

HUMAN-ELEPHANT COEXISTENCE TOOLBOX

ADVICE, ACTIONS AND TOOLS TO REDUCE CONFLICT WITH ELEPHANTS
A TECHNICAL MANUAL FOR TRAINERS AND COMMUNITY LEADERS



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Save the Elephants' Human-Elephant Coexistence Program

English Edition 1.1 – November 2022





HUMAN-ELEPHANT COEXISTENCE (HEC) TOOLBOX

Welcome to the first edition of Save the Elephants' illustrated, evidence-based toolbox of tried and tested methods that can help rural communities in Africa to live safely with elephants.

The toolbox is designed for trainers, project officers and community leaders to identify the source of conflict with elephants and then guide people on how best to protect their property with the resources available. The toolbox is split into seven chapters, with all materials, ingredients, and technical details beautifully illustrated by our Kenyan artist Nicola Heath.

These methods have been collated from across the elephant range, from savannahs to forests, from conservation field partners to rural farmers, including innovative individuals who have invented novel ideas that really work. Contributors to each tool are listed at the back of each education pack and we also have an extensive reference library online with links to videos and publications for you to use. You can download all of the updated toolbox education packs from www.ste-coexistence-toolbox.info

Each method has a budget point, a difficulty range, a risk factor, and be prepared that nothing is 100% effective. We recommend combining or rotating the various mitigation tools to help prevent elephants from getting used to any one technique. Additionally some tools can actively help boost crop yields and income generation through elephant-friendly enterprise ventures.

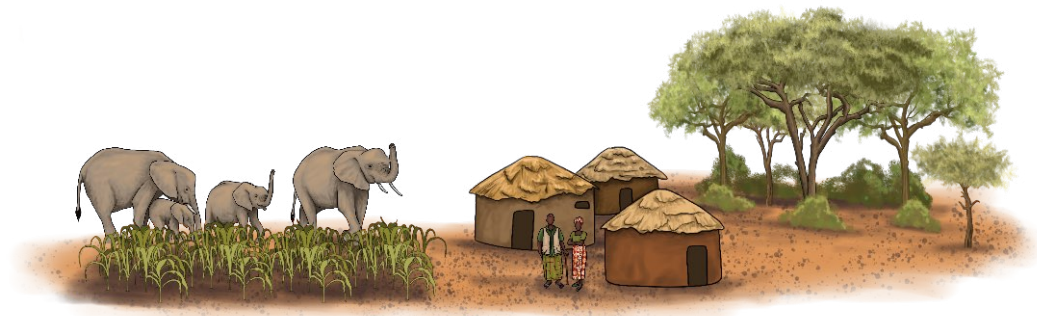
Africa's elephants are endangered and they also need their space to roam and forage. We also urge leaders to prevent any blocking of wildlife corridors and that national park boundaries, and the integrity of our valuable wild ecosystems, are respected. We all have to play our part in seeking true coexistence with nature.

Try out the tools and please send us feedback on what does and doesn't work plus any new methods that are effective for you. We hope you enjoy using and sharing this free coexistence toolbox.

Lucy King

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IUCN African Elephant Specialist Group
HEC Taskforce Member



HOW TO USE THE TOOLBOX – A TRAINERS GUIDE



1. UNDERSTAND THE PROBLEM

Take plenty of time with members of the community that are dealing with a conflict with elephants. How many conflict events are happening in what time frame? Are they daily events or do elephants only come during certain months? Is it day or night conflict? Are they single bulls or whole family herds? Who do the community expect to assist them during conflict events? Is there an underlying conflict between the community and wildlife department that is adding to the stress? By establishing the frequency, intensity and source of the conflict, you can start to identify what resources and level of budget will be needed to resolve the problem.



2. UNDERSTAND WHY THE ELEPHANTS ARE THERE

Why are the elephants overlapping with the farm or property in the first place? Are they looking for food or water? Is the farmer attracting elephants by growing crops they love to eat? Or is the farm or property blocking a natural migration route for elephants? It may be possible to reduce the conflict situation at source by ensuring the elephants have open access to a source of water, can freely enter and exit a natural bush area for foraging, or to identify and move a fence that is blocking a natural migration path. Disturbance within a neighbouring national park (i.e. livestock grazing inside the park) can also push elephants out into communities. Most conflict situations are caused by humans changing the land so by identifying and removing any human-caused structures or disturbance inside the elephant foraging zones, it may reduce the conflict for the long term.



3. MAP THE ELEPHANT MOVEMENTS

Ask the community to map the movements of the elephants around the conflict issue – i.e. if elephants are entering a school compound ask a teacher to map their plot on a piece of paper and draw which direction the elephants typically enter the compound to cause damage. You may find that there is one weak point in the boundary defenses that needs focal attention for investing in deterrents. Don't spend limited resources on boundary sides that do not have elephants breaking in. Use these maps to keep a record of events and to compare before & after behaviour once a barrier has gone up.



4. WORK OUT YOUR TIME & BUDGET RESOURCES

Once the site of conflict has been identified and any immediate solutions to free up barriers to the elephants' natural migration paths have been cleared, try to work out how much time or labour resources the individual has. When working on a budget, think about:

- Initial purchase & transport costs of materials
- Labour costs to install the deterrent
- Maintenance and management costs into the future



If the individual doesn't have a lot of time (i.e. he has a job away from his farm or tree plantation) that individual will typically need to be prepared to spend more funds on deterring elephants from his site of conflict. If an individual is a full time farmer or agronomist growing trees, they might be able to afford to spend more time and less income on their deterrent methods if they live and work on site and are able to respond immediately to approaching elephants.



Be wary of encouraging the use of expensive loans to construct deterrents to farms, property, or water tanks. If the farmer doesn't have the ongoing resources to maintain that deterrent method it can quickly fall into disrepair and become useless and a waste of investment. Help them choose a combination of affordable methods that you know they can maintain for the long term. Photocopy or download & print the method sheets and leave with the farmer.



5. FOCUS ON HUMAN BEHAVIOUR CHANGE

Its hard to change elephant behaviour or elephant migration routes that have been established over decades. However, encouraging behaviour change and educating community members when planning new developments is a more achievable task. When using this guide, do start with **Chapter 1 – Understanding Elephants**. This information will help educate community members, teachers, children and land use planners on why elephants behave as they do, why they are important to our ecosystems, and why certain negative interactions are happening in the first place. Elephants are sentient and endangered, there are only around 500,000 left on our continent and every one deserves the right to live and thrive as much as we do.

HEC TOOLBOX CONTENTS

1. UNDERSTANDING ELEPHANTS

- ✓ Introduction to elephants
- ✓ Elephant-aware behaviour
- ✓ Elephants as ecosystem engineers
- ✓ Importance of connectivity to reduce conflict
 - *Elephant behaviour, social units and reproduction*
 - *Elephant Threats and solutions*

2. FARM BOUNDARY PROTECTION

- ✓ Noise deterrents
- ✓ Organic smelly elephant repellent
- ✓ Trenches
- ✓ Chilli deterrents
- ✓ Metal strip fence
- ✓ Bio-fences as barriers
- ✓ Food storage & protection
- ✓ Beehive fences
 - *Stone walls & gabions*
 - *Electric fencing*



3. EARLY WARNING SYSTEMS

- ✓ Night guarding with light and fire deterrents
- ✓ Trip alarms
- ✓ Cellphone & LED lights-based warning systems
- ✓ Infrared or motion-triggered sensors
- ✓ Watchtowers / observation towers
- ✓ Drones & aerial interventions
- ✓ GPS tracking collars and geofences



4. ELEPHANT-COMPATIBLE FARMING

- ✓ Crop choices and kitchen garden practices if you live alongside elephants
 - *Conservation agriculture for healthy communities*

5. ELEPHANT-COMPATIBLE INCOME GENERATING ACTIVITIES

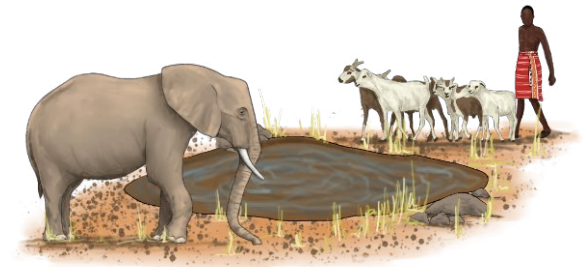
- ✓ Alternative income from elephant-friendly enterprises
- ✓ Guide to beekeeping and safety

6. BIODIVERSITY PROTECTION

- ✓ Tree protection

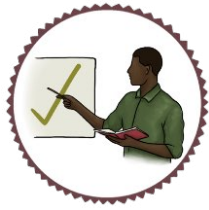
7. PASTORALISTS / SCHOOLS LIVING IN SHARED SPACES WITH ELEPHANTS

- ✓ Water tank protection
- ✓ Shared / alternative water points
- ✓ Protecting schools & compounds
 - *Compensation/ consolation schemes*

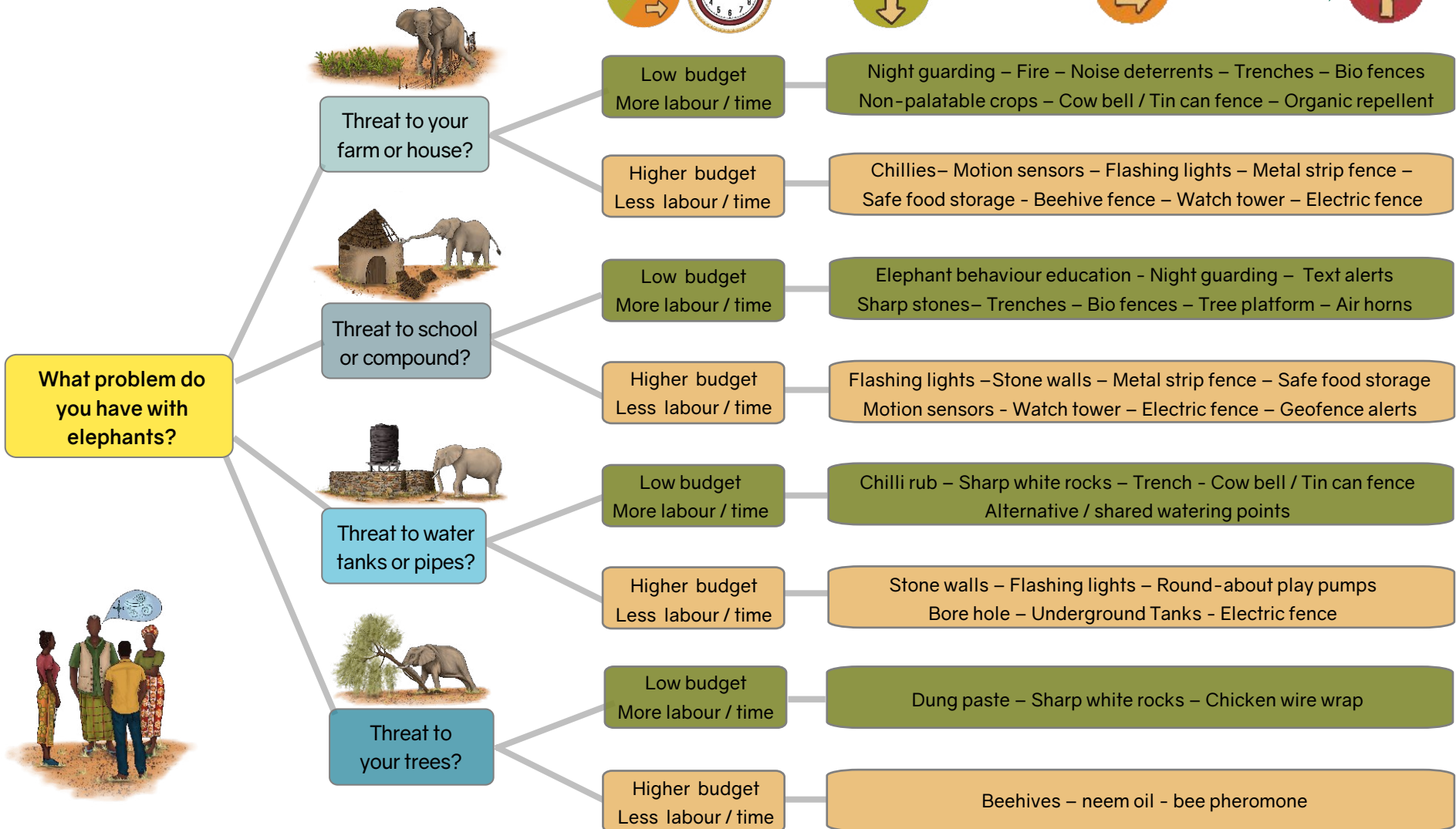


Download tool education packs from
www.ste-coexistence-toolbox.info

- ✓ Included in Edition 1.1
 - *Under development for Edition 2*



TOOL DECISION GUIDE



TOOLBOX ICON KEY

HEC TOOLBOX METHOD ICONS



Watch Towers



Organic Smelly Elephant Repellent



Water Tank Protection



Beehive Fences



Elephant Aware Behaviour



Chilli Deterrents



Introduction to Elephants



Tree Protection



Elephants as Ecosystem Engineers



Trip Alarms



Infrared and Motion Triggered Systems



Cellphone & LED Lights Based Warning System



Noise Deterrents



Trenches



Food Storage and Protection



Metal Strip Fence



Protecting Schools and Compounds



Crop Choice & Kitchen Garden Practices if You Live Alongside Elephants



Night Guarding with Lights and Fire



Bio-fences as Barriers



Alternative Income from Elephant Friendly Enterprises



Shared/Alternative Water Points



Guide to Beekeeping and Safety



GPS Tracking Collars & Geo-fences

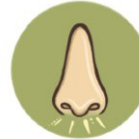
SENSORY ICONS



LOOK



HEAR



SMELL



TASTE



TOUCH



KEEP SILENT

ELEPHANT SENSORY ICONS



HEAR



LOOK



SMELL



TASTE



TOUCH



Observe elephants



Protect and defend



Stay Calm

SUITABILITY ICONS

	LOW	MEDIUM	HIGH
COST	\$ ↓	\$\$ →	\$\$\$ ↑
HUMAN DANGER	1 skull	2 skulls	3 skulls
ELEPHANT DANGER	1 skull	2 skulls	3 skulls
INCOME GENERATION	\$	\$\$	\$\$\$
NO ELECTRICITY NEEDED			
ELECTRICITY NEEDED			
Keep elephants away Low			
Keep elephants away Medium			
Keep elephants away High			





TOOLBOX ICON KEY

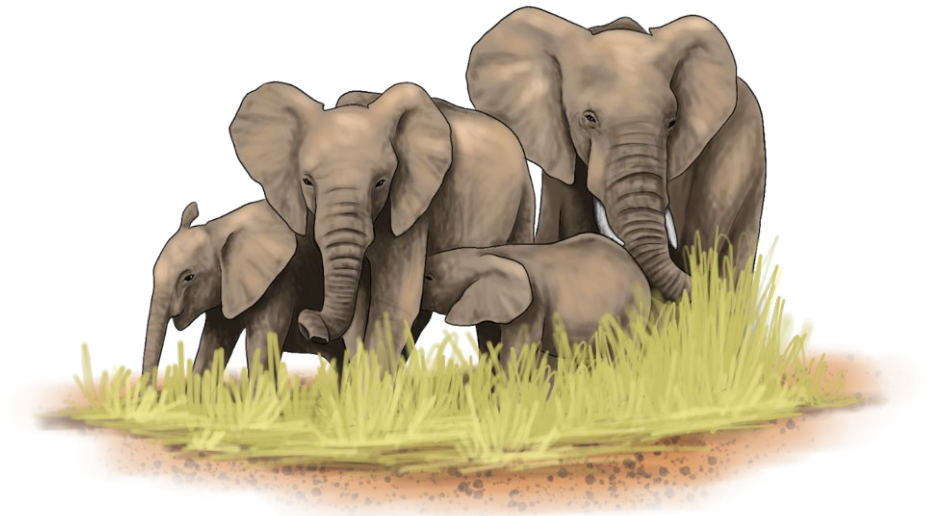


“It is in your hands to create a better world for all who live in it.”

Nelson Mandela

UNDERSTANDING ELEPHANTS

-  Introduction to elephants
-  Elephant-aware behaviour
-  Elephants as ecosystem engineers
-  Importance of connectivity to reduce conflict





INTRODUCTION TO ELEPHANTS

Learn more about elephants here

LARGEST LAND MAMMALS

WHAT ARE ELEPHANTS?

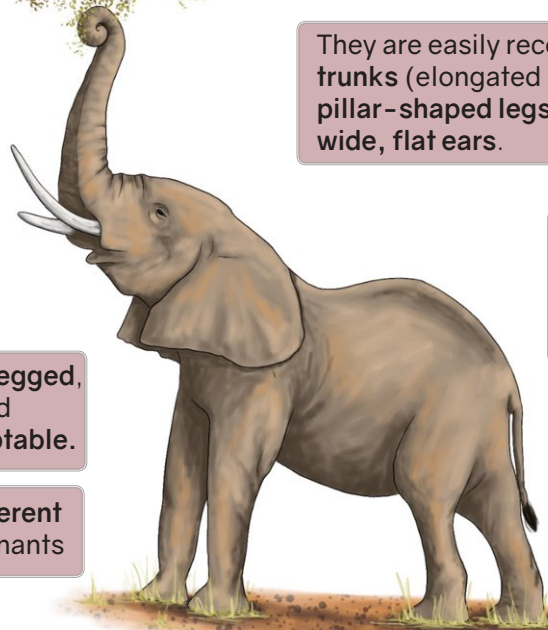


Elephants are the largest living land mammals on earth – they belong to the family Elephantidae.



They are easily recognised by their long trunks (elongated upper lip and nose), pillar-shaped legs, and huge head, with wide, flat ears.

Elephants are grayish to brown in colour, and their body hair is sparse and coarse.



They are four-legged, herbivorous and extremely adaptable.

There are 3 different species of elephants

- They are found most often in savannas, grasslands, and forests but occupy a wide range of habitats, including deserts, swamps, and highlands in tropical and subtropical regions in both Africa and Asia.
- Only one hundred years ago, there were 10 million African elephants inhabiting the African continent. By 2016, however, their numbers were reduced to only about 450,000.

ELEPHANT SPECIES

THERE ARE 3 DIFFERENT SPECIES OF ELEPHANTS:

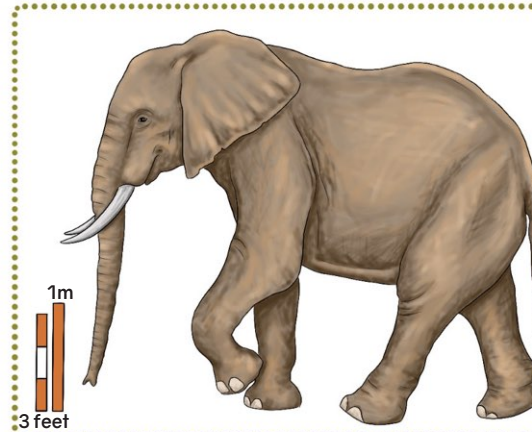
AFRICAN SAVANNAH ELEPHANT

Loxodonta africana

The African Savanna elephant weighs up to 7,000 kg and stands 3.5 to 4 metres at the shoulder.

Adult bulls have wide rounded heads compared to narrow pointed heads of female elephants.

They have long curved tusks.

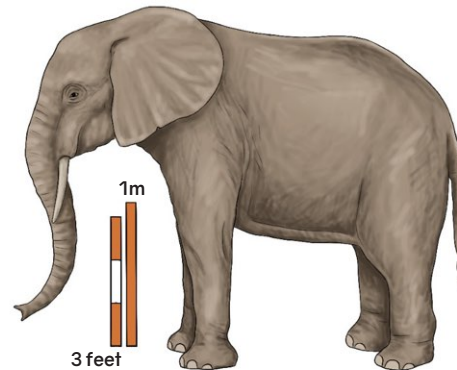


AFRICAN FOREST ELEPHANT

Loxodonta cyclotis

Forest elephants live in rainforests, and were recognized as a separate species in 2021. They are slightly smaller than Savanna elephants and rarely larger than 5,000 kg.

They have slender, downward-pointing tusks and rounder ears.

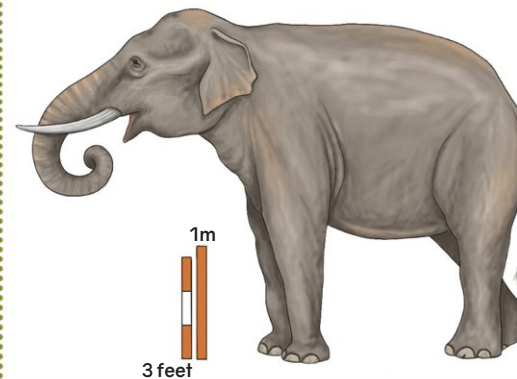


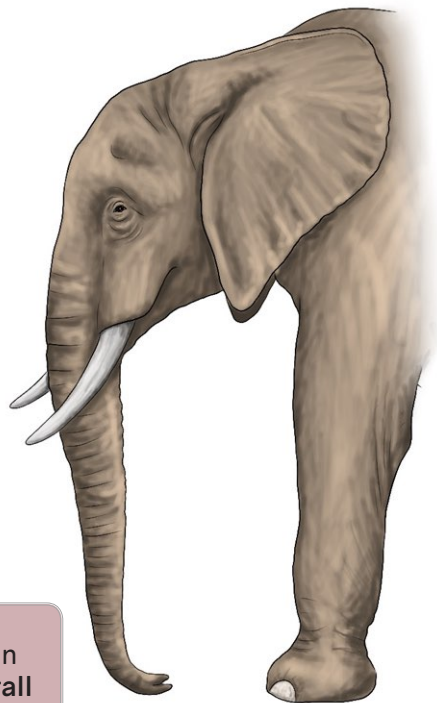
ASIAN ELEPHANT

Elephas maximus

The Asian elephant includes three subspecies: the Indian, or mainland (*E. maximus indicus*), the Sumatran (*E. maximus sumatranus*), and the Sri Lankan (*E. maximus maximus*).

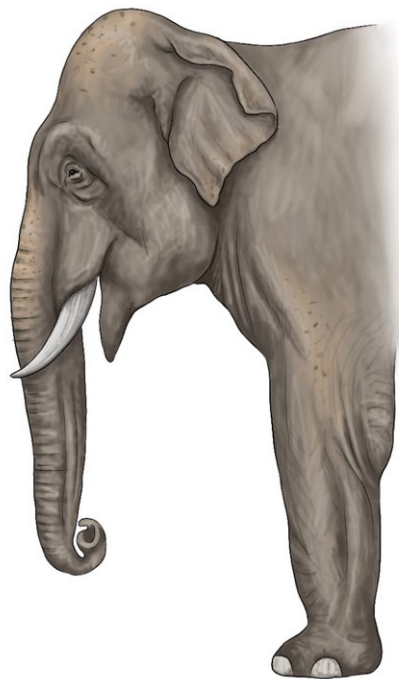
They weigh about 4,000 kg and have a shoulder height of up to 3 metres.





Male African elephants can reach 3.5 m tall and weigh between 4,000-7,500 kg.

Skin is up to 32 mm thick in places and almost paper thin in other places.



Asian elephants are smaller, reaching 3m, weighing 3,000-6,000kg.

Daily food intake 4-7% of body weight.

Feeds on as many as 173 plant species, including a wide variety of grasses, leaves, fruits, bark and roots.

HOW TO RECOGNISE EACH SPECIES

- Did you know that until recently, African Forest elephants were considered a subspecies of African elephants, but new research discovered they are a separate species (IUCN 2021).
- Forest elephants have straighter tusks and more rounder ears than Savannah elephants.
- Asian and African elephants can be differentiated by the shape of their ears, trunks and heads.
- The trunk of the African elephant may be more extendable, but that of the Asian elephant is more dexterous and adaptable.
- The best way of recognising the difference between African and Asian elephants is the shape of the ears and head.
- Asian elephants have a much more protruding and pointed forehead than African elephants.
- African elephants have much larger ears, which they use to help spread their body heat.

- Once their populations covered large continuous areas of land. It is no longer like this.
- Now they live in increasingly more fragmented areas.

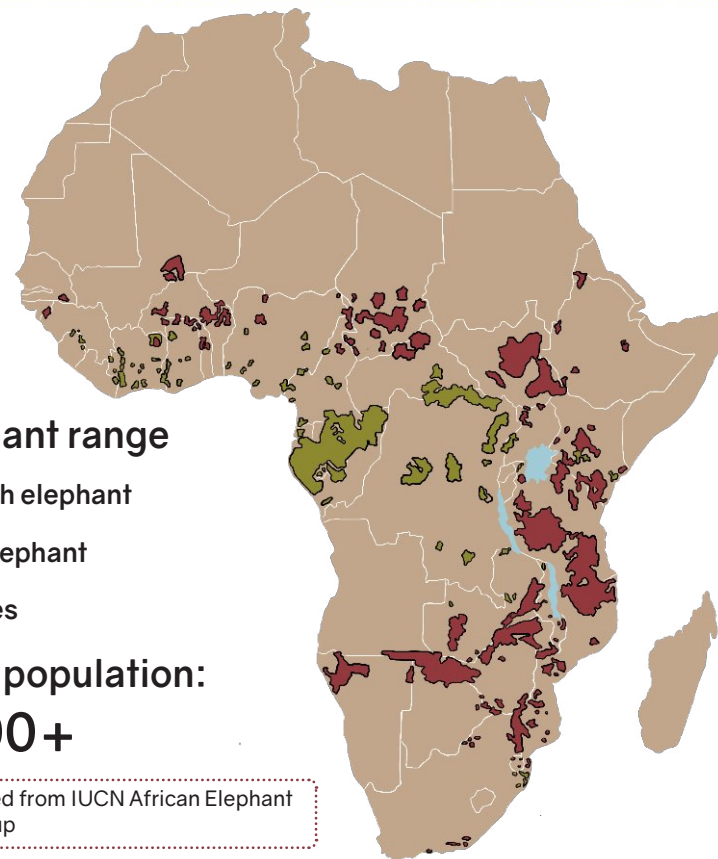
2016 known elephant range

- African Savannah elephant
- African Forest elephant
- East African lakes

Estimated current population:

450,000+

Credit: Adapted from IUCN African Elephant Specialist Group



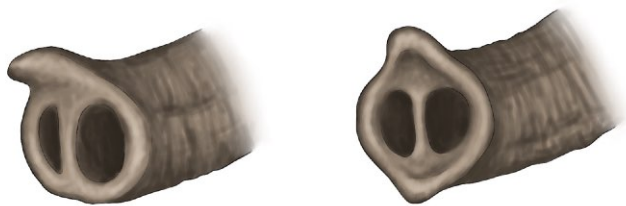


ELEPHANT TRUNKS/ PROBOSCIS

The elephant trunk is also known as the “proboscis”



- ⦿ The trunk, or proboscis, of the elephant is one of the most unique and versatile organs to have evolved amongst mammals.
- ⦿ This structure is unique to members of this family, which includes the extinct mastodons and mammoths.
- ⦿ The trunk is a fusion of the upper lip and nose; the nostrils are located at the tip.
- ⦿ The trunk is large and powerful, weighing up to 140kg in an adult male and it is capable of lifting a load of about 250 kg.
- ⦿ It is like a hand. It is mobile and sensitive, which sometimes makes it seem independent of the rest of the animal.
- ⦿ The trunk is made up of a total of nearly 40,000 muscles.

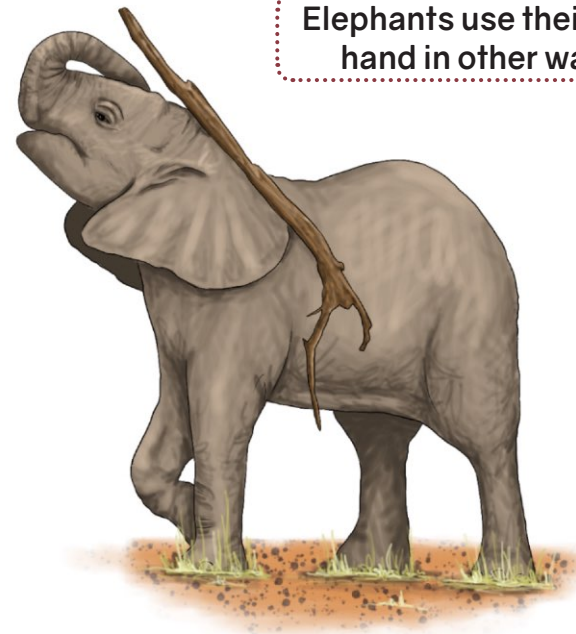


- ⦿ Within the trunk is an extremely complex network of muscle fascicles that provide fine movement.
- ⦿ The trunk is extremely sensitive and can smell up to 12 km away.

- ⦿ The end of the trunk has flaplike projections.
- ⦿ This allows elephants to perform amazingly delicate functions, such as picking up a coin from a flat surface or cracking a peanut open, blowing away the shell, and putting the kernel in the mouth.
- ⦿ An Asian elephant most often curls the tip of its trunk around an item and picks it up in a method called the “grasp”.
- ⦿ African elephants use the “pinch”, picking up objects similar to the way a human would use the thumb and index finger.

TRUNK USE

Elephants use their trunks like a hand in other ways as well.

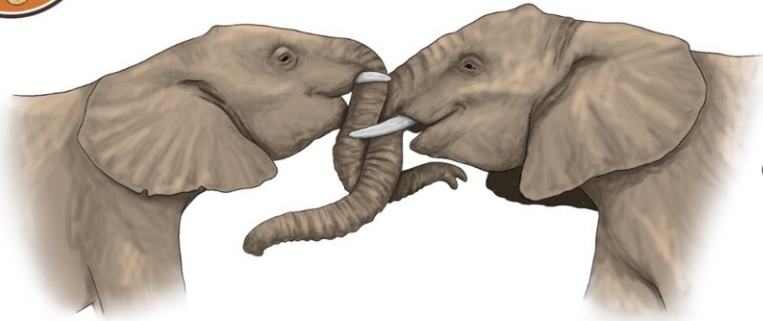


USING AS A TOOL

- ⦿ Elephants use their trunks to hold branches and scratch themselves in places that the trunk and tail cannot reach.
- ⦿ Sometimes they throw large branches and objects as a display of threat.

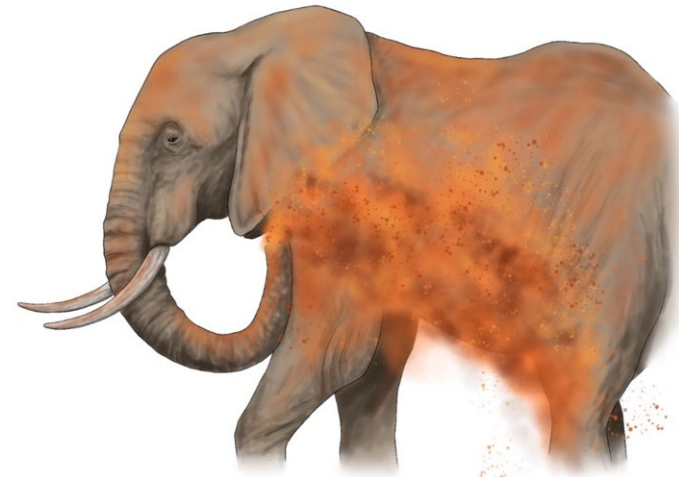


ELEPHANTS GREETINGS



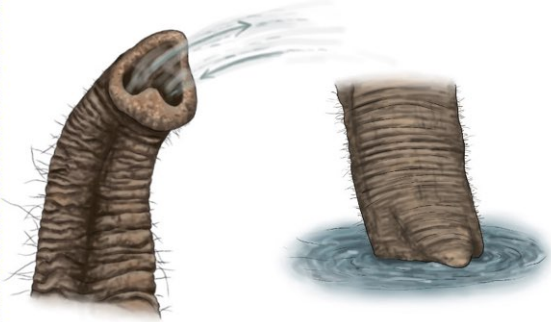
- When elephants meet, one may touch the face of the other, or they will intertwine trunks.
- This “trunk-shake” is like a handshake; communicating assurance, affection, greeting or as a way of assessing strength.

DUST OR GRASS SPRAYING



- Elephants also use their trunks to collect dust or grass for spraying onto themselves for protection against insect bites and the sun.

BREATHING



- Breathing, drinking, and eating are all important functions of the trunk.
- Most breathing is done through the trunk rather than the mouth.

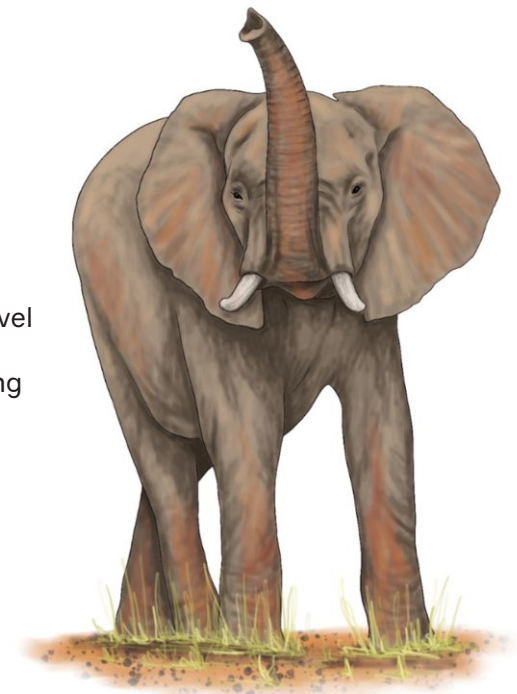
DRINKING AND EATING



- Elephants drink by sucking as much as 10 litres (2.6 gallons) of water into the trunk and then squirting it into the mouth.
- An adult elephant can eat about 200-400 pounds (90-181kgs) of food in a single day.
- They eat by detaching grasses, leaves, and fruits with the end of their trunk and using it to place into their mouth.

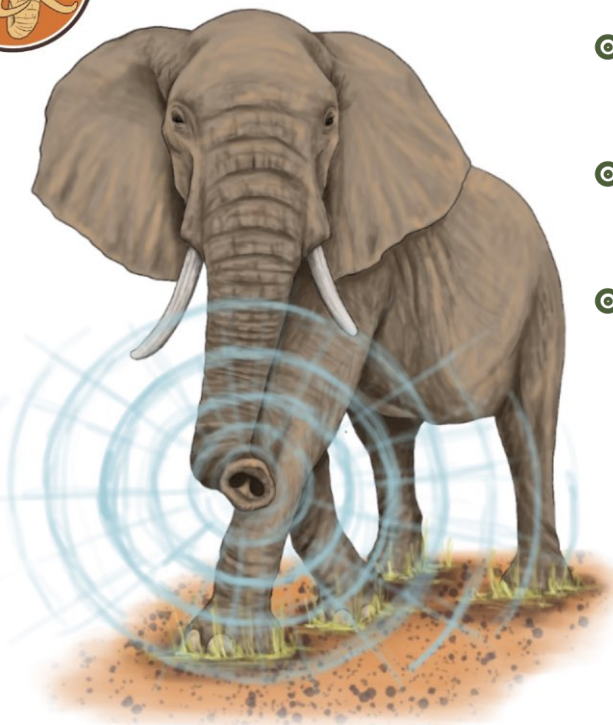
DANGER

- If they suspect danger, elephants raise and swivel the trunk as if it were “a smell periscope” sniffing the air for information.





SOUND PRODUCTION



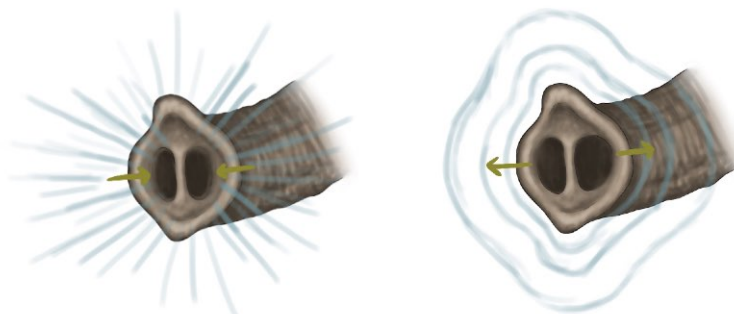
- These sounds are produced from a special structure in an elephant's voice box (larynx).
- It is called the "Pharyngeal pouch".
- Elephants also make other sounds by **beating their trunks** on hard ground, a tree, or even against their own tusks.

Did you know elephants detect vibrations through their feet?



- Sometimes they make calls emitted at frequencies **below the range of human hearing**.
- These **low-frequency (5–24 hertz) calls** can be heard by other elephants up to 4 km (2.5 miles) away.
- Low-frequency sound waves** travel through the ground as well as the air, and experiments have shown that elephants can detect **infrasonic calls** as **seismic waves** in the ground.

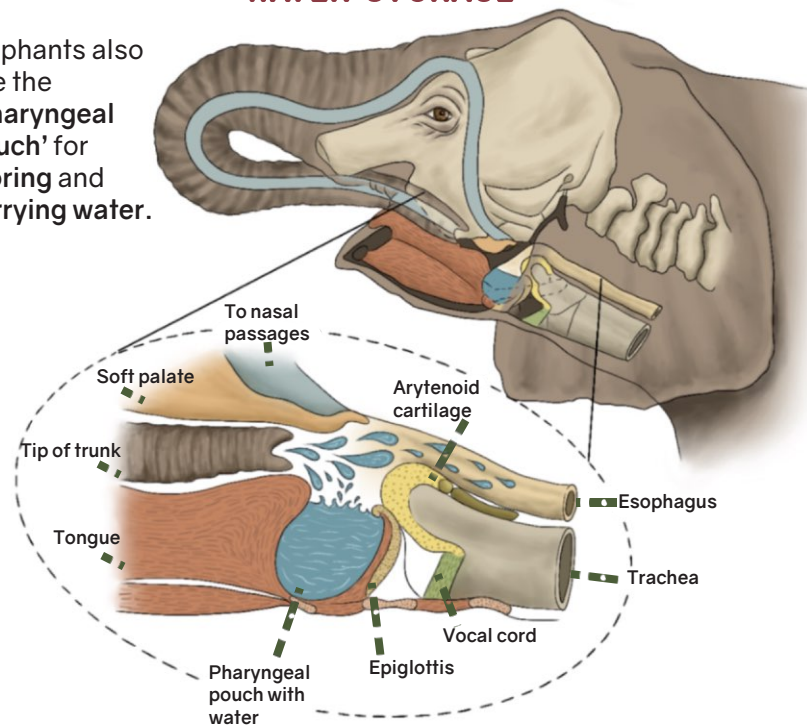
- Low sounds** (such as **growls**) and **high sounds** (such as **trumpets**)



Elephants produce two types of sound vocalization by changing the size of the nostrils as air is passed through the trunk.

WATER STORAGE

- Elephants also use the 'pharyngeal pouch' for **storing and carrying water**.



- On **hot days** and in times when there is no water nearby, elephants will insert their trunks into their mouths, suck out the liquid, and **spray themselves** with it.



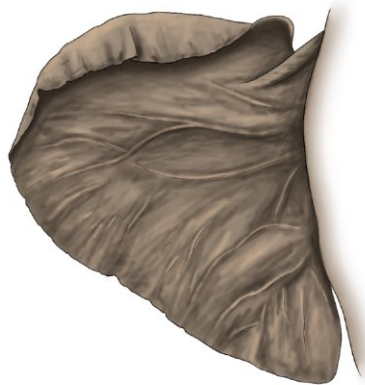
ELEPHANT EARS



African elephants have larger ears than Asian elephants.

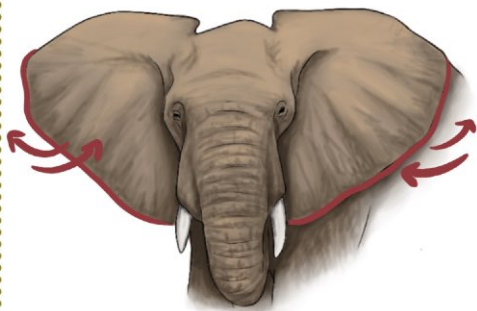
One way of telling them apart is that African elephant ears are also shaped like the continent of Africa.

1. ELEPHANTS USE THEIR EARS TO STAY COOL



- Elephants' ears have a **large surface area** and are made up of **thousands of blood vessels** that are thin and close to the skin.
- Elephants **do not** have very **many sweat glands** (this is what helps humans and other animals from overheating)

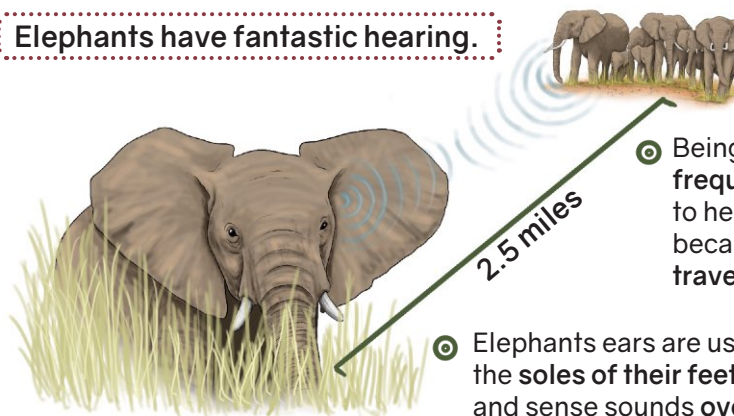
Large ears are an adaptation to help stay cool



- They allow the **excess body heat** to escape the elephant's body to **regulate their body temperature**.
- The **large surface area** and **thinness** of elephant ears help them to **radiate heat** and **thermoregulate**.
- Another reason why elephants have **big ears** is to use their ears as fans to **cool off their bodies**.

2. ELEPHANTS' EARS HELP THEM HEAR LONG DISTANCES

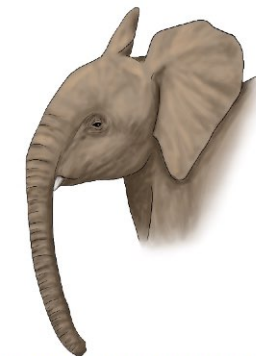
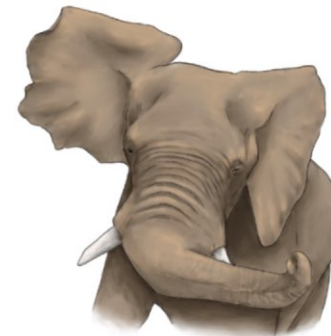
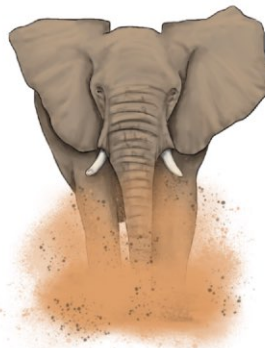
Elephants have fantastic hearing.



- Being able to hear **low frequencies** allows them to hear sounds far away because the **lower sounds travel further**.
- Elephants ears are used in conjunction with the **soles of their feet** and their trunk to hear and sense sounds **over long distances**.
- They can **communicate with each other** over distances as far as **2.5 miles** from their **current location**.

3. ELEPHANTS USE THEIR EARS TO COMMUNICATE

- Aside from hearing and cooling off, elephants also use their ears **to communicate**.
- Researchers have discovered that elephants also **use body language**.
- When they are trying to **intimidate** other elephants, humans, or other animals, they spread their ears wide open. By doing this, they are trying to **show dominance and intimidation**.
- Elephants also use their ears to **show excitement and playfulness**.

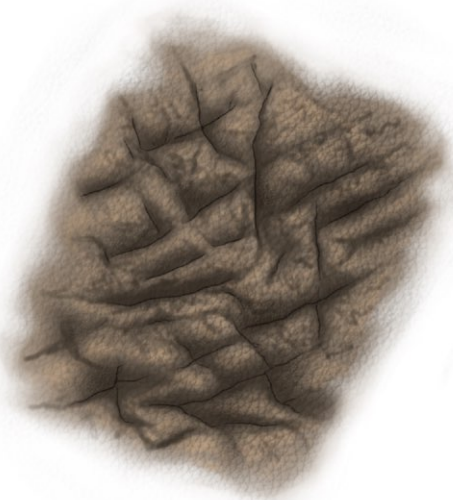
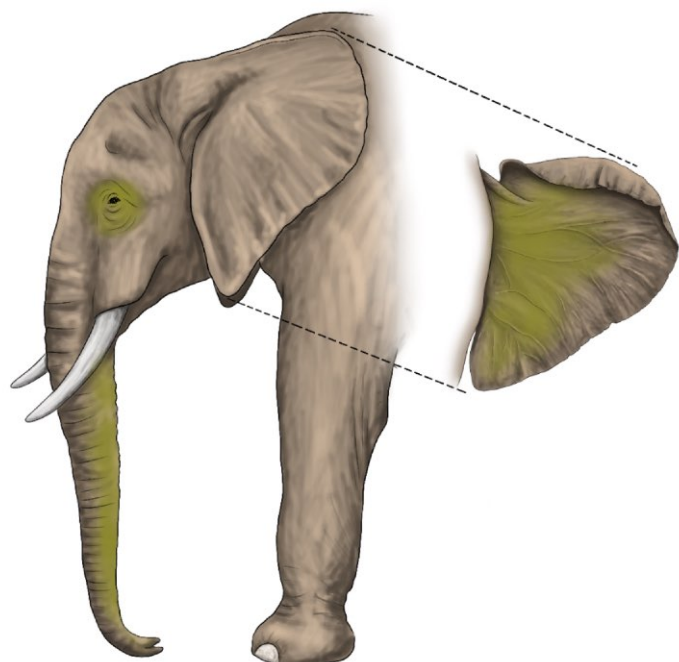




ELEPHANT SKIN

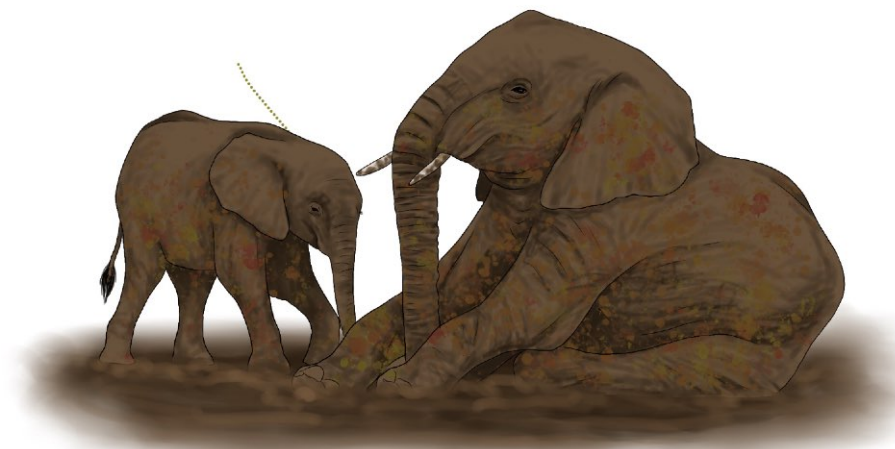
An African elephants' skin is its largest organ and can weigh upto 900 kilograms.

- ⦿ The **thickness** of an elephant's skin **ranges** throughout their body.
- ⦿ They have **thick skin** in certain places such as the **back** and the **sides** where it is about 2 – 3cm thick.
- ⦿ The **thinnest parts** of skin are **behind their ears**, **around their eyes** and **inside their trunk**. On these parts, their skin is as **thin as paper**.



- ⦿ Elephant skin is **very wrinkly**.
- ⦿ Studies of elephant skin have shown that they have an **intricate network** of **tiny crevices** on their skin.
- ⦿ During bath-time, these crevices and wrinkles fill with **water and mud**.
- ⦿ **This helps protect** them against the **heat of the sun**, and allows them to **remain cool**.

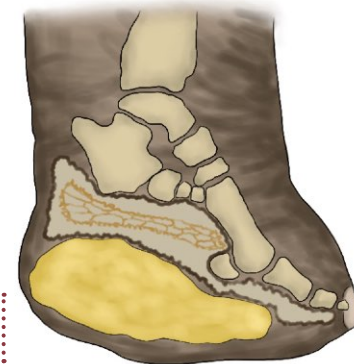
- ⦿ Elephants like to **mud wallow**. This helps provide protection for the skin against **parasites** and the sun's **UV (ultraviolet) rays**.



- ⦿ Even though this large mammal has thick skin, the anatomy of their skin makes it **sensitive to touch**.
- ⦿ An elephants' skin is so **sensitive** and **rich in nerves** that it can detect even the **smallest insects** landing on their skin, and even **changes in the climate**.

ELEPHANT FEET

- ⦿ An **elephant's foot** is designed in such a way that elephants actually walk on the **tips of their toes**.
- ⦿ The **sole** of an elephant's foot is made of a **tough, fatty connective tissue** which acts like a **spongy shock absorber** and allows the elephant to **move about silently**.
- ⦿ This **'elastic spongy cushion'** causes most noises (including the cracking of sticks and twigs) to be **muffled**.



This is why elephants can be extremely quiet



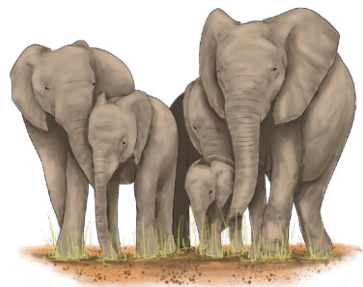
Because of the way they walk, elephants are also known as 'digitigrades' and belong to a group of animals that includes horses, cattle, sheep, camels and rhinos.



BACK FOOT



FORE FOOT



An elephant's front foot is more circular, whereas the back foot takes a more oval shape.

- Elephants are capable of having an extraordinary sense of touch because of cells called "pacinian corpuscles"
- These are extremely sensitive to vibration.
- Elephants also have these cells in the soles of their feet, concentrated in the front and back (toes and heel area).
- Having "pacinian corpuscles" on their feet allows them to feel the low rumbles of other elephants and even the earth moving.

ASIAN ELEPHANT



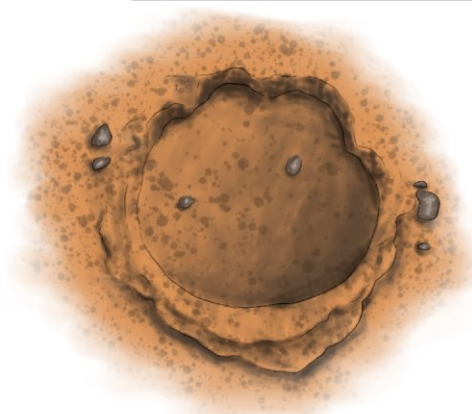
Most Asian elephants have 5 toenails on their front feet and 4 toenails on their back feet.

AFRICAN ELEPHANT



Most African elephants have 4 toenails on their front feet and 3 toenails on their back feet.

This may vary amongst elephants



- The footprint can also tell you important information about the elephant.
- Elephant footprints can help tell the age the elephant might be, or even the height of the elephant.

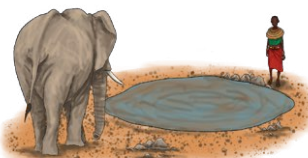
- Elephants' feet have many uses.
- They create holes which collect water.
- They help with digging up roots from the ground.
- They help with moving on difficult lands.



CAUTION TIPS:



- Elephants are wild animals and can be very dangerous. Always take care and prioritise your safety when encountering elephants.
- Learn more about elephants to understand how to identify them, and how to recognise elephant behaviour.



CREDITS AND DISCLAIMER:

We have collated information from multiple resources. Main sources include: www.elephantvoices.org, www.savetheelephants.org, www.encyclopedia.com. This manual is not extensive. The learn more and explore the literature further, see [References](#). Save the Elephants advises caution with all the methods and information collected and presented in this toolbox.

* Save the Elephants is not liable for any costs, damages or injuries incurred by the use of this information.





ELEPHANT AWARE BEHAVIOUR



It is important to respect and understand elephants. Being familiar with elephant behaviour can help avoid possibly **dangerous interactions**.

The loss of elephant habitat due to the expansion of human settlement and agriculture is forcing more interactions between humans and elephants.

4 ZONES OF PERSONAL SPACE OBSERVING ELEPHANT BEHAVIOUR

Credit: 'Understanding Elephants' by [The Elephant Specialist Advisory Group](#), 2017, and Elephant Safety Manuals from [Elephant Human Relations Aid](#)

- THE CRITICAL ZONE
- THE WARNING ZONE
- THE ALERT ZONE
- THE COMFORT ZONE



There are **four zones** of elephant personal safety.

Be mindful of what you should do when you find yourself in any of these zones.

Within all these zones, you should **remain quiet and stay calm**.



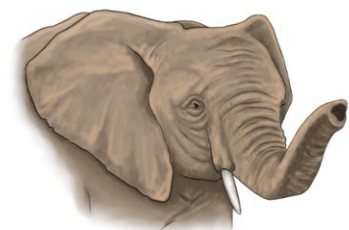
1. THE COMFORT ZONE - ELEPHANTS MAY BE RELAXED

- ⦿ In this zone, the elephants **remain relaxed** and may go on with their activities.
- ⦿ It is almost as if you are not present.
- ⦿ Here, the elephants **do not feel threatened**.

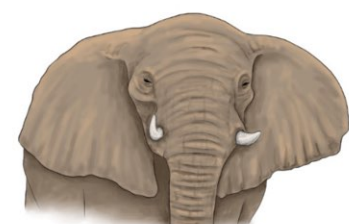


2. THE ALERT ZONE - ELEPHANTS MAY BE CAUTIOUS

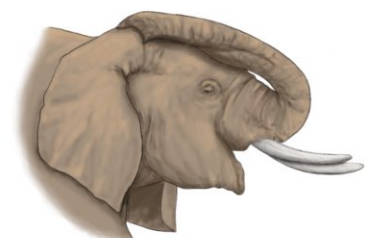
- ⦿ The elephants are aware of your presence.
- ⦿ They may pause and interrogate their surroundings.
- ⦿ They may raise their trunks to smell or stop their feeding.
- ⦿ It is important that you **stay still**.



Smelling or looking at you.



Listening.

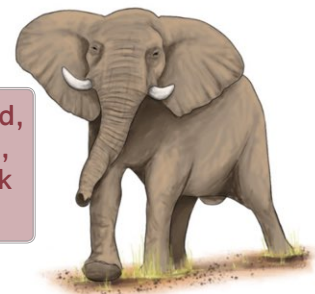


Touching the face or ear.

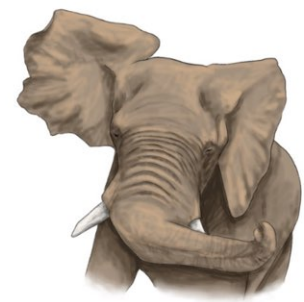


3. THE WARNING ZONE - ELEPHANTS MAY DISPLAY WARNING SIGNS

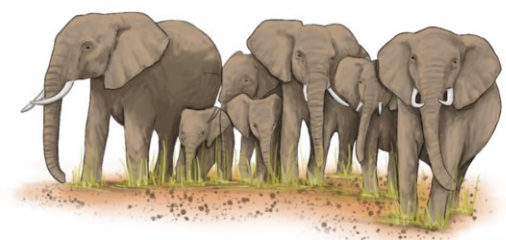
- ⦿ Here, elephants may be **annoyed with your presence**.
- ⦿ Look out for **signs of intimidation** from the elephant such as a headshake, standing tall with the head held high, or a mock charge.
- ⦿ You should slowly **move away from the elephant's personal space**.



Kicking forward, pointed tusks, swinging trunk forward.



Shaking head.



Protective circle.



4. THE CRITICAL ZONE

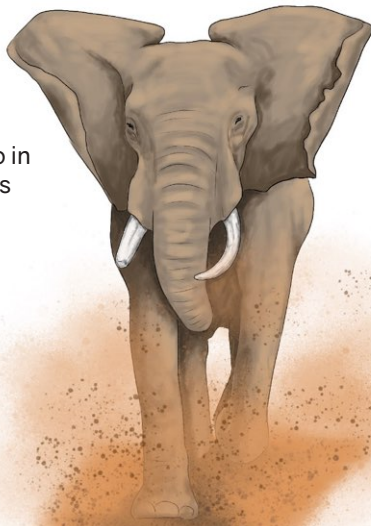
ELEPHANTS MAY ATTACK OR RUN AWAY



This zone triggers the elephant's fight or flight response.

FIGHT

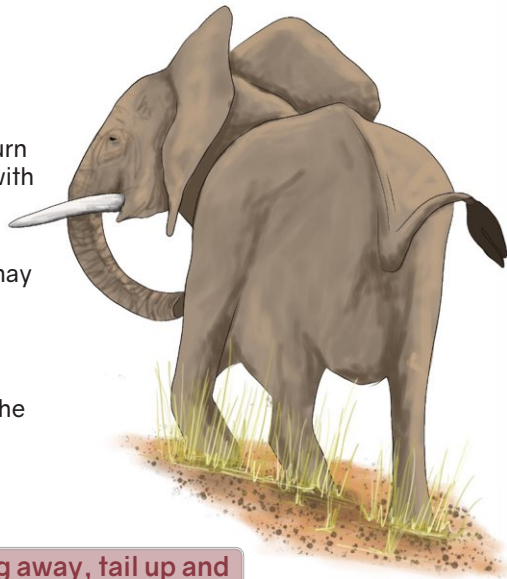
- The elephant may go in a **full charge** towards you.
- Usually the head is kept down, and the trunk is tucked, exposing its tusks ready for attack.



Running forward in charge, usually silent and no trumpeting.

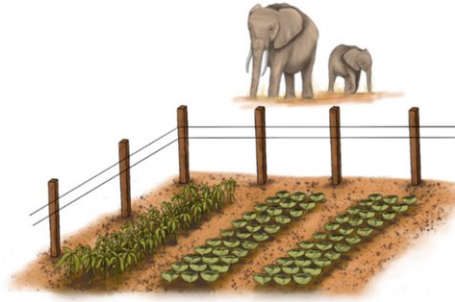
FLIGHT

- Usually the elephant will turn and run away with **tail raised up**.
- The elephant may **trumpet** while running away.
- Do not follow the elephant.

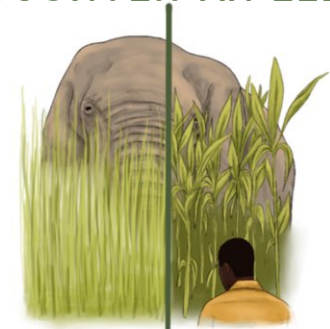


Running away, tail up and head up.

INSTANCES WHERE YOU MIGHT ENCOUNTER AN ELEPHANT



Elephants **approaching your farm**, outside of the farm boundary.



Elephants **hidden in the bush**.



At a **water point** you are taking your livestock to drink.



Elephants **breaking into your house** to steal your maize, or to drink from a water tank.

STAY SAFE AROUND ELEPHANTS

1.



Listen for **trumpeting** and **branch breaking**.

2.



Look and smell for **fresh dung** around you.

3.



Look for **broken branches** on the ground.

Look for **tracks** of more elephants.

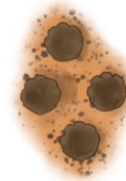
4.



Stay quiet. Turn around and slowly walk back.

Check for the **wind direction**. (You can throw dirt in the air to do this)

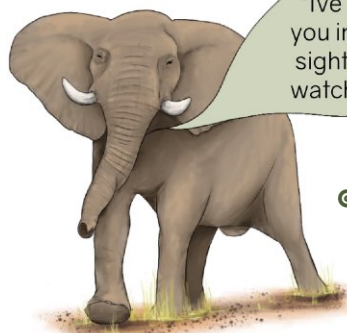
Try to go **downwind**.





WARNING SIGNALS TO LOOK OUT FOR

1 STANDING TALL

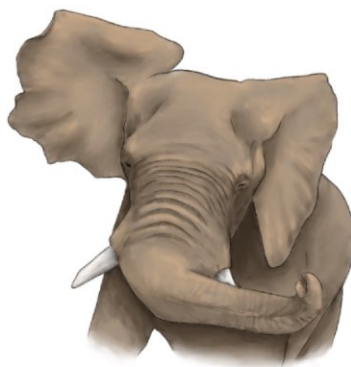


"I've got you in my sight, so watch it!"

⦿ **Standing tall**, ears spread out and pointing tusks to its opponent.

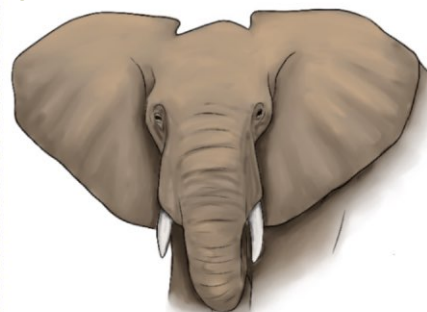
- ⦿ The elephant may appear to **increase in height** and might stand on an object such as a log or anthill to increase its height.
- ⦿ A **direct gaze** with the chin raised, looking down over the tusks. This is normally a **warning** toward threats, such as predators and people.

2 HEAD SHAKING



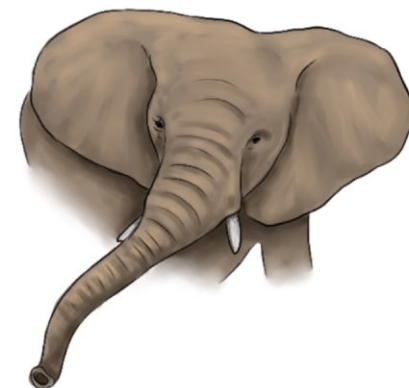
- ⦿ If the elephant **shakes its head** quickly and flaps the ears sharply, it is **annoyed**.
- ⦿ The shake usually starts with the head twisted to one side and is then rapidly rotated from side to side.
- ⦿ The ears slap against the side of the face or neck making a **loud smacking sound**.
- ⦿ **Head jerking** and **head-tossing** are also mild displays of threat.

3 EAR SLAPPING



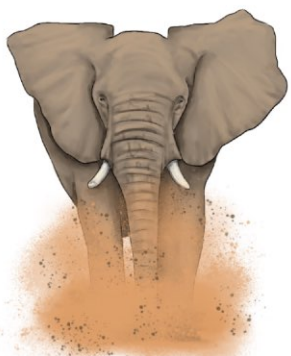
- ⦿ **Ear slapping** against the side of the body.
- ⦿ The elephant may face an opponent head-on with **ears fully spread** (at 90 degrees from the body), sometimes for the purpose of seeming more intimidating.
- ⦿ Elephants also sometimes spread their ears when they are **excited, surprised or alarmed**.

4 SWINGING TRUNK



- ⦿ **Exaggerated swinging** of the trunk towards its opponent.
- ⦿ The elephant may **swing and throw its trunk** in the direction of its opponent, typically while trumpeting.

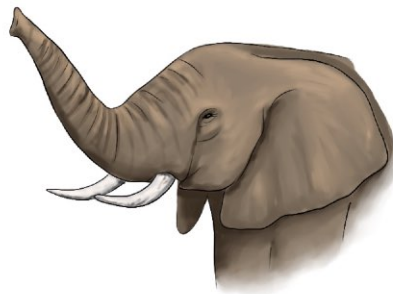
5 MOCK CHARGE



- ⦿ Rushing forward in a **mock charge**.
- ⦿ The elephant rushes toward an adversary or predator while **spreading its ears**.
- ⦿ The elephant may stop short of the target, **swinging its trunk forward** and **kicking up dust**.

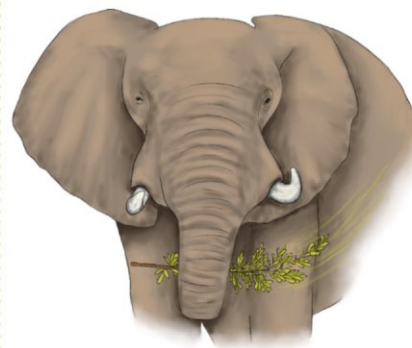
- ⦿ A mock charge is often associated with **shrill trumpeting**.
- ⦿ **Do not show your back** to an elephant mock charging.

6 TRUNK UP



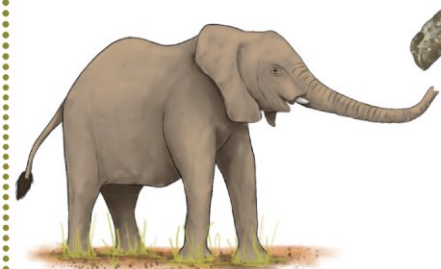
- ⦿ **Trunk up**, sniffing the air to pick scents.

7 DISPLACEMENT FEEDING



- ⦿ The elephant may **pluck vegetation** and slap it against its body instead of feeding.

8 THROWING OBJECTS



- ⦿ The elephant **lifts or uproots objects** and throws it in the direction of an opponent.
- ⦿ An elephant's aim can be very **accurate**, even at a distance.



9

TRUMPETING



- ⦿ The elephant may trumpet or blow air to create a popping sound.

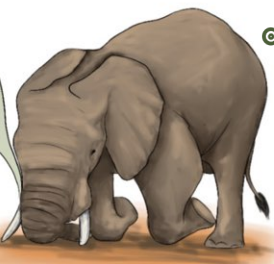
OTHER SIGNALS TO WATCH OUT FOR

- ⦿ Backward and forward swinging of one forefoot.
- ⦿ Touching its own face.
- ⦿ Holding the trunk in its mouth.
- ⦿ Causing commotion or making noise to show strength.
- ⦿ Tossing its head and tusks back and forth through bushes or other vegetation.

