

A modest Tigray botanical garden in Belgium - illustration of the Afromontane vegetation

Version 4, 10/5/2024

Jan Nyssen

Ghent University, Department of Geography, Belgium



View on the Tigray Garden on 17 August 2023.

TABLE OF CONTENTS

- Abstract
- Introduction
- Mullein
- Meskel flower
- East african cedar
- Tembien banana
- Rue
- Tree heath
- Cedrate
- African wild olive
- Red hot pokers
- Candelabra tree
- Leafy spurge
- Trefoil
- Jacaranda
- Buckthorn
- Winter thorn
- Apple
- Fig tree
- Sand Olive
- Sorrel
- Grapes
- Eucalyptus
- Sumaq
- Management in winter
- References

Abstract

The Afromontane biogeographic region includes plant species found in Africa's highlands. Temperatures in these regions are comparable to those encountered in temperate climates, with the major temperature contrast being between day and night. The Dogu'a Tembien massif in Tigray is a 'sky island', that served as model for the establishment of a modest Afromontane floral park. The garden, dedicated to the slain Tigray people, was established in 2023 and holds thirteen woody, seven herbaceous, one palm and one succulent species. The garden is managed organically,

with compost used as fertilizer, no herbicides, and only a metaldehyde-based molluscicide. Geomembrane sheets are used to limit the abundant local vegetation, and plant labels are prepared in French with scientific and Tigrinya names in small lettering.

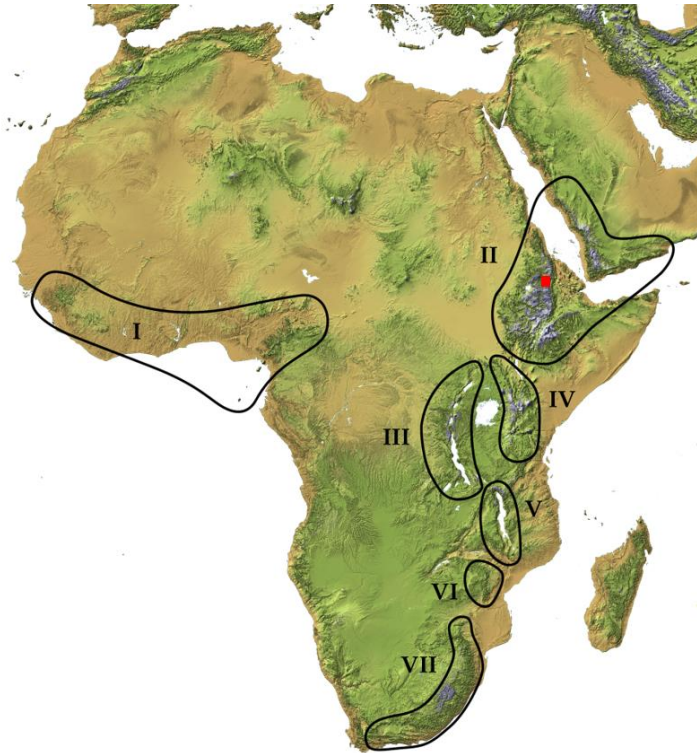
Afromontane vegetation

The vegetation of the Afromontane biogeographic region includes plant species found in Africa's highlands. The Afromontane regions are discontinuous, separated from one another by lower-lying areas, and are distributed as a series of "sky islands" [3]. Temperatures in these tropical mountain climates are comparable to those encountered in temperate climates, with the major temperature contrast being between day and night rather than seasonal [4].

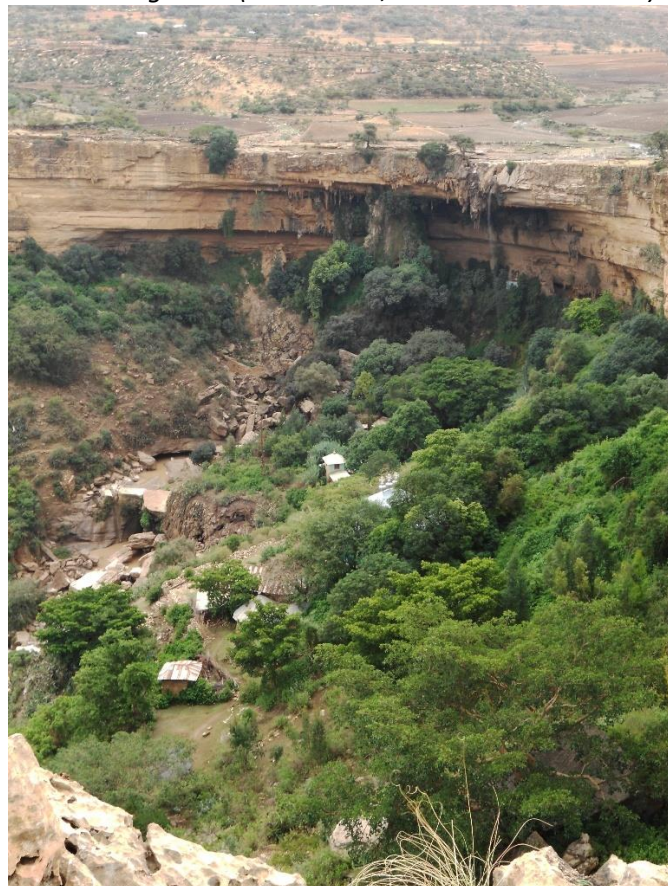
Tigray context

One of these Afromontane regions are the Ethiopian highlands. Zone II looks to be cohesive on the map, but it is actually an 'archipelago' of Afromontane islands [3]. The Dogu'a Tembien massif in Tigray is such a sky island, where the author has spent several years living and working.

Tigray has suffered through a brutal war waged on it by the Ethiopian, Eritrean, and Amhara armies (2020-2022), and there is still starvation and extreme insecurity [5]. We attempted to build a modest Tigray garden in Belgium as a token of friendship and empathy. Despite the occasional severe cold in Belgium (at approx. 50°N and 180 metres elevation), the



Map of the Afromontane regions. The red dot indicates the Dogu'a Tembien sky island that is represented in the botanical garden (© A. Colvin, Wikimedia Commons)



Remnant forest at the Tinsehe waterfall in Dogu'a Tembien, Tigray [2]

overall temperature similarity with Dogu'a Tembien allowed for the establishment of a modest private botanical garden representing species frequently occurring in Dogu'a Tembien (Tigray).

The Tigray garden

The Tigray garden was established in 2023 near Liège (Belgium). Some species had been planted for many years, while others are more recent additions, that have not yet completely grown. The garden holds thirteen woody, seven herbaceous, one palm, and one succulent species and was inaugurated in 2023. Some of the species were brought from Tigray, others obtained in Europe, and for a few, we substituted the Tigray species by a species of the same genus and with the same morphology, that can grow in the Belgian climate.

The garden is managed organically, with compost as fertilizer, no herbicides, and only a metaldehyde-based molluscicide. During the summer, geomembranes are used to reduce the abundant local vegetation ("weeds"). The geomembrane sheets are fastened with flintstone mined from a local outcrop of 'flint eluvium' [6-9] because it was impossible to carry a sufficient volume of the vast range of Dogu'a Tembien lithology [2].

