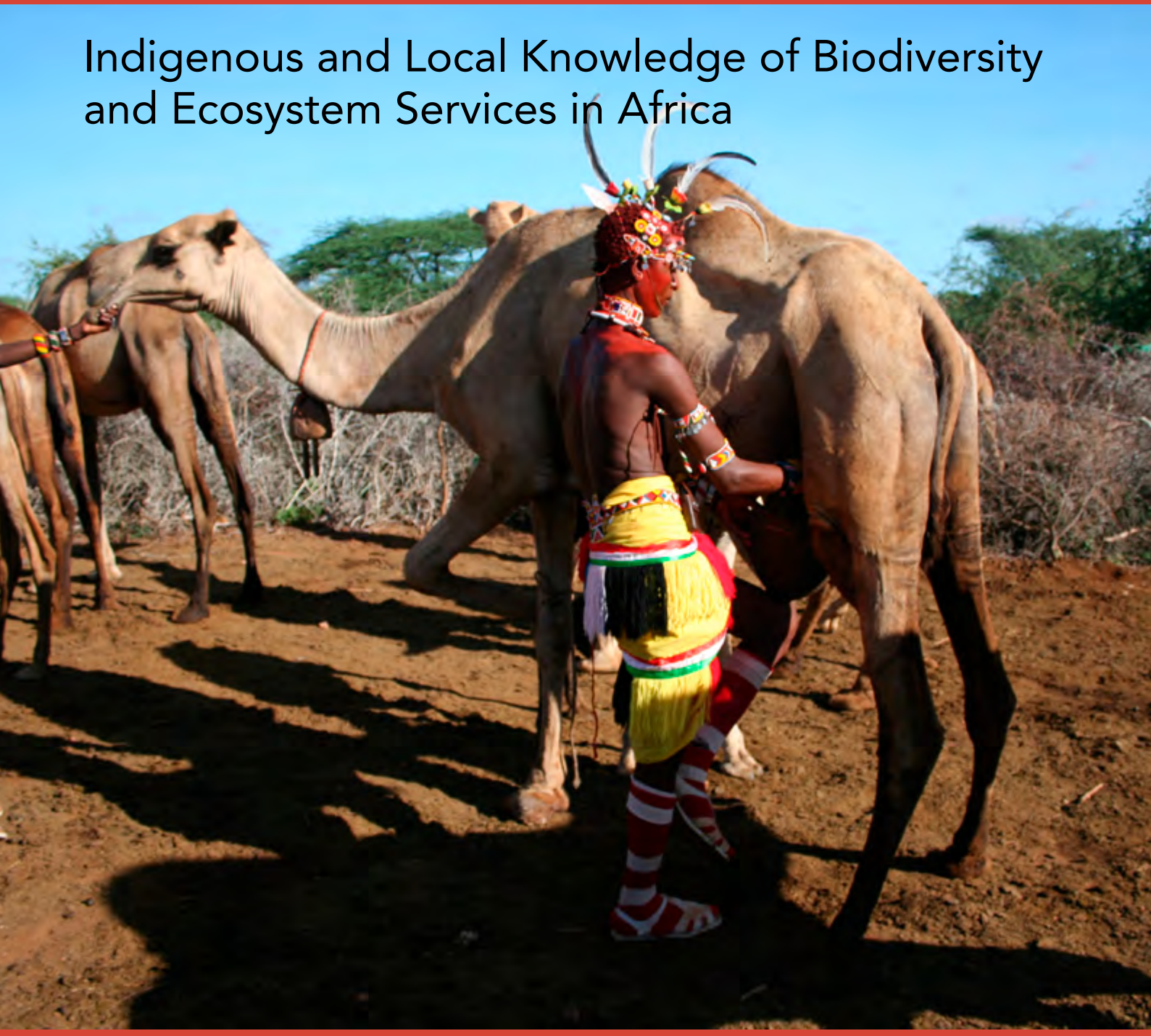
# Knowing our Lands and Resources

## Indigenous and Local Knowledge of Biodiversity and Ecosystem Services in Africa



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## Indigenous and Local Knowledge of Biodiversity and Ecosystem Services in Africa


▶ **Edited by:**

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**Task Force on Indigenous and Local Knowledge Systems**
**Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES)**

▶ **in collaboration with the:**

**IPBES Expert Group for the African Regional Assessment**

▶ **with support from**

**Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES)**
**United Nations Educational, Scientific and Cultural Organization (UNESCO)**

▶ **14–16 September 2015 • UNESCO • Paris**


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Science and Policy for People and Nature

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Published in 2017 by the United Nations Educational, Scientific and Cultural Organization, 7, place de Fontenoy, 75352 Paris 07 SP, France



ISBN: 978-92-3-100208-3



To be cited as:
M. Roué, N. Césard, Y. C. Adou Yao and A. Oteng-Yeboah (eds.). 2017. *Knowing our Lands and Resources: Indigenous and Local Knowledge of Biodiversity and Ecosystem Services in Africa.* Knowledges of Nature 8. UNESCO: Paris. 156pp.

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Funded by:
Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES)
United Nations Educational, Scientific and Cultural Organization (UNESCO)

English and Copy Editor: Kirsty McLean

Cover photo: Ole Kaunga

Graphic and cover design, typeset: Julia Cheftel

Images: Yildiz Aumeerudy-Thomas, Patrice Bigombe Logo, Finn Kjellberg, Nicholas Oguge, Verohanitra Rafidison, Bakolimalala Rakouth, Riziki Shemdoe and Claude Villeneuve

Hard copies are made available compliments of UNESCO

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# Introduction

The Intergovernmental Platform for Biodiversity and Ecosystem Services (IPBES) includes as one of its operating principles the following commitment:

> *Recognize and respect the contribution of indigenous and local knowledge to the conservation and sustainable use of biodiversity and ecosystems.*
>
> UNEP/IPBES.MI/2/9, Appendix 1, para. 2 (d)

To spearhead its work on this challenging objective, IPBES Plenary created at its Second Meeting the Task Force on Indigenous and Local Knowledge (ILK) Systems.

The present document is a contribution to the IPBES regional assessment for Africa. Its aim is twofold:

- To assist the co-chairs, coordinating lead authors and lead authors of the regional assessment for Africa by facilitating their access to indigenous and local knowledge relevant to the assessment theme.
- To pilot the initial approaches and procedures for building ILK into IPBES assessments that are under development by the ILK task force in order to test their efficacy and improve the final ILK approaches and procedures that the task force will propose to the Plenary of IPBES.

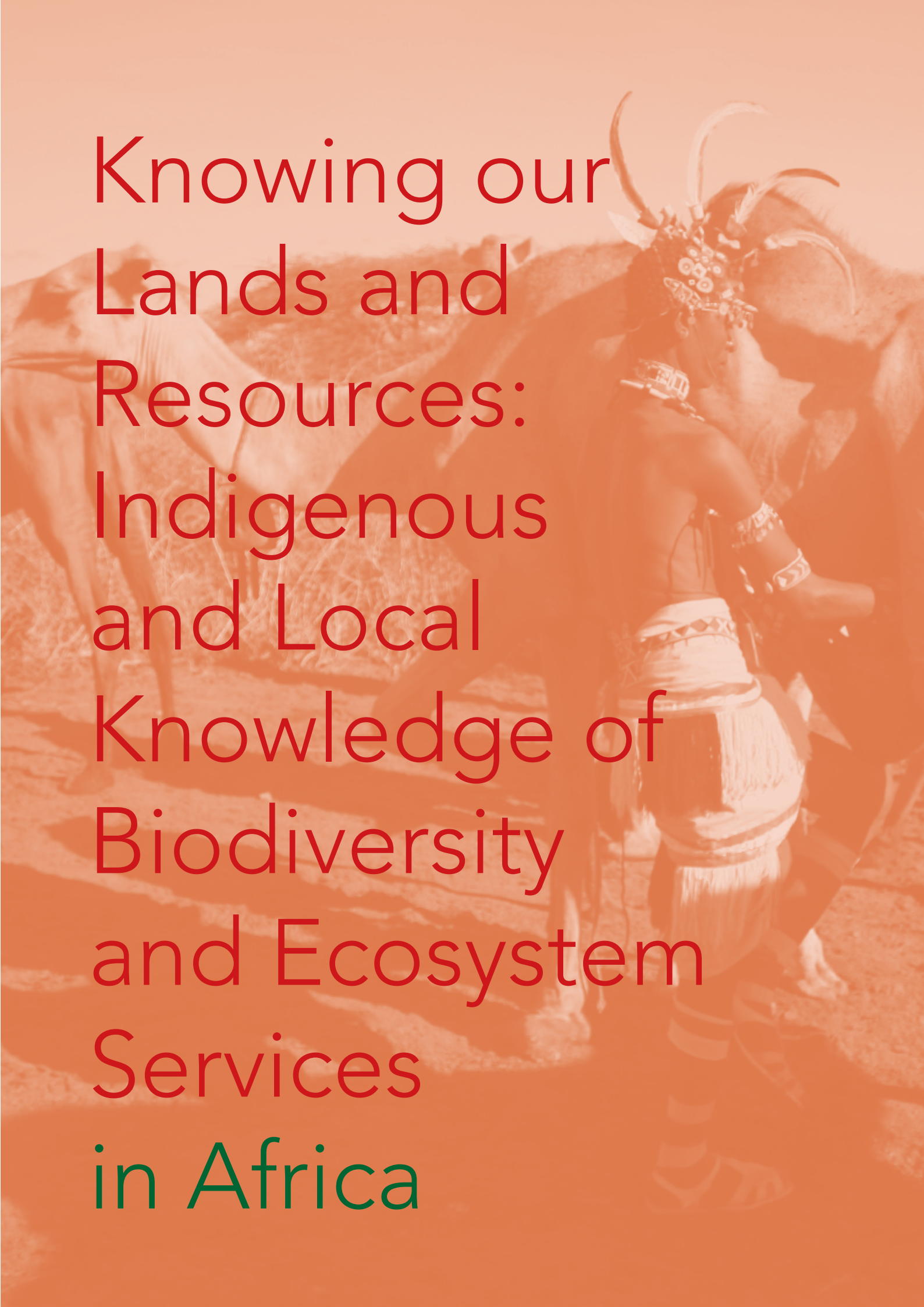
To meet these two objectives in the framework of the African regional assessment, the task force on ILK implemented a step-wise process including:

- A global call for submissions on ILK related to biodiversity and ecosystem services in Africa;
- A selection of the most relevant submissions from ILK holders and experts, taking into account geographical representation, representation of diverse knowledge systems and gender balance;[1]
- Organization of an Africa Dialogue Workshop (Paris, 14–16 September 2015) to bring together the selected ILK holders, ILK experts and experts on ILK with the co-chairs and several authors of the IPBES assessment report;
- Development of proceedings from the Africa Dialogue workshop in Paris that provide a compendium of relevant ILK for authors to consider, alongside ILK available from the scientific and grey literature, when drafting the Africa assessment report; and
- Organisation of local follow-up work sessions by the selected ILK holders, ILK experts and experts on ILK in order to work with their communities to address additional questions and gaps identified with authors at the Paris workshop.

These contributions from the Africa Dialogue Workshop in Paris and its various follow-up meetings, provide a compendium of ILK about biodiversity and ecosystem services in Africa that might not otherwise be available to the authors of the assessment. It complements the body of ILK on biodiversity in Africa that the authors are able to access from the scientific and grey literature.

1 Note that in rural/indigenous societies in Africa, men and women's roles are often complementary but distinctive. This in turn results in complementary and distinctive sets of men and women's knowledge.

# Knowing our Lands and Resources: Indigenous and Local Knowledge of Biodiversity and Ecosystem Services in Africa



# 1. The use of indigenous traditional knowledge for ecological and bio-diverse resource management by the Laikipia Maasai and the Samburu

Johnson M. Ole KAUNGA

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## 1.1. Background

The Laikipia Maasai are a community of the wider Maasai who live in Laikipia County in north central Kenya. The Samburu are known to be distant cousins of the Maasai, and live in Samburu county and parts of Laikipia, Isiolo and Marsabit. They migrated to Kenya from North Africa. They speak the *Maa* language. Both communities practice pastoralism in the northern rangelands of Kenya. The mobility of people and livestock is a key element of their livelihood, and fundamental for the optimal use of rangelands and range resources.

Pastoralism is a traditional occupation, and a productive livelihood where a finely-honed symbiotic relationship between people (pastoralists), domesticated livestock, and local ecology in resource-scarce and highly-variable arid regions (rangeland) is evident (**Photo 1.1**). However, pastoralists' livelihoods are increasingly on the decline. The fundamental resources that are critical for the survival of these communities are dwindling, leading to intense conflicts between different communities.

This paper reports on the outcome of two workshops organized in Twala, Laikipia North (23–24 November 2015) among the Laikipia Maasai and in Wamba, Samburu (25–26 February 2015) among the Samburu. The workshops considered indigenous traditional knowledge and practices to mean the body of skills (including but not limited to traditional medicine, indigenous spirituality, traditional natural resources management practices and inter-generational know how) used by these communities collectively to manage and guide their traditional means of occupations and ensure general community wellbeing in a rapidly changing political, social, cultural and natural environment.

In this paper, emphasis is on the role of the Laikipia Maasai and Samburu indigenous communities in using their own traditional ecological knowledge to respond to and manage interrelated processes and functions of life that centre around their livestock and natural environment. Traditional knowledge is holistic in outlook and adaptive by nature, gathered over generations by observers whose lives depended on this information and its use. It often accumulates incrementally, tested by trial-and-error, and is transmitted to future generations orally or by shared practical experiences. The knowledge is passed to younger generations during herding, milking and rituals and also ceremonies. Children are introduced into herding while they are

Ole Kaunga

**Photo 1.1:** A Samburu woman enroute to Laikipia, Serat Oldonyo Keri (Mt Kenya plain) for pasture. Indigenous women play an important role in livestock production system and in generating and transmission of indigenous traditional knowledge.

young; they go out to tend livestock usually with guidance of an elder who mentors them about the vegetation and terrain.

As we will see from the outcomes of the two workshops, the communities have their own natural resource management systems, knowledge, innovations, and practices (i.e. *in situ* conservation and sustainable use) regarding indigenous flora and fauna, where dynamic knowledge, including specific and fine details, is learned and transmitted from one generation to the next. The ways of life and learning are directly linked to nature, culture, spirituality, and customary laws and values; rights, responsibilities, and duties of the community are determined according to what knowledge each community has accumulated over a period of time.

The customary practices relating to biodiversity and traditional knowledge by the Samburu and Laikipia Maasai communities are strategically intertwined with indigenous traditional livelihoods systems due to their continued interaction with drylands and natural resources associated with these areas. There is a need to examine and document the current evidence and indicators, as they pertain to knowledge, customs, and traditions being practiced, and the scope of their contribution to sustainable use of biodiversity and ecology (**Photo 1.2**).

Ole Kaunga.

**Photo 1.2:** A young warrior herding his family cattle at Serat Oldonyo Keri ("Sprawling plains facing Mt. Kenya"-literal translation). In the extreme left of the picture there is an oxen with pronounced horns with a unique shape– among the Maasai, the shape of the horns can be used to foretell the wellbeing of the family/owner of the oxen. In this specific case a blessed future of abundance and plenty is foreseen and also the semi circle shape indicates that the homestead (family) will not break. The oxen is sacred and cannot to be sold unless there is a pressing situation where some rituals can be performed. It can be slaughtered at an old age or for ceremonies where certain rituals are performed.

There are similarities across the two social groups in the two target counties of Laikipia and Samburu but there are also fine differences that relate to indigenous spirituality. This case study needs further work to define and clarify to what extent their indigenous and traditional knowledge and practices are still used in biodiversity conservation and ecological restoration of the environment.

Being to a large extent dependent on natural resources, these communities have accumulated a large body of indigenous knowledge through their close interactions, use and observations of the drylands and natural resources associated with rangelands. This body of knowledge has continued to enable these communities to survive through challenging and unpredictable droughts. Building and accumulating the large body of knowledge that is necessary to build individual and communal resilience enables them to optimize the use of different eco-regions with the rangelands through different seasons. The rangelands are considered to be harsh and tough environments; however, the pastoralists, agro-pastoralists and hunter gatherers have developed unique skills to cope with the challenges presented by these livelihoods.

The indigenous and traditional knowledge skills, experiences and practices are generated from direct and long term interactions arising from the community's needs, situations, circumstances and specific environments on different occasions. The Samburu and Laikipia Maasai have used these sets of skills to engage with the environmental changes in order to sustain their livelihoods.

## 1.2. Management, governance and transmission of traditional knowledge

The Samburu and Laikipia Maasai both have their own traditional and spiritual leadership and institutions of decision-making and governance. Indigenous knowledge is governed and transmitted through these governance systems. Transmission is through ceremonies, rituals, folklore and social networks. Traditional authority is held and controlled by the elders, and each age-set has their own traditional Chiefs the head leader. The age-sets are defined within a span of 5–10 years. However, this has now changed due unpredictable conditions. The age-set ceremonies and other important rituals or celebrations are usually held when there is plenty of pasture,

which guarantees milk, honey and some instances meat, that are fundamental ingredients of the ceremony. Milk and traditional brews made of honey and aloe vera roots are used for blessings. Some specific portions of meat are also used in the ceremony to symbolize or mark special bonds. Due to fluctuating weather conditions it has become a challenge to plan ahead of time. Presently, such ceremonies are organized when rains have been prolonged and livestock have returned. A good example is the ongoing age-set ceremonies all over Maasai land due to the good rains in between March–May 2016 (**Photo 1.3**).

The roles of age-set leaders are vital for the management of indigenous traditional knowledge with regard to the access, management and use of the natural resources and the environment in which they exist. Traditional Authorities (elders, age-set leaders, spiritual leaders) are a community legislative mechanism or process that is responsible for advising their communities on the use of natural resources. The head-leaders of these communities also play mainstream roles in building relationships between people in the community and the use and management of land and natural resources, through directing communities to ensure that its members use the natural resources at their disposal on a sustainable basis and in a manner that conserves the environment and maintains the ecosystems for the benefit of all.

Ole Kaunga

**Photo 1.3:** Samburu warriors of the Il Meoli age group participating in a traditional ceremony in Merrile Marsabit that marks one of the several spiritual and cultural rituals from Junior warriors , senior warriors, junior elders then allowed to Marry leading to elders and before culminating to senior elders who are custodians and stewards of all traditional institutions of governance. The gap between this transition use to be about 10 years however due to unpredictable and intermittent rains it is has now reduced to about 5 years depending on season. Most ceremonies are held during rainy seasons when livestock are back home at the end of dry spells.

Traditional knowledge about the use and availability of natural resources is an important indicator for understanding the communities' customs, traditions, production, beliefs, rituals and patterns of thought: to develop a balance between the maintenance of life and dependence on nature as appropriate across the different seasons. They use natural resources in every aspect of their lives, from food to housing, clothing, cosmetics and healing rituals; for example, this is why certain tree species are have spiritual value and are used in rituals.

Young people are taught about the plants with spiritual values that are used during important ceremonies such as circumcisions, cleansing, naming of children, giving age-set names, and childbirth. Such trees include the *Olorien* (African olive), *Oreteti*, and *Oseki*, among others. People are not allowed to cut these tree species, and it is considered an abomination if you cut them. Among the Samburu, young but mature boys ready for circumcision would venture into the wild and collect resin from the *oloishimi* tree (*Acacia commiphora*) that is used in the ceremony.

The seasonal grazing patterns that have been developed over years ensure that certain areas are left at certain times of the year or season to allow regeneration of certain plant species that are palatable for the livestock, or to minimize use of certain species that are used for rituals and ceremonies such as boys' circumcision ceremonies and age-set naming ceremonies among other uses.

The mechanisms of intergenerational transmission of knowledge are embedded in the social systems; for instance folklore, mythologies, ceremonies and songs are avenues of passing on information and knowledge, as they are carried out at times that may be defined by the elders or age-set leaders. There are also local stewards or leaders, usually defined by clan or age-set. Furthermore, information exchange also takes place at the water point, when members of the community meet at the market.

## 1.3. Indigenous traditional knowledge of the Laikipia Maasai and the Samburu

### Spirituality and sacredness

The Laikipia maasai have spiritual and traditional experts who use their special skills to understand and interpret nature and then advise the community. The Samburu have spiritual diviners of different sets. The *Ilkursaai* (*Okursai*, singular) are cosmologists who meditate while observing the stars/planets at night, and they advise the community about rain patterns and other imminent issues that can affect community life. There are certain clans and families who have this knowledge. One well-known authority on this is *Elder Lesepen* who lives around the Ndotto Mountains on the border of Samburu and Marsabit Counties. He is known to be the custodian of the Ndotto Mountains, which are considered to be of spiritual value to the Samburu. He is known to study the stars and interpret situations that range from normal life, to imminent rains or droughts, and wars, among other things. The community consults him widely. The rituals and ceremonies help the community connect with nature and remember the role of nature in sustenance of life. They help the community interpret unusual signals from the ecosystem and also make key decisions about preparation for migration as advised by the spiritual leader.

The Laikipia Maasai do not have such spiritual leaders to look and interpret the stars and the future of life and its well–being; because they border the Samburu and occasionally live together, they rely on guidance from the *Ilkursaai* who are so treasured and respected by the Samburu community.

### Seers and diviners

There are some families with special knowledge of "reading" animal intestines. A goat or sheep of a specific colour and without blemish (has not given birth) is identified and slaughtered. The specialists are asked come to "read" the intestines before any part of the goat or sheep has been removed from the slaughter site and cooked/roasted. The different sections/parts of animal intestines are considered to be large permanent rivers, small permanent streams and seasonal streams. The traditional specialists are able to interpret the seasons and foresee drought, rains or other situations such as conflicts with the neighbouring communities or government. The

Samburu and Laikipia Maasai both have these traditional specialists. However, the families are not related or share clans' origin. The traditional knowledge does overlap in the sense that they are used for similar purposes or situations. However, they use different skills to interpret the situation. They are mutually supportive and intended for the wellbeing of the community and the environment. They are all custodians of the environment and promote ecological values needed for a healthy environment on which the livelihoods of the community depend.

Both communities have the *Loibonok* (diviners/seers) who can tell fortunes, foresee and tell the future of individual, family and community life. Because the communities are dependent on livestock for the sustenance of life, and the livestock entirely depend on a healthy environment for their survival, a large proportion of traditional knowledge is grounded in understanding and interpreting the biodiversity of the eco-regions.

There are also traditional healers or medicine men/women, who have deep and broad traditional environmental knowledge and eco-regions. They know what plants, trees or parts of plants are used for different ailment and where they can be located.

The spiritual leaders are recognized and respected. Their interpretation of nature and situations are credible and accurate. They shape how traditional knowledge is generated, used/applied in relation to the environment.

Some aspects of spiritual traditional knowledge and practices are considered sacred and as such secret. Not all rituals are performed in public or in the open. At times the knowledge holders have to walk deep into the forest to meditate and perform sacred rituals.

## The role of women

The women in the Samburu and Laikipia Maasai communities have specialist skills and experiences in monitoring the quality of livestock dung and drops. For example, cow dung is used in making traditional houses. The harder and brownish dung indicates that the livestock have limited access to water and green pastures – it indicates that the livestock need to be moved to areas with better pastures and water. When milking the livestock they also observe the quantity and colour of the milk. When pasture and water are readily available the milk is exceptionally plentiful and white or a normal milky colour, but during dry seasons the milk output per cow drops and the milk colour turns towards beige. The taste of the milk is used to tell the dominance and availability of certain plant species within the ecological areas currently being used by the livestock. The women use specific livestock to monitor all these aspects. They can differentiate between when milk productivity drops due to animal health, pregnancy or non-availability of plants.

## Traditional knowledge and livestock breeding

For many years, both the Samburu and the Laikipia Maasai have kept indigenous breeds resilient to the conditions in the rangelands and dry lands. These include the small east African goat, the red Maasai sheep, and the zebu cattle. In the recent times and with support from the government programs and on their own initiative, they have been able to access exotic breeds such as the dopper sheep (South Africa), galla goats, boar goats, Sahiwal cows, and improved Borans (cattle). However, these breeds are not resilient to drought and the communities' coping mechanisms for drought have consequently been weakened. However, during the good seasons they grow faster and produce more milk. Indigenous breeds can go several days without water and are able to able to walk for long distances compared to the exotic or improved breeds.

The Laikipia Maasai say "the cow is the soul of the Maasai and the land is its heart." Families cherish the livestock that survives tough droughts, as they are considered tough and resilient. The breeding bulls are selected from the lineage of survivors. These livestock assume a special place in the family and when dancing and singing, the warriors, women and children will always praise

their hero-cow. Dances and songs always mark grand homecomings – when livestock return to their homes after a long spell of mobility across and between eco-regions in search of pasture.

Livestock behavior is also used for weather forecasting, as well as to assess the quality of pastures. When the bulls and Billy goats are on heat it indicates that the pasture is plentiful and of good quality, or the rains are expected soon. When there is plenty of pasture and the bulls or Billy goats are not active or not on heat, it indicates that the quality of the pastures has deteriorated or there is overuse; thus signaling that it is time to leave that eco-region to allow for regeneration or restoration.

When calves or goat kids of certain colours are born and dominant in the herds it can indicate that the wellbeing of the specific households is good, and because livestock ownership signifies wellbeing this is used to interpret that the season is going to be good. Certain indicators signify good health, luck and posterity while others signify doom. For instance, when the dominant bull comes home more than once during the daytime, it signifies that something bad will happen to the head/owner of the household/family. It could also be used to foresee bad events such as conflict with neighbouring communities.

Livestock resilience is enhanced by withholding water on a daily basis. The young calves and kids are deliberately denied water for 1–2 months after birth as a way to build individual livestock coping ability. This is also a traditional natural resource management strategy to enable the communities to use certain resources for a specific period of time.

When livestock (cows, goats, sheep) give birth during severe droughts with no indications of rains, the young ones are killed so that the mothers can regain energy and improve their chances of survival.

## 1.4. Traditional knowledge associated with the use, monitoring and restoration of the environment and natural resources

The Samburu and the Laikipia Maasai have developed traditional/customary natural resource management strategies that they have used to assess, manage and restore ecological zones or regions. For years, the two communities have used different and unique observations and interpretations such as stars, livestock milk productivity and skin quality, and "reading" the intestines of slaughtered animals, wildlife migratory patterns, plant species etc. to predict changes in weather patterns as well as to determine how healthy the environment is. This traditional weather forecasting is still relevant to date and does contribute to drought coping strategies for the pastoralists.

Pastoralists in these communities have developed unique indigenous and traditional skills to monitor, manage and restore their environment. Mobility of people and livestock isone such practice, where livestock are moved to certain geographical locations at certain times of the year while other eco-regions are left to regenerate.

Among the Laikipia Maasai, every age-set has their natural resource or biodiversity monitors or specialists who are called the *Laleenok* (which loosely translates to "the harbingers").They have exemplary knowledge of the ecological regions and biodiversity of their areas. When certain plant species are no longer easily available – especially the ones used in ceremonies – they alert the traditional elders/authorities.

The Samburu elders would then send warriors in different directions to assess the local situation, and advise if they can move the livestock in that direction. The women too, would also advise on the quality and quantity of milk. When the milk is brownish and thick they consider that as indicator that the livestock are not getting adequate pasture or enough milk, thus requiring them to be moved to an area with better pasture.

The pastoralists planned their families around the seasonal calendars. During long dry spells the men are away with livestock and no children would be expected during that time. Pregnancy is avoided through men staying away during the dry spell. However, the children born during this season are given special names relating to the season – drought, rainy, born on certain plains, forest etc. For example, *Nolare* – "one born by the wells", *Supuko* – "one born by or in the forest", etc.

When milking women compose and sing certain songs these are believed to soothe the animal so as to produce more milk. When the cows cannot produce more milk persistently after the songs, then it indicates that pasture availability is diminishing. The *Laleenok* will be triggered to explore in other ecological regions and advise in what direction the livestock can be moved. Pastoralist mobility is therefore not sporadic; it is planned, and based on traditional weather forecasting and information generated and shared at the community and household levels.

Pastoralists have used the special interaction and symbiotic coexistence between the hunter-gathering communities living on the fringes of the Laikipia Maasai and Samburu pastoralists to interpret the quality of the ecological regions and also biodiversity in those areas. The Yaaku live on the fringes of Mukogodo forest in Laikipia. The Suei are a hunter-gathering segment of the Samburu living on the Mathews Ranges. Both communities provide honey for ceremonies and they monitor the quality of their areas via availability of bees and honey. When certain trees are flowering, they can tell it is a good season and there will be more rains. When certain tree species or plants take long to flower, or have short or brief flowering seasons – they say the trees have *aborted* (flowering does not reach maturity) due to poor health of the range or the trees have *sensed* that there will be no rains.

The hunter-gatherers use indicators such as reduced honey production, non-availability of certain herbs or changes in migratory routes of certain wildlife species to forecast how the weather will be, in addition to the quality of the rangelands or eco-regions in terms of natural resources. The hunter-gathering communities support their pastoralist counterparts by advising them on the health of range and forest lands. When the bee presence reduces around the forest or parts of the rangelands they can tell that they have migrated to other parts. The hunter-gathering communities also have deep knowledge of medicinal and spiritual plants, and certain knowledge is associated with certain clans.

When the women, warriors or members of the community meet they exchange information about the general situation of pasture, water, livestock health. This is standard practice and it has been further enhanced with the introduction of mobile phones.

## 1.5. Traditional praise song for livestock (cows, goats, sheep)

The Samburu and Maasai have praise songs for their livestock. The songs are composed and sung in different occasions. The songs by men, warriors, boys, girls and women are all based and defined by age-set. The songs are an intimate communication between the cow and the person singing. The songs are usually sung when livestock are leaving home or as a welcome song when they come back home.

There are milking songs that are sung to soothe the lactating animal to produce more milk. The song is a sign of bondage, close attachment and interdependence between the cow and the family. The family depends on the milk for sustenance. The song is also meant to appreciate this fact, that the cow is part of the family identity based on the marks or brands on the animal body. It is easy to identify livestock as belonging to a certain family or clan among Maasai and Samburu cultures. An example of a women's song for milking the cows is provided below.

***A Samburu women's song for milking a cow***

*Mayor ee yeyolai nonkutuk namelok*
*Mayor ee yeyolai nayor ee yeyolai*
*Mayor ee yeyolai nonkutuk ee yeyolai namelok*
*Ng'otonye lmoogi namelok ee yeyolai*
*Ng'otonye lmoogi namelok ee yeyolai*
*Ng'otonye ntawa namelok ee yeyolai*
*Ng'otonye ntawa namelok ee yeyolai*
*Ng'otonye ntawa nanyor ee yeyolai namelokai*
*Ng'otonye ntawa nanyor ee yeyolai namelokai*
*Mukurwa aa lepito nonkutuk ee yeyolai namelok*
*Mukurwa aa lepito nonkutuk ee yeyolai namelok*
*Aruaki labura linong'op nanyor ee yeyolai namelok*
*Aruaki labura linong'op nanyor ee yeyolai namelok*
*Naleputa ake ee tukutuk nanyor ee yeyolai namelok*
*Mukurwa aalepito nkutuk ai namelok*
*Labura a leputei nkutukai namelok*
*Mutupukoo nkera nkutukai namelok*
*Muure lepeta nkutukai namelokNkaina kaituko nkutukai namelok. Hiik!*

***[Translation in English]***

*My mother's Nanyor with sweet mouth*
*My mother's Nanyor the loved one of my mother*
*My mother's Nanyor, the sweet mouth of my mother*
*You are mother to our bulls, the sweet one of my mother*
*Mother to our bulls, the sweet one of my mother*
*Mother to our heifers the sweet one of my mother*
*Mother to our heifers the sweet one of my mother*
*Mother to our heifers the sweet one of my mother*
*Do not kick me when I am milking you the sweet mouth of my mother*
*Do not kick me when I am milking you the sweet mouth of my mother*
*Do not let your white foam pour your foam (milk) to the soil the loved one and sweet one of my mother*
*Do not let your white foam pour your foam (milk) to the soil the loved one and sweet one of my mother*
*I am milking your foam when it is warm the loved sweet one of my mother*
*I am milking your foam when it is warm the loved sweet one of my mother*
*Do not kick me as I milk you, my sweet mouth*
*It is only milk am getting from you, my sweet mouth*
*Do not make my children sleep hungry, my sweet mouth*
*Do not fear milking, my sweet mouth*
*I am only washing my hands clean, my sweet mouth. Hiik!*

Source: Wachira, J.M. 2001

## 1.6. Traditional medicine of the Maasai and Samburu: Indigenous Pharmacopeia

The traditional medicine knowledge and practices of the Maasai and Samburu is deep and broad. These communities have knowledge relating to the medicinal plants and spiritual use. Young traditional medicine men and women are harvesting, preparing and administering their medicines and administering them through the guidance of senior healers (**Photo 1.4**). These communities have different medicine for different diseases relating to the different seasons of the year and also the eco-regions in which they live (lowlands, highlands, rangelands).

