Mongolia, their habitat and associated flora. Ranging from a relict woodland in the mountains of the Gobi desert to the remote mountains of Khövsgöl Aimag.



Fig. 1: Betula pendula ssp. mandshurica in the Khugnu Khan mountains

The authors

Paul Bartlett is the Garden Manager at Stone Lane Gardens, an arboretum containing National Collections of *Betula* and *Alnus* near Chagford, Devon, UK.

Marcin Kowalczyk is a Music Publisher from Krakow, Poland. He is a keen dendrologist who carries out many plant study expeditions in the wild.

Prof. Oyuntsetseg Batlai is Professor in the Department of Biology at the School of Arts and Sciences in the National University of Mongolia.

Dr. Baasanmunkh Shukherdorj is a research Doctor at Changwon National University, South Korea.

Choinom Chingis-Od is a Master student at the National University of Mongolia.

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Introduction by Paul Bartlett

Stone Lane Gardens holds National Collections of *Betula* (Birch) and *Alnus* (Alder). The late Kenneth Ashburner became an acknowledged expert on *Betula* and, since the formation of the Stone Lane Gardens charity after his death, we have achieved some notable success in making the organisation better known for our specialist knowledge of Birch.

We are now regularly contacted by other specialists around the world, and have built up some useful international contacts. One of these, Marcin Kowalczyk, a keen dendrologist from Poland, invited me on an expedition to Greenland in 2022, where we successfully studied and recorded the birch of that challenging landscape. Marcin and I teamed up once again on this expedition to study the flora of the uniquely varied landscape of Mongolia.

I welcomed this opportunity to study the unusual and interesting shrub and tree birch of this region. Due to the extreme and remote conditions of their natural habitat, they are an under-studied group of woody plants. Few western botanists have studied them in detail, and there is currently some confusion over the identification of wild populations and the presence of overlapping species and hybrids.

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Stone Lane Gardens,
Stone Farm,
Chagford,
Devon
TQ13 8JU
United Kingdom

paul.bartlett@stonelanegardens.com

<https://stonelanegardens.com/>

The Study areas



Gorkhi-Terelj study area

N 47.9017° E 107.4309°



The Gorkhi-Terelj National Park lies to the east of Ulaanbaatar, a relatively short distance from the capital. It is an area of rolling hills and mountains, with a mixture of forest and open grassland. Very popular with domestic and foreign tourists.

We spent one afternoon in an easily accessible location, where we studied *Betula fruticosa* and *Betula pendula* ssp. *mandshurica*. The *B. fruticosa* formed a dense thicket of multi-stemmed shrubs spreading for over a kilometre along the bottom of a side valley, in a noticeably boggy area. We also noted several shrubby birch amongst the *B. fruticosa* that looked to be intermediate between the two species. We initially surmised that these were probably hybrids. It will be interesting to see what characteristics the seedlings of these trees develop. The *B. pendula* ssp. *mandshurica* were slightly elevated from the valley floor on drier rockier ground.

Yolyn Am study area

N 43.485435° E 104.091247°



We flew south from Ulaanbaatar to reach our second study area, situated at the northern end of the Gobi desert. Yolyn Am is a famous gorge just south of Dalanzadgad, very popular with tourists. It is situated in the Gobi Gurvan Saikhan National Park. The gorge itself is a deep defile in the Zuun Saikhan region of the Gurvan Saikhan mountains. We were initially based near the gorge, as this was the easiest approach route, but our studies focussed on the mountainous areas to the south and east. We spent two nights at our initial campsite before moving further east to spend another night at a more remote location.

We found *Betula microphylla* and *Betula pendula* ssp *mandshurica* in one high valley to the east of Yolyn Am (fig.52). We have learnt that this valley is a relict location in this mountain range, being the only valley that holds enough moisture throughout the year to support a wider range of woody species – until recently this location always retained snow.

Elsen Tasarkhai study area

N 47.342202° E 103.678168°



On our return to Ulaanbaatar, we drove west to the strange desert-like landscape of Elsen Tasarkhai. Part of the Mongol Els, a band of sand dunes that run for 80km through central Mongolia. The tops of the dunes are free draining and devoid of plant life. However, the hollows between the dunes are more sodden and so herbaceous and woody plants can survive despite the seemingly inhospitable conditions.

These hollows contain quite large colonies of *Betula microphylla*, definitely the dominant species. To the north, the Khugnu Khan mountain contained occasional *Betula pendula* ssp *mandshurica*. *B. microphylla* did not extend into these mountains and *B. pendula* ssp *mandshurica* did not appear in the dunes, so there appeared to be no overlap of the two species.

Khövsgöl Aimag study area

N 50.674878° E 99.234916°



Our final study area was north west of Mörön. We travelled overland from Mörön to Altraga where we spent one night at a Ger camp at Boshloi Rock, 8km west of Altraga. Here we studied our most northerly population of *Betula microphylla*. We then travelled further north west over the Öliin davaa pass, where we studied a large population of what we initially believed to be *Betula fruticosa* on upland heath. More detailed examination of the fruits later, led us to conclude these plants are *Betula humilis*. Interestingly the species did not grow in such boggy areas as the *B. fruticosa* we found in Terelj, but favoured slightly drier ground. This may be due to the cooler mountain climate here, where even drier areas still contain a reasonable level of soil moisture. Our final destination was just north of Ulaan Uul, one of the only towns in this area. Here we spent two days searching for *Betula glandulosa*, reported to be in this location. We eventually found a small population on the bank of a large river at the edge of the Khoridol Saridag mountains. This area was also rich in *B. humilis*. We saw only a few shrubs that could possibly be hybrids, with surprisingly little obvious hybridisation between the two species.

Preface

Before we describe the morphological characteristics that we observed, we would like to clarify our method.

We have used 'The Genus Betula' by Ashburner and McAllister (Kew 2013) as our guide. Our descriptions are not complete, but simply add to the information already in that monograph, and sometimes highlight anomalies.

The monograph description does commonly have one flaw, and that is the lack of differentiation between leaves on current year's growth and leaves pre-formed in the previous year. To clarify, the leaves that grow from buds formed in the current season of new growth (neo-formed leaves), are often quite different in shape and margin, than leaves that emerge from buds that were formed in the previous year on older wood (pre-formed leaves). In our descriptions, we seek to describe both types of leaf.

