Identifying wild populations of rare Birch in Georgia

A conservation project to locate *Betula megrelica* and assess its conservation status

Executive summary

Betula megrelica is an extremely rare birch known only from collections made many years ago from Mt Migaria in Georgia. It's exact whereabouts there remained a mystery. It was vital that wild populations of this shrub were located so that we could understand the extent of its distribution, how critically endangered it was and therefore decide how much protection it needed to survive. With the support of Tbilisi Botanic Garden and the Institute of Botany, seed and plant material were collected and analysed, dangers to the populations recognised and next-generation plants will be propagated for possible re-introduction into the wild if appropriate.

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Manana Khutsishvili is an experienced botanist and the Head of the Herbarium at Tbilisi Botanic Garden. She has been heavily involved with the Kew Millenium Seed Bank project.

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Acknowledgements

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History

The high altitude shrub birches of the Caucasus and north-east Turkey are very distinct from any other known birches. Their closest relatives are probably tall tree birches of the mountains of China (*B. insignis*), Japan (*B. globispica*) and eastern North America (yellow birch, *B. alleghaniensis*), so the Caucasian populations are Tertiary relicts which have probably survived and evolved in isolation in the region for around 15 million years, similar fossils of this age being known from Iceland (McAllister & Ashburner, 2007; Ashburner & McAllister, 2013). The relatively small wild populations in the Caucasus are thus of considerable conservation and evolutionary interest.

First to be described was *B. medwediewii* from the Transcaucasus, in 1887, from specimens collected in 1886, late for such a distinct species, but, as at present, the region was politically unstable and dangerous for non-indigenous visitors. This species was introduced to cultivation in 1897 and is fairly frequently seen in arboreta and so available for study as living specimens. Unusually for a birch, it is self-compatible and comes true from seed.

Betula megrelica was described as a distinct species from Mt. Migaria in the Mingrelia (or Samegrelo) region of N.W. Georgia in 1934 by D. Sosnovsky (Kuzeneva, 1936), but has often been treated as a synonym of *B. medwediewii* (Rehder, 1940; Bean, 1970; Govaerts & Frodin, 1998), probably largely because so little was known about it. However, the Russian Red Data Book (Iliashenka & Iliashenko, 2000) describes it as distinct and being very rare. Two Russian botanists E.E. Gogina and Rusanovich visited the mountain in 1971 and collected seed or living plants as well as herbarium specimens. (M. Romanov pers. comm.. 2013) Plants were then grown and planted at Moscow Botanic Garden, Pereslavl-Zalessky in Yaroslavl Oblast and Kirovsk in Murmansk Oblast (I. Yatsenko pers. comm. 2013) Seed from the Moscow plants was sent by Dr Skvortsov to Dr. Hugh McAllister in 1982. Plants raised from this seed and planted at Ness Gardens looked distinct from *B. medwediewii* in overall appearance and also detailed characters such as the narrower shape of the smaller leaves, grey twig colour and smaller catkin size. A chromosome count of 2n=168 (dodecaploid 2n=12x14) was obtained for *B. megralica,* whereas previous counts on *B. medwediewii* had given 2n=140 (10x). Rooted cuttings of the most distinct seedling were sent to Wakehurst Place and Stone Lane Gardens and seed distributed through the botanic garden seed exchange system. Dr Skvortsov later arranged for more seed to be collected from the Mt Migaria region in 1984, but no specific localities were given. Plants raised from these six separate collections more closely resembled *B. medwediewii* and were found to be decaploid. . This unexpected result raised questions about the accuracy of the chromosome counts (such large numbers can be difficult to count accurately (Favarger, 1978)) and the nature of *B. megrelica.* However, Dr. Richard Buggs and Nian Wang of Queen Mary University, London, using flow cytometry to measure the quantity of DNA in cells, have shown that *B. medwediewii* appears to be decaploid and *B. megrelica* dodecaploid, probably confirming this important genetic distinction.

Since then no wild collections or wild study of *Betula megrelica* appears to have been made in the Mt. Migaria area. Sadly the exact locations of the 1971 collections are not known as the two botanists are dead and their field notes have been lost. The plants at Moscow Botanic Garden grown from those collections have also died. (M. Romanov pers. comm. 2013). The plant at Kirovsk in Murmansk Oblast died a few years ago and never bore fruit (pers. comm.. Igor Yatsenko 2013).

Clearly we needed to know more about this rarely studied birch. Having already made one Birch study trip to Georgia in 2012, I felt I knew the ground fairly well and had a good chance of finding *Betula megrelica* on Mt. Migaria. So early in 2013 I organised a plant study/conservation trip back to Mt Migaria in partnership with Tbilisi Botanic Garden and the Ilia State University Institute of Botany. I was awarded funding from the Rufford Foundation and Plant Heritage (Devon group). I employed the same botanist and driver from Tbilisi Botanic Garden, and in September 2013 we set off to the Samegrelo (Mingrelia) region.

Introduction

In September 2013 our joint UK/Georgian botanical conservation team spent 8 days in the Mingrelia region of Georgia. We spent 3 days and 2 nights camping on Mt Migaria, one day exploring possible sites by car and 2 days/1 night camping in the Tsashkibuli mountains.

A shrubby birch believed to be *Betula megrelica* was found only in the Mt. Migaria area.