All planted species are very common in Tigray, and one may occasionally find them in gardens in different countries; none of these species are on the IUCN Red List. It is their grouping in this garden that makes it unique, hence the name "Tigray Garden", "Jardin du Tigray" in French, ገደና ትግራይ [gedena tigray] in Tigrinya. "Gedena" points to a spot in the backyard of the farmer's homestead, meant for planting, multiplying and preserving the family's most valued and essential plants and vegetables. I received many other suggestions, including ድሕረ ቤት [dehri bêt] which points to the broader backyard [10] and ማእኸል እፅዋት [ma'ekel 'etswat] for botanical garden, which is a bit overdone for this small garden.

As the garden is visible to the general public, plant labels are produced in the local French language, with scientific and Tigrinya names written in smaller font.

<p>Bananier <i>Musa basjoo</i> ሙዝ ተምቤን [muz tembien]</p>	<p>Jardin du  Tigray</p>	<p>Rue <i>Ruta graveolens</i> ጩና ኣዳም [ch'enna-addam]</p>	<p>Jardin du  Tigray</p>
<p>Cédratier <i>Citrus medica</i> ትሩንጊ [trunghi]</p>	<p>Jardin du  Tigray</p>	<p>Olivier brun <i>Olea europaea subsp. cuspidata</i> ኣውሊዕ [awli'i]</p>	<p>Jardin du  Tigray</p>

Sample of species labels in the Tigray garden, represented at scale 1/3

The next pages give a description of the species planted, their context, and summary of their management in the Belgian climate.

Mullein

Verbascum sinaiticum

The plant is common in Tigray and endemic to the Horn of Africa and SW Asia. The plant has multiple uses in traditional medicine [11]; its roots have antibacterial properties [12]. In traditional veterinary use, it is administered against anthrax, and the leaves may be tied around animal legs to cure dislocated bones [13].

In Tigrinya : ትርናኻ, ጥርናቕ [tirnakha, t'irnaqa] [14], ሓጎደጋ [handega] [11].



Substituted by *Verbascum nigrum* in the Tigray garden (Belgium) (May 2024)



Verbascum sinaiticum in Addi Qwolqwal (Tigray) (October 2023)

Verbascum sinaiticum would not resist the cold winters in Belgium, hence we opted for the very similar *V. nigrum*, locally widely available in Belgium.

Meskel flower

Bidens macroptera

By the mid of September, near the end of the rainy season, Tigray's landscapes are green, with large spots of bright yellow Meskel flowers, named after the Meskel holiday that is celebrated at the end of September. The *Bidens* genus is widespread all over Africa, and beyond [15].

In Tigrinya : ገልገለ ሙስቀል [gilgile meskel] [14], locally also ዕምባባ ዮሐንስ [imbaba yohannis], Yohannes flower, after Saint John (patron of the local new year's day) who is celebrated at the moment when these flowers start flourishing.



In the Tigray garden (Belgium), *Bidens macroptera* is substituted by *B. ferulifolia* (August 2023)



Typical growth of *Bidens macroptera* mingled with other herbs in Tigray (May Ntebteb, Dogu'a Tembien) (October 2023)

Plants purchased in 2023 from Home Meets Nature (The Netherlands) through mail order. Supports temperatures down to -5°C. It did not survive the -10°C of the 2024 winter, and needed to be planted again. In 2024, the plants were obtained from the Bakker nurseries, also in The Netherlands.

East African cedar

Juniperus procera

A coniferous tree native to mountainous areas in Africa and the Arabian Peninsula. It is a characteristic tree of the Afromontane flora. It often reaches a height of 25 metres [16].

In Tigrinya : ፅሕዲ [tsihdi] [17].



Substituted by the winterhard *Juniperus communis* in the Tigray garden (Belgium) (May 2023)



Juniperus procera (Awulo, Tigray, 2023)

Juniperus communis obtained from a nursery in Belgium, and planted around the year 2000.

Tembien banana

Musa acuminata × *M. balbisiana* (Bluggoe subgroup)

Banana plants grown traditionally in Tigray and the wider Ethiopia are of local cultivars [18], which produce short and very tasty bananas, internationally called “apple banana” [19].

In Tigrinya : ጡዝ ዓዲ [muz ‘addi] (local banana) or ጡዝ ተምቤን [muz tembien] (Tembien banana), in contrast to the commercial banana ጡዝ ፈረንጅ, “banana from abroad”. The “local” banana species reached Tigray between 700 and 1100 CE, originating from Taiwan and the Philippines [20], the “foreigners’ bananas” (mainly Cavendish) came in a recent wave after a detour through Latin America [21].

The Tembien banana cultivar was identified as “Bluggoe” (genome ABB) [22] by banana researcher Roni Swennen (IITA). It is one of the best drought tolerant starchy bananas. The cultivar has been studied in detail in deep valleys in Oman [23], where it similarly has a very good taste, presumably due to the specific environmental conditions. Note that Oman is along the trade route from SE Asia to the Horn of Africa.



The Tigrayan “local banana” plants were substituted by the winterhard *M. basjoo* in the Tigray Garden (Belgium) (June 2023)



Tembien banana tree (Abiy Addi, Tigray) and a bunch of Tembien bananas with pen for scale (Photos Seifu Gebreselassie and Sarah Tewoldeberhan, May 2023)

The shoots of *M. basjoo* planted in the Tigray garden were obtained in 1992 from a hobby gardener in Liège (Belgium). The plant was grown in pot until 1995. Planted in full ground in 1996. Every winter the foot is covered with decayed leaves and straw. Re-emerges in spring and produces small fruits by August-September. Vegetative multiplication.

Rue

Ruta graveolens

(herb-of-grace)

Rue is grown as culinary herb and medicinal plant in Tigray [11, 24]. It is also cultivated as an ornamental plant, and as an insect repellent and incense. The plant is native to the Balkans, and may be found in traditionally managed gardens in Belgium.

In Tigrinya : ጩና ኣዳም [ch'enna-addam] [14].



Herb-of-grace in the Tigray garden (Belgium) (August 2023)



Herb of grace in Hagera Selam (Tigray) (October 2023)

Plant obtained from a hobby gardener in Liège (Belgium) in 2023. Grows in full ground; winterhard.

CARE: urticant

Tree heath

Erica arborea

In Tigray, heath trees can be up to 10 m high. They form the upper tree belt on Tigray's highest mountains. For instance, the upper tree line is at 3700 m on Ferrah Imba, the peak of Tigray [25]. *Erica arborea* has a large distribution from the Mediterranean maquis to Afromontane ecosystems. The *E. arborea* populations in these areas have been separated for a long time, hence there may be genetic variants with possible different ecological behaviour (pers. comm., B. Muys, 2023).

In Tigrinya : ሻቅቶ [shaqto], ሓስቲ [hasti] [14].



Tree heath in the Tigray garden (Belgium) (April 2024)



Tree heath on Dabba Selama mountain at 2646 m in Dogu'a Tembien, which is exceptional as the minimal elevation for the plant in Ethiopia is generally considered as 2800 m [26]

Plants purchased from Esveld nursery (The Netherlands) through mail order in 2023. Reputedly grows in full ground without reproduction. Said to reach up to 2 m high in the Belgian climate. The planted variety is expected to be of Mediterranean origin and may have characteristics that are slightly different from the Tigrayan variety [27]. It resists frost up to minus 10°C; verified in January 2024 when this temperature was reached several consecutive days.