Flora - The Birch

Betula fruticosa



Fig. 2: Paul Bartlett recording observations of *Betula fruticosa*

We examined this species in only one area on our expedition, in Gorkhi-Terelj National Park (the three provenances in Khövsgöl Aimag later being identified as *B. humilis*). It was a short, multi-stemmed shrub that formed large populations in thickets in poorly drained, open grassland, very common in the area we studied. It was never seen in very dry soils.

Hybridisation

We witnessed populations of *B. fruticosa* alongside *Betula pendula* ssp *mandshurica* in Gorkhi-Terelj National Park. We did see several taller, less bushy birch with paler bark. We suspect these are hybrids with nearby *B. pendula* ssp *mandshurica*.

Observations

Using 'The Genus *Betula*' (Ashburner and McAllister 2013) as our guide, we would largely agree with the description of the morphology. However, we have noted some additional observations that broaden the description.

Multi-stemmed shrub up to 6 metres in height. New growth shoots grey-brown, generally hairless or with only a few hairs, very glandular. Leaves small, elliptical to ovate with cuneate, toothless base. 3-5 veins. Neo-formed leaves - leaf margin with larger, sharper teeth. Pre-formed leaves rounder with more serrate margin and smaller teeth. Petiole longer in pre-formed leaves. Buds green-red, generally thin. 2-3mm. Older twigs grey-brown, roughly glandular with white resin glands. Immature male catkin green-brown and smooth, many hairs around edge of scales. 1-2 at tip of new growth. Fruit erect to horizontal. Borne singly. Fruit scale – lobes do not separate until near tip. Mid lobe slightly longer. Wing less than or equal to nutlet width.

Companion species

Larix sibirica, *Dasiphora fruticosa* (syn. *Potentilla fruticosa*)



Fig. 3: typical multiple-stem growth



Fig. 4: Neo-formed leaf



Fig. 5: Male catkins



Fig. 6: Mature fruit

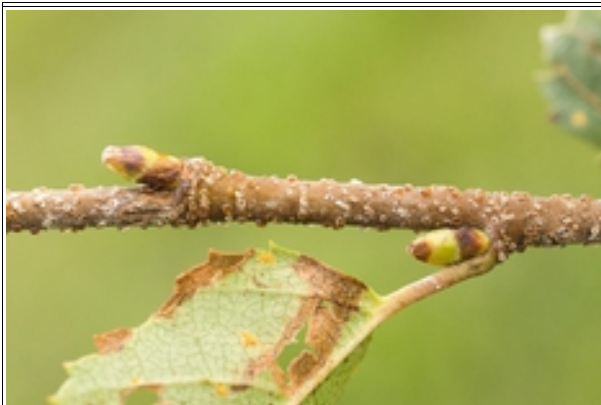


Fig. 7: Current season's shoot showing abundant resin glands



Fig. 8: Pre-formed leaves

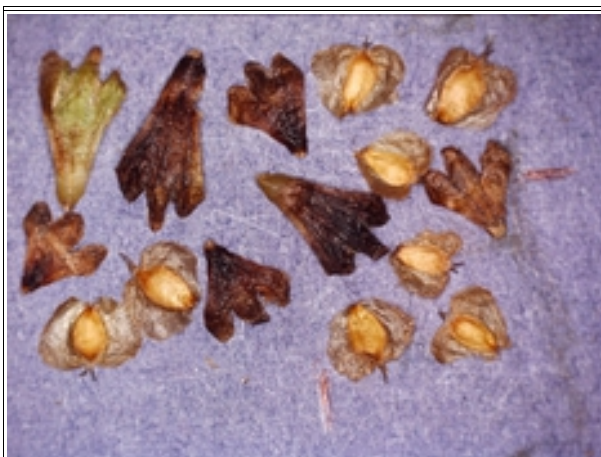


Fig. 9: Nutlets and fruit scales

Betula glandulosa



Fig. 10: *Betula glandulosa* on bank of Gun river

We studied this birch in one location on the bank of the Gun river, near Ulaan Uul in Khövsgöl Aimag. We had coordinates for two locations from previous expeditions, but we could only find it in one location.

It grew in great quantity on one north-facing bank of the Gun river, where it was partly shaded on the edge of *Larix sibirica* woodland. The population was the dominant shrub in this area, which covered about 200m x 50m. The plants were about 2 feet high and often had a spread of up to 4 feet wide. We could find no obvious reason why

B. glandulosa occupied this area of bank, when all the other north facing banks in the area consisted only of *B. humilis*. The plants were growing on a moderate slope that was quite moisture-retentive due to the dense covering of mosses.

Hybridisation

This population of *B. glandulosa* were surrounded by many *B. humilis*. We studied the *B. humilis* in the immediate vicinity but found very little sign of hybridisation. Just a couple of plants that had slightly unusual features (M24030 - smaller plant with smaller, rounder leaves). It is possible that the flowering times do not coincide, and this would be worthy of further study.

Observations

The plants broadly fitted that of 'The Genus *Betula*' (Ashburner and McAllister 2013) with the addition of the observations we made in our Greenland expedition report (2022).



Fig. 11: Pre-formed leaves



Fig. 12: Male catkin on tip of current season shoot



Fig. 13: Mature fruit



Fig. 14: Neo-formed leaves



Fig. 15: Nutlets and fruit scales

Betula humilis



Fig. 16: *Betula humilis* in heathland near Ulaan Uul

We examined this species in three locations on our expedition, all within Khövsgöl Aimag. It was a short, multi-stemmed shrub that formed large populations in thickets in heathy, open grassland, although we also found it in glades among stunted larch woodland. It was very common in the area we studied.

Although this shrub is almost identical to the *B. fruticosa* we studied in Gorkhi-Terelj, we never saw it growing in such damp, boggy conditions. It would appear to require moist but not water-logged soil.