Figure 1 Bejan (driver/guide), Roman Tolurdava (guide), Paul Bartlett, Manana Khutsishvili (Botanist - Tbilisi Botanic Garden), Temuri Siukaev (driver/guide - Tbilisi Botanic Garden) and Paata (horseman)

Access

Access to the mountains of Samegrelo is difficult due to the limited number of roads in the area. There are a few tracks into the mountains used for forestry and shepherding activities. These are extremely rough and only accessible by 4 or 6 wheel trucks (see Fig. 54).

Geography – see maps on page 21

Mt Migaria sits on a ridge running roughly East South East - West North West. The topography to the immediate north echoes this pattern, though the Migaria ridge is the most prominent. Further north the mountains rear up to 4000 + metres. To the south the land drops swiftly to a plain. At its eastern end, the Migaria ridge-line drops to a valley before quickly ascending to join another prominent East – West ridge. To the west the ridge drops down to the Khobistskali river gorge (a dramatic geological feature separating the Migaria ridge from the Tsashkibuli mountain range. The land is heavily forested up to a height of about 1800 metres.

Figure 2 The north face of Mt Migaria

The north facing escarpment of the Migaria ridge is mostly very steep, made up of steep, grass- clad scree; cliffs and gullies. Thus it is clear of large trees. Where the escarpment is less steep, the forest returns. The south side of the ridge is generally easier angled.

The Migaria ridge appears to be made of a very white limestone rock. This is quite different from the rock of the surrounding mountains, which appears to be a much darker, harder form of limestone. Large areas of the surface around the summit of Mt Migaria are a kind of limestone pavement – flat sheets of rock that have been eroded in a criss-cross pattern and are quite sharp in places. See Fig. 60

Habitat

Our explorations of the Mt Migaria area covered :-
i) from the col north and westwards underneath the cliffs of the North East face of Mt Jvari ;
ii) from the col north and eastwards under the cliffs of the North face of Mt Migaria;
iii) up the north face of Mt Migaria;
iv) the western slopes from the shepherd hut below the col up to the summit of Mt Migaria.

See map on Page 22

Area i)

42°38'25"N 42°19'04"E

Figure 3 The north face of Mt Jvari

My previous visit to this area in 2012 had revealed shrub birch in area i), so this is where we first explored. As in the previous visit we found small, grazed plants of *Betula megrelica* at the bottom of the grass-covered scree at an altitude of 1500m (see Fig. 9). These plants were no more than 4 feet high and clearly being grazed, probably by the herds of domestic goats pastured there in the summer. No seed was found on any plants, though there were many dotted about the slope. Shoot samples taken here (PBG209) were later analysed by Nian Wang of Queen Mary University of London and found to be dodecaploid (2n=168). This fits with the definition of *Betula megrelica*. I persevered up the slope to the base of a large cliff in the hope of finding plants that had escaped grazing damage. By working my way westwards along the foot of the cliff I eventually found a few slightly larger plants that had one or two fruits. Seed was collected along with more shoot samples (PBG201). These were also later shown to be dodecaploid. At the western end of the cliff it was possible to scramble higher. The steeper nature of the terrain seemed to have dissuaded grazers and fortunately much larger specimens of *Betula megrelica* were found here. Most had fruits intact, some had plenty of fruits, others none. I recorded birch with stems of up to 12 feet in length (PBG218). Almost all the plants here were growing on the sides of rock outcrops with very little soil. Whilst some plants had upward curving stems, most had stems generally curved downward away from the rock with the tip of the stem often lower than the base of the stem. A sort of upside down tree! (see Fig. 16 and 17)

I had read about this phenomenon in a Georgian scientific paper (Dolukhanov 1978). It appears that the weight of winter snow forces the stems down – sometimes to the point that the stems are covered with soil causing new roots to form along the stem.

Observations at this eastern end of my explorations below Mt Jvari led me to believe that the birch would be found all the way along this north face.

Area ii)

42°38’24”N 42°20’19”E

Figure 4 Search area ii) below the north face of Mt Migaria

The next day we set out to explore the area below the north face of neighbouring Mt Migaria. Observations of the face from my position on Mt Jvari the previous day showed that the terrain was very similar. Again, we found very small grazed plants on the lowest grassy slopes where the angle of the terrain was very gentle. No seed was found here. As we worked our way up towards the rock outcrops and gullies the plants became larger as grazing would have become more difficult.

At this point we started to enter

Area iii), the north face itself.

42°38’19”N 42°20’24”E

Figure 5 Search area iii). About halfway up the north face of Mt Migaria. Mostly *Betula megrelica* in the picture, with *Salix* and *Picea*.

The north face is made up of a series of cliffs and gullies. The steeper nature of this terrain prevents larger trees from establishing. *Fagus orientalis* (to 5m) was present as an occasional stunted tree, along with *Sorbus migarica* and *Salix sp.* (2-3m). *Picea orientalis* was also present and these occasionally reached 10-12m. But by far the most dominant species was *B. megrelica*. Here it grew everywhere on the mountainside except for the steepest cliffs. The bushes are very multi-stemmed, with a height of 3-4m, though height is a poor indicator of mass, as so many of the stems are flattened and curving away from the base due to winter snow pressure. So a shrub of 3m height may have stems 5m long (see

Fig. 23). The trees grew in thickets, quite densely shading the ground beneath. Some quite mature bushes had no fruits at all, whilst others were full of fruits.

