



# Distribution, importance and constraints in gum and resin bearing species in Ethiopia

## Distribución, importancia y limitaciones de las especies productoras de goma y resina en Etiopía

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### Article Data

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### Abstract

Dry forest is the largest forest type in Ethiopia that currently covers 55 M ha. These forests are predominantly rich in *Acacia*, *Boswellia* and *Commiphora* species that gives the important export commodities such as gum arabic, frankincense and myrrh. However, these forests are suffering by huge degradation due to anthropogenic pressures also they are shrinking continuously by the expansion of agricultural lands, human settlement, overgrazing, and lack of policy and inappropriate tapping method. The aim of this paper was to review distribution, importance and constraints in gum and resin bearing species in Ethiopia. In Ethiopia expected areas covered by natural gum and resin bearing species in the different regions, the leading one Tigray have 940000 ha coverage, the other Amhara, Oromía, Gambela, Somalia, Beneshangul-Gumuz, Nationalities and Peoples of the South (SNNP) and Afar followed Tigray region respectively. The majority of the households in rural Ethiopia make use of non-timber forest products (NTFPs) for different purposes, extending from food, feed, energy, and medicine to income generation and cultural practices. Among the range of NTFPs, gums and resins are advantageous trade commodities with a potential for helping social and economic developments both at rural and urban areas in Ethiopia. Commercial gums and resins are produced in rural areas, traded in urban and utilized by western countries and, hence, touch varied ranges of human lives and cross-sections. Therefore, adequate research and clear action oriented plans, improve tapping methods, clear policy about utilization and conservation gum and resin bearing species and identify method of propagation is recommended.

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### Resumen

El bosque seco es el tipo de bosque más extenso de Etiopía, con una superficie actual de 55 millones de hectáreas. Estos bosques son predominantemente ricos en especies de *Acacia*, *Boswellia* y *Commiphora* que dan importantes productos de exportación como la goma arábiga, el incienso y la mirra. Sin embargo, estos bosques están sufriendo una enorme degradación debido a las presiones antropogénicas y están disminuyendo continuamente por la expansión de las tierras agrícolas, los asentamientos humanos, el pastoreo excesivo, la falta de políticas y un método de explotación impropio. El objetivo de este artículo fue examinar la distribución, importancia y limitaciones de las especies que contienen goma y resina en Etiopía. En Etiopía se espera que las áreas cubiertas por especies naturales portadoras de goma y resina en las diferentes regiones, la principal Tigray tiene una cobertura de 940000 ha, la otra Amhara, Oromía, Gambela, Somalia, Beneshangul-Gumuz, Nacionalidades y Pueblos del Sur (SNNP) y Afar siguieron a la región de Tigray, respectivamente. La mayoría de los hogares de las zonas rurales de Etiopía utilizan productos forestales no madereros (PFNM) con distintos fines, que van desde la alimentación, la nutrición, la energía y la medicina hasta la generación de ingresos y las prácticas culturales. Entre los PFNM, las gomas y las resinas son productos comerciales ventajosos con potencial para contribuir al desarrollo social y económico de las zonas rurales y urbanas de Etiopía. Las gomas y resinas comerciales se producen en zonas rurales, se comercializan en zonas urbanas y son utilizadas por los países occidentales, por lo que afectan a diversos ámbitos de la vida humana. Por lo tanto, se recomienda una investigación adecuada y planes claros orientados a la acción, la mejora de los métodos de extracción, una política clara sobre la utilización y conservación de las especies portadoras de goma y resina y la identificación de métodos de propagación.

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## Introduction

In Africa, Sudan is the world's leading producer and exporter of gum arabic (GA), frankincense and myrrh accounts for 80 % of the world's GA production, followed by Senegal, Nigeria, Mauritania, and other countries like Mali, Ethiopia, Chad, Tanzania and Niger, according to their importance<sup>1</sup>. The European Community is by far the largest regional market for GA. Averaged imports about 28000 t/year, with a peak of above 32000 tons in 1991 reports<sup>2</sup>.

In Africa dry land forests represent significant resource base for economic development and livelihoods<sup>3,4</sup>. If managed wisely they have the capacity to afford a perpetual stream of subsistence products and income, although supporting other economic actions through ecological services and functions<sup>5,6</sup>.

In Ethiopia the largest remaining forest type is dry forest and it currently covers 55 M ha<sup>7,8</sup>. These forests are mainly rich in *Commiphora*, *Boswellia* and *Acacia* species<sup>9-11</sup> that affords the essential export commodities such as frankincense, myrrh and GA<sup>2,9,10,12,13</sup>. But, these forests are suffering by huge degradation because of pressures related to anthropogenic factors<sup>10,14,15</sup> and results in shrinking incessantly by the expansion of human settlement and agricultural lands<sup>14</sup>.