Hybridisation

On the bank of the Gun river, we found *B. humilis* growing around an isolated population of *B. glandulosa*. We studied the *B. humilis* in the immediate vicinity but found very little sign of hybridisation, despite the close proximity of the two species. Just a couple of plants that had slightly unusual features (M24030 - smaller plant with smaller, rounder leaves). As already noted in the section on *B. glandulosa*, it is possible that the flowering times do not coincide, and this would be worthy of further study.

Observations

Using 'The Genus *Betula*' (Ashburner and McAllister 2013) as our guide, we would largely agree with the description of the morphology. However, we have noted a few additional observations:-

Immature male catkin brown and smooth, many hairs around edge of scales. 1-2 at tip of new growth. In contrast to 'The Genus *Betula*', we only saw male catkins on the tips of current season growth, never further down the twigs on spurs of the previous season's wood. Fruit scale – lobes separate about halfway along. Mid lobe noticeably longer.

The main difference between *B. fruticosa* and *B. humilis* in Mongolia appears to be the fruit scales. The lobes of *B. fruticosa* separate near the tip of the scale and the central lobe is only slightly longer (Fig.9). The lobes of *B. humilis* separate about halfway along the scale and the central lobe is noticeably longer (Fig.23). Bark colour at the base of stems is also paler on *B. fruticosa*, although this may not be apparent on immature shrubs.

Companion species

Larix sibirica, *Salix* spp., *Rhododendron tomentosum*, *Rhododendron parvifolium*, *Vaccinium uliginosum*



Fig. 17: Bark colour always dark



Fig. 20: Male catkin showing hairs around edge of scales



Fig. 22: Neo-formed leaf and resin glands on current season shoot



Fig. 18: Male catkins on tip of current season shoots



Fig. 19: Pre-formed leaves



Fig. 21: Mature fruits



Fig. 23: Nutlets and fruit scales

Betula microphylla



Fig. 24: *Betula microphylla* in the dunes of Elsen Tasarkhai

We studied this species in three, widely separated, areas of Mongolia. Yolyn Am, Elsen Tasarkhai and Khövsgöl Aimag. Where found it is a common tree, forming dense woodland in Yolyn Am and in the wetter basins of the Elsen Tasarkhai dunes. Further north it is more widely spaced in the drier gullies of Boshloi Rock (Khövsgöl Aimag) though still common. Although there were mild differences between the provenances, the species was broadly similar and easy to identify throughout its range. It is reliably multi-stemmed, and although the twigs, fruits and leaves are very similar to *B. fruticosa*, it

becomes taller, with broader trunks, than *B. fruticosa*. The bark is usually paler, turning to a lovely creamy white in older trees. One tree in Yolyn Am did exhibit very rich brown/red bark, but this was very unusual. The seeds and scales of the fruit have some noticeable differences to *B. fruticosa*, although there is variation.

Hybridisation

In Yolyn Am, the occasional *B. pendula* ssp *manshurica* grew among the *B. microphylla*. There were no obvious hybrids, although some *B. microphylla* appeared much taller and whiter than others. However, this could be down to very localised environmental factors. In Elsen Tasarkhai, no other birch inhabited the dunes. But again *Betula pendula* grew as an occasional tree just north of the dunes on higher, rockier ground. We saw no examples of hybridisation here. At Boshloi Rock we did not see any other birch species.

Observations

Using 'The Genus *Betula*' (Ashburner and McAllister 2013) as our guide, we would largely agree with the description of the morphology. However, we have noted some additional observations that broaden the description.

Bark often creamy white, especially on mature trees. Young shoots had almost no hair. Buds red/brown. Leaves elliptical to ovate with cuneate, toothless base. 4-6 veins. Neo-formed leaves - leaf margin with larger, sharper teeth. Vein-end teeth often larger. Pre-formed leaves rounder with more serrate margin and smaller, blunter teeth. Petiole sometimes longer in pre-formed leaves. Fruit scales dividing near tip with very short lateral lobes. Nutlet wing equal to or greater than width of nutlet.



Fig. 25: Consistently pale bark and multiple stemmed habit



Fig. 26: Current season shoot with conspicuous resin glands. Also older twig with pale glands



Fig. 28: Pre-formed leaves



Fig. 27: Neo-formed leaf

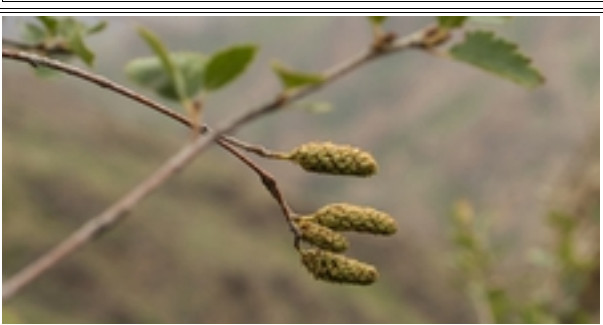


Fig. 30: Mature fruits

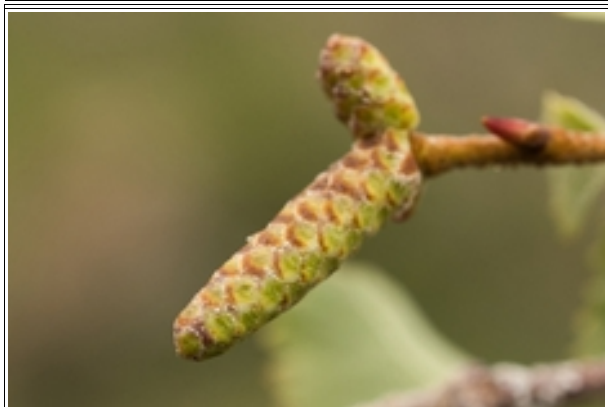


Fig. 29: Male catkins on tip of current season shoot

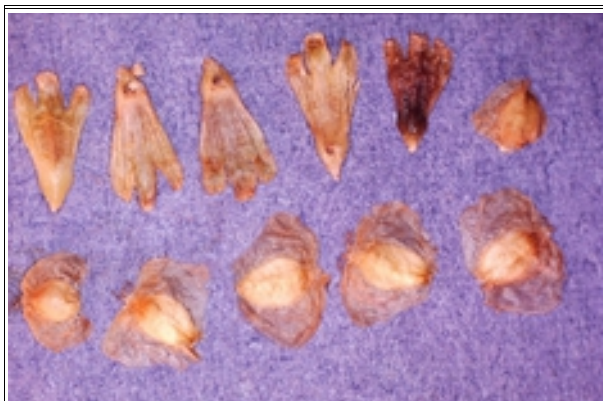


Fig. 31: Nutlets and fruit scales (Khövsgöl Aimag)