We made our way up a couple of gullies to about the halfway point on the north face. This enabled me to study the birch in detail over quite a large area, observing their habit and collecting much seed (PBG206, 207, 208, 211, 213) and several shoot samples (PBG206, 213) for analysis (these later proved to be dodecaploid). My view of the top half of the face showed that *B. megrelica* continued in thickets up the slope towards the summit. We then retreated down the gullies and back to our basecamp.

Area iv)

42°38'01"N 42°20'12"E

Figure 6 *Betula megrelica* at top of north face with summit of Mt Migaria above.

During that day, Manana Khutsishvili and Temuri Siukaev had made their way up area iv) the western slope of Mt Migaria to the summit. Manana reported no birch sighted. This was to be expected, given my accumulating knowledge of the species and its preference for the north/east facing slopes. Later that afternoon I also took this route to the summit of Mt Migaria, so that I could have a look down the north and east faces to search for birch. The east face was so steep that I could not see any sign of vegetation – the cliff simply dropped away. However, the north face was less shear and I was able to work my way down about 100 metres from the summit, where I found the highest point of distribution of *B. megrelica* on this mountain (42°38’13”N 42°20’29”E). The dwarf forest of trees stopped quite abruptly where the slope angle eased just before the summit.

It is difficult to say whether this was down to grazing pressure or simply the natural temperature threshold for sustainability of this species. It is possible that the increase in exposure as the summit is neared causes the temperature to drop significantly here. Also I would estimate that there would be less snow cover here during winter due to the increased exposure to winds. A thinner snow covering would mean less protection from dessication. A further possibility is that at this altitude the snow remains on the ground for much longer into the spring, making growth of germinating seed more difficult, with a much shorter growing season.

Seed and shoot samples were taken at this high point (PBG216, 221). Analysis of the shoots confirmed a ploidy level of 2n=168 (dodecaploid).

Conclusions on habitat necessary for stable populations of *Betula megrelica*

From my experiences in Georgia, it would seem that *B. megrelica* occupies a very niche habitat in the lower Caucasus of north western Georgia. There are three possible main reasons for its limited habitat.

Firstly, its slow growth rate (unusual for a birch) results in it being overtopped and suppressed by faster and taller growing species at lower, altitudes and in more sheltered situations.

Secondly, on less steeply angled slopes it is prone to grazing damage by animals. This would have started to affect its distribution ever since humans first began the practice of high summer grazing but has been made worse by recent increases in numbers of domesticated livestock pastured here.

Thirdly, birch generally prefer north to east facing slopes, as they are damper, remembering that the climate may have been warmer and drier in former times.

This narrows the suitable habitats to locations high enough to suppress the growth of taller growing species, steep enough to avoid the attentions of grazing animals, and where the aspect is between north and east. The only locations in the area around Mt Migaria that fit these criteria are all on limestone. (This may be another factor as species at the edges of their ranges are often confined to limestone as the nutrient (especially nitrogen and phosphorus) poor thin soils reduce the vigour of taller growing competitors).

My observations in the Mt Migaria area lead me to surmise that here *Betula megrelica* will be found at altitudes of between 1500 and 2000m, on north to east facing slopes of at least 35 degrees to the vertical. These slopes are easy to spot on a map or satellite image because they will be free of dense forest vegetation.

White barked birches are often pioneer species, but this is less true of many of the non-white barked species, probably including *B. megrelica.* It appears to be the dominant species here for as long as the habitat remains.

Indicator species associated with *Betula megrelica*.

Wherever we found *B. megrelica* in the Mt Migaria area, there were always certain other species co-existing in that habitat.

The most obvious of these were the grasses. (Fig. 9 and 58)
The grass covered most of the ground between the shrubs and made walking difficult because the height of the grasses (1-2 feet) and the steep angle of the slope made it impossible to see the loose stone you were stepping on. These course broad-bladed grasses are an instantly recognisable feature of the locations in which we found *B. megrelica.*

Cyclamen colchicum (Fig. 57) was found amongst rocks at the lower end of the distribution.

Also found at the lower end of the distribution was Sycamore (*Acer pseudoplatanus)*, (Fig. 22 far left) though trees did not reach a great height, unlike in the lower forests.

Oriental Beech (Fagus orientalis) (Fig. 9 left) was occasionally evident in a stunted form.

Willow (Salix spp.) (Fig. 5 left) were found in occasional thickets, generally in the gully beds. They reached 2m height.

Oriental or Caucasian Spruce (Picea orientalis) (Fig. 59) was the most common tree amongst the *B. megrelica*. These tended to be lone specimens on the steeper slopes and dense groupings where the ground was flatter. Height varied from saplings of 2m to mature trees of 15m.

Honeysuckle Azalea (Rhododendron luteum) (Fig. 23 foreground) grew in occasional groups to a height of 1.5m.

Sorbus migarica was an occasional shrub to 2m.

Detailed description of *Betula megrelica*.

Here is the description from 'The Genus Betula', (Ashburner and McAllister, 2013).