The majority of the households in rural Ethiopia make use of non-timber forest products (NTFPs) for different purposes, extending from energy, feed, food and medicine to cultural practices and income generation<sup>16,17</sup>. From other NTFPs, resins and gums are valuable trade commodities with a potential for helping economic and social developments both at urban and rural areas in Ethiopia<sup>12,18,19</sup>. Commercial resins and gums are produced in rural areas but, it traded in urban areas and utilized by western countries and so it touch varied ranges of human lives and cross-sections<sup>20-22</sup>.

Some of the major factors that causes deforestation and degradation of dry forests in Ethiopia are rapid population growth from natural birth as well as migration, clearance for cropland expansion, overgrazing and intensification of gum-resin extraction<sup>10,14,15</sup>. Therefore, the objective of this paper was to review the distribution, importance and constraints in gum and resin bearing species in Ethiopia.

## Development

*Description, distribution and ecology of gum and resin bearing species and their production aspects.* Ethiopia is rich in dry land forests and those forests includes species like *Boswellia*, *Commiphora* and *Acacia* that are known to produce frankincense, myrrh, and GA. In the country, total area land cover about 2.9 million ha for species that bearing oleo-gum resin, with the potential over 300000 tm of natural gum production<sup>23</sup>. Those trees produce resin in the dry season and provide people with important economic activities in a period with few other economic actions<sup>15</sup>. In the country, there is above 60 species found which produce resin and gum<sup>24</sup>.

In Ethiopia, Region of Tigray, Amhara, and Oromía has highest coverage of gum and resin bearing species with an estimated area of 940000, 680000, and 430000 ha respectively. The list is Afar region with coverage estimated 65000 ha. While Gambela, Somalia, Beneshangul-Gumuz, and SNNP ranking from 4 up to 7 with estimated area of 420000, 150000, 100000 and 70000 ha respectively<sup>17,23</sup>.

*Gum and resin products Socio-economic importance in Ethiopia.* In the generation of income, the economic importance of plant gums resins, oils and other extracts to the government as a source of valuable foreign currency has been extensively demonstrated in Ethiopia<sup>25</sup>. According to this author the amount of

natural gum export in Ethiopia is increase from 1594 tons to 2720 in year of 1999 to 2003 and its monetary value increase from 2,134 389.6 to 4,128 165.3 (USD) during those years.

Throughout the year employment opportunities have been generated by the *Boswellia* products sub sector include tapping and collection, transportation, processing includes cleaning, sorting and grading, also marketing of frankincense and protecting facilities of storage<sup>26</sup>. At household level, studies agreed that in one region of Ethiopia have shown that the gum resins business provides 3 times greater than in income than about contribution of crop farming<sup>27</sup>.

*Potential importance of gum and resin products.* Frankincense and myrrh are safe raw materials in industries like pharmaceuticals and food industries also used in folk flavoring beverages, and liqueurs, medicines, cosmetics, creams and perfumery detergents, paints, dyes manufacturing and adhesives<sup>7,28,29</sup>. Both of them (myrrh and frankincense) are huge valued for their aromatic fragrances and they are common ingredients in perfume, incense and potpourris, detergents, soaps, lotions and creams and included in meditation blends, aids in deepening the meditative state and as it strengthens the psyche<sup>30</sup>.

*Pharmacological uses.* The uses of gum resins known as myrrh and frankincense is used for medicinal purpose are among man's oldest treatments. About 1500 b.C. the Papyrus Ebers is perhaps the oldest list of prescription, in which the priests who directed mummification, funerals and cremations defined the value of both resins in each of these procedures, as well as in the treatment of wounds and skin sores<sup>31</sup>. In regions ranging from China to North Africa, both myrrh and frankincense are still widely used therapeutically<sup>32</sup>, and mainly in the traditional Ayurvedic medicines of Arabia, China and India as well as in Somalia and Ethiopia<sup>27,33</sup>.

*Gum arabic.* From *A. Senegal*, GA is produced and used as stabilizing, thickening, emulsifying and suspending agent in drink and food industries; used as

tablet-binding agent and cream- and lotions- suspending and emulsifying agents in pharmaceuticals, as sizing agent in printing and textile industries and film forming<sup>29</sup>. Also it is used in paints, ceramic, textiles, inks, and adhesives<sup>6</sup>.

*Food applications.* Mostly GA is used in confectionery industry, and it is collective in a wide range of goods also GA is used in wine gums as part of cultures in long tradition, where it yields a clarity that is greater than the clarity gained with other hydrocolloids, also used in chewing gum a pigment coating agent and stabilizer. Because of its great stability and solubility in acid conditions, GA is well appropriate for use in cola and citrus flavor oil emulsions. When we see in beer, it is used as a foaming agent and to support lacing. Gradually GA use as a source of soluble fiber in dietetic beverages and low calorie. Because of its low viscosity, high water solubility and emulsification properties GA is an effective encapsulation agent and it is used in dessert soups and mixes<sup>34</sup>.

