Flora and Vegetation of the Simen Mountains National Park, Ethiopia

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The Simen Mountains National Park, a UN World Heritage site, known for its spectacular scenery, the endemic Walia Ibex, and endemic plant species such as *Rosularia semiensis* (Crassulaceae), comprises a high plateau area (usually above 3200 m, to over 4000 m), steep escarpments, and a "lowland area" (usually less than 3000 m, down to less than 2000 m, where it is dissected by river valleys). Flora and vegetation of all parts of the park were studied during three expeditions (December 1996-January 1997, September-October 1998, and May 1999). While the afroalpine area, with its large and common stands of *Lobelia rhynchopetalum* in *Festuca*-dominated grassland, is the most spectacular part of the park, the "lowland" (*i.e.* afromontane) area of the park is far more interesting botanically, and also much richer in species. As this part of the park is rather densely populated, only patches of relatively undisturbed afromontane vegetation remain. They comprise, depending on their exposition and location, "wet" types of forest (rather species rich), "dry" forest patches (dominated by *Olea europaea* subsp. *cuspidata*, but usually not *Juniperus procera* which is rather uncommon in the park), and intermediate vegetation types. The escarpments between the "low" and "high" areas of the park have dense stands of *Erica* forest, with *E. arborea* locally replaced by *E. trimera* at higher altitudes. Steep and shady gorges with extensive, often vertical cliffs harbour interesting and rare plants such as *Dianthus longiglumis*, *Saxifraga hederifolia*, *Primula verticillata* subsp. *simensis*, and *Rosularia semiensis*.

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Introduction

The characteristic vegetation types and zonation of the East African high mountains were extensively investigated by Hedberg (1951, 1957, 1964). One clear topographic difference between the Ethiopian and East African mountains is that the latter mountains are clearly separated by extensive lowland areas, while the former are connected by a high plateau with extensive farming. In Ethiopia, the ericaceous and afroalpine belts *sensu* Hedberg (1951) have been intensely degraded through burning, firewood collection, grazing, and agriculture (Scott 1958; Hedberg 1971, 1978).

The northern highland areas of Ethiopia were the first to be explored, more than a century ago, by various European botanists *viz.* G. W. Schimper, R. Quartin-Dillon, A. Petit, E.