This is a deciduous shrub to c. 4m height with several main stems radiating from just above soil level. The trunk and branches are a metallic grey-brown. Twigs are greyish, spotted with white lenticels, stiff, 2-2.5mm in diameter. Bud to 6 x 3.5mm, ovoid to more or less triangular in smaller buds, blunt, greenish-brown. Young shoots brown with scattered long silky hairs c.2mm long over fairly dense puberulence of very short (c. 0.1mm but variable) hairs about their own height apart, and few hairs intermediate in length between the silky and very short hairs, eglandular. Petiole c. 9mm, densely covered with long (c. 2mm) silky hairs, very short hairs absent. Leaf lamina 41-60 x 22-36 mm, broadly elliptical-ovate, more or less sharply double toothed almost to base, veins on lower (abaxial) surface densely silky hairy, lamina glabrescent beneath, veins on upper (adaxial) surface with scattered silky hairs which extend onto the lamina; small reddish glands scattered over the lower surface of the lamina but confined to the main veins on the upper surface. Male catkin cylindrical, stout, when living c. 20 x 5.5 mm with green, brown tipped scales, when dry 20 x 3.5 mm with brown, clearly overlapping triangular scales. Fruiting catkin erect, with peduncle c. 5mm, to 18-30 x 17 mm when dry; scales divergent, 6-8 x 3 mm with central lobe spatulate, 3-5 mm long, and laterals to 2.5 mm long. Seed c. 2.5 x 1.5 mm with wings c. 0.25mm broad.

To this I would like to add some additional observations from the wild populations on Mt. Migaria and Mt. Jvari.

Trees in the wild are frequently more sprawling in nature, with the main stems (particularly those stems on the down-hill side) often being horizontal or even downward curving at the base, with only the tips growing upward (see Fig. 17 and 23). This can sometimes result in the tip of the stem being at a lower altitude than the root. The longest stem I recorded was 6m, all of which was below the root. This behaviour of multi-stemmed shrubs in mountain environments is well documented and is a response to the constant weight of winter snowfall (often referred to as crook-stem forest). The widest stem I recorded was 15cm diameter at the base, but there was evidence of older broken or rotted stems thicker than this on several trees, so larger trees must occasionally exist (Fig. 17).
The main stems on older plants can take on an almost silver appearance, as their bark can have a very metallic sheen. There is almost no peeling on younger stems, with only small tight slivers of peeling bark on older stems. Twigs are dark grey to grey-brown with white lenticels, frequently very dark grey. Buds were occasionally partially coated with white resin. Young shoots were slightly glandular. Leaf lamina shape varied enormously from broad ovate to much narrower. Even leaves of pre-formed buds varied in their length/width ratios. Lateral lobes of scales on fruiting catkin grow separately from the base but only diverge about half-way along the length of the central lobe. Seed shape varied enormously from almost round to dart shaped (where the bottom of the seed was distinctly pointed) – see Figs. 48 and 49. The size of the surrounding wing also varied greatly.

Weather – conditions

I arrived in Samegrelo well into Autumn. Whilst most trees still had their leaves, many were colouring. The *B. megrelica* varied from still being green, to crispy dark brown higher up the slopes. Beech (*Fagus),* maples *(Acer)* and poplar (*Populus)* were all colouring. The weather was bright and sunny most of the time on Mt Migaria, with temperatures pleasant. However, as soon as we descended from Mt Migaria the weather deteriorated. Cloud thickened and lowered and heavy, constant rain ensued. This lasted for the next two days, causing localised flooding and a landslip to block the main road from Jvari into Svaneti. This hampered our subsequent trip up to the area around Mt Tsashkibuli, which had to be postponed by one day. The heavy rain also forced us to split the party on Tsashkibuli, with myself, one guide/interpreter and our horseman travelling higher than the rest of the group to spend one night at a high shepherds hut. Low cloud hampered visibility and forced me to cut short a lengthy search of the higher slopes. However, I do not think that *B. megrelica* would be found in that area because few of the indicator species were present and the terrain was quite different. We were also well above 2000m (and only just below the snow-line). The rain on Tsashkibuli had obviously fallen as snow on the higher slopes. The shepherds had left their summer huts and were moving their cattle and goat herds down the mountains during the time we were in Samegrelo. Ironically the weather cleared on the day we left Samegrelo. Flying out two days later, the mountains of Samegrelo and Svaneti were all revealed covered with fresh snow.

Figure 7 Mt Tsashkibuli, with snow on upper slopes. Searches were carried out below the snow-line.

From my own observations and discussions with the local guides in Samegrelo, it is clear that snow falls early in the region. The winter is long with a great depth of snow. It is likely that the shrubs of *B. megrelica* are almost entirely buried throughout the winter.

Summary

This conservation project had two main aims. Firstly, to find wild populations of *Betula megrelica*. Secondly, to assess the size of the populations and any threats they faced. The project achieved both those aims.

