

African elephants putatively self-medicate with medicinal plants in the Mount Elgon region, Kenya

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Supplementary Information

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Supplementary Material S1:

Interview Notes - Interviewee 1

I am a guide and my knowledge of this place [Mt. Elgon] was acquired when I was young as I grew up here. At this time the elephants weren't confined to a fenced and protected area [Mt. Elgon National Park] and interacted with the community a great deal. My personal interaction with the elephants and the other animals in this park has therefore been for a very long time.

Development in this area [Mt. Elgon] has only occurred recently. Before, local people used to entirely depend on plants for medication. We learned which plants can be used for medication by observing the behavior of the elephants, and still use these plants to this day. For example, elephants tusk many of the indigenous and protected trees of Mt. Elgon such as the Elgon Teak tree. People saw these trees had been tusked by the elephants and thought it might be medicinal so began to eat mostly the bark but also the roots by boiling into broths. Back when my grandmother used to get game meat and honey from the bush, they would follow the elephants and observe what they were eating from their droppings. When they saw sweet potato leaves in the droppings, they found the plant with these leaves and discovered sweet potatoes in the ground. People here will follow elephants and try to eat what they eat as they believe it will also be good for them.

Elephants eat part of the *Dombeya* plant, which has a slippery substance between the bark and the stem. They strip off the bark and eat this substance to help soften their stool. Local people also eat the same part of this plant as a relief from constipation and stomach problems. People, elephants, and baboons feed on bamboo. Elephants eat the bamboo directly and humans smoke the split bamboo shoots over a fire before eating them as both a nutritional food and a general medicine. Elephants uproot the *Toddolia* plant (a climber) to eat the bark and roots. The elephants really like this plant. Local people also eat the bark of the *Toddolia* by boiling it into a broth to treat sexually transmitted infections (STIs).

Both elephants and local people eat the tender leaves of the *Warburgia ugandensis* which has a hot peppery taste, and sometimes the bark. Local people use this to clear chest congestion but it is very strong so only a small amount is required. Elephants also only eat a small amount of this [*Warburgia*

ugandensis] sometimes.

The elephants eat stinging nettles by uprooting the plant and eating only the upper part and discarding the rest but this is likely just nutritional. The Ogiek that live on the mountain do exactly the same for nutrition. Elephants pull down *Vachellia (Acacia)* trees to eat the leaves and the bark. Humans also use the bark, along with the bark of the *Croton* tree, to feed sick babies. The bark can be boiled into a broth or the inner part of the bark can be eaten directly and is commonly used by local people to treat diarrhea.

Mostly during the dry season, the elephants sometimes eat the bark of the Cedar tree. Local people also use Cedar bark to treat the flu by eating the inner part of the bark. Baboons have also been observed eating this bark.

Elephants eat both the seeds and the bark of the Podo tree. They crush the hard seeds to eat them but this might just be nutritional. Local people use the bark of the Podo tree by burning it and soaking in water (soda ash) to soften old hard meat and prevent illness after eating it.

I think it is instinctive that elephants self-medicate. The elephants sense they have a health problem and follow the lead of the old matriarch who knows what to eat. These old females have accumulated knowledge over a long period of time which they pass on to their babies.

The elephants dig out areas of red soil with their tusks, especially near elephant platform in the park. This is mainly done by the female elephants. The males sometimes also dig out the soil to sprinkle it on their bodies but the females eat this soil. I learned from the local people that red soil is rich in iron and they might have learned this from elephants. It is possible that they replenish their iron by eating this soil and may be related to their reproductive cycle.

Mt. Elgon receives a lot of rain causing leaching so elephants lack key minerals which they must source outside their usual plant diet. One of the places they get these minerals is the caves of Mt. Elgon by tusking the salt-rich rock of the cave wall. In these caves they also eat clay which might contains additional mineral. Sometimes, and normally seasonally based, the elephants smear the clay on their bodies which can be observed as they exit the cave much darker in color. Exactly why they eat the clay

remains unknown. Some of the caves they are known to visit include Kitum and Kibalo cave (in Chesamo) where they mine salt and also eat clay. In Chemombut cave, they mine salt and eat the clay, but human activity such as smoke from fires has discouraged the elephants from frequenting the cave. In Tupkeber cave (c. 1km from Chemombut), the elephants have also been known to visit but collapsing of the cave has stopped them visiting. In Chepnyalil cave the elephants visit but they do not mine salt or do any other activities that we know of.