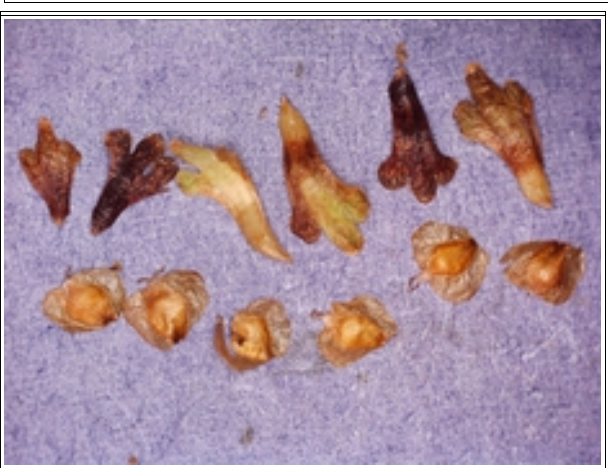


Fig.32:Nutlets and fruit scales (Yolyn Am)

Betula pendula ssp. *mandshurica*

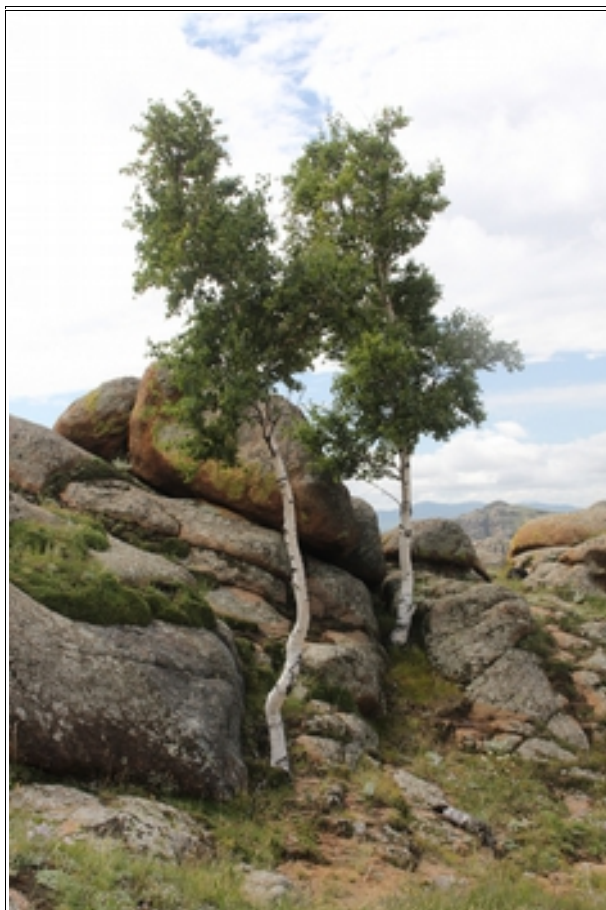


Fig. 33: *Betula pendula* ssp. *mandshurica* in the Khugnu Khan mountains

We studied this species in three, widely separated, areas of Mongolia. Gorkhi-Terelj, Yolyn Am and Khugnu Khan near Elsen Tasarkhai. We only found it as an occasional, isolated tree. It was never common.

It appeared higher up the hillsides than the shrubby birches, although we found it intermingled with *B. microphylla* near Yolyn Am. It was always an attractive upright tree with pure white bark.

The Khugnu Khan provenance exhibited some differences in leaf, bud and fruit that would warrant further study, especially with other nearby provenances.

Hybridisation

In Gorkhi-Terelj, we found *B. pendula* quite near *B. fruticosa*. Among the *B. fruticosa* there were several larger, paler shrubs with larger leaves that could have been hybrids of the two. In Yolyn Am we never saw any obvious hybrids, although *B. pendula* and *B. microphylla* existed side by side. In Elsen Tasarkhai, *B. pendula* were found in hills just to the north of the dunes containing *B. microphylla*, but we found no sign of hybrids there.

Observations

Using 'The Genus *Betula*' (Ashburner and McAllister 2013) as our guide, we would largely agree with the description of the morphology. However, we have noted some additional observations that broaden the description.

Shoots – we found the Yolyn Am and Terelj provenances to be glandular and warty. However, the Khugnu Khan provenance had smooth shoots. Buds of Khugnu Khan provenance 6-8mm long. Other provenances 2-5mm. Neo-formed leaves – sharply toothed with longer vein-end teeth and sometimes little double-toothing. 5-6 veins. Slightly glossy (although Khugnu Khan leaves matt). Pre-formed leaves – bigger leaves and longer petioles. Truncate at base. Petiole of Khugnu Khan provenance 15-20mm, other provenances 20-40mm.



Fig. 34: Male catkins at tips of current season shoots



Fig. 35: Mature fruits



Fig. 37: Bark consistently white



Fig. 36: Neo-formed leaves



Fig. 38: Pre-formed leaf

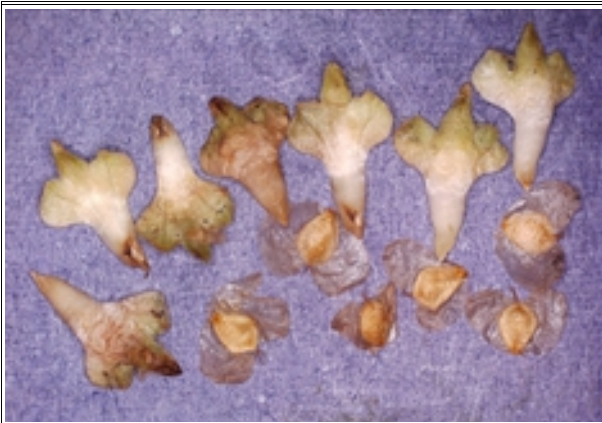


Fig. 39: Nutlets and fruit scales (Terej N.P.)