I found evidence of a large wild population on the north and east faces of Mt Jvari, and from study of maps and photos I would estimate this population spreads for 3km along the north face of the ridge, covering an area of 3km x 0.5km. **Further study of this population would improve our knowledge of its full extent.**

I also found evidence of a large wild population on the north face of Mt Migaria, spreading over a length of half a kilometre, covering an area of 0.5 x 0.5km. Although I did not have time to search the east face of Mt Migaria, I would expect the population on the north face to continue round onto the east face. This would extend the area covered by another 1.5 x 0.5km, although the upper east face is sheer and there would be limited opportunities here for growth of *B. megrelica*. **Again, further study of this population would be useful.**

Casting the net wider, I have been poring over photos, maps and satellite images of the area surrounding Mt Migaria. Now that we have a better understanding of the niche habitat *B. megrelica* requires, we can look for other likely sites for wild populations.

The nearest possibility is the Opitsaris range (42°36'08"N 42°31'25"E) 8km south East of Mt Migaria (see Fig.8). This has steep, roughly north facing slopes that appear devoid of forest. I could see the north face of this range from Mt Migaria and it would appear to be the right steepness and altitude for the existence of *B. megrelica*. Also we know that the land immediately to the south (the Askhi massif) consists of limestone, so it is likely that the terrain is appropriate to support the species. There is also an east facing slope (42°34'47"N 42°36'16"E) at the eastern end of the Askhi massif near Zubi which looks promising.
It would be very worthwhile studying these two areas.

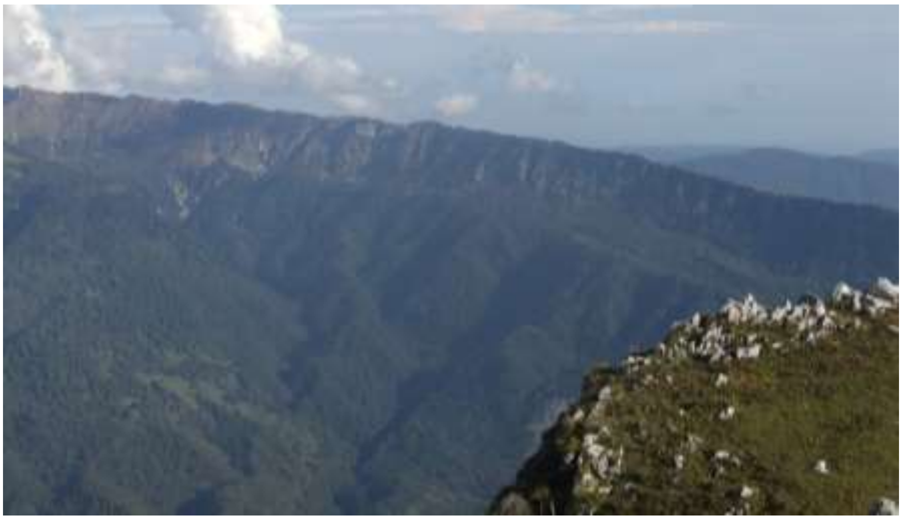

Figure 8 The Opitsaris range from the summit of Mt Migaria. The upper slopes of that long north face look promising.

Conservation Concerns

Farming and Forestry

Clearly this is the biggest concern. Georgia has a struggling economy and in the past has suffered from widespread corruption. This has allowed timber-felling of the natural forests to proceed with little if any policing or protection. Mt Migaria sits within the Samegrelo Planned Protected Area. This status has no visible effect on use/mis-use of the resources on the ground. I witnessed a great deal of small scale felling around Mt Migaria. There was even a portable saw-mill in use at one site. Fortunately, forestry operations are not likely to directly impact the niche habitats of *B. megrelica*, as there is no timber worth felling in such sites and access would be difficult. However, if the slopes around Mt Migaria are cleared of forest, then more grazing animals may be introduced and over-grazing could lead animals to move into the areas inhabited by *B. megrelica*. This is probably the biggest threat to these wild populations.

Figure 9 The lower northern slopes of Mt Jvari. These slopes were heavily grazed and all the *Betula megrelica* here were under 4 foot high with chewed tips and no seed-bearing apical growth intact.

Tourism – Development is unlikely to impact on the habitats as the terrain is too steep. Skiing could have an impact, but there are no resorts in this part of Georgia.

Forest and grass fires do not appear to have affected the sites we visited.

Hydro-electric schemes are unlikely to have an impact on habitats at this altitude.

Mineral extraction/mining does not currently take place around Mt Migaria.

Seismic activity – Georgia does suffer from regular earthquakes, but nothing too alarming. The Mt Migaria area does not appear to be in an area of recent activity, though the area immediately west in Abkhazia has recorded quakes in 2013. Obviously earthquakes could destroy unstable cliffs and cause considerable movement of steep mountain faces, resulting in loss of plants and habitat. However, it is likely *B. megrelica* would also be among the first plants to re-colonise any such disturbed ground.

The Future

The project should now continue on two fronts:-

1. Further study of the area to identify other wild populations on likely north/east facing mountain slopes. This would help us define the boundaries and size of the wild populations. I have already identified several likely nearby sites.

2. Communicating our findings to the conservation groups that already work in Georgia so that they can co-ordinate an approach to the Georgian government for the implementation of a long-term conservation strategy.

We have identified that *B. megrelica* exists in small, niche habitats in a very small area of the Caucasus mountains. This makes it vulnerable to damage or destruction by both natural and man-made events. We must prepare for this and take action to limit any destruction as far as possible.