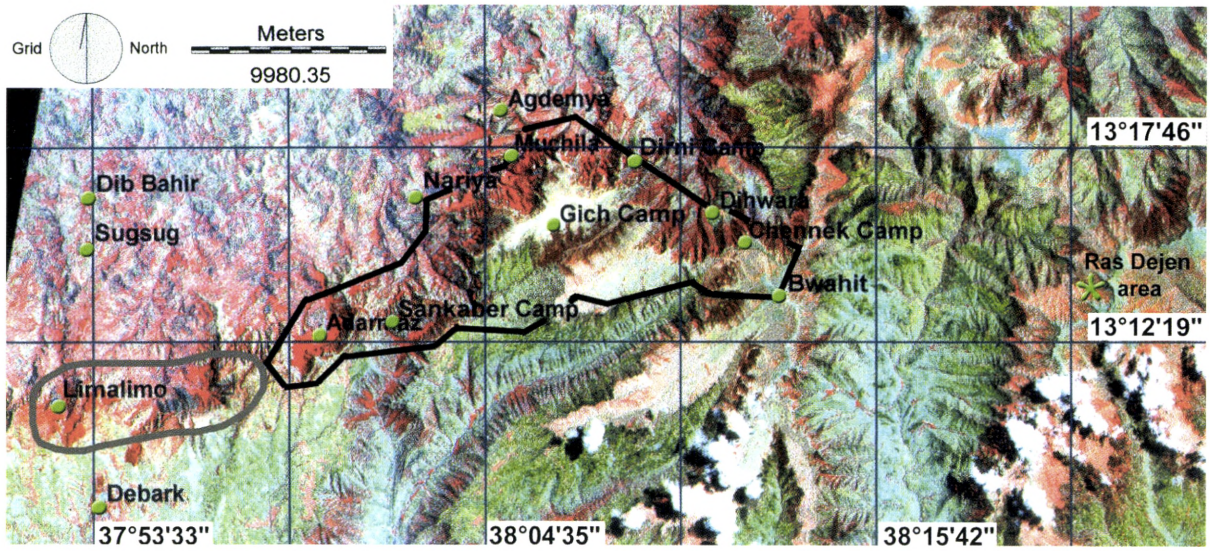


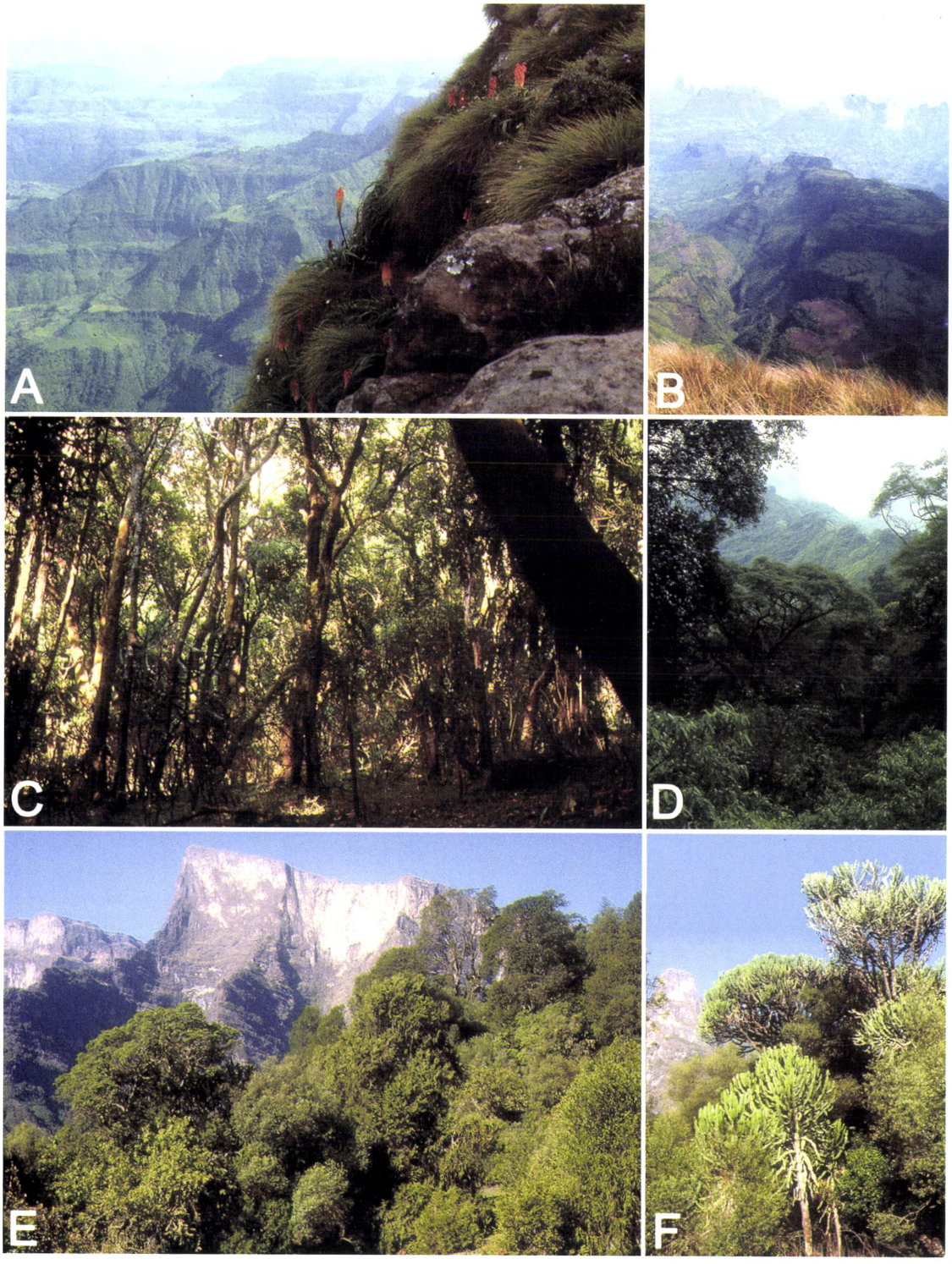
Fig. 1. LandSat image of the Simen Mountains National Park (border delimited by black line), the adjacent Lemalimo (= Limalimo) escarpment and surrounding areas. Solid plant cover (forested areas, etc.) show up in red. A white haze obscures the core area of the afroalpine belt (around Gich Camp).

Rüppell, and H. Steudner, laying the ground work for A. Richards' *Tentamen Florae Abyssinicae* and G. Cufodontis' *Enumeratio plantarum Aethiopiae Spermatophyta*. More recently, Scott (1958) and Sebald (1968) explored Simen (sometimes also spelled Semien or Simien) and made extensive collections. Some of the species found by these collectors have not been encountered since.

Simen Mountains National Park (SMNP; Fig. 1) is listed as one of the world heritages with an area of 22,000 ha (in the year 1978) and situated approximately at 13° 14' N, 38° 04' E. The park occupies a broad undulating plateau of open grassy plains and includes a wide altitudinal range at 1900-4624 m (World Bank 1993). The plateau is bounded on the south and northeast by the deep valleys of the Tekeze River and its tributaries, and is dissected from north to south by the Meshah River (which is the principal catchment area). The SMNP is a delineated sanctuary for threatened fauna such as the Walia Ibex (*Capra walie*), the Geleda Baboon (*Theropithecus gelada*), and the Ethiopian Wolf (formerly known as the Semien Fox; *Canis simensis*). The Walia Ibex has always had a restricted distribution range in Ethiopia, and the Simen Mountains are the southernmost limit of all species of ibex (Curry-Lindahl 1968). The SMNP does not include the nearby Ras Dejen, the highest peak in Ethiopia.