*Non-food applications.* GA was widely used in the pharmaceutical industry, but it is now changed by modified starches and celluloses in many applications, still it is used as emulsifier, adhesive, suspending agent, and in demulcent syrups and binder in tablet<sup>29</sup>. GA in cosmetics, used as a stabilizer in lotions and protective creams, where it imparts spreading properties, increasing viscosity, and affords a protective coating and a smooth feel also used as a foam stabilizer in liquid soaps and as an adhesive agent in blusher<sup>35</sup>.

At textile industry, GA is used as a thickening agent in printing pastes for the coloration of knitted cellulose fabrics. Other importance are ink and pigment manufacture, heat- and shear-sensitivity of the gum, ceramics, and polishes<sup>34</sup>.

*Constraints in development, conservation and utilization of gum resin bearing tree species.* Due to remoteness as well as rugged and undulating topography of the habitat where the gum producing species

grow, absence of access roads and infrastructure or facilities like residential quarters and insufficiency of transport facilities to the potential production areas have made equipment and supplies, mobilization of labor force, collection and transportation of harvested natural gums very problematic. Activities include deforestation, over grazing, resettlement and other land use change influences and clearing of the woodlands for agriculture and settlement, deliberately set fire, and harvesting for fuel wood are becoming the major hazard to the future of the oleo-gum resin producing vegetation's as well as the biological resources associated with them<sup>36</sup>.

In the last 20 years, in Tigray region more than 177000 ha of *Boswellia* forest is destroyed<sup>26</sup>. Related reports exist for Gonder<sup>36</sup>, and the Somali region<sup>27</sup>. According to assessments of *B. papyrifera* population in the northwestern and north parts of Ethiopia showed shortage of natural regeneration leading to the register of the species as one of the endangered species in Ethiopia and unsuitable tapping of *B. papyrifera*<sup>26</sup>. The proportion of trees damaged/attacked by the unidentified worm was greater in tapped trees than those with untapped trees<sup>1</sup> showing that tapping exposes the tree for attack by pests and other damages.

By inducing the production of non-viable seeds the worm attack has been found to damage regeneration<sup>36,37</sup>. According to<sup>33</sup>, the whole damages done to frankincense trees owing to unsuitable tapping are tremendous, and also over 50 % of the frankincense trees subject to tapping are often damaged. Composed with other damages such as improper tapping, fire, clearance for agriculture and overgrazing is leading extensive damage including hampering natural regenerations. In the dry lands the deterioration of the woodland vegetation stocks is the major cause for advancing desertification in the region<sup>5</sup>.

To tapping natural gums, lack of trained manpower, interference from human and domestic animals have, in one or other way, contributed to the low quality of

products and volume<sup>26</sup>. No efforts have been made to domesticate the species as yet in spite of the fact that seeds, from them *B. papyrifera*, can germinate easily with absence of dormancy<sup>28</sup> and with relatively vegetative propagation is easy. Lack of technologies or mechanism, to promote the countries' potential for value addition and industrialization of gum resin products. The insufficient of research undertaking is one of the gaps owing to the prevalent lack of trained researchers, absence of instrument and shortage of budget in the Forestry Research System as a whole, and low profile and priority given to the Forestry Sub-sector in the country.

## Conclusion

Ethiopia is rich in dry land forests and those forests includes species like *Boswellia*, *Commiphora* and *Acacia* that are known to produce frankincense, myrrh, and GA and in the country, species that bearing oleo-gum resin covered about 2.9 million ha. Tigray region is the leading one followed by Amhara region in its coverage. Gum and resin bearing species have socio-economic importance like source of income, employment opportunity and as a source of valuable foreign currency. Potential importance of gum and resin products are raw materials in pharmaceuticals and food industries, cosmetics, creams, medicines, folk flavoring beverages and perfume detergents.

Constraints utilization of gum resin bearing tree species are absence of infrastructure, labor force, lack of equipped manpower, method of collection and transportation. Activities include deforestation, over grazing, improper tapping, disease, resettlement and other land use change influences and clearing of the woodlands for agriculture and settlement, deliberately set fire, and harvesting for fuel wood are becoming the major hazard to the future of the oleo-gum resin producing vegetation's as well as the bio-

logical resources associated with them.

Therefore, sufficient research and clear action oriented plans, improve tapping methods, clear policy about utilization and conservation of gum and resin bearing species is needed. The country is collecting and exporting gum and resin without any value addition to solve this problem creating mechanisms to promote the countries potential for value addition and industrialization of gum and resin products also work with collaboration with relevant ones to the future, to get hard currency and to enhance income from those species, export their various final products to developed countries.

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### Conflicts of interest

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### Ethical considerations

During this study carried out, ethical considerations were taken into account and there in no scientific misconduct.

### Research limitations

One of the primary limitations is the availability of data. There is a lack of comprehensive and up-to-date data on the distribution, abundance, and importance of gum and resin-bearing species in Ethiopia. This

can make it challenging to obtain accurate and reliable information so, this review gives hint on this aspect.

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