10

TUSKING THE GROUND

"look what I will do to you"



- ⦿ This is mostly done by musth males.

- ⦿ The elephant may bend or kneel down, tusing the ground and uplifting vegetation as a demonstration of "look what I will do to you".

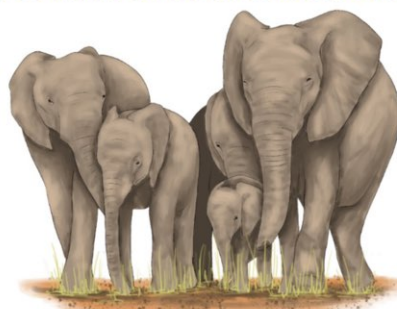
11

A REAL CHARGE



- ⦿ The elephant rushes toward its opponent with its ears spread and head raised or lowered.
- ⦿ Its trunk may be tightly curved under so the tusks can make contact first.
- ⦿ A real charge is usually silent and extremely dangerous.
- ⦿ Try to get away as quickly as possible, run in a zig-zag pattern, or find something large to keep between you and the elephant (e.g water source, anthill, boulder, etc).

WHEN TO BE EXTRA CAREFUL



FEMALES WITH YOUNG

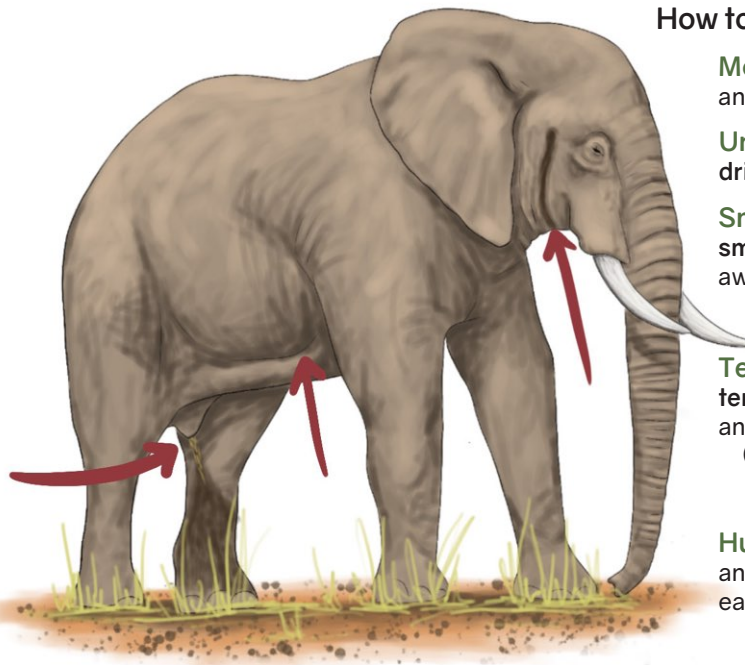


- ⦿ Females with young are very protective, especially if their calves are young.
- ⦿ Take care around family groups and do not get in the way of mothers with calves.
- ⦿ When threatened by a predator, adult elephants may form a protective ring around the young elephants.

BULLS IN MUSTH

- ⦿ This is a period when male elephants have a rise in reproductive hormones. This is characterized by highly aggressive behaviour.
- ⦿ When bull elephants are in musth, they are often looking for females to mate with.

How to recognize bulls in musth?



Moody – the bull will be moody and can get angry easily.

Urine dribbling – the bull will dribble urine while walking away.

Smelly – the bull will be very smelly, you can smell him from far away.

Temporal gland secretion - the temporal glands will be secreting an oil fluid and can be swollen (It looks like the elephant is crying from his temple)

Hungry – the bull can look hungry and skinny, because he doesn't eat much whilst in musth.

- ⦿ An elephant bull can be in musth once a year for 2-3 months at a time.
- ⦿ When male elephants are in musth, they can be more aggressive.
- ⦿ Do not approach or disturb him – stay calm and quiet.



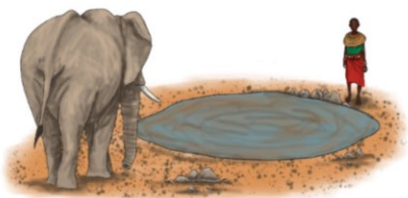
NIGHT TIME



- Accidental meetings with elephants can happen at night time when it is harder to see.
- When elephants are within community land - avoid walking around at night, avoid alcohol and be extra vigilant.
- Use torchlight and phones to communicate elephant whereabouts with your neighbours and community.



DURING THE DRY SEASON



- During the dry season, you are more likely to meet elephants at shared water points.
- Maintain a safe distance and be aware of elephant behaviour.
- Be spatially aware and have an escape route.
- If you must approach at the same time, put the water between you and the elephant.

CROPS



- When crops are maturing, take care as elephants have an extremely powerful sense of smell.



- They are more likely to raid farm when crops are ripe.

IF IN A CAR

- When approaching elephants in a vehicle. Respect the elephant's personal space.
- Do not get out of the car. Do not overtake, follow closely or push elephants when in the car.
- Give elephants the right of way. Be aware of musth bulls and give them extra space.
- Do not drive between breeding herds or speed past elephants.
- When driving, slow down when approaching elephants.
- Stay calm. Stay alert and be aware of elephant body language.
- Take care when walking or driving at night in areas where elephants pass through.

ACTIONS TO TAKE

PROTECT AND DEFEND



- Protect your farm, home or boma using farm based deterrent methods (e.g fencing, watchtowers, repellent)
- Defend your farm - Use loud noises, flashing lights and night guarding. When using farm boundary fires for night guarding - be very careful and make sure these are controlled.
- Storage - Store your food and water as safely as possible.

See Food Storage & Protection for more information



OBSERVE ELEPHANT BEHAVIOUR



- If possible, stay downwind of elephants so they do not pick your scent.
- Give elephants the right of way. Pay attention to the elephant's personal space.
- Throw a backpack, extra shirt, etc. as a decoy when escaping to distract the elephant.
- Observe the elephant's behaviour and reaction towards you, before approaching.
- If an elephant shows threatening behaviour or uneasiness, slowly back away and give space.



STAY CALM



- Elephants can read your body language too. Don't panic or be scared. Be quiet and maintain calmness.
- Don't make sudden movements or run away.
- Always try and have an escape route if possible. Try climb a tree if you can.

DON'T AGGRAVATE ELEPHANTS



- Don't annoy elephants when they are nearby. (particularly in warning and critical zones)
- Don't throw rocks at elephants - this may irritate them more.
- Don't throw fire at elephants.

CAUTION TIPS:



- Human elephant conflict is the second largest threat to elephants. Elephants are wild animals and they can be very dangerous and unpredictable. Despite heeding the warning signals, sometimes elephants may behave unusually.
- Always take care and prioritise your safety and keep a safe distance when encountering elephants.



CREDITS AND DISCLAIMER:

'Understanding Elephants' by the [The Elephant Specialist Advisory Group](#), 2017, and Elephant Safety Manuals from [Elephant Human Relations Aid](#) (EHRA, Namibia). This document is not extensive. To learn more on elephant behavior and safety around elephants, see [References](#) for more resources. Save the Elephants advises caution with all the methods and information collected and presented in this toolbox. Further research may be required before any site-specific implementation.

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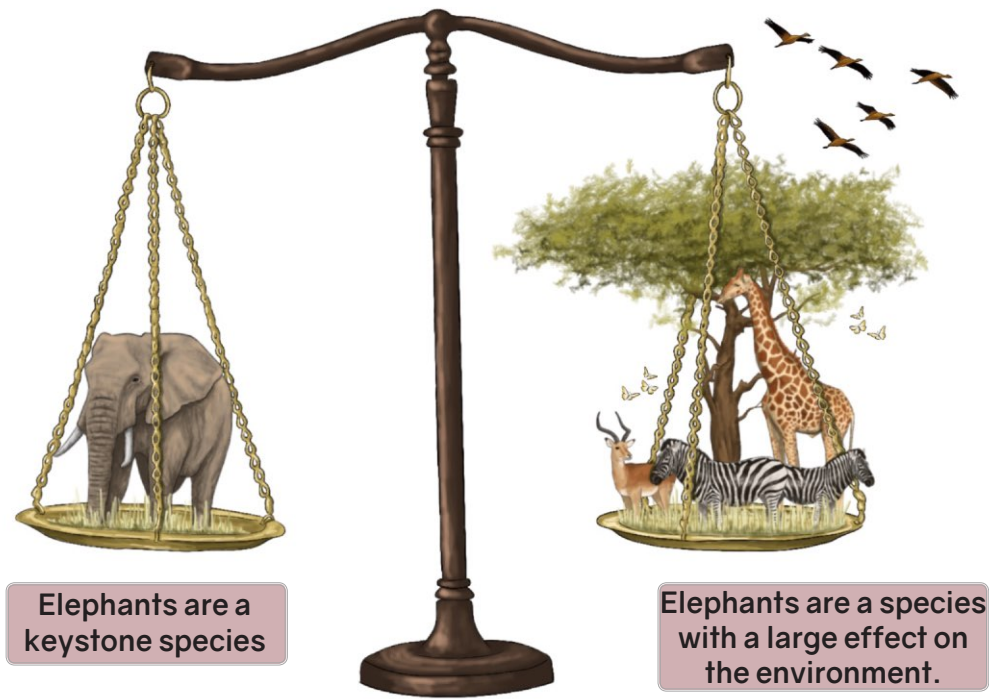


ELEPHANTS AS ECOSYSTEM ENGINEERS



Ecosystem engineers are animals that **create, modify or destroy a habitat**. They are important for maintaining the health and stability of the environment which they are living in.

KEYSTONE SPECIES
A keystone species is an organism that helps hold the system together and is vital for its ecosystem.



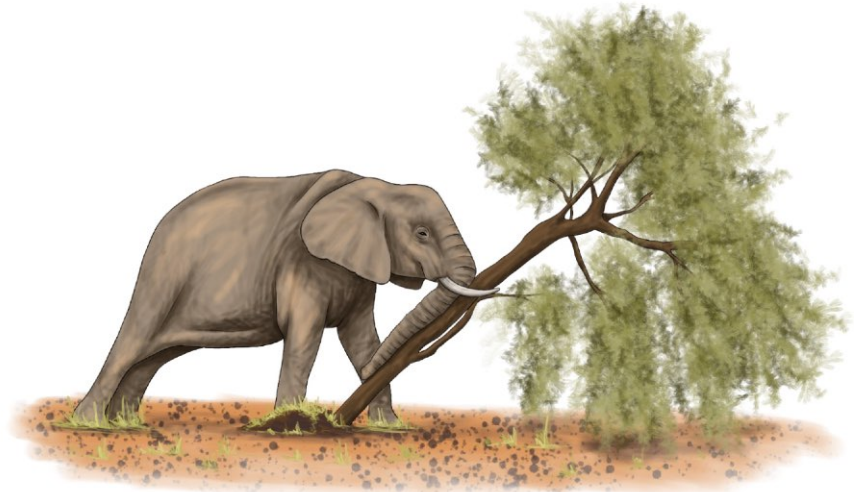
Elephants are a keystone species

Elephants are a species with a large effect on the environment.

- Many other species depend on keystone species.
- Removing a keystone species from a major ecosystem will result in a **severe imbalance** in the entire system.
- Studies show that elephants are the **gardeners, contractors, roads and the overall balancers** in the ecosystem!

ECOSYSTEM ENGINEERS

1. PUSHING TREES AND VEGETATION



- Elephants pushing over trees can help to maintain savannah ecosystems. This also helps to **create new paths** to allow smaller animals to move more freely.
- This also allows **more light to the floor**, creating opportunities for other plants to flourish.
- Pruning trees also helps improve growth and offer food.

2. EXCAVATE WATERHOLES

Elephants allow other animals to survive dry habitats.

- Elephants have an amazing ability to detect water.

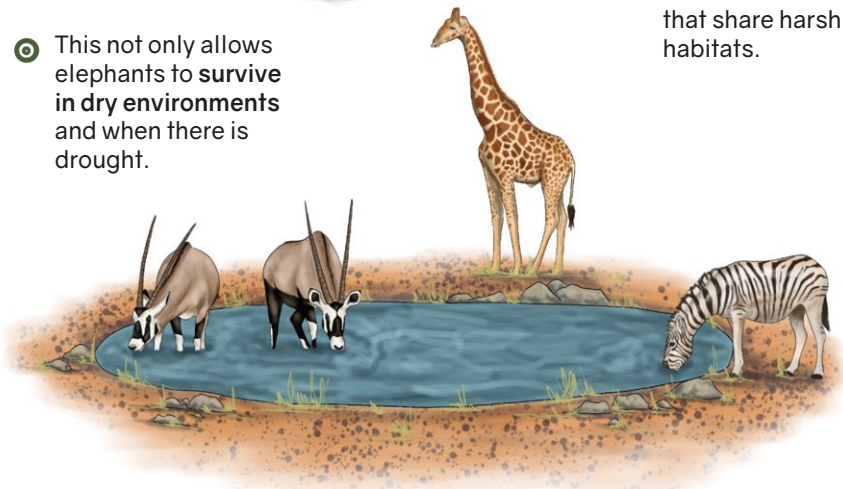
- During the dry season and times of intense drought, elephants use their trunks to sniff out areas where water may be found underground.



- They use both their tusks and trunks to dig for water.

- They also provide water for other animals that share harsh habitats.

- This not only allows elephants to survive in dry environments and when there is drought.



3. PROVIDE SHELTER

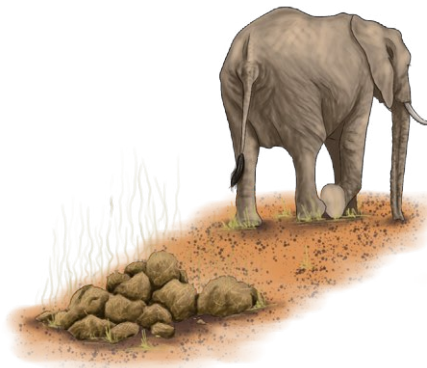
Footprints fill with water and create shelter for small creatures, like amphibians and insects.

- During the dry season, elephant tracks fill up with water. This creates an ideal environment for frogs to lay their eggs and for tadpoles to grow in.
- The footprints of elephants provide predator-free breeding grounds for frogs and act as connecting sinks for frog populations to connect.



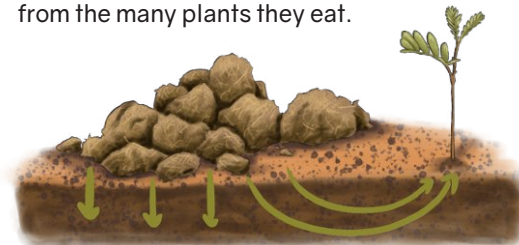
4. HELP SEED DISTRIBUTION

Elephants roam and disperse seeds over long distances, helping create resilient and healthy forests. This in turn helps reduce the effects of climate change.



- Elephants' digestive systems are not very good at processing many of the seeds that they eat.
- Wherever they live, elephants leave nutrient rich dung that is full of seeds from the many plants they eat.

- When this dung is deposited the seeds are sown and grow into new grasses, bushes and trees, boosting the health of the savannah ecosystem.
- Many tree seeds need to pass through the gut of an elephant in order to germinate. Without elephants they might not survive.
- This also helps to fertilize land, providing nutrients and promoting germination and growth.

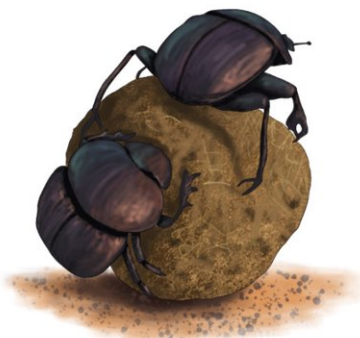


- As elephants move from one area to another, they help plants colonize and grow in newer regions, creating plant diversity and additional habitats for animals.

5. ELEPHANT DUNG

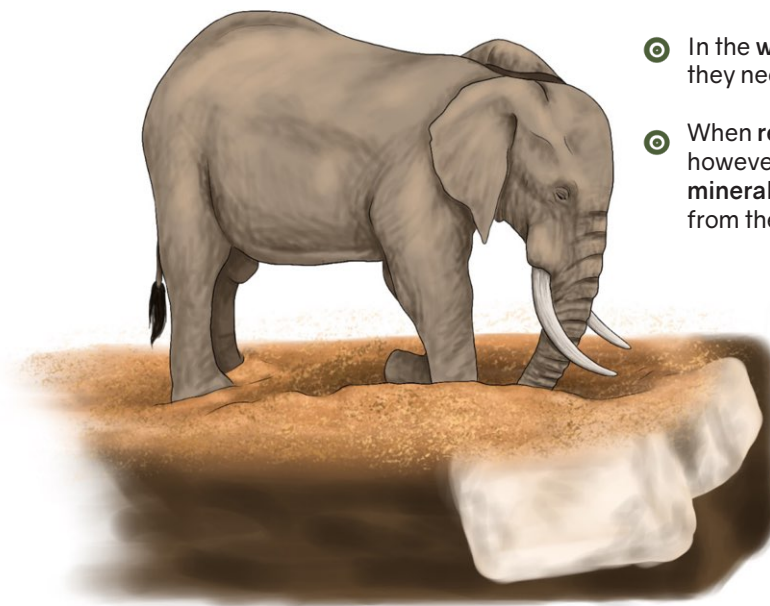
Elephants poop over 15 times per day, their dung creates ample food for those species who rely on it.

- Elephant dung provides food for many animals (mostly insects) Their dung is home to thousands of small invertebrates.
- These insects are a useful food source for birds, reptiles and small mammals.
- Butterflies have even been recorded visiting fresh dung to keep warm. The dung may also contain essential minerals for butterfly reproduction, ingested by males.
- Many important ecosystems would partially collapse if elephants were not around.



6. FINDING NATURAL SALT LICKS

Minerals are essential for the growth and development of most creatures, including elephants.



- In the wild, elephants obtain the minerals they need from plants.
- When resources are scarce, however, they can obtain other minerals, especially sodium, directly from the soil.
- Elephants have a good sense of smell and use their trunks to detect areas in the ground that have large quantities of minerals.

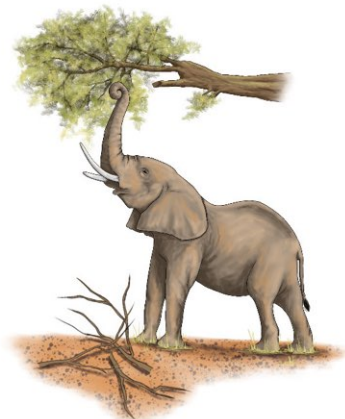
- They will then use their tusks to dig into the soil and then bend down to eat it.
- These salt lick sites are not only used by elephants, but also other herbivores that may need to increase their mineral intake.
- Providing salt licks can help encourage elephants to stay inside parks and out of community areas.



Read more on: [Food selection by elephants in the 'miombo' biome, in relation to leaf chemistry](#)

7. VEGETATION PATHWAYS

When forest elephants eat, they create gaps in the vegetation.



- These gaps allow new plants to grow and create pathways for other smaller animals to use.
- They are the perfect forest gardeners.
- When elephants forage for food, tree branches, leaves, fruits and twigs will fall to the ground.
- This helps in the pruning of trees, which is good for their growth.

CAUTION TIPS:

- Just as completely removing a keystone species from an area will destroy it, so too will having too many of that one species.
- If there are too many elephants in a fenced reserve or fragmented national park where they are not able to migrate to different parts in their continual search for preferred food – over time their impact on their contained environment may become destructive, and the ecosystem will be severely impacted.
- This can result in a loss of trees, displacement of other species, and decline in other wildlife that cannot compete.

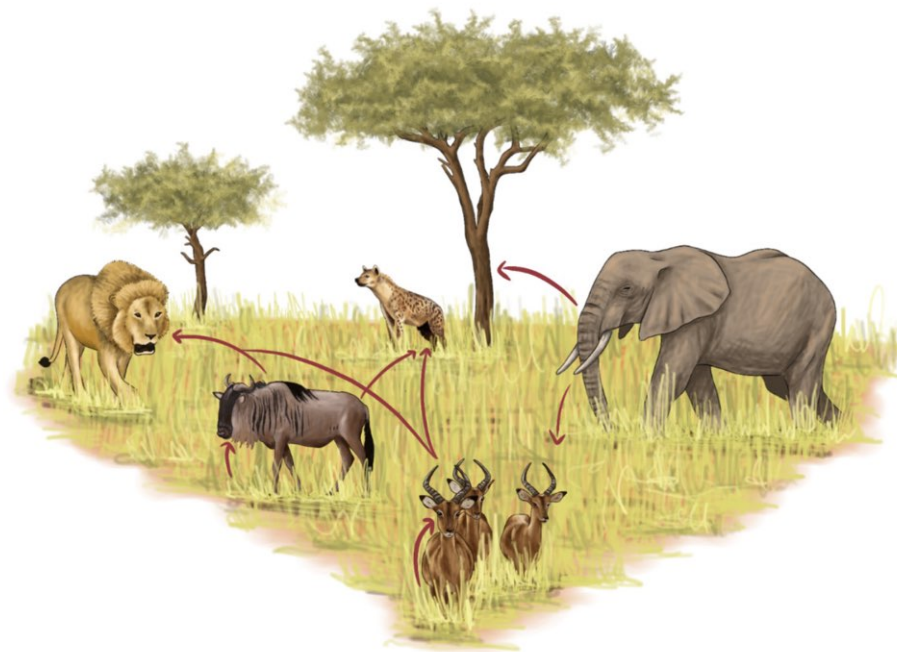


Wildlife movement corridors and habitat connectivity is important for both elephants and humans.

8. GRASSLANDS

On the savannahs, elephants feeding on tree saplings and shrubs help to keep the plains open and able to support the plains game that inhabit these grassy ecosystems.

- This feeds a range of herbivores like impala and wildebeest, which in turn feed important predators and scavengers like lions, hyenas and jackals.



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IMPORTANCE OF CONNECTIVITY TO REDUCE CONFLICT



Wildlife corridors are areas of habitat across which animals, including elephants, use to travel between two connected, yet often fragmented, habitat areas.

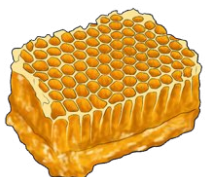


Securing healthy corridors is a **long-term strategy to prevent human-elephant conflict**, facilitate movement of elephants and their genes, and allow them to socialize and breed.

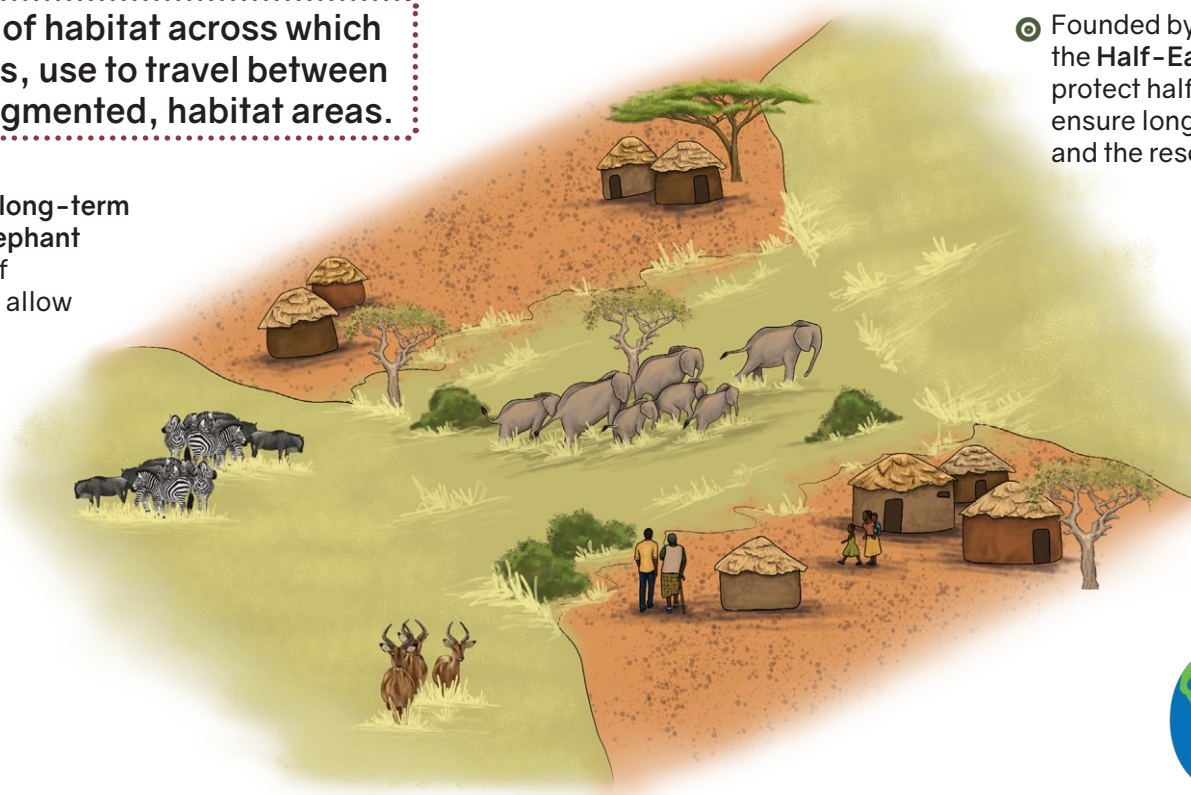
Corridors enable elephants to move to **new territory and food/water resources** in times of drought which enables the grass and forage to recover for other species.

A corridor is not necessarily a habitat for elephants to reside in. It ideally **facilitates movement** across and between two protected areas.

Keeping corridors free of development can have other benefits for communities such as resources for **fire wood and indigenous/ medicinal plants, honey or fruits/berries** for consumption.



Wildlife Corridor Gives Endangered Elephants In India Passage Between Reserves.



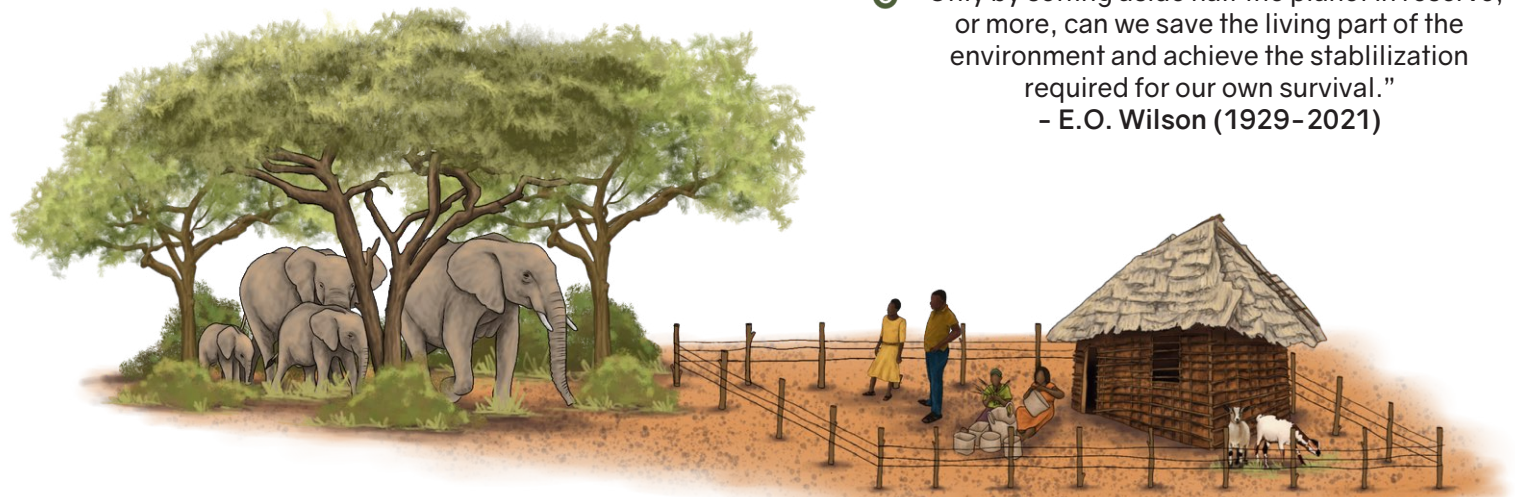
Founded by Philosopher E.O. Wilson, the **Half-Earth Project** focuses to protect half the land and half the sea to ensure long-term health of our planet and the resources that we depend on.

It also focuses on **conserving land critical to biodiversity** and resorting natural **wildlife corridors** in the efforts to protecting endangered species.

Read more on [Half-Earth Project](https://www.youtube.com/EOWilsonBiodiversity)
<https://www.youtube.com/EOWilsonBiodiversity>



“Only by setting aside half the planet in reserve, or more, can we save the living part of the environment and achieve the stabilization required for our own survival.”
- E.O. Wilson (1929-2021)



THREATS TO CORRIDORS

⦿ The presence of **human settlements, farmlands and infrastructure** can cause **blockages** between wildlife habitats.

⦿ Elephants are sensitive to **disturbances from human activity**, making them hesitate to move through or around **blocked or noisy migratory routes**.

⦿ When human developments close a corridor or pathway, wildlife must find other means to get to the resource, which can **force them to wander into human settlements and farmlands**.

Read more on: [Tracking elephant movements reveals transboundary wildlife corridors](#), [Vital Wildlife Corridor Connects Conservancies](#).



⦿ Establishment of **human settlements** in or on top of **wildlife migration areas** increases **conflict** between people and wild animals.

⦿ Consider **clustering** homes and farms into **smaller areas** to **free up corridors** and to share the cost of farm boundary barriers.

COMMON CAUSES OF CORRIDOR BLOCKAGES



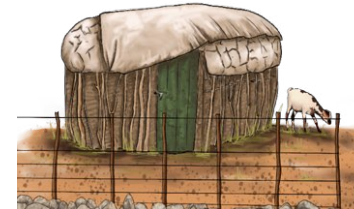
Construction



Development



Agriculture



Human Structures



Deforestation

[Gara, T. W., Wang, T., Dube, T., Ngene, S. M., & Mpakairi, K. S. \(2020\). African elephant select less fragmented landscapes to connect core habitats in human dominated landscapes.](#)

[Green, S. E., Davidson, Z., Kaaria, T., & Doncaster, C. P. \(2018\). Do wildlife corridors link or extend habitat? Insights from elephant use of a Kenyan wildlife corridor.](#)

ELEPHANT MIGRATION AND HABITAT CHOICE

⦿ All 3 species of elephants (African, Forest & Asian) are strongly driven by their daily need to drink and so they migrate in search of sufficient water supplies during dry seasons.

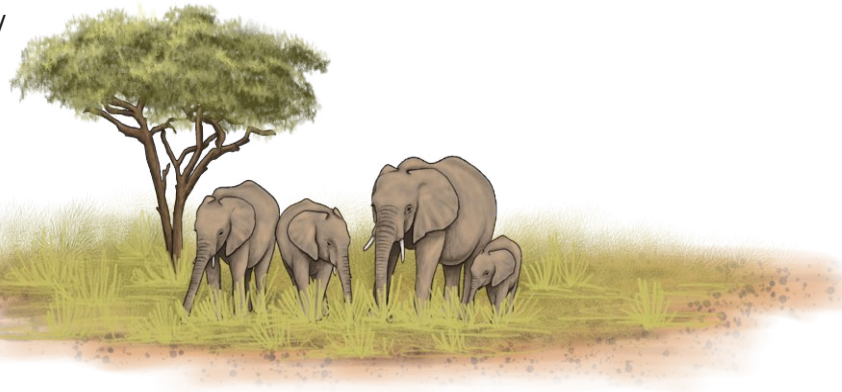
⦿ As the rains return, the herds usually return to their home regions.

⦿ Matriarchs (leader of a herd) use their incredible memory to lead their families to food and water, and then back home.

⦿ Migrating elephant herds are increasingly encountering new threats such as recently built infrastructure, fences and farmland.

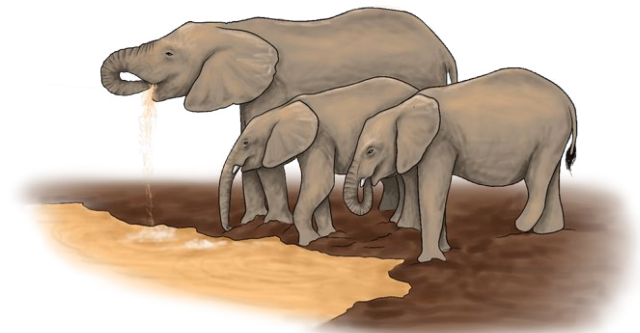
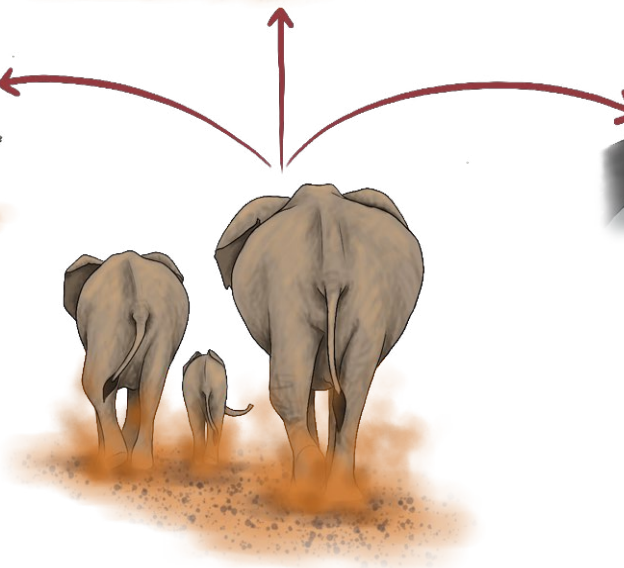
⦿ Communities need to understand that converting natural habitat to farm land / infrastructure is often why conflict with elephants is increasing.

⦿ Ensure that the effects of habitat loss and fragmentation are minimized by promoting habitat connectivity through protected corridors that retain natural vegetation.



Wildlife overpass enabling wildlife to cross 3 highways at the same time © Centre for Large Land Conservation. <https://largelandscapes.org/news/invest-act/>

⦿ Corridors can go under or over highways. The advantage of over passes is that the animals don't even notice a change in habitat and this is less stressful for elephants with young calves.



Watch [Understanding Wildlife Corridors - Nature Conservation Foundation](#)

CASE STUDIES

1. MOUNT KENYA ELEPHANT CORRIDOR - UNDERPASS



- The [Mount Kenya Elephant Corridor](#) (MKEC) has been established to help the elephants safely pass under a highway to use their ancient pathways, previously lost to farming and poaching.
- The MKEC connects **14 kilometres** of a historical elephant migratory route between **Mount Kenya and Samburu**, allowing safe passage for elephants.



<https://mountkenyatrust.org/wildlife/>

- Fences on either side of the corridor ensure communities are better protected and the elephants are **safer and free to migrate with no interference**.
- **Underpasses** under highways traversing conservation areas are a valuable mitigation tool to ensure animals can cross between habitats without getting killed from vehicle collisions or injuring people in the process.

Watch this video on the Mt Kenya Corridor - <https://www.youtube.com/watch?v=aoCs3aw4E5E>

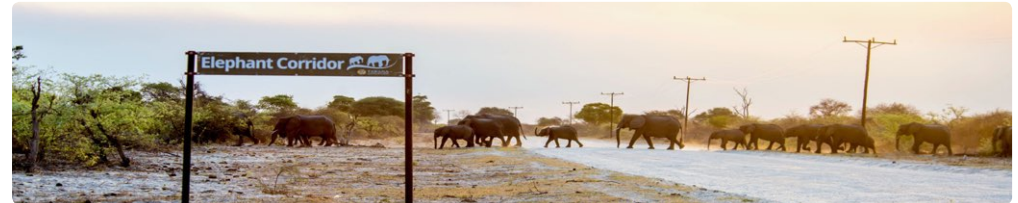


Elephants using the underpass to safely pass from one area to another © Mount Kenya Trust

2. OKAVANGO DELTA, BOTSWANA

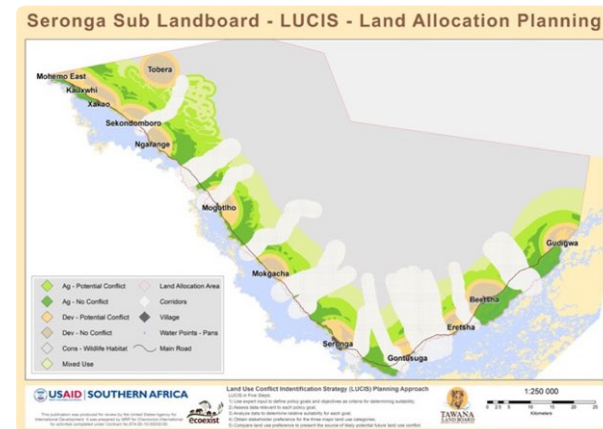


- EcoExist have helped to protect and restore migration routes around the Okavango Delta.



An Ecoexist Elephant Corridor in the Northern Okavango Delta
© EcoExist

- The community positively engaged with the team to clear a series of corridors of both human settlements and farms between the **water and the bush**. Each of **14 corridors** have been marked with signs.
- Farm land inbetween corridors are now **highly protected** with **cluster solar fences** and **beehive fences** to ensure elephants do not wander off their corridor into the farms.
- The communities have learned to **live with elephants** by respecting the behaviour of the elephants and recognizing their **daily behaviour** of needing to walk between the water and the bush to feed.
- The farmers are now **attracting tourists** who are interested in their coexistence approach and this is bringing further **elephant-friendly employment and opportunities**.



https://www.sanparks.org/assets/docs/conservation/scientific_new/savanna/ssnm2017/land-use-planning.pdf

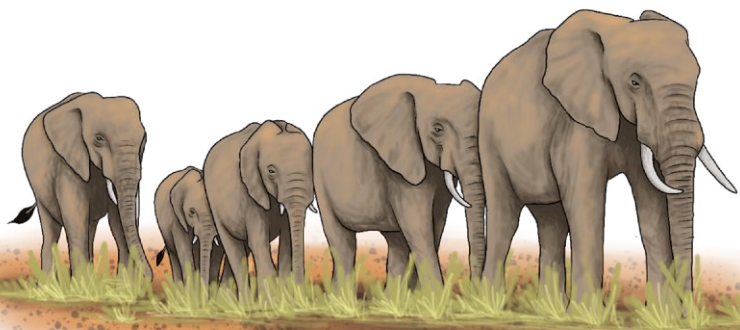
3. KASIGAU WILDLIFE CORRIDOR



Elephants crossing through Kasigau Wildlife Corridor © Fillip/Wildlife Works

<https://www.wildlifeworks.com/kenya>

- Tsavo Conservation Area is the **largest wildlife protected area** in Kenya holding the **largest population of elephants** in the country.
- Connecting Tsavo East and Tsavo West National Parks is the **Kasigau Wildlife Corridor Project** consisting of 500,000 acres of **dryland forest** that supports **local communities** in job creation and **sustainable development activities**.
- This vast wildlife corridor provides **safe passing** for **endangered species** such as elephants, Grevy's zebras, cheetahs, lions and African wild dogs, as well as over 300 species of birds.
- **Carbon credits** help to fund the management of the **corridor** and support the **communities** that live along side the wildlife protected within it.



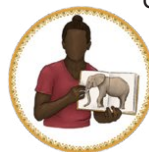
Read more on [Kasigau Wildlife Corridor Project – Kenya](https://www.youtube.com/watch?v=XkyhdaV_KM)
https://www.youtube.com/watch?v=XkyhdaV_KM

4. MAMA TEMBOS, NORTHERN KENYA



Mama Tembos in the field © Jane Wynyard/Save the Elephants.

- The **Mama Tembos** are a group of women from **Samburu and Turkana** tribes working with [Save The Elephants](#) and the Kalama community conservancy to **guard wildlife** and livestock corridors in Northern Kenya.
- Using **GPS devices** the Mama Tembos have collected valuable data on **wildlife movements**. They have alerted authorities to the construction of **illegal bomas and settlements** that could **block** wildlife and livestock movements through the corridors.
- By keeping these corridors open, the elephants can continue to move **between game reserves** without needing to enter the villages or farms.
- The women also engage with their own **communities** and families on the **importance of safe passageways** for wildlife to reduce conflict for their own households.



- More than twenty years' worth of tracking elephants and analysing their movements has helped **STE** identify **key corridors for elephant movement** in Northern Kenya, including four wildlife corridors that cross the main Cape-to-Cairo highway.

Read more on: [How the Mama Tembos are changing hearts and minds in Northern Kenya.](#)



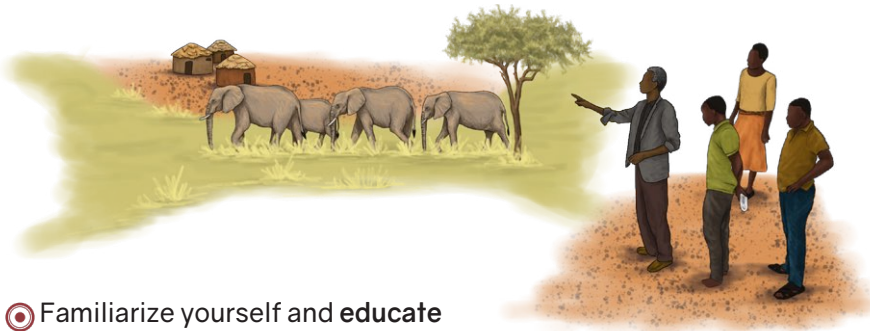
- Look out for any sign boards indicating important Wildlife Corridors.



Sign indicating for vehicles to slow down as animals may be crossing over © Wildlife Works



<http://tsavoconservancy.com/visit-us/maps-directions/>



- Familiarize yourself and educate your family and friends about the importance of corridors and how, by protecting them, your community can live more peacefully with elephants.



CAUTION TIPS

- Ensure you do not build your house or plant a farm inside a wildlife corridor.



- Do not cut down trees or overgraze the wildlife corridor – if elephants have no food inside their corridor they will come looking for food in your farm or house.

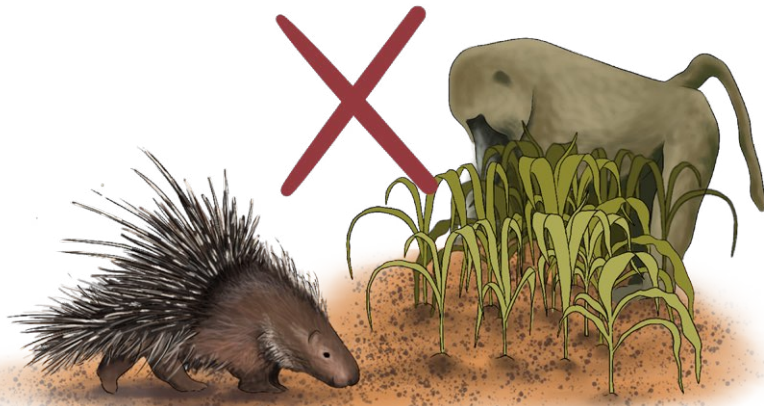


- If you decide to plant a farm next to an elephant corridor, understand the risks and be prepared to invest in strong barriers to protect your farm.
- Do not be surprised to see elephants if you have chosen to farm next to their habitat.

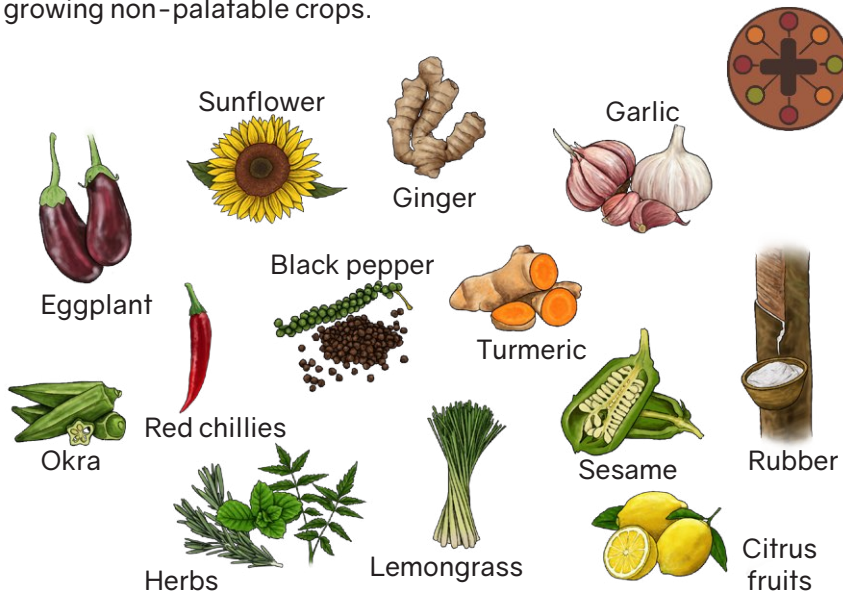




- If there are elephants using the corridor, there are likely to be **other wild animals** (like baboons and antelope) that can also become **crop-raiders**.

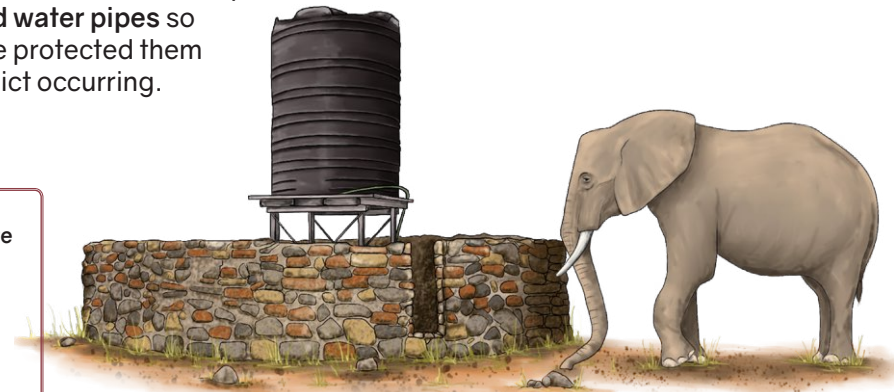


- Elephants may still **wander out of the corridor into farmlands** in search for food and water. **Do not** grow foods that elephants like to eat if you live next to an elephant corridor or game reserve.
- Use **combined deterrent methods** to protect your farms including growing non-palatable crops.



- Elephants will also be attracted to your **water tanks and water pipes** so ensure you have protected them to prevent conflict occurring.

See Water Tank Protection for more information.



- Switch to **small scale conservation agriculture farming** as it requires **smaller farmland**, **uses less water**, **does not require expensive use of dangerous pesticides**, is easier and cheaper to protect from crop raiding elephants and can provide **high yields** in return.

See Crop Choice & Kitchen Garden Practices for more information.



CREDITS AND DISCLAIMER:

We have collected the information above from multiple sources that are sourced throughout the document. Main sources are [Save the Elephants](#), [EcoExist](#) and [Wildlife Works](#). This manual is not extensive. To learn more and explore about Importance of Corridors, see [References](#). Save the Elephants advises caution with all the information collected and presented in this toolbox. **Further research** may be required before each site-specific implementation.

* Save the Elephants is not liable for any costs, damages or injuries incurred by the use of these methods or information.



SAVE THE ELEPHANTS

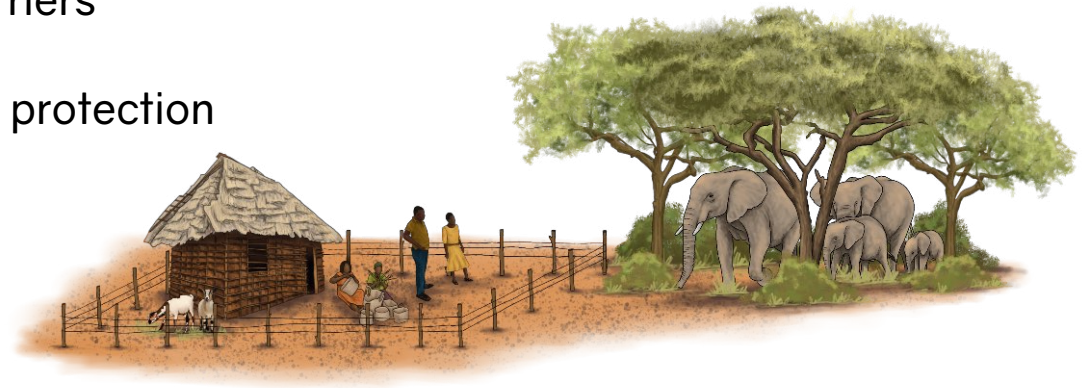
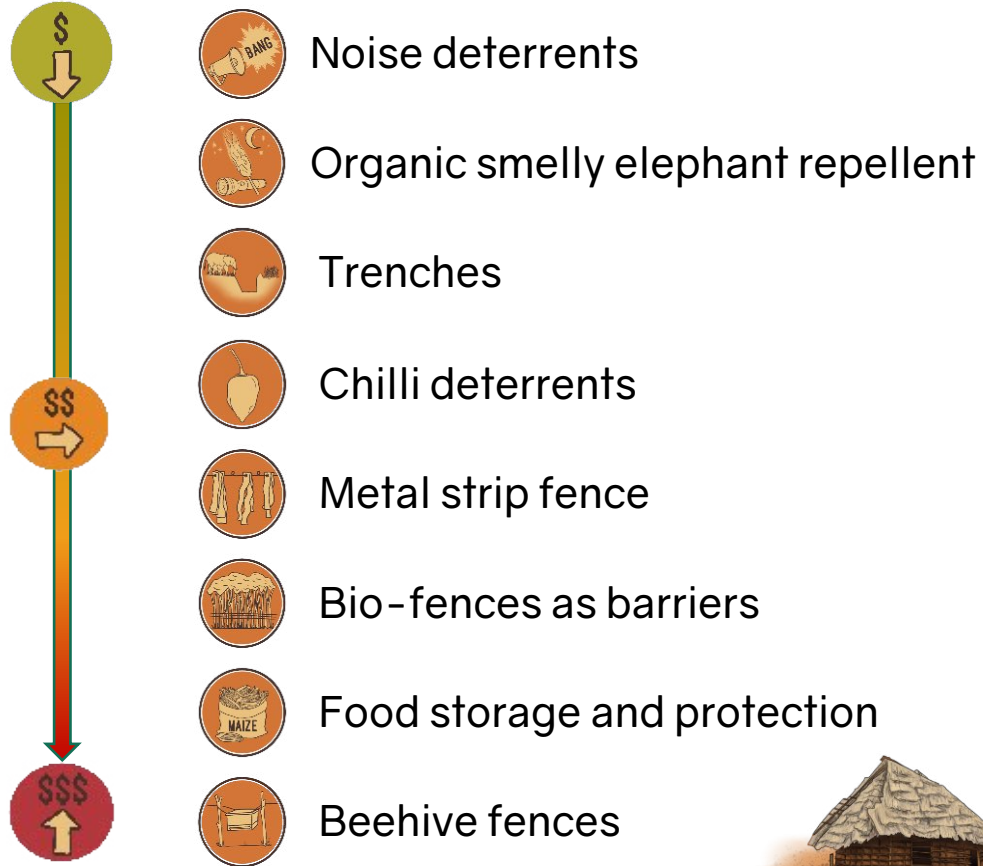




“Resilience can refer to positive adjustment in the face of adversity. Resilience has also been defined as the capacity of individuals to cope successfully with significant change, adversity or risk.”

Hyun Lee and James Cranford

FARM & BOUNDARY PROTECTION





NOISE DETERRENENTS



“Noise deterrents are noises which are used to deter elephants, either by the shock value of an unexpected loud noise, or by specific noises that are known to scare elephants” (Parker et al., 2007).

- Loud noise is an effective short-term deterrent against elephants.
- Elephants are incredibly intelligent and can get used to repeated tactics or learned-behaviour. Over time, elephants may ignore deterrents, once they realise that they do not cause harm.
- These can be flexible to use, low cost and can be combined with community-based plans.

TYPES OF NOISE DETERRENENTS



Beating drums



Cracking whips



Barking dogs



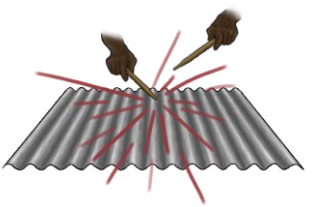
Firecrackers



Airhorn/Vuvuzela



Firing live rounds in the air



Loud banging on barrels, tins, corrugated iron, trees etc.



Shouting, yelling, and whistling



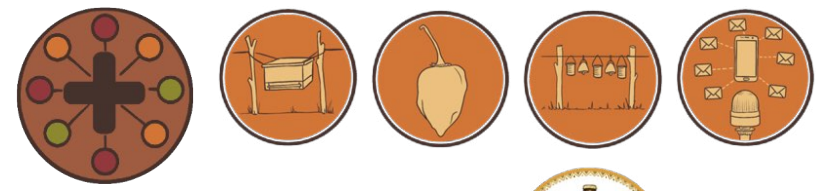
Audio playback of bee sounds and of large carnivores (lions, leopards, and tigers)

TRADITIONAL DETERRENENTS

- These are often made from simple and widely available materials.
- Farmers may use a range of noisemakers, such as beating drums and tins, ‘cracking’ whips, yelling and whistling to chase elephants away.



- Farmers may use tools that are readily available to help with making loud noises (metal sheet, pot, drum)
- These are best used in combination with other deterrent methods and nightguarding.



- Avoid alcohol/intoxication during the crop raiding season, maintain vigilance.



- Traditional deterrents to chase elephants out of farms tend to lose effectiveness with repeated use.



1. SHOUTING, WHISTLING, BANGING CORRUGATED IRON AND POTS, DOGS BARKING



This is something almost every farmer will attempt.



Should be used with other farm protection methods.

PROS +

- If enough people are mobilised, this can be an effective way of driving away elephants.



- Barking guard dogs can wake you up when elephants are approaching your farm and their noise can help deter elephants.



CONS -

- Not sustainable.
- Can be **dangerous** as people and elephants get too close, accidents can occur.
- Farmers **cannot sleep** properly as most crop raids occur in the middle of the night.



- Elephants can **habituate** to this noise.

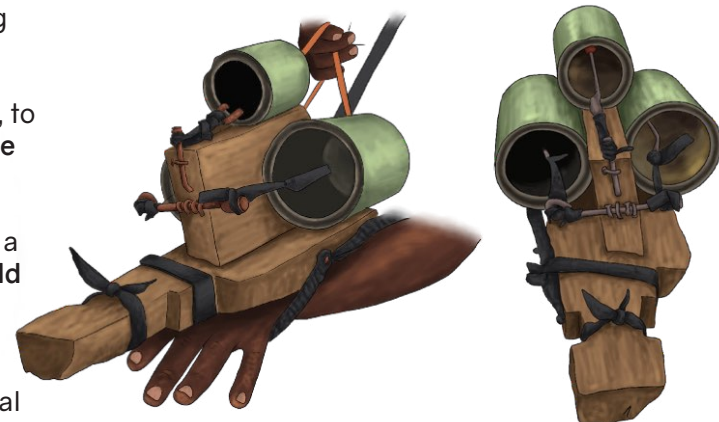


- High stress** and may be difficult to do if on your own.

2. HOMEMADE NOISE GUNS



- These can be **homemade devices**, made using recycled materials.
- It is like a **noise gun**, to help with extra noise making.
- The idea is to create a machine that uses **old tins** to increase the **horrible scratching sound** of metal rubbing against metal



MATERIALS NEEDED



Old tin cans



Nails



Piece of wood



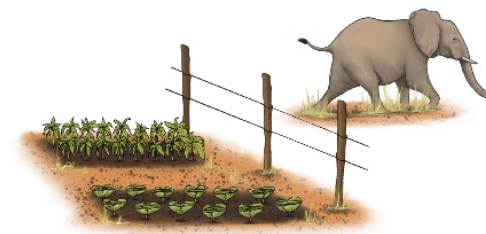
Rubber

- This is best used with a **strong torch**.
- By pulling the nails in and out, the scratching nails make a **horrible sound** that has proven effective at scaring elephants.



PROS +

- This is **mobile and flexible** to use.
- Low cost** and recycled materials can be used.
- Anecdotes that it can be **very effective**.



Credit: Jones Mwakima, Kajire, Taita Taveta.

3. AIRHORNS/VUVUZELAS

- These are devices designed to cause loud noise for signaling purposes.



- The horn increases the sound, making it louder.

PROS +

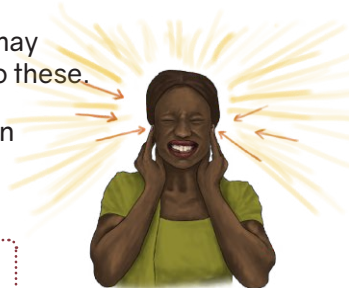


- They can be **cheap** and **easy** to find.
- They require **little training** and are easy to use, with **little risk** to either human or elephant.
- Best used in tandem with **LED lights** and other methods.



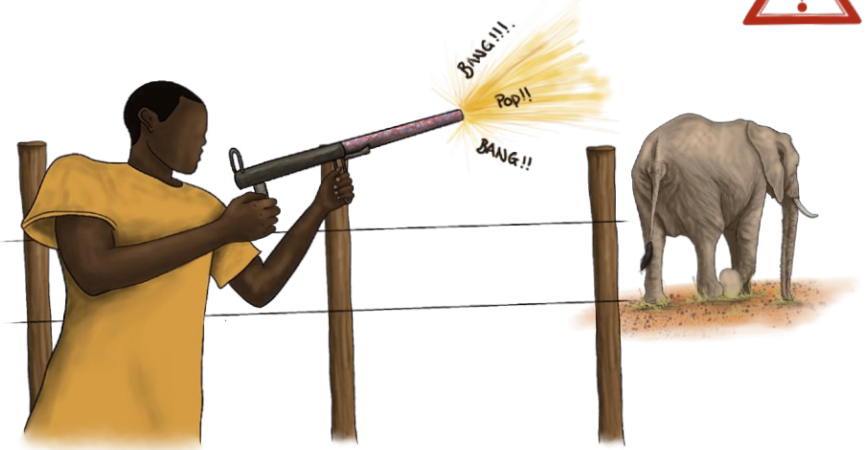
CONS -

- Easy habituation.** Elephants may get used to and easily adapt to these.
- The persistent loud sounds can be **disruptive**.



Credit: Honeyguide Human Elephant Conflict Handbook

4. ROMAN CANDLES

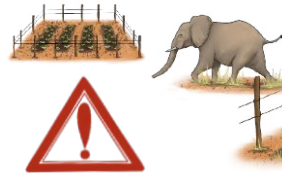


- This is a **candle-firework** that provides a series of loud explosions, and bright flashes.
- Should only be used as a **last resort**.
- Regular training and experience** is needed!



PROS +

- They can be very **effective** at chasing elephants away, if used correctly.



CONS -

- These can be **high risk** to the elephant or people if used incorrectly.
- Relatively **expensive** (approx. cost \$30/3,631Kshs per explosive)
Credit: www.honeyguide.org
- Should be only used as a **last-minute resort** and with **maximum caution**.



- The device causes an **explosion**, so should not be used in places with security issues.

- May chase **elephants** into neighbouring farms.
- If elephants are **successful** with feeding, they may get used to this method.

- Take care** when using these, and communicate with your neighbours and community.



If there is a concern for safety, do not use this device!

Credit: For more information, visit the Honeyguide Human Elephant Conflict Handbook, www.honeyguide.org



5. NOISE PIPE BOMBS

1. Seal a metal pipe at one end and fill it half full with water.

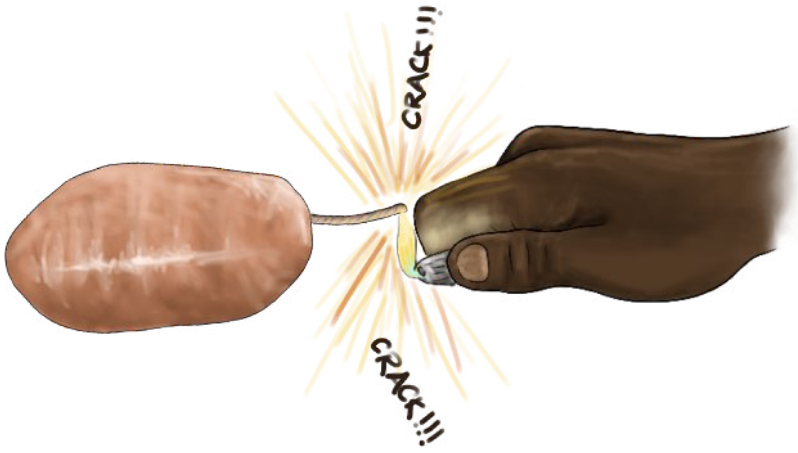


2. Bung the pipe and place it on a fire.




3. When it heats up, the bung will explode from the pipe making a rifle-shot sound.

6. CHILLI CRACKERS



- Chilli crackers combine auditory and physical deterrents by using chilli powder and firecrackers.
- When lit, it is thrown in the air, in the direction of the elephants.

See Chilli deterrents for other methods using Chillies.



Sources: www.connectedconservation.com, www.honeyguide.org, www.wrcsindia.org, www.ecoexistproject.org, and www.maraelephantproject.org.

7. COWBELLS / TRIP ALARMS



See Trip Alarms for more information.



- Cowbell or tin cans with stones are hung along a simple string fence at the edge of vulnerable fields.
- As elephants attempt to enter the fields, they push the alarms, ringing the bells and alerting farmers to the presence of elephants.

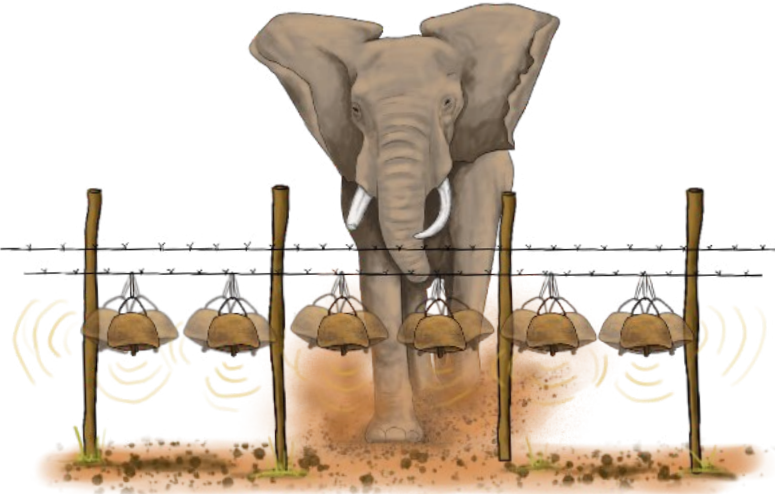
PROS +

Cheap and readily available, works very efficiently



CONS -

- Not a long-term solution.
- Elephants may get used to this very quickly.
- In high rainfall conditions, trip alarms with electrical systems are difficult to maintain, and they are also vulnerable to theft.





8. GUNSHOTS



BANG

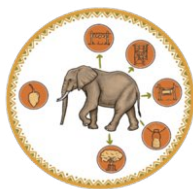


- ⦿ A longstanding and widely-used deterrent throughout the continent.
- ⦿ This involves the deployment of governmental or national wildlife employees who fire shots over crop raiding elephants' heads and into the sky.

Firing live rounds directly at the elephants must be avoided at all times.

PROS +

- ⦿ The immediate and very loud sound, scares and disperses elephants effectively.



CONS -

- ⦿ At best considered a temporary respite from elephants.
- ⦿ Potentially dangerous as could spook elephants too much.
- ⦿ Not suitable in areas with sensitive security issues.
- ⦿ Relying on centralised wildlife enforcement units may have logistical challenges, for example with remote locations and poor access.
- ⦿ This may affect the response times and is costly for wildlife enforcement agencies.



⦿ "There is a large body of anecdotal evidence to suggest that elephants habituate to gunshots if exposed to them for a prolonged period of time" (Parker et al., 2007)

- ⦿ High cost.

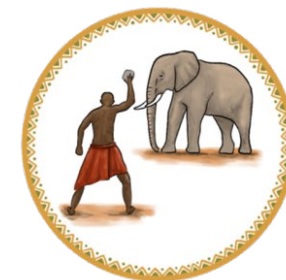


COMMON PROBLEMS WITH TRADITIONAL ACOUSTIC DETERRENTS:

- ⦿ Over-reliance on a few methods, used repeatedly with little variation (Variation is needed).
- ⦿ These deterrents often involve getting close to elephants, increasing the potential risk of injury to both people and elephants.
- ⦿ Most methods may be considered 'empty threats' since the elephant may be scared by them, but they cause no actual harm.
- ⦿ Therefore, elephants may habituate to them and may eventually ignore them altogether.



- ⦿ Some elephants are persistent and bulls can be particularly difficult to chase out of farms.
- ⦿ Always prioritise your safety and avoid aggravating elephants as this could provoke aggressive behaviour.

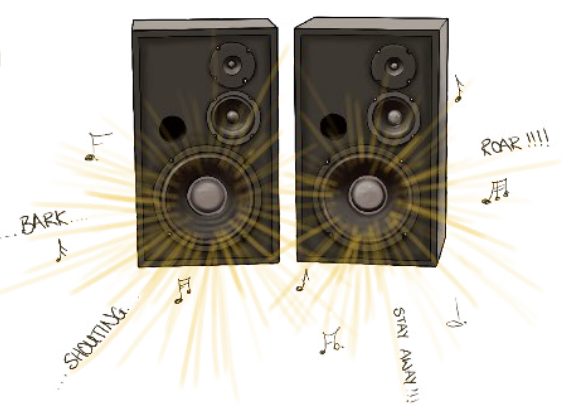







EXPERIMENTAL DETERRENTS



- There are many innovative ideas which are currently being field tested.
- Most of these new acoustic deterrents are based on research into the use of noises produced by animals, people, or things that elephants have a known aversion towards.