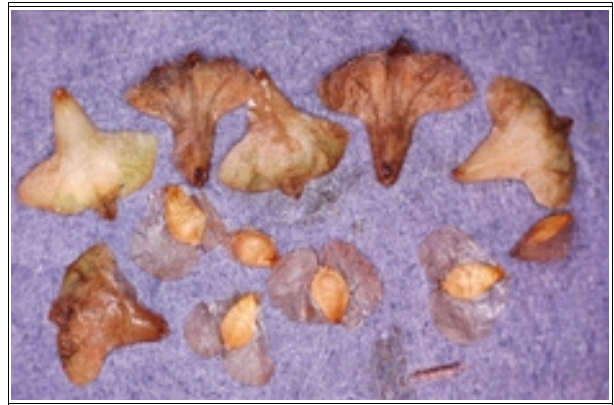


Fig.40: Nutlets and fruit scales (Khugnu Khan)

Flora - Other woody plants

Salix



Fig. 41: unknown Salix

There were several species of *Salix* (Willow) observed in the Yolyn Am study area. They were distributed fairly widely throughout the one high valley in the Zuun Saikhan region of the Gurban Saikhan mountains to the east of the gorge, where we saw *Betula microphylla*. *Salix* and *Betula* are often found in similar environmental conditions, so this is not surprising. *Salix* were also present on the other hillsides and valleys around that area, but only at the edges of watercourses, the slopes and ridges being too arid to support them. We have tentatively identified one species as *S. rorida*. This had attractive white bark on the young stems. The 2005 study *Flora of Gurban Saykhan mountains* identifies others as *S. taraikensis* and *S. bebbiana*.

Salix were also seen frequently in the Khövsgöl Aimag study area.

Larix sibirica

Larix sibirica (Larch) is probably the most common conifer in Mongolia. Often found in the same areas as *Betula*. We commonly saw *L. sibirica* in the Gorkhi-Terelj study area and in the Khövsgöl Aimag study area, where it was the dominant tree species.

Pinus sibirica

We saw *Pinus sibirica* occasionally in mainly *Larix sibirica* forest around Ulaan Uul in the Khövsgöl Aimag study area.



Fig. 42: Larix sibirica with Betula humilis at it's base. (Ulaan Uul)

Juniperus sabina

A very common low, spreading shrub in the hills of the Yolyn Am study area, where it forms dense thickets. In many areas of Mongolia this shrub is reportedly under threat from cutting for ritualistic incense burning. We certainly witnessed thickets that had been reduced considerably by harvesting.

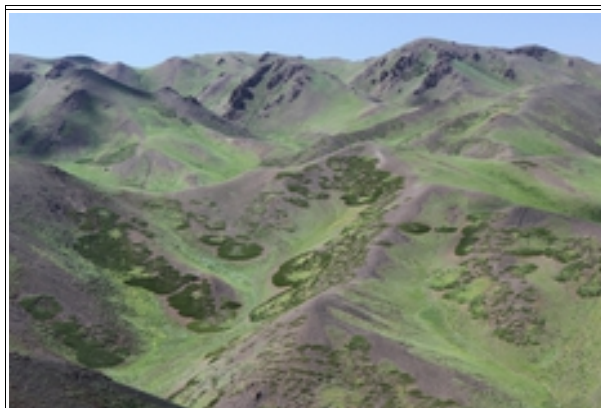


Fig. 43: Carpets of *Juniperus sabina* near Yolyn Am



Fig. 44: *Cotoneaster mongolicus* near Yolyn Am

Cotoneaster mongolicus

Quite a common small shrub in the one high valley in the Zuun Saikhan region of the Gurban Saikhan Mountains to the east of the gorge, where we saw *Betula microphylla*. We also saw occasional plants in the Khugnu Khan mountains just to the north of the Elsen Tasarkhai study area.

Prunus pedunculata

This species was found in the arid hills of the Yolyn Am study area. Usually as single specimens but occasionally in very small groups. A small, tough shrub with somewhat tangled growth. Mature fruits appear almond-like. Bark was reddish-grey on mature stems and branches. Leaves were sparsely toothed.



Fig. 45: *Prunus pedunculata* near Yolyn Am

Rosa acicularis

A common spiky shrub in the Yolyn Am study area, especially near watercourses.

Ribes aciculare

Very common small shrub in the Yolyn Am study area, often forming thickets. Distinct mass of spines on the stems. Mature fruits sweet and edible. Similar to cultivated gooseberry.



Fig. 46: *Ribes aciculare* near Yolyn Am

Lonicera microphylla

Small shrub with attractive berries that varied between orange and red. Common on the arid hills of the Yolyn Am study area.



Fig. 47: *Lonicera microphylla* near Yolyn Am

Ulmus

In the Elsen Tasarkhai study area we saw one species of *Ulmus* (Elm), in the Khugnu Khan mountains to the north, which we tentatively identify as *Ulmus pumila*.

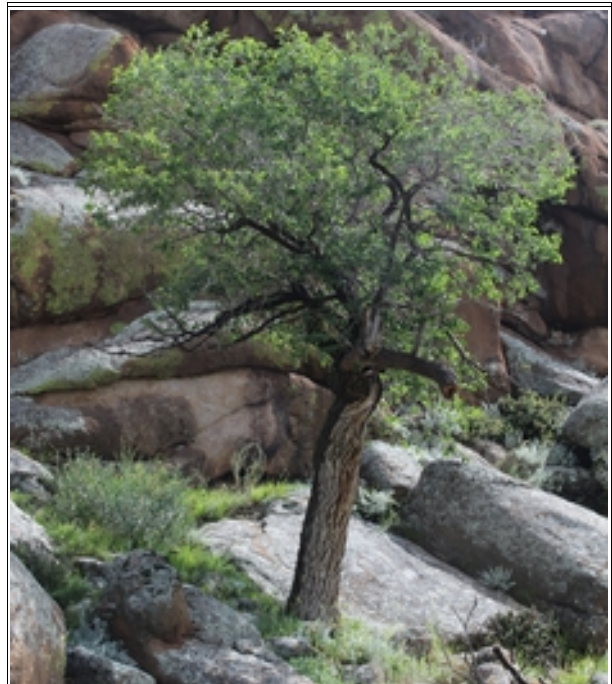


Fig. 48: *Ulmus* sp. in the Khugnu Khan mountains

Berberis sibirica

We found this small shrub in the Yolyn Am study area, mainly near water-courses. Sharp spines on the stems and spiky margins to the evergreen leaves. We also saw this shrub occasionally in the Khövsgöl Aimag study area.