Ole Kaunga

**Photo 1.4:** Young Samburu Warriors: they undertake the herding and consultation on issues of mobility and pasture. Mobility of people and their livestock between varied bio- ecological zones is important for generating adaptive indigenous traditional knowledge.

The traditional healers are custodians and guardians of spiritual healing knowledge that is used collectively by the whole community although it could be associated with a certain clan. The traditional healers know the symptoms of the diseases or evil spirits or curses, and they know how to prepare the medicine. Some diseases and treatments are managed secretly and confidentially while others can be treated in public. The plant species used for their treatment, including parts of the plants used, how it is harvested, prepared and availability of the plants is usually in the domain of the healers themselves. However, the treatment of common ailments such as common cold and small injuries is in public domain.

This is 'living' knowledge that has now been commercialized and is evident in all major towns in east Africa. The Maasai can be seen walking with plastic containers and drinking cups selling concoctions of different types and mixtures. There are direct and indirect uses of plants for medicinal purposes. The communities do also access hospitals, but to a large extent only when they cannot manage the situation. They have knowledge and skills on how to administer the treatment to address different ailments. Some of them develop special skills and become medicine men who are consulted by members of their community.

Direct use includes the use of the roots, barks, latex and resin for different purposes. For instance, *suguroi/osuguroi* (*Aloe vera*) is used to apply to injuries or burns. Other plants are boiled and mixed with bone soup or taken in different forms and quantities depending on age and pregnancy status.

Honey is used for different purposes depending on the eco-region from which it comes. Different eco-regions such as *Olpurkel* (lowlands) and *Osupuko* (highlands) have different plants, and consequently nectars are different too. For instance, the Europhobia nectar honey is very good for treating cold and throat infection. Examples of other plants used for medicinal purposes are included in **Table 1.1**.

**Table 1.1:** Examples of plants used for medicinal purposes

| Plant Maa name (Maasai/Samburu) | Scientific name | Use |
|---|---|---|
| *Olosuiki/loisuki* | *Zanthoxylon chalybeum* | Boiled and used to treat cold and sore throat mouth infections |
| *Osinoni/sinoni* | *Lippia Favarica* | Used as disinfectant or washing skin infections (it has an aroma) |
| *Esonkoyo/sonkoyo* | *Indigofera Voheramensis* | Used as perfume due to its fragrance, and also used for cleansing purposes to get out bad spirits |
| *Esarunchu/sarunchu* | *Adenia Gummifera* | Used for ritual (good luck) |
| *Entulelei* | *Solanum dubi* | Used to treat fever, sorethroats |

## 1.7. Artisanal traditional skills

The Maasai and Samburu have specialized subclans known as the *Ilkunono* or the "blacksmiths" – they are the service nomads who provide essential services to the pastoralists proper by producing essential artifacts, including cow bells, swords, bungles, containers and other decorations, traditional clubs, and spears. The community has used their skills and natural resources to make important tools needed for the management of the pastoralists' livelihoods. They still practice their skills today and produce the materials in small scale. There is a need to tap into and add value to these services through training, access to market and also protecting their skills and intellectual rights. A future project will explore strategies of organizing the blacksmiths among the Maasai and Samburu into an association or cooperative that will provide support to brand and market their products in Kenya and other areas.

## Conclusion

The Laikipia Maasai and Samburu communities have to a large extent managed to permeate address the pressures and challenges associated with the loss of traditional knowledge and social destabilization by transmitting their indigenous traditional knowledge through customs, practices, songs, legends, stories, rituals, and practical daily activities, especially those related to their traditional livelihoods and occupations.

However, the process of transmitting this knowledge from one generation to the next has been eroded severely by the changes in social, economic, land reforms and political history and in some communities it is at the point of extinction. The main factors that play a role in cultural erosion and changes in social and economic activities taking place in the communities relate

to the influences of the external development system that emphasizes commercial economic concepts, religion, and formal education.

The livelihood system is dependent on natural resources, and with changes in land ownership structure and with more land going for other development needs (as defined by broad government goals), it will be challenging for the Maasai and Samburu to maintain their indigenous traditional knowledge.

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# 2. Landscape ethnoecological knowledge base and management of ecosystem services among the Samburu of northern Kenya

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## Abstract

In this study, I set out to characterize the Samburu landscape of ethnoecological knowledge through characterization of traditional regulation of natural resource use. I used a qualitative research approach, and data collection was based on two focus group discussions consisting of elders, women and *moran* (youth). The natural resources law on grazing management entailed:

- segregation of landscape into grazing, settlement and watering areas;
- designation of dry season grazing areas;
- prohibition of cutting the *Acacia tortilis* tree; and
- prohibition of burning forests and grasslands.

Community elders are the custodians and enforce the law through penalties. Knowledge transmission is through folklore, songs and oral education. However, the landscape has been changing, with key drivers being both anthropogenic and ecological. The two Samburu communities in this study attributed these changes to reduced attention to the traditional governance system as the commoditization of natural resources takes root. The communities have responded through diversification of livelihood sources to include ecotourism. These responses have led to limitations in use of some areas within the landscape, hence supporting regeneration of ecosystem services and reducing destruction of ecosystem goods. For both communities, the anticipated outcome is to ensure a fair distribution of ecosystem goods and services among community members.

## 2.1. Introduction

Natural resource governance is highly complex and dynamic, involving multiple stakeholders and a variety of interconnecting regulatory frameworks and governance processes that impact on different aspects of use, management and human livelihoods (IUCN 2011). The large and complex social, political, economic and ecological systems involved in natural resource governance makes it difficult to define a starting point of intervention (GSDRC 2011), especially towards sustainable and inclusive growth.

In Kenya, the *Constitution of Kenya* promulgated in 2010 profoundly influences the regulatory frameworks (policies, laws and institutions) and processes of natural resources governance in practice; for instance, by providing a framework for the decentralisation of governance mechanisms. This paradigm shift for natural resource governance affords the opportunity to embrace indigenous and local knowledge in natural resource governance.

Myriad studies (Parlee & Berkes 2006; Diawuo & Issifu 2015; Kafalew *et al.* 2015; Tugume *et al.* 2016) have shown the value of indigenous knowledge in the use, management and conservation of natural resources. Despite recent increases in use of indigenous knowledge in socio-economic studies (Torri & Hermann 2011), inadequate attention has been given to this institution in conservation policies (reviewed in Diawuo & Issifu 2015). Hence, despite a progressive constitution, the important link between local cultures and sustainable natural resource management has not been taken into consideration in Kenya.

An important preliminary step in assessing natural resource governance mechanisms is the identification of the most important natural resources in an area from livelihood and conservation perspectives (IUCN 2011). In the semi-arid landscapes of northern Kenya inhabited by the Samburu people (a pastoral culture that has co-existed cattle with wildlife for centuries), pasture and water are critical natural resources. Livelihoods here depend on these two resources, and their approach to governance is a consequence of culturally evolved ecological knowledge system (Torri & Hermann 2011). Such ecological knowledge systems have been shown to be effective in the conservation of biocultural diversity (Molnár *et al.* 2015) and exist as a knowledge-practice-beliefs complex (Torri & Hermann 2011).

A number of major challenges and threats are impacting these values. Historically, the Samburu people were highly mobile, migrating several times a year in accordance with rainfall and pasture availability. They have co-existed with many wild animal populations in communally owned lands; and use plants for building materials, fodder, weapons and as important traditional medicines (Bussmann 2006). They live in group ranches with strong group rules enforced by appointed elders, who have traditionally been essential in the conservation and wise use of communal natural resources.

Climatic variations and human activities in the landscape are leading to land degradation invoking the process of desertification. Base studies in the area showed that range conditions have already been decreasing from more than three decades ago, with a change in herbaceous cover from 42% in 1961 to 31% in 1970, then 22% in 1980; with plant composition of desirable species also declining from 68% in 1961 to 49% in 1970, then to 33% in 1980 (Skovlin 1980). This is a serious threat that needs a rehabilitation program through a scientists-communities synergy to avoid, minimise or remedy adverse impacts, and ensure that remedial impacts are at acceptable levels. This is possible since progress in range science and better appreciation for indigenous knowledge have increased awareness of the resilience of rangelands and the reversibility of degradation of rangeland ecosystems (reviewed in Hazell 2001).

In this study, I set out to characterize how the Samburu perceive, name, imagine, classify and manage the living landscape they inhabit, hence capturing their landscape ethnoecological knowledge (Molnár *et al.* 2015). Since the knowledge generation process is a factor of the particular social, cultural and ecological context (Parlee & Berkes 2006), I found it necessary to assess two neighbouring communities, experiencing different ecological variability, in order to better capture how they perceive and manage their landscape.

The aim of the study was to characterize how the Samburu communities have traditionally regulated the management of natural resources in the landscape and its ecosystem services. I used a comparative approach to reconstruct landscape ethnoecology of two communities, i.e. the Ngutuk Ongiron and Nkaroni Group Ranches. My hypothesis was that since the two communities are experiencing varying levels of habitat degradation, their knowledge-practice nexus might differ. I specifically set out to:

- investigate indigenous ethnoecological knowledge of the landscape;
- determine cultural values of natural resources, and practices that enhance or preserve biodiversity and ecosystem services;
- determine the governance structure of natural resources and their use in the group ranch; and
- determine cultural responses to top-down (ecological) and bottom-up (anthropogenic) drivers of environmental change in the group ranch.

## 2.2. Study Area

The study was undertaken between two community group ranches (Nkaroni and Ngutuk Ongiron) in the eastern part of the Samburu County, Kenya (**Figure 2.1**). Two major geographic features characterize the landscape, the Ewaso Nyiro River to the south and the Mathews Range in the north. This unique landscape is rich in culture, wildlife, and habitat diversity. It contains one of the highest concentrations of threatened savannah species including the Grevy's zebra (*Equus grevyi*), reticulated giraffe (*Giraffa camelopardalis reticulata*) and Somali ostrich (*Struthio camelus molybdophanes*).

High temperatures and low humidity characterize this semi-arid area. Though temperatures are warm and stable throughout the year, seasonal changes in wind patterns result in distinct wet and dry seasons. There is a wide range in the total seasonal rainfall, but the minimum is at least 51 mm per year. Against a high rate of evapo-transpiration and limited technological capability, the low and unreliable rainfall seriously limits livelihood options in the landscape. The native flora, fauna and microbial communities here have developed special strategies to cope with the low and sporadic rainfall in this ecosystem. Such adaptive traits have global importance, especially in the context of predicted climate change.

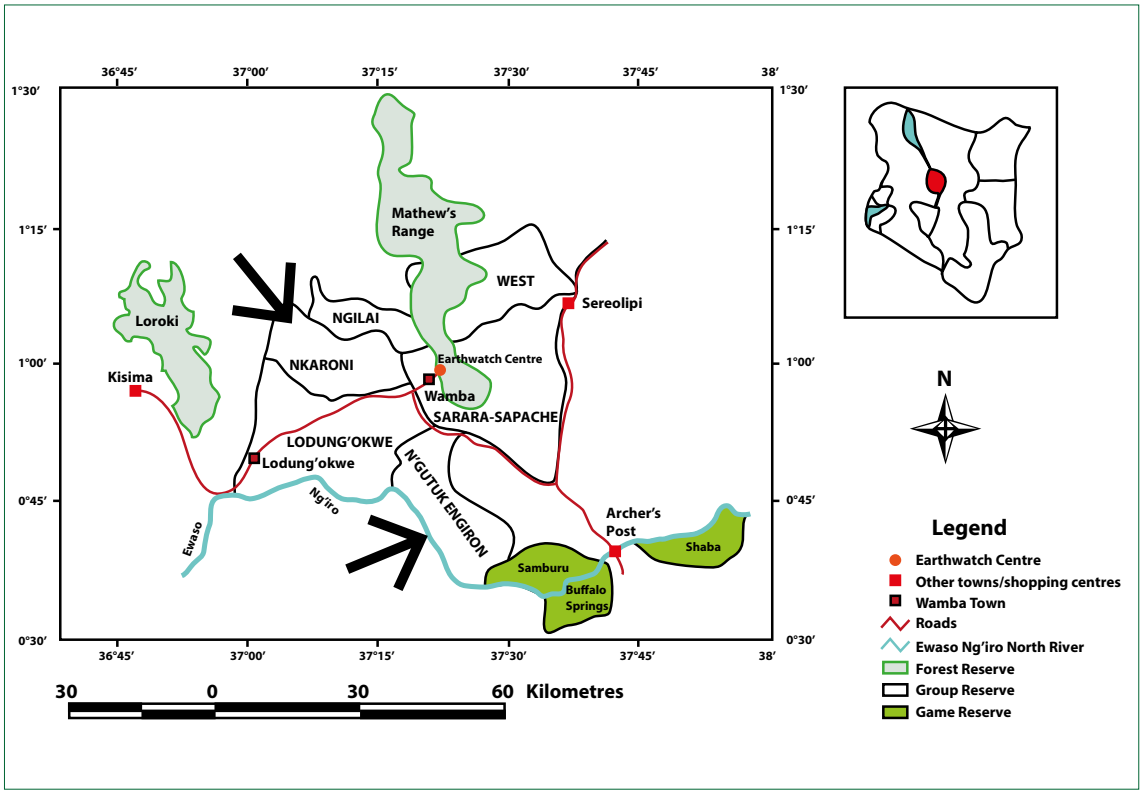


**Figure 2.1:** Location of the two study communities in Samburu County, Kenya

The Ngutuk Ongiron Group Ranch (UTM 215846000) occupies an area of 389 km$^2$. It borders the western edge of Samburu National Reserve on its southern end, and the Ewaso Nyrio River runs along part of its southern and most of its western border (**Figure 2.1**). It therefore provides a dispersal habitat for wildlife from the Protected Area systems (PAs), i.e. Samburu and Buffalo Springs National Reserves. Due to high wildlife biomass in the Group Ranch, the community made a conscious decision to convert their land into the Westgate Community Conservancy. A community conservancy constitutes an area where communities actively manage their land for wildlife protection (Ihwagi *et al*. 2015). The Nkaroni Group Ranch (UTM 206861000) is about 30 km west of Ngutuk Ongiron and occupies an area of 499 km$^2$. Although the wildlife biomass is lower in Nkaroni, regular calving of the Grevy's zebra have been observed in a particular area within the ranch, which is locally termed "the maternity of Grevy's zebra". The Group Ranch therefore provides an important habitat for the conservation of this highly endangered equid. The community joined up with the Lodungokwe community (435 km$^2$) to form the Meibae Community Conservancy.

Both Nkaroni and Ngutuk Ongiron Group Ranches are a mosaic of open grasslands, woodlands and bushlands with a dominant *Acacia tortilis* transitioning into an *Acacia-Commiphora* dominated area with dense to sparse bushes (**Photo 2.1**).

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**Photo 2.1:** *Acacia tortilis* stand in Ngutuk Ogiron

## 2.3. Methodology

This paper reports on primary research that targeted the Ngutuk Ongiron and Nkaroni Group Ranches in Samburu East Constituency of Samburu County, Kenya. I used a qualitative research approach. Data collection was based on two focus group discussions, one per each group ranch, held between 7–10 January 2016. Preliminary discussions suggested that villages within group ranches were homogeneous. Thus participants were aggregate representatives of few villages in each group ranch. Scientific names of plants were sourced from Fratkin (1996) and Dikko (2014).

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**Photo 2.2:** Members of the focus group discussions in Nkaroni (left) and Ngutuk Ongiron (right) communities of Samburu County, Kenya in January 2016.

## 2.4. Results

### 2.4.1. Community demographics and assets

Respondents in Nkaroni included elders (aged between 56 and 63 years), women (30–44 years) and *moran* (21–32 years); in Ngutuk Ongiron, only elders (33–51 years) and women (32–60 years) were available (**Photos 2.2**). The composition of the focus groups was considered adequate to ensure a good knowledge of the culture, spirituality and the Samburu landscape.

Demographic parameters for the two communities differed in terms of family size, gender composition and asset ownership (**Table 1.1**). In Nkaroni, average households have three women and nine children, most (67%) of which are male. In Ngutuk Ongiron, an average household would have two women and eight children largely (75%) of female gender.

In both communities livelihoods rotate around livestock, with goats being predominant (**Table 1.1**). On average, households at Ngutuk Ongiron stock more livestock than in Nkaroni. While dogs and cats form part of Nkaroni households, this was rarely the case at Ngutuk Ongiron. Both communities obtained similar benefits from their livestock:

- **Cattle, goat, and sheep**: milk, blood, skins and hides, household income from sales, cultural uses e.g. dowry
- **Chicken**: eggs, meat, household income from sale, for breeding
- **Donkey**: transport of water for domestic use, food stuff, transport of children during migration
- **Camel**: same as cattle as well as for transport during migration

### 2.4.2. Natural resource governance

The natural resources law on grazing management entails (i) segregation of landscape into grazing, settlement and watering areas; (ii) designation of dry season grazing areas; (iii) prohibition of cutting the *Acacia tortilis* tree; (iv) prohibition of burning forests and grasslands. Community elders are the custodians and enforces the law through penalties, e.g. if a child commits an offence, the father pays as per agreed penalties.

Penalties for offenders are enforced by elders and vary with regularity of commission. That is, first offenders are fined the three biggest goats in their herd; second offenders are fined five goats

**Table 2.1:** Demographic parameters of Nkaroni and Ngutuk Ongiron communities of Samburu County in January 2016 as suggested by respondents in focus group discussions.

| Parameter | | Value | |
|---|---|---|---|
| | | Nkaroni | Ngutuk Ongiron |
| Community land size (km²) | | 499 | 389 |
| Average livestock (heads per household) | | | |
| i. | Cattle | 4.5 | 10 |
| ii. | Goats | 10 | 20 |
| iii. | Sheep | 2.5 | 20 |
| iv. | Donkeys | 2.5 | 1 |
| v. | Camels | 0.5 | 0.5 |
| vi. | Dogs | 1 | 0 |
| vii. | Cats | 0.5 | 0 |
| viii. | Chicken | 2.5 | 0.5 |
| Average house hold size | | | |
| i. | Number of women | 3 | 2 |
| ii. | Number of children | 9 | 8 |
| iii. | Children's gender: | | |
| | Male | 6 | 2 |
| | Female | 3 | 6 |

or KES 10,000 (USD 100); third offenders are fined the biggest bull in their herd; and fourth offenders are excommunicated from the community. Killing of wild animals is now reported to the wildlife authorities as this constitutes poaching, a penal code offence as per the legislation on wildlife (RoK 2013).

## 2.4.3. Knowledge of the landscape, ecosystem goods and services and uses

The communities studied characterised the landscape into five types. Each had unique ecosystem goods and services. The five types included pasture land, forests, water sources, hills, and hardpan; there were also sacred areas.

### Pasture land (*angata*)

Locally known as *angata*, the community derived a number of ecosystem goods and services from this pasture landscape including grass for livestock, wildlife habitat, posts for building and fencing, firewood, matts for roofing, fibre for cultural costumes, simple weaponry for taking care of livestock, i.e. clubs (*rungu*) and sticks (*fimbo*), medicinal plants, and the *Acacia tortilis* (*itepes*) thorn tree. *Acacia tortilis* was given special mention as it provided a number of goods and services including:

- Shade for humans, livestock and burial grounds
- Green leaves for fodder (goats and camels)
- Dry leaves for fodder (livestock)
- Flowers and pods for livestock

- Bark for ropes
- Thorns for removal of pricks from skin and for sewing
- Roots for medicinal purposes (to ease constipation)
- Gum for easing eye ailment
- Branches for fencing
- Enhancement of biodiversity

The Samburu communities obtained a variety of medicinal plants from this landscape (**Table 2.2**). Two important fruit types obtained from the landscape included *mpasha* and *ngalayio* (scientific names could not be immediately established). Conservation measures included allowing co-existence between livestock and wildlife by discouraging illegal killings, with exceptions of small antelopes for domestic consumption and killing of large predators due to livestock depredation. The killing of lions was limited to nine in a lifetime though the study did not determine how this was regulated. Other measures included limiting use of grazing resources by segregating specific areas for dry season grazing; harvesting of medicinal plant parts only for medical use (i.e. not removing the whole plant and not using it for commercial purposes); regulation of tree felling; and directing animal movements and varying routes to avoid erosion along tracks.

**Table 2.2:** Medicinal plants obtained from different landscape types by the Samburu of northern Kenya

| Samburu name | Scientific name and identification | Scientific family | Medicinal uses | Landscape |
|---|---|---|---|---|
| *Lchaningiro* | *Commiphora africana* (A. Rich.) Engl. | Burseracea | Diarrheal conditions in children | *Angata* (pasture land) |
| *Ldepe* | *Acacia nubica* Benth. | Mimosaceae | Digestion and malaria | |
| *Lderkesi (l-terikesi)* | *Acacia senegal* (L.) Willd. | Mimosaceae | Abdominal stitch | |
| *Lturkan* | *Sericocompsis pallida* (S. Moore) Schinz | Amaranthaceae | Acidity and induces vomit | |
| *Lgirei (l-nge'rriyei)* | *Olea africana* Mill. | Oleaceae | Constipation, eases diarrhea from malaria symptoms | |
| *Lnyirman (nyiriman)* | *Hildebrantia sepalosa* | Convolvulaceae | Stomach acidity and malaria | |
| *Lmarti* | Unidentified | | Post natal immunity | |
| *Lchakwai* | Unidentified | | Stomach ache | |
| *Lnga'layoi* | *Cissus* sp. | Vitaceae | Ease blindness | |
| *Ltepes-* | *Acacia tortilis* (Forsk.) | Mimosaceae | Roots used to ease bloating | |
| *Lakirdingai* | *Croton dichogamus* Pax | Euphorbiaceae | Used for treating cold | *Ntim* (forests) |
| *Lkinyil* | *Rhamnus prinoides* L'Herit. | Rhamnaceae | Used as "energizer" by warriors | |
| *Makutikuti* | *Clerodendrum myricoides* | Verbenaceae | Used for treating malaria and fever | |
| *Sukuroi* | *Aloe secundiflora* Engl. | Liliaceae | Treatment of ulcers and wounds | |
| *Siokotei* | *Salvadora persica* L. | Salvadoraceae | Oral hygiene | *Sere* (water course) |

## Forest landscapes (*ntim*)

The *ntim*, forest landscapes, are found largely around hills and provide a number of ecosystem goods and services, such as: provision of habitats for diverse wildlife important for cultural and financial resources through tourism; grazing during dry seasons; and medicinal plants that are not found in the pasture land including *lakirdingai*, *lkinyil*, *makutikuti* and *sukuroi* (**Table 2.2**). Other resources acquired from forests include gourds; fibre for weaving roofing material; fruits (e.g. *laitipai*); and from various plants, e.g. *ingánlaiyo* (*Cissus* sp.), *lorien* (a partially burnt stick) is obtained for disinfecting gourds (scientific names for the latter plants were not determined in this study).

Conservation measures included a prohibition on unnecessary cutting of trees. Women are allowed to harvest gourds, posts for building and firewood, while men are allowed to harvest sticks for making traditional weaponry such as spears, rods and walking sticks. Other resources included material for making traditional seats, pillows and material for cultural games, e.g. *Ntotoy*. Foreigners (non-Samburu) are allowed to collect dry wood for making charcoal since the Samburu do not traditionally process wood for charcoal.

## Water sources (*sere*)

Critical sources of water for the communities included springs from which water for domestic use were obtained; water point for livestock use (*lare*); points from which water for bathing would be sourced. Resources associated with water courses included toothbrush (*ngige*), e.g. from *siokotei* (*Salvadora persica*); building material including soil for plastering houses (*lboroi*) and mats for roofing from ndupai (*Sansevieria robusta* N.E. Br.; Agavaceae); *lorien*, plant parts for disinfecting gourds; medicinal use of salty/bitter water for stomach cleansing (*lareodua*); fruits, e.g. *lkinoi* (*Lannea alota* (Engl.) Engl.; Anardiaceae) only obtained at Ndonyuo Naanyekie a place along Ewaso Ngiro river; salt lick (*bolei*); and shade trees, particularly along river courses.

The community undertakes a number of conservation measures including fencing of water points (*lare*) to keep away wild animals, e.g. along dry riverbeds (**Photo 2.3**); slaughtering livestock at safe distances from water points; prohibition of cutting trees along water courses; limiting points and seasons for sand harvesting; and protecting domestic water point sources.

Ole Kaunga

**Photo 2.3:** Fetching water from a shallow well dug on a dry riverbed

### Other landscapes and sacred areas

Other important landscapes include hills (*lowuan*) used as dry season grazing areas, honey harvesting and as a viewpoint for scanning resource availability and detection of lost livestock. *loijuk* is a hardpan area that will hold water seasonally. This temporary wetland is used for grazing and watering of livestock and wildlife at the beginning of dry spells. It is also a source of a rare fruit locally known as *ldorko*.

The Ngutuk Ongiron community shared their knowledge of a sacred site (*naapo*). During extreme dry periods, the community undertakes prayer in search for rains at the Lmoti Hill. The hill has a stone that vibrates and is used for spiritual purposes. The ceremony involves prayers, pouring of milk, slaughtering black and white goats and songs. From the hill, the procession heads to a sacred tree called *lmomoi* (*Kigelia aethiopica* Decne; Bignoniaceae) along the Ewaso Ngiro River. In September 2015 the community undertook such a spiritual ceremony following prolonged drought. According to the focus group, by the time they completed the ceremony at the *lmomoi* tree, it had commenced raining, but only along the route of the ceremony. Such ceremonies create visibility and awareness among the youth hence they are a form of knowledge dissemination for the protection of the sacred sites.

Among the Nkaroni community, a sacred structure would be constructed inside *lorora* (big boma) during a *muget* (a given community function). Elders use such structures like a parliament to consider all issues guiding the community. *Lorora* are in turn constructed according to need, e.g. during circumcision ceremonies or ushering in new age groups.

## 2.4.4. Transmission of knowledge between generations

Knowledge transmission is through folklore, songs and oral education. Oral transmission occurs on three streams:

- by household heads conveying to their wives and children information on laws agreed upon from elders meetings;
- by practical teaching of the youth on cultural norms, importance and use of natural resources, e.g. types, harvesting and uses of medicinal plants; and
- through women providing lifelong training for girls, and early childhood training for boys.

## 2.4.5. Perceived changes in the landscape

The communities indicated that the landscape has changed from grassland to a mosaic of wooded grasslands and bushes. This has been accompanied by an increase in acacia bushes, loss of grass cover, and local extinction of six nutritious grass species (*lkawa*, *lmruayi*, *nangorereki*, *leniunenei*, *loisao* and *lorririmowuo*) in Nkaroni. There is a decline in cattle numbers and milk production, an increase in goat population, changes in soil profile to sandy characteristics, and formation of gulleys across the landscape. The spread of *Acacia reficiens* subs *misera* (locally known as *ljorai*), an invasive species, since 1973, has increased to cover large swathes of grazing land.

According to the discussants, the course of landscape change is primarily due to a breakdown of the traditional governance system, since many no longer adhere to it due to a lack of good plans for the implementation of traditional laws. The loss of grass cover and nutritious forage species was due to overgrazing, low rains and increase in drought events. This has been accompanied by dispersal of acacia seeds by goats, leading to encroachment of woody vegetation on denuded land, contributing further to the degradation of pastureland.

The Samburus have recently accepted wildlife-ecotourism as additional livelihood base, leading to setting up community-managed conservancies. This has necessitated application of formal governance systems on the landscape. In areas zoned for wildlife use, re-emergence of three nutritious grass species (i.e. *lkawa*, *loisao*, *lorririmowuo*) extinct in grazing zones, has been observed.

## 2.5. Discussion

My study focused on how Nkaroni and Ngutuk Ongiron communities of the Samburu ethnic group managed pressures relating to human activities on ecosystem goods and services using the traditional governance system. I first assessed how the two communities classified landscapes, and ecosystem goods and services that they derive therein. Human pressures included unsustainable use of resources in forests, rangelands and water sources that can lead to degradation of respective ecosystems. Degradation would lead to loss of biodiversity, and ecosystem goods and services.

The two communities differed somewhat on some demographic parameters including family size, gender composition of offspring, fertility rate and asset ownership (**Table 2.1**). The skew in sex ratios in both communities would appear like an anomaly with gender bias of children towards male (67%) in Nkaroni and female (75%) in Ngutuk Ongiron. The reason for such skew and bias was beyond the scope of this study but if proven, will have implications on future use of natural resources, production, and transmission of knowledge in the landscape (Leisher *et al*. 2015). However, both communities had a number of similarities, i.e. a livelihood base that rotated around livestock; knowledge and use of landscapes; and traditional governance structure.

The two communities recognized five types of landscape key to their livelihoods. These included pastureland (*angata*), forests (*ntim*), water sources (*sere*), hills (*lowuan*), and hardpan (*loijuk*). From these landscapes, they obtain food, water, medicinal plants, building material and cultural artifacts. Additionally, these landscapes sustain their livestock, which is a major source of livelihoods and cultural resources. The communities recognize that the state of the natural environment was changing over time in response to pressures. Changes in species composition (e.g. loss of six grass species in grazing areas), increase in woody vegetation including an invasive *Acacia* species, loss of grass cover, and new gulley formations were identified by discussants as reflecting the changing quality of ecosystems in this landscape.

Drivers of these changes were anthropogenic, e.g. overgrazing, sedentarization and population pressure; and ecological, e.g. poor rains, and increased frequency and intensity of drought events. Increase in population has led to higher stock numbers, increased grazing pressure and demand for water. Land tenure challenges are also driving the initially nomadic communities to a more sedentary lifestyle with concomitant demand for building, fencing and other material to support livelihoods. This has impacted the environment through denudation of the grassland, loss of tree cover, and spread of invasive species as identified by the communities. Intuitively, it has also led to a reduction or a shortage of ecosystem services derived from the different landscapes. Although the study did not determine the grass species lost, we have previously recorded a number of perennial species in the area including *Brachiaria* spp., *Cenchrus ciliaris*, *Chloris* spp., *Cynodon dactylon*, *Digitataria* spp., *Eragrostis* spp., *Panicum* spp. *Pennisatum mezianum* and *Rhynchelitrum repens*. Spread of the invasive *A. reficiens* is an indication of increasing landscape degradation. This is because the shrub is known to be opportunistic, encroaching on disturbed soils (Bester 1999) and have no known cultural or economic value (Kigomo 2001).

The two communities attributed these changes as resulting from reduced attention to the traditional governance system as commoditization of natural resources takes root. Similar challenges to communities' traditional life ways have been recorded (Gregory 2010) and attributed to changes from mutual exchange-based economy to one based on wages; in addition to influx of material goods that supplants traditional worldviews. The Samburu communities here have responded through diversification of livelihood sources to include ecotourism. This has led to changes in land use that include wildlife conservancies. Hence, the Nkaroni community, together with neighbouring communities, formed Maebae Conservancy; while the Ngutuk Ongiron community set up the Westgate Conservancy. These are actively managed areas for wildlife protection with trained armed rangers. A recent study in Samburu-Laikipia region (Ihwagi *et al*. 2015) has shown significantly higher densities of elephants in community conservancies than in pastoral areas indicating their importance in biodiversity conservation.