The climate of Simen Mountains is characterised by frequent frost, occasional snow at high elevation, and frequent hailstorms

Fig. 2. A-B. View of "lowlands." **A**. From around Sankaber Camp (c. 3200 m). **B**. From Gidir Got area (c. 3400 m). Note patches of Afromontane forest (at c. 2400 m) around fields. **C-F.** Afromontane forest in the "lowlands." **C-D**. "Wet" types. **C**. Interior of Adarmaz forest (c. 2400-2700 m; see text). **D**. *Albizia schimperiana* dominated forest in the Adarmaz T/Himanot R. valley (c. 2060 m). **E-F.** "Dry" types (near Tiya village; c. 2800 m). **E.** A type with *Juniperus* and *Olea*. F. A type with also *Euphorbia ampliphylla* dominant. Reproduced from colour slides by C. Puff. →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(Hurni *et al.* 1987; Sebald 1968). Changes between clear days and night hailstorms have frequently been reported. During September/October (almost end of the rainy season) we observed clear mornings that were frequently followed by a strong build-up of fog, which instantly may cover the mountains, and heavy rain and hailstorms at night. Under these conditions, it was practically impossible to see the mountains and sceneries of the Simen Mountains in the afternoon. It is very cold at night and relatively warm with clear skies in the day, especially in the mornings during the rainy season. We observed frequent snow in December/January (dry season). The more accessible (*i.e.* less steep and ± flat) parts of the Simen Mountains are favourable for barley cultivation, which is practised up to *c.* 3600 m. Hurni *et al.* (1987) characterised the climate of Simen and divided it into two categories, namely the upper (above 3500 m) and the lower (1500-3200 m) climatic types.

Gillett (1955) described the differences between the plateaux of Ethiopia and the East African Mountains, while Beals (1968) pointed out that the Simen Mountains are floristically different from the high southern and south-eastern mountains of Ethiopia. Hedberg (1971) pointed out that such differences might be due to insufficient collection of the Ethiopian flora.

Since the time of G.W. Schimper, the flora of Simen Mountains has been relatively little investigated by botanists, partly due to recent socio-political problems. The SMNP and the surrounding high mountains are type localities for *c.* 220 taxa. Many of the type collections (especially G.W. Schimper's) for these taxa were destroyed during the Second World War in Berlin. The National Herbarium, Addis Ababa University, has relatively few representative collections from Simen Mountains. The present study was designed to (1) provide new collections to facilitate the writing of the Flora of Ethiopia and Eritrea, (2) provide data on the endemic plants in the park to help the SMNP management, and (3) provide an overview of the tree species of the afromontane forests inside the park.

Terminology

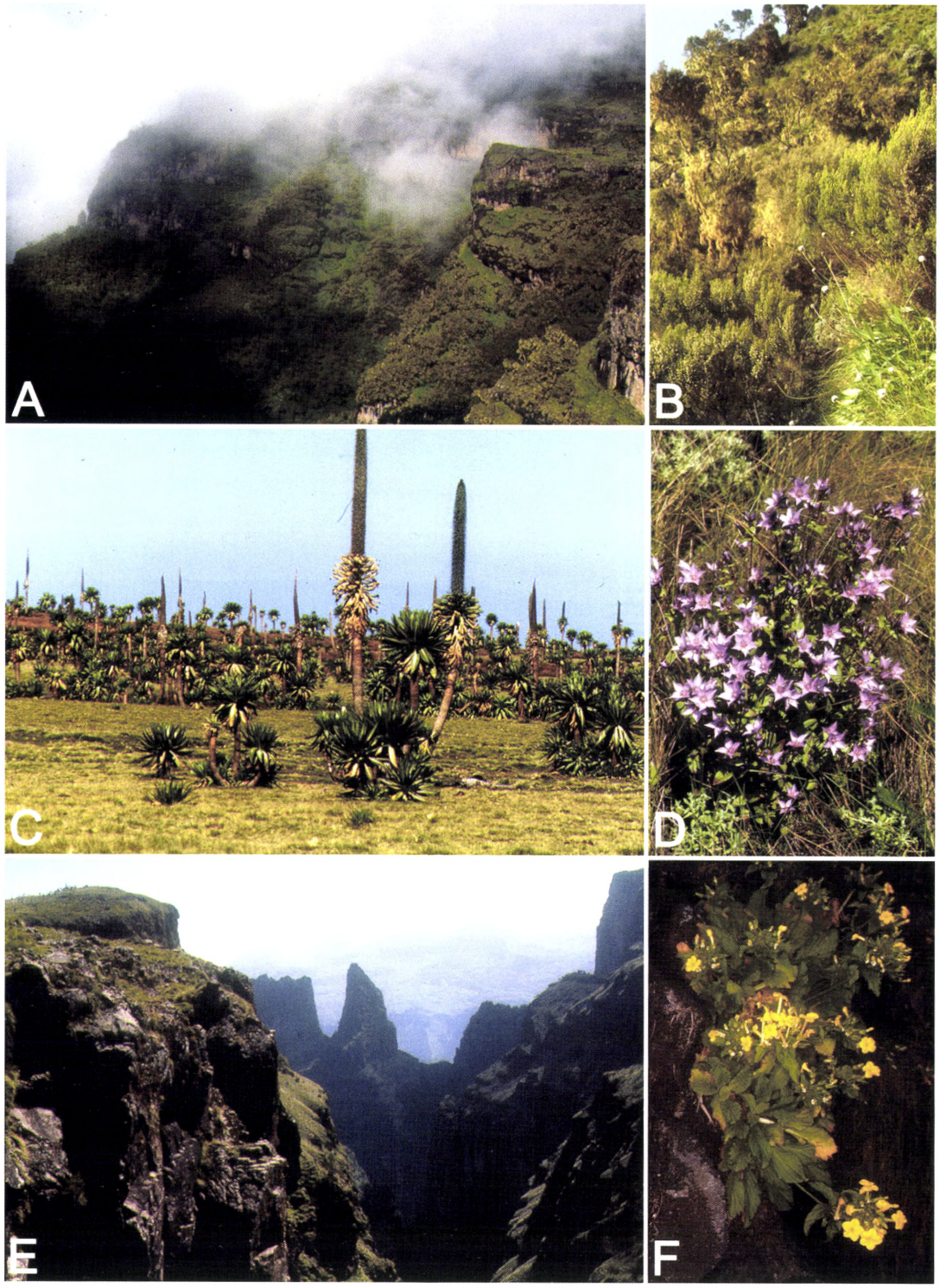
The terms afroalpine, ericaceous, and afromontane are used according to Hedberg (1951), and assuming that these terms are also applicable to Ethiopian vegetation.

