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The Main Outcomes and Road Map

The Future of Frankincense Online Workshop

March 15th, 17th, 18th 2021.
1-4 pm GMT.



Three main messages



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- 1 Each of the 24 species of *Boswellia* are different and face different current conditions and threats. Differences mentioned in the workshop include different genetic pathways, phenotypes, ranges, needs, growing habits, habitats and regeneration patterns. The resins and oils also have different constituents, medicinal and aromatic properties and end uses. Each species has different dynamics of socio-economic and environmental management, or mis-management, ownership (or not), harvesting (or not). There is also variation in sorting and storage, trade routes, local regional, national and international trade licensing and regulations and different pressures, threats and challenges.
- 2 The frankincense value chain has many steps and currently a very small percentage of the overall profits return to the harvesters. Feedback during the workshop from six sets of focal groups in Somaliland, Ethiopia, Kenya and Oman shared the harvesters requests for access to steady fair prices and markets, regulated working conditions, safety and protective equipment, food, water, healthcare, education and adult literacy, supportive infrastructure and community development.
- 3 To be able to sustain the long term future of the species and their products, and the long term commitment of the communities which depend on them, accurate information on the whole value chain is required. Targeted actions towards a sustainable future is currently scattered and limited. Moving forward depends on coordinated and focused information gathering, collaboration, research and action.

“Of course we should not treat frankincense as a single monolithic entity. We need to look at the different situation and threats that each individual species faces and not extrapolate from one species to the next.”

Focusing on Frankincense trees and the communities that harvest them

Frankincense is the resin produced in response to injury of the under bark of trees of the *Boswellia* species. There are currently 24 recognised species. Some species have limited geographical range. For instance, 11 species are endemic to the island of Socotra in the Red Sea between Yemen and the Horn of Africa. Yet together, *Boswellia serrata*, *B.sacra*, *B.papyrifera*, *B.dalzielii*, *B.neglecta* and *B.rivae* spread across at least 17 countries, from India, across the Arabian peninsula, the greater Horn of Africa to West Africa, with some individual species ranges spanning more than 2000kms¹. The trees tend to grow in arid/semi-arid conditions, supported either by orographic moisture (*B.sacra*, *B.frereana*,) and/or seasonal rain (*B.serrata*, *B.papyrifera*, *B.dalzielii*, *B.neglecta* and *B.rivae*). Many trees grow in the relatively inaccessible areas where populations have access to limited resources. Gathering accurate information on the current ranges, status, mortality and regeneration rates and health of the different species and populations, has consistently emerged as a top research priority.

¹ E.g. *B. neglecta* spans from Northern Tanzania to Northern West Ethiopia



Frankincense is one of the oldest known globally traded products and has been a valued ingredient in Asian traditional medicine systems for millennia. *Boswellia papyrifera* from Ethiopia has for the last few decades been the most traded resin, both internally within Ethiopia and exported for religious and other purposes. Especially in the last decade there has been a surge in the use of the essential oils distilled from traded *Boswellia* resins for aromatherapy and other uses. Most frankincense commercial oil is extracted from *Boswellia sacra* (and *B. sacra* syn *carteri*) resin from Somalia/ Somaliland and Oman, with lesser amounts from *Boswellia serrata*, *B. papyrifera*, *B. rivae*, *B. neglecta* and *B. dalzielii*. So far four species, *B. serrata*, *B. sacra*, *B. papyrifera* and *B. dalzielii*, have also shown high levels of four main bioactive boswellic acids in the resin (not the essential oils or hydrosol). In vitro and in vivo research and one or two clinical trials using resin extracts of *Boswellia serrata*, *sacra* and other species have demonstrated anti-inflammatory, anti-microbial, fungal, viral and cytotoxic effects.