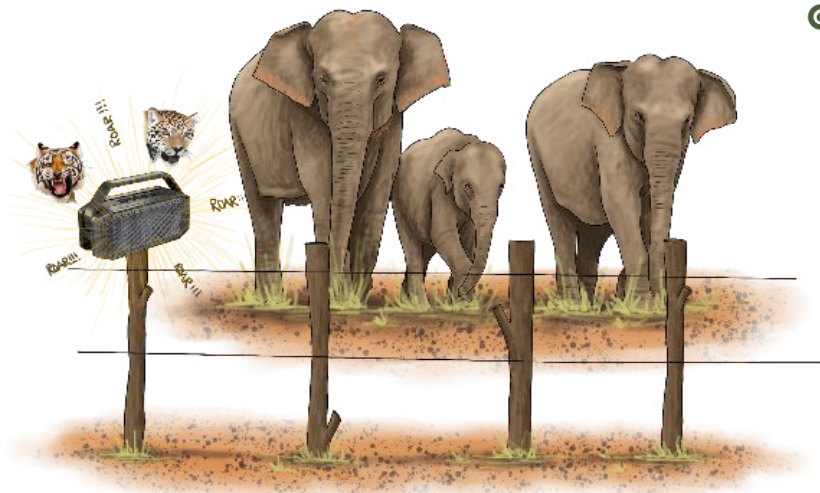
- Playbacks can be short term strategies.
- 

- Electronic devices may be more prone to weather and maintenance is required.
- 
- 

EXAMPLES

1. TIGER AND LEOPARD GROWLS IN INDIA

(THUPPIL ET AL., 2012 & 2016)



- Tiger and leopard growls were played using a battery-powered, waterproof-speaker system to wild Asian elephants in Ananjera National Park in India.



- The elephants appeared to be able to distinguish between the two sounds. While the leopard growls elicited aggressive vocalizations by the elephants, tiger growls prompted a stealthy, silent retreat” (Hahn, 2015).

You can watch their responses to the growls below:

Tiger growls: <https://www.youtube.com/watch?v=CSdcQp3BsPU&t=26s>

Leopard growls: <https://www.youtube.com/watch?v=mlUkmEa3m50&t=49s>

Credit: Thuppil V. & Coss, R. (2012). Using Threatening Sounds as a Conservation Tool: Evolutionary Bases for Managing Human–Elephant Conflict in India. *Journal of International Wildlife Law & Policy*, 15. 167–185. Thuppil, V., & Coss, R. (2016). Playback of felid growls mitigates crop-raiding by elephants *Elephas maximus* in southern India. *Oryx*, 50(2), 329–335.)

2. ELEPHANT VOCALISATIONS AND HORNETS IN SRI LANKA

(WIJAYAGUNAWARDANE ET AL., 2016)



- Experiments on wild male adult Asian elephants in Udawalawe National Park, Sri Lanka.
- They used pre-recorded wild Asian elephant vocalisations and the sounds of disturbed Sri Lankan hornets (*Vespa affinis affinis*). Each recording was played for one minute in an area where they placed foods known to be favoured by elephants.
- These are the four different sounds and the number of elephants that retreated upon hearing them:

a) Matriarchal family group vocalisations :	11/17 [65%]
b) Disturbed Sri Lankan Hornets :	2/12 [17%]
c) Lone female vocalisations :	1/8 [13%]
d) Chainsaw control sound :	0/11 [0%]

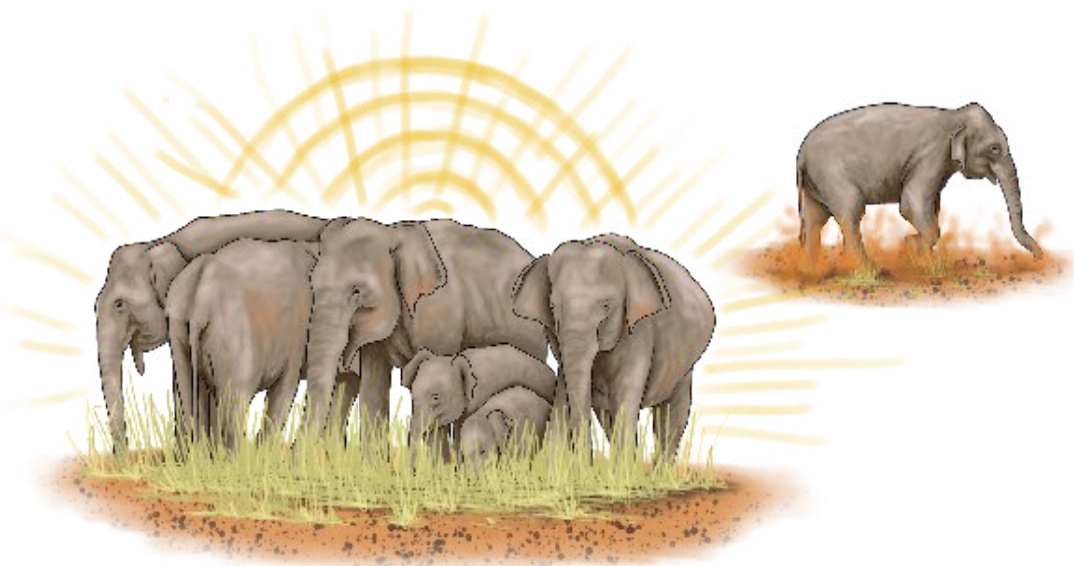
- Played all four sounds to each elephant unless a flight response occurred.



⦿ The results provide evidence that **playbacks**... could scare wild Asian elephants away from a **food source**, suggesting that the provision of **simple sound recordings** may be an **effective way** to reduce HEC in Sri Lanka and Southeast Asia.”
(Wijayagunawardane et al., 2016).

⦿ The response to the hornets was lukewarm, with only two elephants retreating. However, the two that responded did so **vigorously** and showed **clear discomfort**, confirming that the response was from **learned experience**.”

⦿ The authors noted that “the most significant finding was the marked flight response of lone adult male elephants to ... matriarchal family group vocalisations”
(Wijayagunawardane et al., 2016).



⦿ This study showed that male elephants could **recognize the sounds of female elephants** and distinguish between the call of a single female and a matriarchal/mother-led family group.

Credit: Wijayagunawardane M., Short R., Samarakone T., Nishanyi K., Harrington H., Perera V., Rassool R., & Bittner E. (2016). The use of audio playback to deter crop-raiding Asian elephants: Vocalizations to Deter Crop-raiding Elephants. *Wildlife Society Bulletin*, 40. 10.)

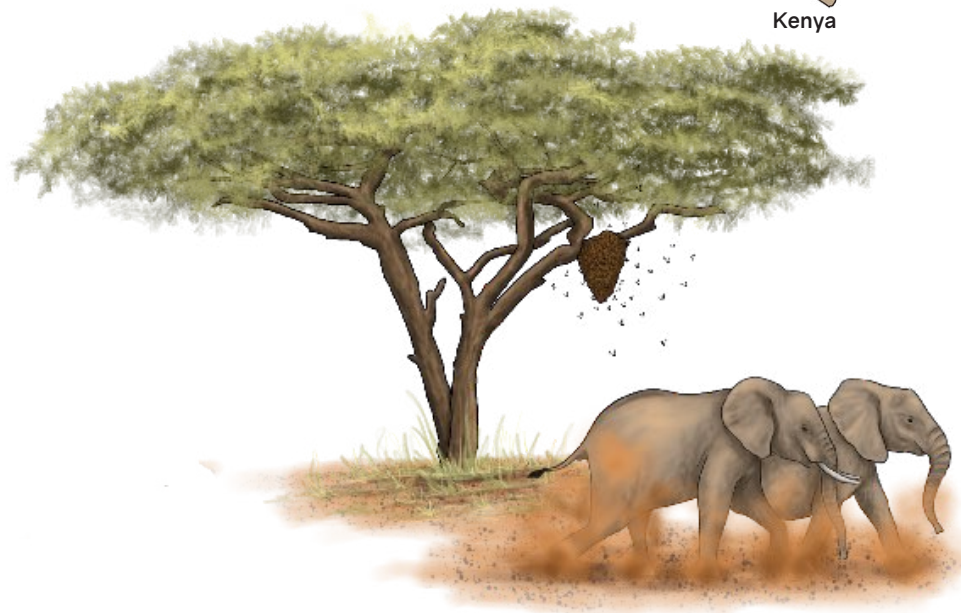
3. BEES IN KENYA AND EAST AFRICA

(KING ET AL., 2007)

⦿ Through traditional, individual and scientific evidence, Lucy King sought to find out how distressed elephants become upon hearing the sound of an angry swarm of bees.



Kenya



⦿ The initial study showed that after hearing recordings of bees ~ “16 out of 17 elephant families observed, abandoned the tree they were standing under within 80 seconds of the noise starting, of which 8 out of the 16 left the tree within 10 seconds” (King et al., 2007).

⦿ King's findings also noted that elephants will habituate to the recordings after they learn that the sounds are not accompanied by stings. So whilst effective in the **short term**, the long term requires other methods.

⦿ This research led on to the development of **beehive fences** as elephant deterrents.



See **Beehive fences** Toolbox sheet for more information; www.elephantsandbees.com,



4. PLAYBACK OF DIFFERENT ETHNIC GROUPS IN KENYA

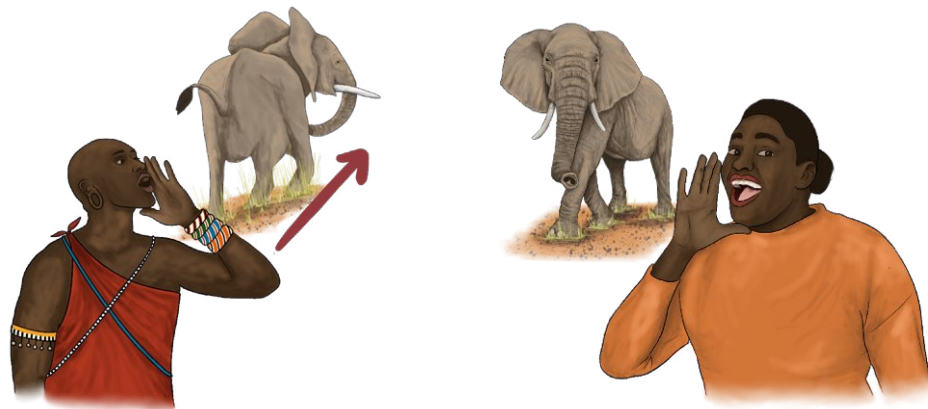
(MCCOMB ET AL., 2011 & 2014)

Elephants can determine ethnicity, gender, and age from acoustic cues in human voices (McComb et al., 2014).

- Karen McComb played recordings of Maasai male, female, and children's voices to wild elephants in Amboseli, Kenya. She also played recordings of male Maasai voices and male Kamba voices.



She discovered that... "elephants exhibited a significantly greater probability of retreat and investigative smelling when responding to a male compared with female voices" (McComb et al., 2014).



Moreover, "the voices of Maasai men were clearly discriminated from Kamba men, with the former eliciting higher levels of defensive bunching and investigative smelling, responses that would be highly adaptive if Maasai men were actually present" (McComb et al., 2014).

- Elephants can tell the difference between male and female lions. McComb played a series of audio recordings of lions to several elephant groups in Amboseli in 2008.
- Matriarchs/ female leaders can discern between female and male lion sounds, (McComb et al., 2011) and between human voices (McComb et al., 2014).



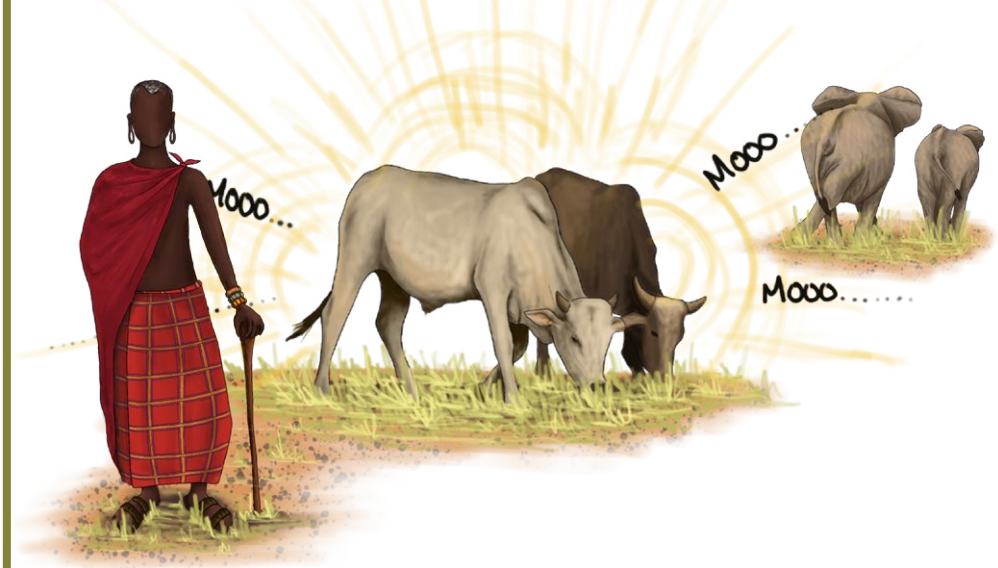
Credit: McComb K., Shannon G., Durant S. M., Sayialel K., Slotow R., Poole J., & Moss C. (2011) Leadership in elephants: the adaptive value of age, Proc. R. Soc. B.2783270–3276; McComb, K., Shannon G., Sayialel K. N., & C. Moss (2014) Elephants can determine ethnicity, gender, and age from acoustic cues in human voices. Proceedings of the National Academy of Sciences of the United States of America, 111:5433–5438.)

5. PLAYBACK OF CATTLE SOUNDS IN KENYA

(MCCOMB ET AL., 2011 & 2014)



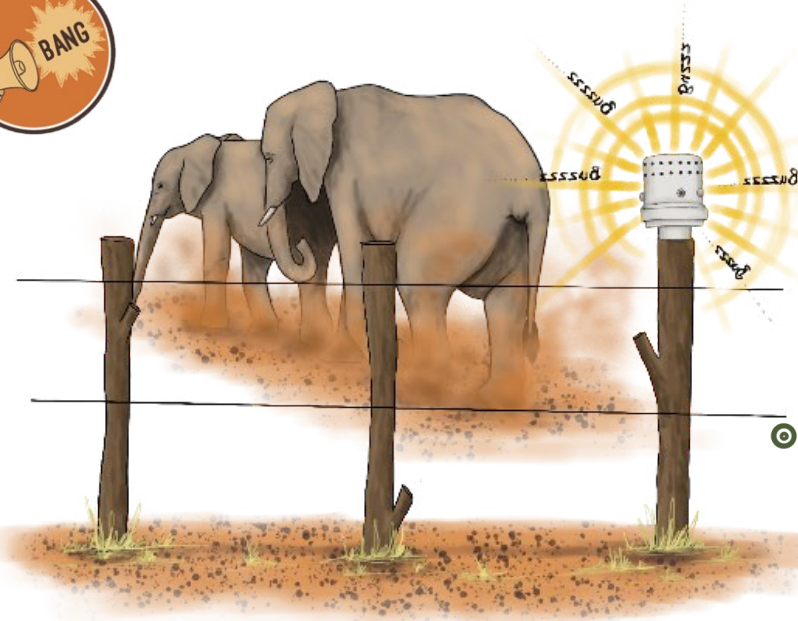
Amboseli - Kenya



- Using recordings of Maasai cattle scared off elephants in Amboseli NP, Kenya.
- These elephants have lived alongside the Maasai for generations and are careful due to previous cases, and learned behaviour.
- This method requires a specific environment and historical context.
- It also uses expensive recording and playback equipment.



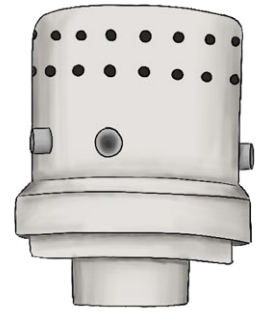
Credit: Garstang, M. (2004) Long-distance, low-frequency elephant communication. Journal of Comparative Physiology A, Neuroethology, Sensory, Neural, and Behavioral Physiology, 190:791–805.)



6. BUZZ BOXES

They have **motion sensors** which can detect up to **two metres**, and so must be strategically placed.

This will **shock** the elephant and stop them from continuing with their raid.



- A recently developed gadget from **Wild Survivors** which can be attached to anything from fence posts to trees.
- Once the sensor is tripped by a crop raiding elephant, the box will **play a recording of agitated bees**.
- Each buzz box contains batteries that are charged from a **small solar panel**.

PROS +

- Small, **easy to install** and can operate for a good amount time before needing to be replaced.
- The sound is **loud** and can scare away elephants.
- Sure to make a noise when actual **bees are not available**.

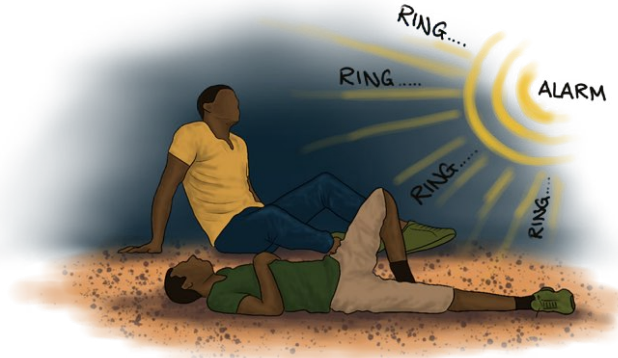


CONS -

- As with any **electrical device**, they are liable to not function after a while.
- Buzz boxes often need to be deployed in very rural areas. Farmers must have **easy access to another means of charging the batteries** if the weather is overcast.
- There is **no guarantee** the boxes will always be triggered, and it is often the case that the elephant would need to pass **within a few feet** of the Buzz Box for the sound to be triggered, making the chances of it working less likely.
- May be **over-triggered** by other moving objects or animals. Can create **disturbance** and risks elephants getting used to it.

Credit: www.wildsurvivors.org

7. ALARM SYSTEMS



- Alarms stationed along boundaries of farms have a **tripwire** which **makes a loud noise** when triggered.
- This helps alert farmers.



Certain systems using **sirens** have had some success. However, **electrical systems are easy to steal** and have limited use in areas with **high rainfall**.

Farmers in Zimbabwe found them to be important for field guarding as:

- a) they always knew when the elephants were approaching.
- b) the bells sometimes drove the elephants away.



Many farmers complained that it was **exhausting** guarding the fields all night and it was impossible to maintain constant vigilance.

For this reason, alarm systems are good because they **allow farmers to sleep while maintaining a level of guard**.



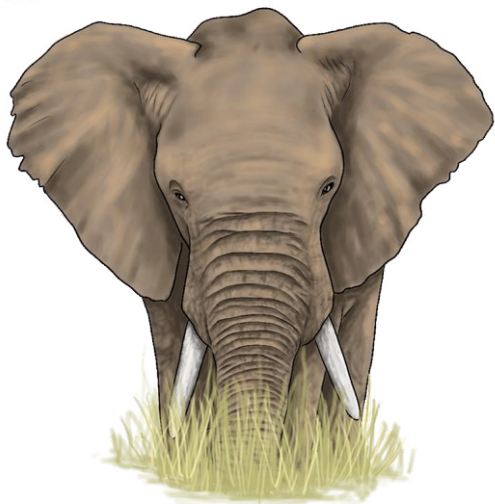
Credit: Parker G.E., Osborn, F.V., Hoare R.E. & Niskanen, L.S. (eds.) (2007): Human-Elephant Conflict Mitigation: A Training Course for Community-Based Approaches in Africa. Participant's Manual. Elephant Pepper Development Trust, Livingstone, Zambia and IUCN/SSC AfESG, Nairobi, Kenya)



COMMON PROBLEMS WITH ACOUSTIC DETERRENENTS

- Elephants are highly adaptable and can rapidly habituate to 'empty threat' deterrent methods - those which scare but cause no physical harm.

The effectiveness of any traditional method can be reduced once elephants are exposed to them multiple times: "all traditional deterrents ... tend to become ineffective over time." (Parker et al., 2007)

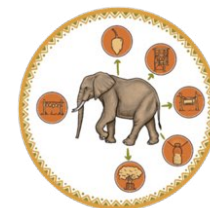


- Materials for more experimental and technical deterrents can be expensive or hard to source: e.g. ammunition (permits for firearms), solar panels, electricity, audio recordings.

- These experimental deterrents often rely upon outside organisations for money, resources, and expertise.



TIPS FOR MANAGEMENT / HELPFUL ADVICE



- Variation is the key to establishing an effective deterrent system.
- Methods used should be a starting point, not as a silver bullet.
- Over time, new methods should be introduced.
- Innovation of novel deterrent techniques should be greatly encouraged amongst farmers.
- Farmers need support to establish mitigation methods and strategies.
- Important to not foster a culture of dependence on the charity or organisation helping these farmers. Farmers should feel confident that these methods can eventually be implemented without outside support.



CAUTION TIPS

- Some of these methods are not suitable in areas with sensitive security issues.
- These studies underline just how intelligent and clever elephants can be. Elephants can discern between the sounds of different carnivore species and even the sex of those carnivores. They can discern the age, sex and ethnicity of people and the levels of danger that each group possess.
- This intelligence and ability to gauge real and empty threats is what make it so difficult to find one main solution to deterring them.

CREDITS AND DISCLAIMER:

We have collated resources from a range of different sources. Some of the methods represented are experimental and further research is needed. Some original words commonly used have been simplified for easy understanding. Main sources included in [References](#). To learn more about noise deterrents, explore the literature further.

Save the Elephants advises caution with all the methods and information collected and presented in this illustrated toolbox. Further research may be required before each site-specific implementation.

* Save the Elephants is not liable for any costs, damages or injuries incurred by the use of these methods.





ORGANIC SMELLY ELEPHANT REPELLENT



This is a strong-odour repellent made from low-cost ingredients. It has **2 methods** of application and can help protect crops and prevent elephants from entering the farm boundary.



This idea was pioneered by students in Northern Uganda and further developed by WildAid Africa.

METHOD 1 : SPRAY

20 litres protects 1/2 acre if sprayed OR 1 acre using the fence method.



Spray this on crops as they are maturing or when elephants have begun crop-raiding.

This repellent is a good organic fertiliser and may also help keep away crop pests.



Experiments on this new method are still ongoing. Please contact WildAid (africa@wildaid.org) for the latest recipe and details of how this repellent is best applied to protect your crops.

METHOD 2 : FENCE

1 Fill the bottles halfway with the finished repellent.



2 Make holes in the sides of the bottle (above the repellent level) as well as in the lid.



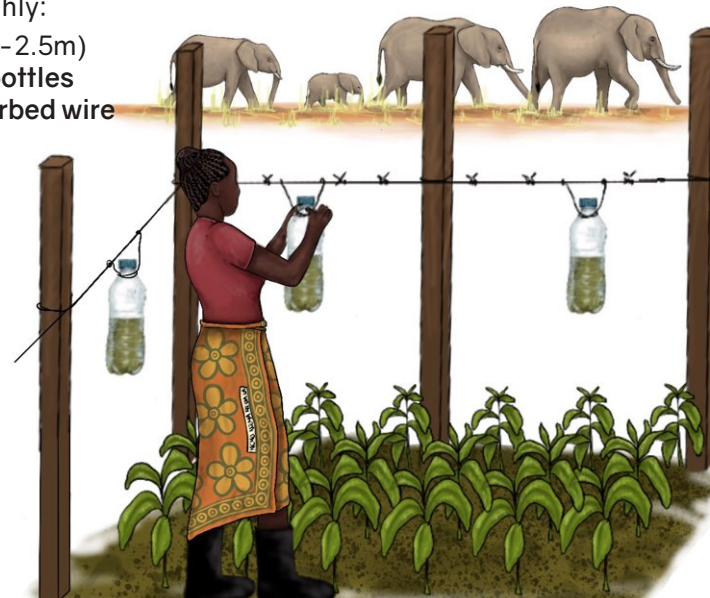
3 Hang these around the farm using wire or string.



For a 1 acre fence, you will need roughly:

- 24 poles (2-2.5m)
- 140 - 160 bottles
- 260m of barbed wire

Place posts at 10 m intervals



4 This powerful smell will reach and deter any approaching elephants.

The more holes in the bottle, the better the smell will diffuse out.





TRENCHES



WHAT ARE TRENCHES?

These are a type of **physical barrier** for elephants and other wildlife.

These barriers are used for **preventing elephant exit** outside forest reserve areas or **entry** into cultivated fields or human habituated areas. They **may be used to guide** elephants through funneling to over bridges or underpasses.

They require **wider environmental consideration, maintenance and management.**

WHY DO THEY HELP?



- Elephants cannot jump, so a trench that is too wide or deep may act as an **effective barrier**.
- These are suitable as **permanent installations** where **soils are stable** enough to allow digging and where **soil erosion is limited**.
- Trenches can be dug on **dry and flat land**. They cannot be dug on a slope or in areas prone to flooding as trenches will fill with water, allowing elephants to swim across.
- Try not to cut down trees**, bush or vegetation to create trenches. This will affect the local ecological balance and cause further erosion.



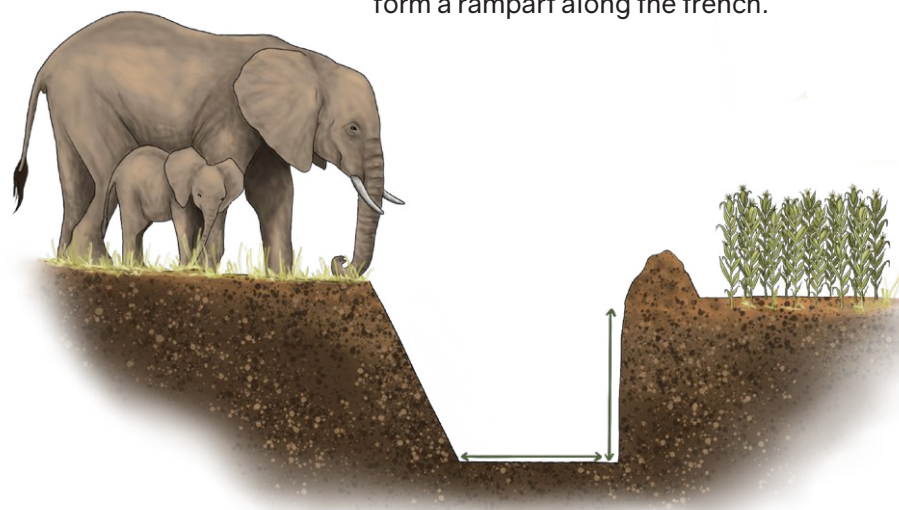
CASE STUDY:

- Around **Kibale National Park (Uganda)** trenches have been excavated to **restrict movement** of elephants onto adjacent farmland.

Credit: Gross, E. M., Lahkar, B. P., Subedi, N., Nyirenda, V. R., Lichtenfield, L.L., Jakoby, O. (2019) Does traditional and advanced guarding reduce crop losses due to wildlife? A comparative analysis from Africa and Asia, Journal for Nature Conservation, Volume 50, August 2019, 125712.



- The trench is excavated **two meters deep** and **two meters wide**, and the soil is piled up to form a rampart along the trench.



- Newly dug and **well-maintained** trenches have proven reliable in keeping out elephants.
- According to Gross (2019) Farmers living around Kibale NP regard the trench, which is mainly paid by NP revenues, as very useful.

Credit: Gross, E. M. (2019) Tackling routes to coexistence, Human-Elephant conflict in SubSaharan Africa.

PROS +

- Materials - Can be constructed without too many materials. Mainly man power and tools.



- Cost - Can be a low-medium cost option.



- Reduction in visits of other crop raiders. Trenches may prevent access from other frequent crop raiders.



- Physical barrier to people and livestock.

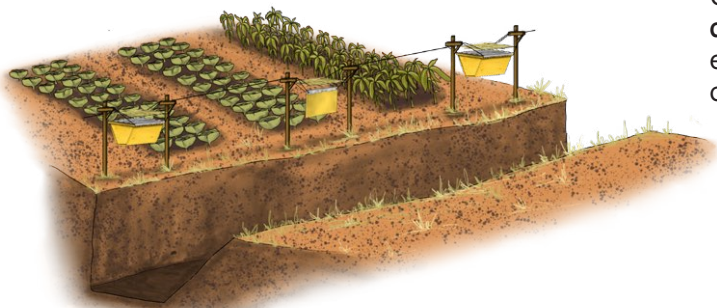


- Long term strategy to help restrict elephant entry or exit.

WHAT ELSE SHOULD THEY BE USED WITH?



Use with **combined deterrent methods** – e.g beehive fencing or chilli fencing.



DO NOT use spikes or other sharp objects.
These are very dangerous to elephants, other wildlife, livestock and people.



CONS -

- Soil erosion - Promotes further erosion, especially during the rainy season. Trench walls need maintenance.



- Maintenance - The success of the trench lies in its maintenance, which can be labour intensive and costly, particularly after heavy rains.

- Limitations - when soil topography does not support digging trenches (too steep) or where water bodies are cutting through.

- Physical barrier to people and livestock

- Dangerous -

Elephants or other animals and livestock could be injured or get trapped by falling into deep trenches.

Elephant babies are particularly vulnerable to falling in trenches or getting stuck



Can be dangerous for humans too.

- Restricted access - Elephants might still find a way to get across - stories of elephants pushing down trees or pushing mud in the trench to find a way across or elephants may move along the trenches to look for crossing points.

In case they find crossing points and enter into croplands, chasing them back to the PA may become difficult as the access back is blocked.

- Mixed results and this is not the most effective method.

CONSIDERATIONS

ENVIRONMENTAL CONSIDERATIONS AND IMPACTS

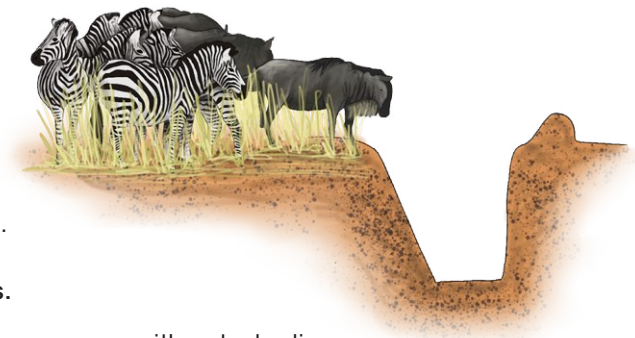
- These are not highly recommended for possible large-scale changes in landscape.

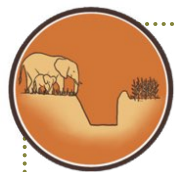
- Trenches may affect or block natural migration routes for other animals.

- Best to first trial and adapt other methods and farm-based deterrents.

- Could have long term consequences.

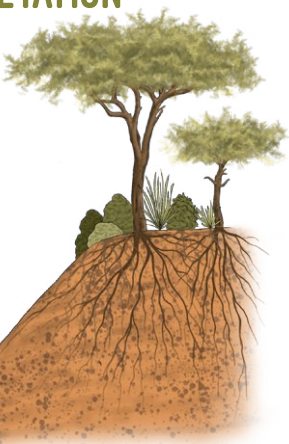
- These are not recommended on slopes, or areas with water bodies.





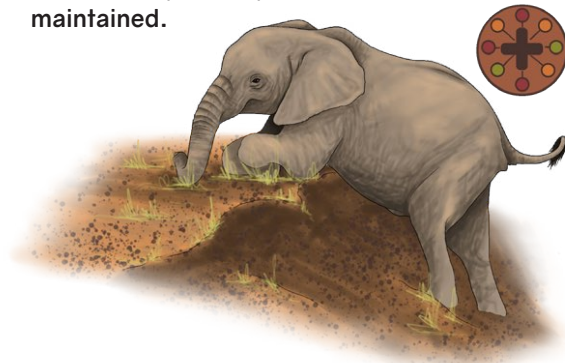
PLANT TREES OR VEGETATION

- Plant trees, vegetation or a cover crop to **stabilize** and **prevent soil erosion**. They are prone to soil erosion, especially **along slopes and high rainfall areas**.
- Try **avoid cutting trees and vegetation**.



COMBINED MEASURES

- Combine trenches with an electric or beehive fence built on the farm side of the trench for a **combined elephant barrier**.
- Ensure one side of the trench is **sloped** so elephants don't get stuck and can climb back out.
- Must be used in conjunction with other measures and most importantly needs to be **well maintained**.



MAINTENANCE AND MANAGEMENT

- Due to **soil erosion**, and especially after **heavy rains** – trench walls can become weak making it easy for elephants to cross.



- Large scale trenches** require **high investment** and are **difficult to maintain**.
- Pave the trenches with concrete, if resources are available.
- Best to have a **long-term management plan**.
- For best management – creation and maintenance of elephant-proof trenches should be handed over to the **district administration or local authorities**.

PERMISSIONS AND RESEARCH

- Relevant permissions** from authorities may be needed.



- Long term research** needed.
- Digging a trench may cause a **micro-environmental disturbance**, changing dynamics in an ecosystem.
- It may **affect species** living in that area, as well as **vegetation, water flow and tranquillity**.



COLLABORATION WITH NEIGHBOURS

- Work with your **neighbours and community** to find the most suitable methods for coexistence.
- Work with **local government and wildlife authorities** on landscape management.

NOTE/ DISCLAIMER

- This has been used, with **mixed effectiveness** in Asia.
- Success or effectiveness is dependent on various different factors.
- Maintaining and protecting wildlife corridors** is important for elephant movement.
- ** Trenches require wider environmental consideration, maintenance and management. Elephant proof trenches should be installed with discretion only where the situation demands.**



Only use if completely necessary.

CAUTION TIPS:

- Trenches may include **large-scale adaptations** and a significant change to a localized environment.
- Use **other methods** or ideas before resorting to this method.
- Find out more about the **suitability** of this method in your environment and what the **long-term implications** may be.
- This doesn't work in all contexts * **More site-specific research is needed!**
- Must be used in **combination with other deterrents**.
- Elephants are very **intelligent** and may **habituate** or find ways across.
- Trenches may become weak over time** due to an accumulation of soil and rubble. **Maintenance is required.**
- Take care of **livestock and humans**, nearby trenches.
- The consideration and management of **elephant migratory corridors** is needed.



CREDITS AND DISCLAIMER:

The ideas presented here are from various sources and based on case studies. This method has been used with **mixed effectiveness**.

See [References](#). Save the Elephants advises caution with all the methods collected and presented in this toolbox. Further research may be required before each site-specific implementation.

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See document on **Elephant-aware behaviour**





CHILLI DETERRENTS



Chilli is a natural deterrent. It contains a chemical called capsaicin that irritates elephants' noses and eyes. Chillies can be used in a number of ways and as a low-tech and non-lethal method for repelling elephants.

Capsicum is the ingredient that makes chilli spicy.

When this is affected by moisture (e.g inside a trunk) - it will cause an uncomfortable burning sensation.



Elephants have an extremely good sense of smell and will be able to smell chilli from a distance.

Credit: Osborn F.V., Rasmussen L.E.L. 1995. Evidence for the effectiveness of an oleoresin capsicum aerosol as a repellent against wild elephants in Zimbabwe. *Pachyderm* 20:55-64.

DIFFERENT METHODS

METHOD 1:
CHILLI BARRIER CROPS + GROWING DIFFERENT CHILLIES

METHOD 2:
CHILLI FENCING

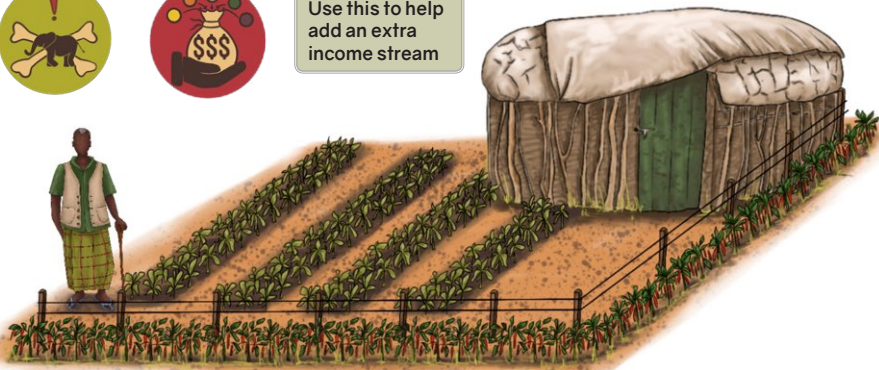
METHOD 3:
CHILLI SMOKE TECHNIQUES

METHOD 4:
CHILLI NOISE/ CRACKER VARIANTS

METHOD 1: PLANTING CHILLI BARRIER CROPS



Use this to help add an extra income stream



- Grow hot chillies as **barrier plants** or to intensify other methods of deterrent.
- Chillies **irritate** elephants and create an **unpleasant experience** that will force elephants to move on to other areas.
- Raw chilli can be a **high-value** product and chili farming provides **other economic options**.
- Chillies can **help diversify income** from agriculture and can be sold as a **cash crop**.
- Elephants are **very smart and intelligent** and will learn how to adapt over time, so it is best to **use multiple deterrents** and only use these methods when necessary to avoid elephants getting used to them.



Dried chilli flakes



Chilli sauce

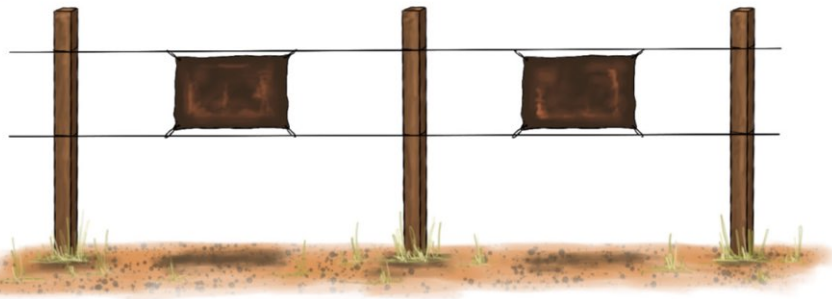


Chilli pickle



METHOD 2: CHILLI FENCES

TYPE 1: CHILLI RAG FENCE



- ⦿ A **chilli fence** is usually made up of a mixture of chilli, oil and a piece of cloth.
- ⦿ You can also use **vegetable oil**.
- ⦿ Two **sisal strings** are hung horizontally from posts around the farm perimeter.
- ⦿ The pieces of **cloths** are stretched and tied to the sisal strings at regular intervals.
- ⦿ It is important that the fence is designed in such a way that **elephants cannot cross** without coming in **close contact** with the **chilli rags**.
- ⦿ You can cut up an **old sheet or clothes** for the cloth pieces. If you do not have this, you can use **chilli ropes** dipped in the mix instead.
- ⦿ Once an elephant reacts to the chilli on its trunk, **other elephants will react cautiously too**.

MATERIAL CHECKLIST (FOR 1 ACRE)



Around 10 litres of vegetable oil



32 pieces cloths (60x40cm)



5kgs of sisal string



2.5kgs of ground chilli



36 poles, at least 3m (118 inches) long and 3 to 4 inches in diameter.

PROCESS:

Credit: Collaborative Manual by Chang'a et al. 2015. Chilli fences keep elephants out of crops! How to make and support chilli fences.

1.

The **ground chilli** is mixed with the **vegetable oil**.



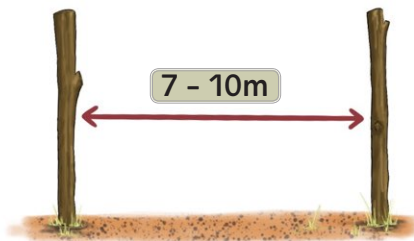
2.

The **sisal string** and the **cloths** are then soaked in this mixture.



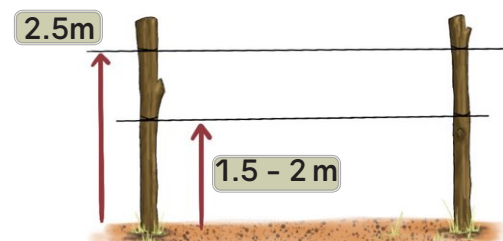
3.

The **interval** between subsequent poles should be 7 to 10 m apart.



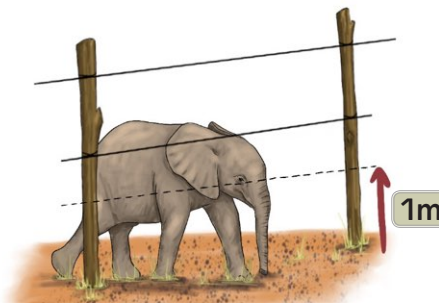
4.

The **height** of the upper and lower sisal strings should be 2.5 m and 1.5 to 2m above the ground respectively.



5.

The farmer may choose to add another string **1 m** above the ground, just in case there are babies within the elephant herd.



6.

Live poles that can root and **re-sprout** can be used in place of poles.



TYPE 2: CHILLI ROPE FENCE

- ⦿ This is the same concept, without using the cloths.
- ⦿ Grind 1 kg green chilli in a thick paste without adding water.
- ⦿ Add 1 kg tobacco, and 1/2kg grease and 1/2kg waste engine oil.
- ⦿ Apply the mixture on a rope and hang the rope around the area you wish to protect.
- ⦿ Use in combination with other methods.

TIPS FOR MANAGEMENT

- ⦿ You must **regularly monitor the fence** to make sure all the components are in place.
- ⦿ Identify when is the **best time** to put up the fence and when to take it down.
- ⦿ Put this up when the crops are ripening near the time of harvest and **take down after harvest** to avoid elephants habituating to it.
- ⦿ Lining **thorny acacia branches (bio-fences)** along the fence may help keep the calves and other small animals away.
- ⦿ Assess **which direction** the elephants usually come from and hang the rags.
- ⦿ It is important to **maintain** your chilli fence and **re-apply chilli** when needed.
- ⦿ The **heat** will reduce with time (after 20 days if it has been dry, 7 days if it has been raining heavily).
- ⦿ Use **rubber gloves and protective wear** when handling the chilli mixture.
- ⦿ **Do not touch your eyes or face** when handling chilli. Avoid contact with skin.
- ⦿ This is a **short-term measure** and should be used with **combined deterrents**.



TIP: You can set up chilli fences and other noise/smell deterrents **strategically** on the **approach paths** from the bush to your farm. Elephants **fear** crossing unexpected barriers or deterrents and should shy away from getting too close to your farm/village. **Combine and rotate** chilli fences with trip alarm fences to **avoid habituation**.

More info: [The Virtual Fence Dynamic: A Breakthrough for Low-Cost and Sustainable Mitigation of Human-Elephant Conflict in Subsistence Agriculture](#)

PROS +

- ⦿ This is effective for **small fields** and during the **dry season**.
- ⦿ **Flexible fence** (It is simple and easy to take down and put up)
- ⦿ **Relatively inexpensive** for farmers to build and just take a few days to construct.
- ⦿ **Low cost** and materials can be sourced locally, especially when chilli is grown as a buffer crop.



CONS -

- ⦿ This can be **labour intensive** especially during the rains when chilli needs to be re-applied.
- ⦿ Farmers need to have a **sustainable means of sourcing materials** in order for the fence to be regularly re-applied.
- ⦿ There are a **few environmentally acceptable disposal materials** used as fence materials (e.g old engine oil).
- ⦿ Fence **maintenance is critical**. Chilli fences may fail if farmers are unwilling or financially unable to maintain the fences.
- ⦿ Chilli fence can get **painful and messy** when applying.
- ⦿ Chilli potency **degrades** with time.



Reinforce any fence with chilli to help keep elephants away.

More info: www.connectedconservation.com, www.honeyguide.org, www.ecoexistproject.org, www.maraelephantproject.org



METHOD 3: CHILLI SMOKE TECHNIQUES

Credit: Ecoexist Project, Okovango delta, www.ecoexistproject.org



Burning chilli is a good way to keep elephants away.

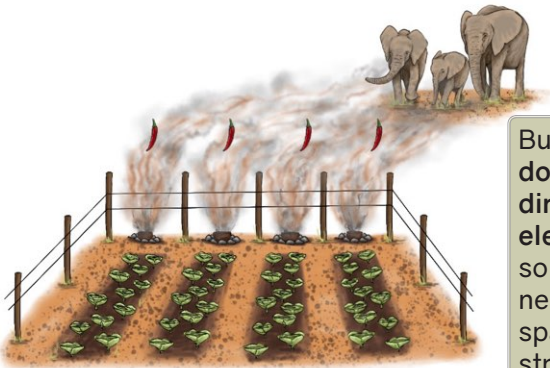
They hate the smell, plus chilli smoke will mask the smell of ripe crops.

Burning chilli is a good way to keep elephants away.

This is made up of a mixture of elephant or cow dung, ground chilli and water. This is moulded into briquettes and left to dry.



Once the brick/briquette is dry, you can burn it to create a hot chilli smoke that elephants can smell from a distance.



Burn these downwind in the direction of the elephants' path, so your neighbours are spared from the strong fumes.

TYPE 1: CHILLI BRIQUETTES

INGREDIENTS



Ground chilli



Elephant or cow dung



Water

PROCESS



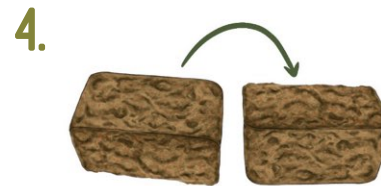
Mix ground chilli and crushed elephant/cow dung at a ratio of 1:2.



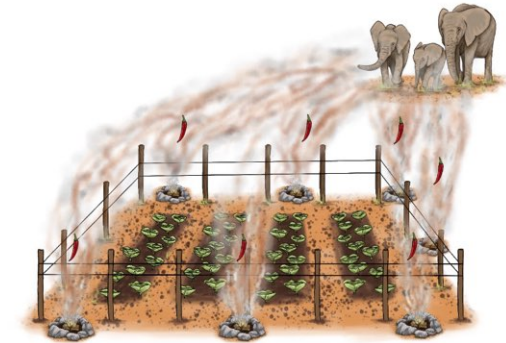
Press this into moulds of 20cm diameter and 15cm height. Use moulds like an old tin or plastic box.



Remove the moulds once the mixture has set and then leave out to dry.



Turn the briquettes over after two days to ensure the briquettes dried evenly.



When crops are ripe and elephants are visiting, establish small and controlled fireplaces around the farm.



Add these briquettes to produce a strong smelling smoke that will blow to the direction the elephants will approach the farm from.



Take care to check which direction the wind is coming from.



Do not leave fires unattended.



TYPE 2: CHILLI BALLS

PROCESS

Credit: Dinokeng Game Reserve's HEC Mitigation toolkit 4.0, Antoinette van de Water

INGREDIENTS



Elephant or cow dung



Sunflower oil or vegetable oil



Sharp pointed stick and Funnel



Clean and empty paint can



Kerosene/ Paraffin



Ground chilli powder

1.

First you need to collect some elephant dung.



2.



Dry the dung and form into balls and place to one side.

3.



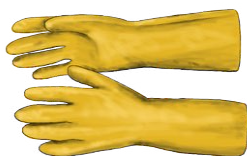
Take a medium bottle of sunflower oil. Pour out a little less than a quarter of the oil and fill the bottle with chilli.

4.



Shake well!

5.



This is a very strong repellent, so use necessary protective wear during this process.

6.



Use a stick to poke a hole in the ball, and use a funnel to insert the chilli liquid.

7.



Take half litre empty and clean cans of paint.

8.



Make small holes 3 inch above the bottom of the tin.

9.



For best and safest practise - put the dung ball in the tin can. Just before you plan to light it, add a few drops of kerosene or paraffin on the ball and place it in the tin can to prevent a fire.

10.



Once the ball is alight, gently turn it around in the can to smother the flames so that it is just smoking.

11.



The balls burn slowly and produce a strong smelling cloud of chilli smoke.

12.



Cover the tin with its lid so no water goes inside.

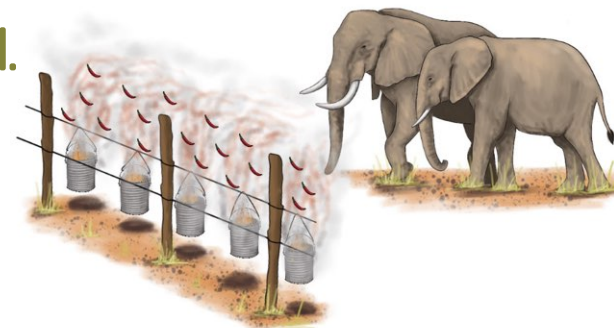
13.



The smoke should come out of the holes in the tin and spread into the surrounding area.

Hang this around several safe areas around the farm

14.



If elephants are approaching the farm, the smell of the burning chilli smoke will keep them away.



Ensure you are **close enough** to keep an eye on the smoking cans.

Take care of your **safety** and do not **stand downwind**. Chilli smoke can be very unpleasant for humans too!



Communicate with your neighbours and take special notice of the **wind direction** to avoid harmful interaction with the smoke.

PROS +

- Research has shown that **even the smallest amount of chilli smoke causes elephants to react and leave!**
- Chilli briquettes are a more **affordable** option for small scale farmers.
- Installation is **very flexible and easy** to implement.
- Materials are **locally available**, especially when chilli is grown as a buffer crop.
- Can be effective in helping **change elephant movements**.



CONS -

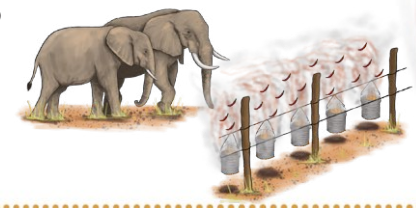
- Sometimes elephants change their movements to **go around chilli sites** either before or after the chilli is burnt.
- Depends on the **wind direction**. If the smoke blows in the wrong direction, this can cause irritation to the farmer if his/her homestead is nearby.
- A big amount of chilli is needed** for production. Many chilli bricks are needed to protect a field. (**5 briquettes every 100 metres**)
- During the rains, this is not very effective. Some type of roofing might need to be considered in case of **strong rains**.
- These do not deter elephants in the long-term. Chilli briquettes are good as a **short-term measure**, but not as long-term strategies.



Credit: Wildlife, Research and Conservation Society, www.wrcsindia.org

TYPE 3: TIN CHILLI SMOKE

- During the rains, it may be difficult to make chilli smoke so we suggest the use of a **chilli smoke tin**.
- Take **1/2 litre** empty tin cans with a lid e.g. old paint tins
- Make small holes **3 inch** above the bottom all around the tin.
- Put coal, **dry grass, red chilli pods, chilli seeds**, etc. inside the tin.
- Light the fire inside the tin so smoke will come out of the holes. **Cover the tin** with its lid so no water goes inside.
- Hang** several such tins around **entry point**.





METHOD 4: CHILLI BOMBS, CRACKERS OR AEROSOLS



Use combined methods for most effective farm protection.

If lights and air horns have not worked, you can **throw multiple chilli crackers in succession**. One single cracker might not be enough to completely chase an elephant herd off a farm.



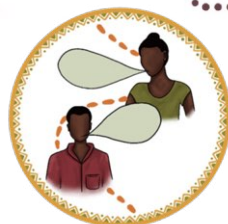
This is best used to **prevent** elephants and other animals from entering a farm.

Over time, these may decrease in effectiveness as **certain bull elephants** may get used to it.

They may chase **out** elephants that are already in farms.



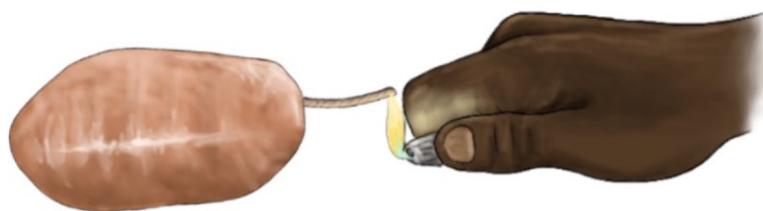
Be wary of chasing elephants into **neighbouring farms**.



Good communication is key

TYPE 1: CHILLI BOMBS OR CRACKERS

- Chilli bombs are a mixture of chilli and firecrackers, in a condom or large balloon.
- The idea is to **fill the condom with chilli** and then top it up with a firecracker.
- It is then lit and thrown near elephants, the **result is a bang that has light, smell of chilli and noise**.
- Chilli crackers **combine sound and physical deterrents** by using chilli powder and firecrackers.



Credit: a Honeyguide innovation. Honeyguide in partnership with The Nature Conservancy trialed this in the area surrounding Tarangire. www.honeyguide.org.

MATERIALS NEEDED

Credit: Conflict Mitigation Manual by the Elephant Education and Training PEACE Project, www.ehranamibia.org



Stone/sand



Chilli powder



Condom or balloon



Firecracker

PROCESS

- These are made from **chilli powder and a firecracker**, all tied together in a condom, to create a chili cracker.

Small particles of stone are mixed with the chilli to get some weight on the condom to increase throw distance (**3 teaspoonfuls of each chilli powder, 3 teaspoons of stone/sand**).

- The chilli crackers are then lit and thrown above the heads of elephants, taking wind direction into account.

- The **explosive sound of the device and the chilli powder irritant** combine to form a powerful deterrent to elephants.

- Take care when handling firecrackers or explosive devices.



PROS +

- Combines two known deterrents into one, **using smell and sound deterrents**. The loud noise helps with scaring away visiting elephants.



- Cheap and easy** for anyone to assemble given basic training.



- Effective in deterring elephant herds if used **in succession**.

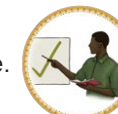
CONS -

- There can be **high risk** to the user and the elephant if used **improperly**.



- Some **bull elephants** may still return to farm not long after being chased away.

- Training required** to ensure proper use.



- Do not** use this in a place where chilli bombs can be misused.



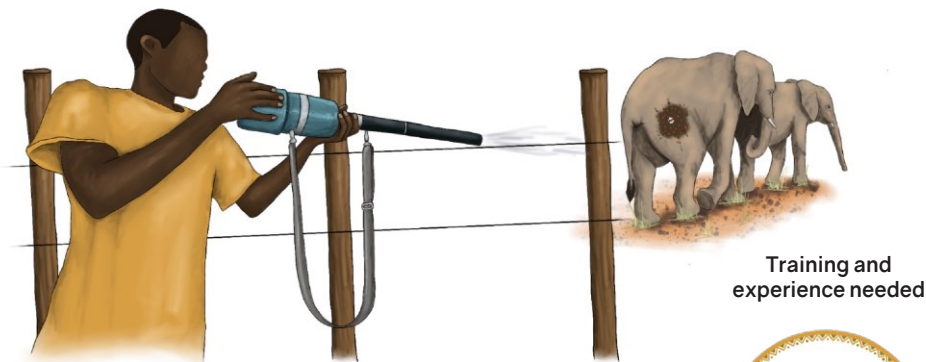


TYPE 2: CHILLI AEROSOLS



- ⦿ This method may use **motion triggered devices** that can be installed on the fence (like automatic air freshener dispensers).
- ⦿ When an elephant gets close to the fence, the **device will spray a light peppered mist** in the elephants direction.

TYPE 3: CHILLI PEPPER GAS DISPENSER / CHILLI BOMBERS



Training and experience needed



- ⦿ This is a **device to shoot ping-pong balls filled with chilli-oil extract** against elephants.
- ⦿ The ping pong balls need to be fired with **strong force**, so it will reach the elephant and break when hitting the skin.
- ⦿ While these are unpleasant, they are **non-lethal**.



Do not misuse this device, and use other deterrents first!

Credit: Repelling elephants with a chilli pepper gas dispenser: field tests and practical use in Mozambique, Zambia and Zimbabwe from 2009 to 2013

PROS +

- ⦿ This is good because elephants can be deterred **without direct human intervention**.
- ⦿ When used correctly this can be a **very effective method**. (positive outcomes in Zimbabwe)

CONS -

- ⦿ Relatively **expensive and high maintenance**.
- ⦿ The direction of the spray may be **influenced by the wind**.



CHILLI BEESWAX RUB



Beeswax rub is a new innovation combining dried chilli melted into beeswax which helps it stick to various surfaces.

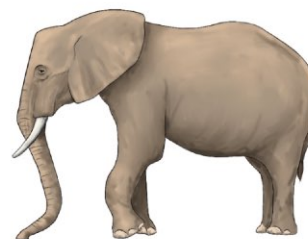


Credit to Loki Osborn and Malvern Karidozo from Connected Conservation who have designed this.

www.connectedconservation.com



Only to be applied by professionals during darting operations!



Elephants



Outdoor structures



Tree saplings



Water pipes



Fence posts

It retains the chilli oil enabling it to be an **effective elephant deterrent** for many weeks.

ACTIONS TO TAKE

CHILLI MARKETS

Chilli fences and chilli bricks can create a **new income stream** for farmers, as they grow chillis for themselves, to use and as a cash crop. Extra can be sold in the market.

With **new enterprise development**, it helps when there is already an existing market for chillis!

Value-added products can be made out of raw chilli, including chilli oils, sauces, jams, powders and flakes.

TRAINING

Training and experience is needed with certain methods, particularly the more technical methods.

Chillies are **very potent** and can be **extremely painful** to humans too!

CHILLI PRODUCTION

If chilli pepper is going to be used as a serious deterrent, **local production** needs to be ramped up.

Try and scale up chilli production, through **establishing nurseries** or **greenhouses**.

WIND AND SAFETY

Wind is a big factor to consider with smoke and aerosol techniques.

Take care with children and the elderly.

Wash hands thoroughly when touching chilli.

HABITUATION

Elephants are very intelligent and may get used to a method.

Sometimes the **effectiveness of methods reduce** as elephants become **more habituated** to them.

Use these spicy deterrents in combination with other methods.

GOOD FOR DRYLAND

Chillies are more **drought resistant** than crop species like maize, and are more suitable for arid areas with more unpredictable rainfall (**grows well in low rainfall areas**)

ALTERNATIVE CROPS

Instead of growing plants that **attract elephants**, farmers are encouraged to plant crops that are disliked by elephants – e.g **sunflowers, ginger, lemongrass, chilli, garlic, onion, tobacco, rubber, cotton or eggplants** along the fence line.

This might reduce the appeal of crop raiding and may help **prevent fence breaking**.

CAUTION TIPS:

- When working with chilli, **do not to touch eyes, mouth and sensitive areas**
- Use **protective wear and safety equipment**. The use of rubber gloves is advisable when handling chilli
- Use methods strategically to avoid elephant habituation**
- When using boundary fires or chilli smoke techniques – **be careful not to set fire to the farm!**
- Keenly observe the direction of the wind.**
- These methods are **only suitable if the wind is blowing away** from the fields and home towards the approaching elephants
- Some methods require training and expertise. **Be sure to have the relevant training experience.**
- Take care** of livestock and children. **Prioritise safety first with all methods.**



CREDITS AND DISCLAIMER:

We have collected the information above from multiple projects. Main sources include: www.connectedconservation.com, www.honeyguide.org, www.wracsindia.org, www.ecoexistproject.org, and www.maraelephantproject.org. This manual is not extensive. To learn more on using chilli and explore literature further, see [References](#). Save the Elephants advises caution with all the methods collected and presented in this toolbox. Further research may be required before each site-specific implementation.

*Save the Elephants is not liable for any costs, damages or injuries incurred by the use of these methods.





METAL STRIP FENCE



The Metal Strip “Kasaine” fence installed around the outside of a farm creates erratic metal clanging noises as it blows in the wind. It reflects the sun or torch light towards approaching elephants creating both a visual and noise deterrent.

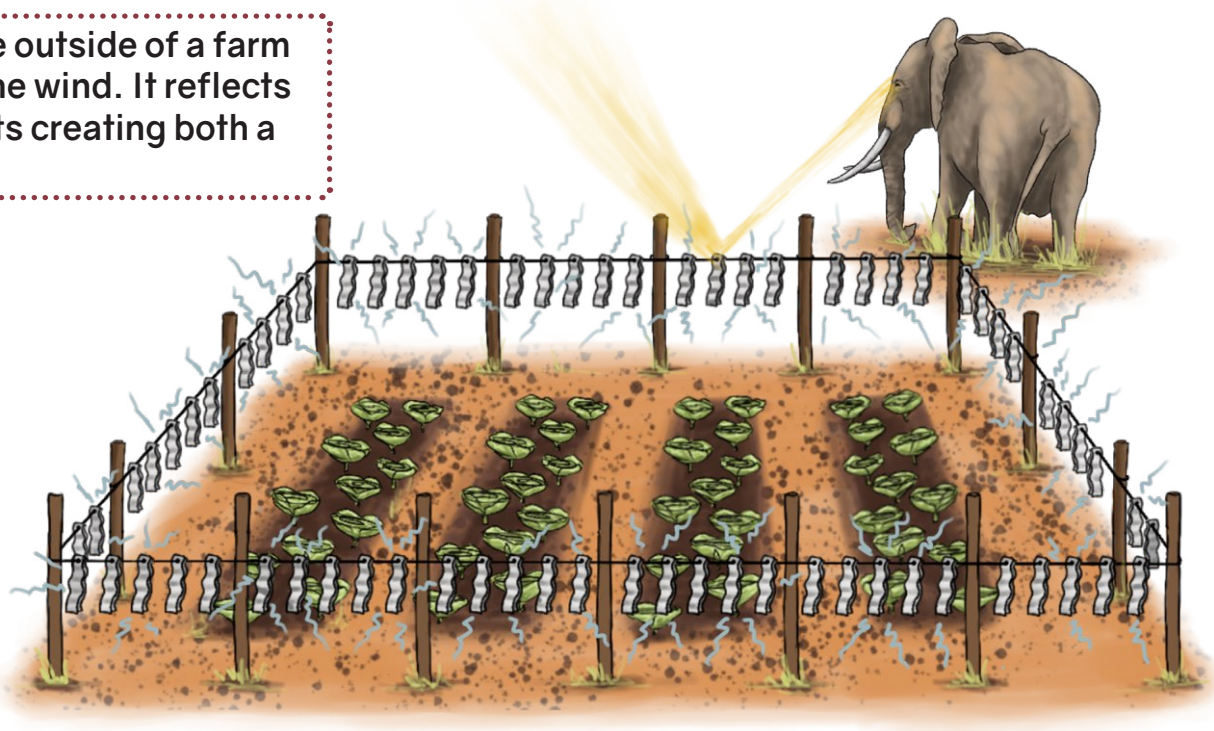


Kenya - Kasigau Wildlife Corridor, Saseyi



- The fence is made of lightweight strips cut from corrugated metal strips strung on binding wire.
- An ideal deterrent method for low budgets that farmers can make themselves from widely available materials.

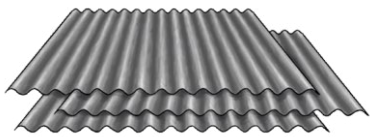
Von Hagen, R. L., et.al. (2020). Metal strip fences for preventing African elephant (*Loxodonta africana*) crop foraging in the Kasigau Wildlife Corridor, Kenya. *African Journal of Ecology*, 59(1), 293–298.



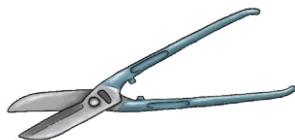
MATERIALS NEEDED FOR FENCE

To construct the Mabati/Metal strip fence, you will need to gather the following items:

As noted in the Construction Manual by Wildlife Works, 2021



Metal (mabati) sheets, metal rolls or any other galvanized metal (Iron or Steel)



Tin snips



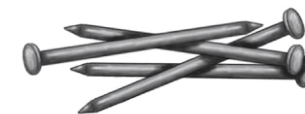
Binding wire



Hammer



Insecticide/old engine oil/nylon paper to protect posts from termites



Nails



Paint brush



Posts/trees to use as posts



Pliers



Shovel/jembe



Measuring tape

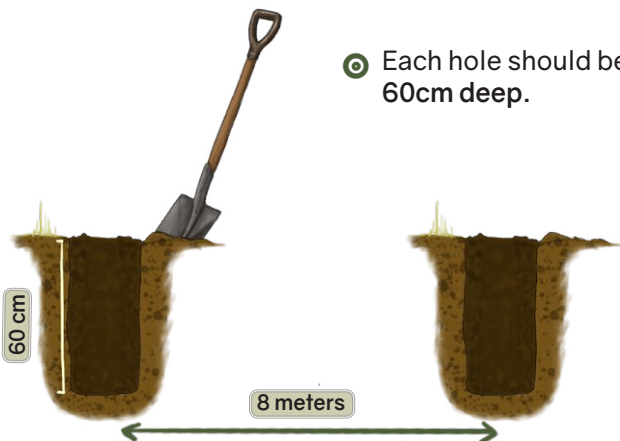


Thick work gloves for protection

CONSTRUCTION METHOD

PREPARATION OF POLES

- ⦿ Dig holes around your farm for the poles with a distance of 8 meters between each pole.