Study areas and itinerary

This study presents information and observations on Mt. Bwahit, Ras Dejen, and the Lemalimo Wildlife Reserve. Both Bwahit and Lemalimo are bordering the park, and there are plans to add these areas in the future. For the importance of the former area as type locality for many species, see Edwards (1996). Ras Dejen is further away from the SMNP in a northeasterly direction.

Three expeditions were made to the study area. The first expedition took place in December/January 1996-1997 (dry season). Collections of specimens around Sankaber, Gich, Emet Gogo, Saha and Muchilla Afaf, and investigation of the afromontane forest along Wazla

Fig. 3. A-B. Ericaceous belt. **A**. Escarpment below Chennek Camp (c. 3600 m); in this area, *Erica trimera* is more common than *E. arborea*. **B**. Around Chennek Camp; both *Erica trimera* and *E. arborea* (foreground, left) are visible (*Dipsacus pinnatifidus* in the foreground, right). **C-D**. Afroalpine belt around Saha (c. 3700 m). **C**. *Lobelia rhynchopetalum*, with *Carex monostachya*, brown, in the background. **D**. *Swertia fimbriarta* in *Festuca abyssinica* grassland. **E**. Entrance to Dirni gorge (c. 3700 m); *Primula verticillata* subsp. *simensis* (seen in **F**) is common in the shady, vertical cliffs. Reproduced from colour slides by C. Puff. →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Wenz were undertaken. The second expedition was made in September/October 1998, almost at the end of the rainy season. This expedition was organised into three phases.

1. Phase 1: Activities around the Sankaber Camp (see landscape on Fig. 2A).
2. Phase 2: Activities around the Gich Camp; collection around the camp, day trips to Saha (see landscape in Fig. 3C-D), Emet Gogo and Muchilla Afaf.
3. Phase 3: Activities around the Chennek Camp (see landscape in Fig. 3A-B) and work in the "lowland" (locally called *Kolla*). The trip to Kolla was organised with mules and mule drivers hired at Chennek Camp (3600 m). The expedition team camped at sites between Chennek and Adarmaz Camps (2400 m). We climbed up to Sankaber Camp (3100 m) from Adarmaz via Chilkiwanit, using wire ropes fixed on the cliffs. These wire ropes have been fixed by mountaineers of the Nature Oriented Tourism Development Project, Austria. The route from Adarmaz Camp (2400 m) to Chilkiwanit (slightly over 3000 m) was previously only accessible to local people because of the very steep cliffs.

The third expedition was made in May 1999 at the beginning of the rainy season. The expedition team left the Sug Sug area (*c.* 2150 m), a few kilometres above Dip Bahr village, for the Chennek Camp, passing through the "lowland" areas (See Fig. 2A-B). It took the team two days to reach Adarmaz Camp and 6 additional days to reach Chennek Camp. The trip to Ras Dejen was organised from a base at Chennek Camp.

Geographical positions, using GPS readings, were established at each camp, and botanically interesting sites were localised with a Magellan GPS Pro 5000. Altitude was measured with a Thommen altimeter with a range to 6000 m.

Vegetation

The vegetation of Simen Mountains can be divided into 3 distinct types ("belts" sensu Hedberg 1951), namely (1) the afromontane forest, (2) the ericaceous belt, and (3) the afroalpine zone. There is a clear transition from one belt to the other, although the upper and lower altitudinal limits of indicator species such as *Erica arborea* may vary with microclimatic conditions. *Lobelia rhynchopetalum* (which is the characteristic species of the afroalpine belt) also grows in wet sites at lower altitudes, *e.g.* near streams in ericaceous forest, which is sometimes dotted with *Hypericum revolutum*. The vegetation types are sometimes not clear because one or more types are strongly modified by human impact, such as cutting and clearing, or completely replaced by cultivation. This impact is very strong around Amba Ras, Argen, and Gich village where both the ericaceous and afromontane forests are cleared and replaced by cultivation.