Citron or cedrate

Citrus medica

A variety of lemon that is widespread in the Middle East and also in Tigray [28]. It is a large fragrant citrus fruit, a huge, rough lemon with a thick rind, which is consumed. It is one of the original citrus fruits from which all other citrus types developed through natural hybrid speciation or artificial hybridization [29].

In Tigrinya : ትሩንካ [trunghi].



Citrus medica in the Tigray garden (Belgium) (July 2023)



Citrus medica tree in Israel, where it is called “etrog” (<https://gardening.stackexchange.com>)

Tree purchased from Plantencentrum Exotica (Belgium) through mail order. Grown in pot, and transferred to frost-free environment from 1 November till the end of April.

African wild olive

Olea europaea subsp. *cuspidata*

The wild olive tree is very useful for dryland restoration, as it is drought and frost resistant [30]. The tree is also harvested for its durable timber. The leaves make good livestock fodder during the dry season and when burnt, the smoke from its leaves and stem is being used to fumigate food and liquid containers. Root and bark are used to treat malaria [11]. Because of the many uses of this tree, it has been over-harvested dramatically in Tigray (www.weforest.org).

In Tigrinya : አውሊዕ [awli'i] [17].



African wild olive in the Tigray garden (Belgium) (July 2023)



African wild olive tree near the edge of Des'a forest in Tigray

Tree obtained from the May Zahla nursery in Dingilet (Tigray). Grown in pot, and transferred to frost-free environment from 1 November till the end of April. The tree sheds nearly all its leaves in winter, presumably due to poor light conditions.

Red hot poker

Kniphofia foliosa

Five endemic *Kniphofia* species are known in Ethiopia; they most often grow in wet and stony habitats [31]. Annually the Ashenda festival (named after this plant) is organised in almost all villages and towns of Tigray, which empowers, inspires and provides freedom to women and girls (who wear a skirt prepared from *Kniphofia* leaves over their clothes) in a society that traditionally subordinates them [32].

In Tigrinya : አሽንዳ [ashenda] [14].



Substituted by *Kniphofia* 'Papaya Popsicle' in the Tigray garden (Belgium) (August 2023)



Ashenda along the Rift Valley escarpment (photo Tesfa Tours)

Plants purchased from Esveld nursery (The Netherlands) through mail order. Grows in full ground in the Belgian climate, with leaves that totally decay during winter and regrow in spring. It survived the cold 2024 winter under a thin mulch of straw. Vegetative reproduction.

Candelabra tree

Euphorbia candelabrum

Euphorbia candelabrum is one of the species that dominates a major vegetation type occurring in Tigray, i.e., montane evergreen thicket and scrub with on shallow soils [33]. Though of a totally different family, this tree shows isomorphism with cacti as in Arizona – the two species, on different continents, evolved into similar morphology with succulent stems and spines, given similar environmental conditions [34]. Cacti are from the Americas and have single spines, or grouped in cluster, while euphorbias (from Afro-Eurasia) have twin spines. The latex is used as medicine for various diseases, and also as a base for ointments (mixed with other herbs) [11].

In Tigrinya : ቁልቁል [qwolqwal] ; as the plant produces latex when damaged, it is also called “qwolqwal demay”, where "demay" means 'bleeding' [17].



Euphorbia candelabrum in the Tigray garden (Belgium) (August 2023)



Euphorbia candelabrum near Abune Ayezgi church in Haddinet (Dogu'a Tembien, Tigray, 2017).

A branch was taken from a tree in Addi Qoylo (Tigray) and potted around 2014. Vegetative multiplication. Grown in pot, and transferred to a frost-free environment from 1 November till the beginning of May.

CARE: urticant

Leafy spurge

As a cousin of the large candelabra euphorbias, there are leafy spurges in the herb layer, also in Tigray. Most common is *Euphorbia petitiana*, called “cat’s milk” in the local Tigrinya language, obviously after the latex it produces when cut [35]. One characteristic that all euphorbes have in common is indeed their poisonous, latex-like sap as well as the distinctive flower structures. Jointly, the heads of flowers appear like a single. Every flower in this head has been stripped down to the absolute minimum necessary for sexual reproduction. Each flower is classified as either male or female, with the males consisting solely of the stamen and the females exclusively of the pistil [36]. *Euphorbia petitiana* is a herbaceous perennial with several ascending stems from a woody rootstock, to 40 cm tall; in Tigray, it grows in open grassland or evergreen bushland above 2500 m, and flowers in July.

The latex of the various euphorbe species in Tigray is used as an ointment against several diseases; it also serves as a base ointment to which other herbs are added for application in case of specific diseases [35].

In Tigrinya : ጸባ ድምጽ [ts’aba dummu] (literally: “cat’s milk”) [35].



Euphorbia platyphillos in the Tigray garden, July 2023



Holotype of *Euphorbia petitiana*, collected in Tigray’s Wajirat district in 1847, and conserved at the Muséum National d’Histoire Naturelle in Paris [37].

In the Tigray garden, *Euphorbia platyphillos* has spontaneously grown in the pots of the large candelabra tree, as well as the jacaranda. Since both of the large plants are brought indoors for the winter, the species, which is rare in Belgium, most likely benefits from the niche created by the lack of frost. It is assumed that *Euphorbia petitiana* could also grow in Belgium under the same conditions.

Trefoil

Lotus quinatus

Trefoil is so common on grasslands in Tigray, yet there are few studies about it. In the highlands of nearby Eritrea, it was recognised as a promising indigenous forage legume on dry hillsides [38].

For the most common *Lotus quinatus*, Cufodontis [39] mentions the Tigrinya name “hamat semanberri” or “hamat yemanberri” – this still requires observations on the spot, to be confirmed with local people, as none of the more recent plant lists for Tigray mentions the species, leave alone its name.



Lotus corniculatus in the Tigray garden (Belgium) (July 2023)



Sample of *Lotus quinatus*, collected in Dogu'a Tembien in 2005 at an elevation of 1950 m [40]

In the Tigray garden in Belgium, cousin *Lotus corniculatus* grows abundantly, in relation to absence of herbicides or pesticides, and low frequency of mowing.

Jacaranda

Jacaranda mimosifolia

Though jacaranda originates from Brazil, it is a popular ornamental tree in Tigray. It grows in most soils, prefers highland areas but can also grow in drier places [41]. Jacaranda may not be deemed naturalised or invasive in Tigray since it requires human assistance for reproduction (unlike in Tanzania or South Africa), yet it uses a lot of ground water (phreatophyte) [42].

In Tigrinya : ጃካራንዳ [djakaranda].



Jacaranda in the Tigray garden (Belgium) (July 2023)



Jacaranda trees in a street of Mekelle (photo Olav Greve)

Tree purchased from a nursery in Mekelle (Tigray) around 2015. Permanently grown in pot, and transferred to a frost-free environment from 1 November till the beginning of May. We managed to obtain lush vegetative growth but no flowers, so far.