Supplementary Material S2:

Interview Notes - Interviewee 2

Elephants eat the bark of the *Toddolia sp.*, which is a shrub with spiked bark. Local people consume the bark and the roots of this plant by boiling them into a broth, sieving it, mixing with honey, and drinking after 2-3 days. They use this for most illnesses and often mix other plants into this broth too. The elephants also eat strips of bark from the *Dombeya* species (*Dombeya torrida* and *Dombeya rotundifolia*) that contains a slippery substance that aids their digestion and softening of their droppings. Elephants eat the bark of the cedar trees. Local people also eat this bark as a medicine. I think this is likely a medicinal plants for the elephants as they only eat it sometimes.

Elephants also feed on the barks of the Podo, Elgon Teak, *Warburgia ugandensis* and *Croton sp.* as a medicine when they are sick. Other animals in the park such as buffalo, baboons, and water buck also feed. Mostly when it is wet, elephants dig red soil for termites and mushrooms. They do this both when they are sick and when they are not so it may also be for nutritional reasons. In Kitum cave the elephants cover themselves in a layer of mud and water which might help regulate heat and kill ticks. They also eat the clay in Kitum.

In Kitum cave elephants mine for minerals which may be due to the high rainfall Mount Elgon receives causing leaching and mineral deficiencies in the elephants' normal diets. In Chepnyalil cave the elephants visit but they do not mine for minerals.

Supplementary Material S3:

Interview Notes - Interviewee 3

The elephants are the largest animals in this region that live in herds of many females. Historic poaching has meant the government has stepped up ways of looking after the elephants and new scouts in the region have started to gather up to date information on their movements. I grew up my whole life with the elephants here. They are intelligent animals with very sharp memories, not losing it for years. They can pass on twenty, even thirty-year-old knowledge between kin.

Besides foraging and eating trees and grass for food there are certain plant species they take as medicine. The indicator that they are taking a plant as medicine is when you follow the herd they might have removed only a small root from a particular plant, chewed it or crushed it, and given to a young elephant. Therefore over time we have learned there are specific species of trees they can use as medication.

The specific trees elephants use as medicine are also the ones that people use and are mostly found there in their habitat. Whether people learned which plants are medicinal from the elephants is not something we have studied, but there are certain human families with special relationships to elephants. For example it was told that when the elder of one of these families passed, the elephants came to their dwelling and mourned their death without destroying anything. Elephants even mourn their own kin too, moving their bodies and placing branches and leaves on them.

There is a specific type of fig tree where elephants take the bark as medicine, and the roots of the red acacia and leaves of the *Warburgia sp.* There are certain shrubs also with red flowers and spikes they take as medicine. [Showed *Dombeya* and *Toddolia* pictures] in English it is called the Dombeya Rotundifolia [from encyclopedia of Kenya flora with English-Swahili translations]. The Elgon Teak is called the *Olea capensis* and the Croton is the *Croton macrostachyus*. The Podo trees there are two the *Podocarpus gracilior/ falcatus* and *Podocarpus latifolius*. The Cedar tree humans take as a medicine by using both the bark and the roots.

My interest was to follow what specific trees they browse on and the frequency that they eat it. In the park the trees also live in families in one area, and the elephants will often only browse on one or two

trees or small shrubs which suggests it is not food but medicine. For example they might just uproot one or two of the *Vachellia/Acacia* trees which suggests it is medicinal. To understand the illnesses that elephants take particular plants for requires deeper research and we can't simply ask local people, but the old custodians such as Mzee Kiberenge ("The Elephant Man") may have more knowledge of this.

We are happy to have the elephants in our region but often the people are not getting the benefit.

We have myths stories and songs about the elephants being scared of bees they hide their trunks and run very fast.

Supplementary Material S4:

Interview Notes - Interviewee 4

I started tracking the elephants in 2017 and in June 2019 I began working for MEEP and started mobile monitoring using the SMART technology in 2021. I have lived all my life in Socio which is my scouting block and have a lot of experience working with elephants even before working for MEEP.