1. Afromontane forests

There are two types of afromontane forest encountered in this study: the dry and the wet types. Various environments such as exposed slopes, rock outcrops, open areas, and gullies are found in the afromontane forest belt of the Simen Mountains. These varied environments support different species.

1A. Wet afromontane forest patches

These patches are often found on the moist North- or Northwest-facing slopes, and in steep and shady gullies. The characteristics and species composition of these wet afromontane forest patches are presented below.

i. Adarmaz forest – This forest (see Fig. 2C) is found at 2400-2700 m. Large and prominent tree species are *Prunus africana, Apodytes dimidiata* var. *acutifolia, Bersama abyssinica, Schefflera abyssinica, Olea capensis* subsp. *hochstetteri,*

Euphorbia ampliphylla, and *Pittosporum viridiflorum*. Epiphytic plants such as ferns and *Peperomia* species are common on tree trunks and large branches, and mosses are also present. The herbaceous layer is very poor because of the limited amount of light that penetrates the canopy. *Brucea antidysenterica* reaches in this forest the rather unusual height of about 10 meters. The forest is also characterised by the presence of woody lianas, such as *Embelia schimperi* and *Phytolacca dodocandra*, and a shrub layer with *Pavetta oliveriana* and the pauchycaul *Lobelia giberroa*.

Olea europaea subsp. *cuspidata* occurs in the drier, more exposed part of the forest patch. *Dombeya torrida* subsp. *torrrida*, on the other hand, is only found at the upper limit of the forest. Other characteristic species are enumerated in Table 1.

The Adarmaz forest is comparable to the forest patch along the valley of Wazla Wenz (restricted to gully) with regard to species composition, presence of epiphytic *Peperomia*, and the niche preference of *Olea europaea* subsp. *cuspidata*. These two forest patches differ, however, in the composition of canopy species. *Olea capensis* subsp. *hochstetteri* and *Apodytes dimidiata* var. *acutifolia* are absent as canopy trees from the Wazla Wenz forest patch. On the other hand, *Myrsine melanophloeos* (syn. *Rapanea simensis*) and *Myrsine africana*, common in the Wazla Wenz area, are absent from Adarmaz forest. Furthermore, the canopy of Adarmaz forest is more closed.

ii. Albizia schimperiana dominated forest – This forest patch occurs at *c.* 2060 m in the valley of Adarmaz T/ Himanot River (see Fig. 2D). The canopy of this forest includes *Albizia schimperiana, Millettia ferruginea* subsp. *ferruginea, Croton macrostachyus, Olea capensis* subsp. *hochstetteri, Euphorbia ampliphylla*, and *Schefflera abyssinica*. *Olea europaea* subsp. *cuspidata* is mostly restricted to the drier and exposed portions of this forest. The herbaceous layer is poor in species composition. There is a pure stand of *Debregeasia saeneb* along the river bank. One species characteristic of riverine forest, *Mimusops kummel*, is also recorded. Characteristic species are enumerated in Table 2.

iii. Muchila – Neznazit afromontane forest patch – This patch is restricted to slopes facing North and Northwest and in shady gullies. The forest is characterized by the presence of *Hagenia abyssinica*, *Dombeya torrida* subsp. *torrida*, *Myrica salicifolia*, and *Schefflera abyssinica*. *Olea europaea* subsp. *cuspidata* mostly occupies drier part of this forest. Woody lianas such as *Rubus steudneri* and *Pterolobium stellatum*, form impenetrable thickets. Species recorded are listed in Table 3.

1B. Dry afromontane forest patches

These forest patches are generally located on South- or Southeast-facing slopes and are rather poor in species. Characteristic taxa are *Juniperus procera*, *Olea europaea* subsp. *cuspidata*, and *Euphorbia ampliphylla*. *Juniperus procera* is rather uncommon in the SMNP. More extensive stands were observed between Antola, Tiya, and Truwata villages. There was also a remnant *Juniperus-Olea-Euphorbia* forest at the graveyard near Tiya village (see Fig 2E-F). The typical *Juniperus-Olea* dry forest common elsewhere in the northern highlands of Ethiopia is otherwise not present in the park.

The dry afromontane forest patches typically contain the species listed in Table 4. Some afromontane forest remnants are intermediate in that both „wet“ and „dry“ elements occur in it.

1C. Farmland and secondary scrub

In many places, natural afromontane vegetation is replaced by farmland and secondary scrub. The most common and prominent solitary, large trees (10 m to > 20 m) found in such areas are listed in Table 5.

Appendix to 1. Afromontane forests: The Lemalimo Wildlife Reserve (LWR) and its vegetation

The LWR is not part of the SMNP, but it is located immediately adjacent to it. It includes the area that is the continuation of the SMNP escarpment to the West. The LWR thus encompasses altitudes from over 3000 to less than 2300 m. The main road leading from Debark northwards, taking one down the escarpment (this is the famous "Wolkefit pass" collecting locality of older collectors!), divides the LWR into two parts.