Buckthorn

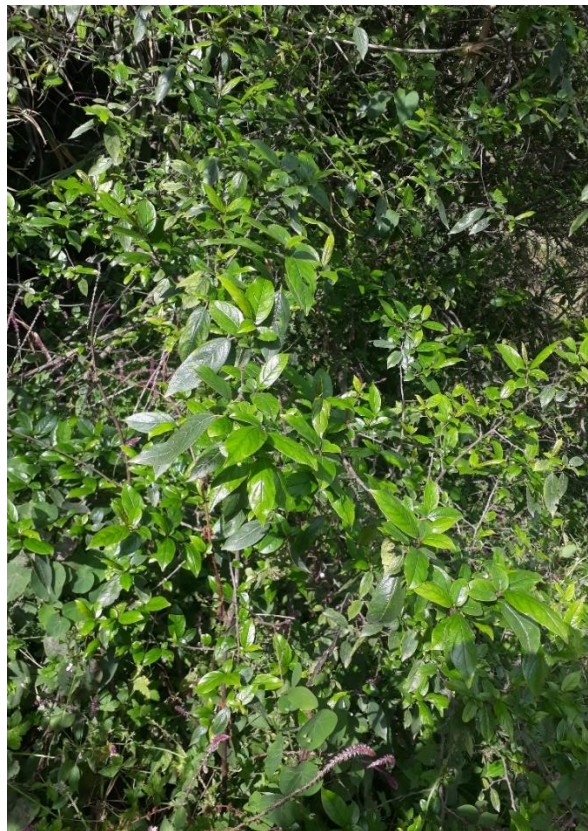
Rhamnus prinoides

Gesho (*Rhamnus prinoides*) is a perennial shrub or bushy tree with red berries, that naturally grows near streams or along forest margins [43]. It is commonly cultivated in backyards and is one of the basic ingredients of *siwa*, the Tigrayan local beer, in addition to water, a home-baked and toasted flat bread and some yeast (*Saccharomyces cerevisiae*). The dried leaves of *gesho* serve as a catalyser [44]. Gesho leaves are harvested by hand-picking or by cutting together with adjacent shoots. After the leaves are collected, they are dried in the sun; after sun-drying, the quality of the leaves is judged from its colour, which should be green-yellowish [45].

In Tigrinya : ገሻ [gesho] [14, 17].



Rhamnus alaternus as a substitute for gesho in the Tigray garden (Belgium) (May 2024)



Rhamnus prinoides at May Zahla, Dingilet, Tigray (October 2023)

Growing *gesho* in Belgium would be impossible in full ground. In our garden, we substituted it with Mediterranean buckthorn (*Rhamnus alaternus*), another species of the same genus, which is said to support frost up to -3°C . It was covered by an amovable greenhouse fabric in winter; in this way it survived the -10°C of January 2024. The *Rhamnus alaternus* was obtained from TheOriginalGarden in Miramar (Valencia, Spain).

Winter thorn

Faidherbia albida

Faidherbia albida (“momona”) is a typical scattered tree on farmlands in Tigray. It is highly valued in traditional agroforestry systems, because on the one hand (as all leguminous trees) it is a nitrogen fixer, enhancing soil fertility in its surroundings. And on the other hand, it sheds its leaves during the crop growing season (rainy season) so that it does not compete with the crops [46]. Note that the rainy season in Tigray is in the summer (we are in the northern hemisphere), but a popular mistake is to associate it to winter because clouds and rain make it the coldest season in daytime.

In Tigrinya : ጞጞና [momona] [14, 17].



Robinia pseudoacacia as a substitute for *momona* in the Tigray garden (Belgium) (May 2024)



Momona at May Shewat, Hech'i, Tigray (October 2023).

Growing *Faidherbia albida* in Belgium is nearly impossible in full ground; it would require a large greenhouse to avoid frost in winter. In our garden, we substituted it with another leguminous tree, *Robinia pseudoacacia*, popularly called “acacia”, which sheds its leaves in winter and which allows pruning to obtain a typical acacia savannah tree shape. Both species are thorny. The robinia was obtained from the Amazonia plant shop in Rocourt (Belgium) around 2010.

Apple

Malus domestica

Apple trees have been introduced into the tropical mountains of Tigray, in Adigrat first, by Italian missionaries around 1980, in Wukro around 2000, and in Mekelle and Hagere Selam in 2002 at our initiative [4]. Building on this expertise, the Relief Society of Tigray further introduced the Ana cultivar to many highland areas in Tigray. Although seasonal temperature amplitudes are still too low to obtain effective winter chilling [47] at these high elevations in the tropics, average temperatures are lower, making it simpler to approach chilling conditions [48]. Warm winters cause apple trees to hibernate for an extended period, which causes poor blossoming, extremely vigorous upward growth, unsynchronized phenology, and low yields [49]. The strategy used is to discontinue watering the trees, which is followed by hand defoliation [50, 51]. After harvest, defoliation—the removal of mature foliage—prevents the buds from going into endo-dormancy and instead encourages them to develop again [47]. Most apple trees around Hagere Selam are taken care of in this manner [4].

In Tigrinya : አፕል [apl] or ጠጣ [mèla].



Medium stem apple tree (Belle-Fleur cultivar) in the Tigray garden (Belgium) (June 2023)



Apple trees at May Zahla Experimental Orchard near Hagere Selam in 2007. Cultivars introduced and tested are Golden Delicious, Granny Smith, Jonagold and Gala Must. Given the need for hand defoliation, only short stem trees were introduced to Tigray.

Apple trees in Belgium are typically grown in full ground without irrigation. Traditionally in the surrounding vegetable and fruit growing area, they had been planted as tall stem. Here we have opted for medium stem, for easier management and access, while keeping the ground free for other activities. A traditional *Belle-Fleur* cultivar [52] was planted around 2010, obtained from Frijns Nursery in Groot-Welsden (The Netherlands), which supplied also the first batches of apple trees planted in Dogu’a Tembien and in Mekelle University’s orchard.

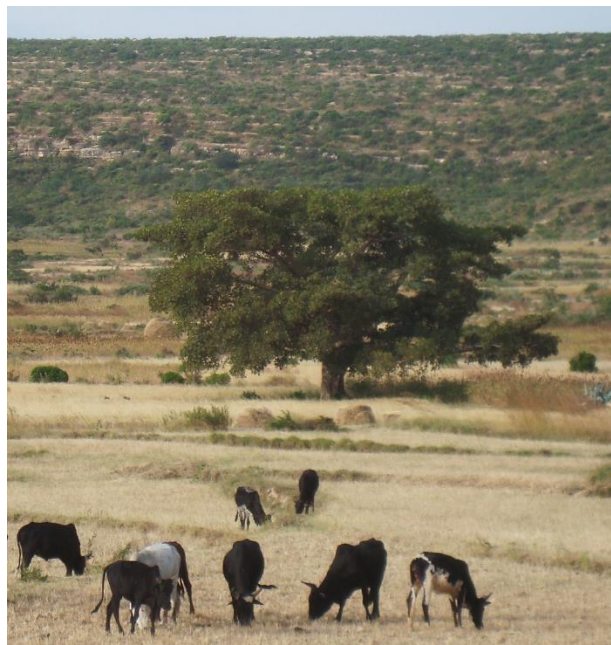
Fig tree

Ficus vasta (fig tree), *F. sycomorus* (sycamore) and *F. sur* (Cape fig) are common large wild fig trees from Tigray. They often stand isolated in farmlands, and nearby springs [53]. *F. vasta* grows in or near the Horn of Africa while *F. sur* is widespread across Africa [54]. The trees produce small figs which invite the children to climb the trees. These wild edible fruits are however not marketed [55]. In Tigray, the tree's latex may be smeared on warts for curing them [56].

