

Add missing forests in Malawi

Paulo van Breugel, based on information provided by Cornell Dudley

Methods

The smaller areas which were classified as montane forest on the original national maps were reclassified the same as the surrounding vegetation types in version 1.0 of the VECEA potential natural vegetation map of eastern Africa. New data on the distribution of *Prunus africana* suggest that this was not the right decision.

On the digitized version of the original Young and Stobbs maps, there are a number of smaller forest areas mapped. Upon inspection (comparing with altitude), the locations of the polygons seem somewhat inaccurate. We therefore decided to use the information provided by Cornell Dudley, which is reproduced in the next section “forest reserves, principle timber plantations and pulpwood plantations.

We used this information to identify other areas in central and southern Malawi to be reclassified as Fa/Fb. After comparing the different forest reserves mentioned in this document and their location, and looking at known locations of *Prunus africana*, a species characteristic for Fa and Fb, we classified all areas with an altitude of 1600m or more that fall within the limits of the polygon in vector layer 'correct central and south Malawi forests' (you can find this layer on http://vegetationmap4africa.org/4_Documentation/Versions.html) as Fa / Fb, using the GRASS commands below.

```
g.region rast=pnv_vecea2
r.mask raster=pnv_vecea2 --overwrite
v.to.rast --overwrite input=Correct_malawi@vegetation output=Correct_malawi use=val
r.null map=Correct_malawi@vegetation null=0
r.mapcalc --overwrite "pnv_vecea3a = if(dem@PERMANENT > 1600 &&
Correct_malawi==1,15032,pnv_vecea3) "
```

In version 1.1 the forest areas in Malawi were classified as Gm/F (Fa/Fb/Fh/g), while according to the document on Malawi's national forest reserves, only for Nyika National Park and the South Viphya Plateau mentioning is made of noticeable areas with mountain grasslands. The rest was therefore classified as a compound vegetation of Fa and Fb.

```
v.extract input=mask_vecea@PERMANENT cats=30,54 output=AAtmp1 --overwrite
v.extract input=veg_malawi_suppl@vegetation cats=1,19 output=AAtmp2 --overwrite
v.overlay ainput=AAtmp1 binput=AAtmp2 operator=xor output=AAtmp3 --overwrite
v.to.rast input=AAtmp3@vegetation output=AAtmp3 use=val --overwrite
r.mapcalc --overwrite "pnv_vecea3a = if(AAtmp3==1 &&
pnv_vecea3==1401,15032,pnv_vecea3) "
r.patch --overwrite input=pnv_vecea3a@vegetation,pnv_vecea3@vegetation
output=pnv_vecea3a
```

Forest reserves, principle timber plantations and pulpwood plantations

The text below is based on information supplied by Cornell Dudley. Where possible the mentioned reserves and parks have been located in the World Database on Protected Areas (WDPA, annual release 2009, dataset 2A for national protected areas). Only if not available in this database, the area was digitized from the first mentioned map. In purple additional notes by Paulo van Breugel.

Northern Malawi

The following three forests were probably once contiguous and could be mapped so.

- Mugheze Forest: (09.39oS, 33.32.54oE) 7.2 km², 1600-1889m (present elevation limits) - PNV 1.1.2
- Matipa Forest: 13.5 km², 1750-2050m (present elevation limits) - PNV 1.1.2
- Wilindi Forest: 10.4 km², 1700-1900m (present elevation limits) - PNV 1.1.2

Boundaries of the following areas are larger than the evergreen forest part. The evergreen forest was assumed to be confined to the altitudinal limits indicated.

- Mafinga Mts. : (09.57-10.01oS, 35.20-35.22oE) 2.5 km² , 1600-1800m (present elevation limits) - PNV 1.1.2
- Musisi Hill: (10.05oS, 33.39oE) 3.0 km² , 1600-1850m (present elevation limits) - PNV 1.1.2
- Uzumara Forest: (10.52.5oS, 34.7.5oE) 5.4 km² , 1600-1920m (present elevation limits) - PNV 1.1.2
- Chimaliro Forest: (12.24.5oS, 33.38.5oE) 1.8 km² , PNV 1.1.2
- Kaning'ina Hills: (11.26-11.28oS, 34.05oE) 6.7 km², 1000-1500m (present elevation limits) - PNV 1.1.3
- Nkwadzi Forest: (11.41.5oS, 34.14.5oE) 6.0 km², 600-650m PNV 1.1.4
- Chisasira Forest: (11.55oS, 34.04.5oE) 6.0 km², 600-650m - PNV 1.1.4
- Kuwilwe Hill: (12.07.5oS, 34.01oE) 2.0 km², 500-1200m - PNV 1.1.4

South Viphya Plateau

This forest reserve is much larger and more diverse botanically than the above. Also, much has been cut over to produce large plantations of pine. In the indicated areas, probably at altitude shown, most of the PNV would have been as indicated. Note that the indicated areas are not mapped separately.