These responses have led to limitations in the use of some areas within the landscape, hence supporting regeneration of ecosystem services and slowing destruction of ecosystem goods. This was alluded to by discussants in Nkaroni who indicated re-emergence of three grass species in the conservation area, species that have disappeared in grazing areas. In addition, the Ngutuk Ongiron community has embraced holistic management of the grazing areas. This is a further response geared to producing ecosystem services from degraded landscapes. For both communities, the anticipated outcome is to ensure fair distribution of ecosystem goods and services among community members.

## Acknowledgements

I wish to acknowledge field support from Simon Bulari and Eunice Sudi. Simon was kind to also interpret discussions in Samburu dialect during Focus Group Discussions while Eunice summarized the huge amount of data collected. The Nkaroni and Ngutuk Ongiron communities were very generous with their knowledge of the Samburu landscape. I must also acknowledge invaluable inputs from Douglas Nakashima and Marie Roué who reviewed the draft manuscript. Funding from UNESCO, for which I remain very grateful, supported this study.

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# 3. Community dialogue on ILK relevant for food and water protection in Tharaka, Kenya

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## 3.1. Background

### 3.1.1. Tharaka culture, religion and social organization

The Tharaka people believe they came from a region called *Mbwaa*, which is believed to be on the coast. They migrated eastwards towards Mt. Kenya and settled at Igaironi, from where different clans migrated to different sections of the territory. They mainly settled on mountains from where they could see enemies approaching. The Aatharaka live in semi-arid parts of Tharaka Nithi County and their livelihood is mainly agri-pastoralism. They have 32 clans with a common history and origin with other Meru sub-tribes. These clans are divided into sub-clans with very strong social ties and taboos (or, more accurately, restrictions) that govern social relationships including marriage. Their culture is dynamic and they hold clans in great regard.

Traditionally, the Aatharaka are a very religious community. They call God *Murungu*, whom they believe resides on *Kirinyaga* (shortened from *Kirima kia Nyaga*, "The Mountain of Ostriches"). This is the mountain that is today called Mt. Kenya. It was their paramount traditional sacred place because it was where *Murungu* resided and revealed himself to the community. Aatharaka had other smaller sacred places of worship and sacrifices called *Irii*. *Irii* occur on mountains and rivers, with the Kathita River having more than fourteen sacred sites along its stretch of 120 km from the source (Mt. Kenya) to its confluence with the Tana River. Of the 32 clans, four clans have the traditional custodial responsibility for sacred sites in the land of Aatharaka. These are Mbura, Rurii, Kitherini and Gankena. Traditionally, Aatharaka conducted rituals at the *Irii* to pray for rains; for the wellness of people, livestock and crops; and for protection of territory from diseases and pests. Traditional seeds, especially millet, played a central role in ritual practice in Tharaka as no ritual could happen without them.

### 3.1.2. Geography, weather & climate

Tharaka lies on the low plains between Mt. Kenya on the West and the Upper Tana River in the east. The area is mainly plains, with the major ecosystem type being scrubland. The area is generally hot, with unreliable rainfall, which quite often leads to crop failure. Drought is a recurring challenge to the livelihoods of the people of Tharaka, from the lowest slopes of the mountain to the banks of the Tana River (Smucker 2007).

Tharaka straddles a 1,513 square km land mass and has a population of 130,098 according to the 2009 Kenya National Census. The Tharaka region is generally semi-arid with short trees, with forests occurring mainly on the mountains. General temperatures in Tharaka are hot, ranging between 29°C – 36°C, though during certain periods they can rise to as high as 40°C (Recha *et al*. 2011).

Due to the effects of climate change, rains have become erratic in the area. The area experiences a bimodal rainfall pattern with annual rainfall averaging between 500–800 mm per year. Rainfall varies in amount and effectiveness in the rainy seasons (from March to May, and from October to December) as well as the inter-annual and inter-decadal rainfall variability that characterises Sub-Saharan climatology. Over the years, annual and October–December rainfall analyses have depicted below normal rainfall patterns in Tharaka (Recha *et al*. 2011).

The rainy seasons in Tharaka are very different to the rest of the country. Unlike other parts of the country, the short rains are from March to May (known as *Nthano* season) and the long rains in the area are experienced from October to December (known as *Muratho* season). According to the custodians of sacred sites and clan representatives who participated in preparation of this paper, this season is traditionally the beginning of the Tharaka New Year and whatever happens in the rainy season sets the pattern for the whole year.

Traditionally (and to some extent today), Tharaka people used certain signs to understand the weather. They used to determine seasons by use of the sun and moon and their position in the sky. They also used plants and birds. For instance, when Acacia trees start producing green leaves, that signified the onset of *Muratho* (the local long rain season); very hot sun, the presence of many different birds that eat cereals, and livestock miscarriages signify *kiathu* (a short dry season). When coppicing species start sprouting new shoots, this signifies the onset of *Nthano* (the local short rain season); when trees start dropping leaves, this signifies onset of *thaano* (a long dry season) when most ceremonies are done. A certain manifestation of the whirlwind, bees migrating from highlands to lowlands, certain tree species shedding leaves signify the onset of rains; certain types of insects that crawl show the intensity of rains and good harvest (*unoru*); some sacred sites would produce a certain sound which indicated the intensity of the rains. If no sound is produced this signified low rains; a pronounced rainbow joining two sacred sites also showed heavy rains would come. They also relied on celestial bodies like the moon and stars to detect seasonal changes.

Tharaka has 13 permanent and seasonal rivers flowing through the land. Out of these, the Kathita River is the most important. It is a 120 km long permanent river, flowing from the top of Mt. Kenya to join Tana River and flow into the Indian Ocean. It has 14 sacred sites along its course. The river provides a significant proportion of the people of Tharaka and Meru with water. However, the river is facing challenges due to pollution coming from towns, abstraction and damming (leading to reduced river water volumes), destruction of riparian reserve and catchment areas, destruction of sacred sites along its course, and disregard for cultural ecological laws which were used to govern the use of the river. Other rivers in the area have changed from permanent to seasonal character, and the community now fears that the Kathita River might disappear in the coming few decades.

The main natural resources of the area include arable land, tourist attractions such as the Mutejwa National reserve, forests, wildlife and sand quarries. The main economic activities include farming, pastoralism, and mining of gemstones (Transition Authority 2014). Others are sand harvesting and stone quarrying. Apart from crops and livestock, *nyoni* (birds), *makuyu* (fishes) and a variety of domestic and wild fruits contribute a significant share to local foods. There is a fast growing trade in crops and livestock, which is also known to contribute to occasional food deficits that require food relief in the area.

## 3.2. Tharaka agricultural knowledge

### 3.2.1. Local crops

Agriculture is one of the major economic activities in Tharaka. Farmers have traditionally grown a wide variety of grains for different benefits (speed of maturation, taste, market price) but some of these varieties have been lost during severe droughts.

Seasonal harvests are undertaken in January and June respectively. Seed varieties grown in the area are:

- Millet *(mwere)* – *ciakaungi, mututua, mugoi*
- Sorghum *(munya)* – *mugeta, mukubu, mucuri, mugana, mweru, karigu, kaguru, muruge, mucarama, mucombo*
- Green grams *(ndengu)* – *kithara, mugaci, nkina*
- Cowpeas *(thoroko)* – *karuria iguru, muboo, karanga, muriungi wa ntaari, matu ma nthia, range, kimweri/kaburungui, ikamburu, muthara*. It was used to heal tonsils [*ng'arang'ari*].
- Winter melon (*matanka*) – was used to treat constipation in cows
- Nyungu
- Finger millet (*ugimbi*) – *mukubu, muguunga*
- Castor seed (*mbariki*) – seeds produce oil which was used by women for beautification, to soften the skin, and to bless youth before circumcision and when newly married.

Important vegetables include:

- *Marigi, muthunka, mathunju, nkunda, nkunda njeru, nthururiga, mparia, magenda na akuru, rwoga, ntura nkunu, terere/mujuri, muukwa*

Domestic fruits prevalent in some parts of Tharaka are mangoes, bananas, oranges, and wild fruits such as tamarinds, sycamores, figs, and many others. However, like many other small-scale farmers, the farmers in Tharaka are faced with challenges of increasing population pressure, food insecurity, very low levels of agricultural productivity and rapid natural resource degradation associated with nutrient depletion through soil erosion and excessive runoff (Okeyo *et al*. 2014). A progressive decline in harvests has been reported by farmers and noted in studies by Smucker and Wisner (2008). Cash crops are rarely cultivated, but when they are they comprise cotton, sunflower and castor. Aatharaka keep goats, sheep and cattle.

### 3.2.2. How Tharaka people understand seeds

Aatharaka grow different seeds on different types of soils. Some types of indigenous seeds and the soil type where they give maximum produce are listed below:

- *Mwere* – millet – (3 different varieties), grow on sandy and loamy soils;
- *Munya* – sorghum (5 varieties), grow on sandy and loamy soils;
- *Ndengu* – green grams (3 varieties), grow on sandy soil;
- *Ikwa* – yams, grow on loamy soil;
- *Nthoroko* – cow peas, grow on sandy soil;

- *Marenge* – pumpkins grow on sandy soil;
- *Rungu* – gourds (3 varieties), grow on sandy soil;
- *Ncugu* – peas, grow on both sandy and loamy soils.

A local research group has been set up which includes the young, middle aged and elderly generations from the community. They go around meeting with elders to collect and record the seeds, and then they share these with the farmers who multiply them and keep sharing. They share the knowledge of when and how to plant; when and how to store. They also share characteristics of different varieties such as those plants that grow fast, and those that are easily attacked by birds. This process ensures that the revived seeds and knowledge are shared with as many farmers as possible.

"Improved" millets are not growing well when compared to the local cultivar. New seeds introduced from the government have been found to be less resilient, and it is important for farmers to have this knowledge so that they can distinguish new seeds from the older and more resilient seeds.

The community has knowledge of seed management and storage. Indigenous seeds are chosen according to their relevant characteristics, and this knowledge is passed down from generation to generation, from mother to daughter. The choice of planting materials took place from the time the crop was in the field, i.e. before harvesting. It involved selecting/sorting and preparing storage containers and structures well before time of storage. Seed knowledge is essentially female knowledge. There is even a local name for the "best seed": *thegerembe*. Seed mapping is one of the approaches that people in the area are using to track seeds that are becoming extinct.

Seed selection was carried out by observing the following traits:

- fast growing – how long it takes to produce seeds;
- formation or structure of the seeds;
- distinguishing seeds that do well during dry season from those that require more rain.

To use the head of millet as an example, the women would look at the number of seeds per head. They would also check and remove the seeds of one head of millet by rapping it on the stones. If the seeds come out fast, it would be good for seeding. If the seeds are stuck, then they would not be selected.

For on-farm seed management, the community did not allow livestock (particularly goats) to graze directly in the farms. They had knowledge about maintaining the vigour of their crops and animals through seed sharing and exchanging males for breeding. Seeds and male animal breeding stocks were shared or exchanged based on clans. Breeding was a purely spiritual process and many taboos were attached to it to ensure the best people got the best seeds. Acquiring seeds or sires from the wrong clan was considered desecration and had far reaching ramifications, including reduction in yields and herd decrease, as well as requiring cleansing rituals.

Planting used to be preceded by a ritual called "escorting the seeds" (*kumagaria mbeu*) usually done by an elderly woman who would rise up very early to plant a sample of the seeds and thereafter the rest of the community would be allowed to plant. This lady was identified by the community based on her character, industry and wisdom. This ritual was preceded by another ritual known as *kuangia mburi* that was intended to pray for rains, cleanse and bless the land, and atone for sins. Certain utterances like obscenities defiled the land and angered the spirits of the ancestors, who had to be appeased through rituals and pouring libations.

Crops used to be protected from diseases and pest attacks through a variety of methods including rituals and physically scaring them away. Serious attacks by worms and locusts invited performance of a ritual (*muthega wa matongi* or *muriu*) after which the pests disappeared.

### 3.2.3. How Tharaka people obtain seeds

Seed is used locally as a general term referring to materials that are planted. These could be cereals, tubers, or cuttings. The community has a very clear seed selection system, especially for cereals, based on grade and size. Selection would happen either at the garden when growing, during harvesting, or when threshing.

The community has identified 3 different categories of seeds:

- *Nthegerembe* – the best of the seeds;
- *Nthegenjiu* – given a lower rating compared to *nthegerembe*;
- *Mwentia* – cuttings.

The community had different strategies for seed storage. Once selected, the seeds would be put in a gourd and placed in the store. This way the seeds were separated from the rest of the items. On very rare occasions, especially during extremely severe drought, seeds would be converted into food. Even then, this would only happen to prevent the death of children. For certain crops, seedlings would be secured during weeding, or when fencing and cultivating. These would then be re-planted on the farm. Cuttings were prepared before the rains fell or during the dry season and planted when the rains were almost falling. For tubers, the main tuber root was not uprooted to save the plant for use in the next season. Tharaka people could not sell seeds; however, seeds would be shared freely (even though there were taboos barring seed sharing among certain clans). Clan relations guided seed sharing; for example it was taboo for certain clans to share seed.

Seed management was a female affair. Women would go to plant with young girls who learned how to handle and manage seeds as they helped their mothers and grandmothers work on the farms. However, preparation of the farm was done by both men and women, each gender with specific roles. Men would mainly prepare the fields, especially opening new pieces of land, as well as protect crops from pests and wildlife. Women would generally plant the seeds and harvest.

### 3.2.4. Planting and crop management for seed production and agriculture

Planting required keen planning to ensure the land was prepared well in advance before the rains started; the required seeds were selected and packed according to the desired types for the season. Planting was also a spiritual process, preceded by prayers to bless the soils and a ritual called *Kuangia mburi* that was intended to protect crops from disease and pest attacks. Further, crops would be protected through smoking or spraying with ash. Some people would also prepare a cow-dung spray to be used as a pest repellent; others used dung for seed storage so that it could not be used as food. Before harvesting, other rituals would be done to bless and cleanse the harvests before consumption by people and livestock.

The Aatharaka manage their crops with two objectives:

- to produce good seeds;
- to produce a good harvest.

In order to achieve the above, they employ different strategies including:

- keeping the plants free from pests and diseases through rituals, smoking and spraying;

- early weeding to ensure healthy plant development;
- chasing away birds, baboons and monkeys;
- strict surveillance programme, which included identifying the right plants to produce seeds and protecting them along the way through rituals and physical management practices as outlined above.

### 3.2.5. Uses of the harvests

The products of the harvests were either seeds or food. Food was used in the household or used for barter trade. It was also used in ceremonies such as weddings, as well as feeding birds and wild animals. Seeds, on the other hand, were used for planting, rituals and sharing. For example, a newly married woman would be given seeds to plant on her new field as a sign of blessing. She would plant the seeds from her parents before she planted others.

Several rituals were conducted using seeds, such as millet, as follows:

- ritual to bless the earth before planting;
- ritual to prevent pests and diseases;
- ritual to bless the family;
- reciprocity ritual to thank God before the family can use the harvests.

### 3.2.6. Transmission of ecological knowledge, including seed knowledge

Traditional learning is graduated by age, with each stage for males taking place in certain spaces. During initiation, boys and girls are taught how to protect the environment. They are introduced to sacred sites and how to respect them. They learn about clan relations and how to handle seeds. Although several of these practices had been abandoned, they are being slowly reintroduced today to positive response.

Learning spaces for males included:

- *Kibuuru* – This space was for boys who are approaching circumcision age. It includes general training on discipline, social relations, general environmental protection and hygiene.
- *Gaaru* – This space was for young males (20–25 years old). It provides advanced learning on the culture of the community, environmental protection, community protection and discipline. Elders played a key role in training at Gaaru.
- *Njuri* – This is the council of male elders where further training happens. It is the highest traditional governance organ in the community. They handle general community issues including environmental destruction, land disputes and disciplinary issues.

Girls also go through these stages, but they are trained by their mothers. They are trained according to their age, and each age stage has its specific teaching. Mothers train their daughters about farming from a very tender age. Training occurs alongside responsibilities the girls were taking at each stage. Grandmothers also contributed a lot of the training for girls. After marriage, youthful women were trained by elderly women. Celebrations and festivals provided important learning spaces for both girls and boys.

Other gender-related institutions concerned with ecosystem protection include *Kiburu* and *Rwamba*. *Kiburu* is comprised of women who protected sacred sites from destruction. It is a very powerful institution and most of the cases it handled received strict compliance. *Rwamba* is

comprised of men and was the highest human-driven environmental protection institution in the community. If an issue failed to be resolved at *Kiburu*, it would be taken up by *Rwamba*. If it failed there, then it was taken to the spirit realm through a powerful ritual.

### 3.2.7. Cultural practices that enhance ecosystem resilience

Rivers and sources of water used to be given special protection. For example, one would be severely punished if found washing dirty clothes directly in a river or water source. People were expected to not bathe directly in rivers or places used as sources of water. There were also specific points along rivers where animals were watered (*mariuko*). These rules were strictly enforced to prevent river pollution.

Hills were equally critical ecosystems as they acted as watersheds, sacred sites and safe havens in times of danger. In fact, a number of hills in Tharaka land are regarded as sacred. The people understand ecosystem services provided by hills, including trapping rain-bearing clouds and hence influencing rainfall regimes, hosting forests rich in biodiversity, hosting honey bees, wildlife, and being sources of rivers and valuable wood. Hills are currently being threatened due to rising demands for timber and agricultural land, which has led to illegal logging and encroachment of these forests. In addition, reduction in grazing land has led to residents taking their animals to forested hills and watersheds for grazing which has greatly degraded these ecosystems.

On ecological governance and spirituality, the community had sacred areas where elders used to lead community members to offer rituals. But only few selected individuals performed rituals. These few came from certain clans such as Mbura, Rurii, Gankina and Kitherini. Rituals and sacrifices were important in enhancing resilience of the land. When certain calamities struck, the community would perform a cleansing ritual (*kuangia mburi*). Such calamities included prolonged drought, epidemics, as well as massive pest attack such as infestation by locusts. When performing this ritual, the community pleaded for rains, destructions of the pests, end of the epidemic, etc. The Kamurige clan was known to offer prayers for rains.

Certain seeds/crops were critical during rituals and ceremonies. For instance, millet was so special that porridge made from it was used in most ceremonies. Honey was also important during ceremonies such as marriage, since a special brew made from it was used as part of materials given out during dowry settlement and drunk during the wedding ceremony.

Indigenous seeds were normally preserved above the fireplace on the wood rack and in gourds. Ash and a traditional herb called *matata* were used as preservatives to protect seeds from weevils and other pests. The community normally practised multiple cropping, where several crops were grown together. Ceremonies used to be performed to celebrate and thank the ancestors for a good harvest. It was noted that certain varieties of millet and sorghum among others had been lost and so is the associated knowledge as well as ceremonies and rituals depending on them. This was a major concern.

### 3.2.8. Land degradation

Traditionally, the community had a system of classifying land according to levels of degradation as follows:

- *Kuonda kwa muunda* – land degradation. Signs are galleys start appearing, weak crops, disappearance of trees, plant types that grow on drylands (*mang'ariani/matuuruni*) start appearing.
- *Muunda umunoru* – fertile land. Signs are the status of plants growing on the land; *gitaka* – loam soils; gradient of the land.

- *Muunda umuondu* – infertile land. Signs are weak plants. Land is described as *ituuru*; a very hard surface that does not allow infiltration by water.

The community had a very clear strategy of land and environmental protection based on the following principles:

- ***Diversification of crops***, e.g mixed cropping and mixed farming.
- ***Rotational grazing system***, practiced in a semi-nomadic pastoralism setup.
- ***Selective felling***, e.g trees were cut selectively with some being left standing to control rains, provide shade, habitat for birds, hanging beehives, etc. They dissuaded clear-felling and overharvesting of certain species.
- ***Protected species***, e.g certain species such as *Ficus* spp. (*mukuu*), *mukame*, *muthithi*, etc, were considered to be sacred and therefore were under cultural protection. All fruit trees were never cut as they contributed to food and nutrition security, and provided food for domestic and wild animals.
- ***Shifting cultivation*** was practised in order to give land time to rest before being used again. New farmland was cultivated for two seasons before being left fallow.
- ***Crop selection***, e.g specific crops were planted during specific seasons according to their water requirements. For instance, green grams require little rain while millet requires extended rain. Different varieties were planted in a mixed cropping system during the extended long rain season.
- ***Breeding*** was carried out among domestic animals to improve on certain traits. Plants were not bred but seeds were continuously selected and shared to develop the desired traits.
- ***Ritual***, e.g planting and harvesting seasons were preceded by certain ceremonies/rituals (such as *kumagaria mbeu* and *kurugiira*).

Due to the lack of recognition of traditional governance, some community members are breaking age-old taboos such as cutting trees at the sacred sites, shedding innocent blood, etc, which defile the land and result in increasing occurrences of drought and famine, pest infestation and epidemics.

## 3.3. Drivers of change as observed by the community

The community has been observing changes that have been happening in their region in relation to seed and food. They identified the following as important causes of the changes that would need to be addressed to reverse the situation.

### 3.3.1. New seed varieties

Introduction of new seeds made people forget their indigenous seeds. Emphasis on new seeds by government extension officers, and referring to indigenous crops as 'orphaned' crops may have contributed to their disappearance. A number of varieties (especially cereals) have disappeared and are being recuperated. This loss has been compounded by changing social-cultural behaviours, especially the youth who find little appeal in some traditional foods.

In Kenya, a new seed law has been passed which makes it criminal to handle seeds that are not certified. This means that farmers will only use seeds that have been bred by research institutions or certified plant breeders. While this affects specific seeds, it also means that the cultural practices

associated with seeds will disappear together with the traditional seeds. The actions of the government are being backed by a strong international law on seeds, which are criminalizing the informal seed sector, with the ultimate objective of controlling global seed sector for profits. In Africa, the African Regional Intellectual Property Organization (ARIPO) is leading this onslaught with the *Arusha Protocol for the Protection of New Varieties of Plants* which proposes extremely strong intellectual property rights to breeders which further restricts the rights of farmers to freely save, use, share and sell seeds and material for propagation.

### 3.3.2. Biotechnology

Another challenge is genetically modified seeds, which are being promoted as having the potential to resolve the hunger problems of Africa. Use of genetically modified seeds will eliminate other seeds as they are usually grown in monocultures. Biotechnology developments also increase and promote the use of hybrid and exotic varieties, including the use of terminator seeds. While genetically modified organisms have not been commercially released in Kenya, there is a huge push to allow them and this is expected to present a significant threat to indigenous seeds.

### 3.3.3. Use of chemicals

Some farmers in the community have been using chemicals that affect plants, soil, water, animals, air and insects. Use of such chemicals and consequent destruction of habitats has led to the disappearance of important insects which support crop and seed development.

### 3.3.4. Land degradation

Destruction of ecosystems to pave the way for farming, coupled with poor farming methods in a semi-arid area, have led to degradation of the land. Top-soils are usually washed away and gullies emerge each rainy season. As a consequence, biodiversity is fast disappearing in the area.

### 3.3.5. Climate change

Climate change, particularly lowered rainfall levels, has led to the disappearance of some of the indigenous seed varieties and also weakening of critical ecosystems like forest watersheds. This has affected the seasonal rainfall patterns by reducing the length of the rainy periods as well as the amount of rain. Continued failure of crops is compromising the capacity for production of good seeds. Also, anthropogenic activities along rivers have contributed to reduction of river water volume over time. Climate change has also caused disruption of the planting calendar as it has become increasingly difficult for youthful farmers to predict seasonal regimes.

### 3.3.6. Loss of seed knowledge

Loss of cultural values has led to a significant number of young people lacking the requisite knowledge for management of indigenous seeds. They have been planting new seeds and have resisted learning about indigenous ones. Elders do not have youthful and wiling repositories for this knowledge and so they do not share it. Once the elders pass on, their knowledge disappears along with them.

### 3.3.7. Modern faiths

Modern faiths have no regard for sacred natural sites and rituals. Ancestral worship, which involved use of indigenous seeds, has been demonized, and the practices are disappearing together with the seeds.

### 3.3.8. Lifestyle changes

Lifestyle changes have led young people to develop prejudices against local and indigenous foods. They have embraced fast foods and hybridized varieties of crops that they consider easy to manage. This has trend has also been influenced by commercialization of agriculture, where farming is dictated by markets.

### 3.3.9. Invasive species

The community has experienced the phenomenon of invasive species of weeds such as *ciakamomora*, *ciaconde*, *nduruntune*. While there were no specific traditional strategies to deal with invasive plant species, certain rituals would be carried out to chase away pests that invaded farms.

### 3.3.10. Seed recuperation

In Tharaka, the Institute for Culture and Ecology (ICE-Kenya) is working with the community to recuperate the seeds that have disappeared as well as reviving the whole social ecological system to enable the land support growth of the seeds. This is being done through the development of eco-cultural maps and calendars as well as seed mapping. ICE is also supporting the community to engage local government departments responsible for agriculture and water development to address the challenges of destruction of riparian reserves and uncontrolled water abstraction. Similarly, the organization is supporting a broad-based cultural revival including traditional spirituality, which is based on a strong relationship with natural phenomena. Most sacred sites are found on mountains and along the courses of rivers.

## 3.4. Conclusion

The Tharaka community believed that there is a strong connection between conservation of seeds and protection of sacred sites. If sacred sites are well protected, then they would have rains and good crops which would eventually give them good seeds. The Kathita River, which has 14 sacred sites along its course, therefore becomes an important eco-spiritual phenomenon for the community. Protection of the sacred sites would lead to protection of the river. Destruction of the riparian reserve of the river leads to destruction of sacred sites and therefore a disruption of the relationship between the people and nature, which would be manifested in drought and poor crops, and hence no seeds.

A lack of indigenous seeds meant that the community could not do their rituals, since seeds are an important component of ritual practice. Before the sacred sites were destroyed, they would produce a sound that would help people anticipate the amount of rain that would fall. This would then help them to determine which crops to plant – those which require a lot of rain or

little rain, depending on the sound from the sacred sites. Potentiating sacred sites requires revival of the ritual cycle, which then requires that indigenous seeds be available for the rituals to be conducted. Reviving the ritual cycle therefore means reviving a whole social ecological system. It is for this reason that the community is restoring Kathita River and the sacred sites on its course, so that they can continue conducting rituals at the sacred sites.

Reclaiming the lost cultural traditions and indigenous knowledge is becoming critical, as it would help to address the environmental degradation and strengthen the resilience of the territory. Traditional institutions like *Gaaru* (the place of seclusion and advice after circumcision) also need to be revived as a step towards restoring traditional governance institutions.

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# 4. Indigenous and local knowledge for biodiversity and ecosystem services in Tanzania: The case of two selected communities

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## 4.1. Introduction

### 4.1.1. Background

It is obvious that land degradation has had a major impact on the food security and livelihoods of communities, especially those depending on the land for their lives. Literature has shown that one of the factors contributing to the land degradation is the increase in population, which puts pressure on land resources to produce food and other needs of the people, often without improved technical inputs and proper land management. As a way to ensure that local and indigenous people in various areas in the world can survive in their areas where they live, various indigenous knowledge and techniques have been used some of them through trial and error – to ensure that such communities can sustain themselves. Indigenous and local knowledge and techniques have also resulted into improved availability of food as well as enhancing sustainable land management through averting unsustainable use of land and its associated resources.

In Africa, ILK and techniques have been employed in ensuring that various land practices are traditionally used to reduce land degradation and enhance sustainable land management, conserve biodiversity and enhance availability of various ecosystem services. Practices such as traditional forest management using sacred sites, seed conservation, and use of indigenous and local knowledge to determine the fertility and quality of the soils, have been used when determining types of crops to be planted, as well as the time of planting, to ensure that local communities can sustain their lives.

Tanzania has more than 120 tribes. Each tribe has its own vernacular local knowledge and practice that is used in the whole process of the utilization of natural resources (biodiversity and various ecosystem services). Assessment of biodiversity and utilization of various ecosystem services needs the understanding of the indigenous and local knowledge of the respective tribe and location of the tribe in the agroecological zone. It is also known that ILK can have significant impacts on the availability of ecosystem services. Understanding ILK and its practices could influence the availability of:

- ***Provisioning ecosystem services*** (e.g. fodder provisioning, water supply, fuel wood and charcoal, forest goods and services);

- ***Regulating ecosystem services*** (e.g. water flow regulation, erosion prevention, climate regulation (carbon sequestration));
- ***Cultural ecosystem services*** (habitats for supporting ecotourism, cultural heritage (wetlands), biosphere reserves); and
- ***Supporting ecosystem services*** (e.g. nutrient recycling, soil formation).

This paper provides examples of ILK and practices in Tanzania, including their linkage to biodiversity and ecosystem management. The cases are from the Usambara Mountains (rainforest area) and Mpwapwa District (semi-arid lands) in central Tanzania. In addition, information previously collected and published in various papers was verified by the communities during various ILK holder meetings held in the respective districts.

### 4.1.2. Tracking ILK for traditional tillage practices, soil quality and ecosystem services in Mpwapwa District, Central Tanzania

Mpwapwa is one of the six districts of the Dodoma region in Tanzania. It is located 120 kms from Dodoma Regional Headquarters. It is one of the oldest colonial districts in Tanzania, boasting local German colonial government headquarters, or *bomas*, in the early 1890s, and British administrative offices after World War I. The district lies between latitude 6°00" and 7°30" S and between longitude 35°45" and 37°00" E. It borders the Kilosa District on the eastern part, Kongwa District on the northern part, Chamwino District on the western area and Kilolo District on the southern part. The District covers a total area of 7,379 km$^2$ (18.1% of the total area of the Dodoma Region).[2]

This paper reports on an assignment to track the ILK on traditional tillage practices conducted in representative villages of the Mpwapwa District. Meetings with community representatives involving elders, female, male and youths was carried out in Kioskwe village, which is one of the three villages in the Mazae ward. This village was used previously as a case study village for studies on traditional tillage practices between 2005 and 2009. According the 2012 National Census, Kisokwe village is estimated to have a population of 3,525 people. Kisokwe is predominantly a farming village although the trend is increasingly changing over time. Field visits and focus group discussions were the main approaches used to gather information for the assignment and finally a joint workshop with a group of 15 people (males and females) was conducted to verify the findings obtained in the field, as well as for data that were previously reported in the literature in Hatibu *et al.*1999; Shemdoe & Mwanyoka 2006; Shemdoe *et al.* 2008; and Shemdoe *et al.* 2009a and 2009b.

## 4.2. Traditional tillage practices in Mpwapwa districts

### 4.2.1. Traditional land use practices in use

Previous studies (e.g. Shemdoe *et al.* 2008, 2009a, 2009b; Hatibu *et al.* 1999; Shemdoe & Mwanyoka 2006) indicate that a range of traditional tillage practices have been in use in Mpwapwa district for years. These include:

- no-till farming, referred to as *sesa* in Kiswahili and known locally known as *kusesa*;
- shallow tillage, called *kutifua* in Kiswahili and known locally as *mbundugwa*; and



2 http://mpwapwa.blogspot.com

- ridging, called *matuta* in Kiswahili and known locally known as *majeleka*.

This study confirmed that to date these practices are still in use and that there are no new practices being practiced. However, it was noted that although all these practices are still in use, shallow tillage (*mbundugwa*) is becoming more dominant and commonly used compared to the other two practices. It was reported that shallow tillage is more productive compared to the other methods, and also more time saving. This is attributed to the fact that a large number of farmers make use of bullock or ox, popularly known in Kiswahili as *maksai*. For example, it was pointed out that in a one acre of land cultivated using *maksai* a farmer could produce between 8–10 bags of groundnuts, while only 4 bags of groundnuts could be produced on the same land size using *sesa*.