Fig. 49: *Berberis sibirica* near Yolyn Am

Rhododendron



Fig. 50: *Rhododendron tomentosum* near Ulaan Uul



Fig. 51: *Rhododendron parvifolium* near Ulaan Uul

We found two species of dwarf *Rhododendron* during our expedition, both in the Khövsgöl Aimag study area. *Rhododendron tomentosum* was found in dense woodland, mainly *Larix sibirica*, near Ulaan Uul. We found one plant in flower, which enabled the identification. In the same area but also in more open heathland, we found plants of what we believe to be *R. parvifolium*.

Vaccinium

This small shrub was common in the *Larix sibirica* forests of the Khövsgöl Aimag study area, where we feasted on the delicious berries. We believe the species was *V. uliginosum*.

Summary of expedition findings and observations

by Paul Bartlett & Marcin Kowalczyk

Our reason for setting up this expedition, was to study the *Betula* of Mongolia in the wild, so that we could gain a better understanding of them. Their range, habitat, morphology and variation. Neither of us had much knowledge of Mongolian birch beforehand, as there are few examples of them in UK or European gardens. Indeed there seemed to be some confusion, or at best a lack of clarity, about the species that inhabit this remote part of the world. We were particularly interested to observe any potential hybridising between species. As northern Europeans, we were also keen to observe birch growing in sand dunes (Fig.24)! And as always on these expeditions, we used the opportunity to observe the other plant-life inhabiting the areas we visited, albeit briefly.

When we began planning the expedition, we had to be realistic about what we could achieve in two weeks. We spent much time in consultation with our Mongolian team about what was possible. We were lucky. The weather and the transport were kind to us. Time is always short and we would have loved to spend more time exploring the study areas and beyond. What we really got was a taster of Mongolia, and it would be a dream to return for further exploration.

History has endowed Mongolia with a host of birch names. *Betula fruticosa*, *Betula microphylla*, *Betula tessingolica* – now considered to be *Betula microphylla*, *Betula reznitzenkoana* – also considered to be *Betula microphylla*, *Betula hippolyti* – considered to be *Betula pendula* ssp *mandshurica*, *Betula fusca* – considered to be *Betula fruticosa*, *Betula exilis* – considered to be *Betula glandulosa*, *Betula rotundifolia* – considered to be *Betula glandulosa*, *Betula nana* ssp *rotundifolia* – considered to be *Betula glandulosa* and *Betula platyphylla* – now *Betula pendula* ssp, *mandshurica*.

Notably absent from this list is *Betula humilis*, which in Mongolia has generally been treated as *B. fruticosa* (Skvortsov - referenced in *Flora of China*). However, the small, dark barked shrubs we saw in the Khövsgöl Aimag would appear to be *Betula humilis*, not *B. fruticosa*, which in all our studies has a paler bark and differs in the fruiting scales. This conclusion backs up the findings of Maurice Foster (MF325).

We were very fortunate to be able to visit the high northern slopes of the Zuun Saikhan region of the Gurban Saikhan mountains to the east of the Yolyn Am gorge. It was educational to witness the vegetation found in the uniquely humid conditions of just one high valley in that area, and compare it with the drier slopes around it.

This one humid valley appears to be a relict of how the entire range would have appeared in the lower temperatures of the past. Multiple sources suggest that ice fields were once a year-round feature of the peaks around Yolyn Am.



Fig. 52: Marcin Kowalczyk negotiating an outcrop in Zuun Saikhan (Birch woodland behind)

Indeed this was a feature that drew many tourists to the area. Sadly the ice appears to have been retreating in recent years. We did not witness any ice on the slopes. But clearly the high valley we studied holds more moisture than those around it. This is apparent by the presence of dense (albeit stunted) woodland stretching across the north facing slopes from 2340m to 2540m. This contained a mixture of *Betula*, *Salix*, *Juniperus* and *Cotoneaster*. Lesser woody genera were *Ribes*, *Clematis* and *Rosa*. One hypothesis (*Mountain forest islands and Holocene environmental changes in Central Asia: A case study from the southern Gobi Altay, Mongolia: 2007 - Georg Mieke et al*) suggests that woodland only exists on sites undisturbed by human activity. They suggest the surrounding slopes have been denuded of woodland by human activity and subsequent livestock grazing, thus creating more arid areas unlikely to re-establish. The soil in areas covered by woodland retains permafrost and moisture for longer, whereas the more open areas lose soil moisture early in the season and so create poor conditions for woody plant growth. It may also be significant that the wooded area is more hemmed in by a high ridge and steep cliffs. Thus making it more sheltered and creating a more humid environment. In the surrounding hills, *Betula* was entirely absent, while most of the other woody genera were only witnessed by watercourses. *Lonicera microphylla*, *Prunus pedunculata* and *Berberis sibirica* were present in these drier slopes, where they were absent in the more humid area. It may be inevitable that a changing climate eventually renders even that one high valley uninhabitable for the genera currently occupying it. It is therefore essential that the area continues to be studied, all flora recorded, and where possible seed collected and ex-situ collections created.

In the Gorkhi-Terelj National Park we witnessed what we believe to be hybridising between *Betula fruticosa* and *Betula pendula* ssp *mandshurica*. It will be interesting to see the behaviour and variation of any seedlings from this area.

In Elsen Tasarkhai we were able to study birch in a very unusual environment. This vast area of sand dunes appears to be an unlikely habitat for birch, so we were intrigued by their presence. Amongst the dunes *Betula microphylla* are the most dominant woody plant, and appear to thrive in the hollows between the dunes. Local botanists informed us that rain-water passes quickly through the sand of the dunes and collects in these hollows. This creates a moist, sheltered zone, which has been colonised by the birch. We did not witness any obvious hybridising with the *Betula pendula* ssp *mandshurica* from a nearby mountain.