Two areas of the LWR were surveyed:

i. afromontane forest areas both to the left and right of the road, at 2600-2700 m, and
ii. the steep, wooded slopes along the road (Wolkefit pass) from the Spring (2610 m) down to 2550 m.

i. Afromontane forest – The forest shows a species composition that, as far as woody plants are concerned, is essentially comparable to Adarmaz forest (Table 6; compare with Table 1). The major difference, however, is that the general canopy height is low, mostly under 10 m; only few solitary large (*i.e.* 20-25 m) trees are left. The latter is an indication that the forest has been – and is – selectively logged (see also below!).

There is a swampy area at the middle of the forest lined by a nice stand of *Salix subserrata* trees.

ii. The steep, wooded slopes along the road below the spring (Wolkefit) – These sites are also of considerable botanical interest because the steep to vertical, permanently wet rocks and their immediate surroundings harbour a number of plants which are otherwise only found in the high Simen, at altitudes well above 3300 m (Table 7).

2. Ericaceous belt

This belt is situated above the afromontane forest belt *sensu* Hedberg (1951). However, the altitudinal range of this belt on Simen Mountains does not correspond to it altitudinal range on the mountains of tropical East Africa. The ericaceous belt on the Simen Mountains is characterized by the occurrence of *Hebenstreitia dentata, Scabiosa columbaria, Arabis alpina, Swertia engleri* var. *engleri, S. lugardae, S. fimbriata* (see Fig. 3D), *Haplosciadium abyssinicum, Arabis thaliana, Saxifraga hederifolia*, and *Satureia simensis*. Of the ericaceous shrubs or trees, only *Erica arborea* was previously recorded from the SMNP (Klötzli 1986; Hurni *et al.* 1987), but we found that *E. trimera* is also present, locally replacing *E. arborea* at higher altitudes.

The ericaceous formations are different from site to site because of differences in the intensity of grazing and anthropogenic disturbances. In some little disturbed sites *E. arborea* has a well-developed bole, a feature rarely seen elsewhere. On the northern or northwest sides, *e.g.* facing Hawuza or Dirni (see Fig. 3E), the ericaceous forest is highly affected by human encroachment such as clearing for cultivation. These sides are more humid than the east or southeast-facing cliffs, which are exposed to a longer period of direct sun. However, patches of pure ericaceous forests still cover the inaccessible cliffs and rocky outcrops. Furthermore, the inaccessible cliffs and steep slopes provide a good habitat for Walia Ibex. The accessible *Erica*-dominated forests have few herbs due to overgrazing and human impacts such as cutting *Erica* for construction and fuel and clearing for cultivation. These forests are dotted with *Hypericum revolutum*. There are notable differences in disturbance of the ericaceous forests on the north/northwest and eastern/south-east facing slopes. Unfortunately, there is no sign of regeneration of *E. arborea* in any of the studied sites. The grass-dominated undergrowth of the open ericaceous forest is

dotted with beautiful flowers of *Gladiolus abyssinicus*, *Dipsacus pinnatifidus*, *Kniphofia foliosa*, and *Hebenstretia dentata*. The ericaceous belt at Chilkwanit harbours a rare Simen endemic species, *Ceropegia sobolifera* (Asclepiadaceae), that was encountered in small populations only twice during the field trip.

3. Afroalpine belt

The afroalpine region is dominated by various grass and herbaceous species, but the really magnificent landmark species is *Lobelia rhynchopetalum*. *Helichrysum* scrub, *Carex monostachya* bog, and *Festuca* grasslands are the most important plant communities. Different plant communities also occur along streams and on rocky outcrops. Characteristic species of this area include *Trifolium* and *Alchemilla* species, *Ranunculus oreophytus*, *Arabis alpina*, *Swertia engeri*, *S. fimbriata*, *Dipsacus pinnatifidus*, etc. Some of the herbaceous species of the area are characterised by the development of a thick, deep tap root system and short internodes (*e.g. Haplosciadium abyssinicum*). The afroalpine belt on Mt. Bwahit is mainly rocky and relatively species poor in comparison to a comparable area at Saha and Emet Gogo. This area is roughly above 3500 m and is mainly grassland with different plant communities. The communities are presented separately below:

3A. Long Festuca abyssinica-Lobelia rhynchopetalum community at Saha

This community is not affected by grazing because of the unpalatable *Festuca abyssinica*. The soil is as disturbed as on the Bale Mountains, where mole rats play an important role for the establishment of pioneer plant species. The herbaceous species of this community are *Swertia fimbriata, Dipsacus pinnatifidus,* and *Trifolium* species. The community is poor in species.

3B. Carex monostachya bog with scattered Lobelia rynchopetalum at Saha

This community has a very restricted distribution in the Simen Mountains.

3C. Rocky outcrops

This habitat harbours succulent plants such as *Rosularia semiensis*, *Aeonium leucoblepharum* and other afroalpine species such as *Arabis thaliana*, *Primula verticillata* subsp. *simensis* (see Fig. 3F). This habitat is mainly found on steep, inaccessible cliffs.