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**Photo 4.1:** A farming practice traditionally known as *majeleka*

**Table 4.1:** Advantages and disadvantages of traditional tillage practices

| S/n | Tillage practice | Advantages | Disadvantages |
|---|---|---|---|
| 1 | *Sesa* (no till) | • Does not disturb the soil structure<br>• Takes a short time to prepare a farm | • Fewer and more unhealthy yields e.g. 4 sacks of maize per acre<br>• Inhibits moisture infiltration |
| 2 | *Kutifua* (shallow tillage) | • Smoothens soil surface to cut moisture infiltration<br>• Greater and healthier yields than in sesa, e.g. 8–10 sacks of groundnuts per acre<br>• Few weeds and takes less time to weed<br>• The best intervention where there is rain shortage, guarantees harvesting | • With loosened soil structure, erosion occurs more easily during heavy rains<br>• Takes a long time to prepare a farm (about a week per person per acre or a day using a maksai) |
| 3 | *Matuta* (ridging) | Prevents soil erosion during heavy rains<br>• Keeps soil moisture for a significant time<br>• Easy to weed<br>• Provides better and healthier yields, e.g. 6 sacks of maize per acre | • Does not provide greater yields compared to shallow tillage, e.g. 6 bags of groundnuts per acre<br>• More land space is lost through spacing of ridges<br>• Laborious and time consuming<br>• Financially costly, e.g. cost of about 80,000 TZS to prepare an acre of ridges |

### 4.2.2. Advantages and disadvantages of traditional land use practices

It is interesting to note that farmers are well informed about the advantages and disadvantages of all the tillage practices they use in their localities, implying that decisions to use either of these practices is guided by such knowledge. **Table 4.1** shows advantages and disadvantages of each of the practices as reported by the respondents.

In terms of choosing and deciding on the type of tillage practices, the respondents named several determining factors including costs (in terms of money and time associated with farm preparations and weeding), land tenure, population pressure (land shortage), and culturally embedded crops like millet and maize. Land tenure was named as a limiting factor in that not all people own the land and therefore one could not put in place a permanent structure such as ridges or terraces if the land were not owned, as this would not be accepted by the landowner.

### 4.2.3. Knowledge transfer from elders to the young ones

Various methods are used to disseminate indigenous knowledge from elders to the next generation. These include involving children in farming activities, through which elders educate and pass on knowledge to their children. This approach is literally learning by doing. Another way is through local community gatherings, at which people talk and discuss community issues, including farming practices and also copying and adapting techniques from other farmers. It was reported that young people did not firmly possess the knowledge of the elders, largely because most of the youth do not apply such knowledge in the way it was previously used. It was indicated that the youth are fond of new innovations and ways of doing things, such as farming, using tractors, and undertaking other income generation activities such as charcoal making and ferrying passengers using motorcycles (known as *boda boda*).

### 4.2.4. The impact of population increase on tillage practices

Respondents and participants in the validation workshop indicated that population is on the increase in the villages and Mpwapwa district in general. This is partly attributed to natural population increase and also to in-migration. The increase in population exerts pressure on the existing natural resources including land, and indeed it results in land shortages. Population increase is also associated with an increased pressure on natural forests, with the ever-growing charcoal-making business in the area. These impacts expose the land to erosion and subsequently affect the usage of traditional tillage practices.

### 4.2.5. Climate change and its impact on land and tillage practices

Although farmers were not familiar with the term climate change, from their basic knowledge it was clear that they knew what it is. They talked of the change in rainfall trends in their area and its impacts. It was reported that the change of rainfall patterns has affected the use and preference of the type of tillage practices, and as a result people prefer using shallow tillage as opposed to no-till and ridging. As indicated earlier, shallow tillage is believed to be more productive even during dry seasons.

### 4.2.6. Use of social capital to enhance traditional tillage practices

Social capital was mentioned as a form of economic and cultural capital through which traditional tillage practices are implemented. Farmers reported that they normally use demonstration plots (*shamba darasa*) where other farmers can learn about the best farming practices. The learning is either facilitated by one of the farmers or the agricultural extension officer. Moreover, it was

noted that farmers use traditional gatherings (locally known as *sanji*). This is an event where a group of farmers come together and work on one of their fellow's farms. It could involve any village members or sometimes it involves relatives of the host. One of the important conditions for this event is that the host should prepare some food (*makande*) and local brew for people to eat and drink as they work on his/her farm. *Sanji* are usually done rotationally and have been proved to be very useful. Their main benefit is to reduce costs for the farm preparations.

### 4.2.7. Governance issues in relation to the use of traditional tillage practices and their impacts

The meeting participants indicated that governance has implications on the traditional tillage practices. They indicated the need to work quite closely with extension officers who, in addition to promoting modern tillage practices, also encourage farmers to use traditional tillage practices which are environmentally friendly.

## 4.3. Tillage practices and land productivity

### 4.3.1. Knowledge of soil quality evaluation indicators

It was deemed necessary to know whether farmers use any indicators to determine and evaluate soil quality using their own knowledge. Farmers in these areas have indicated they use their knowledge to determine soil quality using a range of parameters including soil color and types of plants/weeds growing in a certain area. Using local names farmers provided some examples of plants such as *mahata* (*Tragus berteronianus*). The presence of these plants in a certain area has been reported as an indicator that the soil is suitable for growing maize. Similarly *mphangalile* (*Bidens lineoriloba*) was named as a plant that indicates that the soil is suitable for growing groundnuts. These indicators have been in use and are still in use in the Mpwapwa district especially in the lowland areas. In so far as the use soil color as an indicator is concerned, community representatives mentioned black soil to be suitable for growing maize; millet and simsim grey soils as suitable for ground nuts; while red soils are appropriate for sorghum, simsim and millet. Community representatives listed a number of advantages and disadvantages that are being used to determine the suitability of the soil as shown in **Table 4.2**.

**Table 4.2:** Advantages and disadvantages of plants used as indicators to determine soil quality

| S/n | Plant type | Advantage | Disadvantage |
|---|---|---|---|
| 1 | *Idilo* | Helps a farmer to determine types of crops that fit the soil type | Difficult to weed if not done in time, as these plants invaded the farms very quickly and vigorously |
| 2 | *Mahata* (*Tragus berteronianus*) | Used as an animal food | Not mentioned |
| 3 | *Mphangalile* (*Bidens lineoriloba*) | Used as a wild vegetable | Not mentioned |

Whether the knowledge on indicators is passed over to the young ones (next generation), it was reported that elders usually do this by taking their children to the field and train them. This is regarded as the best way to pass on knowledge. This was evidenced by the fact that many of the young people who participated in the focus group discussions seemed to be conversant on these indicators.

### 4.3.2. Impact of population increase on soil quality indicators and land degradation

It was reported that due to population increases in the Mpwapwa District and the low land villages, interaction between the natives and immigrants has been quite high, coupled with some elements of "modernization". As a result it is increasingly realized that young people are rarely applying traditional knowledge in farming. In the course of the discussions held with community representatives there was a clear worry that application of this knowledge is likely to diminish over time. Again it was noted that pressure on the exiting natural resources (e.g. cutting down of trees for charcoal) attributed to the increased population is immense in the district, resulting in serious soil erosion and land degradation.

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**Photo 4.2:** Young farmer holding a plant traditionally known as *mahata* (*Tragus berteronianus*), used as an indicator for soil crops suitability.

## 4.4. Factors influencing tillage practices

### 4.4.1. Experience with weather and climate variability changes

Community representatives reported that in recent years they have experienced short rain seasons and at times experience sporadic rains. They reported on prolonged dry seasons that have affected their farming practices quite significantly. They indicated the change in weather affects the application of traditional tillage practices as they are compelled to mainly use swallow tillage, which they feel it is the best practice in terms of securing moisture storage during short rains. It was indicated that the change in weather impacted crop production and availability of other critical ecosystem services such as water. For instance, it was reported that the change in weather has caused a shortage of crop yields and eventual hunger and famine. As a result, Mpwapwa has been one of the districts experiencing food insecurity and hence requiring regular food relief. Participants noted that change in weather (resulting in drought and floods in different seasons) has caused water shortages due to destruction of water and sanitation systems, consequently impacting community members. School attendance was also affected, leading to dropouts because school children lack meals to sustain them while at home and in school. More and more other parents are being compelled to migrate to other places within and outside the Mpwapwa district in search of food for their families.

## 4.4.2. Diseases and pests

It was reported that crop diseases and pests has been one of the major issues challenging farming in both districts. Famers linked eruption of diseases and pests with the change of weather, as they usually experience them during short rains and prolonged dry seasons. *Nguruchila* was identified as the most harmful disease in the villages studied in Mpwapwa district, as it results into significant decline of production of millet and maize.

In the Usambara Mountains, a common pest is milkweed locust that is known as ngeda in the Sambaa vernacular, which has been noted as a destructive insect that destroys crops during dry season, and has prevailed in recent years. When the destructive insects invade an acre of cassava they reduce both the quality and harvest let's say from 10 to 8 bags. If an acre of maize is invaded by destructive insects the quality and harvest will decrease to 6 or 2.5 bags.

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**Photo 4.3:** Milkweed locust *ngeda* as a destructive insect used to be controlled through ILK.

Frequent eruption of these pests has been linked to the abandonment of ILK and practices. Community representatives mentioned that up until 1990 in the Usambara Mountains especially in the West Usambara, there was an indigenous practice called "*hande*" which was used by elders to control the eruption of pests. Elders used to prepare a concoction of trees and put them in water then use the water to spray onto different farms. This resulted in fewer pests and hence more crop yields, an outcome that is not occurring now.

Farmers named a range of diseases/pests and crops mainly attached by such diseases as presented in **Table 4.3**.

**Table 4.3:** Crop type, diseases/pests and their perceived causes and effects

| Sn. | Crop type | Pest/disease Local name | English name | Cause | Effects |
|---|---|---|---|---|---|
| | Groundnuts | *nguruchila* | Fungus | - Prolonged sunny days/ shortage of rainfall<br>- Long grasses in the farm | Inhibits proper growth of nuts on plants |
| | Millet | *manghwilili* | | Prolonged sunny days | Kills millet grains before they are ripe, forms a black powder-like cover which tastes bitter |
| | Maize | *vidunha* | Straiger | Prolonged sunny days | Pests eat corn stem and grains before ripe |

### 4.4.3. Change in weather and transfer of ILK to youth in the Mpwapwa district

It was revealed that the changes in weather experienced in the Mpwapwa District have provided lessons and this is being used as an opportunity to transfer indigenous knowledge to the youth. This is done by the elders informing and educating the youth about the danger of cutting down trees and forest/bush fires. In connection to this the youth are taught about various ways of preventing soil erosion and degradation. Simulation of tillage and conservation practices were mentioned as the main approaches used to pass on the knowledge, which is done by practicing interventions and observing.

## 4.5. Tracking ILK for biodiversity and ecosystem services in Usambara Mountains

In the Usambara Mountains, literature has reported various roles of ILK in biodiversity and ecosystem services management. Existence of ILK in relation to the biodiversity and ecosystem services as reported in the literature needed verification by community members residing in these areas. Two major ILK practices validated by communities in the area include the sacred forests and the traditional selection of tree species for various uses as detailed in Bwagalilo *et al.* (2015) and Kweka (2004).

### 4.5.1. Sacred forests and other traditional practices

Although in the past the sacred forests used to exist in the Usambara Mountains, at the moment they no longer exist. In the past, there was one in Kimbo village where elders used to conduct traditional ceremonies by leaving a calabash in the forest. If they found the calabash in the river the following day, that would symbolize acceptance of their prayers. The practice of using a calabash was conducted to attract rains to ensure the appropriate length of the planting season. On another occasion, villagers were strictly required to do what they intended if they went to the forest, and not anything different that they might wish to do while already in the forest. In cases where they would do otherwise, for example one intending to fetch firewood decides to fetch water while in the forest, such a person would never come out of forest as a result of changing their mind.

Elders are the only people who were allowed to visit sacred forests to conduct traditional ceremonies. Examples from the Usambara Mountains include traditional restrictions to access the forest in which the fear limited people's accessibility to the forest which contributed to some forest to remain intact, reduced biodiversity loss enhanced all categories of ecosystem services. Another example of ILK validated during this meeting is the tradition of selecting tree species for various uses.

Regarding water resource use, in a forest there was a point away from a sacred area where people were allowed to fetch water. With time, sacred areas were abandoned due to religious reasons. People in the Usambara Mountains have retained ILK and practices for water harvesting, ndiwa and nkunisa, which are traditional harvesting techniques such as water wells or constructed water reservoirs, which have been reported to be useful in crop production in the mountainous areas during dry seasons.

Another practice that is still in use as confirmed during the meeting is the construction of traditional houses. Traditional houses are still in use because they are affordable. The disadvantage of traditional house construction is that they are not durable and hence the frequency of cutting trees for reconstruction is high. In modern times, forests are used for construction, woods, poles and ropes. Construction of houses which depends on the forest was very selective to certain types

of tree species. Some tree species which were not used for construction of houses as mentioned in Bwagalilo *et al*. (2015) include *msambia* (*Sispela* spp), *mwiza* (*Bridelimicrathesi*), and *mnawia*; some of these were believed to be friendly to snakes. This has resulted in maintaining these trees, and hence generate a direct link to biodiversity conservation that as a result has contributed to the enhancement of all four major categories of ecosystem services.

### 4.5.2. Population increase and natural resource use

In the study areas, community representatives mentioned population as one of the factors that has resulted in the diminishing roles of ILK in biodiversity and ecosystem services management. Two factors were identified as contributing significantly to population increase: birth rate and migration. Population increase has affected the way people perceive traditional norms and customs and their conduct. For example, there was one mountain hill which was used as a sacred area in the past; in recent years due to increased population, people are conducting livelihood activities including farming activities there, which has completely removed the traditional role of the hill. Due to the increased population, more people have been looking for areas to practice agriculture, hence they have decided to use even those areas that were respected as sacred places. Moreover, population increase has also impacted on natural resource use, for example through forest destruction and destruction of water resources.

### 4.5.3. Climate variation

Community representatives in the Usambara Mountains are aware of the impact of climate variation and that it is causing a number of problems. Problems mentioned include variation in rainfall in the study areas, drought that has resulted into drying of some rivers, as well as eruption of diseases that are affecting both humans and plants. Several quotes have been documented showing how community representatives link climate change to their day-to-day lives and also the availability of ecosystem services:

> *Due to climate change, rainfall patterns have changed, 2015 was a bad year because of little and delayed rainfall / In 1989 there used to be three rain seasons in a year, first in February/March, second in July, and third season in September/October, which allowed us to plant maize and rice three times a year. But recently there is only one rainy season whereby maize and rice are all planted in one season only. Forest destruction, which includes clearing of large trees, has led to bare land and less rain. To curb the effects of climate change, the community work together during constructions, farm preparation and planting under the system called kuwili or ngemo which is the action of inviting colleagues and neighbours to assist you for farm preparation in a day, and after that when they come back to your house you prepare food for them for it.*

## 4.6. Traditional leaders and other actors of influence

### 4.6.1. The role of traditional leaders in enhancing soil productivity and ecosystem services

It was interesting to note that traditional leaders are still recognized and respected in Mpwapwa district. The farmers reported that they have chiefs (or *Watemi* as they are known in the local language). They said these people command a lot of respect and one of their key responsibilities is to set rules that should be followed and abided by the people. They gave examples of such rules as a prohibition on cutting down trees in certain areas such as water sources, and prohibiting cultivation close to water sources.

Local chiefs are also given opportunities to advise local government officials on issues related to agriculture and conservation. Farmers believe that the chiefs are gifted with spiritual powers and they could use these powers to address some of the challenges critical to the community. They gave the example that their Chief/*Mtemi* (named Stephano Mapya) once gave a special prayer (taboo, or *tambiko* in Kiswahili) to a water source in the Chinolo area in Kisokwe village. They reported that since then the water source has never run dry and to-date people continue enjoying water from that source. Clearly such beliefs have been quite useful in managing critical natural resources in the past and conceivably they are worth nurturing.

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**Photo 4.4:** Source of water that is traditionally governed

## 4.6.2. The role of government, local authorities and community organisations

The Government has introduced some initiatives to improve the value and availability of ecosystem services. Examples of these include the local government bylaws that demand people not pollute water in the rivers, i.e. not allowing people to take baths or wash clothes and dishes on the river banks. Other laws prohibit cultivation within 60m from the river bank or source of water.

It was reported that local authorities are helpful in influencing soil and crop productivity in that they work closely with the farmers. In the course of doing so, local authority officials and particularly extension officers provide extension services including education and other services such as provision of seeds and pesticides to farmers.

Non Governmental Organizations (NGOs) and Community Based Organizations (CBOs) have also played a role in improving the value and availability of ecosystem services. In the Usambara Mountains, some of the CBOs include a registered conservation CBO called *Umoja wa Wakulima hifadhi Mazingira Kihuhwi na Zigi* (UWAMAKIZI), which is financed by the Tanga Urban Water Supply (TANGAUWASA). Both types of organization focus on restoring rivers by planting trees surrounding water sources. They also encourage traditional agricultural practices such as using ridges to restore water moisture. The Tanzania Social Action Fund (TASAF) and the Tanzania Forest Conservation Group (TFCG) are organizations that have contributed towards forest conservation and social services provisions such as health and education. This shows that there are various actors in the area that are addressing issues related to biodiversity and ecosystem services management.

It was noted that there are almost no NGOs working in Kisokwe village in Mpwapwa district. However, farmers mentioned the International Small Group and Tree Planting Program (TIST) as the only project they know – under the Anglican Church it has been working with villagers and supporting them in tree planting. No development agencies and private investors working in the area were noted.

### 4.6.3. Other human activities reducing/affecting local community's application of ILK

The participants mentioned a number of other human activities such as charcoal making, logging/lumbering and quarrying, noting that these have clear implications and impacts on the use of indigenous knowledge as they destroy vegetation and water sources. They also said there is now a clear shift from farming to non-farm and off-farm income-generating activities, hence less attention to traditional tillage practices. This shift was attributed to the emerging off-farm activities such as charcoal making being source of more and "quick" money as compared to farming. For instance it was pointed out that a small size bag of charcoal sales between TZS 5,000/ (USD $2.50) and 10,000/(USD $5) and this could be obtained within a relatively short period of time.

Shockingly, farmers reported that farming previously used to be their primary economic activity, but in recent years charcoal making has become the main economic activity in Kisokwe village with farming now second. Both genders are involved in charcoal making; however, they noted that the distance to where they obtain wood/trees for charcoal production is ever increasing, implying that this activity is also becoming costly. Charcoal making, which clearly implies wanton tree cutting and clear-felling, could provide a clear explanation for the dominating environmental problems in the Mpwapwa District and Kisokwe village; notably rampant soil erosion, stream sedimentation and poor crop harvest.

## Conclusion and recommendations

The situation on the ground suggests that the traditional practices, indigenous knowledge and the role of traditional leaders in land conservation and management are dwindling, and they are likely to demise if the status quo is maintained. It is important therefore that such knowledge, practices and skills are restored where they are no longer in use, and enhanced where they are practiced but not effectively. Having the practices and knowledge well documented is critical if they are to be properly disseminated. Equally important, translating the documented practices into national and local languages could be even more helpful not only to the local community but also to researchers and the nation at large.

An initiative that is called for is to make ILK practices sustainable through integrating them into the existing modern farming interventions and perhaps into the existing local and national policies. Apart from promoting these traditional tillage practices; it is equally important that capacity building initiatives are given priority by the responsible authorities in the Mpwapwa district in terms of awareness creation and training on improved land use practices, notably Soil and Water Conservation (SWC) measures such as ridging and terrace farming. If judiciously implemented, such measures can help a lot in addressing the problems of soil erosion, sedimentation and increased farm production and enhance the traditional tillage practices. This contribution therefore proposes a detailed study that quantifies the impact of the erosion of ILK in the biodiversity, ecosystem services in relation to the wellbeing of the communities in these areas.

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# 5. Savoirs et pratiques traditionnels et locaux en agroécologie et conservation de la biodiversité : zones forestières du centre et sud Cameroun

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## English Abstract

### Traditional and local knowledge and practices in agroecology and biological conservation: A case study in the Centre and South regions of Cameroon

This case study documents the local and traditional knowledge and practices in agroecology in the forest areas of Cameroon. In these regions, forest-dependent communities practice forest agriculture (commonly known as slash and burn agriculture) for agricultural production – based on agricultural land uses, fallows, tree crop plantations and forests, ensuring social control of lands and resources and the mobilization of financial resources for family livelihoods. Building on the agro-ecological practices prevailing in the Centre and South regions, and on the basis of theory, observations, interviews and participatory system analysis through a workshop with the custodians of traditional/local knowledge and agro-ecological practices, the study explores their socio-cultural roots and clarifies key points which would allow for new interactions in decision-making between scientific responses and indigenous and traditional knowledge and practices to support agro-ecological resilience. The main findings are summarized as follows:

#### On the social representation of the concepts of knowledge and practices in agroecology

- The concepts knowledge and practices can have polysemic meanings in the Fang-Beti-Bulu, Ossananga and Bassa languages compared to the French language; so there is a challenge of intercultural communication.
- *Fëg* refers to an intuitive ability, prudence, foresight to insight, more related to self-organization, and self-projection in the unknown future and its realization, while *akeñ* mostly related to the practice, appropriation of innovations and know-how. *Akeñ* and *fëg* are complementary when used to solve problems of their environment at the local time-scale, as a means of enhancing resilience. To do this, it is crucial to understand the state of knowledge on adaptation; to revive the debate on *fëg* and *akeñ* as a means for adaptation.

- Reading the weather allows one to interpret future changes in the environment. Therefore, anyone in the local community who can understand the signs and knows how to interpret them, can organize their lives in consequence.
- The past is lost, and yet, it is evocative. Take into account the past to live the present and predict the future. These observations allow us to reconcile the past, present and future.

## On land degradation and restoration

- The degradation of land and its restoration are part of the life cycle of the land, where tension is embedded in the dynamics of soil fertility through the forest crops/fallow forests conversion cycle.

Soil fertility is one of the key challenges in achieving life objectives and livelihoods strategies. The practice of leaving fallow land is one of the main strategies used to restore the fertility of the soils; each household uses a pool of land in order to maintain a spatio-temporal scale of agro-ecological sustainability and resilience through the conservation of forest species, also bearing in mind the restoration of lands and local species.

- Farmers use a multi-criteria approach to manage soil fertility in order to maintain a threshold of balance through the forest-culture-fallow-forest conversion cycle. To achieve this, and on the basis of its natural capital, they combine several factors such as: the age of the vegetation, previous use of the land, and bio-indicators of soil fertility including the soil color, the activity of worms on the lands and the presence of other indicators of soil fertility.

## On the conservation and sustainable management of agricultural biodiversity

- Agricultural biodiversity includes all plant and animal species that rural households use in their living environment for farming. More than 20 species of plants can be combined in a single mixed field; this diversity is justified by risk management through combining varieties of the same species with complementary agronomic and bio-ecological characteristics.
- Conservation and use of agricultural biodiversity evolves in response to life objectives, the definition of well-being, agronomic quality, multiple uses, market needs and knowledge on coexistence between crops and other plant species at the spatio-temporal scale.
- Crops such as peanuts (*Arachis hypogea*), cassava (*Manihot esculenta*), the plantain banana (*Musa* sp.), cocoyam (*Xanthosoma sagittifolium*) and maize (*Zea mays*) are significant for well-being and livelihood mobilization strategies.
- Only the forest species with multiple socio-economic uses or specific uses are kept for agricultural use and ecological succession.

## On the management and control of invasive species

- Strategies to manage invasive species are part of the environment in which traditional knowledge and practices are evolving, and are applied as part of agroecological practices.
- Invasive species are represented by more than 20 plants (mainly herbs and shrubs) and animal species (mainly insects) with a few plants and insects for which the origins are more or less known.
- Some invasive species appear to have both positive and negative impacts; the magnitude of impact is variable depending on the environmental context, the type of agricultural land use

and former use of the land. The example of *C. odorata* has advantages and disadvantages that may contradict an absolute definition of invasive species.

- Management strategies to control invasive species depend on local knowledge regarding their ecology, and the nature and magnitude of their impact on the preparation, maintenance and harvesting of farms, and the fallow system.

### On environmental and climate uncertainties

- Environmental and climatic changes are perceived through the behaviour of local bio-ecological indicators including weeds, shrubs insects, animals such as birds and trees.
- Local indicators are used to interpret changes in order to predict and anticipate uncertainties associated with environmental and climate changes; the seasons and weather are the determining factors for the organization of socio-economic activities necessary to achieve life goals.
- Adaptation actions are undertaken in response to environmental and climate uncertainties, and are applied depending on the nature of the impacts and the knowledge of their causes.
- The case study shows that the articulation of the agricultural cycles to agro-ecological units is based on an integrated "agroforestry" approach combining food crops, domestic fruit trees and non-domesticated resources (trees and other forest products). This approach is the foundation of the resilience of indigenous and traditional agro-ecological systems. Key points have been listed that could mark a new era in the valuation of traditional knowledge in a context dominated by the interest-based approaches at the expense of the rights-based approaches for the sustainable management of biodiversity and life: a planetary challenge.

## Résumé

Cette étude de cas documente les savoirs, connaissances et pratiques indigènes et traditionnelles en agroécologie Dans la zone forestière du Cameroun, les communautés riveraines des forêts pratiquent l'agriculture de forêt (communément appelée agriculture itinérante sur brûlis) pour la mise en valeur des terres (s'appuyant sur les champs, jachères, plantations et forêts), assurer le contrôle social des terres et des ressources et la mobilisation des moyens d'existence nécessaires pour la subsistance familiale. Prenant appui sur le cas des pratiques agro-écologiques dominantes dans les régions du Centre et Sud, et sur la base de la théorie, l'observation, des entretiens et d'un atelier d'analyse participante avec les détenteurs de ces savoirs et pratiques, l'étude explore les racines socio-culturelles des savoirs et pratiques appliquées en agroécologie et dégage les points d'attention qui permettraient d'actionner de nouveaux rapports et de nouvelles démarches dans la prise de décision entre les réponses scientifiques, et les trajectoires des savoirs et pratiques traditionnels et locaux d'appui à la résilience agro-écologique. Les principaux constats se résument ainsi :

- **La dégradation des terres et leur restauration** font partie du cycle de vie du foncier dont la tension se joue sur la fertilité des sols. La pratique de la jachère est la principale stratégie utilisée à l'échelle du paysage pour assurer la durabilité et la résilience des agro-écosystèmes alors qu'à l'échelle de la parcelle, les pratiques de régénération assistée des espèces forestières ayant une portée sur le processus de restauration des terres sont souvent mises en avant.
- **Les stratégies de conservation de la biodiversité et son utilisation durable** sont déterminées par une combinaison des facteurs, y compris la définition des objectifs de vie qui vont être croisés avec les potentialités en ressources naturelles ainsi qu'une diversité d'espèces sauvages et cultivées ayant des semences de bonne qualité, la dotation en espèces d'arbres à usage multiple, le statut de la propriété foncière coutumière foncière et des besoins du marché.

- **Les espèces invasives** font partie de l'environnement dans lesquels se développent les savoirs et les pratiques en agroécologie. Elles sont représentées par une vingtaine d'espèces végétales, animales dont les moyens de contrôle dépendent de la nature des impacts et de leurs impacts sur la préparation des champs, leur gestion y compris les phases d'entretien et de récolte, et la mise en jachère.
- **Les indicateurs locaux** mettant en avant le comportement des insectes, de certains oiseaux et des espèces d'arbres utilisé pour interpréter les changements environnementaux afin de prédire et d'anticiper sur les incertitudes liées aux changements environnementaux et climatiques.
- L'étude de cas montre que l'articulation des cycles agricoles aux unités agro-écologiques est fondée sur **une démarche « agroforestière » intégrée combinant à la fois les cultures vivrières, les arbres fruitiers domestiques et les ressources non domestiquées** (arbres et autres produits forestiers). Cette démarche est le fondement de la résilience de systèmes agro-écologiques indigènes et traditionnels. Les points d'attention énumérées pourraient marquer une nouvelle ère de valorisation des savoirs et traditionnels dans un contexte dominé par les approches sur les intérêts au détriment des approches fondées sur les droits pour la gestion durable de la biodiversité et de la vie, un défi planétaire.

# Introduction

## 5.1. Background

Le discours sur la crise environnementale et climatique globale est caractérisé par une perspective bio-centrique dont quelques facies sont :

- la perte de biodiversité et la déforestation en milieu tropicale ainsi que leurs impacts sur le changement climatique ;
- l'agriculture forêt (classiquement appelée agriculture itinérante sur brûlis) est l'un des agents du déclin de la biodiversité; et
- la séparation spatio-temporelle des forêts, des aires protégées et des espaces agricoles en unités distinctes pour la recherche et gestion sur les plans administratif et conceptuel (Instone 2003a, 2003b ; Mala 2009).

Pour répondre aux défis énoncés par cette approche bio-centrique et contrairement à un univers complexe d'agriculture de forêt, des technologies « simplistes » ont souvent été proposées depuis des décennies mais leurs impacts restent limités. Pour surmonter ces limites, il y a l'urgence à questionner la pertinence des démarches actuelles et d'innover à travers, une réévaluation du rapport entre les connaissances et l'action ; ces démarches requièrent de la flexibilité et une co-construction des savoirs et innovations des systèmes agro-écologiques.

Le Bassin du Congo est marqué par la persistance historique et culturelle de l'agriculture de forêt -encore appelée agriculture itinérante sur brûlis, d'une part, et par les contradictions entre la pertinence des technologies agricoles et les évolutions des mosaïques agricoles productives, d'autre part. Ces dynamiques qui semblent avoir façonnées les frontières agricoles dans l'ensemble du Bassin, ont été documentées depuis plusieurs décennies (Forbi 2015 ; Oyono 2002 ; Diaw 1997 ; Bahuchet 1996 ; Dounias 1996a ; Balandier 1982). Le défi reste « l'actionabilité » de certains résultats dans la conception et le développement d'espaces agro-écologiques durables basés sur un compromis entre la vision indigène et locale des mosaïques agricoles et le modèle scientifique fondé sur les technologies agricoles conventionnelles.

Au Cameroun, les communautés riveraines des forêts pratiquent l'agriculture de forêt pour la mise en valeur des terres (Diaw & Oyono 1998 ; Dounias 1996a, 1996b), le contrôle social des terres et des ressources (Robiglio & Mala 2005 ; Oyono *et al*. 2003 ; Carrière 1999 ; Diaw 1997) et la mobilisation de ces ressources et des produits nécessaires pour assurer la subsistance familiale (Gockowski *et al*. 2004 ; Santoir 1992 ; Leplaideur 1992). Pour atteindre leurs objectifs de vie et assurer les moyens de subsistance, les ménages ruraux s'appuient sur des savoirs et des pratiques d'aménagement de l'espace, de gestion de la fertilité des sols, de conservation et gestion de la biodiversité y compris des maladies des plantes et des espèces invasives (Mala *et al*. 2012 ; Coert *et al*. 2010 ; Bidzanga 2005 ; Bütner & Hauser 2003 ; Dounias & Hladik 1996). Ces pratiques restent insuffisamment prises en compte pour développer des innovations agro-écologiques visant l'amélioration des performances et des capacités d'adaptation paysannes.

Sous une autre perspective, les savoirs et connaissances indigènes et traditionnelles ont reçu un intérêt politique grandissant depuis la décennie 2000. La Plateforme Intergouvernementale sur la Biodiversité et les Services Ecosystémiques (IPBES) est une opportunité pour trouver des passerelles visant à actionner le rôle de ces savoirs et connaissance dans les processus de prise de décision. C'est dans cette perspective que s'inscrit l'évaluation africaine entreprise par l'IPBES, l'Organisation des Nations Unies pour l'Education et la Culture (UNESCO) et le Fonds pour l'Environnement Mondial (FEM) à travers le *IPBES/African ILK Dialogue Workshop* qui s'est tenu du 14 au 16 septembre 2015 à Paris. Afin de dégager une perspective africaine de l'évaluation, quelques études de cas ont été assignées aux experts africains afin de les documenter.

Cette étude de cas est organisée en 4 grandes parties, la première partie est consacrée à l'introduction par la présentation du contexte et étale le cadre conceptuel, la deuxième partie présente la méthodologie utilisée pour atteindre les objectifs de l'étude cas, la troisième présente les principaux constats aux thèmes de l'évaluation et la quatrième conclue.