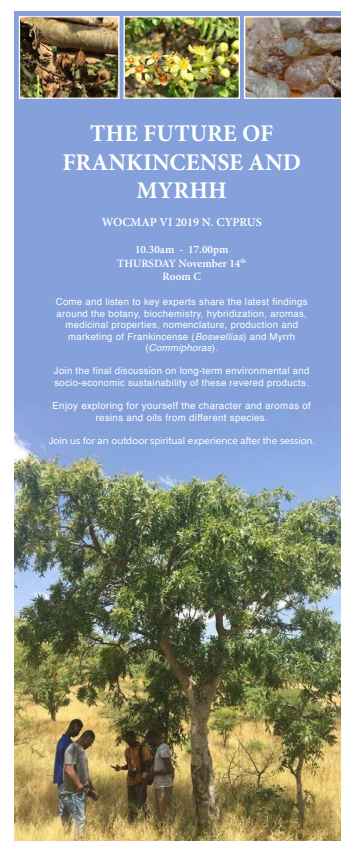
The current and potential increase in demand for resin has led to a growing concern about the long term viability of the trees, the well-being of the harvesters and the harvesting practices; particularly in accessible heavily harvested areas. Many species face multiple challenges including grazing from livestock, fire, land conversion (for agriculture, roads, mining etc.), lopping and felling for household needs as well as climate, and environmental stress. The challenges may differ between species and between locations within the range where a species occurs. For some species and some areas we have little factual information. There are a few reports of extensive healthy forests of *B. neglecta* and *B. rivae* across the Somali region of Ethiopia and Northern Kenya, and natural regeneration has been reported in Oman, Sudan and Western Ethiopia. At the same time, there are well-documented reports of declining populations and a lack of regeneration in Ethiopia, Eritrea, Sudan, Somaliland and reports of decline of *B. serrata* in India².

There is very little documented information on the communities and harvesters themselves. According to one study over a quarter of a million people are estimated to be dependent on Frankincense for over 50% of their income in the East Gollis / Saanag region of Somaliland alone³. With dependent forest tribes in Madhya Pradesh in India, to extra dry season income for Samburu women, to Somali clans living deep in the bush, the exact number of those for whom the currently small extra income ensures survival and access to food, water, healthcare and education is unknown. A major focus of this workshop has been to ask 'What are the main gaps in our knowledge?' and 'What can we do?'.

Given the rising concern about the well-being of the trees and communities, a growing platform, named the Global Frankincense Alliance (GFA) was created by concerned individuals out of a special session on Frankincense and Myrrh at WOCMAP. At the same time, an informal working group on *Boswellia* had been initiated within the UN Convention on International Trade on Endangered Species (CITES) to gather accurate data on the range, status and health of the trees and how they may be being impacted by international trade. Due to COVID, the second International Conference on Frankincense and Medicinal Plants in Oman has been postponed until 2022. GFA decided to create an open online workshop called 'The Future of Frankincense' to gather those concerned to prioritise and coordinate current research needs, as well as to craft a roadmap of the most important and urgent activities. Over 300 people filled in the pre-workshop survey⁴ and between 96 - 106 people attended each day.



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² See Bongers et al (2019), DeCarlo et al (2020)

³ FSNAU FAO & FEWS NET (2016)

⁴ See Outcomes of the pre-workshop online survey

As mentioned above, the purpose of the on-line dialogue has been to prioritise what we need to know and do to support the long-term future of frankincense trees and the communities that harvest and depend on them. With over 100 people participating each day, it was agreed to keep a core of participants discussing in themed working groups. Each of the four themes, outlined below, had two break away groups who joined on the last day to collate their final prioritised lists. Parallel main room conversations focused first on the communities and secondly on conscious consumerism. While it was highlighted that the workshop was a great opportunity for networking, the main intended outcome of the workshop is a ROADMAP of the gaps in information, the actions we need to take and how we can take them.