Conservation of the natural resources and threat to biodiversity of the park

The accessible ericaceous and afromontane forest belts are increasingly being cleared for cultivation. Overgrazing and human encroachment for new agricultural fields, logging for charcoal, timber, and firewood limit the regeneration of the vegetation in the ericaceous and afroalpine belts. The herb layer of the *Erica* forests is very open or almost non-existing, consisting merely of short grasses. The afroalpine belt suffers from overgrazing, which has facilitated erosion, especially along cattle trails. The characteristics of intensive overgrazing are seen above Gich (above 3600 m) and around Chennek and Amba Ras, where the vegetation consists of extremely short grasses and lacks the regeneration of *e.g. Kniphofia foliosa, Lobelia rhynchopetalum* and other species, which normally occur at this altitude in undisturbed areas. Herds of different grazing capacity (sheep, cattle, mules, horses, and donkeys) usually graze in the park, and the trampling of these herds is believed to be the major cause for the failure of the establishment of seedlings. We compared a relatively inaccessible and well-protected pocket of ericaceous vegetation at Chenneck with the same formation at roughly the same altitude at Gich, which is severely affected by overgrazing. The comparison showed that the number of small,

herbaceous species at Gich is only 25% of the number of species at Chennek, thus documenting the dramatic impact of overgrazing and trampling on the biodiversity of the park. Similarly, there is a significant difference between disturbed and undisturbed afroalpine environments with regard to biodiversity. An exception is the afroalpine areas of Mt. Bwahit (c. above 4000 m) which is rocky and naturally species poor.

We therefore recommend that

1. the remaining environments of the park be effectively protected as quickly as possible (to ensure recovery and regeneration), and
2. the Lemalimo area be added to the SMNP.
3. Grazing, selective logging and human encroachment be strictly forbidden in the park for the reclamation of the degraded environments of the park and conservation of its natural resources. In our opinion, *immediate action* is needed, as during our preliminary exploration, disturbing signs of illegal exploitation were observed: trees (and mostly the largest ones still left) are apparently felled at a regular basis, as can be concluded from tree stumps with cut-marks of varying ages. During a single afternoon, smoke from illegal charcoal making was observed from three different, more remote areas of the Lemalimo Wildlife Reserve. Moreover, far too many cattle from neighbouring farms are driven into the forest each day. There are distinct signs of overgrazing. The many cattle trails seriously hamper natural regeneration of forest elements.
4. the park boundaries are to be redelimited.

Acknowledgements

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Table 1. The most common woody and herbaceous plants found in Adarmaz forest.

Taxon	Family
Prominent large trees	
Apodytes dimidiata var. *acutifolia*	Icacinaceae
Bersama abyssinica subsp. *abyssinica*	Melianthaceae
Dombeya torrida	Sterculiaceae
Ekebergia capensis	Meliaceae
Euphorbia ampliphylla	Euphorbiaceae
Olea capensis subsp. *hochstetteri*	Oleaceae
Olea europaea subsp. *cuspidata*	Oleaceae
Pittosporum viridiflorum	Pittosporaceae
Prunus africana	Rosaceae
Schefflera abyssinica	Araliaceae
Less prominent trees	
Brucea antidysenterica	Simaroubaceae
Cassipourea malosana	Rhizophoraceae
Clausena anisata	Rutaceae
Croton macrostachyus	Euphorbiaceae
Discopodium penninervium	Solanaceae
Erica arborea	Ericaceae
Galiniera saxifraga	Rubiaceae
Hypericum revolutum	Guttiferae
Woody lianas	
Embelia schimperi	Myrsinaceae
Phytolacca dodecandra	Phytolaccaceae
Shrubs	
Maytenus arbutifolia	Celastraceae
Pavetta oliveriana	Rubiaceae
Rhus glutinosa subsp. *glutinosa*	Anacardiaceae
Ritchiea albersii	Capparaceae
Rosa abyssinica	Rosaceae
Herbs and pachycauls	
Girardinia bullosa	Urticaceae
Lobelia giberroa	Lobeliaceae
Thalictrum rhynchocarpum	Ranunculaceae

Table 2. The most common woody plants of the *Albizia* dominated forest in the valley of Adarmaz T/Himanot River.

Taxon	Family
Prominent large trees	
Albizia schimperiana	Mimosaceae
Croton macrostachyus	Euphorbiaceae
Euphorbia ampliphylla	Euphorbiaceae
Millettia ferruginea subsp. *ferruginea*	Fabaceae
Olea capensis subsp. *hochstetteri*	Oleaceae
Olea europaea subsp. *cuspidata*	Oleaceae
Prunus africana	Rosaceae
Schefflera abyssinica	Araliaceae
Smaller trees	
Bersama abyssinica subsp. *abyssinica*	Melianthaceae
Brucea antidysenterica	Simaroubaceae
Debregeasia saeneb	Urticaceae
Erica arborea	Ericaceae
Mimusops kummel	Sapotaceae
Phoenix reclinata	Arecaceae
Richtiea albersii	Capparaceae
Teclea nobilis	Rutaceae
Woody lianas	
Phytolacca dodecandra	Phytolaccaceae
Pterolobium stellatum	Caesalpiniaceae

Table 3. The most common woody and herbaceous plants of Muchila-Neznazit forest.