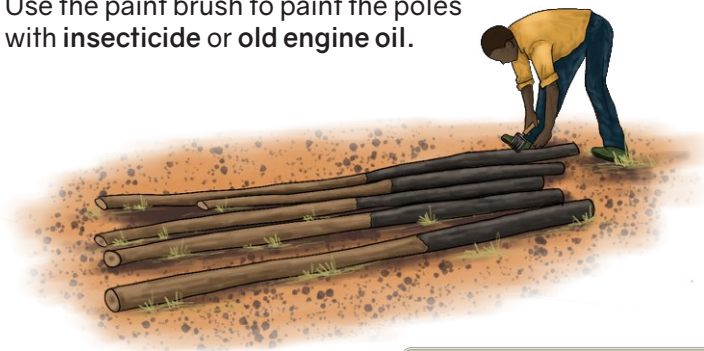


- ⦿ Each hole should be 60cm deep.

- ⦿ Each post should be 2.5m long.



- ⦿ Use the paint brush to paint the poles with insecticide or old engine oil.



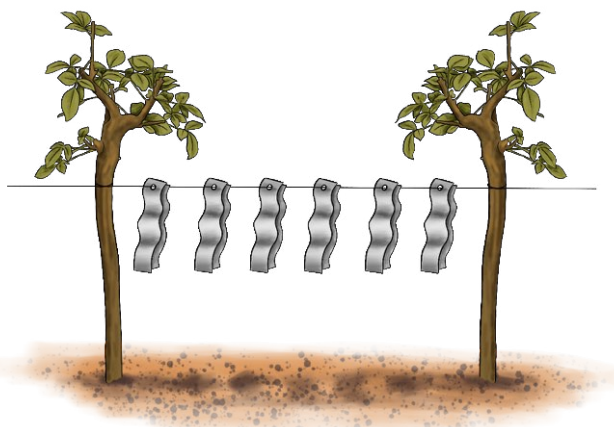
TIP
This prevents termites from destroying the poles.

- ⦿ Leave the treated poles to dry for 24 hours. After treatment, pack the poles into the holes firmly so they are set in position.

TIP
You can grow mint in your farm to keep termites away from the poles.



- ⦿ You can also tightly wrap nylon paper around the base of the poles.



TIP
Preferred option for poles is using natural trees like *Commiphora* spp, which re-grow with roots. There is no need to cover them with oil or insecticide.

PREPARATION OF MABATI STRIPS:

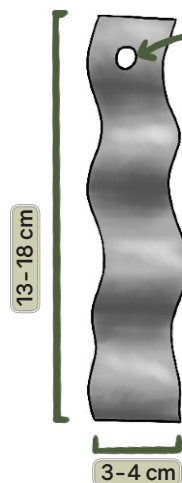
- ⦿ Using tip snips, carefully cut the Mabati sheets with measurements of 13 to 18 cm long and 4 to 5 cm wide.

SAFETY TIP: Use thick work or rubber gloves to avoid injury.

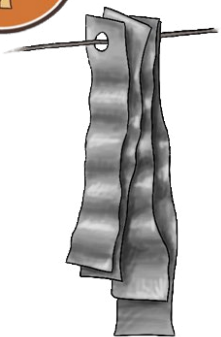


TIP
Different sizes assist by causing more noise when the metal pieces clatter against each other.

- ⦿ Use a nail and hammer to bang a hole in the top of each metal strip to hang them.

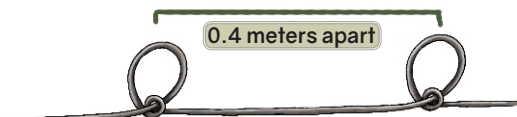


TIP
Make sure the hole is not too close to the edge of the metal strip, as it may cut and fall off.



- Cut the binding wire to **12 m long**. This will be the length between 2 poles, including loops and end sections.
- Gather **3 to 4 metal strips** together and put the binding wire into the holes.
- Make sure you leave **1m** of plain wire on each side to tie **tightly** around the poles. Use a nail if you need to create a firm fixing for the wire on the post.

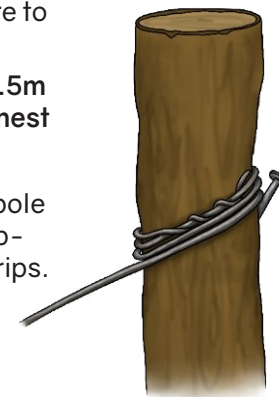
- Using pliers, make twists on the binding wire between each bundle of metal strips.



TIP
This is to prevent all the metal strips from sliding together on the wire which would reduce effectiveness.

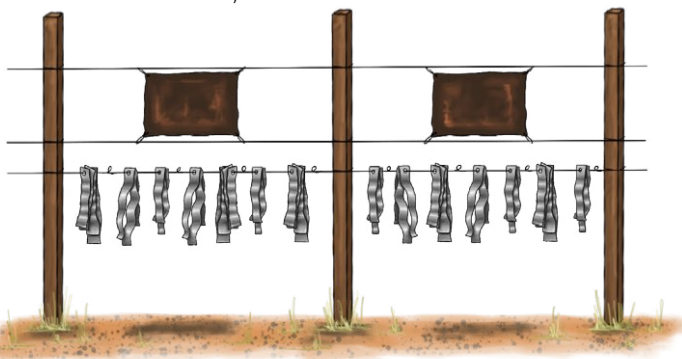
- Continue this process until you have prepared a length between 2 poles.

- Tie each end of the binding wire to the poles.
- Wire should be at a height of **1.5m** from the ground which is the **chest height** for an elephant.
- You can hammer a nail on the pole and hang the wire over it to support the weight of the metal strips.
- Continue until you have fenced the whole area of your farm.



TIPS FOR MANAGEMENT

- It is important to have **strong poles** to support the weight of the metal strips.
- We advise **removing the Metal Strip “Kasaine” fence** after harvest season, and store it. The less elephants are exposed to the metal strip fence, the less likely they are to become used to it.
- With time, the moving metal strips will **wear down** the hole and fall off.
- The shininess of the metal will **dull** with time, but the noise should remain.
- **Add a second layer of metal strips** for more effectiveness.
- **Combine with Chilli Fence or other Noise Deterrent methods.**



CAUTION TIPS:



- Beware of **sharp corners** of the metal which can cut skin.
- Use **protective equipment** when needed.
- Minimize usage of insecticides. In high amounts they will **negatively affect** the environment.
- There is a risk of **elephant habituation**. It is best to combine different methods to increase effectiveness.

+ PROS

See: [Kasaine Metal strip fence Construction guide](#).

- **Low-moderate** set up cost.
- The Metal sheets are **easily available** at local shops.
- The fence requires **low maintenance** as metal lasts for **years**.
- Fencing is a **long-term investment**. Good fences should last several years.
- The erratic noise generated by the fence may make this technique **resistant to habituation**.
- Any **sound or reflection** could **prevent elephants** from approaching closely.
- If elephants break through the fence, the **noise** and the annoyance of the sharp metal may make them **feel unsafe** and could wake up the farmer who can chase away the elephants.



CREDITS AND DISCLAIMER:

This idea was created in Kenya by Simon Kasaine and developed and tested by the Elephants and Sustainable Agriculture in Kenya (ESAK) project and its partners: Wildlife Works, Western Kentucky University, Jomo Kenyatta University of Agriculture & Technology, Auburn University, the Earthwatch Institute and the International Elephant Foundation. For literature and resources used, see [References](#). More research may be required before each site-specific implementation. Safety and caution is advised with all the methods presented in this toolbox.

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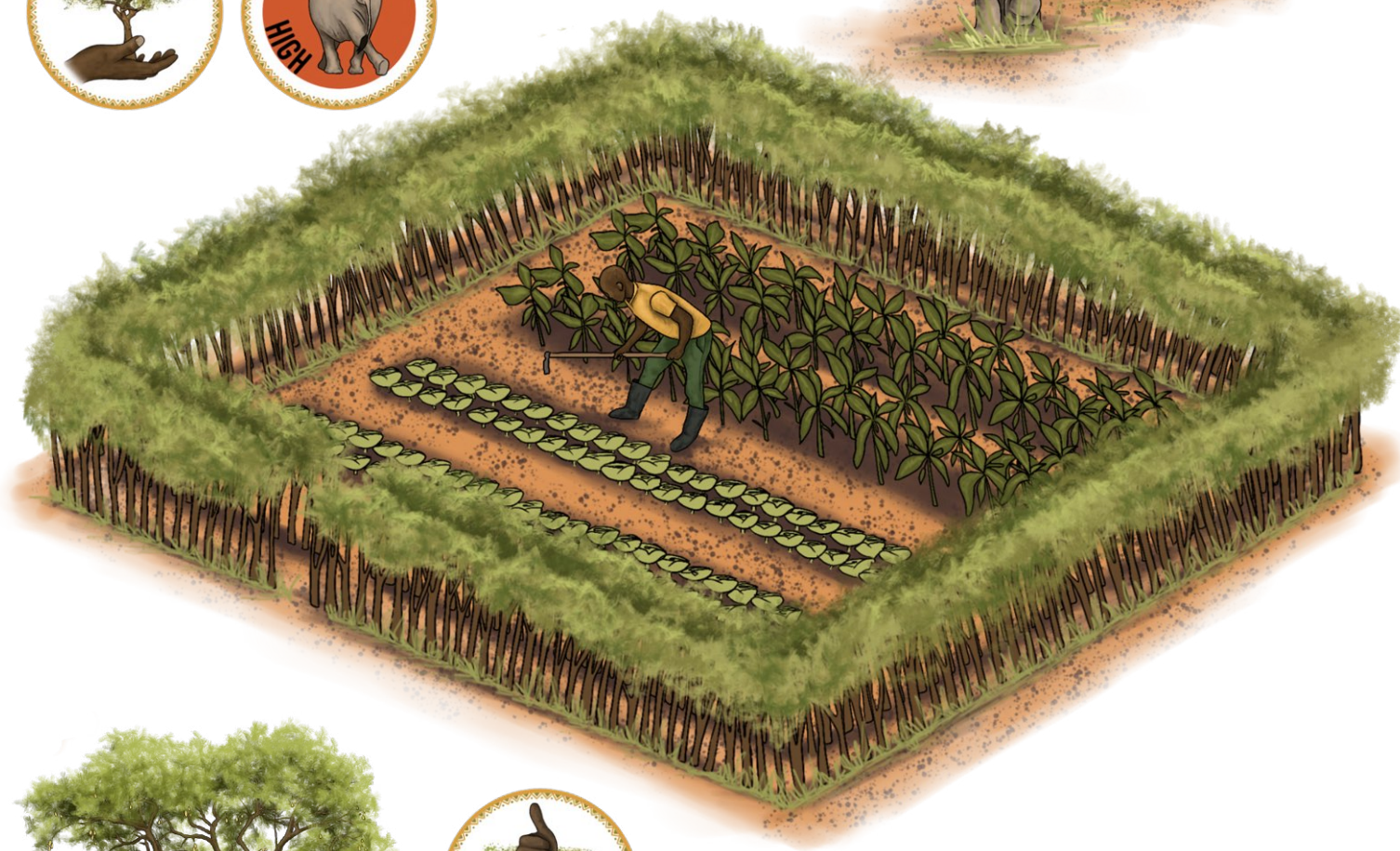
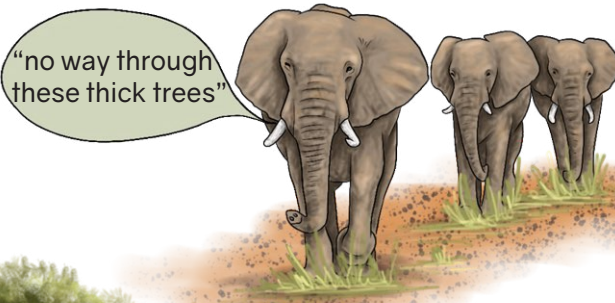




BIO-FENCES AS BARRIERS



These are eco-friendly barrier fences made from living plants or trees that keep elephants and other wildlife away from farms and compounds.



With natural fencing, instead of cutting down trees to make materials for building fences, we can live in harmony with nature by planting more trees and shrubs.

Placing any type of boundary, such as bio-fences, trenches, or electric fences must be considered carefully so as not to increase conflict by cutting off movement corridors, fragmenting populations, and causing elephants to become more desperate or aggressive. (Fernando et al., 2008; Gunaryadi et al., 2017).



Apart from their protective role, live fences play an important part in environment management, soil stability, nutritional balance and income generation.



Selection of plant species, design of fences and management all depend on climate conditions.



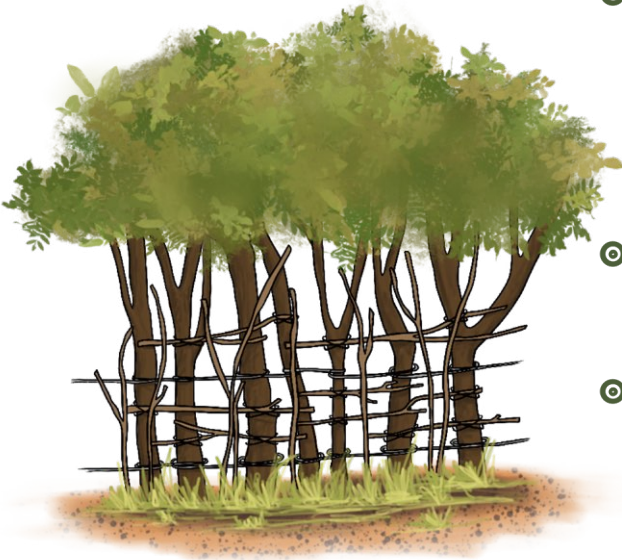
Mishra, S., Vasudevan, P., & Prasad, S. (2011, June). [Biofencing- an eco friendly boundary wall.](#)



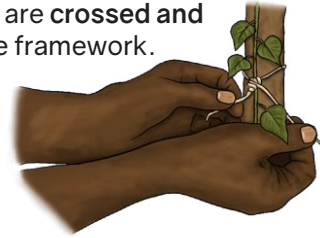
DESIGN OF BIO-FENCES:

A) LIVING FENCES WITH WOODEN FRAMES/LIVE FENCE POSTS:

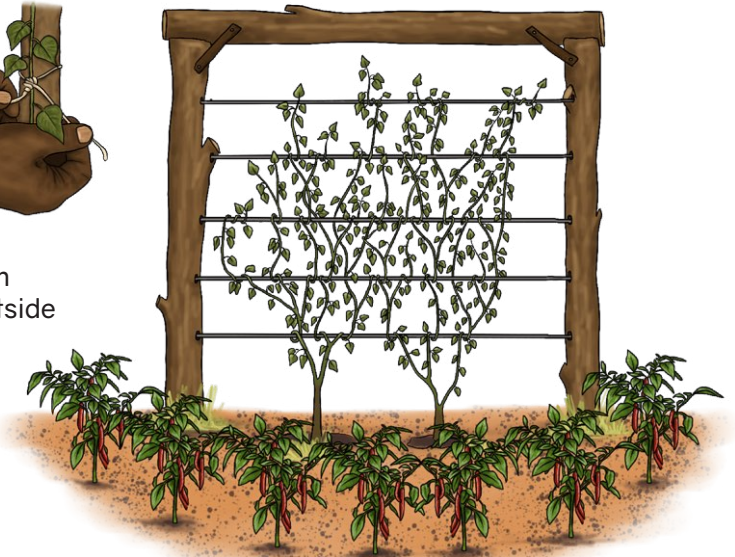
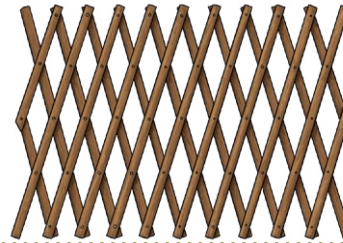
- Live fence posts are trees that are grown in single lines used instead of metal or wooden posts for supporting **barbed wire, bamboo or other fencing materials**.
- Dense dead twigs and branches** can also be tied upright along the live fence.
- For **creeper plants**, creating a structure can help the plants grow around the frame and eventually form a **dense, tight barrier fence**.



- As the trees grow, branches are **crossed and tied** to the framework.

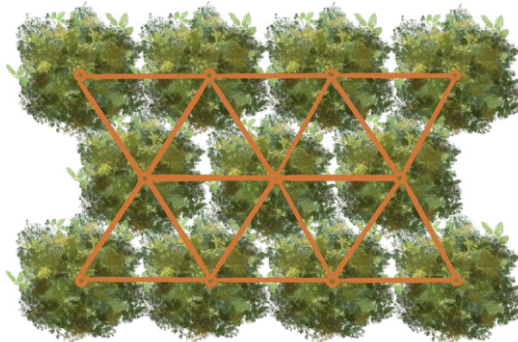
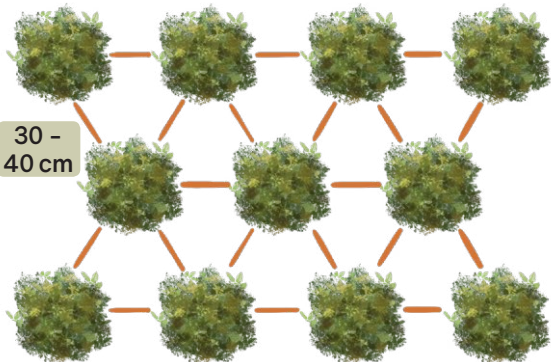


- Living fences combined with **chilli shrub fence** on the outside may keep elephants out.



B) HEDGES:

- Live hedges are **thicker, more densely spaced** and are **intercropped** with a variety of species.
- Hedges are often comprised of **thorny species** and may or may not be strung with wire.
- The trees are planted in **zigzag pattern**, having a gap of **30cm- 40cm** between the 3 to 4 rows.

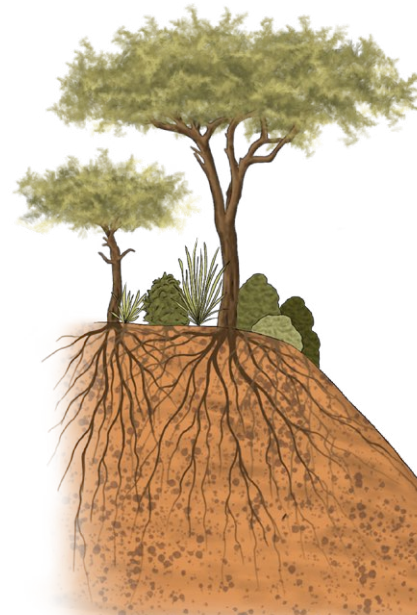


DIGGING TRENCHES WITH BIO-FENCES:

A system of trenches improves **water infiltration** and increases root growth.

The trenches aid in plant recovery while minimizing the labour work.

Border trenches should measure a **width of 50 cm for single rows, 80 cm for double rows**, and be **60 cm deep**.



See Trenches for more information.





EXAMPLES OF COMMON TREES USED:

Thorny plant species work best to form live barriers and hedges as the thorns may cause pain to elephants.



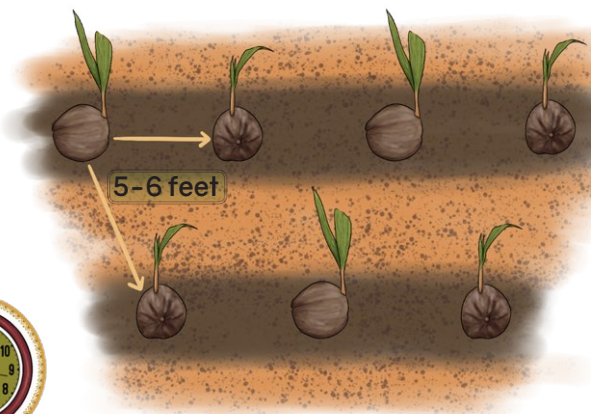
Location; Sri Lanka

1. PALMYRA PALM TREES:

Palmyra repels elephants with **razor-sharp edges** that grow on the trunk.

It involves planting **four rows of seeds in a zig-zag pattern** with 5-6 feet between each tree planted and approximately 8 feet between rows.

It takes approximately **eight years** for palmyra plants to reach full maturity and be at a point where they can function as a thick spikey bio-fence (Stearns, 2014).



Another **long-term deterrent fence** must be used for the time being while the trees are growing.

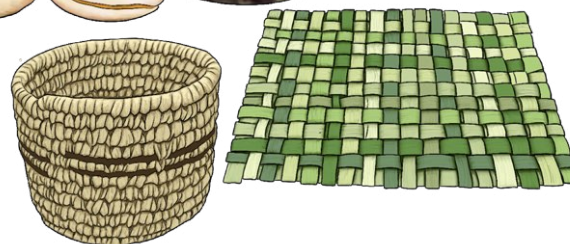
The Palmyra fences can survive **extreme weathers** such as droughts, forest fires, and live in any type of soil.



This tree species produces **fruits that can be sold for additional income** for the farmer.



Farmers can use the **leaves** for fuel and thatching roofs, walls and mats, and weaving baskets.



See Tree Protection for more



Read more on: [Palmyra Bio Fencing: a sustainable solution to resolve human elephant conflict in Sri Lanka. Practical Action Sri Lanka.](#)

YouTube links: - https://www.youtube.com/watch?v=aoASL_lqGAE - <https://www.youtube.com/watch?v=oLN3RVCFQzq>

TOP TIP

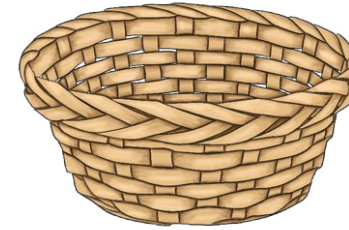
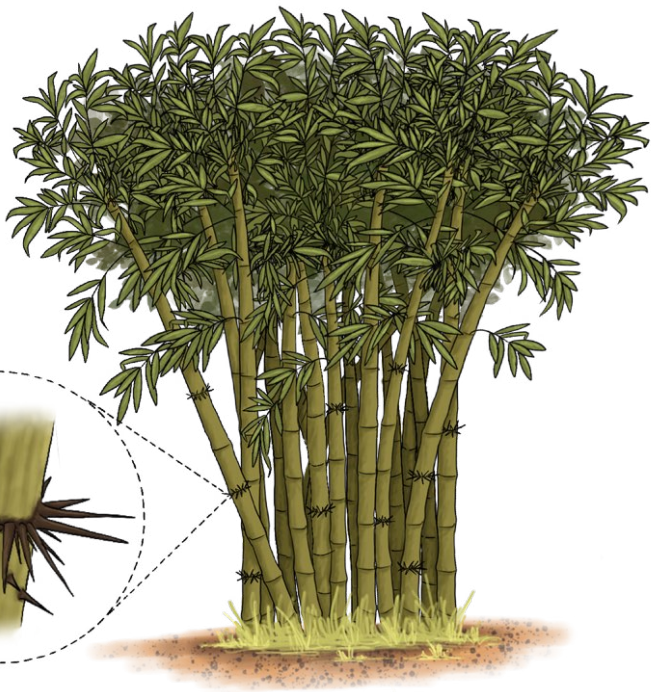
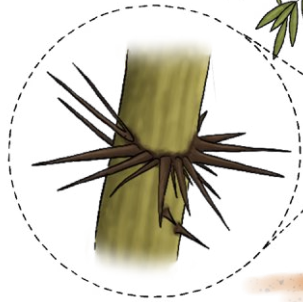
To ensure elephants do not feed on the fruits, cover the tree trunks with **dung paste** or build a **sharp rock barrier** around the trees.

2. THORNY BAMBOO:

- They grow **fast** and have other uses such as- house construction, thatching of roofs, weaving baskets, furniture, etc. that can be sold for **additional income**.

- Bamboo **skins** are also weaved into **barriers**, which are later sealed with **chilli and cow dung paste**.

See Chilli Deterrents and Tree protection for more on dung paste



3. ACACIA SPECIES:

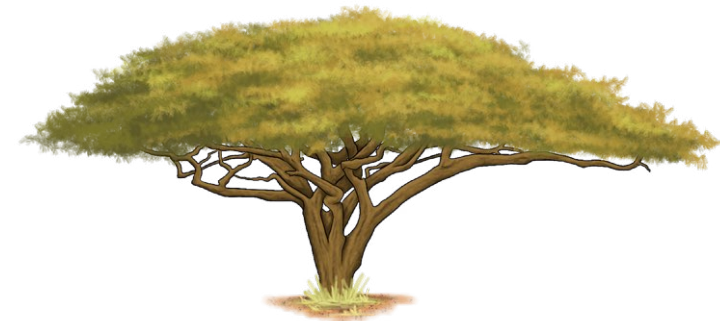
- Species such as *Acacia brevispica*, *Acacia nilotica*, *Acacia tortilis* can be grown as biofences.



Acacia brevispica



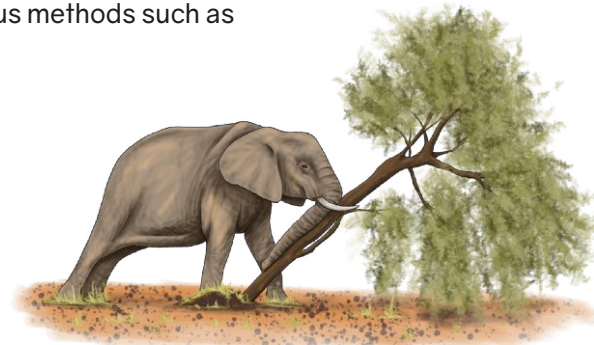
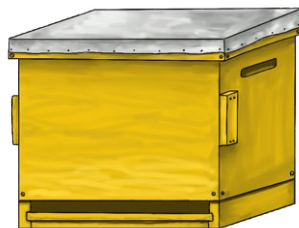
Acacia tortilis

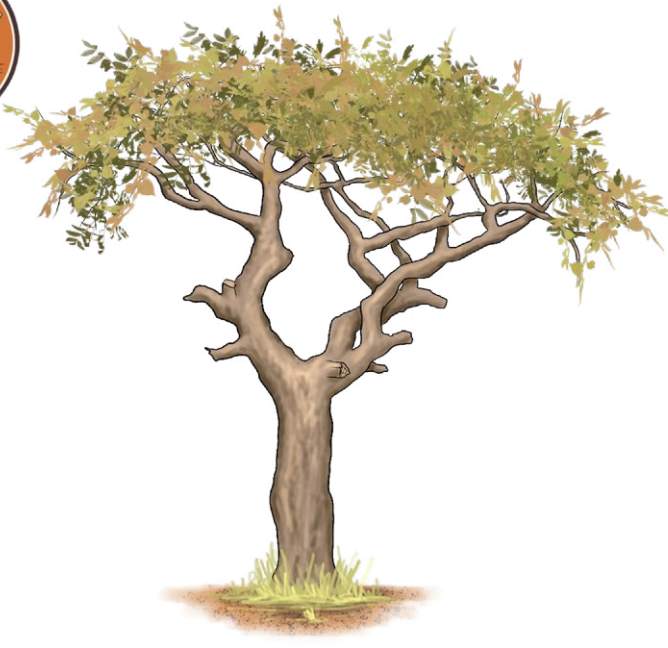


Acacia nilotica

- Elephants like to feed on the leaves of Acacia trees. You can protect your trees using various methods such as **hanging beehives** or applying **dung paste**.

See Tree Protection for more

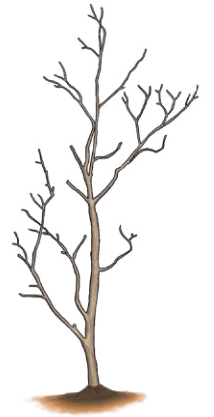




4. COMMIPHORA SPP:

- ☉ Trees such as *Commiphora africana* grow well in dry lands, providing medicinal, food and various other uses.
- ☉ A post cut from a mature tree can be re-planted in the soil and it will re-grow into a new tree.
- ☉ Some Commiphora species such as *Commiphora Jacq* are favoured by elephants and in some areas the trees are destroyed in great numbers, so be sure to understand which species you are using.
- ☉ For example, in the Mapungubwe National Park, in Northern Limpopo Province, South Africa, elephants have severely damaged these trees. Often the very old trees are targeted and almost destroyed completely.

Holscher, B. (2011). Commiphora. Plantz Africa.
<http://www.plantzafrica.com/plantcd/commiphora.html>



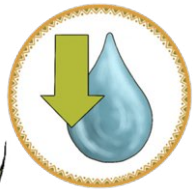
5. CITRUS FRUITS- LEMONS & ORANGE:

- ☉ The Orange Tree Barriers: In Sri Lanka, [Project Orange Elephant](#) is an innovative initiative put forward by the [Sri Lanka Wildlife Conservation Society \(SLWCS\)](#) in the year 1995. They theorized that Asian elephants avoid citrus fruits.
- ☉ They approached the Dehiwala Zoo and conducted feeding trials on elephants by offering different foods such as carrots, bananas, cucumbers and orange.
- ☉ Elephants avoided the orange leaves, while eating the other food.
- ☉ Orange trees mask the smell of crops and deliver a natural deterrent to prevent elephants from raiding farms, hence, reducing the chance of conflict.
- ☉ Mature citrus trees are tall enough that the elephants won't trample them.
- ☉ The fruits from citrus trees can be used to make pickles, or sold in the market by the farmer.



SISAL:

- ☉ Agave is a fibre yielding drought tolerant plant that grows well on drylands.
- ☉ Cactus and similar plants are good for dry, arid climates where other types of plants have difficulty surviving.





PROS +

Bio-fences act as **windbreakers**, protecting soils from soil erosion, which overall increases **crop yields**.



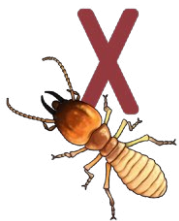
It is environmentally friendly.



Cost effective, as compared to other walls such as electric fences and stone walls.



Termites will not attack living trees.



Strengthens and enriches soils.



Moderate maintenance required to remove weeds.



CONS -

You must know which tree species will grow well in the weather in your environment.



It takes a **long time** for trees to mature and become effective.



Seedlings require lots of **care and attention**.



See Crop Choice & Kitchen Garden Practices



If not taken care of, the seedlings will die in the initial stages.

TIPS

Make sure you are not blocking important **wildlife and elephant corridors**. This will increase conflict and force elephants to enter in your farms.

Use combined fence barrier methods while the seedlings are still maturing.



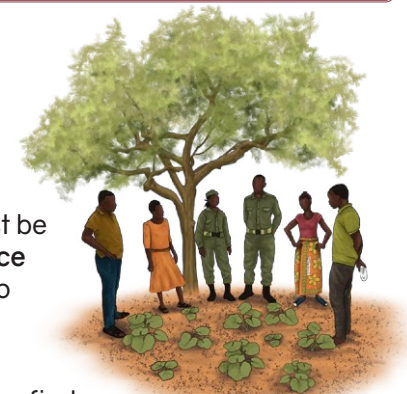
See Protecting Schools & Compounds for more on Bio-fences.



Protect your trees from debarking by elephants- see **Tree Protection**.



When relying on bio-fences as farm barriers, there must be consideration on long-term **landuse planning** and advice from informed wildlife advocates and rangers in order to place fences in appropriate areas.



The fences must be **weeded** two or three times during the first year after planting, to reduce competition from weeds.

Medicinal plants such as **Neem** and **African cherry** can also be grown within live fences. (Elevitch and Wilkinson 2000).



Some tree species **omit smells** that elephants do not like, which can be used to mask the smells of palatable crops.

Always consider using **organic/natural pest control**, when necessary.

Be careful when selecting species like bamboo to use as a living fence, as they can easily **spread out of control** if they're not carefully maintained.

[Giribawa Elephant Bio Fence. Regenerative Organic Sri Lanka.](#)

CREDITS AND DISCLAIMER:

We have collected the information above from multiple sources that are sourced throughout the document. This manual is not extensive. The learn more and explore about Bio-fences and Walls/Barriers, see [References](#). Some original words commonly used have been simplified for easy understanding. Save the Elephants advises caution with all the information collected and presented in this toolbox. Further research may be required before each site-specific implementation. * Save the Elephants is not liable for any costs, damages or injuries incurred by the use of these methods or information.





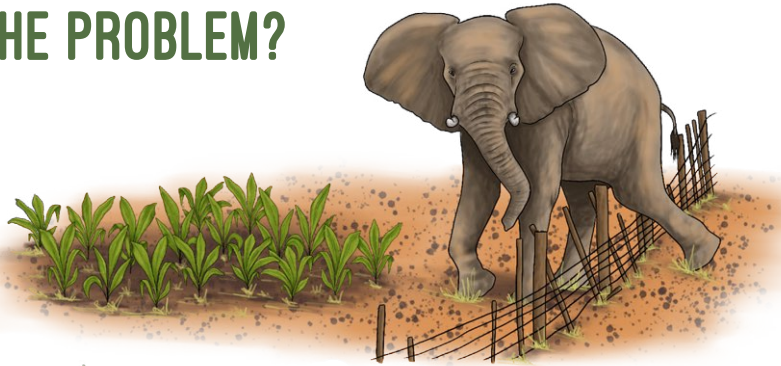
FOOD STORAGE AND PROTECTION



Goal: Develop elephant-proof crop storage methods to help protect your food from elephants.

WHY/WHAT IS THE PROBLEM?

In addition to raiding crops, elephants may **damage houses** and property in the search for stored food.



Elephants sometimes learn to feed on **staple crops** or other **readily available** food on farmland or stored in houses as it tends to be nutritionally rich.

COSTS



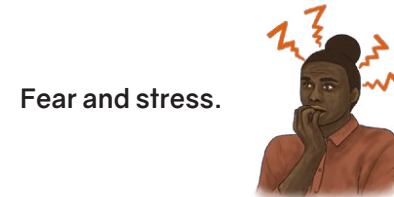
Damage to property.



Loss of income from crops.



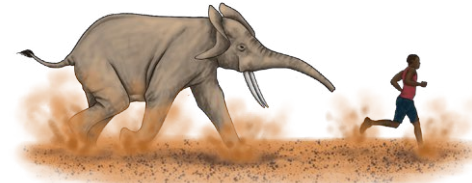
Loss of food source.



Fear and stress.



Human injury.



Other negative or possibly harmful interactions between humans and elephants.

MAIN IMAGES OF THE PROBLEM



Property damage – Elephants may damage property in the pursuit of food by breaking into homes to access food sources.



Elephants may cross paths with humans in their search for food within homes or buildings.



Surprise encounters and direct confrontations with elephants can be extremely **dangerous** or **fatal**.



Food security – Threats to food stores and income from selling food as elephants may consume valuable subsistence harvest. This can lead to more livelihood **stress** and household **vulnerability**.



WHEN IS FOOD RAIDED?

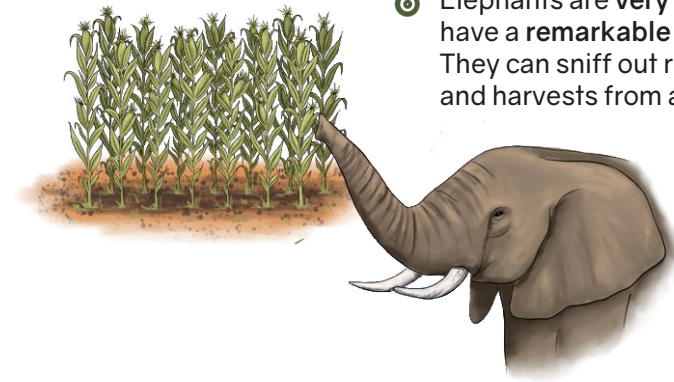
⦿ This usually happens during the **night time** when elephants are more comfortable walking through villages and farms.



⦿ Or in the **dry season** when food sources are **scarcer** for elephants to find.



⦿ Elephants are **very intelligent** and have a **remarkable sense of smell**. They can sniff out ripe and tasty crops and harvests from a **distance**.



METHODS TO HELP PROTECT FOOD

HELPFUL TIPS SAFER FOOD STORAGE METHODS

- ⦿ There are different types of grain stores – use a method that is most appropriate for you.
- ⦿ The most effective way to avoid elephant raiding is to store crops in **concrete/brick granary stores**.
- ⦿ Unfortunately, these types of stores can be **expensive** and **labor intensive** to build.
- ⦿ Whenever possible, farmers should store their crops in **airtight containers** so that elephants cannot smell them.



Sealed calabash



Bucket container



Large plastic Tupperware

Ensure your grain is well dried before storage.

EXAMPLES OF FOOD STORES

1. TRADITIONAL TIMBER/ THATCH STORES

- ⦿ These are typically made of **timber**.
- ⦿ However, elephants may find these easy to destroy or damage and they are more fragile and vulnerable to elephant raids.
- ⦿ These can also be **vulnerable to pests**, if not airtight.
- ⦿ Problems with some of these traditionally built stores can be addressed by modifying the design.



South Africa



Source: International Elephant Foundation
<https://elephantconservation.org/hec-in-nkala-game-management-area/>



Use combined methods for extra protection/ barriers to hinder elephants advancing.



- For example - Buffer crops, chilli fences or white rock barrier with sharp rocks.
- Use specific concentrated boundary protection methods to protect food stores or growing crops.



- These help to add extra protection.
- Sharp white rocks can be used to fortify traditional timber structures.



See document on Chilli deterrents for ways to use chilli to protect your grain store.

SOURCES:

See Awely Red Caps Program, Awely Wildlife and People (2015) Eva Gross for construction details and concept design - <https://www.awely.org/en/information/>

2. BRICK OR CEMENT STORE OR 'FELUMBUS'



- Traditional grain stores can be adapted to be stronger and less vulnerable to raids using concrete instead of just mud, and adding a **heavy lid** and **small door** opening but maintaining a traditional shape.
- The store door can also be locked, helping prevent theft by people too.
- A felumbu/ 'elephant-safe grain store'- is a grain store, shaped like a giant upturned mug and is made of bricks and cement and can hold up to a ton of maize grain.
- There are different variations to this design.



WHAT IS AN ELEPHANT SAFE STORE

- This is a **concrete and sealed construction** consisting of a body attached to a cement grounding.
- It has a **removable lid** for filling crops and a small door on the lower part, for regular access to the grain.



- Elephants are known to easily demolish traditional structures and break into homes.
- These safe stores **help to reduce damage** to homes as elephants come into the village looking for food – because they make it less easy for elephants to smell out or access the grains.
- Best for individual family level or shared between a small group (good cooperation is needed if shared between groups as grains inside are merged).

Credit: The elephant safe granary store has been developed and successfully tested by the French based NGO Awely – Wildlife and People and further implemented by Conservation South Luangwa, Zambia.



A. BRICK OR CEMENT

- ⦿ Made of locally produced bricks and cement.

+ **Pros:** lower cost - bricks can be produced in the village.

- **Cons:** firewood is consumed for burning bricks and, if not made accurately, the store might crack.

- ⦿ Needs to be constructed well, or it will be at risk of cracking.

MATERIALS



3 bags cement (for construction, lid and plastering)



300 bricks (dimension: L: 22.5 cm, W: 12 cm, H: 7 cm)

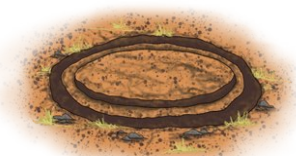


1 wheelbarrow of stones.



19 wheelbarrows of river sand.

1.



Digging the foundation with a diameter of 145 cm. Dig the circle with a depth of 10 cm.

2.



Lay mortar of cement into the ring and lay 3 layers of bricks. When dry, fill the centre with soil, hard rocks, water and compact.

3.



Once foundation is dry, lay plastic sheet of 2x2m on top to create a moisture seal. Then lay bricks in a circle to construct the round wall. Use 16 bricks per layer. Leave out 1 brick per layer to create small door opening about 10cm - 10cm.

SOURCES:

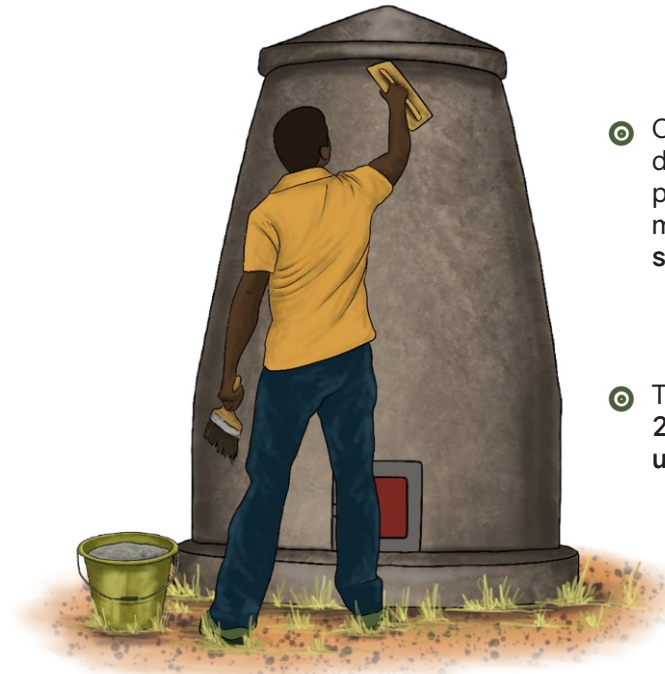
FAO, <https://www.fao.org/3/x0530e/X0530E05.htm>
Awely Red Caps Program, Awely Wildlife and People (2015) Eva Gross for construction details and concept design; Conservation South Luangwa.

Conservation Lower Zambezi Watch: Elephant Safe Food Stores in South Luangwa, Zambia, 2021 - <https://www.youtube.com/watch?v=MOncVdXF4BM;>



Zambia

B. FULL CEMENT STORE



- ⦿ Once the brick construction is dry, use a wooden block to plaster the outside with cement to give the structure extra strength.

- ⦿ These can be used to store 20 x 50 kg bags of maize, upto 1,000kg.

<https://cslzambia.org>

<https://cslzambia.org/human-wildlife-conflict-mitigation-community-engagement>

+ **Pro:** no fuelwood consumed and store is heavy duty.

- **Con:** expensive because all materials must be purchased.

MATERIALS



7 bags of cement (3 for blocks and 3 for construction, lid and plastering)



Wooden block (to plaster cement onto the brick structure).



1 wheelbarrow of stones



30 wheelbarrows of river sand



TIPS:

- Poorly constructed shelters may crack – allowing intrusion of pests like termites or weevils. Ensure there are **no cracks or holes** in your store as pests will be able to infest your store.
- Shelters need to be properly built and maintained, **using construction instructions**. (See Awely booklet for more details)
- Create a lid that can be fixed on and removed during the next season. **Seal the lid well**.
- **Door** – Construct a small door at the bottom in order to access your grain. You can include a lock in your design to help prevent theft. Make sure it's wide enough to fit a spade to shovel out your grains.
- It is important to seal the lid and door properly so that no insects or other pests can enter. A **roof** is recommended to help **protect the structure** from the elements in the long term.
- Regular **checks and maintenance** are required.
- **Clean and dry** your store between harvests.
- Maize needs to be **perfectly dried** for storage.
- **High initial investment cost** due to materials needed, but low maintenance once built.



SOURCES:

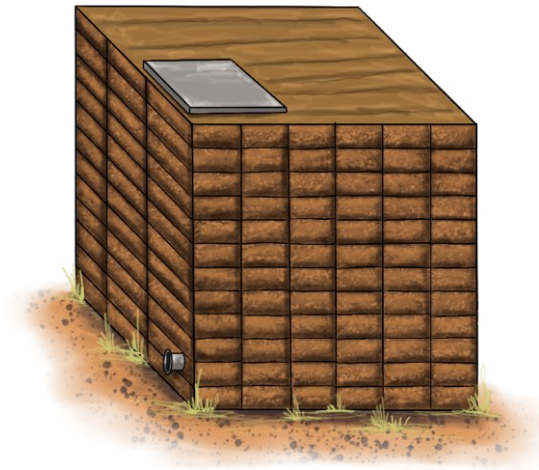
See Awely Red Caps Program, Awely Wildlife and People (2015) Eva Gross for construction details and concept design.
Conservation South Luangwa -
<https://www.youtube.com/watch?v=MOncVdXF4BM>

3. SOLID WALL BINS

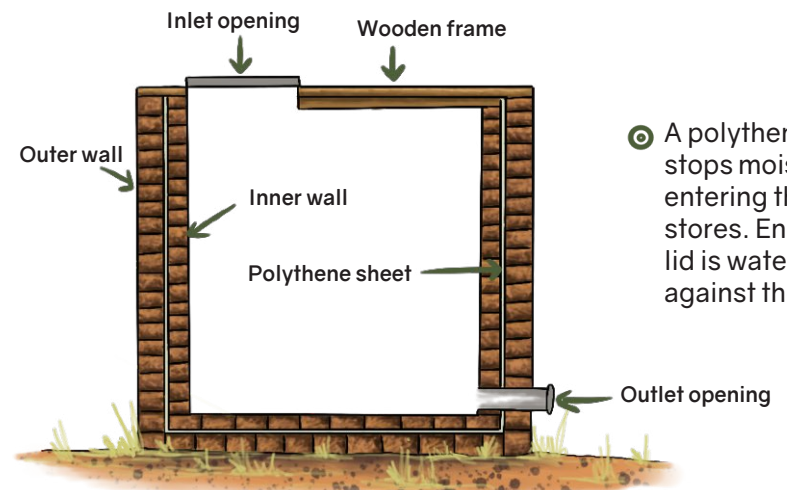
- Usually used in dry climatic conditions (traditional in Sahel region of Africa).
- Usually made of timber, mud or clay.

EXAMPLE = THE 'PUSA' BIN

- Developed by the Indian Agricultural Research Institute (I.A.R.I.)
- These silos can be **made of earth/sundried bricks**.
- They are **rectangular in shape** and have a capacity of 1 to 3 tonnes.



- These larger storage **bins** can be more appropriate for communal village storage of grains.



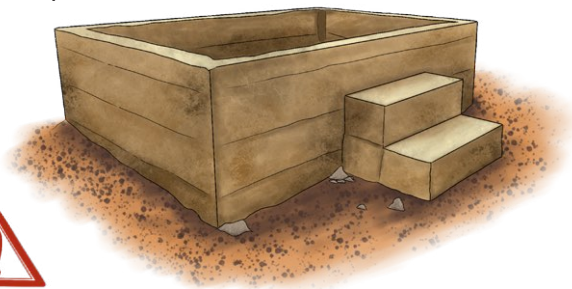
- A polythene sheet stops moisture from entering the grain stores. Ensure the lid is water tight against the rain.

<https://www.fao.org/3/t1838e/T1838E14.HTM#Alternative%20storage%20technology%20at%20farm/village%20level>

4. WATER TANK FOR CASSAVA MATURATION



- Location – Central Africa – In some places, Cassava is a main staple food and many families rely on it as a daily meal.
- Cassava consumption can be **dangerous** as the plant is **toxic** and needs a water treatment of 2-5 days in fresh water to **remove toxicities** in the tuber.
- Initiative- Construction of a small ripening tank in the village where people can safely store their cassava bags. This removes the need for frequent river visits.



PROS +

- Provides a safe place for ripening cassava.
- Improves community life by decreasing effort/time needed to reach the river, carrying heavy cassava bags.

CONS -

- Need access to a functional water pump.
- Older farmers may be slow to adopt new ideas and prefer to stick to their traditional methods of storing cassava to avoid toxins.

TIPS:



Good community collaboration is needed.



More research is needed.



You can use white rocks/chilli methods to help fortify this food storage method against curious elephants.



SOURCES: <https://encosh.org/en/initiatives/water-tank-for-cassava-maturation/>
(NGO initiative led by Antoine Ede)

5. OTHER STORAGE OPTIONS TRADITIONAL FARM/VILLAGE STORAGE METHODS

TEMPORARY STORAGE METHODS

Grains need to be dried appropriately before being stored.

AERIAL STORAGE



Hanging crops to dry can keep it out of reach from pests temporarily.

STORAGE ON THE GROUND/ FLOORS



Most crops need drying before storing to avoid rotting.

OPEN TIMBER PLATFORMS



Common storage methods.

SACKS

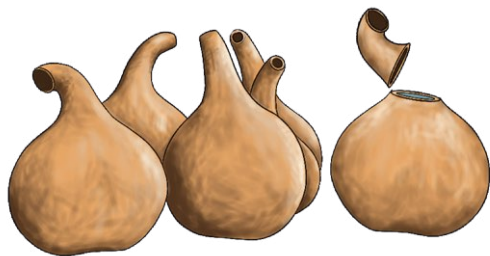




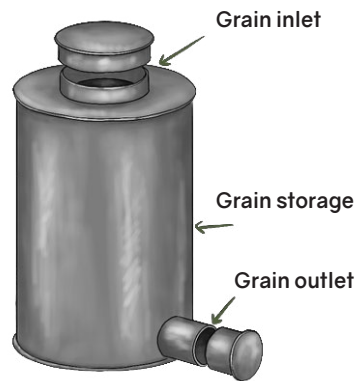
LONG-TERM STORAGE METHODS

STORAGE BASKETS (CRIBS) MADE OF PLANT MATERIALS

CALABASHES, GOURDS, EARTHENWARE POTS



METAL SILOS AND TANKS



JARS

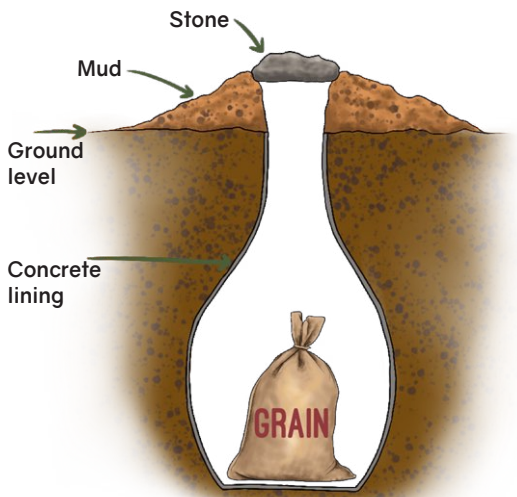


PLASTIC DRUMS OR SILOS



ALTERNATIVE STORAGE TECHNOLOGY AT FARM/VILLAGE LEVEL

UNDERGROUND STORAGE



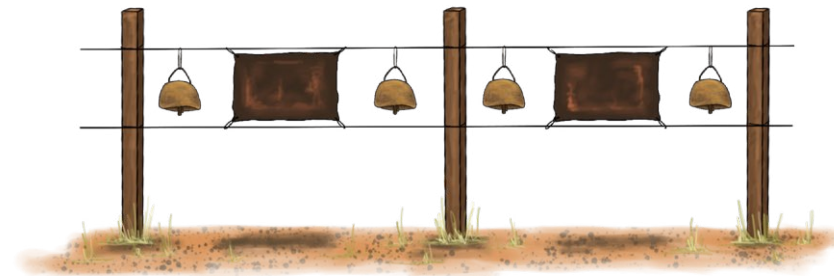
- Used in dry regions, where water table does not endanger contents.
- Few problems with rodents and insects, temperature usually remains constant. No need for continuous inspection.
- Disadvantages include laborious construction, difficulty removing grain stores and penetration by water is possible.



- The floor of the pit may be strengthened with stones, earth or concrete; and the walls can be solidified with cow dung, or chicken wire mesh plastered with cement.
- A double layer of concrete, each layer about 5 cm thick, with chicken wire sandwiched between the 2 layers can provide extra strength.
- Recommended to put grains into plastic sacks and stack them in the pit.
- Digging small trenches around the pit can help divert rain water away from the stored grains.

<https://www.fao.org/3/t1838e/T1838E13.htm>

OTHER WAYS TO HELP PROTECT FOOD USING COMBINED METHODS



Use **combined methods** for extra protection and resilience. Example: add a trip wire or chillies to protect your grain store.





FARMING ALTERNATIVE CROPS



- ☉ Farming and marketing alternative crops that **elephants don't like to eat**, such as crops containing **essential oils**, that also will not attract elephants when stored.
- ☉ **African elephants** have been seen to avoid chillies, sunflowers, lemon grass, ginger, and garlic and Asian elephants are seen to avoid basil, chamomile, coriander, lemon grass, mint, and turmeric.

DO NOT STORE FOOD IN YOUR HOME OR SLEEPING AREA



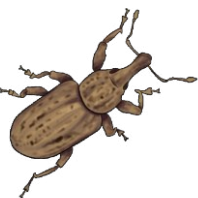
- ☉ If you can, try **not** to store food in your home/ sleeping area.
- ☉ Farmers are also encouraged to store their crops **outside of the home** to decrease the chances of injury and/or destruction of the home in the event of an elephant raid.

Gross et al. (2020) – “suggest the need to reduce the attractiveness of villages storing food in locked and safe places, away from sleeping areas, and to foster the development of elephant safe stores, appropriate to the particular cultural background of the target area.”

PESTS



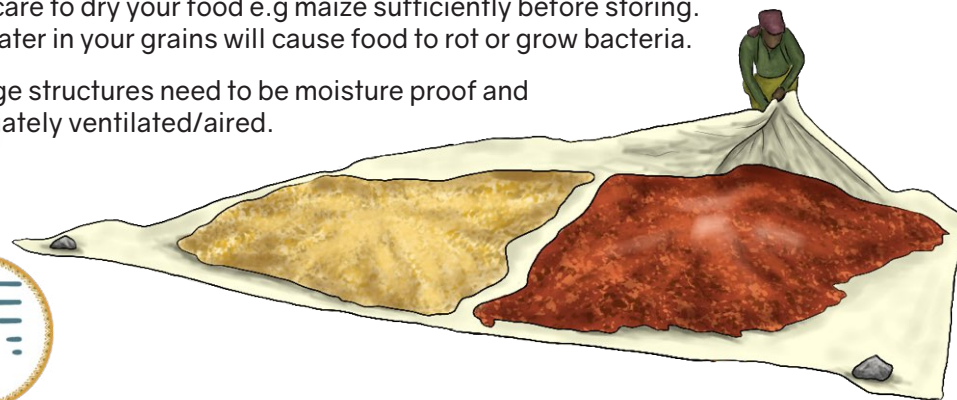
- ☉ Take care of pest management when storing your food. These food storage methods/ideas can help save food that might be damaged by insects (may be helpful against pests).



- ☉ Using a solid/well-secure grain storage method is important, as elephants are not the only threat to crop harvests.

DRYING AND STORING FOOD/ HARVEST

- ☉ Take care to dry your food e.g maize sufficiently before storing. Any water in your grains will cause food to rot or grow bacteria.
- ☉ Storage structures need to be moisture proof and adequately ventilated/aired.

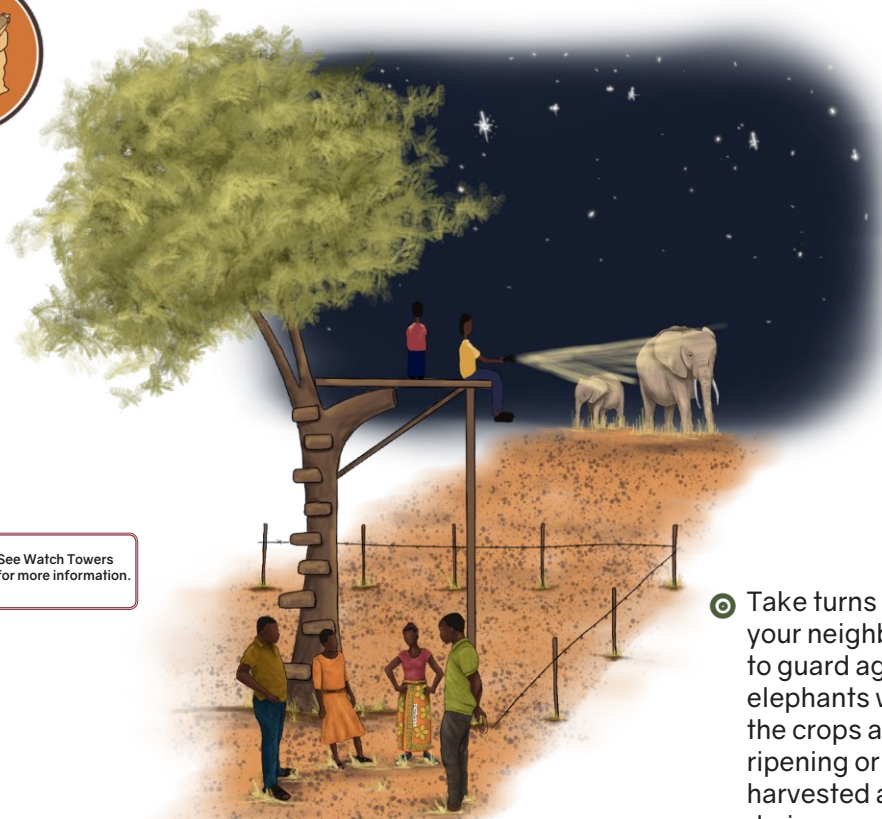




ACTIVE NIGHT GUARDING

🕒 Night guarding should be well coordinated and planned.

“The habituation of elephants to human disturbance is a risk factor, which is likely to increase, especially when guarding techniques are carried out in an uncoordinated and ineffective manner.” (Gross et al. 2019)



See Watch Towers for more information.

🕒 Take turns with your neighbours to guard against elephants when the crops are ripening or just harvested and are drying.

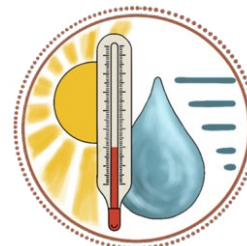
OTHER CHALLENGES FOR FOOD STORAGE AND GRAIN LOSS:



Pests and other small animals (insects/birds/rodents)



Microorganisms



Weather/Temperature/ Moisture



Individual vs community storage options



Theft

TIPS + CONSIDERATIONS



- 🕒 Elephant safe food storage methods can help with reducing the damage by elephants, but may not stop elephants from still trying to access food sources.
- 🕒 Emphasis on **building structures** well and with good quality = to maximize grain protection.
- 🕒 With all methods, there is a risk of elephant habituation. Best to combine and vary strategies. Elephants are **very intelligent** and may **adapt their behaviour** over time. Consider rotation or combined method.
- 🕒 Always **take care** and **prioritise safety** when encountering elephants.
- 🕒 When guarding at night, be aware of elephant behaviour and **keep a safe distance**.
- 🕒 **Disclaimer** – Use the right grain store for you - <https://postharvest.nri.org/lossreduction/choosing-the-right-grain-store/metal-silos-and-tanks>
- 🕒 Consider differences in Dry Season vs Wet season storage.

CREDITS AND DISCLAIMER:

We have collected the information above from multiple sources. The ideas presented here are from Conservation Lower Zambezi, Conservation South Luangwa, Awely CAPS Programme and the International Elephant Foundation. See [References](#) for more information. Save the Elephants advises caution with all the methods collected and presented in this toolbox. Further research may be required before each site-specific implementation. Save the Elephants is not liable for any costs or damages incurred by the use of these methods.





BEEHIVE FENCES



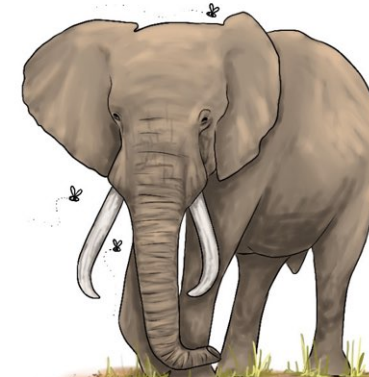
Beehive fences are a series of interlinked beehives connected by wire and built around the outside of a farm to help protect crops from elephant raids. The bees also provide **honey** and **pollination services** for the farmer.

Elephants display a negative reaction towards bees.

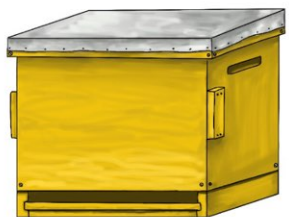


If elephants attempt to enter the fenced area, they will try to pass through this wire connecting the beehives.

This will pull the wire, causing the beehives to swing, releasing the bees.



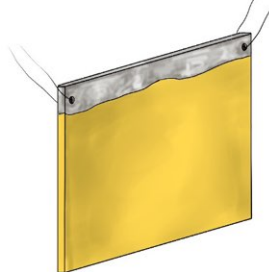
DIFFERENT HIVE DESIGNS



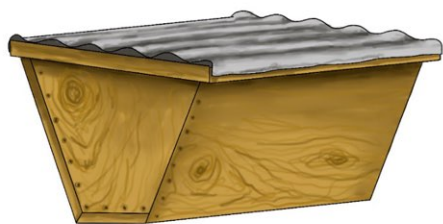
Langstroth hive

DUMMY OR FAKE HIVES

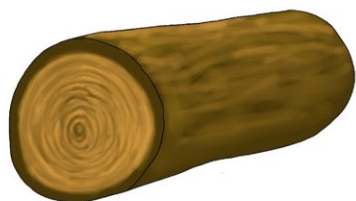
“Dummy” or fake beehives help reduce fence costs and help give some distance between bee colonies.



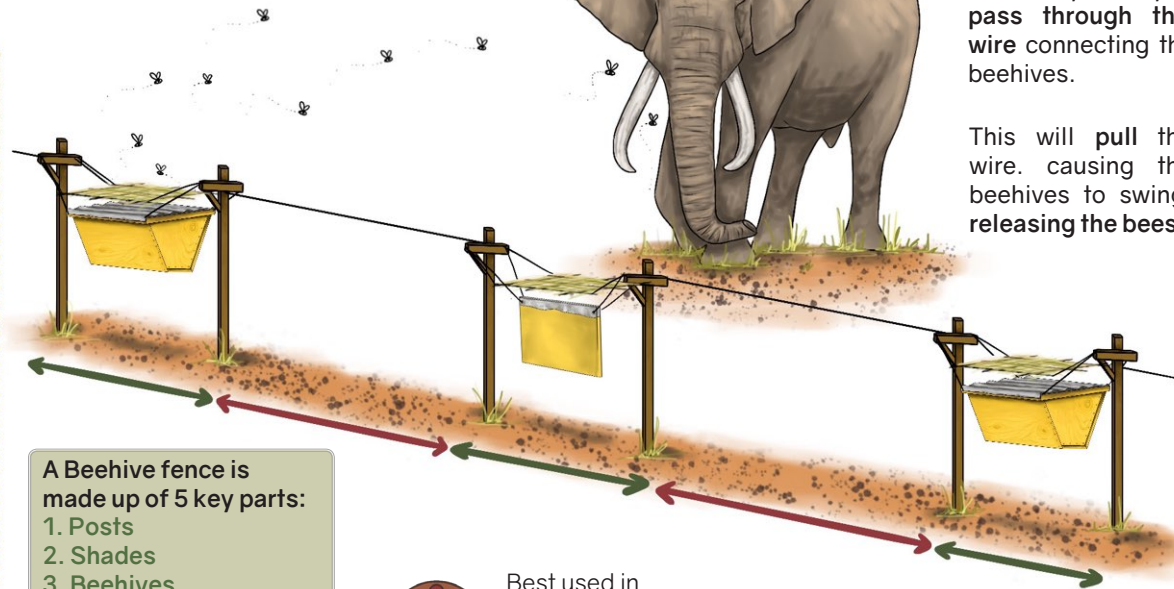
Dummy hives are like the shadow of beehives and can help fool elephants approaching the fence.



Kenyan Top Bar hive



Traditional log-hive



A Beehive fence is made up of 5 key parts:

1. Posts
2. Shades
3. Beehives
4. Dummy hives
5. Wiring



Best used in combination with other deterrents.

www.elephantsandbees.com

MATERIAL CHECKLIST: (TO PROTECT 1 ACRE OR 300 METRES OF FENCE LINE)



Measuring equipment



Digging Tools



Pliers



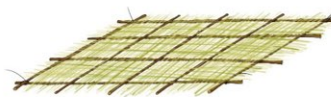
25kgs of galvanised/
non-rust fencing wire



25kgs of binding wire



60 posts



15 shades



15 dummy hives



15 beehives

CONSTRUCTION PROCESS

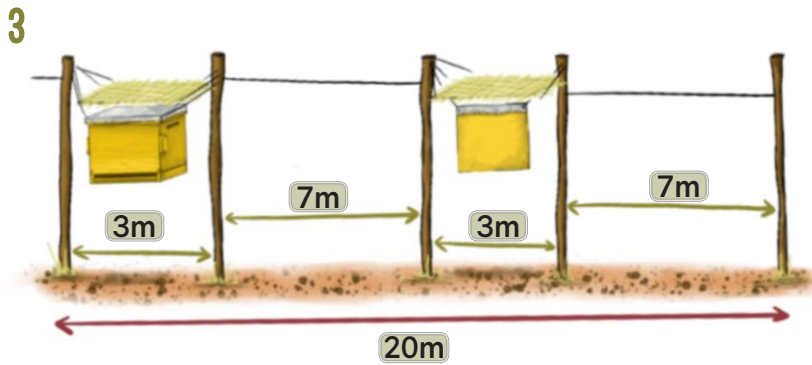
1 MEASURING:

Check out the Elephants and Bees [Beehive Fence Construction Manual \(4th Ed.\)](#) for more fence and construction details. www.elephantsandbees.com



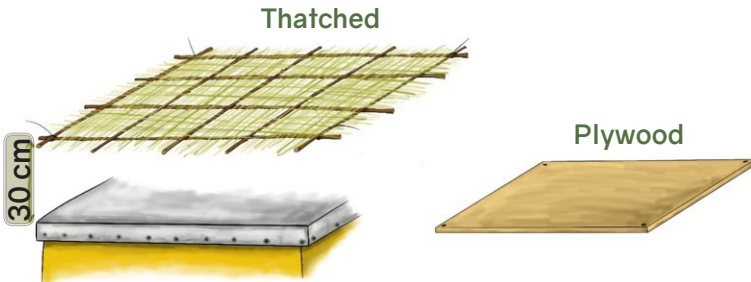
1 First, identify an area of your farm you would like to protect.