Historically, human beings share medicines with the elephants, but I think it is separate that humans and elephants eat the same things for medicine. There are some plants that the mother elephant will chew the bark of and give to the small babies. There are some plants that are poisonous for humans but not for elephants so people have to be careful following what they eat.

They don't eat the medicinal plants every time, instead taking them seasonally and especially when babies are born. In the upper and lower regions of my block, there are different plants that the elephants use as medicine. Before elephants our ancestors would stew plants and take them as medicines. The elephants eat the bark, roots, and leaves of certain plants just the same as we do. For some trees the elephants will eat the leaves for food but then uproot the tree and take the roots for medicine.

Simotweet is a plant people use as medicine by cutting the bark and taking just a teaspoon of a milky substance and mixing with other plants. This can be used to treat wounds in people. Elephants just chew the bark but also as a medicine. People use the tap roots of Markasheet (a 3.5 feet tall shrub) as a

medicine by stewing them and drinking the broth when their bodies are weak and they need help with digestion or stomach aches. This medicine works very well. The elephants also just eat the roots as medicine. Humans and elephants take the roots and bark of the Karasheet. The elephants like this one a lot too but they may take it as food as well as medicine. In people, it is used for young children to treat allergies, worms, and stomach problems. Women take Matip Sorin when they are pregnant or have problems with fertility. If fertility is a problem, then both partners take the roots of Matip Sorin (look like cassava). Elephants take the leaves and roots but leaves might just be a food. In people it makes you feel fresh and like you can breathe well and exercise. Women over 49 also take the bark of the Sapteet but I don't know why they do and only people above this age. The elephants also eat the bark. Moobarawa is a strong medicinal plant and very expensive that is used to treat allergies in young children. People take the roots and elephants take the roots and leaves.

Another plant Chepkata is mixed with Matip Sorin and Moobarawa and taken to treat for STIs and is a very powerful medicine. You first take an injection and then take the plant medicine. If you get the injection but don't take the plant medicine recovery is much slower but you do have to go to the doctor first before taking the traditional medicine. Both people and elephants eat the roots as medicine.

I remember one day I went to monitor the elephants and I took a Moobarawa for myself then the very next day I find the elephants have taken the same thing. I think they [elephants] pass the knowledge from mother to baby but I don't know how they originally learned to eat certain plants for medicine.

Elephants eat clay also but I don't know for what purpose. They like to eat it in a swamp but we never know why.

If they [the elephants] find the medicine they don't always take it. When the elephants come across the plants they take them but they don't know what disease they use it for. Sometimes they just pass the plants and don't take them at all. For stronger medicines they just take one or two plants and not all of them in an area, but they might come back for more the next day as often these plants aren't found everywhere.

Supplementary Material S5:

Interview Notes - Interviewee 5

I come from Labot block B. It is quite a big area and I am in the lower side. My parents have been there for a long time but I went to school and we settled in the lower side and I have been there since 2000 interacting with the elephants. Our main activity there is keeping livestock.

From my experience you can see that lots of plants elephants feed on are also used as medicine for livestock. People feed the livestock the plants and also some livestock even eat them directly as medicine.

These plants elephants feed on often have thorned structures. Whenever they find them they will feed on them. For me I think they are medicinal as they feed on these plants over all of the plants in the forest and they dig them out and feed them to the babies.

The bark of the *Olea africana* is used by locals and mixed with some other plants not fed on by elephants, honey and water. It then keeps a long time and has a sour taste. It is used to clean the body and blood stream and to treat STIs so it is taken a lot. Elephants eat both the leaves and the bark as medicine. Poroweet is the most fed by elephants out of plants I have mentioned. If someone has diarrhea you can boil the bark of this tree and it stops this problem. They [elephants] take both the bark and the leaves. Nyaltiit is also a medicinal plant for elephants and people by taking the leaves but I am not sure what to treat exactly. Sikoweet is a plant people take as medicine and feed their animals when they are suffering. Elephants and people take the roots.

Elephants feed on the leaves but not the roots of the Markasheet. In people, they take the roots and combine with other plants to cure STIs. It is almost always combined to make it more effective.