The Theme and Breakout room leaders were:

1. **Theme 1: Botany identification & current status of the trees:** Professor Sebsebe Demissew, Dr Shahina Ghazanfar, Stephen Johnson.
2. **Theme 2: Communities, intentional propagation & forest management:** Professor Frans Bongers, Dr Anjanette de Carlo.
3. **Theme 3: Biochemistry and Medicinal Applications:** Professors Ahmed al-Harrasi and Abdul Latif Khan, Ahmed al-Rawahi.
4. **Theme 4: Supply chains, products, regulations and trade:** Professors Ben-Erik van Wyk and Tony Cunningham, Denzil Phillips.



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“ Generally speaking there is not a clear understanding between local taxonomies versus western taxonomies. So obviously the western taxonomies are pretty dynamic as they are, new species are being described at the moment and if we keep doing field work and taking herbarium specimens I am sure we will find more and more species. ”

The Road Map

The most pressing gaps in knowledge and the actions identified in each theme are:

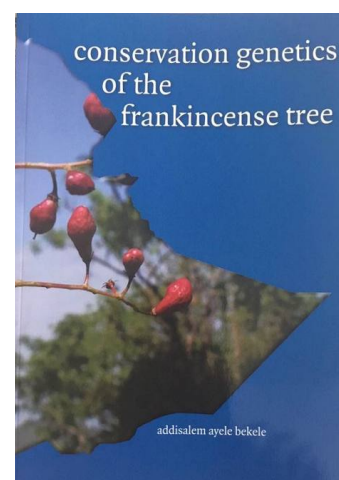
Theme 1: Botany, identification, and current status of the trees

GAP 1: How do we collectively gather adequate information on the current distribution and status of each of the *Boswellia* species populations?

ACTION 1: We need to fund and coordinate data collection on the current distribution and status of each of the *Boswellia* species population, (ages, structures and regeneration), the harvesting practices and pressures and how broader ecosystem issues of degradation, other threats and/ or climate change are affecting the status of each *Boswellia* species in their different populations and ranges. Multi-layered climate, soil and vegetation data can propose possible ranges of the different species. We then need to use strategic sampling and rapid qualitative and quantitative research, combining basic quantitative surveys with significant local integration/participation and focusing on local knowledge, in fully explained/consenting partnership with local communities. There is a need to develop functional tools that can be used by a combination of local university students and communities to assess the trees and yields. Range changes and shifts can be assessed from historical data, as well as a comprehensive inventory of where natural or intentional propagation and regeneration is happening.

GAP 2: How to have a central repository of information?

ACTION 2: Compile all the disparate information into an accessible location/ database so that there is a comprehensive and publicly available understanding of the current knowledge base, in order to identify what other information is urgently needed. Who can do this work? Who funds and coordinates it?



GAP 3: How to deeply understand how harvesters relate to the trees?

ACTION 3: There is an urgent importance of engaging further with the harvesting communities who actually manage the trees and understand how they perceive, engage with and manage the *Boswellia* trees. How do their local taxonomies, observations and cultural understandings of the trees and resins Interface with 'western' botanical taxonomies, research and understanding? How do these both, in turn, link up with the current perceived quality and value of each resin or essential oil product as it enters the current value chains? A lot of useful data by engaging with these groups as equal partners on the status and future of the different *Boswellia* populations.

GAP 4: How can the resin, essential oils and other products of each species be tracked back to specific species and woodlands?

ACTION 4: Understand and share how the different species, resins and essential oils are currently identified and develop tools to trace resins from their source and the specific resins and oils being harvested and traded. There is a need to develop tools to trace resins from their source into the global market. How can this be done and funded effectively? What specific markers should be looked at? What makes the most sense to be deployed? For instance, if the question is 'Can buyers or customs easily identify a resin or oil?'; What cost effective accessible tools and markers can be developed to differentiate and link resins and essential oils back to specific trees, populations and species?



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“ The other topic that came up again and again is exploring the options to add value and shortening the supply chain between communities and the market. ”

Theme 2: Communities, regeneration (intentional propagation) and forest management.