2 Construct your beehive fence at the perimeter of this planting area.



- Measure 7 metres to the start of the next pair of posts, to make a 3-7-3-7 metre arrangement.
- Posts for hanging beehives and dummies should be 3 metres apart.
- There should be one beehive and one dummy hive for every 20 metres of beehive fence.

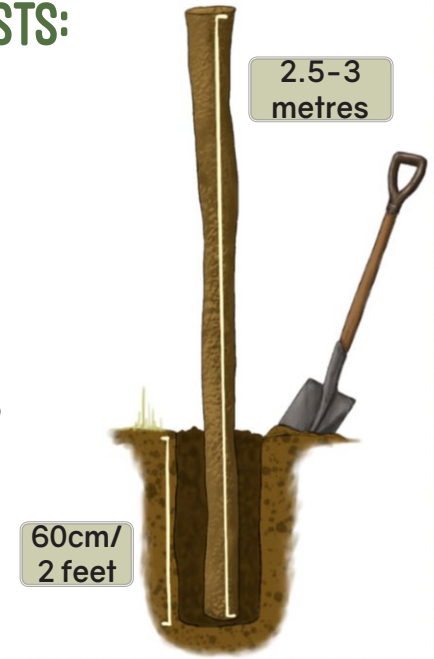
4 SHADE FOR YOUR BEEHIVES:



- Shades protect the hive from over-heating, which will cause the bees to leave.
- Shades should be hung 30 cm above the hive for good air circulation.
- They can be made from a plywood sheet or thatched from woven sticks and dried grass.
- Attach simple binding wire to each corner of the shade and loop around the posts. This will make it easy to adjust the shade if needed.

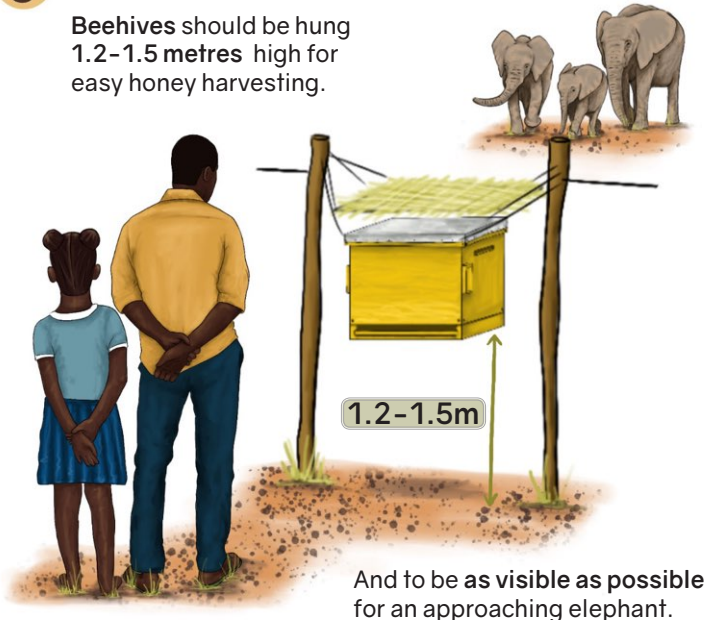
2 DIGGING POSTS:

- Each post should be 2.5-3 metres long.
- The post holes should be dug at least 60cm deep.
- Pack in the soil as tightly as possible to ensure the posts are stable.



3 HANGING THE BEEHIVES:

Beehives should be hung 1.2-1.5 metres high for easy honey harvesting.



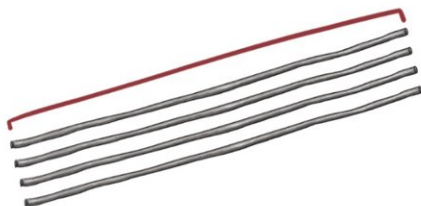
And to be as visible as possible for an approaching elephant.



5 WIRING TOGETHER THE BEEHIVE FENCE:

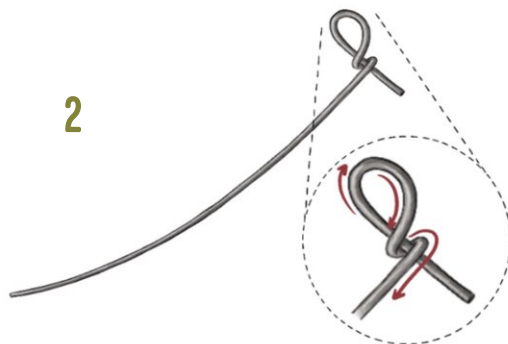
STEP 1: ATTACHMENT POINTS

1



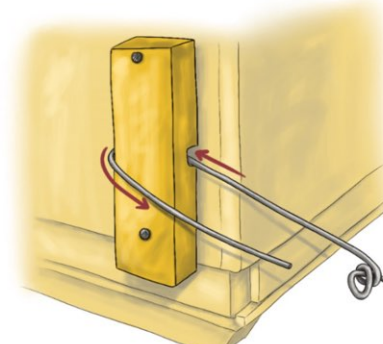
Cut **galvanized or non-rust fencing wire** into 30 cm. These will be used to hang the beehives) (you will need 4 per each beehive)

2



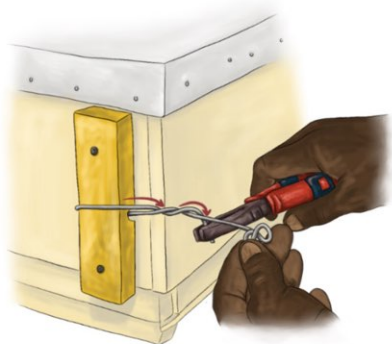
Twist a loop in one end of each piece.

3



Insert these pieces into the **attachment points** on the corner of the hives.

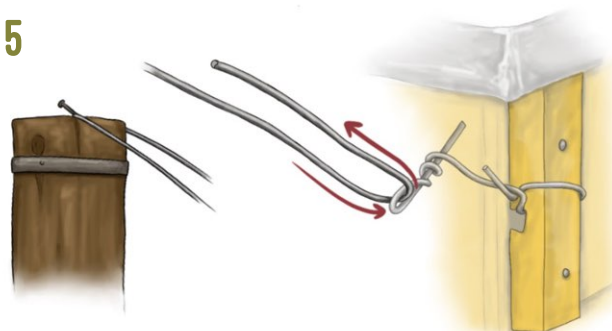
4



Secure the loops by gently twisting this 2-3 times.

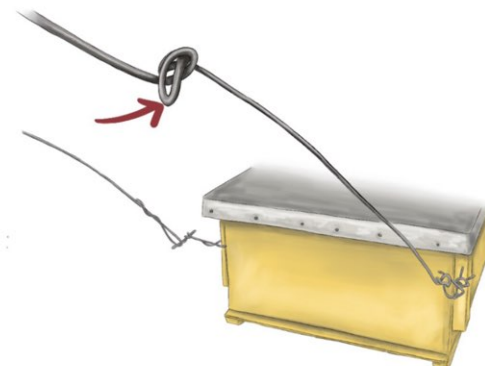
STEP 2: HANGING THE HIVE FROM THE POSTS

5



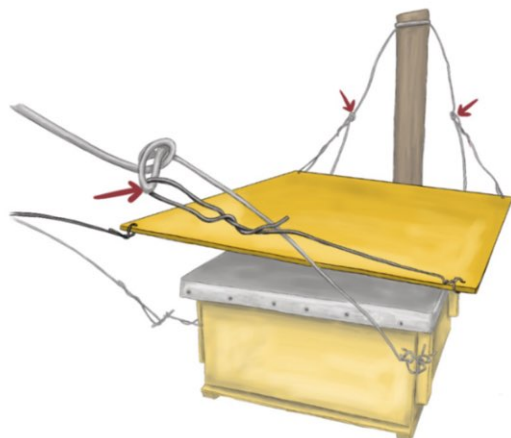
To **hang the hive**, insert a new piece of **galvanized wire** through each loop and around the nail on the post. The hive should be suspended approximately **1m** above the ground.

6



Twist a **small loop** in the wire around **halfway** between the hive and post. This will be used to hang the shade over the beehive with thinner binding wire.

7



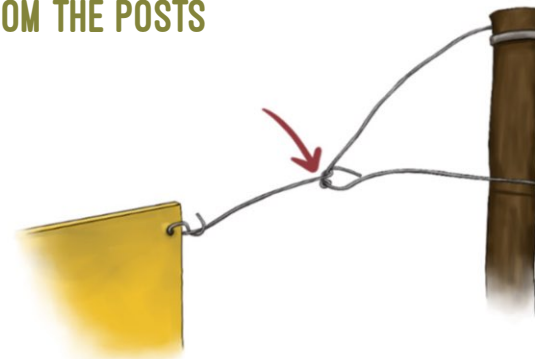
Suspend the shade by connecting these loops to the holes in the shade using **binding wire**.

STEP 3: HANGING THE DUMMY HIVE FROM THE POSTS

8

Same idea for **dummy hives**.

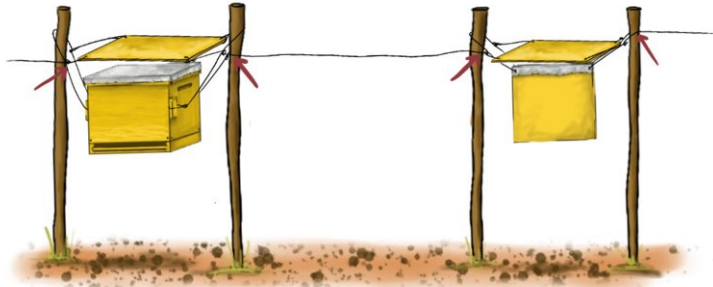
Connect the dummy hives to the posts using **galvanized wire** and **twist a small loop** approximately halfway along.





STEP 4: LINKING THE MAIN FENCING WIRE CONNECTING ALL THE HIVES TOGETHER

9



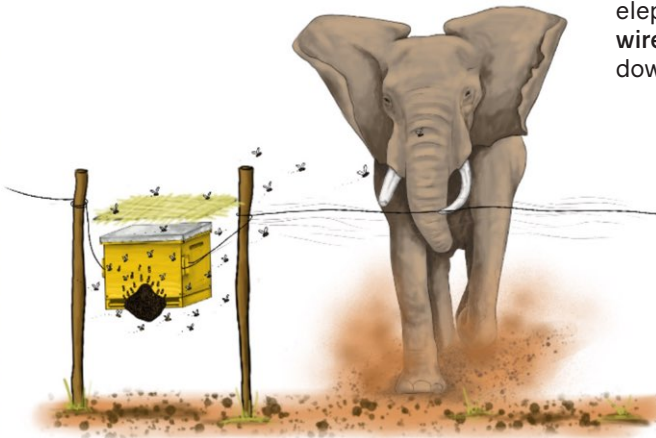
Make sure the wire passes on the outside of the posts.

10



Do not twist this wire so that when under high strain it will release instead of pulling down the post and beehive.

Excessive force from an elephant will release the wire, rather than pulling down the hive.



Sensitive body parts like elephant ears and trunks are especially vulnerable to bee stings.

TIPS FOR MANAGEMENT:



If the beehive is too low to the ground (less than 1.2 metres), it can become vulnerable to predators such as honey badgers.



If you can, provide clean water nearby for the bees during the dry season.



Weak or unstable posts may fall over in the heavy rain or when the hive is full of honey.

It is important to keep your beehives as clean as possible. Bees will not want to occupy a hive if there are pests.



Do not cut down indigenous flowering plants or trees bees will feed on.



Using grease on the wiring helps to repel pests like ants



Rubbing fresh beeswax on the bars and rubbing propolis round the entrance may attract passing bees and encourage hive occupation.



Some tree species can be cut and replanted. These may regrow roots to create a 'live' tree-fence to hang your beehives from. Beehives can be used to help protect trees.

Encourage bees by planting flowering plants and crops.

Planting sunflowers is a good idea as bees love them, and elephants do not!



Visit <https://beesfordevelopment.org> for helpful beekeeping resources

Beehives need to be occupied to be effective as a deterrent method.

CAUTION TIPS:



- Make sure you construct the fence a safe distance from nearby homes, livestock or roads.
- Use protective clothing and always take care when handling bees.
- Any work on beehives that are occupied should be done at night when it is cooler.
- African honeybees are very aggressive and bee stings can be fatal if you are allergic.



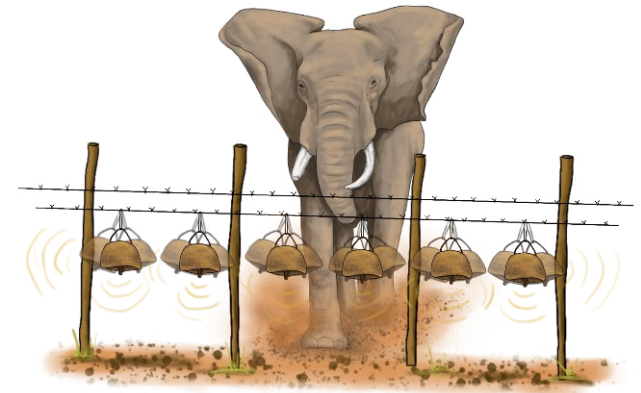
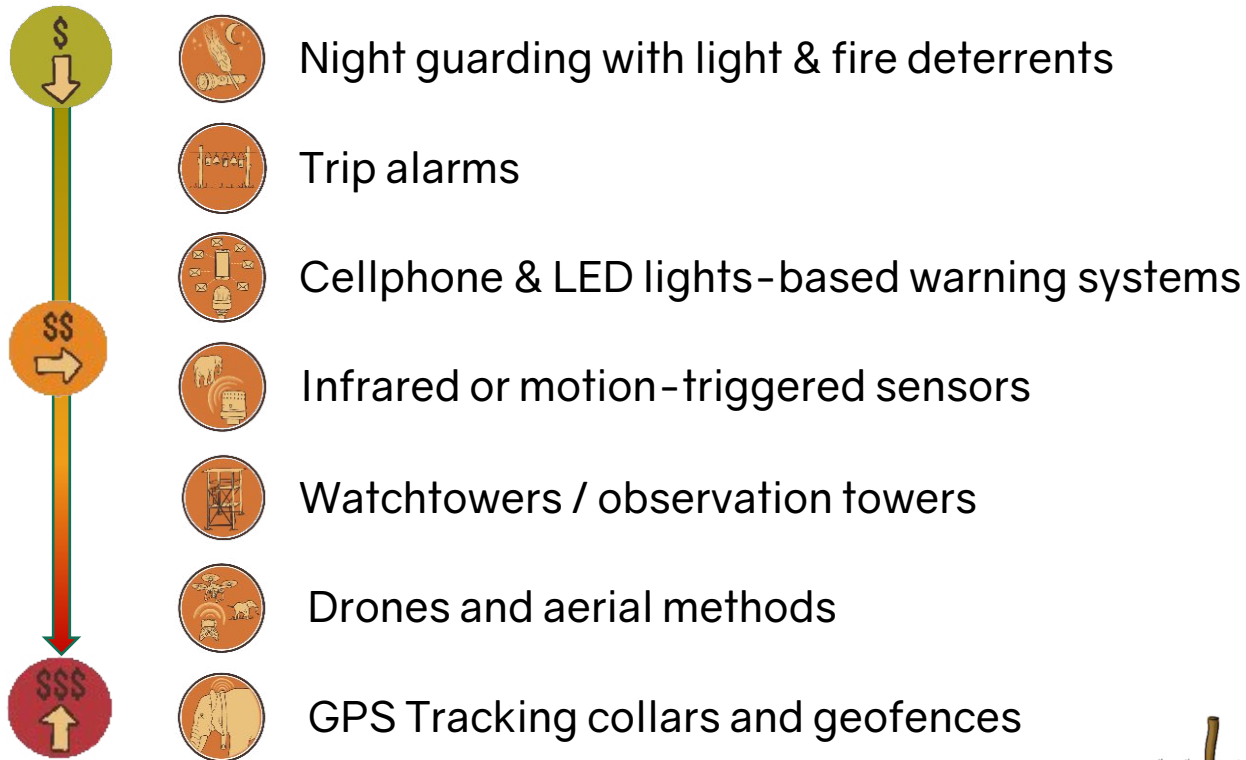
CREDITS AND DISCLAIMER:

This idea was developed by Dr. Lucy King, Elephants and Bees Project, Save the Elephants. More information: elephantsandbees.com. For literature and resources used, see [References](#). More research may be required before each site-specific implementation. Safety and caution is advised with all the methods presented in this toolbox.

*Save the Elephants is not liable for any costs, damages or injuries incurred by the use of these methods.



EARLY WARNING SYSTEMS

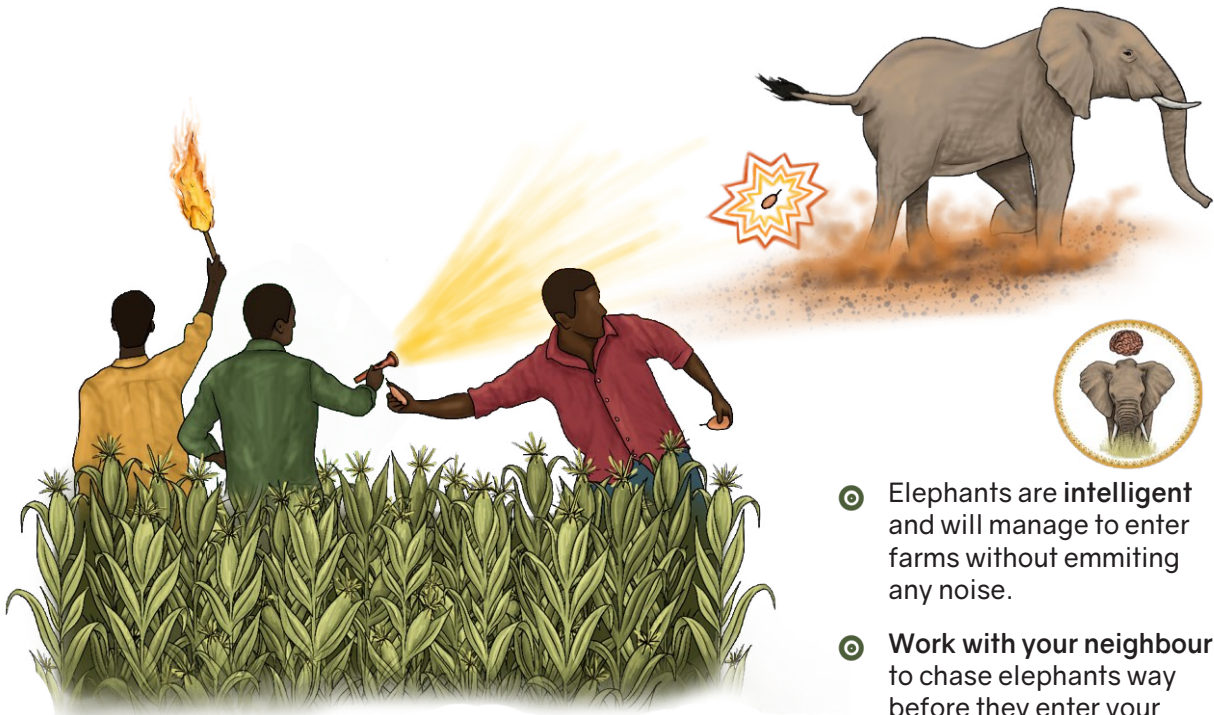




NIGHT GUARDING WITH LIGHT AND FIRE DETERRENENTS



Elephants are well known to raid farms during the night. To ease guarding at night, lights and fire deterrent methods are seen to be most effective to chase elephants away from farms and bomas.



- Elephants are intelligent and will manage to enter farms without emitting any noise.
- Work with your neighbours to chase elephants away before they enter your farm/compound.

Light and fire deterrents, together with noise, have been traditionally used to chase elephants away.



Researchers have found that elephants are more alarmed by flashing lights than barking dogs.



See Trip Alarms and Noise Deterrents documents for more



TIP Equipping yourself with an elephant alarm kit can increase effectiveness in deterring elephants.

THE KIT SHOULD CONSIST OF:

A cell phone to send an SMS to the community on the ground



High-powered flash light/spotlight



An airhorn/vuvuzela, or any item that will produce loud sounds when used.

Ready-made chili crackers prepared before night guarding.

It is best **not** to solely depend on light & fire to protect your crops and homes. Use alongside with other farm protection barriers and deterrent methods.



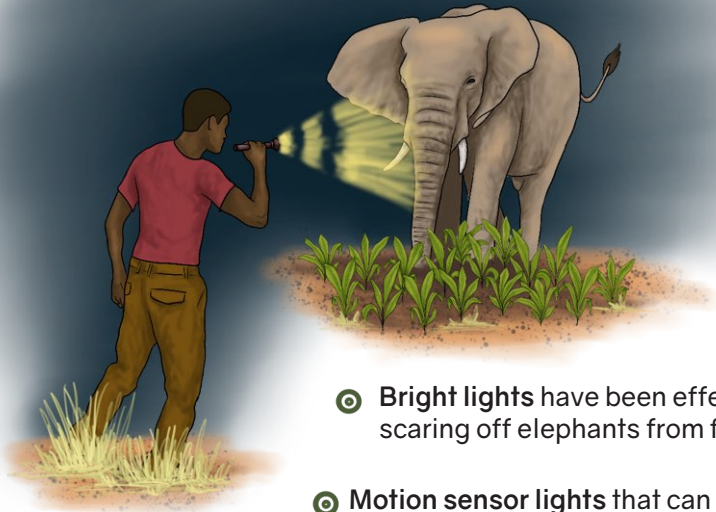
SAFETY TIP: ⚠

Always consider which deterrent method you choose to use, so as not to put others in danger.



Read more on: [Using Fireworks to Save Elephants.](#)

LIGHT DETERRENENTS:



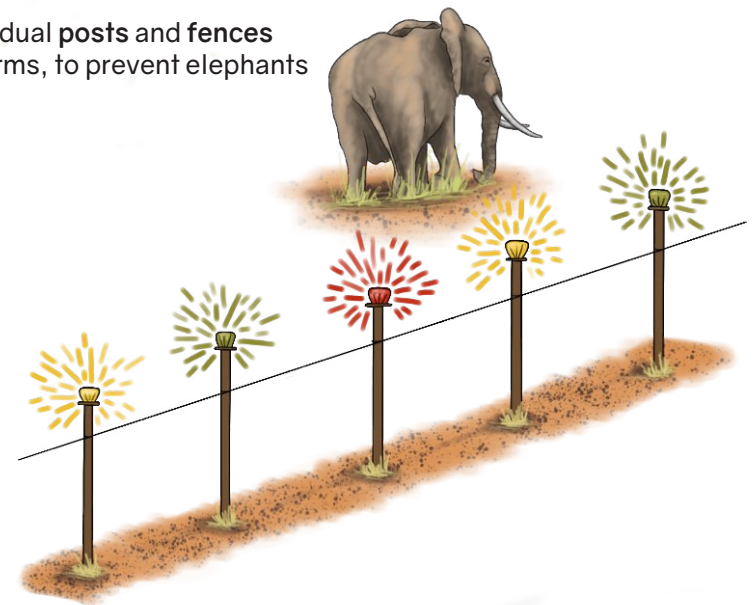
- ⦿ Bright lights have been effective in scaring off elephants from farms.
- ⦿ Motion sensor lights that can suddenly flash/shine very brightly, can cause elephants to run away from the source of light.

- ⦿ They are installed on individual posts and fences around compounds and farms, to prevent elephants from entering in.

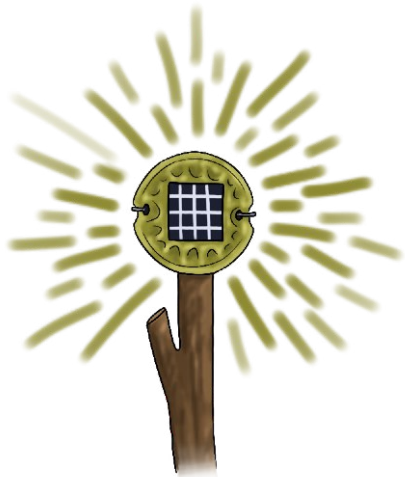
See Protecting Schools and Compounds for more on flashing lights.



They are most effective during the night.



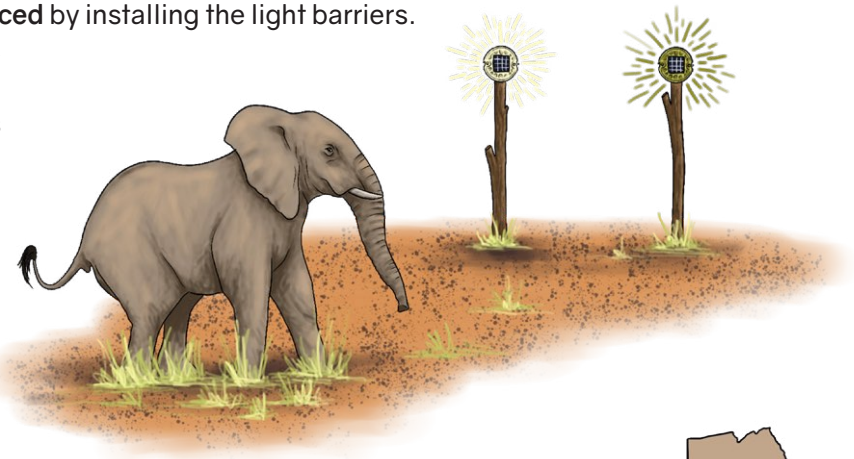
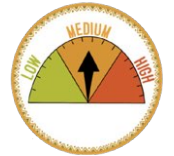
STROBE FLASHLIGHTS AND FLASHING SOLAR LIGHTS:



- ⦿ Bright strobing flashlight/torch is a strong and safe tool for night guarding.
- ⦿ Elephants do not like flashing lights and is therefore it is an effective and quick method to chase elephants away.
- ⦿ Flashing solar lights can also be used to construct a boundary fence around farms and compounds.

- ⦿ A conservationist group 'Elephants Without Borders' has proven that flashing lights were an effective deterrent method against elephants in Botswana.
- ⦿ Their objective was to investigate whether crop raids at night could be reduced by installing the light barriers.
- ⦿ Elephants are likely to habituate to these methods. It is recommended to regularly change strategies to keep elephants away from your farm.

CASE STUDY:



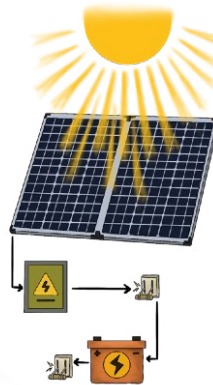
SOURCES:

[Panic at the disco: solar-powered strobe light barriers reduce field incursion by African elephants *Loxodonta africana* in Chobe District, Botswana.](#)



PROS +

- Fence lights are **portable/movable**, as lights are mounted on individual posts.
- Effective method to deter elephants.
- The solar flashing lights are able to **recharge** during the day to be used at night when the majority of elephant raiding occurs.
- Moderate cost.
- **Moderate maintenance** required to ensure posts are not knocked off by elephants.
- Flashing lights also seen to **deter other wildlife** like lions.



Read more on: [Solar-powered lights to deter animals a hit among farmers](#)

CONS -

- Theft of lights is easy.
- Only **effective at night** and not during the day.
- Elephants have been seen to **habituate** to lights over time.
- Some elephants that are chased away from the farm may return the same night.



TOP TIP

See Noise deterrents for more

A combination of **noise deterrents** and **lights** may be more effective in deterring elephants.



WATCH TOWERS:



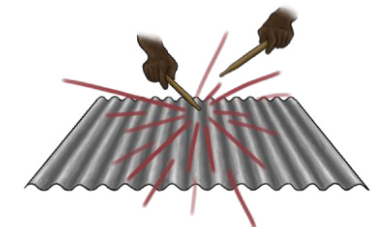
- Night guarding on **watch towers** built on farms and in compounds help with **early detection** of approaching elephants.

- They allow guarding from a **safe distance**, as patrolling **alone** on foot can be dangerous in the night.

See Noise Deterrents for more



- Often the presence of a **group of farmers** is one of the most **effective methods** to chase elephants/keep them away from farms.
- **Co-operation patrolling** where farmers take turns in doing **night shifts** to keep an eye out for approaching elephant can be performed.
- Equipped with **powerful flash lights**, elephants can be detected at a distance and can be **chased off** before they reach the premises.
- **Airhorns** can be blown, **metal sheets** and **drums** can be beaten to alert ground patrol, residents and your neighbours.



FIRE DETERRENTS:

- ⦿ The objective is to **chase elephants** away from farms and compounds using a variety of fire deterrents that will not harm elephants.



- ⦿ Burning a mixture of **old elephant/ cow dung** with **chilli** creates a **pungent smoke cloud** that chases elephants away.



- ⦿ Traditional methods involve lighting fires in **small pits** on the ground at the **edge** of the village, away from homes and livestock.

[Assessing farm-based measures for mitigating human-elephant conflict in Transmara District, Kenya.](#)

MATERIAL NEEDED FOR CHILLI SMOKE ROLLS:



1 cardboard piece (0.75m x 0.5m); milk cartons, old boxes



5 dried tobacco leaves (if available)



15-20 dry red chillies



Dry straw, grass and weeds



1 m long stick



Rope/string



Pair of scissors/knife to cut the cardboard

1) CHILLI SMOKE ROLLS:

- ⦿ **Dry chilli**, when burnt together with the right materials, produces a **strong smoke** which irritates elephants as they inhale.



See Chilli Deterrents methods for more information.



SOURCES:

[Living with Elephants in Assam - a Handbook](#)



METHOD:

1.

Cut the cardboard and spread a mixture of **dry straw, grass and weeds** evenly on it.



2.

Place a layer of **tobacco leaves** and dry **chillies** on top.



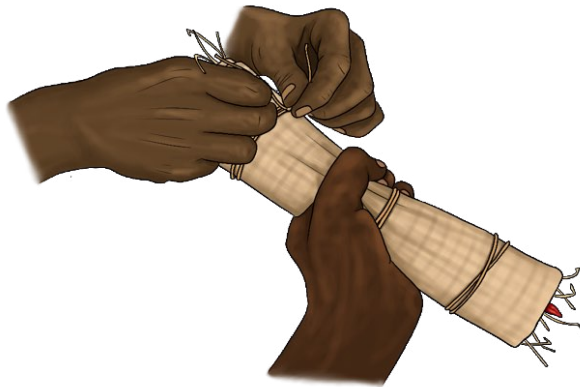
3.

Roll the cardboard together from one end to **pack the ingredients**, and **tightly tie** it with a string.



4.

Attach the roll **firmly** to a strong **tree branch** with **rope/string**, so that the roll can be held away from you when it is lit.



5.

Light the top end of the roll with **fire** and let it start **smouldering**.



TIP
Determine the **wind direction**.



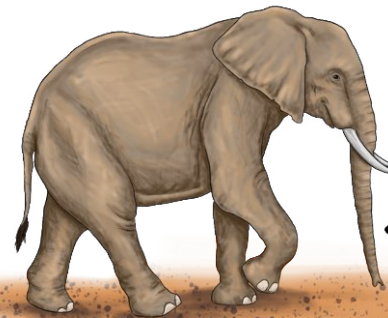
TIPS

- It may be possible to plant the burning smoke rolls **into the ground**, or lay them on the floor, so that people can then **safely move away** from the elephants and smoke.
- A standard sized chilli smoke roll can burn upto **15-20 minutes**.
- Prepare them in advance and store.



CAUTION TIP

Do not light fire torches or chilli smoke rolls while you are up on the watch tower.



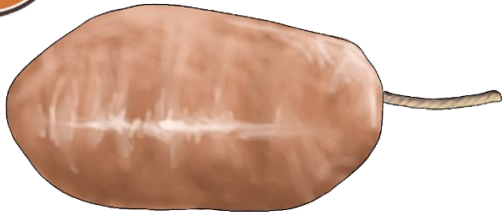
Do not approach the elephants closer than **50 meters**.

50 meters



SOURCE: [Assam Haathi Project: Living with Elephants in Assam.](#)

2) CHILLI CRACKERS:



See Chilli Deterrents methods for more information.



- This is a combination of **chilli and noise** that targets both the elephants' sense of smell and sound.

[Learn how chilli crackers are made and used in Tanzania](#)

Read more on: <https://www.nature.org/en-us/about-us/where-we-work/africa/stories-in-africa/using-fireworks-to-save-elephants/>

CONS

- **Wind and weather** are an important factor in determining how **effective** fire can be in chasing elephants away.
- **Large amount of chilli** is required for these methods to be effective.
- **Short-term** effectiveness, as the materials burn for a short while.



ALWAYS REMEMBER:

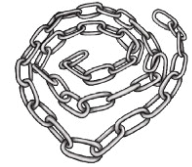
- Ensure that the smoke is not blowing towards people and livestock as the smoke is **painful/irritating** when inhaled.
- Avoid using smoke deterrents if the wind direction is **not suitable**.
- This could cause elephants to run in the direction of houses and people.
- It is more effective when chilli smokers are prepared in advance.



3) ROTATING FIRE BALLS:

- A rotating fire ball is made up of an old cloth, a chain and kerosine.

MATERIALS NEEDED:



Strong aluminum chain



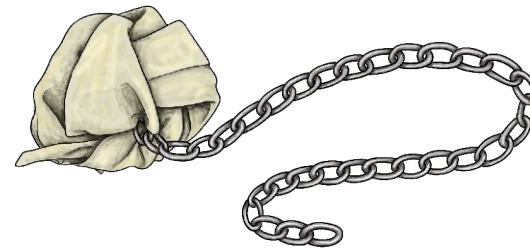
An old cloth/rag



Kerosine/petrol



1.



Tie an old cloth into a ball and attach it to an **aluminium chain** and keep it ready.

2.

Pour some **kerosine** into a **container** and also keep it ready.



3.

As soon as elephants are spotted, **dip** the cloth ball into kerosine and **carefully light** it on fire.





4.

- Swing it in the air in large circles.
- As the chain is swung in the air, it produces a swooshing sound and burns brightly.

Watch how the rotating fire ball works:

<https://www.youtube.com/watch?v=CKeVmhbvZUY>



CAUTION TIP

Ensure there are no people around when you are swinging the fire ball in the air. It is always safer to give people early warnings that you will use fire to deter approaching elephants.

Mehta, P. (2012). How to Protect your Crops from Elephants. A Handy Guide for farmers and Forest Department. Supported by Asian Elephant Conservation Fund, USFWS.

KEEP IN MIND WHEN USING FIRE:



Always be **extra careful** when handling fire.



Fires can be a **hazard** if mishandled.



Do not leave fires unattended.



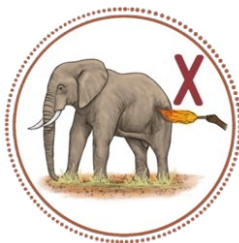
Make sure to **completely put out the fires** after the elephants have gone.



Big fires are hazardous and must be avoided. This causes a risk of them spreading into wild fires.



Light fires away from homes/bomas.



Fire torches are solely to **chase elephants away**. Do not harm the elephants with fire torches.



Do not run behind the elephant with fire torches.



Do not throw **burning sticks, spears** or anything that might pierce skin and injure elephants. This can make them **aggressive and unpredictable**.

SAFETY TIPS:



- You can throw **chillies** into pit fires made at the edge of your farm, if you have not prepared the smoker in advance.
- Only use a fire torch when **completely necessary**, as these can be dangerous to both humans and elephants.
- Put up effective **farm protection barriers and fences** to discourage the frequent use of fire to chase elephants.

See protecting schools & compounds for more information on field barriers.

CREDITS AND DISCLAIMER:

We have collated resources from a range of different sources. Some of the ideas presented here are from [Elephants Without Borders](#), [Wildlife Research & Conservation Society](#) and [The Assam Haathi Project](#). Some original words commonly used have been simplified for easy understanding. See [References](#) for more literature and information on Night Guarding with Light and Fire Deterrents.

Save the Elephants advises caution with all the methods and information collected and presented in this illustrated toolbox. Further research may be required before each site-specific implementation.

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WRCS



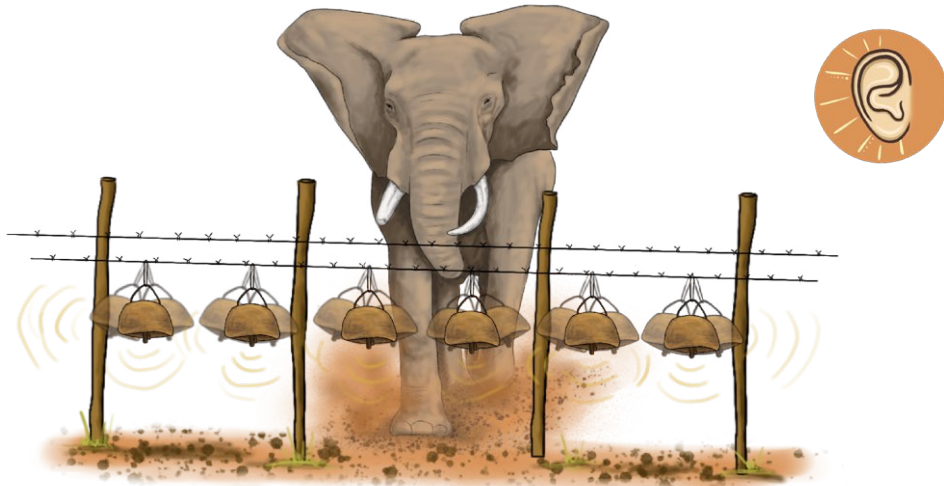
Elephants Without Borders
"Conservation Beyond Boundaries"



TRIP ALARMS

WHAT IS A TRIP ALARM?

This can be a **simple, low-tech method** to help with **farm guarding**, alerting farmers when elephants are entering farmland.



- One of the easiest methods that can be used is a **trip wire**.
- This **triggers an alarm** when placed in the path of the elephant.
- The most commonly used types of trip-alarms include **crackers and cans filled with stones**.

WHY ARE THEY USEFUL?

- The trip alarm is very useful for **early detection of elephants** and warning others.
- At times elephants can be **extremely quiet**, and it is **not always easy** to see them entering farms.
- This may also help prevent **accidental encounters**.



Note: this is also a good acoustic deterrent

- When the trip wire is moved by an elephant, it will produce helpful **alarm sounds** to help in **night-guarding efforts**.
- The ringing bell is very **useful for alerting farmers** about the **presence of elephants**, and may help to drive away elephants before they begin to feed.
- When the wire is triggered, it will pull the bell, causing it to ring and notifying anyone nearby and help with **crop-guarding**.



DIFFERENT TYPES?

BASIC AND MORE ADVANCED METHODS

- Trip-wire fences** that trigger **electronic sirens**.
- More commonly used alarms such as **crackers, bells or cans filled with stones**.
- You can be creative and use what is available to you to make a **noise-making alarm**.



WHAT ELSE SHOULD YOU USE THEM WITH?

- Trip alarms are most effective if used along with **night guarding techniques** and **combined deterrents**.
- Other night guarding techniques include;** tree platforms, watchtowers, torchlight, early warning systems, strong spotlights, radios or mobile phones for communication.
- It helps to know where are the **active routes for entry and exit** for the elephants – to **concentrate your guarding efforts**.



TYPE 1: SIMPLE TRIP ALARMS

PROCESS



MATERIAL CHECKLIST



Recycled tin cans



Stones



Barbed wire or wire

1.



Make sure you make **little holes** on the sides of the tin cans – this is so that rain water can filter out and does not collect in the can.

2.



Add some **stones** to each tin can. When it shakes it should be noisy!

3.



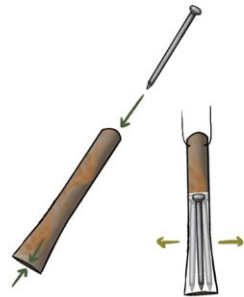
You can use **livestock bells** if available.

4.



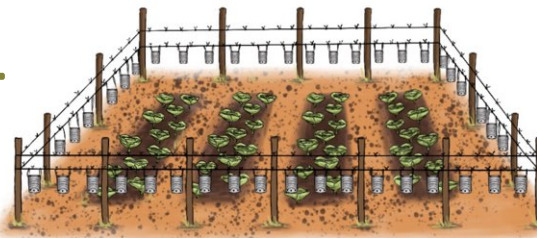
Reused old metal pipes or tubes can also be bent to make bells.

5.



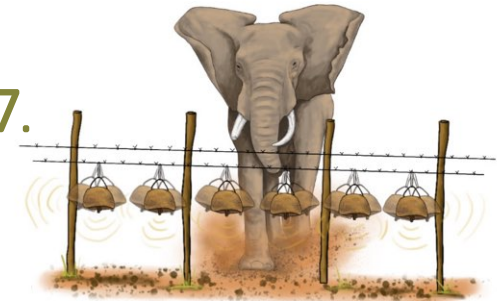
Insert a nail inside to make the ringing sound.

6.



Hang these around the **perimeter** of your crop field using barbed wire.

7.

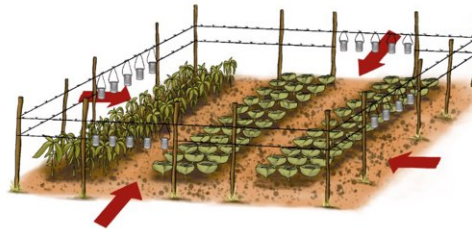
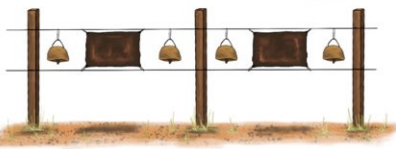
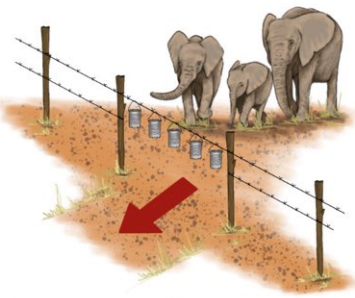


If an elephant tries to **enter the boundary**, they will push the wire with the bells, and hopefully this will alert the farmer.

TIPS:

Install the trip alarms near the **entry point** of elephants.

Use chilli methods with a trip wire.



If there are multiple entry points, **secure all the points** with the alarms to ensure **full boundary protection**.



You can use any **noise-making devices** available to you.

PROS/ CONS

- It does not stop elephants from entering and is not always a deterrent.
- It is most effective for **early warning**.
- Best used in combination with watchtowers, light and noise deterrents.
- Elephants are **very intelligent** animals and may learn how to find ways around the methods.



TYPE 2: DOORBELL TRIP ALARMS

MAKING THE TRIP ALARM

MATERIAL CHECKLIST



1 Metal clamp with two holes



Electrical wire



Nylon rope (length of the boundary of your farm)



Scissor



Door-bell with 2 pencil cells (and a loud sound)



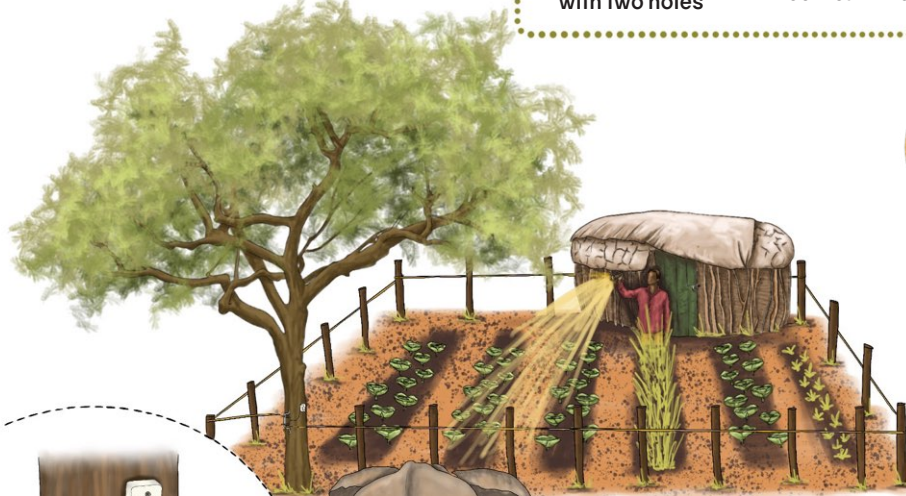
Two 2-way switches



U nails and plain nails



Hammer



Please watch video for more details on how to make this trip alarm: https://www.youtube.com/watch?v=7rPFTi_Elg

This design has been supported by the Asian Elephant Conservation Fund (USFWS) and is being implemented by the Wildlife Research and Conservation Society. www.wracsindia.org

TIPS:

- ⦿ You may need to protect the bell from rains by covering it with some kind of roofing or plastic.
- ⦿ If an elephant triggers the system and breaks the trip wire, it may need quick repair to remain functional. This can be very difficult and even dangerous during dark nights or with elephants around.
- ⦿ These can be helpful when set up correctly.
- ⦿ Make sure you switch off the bell after it has been triggered otherwise it may keep ringing the whole night and the battery will run out.



- ⦿ Some bell units may allow you to include the sounds of elephant distress calls, tiger roar, dog bark, leopard growl, or people shouting.



- ⦿ Using a clamp is important. You may need to have it made from an ironsmith if needed.
- ⦿ Design adaptations may be needed to suit your farm best. Use combined methods.



CAUTION TIPS:

- ⦿ Early warning systems can help with detecting the presence of elephants, but they are also short-term measures.
- ⦿ There is a risk of elephant habituation. Best to combine methods.
- ⦿ May cause alarms with birds and other animals..
- ⦿ With all methods used, always take care and prioritise safety when encountering elephants.
- ⦿ When guarding at night, be aware of elephant behaviour and keep a safe distance (See document on Elephant-aware behaviour)
- ⦿ The above method (Type 2) has been demonstrated to be an effective method for Asian elephants. Further field trials and adaptations for African elephants may be needed.



CREDITS AND DISCLAIMER:

We have collected the information above from multiple sources. The ideas presented here are from Dr. Prachi Mehta, Wildlife Research and Conservation Society. More information: www.wracsindia.org. See [References](#). Save the Elephants advises caution with all the methods collected and presented in this toolbox. Further research may be required before each site-specific implementation.

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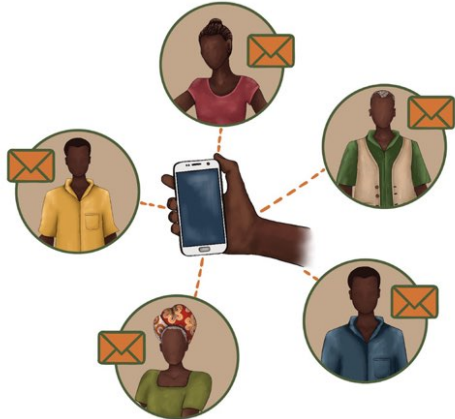
WRCS



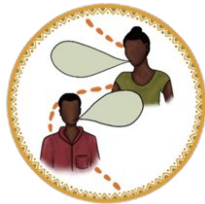
CELLPHONE & LED LIGHTS BASED WARNING SYSTEM



TEXTS AND VOICE CALL ALERTS



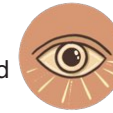
- ⦿ This is a simple **SMS based system** to warn people about approaching elephants and to inform **Rapid Response Units** in the area.
- ⦿ People living nearby are encouraged to **subscribe to the service**.
- ⦿ This is a **simple crowd-sourcing based information system** that gives the location of elephant sightings to those subscribed to the service.
- ⦿ People living within a **two-kilometer radius** of recent elephant alert locations, will **receive an alert first**.
- ⦿ In turn, the community can **spread the word to friends and families**, who can take necessary precautions and measures.



Research conducted by **NCF's Ananda Kumar** in Tamil Nadu's Valparai area, Anamalai hills (home to second largest population of elephants in India), between 2002-2007 found that elephants in the area are most likely to be found within two kilometers (1.2 miles) of their previous day's location.

Credit: **Mongabay 2015**, Tapping into evolutionary responses to guard crops against elephants

ALARM BEACONS



- ⦿ The **Nature Conservation Foundation** team have created an application using **mobile phones** to communicate to an entire village using **signal beacons**.
- ⦿ **Beacons** are placed in **strategic, elevated locations** to provide **maximum visibility** to both residents and visitors in the area who may be unaware to elephant presence.
- ⦿ When elephants are known to be less than **1 km** from an alarm beacon, a **call or text message** can be sent to turn on the beacon which emits a **blinking red light**.
- ⦿ **Lights** are operated by calling a number from a **mobile phone**. If someone sees an elephant, they can **call the number** and the **light is activated**, alerting people to the fact that there is an elephant in the region.



ADDITIONAL MEASURES:

- ⦿ NCF have also used **digital 24 hour display boards**- to warn people about elephants.
- ⦿ **Whatsapp groups** can be set up for **mass messaging** and information is spread quickly through the app.
- ⦿ **Radio devices** can be also used for alerting.



WHY ARE THEY USEFUL?

- ⦿ This may help especially with **reducing accidental elephant encounters**, bumping into them at night, on the road or when **visibility is poor**.
- ⦿ If elephants are surprised by the sudden appearance of a person in front of them, they may **panic and charge**.
- ⦿ With **advanced warning** of elephant locations, many conflicts can be avoided.
- ⦿ Using this knowledge, people can take **alternative routes** or use the warning to help the elephants to **change direction**.



CAUTION TIPS:



- ⦿ This method needs **community involvement and participation** in receiving messages, reporting elephant locations and sharing information.
- ⦿ With all methods, there is a risk of **elephant habituation**. It is best to **combine and vary strategies**.
- ⦿ **Best used with watchtowers**.
- ⦿ The above method has been demonstrated to be an effective method for **Asian elephants**. Further field trials and adaptations may be needed for **African elephants**.



CREDITS AND DISCLAIMER:

We have collected the information above from multiple sources. The ideas presented were developed by **Ananda Kumar, Nature Conservation Foundation**. More information: www.ncf-india.org. See **References**. Save the Elephants advises caution with all the methods and information collected and presented in this toolbox. Further research may be required before each site-specific implementation.

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nature conservation foundation





INFRARED OR MOTION-TRIGGERED SENSORS



WHAT IS AN INFRARED SENSOR?

An Infrared sensor is an electronic sensor that is triggered when an animal or object passes in front of it.

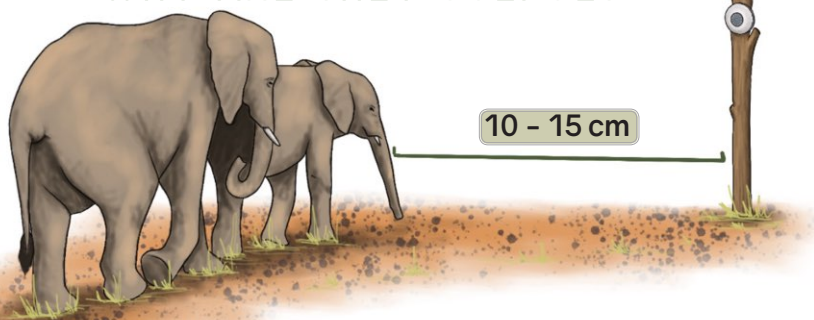


- ⦿ A passive infrared sensor (PIR) is a sensor that measures infrared light radiating from objects in the field of view.
- ⦿ Materials for this device might be available in a local electronic market and can be put together by those with some knowledge of electronics.

See more [Youtube](#) links on how to make an infrared sensor.

WHY ARE THEY USEFUL?

Automated and early warning systems could help reduce the need for constant guarding by farmers.

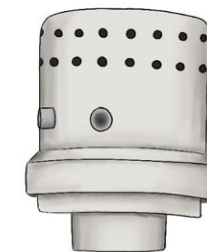


- ⦿ The motion sensor detects arrival of the elephant (within 10 to 15 m).
- ⦿ This device consumes very little battery power and lasts a long time in the field if properly made.
- ⦿ Once the PIR sensor is activated, it rings a bell placed at the watchman's hut.



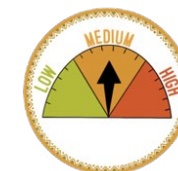
OTHER TYPES:

- ⦿ Some sensors may have a speaker inbuilt to the device.
- ⦿ The infrared sensor activates the speaker system
- ⦿ Playbacks of predators and bees can be used to help scare elephants away.
- ⦿ Example, Buzz Box by Wild Survivors.



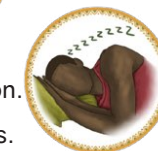
WHAT ELSE SHOULD YOU USE THEM WITH?

Best used in combination with other farm-based deterrents.



PROS/CONS

- ⦿ The radius of this device may be limited.
- ⦿ It may respond to any animal or vehicle that passes by.
- ⦿ Not ideal for wet conditions.
- ⦿ These devices may be a costly and more technically challenging option.
- ⦿ If they work, this could reduce the stress of crop-guarding for farmers.



CAUTION TIPS:



- ⦿ This document is not extensive. More research and design adaptations needed.
- ⦿ This method is dependent on battery power. Ensure devices are well charged for maximum success.
- ⦿ With all methods, there is a risk of habituation. It is best to combine and vary strategies.



CREDITS AND DISCLAIMER:

We have collected the information above from multiple sources. Main sources include: [Narayana, S. \(2014\)](#), The [Nature Conservation Foundation](#), [Mongabay \(2015\)](#) and [Wild Survivors](#). For more information, see [References](#). Save the Elephants advises caution with all the methods and information collected and presented in this illustrated toolbox. Further research may be required before each site-specific implementation.

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WATCHTOWERS



A high, safe place can be helpful for active farm-guarding at night and observing approaching elephants

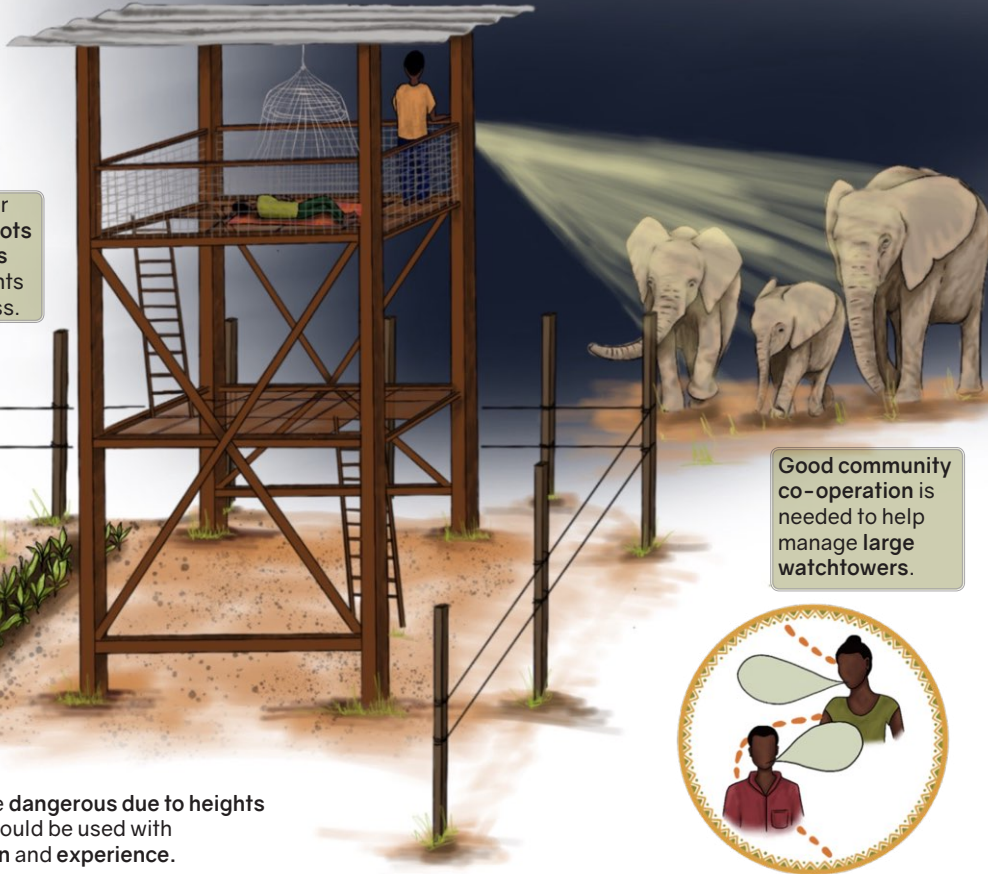
METHOD 2: LARGE OR COMMUNITY-MANAGED

Using a heavy-duty metal or wooden structure.

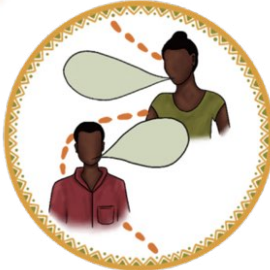
Using watchtowers and night-guarding helps with enabling farmers to react quickly and have an early warning system when elephants are nearby.



This is ideal for conflict hotspots and key routes where elephants frequently pass.



Good community co-operation is needed to help manage large watchtowers.



Can be dangerous due to heights and should be used with caution and experience.

The main purpose is to provide a high, safe vantage spot to guard and observe the surrounding area, and to send alarm signals

METHOD 1: SMALL, FARM BASED

Small watch platforms can be made up a tree or on top of houses.



Best used with noise and light deterrents

This is ideal for individual farm guarding at a household level

Through active guarding farmers can help reduce elephant crop raids and farm visits

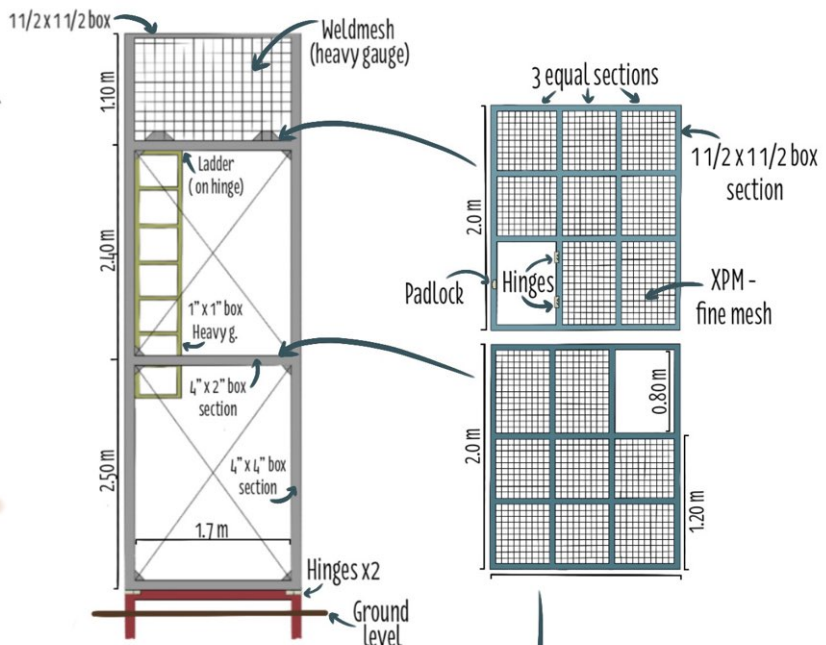
ESSENTIAL TOOLS FOR NIGHT GUARDING

- Flashing lights or torches
- Mobile phones
- Noise making deterrents
- Sleeping equipment and supplies
- Trip alarms for warning

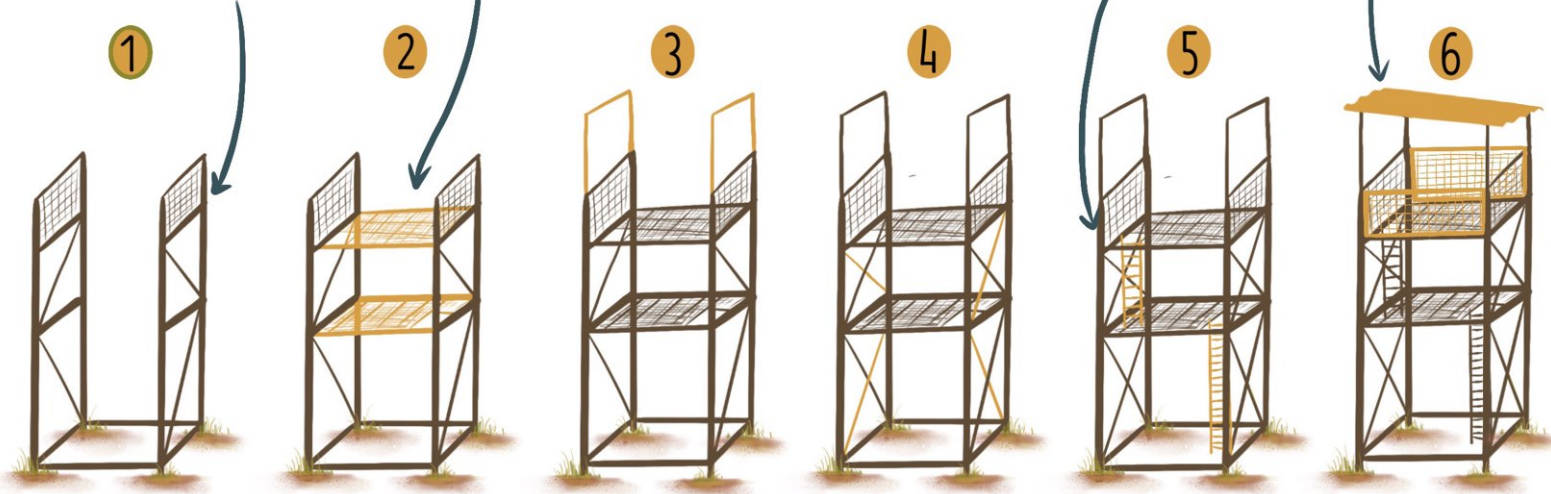
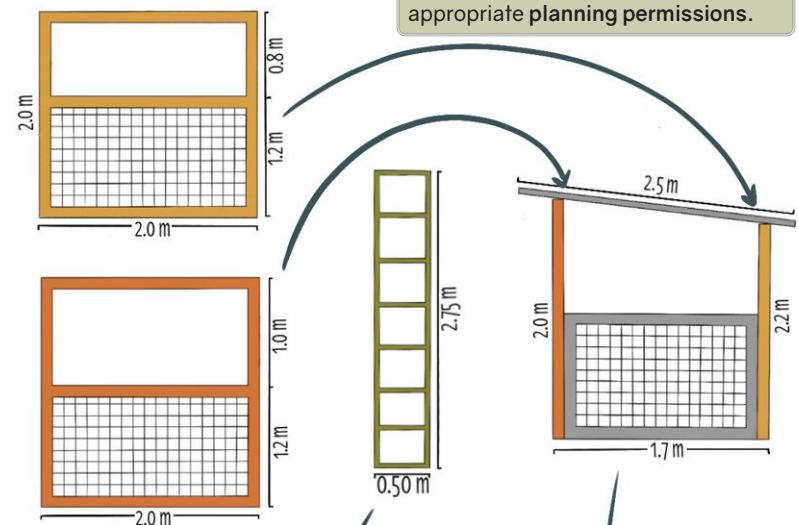


Simple alarm systems using a network of cowbells or tins filled with stones can also be effective in helping alert farmers.





If constructing a large watchtower, adapt the design according to your specific requirements. You may need appropriate planning permissions.



CAUTION TIPS:

- There are some high risk factors when using watchtowers or tall platforms.
- Use **safety instructions** or protocols for both the **construction** and **use** of watchtowers
- Ensure you have **good visibility and light** when using the towers at night.
- Take care** when ascending and descending the platforms. **Do not** climb towers under the influence of **alcohol**. No running or jumping off the watchtower.
- Advise **special caution** with children and the elderly.

CREDITS AND DISCLAIMER:

This Sagalla watchtower design was adapted by the Elephants and Bees Project, designed by Chris Campbell-Clause. More information: elephantsandbees.com. For literature and resources used, see [References](#). Further research and exploration of case studies may be required before each site-specific implementation. **Safety and caution** is advised with all the methods presented in this toolbox.

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SAVE THE ELEPHANTS



DRONES AND AERIAL METHODS



Drones are flying devices that can be controlled from the ground using a remote control to push elephants out of farms towards safety.

- They are a high-cost, high-tech solution that allows rangers/authorized persons to rapidly respond to mitigate conflict to protect both humans and elephants.

- Flying drones sound like a swarm of bees.

- When elephants are faced with a moving, flying drone that sounds like a swarm of bees, they will quickly move out of an area away from the direction of the sound.



Read more on: [Research done to prove drones sound like bees](#)

- Scientists have known for years that drones flown too close to wildlife, elephants included, have the capacity to disturb and even direct them towards a given point.
- Hahn et al. confirmed this in their 2017 case study, showing with a 100% success rate that elephants can be effectively chased from areas with human-elephant conflict using drones.

- Drones can be used to capture videos and photos as well, which allows researchers to understand elephant movement and behaviour, hence helping to mitigate conflict.



- Other aerial methods include using a helicopter to chase elephants safely out of settlements and farms.



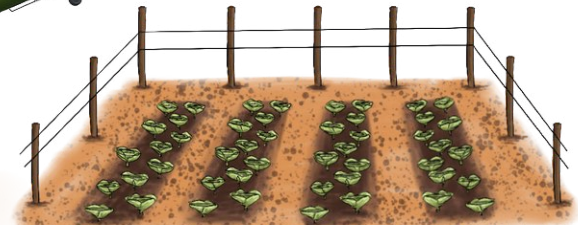
<https://www.pbs.org/newshour/show/drones-keep-elephants-away-people-tanzania>



🕒 The Mara Elephant Project (MEP) in Kenya use a helicopter for this purpose and it is an essential tool in their **human-elephant conflict toolkit**.