In Tigrinya : *Ficus vasta* ዳዕሮ [da'iro]; *F. sycomorus* ሰግላ [sagla]; *F. sur* ሻፋ [shafa], ኮዶ [kodo] [14, 17]



A common fig cultivar (*F. carica*) was planted as a substitute for the large sycamores in the Tigray garden (Belgium) (June 2023)



Ficus vasta at Addi Keshofo, Dogu'a Tembien, Tigray. Cattle in the foreground are grazing the stubble after harvest [57].

Growing sycamores or Cape figs in Belgium would require an extremely large greenhouse. In our garden, we substituted it with a Mediterranean species of the same genus, *Ficus carica*, which is winterhard. The common fig plant was obtained from a hobby gardener in our neighbourhood.

Sand olive

Dodonaea viscosa subsp. *angustifolia*

Dodonaea viscosa subsp. *angustifolia* is one of the world's most greatly disseminated transoceanic plants in places with tropical and mediterranean climates [58]. In Tigray it is part of the undergrowth of natural forests, but also frequently used for reforestation as the small tree disperses a large number of seeds. It has a strong resistance to drought and poor soil [59]. It forms a bush or small tree up to 10 m high.

In Tigrinya : ታህሰስ [tahses] [14, 17].



Dodonaea viscosa "purpurea" as a substitute for *D. viscosa* subsp. *angustifolia* in the Tigray garden (Belgium) (June 2023)



Tahses at Addi Qwalqwal, Tigray [60].

We could not yet obtain a plant of *Dodonaea viscosa* subsp. *angustifolia* from Tigray. In our garden, we substituted it with a cultivar of the same species, *D. viscosa* "purpurea", which supports frost up to -3°C. Leaves turn purple in winter, but otherwise its morphology is very similar to *D. viscosa* subsp. *angustifolia*. It was covered by an amovable greenhouse in winter but did not survive with outside temperatures of -10°C. As a back-up two additional plants survived in pot in a tepid place during winter. The *Dodonaea viscosa* "purpurea" was obtained from TheOriginalGarden in Miramar (Valencia, Spain).

Sorrel

Rumex nepalensis

Sorrel is very common on valley bottom Vertisols and other humid locations in Tigray; as the plant flowers at the end of the rainy season, its red colour allows visualising the location of seasonal wetlands in the landscape.



Crop cultivation on vertic Cambisols in Harena (Dogu'a Tembien) – all land is cultivated, except two seasonal wetlands (spring areas) that are widely covered with sorrel (dark red colour, indicated by arrows) [1]. Photo taken in September 1994 during the author's first fieldwork in Tigray.

The native range of this sorrel species (*Rumex nepalensis*) is Southern Asia, Eastern and Southern Africa and the Eastern Mediterranean. It is a perennial and grows primarily in the temperate biome [61]. Synonyms: *R. bequaertii*, *R. peregrinus* [1, 61]. Not to be confused with *R. nervosus*, a woody species that is widespread in Tigray [62].

The roots of *R. nepalensis* are traditionally used in Tigray in the treatment of infertility, abdominal colic, diarrhea, tonsillitis, and arthritis. They are also used to induce labor and abortions [63, 64].

In Tigrinya : ሸምቢዕታ [shimbowa'ita].



Sorrel (*Rumex acetosa*), in the Tigray garden (Belgium) (May 2024)



Rumex nepalensis at May Ntebteb – the dominant broad-leaved plant (October 2023).

We have not taken the risk of transplanting *R. nepalensis* to Belgium as it might occupy the same habitat as our local *R. acetosa*, and become invasive. The local *R. acetosa* has spontaneously grown in the Tigray garden (Belgium).

Grapes

Vitis vinifera

In Tigray, a homestead or village bar (*inda siwa*) with a yard covered in grapevines (*Vitis vinifera*) is a good place to rest during fieldwork. Little is known about Tigray's traditional vines, that existed long before the recent introduction of modern vineyards such as in Aynalem.

Archaeologists recovered grape seeds in archaeological finds at Bieta Giyergis near Aksum, dating back to the early Aksumite period (100 BCE – 400 CE) [65]. Wine and (reportedly black) grapes were well-known in Aksum, according to historical sources and illustrations [66, 67]. Further, in the 18th century, Ch'elekwot was noted for its multiple grapevines at homesteads [68].

Wine production at the time struggled to take off because its rival *myes* could be made from honey at any time of the year. Wine preservation was difficult by the lack of glass bottles [66].

With the early introduction [66, 69] and reintroduction in the nearby Adwa region by German botanist Schimper [70], Aksum remained the hotspot for grapes. Between the 16th and 19th centuries, various travelers made reference to the wineries in the area of Aksum [67].

It is also reasonable to suppose that Italian colonizers in the 1930s brought grapevine varieties with them.

Hence, there are several probable origins of the vines that are now grown on homesteads in Tigray; they are undoubtedly not “wild” as they only occur at homesteads, and Tigray is also beyond the natural range of wild grape [67].

Unfortunately, we are unaware of any botanical or horticultural research on the grapevine cultivars that are customarily grown on some Tigrayan homesteads. During fieldwork, we observed that regular watering was the major management applied; in some cases they are pruned. Barradas [71] noted already that “the abundant foliage does not permit the force of the sun to warm and ripen [the grapes] well”. Beside the shade vines provide and the prestige that comes with having grapes at one's residence, experienced people increase the productivity of the vines by simple pruning at the beginning of the rainy season.



In Tigrinya : ወይኒ [weyni] [14].

Grapes in Abiy Addi (July 2023), on a well-managed (pruned) vine plant (Photo: Alemtsehay Tsegay)



Vines (Cabernet-Jura cultivar) in the Tigray garden (Belgium) (July 2023)



Vines at Addiha, a neighbourhood of Mekelle (July 2023). Photo: Desalegn Kiros

The vines in the Tigray garden have been obtained from Dalaheim Castellum winery in Dalhem (Belgium) around 2007 (<https://dalaheim-castellum.eu/>). Grows in full ground, irrigated during dry spells; winterhard. The Cabernet-Jura is a quite recently created hybrid that resists fungus [72]; not any herbicide or pesticide is necessary.