Fig. 53: *Betula microphylla* among the sand dunes of Elsen Tasarkhai

In the Khövsgöl Aimag near Ulaan Uul, we studied one isolated population of *Betula glandulosa*.

It seems surprising that this shrub appeared as a healthy population in one site and yet was absent from every other likely site nearby. There appeared to be no obvious difference between the sites. Perhaps a changing climate is favouring *Betula humilis*. It is certainly the larger of the two shrubs so presumably would out-compete *B. glandulosa*. We saw little sign of hybridising, apart from one or two *B. humilis* with a smaller stature and rounder leaves. It will be interesting to see the behaviour and variation of any seedlings from this area.



Fig. 54: Marcin Kowalczyk, Prof. Oyuntsetseg Batlai, Paul Bartlett and Choinom Chingis-Od

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Difficulties encountered

by Paul Bartlett & Marcin Kowalczyk

Travel

Mongolia is a very large country with a limited number of good roads. The vast distances between study sites necessitated the use of internal flights during the expedition. The standard form of transport for Mongolians is 4 wheel drive vehicles.

Once off the main highways, we often had to travel for hours over plains and hills on a mixture of earth and stone tracks. It was sometimes necessary to backtrack when routes were impassable, or where tracks suddenly went off in the wrong direction. Our drivers used satellite imagery on their phones to plan the route ahead, and there was much consultation with passing shepherds and drivers to ascertain the best route. It generally takes a long time to get anywhere once off the roads, as the rough ground means slow



Fig. 5: Our transport (the car, not the camels behind!) with driver Senna

speed. However, we were very lucky with the weather, and so the ground conditions were generally favourable for driving. Our drivers, picked by our Mongolian botanist partner Dr. Baasanmunkh Shukherdorj ahead of our expedition, were excellent. Internal flights were also efficient. The travel arrangements had to work well for our short time in the country. We had planned the schedule so that we could have missed one site in the event of unexpected delays. Fortunately this was unnecessary. Nonetheless our expedition was still very frenetic, and we, in a country steeped in a nomadic lifestyle, felt like nomads ourselves.

One of the most limiting factors for moving around the country, was that all internal flights operated from the capital, Ulaanbaatar. There were no direct flights between regions. So time was spent getting back to the capital, in order to go straight out to another region. And the roads around Ulaanbaatar were so congested that hours were spent just sitting in queues every time we returned to the capital.

Food and Accommodation

When we planned the expedition, we assumed we would be spending some time away from our transport. So we took tents, stoves and plenty of dried food. However, we always managed to get our vehicle near to the study sites. So were able to camp by the vehicle and carry out our explorations in day trips. With hindsight we could have bought food locally (which we did for the drivers and our botanist guide Choinom) and cooked at the campsite each day. On a couple of occasions we slept in Gers (Yurts) which were a lot more comfortable than camping!



Organisation

We are indebted to our Mongolian botanist partners Prof. Oyuntsetseg Batlai, Dr. Baasanmunkh Shukherdorj and Choinom Chingis-Od of the National University of Mongolia. They acted as interpreters, guides and cultural ambassadors. Their help was pivotal in the success of our expedition. Above all they were friendly and excellent hosts. During the planning of our expedition, we contacted many botanists and scientists who had knowledge of Mongolia. One particular contact, Prof. Karsten Wesche, Director of Senckenberg Museum of Natural History, was very helpful in supplying essential contacts and scientific papers. We were delighted to meet him in Ulaanbaatar during our expedition.



Itinerary

- Day 1 – Arrived in Mongolia. Landed in Ulaanbaatar. Met Mongolian botanists from University. Short trip to Terelj National Park. Stayed in Ulaanbaatar hotel.
- Day 2 – Early flight to Dalanzadgad. Met driver and drove to Yolyn Am. Set up camp and spent afternoon botanising in nearby valleys and hills.
- Day 3 – Whole day botanising in high, wooded valley.
- Day 4 – Drove to area east of Yolyn Am to study other hills and valleys. Set up camp and spent afternoon botanising in hills nearby.
- Day 5 – Drove back to Dalanzadgad. Flight back to Ulaanbaatar. Drove west to Elsen Tasarkhai. Stayed at Ger camp.
- Day 6 – Spent day botanising at Elsen Tasarkhai and nearby hills. Drove back to Ulaanbaatar. Stayed in hotel.
- Day 7 – Early flight to Moron. Met driver and drove to Altraga and then to Boshloi. Spent afternoon botanising in gullies around river. Stayed at Ger camp.
- Day 8 – Drove to Ulaan Uul. Botanising at two locations on route. Set up camp outside Ulaan Uul.
- Day 9 – Botanising all day.
- Day 10 – Drove back to Moron. Stayed in hotel.
- Day 11- Early flight back to Ulaanbaatar. Checked into hotel. Cleaned and prepared seeds.
- Day 12 – Morning meeting at National University with Head of Biology department. Handed over seed collections. Rest of day free for sight-seeing.
- Day 13 – Leaving Mongolia. Early flight to Istanbul for onward connections.