Read more on [The Only Helicopter in the Mara. Mara Elephant Project.](#)

🕒 However, some elephants may have already **habituated** to the loud sounds. In the case of **female herds**, the matriarch together with older elephants, may stand their ground to **protect their babies**.



See Elephant Aware Behaviour for more information



Watch how elephants are safely pushed out of farms: <https://vimeo.com/435717204> , <https://vimeo.com/465705025> , <https://www.youtube.com/watch?v=D4-ZVdW1p3w&feature=youtu.be>

CASE STUDY

Read more on: <https://maraelephantproject.org/mep-staff-trained-to-operate-drones-for-conservation/>



🕒 In 2016, MEP partnered with RESOLVE and the [Tanzanian Wildlife Research Institute](#) to begin a drone-based human-elephant conflict **training program** for rangers within the Tarangire and Serengeti National Parks in Tanzania.



🕒 5 trained teams of **wildlife managers** deployed drones in response to elephant crop raiding events during peak maize harvest.



🕒 Drones were used a total of **51 times** to drive off elephant herds, at **38 farms** and **13 settlements** within the protected ecosystems.

🕒 The operation had a **100% success rate**.

🕒 They found that sweeping the drone **back and forth** behind the elephants in a herding fashion is the **safest way** to prevent elephants from turning back towards people.



🕒 MEP developed a “**Drone Flying Manual**” for this program which is **available by request** to help other organizations use drones to reduce conflict.

Watch [Protecting Kenya's Elephants from Above.](#)





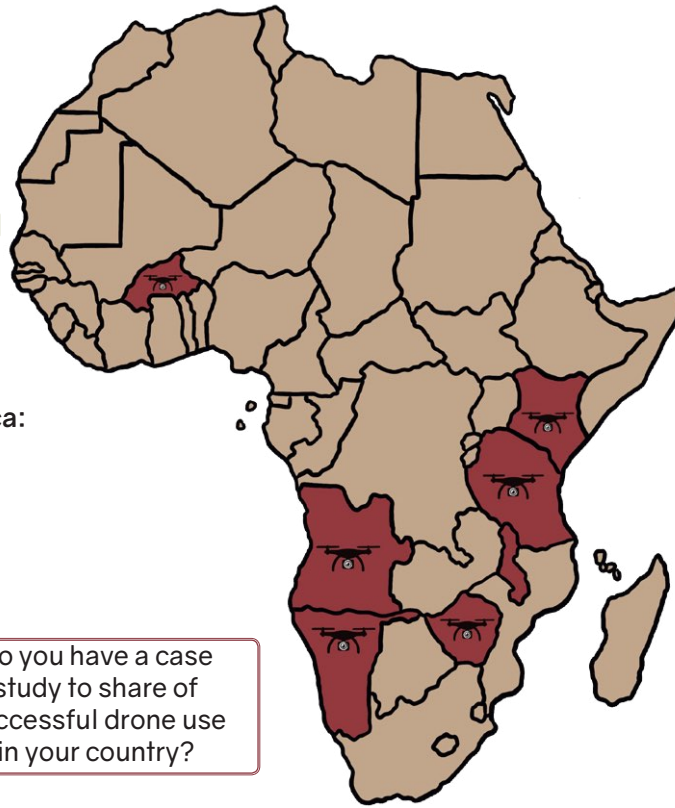
KNOWN COUNTRIES DRONES ARE BEING USED



Eastern, Central, and Southern Africa:

- Angola
- Burkina Faso
- Kenya
- Malawi
- Namibia
- Tanzania
- Zimbabwe

Do you have a case study to share of successful drone use in your country?



[Watch more on drones](#)

PROS +

- Cheaper to maintain than a helicopter.
- Safer to fly and control.
- No runway needed to land the drone.
- It can be **remote controlled** on the ground, at a safe distance from the elephants.
- **Effective** in chasing elephants out of farms & compounds.
- If handled with care, it can be **long-term**.
- Drone technology and batteries are improving all the time.



CHALLENGES

1. LEGALITY & PERMISSION

- You must apply to receive legal permits and drone pilot licenses needed to own a drone in Kenya.



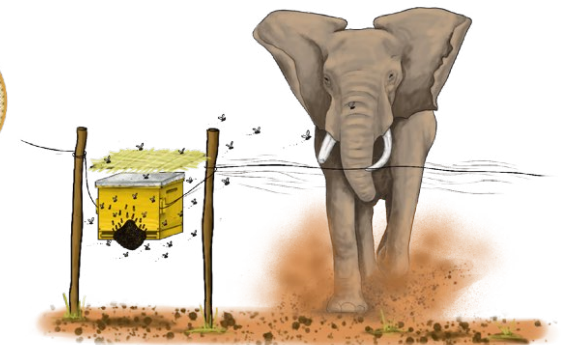
- Failure to secure a license could result in fines or even jail time.

2. ELEPHANT HABITUATION

- Drones have the potential to be an effective elephant deterrent, however there is **little research** on habituation and the **long-term efficacy** of this technique.
- Studies show other elephant deterrent methods, such as **Noise Deterrents and Trip Alarms**, become **less effective** over time, while others such as **beehive fences** remain effective.



See
Beehives
fences for
more
information



3. DISTURBANCE

Some studies have noted that drones may disturb wildlife.

Various species of birds, reptiles, and mammals have all been recorded shifting behaviour in response to drones.



Rebolo-Ifrán, N., Graña Grilli, M., & Lambertucci, S. A. (2019). Drones as a Threat to Wildlife: YouTube Complements Science in Providing Evidence about Their Effect. Environmental Conservation, 46(3), 205–210. <https://doi.org/10.1017/s0376892919000080>

4. TRAINING

All drones require trained experts to operate effectively.



5. ETHICS

Drones may interrupt people's privacy, as most drones have the ability to capture photos and videos.



6. COSTS

Drones are high-cost devices.

The more advanced the drone type, the higher the cost of buying and maintaining it.

Training people to fly drones will further add to the cost.



Some drones are less effective at night as they may be difficult to fly in the dark.

There is a higher risk of it crashing or flying too close to the elephants.



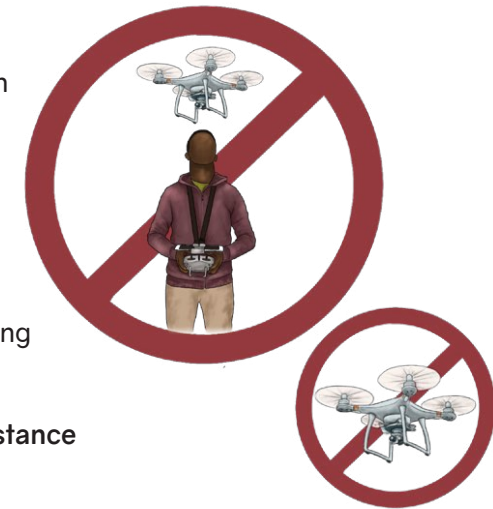
<http://moef.gov.in/wp-content/uploads/2017/08/HEC-management-guideline-Final1.pdf>

The average time an affordable drone will fly is 20–25 minutes. The batteries need to be recharged thereafter.



TIPS

- Do not misuse drones, especially within a certain distance of any airport/secure location/country borders, where restrictions are highest.
- Violations of these regulations can lead to large fines and possibly jail time.
- Fly drones with care to prevent them from crashing or getting stuck on trees.
- Always ensure you are flying drones at a safe distance from wildlife and people, to prevent injuries.



CREDITS AND DISCLAIMER:

We have collected the information above from multiple sources that are sourced throughout the document. Main source includes: Connor Bennet and Mara Elephant Project (MEP). This manual is not extensive. To learn more and explore further about Drones and Aerial Methods, see [References](#). Some original words commonly used have been simplified for easy understanding. Save the Elephants advises caution with all the information collected and presented in this toolbox. Further research may be required before each site-specific implementation. * Save the Elephants is not liable for any costs, damages or injuries incurred by the use of these methods or information.

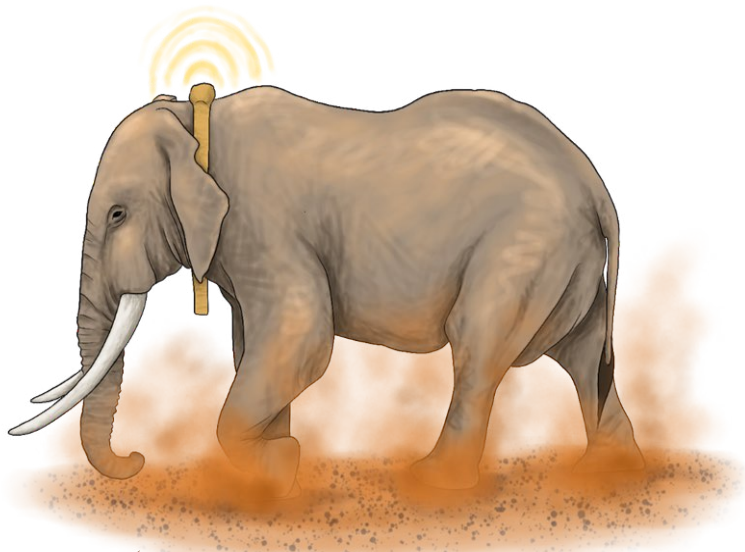




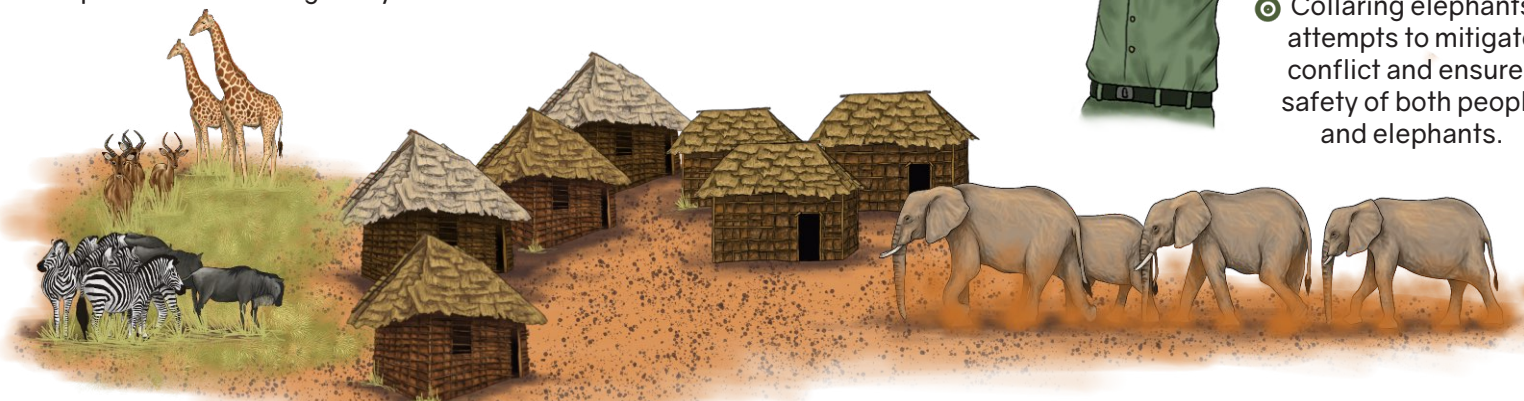
GPS TRACKING COLLARS AND GEO-FENCES



GPS (global positioning system) tracking collars are a highly accurate satellite-based navigation and location system that are fitted onto elephants to monitor their movements in real-time across landscapes.



- As a migratory species, most elephants in Africa spend most of their time **outside protected areas**, meaning many are likely to cross through nearby villages and farms.
- Increase in **human population** has prompted the development of **human settlements** and roads that completely **block or restrict passage** through important wildlife migratory routes.



- Collaring elephants attempts to mitigate conflict and ensures safety of both people and elephants.



- [Save the Elephants \(STE\)](#) use GPS-tracking equipment to understand elephant lives, decisions and needs.
- STE founder **Dr. Iain Douglas-Hamilton** was the first to track elephants using **radio collars** (1969) and STE remains at the forefront of tracking technology.
- Collars contain advanced **GPS satellite or GSM tracking devices** that allow scientists and wildlife rangers to monitor, in real time, when and where individual animals are moving across the landscape.



Bull elephant called Wide Satao with a fitted collar © Naiya Raja/Save the Elephants

Read more on: [-Tracking - Real Time Monitoring. \(2022, March 11\). Save the Elephants.](#)

[Kenya uses satellite-linked GPS collars to protect elephants, people. \(2016, September 9\). Save the Elephants.](#)

Watch: [War of Space | Human/Elephant Conflict in the Maasai Mara. \(2022, May 16\).](#)



When collared elephants are approaching farmlands/community areas or are in any danger, rangers are able to inform **rapid response units** and **ground patrol** to make their way to the site and attempt **safely to scare the elephant away**, using various **deterrent methods** such as noise and chilli bombs.



The need to understand patterns of **elephant movement** and **interactions** with farmlands allows us to compile **effective mitigation methods** to reduce levels of conflict and **promote tolerance** of elephants in rural communities.



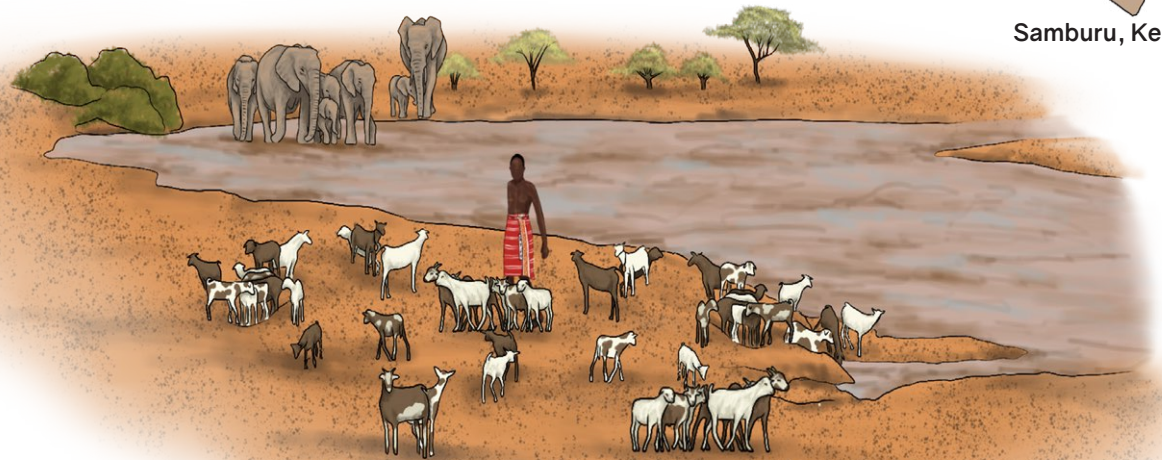
A bull called Manolo near a village around Lake Jipe © Save the Elephants

CASE STUDIES

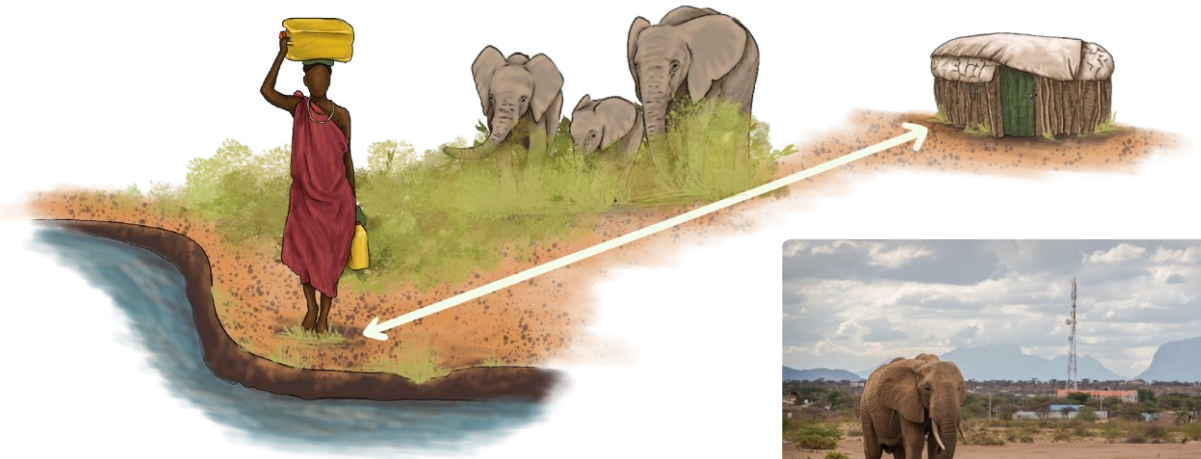


Samburu, Kenya

In and around **Samburu Game Reserve** in Northern Kenya, elephants often come in contact with **herders** and their **livestock** at water points such as rivers.



- Collared elephants around Samburu are monitored to prevent them from coming in **conflict with humans**, as some clashes can be **fatal** to both elephant and people.
- Collars also help to understand important **elephant corridors** and inform the community to be more careful about where is safe to build their houses and herd their livestock.



Elephant passing close to village in Samburu © Jane Wynyard/Save the Elephants

Watch more on [Protecting Africa's elephants with Save the Elephants](#)



- ⦿ A male elephant named **Mangelete** was collared in Tsavo West National Park (2022) and was then translocated.



Tsavo, Kenya



Translocating a bull
© Sheldrick Wildlife Trust

- ⦿ He frequently broke into fences and raided crops in the nearby village and the community was not happy.
- ⦿ He is currently monitored by authorized officers.

[Read the whole story on: Relocating a Troublesome Bull Through His Collar](#)

- ⦿ **Tim**, an iconic **tomato-loving** male elephant from **Amboseli** grew a taste for **farmed foods** and so he was a good target for collaring.



Amboseli, Kenya

- ⦿ His tracking data provided insight into his **crop-raiding behaviour** and enabled conservation partners to improve **rangers patrol strategies** so that villagers can live more harmoniously with elephants.



- ⦿ Rangers tracked Tim using **EarthRanger** and were able to chase him and other elephants out of farms, preventing many crop raids.



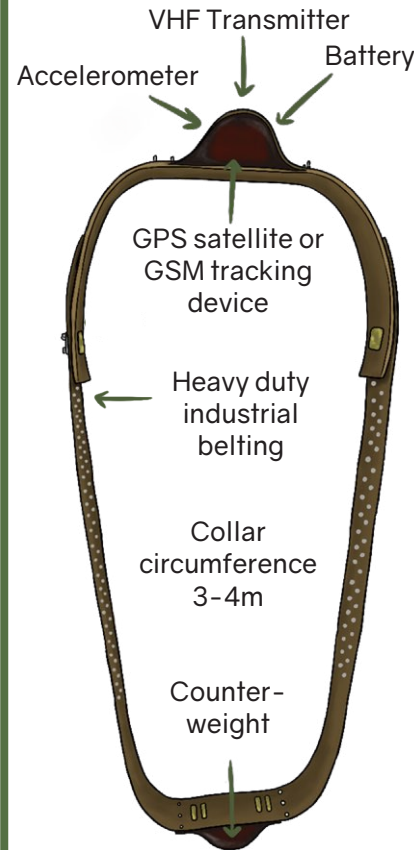
Fitting a tracking collar in Tsavo, Kenya
© Naiya Raja/Save the Elephant



Frank Pope of Save The Elephants explains to Maasai women how a mobile phone is used to see the location of an elephant fitted with a tracking collar © Paul Obuna/WildlifeDirect

[Kahumbu, P. \(2021, October 29\). The day we collared Tim, the great tusker. The Guardian.](#)

COMPONENTS OF THE COLLAR

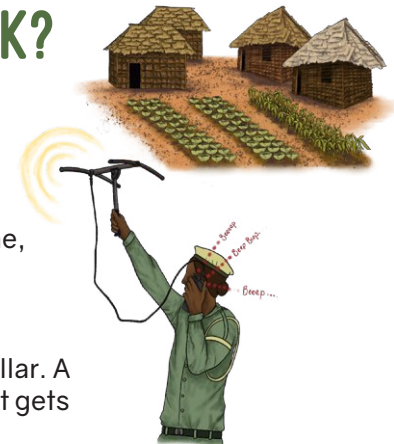


- ⦿ The collar consists of a **VHF transmitter** and a **battery**, a **counterweight** and a **belt**.
- ⦿ **Accelerometer** modules can provide immediate **data** on elephant activity, e.g., when the elephant suddenly **streaks/runs**, is moving **slowly**, and when it is **not moving at all** and could be dead or injured.
- ⦿ The collar goes around the elephant's **neck** with the tracking device **resting on top**, where the signal can be **strongest**, while the weight hangs between the two ends of the belt under the elephant's chin, to keep the collar in balance.
- ⦿ The outer shell of the top unit is made of **thick resin** which provides a **tough protection** to prevent all the equipment inside from breaking.
- ⦿ Collar designs have evolved after many years of experience in the field and each collar brand has different **pros and cons**.
- ⦿ A satellite collar can last up to **3-4 years** after which it is **replaced or removed**.
- ⦿ Collar life depends on the **setting** you ask of the collar (e.g. how many positions per day and how often you download the data).
- ⦿ Collars **do not affect** the lifestyle of **elephants**.

Common types of collars used in Africa include; [African Wildlife Tracking](#), [Savannah Tracking](#) and [Vectronics](#).

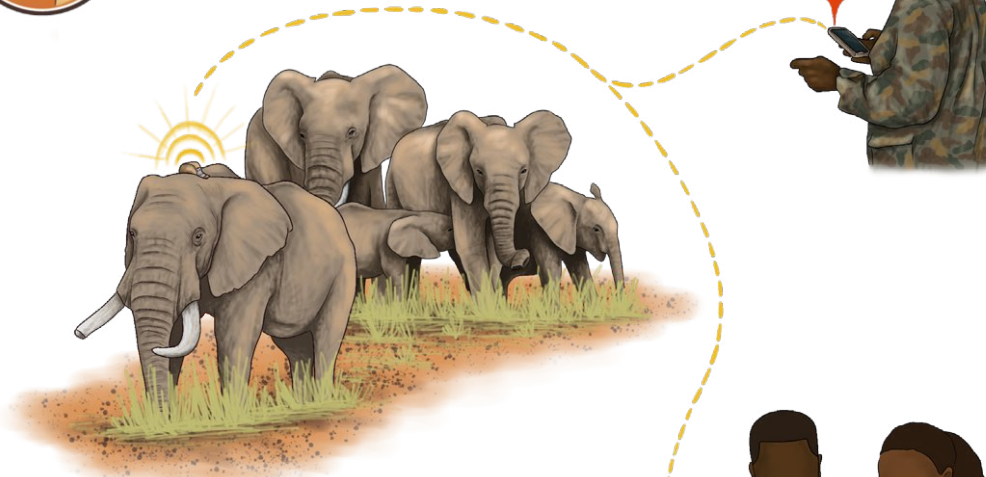
HOW GPS COLLARS WORK?

- ⦿ GPS system gives information about the **location/position** of the **elephant**, typically **every hour** (time could be adjusted).
- ⦿ Transmitters in the collar send a signal via a satellite, which sends information to a Central database, or to an application on the phone, for example [WildTracks & Earth-Ranger](#).
- ⦿ If the collar **fails**, a directional antenna is used to detect signals emitted by **VHF (Very High Frequency) Transmitters** inside the collar. A **"beep-beep-beep"** sound is produced in the radio as the elephant gets closer to the receiver.



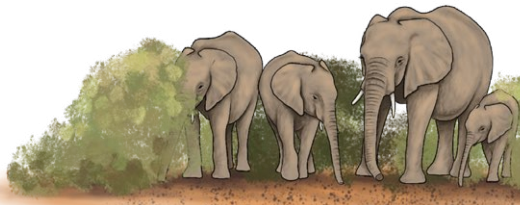


- ⦿ The signal can sometimes be distorted by **obstacles** in the landscape, like hills/ mountains, gullies, dense vegetation, etc.



Read more on: [First GPS Collars for Elephant Tracking](#), [Save the Elephants GIS Elephant Tracking](#), [Tracking elephants using mobile phone technology](#)

- ⦿ Collars have radio transmitters with **different frequencies**, so that each elephant can be located using a **unique frequency**.



Dr. Lucy King using a VHF antenna to locate a collared elephant © Madi Chan.

[VHF tracking to locate collared elephants at Lake Jipe. Elephants & Bees.](#)

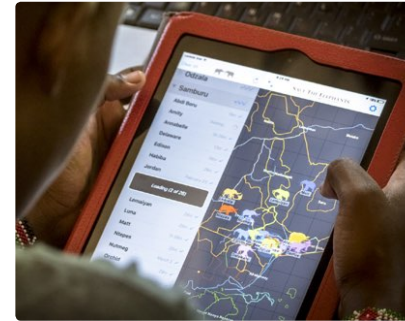


EARTH-RANGER/WILDTRACKS APP

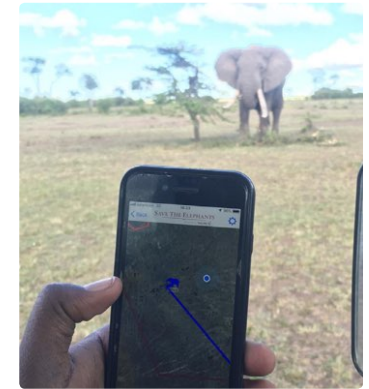
- ⦿ **Earth Ranger** is a software developed by **Vulcan Inc** (with input from **Save the Elephants**) used in several protected areas across the globe that displays **all animal movements** to help tackle challenges such as **human-wildlife conflict**.

[Elephant Movement Animation on EarthRanger, MEP.](#)

- ⦿ **WildTracks** is a tracking application developed by **Save the Elephants** and **Vulcan Inc** that has powerful advantages where animal movements are displayed to highlight the **speed** at which they are moving and **where they travel** by day and night.
- ⦿ If the elephants approach **human settlements**, these apps can send an **alert to rangers**, allowing them to **respond** before an incident takes place.
- ⦿ Using these platforms, collared elephants can be monitored **online** from anywhere in the world.



Tracking elephant movement through WildTracks app © Save the Elephants



EarthRanger Tracking Platform © Mara Elephant Project

Read more on: [STE Tracking App](#) & [The conservation apps revolutionizing how rangers work.](#)

GEO-FENCES

- ⦿ Geo-fencing is a feature that uses **GPS** or **radio frequency identification (RFID)** to create **virtual geographical boundaries** on a device. These boundaries are called **Geo-fences**.
- ⦿ There are no actual **physical barriers** on the ground, so people and elephants cannot see them with their eyes.
- ⦿ Geo-fences can be virtually “marked” around **reserve fences, local villages, farmlands** etc.



Geofence in Sagalla, Kenya, created using WildTracks App © Save the Elephants



⦿ If the elephant strays outside of its known range and either breaks a “**marked**” fence or enters a local village to raid crops, the collar sends an **SMS text message**, email or WhatsApp message to **authorized officials** alerting them of the **immediate problem** and the **location of the elephant**, enabling rapid action.

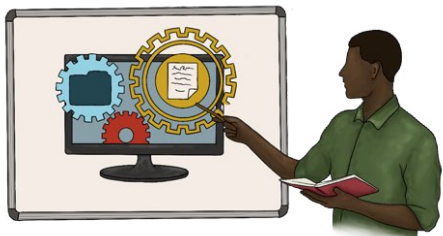


- ⦿ Although GPS and GSM collaring is widely used, geofencing is still primarily applied in **Kenya and some other African countries**. However, it can be a great tool for other species as well.
- ⦿ **Physical boundaries** are **costly** in terms of time and money and also cause habitat fragmentation which can raise **conflict** and **migration blockage** on affected species.

Read more on [Geo-Fencing, Save the Elephants](#).

GENERAL INFORMATION

- ⦿ Collars should only be fitted on elephants by persons **properly authorized** and sensitive data can only be accessed by them, as this data could be **mishandled** with the wrong intentions.
- ⦿ **Advanced knowledge** and **training** are needed to use this technology.



- ⦿ **Collar disfunctions** can occur and they wear out every few years so they need to be replaced.
- ⦿ Sometimes communities think placing a collar on an elephant implies **ownership** and responsibility for the havoc it causes.

⦿ Collaring operations are both **labour-intensive** and it is **expensive** to fit a collar on an elephant which is why not all elephants have a collar.



⦿ Collaring involves **immobilizing the elephant** which may be risky to the elephant.



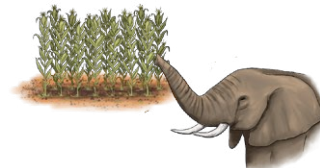
CASE STUDIES



Example of an SMS alert when a collared elephant (Genghis Khan) crossed a geofence © Save the Elephants

- ⦿ An elephant bull named Kimani was the first elephant to be collared and tested under the Geofencing (OI Pajeta) due to his skills in breaking fences and raiding crops.
- ⦿ STE placed a **mobile phone SIM card** in Kimani's collar, then set up a virtual “**geofence**” that surrounded the conservatory's boundaries.

- ⦿ When Kimani approached the virtual fence, his collar sent a **text message to rangers**.
- ⦿ Kegol is one of **Mara Elephant Project's (MEP)** larger male elephants that was collared and monitored in partner with STE (2015).
- ⦿ He's known to leave the safety of the Mara North Conservancy and so **Geo-fences** have been positioned around vulnerable villages and farmlands.
- ⦿ If Kegol crossed into an un-safe zone to crop raid, for example, MEP would **receive an alert** to let them know that there is **danger of human-elephant conflict**.

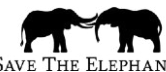


CREDITS AND DISCLAIMER:

We have collected the information above from multiple sources that are sourced throughout the document. Main sources are [Save the Elephants](#) and [Mara Elephant Project](#). To learn more and explore about GPS Tracking Collars and Geo-fences, see [References](#). Some original words commonly used have been simplified for easy understanding.

Save the Elephants advises caution with all the information collected and presented in this toolbox. **Further research** may be required before each site-specific implementation.

* Save the Elephants is not liable for any costs, damages or injuries incurred by the use of these methods or information.



ELEPHANT COMPATIBLE FARMING



Crop choices and kitchen garden practices

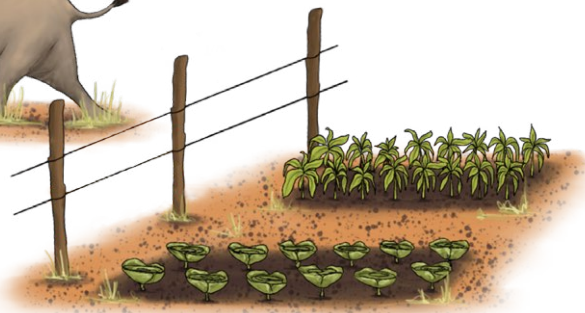
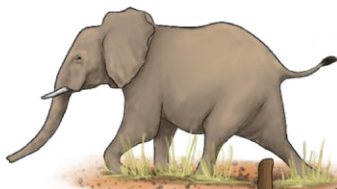




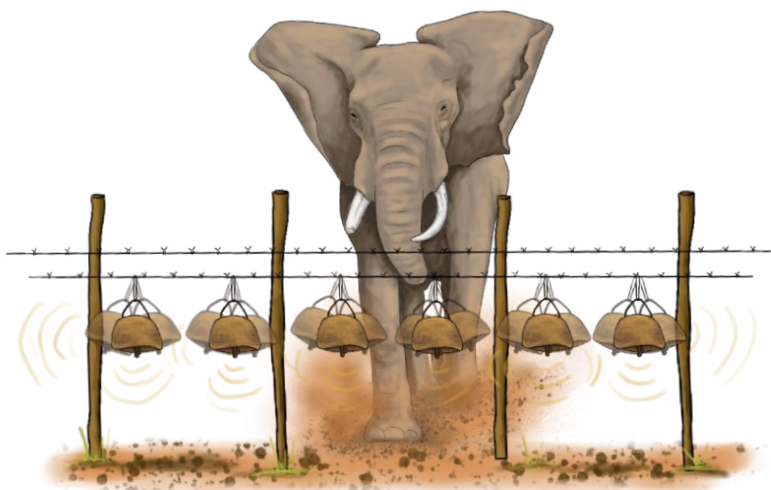
CROP CHOICE & KITCHEN GARDEN PRACTICES IF YOU LIVE ALONGSIDE ELEPHANTS:



Elephants need large amounts of food to survive; up to 450kg a day. With prolonged drought periods, food for elephants becomes limited and they can be forced to search for food in farms.



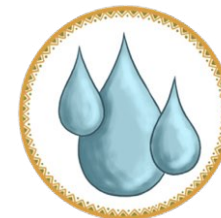
- If you live near a **national park/ reserve**, plant crops that elephants **do not eat** to ensure they are not attracted to your farm.
- These are called **non palatable crops**.
- Such crops may be **cash crops** and can provide an **alternative income** when processed.
- With your added income you can then buy **food items** like **maize** and **beans** from farmers who are not living in an elephant conflict zone.
- Use additional **boundary** or **early warning deterrent methods** around your farm to protect your crops from getting raided.



TIP

It is advisable to plant crops in **smaller farmlands**, especially in areas around elephants, as it is **cheaper** and **more efficient** to protect **small crops fields** against elephants using different boundary protection methods.

- Small farms generally require **less water**.
- Soils can **degrade** fast if you plant the same crops every season (**monoculture**).
- In order to farm successfully in a small **1-3 acre farmland**, try to practice **Conservation Agriculture techniques** to **preserve soil health** and **water retention**.



TIP

Avoid planting the same crop in the same field for more than one cropping season. **Rotate** non-palatable crops each season and **intercrop** with nitrogen fixing plants like **beans/legumes** to keep soils healthy.





"I cannot eat these, they are not tasty"

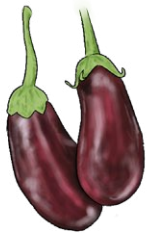


NON - PALATABLE CROPS:

- Non-palatable crops are those that elephants do not eat.
- Planting these can decrease elephant visits to your farm.
- It is a safe way to **generate an income** without needing as much crop or farm boundary protection against elephants.
- Growing such crops **reduces the stress** to constantly guard your crops.
- You only need a **small farming space** to grow many non-palatable crops.
- Make sure you establish a market to sell your crops to before you change to non-palatable crops.

EXAMPLES OF NON-PALATABLE CROPS YOU CAN HARVEST ON YOUR FARM:

[Gross, E. M., McRobb, R., & Gross, J. \(2015\). Cultivating alternative crops reduces crop losses due to African elephants.](#)



Eggplant



Sunflower



Ginger



Garlic



Turmeric



Rubber



Okra



Red chillies



Black pepper



Sesame



Herbs e.g. mint, rosemary and neem



Lemongrass



Citrus fruits such as lemons

IMPORTANT TIP:

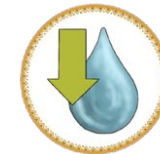
- Some non-palatable crops will not completely keep elephants off your farm.
- Elephants can still **trample** crops even if they don't eat them.



- Combined farm deterrent & protection methods will help to provide more protection against elephants entering your crop field.



- Most non-palatable crops listed above are **drought resistant**, and will grow well with a sufficient amount of water.



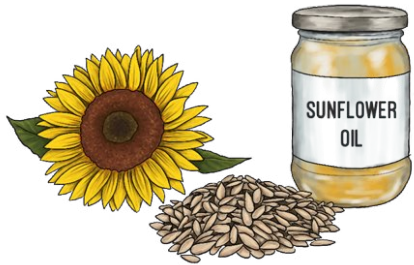
- Several non-palatable crops can be grown in **vertical flour sacks, tubs** by the house or in **small kitchen gardens**. These techniques require **small farming space**, making it **cost effective** and require **less water**.

CASE STUDIES:



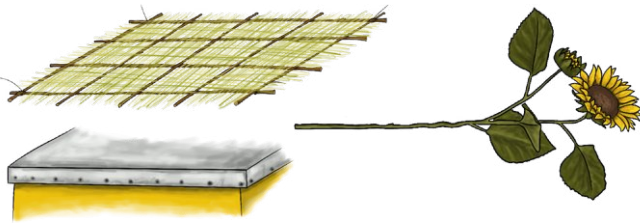
Location: **Elephants & Bees Project, Sagalla, Kenya**

- It was observed that elephants avoided eating sunflowers that had been planted to provide fodder/ food for the bees in the beehive fences.



- Elephants occasionally walked over the sunflowers but the heads could still be harvested and dried, and the seeds sold/pressed into sunflower oil.

- Sunflowers grow quickly in the **iron-rich soils** of Tsavo and their stalks can be fed to livestock or used as simple thatching materials to make roofs for beehives.



- Sunflowers seeds/oil is high in **Vitamin C & E** and sells well in most local markets.

2 methods helping with living in harmony with elephants, Elephants & Bees Project. <https://elephantsandbees.com/2-methods-to-help-with-living-in-harmony-with-elephants/>

Read more on: <https://www.kenyanews.go.ke/farmers-opt-for-sunflowers-to-keep-jumbos-away/>

CONS —

- Market availability needs to be present for alternate crops.
- Switching from traditional farming methods to new practices may take time.
- Farmers need **training** on how to properly grow new crops.
- Switching to cultivating new crops requires **specific and new skills** that could take **time** as well as costs in trial and error.



Location: **Zambia**

- They tested plots of **maize, ginger, garlic, and lemongrass**.
- The findings were that **maize**, when left **unprotected** was completely **destroyed by elephants**.
- Lemon grass** was **trampled** (walked over) as well as some **trampling on garlic and ginger**.



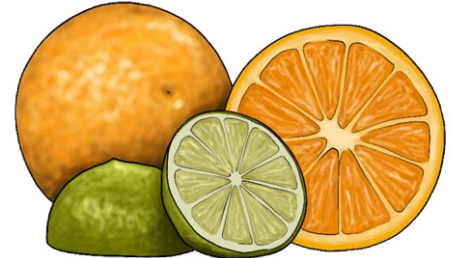
- Evidence suggested that elephants **tasted the lemongrass and ginger plants** but did not eat them suggesting that they were not interested in the two crops.
- They discovered that the **ginger grew very well**, even if trampled on it was able to be **harvested and sold**, as it grows underground.

[Gross, E. M., McRobb, R., & Gross, J. \(2015\). Cultivating alternative crops reduces crop losses due to African elephants.](#)



Location: **Sri Lanka**

- Asian Elephants in Sri Lanka do not eat oranges.**



- To test this observation an experiment was conducted with six Asian elephants at the **Sri Lanka National Zoological Gardens**.

[Dharmarathne, C., Fernando, C., Weerasinghe, C., & Corea, R. \(2020\). Project orange elephant is a conflict specific holistic approach to mitigating human-elephant conflict in Sri Lanka. Communications Biology, 3\(1\).](#)

- Project Orange Elephant:** By growing a **barrier of citrus trees** around rice crops, rural Sri Lankan families can create a **safe and sustainable elephant deterrent**. Elephants do not tend to "raid" citrus trees and they are **tall** enough that the elephants are unable to **trample them**. (Vallery, A. 2015)

[Vallery, A. \(2015, February 26\). This Incredible Organization is Using Oranges to Save Asian Elephants. One Green Planet.](#)

POINT TO NOTE:

Even though citrus crops are less attractive to African elephants, they may **not be completely unpalatable** or even repellent to them. (Goss et al. 2016)



VERTICAL BAG FARMING:



Greens grown in vertical sacks, Elephants & Bees Research Centre, Sagalla, Kenya

- ⦿ This involves growing plants vertically in sacks (gunias) that have holes on them.
- ⦿ The bags allow people to grow a lot of **nutrient rich, high yield vegetables** in places with limited land and water.
- ⦿ **High crop yields** are harvested in just a **small area of land**.
- ⦿ Multiple sacks can be grown in very small **kitchen gardens** close to the house that are easier to protect against elephants.

- ⦿ **Rainwater** from the roof of your house can be collected to drip feed into these sacks and provide year-round vegetable production.



MATERIALS NEEDED TO SET UP A VERTICAL BAG FARMING:



A sack (e.g. flour bag) or net sacks



Treated animal manure



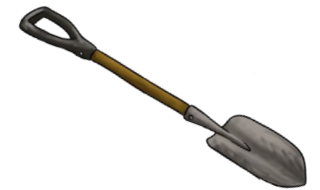
Soil



A tin (empty paint tin or any other strong 4kg tin)



Scissors/knife/small sharp tool to make holes in the bag



Shovel



Small piece of cloth



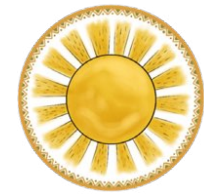
Rocks or pebbles



Small nursery area to grow seedlings

HOW TO SET UP YOUR VERTICAL BAG FARM:

- ☉ Choose a location with **good sunlight**.
- ☉ Make sure there is **no disturbance** from livestock.
- ☉ You can place the sacks close to each other, but leaving enough space to **allow growth** of plants from the sides.



1. Place your sack on the ground and fill it with **15–20cm** of soil to form the base.



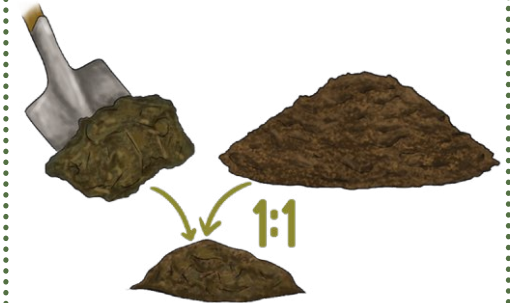
2. Remove the lid of the tin. Using a knife/sharp tool, carefully cut the bottom of the tin to make a **hollow pipe**.



3. Place the **hollow tin** in the centre, on the surface of the soil and start filling the tin with **rocks/pebbles** until the top of the tin.



4. Mix **manure** and **soil** in the ratio of **1:1** to form a mixture.



5. Leave the tin in place and **cover** the opening of the tin with a **cloth** to prevent soil from falling into the rocks. Tie the cloth or secure with a rubber band.



6. Add the **mixture** of manure and soil **outside** the tin until you reach the **top edge** of the tin.



7. Evenly spread the soil with hand and **sprinkle some water** over it to make it **moist**. Do not pour too much water as it will cause the sack to **bend** sideways.

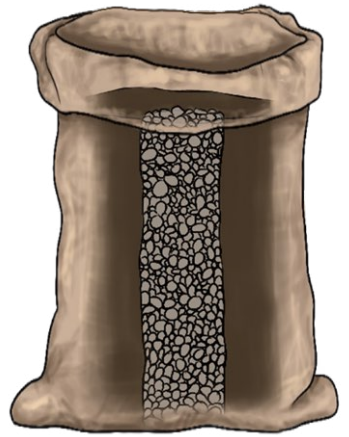


8. Remove the cloth. **Twist and slowly pull** the tin **upwards** until the base of the tin reaches the surface of the soil layer. The tin will leave behind a trail of rocks in the centre of the soil. **Do not pull out the whole tin** out from the soil.



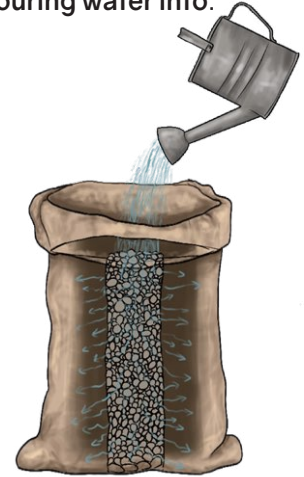


9. Refill the tin with more rocks and repeat the process until the sack is filled with soil.



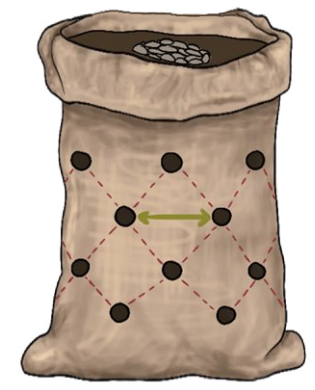
TIP Do not fill soil until the very top of the sack. Leave 5cm of sack without soil.

10. The tin helps to create a **column of rocks** in the centre of the sack. **This is where you will be pouring water into.**



The rocks evenly **distribute the water**, preventing water logging the base of the sack.

11. Once the sack is filled with soil and rocks, using a stick/sharp object, make holes in a **zigzag manner** on the sack.



For **net sacks**, make small coin sized holes all around with a distance of **15cm** between each hole. For **other sacks**, the size of the holes should be **0.5cm** wide.

TIP Holes are to allow crops to grow through them. Make sure the holes are **not in a straight line** on the bag. This is to prevent crops from blocking lower crops from the sun.

Once your **seedlings** are ready in the nursery, place them from the top of the sack and in the holes.

TIP Only provide a **moderate amount of water**. Too much water will get **drained out** of the holes and it will **clog** at the base of the sack. You can plant up to **50 seedlings** in a normal sized sack, and upto **100** in a large sack.

[Making a sack garden | Shamba Chef](#)

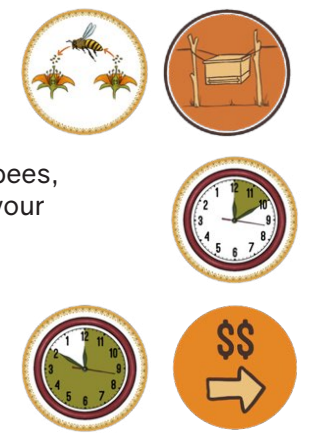
PROS +

- A smaller farm space is **easier** to protect against elephants.
- It takes up very **little farm space**. All you need is a sack.
- Maintenance is **very low**.
- Cost efficient.
- Weeds rarely grow on bags, and if they do, they can be **uprooted by hand**.
- You can **recycle laundry water** to grow your crops.
- Sacks are water effective. **Requires less water**.
- **Larger produce** of crops in a limited space.



CONS -

- **Less pollination:** if you place your sacks in an enclosed, shaded net area, it will keep away pollinating insects, including **bees**.
- Solution: grow flowering plants outside to attract bees, especially if you have a **beehive fence** protecting your farm.
- **Cement bags** typically can only be used for **one harvest season**.
- **Net sacks** can last upto **5 years**, but are **more costly** than other sacks.





CROP CHOICES FOR VERTICAL BAG FARMING:



Sukuma (collard green plant)



Lettuce



Kale



Coriander



Tomatoes



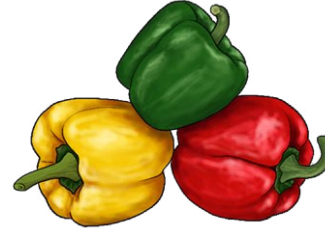
Spinach



Ginger



Lemon grass



Capsicum



Eggplant

TIP

Ensure the bags are well protected from elephants. Install **farm & boundary protection methods** around your area.



NURSERY ESTABLISHMENT FOR SEEDLINGS:

- Nurseries are important in helping **seeds** grow **healthier** in the first stages, before they are planted in the field or in your vertical sack garden.
- Some seeds germinate **slowly** and if planted directly in the field, they would **die** due to weed growth.



METHOD:

1.

Select a **shady** location to set up your nursery. You can also use **old car tyres** as the nursery.



These can be placed right next to your vertical sack garden for **easy watering**.

Old tyres retain water, making your nursery more **water-efficient**.

2.

Clear all **weeds** and **grass** by hand.



3.

Dig the soil well so that there are **no lumps**. Do not dig too deep.





4. 1 week before planting the seeds, add a **layer of prepared compost or treated/rotten animal manure**.

TIP Most nurseries do not require manure to germinate. Manure can be added directly to the field.



5. Soak the seeds in **warm water** for **30 minutes** before planting them. This will help the seeds germinate faster.



8. Cover the seeds with a **thin layer** of soil and add a layer of **mulch**.

The mulch layer helps soil to retain **moisture**.

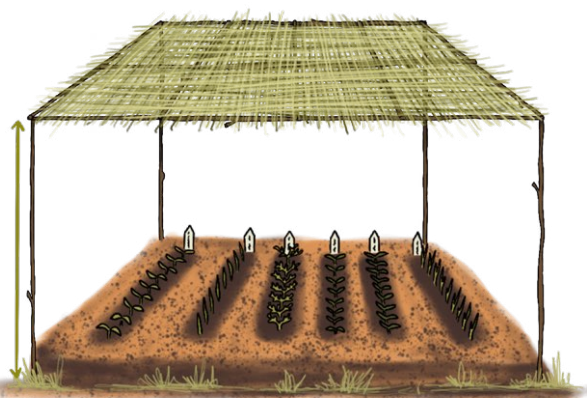
Water the bed with a sufficient amount of water. Do not add too much water.



9. Seeds will start to germinate after **5-7 days**.

As they start to germinate, remove the mulch layer and put a **1m high shade** over the nursery bed.

TIP Use a **thatched roof** (with dried grass and straw) to ensure some sunlight passes through.



6. Using a thin stick, make **shallow furrows** in rows across the nursery.



7. For **underground** crops (e.g. potatoes, onions), plant seeds **8cm deep**. For crops that grow **above ground** (e.g. kale), plant the seeds **2cm deep** in rows that are **15cm apart**.



10. Carefully remove any **weak seedlings** and plant them in another bed to care for them separately.

Keep the soil **damp** but not wet. Too much or too little water will kill the seedlings.

When transplanting your seedlings from the nursery to your farm/sack, carefully pick the seedling with its **roots still intact**, and place it gently into its new soil.



TOP TIP:

- 🎯 Nurseries require sufficient **attention, care** and some adequate **skills**.
- 🎯 Not all seeds require a nursery. These include cereals, carrots, coriander, etc.

1. [Setting up a nursery](#)

2. [How to prick out seedlings](#)

KITCHEN GARDENS:



Kitchen garden at Women's Enterprise Centre (WEC) at Elephants and Bees Research Camp, Sagalla, Kenya

- ⦿ Kitchen gardens are set up close to homes and allows farmers to grow a large variety of crops in a **small area**.
- ⦿ An ideal kitchen garden size for **one family** is 12m by 10m and is covered by **black net** to allow sufficient sunlight through, and also **keep pests out**.
- ⦿ Simple **drip irrigation** can be installed in the kitchen garden.
- ⦿ You can also include **vertical bag farming** to ensure high crop yield in a small farming space.

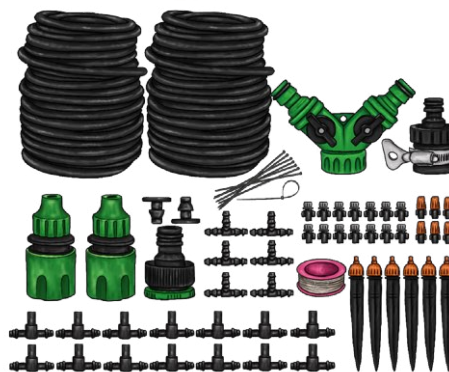
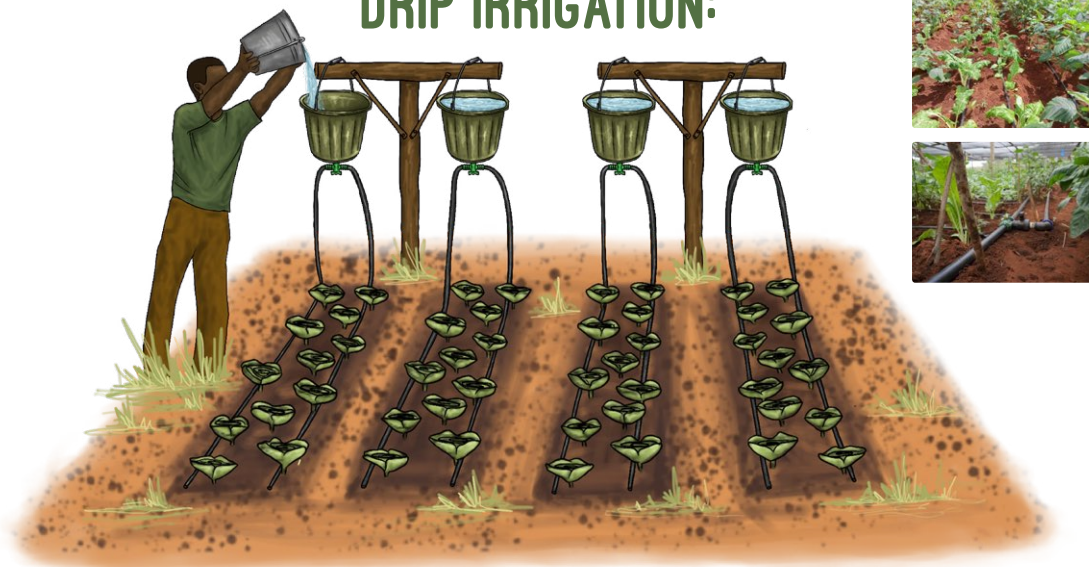
<https://elephantsandbees.com/permaculture-garden/>

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DRIP IRRIGATION:



- ⦿ These are ideal as it minimizes the drainage problems associated with other water application methods.
- ⦿ The **drip irrigation kit** is normally installed, with drip lines being around **2m apart**.
- ⦿ Drip kits may be installed with **buckets**, if tanks are unavailable.
- ⦿ A tap/valve are usually attached to the base of buckets/tanks to control the flow of water.
- ⦿ Rain water can be collected and put in the buckets.

TIP

- ⦿ Always ensure you use **farm protection/deterrent methods** to protect your garden from elephants.
- ⦿ Use combined methods to increase deterrent effectiveness.
- ⦿ Grow natural pest repelling plants such as **neem** and **marigolds** to keep insects away.



CONS

- ⦿ Expert help is required to install the drip kit.
- ⦿ The cost for buying the drip kit is high.
- ⦿ Farmers must acquire **skills and knowledge** on how the system works.
- ⦿ If not installed well, water is wasted and soil can get clogged.



ELEPHANT COMPATIBLE INCOME GENERATING ACTIVITIES



Alternative income from from elephant-friendly enterprises



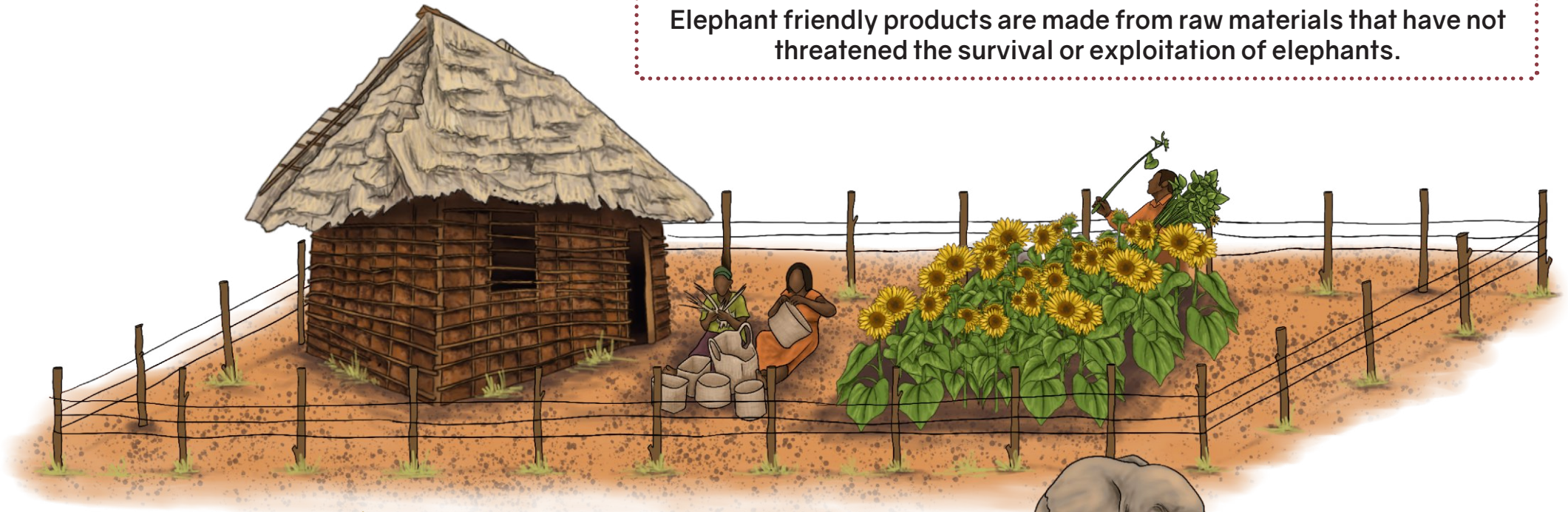
Guide to beekeeping and safety



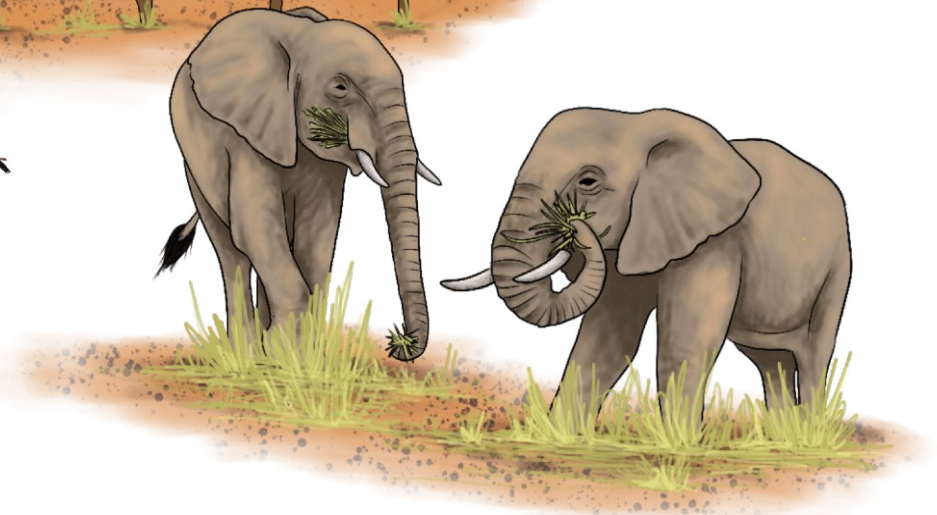
ALTERNATIVE INCOME FROM ELEPHANT FRIENDLY ENTERPRISES

Alternative income generating activities provide opportunities for farmers to earn extra income through other diverse ways, rather than fully depending on farming.

Elephant friendly products are made from raw materials that have not threatened the survival or exploitation of elephants.



- Communities sharing the same space with wildlife are also provided with other **benefits** resulting from **ethical wildlife protection**.
- This, in return, boosts **co-existence** between people and wildlife.
- Because of the **changing climate**, **drought** is becoming more persistent, which is why crop yields either do not reach market standards or are not planted due to lack of rainfall.
- Having other **income sources** other than crop harvests also reduces the household shock should an elephant **successfully** raid a farm and damage/eat crops.

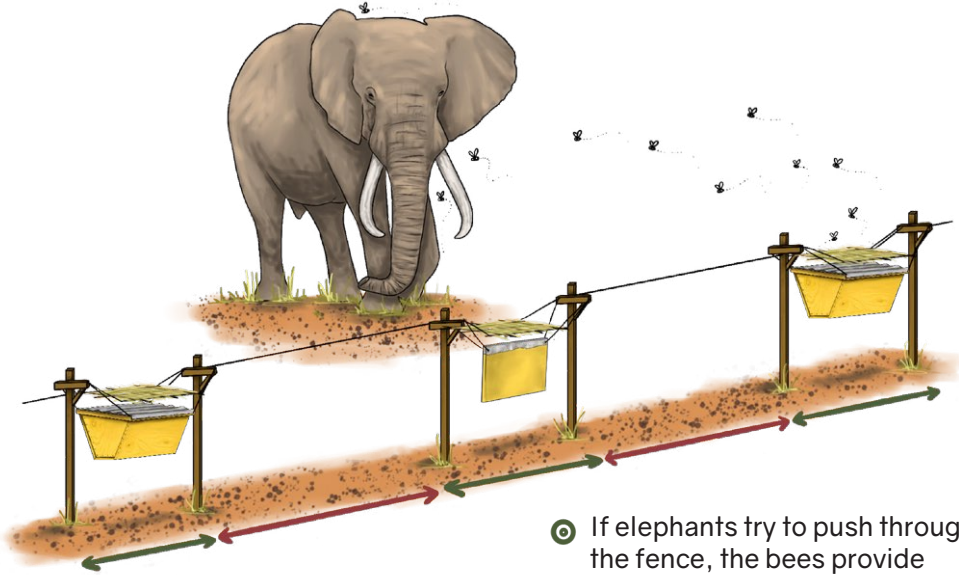


- One Health:** people, animals and the environment all have to be healthy for our communities and ecosystems to thrive.

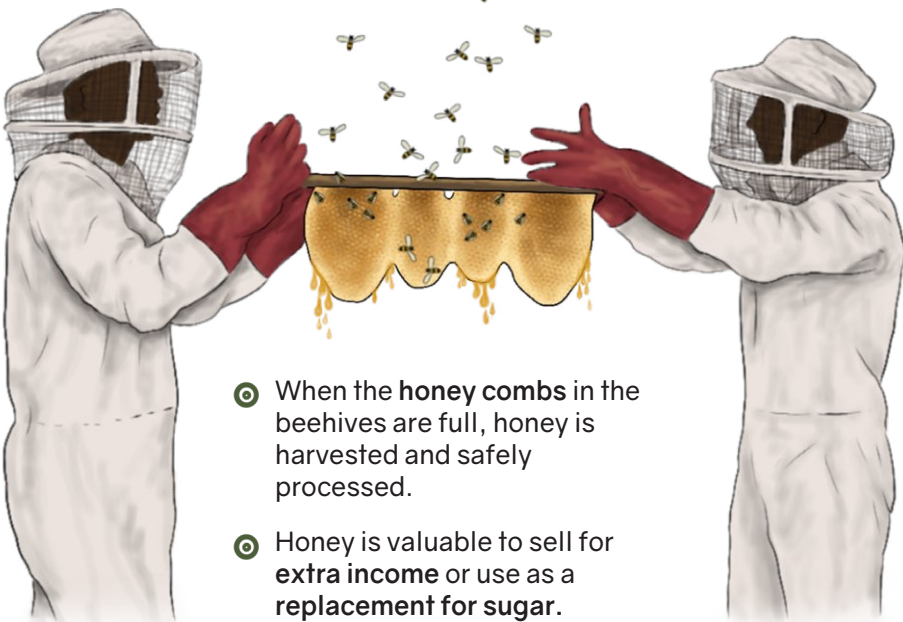


1) ELEPHANT FRIENDLY HONEY

- Elephants do not like honey bees so hanging beehives around your farm will make a good mitigation method for elephants.

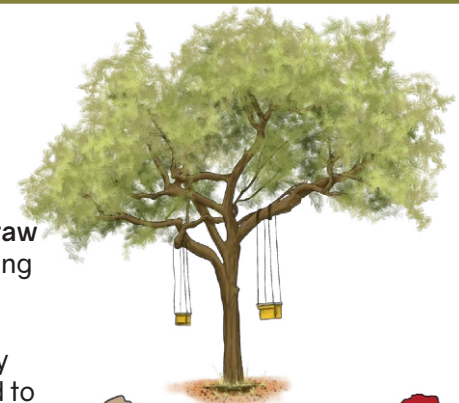


- If elephants try to push through the fence, the bees provide 'natural electricity' (or stings) that deter elephants.



- When the honey combs in the beehives are full, honey is harvested and safely processed.
- Honey is valuable to sell for extra income or use as a replacement for sugar.

- Lip balms can also be produced with natural beeswax and sold.
- [Elephants & Bees Project](#) (Sagalla, Tsavo) purchase raw honey from farmers that have beehive fences protecting their crops from elephants.
- [Elephants Alive](#) (Limpopo, South Africa) collect honey from beehives hung from Marula trees which are used to protect the trees from elephant damage.
- Protective beehives hung in trees can also discourage people from cutting down trees for charcoal.



Kenya, Sagalla



South Africa, Limpopo



Elephant friendly honey jars and lip balms © Elephants & Bees Project

See Beehive Fences for more information

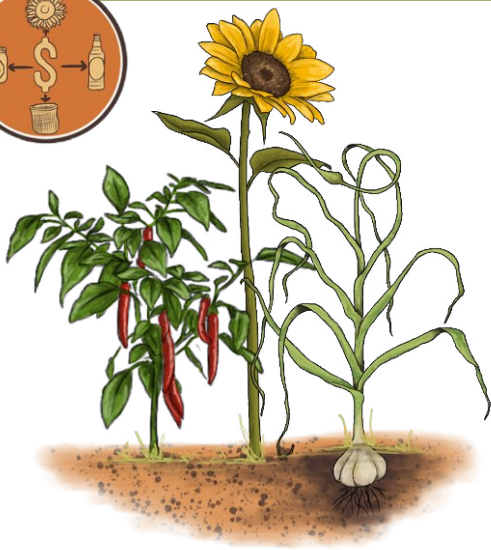



Candles made from beeswax © Elephants & Bees Project

2) ELEPHANT FRIENDLY NON-PALATABLE CROPS

- Non-palatable crops are those that elephants do not eat. Planting these reduces elephant crop raids, in turn reducing conflict.

See Crop choice and kitchen gardens for more on non-palatable crops



- Such crops include sunflower, chillies, okra, lemongrass and garlic etc.



- The [Pepper Company](#) get raw materials (baobab, sorghum, marula and chilli) from farmers living in human - wildlife conflict areas who engage in conservation measures, and produce finished products such as chilli pickles and sauces.



Fruit jelly and Marula Baobab jelly © The Pepper Company

- The [Tom Yum project](#) (Thailand) and [Elephants & Bees Project](#) (Sagalla, Kenya) support farmers to organically grow non-palatable crops.



- These crops are then used in a range of handmade products such as soaps and candles.