## 5.2. Cadre conceptuel : savoirs/connaissances et pratiques indigènes/traditionnelles en agroécologie

Face à une domination des approches de gestion de la durabilité environnementale fondées sur les intérêts au détriment d'approches fondées sur les droits, dont le levier est la gouvernance, l'influence des savoirs indigènes et traditionnels peut-elle avoir encore une résonance ? Si oui, sur quels aspects peuvent-ils contribuer à l'effort global pour résoudre la crise environnementale globale à travers les objectifs de gestion durable. Diaz *et al*. (2014) ont proposé un cadre conceptuel simplifié qui établit les liens entre la multitude des parties prenantes et la diversité naturelle, afin d'encadrer la compréhension interculturelle et interdisciplinaire. Cet outil facilitera la prise en compte de savoirs traditionnels sur la biodiversité dans les processus de prise de décision à différentes échelles spatio-temporelles. Par ailleurs, l'incapacité de l'agriculture conventionnelle à répondre aux défis de la gestion durable, les approches indigènes et traditionnelles d'aménagement de l'espace ont permis de redécouvrir l'agroécologie comme une piste pour alimenter les démarches vers la durabilité agricole (Altieri 1995 ; 1998 ; Dounias 1996a). Les savoirs et pratiques qui animent ces approches intègrent les enjeux liés à la complexité aux échelles spatio-temporels à partir des observations et savoirs sur les vivants, la biodiversité et les dynamiques entre les systèmes naturels et les systèmes sociaux. La résilience semble être un style de vie et non un simple moyen d'atteindre les objectifs de vie au plan socio-économique en équilibre avec la nature.

En effet, les leçons tirées des savoirs et pratiques indigènes et traditionnels en agroécologie semblent indiquer les capacités d'adaptation des systèmes traditionnels au regard de leur contexte institutionnel et culturel, représentations sociales, et environnemental et bioécologique (Mala *et al*. 2010 ; Mala & Oyono 2004 ; Oyono 2002 ; Vermeulen & Carrière 2001 ; Diaw & Oyono 1998 ; Dounias & Hladik 1996 ; Mviena 1970). Bien que les peuples forestiers ciblés par cette étude appartiennent à la même sphère socioculturelle de Fang-Beti-Bulu (Diaw 1997), les pratiques

agro-écologiques semblent varier suivant le degré d'intensification de la gestion des ressources naturelles et l'accès aux marchés (**Figure 5.1**). Pour actionner des démarches d'innovations, les différences et les convergences sur les innovations agro-écologiques restent des défis à relever en tenant compte de la dégradation et restauration des terres, gestion durable de la biodiversité ainsi que celle des espèces invasives et leur contrôle.

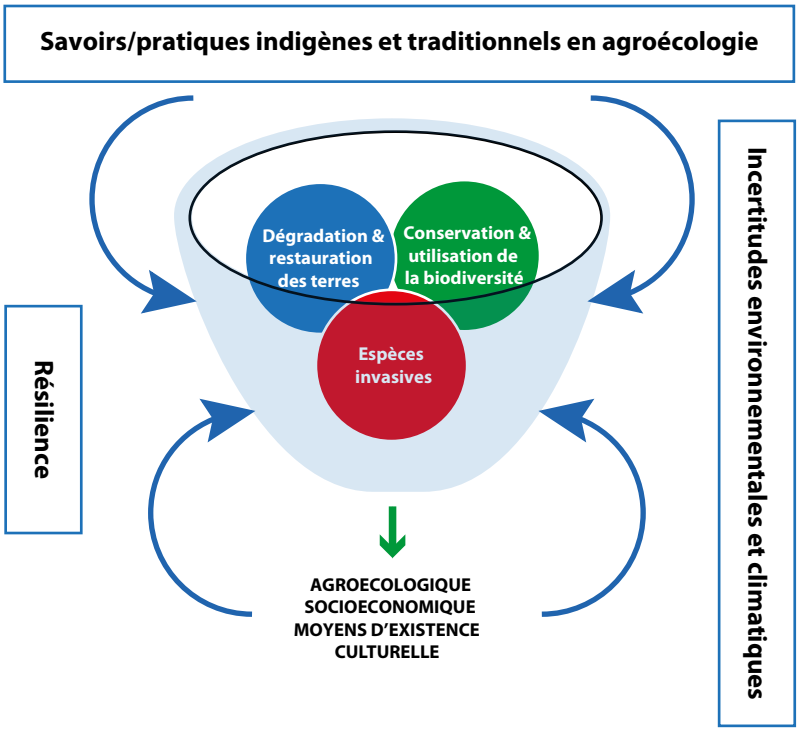



**Figure 5.1.** Cadre conceptuel sur les savoirs/pratiques indigènes et traditionnelles en agroécologie.

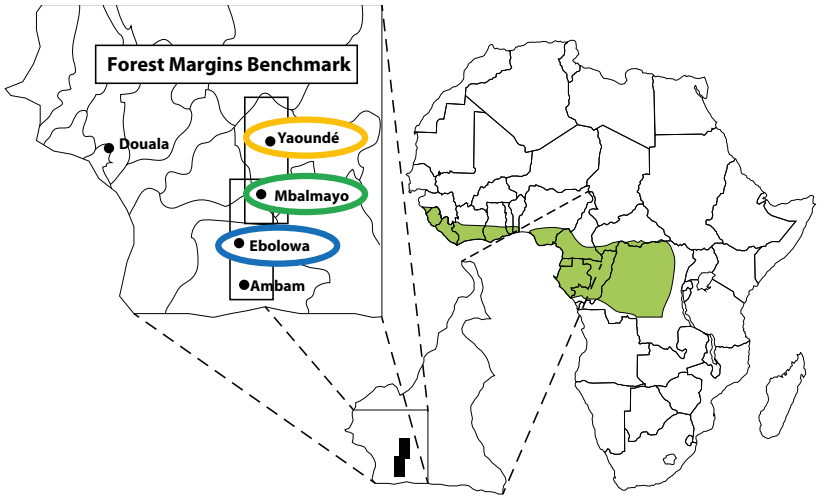
## 5.3. Méthodologie

### 5.3.1. Présentation sommaire de la zone d'étude

La zone de cette étude de cas fait partie du massif forestier du Bassin du Congo – encore appelée forêt tropicale africaine ou « forêt équatoriale » – dont les caractéristiques structurales du millier d'espèces qui la compose, ont été largement documentés (Letouzey 1979). Ces espèces sont réparties entre les forêts denses décidues, les forêts congolaises denses humides sempervirentes et les forêts biafraéennes denses humides sempervirentes (Letouzey 1985). Cette forêt couvre les régions du Sud-Ouest, Littoral, du Centre, Sud et de l'Est mais se trouve en grande partie dans les régions du Centre, Sud et de l'Est, région biogéographique appelée Cameroun Méridional ou Sud-Cameroun. La zone est habitée par les Bantou et les Pygmées Bagyéli vers la côte Littorale et les Medzang dans le Centre Ouest – Ngambe Tikar et Yoko (Dugast 1949).

L'un des groupes ethniques les plus importants est le groupe Fang-Beti-Bulu, localisé dans les régions du Centre et Sud du pays ; ils sont sédentaires et agriculteurs. Leurs principales activités socio-économiques sont par ordre d'importance : l'agriculture, la collecte des produits forestiers et non ligneux/ou la cueillette et la collecte des fruits sauvages, des écorces de plantes médicinales et les épices, la chasse et la pêche (Gockowski *et al.* 2004 ; Tchatat 1996). Ces activités ont connu des changements depuis une centaine d'années avec l'introduction des cultures de rente telles que le cacao, le café et plus récemment le palmier à huile ; celles-ci ont induit des mutations de

l'organisation et la division du travail entre les hommes et les femmes, ainsi que sur l'aménagement de l'espace forestier, la spécification et configuration des droits fonciers coutumiers (Diaw 1997 ; Santoir 1992 ; Leplaideur 1992). La femme et la terre sont liées dans la culture Fang-Beti-Bulu. Cette interaction assure la reproduction sociale de certains droits sur les cours d'eau et sur les terres à travers les différents systèmes d'utilisation des terres dans lesquels elle mène ses activités agricoles dont la culture d'arachide.




| Gradient de densité démographique et d'utilisation des ressources | | | |
|---|---|---|---|
| **Paramètres (moyenne)** | **Yaoundé** | **Mbalmayo** | **Ebolowa** |
| Précipitations mm/an | **1510** | **1643** | **1820** |
| Population rurale /km$^2$ | **14–88** | **10–41** | **2–15** |
| Distance par rapport au marché (km) | **17** | **20** | **21** |
| Durée de la jachère (années) | **3.9** | **5.4** | **7.5** |
| Surface annuellement cultivée en ha /ménage | **1.4** | **0.9** | **1.1** |

| |
|---|
| **Forêt dense semi-décidue** |
| **Forêt congolaise dense humide sempervirente** |
| **Forêt atlantique (fiabréenne) dense humide sempervirente** |

**Figure 5.2.** Zone d'étude (Adaptée de Gockowski *et al.* 2004).

L'alimentation est diversifiée avec pour base les graines telles que l'arachide, les noix de palme, les amandes de mangue sauvage, les légumes et les tubercules tels que le manioc, le macabo et l'igname ainsi que la banane plantain comme accompagnements. Les safou, goyaves, papayes, avocats ainsi que de nombreux fruits sauvages font partie de l'alimentation. La consommation de la viande et du poisson varie selon les localités. Le vin de palme et de raphia, ainsi que l'*odontol*, une liqueur indigène fabriquée à base des boissons précédemment citées, sont les principales boissons consommées.

### 5.3.2. Echantillonnage

Les participants à l'atelier ont été sélectionnées sur la base d'une approche raisonnée intégrant la diversité géo-spatiale des sites d'étude dans lesquels nous conduisons des recherches depuis plus d'une dizaine d'années, de ceux où les étudiants de notre équipe de recherche ont récemment intervenu, et enfin, de ceux où d'autres chercheurs travaillant sur les thèmes similaires et connexes. Au total, 24 personnes ont été sélectionnées et réparties dans une quinzaine de localités.

### 5.3.3. Collecte des données

Elle s'est faite à travers trois sources :

- Une revue de littérature sur les thèmes associés à l'étude de cas dans les régions forestières du Cameroun et ailleurs.
- Des enquêtes exploratoires portant sur les trois thèmes de l'étude de cas dans quatre sites dont Akok et Makak situés dans la région du Centre et Akok et Mvoutessi dans la région du Sud. Ces enquêtes ont été menées par des entretiens individuels avec trois informateurs clé par site puis elles ont été complétées par la tenue des focus groups de 10–15 personnes représentant les catégories sociales ainsi que des personnes appartenant aux groupes usagers tels que les chasseurs et les pêcheurs. Ces groupes de discussion ont duré entre 1h30min et 2h. Au terme des échanges, des critères pour la sélection des participants ont été proposés à la communauté pour le choix d'un participant à l'atelier sur la base des critères tels que la reconnaissance sociale d'être détenteur de savoir et l'habilité à communiquer et la disponibilité à y participer.
- La tenue d'un atelier diagnostic et d'échange entre les dépositaires des savoirs et pratiques indigènes/traditionnels en agroécologie. Cet atelier tenu à Sangmélima (Région du Sud Cameroun) du 5 au 8 janvier 2016, a regroupé 25 personnes dont la moitié des participants étaient des femmes au regard des liens anthropologiques et socio-économiques entre la femme et la terre dans les cultures des peuples Fang-Beti-Bulu ainsi que chez les autres peuples forestiers des régions du Centre et Sud Cameroun. Pour faciliter la collecte des données pendant l'atelier, les participants ont été répartis en en groupe de travail pour traiter de chaque thème de l'atelier. Les travaux de groupe ont été précédés de brainstorming, suivis d'une restitution en plénière, d'une discussion générale et d'une synthèse des points d'attention.

### 5.3.4. Analyse des données

Les données collectées des différentes sources ont été traitées et analysées suivant les centres d'intérêt délimités pour renseigner les quatre principaux thèmes de l'étude de cas : la dégradation des terres ainsi que leur restauration, la conservation et l'utilisation durable de la biodiversité, les espèces invasives et leur contrôle, et les incertitudes environnementales et climatiques. Ainsi, les données de l'atelier ont été consolidées sur la base des termes de références puis analysées pour le contenu et la forme, pour s'assurer de la cohérence et consistance des informations générées par thème.

Le logiciel Tropes VF845 a été utilisé pour le traitement des données secondaires et primaires textes. Le logiciel travaille en six étapes en effectuant un traitement complexe visant à affecter tous les mots significatifs dans ces catégories, à analyser leur répartition en sous catégories (catégories de mots, classes d'équivalents), à étudier leur ordre d'arrivée à la fois à l'intérieur des propositions (*relations, actants et actés*), et sur l'intégralité du texte (*graphe de répartition, rafales, épisodes, propositions remarquables*). Les résultats ont été présentés sous forme de graphe :

- le graphe en étoile affiche les relations entre références, ou entre une catégorie de mots et des références; et
- le graphe des acteurs qui représente la concentration de relations entre acteurs. Il permet de faire une comparaison visuelle du poids des relations entre les principales références.

## 5.4. Principaux constats liés aux savoirs et pratiques traditionnels en agro-écologie

### 5.4.1. Univers complexe des repères cognitifs et communicationnels sur les savoirs indigènes et traditionnels en agro-écologie

Les dialectes Ewondo, Bulu, Ba'ane et Eton disposent en commun une série de mots qui s'accommodent et se rapprochent des concepts modernes de savoirs, connaissances et pratiques. Le mots *fëg* (Ewondo et Bulu)/*pëg* (Bassa/Eton) et *akën* (Ewondo)/*atyen* (Bulu), *nneme/evu* (Ewondo/Bulu) sont souvent utilisés pour désigner les traits de caractères des détenteurs de savoirs, connaissances et pratiques. La représentation sociale de ces concepts se fait en comparaison avec leurs antonymes ainsi l'antonyme de *feg*, serait *akut*, celui de *aken* serait *asuk* et celui de *nneme* serait *esuklu* en langue Ewondo. Ainsi personnes détentrices de savoirs et connaissances sont qualifiées de *mfefeg*, *beyem-man* ou *bebobeman*. Quelques traits caractéristiques qui particularisent chacune de ces catégories sont bien décrits, cependant, il existe des traits de caractères communs aux personnes dites *aken* ou *feg*, contrairement aux personnes dites *nneme*, dont les traits de caractères relèvent plus de la sphère mystico-religieuse que de la sphère des savoirs, savoir-faire et des pratiques qu'incarnent la résolution des problèmes.

Pour les participants, les domaines des savoirs et pratiques s'organisent autour de trois sphères qui se côtoient, la sphère mystico-religieuse (*nneme*), la sphère technique (*aken*) et la sphère socio-capacitante et organisationnelle (*feg*). Les personnes qualifiées de *mfefeg* semblent être prévoyantes, prudentes, innovatrices et organisées, semblent avoir une prédisposition naturelle (innée) alors que les personnes dites *aken/atyen* ont accumulé de nombreuses connaissances, et possèdent une certaine habileté à interpréter et s'approprier des nouveaux savoirs et savoir-faire. *Feg* et *aken* sont inter-liés et à la portée de tous à travers des mécanismes de socialisation permettant de les recycler, transmettre et adapter pour répondre aux nouveaux problèmes (**Box 5.1**). *Aken* et *feg* permettent d'anticiper sur la résolution des problèmes du milieu de vie afin d'atteindre les objectifs de vie fixés : c'est un aspect de la résilience. La **Figure 5.3** représente l'univers complexe des savoirs, de connaissances et des pratiques indigènes et traditionnelles chez les Fang-Beti-Bulu et les groupes apparentés.

**Box 5.1** : Témoignage d'un participant à l'atelier de Sangmélima (5–8 janvier 2016)

« Il n'y a pas de mots équivalents à *aken/atyen* (*ewondo/bulu*) et *fêg* (*ewondo/bulu*) en français ; les mots sont une dynamique et chaque nom correspond à une mission pour un individu. Les savoirs traditionnels et locaux en écologie ou d'autres disciplines doivent prendre en compte 3 dimensions : *atyen*, qui signifie intelligence et dont l'antonyme est *assouk*, ne pas savoir faire ; *fêg*, qui signifie inné ; *nneme*, qui signifie le génie. Avant l'avènement de l'école, on avait le *nnenn*, qui correspond à la lecture du temps (hier, aujourd'hui, et prospection futur). Alors qu'*Inne* relève du *fêg*, et apporte une idée innovante et une solution constructive, le *nneme* relève quant à lui du spirituel (appropriation des connaissances invisibles pour ramener au visible). *Ayan* n'est que symbolique. Considérer les trois dimensions (*fêg*, *aken*, *nneme*) conduit à la notion de développement. De plus, ce sont des dimensions qui épousent le contexte environnemental (toutes les ressources autour de nous) ; aucun pays ne s'est développé sans considérer son contexte; aucun pays peuple ne s'est développé sans spiritualité d'emprunt ; aucun arbre n'est allé au ciel sans s'enraciner, ici les racines représentent les savoirs traditionnels et locaux. Nous devons ainsi valoriser les savoirs locaux. *Fêg* allie sagesse et intelligence, et fait écho à la capacité d'apporter les solutions face aux problèmes qui se présentent à nous. *Aken*, est la capacité de s'approprier des connaissances ou des pratiques telles que jouer du balafon. Quel est donc le lien qui existe entre *aken* et *fêg* ? C'est l'acquisition des connaissances étrangères, désigné par l'*aken*, qui nous vient d'ailleurs (exogène à notre culture). »

**S.M. Mvondo Bruno, Chef traditionnel du village Bitilyi II (Ebolowa, Région du Sud Cameroun)**

### 5.4.2. Savoirs indigènes et traditionnels : instruments de prise de décision et d'adaptation face à l'incertitude et à la conquête de l'inconnu

L'incertitude et le saut vers l'inconnu sont probablement les facteurs qui structurent l'univers des savoirs, des connaissances et des pratiques locales et traditionnells en agroécologie. Ceux-ci ont recours à toutes les données qui permettent de rentabiliser son travail (*nsol esie*) en combinant à la fois des savoirs/connaissances sur les parcelles, les types de champs, les espèces, les dynamiques des saisons, les variétés, les caractéristiques des sols et la période des semis. Ces aptitudes et attitudes sont présentées par des détenteurs de savoirs, connaissances et pratiques locales, dans les paragraphes qui suivent.

#### ▶ Représentations sociales des usages du foncier et leurs indicateurs de sélection

Ces représentations considèrent :

- plusieurs indicateurs biophysiques, agro-écologiques et socio-économiques liés aux objectifs de vie sont pris en compte dans le processus de sélection d'une parcelle pour les pratiques agricoles ;
- les usages du foncier pour l'agriculture sont basées sur une analyse multicritère combinant :
  - les caractéristiques des arbres et plantes qui déterminent le stade de maturité de la jachère et le niveau de fertilité des sols ;
  - la couleur et structure des sols ;
  - les traces de l'activité de verres de terre ;
  - les connaissances sur les précédents culturaux et
  - le statut foncier coutumier de la parcelle, sous le contrôle du ménage (*nda bôt*), de la famille étendue (*mvog*) ou du lignage (*ayong*).

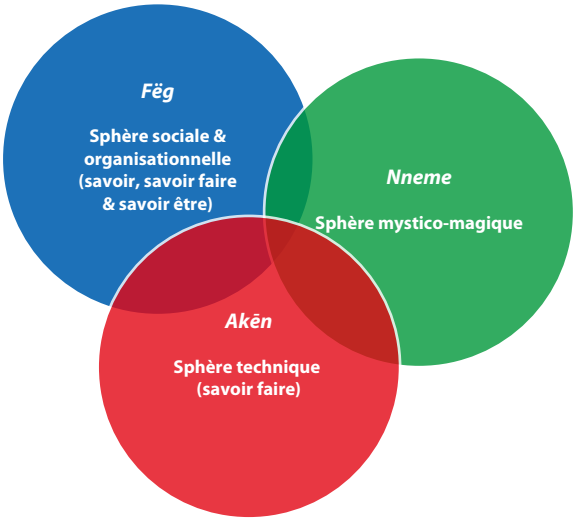



**Figure 5.3.** Univers cognitif sur les savoirs locaux et traditionnels chez les Fang-Beti-Bulu et les groupes apparentés.

#### ▶ Constats sur les facteurs influençant la prise de décision sur les parcelles à cultiver

La prise de décision des participants sur les choix des parcelles se présente ainsi :

- La localisation et le choix du site sont déterminés par une approche multicritère de la démarcation de la fertilité des sols, la distance par rapport aux autres champs, du statut de la propriété de la tenure foncière (concentration des usages familiaux ou lignage). Le choix de l'emplacement d'un champ de courges dépend de l'âge de la végétation et du niveau de

fertilité des sols ; les vieilles forêts (*Nnom ekorog* en Ewondo) ou forêts dites secondaires (*Mbiam* en Bulu) sont souvent sollicitées.

- Le type de champs et des cultures est déterminé par les objectifs de vie, les enjeux de sécurité alimentaire et l'effort physique et financier. Le choix entre un champ en polyculture ou mixte, champ de courges (*Cucumeropsis mannii*), de manioc (*Manioc esculenta*), de macabo (*Xanthosoma sagitifollium*) ou de plantain (*Musa sapientas*) dépend de l'effort à fournir en main d'œuvre pour les travaux de préparation du champ y compris le défrichage, l'abattage et la trouaison pour planter les plantains, le semis des graines de courges, la disponibilité du matériel semencier pour la banane plantain (choix des variétés de plantain).

- La présence des espèces arboricoles à épargner et conserver lors de la préparation des champs est un facteur clé. Celles-ci sont choisies selon une approche multicritère qui combine les différentes utilisations et les bénéfices écosystémiques des arbres tels que : leur influence ou leur cohabitation avec les cultures – les arbres très ombrageants ont plus de chance d'être abattus ou détruits, leur taille/menstrues – plus un arbre est grand, plus, il a de la chance d'être épargné. L'importance socio-économique et/ou des services écosystémiques semblent être déterminants et leur influence négative sur la terre et les cultures. Les espèces forestières héliophiles telles que les *asseng* (*Musanga cecropiodes*) sont souvent abattues à cause de la concurrence qu'ils peuvent présenter pour l'accès à l'eau vis-à-vis des plantes cultivées. Par contre, certaines comme les *abing* (*Petersianthus macrocarpus*) sont préservées pour leurs utilisations multiples. Comme en témoigne un participant : « Lorsqu'on faisait un champ, on n'abattait pas tous les arbres ». Chaque arbre a un nom et porte des chenilles qui les caractérisent. Par exemple, *mbing* est une chenille hébergée par l'*abing* (*Petersianthus macrocarpus*), *nlon* est une chenille hébergée par l'*elon* (*Erythrophleum suaveolens*, *Erythrophleum ivorense*), *nyos* est une chenille hébergée par l'*ayous* (*Triplochiton scleroxylon*), *nysié* est une chenille hébergée par l'*assié/sapelli* (*Milicia excelsa*), etc. La défécation de ces chenilles constitue des fertilisants. C'est donc à juste titre que ces arbres sont considérées par les détenteurs de savoirs locaux comme étant des indicateurs de fertilité de sols.

- Le choix de la période de culture est un facteur déterminant par la lecture du temps basée sur le comportement des éléments de nature. L'apparition ou les mouvements migratoires des papillons, des libellules ou de certaines espèces de termites sont utilisés comme des indicateurs pour interpréter la sévérité de la saison sèche ou de la durée de la saison pluvieuse. Ceci est illustré dans le témoigne d'un détenteur de savoirs locaux : « La lecture du temps et des saisons est faite en observant la nature à la manière de nos ancêtres n'ayant même pas fait d'études. A titre d'exemple, en observant les mouvements et le comportement social de certains oiseaux, on laissait présager si la saison sèche allait être rude ou non, ou de prédire quelle serait la durée des pluies, ou encore à quel moment, elles pourraient arriver ».

### Points d'attention sur la représentation sociale des concepts de « savoirs », « connaissances » et « pratiques » en agroécologie

Ils se résument ainsi :

- Les termes « savoirs », « connaissances » et « pratiques », peuvent engendrer des significations polysémiques dans les langues vernaculaires des participants Ewondo, Eton, Bulu, Ossananga et Bassa ; il y a un défi de communication interculturelle à relever.

- Le *fêg* renvoie à une capacité innée, amène à la prudence, à la prévoyance et à la clairvoyance. Il renvoie plus au domaine de l'organisation, se projette dans l'inconnu et sa réalisation alors que *aken* renvoie au domaine de l'appropriation des innovations et du savoir-faire. *Aken* et *fêg* sont complémentaires pour résoudre les différents problèmes du milieu dans le temps et renforcer la résilience. Pour ce faire, il est important de faire un état de lieux de la nature (pour mieux s'adapter) ; resituer le débat sur le *fêg* et l'*aken* comme moyen à utiliser pour s'adapter.

- La lecture du temps permet d'interpréter les changements futurs de son environnement. Par conséquent, celui qui maîtrise les signes, sait les interpréter, peut bien organiser sa vie.
- Le passé est perdu alors qu'il est évocateur. Bien prendre en compte le passé pour vivre le présent et prévoir le futur par l'observation de la nature.

### 5.4.3. Regards sur les savoirs et pratiques sur la dégradation des terres et leur restauration

#### Regards sur les causes et manifestations de la dégradation des terres

La dégradation des terres est perçue par les participants comme toute modification ou perte des éléments utiles (organiques et minéraux) du sol affectant leur texture et leur fertilité. Elle se manifeste par la perte de productivité, le faible rendement, la modification ou la perte du couvert végétal. D'après leur vécu, la dégradation des terres entraine souvent la diminution des terres cultivables, des espaces cultivés et des terres exploitées, l'érosion des terres arables et les baisse des rendements et des récoltes. Les participants constatent que certaines causes de la dégradation des terres sont liées aux mauvaises pratiques d'utilisation des terres associées à une agriculture intensive caractérisée par une exploitation abusive de la même parcelle, une non-rotation des cultures sur un même site et une pratique de la monoculture permanente. Par ailleurs, les causes lointaines de la dégradation des terres ont également mentionnées tels que l'abattage systématique de tous les arbres, le défrichage abusif des grands espaces et des zones favorables à l'érosion rapide et la pratique systématique du brûlis avant le labour et la culture.

#### Représentation sociale et perceptions sur la mise en valeur des terres et leur dégradation

Les perceptions des participants se résument ainsi :

- la gestion des terres ainsi que leur mise en valeur sont déterminées par leur statut de fertilité, la nature des sols et les types de végetation, l'activité de la faune sauvage ainsi que par les processus de biodégradation et décomposition des feuilles et de la litière vegetale ;
- l'aménagement des terroirs engendre le developpement de forêts, des jachères, un potentiel ligneux, agit sur la qualité du sol, des cultures, affecte la couleur des sols et ainsi que leur fertilité, et influence la nature des fruits et des récoltes; et
- la gestion des terres entretiendrait une tension permanente entre la qualité de sols, l'état de la fertilité des terres et les successions écologiques (jachères, forêts, vieilles forêts), la biodégradation de la litière et la fertilité des terres.

D'après les participants, la gestion de la fertilité des terres se trouve à l'interface entre la dégradation des terres aux causalités multiples et complexes et leur restauration. Elle se résument aux constats suivants :

- la mauvaise pratique du brûlis et la création des grandes plantations ;
- la pression démographique ;
- l'accaparement des terres par les élites et les gros producteurs en laissant les petites superficies aux paysans ;
- les pluies abondantes, le ruissèlement des eaux et l'érosion des sols ;
- le labour superficiel du sol qui favorisent une érosion rapide; et
- le faible enrichissement des plantations de rente par les arbres fruitiers et les essences exploitables.

Les principaux constats sur la jachère se résument ainsi : (i) les jachères sont déterminées par les usages du foncier qui les précèdent dont les forêts et la présence des arbres, les jachères, les vieilles jachères, les jeunes forêts secondaires, les terres, l'état de la fertilité et la végétation précédente ; (ii) les jachères en retour déterminent la diversité des espèces forestières, le profil écologique des jachères et leur catégorisation, le développement des forêts et les différents types de successions écologiques (*ekotok, afan, nfut afan*) à travers l'apparition des espèces héliophiles telles que *Terminalia superba* (*akom*) et *Triplochiton scleroxylon* (*ayous*) et (iii) la gestion des jachères engendre une tension permanente entre les différentes successions écologiques, entre les espèces forestières et les plantes héliophiles à l'échelle spatio-temporelle.

### ▶ Impacts multidimensionnels de la dégradation des terres et actions de mitigation

Les impacts identifiés par les participants ont été regroupés en 4 catégories :

- Les impacts bioécologiques des agroécosystèmes. D'après les participants, il s'agit des effets sur : (i) les sols, leur couvert végétal et la qualité qui se manifeste par le sol dénudé et ferralitique, leur dureté et des fissurations ; (ii) la disponibilité de la faune et de la flore du sol, la forte pression sur les terres et (iii) l'accentuation de la conquête des espaces dits vierges, contrastant avec la disparition de certaines espèces utiles (plantes médicinales et produits forestiers non ligneux – PFNL) et l'apparition d'une végétation ratatinée et rabougrie.

- Les impacts sur les pratiques qui convergent vers la perception d'une tendance à abandonner les savoirs locaux au profit des innovations technologiques non maitrisées par les producteurs, l'adoption des variétés améliorées au détriment des variétés locales, et une utilisation accrue des fertilisants chimiques dans les zones de haute densité démographique.

- Les impacts sur la performance des systèmes qui sont perçus sur la diminution des rendements agricoles affectant la mobilisation des moyens d'existence, l'utilisation des intrants de mauvaise qualité telles que les semences de maïs, de cacaoyer et palmier à huile, l'assèchement des cours des cours d'eaux, la prolifération des maladies, la dégradation du niveau de vie des petits producteurs (agriculture familiale) – la baisse du niveau de vie communautaire accentuant la pauvreté des ménages.

- Les impacts au niveau des rapports sociaux et des institutions de la terre, se manifestant par une recrudescence du phénomène de déperdition scolaire, des conflits fonciers entre les familles et une conquêtes accrue d'espaces dits vierges pour compenser la mauvaise productivité.

Pour le contrôle de la dégradation des terres ou de leurs impacts négatifs, les principales actions ont recours aux savoirs locaux et des connaissances actuelles et se déclinent ainsi :

Les recours aux savoirs locaux se résument à : (i) la conservation et la préservation des espèces utiles ainsi que les pratiques de l'abattage sélectif de certaines espèces ; (ii) le respect d'une durée minimale de 5 ans pour les jachères et d'une chronoséquence ; (iii) l'amendement des jardins de case en fonction des objectifs de vie et des habitudes alimentaires du ménage; (iv) l'association de plusieurs spéculations sur la même parcelle afin d'augmenter les chances pour le ménage d'atteindre ses objectifs de vie et de sécurité alimentaire ; (v) la pratique du brûlis par tas dans des zones spécifiques suivi d'une pratique du labour en profondeur ; (vi) l'utilisation des fertilisants naturels (cendres, déchets de cuisine, compost et déjection des bêtes) ; (vii) la pratique régulière du paillage naturel et (viii) la régénération naturelle assistée de certaines plantes qui attirent les nématodes (les feuilles de Maranthaceae) ainsi que le reboisement et l'enrichissement des plantations cacaoyères par des arbres fruitiers et des essences à hautes valeurs nutritives et commerciales.

Les actions ayant recours aux savoirs actuels et/ou à l'adaptation des savoirs locaux et traditionnels se résument ainsi : la promotion du système multi-strates et l'encadrement par l'approche des écoles paysannes ; la promotion de l'agriculture intégrée afin de valoriser les ressources

naturelles et maximiser la productivité des agroécosystèmes ; la conservation d'une plus grande diversité d'espèces forestières ; l'application des systèmes antiérosif et la canalisation des eaux de ruissellement, et l'adoption de nouvelles méthodes culturales.

### 5.4.4. Aperçu sur la restauration des terres et leurs actions de contrôle

La restauration des terres est perçue comme toute démarche consciente ou inconsciente visant à ramener la terre dégradée à son état initial (la rendre productive, fertile et la maintenir en état de productivité durable l'enrichir en éléments minéraux). La dégradation des terres ainsi que leur restauration sont inscrits dans le cycle de conversation forêts-cultures-jachères-forêts, qui détermine la durabilité des agroécosystèmes traditionnels. Pour restaurer les terres ou limiter leur dégradation, les paysans utilisent les savoirs locaux et les connaissances actuelles.