It [medicinal plant knowledge] all comes from the ancestors and has been passed down generations. The grandfathers used to tell us that whatever works for elephants also works for us and so we can follow what they eat.

Elephants eat the clay in the caves in my area but I don't know why. I think they might just eat this for fun and not for medicine. When the elephants eat the clay they shower and make noises and seem to enjoy it.

Supplementary Material S6:

Interview Notes - Interviewee 6

My block is called Kongit, and I've lived there all my life so I have a lot of experience interacting with the elephants.

People go into the bush and remove the roots of the Kibiriti. This plant you can put in the fire still wet and it burns very well. I don't know why elephants take this this as medicine but I have seen them eating it. For me to discover that maybe this is medicine is because the herbalists take it. I think they take it [Kibiriti] as an antibiotic when mixed with other plants. People take the roots and elephants take the leaves but the elephants only eat it [Kibiriti] sometimes.

Elephants take the leaves of the Tobosweet (Croton) and people take the bark. They only use a small piece of it as sometimes if you use too much it is poisonous. If you have malaria you take it and it makes you better. The elephants don't eat the Tekeldeet as it might taste like a poison. Elephants use Angurweet as a medicine to give to babies, removing just the leaves and chewing it until it smooth along with the roots of some other trees. Then they mix with their milk and give it to the babies who chew on it themselves and spit out the solids remaining. They use it as a kind of immunization along with Nyalit and Simotweet also. For humans, when babies cry they take the roots of the Angurweet, cook them and take a spoonful which cures stomach ache in the babies.

Elephants take Lulyondeet which works for everything as sometimes when there is a sick elephant they go to the tree and eat the bark by tusking it. I have seen elephants that look sick because they do not move more than 300 meters for 2 or 3 days which suggests they might be sick. Normally they would walk 10 km per day. People do also use the bark of this tree too but I am not sure for what.

Armootit is a tree which elephants remove the bark of for medicine and so do local people. It is a very good herbal medication for both people and elephants. There are others [medicinal plants] such as Karaseet which humans take the roots for treating STIs, Bumeetet which humans and elephants take the bark, and Kwiryoondet which humans use to treat diabetes when mixed with other plants. Elephants take the roots.

People say that any tree elephants eat the people also take as they can be medicinal but sometimes elephants can eat poisonous things so people must be careful. Generally people do follow what the elephants eat as they think it will be good for them also. For these medicinal plants elephants eat them according to the season. Some seasons they just leave them and some they eat them. If they can't find the plant they need to eat, for example it is 20 km away, they go straight there without eating anything

to get there quickly. The elephants may also direct you to where there is water and salt licks. They like taking the salty water and can stay there for 2 or 3 days. This is a very unique mountain as they can take salt from the caves. The elephants also sometimes eat clay but I think this is just to get more salt.

Supplementary Material S7:

Interview Notes - Interviewee 7

I worked here [Mt. Elgon National Park] from 1969 to 1996 as a KWS ranger so I have much experience with the elephants. I know every cave and how to access it and every inch of this [Mt. Elgon National] park.

The elephants eat the bark and leaves of the Croton. Any tree that humans use as medicine the elephants also use that. We learnt this through time as we found our forefathers using it for medicine also.

Elephants also dig the roots and eat the bark and leaves of the fig tree. Humans mainly use the bark to treat chest problems and malaria. Elephants are very clever. When they come to an area with many fig trees they eat only one and they all eat from that one. That way they don't waste the medicine if they need it tomorrow.

For the *Dombeya*, they [elephants] only eat the bark and the leaves. Humans use it for stomach problems.

Having worked with the elephants for many years I know when an elephant is sick as it will not browse normally. When I identify a sick elephant from afar, I may see the other elephants in the herd taking some branches to the sick elephant that is not feeding. The sick elephant may then eat the bark or the leaves. The mother elephant can also chew the roots, bark, or leaves of the medicinal tree and give to the sick child. They really treat their babies very well; when the elephants are crossing a flooded river they carry the baby elephants.

There are various varieties of acacia. The umbrella shape acacia is used as food but the other with very hard wood is used as a medicine. People use the roots of this for medication and it is very good. It is called Kwaleet in our local dialect.

There is a shrub called Matip Sorin and people dig the roots. It is expensive and used as a general medicine. People sell the roots of this for 500 Ksh sometimes.