Taxon	Family
Prominent large trees	
Dombeya torrida subsp. *torrida*	Sterculiaceae
Hagenia abyssinca	Rosaceae
Myrica salicifolia	Myricaceae
Olea europaea subsp. *cuspidata*	Oleaceae
Schefflera abyssinica	Araliaceae
Smaller trees or shrubs	
Bersama abyssinica subsp. *abyssinica*	Melianthaceae
Carissa edulis	Apocynaceae
Clausena anisata	Rutaceae
Galiniera saxifraga	Rubiaceae
Myrsine africana	Myrsinaceae
Nuxia congesta	Loganiaceae
Osyris quadripartita	Santalaceae
Pittosporum virdiflorum	Pittosporaceae
Salix subserrata	Salicaceae
Lianas	
Pterolobium stellatum	Caesalpiniaceae
Asparagus africanus	Asparagaceae
Clematis simensis	Ranunculaceae
Rubus steudneri	Rosaceae
Stephania abyssinica	Menispermaceae
Herbs and pachycauls	
Epilobium stereophyllum	Onagaraceae
Eulophia streptopetala var. *streptopetala*	Orchidiaceae
Lobelia giberroa	Lobeliaceae
Pelargonium multibracteatum	Geraniaceae
Rubia cordifolia subsp. *conotricha*	Rubiaceae
Thalictrum rhychocarpum	Ranunculaceae
Epiphytes	
Peperomia abyssinica	Piperaceae

Table 4. The most common woody plants found in dry afromontane forest remnants.

Taxon	Family
Prominent large trees	
Euphorbia ampliphylla	Euphorbiaceae
Juniperus procera	Cupressaceae
Olea europaea subsp. *cuspidata*	Oleaceae
Smaller trees and shrubs	
Clerodendrum myricoides	Verbenaceae
Dodonaea angustifolia	Sapindaceae
Erica arborea	Ericaceae
Hypericum quartinianum	Guttiferae
Hypericum revolutum	Guttiferae
Myrsine africana	Myrsinaceae
Nuxia congesta	Loganiaceae
Osyris quadripartita	Santalaceae
Protea gaguedi	Proteaceae
Rosa abyssinica	Rosaceae

Table 5. Solitary, large trees found in farmland and cultivated fields.

Taxon	Family
Apodytes dimidiata var. *acutifolia*	Icacinaceae
Bersama abyssinica subsp. *abyssinica*	Melianthaceae
Ekebergia capensis	Meliaceae
Olea europaea subsp. *cuspidata*	Oleaceae
Prunus africana	Rosaceae
Schrebera alata	Oleaceae
Syzygium guineense	Myrtaceae

Table 6. Woody plants (trees, shrubs, and woody climbers) observed in the Lemalimo Forest (2600-2700 m).

Taxon	Family
Prominent large trees	
Apodytes dimidiata var. *acutifolia*	Icacinaceae
Dombeya torrida	Sterculiaceae
Myrica salicifolia	Myricaceae
Olea capensis subsp. *hochstetteri*	Oleaceae
Prunus africana	Rosaceae
Smaller trees, shrubs or lianas	
Bersama abyssinica subsp. *abyssinica*	Melianthaceae
Brucea antidysenterica	Simaroubaceae
Buddleja polystachya	Loganiaceae
Cassipourea malosana	Rhizophoraceae
Clausena anisata	Rutaceae
Croton macrostachyus	Euphorbiaceae
Debregeasia saeneb	Urticaceae
Discopodium penninervium	Solanaceae
Dovyalis abyssinica	Flacourtiaceae
Ekebergia capensis	Meliaceae
Erica arborea	Ericaceae
Galiniera saxifraga	Rubiaceae
Hypericum quartinianum	Guttiferae
Hypericum revolutum	Guttiferae
Jasminum abyssinicum	Oleaceae
Maesa lanceolata	Myrsinaceae
Maytenus arbutifolia	Celastraceae
Myrsine africana	Myrsinaceae
Nuxia congesta	Loganiaceae
Olea europaea subsp. *cuspidata*	Oleaceae
Osyris quadripartita	Santalaceae
Pavetta oliveriana	Rubiaceae
Phytolacca dodecandra	Phytolaccaceae
Pittosporum viridiflorum	Pittosporaceae
Protea gaguedi	Proteaceae
Psychotria orophila	Rubiaceae
Myrsine melanophloeos	Myrsinaceae
Rhus glutinosa subsp. *glutinosa*	Anacardiaceae
Rosa abyssinica	Rosaceae
Salix subserrata	Salicaceae
Schefflera abyssinica	Araliaceae
Urera hypselodendron	Urticaceae
Vernonia conyzoides	Asteraceae

Table 7. Common plants recorded on wet rocky cliffs at and below the spring (Wolkefit pass).

Taxon	Family
Bartsia kilimandscharica	Scrophulariaceae
Epilobium stenophyllum	Onagaraceae
Erica arborea	Ericaceae
Galium thunbergianum	Rubiaceae
Myrica salicifolia	Myricaceae
Primula verticillata subsp. *simensis*	Primulaceae
Swertia kilimandscharica	Gentianaceae
Wahlenbergia edulis	Campanulaceae