COMMUNITIES

GAP 1: How we can make sure that local communities have a long-term involvement with the trees and resin and have a fair role and share in the long-term sustainable management and use?

ACTION 1a: We need to find out who are the owners and harvesters in each location? What are their harvesting practices and why? How they are currently organised and paid? How reliant are they on the resin harvest? What are their ownership and land use rights, their understanding of, connection to and long term relationship with the trees? Cooperatives are seen as the future, but beware of powerplays and rules and regulations. It may be questionable to take the past as a model for the present.

ACTION 1b: Cycle Assessments of resin. Follow the plants that produce the resins (how resin is made, how collected, how transported etc.). Evaluate ways to monitor this. Select good cases and detail what and why these are good cases (of forest management and local people involvement), across the whole range.

ACTION 1c: Education and training is needed at all levels, including at local and national government as well as company levels (e.g. Forest departments and their rules and regulations have immense impact)

ACTION 1d: Map per country the companies that get into the forest and use the forest, forest ownership, local regulations, any contestations on ownerships/use rights? Compile an overview of all the rules and regulations per species/country and the implications of these for the situation on the ground. (Forest level, species level. Regulatory taxes, concession rules and payments.

The need to develop a code of conduct for harvesters, buyers and producers (as in other value chains).

“ Even within Ethiopia, there are 5, 6 or 7 different local forest management schemes for the same and different species; let alone the differences between range countries. ”

ACTION 1e: Harvesters, cooperatives and communities need a fairer share of the overall profits. International buyers need to choose the responsible within-country companies to trade with and have checks and balances, as well as an ability to check out espoused practices. Third party voluntary certifications schemes are useful but can be expensive to maintain for small scale cooperatives and companies unless more value returns to them.



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FOREST AND TREE MANAGEMENT

GAP 2: How can we maintain forest and woodland health, and improve forest management and long-term sustainability and use? And how do we translate this into guidelines specific for species, countries and regions?

ACTION 2a: Engage in care for the present forests and woodlands. Develop ways to select areas to protect and set aside for regeneration, enrichment of standing forests and trees and to prevent conversion to other land uses.

ACTION 2b: Incentivise reforestation and plantation/enrichment planting/more species at the same time; i.e.: Combine any long-term plantations with enrichment of standing forests. All those involved along the value chain need to engage in community and forest management and maintenance, not only in profiting from the resin.



GAP 3: How to overcome challenges of large scale enrichment and/or propagation?

CHALLENGES TO ACTION 3: Frankincense trees can take 5-15 years to generate revenue. There are many technical genetic, biophysical, and agronomical issues to overcome with plantations as well as concerns that ex-situ or company owned plantations will not support investment in and empowerment of indigenous communities and forests.

ACTION 3: Compile available knowledge on plantation issues. Develop new experiments based on best practices, country and species specific. Develop comparative study across species and countries, which will lead to generalization for the genus. We need to care for current forests, ensure regeneration by set aside and prevent conversion to other land uses and combine any long-term plantations with enrichment of standing forests.

(NB: There is currently a focus on and funding for tree planting in semi - arid areas, especially in Africa. Investigate including endemic Boswellia (B.papyrifera /B.dalzielii) in the Green Wall Initiative).

Theme 3: Biochemistry and Medicinal Applications

GAP 1: How do we correct the misinformation about the bioactivity and uses of Frankincense as natural medicines?

ACTION 1a: Cancer, COVID and inflammation can usefully be key targets of specific boswellic acids and derivatives in vitro and vivo trials, as well as the synergistic effects of whole resin extracts of specific species. Safety pharmacology should be the key during such trials. When used for medicinal purposes, Frankincense resin products, the essential oils or other derivatives must go through pre or clinical trials/protocols to establish the bioactive chemical constituents and CMC (chemistry-manufacturer-control). The results of these trials needs to be followed up and taken through the country-specific regulatory pathways Medicinal properties should be understood from the basic to the end use product for a specific treatment.