The bamboo is also medicinal. Humans use the roots as a human medicine by eating it. The young shoots are smoked over a fire and eaten. The elephants also eat this as food but when they are sick they

take the roots.

Stinging nettles are medicinal and high in zinc. In Kenya they sell dried leaves of the nettle (100g is 400 Ksh). This is a routine medication for the elephants.

There is a twig we call Kipsokotiit which the leaves, stem, and roots are used as a good human medicine. The knowledge of this is indigenous and passed down the generations.

The elephant has the capacity when they eat the branches to also eat the seeds. They are very good at propagating seeds and seeding the forest. Around the dung there can be many young plants growing.

There are certain plant called Sodomopo humans use. It is good also for human they eat the fruit and the leaves. It can also be used as an anti-venom. They [elephants] eat the whole plant from stem to the roots.

Elephants also eat *Aloe vera* and it is highly medicinal. The elephants take the leaves. There is a certain plant that is like a grass that makes small piping that is a human medicine. They finish what is there when they find it because it does not grow often.

In a nutshell, all medicinal trees humans use for medicine elephants use them also. They don't destroy an entire area or browse on all of them they just take one and leave the rest.

The elephants in the caves scrape the rock. Where they eat the clay is concentrated around where they mine the salt. In certain swampy areas but not all the water is salty and then they take this too.

Elephants are very social. They don't fight one another even when drinking water they allow one to drink then the next. For the many years I have been with the elephants I only see the males playing not fighting. Elephants also know the direction they are moving. They go against the wind when they browse so they can smell anything that is ahead. When the wind turns they keep going against the wind so they know what is ahead of them. When the wind is steady they just stay where they are browsing. If the lead female elephant realizes there is danger she makes a noise and they [elephants in the herd] all run to her and communicate. Some say elephants communicate in a unique way between each other, sensing where there is water and digging to access it. They can create their own small ponds and watering source.

Supplementary Material S8:

Interview Notes - Interviewee 8

I look after the Kapsang block and started work for MEEP in 2017. I have lived here for 20 years and have much experience with the elephants.

There is a plant called Simotweet which I have seen the elephants eating the bark and giving to the child. It cures allergies in people but combined with other herbs too. Elephants also eat the leaves and roots of the Kobortit to treat illnesses in the baby elephants. It is used as a medicine for livestock too by boiling it and giving the broth for them [livestock] to drink. Humans don't take it as a medicine.

Aloe Vera is used by the elephants as an appetizer by giving it to the calves so they want to eat. It is also used by humans for allergies and treating STIs by boiling into a broth for drinking.

There are many other plants they use as medicine but they are mainly found in the [Mt. Elgon National] park so I am not so familiar with them and their names.

Elephants eat clay but not as medicine but just because it contains salt. They also do it for fun.

We learned our knowledge of medicinal plants from our ancestors as it is passed down to us.

The elephants don't take medicinal plants every time they come across them just once in a while and seasonally.

They are intelligent and they know when they are sick and then they look for the medicine but when they are healthy they don't take it.

Supplementary Material S9:

Indirect Photographic Evidence of Medicinal Plant Exploitation by Elephants

Figures S1 – 5 provide further evidence for local elephant self-medication behaviors, as well as information on plant species recorded in this study.



Figure S1. Left: Spiked bark of the *Zanthoxylum asiaticum*. **Middle:** Climbing section of *Z. asiaticum*. **Right:** Suspected elephant tusking of a section of *Z. asiaticum* bark.



Figure S2. Trunk of *Juniperus procera* (Cedar tree), showing suspected elephant tusking.



Figure S3. *Vachellia seyal* (Ndiliet; red acacia) found on a trail traveled by elephants. The leaves, bark, and roots of this tree are eaten by single elephant individuals, but only a few trees at a time are consumed, which suggests this tree is medicinal.



Figure S4. Left: *Solanum aculeastrum* (Sikoweet), a plant whose roots are eaten by elephants. **Right:** Cut top section of the *S. aculeastrum*.



Figure S5. Left: *Solanum acaule* (Sodomepo), which elephants eat entirely from stem to root. **Right:** Leaves and fruit of the *S. acaule*.