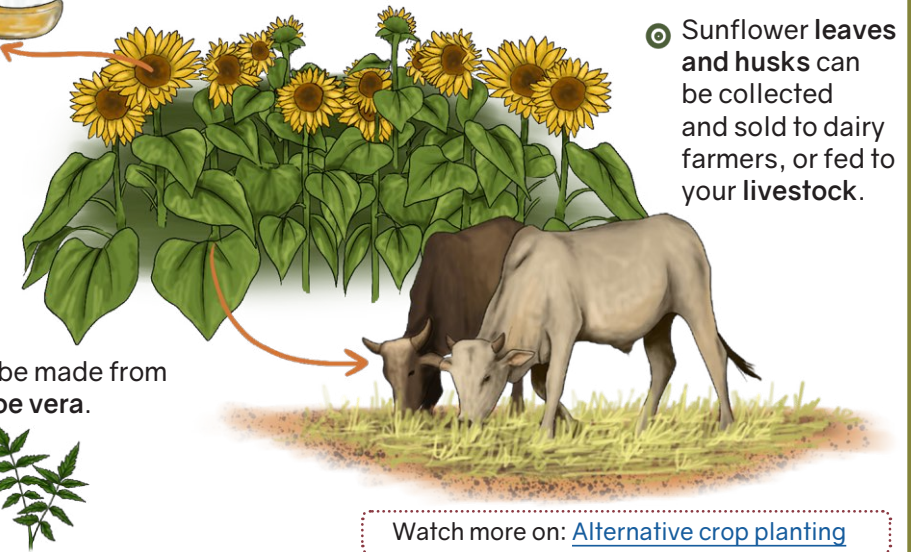


Coexistence candle and Honey soap © Elephants & Co

Sunflower field protected with a beehive fence © Elephants & Bees Project



- Sunflower seeds harvested can be processed into oil and sold.
- The remains after oil extraction from seeds make good chicken feeds.



- Soaps can also be made from neem oil and aloe vera.



Watch more on: [Alternative crop planting](#)

3) ELEPHANT FRIENDLY TEA

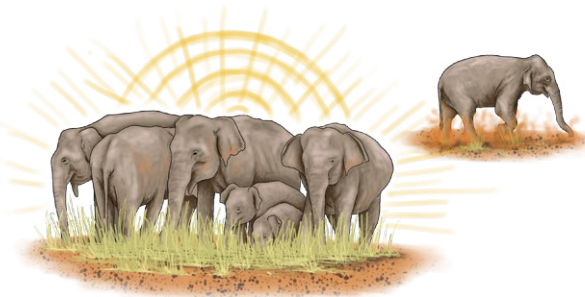
- Elephants do not feed on tea leaves, but agricultural lands planted for **tea production** can play a vital role as corridors of movement between natural areas.
- Common in **Assam, India**, tea gardens are widespread in parts where animals live. Elephants have no choice but to move through them.

- Protection of **elephant habitat** and **water resources**, reduces human elephant conflict as elephants are not forced to enter the tea plantations.



India,
Assam

Tea companies join forces with wildlife conservation efforts to launch the world's first certification program aiming to provide incentives for conservation of elephants in the wild © Wildlife Friendly Enterprise Network



- Elephant Friendly Tea** encourages farmers to grow their tea **organically** - without the use of chemicals such as **pesticides**.
- Plantations must also have **angled trenches** between the tea plant furrows to allow elephants to climb out if they fall in one.

See Trenches
for more



- Chemicals from tea production can **contaminate water** and harm both people and elephants with **toxins**.

Read more on [Tea Companies Invited to Join Elephant Conservation Efforts Through A New Certified Elephant Friendly TeaTMPartnership](#)

4) MICRO-ENTERPRISES



- Women are encouraged to make items such as **jewellery, baskets, bags, bracelets** and others to sell in the market or to **tourists**, to earn an **additional income** for their families.

A. JEWELLERY

- [Mlambeni Basket Weavers](#) (Sagalla, Tsavo) and [Wildlife Works](#) (Voi, Kenya) provides employment to **women** who make hand-made products.
- Every product bought provides women with **income** and **diversifies them** from only earning an income from farming.



Hand-made woven baskets and bags © Elephants & Bees Project



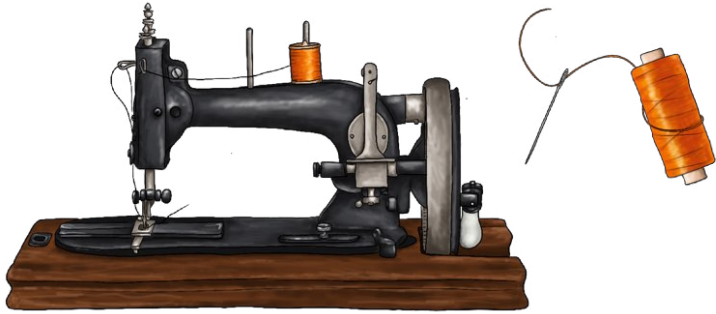
Hand-made beaded bracelets © Wildlife Works

- [It's Wild!](#) (COMACO, Zambia) sell **Snarewear - jewellery** crafted from **snare**s confiscated by local farmers to protect wildlife and available to consumers globally. this encourages community members to gather any snare they find.

Watch more on: [Hadithi Crafts - African Basket Weaving](#).
Read more on [Products sourced from small-scale farmers](#)

B. SEWING AND TAILORING

- This activity requires only a small amount of **training** and can be a protective and appropriate source of **skilled labour and income** throughout the year.



- Sewing is also an ideal activity for **elderly/ disabled community members** who cannot actively defend their farms or build barriers against elephants.

Mlambeni woman using an electric sewing machine © Elephants & Bees Project

TIP

Beekeeping and farming gear such as gloves, masks, beesuits and gowns/overalls can be sewn for your local farmers.



CONS

Most sewing machines require electricity.



Moderate **maintenance** of the sewing machine is required.



[Women in Niger break through with unique sewing cooperatives](#)

C. BACKYARD POULTRY FARMING



- By spending a little time and money on **chicken care and vaccinations**, farmers can collect **eggs and have meat** to sell.
- Chicken droppings** also make good **manure** material to add into farm soils.
- Chicken rearing represents an alternative source of **high-quality protein** for communities.

- Poultry can be an ideal alternative to communities involved in bush meat poaching.
- Chickens also eat **scorpions, ticks, beetles and other pests** from around the kitchen gardens.

CONS

- Feed quality** must be good, otherwise chickens will not grow healthy, affecting size and quality of eggs and meat.
- Chickens need moderate **care and cleanliness**. If not taken care of, **diseases** are easy to spread within the population and the business can collapse.
- Some **knowledge** is needed on how to rear healthy chickens, but most local agriculture officers are able to help with training.



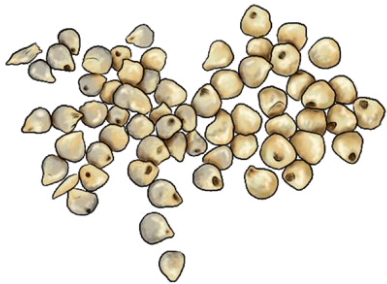
[Chicken farming adds an income source and improves livelihoods.](#)
-Chickens can provide a nice boost to income.

5) ELEPHANT FRIENDLY BREWERY

- Beers can be made from **millet** that is **sustainably** grown in farms.
- Although elephants may feed on millet, it is not their favourite crop, so installing **protective fence barriers** may keep elephants out of your farms.
- Millet is a **drought resistant** crop, and so can grow well on **drylands**.

[More information on millet and elephants: The Living Elephants.](#)

- [Okavango Craft Brewery](#) (Botswana) buy millet from **small-scale farmers** around the Okavango at a fair price to reward them for their efforts to **co-exist with elephants**.



- They turn millet into **craft beers**.
- Elephant-friendly honey can be used to make beer or mead, and breweries provide an alternative market.



This project is run by Ecoexist.

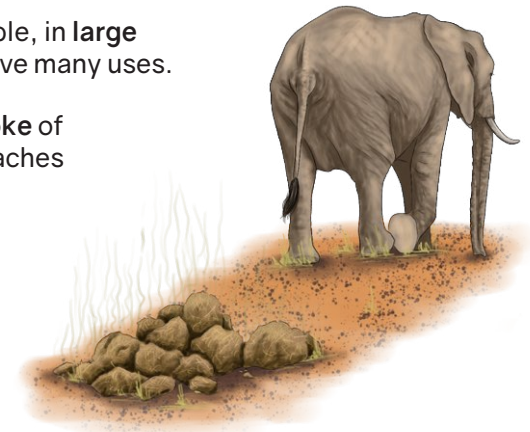


Craft Beers made from millet
© Okavango Craft Brewery

Watch more on Brewery Conservation
<https://www.youtube.com/watch?v=xaR1DObmonw&t=1s>

6) PRODUCTS FROM ELEPHANT DUNG

- Elephant dung is **freely** available, in **large amounts** and has proved to have many uses.
- Traditionally, inhaling the **smoke** of **elephant dung** can treat headaches and reduce toothaches.
- [Kataara Women's group](#) (Rubiriizi, Uganda) are working towards zero poaching by **making paper** out of elephant dung.



Uganda

Products made from elephant dung © Kataara Women's group

- The eco-friendly product is used to make unique, handcrafted gift and stationery products like **photo frames**, **visitor books**, **post cards**, **shopping bags** and **event cards**.

Read more on: - [Making Paper from Elephant Poo - Poo to Fight Poaching.](#)
- [Watch Paper from Elephant Dung](#)

- [Nampath Paper](#) (Mwaluganje Elephant Sanctuary, Kenya) utilizes elephant dung to manufacture **paper**.

- The paper making process starts when elephants feed on **grass and trees** and let it out in the form of **dung**.



- 125 sheets** of paper can be produced from **50kg** of elephant dung.



Nampath paper made from elephant dung: Source - article by Gitonga Njeru

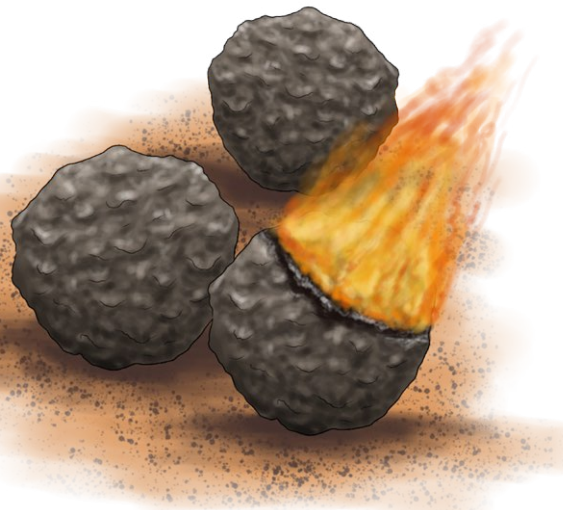
TIP This technique of making paper reduces **deforestation** hence minimizing effects of climate change.

Check out [Thailand online store, selling products made from elephant dung](#)



7) ECO-CHARCOAL BRIQUETTES

- Using alternative cooking fuel to **replace charcoal** is important as cutting down trees for charcoal **stresses the environment**, affecting both people and wildlife.
- Eco-makaa Briquettes** (Kencoco, South of Kenya) takes advantage of the abundant supply of **coconut waste** (coconut shells & husks) in the region to make clean burning **charcoal briquettes** for cooking and heating.



Eco-makaa charcoal briquettes made from coconut waste © The Charcoal Project, Kencoco Ltd

PROS +

- Eco-briquettes serve as a **low-cost alternative** to environmentally damaging fuels such as **firewood, kerosene and wood charcoal** that **emit more carbon**.
- They have **high heat content**, burn for a **long time** and so are more efficient than wood or traditional charcoal.
- They are largely **smokeless**, providing **health benefits** to indoor users.
- Green charcoal briquettes** (Uganda) are made of **agricultural waste** such as **dry banana peels, coffee husks, plant and tree leaves** that are **dried and crushed** into small pieces.
- Mixture is then mixed with **wet clay/mud**, molded into round/block-like shapes by hand and laid on the ground to dry up for 3 days.
- Using agricultural waste serves as an **alternative** to other fuels such as coal and oil.



Environmentally friendly charcoal briquettes. Sourced from article by Godfrey Olukya, Anadolu Agency

CONS -

- Green charcoal briquettes may **take time** to catch fire and burn.

Watch more on [Kencoco](#)

GENERAL TIPS:

Make sure there is an **available market** for the products you decide to produce/make if you want to sell the excess as a business.

Products must **benefit both you and the environment** to reduce effects of climate change and offer an alternative income other than farming.

CREDITS AND DISCLAIMER:

We have collated resources from a range of different sources. Some of the methods represented are experimental and further research is needed. See [References](#) for more information. Save the Elephants advises caution with all the methods and information collected and presented in this illustrated toolbox. Further research may be required before each site-specific implementation.

* Save the Elephants is not liable for any costs, damages or injuries incurred by the use of these methods.





GUIDE TO BEEKEEPING AND SAFETY



Beekeeping is giving proper care and attention to your beehives so that the occupied bees do not abandon their hives and you can safely harvest maximum honey.

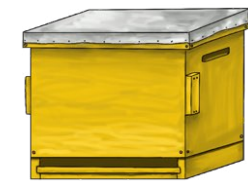
- Honey harvesting is preferably done with 2 to 3 people, and is often done at **night**, when the bees are resting to avoid beestings with children and livestock.



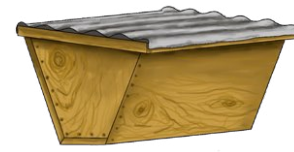
- When harvesting honey at night, use a **red light** as bees are **colour blind** to red and also react **aggressively** to white light.



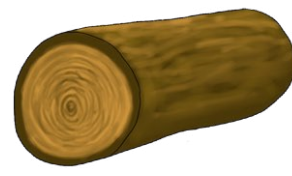
- Avoid opening occupied beehives if it is **raining or windy**.
- The recommended designs of beehives allow **safe harvesting of honey**, without much disturbance to the bee colony.



Langstroth Beehive



KTBH hive



Traditional log hive



- **Regular maintaining** of clean hives is crucial as bees are **very clean themselves** and want a clean home.
- They will not move into a hive that is **dirty** or has become inhabited by **pests** such as wasps, spiders, moths, lizards or even some snakes.
- Always provide **clean fresh water** for the bees as they require water for the colony to **function well**, and **water mixed with sugar (sugar syrup)** during the dry periods.



PROTECTIVE CLOTHING

Bee keeping requires a whole kit that includes:



Light coloured bee suit and veil



Beekeeping gloves



Gumboots (if available)



1. PROTECTIVE CLOTHING

- Make sure to **cover all exposed skin** with the right gear, so bees cannot sting you.



- Sometimes you get **false stings** through the beesuit in case the bees run out of control or the bee suit is **dirty**.
- Check that the beesuit has **no openings/holes**. If holes are present, cover with thick **duct tape** or do a repair.

- Take your time to wear it properly.



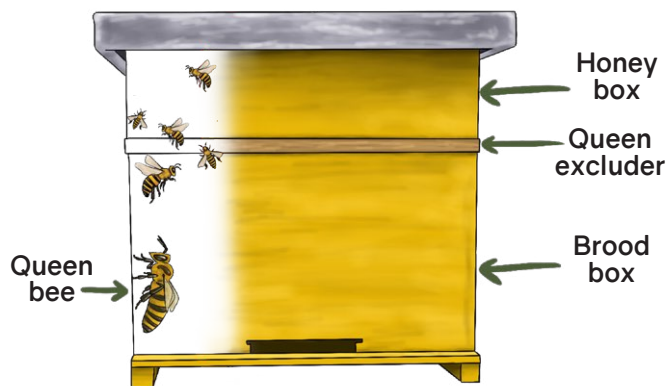
- Do not spray any **perfume** or **scented creams** before harvesting as the smell may **agitate** the bees and cause them to attack.



MAINTENANCE OF HIVES

2. BROOD BOX AND SUPER BOX

- Brood** refers to the **eggs and young ones** of the honey bees.
- A super box is only added once the brood box is occupied fully with a **healthy colony**, and they are actively engaged in brood making.



- A meshed **queen excluder** is placed **between** the 2 boxes; it is large enough for worker bees to pass through but the queen cannot fit through.

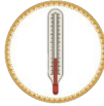
- This may take from **2 weeks to 4 months to fill the brood chamber**, depending on **availability of flowers**.

- Bee colonies thrive well in areas that have lots of **flowers and water available**.

- Adding a super box **too early** will create an empty space for **pests to stay** and will make it difficult for the bees to regulate external temperature.

- The brood box **should not** be harvested for honey, so as not to stress the bees and the queen.

- When brood is **destroyed**, the bees get **frightened** and abandon the hive.



3. AVOID CRUSHING BEES

- When bees start swarming around aggressively, **do not panic** as the beesuit will keep you safe from stings.



- When the bees start to become aggressive, use a **smoker** and gently smoke on them.



- If you get stung, **remain calm** and slowly walk away from the hive.



- Any **sudden movements and loud noise** will agitate the bees even more.



- Avoid crushing bees when you are returning back the frames and lid.

- Use a **soft bee brush** or a **bunch of leaves** to gently brush the bees off the hives and edges of the hive.



- Small colonies** will not harvest honey as they focus on brood rearing.

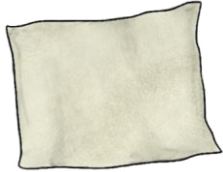
For more information visit:
[Beehive Fence Construction Manual by Dr. Lucy King.](#)

HONEY HARVESTING

MATERIALS NEEDED



Knife/hive tool



Cotton cloth piece/
muslin cloth



Double mesh sieve



Bucket



Empty jars/containers for
honey packaging



Match sticks



Smoking material - wood shavings, elephant dung, sisal sack, small dried sticks and compact dry grass.

1. SMOKING THE HIVE

- Smoke masks the **alarm pheromones** produced by **disturbed bees**, so will decrease their aggression while working.
- The smoke also tricks the bees that there is a fire and bees tend to eat their honey, preparing to move.
- In this process, they cannot sting as fast as when their abdomens are empty.



- When you approach the beehive, smoke a **few puffs** around and through the openings, as you lift the lid.



CAUTION TIPS:



- Do not** over smoke the bees. Do not light a direct fire towards the hive.
- Do not** smoke into someone's face.
- Keep a **close eye** on the fire/smoke; do not leave it unattended.
- Keep the smoker **away** from yourself to avoid **burns**. Position it away from your nose, eyes, and mouth.



2. REMOVING HONEY FRAMES

- Carefully and gently** lift each frame to check if the combs are well filled with honey.
- When removing the frames to check for honey, ensure you return the hives in the **same order they were**.



Even though you are harvesting honey, the hive is still their natural home, and should be handled with care.

- Frames containing **small combs** or large amounts of **uncapped honey** should be **untouched/returned** and checked again the following season.

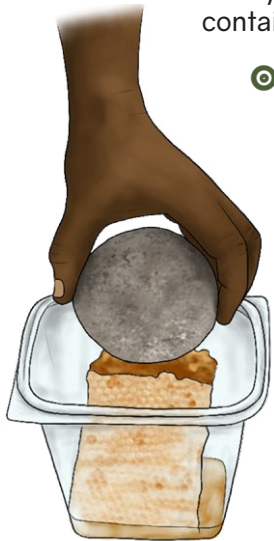
3. EXTRACTING HONEY

- Extract honey **away** from the beehive. Ensure there are **no bees** following you.
- Ensure that all equipment and work surfaces are **fully clean and dried** with no water droplets.
- Take into consideration **hygiene protocols**.
- Carefully cut** (uncap) a thin layer of beeswax formed on the surface of the honey combs using a **knife**, and store it.
- Cut the honey combs from the frames and place into clean container.





- Using a soft clean stone or heavy wooden spoon, **crush/smash** the honey combs in a container.



- Sieve the crushed honey using a double sieve to remove any **large particles**.

- Transfer into a piece of **muslin cloth** sitting over another **double sieve**, and squeeze the honey into a jug.

- What is left after extraction is a **waxy residue** which is boiled to produce **wax** that can be used to make **candles** and **lip balm**.



Solid wax

4. VALUE ADDED PRODUCTS

- Natural honey** can be poured into **jars** and sold to local markets, or organizations that sell honey.
- The **leftover wax** is a **valuable resource** that can be used to make beeswax product such as **candles** and **lip balms** that can be sold for **additional income**.
- Some can also be used to make **new wax strips** for your beehive.

See Alternative Income from Elephant Friendly Enterprises for more.



Read more on [value added products at Elephants & Bees Research Centre](#)



Value added products from beehive fences © Elephants & Bees

INGREDIENTS



Leftover beeswax



candle wick/tightly twisted cotton string



mold to shape your candles



cooking oil

CANDLES

1.



On low heat, gently **melt** the beeswax in a pan.

2.



The mold can be any object that will give **shape** to your candle e.g., cylindrical or square shaped. Spread a layer of **cooking oil** inside the mold.

3.



Cut the wick according to the size of your candle (must be slightly **longer** than the candle), **dip** it in the liquid wax and secure it to the bottom of the mold.

4.



Carefully pour in the **melted beeswax** and allow to **fully cool** for about **5 hours** before use.



INGREDIENTS



200g olive oil



50g Leftover beeswax



50g coconut oil



20g honey



10ml scented essence (any scented herb extracts such as vanilla essence, lavender, mint, rose petals, etc)

LIP BALMS

1.



On low heat, gently melt the beeswax in a pan.

2.



Add olive and coconut oils and stir just until the wax re-melts, then remove from the heat.

3.



Add the honey and scented essence. Mix well, until it starts to thicken.

4.



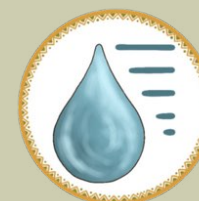
Gently pour into small containers/tins while it is still liquid.

If it solidifies while you are filling the tins, slightly re-heat and continue pouring.

TIP

Always store your harvested honey in a sealed container. Bees are highly attracted to their own honey and will seek it out even in your home.

Extracted honey should be stored in a tight container because it is sensitive to moisture.



More information on: [Beehive Fence Construction Manual by Dr. Lucy King.](#)






- ⦿ Bee stings are not dangerous unless you are **allergic** or get stung by **many bees** at the same time.



SAFETY GUIDELINES

BEE STINGS

See Beehive Fences for more information.



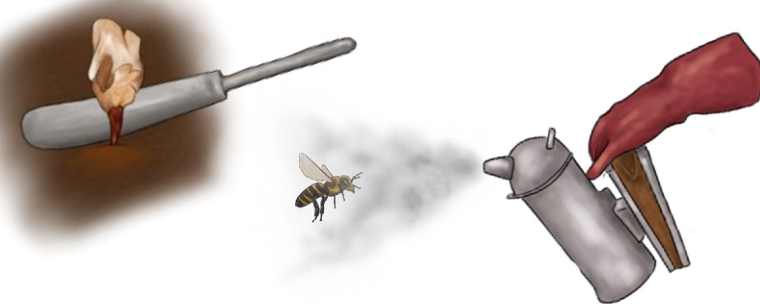

WHAT CAN CAUSE A BEE STING?

- ⦿ Walking too close to an **active hive** (especially during day time).
- ⦿ Standing in the way of the **flight route** or **hive entrance**.
- ⦿ Working on the hive **without** the aid of a **smoker** and **beesuit**.
- ⦿ Wearing **scented** cosmetics or perfumes.
- ⦿ Talking **loudly**, **shouting** or **banging** objects next to a beehive.
- ⦿ Disturbing the beehives/shaking the beehive fence **violently**.

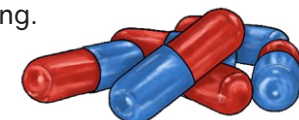


WHAT TO DO IF YOU GET STUNG?

- ⦿ Remove the sting **immediately** to reduce the amount of **venom** spread.
- ⦿ Do this by carefully **scraping** it off with a **nail** or a **knife's edge/hive tool**. Do not directly pull it with hand out as it will spread the venom faster.



- ⦿ **Be careful** if using a knife/sharp object to scrape the sting off.
- ⦿ Move away **slowly** from the hive or colony.
- ⦿ Use a **smoker** at the site of the sting to mask the pheromone and reduce its spread that otherwise attracts more bees to sting.
- ⦿ Keep **antihistamine pills** in your home. They help reduce effects of itching and swelling.
- ⦿ An **EpiPen** can be used in case of **extreme allergic reactions** to a bee sting.



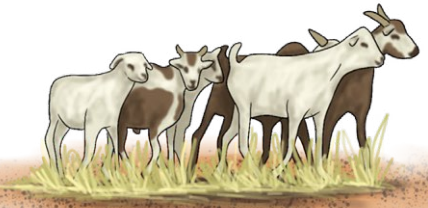
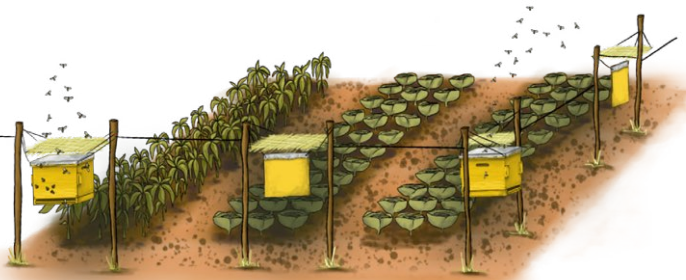
CAUTION TIP

If you are **allergic** to bee stings, seek **medical attention** immediately you are stung.



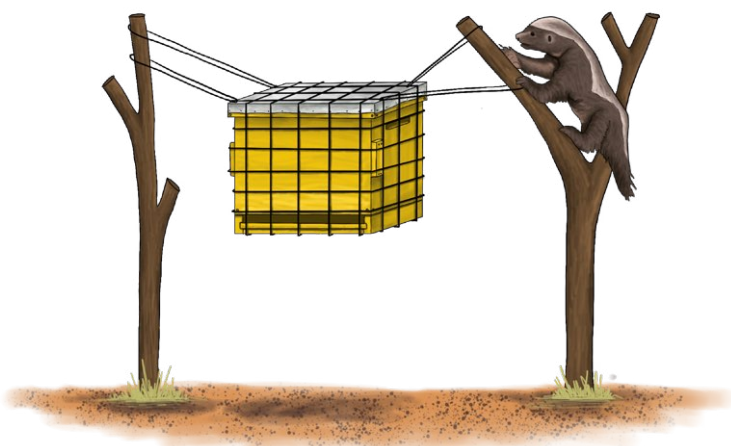
KEEPING CHILDREN SAFE

- Children can be most vulnerable to stings.
- Teach your older kids how to safely move around your farm, keeping a good distance from all beehives.
- Do not leave young children unattended close to the hives.



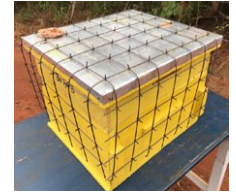
LIVESTOCK

- Just as elephants and people do not like bee stings, they can also cause distress for livestock.
- If you have livestock, make sure you keep them separated from the fence area, at a safe distance.
- Inform people in your area that you keep bees, so that they can keep their livestock away from your farm.



HONEY BADGERS

- Honey badgers are highly attracted to beehives for their honey, and can be aggressive towards other animals.
- They are important to the ecosystem and often feed on rats and snakes, keeping these creatures away from your community.
- They mostly run away from humans, so are of little threat to you and your family.
- Do not hurt or kill honey badgers to protect your honey. From a safe distance, chase them away by shouting and banging objects.
- Use a honey badger cage made from folded metal grid sheets or thick wire and place around each beehive to protect from honey badgers.



Finished honey badger cage © Elephants & Bees

CAUTION TIPS



- It is advised to avoid harvesting honey alone.
- However, if you are working alone, make sure to have a phone/radio with you, so that you can communicate if an accident occurs and you need medical assistance.



Never harvest under the influence of alcohol or drugs.

CREDITS AND DISCLAIMER:

We have collected the information from the [Beehive Fence Construction Manual; 4th Edition by Dr. Lucy King, Elephants & Bees Project, Save the Elephants](#). This manual is not extensive, visit the manual for more information on Beekeeping. To learn more and explore about Beekeeping and Safety, see [References](#). Save the Elephants advises caution with all the information collected and presented in this toolbox. Further research may be required before each site-specific implementation.

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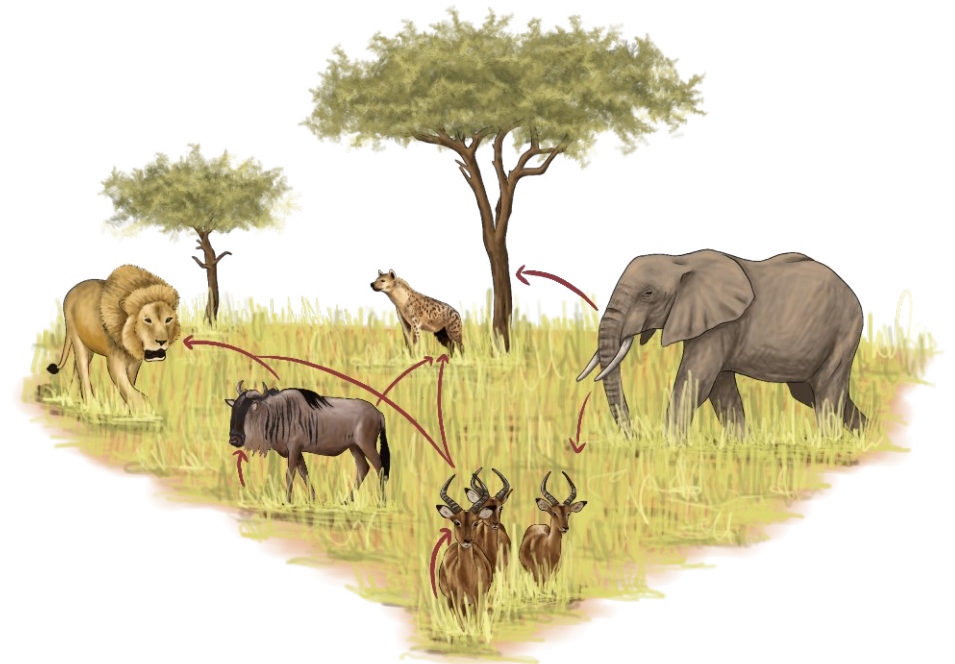
“To limit biodiversity losses and avert the worst effects of climate disruption, we must greatly expand nature protection while simultaneously downsizing and transforming human systems.... By protecting nature generously, and simultaneously contracting and transforming the human enterprise, we can create the conditions for achieving justice and well-being for both people and other species.”

From “Protecting Half the Planet and Transforming Human Systems
Are Complementary Goals” Crist *et al.* (2022)
Frontiers in Conservation Science

BIODIVERSITY PROTECTION



Tree Protection Methods





TREE PROTECTION



PROBLEM: ELEPHANTS DAMAGING TREES

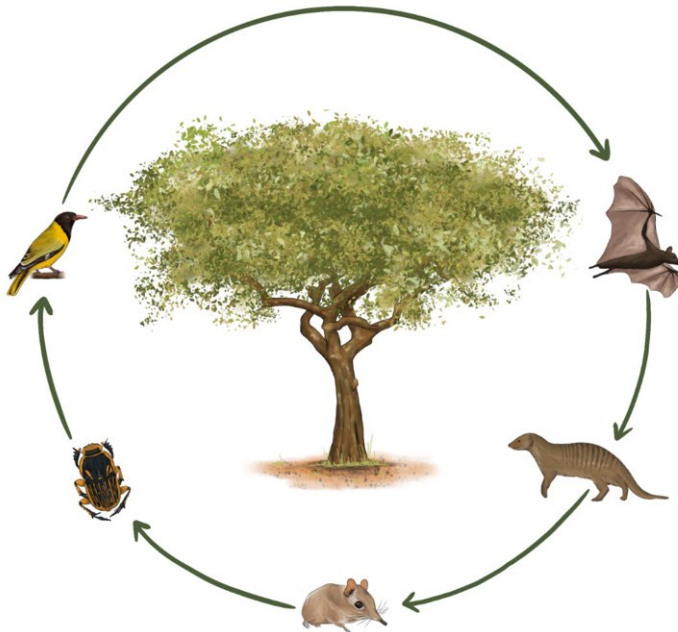
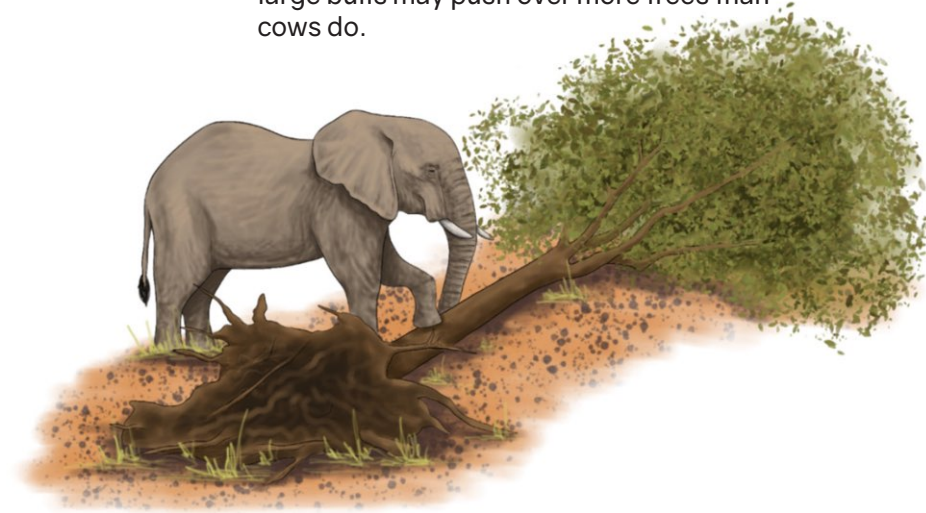
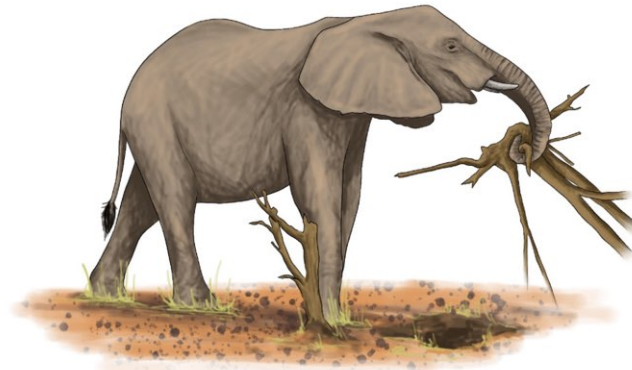
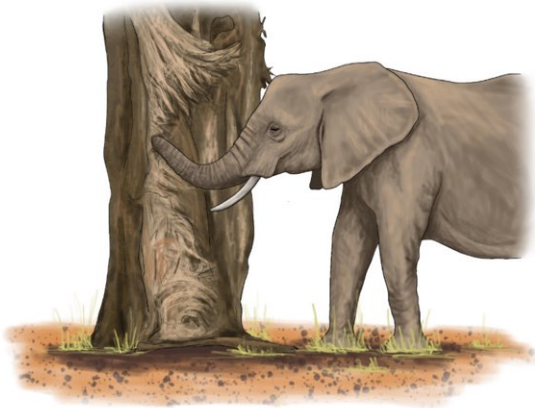
Elephants need to forage on trees and leaves for nutrition, but they can also permanently damage important large trees – they strip the bark, break branches and uproot the trees.



For example, Marula trees in South Africa are important fruit bearing trees and have a high economic value. The destruction of these trees is a source of human–elephant conflict.



Elephants may strip bark, break branches or push trees over as they forage – and large bulls may push over more trees than cows do.



Large and iconic trees are important for economic, cultural and sometimes even for medicinal purposes.

They support a variety of wildlife, animals and plant life.

For example, in Southern Africa, studies have shown that elephants like to use trees such as the Marula, Knobthorn and Red bushwillow for nutrition.

Trees that are trimmed down or broken can become vulnerable to insects and fire.

Protecting trees from elephant damage is important for the whole ecosystem.

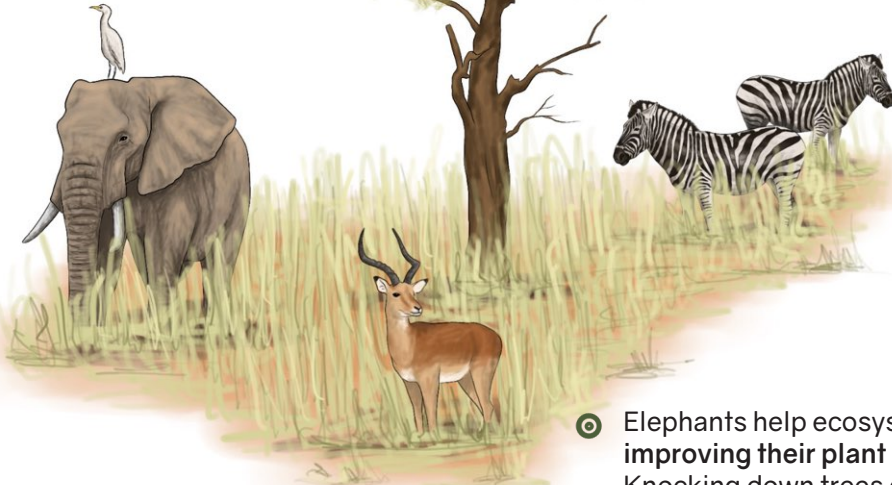
Destroying big trees results in a reduced diversity of birds, bats and small mammals.





ELEPHANT'S IMPORTANCE TO THE ECOSYSTEM

Elephants are known as 'ecosystem engineers'



- Elephants are also **key dispersers and germinators** of tree seeds.
- They can **deposit seeds** in a ball of **organic fertiliser (dung)** up to **65 km** away from the mother tree.
- Seeds often have a **higher chance of germination** after being exposed to acids in the **elephant's digestive system**.
- Elephants produce up to **150 kg of wet dung** per day, adding nutrients to the environment and promoting overall biological diversity.



- Elephant **dung and footprints** provide **habitats** for insects, frogs and reptiles.



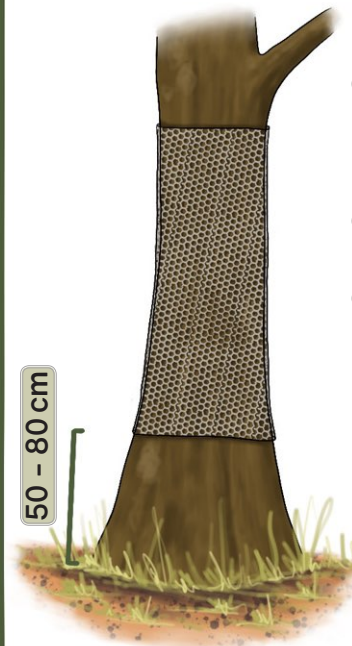
Two methods that have been used successfully to protect trees in the Umbabat Private Nature Reserve region near Kruger National Park are wire-netting and beehives (Elephants Alive)

Credit: [Bees and Trees Manual](#)



1. WIRE NET PROTECTION

- Elephants often **strip the bark** off trees. They may eat the bark, especially during the **dry season**.
- Bark-stripping** can impact the **rate of survival** of individual trees and makes trees especially **vulnerable to weather and pests**.
- Use **wire-net protection** to protect the tree trunk.
- This helps reduce the chance of the trunk being **bark stripped**.



PURPOSE: PROTECTS TREES AGAINST RING-BARKING

Why is ring barking destructive?

- It **prevents the flow** of nutrients in the tree.
- The tree becomes **vulnerable** to insect invasions and fire damage.
- The tree may be **hollowed out** from the inside.

DOUBLE-WRAPPING METHOD

- 13 mm Chicken mesh: 1.8 m tall**
- Measurement of length of mesh required (Tree circumference x 2) + 50 cm.
- Fold the mesh in half and then **wrap this around tree's main stem**, starting **50 cm** above the ground.
- Bind the **chicken mesh** to the tree using **staple nails or wire**.

TIPS FOR MANAGEMENT FOR WIRE NET PROTECTION

- Make sure that the tree has enough **room to grow**. Do not strangle the tree!
- It is Important to **monitor and maintain** the wire-netting over time.
- Wire-netting is only effective against bark-stripping and is **most helpful for protecting the tree trunk**.
- Wire netting **does not affect other types of elephant impact** such as branch-breaking, stem snapping or uprooting trees.



- African honeybees have been used to successfully **protect crops and trees** from elephants.

Credit: Cook, R. M., Parrini, F., King, L. E., Witkowski, E. T. F., & Henley, M. D. (2018). African honeybees as a mitigation method for elephant impact on trees; and King, L.E., Lala, F., Nzumu, H., Mwambingu, E., and Douglas-Hamilton, I. (2017) Beehive fences as a multidimensional conflict-mitigation tool for farmers coexisting with elephants

- Beehives** can be used as a method to protect the **entire tree**.
- As elephants have a **negative reaction towards bees**, hanging hives from trees may encourage elephants to **avoid those trees**.
- Bees have the added benefit of **providing honey** and functioning as important pollinators.



Elephants Alive, www.elephantsalive.org

2. BEEHIVES



Did you know elephants are scared of bees?

Elephants have been observed **avoiding wild beehives** hanging in trees.

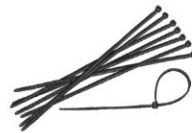
They have since been used an **eco-deterrent** to help protect crops and trees.

www.elephantsandbees.com

BEEHIVE HANGING EQUIPMENT (EXTRACTED FROM ELEPHANTS, BEES AND TREES MANUAL)

The following equipment is required to hang a single beehive from the branch of a tree:

Credit: [Bees and Trees Manual](#)



Cable Ties or wire
(200 mm x 5 mm)
x 8-12 needed



Nylon Rope - Length Equation:
2 x length from branch to 2 m above ground level + 30 cm
(2 strands needed)



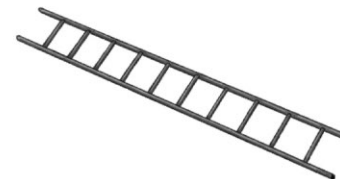
Staples or Nails
x 6



Glue



Wooden board



Ladder



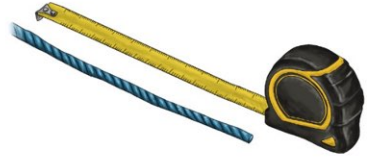
Hammer



Measuring Tape



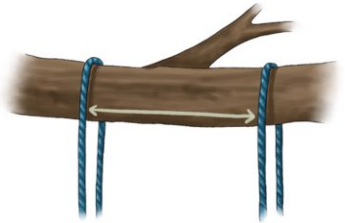
METHOD: PRE-HANGING PREPARATIONS



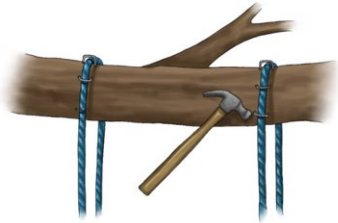
1. Calculate the length of nylon rope you will need by using the **equation**.



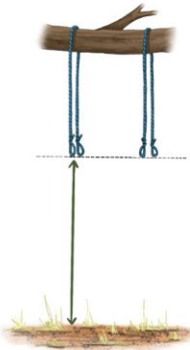
2. Loop the two ends of both nylon ropes so that each end has a loop, which will be connected to the beehive.



3. Place the two nylon ropes over the branch of the tree 50 cm apart.



4. If needed, hammer in three staples or nails per rope to **secure the hanging rope** to the tree's branch.



5. The four loops should be in line with one another and **2 m** above the ground.



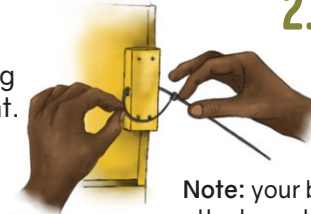
6. Apply a layer of **glue or grease** further up each end of the rope using the wooden slab. This is to prevent ants from raiding the beehives.

HANGING THE BEEHIVES FROM THE TREES

You can use any type of beehive (each hive has its own challenges)



1. If the beehive is active, use a **red-light head torch** when hanging the beehive at night.



2. Place one cable tie or piece of wire in each of the beehive's **attachment points**

Note: your beehive will need these attachment points for hanging



3. Carry the active beehive to the tree from which the beehive will be hung.



Make sure you use beekeeping equipment!

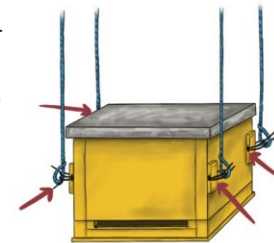


4. Place the ladder next to the four loops. One person will need to help connect the loops to the hanging hive.

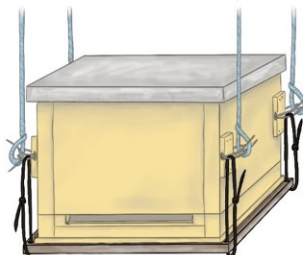


5. Two people should lift the active beehive up so that the cable ties or wire can be tied to the loops.

An active beehive can weigh 15 kg!

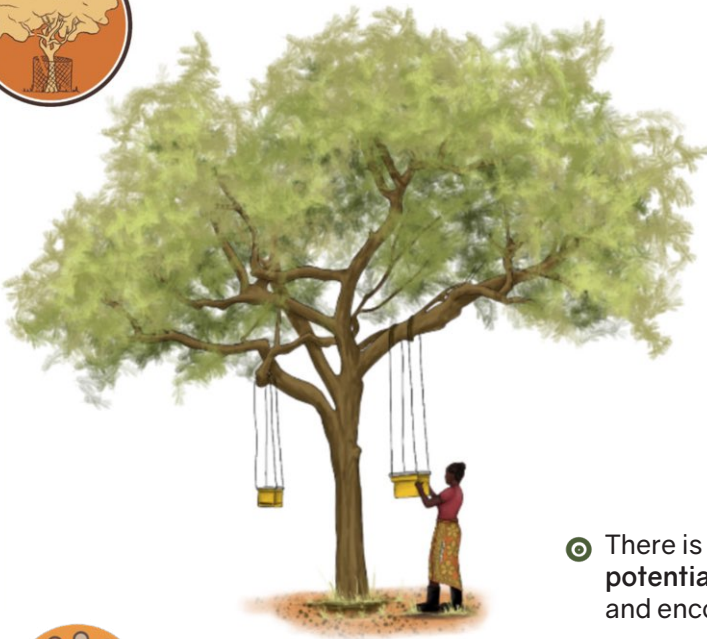


6. Once all four corners have been connected to the four loops, add a second cable tie or piece of wire to each loop for **extra strength and stability**.



7. Place the board **beneath the beehive** so that the hive can rest on it. It will need to have a hole in each corner.

Attach the board to the beehive by placing one cable tie or wire in each of the board's four holes and **connect these to the attachment points** on the hive.



Good for extra income generation

● You should **monitor your beehives** frequently to ensure that **weather and pests** do not impact the hive, and to keep an eye of the **bees activity**.

● Natural elements such as **rainfall, hail, wind, ants, hive beetles, spiders, honey badgers and elephants** can impact a beehive and decrease its chances of survival.

● There is a **high honey production potential** if you look after the hives and encourage **healthy colonization!**

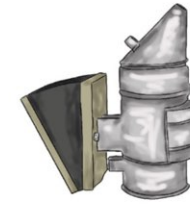


Credit: [Elephants Alive](#) (Resources/Reports) Tree_Protection_Methods_Sept2021

EQUIPMENT NEEDED FOR BEEKEEPING:



Bee suits and gloves



Smoker



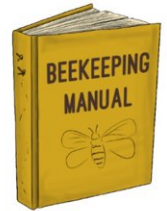
Glue



Hive tool



Grease
(to prevent ant invasions)



Beekeeping knowledge or manual

TIPS FOR MANAGEMENT

● These are best used for **small-scale protection**, protecting specific trees around an area.

● During times of drought or low rainfall, you may need to **help feed the bees**. (you can use sugar solution or nectar supplements)

● **Providing water** for the bees is important. and you can use any container you have available to hold water.

● **Chicken water feeders** are an easy way to provide water for the bees.



● The risks include **bee-stings**. Take special care if you are allergic and be sure to **have an epi-pen nearby**.

● Any beekeeping or adjustments to the hives should be done during the **early morning or late evening or night** when honeybee activity levels are lower and the **temperatures are cooler**.

● Trees with hives without bees are more likely to be visited by elephants, so try and **encourage beehive colonization** for the **most effective results!**

● Try and **avoid using chemical based pesticides** as these are not good for natural pollinators like bees.



This method has also been trialed in Gabon, Central Africa. Study found beehives to be a successful deterrent for forest elephants in Gabon, 2016: Credit: [Ngama, S., Korte, L., Bindelle, J., Vermeulen, C. and Poulsen, J. R. \(2016\) How Bees Deter Elephants: Beehive Trials with Forest Elephants \(Loxodonta africana cyclotis\) in Gabon, PLOS ONE 11 \(5\) e0155690.](#)

3. ROCK/PYRAMID BARRIER

- ⦿ This is a ring of rocks or pyramids stacked around the tree's trunk.
- ⦿ This is good for **small-scale application** around particular trees.
- ⦿ Need a **good distance** between tree's main stem and the end of pyramids or rocks.
- ⦿ The elephant impact decreases as the pyramid radius around the tree increases. (The wider the barrier of rocks, the more effective this method is)

Beware of scorpions when lifting stones!



CALCULATING COST OF METHOD:

- ⦿ **Total cost** = Single pyramid cost x Number of pyramids in a square metre x π (Desired radius)²
- ⦿ Rocks or pyramids need to be **tightly stacked** to prevent elephants navigating between the gaps.
- ⦿ Rocks or pyramids should be placed upto 4-5 m away from the tree's main trunk.

Credit: [Elephants Alive](#) (Resources/Reports) Tree_Protection_Methods_Sept2021

PROS/CONS

- ⦿ **Take care** when moving many large natural rocks around in order to not cause a **micro-habitat disturbance**.
- ⦿ **Physical labour** needed.
- ⦿ This can be an **effective and low-cost method** if done properly.



4. BEE ATTACK PHEROMONE

- ⦿ **Alarm pheromones** are released when a bee stings another animal.
- ⦿ This attracts other bees to the same location and causes the other bees to **behave defensively**.



Note: this is still in the testing and research stage.

- ⦿ **Bee attack pheromone** helps bees recruit more bees from their colony to handle large predators.
- ⦿ The Bee attack pheromone is comprised of chemical compounds which have been manufactured into a **synthetically produced** Specialised Pheromone and Lure application Technology (SPLAT) paste.

Credit: as mentioned in [Elephants Alive](#) (Resources/Reports) Tree_Protection_Methods_Sept2021

TIPS:

- ⦿ **86%** of elephants encountering pheromone smells in **Jejane Private Nature Reserve**, South Africa avoided the area.
- ⦿ Results suggest that this method may be effective if elephants already have experience with bee attacks (**learnt association**).
- ⦿ This is still in the **early research phase** and not yet available to public.
- ⦿ Can last up to **2 months** when applied (**weather dependent**).



5. NEEM OIL



Neem oil is pressed directly from seeds of the Neem tree (*Azadirachta indica*), which is a tropical evergreen tree native to India.

- Neem is an insecticide that controls insects which are harmful in agriculture, forestry and horticulture, and can be used as an alternative to chemical insecticides.
- Neem can be effective against more than 400 pests.

Note: this is still in the testing and research stage

Credit: Riaan van Zyl (Consulting and contracting Arborist) as mentioned in [Elephants Alive](#) (Resources/Reports) Tree_Protection_Methods_Sept2021



PROCESS:

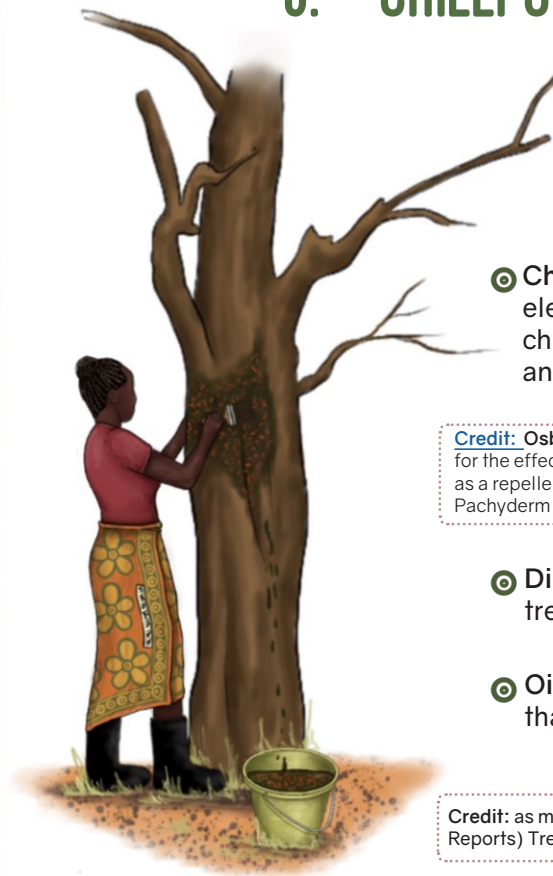
- Neem oil is sprayed over the branches and stem of a tree as an elephant deterrent.
- The idea is that elephants do not like the smell or taste of neem and will avoid the tree.

PROS/CONS

- The insecticide element may mean that other animals are affected.
- It also deters other insects from feeding on the treated plant or tree.
- It helps disrupts insect development. Insects do not reach adulthood.
- Insects are prevented from laying eggs on bioneem plants.
- Honeybees and other pollinators may avoid plants with neem.
- The short life means that trees will need to be continuously sprayed.
- More research is required on this product before being used in a protected area.



6. CHILLI OIL



- Chillies have been used as elephant deterrents in sprays, chilli-grease covered fences and dung balls.

Credit: Osborn FV, Rasmussen LEL. 1995. Evidence for the effectiveness of an oleoresin capsicum aerosol as a repellent against wild elephants in Zimbabwe. *Pachyderm* 20:55–64.

- Directly paste chilli oil onto the tree stem.
- Oil-based chilli lasts longer than water-based chilli.

Credit: as mentioned in [Elephants Alive](#) (Resources/Reports) Tree_Protection_Methods_Sept2021

TIPS:

- More data is required at a manageable scale.
- Use protective wear when working with chilli products.

Reapply every 2-4 weeks.
(weather dependent)

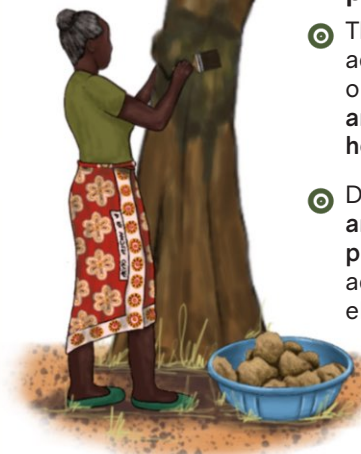


7. DUNG PASTE



Tree healing properties:

- ⦿ This is an adaptation of an old cow dung and clay tree healing method.
- ⦿ Dung paste has anti-bacterial properties and adhesion elements.



Credit: Riaan van Zyl (Consulting and contracting Arborist) as mentioned in [Elephants Alive](#) (Resources/ Reports) Tree_Protection_Methods_Sept2021

TIPS:

- ⦿ This is primarily a tree healing method but elephants have been also been observed avoiding dung covered trees in Botswana.
- ⦿ It helps to seal tree wounds and prevents pathogens to otherwise exposed surfaces.
- ⦿ Paste may be washed away with rainfall, so re-apply when necessary.
- ⦿ Try and source the clay as sustainably as possible.



Clay Buffalo/cattle dung

INGREDIENTS NEEDED:

Elephant dung

Clean drum

Water

Sugar

Paint brush

PROCESS

1. Gather fresh buffalo or cattle manure in a large drum. (Make sure the drum is clean and does not have chemicals inside.)

2. Put 100kg of elephant manure in a clean 200 litre drum. Fill water up to 3/4 level.

3. In a separate container, dissolve 2kg of sugar in hot water.

4. Add this dissolved sugar mix to the elephant dung in the drum. Allow this to ferment for 3 days.

5. On the day of use, mix the fresh buffalo or cattle manure with the clay and add the fermented elephant 'tea' to this mixture.

6. Ensure the final mix is not too fluid-like.

7. Use a brush to paint the tree's main stem, covering as much as you can.

CAUTION TIPS:



- ⦿ Tree populations are affected at different growth-stages.
- ⦿ Certain methods are still undergoing testing and caution is required before large-scale usage.
- ⦿ No method is fool proof, but survival rates of big trees can be increased if methods are applied correctly.
- ⦿ Assess the efficacy and appropriateness of methods before using.
- ⦿ Use protective wear and safety equipment. The use of rubber gloves is advisable when handling chilli. Take care not to touch eyes, mouth and sensitive areas.
- ⦿ Some methods may need technical training and expertise. Be sure to have the necessary training experience. (e.g beekeeping)
- ⦿ Case studies from South Africa may need design adaptation in other sites.



CREDITS AND DISCLAIMER:

- ⦿ We have collated resources from [Elephants Alive](#) (Dr. Michelle Henley and Robin Cook), and [Elephants Alive](#) (Resources and Reports)_ Tree Protection Methods_Sept 2021
- ⦿ Some methods represented are experimental and further research is needed.
- ⦿ To learn more on using tree protection methods, explore the literature further, see [References](#). Save the Elephants advises caution with all the methods collected and presented in this toolbox. Further research may be required before each site-specific implementation.
- * Save the Elephants is not liable for any costs, damages or injuries incurred by the use of these methods.





“When resources are degraded, we start competing for them, whether it is at the local level in Kenya, where we had tribal clashes over land and water, or at the global level, where we are fighting over water, oil, and minerals. So one way to promote peace is to promote sustainable management and equitable distribution of resources.”

Professor Wangari Maathai, Kenya's Nobel Peace Laureate

PASTORALISTS / SCHOOLS LIVING SAFELY IN SHARED SPACES WITH ELEPHANTS



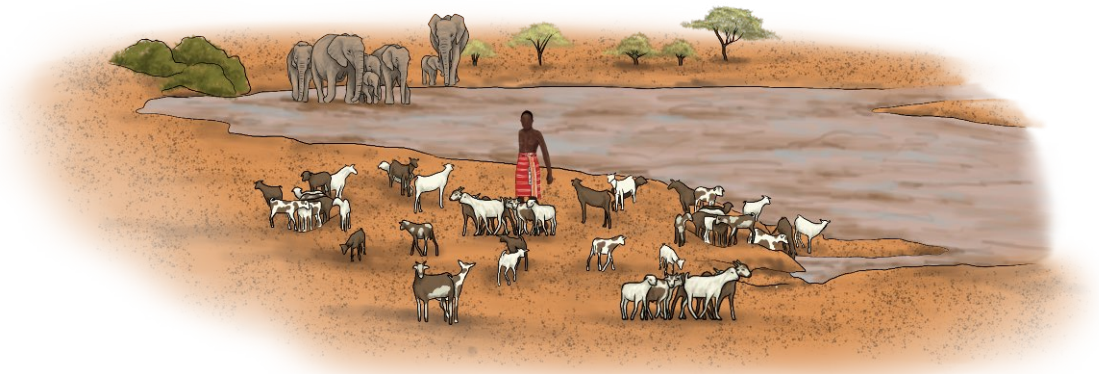
Water tank protection



Shared/alternative water points



Protecting schools and compounds





WATER TANK PROTECTION



During the dry season or times of drought, elephants and humans may come into conflict over resources - like water



METHOD 1 : WATER TOWERS



- ⦿ This can be a metal, concrete or wooden structure, at least 3 metres high.
- ⦿ Make sure the foundations are strong and the structure is sturdy enough to be able to hold the weight of a full water tank.
- ⦿ Depending on the size of the water installation, the higher the tank, the better protected it may be from elephants.
- ⦿ Make sure there is a ladder and safe human access.

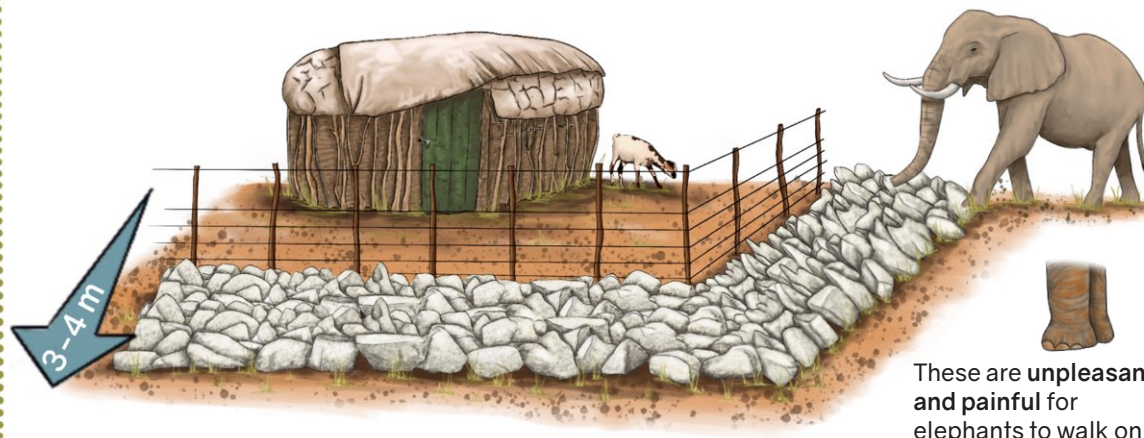
Different physical barriers can help protect water points from elephant damage.



METHOD 2 : WHITE ROCK BARRIERS



This is a barrier of sharp rocks, painted white. This can be used to help fortify fences or farm enclosures.



These are unpleasant and painful for elephants to walk on.

METHOD 3 : STONE WALLS



Wall should be smooth to prevent elephants from climbing over.

This method is being used in Namibia to help with conflict over water sources with desert elephants.



Use sharp white rock barriers to add extra protection for water pipes

Using a combination of deterrents helps increase the water point protection





METHOD 2 : WHITE ROCK BARRIERS

MATERIAL CHECKLIST:



Paint brushes



Cleaning solution for brushes (e.g Turpentine or petrol)



White paint



Large sharp rocks



Physical labour

4

Create a barrier at least 3-4 metres wide.



3 - 4 m

1

PROCESS:



Collect enough large and sharp rocks for your rock barrier.

2



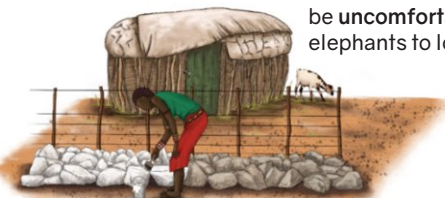
Lay them out in front of the area you wish to protect.

3



Make sure the sharp side is facing upwards.

5



Paint all the rocks white. This will help reflect the sun and will be uncomfortable for elephants to look at.



METHOD 3 : STONE WALLS

MATERIAL CHECKLIST:



40 bags of cement



Water



Spade



Trowel



Wheelbarrow



Sand



Rocks



Pickaxe



Gloves



Physical labour

1

PROCESS:

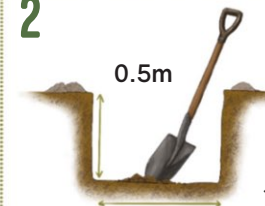


3 - 4 m

Mark the ground.

Make sure there is at least 3-4m between the water installation and the wall to ensure elephants cannot reach over it.

2



0.5m

1 m

Dig the foundation at least 0.5 metres deep and 1 metre wide.

3



1:4

Mix the cement in a ratio of 1 spade of cement: 4 spades of sand and water – to make a thick paste.

4



Lay the bricks. Build the wall at least 2 metres high

Leave a small space for people to access the water tanks.

CAUTION TIPS:



- These are physically intensive to build.
- May require professional help for transport and construction.
- Elephants may still risk pain in the pursuit of tasty crops or water sources, especially during the dry season, so using combined methods will increase the effectiveness of protection methods.
- Take care of safety when accessing the water towers.



CREDITS AND DISCLAIMER:

The Stone wall and White Rock barrier ideas were developed by [Elephant Human Relations Aid](http://www.ehramb.org) (EHRA), Namibia. More information: www.ehramb.org. Water tower design adapted from similar protection methods. For literature and resources used, see [References](#). More research may be required before each site-specific implementation. Safety and caution is advised with all the methods presented in this toolbox.