“ We are now talking about massively increased production of research based products and scientists are very concerned about the sustainability issue and it has to go in both directions A massive production of frankincense products <> Issue of sustainability. ”

ACTION 1b: Correct the misinformation about the bioactivity and uses of Frankincense as natural medicines. The group suggested that a non-technical report needs to be created and disseminated and spread to the public to create awareness of what has been scientifically technically proven and what has not.

GAP 2: How can we overcome the uncertainties created in the literature by using unvouchered samples and different libraries and techniques?

ACTION 2a: We need a joint research collaboration across community, scientists, government regulatory bodies and industries to carry out the basic chemical analysis of the resins and oils of multiple specimens of accurately sourced frankincense of each species is urgently needed. We need to fully understand the origin and source, as well as the biosynthetic pathways and genes responsible for producing the resins. This is urgent because while the resins and oils of each species can demonstrate some consistent terpenoid composition, the % of each constituent can vary considerably across different populations of the same species, probably due to genetic, environmental, seasonal, extraction and testing methodologies and protocols and other unknown factors. High throughput screening technology (HTS) may really help to identify the constituents and find key species specific markers. Building on this research we need essential oils research from basic constituents and compositions, to quantification, and dermal research, and to identify the kinds of boswellic acids that remain in the residual waste product after hydro-distillation oil extraction.



GAP 3: How can genomics assist in identifying species?

ACTION 3: Create international collaboration to find ways to gather the equivalent samples to do molecular and genomics analysis of each species to develop a dataset of sequences for broader taxonomy and population diversity across populations. Carry out more research on the chemistry of ignored frankincense species and their medicinal properties through in vivo and in vitro approaches.

GAP 4: What is the impact of climate change on Frankincense?

ACTION 4: Urgent research is needed on climate change impacts on chemistry and biochemistry, tree growth, harvesting, soil biology, microbial symbiosis and pathogenesis

GAP 5: How do we do this?

ACTION 5: Networking, Collaboration, Consortium: Establishing a consortium or collaboration of scientists (chemists, biologists, taxonomists), who can offer resources, expertise and time. How to fund such research?

“ We do not want to get to the point where pseudo-science and misinformation is used to sell the product. ”

Theme 4: Supply chains, products, regulations and trade

Overarching question: How can reliable, socially beneficial, ecologically sustainable & economically viable supply chains be developed that recognize diverse source species & production regions? *NB: Recognising very diverse uses (nationally) & diverse international markets (resin, essential oils, boswellic acids, fragrances).*

GAP 1: How can transparent, traceable supply chains be developed that deal with this diversity?

ACTION 1: Explore new technologies for tracing supply chains in a transparent way, to deal with adulteration, encourage sustainable harvest & raise awareness (business & consumers). NB: Block chain technology applied for years to food

markets, (Rejeb Et al 2020) more recently carbon markets & suggested for medicinal plants.... lots of hype & significant barriers. (Kouhizadeh et al., 2021) There are practical limitations in some countries. Adapt a variety of tracing systems, from pen & paper to bar codes, using smart phones. Traceability is essential to go to scale (& deal with adulteration & safety issues).



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GAP 2: Where & under what circumstances is sustainable, commercial harvest possible?

There are good examples (e.g.: collection of naturally exuded resins in Somali region of Ethiopia and Northern Kenya) as well as examples of “what not to do” (Frans Bongers’s team’s work highlighting *Boswellia* declines in areas of Ethiopia, Eritrea & Sudan (Bongers et al 2019); Somaliland (De Carlo et al 2020), and Socotra (Lvoncik et al 2020). Research in Ethiopia suggests when owners & harvesters are different, it can have a negative impact on sustainability vs. community ownership (more chance of sustainable harvest). Active research and case studies on effective cooperative structures and producer associations (e.g.: as for baobab) can be initiated, supported and shared. Participants from Somalia and Somaliland pointed out how 30 years ago there were organised cooperatives, but that these have fallen away. Challenges now arise when big buyers prepay harvesters, then pay low prices, with the value addition of grading (which needs to adapt to market needs) & processing happening later.