Blue gum (Eucalyptus)

Eucalyptus globulus

Eucalypts have been introduced from Australia to Addis Ababa around 1890, to supplement for the rapidly disappearing natural vegetation around the town [73]. On the numerous landscape photographs made in the 1930s, eucalypts occur in isolated stands around towns but not yet around villages [74]. Soon after, they had spread as an innovation to the rural areas. For instance, in Dingilet in Dogu'a Tembien, planting of eucalyptus trees in the marshy, clay-rich bottomland started after 1950. An influential priest was powerful enough to plant his own trees on communal land. He planted others in a nearby field, which he irrigated with water from the marshland. The oldest trees of the village, or their trunks, invariably stand along the rivulets. Ever since, many more trees were planted in the valley bottom, which is not marshy anymore [75]. Eucalypts are indeed well-known phreatophytes, plants that consume the groundwater [76]. While in many places in Ethiopia farmers have turned their farmlands into eucalypt plantations [77], such is not the case in Tigray. Yet the tree is conspicuous in homesteads, on farm boundaries and in community plantations.

In Tigrinya : ቀላሚጦስ [qelamit'os] [14].



Eucalyptus globulus near Rocourt St Léon church in Belgium (February 2023). Note frost damage at the top of the tree.



Eucalyptus globulus at Gra Arho, near Hagera Selam (October 2023). These are remnant trees from a much denser plantation (as also shown by the absence of lower branches) that was largely harvested during the Tigray war.

I spotted a rare eucalyptus in a nearby village in Belgium and considered it an extension of the Tigray garden. The tree was planted after 2013 and has grown rapidly, benefiting from a microclimate in between the houses. The top has grown higher than the surrounding buildings and is exposed to cold, what limits the apical growth of the tree [78]. Modelling by KU Leuven foresters shows that the NW European continent will become more suitable for *Eucalyptus globulus*, due to climate change (pers. comm.).

Sumaq

Rhus natalensis

Rhus natalensis, one of the many sumaq species, is a many-branched shrub or tree, sometimes tending to scramble, up to 8 m in height. In Tigray it usually grows in wooded savannah, on forest edges and in midland woodlands at 1600 to 2400 m [41]. We recognised it as a dominant species in woodland on limestone [1]. It is used for firewood, charcoal, farm tools, fruit, medicine (leaves) and toothbrush [41].

In Tigrinya : ጠጠሎ [t'et'alo] [14, 41]



A common sumac species (*Rhus typina*) was planted as a substitute for *Rhus natalensis* in the Tigray garden (Belgium) (May 2024)



Detail of *Rhus natalensis*, pictured in Rwanda [79].

Growing *Rhus natalensis* in Belgium would require an extremely large greenhouse. In our garden, we substituted it with a species of the same genus, *Rhus typhina*, which is winterhard. The shrub was obtained in 2024 from the Arborix nursery in Diksmuide (Belgium).

Management in winter

The Tigray garden is located in the temperate maritime climate of Belgium. Many species require protection from frost or even from cold temperatures.

Winterhard:

- *Verbascum nigrum*
- *Lotus corniculatus*
- *Juniperus communis*
- *Ruta graveolens*
- *Kniphofia* 'Papaya Popsicle'
- *Robinia pseudoacacia*
- *Malus domestica*
- *Rumex acetosa*
- *Vitis vinifera*
- *Eucalyptus globulus*
- *Rhus typhina*

Winterhard, thin straw mulching

- *Erica arborea*

Winterhard, dies back and regrows, thick straw cover when temperatures drop below 0°C

- *Musa basjoo*



Growing *Musa basjoo* in full ground in a temperate climate is labour-intensive. At the first frost, the leaves will decay. This is the moment to cut the dead leaves and to cover the root mass with the leaves and additional straw. If the winter is mild, the banana trees will regrow from the stem. In January 2024 (photo), frost went down to -10°C and stems decayed also. Then, it is better to cut the stems while still frozen, otherwise it will be hard to clean up the decaying filaments in spring. For this cluster of banana plants we have been *playing* with frost during thirty winters, and it expands annually.

Temporary greenhouse when temperatures drop below -3°C

- *Rhamnus alaternus*
- *Ficus carica*



When frost is announced, it is time to protect some plants that grow in full ground (such as *Rhamnus alaternus* and *Ficus carica*) with a temporary greenhouse. Here, fabric was chosen to allow air circulation. Additional straw mulching of the immediate surroundings to protect soil from frost.

Keep inside when temperatures drop below 2°C

- *Euphorbia platyphyllos*
- *Olea europaea* subsp. *cuspidata*
- *Jacaranda mimosifolia*
- *Dodonaea viscosa*

Keep inside when temperatures drop below 5°C

- *Citrus medica*
- *Euphorbia candelabrum*

Annual plant, to be planted in spring

- *Bidens ferulifolia*

References

1. Nyssen, J., *Vegetation and soil erosion in Dega Tembien (Tigray, Ethiopia)*. Bulletin du Jardin botanique national de Belgique/Bulletin van de Nationale Plantentuin van België, 1997: p. 39-62.
2. Nyssen, J., M. Jacob, and A. Frankl, *Geo-Trekking in Ethiopia's Tropical Mountains, the Dogu'a Tembien District*. Springer GeoGuide. 2019, Heidelberg (Germany): Springer Nature. xxxiv + 675.
3. Grimshaw, J.M., *What do we really know about the Afromontane archipelago?* Systematics and Geography of Plants, 2001: p. 949-957.
4. Dereje Ashebir, et al., *Growing apple (Malus domestica) under tropical mountain climate conditions in northern Ethiopia*. Experimental Agriculture, 2010. **46**(1): p. 53-65.
5. Luber, J., *Better than Bullets: Ethiopia is Committing War Crimes by Starving Civilian Populations in the Ethiopian Civil War*. American University International Law Review, 2021. **37**: p. 701-749.
6. Duser, M., et al., *The origin of 'tauw', an enigmatic building stone of the Mergelland: a case study of the Hesbaye region, southwest of Maastricht (Belgium)*. Netherlands Journal of Geosciences, 2011. **90**(2-3): p. 239-258.
7. Nyssen, J., et al., *Lynchets in eastern Belgium—a geomorphic feature resulting from non-mechanised crop farming*. Catena, 2014. **121**: p. 164-175.
8. Pel, J., *Observations géologiques et hydrogéologiques sur le territoire de la commune de Vottem*. Ann. Soc. Géol. de Belgique, 1960. **LXXXIII**: p. 345-350.
9. Bourguignon, P., *Texte explicatif de la carte des sols de la Belgique. Texte explicatif de la planchette de Liège 121E*. 1957: IRSIA.
10. Nyssen, J., Seifu Gebreslassie, and Romha Assefa, *ካብ ሐረሰቶች ደገግ ተምቢ? እንታይ ንሰምዕ?* (What do we hear from the farmers in Dogu'a Tembien?) [in Tigrinya]. 2016, Hagere Selam, Central Tigray, Ethiopia.
11. Teklay, A., B. Abera, and M. Giday, *An ethnobotanical study of medicinal plants used in Kilte Awulaelo District, Tigray Region of Ethiopia*. Journal of ethnobiology and ethnomedicine, 2013. **9**: p. 1-23.
12. Yeabyo, S., et al., *Antibacterial activity of root extracts of Verbascum sinaiticum against multidrug-resistant Enterobacteriaceae family Gram-negative and two Gram-positive bacteria*. Drug Invention Today, 2018. **10**: p. 1387-1394.
13. Teklay, A., *Traditional medicinal plants for ethnoveterinary medicine used in Kilte Awulaelo district, Tigray region, Northern Ethiopia*. Adv Med Plant Res, 2015. **3**(4): p. 137-150.
14. November, E., et al., *Species list Tigrinya – Scientific. Technical note 2002/4*. . 2002: Forest Rehabilitation Project, Mekelle University, Ethiopia and K.U. Leuven, Belgium.
15. Tadesse, M., *An account of Bidens (Compositae: Heliantheae) for Africa*. Kew bulletin, 1993: p. 437-516.
16. Adams, R., *Junipers of The World: The Genus Juniperus*. Trafford. Victoria, 2004: p. 4120-250.
17. Reubens, B., et al., *Tree species selection for land rehabilitation in Ethiopia: from fragmented knowledge to an integrated multi-criteria decision approach*. Agroforestry systems, 2011. **82**: p. 303-330.
18. Asmare Dagne, et al., *Evaluation of Banana (Musa spp.) Cultivars for Growth, Yield, and Fruit Quality*. Ethiopian Journal of Agricultural Sciences, 2021. **31**(3): p. 1-25.
19. Onyango, M., et al. *Analysis of genetic diversity and relationships in east African Apple Banana (AAB genome) and Muraru (AA genome) dessert bananas using microsatellite markers*. in IV International Symposium on Banana: International Conference on Banana and Plantain in Africa: Harnessing International 879. 2008.
20. Watson, A.M., *Agricultural innovation in the early Islamic world; the diffusion of crops and farming techniques, 700-1100*. 1983.