Les savoirs et pratiques locaux se concentrent sur la mise en jachère dont la durée est fonction de la pression foncière, du capital en terres et la pratique de la rotation culturale. Alors que la co-action de ces savoirs et d'autres formes de savoirs est une démarche en quête d'adaptation répondante à temps aux problèmes récurrent de dégradation des sols. Parmi celles-ci, on note : la pratique des jachères améliorées par les espèces fertilisantes (légumineuses) ainsi que le reboisement par enrichissement en essences à indicateurs de fertilité des sols telles que *Terminalia superba* (*akom*), *Milicia excelca* (*abang*), *Triplochiton scleroxylon* (*ayous*), *Microberlinia bisulcata* (*zingana*)… En plus, de la régénération naturelle assistée des espèces forestières ayant des intérêts socio-économiques ou services écosystémiques significatifs, la stratégie de faire des réserves en terres au niveau communautaire en concentrant ses activités dans les zones déjà dégradées, l'association des cultures vivrières avec les légumineuses telles que le haricot et le soja, la pratique de l'agriculture intégrée avec l'élevage, sont des pratiques en cours d'adoption.

#### ▶ Points d'attention sur la dégradation des terres et leur restauration

Ces points d'attention se résument ainsi :

- La dégradation des terres et leur restauration font partie du cycle de vie du foncier qui est adossé au cycle de conversion forêts-cultures-jachères-forêts ;
- La fertilité des sols est l'un des facteur clé déterminant les stratégies collectives d'utilisation de terres afin d'atteindre les objectifs de vie par la mobilisation des moyens d'existence ;
- La pratique de la jachère est l'une des principales stratégies utilisées pour rétablir la fertilité des terres ; chaque ménage utilise un groupe d'usages du foncier afin de maintenir un seuil de durabilité agro-écologique à l'échelle spatio-temporelle ;
- Pour maintenir un seuil d'équilibre dans le cycle de conversion forêt-culture-jachère-forêt, les paysans utilisent une approche multicritère pour gérer la fertilité des sols. Pour cela, en fonction de leur capital naturel en terres, ils jouent sur les facteurs tels que : l'âge de la végétation, l'utilisation antérieure de l'usage du foncier, les bio-indicateurs de la fertilité des sols y compris la couleur du sol, l'activité de vers de terre et la présence d'espèces indicateurs de fertilité.

#### ▶ Conservation et utilisation durable de la biodiversité en agro-écologique

Les stratégies de conservation et d'utilisation durable de la biodiversité sont déterminées par (i) la représentation sociale des forêts et l'espace forestier ; (ii) les trajectoires et les objectifs de vie communautaire, des ménages et des individus, (iii) les moyens et la capacité des ménages à atteindre ces objectifs et (iv) les maîtrises foncières locales/traditionnelles et les ressources naturelles disponibles.

### 5.4.5. Représentation et perception de l'espace forestier et des forêts

La **figure 5.4** représente le discours sur l'espace forestier et les forêts. Les principaux constats se résument ainsi :

- une forte concentration et convergence des relations autour du référentiel forêt et l'espace forestier. Le terroir forestier présente plusieurs facies résultant des interactions séculaires entre les systèmes humains et les systèmes bioécologiques ;
- les principaux facteurs agissant sur la forêt sont l'homme, la faune, les jachères, le *Chromoleana odorata* ainsi que d'autres espèces forestières et les sols. Ceci semble indiquer que les dynamiques forestières sont influencées par les activités anthropiques, le développement des jachères et des successions écologiques (*ekotok*, *mbiam*) et la diversité des espèces d'origine végétale, la nature des sols, les dynamiques de la faune, et…
- la forêt et les dynamiques des forêts affectent fortement sur les objectifs de vie et la spiritualité mais elles permettent de lire le temps et les saisons et influencent la fertilité des sols et la régénération forestière (**Figure 5.4**).

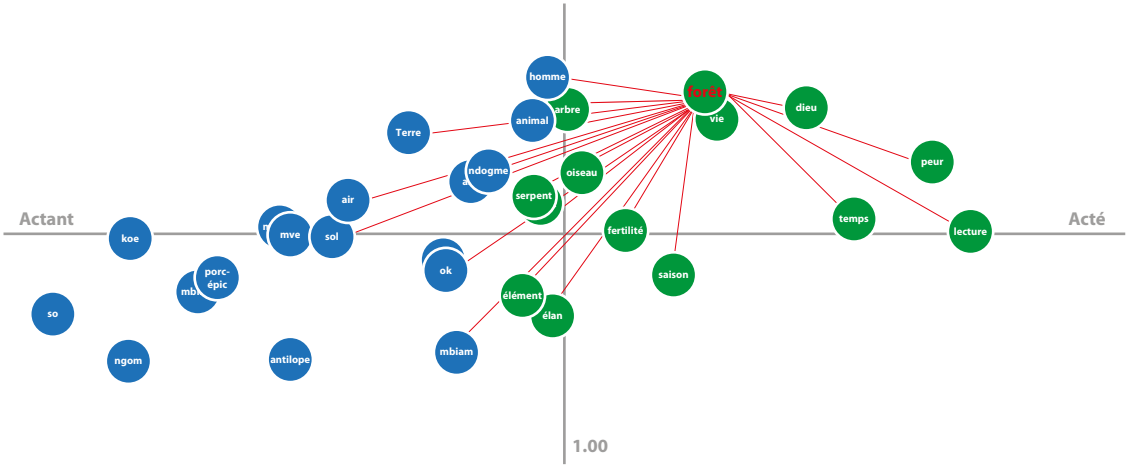



**Figure 5.4.** Représentation graphique du discours sur la forêt. Les boules représentent les paramètres. Les boules de couleur verte représentent les paramètres actés et les boules de couleur grise, les paramètres actants ; plus une boule est rapprochée du paramètre, plus la relation est forte. Les traits indiquent les relations entre la variable sélectionnée et les autres références affichées. Un trait en pointillé indique une relation peu fréquente alors qu'un trait continue indique une relation fréquente à très fréquente.

### 5.4.6. Des plantes cultivées à la biodiversité agricole d'origine végétale : sources d'approvisionnement et traits caractéristiques

#### Représentation sociale du discours sur les plantes et la biodiversité agricole

La **figure 5.5** sur le discours des plantes révèle les principaux constats suivants :

- la diversité des plantes serait influencée par les dynamiques agricoles à l'échelle spatio-temporelle, la spiritualité et le climat ;
- en retour, la biodiversité d'origine végétale influence la diversité faunique à l'échelle spatio-temporelle, les dynamiques agricoles, la lecture du temps, les objectifs de vie et la restauration des sols et …
- les plantes entretiennent des tensions spatio-temporelles entre les pratiques agricoles, les dynamiques agricoles, la spiritualité, les objectifs de vie, les dynamiques agricoles, l'alimentation, la faune et la culture (**figure 5.5**).

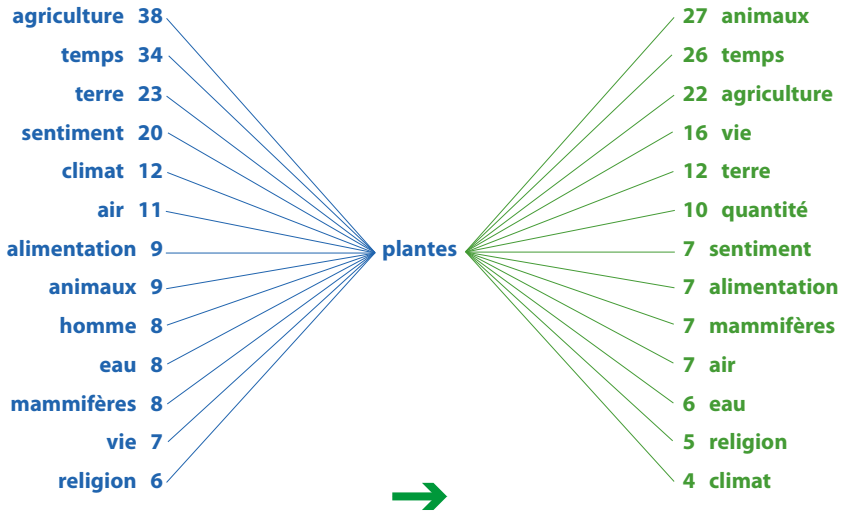



**Figure 5.5.** Représentation en étoile du discours sur les plantes et la biodiversité agricole. Les nombres qui apparaissent sur le graphe indiquent la quantité de relations (fréquence de cooccurrence) existant entre les références. Les références affichées à gauche de la classe centrale (plantes) sont ses prédécesseurs, celles qui sont affichées à sa droite sont ses successeurs.

## ▶ Aperçu de la diversité agricole et ses sources d'approvisionnement en semences

La biodiversité agricole est considérée comme étant l'ensemble du patrimoine végétal (espèces cultivées, espèces sauvages spontanées, etc.) et animal (chenilles, abeilles, vers de terre, etc.) utilisé par l'homme dans l'agriculture. L'espèce (*mvoan* en Ewondo) est l'une des expressions vivantes de la biodiversité agricole permettant de désigner et de distinguer les espèces dans un genre ; on parlera ainsi de *mvoan owondo* (variété d'arachide), *mvoan ndodoè* (variété de piment), *mvoan fon* (variété de maïs). Par ailleurs, on parlera de *mvoan abing ele* (différentes espèces au sein du genre *Petersiantus*). La biodiversité agricole est conservée pour atteindre les objectifs visés pour la consommation ménagère, la commercialisation et la distribution sociale. Elle est à la source la vie et de la production agricole.

Les semences (*mvō/mbo'o*) s'obtient à partir de trois sources : (i) les champs (*afub*) et les anciens champs (*bindi* en Ewondo ou *bulu/haň* en Basa) pour le manioc, macabo, plantain et d'autres plantes à tubercules ; (ii) les réserves de récolte pour les semences d'arachide et de légumes et (iii) d'autres paysans en fonction des affinités familiales et lignagères, auprès des familles des filles allant en mariage – on parle que du *nkalaň mvoň/bôt wé* (qui est un rituel), le transfert des semences sous forme de don d'une personne à une autre en déposant les semences par terre pour les bénéficiaires. Et enfin, par achat dans les marchés et très récemment dans les centres de recherche agricole alors que les semences/plants d'espèces forestières (en général, les sauvageons) s'obtiennent au pied des arbres des espèces rares comme le sapelli (*assié*), et le bubinga (*essingan*).

## ▶ Aperçu des espèces cultivées/variétés les plus sollicitées et conservées

Le champ mixte est l'un des usages les plus communs aux peuples de la forêt ; c'est dans cet usage que s'affirment les savoirs et les pratiques sur la biodiversité agricole. On peut dénombrer une vingtaine d'espèces cultivées dans un seul champ avec 14 espèces en moyenne. Au moins 5 espèces possèdent en moyenne 2–3 variétés, des pratiques jutifiées par la combinaison/complémentarité des caractéristiques des variétales pour réduire le risque d'échec (**Appendice Tableau 5.2**, pp. 77–79). L'arachide (*Arachis hypogea*), le manioc (*Manihot esculenta*) et le banane plantain (*Musa paradisiaca*), le Macabo (*Xanthosoma sagittifolium*) et le maïs (*Zea mays*) en sont les étalons. Cette diversité serait le fondement de la résilience des systèmes alimentaires et des stratégies de mobilisation des moyens d'existence en réponse aux incertitudes environnementales, climatiques ainsi qu'aux besoins du marché.

Les variétés locales portent toutes des noms, soit locaux, soit représentatifs d'une des qualités qui marque la différence avec les autres variétés. Les variétés de maïs, de manioc, de banane plantain et douce, d'arachide, d'igname (*Dioscorea* sp.), de légumes telles la morelle (*Solanum nigrum*), le gombo (*Abelmoschus esculentus*), le melon (*Cucumis melo*), la courge (*Cumumeropsis mannii*). Le **Tableau 5.2** en appendice présente quelques variétés d'espèces cultivées ainsi que leurs noms locaux et leurs caractéristiques bioécologiques et agronomiques. Le rendement abondant, la précocité, la tolérance à la sécheresse et la résistance aux maladies, le bon goût et les apports nutritifs, la forte demande alimentaire/commerciales et la consommation ménagère et la facilité à conserver à toute saison sont les facteurs qui déterminent la conservation des espèces. L'arachide, le maïs et le manioc sont valorisés et garants des savoirs et pratiques de la biodiversité agricole.

### ▶ Conservation d'espèces forestières dominée par les usages socioéconomiques multiples et services environnementaux

Les espèces forestières conservées par ordre d'importance sont : l'*assa* (*Dacryodes edulis*), l'*ando'o* (*Irvingia gabonensis*, l'*ayous* (*Triplochiton scleroxylon*), l'*abing* (*Petersianthus macrocarpus*), l'*ekuk* (*Alstonia boonei*), l'*ezezang* (*Ricinodendron heudelotii*), l'*ekom* (*Terminalia superba*), l'*abeu* (*Cola nitida*), *iteng* (*Pycnanthus angolensis*), *mbel* (*Pterocarpus soyauxii*) et l'*anyóe* (*Allanblackia floribunda*) et à une petite échelle, on trouve l'*essingang* (*Guibourtia* sp.), l'*adjap* (*Baillonela toxisperma*) et le *mevini* (*Diospyros crassiflora*). Cette répartition des espèces varie en fonction des localités, des utilisations multiples ou spécifiques et de la portée des usages sur les objectifs de vie pour leur maintien et conservation dans les usages du foncier (**Tableau 5.1**).

## 5.4.7. Points d'attention sur la conservation et gestion durable de la biodiversité agricole

Ils se résument ainsi qu'il suit :

- La biodiversité agricole inclut toutes les espèces animales et végétales qui se trouvent et sont utilisées dans le milieu de vie pour pratiquer l'agriculture ; la biodiversité agricole évolue en réponse aux objectifs de vie, aux moyens de subsistance, la définition du bien-être et des savoirs sur la cohabitation au fil du temps entre des cultures et des espèces végétales non agricoles.
- Plus d'une vingtaine d'espèces d'origine végétale peuvent être associées dans un seul champ mixte. Plus 5 espèces possèdent en moyenne de 2–3 variétés dont la diversité est justifiée par la gestion du risque en associant dans l'espace des variétés d'une même espèce ayant des caractéristiques complémentaires.
- L'arachide, le manioc et le banane plantain, le macabo et le maïs sont déterminants pour la stratégie de bien-être et de mobilisation des moyens d'existence.
- Seules les espèces forestières à usages multiples ou usage spécifique sont conservées dans les usages agricoles et les successions écologiques.

**Box 5.2** : Utilisation multiple des variétés locales de melon (*Cucumis melo*)

« Je cultive toujours les melons (*Cucumis melo*) dans mes champs d'arachide pour trois raisons ; (i) leurs larges feuilles me permettent de contrôler la poussée des mauvaises herbes pendant les phases de développement des cultures à court cycle, (ii) la vente des fruits de melons et parfois des feuilles me procurent de l'argent et (iii) les feuilles nous servent pour la préparation du *sangha*, un mets fait à base de maïs frais, des feuilles de melon et/ou d'amarante 'zom' et de jus des noix de palme. On peut consommer le melon comme complément ou accompagnement pour les plats traditionnels ou du terroir connus sous noms de *kpem* et de *zom*. » C'est un aliment qui est très utile pour les diabétiques.

**Julienne Edima, cultivatrice, Akono, Région du Centre, Cameroun**

**Tableau 5.1:** Principales espèces forestières sollicitées et conservées dans les champs.

| Noms communs | Noms scientifiques | Biens et services tangibles justifiant la conservation et les utilisations durables |
|---|---|---|
| *Assa******* | *Dacryodes edulis* | Essences conservées à très large échelle pour ses usages spirituels et rituels (sèves et écorces utiles ; fruits comestibles ; alimentation et commercialisation |
| *Esang/ezezan/njanjañ**** | *Ricinodendron heudelotii* | Brise vent, ombrage, alimentation-condiment et pharmacopée, cosmétique (huile) et bijouterie |
| *Ando'o/andok/ ndo'o/ ndoga**** | *Irvingia gabonensis* | Ombrage et fertilisation, brise vent, indicateur des limites de terrain médicinale et culturelle ; alimentation (amandes et fruits comestibles), commerciale (sources de revenus) ; pharmacopée (traitement des amibes et mal de dents, empêche la constipation et l'obésité, repas bio ethnique) |
| *Ayous**** | *Triplochiton scleroxylon* | Ombrage, brise vent, fertilisant et porte chenilles comestibles – feuilles fertilisent le sol et nourrissent les chenilles ; bois/planches de coffrage ; pharmacopée |
| *Abing*** | *Petersianthus macrocarpus* | Ombrage, fertilisant (les feuilles fertilisent le sol) et nourrissent les chenilles ; bois de charpente |
| *Ekuk*** | *Alstonia boonei/Alstonia congensis* | Ombrage ; brise vent ; fertilisant naturel – indicateur de fertilité ; paillage ; bois de coffrage et de chauffage ; pharmacopée ; masques Fang ; rituels Fangs ; ustensiles de cuisine (cuillères, plats et louches) |
| *Asseng* | *Musanga cecropiodes* | Ombrage, indicateur de fertilité des sols, pharmacopée (écorces et sève) |
| *Essingang (oveng)* | *Guibourtia sp.* | Essence rare et protégée, bois précieux ; pharmacopée et mysticisme |
| *Moabi (adjap)* | *Baillonella toxisperma* | Consommation des fruits et production de l'huile pour la consommation et la cosmétique, bois de menuiserie très précieux, pharmacopée |
| *Akom (fraké)* | *Terminalia superba* | Bois de charpente, pharmacopée |
| *Abeu* | *Cola nitida* | Consommation et commercialisation des fruits, usages médicinaux et culturels : utilisation lors des dots, médiation des conflits |
| *Atol* | | Bio-fertilisant et porte chenilles |
| *Iteng* | *Pycnanthus angolensis* | Fertilisant et porte chenilles, feuilles fertilisent le sol et nourrissent les chenilles |
| *Mbel/mbeya* (bois rouge et pimenté) | *Pterocarpus soyauxii* | Brise vent, fertilisant, ombrage ; rituels, danse, maquillage ; essence rare utilisée en bijouterie et artisanat ; bois de charpente ; pharmacopée, spiritualité (combat) |
| *Mevini, anyóe* | *Diospyros crassiflora* | *Allanblackia floribunda* |

**Légende : *** espèce sollicitée à petite échelle à **** sollicitée à large échelle.

## 5.5. Gestion des espèces invasives dans les dispositifs agro-écologiques traditionnels

Les participants considèrent comme 'espèces invasives', toutes les espèces animales et végétales présentes à forte densité et non maîtrisables sur des surfaces exploitables. Ces espèces peuvent être distinguées en fonction de leurs origines et leurs impacts sur la performance des systèmes traditionnels agro-écologiques, l'espace vital des ménages et leurs objectifs de vie.

### 5.5.1. Espèces invasives : origines et impacts environnementaux et socio-économiques

Les résultats ont révélé plus d'une vingtaine d'espèces invasives dont 14 sont d'origine végétale, trois espèces d'oiseaux, sept espèces d'insectes et une dizaine des petits mammifères et rongeurs. On distingue ces espèces en fonction de leur nom local, leur origine, leurs impacts et les moyens de leur contrôle. Leurs origines sont connues pour les espèces indigènes et peu connues pour les espèces introduites (Cas de *C. odorata*, *Calliandra* spp., *Inga* sp., *Cassia* spp., *Thitonia* spp.). Les impacts de ces espèces dites invasives sont à la fois positifs et négatifs selon les cas ; la gestion du compromis du rapport entre l'ampleur des dégâts et leurs aspects positifs à l'exemple de C. *odorata* (**Appendice Tableau 5.3**).

### 5.5.2. Des actions et techniques de contrôle de espèces invasives diversifiées en fonction des espèces et leurs impacts

La nature des actions et techniques de contrôle dépend des caractéristiques bioécologiques des espèces invasives. Les opérations suivantes sont appliquées (**Appendice Tableau 5.3**) :

- Pour les espèces qui se multiplient par les systèmes racinaires et les rhizomes par l'exemple, les actions se concentrent sur le défrichage, le brûlage systématique et l'arrachage jusqu'aux racines. C'est le cas de l'*esong* (*Panicum* sp.), *ozom* (*Panicum* sp.) et *ekok*.
- Pour les espèces qui se dispersent par les graines tel *C. odorata*, le défrichage, suivi du dessouchage des arbustes suivi du brûlis, est souvent pratiqué pour empêcher toute nouvelle propagation ainsi que la mise en jachère (*ikorog*). Dans les champs en phase de production (*wom, bindi*) et les plantations en exploitation, l'espèce est généralement contrôlée par des sarclages et des désherbages fréquents. Par contre, la parcelle colonisée par *C. odorata* est valorisée pour les cultures vivrières annuelles.
- Pour les espèces invasives ligneuses, ces actions portent sur leur abattage pour le bois de chauffage et leur utilisation comme tuteur pour la culture de l'igname pour *Cassia* sp. et pour l'apiculture pour le cas de *Calliandra* sp. Dans certains cas extrêmes, le dessouchage est réalisé pour éviter les repousses de certaines espèces comme *Calliandra* sp.
- Pour les insectes tels que les criquets, les paysans s'accommodent à cause de la récente apparition du phénomène, mais ils utilisent des insecticides faits à base de produits locaux ou le feu pour les éloigner. Dans les cas spécifiques, les insecticides faits à base des plantes locales toxiques (*elon, atui, ndodon, ekezek*) sont utilisés. Ils sont souvent mélangés aux produits chimiques pour détruire les insectes. Certaines espèces de termites et criquets sont consommées par les ménages ; c'est un puisant moyen de contrôle.
- Pour le contrôle des petits rongeurs, comme les porc-épics et hérissons, et des petits mammifères (tel le rat de Gambie), les paysans pratiquent la chasse. Les haies de pièges sont installées dans la limite des champs et les lance-pierres sont utilisées pour chasser les oiseaux lorsque leurs invasions deviennent permanentes. Dans des cas extrêmes, on installe les épouvantails pour simuler une présence humaine afin de faire peur aux animaux.

**Box 5.3** : Mesure de contrôle des insectes contre la culture des courges et melon

« Pour éviter les attaques des fruits de melon (*Cucumis melo*) et des courges (*Cucumeropsis mannii*) par les insectes ravageurs (*Evoug*), nous les cultivons au mois d'août pendant les années paires et en début du mois d'avril, pour les années paires. »

**Edima Julienne, cultivatrice, Akono, Région du Centre, Cameroun**

### 5.5.3 Points d'attention sur la gestion et les stratégies de contrôle des espèces invasives

Ils se résument ainsi qu'il suit :

- Les espèces invasives comprennent aussi bien parmi les espèces animales (principalement insectes et rongeurs) que les espèces d'origine végétale (principalement herbes et arbustes) dont les origines ne sont pas toutes connues;
- Certaines espèces invasives possèdent des avantages et des inconvénients qui peuvent contrarier la définition d'espèces invasives ;
- Les impacts des espèces invasives sont variables et leur ampleur dépend du type d'usage agricole et du précèdent cultural ;
- Les stratégies de contrôle et de gestion des espèces invasives dépendent des savoirs sur leur écologie et leur environnement.

## 5.6. Perceptions des changements environnementaux et climatiques, et capacités adaptatives des populations rurales

### 5.6.1. Aperçu des phénomènes climatiques (saisons) et environnementaux (état de la nature et des ressources naturelles) affectant vos activités agricoles et non agricoles

#### Représentation sociale du discours sur le temps et les saisons en rapport

Les principaux constats des représentations sociales sur le temps et les saisons se résument ainsi : (i) le temps et les saisons sont complémentaires, et ne sont déterminés pas par d'autres paramètres ; ils conditionnent la conduite des activités agro-écologiques. Le temps forge la spiritualité, influence les forêts et les dynamiques forestières, agit sur la vie des oiseaux et la lecture du temps (**Figure 5.6**) et (ii) les saisons quant à elles affectent l'organisation du temps influencée par les rythmes des

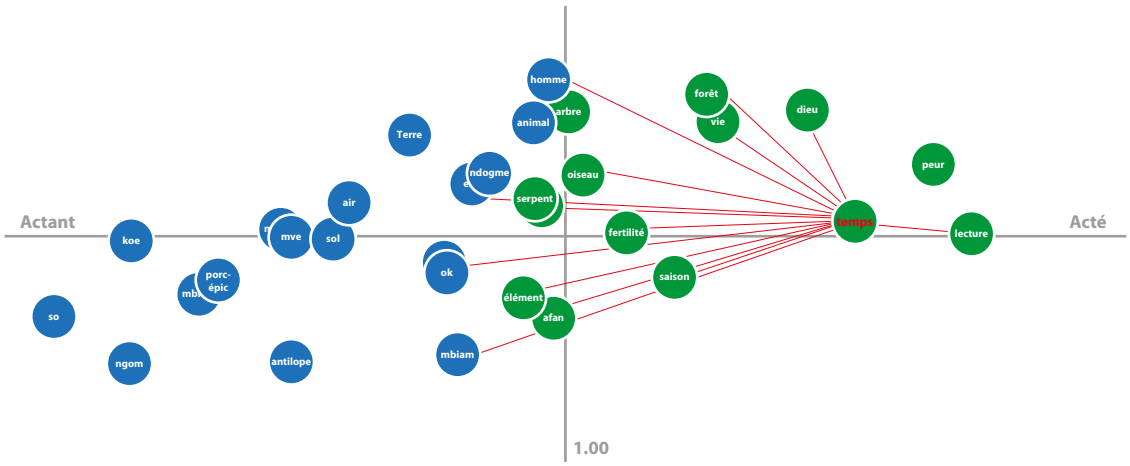



**Figure 5.6.** Représentation sociale du discours sur le temps et la gestion des ressources forestières.
Légende : (Confère Figure 5.4)

pluies qui déterminent les changements possibles ou prévisibles. Ces changements des saisons peuvent être perçus par le comportement des arbres, des insectes tels que les libellules, les termites et les papillons. En retour, les saisons sont perçues comme ayant une influence sur le rythme des pluies, les arbres, la forêt, les ressources naturelles aquatiques et terrestres (**Figure 5.7**) .

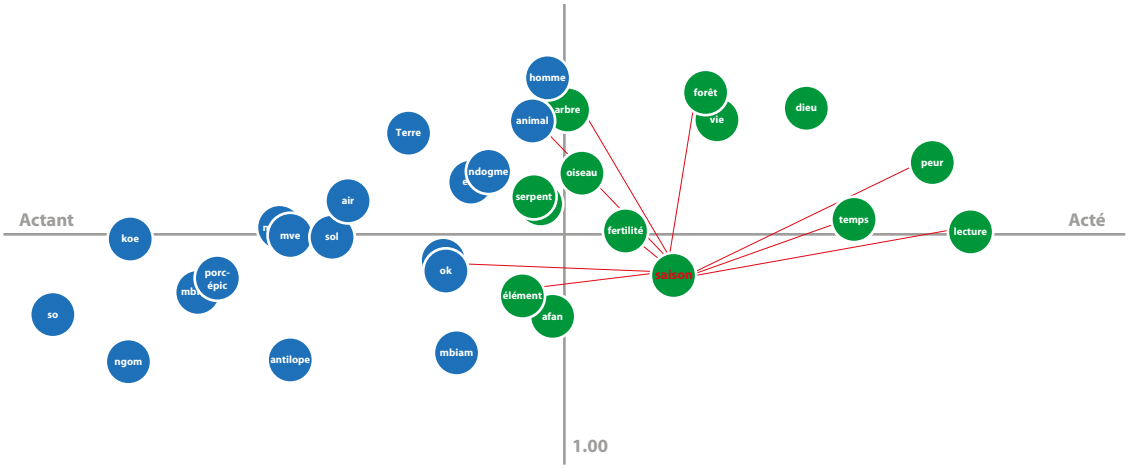



**Figure 5.7.** Représentation sociale dans un graphe étoile des facteurs agissant sur les saisons et effets engendrés par celles-ci. Légende : (Confère Figure 5.4)

### Traits caractéristiques des saisons et perception des changements environnementaux et climatiques

Les participants constatent que les quatre saisons par le passé bien circonscrites sont devenues imprécises. Le découpage temporel des saisons et leurs caractéristiques sont résumés ainsi :

- Grande saison sèche (*essep* en langue Beti) caractérisée par l'assèchement des rivières et puits, le séchage et la conservation, la pêche au barrage et au semis des champs de forêt (*essep*), les incendies et feux de brousse, la prolifération de maladies contagieuses, la disparition de certaines herbes (roi des herbes), la rareté des insectes mais la présence des « Zass, kop »;
- Petite saison des pluies (*mbu* en langue Beti) caractérisée par les pluies régulières mais leur durée devient variable, les travaux de préparation de champs, un climat propice à la renaissance de la vie, l'interdiction de la chasse, la verdure de la nature et l'abondance les grossesses ;
- Petite saison sèche (*oyon* en langue Beti) caractérisée par le grand froid, l'apparition de la rosée sur des herbes, la baisse de la quantité de l'eau, des problèmes limités pour les cultures et récolte, culture intersaison, l'humidité, les papillons chenilles, libellules et oiseaux abondent;
- Grande saison de pluie (*mveng/su'u* en langue Beti) caractérisée par le semis, l'humidité élevée, la réapparition des insectes et la végétation reprenant vie, la maturation des cultures (pousse à la récolte), les inondations et l'abondance des pluies, les vents fréquents et la chute des arbres.

## 5.6.2. Gestion des impacts des phénomènes climatiques et environnementaux sur les activités agro-écologiques

Les phénomènes climatiques et les changements environnementaux font partie intégrante des incertitudes qui façonnent l'adaptation des savoirs et des pratiques en agroécologie. Ils sont perçus par : (i) les perturbations du cycle des saisons et leur irrégularité en durée selon le cas ; (ii) les feux de brousse plus fréquents au Nord de la zone l'étude – lisière forêt-savane, et (iii) l'apparition désordonnée des indicateurs bioécologiques tels que les insectes permettant d'interpréter les changements des saisons. C'est le cas de l'apparition désordonnée des libellules (*minle*), pique-bœufs (*onyon nyak*) et hirondelles (*ndele*) dont le comportement annonçaient la saison sèche.

Les principaux impacts se résument à : (i) l'assèchement des cours d'eau entrainant l'éloignement et rareté du gibier/du poisson, le dessèchement des plantations ; (ii) le non-respect du calendrier agricole ainsi que les activités associées entrainant des baisses de rendement et la perte de certaines variétés ; (iii) la disparition ou apparition de nouvelles espèces (animales et végétales) telles que les criquets et chenilles ; (iv) la production désordonnée des arbres fruitiers à toutes saisons (safou, mangue, avocat, organe …) et (v) l'apparition et la prolifération des maladies étranges (choléra, ACV, ebola, méningite …). Ceci engendre souvent une baisse du train de vie des producteurs, une installation de la famine et de la pauvreté, et l'échec des projets/objectifs de vie fixés.

Les actions d'adaptation se résument : (i) au retard ou à l'anticipation des semis en fonction des conditions naturelles avec un renforcement de champs mixtes; (ii) à l'adoption des nouvelles méthodes culturales ainsi que des variétés améliorées, la valorisation des marécages par l'agriculture de contre saison, l'enrichissement des jardins de case, la pratique de l'agriculture intégrée; (iii) à la modification des habitudes alimentaires et l'accentuation de la chasse ; (iv) à l'ouverture des lits des rivières et le récurage des puits et (v) à la mise en place des ceintures de sécurité autour des champs pour éviter les feux de brousse.

### 5.6.3. Points d'attention sur les incertitudes environnementales et climatiques

Ils se résument ainsi:

- Les saisons et le temps sont des facteurs déterminants pour l'organisation des activités socioéconomiques nécessaires pour atteindre les objectifs de vie ;
- Les changements environnementaux et climatiques sont perçus à travers des indicateurs bioécologique locaux comprenant les herbes, les insectes, les animaux et les arbres ;
- Face aux incertitudes environnementales et climatiques, des actions d'adaptation existent et sont appliquées selon la nature des impacts et la connaissance de leurs causes.