ACTION 2: Promote the good examples of how to add value within countries and within regions, where more is passed back down the supply chain by ethical traders. Educate and engage with creating a code of ethics for buyers and traders. The industry needs to develop sustainable supply chains through a combination of technological management plans that have widespread support & combine use of technology & “on the ground monitoring” at multiple scales that gets around the challenges of working in remote &/or often unstable areas. *NB: The multi-scale approach (LANDSAT mapping, monitoring resin yields, plot based inventories combined to understand potential yields for communities and harvesting cooperatives).*

GAP 3: Where & under what circumstances is cultivation possible at sufficient scale to supplement harvest from wild stocks?

ACTION 3: Collate lessons from Oman (*B. sacra*) and Jason Eslamieh’s work in the USA (including hybrids) with the known challenges of growing other *Burseraceae*. Combine seed & seedling distribution & selection of farmer entrepreneurs with secure tenure over the trees, ideally, in regions with good governance, with policy support for “scaling out” production. *NB:* There are a range of models for successful “scaling out”, including a “decentralized, incentivized” nursery model, where local people get viable seed from known species & there is a “buy back” system. This brings local income & avoids the costs of large, state run nurseries.

- Example: Selecting elite cuttings (based on chemistry) for nursery production. Care is needed with accurate seed sourcing.

“ What came out and one of the big issues is the financial issue on how local people are part of the value chain and how finances, organisation, power very much determines their relative position in the field and their relative position towards the trees and the forest. What we realised is that this is so very different from one area to another one and one species to another. ”



Main Room Discussion 1: Conversation with Field experts on supporting the long term sustainability of the communities and trees.

Discussants: Abeje Eshete, Abdinasir Abdikadir, Muna Ismail, Mohed Jama, Isaiah Lekisike, Dan Reigler, Ed Barrow and Soumya Kori



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GAP 1: How can we build upon local knowledge systems and local institutions to better improve land management?

ACTION 1: Listen and record how the communities manage their resources.

GAP 2: How do we get such local knowledge systems and institutional arrangements respected and recognised by government?

ACTION 2: Gather information not only on the current local, regional and national regulations but also on how they are implemented. Taxes that are raised and assess how they can in practice, best create an optimal enabling environment for value addition at source. Improve the capacities of the forest officers in frankincense areas, on the technical aspects (silviculture, production and management, marketing, etc.) of frankincense trees, for better supervision and following up.

GAP 3: How do we formalize existing local knowledge and institutions in a broad way that will improve management of frankincense trees and forests; embracing tapping, replanting, regeneration and a whole range of relevant issues?

ACTION 3: Capture, formalise and implement local knowledge in such a way that:

1. It will support livelihoods and communities are not being exploited,
2. Communities can defend their rights locally to the elders and nationally to the government.
3. There are supportive policies in place that will support sustainable frankincense harvesting and all the training needed, and equally importantly, the value chains from the farmers/ pastoralists all the way to the final retail marketer.



“ As long as the harvesters only sell raw material and are not involved in the value-added chain, they will always make the lowest cut of the final profit. ”

GAP 4: How much can a harvester earn in a day?

ACTION 4: Determine how long it takes to sustainably collect 1 kg of resin in the different species, regions and seasons. Determine whether the focus is on quality or quantity, as well as the pricing structures and market fluctuations.

Main room Discussion 2: Conversation on being a conscious consumer:

Discussants: David Crow, Bert-Jan Ottens, Dan Reigler, Kelly Ablard and Shebhaz Khan

GAP 1: How many young people still know the ‘sourcing and inner’ aspects of these products, beyond the ingredients?

ACTION 1: Use the retail opportunity to educate and create an emotional and spiritual connection with the young consumer demanding more transparency, connection and sustainability. Use technologies to bring nature closer.