21. Wakuma Biratu, Haile Abebe, and Hailelassie Gebremeskel, *Evaluation of Dessert Banana (Musa spp.) Cultivars for Growth, Phenological, Yield and Yield Components at Raya Azebo Districts of Tigray Region, Northern Ethiopia*. Agro Bali: Agricultural Journal, 2022. **5**(1): p. 113-125.
22. Lim, T., *Musa acuminata x balbisiana (ABB Group) 'Bluggoe'*, in *Edible Medicinal And Non Medicinal Plants: Volume 3, Fruits*. 2012, Springer. p. 557-559.
23. Behrendt, S., et al., *Distribution and diversity of banana (Musa spp.) in Wadi Tiwi, northern Oman*. Genetic Resources and Crop Evolution, 2015. **62**: p. 1135-1145.
24. Teklit Gebregiorgis, *Phytochemical screening and evaluation of antibacterial activity of Ruta graveolens L.-A medicinal plant grown around Mekelle, Tigray, Ethiopia*. Natural Products Chemistry & Research, 2015.
25. Jacob, M., *Treeline dynamics and forest cover change in afro-alpine Ethiopia, as affected by climate change and anthropo-zoogenic impacts*. PhD thesis. 2015, Ghent, Belgium: Department of Geography, Ghent University.
26. Friis, I., et al., *Plants and vegetation of NW Ethiopia: a new look at Rodolfo EG Pichi Sermolli's results from the "Missione di Studio al Lago Tana," 1937*. 2022.
27. McGuire, A.F. and K.A. Kron, *Phylogenetic relationships of European and African ericas*. International journal of plant sciences, 2005. **166**(2): p. 311-318.
28. Alemtsehay Tsegay, Berhanu Abrha, and Getachew Hruy, *Major Crops and Cropping Systems in Dogu'a Tembien, in Geo-trekking in Ethiopia's Tropical Mountains*. 2019, Springer. p. 403-413.
29. Klein, J.D., *Citron cultivation, production and uses in the Mediterranean region*. Medicinal and Aromatic Plants of the Middle-East, 2014: p. 199-214.
30. Aerts, R., et al., *In situ persistence of African wild olive and forest restoration in degraded semiarid savanna*. Journal of Arid Environments, 2008. **72**(6): p. 1131-1136.
31. Tilahun Teklehaymanot, et al., *Karyotype analysis of Ethiopian endemic Kniphofia species*. Ethiopian Journal of Biological Sciences, 2008. **7**(1).
32. Selam Balehey and Mulubrhan Balehegn, *The Art, Aesthetics and Gender Significance of Ashenda girls' Festival in Tigray, Northern Ethiopia*. 2019.
33. Aerts, R., et al., *Ecosystem thermal buffer capacity as an indicator of the restoration status of protected areas in the northern Ethiopian highlands*. Rest. Ecol., 2004. **12**: p. 586-596.
34. Meyen, S.V., *Plant morphology in its nomothetical aspects*. The Botanical Review, 1973. **39**: p. 205-260.
35. Gebremedhin Gebrezgabiher, Shewit Kalayou, and Samson Sahle, *An ethno-veterinary survey of medicinal plants in woredas of Tigray region, Northern Ethiopia*. International Journal of Biodiversity and Conservation, 2013. **5**(2): p. 89-97.
36. Riina, R. and P.E. Berry, *Euphorbia Planetary Biodiversity Inventory Project*. Available at www.euphorbiaceae.org. 2024.
37. Chagnoux, S., *The vascular plants collection at the Herbarium of the Muséum national d'Histoire Naturelle (MNHN - Paris)*. Version 69.355. Occurrence dataset <https://doi.org/10.15468/nc6rxy> accessed via GBIF.org on 2024-04-03. 2024.
38. Snowball, R., et al., *Exploring the wider potential of forage legumes collected from the highlands of Eritrea*. Plant Genetic Resources, 2013. **11**(2): p. 158-169.
39. Cufodontis, G., *Supplement: Enumeratio Plantarum Aethiopiae Spermatophyta (Sequentia)*. Bulletin du Jardin botanique de l'Etat, Bruxelles/Bulletin van den Rijksplantentuin, Brussel, 1955: p. 193-272.
40. Friis, I., et al., *Lotus quinatus var. brachycarpus (Hochst. ex Steud.) J.B. Gillett*. Herbario Nacional de México (MEXU). <https://datosabiertos.unam.mx/IBUNAM:MEXU:1317817>. 2005.