## Conclusion

La conclusion présente ce qu'il faut retenir de chaque objectif de l'étude de cas:

- La dégradation des terres et la restauration sont des phénomènes faisant partie du cycle de vie du foncier des pratiques agro-écologiques des régions du Centre et Sud Cameroun ;
- La conservation et l'utilisation durable de la biodiversité sont déterminées par les objectifs de vie et des savoirs sur l'écologie et le potentiel socio-économique des espèces qui en font partie ;
- Les savoirs et pratiques traditionnels/locaux sur les espèces invasives et leur contrôle dépendent de leurs impacts et des compromis entre leurs impacts négatifs et les effets positifs ;
- Les incertitudes sur les changements environnementaux et climatiques font partie du dispositif de la prise de décision par les détenteurs de savoirs indigènes et traditionnels. Ils engendrent des actions et des mesures d'adaptation propres à chaque situation et à chaque contexte local.

## Remerciements

Nous remercions l'UNESCO et le FEM pour le soutien financier sans lequel ce travail n'aurait pas pu être réalisé.

Nous remercions les détenteurs des savoirs et pratiques ainsi quelques experts en agroécologie dont la participation à l'atelier du 5–8 janvier à Sangmélima a été déterminante pour préparer

ce rapport. Leur engagement, leur disponibilité et leurs savoirs et pratiques provenant d'une quinzaine de localités des Régions du Centre et du Sud ont été valorisées. Ce rapport est donc le résultat d'un effort collectif de personnes dont les noms suivent :

Dieudonné Onana Ebada, Pierre Bekoye Oden, M. L. Ebanda Doudou, Ba'aba Deepa, Virginie Mekoua Ngono, Fabien S. M. Mbassi Mbassi, Jean Georges Etele, Louise Sylvie Mezene me Mvaebeme, Jean Mbarga, Bruno S. M. Mvondo, Alix Bieme, Damaris S. M. Ngah, Laure Nnanga, Cyrille Mekoa, Julienne Edima, Barthelemy Nty Nty, Marie Louise Mewoli, Salomé Eloundou Mbone, Luc Fomo, Epse Ngo Batjom, Prisque Bassong, Jean Aimé Mbom II, Pierre Chima et Essouma Francois Manga.

Nous remercions également les détenteurs des savoirs et pratiques agrocéologiques des villages de Makak II, Akok-Feyo'op/Ebolowa, Bityili/Ebolowa, Bindalima II/Ntui, Awae/Mfou, Mengomo II/ Meyos Centre Nkometou II/Obala ainsi que tous ceux qui ont participé de loin à la production de ce travail. Un remerciement particulier est adressé à Monsieur Manga Essouma François qui a revu en premier ce rapport.

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## 5.7. Appendice

**Tableau 5.2** Traits caractéristiques des variétés locales cultivées dans certaines localités des régions du Centre et du Sud Cameroun.

| Noms commun/ scientifiques | Nom locaux des variétés | Caractéristiques bioécologiques, culturelles et agronomiques | Signification des noms |
|---|---|---|---|
| **Maïs/ *fon/mbas*** | *Zolo'* | Espèces rares, graines de différentes couleur rouge, blanche (Boa zuni) et multicolore | Etrange |
| | *Mesong me ekabeli* | Rendement favorable (2 épis par tige à 25 cm) | Dents de cheval |
| | *Fon nnam* | Tendre et doux réservé aux plats tel que : *ovuk-nsok, ngabet* | Maïs local |
| | CMS 8704/ Pannar blanc | Variété exogène | |
| | *Ngue mekii* | Couleur rouge | Hémorragie nasale |
| | *Ngoň melang* | Graines à plusieurs couleurs | |
| | *Mfūmu* | Couleur blanche, pour rituelle de bénédiction, mariage, fertilité et richesse | |
| **Manioc/ *mbon/nmon*** | *Ekobele* | Grande productivité et très doux au goût et réservé aux hautes personnalités | Sans obstacle |
| | *Zae jebo ma je/ zie ya yi me bo dzé/ nie ya bo me jé/ mibut mi yen moom/ zié ya bome dje* | Précoce (6 mois), produit abondamment/rapidement sur tous les sols | La famine ma fera quoi ? variété familiale |
| | *Evindi mbong* | Spécialisé pour la transformation (couscous et bâton) | Manioc noir |
| | *Ngone kribi* | Utilisation très variée et farineuse | La fille de Kribi |
| | *Bitoutou, mbong doua, nya mbong, komgo* | Manioc jaune | Manioc de consommation directe, variété bossu, manioc patate, manioc mère, manioc de la ville du Congo |
| | *Mbong onone* | Transformation et temps de travail réduit | Manioc des oiseaux |
| | *Ntol bikoa/ayol mbon/ntol bikoe* | Manioc amer, dur pour les bâtons de manioc pour les bâtons de manioc | |
| | *Inouma/enyouma* | Robuste, tubercule rouge, manioc de table…) qui produit en 2 ans et a les boutures blanches | |
| | 8034, 8061, 920326, 961414, 95109 | Agriculture de marché | Manioc amélioré |
| **Igname/*ikora/ bio/ekoto*** | *Mendia (bulu)/masol (eton)* | Plat réservé, rendements surs, vante assurée | Recherché |
| | *Bikoto'o (bulu)/ kalaba/bio (eton)* | Plat réservé | Tordu ; provenant du Nigeria |
| | *Bingong* | Plat réservé et utilisé dans la médicine traditionnelle | Venu du pays des fantômes |

**Tableau 5.2**

| Noms commun/ scientifiques | Nom locaux des variétés | Caractéristiques bioécologiques, culturelles et agronomiques | Signification des noms |
|---|---|---|---|
| **Plantain/*ekon/ likondo*** | *Ebang* | Précoce de 7 à 8 mois, gros doigt ; donne beaucoup de rejetons et très résilient. Très rentable | Fagot |
| | *Essong* possède 3 variétés : *mboé* avec les doigts violacés ; *amoung* ressemble à la banane douce et produit beaucoup – *zeze essong* | Très rentable | Réflexion, poids |
| | *Elat (bulu)/akoss (bulu)/elat meluk* | Réservé aux nobles, pratiques thérapeutiques ; régime se présente en forme de panier avec des doigts liés à la base et destiné aux invités de marques et de bon goût. | Rassembleur, union, lien, conciliation, solidarité, amitié et réconciliation |
| | *Nyat* | Très gros et nutritif | Buffle |
| | *Obel* | Production rapide | Cuisson rapide |
| | *Onyu nji* | Réservé aux patriarches et aux initiés | Doigts du gorille |
| | *Assang nda/assang dà* | Production précoce et hospitalité assurée, gros et longs doigts pour frittes | Une seule main |
| | *Ambane la ngoande* (ossananga) | Production rapide et esthétique | Seins de jeune fille |
| | *Alu vini* | | |
| **Macabo/ *akaba/ekabe/ lebanga*** | *Lebangle mkomo (eton)* | Production tardive | Macabo de nkomo |
| | *Efoumoulou* | Bon rendement | Macabo blanc |
| | *Evele* | Jeune feuille comestible (lombo'o) | Macabo rouge |
| | *Obeu* | Ne meurt jamais même après 5 ans | Cuisson |
| | *Makao ma boutou* (ossananga) | Production tardive | Macabo de nuit/ fantôme |
| **Arachide/ *owondo*** | *Nso kono/nso'o kono/ mfūmu* | Graines courtes et robustes à graines blanches, précoce | Couleur banche/du fantôme |
| | *Along (bulu)/oguegue (eton, ossananga)* | Court et plein | |
| | *Ngom mang/ ngon mana* | Graines de couleur rose | Fille de la maman |
| | *Minkong/mimkoŋ̌g* | Gousses longues à plusieurs graines à grande productivité | Les tuyaux, chenilles |
| | *Nyea owondo* | Tardive mais production abondante | |
| | *Megeteň/megeureg* | Gousses à 2 lobes avec séparation presque nette | |

**Tableau 5.2**

| Noms commun/ scientifiques | Nom locaux des variétés | Caractéristiques bioécologiques, culturelles et agronomiques | Signification des noms |
|---|---|---|---|
| **Cacao/*keka*** | *Salba salba* (forme allongée et rouge) | Grande production et résistante aux maladies | Cabosse rouge et longue |
| | Tout venant | Résistant aux maladies, longévité | Un ramassis de variétés |
| | F5 brésilien | Production rapide et permanente | Variété exogène |
| | *Keka dzaman* (fruits roses) | | |
| **Melon/*aboak*** | Melon-patate | Jaune et sucré | |
| | Melon sec | | |
| | Melon avec beaucoup d'eau | | |
| **Courges/*ngon*** | *Sengle* | Coque fragile et facile à décortiquer | |
| | *Ongbwè* | Amande très petite | |
| **Zom** | *Ossang* | Grandes feuilles et fruits noirs | |
| | *Nya zomo* | Feuilles amères et fruits rouges | |

**Tableau 5.3** Synthèse de résultats des constats sur les espèces invasives, leur origine, leurs impacts et les actions de contrôle.

| Espèces | Noms scientifiques | Origine | Impacts | Actions de contrôle |
|---|---|---|---|---|
| **Espèces végétales** | | | | |
| *Kodengui* (prison), *ndogmo* (prisonnier), *bokassa*, *afaribikorok* (*ewondo*)= arrache les jachères. Plante qui emprisonne les autres plantes ; indicateur de l'âge de la jachère.<br>*Ndogmo/bokassa*<br>Milieu terrestre Ndogmo, Binbè, | *Chromoleana odorata* | Construction des routes (SODECAO); Déplacement des troupeaux de bœufs.<br>Exploitation forestière.<br>RCA, Ghana introduite pour lutter contre les insectes responsables de la pourriture des cabosses.<br>Incertaine mais ayant des vecteurs de transport tels que : le vent, les bêtes (la transhumance des bœufs en particulier) et l'Homme | **Négatifs** : Modifie le paysage avec disparition de certaines espèces (*zizim, zeng, issong, ossangbwa*…) ; Retarde la régénération de la forêt dû à un envahissement rapide et incontrôlé ; accentue la pénibilité du travail (+) ; rend l'accès difficile pour l'exploitation des espèces; bloque, étouffe toutes autres espèces présentes dans ce milieu; rend les récoltes difficiles et occasionne d'énormes pertes ; sert de refuge aux animaux dévastateurs; rend la chasse difficile, disparition de la biodiversité végétale et expose les humains aux accidents.<br>**Positifs** : Fertilisant, facilite le labour, médicinal, bois de chauffage (-) ; Fertilisant naturel; antibiotique ; nourriture des sauterelles consommées par les populations, favorise la culture du manioc, arachide, maïs, patate et pas favorables à la culture du plantain. | Défrichage puis dessouchage les plantes et brûler le champ.<br>Par régulation à la durée de la jachère (*ikorog*).<br>En jachères (*kodok, ekodog*) ne défricher qu'au moment de la mise en valeur.<br>Les champs (*wom, bindi*) et plantations en exploitation : sarclages, désherbages fréquents, éviter les brûlis systématiques. |
| *Ntong, ozom* (chaume) plante herbacée ressemblant au riz, très présente dans la zone de transition forêt/savane | *Imperata cylindrica* | Inconnue par les populations villageoises.<br>Vent, transhumance | **Négatifs** : Empêche toutes plantes de pousser ; Enracinement dense et en profondeur, ce qui impose le labour en profondeur pour extirper toutes les racines, étouffe et fait disparaitre la biodiversité végétale, refuge des ravageurs<br>**Positifs** : Favorise la chasse. | Défrichage et dessouchage.<br>Brûlage systématique, arrachage jusqu'aux racines. |
| Commissaire (emprisonnement)<br>*Nwelngomb* : présence d'épines sur son tronc | *Mimosa invisa* | Incertaine.<br>Transhumance (par les bœufs) | **Négatifs** : Appauvrissement du sol, piqûres douloureuses impossibilité de travailler mais n'est pas refuge des bêtes ; n'a aucun impact positif comme le *ndogmo*. | Brûlage systématique, arrachage jusqu'aux racines |
| *Akon* (haricot sauvage) | | Incertaine, vecteurs de transport (le vent, …) | **Négatifs** : Démangeaison au niveau de l'épiderme) ; Positifs : Fertilisant, médicinal (incite le nourrisson à vite marcher) | Déracinement afin de l'éradiquer |
| *Akou* (fougère sauvage) | | Incertaine | **Négatifs** : Etouffement des graines semées ;<br>**Positifs** Favorisation du labour, comestible | Déracinement systématique |

Tableau 5.3 .

| Espèces | Noms scientifiques | Origine | Impacts | Actions de contrôle |
|---|---|---|---|---|
| *Ekok* (fougère en touffe) | | Incertaine | **Négatifs** : Appauvrissement du sol.<br>**Positifs** : Alimentation du bétail | Déracinement |
| *Nlong* (herbe de savane) | *Panicum* sp. | Avancée du désert et zonale | **Négatifs** : Envahissement, résistant, assèche le sol d'une façon rapide.<br>**Positifs** : Accepte certaine culture telles que le sésame, les arachides, facilitation de la chasse | Utilisation des parcelles selon les cultures |
| *Matrita*, fleur marguerite | *Tithonia diversifolia* | Incertaine | **Négatifs** : Envahissement, pénibilité du travail.<br>**Positifs** : Fertilisant, médicinal (purge…), ornemental (fleur) | Déracinement |
| *Okong* (papier hygiénique) | | Incertaine et zonale | **Négatifs** : Pénibilité du travail.<br>**Positifs** : Fertilisant, papier hygiène, pour le cordage (corde), fabrication des sacs en jute | Déracinement |
| *Esong (sissongo)* | *Penisetum* sp. | Incertaine | **Positifs** : Favorise la fuite des bandits | Déracinement |
| *Zisim* | *Sida* sp. | Incertaine | **Négatifs** : Envahissement ;<br>**Négatifs** : Médicinal, signe de fertilité, balaie dans les maisons et fouet | Déracinement absolu |
| **Espèces introduites** | | | | |
| Acacia (*Eléya si gormo*) arbre avec des fleurs jaunes ressemblant au *ngomntanan* | *Acacia* sp. | Institutions de recherche (IRD). Construction des routes | **Négatifs** : Envahissant, rend le travail très pénible, créé l'ombrage.<br>**Positifs** : Bois de chauffage et tuteur pour le plantain. Enrichie le sol et permet une forte productivité | Dessoucher certains arbres et brûler les souches |
| *Inga* | *Inga* sp. | Instituts de recherche | **Négatifs** : Envahissement.<br>**Positifs** : Bois de chauffe, tuteur | Coupe pour le bois de chauffe |
| *Calliandra* | *Calliandra* sp. | Instituts de recherche | **Négatifs** : Envahissant, pénible pour s'en débarrasser ; Positifs : Sert de barrière, favorisant l'apiculture | Coupe pour bois de chauffe, apiculture |
| *Moringa* | *Moringa* sp. | Instituts de recherche | **Négatifs** : Envahissantes.<br>**Positifs** : Fertilisant, médicinal, alimentaire | Introduction dans les parcelles réservées |



**Tableau 5.3** Synthèse de résultats des constats sur les espèces invasives, leur origine, impacts et action de contrôle.

| Espèces | Noms scientifiques | Origine | Impacts | Actions de contrôle |
|---|---|---|---|---|
| **Oiseaux** | | | | |
| *Okpa (ewondo), okpwa (bulu), essassé (ossananga)* | *Perdix perdix* | Sauvage | **Négatifs** : Déterrassions des graines dans les champs .<br>**Positifs** : Très bonne chair pour l'alimentation | Piège |
| *Odou* (pigeon sauvage) | | Sauvage | **Négatifs** : Déterrassions des graines dans les champs.<br>**Positifs** : Alimentation | Chasse |
| Oiseau gendarme (*ngoah*) | Sauvage | | **Négatifs** : Insalubrité dans les concessions.<br>**Positifs** : Alimentaire, signalisation de la présence des choses étranges, signale l'heure | Accommodage |
| *Ndoué* (aigle)/*obam* (épervier) | Sauvage | | **Négatifs** : Destruction de l'élevage des volailles.<br>**Positifs** : Alimentaire | Chasse au fusil et les frondes |
| **Insectes** | | | | |
| *Mbassana* (criquets puants) | *Zonocerus variegatus* | Insectes migrateurs | Dévoration des feuilles de plantes. Alimentaire | Consommation |
| *Miboul* (criquets verts) | Termites/ Migrateurs | Dévoration des feuilles diverses et des infrastructures. Alimentaire | Consommation | |
| *Foom, kam, keul (ewondo), tyel (bulu)* | Fourmis piquantes | Sauvages | Empêchement du travail en champ Affection des zones très fertile, protection de la zone | Lutte par les insecticides, nettoyage puis brulage |
| *Bibibiam (ewondo), siibem (bulu), djili (ossananga), piny (ossananga)* | Termites | Sauvage | Destruction des endroits qu'elles affectionnent, destruction des plantes. Alimentaire | Usages des plantes toxiques (Elon, Atui, ndodon, Ekezek), combiné à la lutte chimique, destruction des termitières |
| Charançon, *nfoas (ewondo), boassé (ossananga)* | | Sauvage | Destruction des plantes | Aspersion de sable pour le cas du maïs, pour le plantain le parage |

Tableau 5.3 .

| Espèces | Noms scientifiques | Origine | Impacts | Actions de contrôle |
|---|---|---|---|---|
| **Petits mammifères** | | | | |
| *Mveup/mbep/mvep ; nkouessi ; ngom* | Rat-palmiste porc épic Hérisson | Sauvages | Destruction des tubercules, les racines, les gousses. Alimentaire | Chasse, domestication |
| *Evou, odjoé, so'o, zipp (ewondo), iboulou (ossananga)* | Antilope | Sauvages | Destruction des tubercules, les chéreilles, les cabosses. Alimentaire | Chasse |
| *Pa'a, mvog, singes (koy, koe),* | Serpents, Ecureuils et singes | Espèces de la forêt et déportées | Détruisent les récoltes, ravagent les champs, rongent le maïs sur pied, manioc. Alimentaire | Chasse (Sombi, nsom), les pièges, fusils, chiens |
| Homme | | Divine | Vol, malhonnête, accaparement des terres, destruction de son milieu de vie par les pratiques peu orthodoxes | Complémentarité. Permanente |



# 6. Les plantes médicinales traditionnelles des Pygmées Bakola–Bagyéli du Cameroun : usages thérapeutiques, diversification des menaces et mesures efficaces de protection

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Trois groupes ethniques Pygmées[3] vivent au Cameroun. Le premier, les Baka, est le plus nombreux. Il compte près de 40000 personnes et occupe 75000 km² dans le sud-est du pays. Le deuxième groupe, les Bakola–Bagyéli dont nous parlons ici (Vallois, 1949 ; Dikoume, 1997), rassemble environ 4000 personnes et occupe 12000 km² dans la partie méridionale de la région côtière, plus précisément, les Arrondissements d'Akom 2, de Bipindi, de Kribi, de Campo et de Lolodorf et dans le Département du Nyong-et-Kellé. Enfin, le troisième groupe, les Bedzang, avec moins d'un millier de personnes, vit au nord-ouest du Mbam, dans la région de Ngambe-Tikar. Les Pygmées constitueraient environ 0,4% de l'ensemble de la population du pays.

L'aire de peuplement Bakola–Bagyéli, qui nous intéresse dans cette étude, est située dans le Département de l'Océan, région du Sud du Cameroun. Il existe six zones essentielles de regroupement de ces communautés Pygmées. Celle de Bipindi, la plus importante, rassemble pratiquement le tiers de la population. Puis suivent celles de Kribi et de Lolodorf, qui à elles deux totalisent le tiers de la population Bakola–Bagyéli. Le reste de la population est partagé entre

3 Le concept de « Pygmée » est utilisé ici pour des besoins de compréhension et de désignation d'un ensemble de populations qu'on ne peut désigner sans se référer à ce vocable. On sait, par exemple, qu'au Cameroun, ce terme est perçu de manière négative par les principaux concernés, c'est-à-dire les Baka, les Bakola–Bagyéli et les Bedzang. Au Congo Brazzaville, la loi le considère comme une injure faite aux populations autochtones. Les membres de ces groupes préfèrent qu'on les désigne par leurs ethnonymes. En Centrafrique, ce sont les Aka alors qu'en République Démocratique du Congo, comme au Rwanda et au Burundi, ce sont respectivement les Mbuti et les Twa, entre autres.

la localité de Nye'été et la zone Ebemvok-Akok, à cheval entre Nye'été et Akom 2 et la frange septentrionale de l'aire de peuplement qui longe le fleuve Nyong, et enfin le domaine méridional, correspondant à l'Arrondissement de Campo.

En dépit du mouvement irréversible de sédentarisation aux abords des routes et des pistes administratives et à proximité des villages des populations Bantou, qui remonte, pour certains villages déjà, à plus de cinquante ans, les Pygmées Bakola–Bagyéli gardent une vie mobile basée, de manière essentielle, sur l'utilisation des ressources forestières (Bigombé, 2002). Jusqu'à ce jour, la médecine traditionnelle est leur principal mode d'accès aux soins de santé.

Les Bakola–Bagyéli sont détenteurs des savoirs médicinaux importants pour faire face aux maladies en milieu forestier (Bigombé, 2012). La plupart des maladies sont traitées par les écorces d'arbres, les racines, les feuilles, les herbes, la consommation de certains animaux, l'utilisation des insectes et d'autres produits de la forêt, à l'instar du miel sauvage, entre autres. Dans des cas de maladies graves et difficiles à élucider, les Bakola–Bagyéli recourent aux esprits de la forêt et aux devins pour trouver les solutions appropriées.

Chaque localité a un ou plusieurs thérapeutes traditionnels qui détiennent des savoirs médicinaux pour soigner les maladies. Ils initient les jeunes de leur choix à la médecine traditionnelle et leur transmettent progressivement leurs connaissances avant leur mort.

Jusqu'aujourd'hui, aucune étude scientifique visant la documentation de ces savoirs médicinaux autochtones, ni d'identification, de valorisation et de protection des plantes médicinales essentielles utilisées n'a encore été réalisée. La présente étude constitue une première tentative dans ce sens. Elle se veut modeste et respectueuse du consentement des Bakola–Bagyéli.

Modeste parce qu'elle pose les jalons d'une recherche qui devra être approfondie, améliorée et diversifiée, dans l'espace et dans le temps. Respectueuse parce qu'elle est faite avec le consentement libre, informé et préalable et la contribution scientifique des tradithérapeutes Bakola–Bagyéli eux-mêmes. De plus, elle met à la disposition de la communauté scientifique des informations sur les savoirs médicinaux des Bakola–Bagyéli et propose des mesures de protection des plantes médicinales utilisées contre la déforestation et l'exploitation forestière illégale qui prennent une ampleur croissante dans les forêts habitées par les Pygmées Bakola–Bagyéli.

## 6.1. Les plantes médicinales traditionnelles des Pygmées Bakola–Bagyéli et leurs usages thérapeutiques

Le travail d'identification des plantes médicinales traditionnelles utilisées par les Pygmées Bakola–Bagyéli réalisé par les tradithérapeutes eux-mêmes, dans le cadre de cette recherche préliminaire, a permis de relever 92 plantes et produits forestiers utilisés pour les soins de santé chez les Bakola–Bagyéli. Les dénominations des plantes et produits forestiers identifiés ont été données en langue Bakola–Bagyéli. Mais, seules les dénominations scientifiques de vingt plantes et produits forestiers ont été identifiées. Les recherches se poursuivent pour trouver les dénominations scientifiques du reste des plantes médicinales et des produits forestiers.

### 6.1.1. Les plantes médicinales traditionnelles identifiées par les tradithérapeutes Pygmées Bakola–Bagyéli

Vingt plantes et produits forestiers dont les dénominations scientifiques connues ont été formellement identifiées sont des plantes médicinales traditionnelles utilisées par les Pygmées Bakola–Bagyéli.

| N° | Noms des essences en Bakola–Bagyéli | Noms courants | Noms scientifiques | Maladies soignées | Parties utilisées | Nature | Autres usages |
|---|---|---|---|---|---|---|---|
| 1 | *Lisseng* | Parassolier | *Mussanga trecopiodes* | Attirances, toux, mal de dents. | Fleurs, écorces et feuilles | Arbre géant | Fabrication pirogues et instruments de musique |
| 2 | *Selo* | Movingui | *Distemonanthus benthamianus* | Maux de dents, purification du lait maternel, lavages pour des cas de purification | Ecorces | Arbre géant | Construction des habitations |
| 3 | *Liguiong* | Bongo | *Fagara heitzii* | Maux des yeux | Feuilles | Arbre géant | Construction des habitations |
| 4 | *Mpoule* | Moambe jaune | *Enantia chlorenta* | Paludisme et hémorroïdes | Ecorces | Arbre de taille moyenne | Construction des lits |
| 5 | *Lande* | Fraké | *Terminalia superba* | Dysenterie amibiase | Ecorces | Arbre géant | Construction des habitations |
| 6 | *Tombo* | Dabema | *Piptadeniastrum africanum* | Lavage du ventre, traitement des complications liées à la procréation | Ecorces | Arbre géant | Construction des habitations |
| 7 | *Veeng* | Bubinga | *Guibourtia tesmanii* | Socle de la science Bakola–Bagyéli pour les maladies d'ordre spirituel | Culte des ancêtres sur son lieu d'implantation | Feuilles, écorces et fruits | Le plus grand arbre de nos forêts |
| 8 | *Ndzibondi* | Doussié | *Afzelia bipindensis* | Maladies vénériennes | Ecorces | Arbre géant | Construction des habitations |
| 9 | *Doumo* | Okan | *Cylicodiscus gabonensis* | Maux du pied, mauvais sort et douleurs de toute nature | Ecorces | Arbre géant | |
| 10 | *Liteng* | Ilomba | *Pycnanthus angolensis* | Blessures et plaies | Ecorces et la sève | Arbre géant | Construction des habitations |
| 11 | *Yabo* | Moabi | *Baillonela toxisperma* | Mal de dos et infections | Ecorces | Arbre géant | Alimentation. Ses fruits produisent une huile très appréciée dans les arts culinaires |
| 12 | *Loundi* | Tali | *Erythrophleum ivorense* | Blessures | Ecorces | Arbre géant | |

| N° | Noms des essences en Bakola–Bagyéli | Noms courants | Noms scientifiques | Maladies soignées | Parties utilisées | Nature | Autres usages |
|---|---|---|---|---|---|---|---|
| 13 | *Nzuoli* | Essessang | *Ricinodendron heudelotii* | Lavages pour des cas de mauvais sort | Ecorces | Arbre géant | Graines comestibles |
| 14 | *Schuer* | Essock | *Mal de ventre et anti poison* | Ecorces et fruits | Arbuste | Utilisée pour le vin de palme | |
| 15 | *Loulouambo* | Bahia | *Mitragyna ciliata* | Massage dans les cas de douleurs et courbatures | Ecorces | Arbre géant | |
| 16 | *Nguier* | Eyek | *Pachyelasma tessmannii* | Lavage pour des cas de purification | Ecorces | Arbre géant | Fruits en forme de fuseau sont utilisés pour la pêche |
| 17 | Miel sauvage | | | Soigne plusieurs maladies : hypertension, mal d'estomac, envoûtements, blindage blessures | | | Alimentation |
| 18 | *Mbounde* | Niové | *Staudtia kamerunensis* | Contre les morsures de serpents | Sève | Arbre géant | Construction des habitations |
| 19 | *Ndtoua* | Manguier sauvage | *Irvingia gabonensis* | Attirances | transformation des écorces en poudre | Arbre géant | Alimentation |
| 20 | *Likoka* | Azobe | *Lofira alata* | Plaies | Ecorces | Arbre géant | |

### 6.1.2. Les usages thérapeutiques des plantes médicinales des Pygmées Bakola–Bagyéli

Le système des soins chez les Pygmées Bakola–Bagyéli est complexe et diversifié. Il est essentiellement lié à la conception de la maladie, vue comme une rupture de l'équilibre avec la nature, et comme une rupture avec l'environnement social, invisible ou non, qu'il faut rétablir. Enfin, il y a des maladies causées par les sorciers, les jaloux et les méchants. Il faut alors combattre cette sorcellerie. On navigue toujours entre le monde du visible et le monde de l'invisible.

Les vingt plantes et produits forestiers identifiés permettent de traiter tous ces cas. Ils permettent de laver et de purifier des mauvais sorts, de l'infertilité et du poison. Ils permettent aussi de soigner les maux de dents, de ventre et des yeux, le paludisme et les hémorroïdes, les maladies vénériennes.

Dans ce groupe de plantes et de produits forestiers, le Bubinga (*Guibourtia tesmanii*) et le miel sauvage occupent une place importante. Le Bubinga est considéré comme le socle de la science médicinale Bakola–Bagyéli pour le traitement des maladies d'ordre spirituel. Son lieu d'implantation est un site de pratique du culte des ancêtres. Le miel sauvage, quant à lui, assume une pluralité de fonctions thérapeutiques : le mal d'estomac et l'hypertension ; et, en même temps, il protège contre les envoûtements et les attaques mystiques.

Essono Paul Hallleur

**Photo 6.1** Joseph Nkoro, tradithérapeute Bakola–Bagyéli de Nkuongio présentant le manguier sauvage dont les écorces sont utilisées pour l'attirance.

Essono Paul Hallleur

**Photo 6.2** Jean Baptiste Tsagadigui, tradithérapeute de Ndtoua, Kribi, et son asssistant, identifiant le safoutier sauvage utilisé contre le mal de ventre.

## 6.2. Des plantes médicinales traditionnelles Pygmées Bakola–Bagyéli menacées : proposition de mesures de protection de la biodiversité du massif forestier de Lolodorf

Aujourd'hui, les plantes médicinales traditionnelles utilisées par les Pygmées Bakola–Bagyéli sont menacées par la déforestation, la dégradation de l'environnement et l'agriculture. En Afrique centrale aujourd'hui, et particulièrement au Cameroun, « la déforestation est un phénomène grave et qui réclame un traitement d'urgence. Moins spectaculaire qu'en Amazonie, le recul des surfaces forestières, et en particulier des forêts primaires, est rapidement et probablement en accélération. Si rien n'est fait dans les années à venir, la fin des forêts en Afrique pourrait malheureusement se produire entre 2040 et 2060 » (Mercier, 1991).

La déforestation résulte de l'action diversifiée de l'homme sur la nature dans le but de faire du Cameroun une économie émergente à l'horizon 2035. Développer le pays passe par l'exploitation des nombreuses richesses qu'offre l'environnement. Les forêts habitées par les Pygmées du Cameroun, en général, et les Bakola–Bagyéli, en particulier, constituent des foyers où la déforestation s'accélère à un rythme très inquiétant. De Wasseige *et al.* (2009) pensent que « les causes de cette déforestation sont multiples et incluent l'augmentation de la pression démographique, l'intensification des pratiques agropastorales, l'expansion de l'industrie minière ou encore la multiplication des pratiques illégales ».

Pour le massif forestier de Lolodorf qui abrite les communautés Bakola–Bagyéli, riche en forêt tropicale humide à forte valeur commerciale, la préoccupation est forte. Selon Serge Bahuchet *et al.* (1999), « des milliers d'êtres humains y vivent et entretiennent avec ces forêts, des relations culturelles, sociales et symboliques, anciennes, intenses et profondes. Ces forêts et ces hommes ont évolué et continuent à évoluer ensemble. Leurs histoires et leurs destins sont étroitement liés ».

Cette forêt qui a longtemps été un réservoir de ressources pour la satisfaction des besoins nutritionnels, un milieu de culture et de vie sociale, fait progressivement face à un phénomène qui inquiète les populations Pygmées Bakola–Bagyéli et ne cesse d'interpeller le monde : la déforestation.[4]

**4** Sur l'analyse de la déforestation et ses effets sur les populations Pygmées Bakola–Bagyéli, lire Mimboh (Paul-Félix) ; « Les Pygmées Bakola–Bagyéli du Sud-Ouest Cameroun et la déforestation », in *Alternatives Sud, L'avenir des peuples autochtones. Le sort des*

Par définition, la déforestation est synonyme de déboisement, c'est-à-dire, l'action qui consiste à vider la forêt.

Pour Henri Puig (2001), « les écologues considèrent la déforestation comme une diminution ou une perte de biodiversité forestière. Elle correspond au passage du couvert végétal d'un état 'naturel' à un état artificialisé pouvant se traduire par la perturbation du fonctionnement de l'écosystème ».