Plant list

Collection no.	Species	Date collected	Location	Coordinates & altitude	Comments
M24001	<i>Betula fruticosa</i>	17/08/2024	Turtle Rock, Terelj National Park	N 47° 54' 13.9", E 107° 25' 8.18" (1509m ^{asl})	valley floor – boggy
M24002	<i>Betula fruticosa</i>	17/08/2024	Turtle Rock, Terelj National Park	N 47° 54' 14.9", E 107° 25' 7.92" (1509m ^{asl})	valley floor – boggy
M24003	<i>Betula</i> – possible hybrid	17/08/2024	Turtle Rock, Terelj National Park	N 47° 54' 15.4", E 107° 25' 7.53" (1509m ^{asl})	valley floor – boggy
M24004	<i>Betula pendula</i> ssp <i>mandshurica</i>	17/08/2024	Turtle Rock, Terelj National Park	N 47° 54' 47.9", E 107° 25' 3.86" (1539m ^{asl})	valley floor – boggy
M24006	<i>Betula microphylla</i>	19/08/2024	Next valley east of Yolyn Am gorge, Gobi	N 43° 28' 1.62", E 104° 05' 4.28" (2531m ^{asl})	valley floor – boggy - pale banked so possible hybrid with nearby <i>B. pendula</i>
M24007	<i>Betula microphylla</i>	19/08/2024	Next valley east of Yolyn Am gorge, Gobi	N 43° 28' 1.26", E 104° 05' 4.72" (2543m ^{asl})	growing at base of Turtle Rock
M24008	<i>Betula pendula</i> ssp <i>mandshurica</i>	19/08/2024	Next valley east of Yolyn Am gorge, Gobi	N 43° 28' 1.11", E 104° 05' 5.00" (2538m ^{asl})	max elevation of woodland
M24009	<i>Betula microphylla</i>	19/08/2024	Next valley east of Yolyn Am gorge, Gobi	N 43° 28' 1.64", E 104° 05' 5.54" (2491m ^{asl})	highest recorded <i>B. pendula</i>
M24010	<i>Betula microphylla</i>	19/08/2024	Next valley east of Yolyn Am gorge, Gobi	N 43° 28' 2.22", E 104° 05' 5.49" (2449m ^{asl})	
M24011	<i>Betula microphylla</i>	19/08/2024	Next valley east of Yolyn Am gorge, Gobi	N 43° 28' 3.07", E 104° 05' 7.13" (2343m ^{asl})	large tree near bottom of population
M24012	<i>Cotoneaster mongolicus</i>	19/08/2024	Next valley east of Yolyn Am gorge, Gobi	N 43° 28' 1.35", E 104° 05' 4.80" (2543m ^{asl})	dwarf shrub on ridge
M24013	<i>Lonicera microphylla</i>	18/08/2024	West of Yolyn Am gorge, Gobi		
M24014	<i>Pinus pedunculata</i>	18/08/2024	West of Yolyn Am gorge, Gobi		
M24015	<i>Ribes aciculare</i>	20/08/2024	east of 19/08 study area	N 43° 29' 2.5", E 104° 8' 8.79" (2323m ^{asl})	
M24016	<i>Barberis sibirica</i>	20/08/2024	east of 19/08 study area		
M24017	<i>Rosa acicularis</i>	20/08/2024	east of 19/08 study area		
M24018	<i>Barberis sibirica</i>	20/08/2024	east of 19/08 study area		
M24019	<i>Betula microphylla</i>	22/08/2024	Sand dunes of Eilsen Tasarkhai	N 47° 20' 5.69", E 103° 41' 0.50" (1248m ^{asl})	
M24020	<i>Betula microphylla</i>	22/08/2024	Sand dunes of Eilsen Tasarkhai	N 47° 20' 5.47", E 103° 40' 9.41" (1250m ^{asl})	
M24021	<i>Betula microphylla</i>	22/08/2024	Sand dunes of Eilsen Tasarkhai	N 47° 20' 4.57", E 103° 40' 9.04" (1256m ^{asl})	
M24022	<i>Betula microphylla</i>	22/08/2024	Sand dunes of Eilsen Tasarkhai	N 47° 20' 6.28", E 103° 40' 7.80" (1255m ^{asl})	
M24023	<i>Betula pendula</i> ssp <i>mandshurica</i>	22/08/2024	Khugnu Khan mountains, north of Eilsen Tasarkhai	N 47° 24' 8.23", E 103° 42' 2.32" (1366m ^{asl})	one of the group of two birches on the dry rocky hill
M24024	<i>Betula microphylla</i>	23/08/2024	near Boshkoi rock, Atraga, Khovsgol	N 50° 08' 1.88", E 098° 52' 4.27" (1566m ^{asl})	more dwarf with different characteristics
M24025	<i>Betula microphylla</i>	23/08/2024	near Boshkoi rock, Atraga, Khovsgol	N 50° 08' 0.54", E 098° 52' 7.63" (1575m ^{asl})	
M24026	<i>Betula microphylla</i>	23/08/2024	near Boshkoi rock, Atraga, Khovsgol	N 50° 8' 1.02", E 98° 52' 7.8" (1587m ^{asl})	
M24027	<i>Betula humilis</i>	24/08/2024	Oin darva pass, south of Ulsan Uul, Khovsgol aimag	N 50° 34' 0.41", E 099° 08' 1.25" (2036m ^{asl})	
M24028	<i>Betula humilis</i>	24/08/2024	Oin darva pass, south of Ulsan Uul, Khovsgol aimag	N 50° 34' 0.53", E 099° 08' 0.39" (2040m ^{asl})	close to the previous one but on the other side of narrow boggy valley
M24029	<i>Betula humilis</i>	24/08/2024	In Larin sibirica woodland, south of Ulsan Uul, Khovsgol aimag	N 50° 37' 2.57", E 099° 12' 5.02" (1803m ^{asl})	
M24030	<i>Betula humilis</i>	25/08/2024	Riverbank on western edge of Khordoi Saridag mountains	N 50° 40' 3.90", E 099° 21' 4.41" (1785m ^{asl})	
M24031	<i>Betula glandulosa</i>	25/08/2024	bank on Gun river on western edge of Kheridoi Saridag mountains	N 50° 40' 4.36", E 099° 21' 5.47" (1783m ^{asl})	
M24032	<i>Betula glandulosa</i>	26/08/2024	bank on Gun river on western edge of Kheridoi Saridag mountains	N 50° 40' 4.36", E 099° 21' 5.47" (1783m ^{asl})	

Budget (1 person)

Travel	£2,523.00
Trains: £76 + £30 International air fare: £1460 Mongolia domestic travel: £510 + £447	
Food (including dehydrated rations)	£300.00
Accommodation (UK and Mongolia)	£358.00
Total costs	£3,181.00
Grants received	
Stanley Smith UK Horticultural Trust	£1,000.00
Des Rubens & Bill Wallace Grant (John Muir Trust)	£1,500.00
Total grants received	£2,500.00
Personal costs	£681.00