GAP 2: If we seek to deepen consumer understanding, what does consumer education mean?

ACTION 2: There are fewer suppliers that retail customers. Seek to change suppliers focus from lowest price to quality, fairly sourced value chains, species and/or batch specific purchasing and educate consumers on the long-term value of paying a slightly higher price for transparency and sustainability. Work with private companies to create a handbook and conscious consumer campaign that explains the current realities and can act as a basis for raising consumer awareness.

GAP 3: How do those taking the trouble to do it right, such as many diaspora or those working directly with the communities, get recognised, rewarded and differentiated from those who do not?

ACTION 3: Explore mechanisms to celebrate those doing it right and adding value at source and to give those looking to purchase 'ethical' frankincense the means to do so.



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Additional Actions

1. Continue with workshops/conferences as the potential exists for even more information to be collected and assimilated, so we have a better birds eye view of all the different species different issues, through more virtual conferences.
2. Use questionnaires & templates to conduct a survey (via email) to record same information as above; We can have many people contributing and it is a cost effective and efficient way to gather information on the industry. Also online workshops or conferences, with carefully selected participants from all producing regions/countries.
3. Take the 'Gaps & Actions' from this workshop forward through sub-committees with specific tasks, define the themes and see if we can generate any useful cross-regional comparisons. The results can be a Proceedings or Trade Brochure that would talk to all the different role players to disseminate information about: (a) supply chains & how they differ; (b) The different types of raw materials & products that are available; c) a survey of all potential regulations & interventions that can contribute to sustainable use & community empowerment. Currently small companies wanting to know where to buy ethical frankincense do not know how to go about selecting ethical suppliers. They want to contribute to ethical trade but do not have the necessary information.

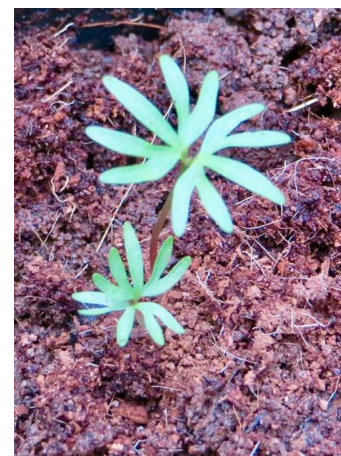
“ The group suggested that a non-technical report needs to be created and disseminated and spread to the public to create awareness of what has been scientifically technically proven and what has not. ”

In summary: the top actions needed are:

1. Create a consortium of local and international scientists and decide sub groups and leads to establish:-
 1. The status, range, health, regeneration, challenges and threats for each species
 2. The physical, chemical, specific markers and current uses of the resins and resin products of each species, matching local taxonomies with western nomenclature and internationally traded products.
 3. The socio-economic realities of each of the communities that own and harvest the trees and to identify what will most incentivize their engagement in the long term sustainability of the trees.
 4. The current trade volumes, patterns and how new technologies can support transparency and traceability.
 5. Which trade and other certification programmes and local, national and international regulations will most support the long term health of the trees and communities that manage and harvest them.
2. Initiate, record and share the results of active 'best practice' pilot projects for both the trees and communities in key harvesting areas
3. Create an accessible handbook on the current established medicinal and aromatic properties of each species
4. Work with private companies to create a handbook and conscious consumer campaign that explains the current realities and can act as a basis for raising consumer awareness.
5. Seek out how to collaborate with existing projects and generate proposals of large scale third party funding. Short-term actions (yr1-2): Mid-term actions (yr2-5): Long-term actions (yr5-10).



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Follow up actions:

- GFA will send this short report out to all participants and make all the workshop outputs available on the website www.globalfrankincensealliance.com
- GFA invite members to form collaborative working groups

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Photos: Dr Sue Canney Davison.

Except: Samburu meeting, page 9: Isaiah Lekisike, Boswellia Carteri Somaliland, page 12: Haris Hassan



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