- Chamambo (11.55.50S, 33.500E) 2.6 km², 1600-1800m - PNV 1.1.2
- Central Plateau 25 km², 1600-1500m (present elevation limits) - PNV 1.1.2

- Eastern Escarpment 25.0 km², 1000-1500m (present elevation limits) - PNV 1.1.2. Note the following description from the [Birdlife International website](#): “The South Viphya Plateau is the second-largest montane complex in Malawi” .. “Montane conditions prevail above 1,550-1,600 m“ ... “The central high plateau supports an enormous plantation (48,000 ha) of exotic pines, mainly Pinus patula. The pines were planted exclusively over montane grassland, while the patches of evergreen forest were deliberately preserved” ... “Three main patches of montane rainforest occur: Nthungwa (11°40'S 33°49'E, 108 ha at 1,600-1,800 m), Chamambo (11°50'S 33°50'E, 260 ha at 1,600-1,800 m) and Kawandama (12°01'S 33°52'E, 75 ha at 1,750-1,850 m)” ... “Numerous smaller patches are scattered on the plateau and down the eastern slopes, totalling probably over 4,500 ha of montane and mid-altitude forest. Outside forests and plantations, the main vegetation-type is rank montane grassland and shrubland, with also some transition miombo woodland down the eastern escarpment, and a few attractive dambos in drainage channels.”

Nyika National Park

Note, this park is not included on the map “Forest reserves, principle timber plantations and pulpwood plantations”. It is, however, included in the WDPA database. The situation in this area is more complicated than the Viphya. I will only give the information that I have. As this altitude is higher than any other place in Malawi except Mount Mulanje, some of the grassland is probably truly montane grassland PNV 4.1.1. Therefore, one cannot simply say that the whole area within the contours was PVN 1.1.1 or PVN 1.1.2. Roughly,

- SW slopes, 5.5 km², 1925-2225m - PVN 1.1.2
- Central Plateau, 25.0-30.0 km², 2225-2500m - PVN 1.1.1
- Eastern escarpment, 34.0 km², 1750-2350m - PVN 1.1.2

Central Malawi

In all the below areas the mentioned PNV can be found within the altitudinal limits indicated.

- Ntchisi Mt 0.3 km² and not mapable, (13.21.5oS, 34.01oE), 1350-1550m - PVN 1.1.3 (This was not in the WDPA database and was therefore digitized from the forest reserves map).
- Chipata Mt 0.4 km² and not mapable, (13.04oS, 33.56oE), 1400-1450m - PVN 1.1.3 (not found on any map)
- Chongoni Mt. 1.8 km², (14.12oS, 34.12.5oE), 1600-1950m - PNV 1.1.2 (Not in WDPA database; digitized and added from Forest reserve map)
- Dedza Mt. 2.3 km², (14.20oS, 34.20oE), 1800-2050 - PNV 1.1.2, 2050-2150m PNV 1.1.1.
- Chirobwe Mt. 6.1 km², (14.32.5oS, 34.32oE), 1800-2000m - PNV 1.1.2, (This was not in the WDPA database and was therefore digitized from the forest reserves map.)

Southern Malawi

In all the below areas the mentioned PNV can be found within the altitudinal limits indicated

- Mangochi Mt. 2.3 km² , (14.28oS, 35.29oE) , 1550-1700m - PNV 1.1.2
- Chikala Hill (15.08oS, 35.30oE) 2.9 km² , 1300-1600m - PNV 1.1.3. There is no Chikala on both in the WDPA data base and in the Forest reserves map. However, (1) the location of Liwonde on the Forest reserves map is incorrect, but correct in the WDPA map (checked various maps on the internet). At the same time, <http://www.geody.com> gives a coordinate for Chikala which falls within the boundaries of what is marked as Liwonde on the Forest reserves map. Therefore, I have assumed that this area is in reality Chikala hill.
- Malosa Mt. (15.16.5oS, 35.18oE) 7.3 km², 1700-1950m - PNV 1.1.2
- Zomba Mt. (15.20oS, 35.16.5oE) 6.0 km² , 1600-1950m - PNV 1.1.2. Malosa and Zomba on the Forest Reserves map overlap largely with what is indicates as the Zomba forest reserve in the WDPA database. I used the latter to represent both the above listed areas as in both the expected PNV in 1.1.2, whereby I have combined the altitude range.
- Chiradzulu Mt. (15.41.5oS, 35.10oE) 1.5 km² , 1450-1750m - PNV 1.1.2
- Lisau (15.41.5oS, 35.09oE) 1.6 km², 1300-1450m - PNV 1.1.3. I can't find Lisau on both the Forest reserves map and the WDPA database. On google maps the location (of the town or village I presume) is in or at the border of Chiradzulu.
- Soche Mt. (15.50.5oS, 35.01.5oE) 1.5 km² , 1300-1520m - PNV 1.1.3
- Thyolo Mt. (16.04oS, 35.02oE) 10.0 km², 1000-1100m - PNV 1.1.3
- Malawi Hills (16.56oS, 35.11.5oE) 4.0 km², 600-940m - PNV 1.1.4 (Not found)
- Thyolo Tea Estates (16.00±02oS, 35.06±02oE) 2.0 km² 1000-1300m PNV 1.1.4. This forest area is scattered as a number of large patches in the region indicated. (Not found)

Mulanje Mountain

This is again a more complicated area. The areas below are difficult to separate with the information available. Also the forested grassland area is interrupted in various places by large rocky peaks. Note also that the Afromontane Evergreen Bushland/Thicket type occurs in this altitude range at the highest altitude.

- Foothills (15.58oS, 35.30oE; 16.02oS, 35.31oE; 16.02oS, 35.43oE) 2.0 km² , 600-950m PNV 1.1.4, Scattered patches in at least three main areas within the region indicated.
- Middle slopes (16.01oS, 35.32.5oE; 15.58oS, 35.39oE; 16.02oS, 35.45.5oE) 18.0 km² , 900-1500m PNV 1.1.3, Scattered patches in at least three main areas within the region indicated.
- Upper slopes and plateau (~15.55oS, 35.38oE) 50.0 km² , 1500-1850m PNV 1.1.2 , 1850-2300m PNV 1.1.1.