41. Bekele-Tesemma, A. and B. Tengnäs, *Useful trees and shrubs of Ethiopia: identification, propagation, and management for 17 agroclimatic zones*. 2007: RELMA in ICRAF Project, World Agroforestry Centre, Eastern Africa Region.
42. Versfeld, D., D. Le Maitre, and R. Chapman, *Alien invading plants and water resources in South Africa: a preliminary assessment*. 1998: The Commission.
43. Pankhurst, R., Gešo, in *Encyclopaedia Aethiopica: D-Ha*, S. Uhlig, Editor. 2005, Harrassowitz Verlag: Wiesbaden, Germany. p. 773.
44. Lee, M., Meron Regu, and Semeneh Seleshe, *Uniqueness of Ethiopian traditional alcoholic beverage of plant origin, tella*. *Journal of Ethnic Foods*, 2015. **2**(3): p. 110-114.
45. Abadi Girmay, *Gesho (Rhamnus prinoides) cultivation in Northern Ethiopia, Tigray*. 2015, Aksum University.
46. Yikunoamlak Gebrewahid, et al., *Carbon stock potential of scattered trees on farmland along an altitudinal gradient in Tigray, Northern Ethiopia*. *Ecological processes*, 2018. **7**: p. 1-8.
47. Tromp, J., A.D. Webster, and S.J. Wertheim, *Fundamentals of Temperate Zone Tree Fruit Production*. 2005, The Netherlands: Backhuys Publishers BV.
48. Osborne, P., *Tropical ecosystems and ecological concepts*. 2000: Cambridge University Press.
49. Cook, N. and G. Jacobs, *Progression of apple (Malus x domestica Borkh.) bud dormancy in two mild winter climates*. *Journal of Horticultural Sciences and Biotechnology*, 2000. **75**: p. 233-236.
50. Jones, H.G., *Repeat flowering in apple caused by water stress or defoliation*. *Trees – Structure and Function*, 1987. **1**: p. 135-138.
51. Diaz, D.H., A. Alvarez, and J. Sandoval, *Cultural and chemical practices to induce uniform bud break of peach and apple under warm climates in Mexico*. *Acta Horticulturae*, 1987. **199**: p. 129-136.
52. Lateur, M., et al. *Distinction between closely related apple cultivars of the Belle-Fleur family using RFLP and AFLP markers*. in *International Symposium on Molecular Markers for Characterizing Genotypes and Identifying Cultivars in Horticulture* 546. 2000.
53. Etefa Guyassa and A.J. Raj, *Assessment of biodiversity in cropland agroforestry and its role in livelihood development in dryland areas: A case study from Tigray region, Ethiopia*. *Journal of Agricultural Technology*, 2013. **9**(4): p. 829-844.
54. Berg, C.C., *Distribution of African taxa of Ficus (Moraceae)*. *Mitteilungen aus dem Institut für Allgemeine Botanik Hamburg*, 1990. **23a**: p. 401-405.
55. Negash Aregay, Getachew Hruy, and Tesfakiros Semere, *Potentials and constraints of underutilized tree fruits and vegetables in Tigray, northern Ethiopia*. *J Drylands*, 2017. **7**(2): p. 664-674.
56. Fitsumbirhan Tewelde and Mebrahtom Mesfin, *Ethnobotanical Use and Conservation of Plants Biodiversity by the Local Community of Welkait Wereda, Western Tigray, Ethiopia*. *Advances in Life Science and Technology* 2020. **83**.
57. Nyssen, J., et al., *Cattle breeds, milk production, and transhumance in Dogu'a Tembien, in Geo-trekking in Ethiopia's Tropical Mountains*. 2019, Springer. p. 415-428.
58. Harrington, M.G. and P.A. Gadek, *A species well travelled—the *Dodonaea viscosa* (Sapindaceae) complex based on phylogenetic analyses of nuclear ribosomal ITS and ETSf sequences*. *Journal of Biogeography*, 2009. **36**(12): p. 2313-2323.
59. Aerts, R., et al., *Species composition and diversity of small Afromontane forest fragments in northern Ethiopia*. *Plant Ecology*, 2006. **187**(1): p. 127-142.
60. Etefa Guyassa, et al., *From runoff contributor to runoff absorber: Spate irrigation on exclosures in Tigray's semi-arid environment (Ethiopia)*. *Ecohydrology*, 2023. **16**(1): p. e2480.
61. Kew. *Rumex nepalensis* var. *nepalensis*. 2023; Available from: <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:77224686-1/general-information>.

62. Equar Gebru, et al., *Honey bee flora diversity and their impact on honey production in Tigray region of Ethiopia*. Livestock Research for Rural Development, 2016. **28**(7): p. 1-20.
63. Tefera Belsty, et al., *Evaluation of Rumex nepalensis Spreng. root extract on biochemical and histopathologic parameters of mice liver*. Journal of The Anatomical Society of India, 2019. **68**(3): p. 205-210.
64. Leul Kidane, Gebrecherkos Gebremedhin, and Tadesse Beyene, *Ethnobotanical study of medicinal plants in Ganta Afeshum District, Eastern Zone of Tigray, Northern Ethiopia*. Journal of Ethnobiology and Ethnomedicine, 2018. **14**(1): p. 64.
65. Bard, K.A., et al., *The environmental history of Tigray (Northern Ethiopia) in the Middle and Late Holocene: a preliminary outline*. African Archaeological Review, 2000. **17**: p. 65-86.
66. Pankhurst, R., *The history of grapes, vineyards and wine in Ethiopia, prior to the Italian invasion*. Journal of Ethiopian Studies, 2008. **39**(1/2): p. 35-54.
67. Sulas, F., M. Madella, and C. French, *State formation and water resources management in the Horn of Africa: the Aksumite Kingdom of the northern Ethiopian highlands*. World Archaeology, 2009. **41**(1): p. 2-15.
68. Ferret, A. and J.G. Galinier, *Voyage en Abyssinie, dans les provinces du Tigré, du Samen et de l'Amhara*. Vol. 1. 1847: Paulin.
69. Crawford, O.G.S., *Ethiopian itineraries circa 1400-1524: including those collected by Alessandro Zorzi at Venice in the years 1519-24*. 2019: Routledge.
70. Schimper, W., *Mittheilungen aus einem Briefe Dr. W. Schimper's*. Zeitschrift der Gesellschaft für Erdkunde zu Berlin, 1872. **7**: p. 484-486.
71. Barradas, M., *Tractatus tres historico-geographici*. Republished in 1996 by R. Pankhurst. 1634, Wiesbaden, Germany: Harrassowitz.
72. Pedneault, K. and C. Provost, *Fungus resistant grape varieties as a suitable alternative for organic wine production: Benefits, limits, and challenges*. Scientia Horticulturae, 2016. **208**: p. 57-77.
73. Breitenbach, F., *Exotic forest trees in Ethiopia*. Ethiopian Forest Review, 1961. **2**: p. 19-39.
74. Nyssen, J., et al., *Environmental conditions and human drivers for changes to north Ethiopian mountain landscapes over 145 years*. Science of The Total Environment, 2014. **485-486**: p. 164-179.
75. Nyssen, J., et al., *Assessment of gully erosion rates through interviews and measurements: a case study from Northern Ethiopia*. Earth Surf. Proc. Landf., 2006. **31**: p. 167-185.
76. Temesgen Enku, et al., *Groundwater use of a small Eucalyptus patch during the dry monsoon phase*. Biologia, 2020. **75**: p. 853-864.
77. Gashaw Molla, Meseret Addisie, and Gebiaw Ayele, *Expansion of eucalyptus plantation on fertile cultivated lands in the North-Western highlands of Ethiopia*. Remote Sensing, 2023. **15**(3): p. 661.
78. Monumental Trees. *Tasmanian Blue Gum in a private garden along the Rue des Héros, Rocourt, Liège, Belgium*. 2024; Available from: https://www.monumentaltrees.com/en/bel/liege/liege/32519_ruedeshros/59775/.
79. Bussmann, R.W., N.Y. Paniagua-Zambrana, and G.N. Njoroge, *Rhus natalensis Bernh. ex C. Krauss Rhus ruspolii Engl. Rhus tenuinervis Engl. Rhus vulgaris Meikle Anacardiaceae*, in *Ethnobotany of the Mountain Regions of Africa*, R.W. Bussmann, Editor. 2020, Springer International Publishing: Cham. p. 1-9.