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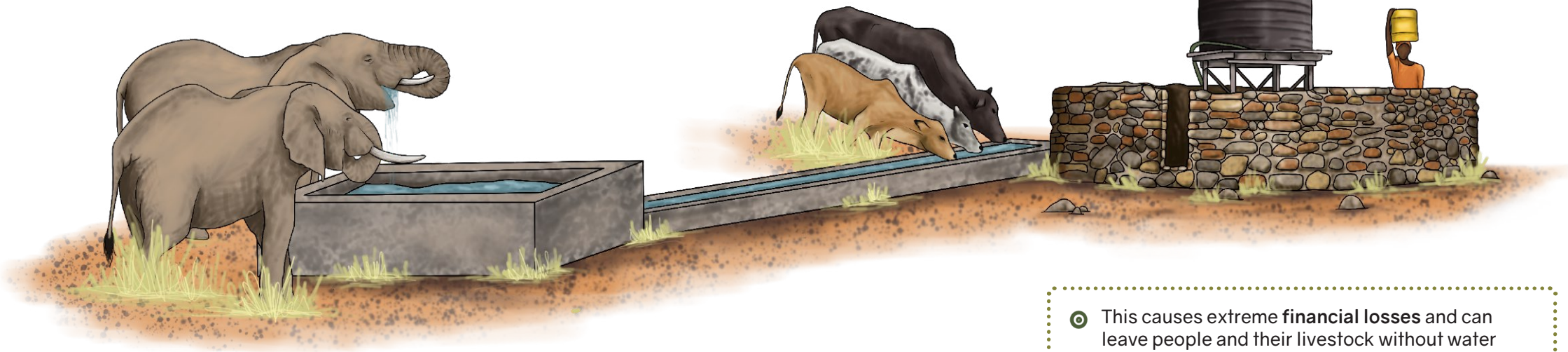




SHARED/ALTERNATIVE WATER POINTS



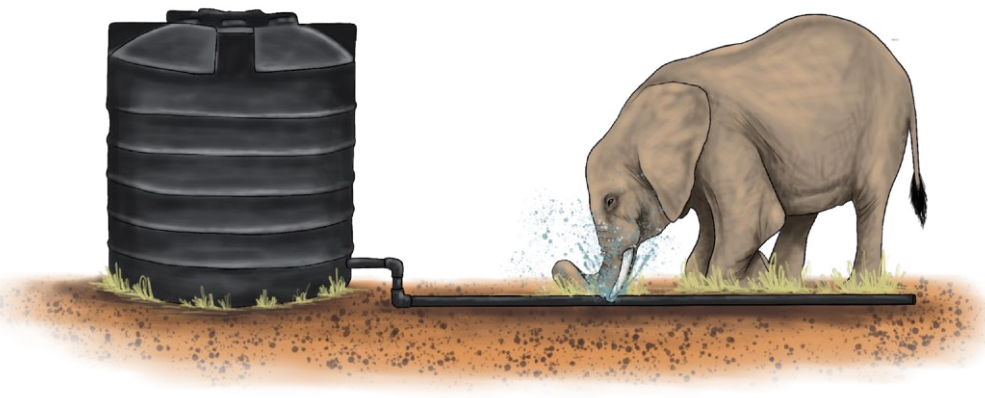
Alternative water points provide safety to rural communities and their livestock that share the same water sources with elephants. This proactively allows both elephants and livestock to drink water without clashes.



The past few years have brought prolonged drought periods and water shortages.

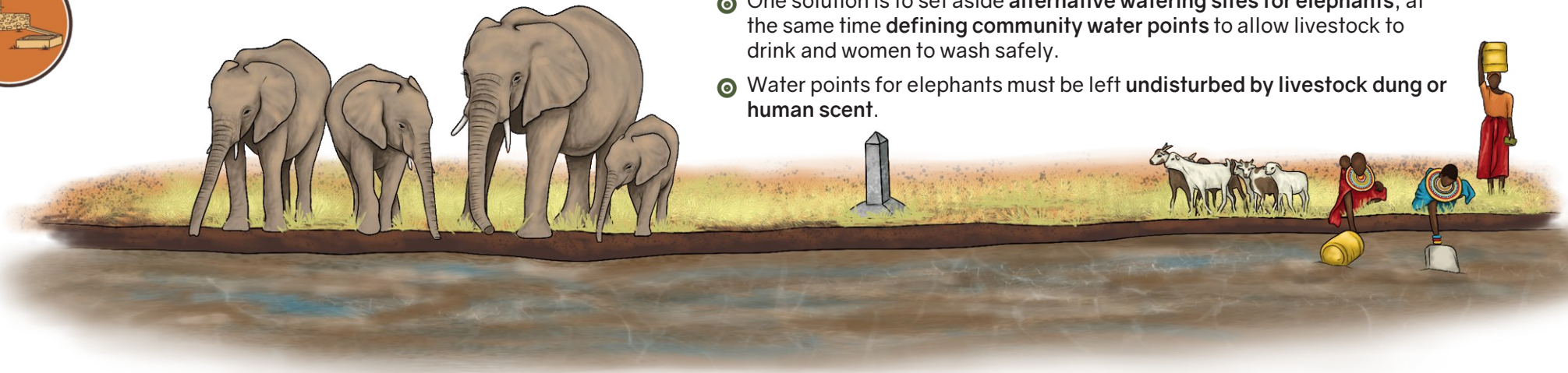


Elephants are attracted to the smell of water stored in villages and can break pipes, water tanks and storage units to access water.



- This causes extreme financial losses and can leave people and their livestock without water for several days, increasing conflict and intolerance towards elephants.
- Vulnerable women and children can be negatively affected as they often have to collect water for the household.

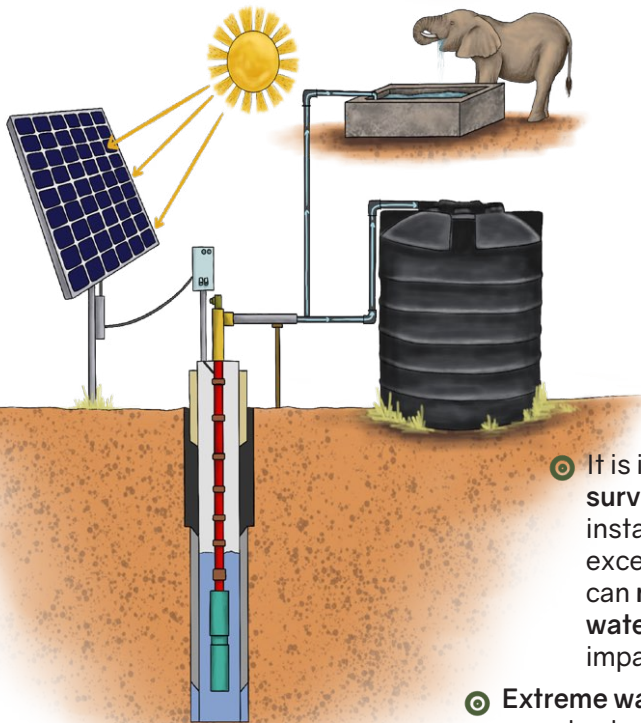




- One solution is to set aside **alternative watering sites for elephants**, at the same time **defining community water points** to allow livestock to drink and women to wash safely.
- Water points for elephants must be left **undisturbed by livestock dung or human scent**.

- This **reduces conflict at the same water point** and elephants can learn to avoid the area used by the community.
- Communities can **demark with posts/pillars** where they have decided to leave water spaces for elephants to come down to drink.
- Livestock and herders will quickly learn that this is a safer way to water cattle when elephants share the same water site.

BOREHOLES



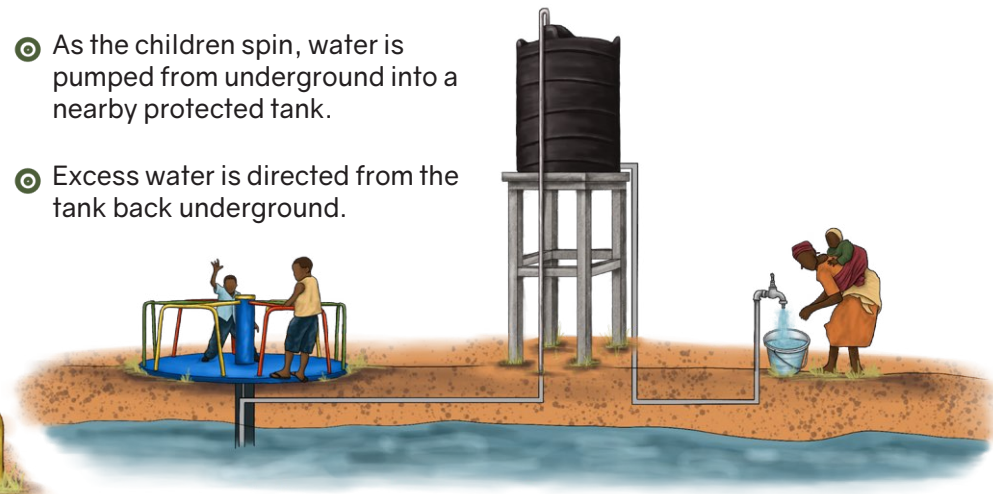
- Boreholes open access to **deeper ground water** that is often not polluted/contaminated.
- The most ideal is **solar powered pumps**, that removes financial pressure from farmers if they were powered by electricity.
- Hand pumps** can draw up water but require **intensive physical labour**.



- It is important to **survey the land** before installing boreholes as excessive extraction can **reduce ground water levels** that might impact farm yield.
- Extreme water extraction** can also lower water levels in natural streams and swamps.



- Some villages also use **roundabouts** to drive the water pump.
- As the children spin, water is pumped from underground into a nearby protected tank.
- Excess water is directed from the tank back underground.



Read more on <http://www.playpumps.co.za/index.php/how-it-works/>

CASE STUDIES



Location: Namibia

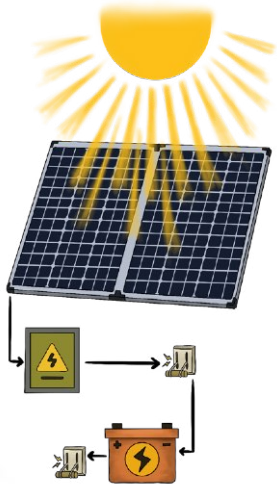
- Elephant drinking dams are built a few hundred meters outside the village.



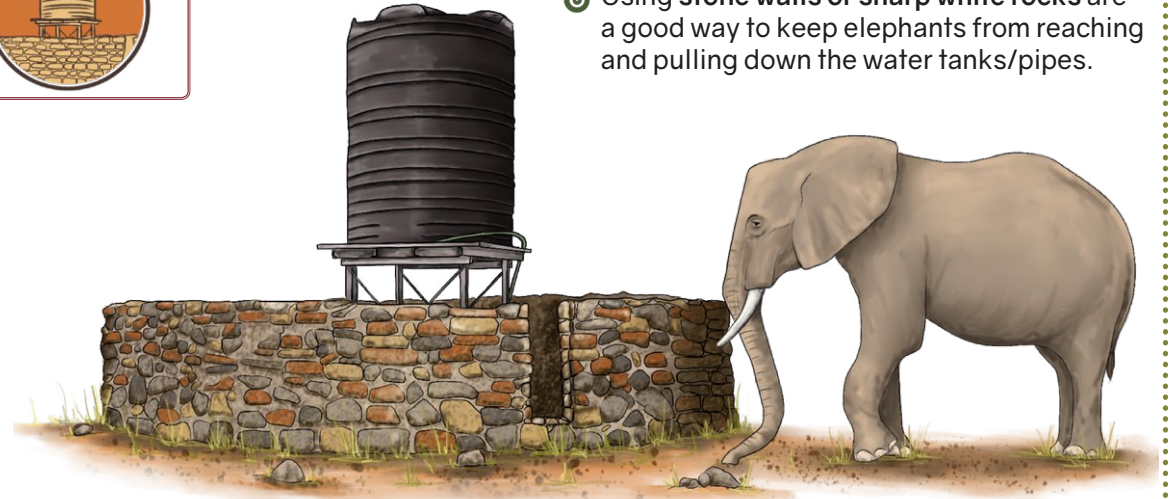
See Water Tank Protection for more



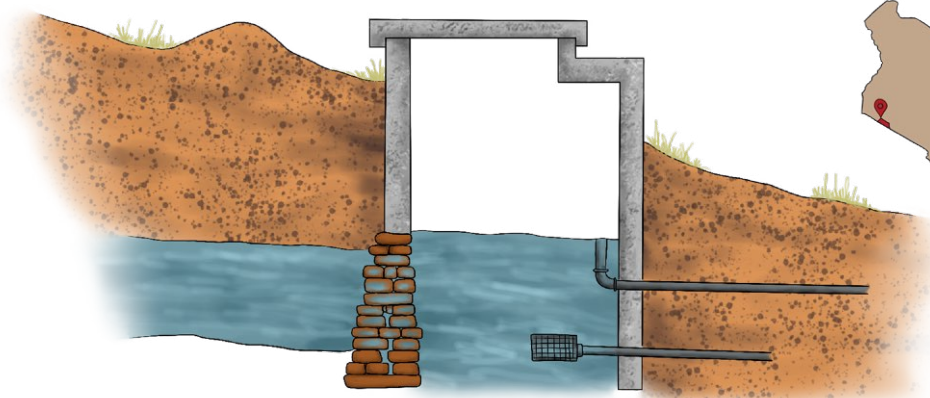
- These dams are filled from the same borehole that fills water tanks for people to access.
- Livestock can also be watered at these outside dams.
- All water storage facilities must be well **protected** to reduce human-elephant conflict.
- Using **stone walls or sharp white rocks** are a good way to keep elephants from reaching and pulling down the water tanks/pipes.



- Solar water pumping systems are relatively simple, require little maintenance, and provide independent water pumping schemes.
- They are suitable for rural and remote water supply where the electricity is not available.



: Read more on: - [EHRA Sturdy Stone Wall](#)
- [Solar powered water source helps reduce human wildlife conflict and provides additional community benefits. WWF](#)

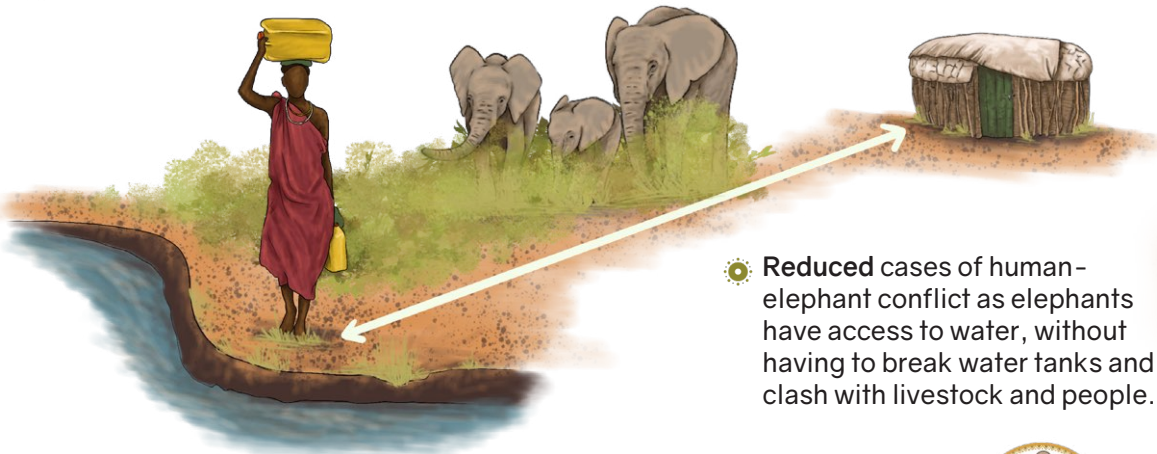


- Nkolale community development organisation in Maasai Mara, Kenya, built a 100,000-litre underground tank that collects water from deep natural springs.
- That water is then pumped into an outer tank, where some of it is directed to open wells further away from the village for wildlife to access.
- More water is pumped by gravity over 13km to serve the surrounding village, schools and health facilities.

Read more on [Spring water conservation cuts down on human-wildlife conflict in Kenya](#)

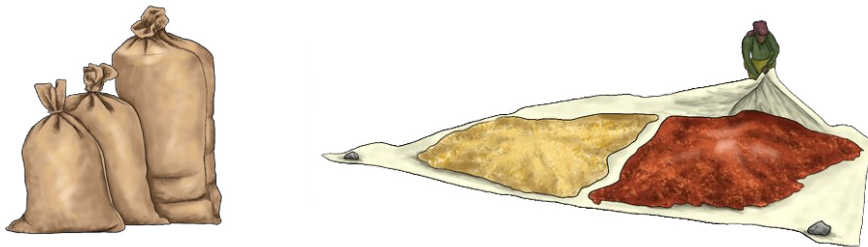
PROS +

- Communities do not have to walk long distances to collect water, reducing their chances of **encountering elephants** on the path/at water points.

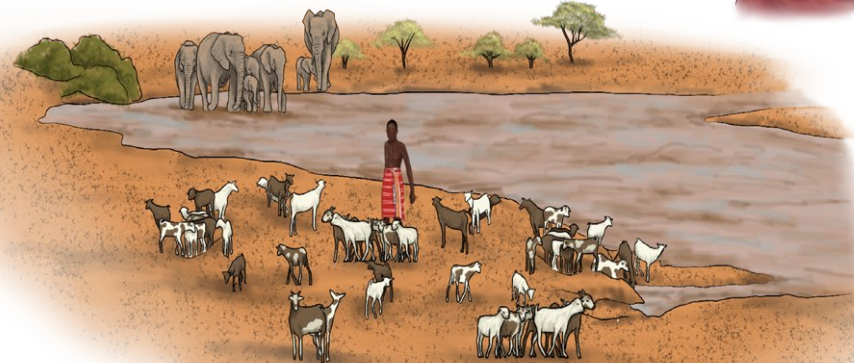
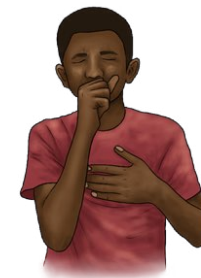


- Reduced** cases of human-elephant conflict as elephants have access to water, without having to break water tanks and clash with livestock and people.

- Increased positive attitudes** towards elephants.
- Availability of clean water also increases **crop production** for farmers to provide to their families and also **sell** to the market.



- Safe access** to water for people, livestock and elephants.
- They are not exposed to **water-borne diseases** that often come with using water that wildlife also shares.



CONS -

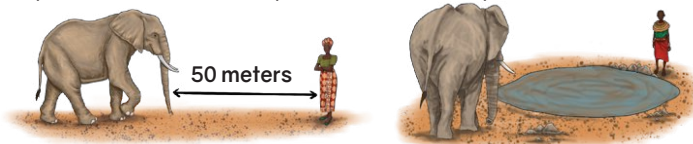
- Cost of installing either a bore hole or underground water storage system and maintaining it is **high** and may require external financial support for both installation and maintenance.
- A **budget for maintenance** needs to be worked on into finance plans to **prevent metal pipes from eroding** and must be maintained to prevent water leaks.
- If the elephant dam is **empty** and the tanks are protected, elephants will try to break walls to reach the tanks.



CAUTION TIPS:



- It is important for villagers to remember to **pump** the elephant dam **full with water**, so elephants can drink and **safely leave** the community area.
- If alternative water points provided are not set up **separately**, they will attract both humans and wildlife to the same point, **increasing conflict**.
- Ensure **children** are educated on which area of river banks and dams are **safe for them to access**, and not to cross the marked boundaries.
- Keep **safe distance** from elephants around water points.



CREDITS AND DISCLAIMER:

We have collected this information from multiple sources. Main sources include: The Elephant drinking dam idea developed by [Elephant Human Relations Aid \(EHRA\)](#), Namibia. For more information on Alternative Water Points, literature and resources used, see [References](#). More research may be required before each site-specific implementation. Safety and caution is advised with all the methods presented in this toolbox.

*Save the Elephants is not liable for any costs, damages or injuries incurred by the use of these methods.





PROTECTING SCHOOLS AND COMPOUNDS



A compilation of different deterrent methods that can be installed around schools and other compounds to safely keep elephants away.



6



7

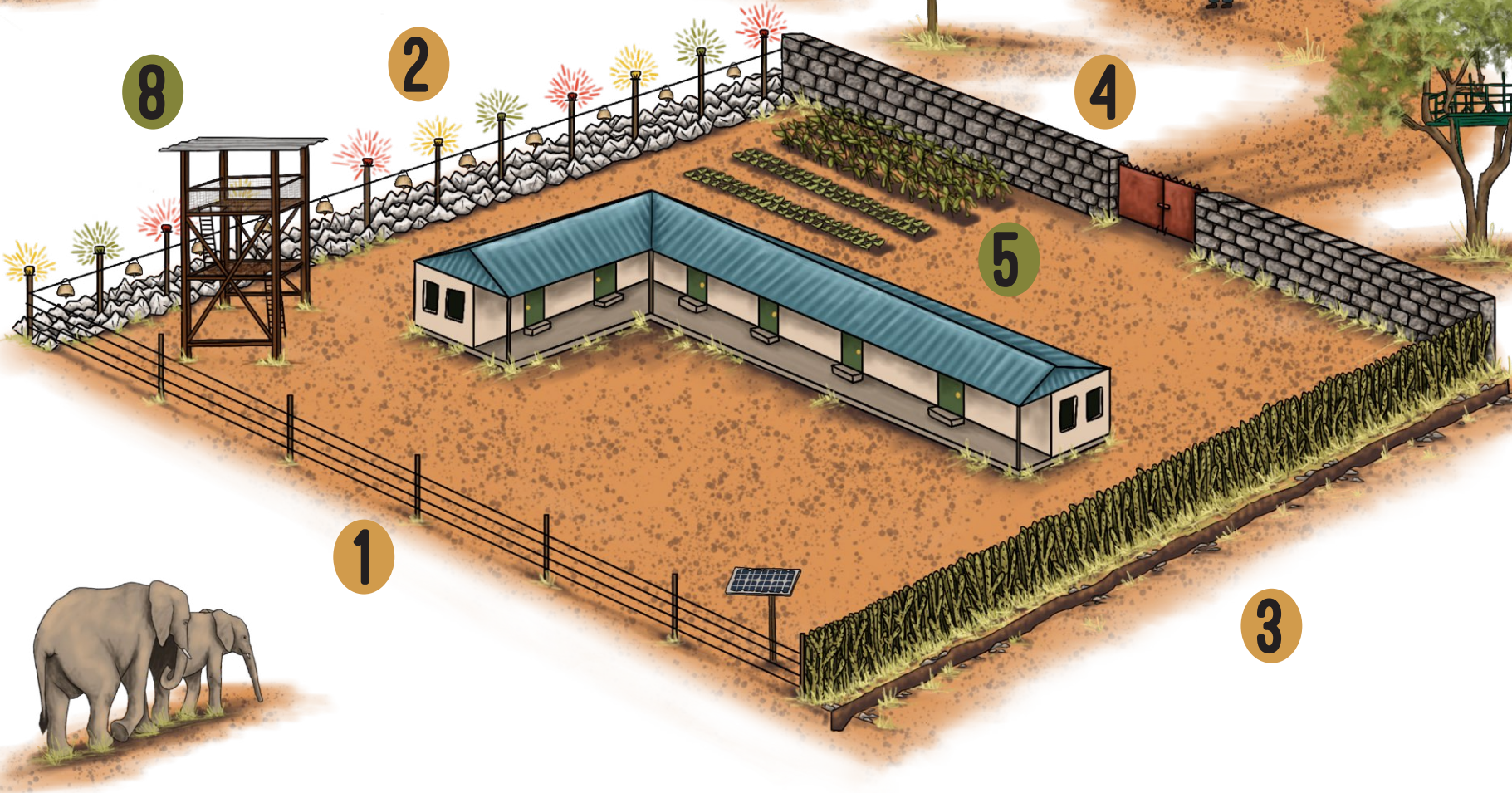


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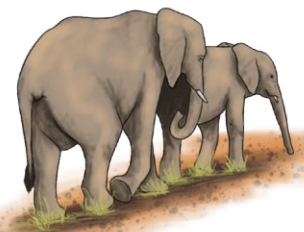
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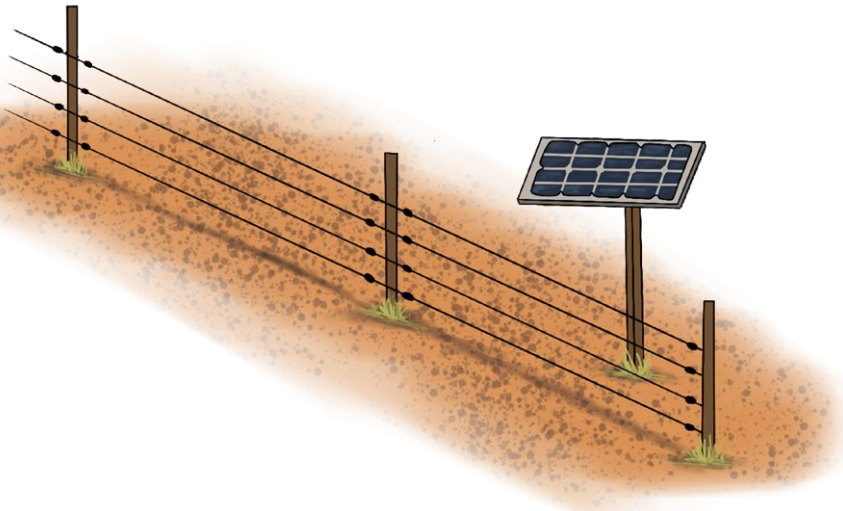
1

ELECTRIC FENCES:



A **well-maintained** electric fence will be an **effective barrier** to elephants.

A **solar powered** electric fence can serve as a **long-lasting** fence type that can be managed with some training.



HOW IT WORKS:

- ⦿ The solar panel collects sunlight energy and converts it into energy that is stored in the battery.
- ⦿ When an elephant touches the fence, it will receive a **short, sharp shock** that is safe and will not kill the elephant.
- ⦿ The shock enables a deterrent effect while ensuring that no lives are lost.
- ⦿ **Solar panels and batteries for the electric fence can be stored safely on top of the Watch Tower Roof that looks over the most active elephant-approach route to the school.**

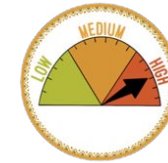
SOURCES:

[Sinha, A. \(2020, June\). How solar-powered fences mitigated human-elephant conflict in Assam. Down To Earth.](#)

[Maintaining Electric Fences \(WWF\).](#)

PROS +

- ⦿ Effective in reducing the number of elephant visits into the enclosed area.
- ⦿ If maintained well, they can **last long**.
- ⦿ No physical harm caused to human beings or animals.
- ⦿ Makes use of **renewable solar energy**.



CONS -

- ⦿ **Regular maintenance** needed, including trimming plants around the fence.
- ⦿ Initial cost of set up can be **high**.
- ⦿ Some elephants become **'fence breakers.'**



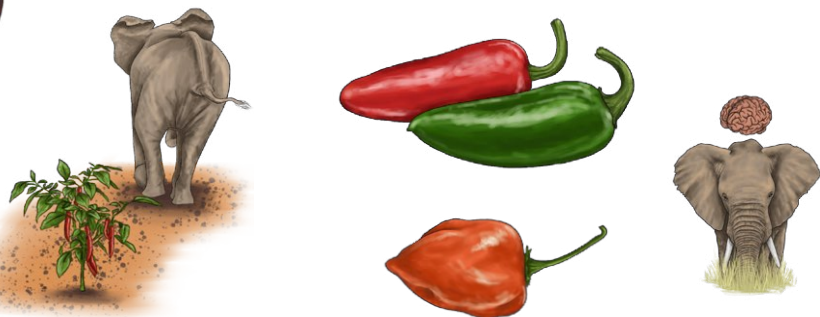
CAUTION TIPS:



- ⦿ Building a small **stone barrier** on the **inside** of the electric fence can prevent children in school from holding the electric wires and getting a shock.
- ⦿ **Poor maintenance** will allow elephants to challenge the fence more often, causing **more breaks and damage**.
- ⦿ Seek **expert assistance** to install electric elements of the fence.
- ⦿ Put up **warning signs** to indicate that the fence is electric.
- ⦿ **Do not connect electric fences to high-tension wires or domestic lines**, as this can be fatal to both humans and wildlife.



1A) CHILLI PASTE ON FENCE POSTS:



- Elephants are intelligent and can learn how to knock posts over.
- All posts used in the electric fence should be covered with **chilli rub/paste** during elephant season.
- Chilli-cow dung paste and chilli rags can also be used to cover water pipes.



See Chilli Deterrents for more information.

TIPS:

- Frequently reapply chilli paste & rags to posts, to retain effectiveness.
- You may also grow **chilli shrubs** on the outside of the electric fence.
- Ensure the posts are **well covered** with chilli paste.
- Chili rub will rub off in the rain so only use when its **elephant season** to save your resources.



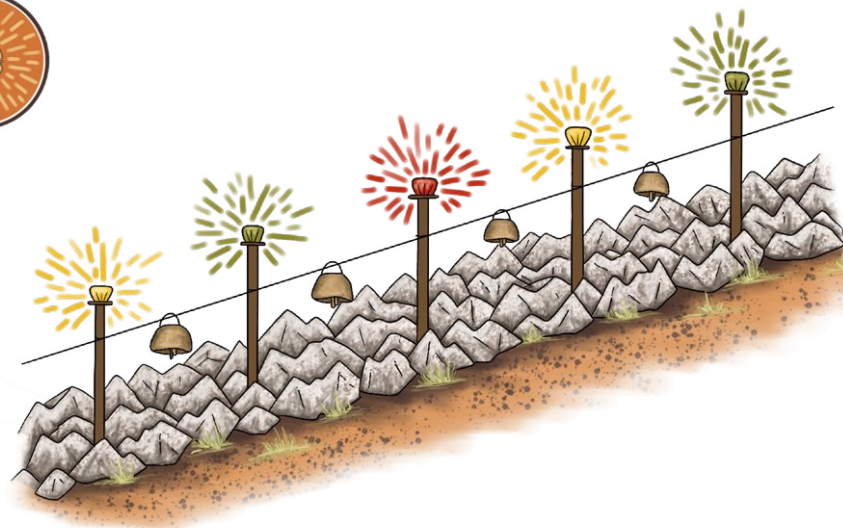
SOURCES:

[Read more on Mitigating Elephant and Human Conflict in the Namibia. \(2020\).](#)

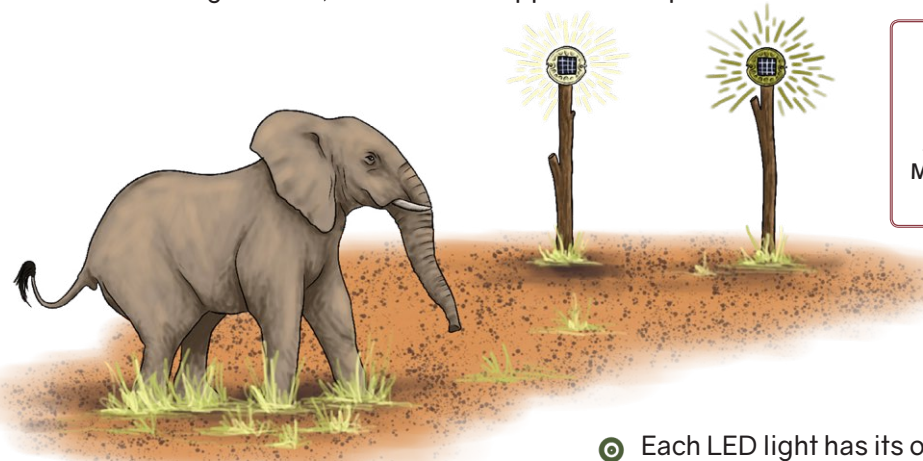
2 FLASHING SOLAR LIGHTS FENCE WITH WHITE ROCKS AND TRIP ALARMS:



As elephants do not like flashing lights, this fence creates an effective barrier.



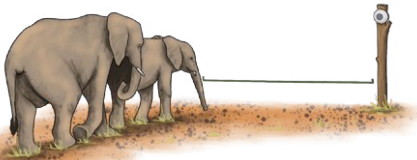
- There are a variety of LED lights, with some that flicker as **motion is detected**.
- Other LED lights flash with **different colours in random patterns** throughout the night, and automatically switch off during the day.
- When elephants see the flashing lights from a distance, they think it is people holding torches flashing at them, hence do not approach the premises.



See Infrared or Motion Triggered Sensors

- Each LED light has its own **solar charger**.
- Lights are all connected with cables and **stuck on top of individual posts** that are secured around the compound.

- Long posts are used so elephants can see them at a distance before they reach the compound.
- The flashing lights are able to **recharge** during the **day** to be used primarily at **night** when elephant visits are more frequent.



SOURCES:

[Experiment was successfully conducted in Chobe District, Botswana.](#)
[Read more on New HEC Tool: Flashing Light Fences. Mara Elephant Project.](#)

PROS +

- Portable fence, as lights are mounted on individual posts.
- Effective method to deter elephants.
- No electricity needed as lights are solar powered.
- Moderate cost & maintenance is required to ensure posts are not knocked over by elephants.
- Flashing lights also seen to deter other wildlife like lions.



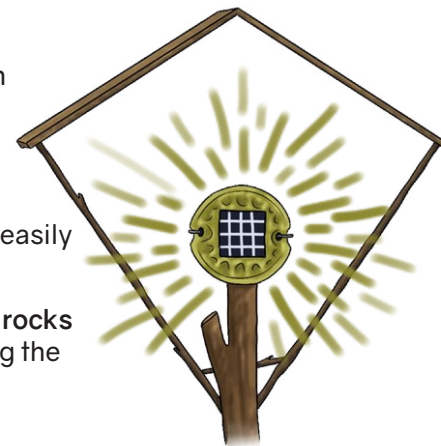
CONS -

- There is the risk of **theft**.
- Most effective at **night**; less effective during the day.
- Must be **weather proof**. If not, it needs to be covered to protect from rain.
- There is a risk of **elephant habituation**.



MAINTENANCE TIPS:

- Make a shade to protect the light from rain, if it is not rain proof.
- Make sure the light is at **eye or chest level** of an adult elephant.
- Posts must be firmly in the ground to avoid them getting easily knocked over.
- Combine with other deterrent methods (e.g **sharp white rocks** or **metal strip fence**) that will help deter elephants during the day.



TOP TIP



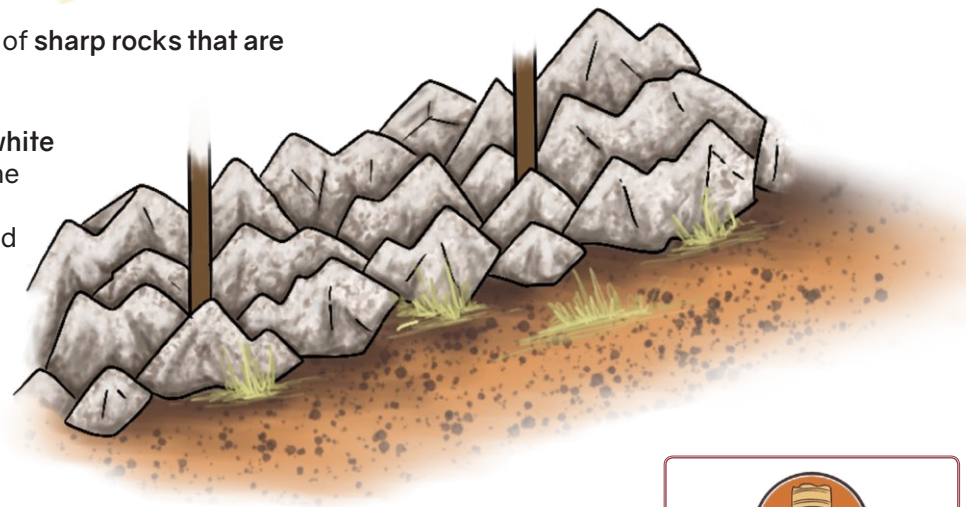
To avoid habituation, **different coloured lights** can be used and the colour pattern should be changed weekly.



See Metal Strip Fence.

2A) WHITE ROCK BARRIERS:

- This is a barrier of **sharp rocks that are painted white**.
- The **2m sharp white rocks** around the outside of a compound could help prevent elephants from entering in.



- The sharpness of the rocks is **unpleasant and painful** for elephants to walk on.
- Combined with **flashing lights** to provide extra protection.



See Water Tanks for more information on white rock barriers.

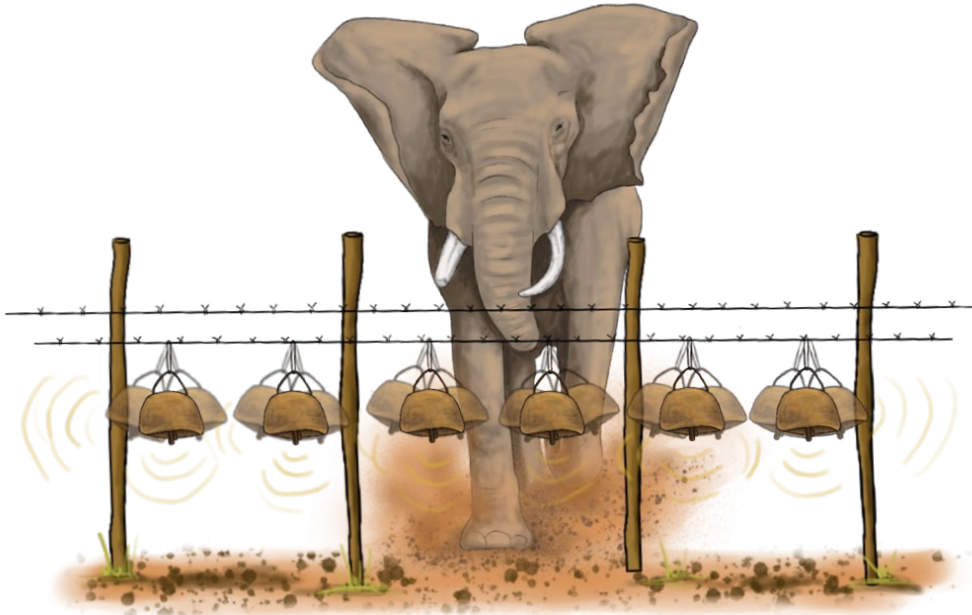
2B) TRIP ALARMS:



See Trip Alarms for more information.



- Trip alarm is a **simple, low-tech** method that helps by giving **early warnings** as elephants are entering the compound.



WHY THEY ARE USEFUL?

- When the trip wire is triggered by an elephant, it will produce **loud noises** that will alert students and teachers at school.
- Elephants can be extremely **quiet**, and it is not always easy to see them entering the compound.
- It helps alert people of an approaching elephant, allowing them to find safety, or use other methods to chase the elephants away.



TIP



Combine with other deterrent methods, such as **flashing solar lights** for added effectiveness.

3 ELEPHANT PROOF TRENCHES WITH BIOFENCES:



See Trenches for more information.

- Trenches form a **physical barrier** for elephants and other wildlife.
- Elephants cannot jump, so a trench that is too wide or deep may act as an **effective barrier**.



WHAT ELSE CAN THEY BE USED WITH:



Bio-fences



Flashing solar lights



Motion sensed lights.

TIP



Trenches combined with **Bio-fences** around a compound can be an effective deterrent method.

- Trenches are prone to soil erosion, especially along slopes and high rainfall areas. The presence of trees (bio-fence) helps to **stabilize and prevent soil erosion**.



PROS +

- Can be constructed without too many materials.
- Can be a **low-medium** cost option.
- Effective physical barrier to elephants.
- **Long term strategy** to help restrict elephant entry or exit.



SAFETY TIP Trenches around school compounds must be dug on the **outside** of the fence, to provide safety for school children.



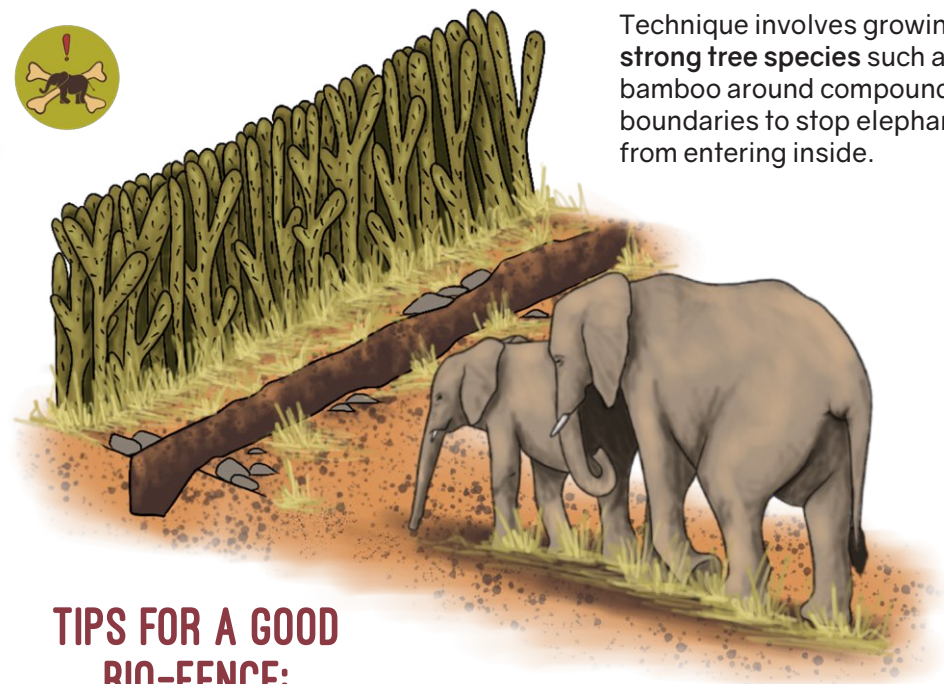
CONS -

- Trench walls need **maintenance**, which are **labour intensive** and **costly**, particularly after heavy rains.
- People, livestock and other animals could be **injured** by falling into deep trenches.
- Elephant **babies** are particularly vulnerable to **falling in trenches/getting stuck**.



3A) BIO-FENCING:

- These are lines of trees/shrubs that are planted around the **boundaries** of schools and compounds to provide protection against elephants and other wildlife.
- The bio-fence acts as a **physical barrier**, preventing elephants from entering the area.



Technique involves growing **strong tree species** such as bamboo around compound boundaries to stop elephants from entering inside.

TIPS FOR A GOOD BIO-FENCE:

- They are established by planting a **line of trees** and/or **spiky/thick shrubs** at relatively close spacing.
- Additional **dead sticks** can be tied to wires and strung across the trees.
- Use **combined methods** to protect trees with fruits from elephants, such as, digging **trenches** on the outside.



EXAMPLES OF TREES YOU CAN PLANT:



- *Commiphora* spp.
- *Mauritius thorn* sp.
- Agave
- Thorny bamboo
- Nile Tulip – flowers that attract pollinators.
- *Acacia nilotica*: medicinal properties
- Lemongrass
- *Ziziphus mauritiana*: has edible fruits
- Physic Nut: creates dense hedges
- Palmyra palm: commonly grown in Sri Lanka

SOURCES:

Read more on:

[Fencing Agriculture Land in Nigeria for more tree species.](#)

[Live fences in Segou, Mali: An evaluation by their early users.](#)



PROS +

- Bio-fences are **environment friendly**.
- **Cost-effective**. It is cheaper than building a brick wall or electric fence.
- Effectively prevents elephants from intruding into compounds.
- Fruiting trees provide extra nutrients to school children.
- Trees attract **pollinators** such as bees, which act as **natural barriers** for elephants.



CONS -

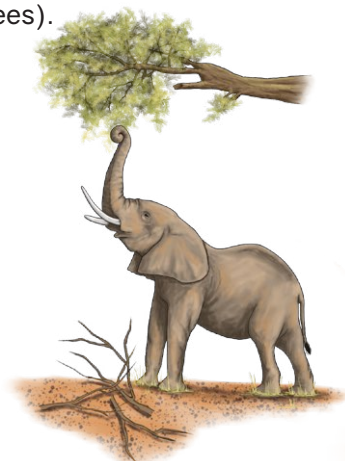
- Trees take a **long time to mature** and become effective.
- Other deterrent methods must be used while the trees mature.
- May require constant maintenance.
- **Risk of grazing** in the initial stages.



CAUTION TIP

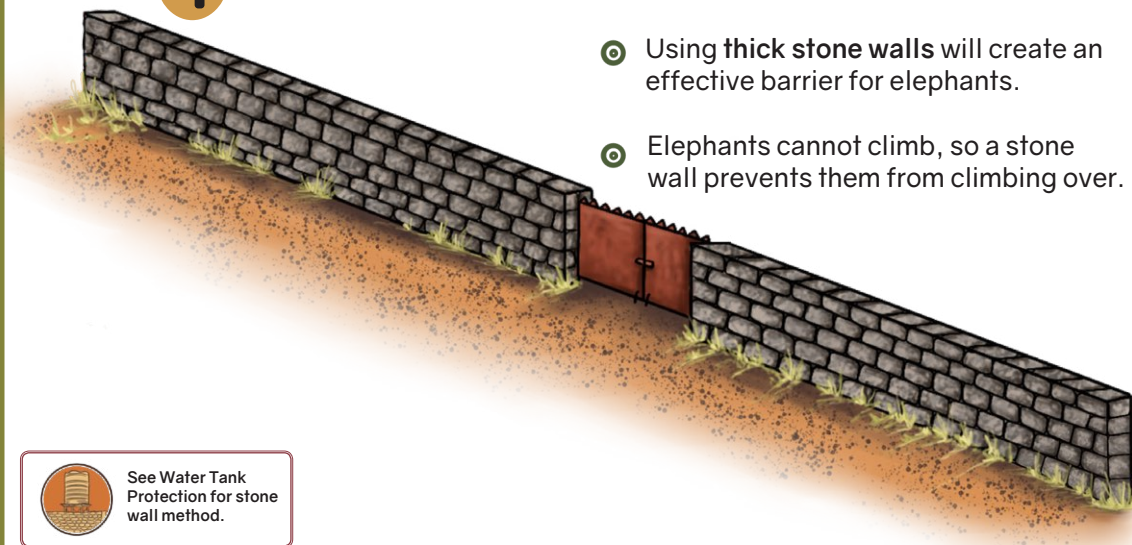
Do **not** plant thorny Cholla Cactus, as the fruits that grow have thorns that can harm elephants and it is an invasive species.

Avoid planting trees that will **attract elephants** to feed upon them (e.g acacia trees).



4

STONE WALLS:



- Using **thick stone walls** will create an effective barrier for elephants.
- Elephants cannot climb, so a stone wall prevents them from climbing over.



See Water Tank Protection for stone wall method.

PROS +

- If constructed well, it can be a moderately **long-term solution**.
- Effectively protects schools and compounds against elephants.
- Moderate maintenance required, to ensure stone wall is still strong.



CAUTION TIPS

- Walls should be at a distance of **3m** from the tanks so elephants can't reach with their trunks.
- Keep an eye to ensure children at schools **do not climb** the walls.
- Elephants **may still risk pain** in the pursuit of tasty crops/water sources, especially during the **dry season**, so using **combined methods** will increase the effectiveness of barriers.

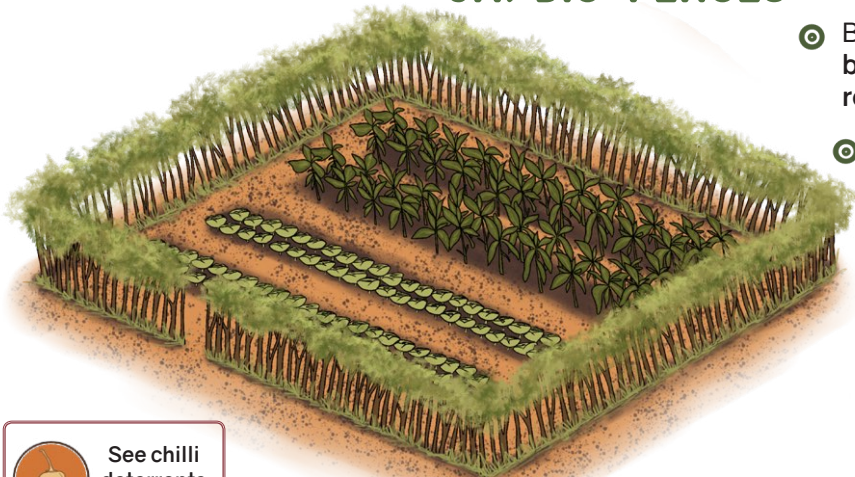


Read more on stone walls: [Sturdy Stone wall - EHRA](#)

5 VEGETABLE GARDENS:

- Vegetable gardens are crucial as they provide necessary **nutrients**, especially to children in schools.
- These methods can help provide **extra protection barriers** to your gardens inside the compound, to ensure elephants do not raid crops.

5A) BIO-FENCES:



- Bio-fences act as **wind breakers** and also **reduce soil erosion**.
- This ensures crop yields are sufficient and high.

TIP

You can also plant **chilli shrubs** as border fences.

See chilli deterrents for more.

5B) FLASHING SOLAR LIGHTS:

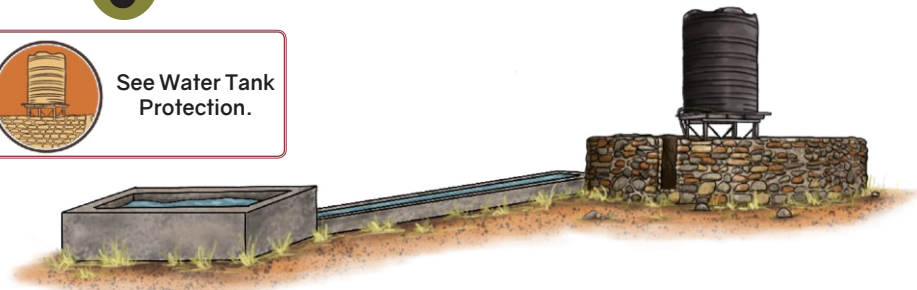


[Solar Predator Lights in Kenya](#)

6 WATER TANK PROTECTION:



See Water Tank Protection.



- Elephants have been known to break water tanks and pipes to gain access to drinking water.
- Rubbing **chilli paste** on or growing **chilli shrubs** around water pipes can help prevent this.
- It is advisable to build protective walls around the whole water installation, including water pipes.

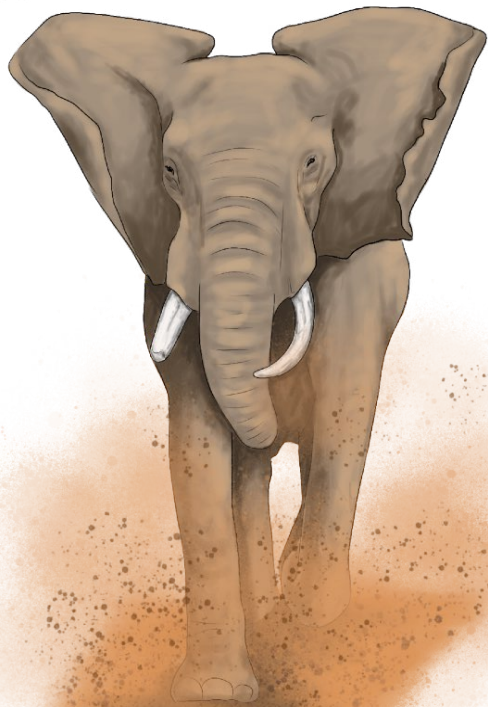


7 CHILDREN ON THEIR WAY TO SCHOOL AND BACK HOME:



- School children are always at risk of encountering elephants when they walk between home and school. **Prioritizing their safety** ensures they do not miss school in fear of elephants and stay safe.

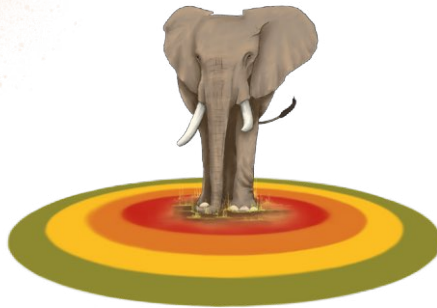
7A) ELEPHANT AWARE BEHAVIOUR EDUCATION:



- Elephant education is important in promoting **human-elephant co-existence**.



- It is important to know **how to react towards elephants**, so as not to provoke them to attack/ agitate them and to **prevent** dangerous confrontations.



- Educating school children will help to familiarize themselves about various elephant **behaviour** and when to take **extra caution**.

TIP



Use pictures to deliver education to school children. Pictures create **mental images** that make it easier for children to understand.

- Wildlife education** is more important for the youth so they can understand the importance of elephants.



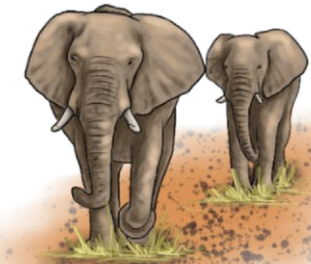
See 'Elephants as Ecosystem Engineers' and 'Introduction to Elephants' for more information.



7B) TREE PLATFORMS:



- Simple Tree platforms can be constructed on **common routes** taken by school children.
- They are **safe** for children to **quickly climb up** when elephants are approaching to avoid conflict.



KEEP IN MIND WEIGHT AND STABILITY:

- Select strong tree species with **strong branches** and well-established **roots** to ensure they last long during heavy rainfalls and strong winds.
- Use **grounded posts** to give extra support to the platform.
- Attach **climbing ropes** with knots tied along the length of the rope for more ways to climb up the platform.



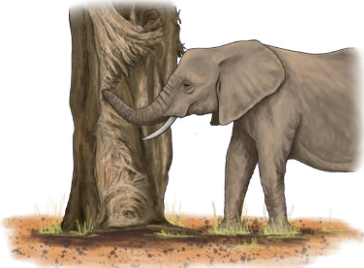
PROS +

- Children sitting up in the platform can spot elephants at a **distance** and keep put until it is safe for them to proceed walking.
- If elephants are heard nearby, children can **safely rest** on the tree platforms until the route is safe to walk again.
- If maintained well, they may last a moderate amount of time.
- Moderate initial cost.



CAUTION TIPS:

- ⦿ Add **chicken wire** around the tree to ensure elephants do not debark and weaken the tree.
- ⦿ Do not construct on trees with few/weak branches.



See Tree Protection for more.



- ⦿ Add a **thatched roof**, if tree canopy is less to provide shade.
- ⦿ Moderate maintenance is required to ensure it is always **safe for children** to climb onto.
- ⦿ If the platform is not firm, there is **risk of injury**.



7C) AIR HORNS/VUVUZELAS:

- ⦿ These devices are **light-weight, easy to carry and quick** for school children to use.



- ⦿ **Vuvuzelas** are used because they **do not threaten** the elephants. This is important because an elephant that feels threatened is more likely to attack.



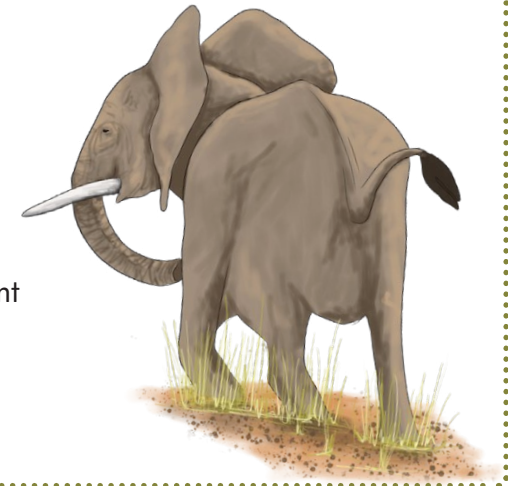
SOURCES:

<https://nation.africa/kenya/counties/kilifi/farmers-re-sort-to-drums-vuvuzelas-to-fend-off-ravenous-elephants-3741868>

<https://learningenglish.voanews.com/a/vuvuzelas-keep-people-safe-from-elephants-attack/2703535.html>

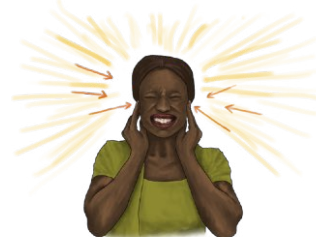
PROS +

- ⦿ The **loud sound** scares the elephant away. It does not threaten the elephant, making it **safe for children** to use.
- ⦿ The sharp and sustained **ear-splitting bleat** from a Vuvuzela can send a fully-grown elephant taking cover.
- ⦿ Airhorns blown together in a group can have more effect in chasing the elephant away.



CAUTION TIPS:

- ⦿ Avoid making any noise until you know exactly where the elephant is.
- ⦿ Do not blow airhorn into someone's ear. It can damage one's hearing.



See Elephant Aware Behaviour for actions to take around elephants.



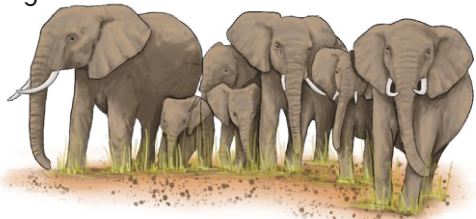
See Noise Deterrents document for more methods.



7D) COMMUNITY/SCHOOL BUSES:



- Community buses can offer a successful **conflict mitigation strategy that significantly reduces human-elephant conflict**, providing adequate safety for school children.
- These buses have been successfully established in **Sri Lanka and Botswana**.
- The **EleFriendly bus** developed by Sri Lanka Wildlife Conservation Society (SL-WCS) show that human-elephant conflict has been **reduced by 80%** since the bus started running.



- Elephant Express Buses** in Botswana provide transport across **elephant corridors** for school children to increase their **safety** around elephants.
- The buses are decorated with beautiful **illustrations of elephants** and equipped with **educational material**, so they display the crucial message that we can find ways to live alongside wildlife.

SOURCES:

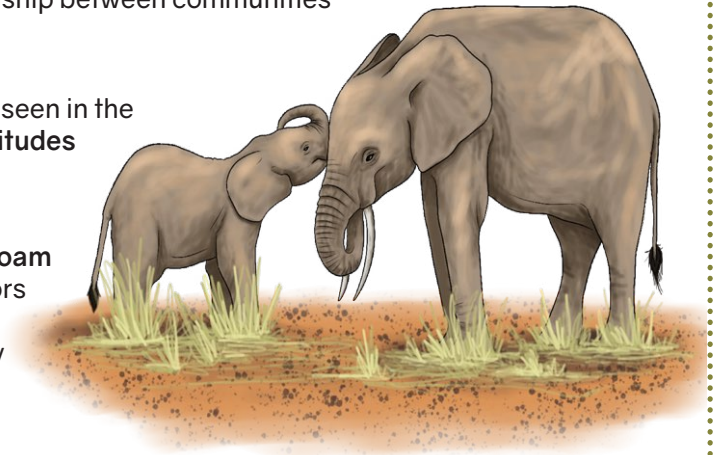
Read more on:

[The World's First EleFriendly bus: A success story.](#)

[Promoting coexistence of wildlife and people in Kavango Zambezi.](#)

PROS +

- Buses help with improving the **quality of education**, as children do not have to miss school due to the **fear of elephants** and also **extreme weather conditions**.
- Parents will be at ease knowing their children travel to school **safely**, with no danger of getting trampled by an elephant.
- Improves the relationship between communities and elephants.
- Success of the bus is seen in the villagers' **positive attitudes** towards elephants.
- Allows elephants to **roam more** freely in corridors where they can **feed and socialize**, as they have done for centuries.
- During term breaks, the buses can be used to assist people heading to clinics.



TIPS:

- Regular maintenance and car service** is required to ensure long term usage of the bus.
- Do not misuse** the bus, as this will reduce the longevity of use and may be prone to damage hence **increasing cost of repair**.
- Insert **educative posters** on the inside of the bus to enhance **elephant education** for the children.
- School children should travel for **free**, while others may pay a reasonable fare to ensure there are **funds** for the maintenance of the bus.

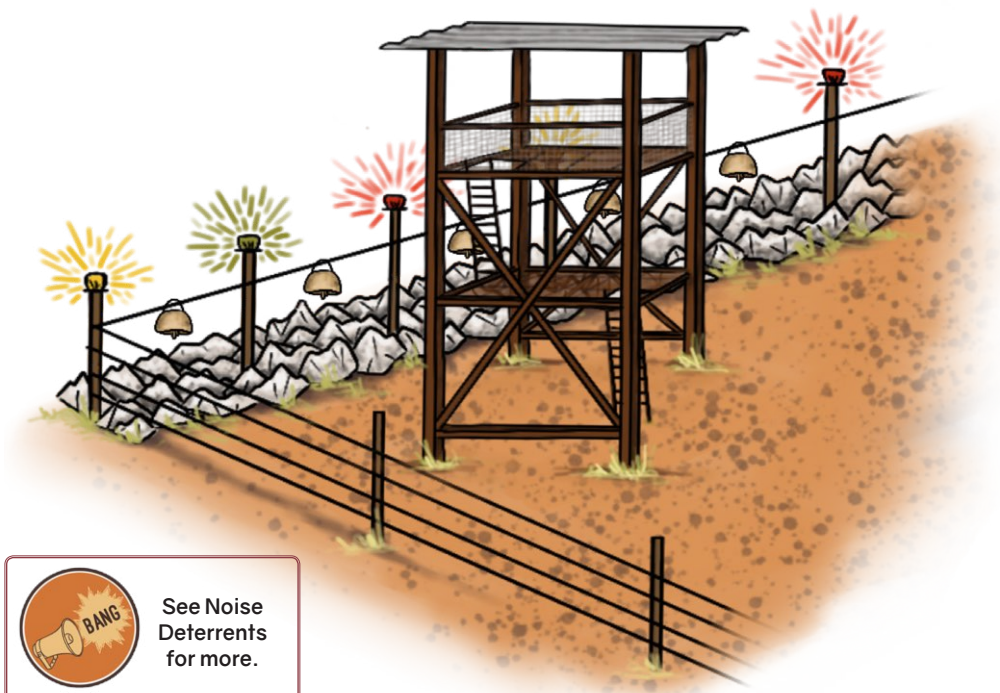




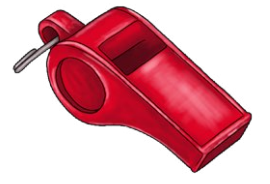
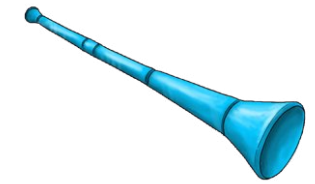
8 WATCH TOWERS:



- Watch towers constructed on the **edge of the school compound looking towards common elephants routes** can help with **early warnings** when elephants are close by.
- They can be utilized during **morning hours** when children are walking to school and **evening hours** when they are walking back home.
- Volunteers** from the school or village can help on the lookout on the watch tower.
- Watch towers on common routes can be made with a **lower level**, so as to also allow children to **safely climb** the tower, if elephants are nearby.



- When elephants are seen **approaching** the school/children walking, they can use **airhorns/vuvuzelas** and **whistles** to alert the children to find safety.



SAFETY TIP:
Place a gate with a lock between the lower level and higher level to ensure children **do not climb** until the top.

CREDITS AND DISCLAIMER:
We have collated resources from a range of different sources. Some of the methods represented are experimental and further research is needed. See [References](#) for more information. Save the Elephants advises caution with all the methods and information collected and presented in this illustrated toolbox. Further research may be required before each site-specific implementation.
* Save the Elephants is not liable for any costs, damages or injuries incurred by the use of these methods.



REFERENCES AND FEEDBACK

We hope you and your community have enjoyed this HEC Toolbox. We're aiming to make this a comprehensive encyclopedia and the work is still ongoing.

We have tried to include and reference as many sources as possible. Some of the credits and publications may originate from you personally, or you may have evidence for a new tool that has been missed out. Please do help us! If you notice any key absent paper, missed credits, errors, or you have any specialized technical manuals you think are relevant please get in touch and share them with us for inclusion.

Our work is all open source and not-for-profit. The more of you helping us to fact check and provide constructive feedback, the more comprehensive this encyclopedia of HEC Tools will be to help people trying to live in better harmony with elephants.

Ultimately elephants will survive only if the communities they live, with and health of their environments, thrive too.

THANK YOU!



Our contacts and constantly updated *Reference List* can be found online at this link:

<https://ste-coexistence-toolbox.info/toolbox-index>

ACKNOWLEDGEMENTS:

We have so many individuals and organizations to thank for providing feedback, advice, and content for the documents. Forgive us if we inadvertently miss anyone out. Organization content and/or contributions gratefully received from:

African Elephant Specialist Group/IUCN, Awely Wildlife & People/Zambia, BigLife/Kenya, Connected Conservation/Zimbabwe, Conservation South Luangwa/Zambia, Deeble & Stone/Kenya, Ecoexist/Botswana, Elephants Alive/South Africa, Elephant Human Relations Aid/Namibia, Elephant Special Advisory Group/South Africa, Elephants Without Borders/Botswana, Elephant Voices/Kenya, ENCOSH, FAO/UN, Frankfurt Zoological Society/Tanzania, Honeyguide Foundation/Tanzania, Kenya Wildlife Service/Kenya, Mara Elephant Project/Kenya, Nature Conservation Foundation/India, PAMS Foundation/Tanzania, Save the Elephants' Elephants and Bees Project/Kenya, Save the Elephants' Samburu team/Kenya, Southern Tanzania Elephant Project/Tanzania, Sri Lanka Wildlife Conservation Society/Sri Lanka, The Elephant Queen Mobile Cinema Outreach Team/Kenya, University of Oxford/UK, WildAid/Uganda, Wild Survivors/Tanzania, Wildlife Research & Conservation Society/India, Wildlife Conservation Society/ Gabon, Wildlife Works/Kenya.

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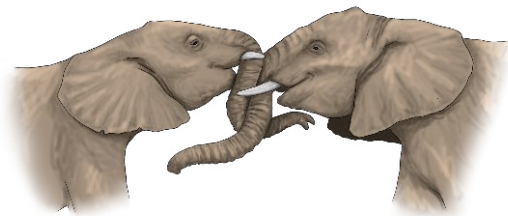
Nicola Heath is our very talented Kenyan illustrator with a BSc in Fine Arts based in Nairobi. Her unique artistic skills and interpretation sensitivity has brought our interactive HEC coexistence toolbox to life.

ABOUT SAVE THE ELEPHANTS

Save the Elephants is a charity working to secure a future for elephants. Specializing in elephant research, we provide scientific insights into elephant behavior, intelligence, and long-distance movements and apply them to the challenges of elephant survival. Education and outreach programs share these insights with local communities as the true custodians of this rich heritage. The team works towards a future of harmonious coexistence between humans and elephants.

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HMRC Number: XT11693

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