By far the biggest recognisable threat is damage to the plants caused by grazing of domestic livestock. **Damage has already been done to the edges of the wild populations of *Betula megrelica* on both Mt Jvari and Mt Migaria**. **As long as grazing continues, it is unlikely that any plants will set seed on the lower slopes of these mountains.** Although I have only been studying one species, it is likely that the grazing in these areas is also reducing wild populations of other plants, both herbaceous and woody. *A recent study of Cyclamen colchicum in the same area by Martyn Denney of the Cyclamen Society and Manana Khutsishvili (co-author of this report) identified over-grazing as the biggest threat to that species* (Denney and Khutsishvili, 2013).

So some control of grazing is needed. There needs to be control of the number of animals and also the areas in which they are allowed to graze. There will undoubtedly be resistance to any control of this kind. The dairy industry (particularly cheese-making) in this region is an important source of income. But if Georgia is to remain a source of valuable biodiversity, then fragile habitats like this must be managed and controlled. There is no reason why a sustainable form of grazing cannot be implemented, given the will and financing to make it happen. But without control, it is inevitable that habitat loss will continue.

Destruction of habitat by uncontrolled felling is also a major threat to this area. Whilst felling is unlikely to directly affect *B. megrelica*, it creates open areas which would become suitable for grazing, thus allowing more livestock to damage a larger area. It would seem prudent therefore, to put in place some protection for the forest at the same time as controlling grazing.

A first step would be the creation of a protected area. Some form of National Park. This then needs to be followed up with rigorous policing of rules by Park rangers on the ground. Local foresters and shepherds must be encouraged to adapt their industries. It should be possible to allow controlled grazing and a smaller amount of controlled felling. If this could be subsidised, then the local population would not suffer unduly. However, there would need to be rigorous policing to stop locals taking the subsidies and still carrying on as before.

Future action summary

1. Growing on of seedlings from each of the seed collections made and count chromosome numbers to confirm flow cytometry results. This should tell us if all the populations in the Mt. Migaria area are dodecaploid (12x), in contrast to *B. medwediewii* which is probably all decaploid (10x).

2. Further study of the area around Mt Migaria to define population boundaries and sizes.

3. Study the morphological and genetic variation among the seedlings.

4. Cooperation with Conservation groups working in Georgia to highlight concerns.

5. Creation of National Park around Mt Migaria

6. Control grazing

7. Control tree felling

8. Encourage shepherds/foresters to adapt industry practices or diversify to new industries.

9. Examine the molecular characteristics of the species in comparison with *B. medwediewii* and other birch species in an attempt to understand their evolutionary history.

Third party evidence

National Biodiversity stategy and action plan – Georgia 2005 (page 43)

The status of forests
Although Georgia is rich is forests, almost half of the forests have been degraded through excessive thinning. These forests no longer provide vital ecosystem functions such as soil protection and flood control, and can no longer regenerate naturally.
The process of licensing for timber extraction is complicated, and lacks transparency, and the current institutional arrangements are in-effective at controlling illegal logging. Furthermore there is a lack of public participation in forest management and decision making. Given this situation, there is little control over the use of forest resources, and rate of unsustainable exploitation is increasing. In order to apply an ecosystem approach to forest management close cooperation is required between the various agencies involved in decision making, and more up to-date scientific information.

And from the later 2010 report*....*

Since 2003, with the support of the World Bank, the development of the Georgian forest sector has been implemented. This project aims to increase contribution of the forest sector in the economic development of the country through efficient management systems based on environmental protection principles. To achieve this aim, the project envisages forest inventory and identification of the functions of forest stands (on the basis of landscape-ecological zoning). To improve the legal regulation of forest management, corresponding legislative changes and normative acts should be elaborated, information systems for forest management should be created, and forest policy and strategy should be worked out.

Authors note:- There is some doubt as to the validity of this statement, as the World Bank pulled out of their 2003 project due to the failure of the Georgian government to meet even the ***minimum*** *requirements of the project*

World Bank

The World Bank undertook a Forestry Development Project in Georgia from 2003-2009. This was curtailed in 2009 because Georgian government did not meet minimum criteria from continuing project. Website link
http://web.worldbank.org/external/projects/main?pagePK=104231&piPK=73230&theSitePK=40941&menuPK=228424&Projectid=P044800

The GLOBE Natural Capital Legislation Study 2013 (page 53)

Ecosystems vulnerability to climate change and anthropogenic action
The main threats to biodiversity in Georgia are the destruction and degradation of habitats and the extensive extraction of biological resources. The principal causes of habitat destruction are timber logging, degradation of water ecosystems, mining, pollution and overgrazing. Intensive grazing is problematic for subalpine forest ecosystems as well as in the semi-arid zones in the south-eastern parts of Georgia where, in both cases, large

numbers of grazing livestock (especially sheep) result in soil erosion. Livestock is often grazed in forest ecosystems, which negatively impacts natural restoration cycles within forest stands.

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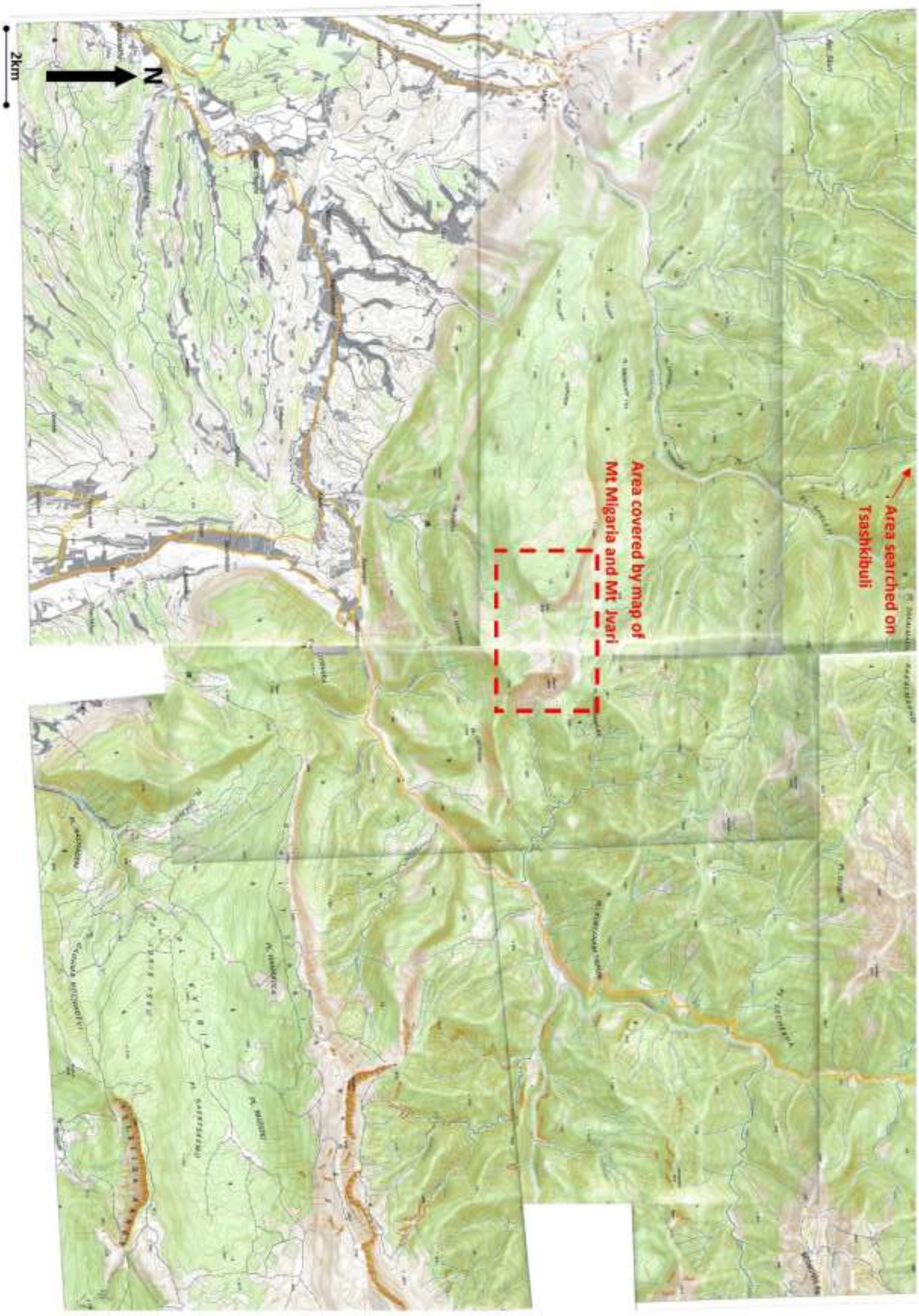
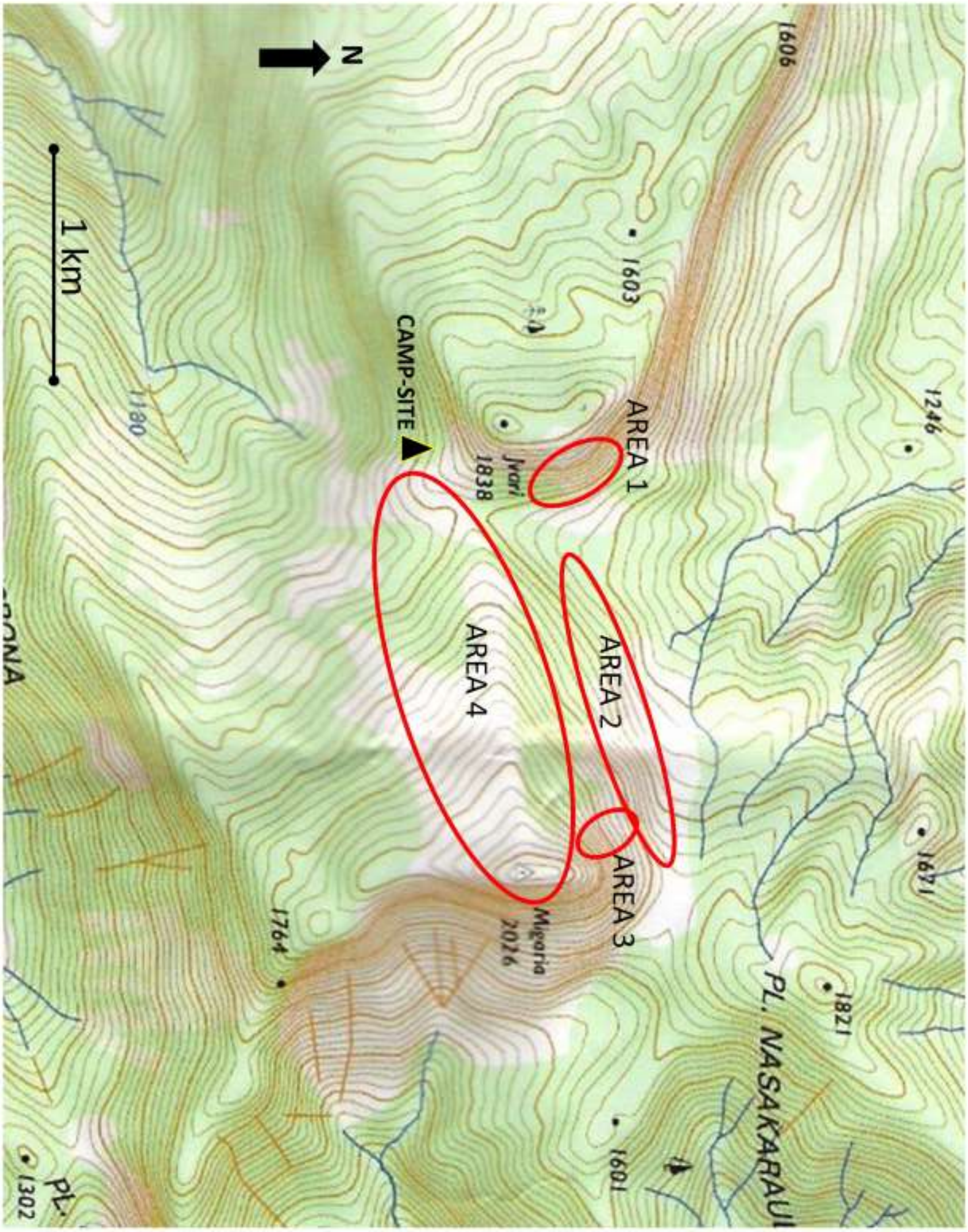


Map 1: Area of Samegrelo showing Mt Migaria and areas searched



Map 2: Areas searched on Mt Migaria and Mt Jvari

Map 3: Areas searched on Mt Tsashkibuli

Photographs of *Betula megrelica* found on 2013 conservation project	
PBG201 – collected 19/9/13 Stem sample 3 plus seed	Mt Jvari – west end of main cliff 42.6378 N 42.3228 E 1612m

Figure 10

Figure 11

Figure 12

Figure 13

Figure 14

Figure 15

PBG218– collected 19/9/13	Mt Jvari – west end of main cliff 42.6378 N 42.3228 E 1612m

Figure 16

Figure 17

Figure 18

Figure 19

Figure 20

Figure 21

PBG213 – collected 20/9/13 Stem sample 4 plus seed	Mt Migaria –bottom of gully just above track on north face 42°38'24"N 42°20'18"E 1643m


Figure 22


Figure 23


Figure 24


Figure 25


Figure 26

Figure 27

***Betula megrelica* on Mt Jvari – 19/9/13**

Figure 28

Figure 29

Figure 30

Figure 31

Figure 32

Figure 33

***Betula megrelica* on Mt Migaria – 20/9/13**

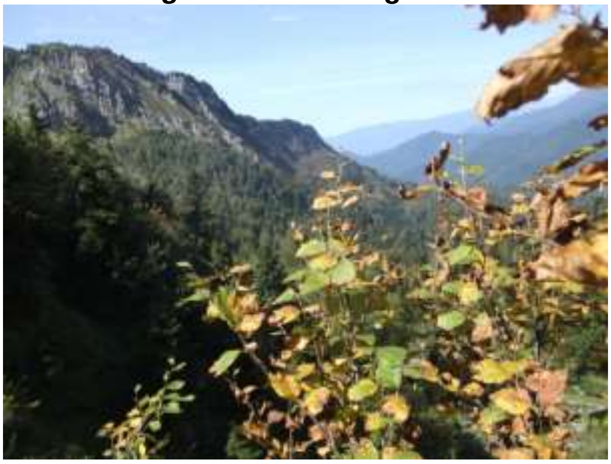


Figure 34


Figure 35


Figure 36


Figure 37


Figure 38


Figure 39


Figure 40


Figure 41


Figure 42


Figure 43


Figure 44


Figure 45


Figure 46


Figure 47


Figure 48 PBG211


Figure 49 PBG220

Figure 50 Roman and Temuri in the back of Bejan's truck on the track to Mt Migaria

Figure 51 Campsite below Mt Migaria

Figure 52 Manana on the col with Mt Jvari behind

Figure 53 Bejan, Roman, Manana and Temuri having the evening meal

Figure 54 Bejan's truck and the shepherds hut with Mt Jvari on left

Figure 55 Roman, Paata, Bejan, Temuri and Manana in the 1st shepherds hut below Mt TSashkibuli

Figure 56 Paata outside 2nd shepherds hut on Mt Tsashkibuli

Indicator plants for *Betula megrelica* habitat

Figure 57 *Cyclamen colchicum*

Figure 58 The tall, broad bladed grass

Figure 59 *Picea orientalis*

Figure 60 Limestone pavement at summit of Mt Migaria