Selon la FAO (2001), « la déforestation implique la disparition durable ou permanente du couvert forestier ainsi que le passage à une autre utilisation des terres (…). Elle inclut aussi les cas où la surexploitation et la modification de l'environnement affectent la forêt de façon telle qu'elle ne peut maintenir un couvert arboré dépassant le seuil de 10 pour cent ». Toutefois, la FAO précise que le terme : « exclut spécifiquement les zones où les arbres ont été enlevés par exemple pour en exploiter le bois et où la forêt devrait se régénérer soit naturellement, soit avec l'aide de mesures sylvicoles ».

La variété des acceptions que recouvre le terme déforestation, et donc l'imprécision de son contenu sémantique, appelle à une grande prudence dans l'emploi de cette expression. La difficulté qu'il y a à trouver une définition qui fasse consensus est liée à la réalité géographique et multidisciplinaire exprimée par ce concept dont l'emploi est différent d'un lieu à un autre, d'une discipline à une autre, et pour le cas d'espèce est fonction de la perception que se fait une communauté victime de ce phénomène.

Dans le massif forestier de Lolodorf, la déforestation bouleverse l'environnement naturel de vie des Bakola–Bagyéli. Le terme utilisé par les Pygmées Bakola–Bagyéli pour désigner la forêt est *siiguii* ou *siiguii pùhmu* exprimant ainsi les profondeurs de la forêt. Pour eux, la forêt est représentée comme un corps humain composé de la tête, du tronc et de quatre membres. Ces composantes sont assimilées aux esprits, aux arbres, aux eaux, à l'air, aux animaux, aux oiseaux, aux poissons, et enfin à l'homme, maître absolu de tous ces éléments.

Ce corps a un fonctionnement harmonisé et organisé qui définit la survie des humains et tout ce qui s'y trouve. Son dysfonctionnement met en danger la vie de ces derniers :

> *La forêt est comme le corps de l'homme qui a beaucoup de parties. Nous avons : les esprits, les arbres, les fleuves, les rivières, l'air, les animaux, les oiseaux, les poissons et l'homme qui est le commandeur de toutes ces choses pour qu'il vive bien* (Apollinaire Matsie, Bakola–Bagyéli de la forêt de Ngomanguelé) / *La forêt contrôle toute la vie des Bakola–Bagyéli. Depuis le temps de nos ancêtres, nous vivions bien en forêt. Mais, de nos jours, les Ngoumba, les Ewondo et les Bamenda sont en train de couper tous les arbres de la forêt et depuis cet instant nous commençons à ne plus vivre bien ici en forêt* (Simon Nzie, campement de Mimbiti I).

Toujours selon Simon Nzie, le chef du campement de Mimbiti I :

> *La forêt contrôle toute la vie des Bakola–Bagyéli. Depuis le temps de nos ancêtres, nous vivions bien en forêt. Mais, de nos jours, les Ngoumba, les Ewondo et les Bamenda sont en train de couper tous les arbres de la forêt et depuis cet instant nous commençons à ne plus vivre bien ici en forêt.*

En langue Bakola–Bagyéli, l'expression qui puisse définir le mot déforestation est difficile à trouver. Mais les différentes expressions utilisées dans ce contexte illustrent plusieurs idées pour mieux appréhender les représentations locales.

Généralement, ces expressions sont : *Kwélé bii léh bii siiguii* (couper les arbres de la forêt, synonyme de déboisement). *Bôhlàh siiguii* (casser la forêt), *boul'ssi siigii* (bouleverser la forêt, semer des

*premières nations*. Louvain La Neuve et Paris : Cetri-LHarmattan, 2000, pp. 189–198.

troubles dans la forêt), *ngnàm'sii siiguii* (gâter la forêt), *siili siiguii* (finir la forêt) et *yôhlà siiguii* (tuer la forêt).

La déforestation est une source de bouleversement du fonctionnement du corps humain qu'est la forêt. Perçue comme responsable du dysfonctionnement de leur vie sociale et culturelle longtemps dominée et rythmée par les liens existentiels avec la forêt, la déforestation entraîne sa mort.

Elle impacte négativement sur plusieurs aspects de la vie des communautés Bakola–Bagyéli, notamment, la dévalorisation des traditions sociales construites, entretenues et maintenues autour de la forêt, d'une génération à une autre, le bouleversement au niveau de l'occupation de l'espace avec la construction des sites d'habitat, le changement progressif de l'alimentation, l'installation de nouvelles formes de croyances, les pertes dans les domaines de l'ethnomédecine, la prise en charge de la santé, l'économie, l'art, les parures, les relations avec l'environnement. Bref, un changement de modes de vie des Bakola–Bagyéli de Lolodorf.

### 6.2.1. Origines et dynamiques de la déforestation dans le massif forestier de Lolodorf

Lolodorf se trouve en pleine forêt équatoriale. Ancienne ville coloniale allemande, elle est aujourd'hui un arrondissement rattaché au département de l'Océan et à la région du Sud. Elle fait partie de la chaîne montagneuse de Ngovayang. Cette unité administrative a une superficie de 1200 km$^2$. Ses données de géolocalisation sont de 3.23314° de latitude nord et de 10.72852° de longitude est sur une altitude de 443,40 m.

Le milieu physique de Lolodorf présente un environnement riche en ressources forestières. En dehors du fait que cet environnement ait longtemps été propice à l'agriculture itinérante sur brûlis pratiquée par les populations locales, aucune activité d'exploitation industrielle n'y avait alors jamais été signalée jusqu'aux années 1960. Il a donc fallu attendre les lendemains de l'indépendance pour voir les premières sociétés forestières occuper les forêts de Lolodorf.

Les données recensées au service d'archives de la Sous-préfecture de Lolodorf et celles collectées auprès de certains informateurs mentionnent que l'exploitation était effectuée par les entreprises forestières telles que la Société d'Exploitation Forestière du Cameroun (SAFOR) et la Société Forestière et Industrielle de la Lokoundje (SFIL). Cette exploitation s'est intensifiée dans les années 1980 avec la société Bois du Cameroun qui après changement de licence d'exploitation a procédé à la modification de son nom et est devenue la Société Forestière du Cameroun (SFOC). Par la suite, se sont installées la WIJMA, Paul Khoury (PK) et Export Industriel du Bois (EXIBOIS).

> *Dans les années 85, les travaux d'exploitation consistaient d'abord à la prospection des essences et à leur identification. Le processus commençait par une visite auprès de l'administration locale afin de s'acquitter des modalités pratiques et des pots de vin. Les communautés riveraines qui devraient bénéficier des avantages issus de cette exploitation, ne recevaient que quelques emplois, des sacs de riz, des cartons de poissons du vin et du tabac. Et parfois toute opposition des villageois face à ce phénomène était sévèrement réprimandée par l'administration ...*
>
> *La coupe sélective intervenait avec l'abattage des essences d'une grande importance. Etant donné que cette société avait une scierie à Eséka et une coupe de bois qui procédait à une exploitation en grumes et en sciages, les essences les plus prisées étaient le Bubinga, le Moabi, le Movingui, l'Azobé. La destruction de la forêt et la dégradation de l'environnement ont été considérables avec un cubage mensuel estimé à près de 8000 à 9000 m$^3$ jusqu'à sa fermeture en 1997 avec la compression des ouvriers ...*
>
> *L'entreprise forestière PK, quant à elle, a étendu ses travaux d'exploitation de l'autre côté de la route dans le massif forestier de Ngovayang à partir de Ngoyang vers Melombo. Elle a aussi évolué dans les mêmes principes. Les quantités exploitées variaient entre 5000 et 7000 m$^3$ par mois.*

Pour Paul-Felix Mimboh :

> *La forêt où vivent les Bantou et les communautés Bagyéli de Ngongo I, II et Mbango Pinda a drastiquement été exploitée par les sociétés forestières WIJMA et EXIBOIS vers les années 90. Bien*

*qu'ayant pris en compte quelques doléances des communautés riveraines avec l'amélioration du réseau routier local, l'amélioration de certains bâtiments scolaires, l'emploi de certains jeunes, le processus n'a pas échappé à la politique des sacs de riz, cartons de poissons, bouteille de vin et des enveloppes considérables aux autorités administratives en place ...*

*Les communautés locales étaient sommées sans mots dire de voir leur forêt partir en ruine. Pour les Bakola–Bagyéli qui y vivent au quotidien, la désolation n'était que chaotique. Les besoins de chasse, de pêche, de collecte et en pharmacopée commençaient par s'exprimer en manque. Alors que les avantages que ceux-ci ont pu tirer des firmes forestières furent limités, les inconvénients sont multiples. Par conséquent, la quantité et la qualité des essences exploitées demeurent inestimable ...*

De tout ce qui précède, ces témoignages ne peuvent que traduire avec certitude, la corruption bien établie dans le domaine de l'exploitation forestière à Lolodorf.

Pour Pierre Mashuer, du campement de Mbango Pinda, leurs préoccupations ne sont pas entendues. Face à cette situation, il s'interroge:

*Où devons nous vivre maintenant? Que mangeront nos enfants et nous-mêmes ? Avec quelles écorces nous guérirons-nous ? Le gouvernement et nos frères Bantou tiennent-ils compte de notre situation? Allons-nous survivre avec la disparition de la forêt ?*

La déforestation peut également être liée à l'occupation de la forêt par la population locale, par exemple pour la construction de maisons d'habitation en fonction de la taille de la population. Elle est négligeable dans les zones rurales et dans les campements Pygmées. Ensuite, la déforestation liée à l'agriculture itinérante sur brûlis est la plus grande forme de déforestation longtemps pratiquée dans le massif forestier de Lolodorf. Les superficies utilisées sont considérables et non négligeables, vu le nombre d'espaces sollicités en moyenne par an pour les activités agricoles. Il faut également considérer la déforestation liée à la réalisation des routes et des espaces de loisirs : construction des aires des jeux, des tribunes, des hangars et des routes.

La déforestation liée aux grandes plantations industrielles est réalisée par les activités des entreprises et des firmes multinationales dans le cadre des activités agricoles industrielles. Les espaces mobilisés peuvent atteindre des centaines d'hectares. Enfin, la déforestation liée à la coupe illégale du bois est la plus grande forme de déforestation qui affecte le massif forestier de Lolodorf. Elle implique l'exploitation des essences et des produits forestiers non ligneux sur plusieurs aspects. Les superficies relatives à cette forme de déforestation peuvent atteindre des milliers d'hectares.

Le sciage artisanal du bois est devenu une activité essentielle dans le massif forestier de Lolodorf depuis plus d'une décennie. Celle-ci se produit dans l'ignorance totale des normes étatiques prescrites en matière d'exploitation forestière et néglige tout principe d'éthique environnementale. Devant le silence des autorités administratives, l'accélération de cette pratique qui ruine les populations locales s'est enracinée dans le massif forestier de Lolodorf.

Les témoignages sont nombreux. Un notable à la Chefferie de groupement Ngoumba-Centre nous a donné son témoignage :

*La coupe frauduleuse du bois a commencé au niveau de Mougué dans la grande forêt de Nkouambpoer I il y a plus de dix ans. Le Chef de groupement a pris une décision relative à l'arrêt de cette exploitation ; mais celle-ci n'a pas connu grand effet compte tenu de la misère, la corruption et la pauvreté qui sévissent dans sa zone de compétence.*

*Les populations locales font entrer dans la forêt des gens venant de tous les horizons. Ceux-ci sont en majorité composés d'étrangers avec leurs équipes de scieurs et de transporteurs. Le processus consiste à aller camper en brousse en bande et puis passer à la prospection des essences importantes comme le Bubinga, le Moabi et d'autres essences forestières économiquement rentables. Après avoir localisé un arbre, le villageois Bantu à qui revient la parcelle de forêt le vend à une valeur très négligeable.*

*Les produits issus de cette exploitation sont transportés par des hommes-transporteurs vers les abords de route et ensuite acheminés par camion vers les lieux de vente.*

*Un autre type est lié au prélèvement d'écorces de certains arbres. Celui-ci est effectué en général par les populations Bantou et les jeunes Bakola–Bagyéli. Le principe consiste à localiser un arbre en pleine forêt à l'abattre et puis à le débarrasser de ses écorces.*

Le massif forestier de Lolodorf devient continuellement une cible pour les multiples exploitants forestiers illégaux. Certains agiraient sous le couvert de certaines autorités locales. Un exploitant forestier illégal relève, à cet effet, que :

*Le Cameroun, c'est le Cameroun. Qu'entendez-vous par documents administratifs liés à l'exploitation forestière ? Toute cette paperasse n'est d'aucune importance ; on sait comment ça se passe. Avant de lancer ton chantier dans un village, tu vas d'abord causer avec toutes les autorités, y compris le Chef de poste forestier. Une fois l'arrangement passé, le reste tu négocies sur place avec les villageois qui sont lessivés par la misère et les problèmes de toutes sortes.*

*Pour les Pygmées tu leur donnes juste un peu à manger, à boire et à fumer même s'ils se plaindront plus tard. Toutes les promesses que tu leur feras ne seront jamais tenues parce que tu sais que l'administration est à tes côtés. Et pour convoyer les planches par camion vers les grandes villes de Douala ou Yaoundé, on cause encore avec les autorités qui intiment l'ordre à leurs subalternes de ne pas nous déranger dans leur zone de compétence. Le reste se gère par des arrangements sur les barrières de contrôle le long du trajet.*

Les principales essences forestières prisées par le sciage artisanal sont présentées dans ce tableau.

Les effets de la déforestation se ressentent particulièrement dans l'alimentation et l'ethnomedecine Bakola–Bagyéli. L'alimentation repose de moins en moins sur du gibier devenu rare. Les produits forestiers ont diminué dans l'alimentation.

Henri Mbpile, un Nkola de la forêt de Ngomanguelé, fait ce constat :

*De plus en plus, nous achetons du poisson dans les boutiques, du riz, du bâton de manioc. Les outils et les techniques pour chasser aussi ont changé. Certaines ne sont même plus utilisées de nos jours. Le fusil est devenu l'arme fatale utilisée. La pratique de l'agriculture avec la réalisation des champs et le petit élevage des poulets est de plus en plus présente. Par ailleurs, quelques écorces d'arbres exploitées par les Pygmées Bakola–Bagyéli sont aussi brandies sous forme de troc, en échange des produits consommables.*

L'ethnomédecine Bakola–Bagyéli fait face à plusieurs difficultés liées à l'érosion de la biodiversité. Le domaine végétal qui était la base des produits de cette pharmacopée est devenu très pauvre parce que la forêt est vidée de ses ressources. La rareté des arbres médicinaux, la disparition et l'éloignement de certains animaux et des oiseaux causent d'énormes problèmes à cette médecine.

La forêt ne pouvant plus donner une pharmacopée riche, son efficacité de moins en moins crédible ne permet plus de résoudre les problèmes fondamentaux de santé. Seules les maladies d'ordre spirituel continuent à être bien prises en charge et traitées. Les autres cas de maladie sont traités dans les hôpitaux. Les multiples fréquentations et les rapports entretenus avec les Bantou entraînent de nouvelles maladies comme le VIH/SIDA, la tuberculose…

Les systèmes de croyances qui reposaient essentiellement sur la tranquillité de la forêt sont considérablement perturbés par la déforestation et les bruits qu'elle occasionne au travers des technologies mobilisées. La crise des systèmes de croyances se traduit par les multiples problèmes auxquels les Bakola–Bagyéli sont confrontés dans leur vie religieuse et spirituelle.

Des mesures efficaces de protection de la forêt et de ses ressources sont nécessaires pour préserver le milieu de vie, la mamelle nourricière et la pharmacopée des Pygmées Bakola–Bagyéli.

### 6.2.2. Préservation des plantes médicinales utilisées par les Pygmées Bakola–Bagyéli et mesures de protection de la biodiversité du massif forestier de Lolodorf

Face aux menaces qui pèsent sur la biodiversité du massif forestier de Lolodorf, des mesures de protection s'avèrent nécessaires pour préserver les plantes médicinales utilisées par les Pygmées Bakola–Bagyéli. Quatre mesures principales sont proposées pour préserver la biodiversité du massif forestier de Lolodorf et prévenir la disparition totale des essences forestières utilisées pour soigner les maladies chez les Pygmées Bakola–Bagyéli :

- la création d'une association des tradithérapeutes Bakola–Bagyéli ;
- la mise en place de comités de surveillance locale des forêts et de lutte contre l'exploitation forestière illégale ;
- la sensibilisation des autorités locales sur le respect de la légalité forestière et la protection des droits forestiers des Pygmées Bakola–Bagyéli; et
- l'élaboration et la mise en œuvre de micro-projets communautaires de plantation et de domestication des plantes médicinales traditionnelles essentielles des Pygmées Bakola–Bagyéli.

L'association des tradithérapeutes Bakola–Bagyéli constituerait une force de mobilisation et d'action pour le développement de l'ethnomédecine Pygmée, pour la formation et la transmission des savoirs médicinaux et pour la préservation des plantes médicinales traditionnelles essentielles (UNESCO, 2013). Elle contribuerait également à la sensibilisation des autorités locales, nationales et internationales sur le respect de la légalité forestière au Cameroun, la reconnaissance et la protection des droits forestiers des Pygmées Bakola–Bagyéli, en particulier, la nécessité de protéger des essences forestières importantes pour la vie et la survie thérapeutique des Pygmées Bakola–Bagyéli (Bubinga, miel sauvage, etc.).

Les comités de surveillance locale des forêts et de lutte contre l'exploitation forestière illégale contribueraient à la protection du massif forestier de Lolodorf. Ils pourront efficacement lutter contre le sciage artisanal et l'exploitation forestière illégale tout en dénonçant les activités d'exploitation forestière illégale auprès des autorités publiques à Yaoundé, des institutions d'observation indépendante de la gestion des forêts et des organisations nationale et internationale de protection et de gestion durable de la nature.

| Noms scientifiques | Noms commerciaux | Usages |
|---|---|---|
| *Enantia chlorantha* | Enantia, moambe jaune | Médecine (écorce) |
| *Entandrophragma cylindricum* | Sapelli | Meubles menuiserie et sculpture |
| *Entandrophragma utile* | Sipo | Meubles menuiserie et sculpture |
| *Baillonella toxisperma* | Moabi | Meubles, menuiserie, sculpture et Médecine |
| *Guirbourtia tesmanii* | Bubinga | Médecine/industrie du bois |
| *Naucléa diderrichi* | Bilinga | Médecine/Industrie du bois |
| *Pterocarpus soyauxii* | Padouk | Médecine/Industrie du bois |
| *Milicia excelsa* | Iroko | Industrie du bois |
| *Terminalia superba* | Fraké | Bois de coffrage |
| *Triplocliton scleroxylon* | Ayous | Bois de coffrage |
| *Irvingia gabonensis* | Mangue sauvage | PFNL (fruit et culinaire) |
| *Coula edulis* | Arbre à noisette | PFNL (fruit) |
| *Rincinodendron heudoltii* | | PFNL (culinaire) |
| *Garcinia cola* | Bitter cola | PFNL (aphrodisiaque) |

Enfin, l'association des tradithérapeutes Bakola–Bagyéli pourrait assurer l'élaboration, la mobilisation des financements et la mise en œuvre des micro-projets communautaires de plantation et de domestication des plantes médicinales traditionnelles essentielles des Pygmées Bakola–Bagyéli, dans les villages et les campements des Pygmées Bakola–Bagyéli.

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# 7. Pratiques et connaissances naturalistes des communautés Betsileo : lisière du corridor forestier Andringitra-Ranomafana, Madagascar

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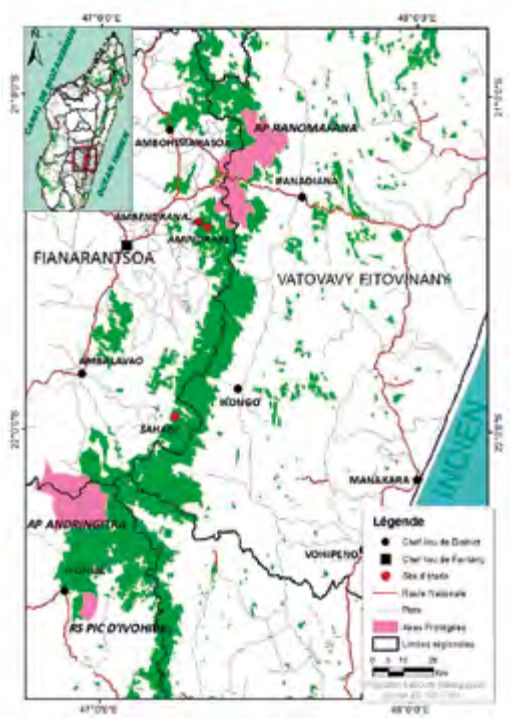
## 7.1. Contexte général

Les savoirs locaux et autochtones naturalistes sont reconnus par la Convention pour la Biodiversité (1992) et le protocole de Nagoya (2012) quant à leur rôle potentiel pour la protection de la biodiversité. Le Groupe de Travail de l'IPBES sur les savoirs autochtones et locaux travaille dans le sens d'une meilleure intégration de ces savoirs dans le cadre des évaluations de la biodiversité et des services écosystémiques pour la région Africaine. C'est dans ce contexte que se situe notre contribution que nous appuyons avec nos données de recherches menées depuis 2008 chez les Betsileo vivant à la lisière du corridor Ranomafana-Andringitra dans le centre-est de Madagascar, à proximité de la ville de Fianarantsoa (**Carte 7.1**). Le label de corridor forestier est utilisé à Madagascar pour signifier l'existence d'une bande de forêt reliant deux zones plus vastes, dans le cas présent les deux parcs nationaux et qui est censé faciliter le flux de pollen, d'animaux et par ce fait contribuerait positivement à la conservation de la biodiversité (Carrière-Buchsenschutz 2007). Nos travaux ont montré que les arbres isolés des terroirs agraires contribuent également à cet effet corridor (Rafidison 2013).

L'Atelier de dialogue sur les savoirs autochtones et locaux pour la région Afrique de l'IPBES tenue à Paris a donné suite à un atelier de discussion avec des représentants des communautés locales Betsileo afin de confirmer et de discuter de nos données de recherche d'une part, et d'autre part d'ouvrir des perspectives plus larges sur leurs savoirs sur les plantes. Nous avons recueilli des informations et des connaissances auprès de représentants des communautés locales sur l'utilisation et la conservation des plantes, le rôle des plantes dans les pratiques de fertilisation ou de restauration des sols et leurs rôles comme espèces indicatrices du changement climatique.

Notre but était de comprendre comment les savoirs locaux associés à la biodiversité contribuent au bien-être des communautés et à la durabilité des systèmes agraires. Dans une deuxième partie nous présentons le travail de recherche intitulé : « Ethnobiologie et écologie des *Ficus* des terroirs Betsileo et du corridor Ranomafana–Andringitra » mené entre 2008 et 2010 qui avait pour but d'analyser et comprendre comment les pratiques et les savoirs locaux favorisent la distribution des espèces de figuiers dans les terroirs agraires chez les Betsileo. Une approche ethnobiologique avait été adoptée dans le cadre d'une thèse soutenue en 2013 (Rafidison 2013) ainsi que de divers articles en cours de soumission (Rafidison *et al.* soumis, Rafidison *et al.* en préparation).

Ces travaux permettent d'illustrer de façon détaillée les savoirs portant sur un groupe d'espèces clé sur le plan social et biologique, les *Ficus* dans les terroirs agraires Betsileo. Ils se fondent sur l'hypothèse que les figuiers conservés pour des raisons socio-culturelles, comme il a été démontré ailleurs dans le monde (Wilson & Wilson 2013 ; Eden *et al.* 2015), sont très favorables à la conservation de la biodiversité, directement par leur présence, et indirectement en servant de perchoirs et de sources de nourriture pour de nombreux animaux dans des territoires agraires très ouverts. Si on considère les arbres isolés des territoires agraires de la bordure du corridor forestier reliant le Parc National Ranomafana et le Parc National Andringitra, les espèces de *Ficus* représentent plus de 30% des arbres présents (Martin *et al.* 2009). Nos travaux ont démontré qu'ils jouent un rôle clé à la fois sur le plan culturel et biologique (Rafidison 2013). Sur le plan culturel, leur présence fait référence aux ancêtres, ce qui leur vaut beaucoup de respect selon des critères décrits plus bas. Sur le plan biologique, ces arbres attirant beaucoup d'oiseaux et de mammifères, dont les chauves-souris mais également certains lémuriens, entraînent des phénomènes de nucléation, c'est-à-dire la formation de petits bosquets forestiers issus de graines transportées par des frugivores qui s'alimentent sur ces arbres et diffusent ainsi des graines en provenance de la forêt à travers leurs déjections (Rafidison 2013 ; Rafidison *et al.* en préparation).




**Carte 7.1 :** Localisation des trois sites d'études

Nous avons travaillé dans trois terroirs villageois situés dans les lieux suivants :

- Ambendrana, situé au nord-ouest du corridor forestier ;
- Amindrabe, situé au nord-ouest du corridor ;
- Sahabe, situé au sud-ouest du corridor.

Lors de l'atelier organisé à Antanarivo du 25 au 27 février 2016 à l'initiative du Groupe de Travail sur les savoirs locaux et autochtones de l'IPBES, nous avons invité des représentants de ces trois villages qui avaient été nos informateurs et avec lesquels nous avions beaucoup échangé sur le terrain pendant de longues périodes de séjour entre 2009 et 2010.

Ces terroirs villageois sont occupés par des communautés locales appartenant au groupe culturel Betsileo. Les Betsileo constituent un groupe ethnique habitant les parties Sud des hauts plateaux Malgaches (Dubois 1938).

Les Betsileo présentent une organisation sociale et coutumière qui dépend des anciens représentants des lignages toujours vivants, *Ray amandreny* (littéralement : père et mère). Les coutumes Betsileo sont très attachées aux ancêtres défunts, leur histoire, leur mode de vie et leurs faits et gestes. La place des tombeaux des ancêtres au sein de leurs territoires constitue un des marqueurs principaux de ces derniers, ainsi que les traces des anciens villages, les stèles célébrant leurs activités passées. Un ensemble de tabous (*fady*) liés à des liens particuliers avec les ancêtres défunts, règle la vie quotidienne tout autant dans le domaine alimentaire que dans la façon de traiter la nature, de se vêtir et de traiter les animaux. L'économie agraire des Betsileo est fondée sur la riziculture inondée (*vary ankoraka*) et pluviale (*tavy*), les cultures sèches et l'élevage de zébus. Les parcs à zébus constituent également des marqueurs importants des territoires Betsileo et sont intimement liés à l'existence des villages. Outre l'importance des zébus dans les travaux agricoles et comme source de protéines, leur rôle prépondérant dans les rituels mortuaires en font des animaux à très forte valeur culturelle pour les Betsileo.

L'unité spatiale de base autour duquel s'organise la vie des familles Betsileo est constituée par la maison, associée à des parcs à zébus, des zones agraires et des parcelles de forêt. Ces dernières sont des zones de collecte de produits sauvages (exemple : miel, légumes sauvages) mais elles sont également utilisées pour l'agriculture sur brûlis (*tavy*). Le tout est organisé en unités paysagères situées autour de collines (**Photo 7.1**). Chaque espace distinct au sein de ces collines faisant l'objet d'une nomenclature locale partagée et de techniques de mise en valeur distinctes, a été décrit par Blanc-Pamard qui les définit comme des catégories locales associées à des techniques culturales bien spécifiques qu'elle nomme « facette écologique » (Blanc-Pamard & Ralaivita 2004).

Pour élargir leurs surfaces cultivables, les communautés Betsileo vivant à la périphérie du corridor forestier défrichent progressivement la forêt, mais, pour des raisons matérielles ou socioculturelles, certains arbres sont préservés, voire sélectionnés et entretenus. Ces arbres, à l'origine forestiers, deviennent dès lors des éléments constitutifs des zones agraires.

Y.A. Thomas

**Photo 7.1** Terroir Betsileo

V. Rafidison

**Photo 7.2** Un tradipraticien lors d'un entretien

## 7.2. Méthode d'étude

Lors de l'atelier organisé à Antananarivo nous avons discuté collectivement avec les représentants de nos trois sites d'étude sur l'ensemble des espèces végétales conservées, y compris sur le genre *Ficus*, ainsi que sur des espèces indicatrices de sols fertiles et stériles, ainsi que sur celles participant à la fertilisation ou à la restauration des sols stériles. Des données sur la perception du changement climatique ont également été recueillies. Cet atelier a été organisé avec les représentants des communautés locales des villages de Ambendrana, Amindrabe et Sahabe qui sont tous des hommes. Etaient présents : A. F. R. Ralaha et A. Rakotomaro (village d'Ambendrana); J. F. Rafanomezantsoa et E. Rasabo (village d'Amindrabe); ainsi que R. Rakotozafy (village de Sahabe). Cet atelier avait pour objectif d'identifier les pratiques et les connaissances locales sur la conservation et l'utilisation des plantes : de la graine à la plantule et à l'arbre, les savoirs locaux associés à des pratiques de fertilisation ou de restauration des terres, notamment les espèces indicatrices de sols fertiles et celles pouvant restaurer les sols stériles, ainsi que les savoirs locaux associés aux changements climatiques. Pour chaque espèce citée, la forme de la plante est indiquée entre parenthèses par les signes suivants : (A) pour arbre, (H) pour herbacée, (B) pour buisson et (L) pour liane.

Nos travaux antérieurs sur les espèces de *Ficus* constituent un exemple détaillé des savoirs locaux des Betsileo sur un groupe d'espèces, les *Ficus* qui ont des usages multiples. Ils se fondent sur des données ethnographiques recueillies lors des entretiens concernant les relations des communautés Betsileo avec la biodiversité à l'échelle du paysage agraire. Nous avons mené des entretiens auprès des communautés locales et avons effectué des relevés de terrain sur le système de dénomination et de qualification des espèces de *Ficus*. Ces entretiens ont été réalisés dans la langue locale auprès des aînés ou *Ray amandreny* (**Photo 7.2**), des chefs du village ou de lignage et des membres des maisonnées ainsi qu'avec des habitants incluant des enfants, des femmes et des hommes en âge de travailler.

## 7.3. Atelier sur les savoirs des communautés Betsileo vivant sur la lisière du corridor Ranomafana-Andringitra

Trois thèmes ont été abordés lors des ateliers menés à Antananarivo : les pratiques locales relatives à l'utilisation des plantes qui induisent des pratiques de conservation, les plantes participant à la gestion de la fertilité des sols, ainsi que les perceptions locales liées aux changements climatiques. Nos résultats contribuent à mieux définir les modalités d'interaction entre les communautés Betsileo et le monde végétal. Dans les paragraphes suivants, nous utilisons la signalétique suivante pour catégoriser les espèces végétales : A pour arbre, H pour herbacée, B pour buisson et L pour liane.

### **Thème 1**. Pratiques et connaissances locales sur la conservation et l'utilisation des plantes : de la graine à la plantule à l'arbre

Nous présentons ici les éléments saillants des discussions et des idées développées :

- **Augustin François Régis Ralaha (Ambendrana) a présenté les espèces d'arbres protégées par les anciens et qui ne sont pas autorisées à être coupées :**
- *Aviavy (Ficus trichopoda)* (A) ;
- *Voara (Ficus tiliifolia)* (A) ;
- *Nonoka (Ficus reflexa)* (A) ;
- *Amontana (Ficus lutea)* (A).

Ce sont des arbres trouvés fréquemment près d'anciens hameaux abandonnés tels que les villages royaux et les endroits sacrés ; de ce fait les descendants n'osent pas les couper.

Selon A. F. R. Ralaha ces plantes sont indispensables à la vie quotidienne des êtres humains et doivent être conservées. Il existe plusieurs types de relations entre les plantes et les humains :

### Les plantes et les « mauvais moments » (ex : en cas de décès) :

Les matériaux utilisés pour préparer et transporter le cadavre sont tous d'origine végétale :

- *Tarambitona (Macaranga alnifolia)* (A) et la liane *Vahimboamena (Abrus precatorius)* (L) sont utilisées pour transporter le cadavre ;
- *Zozoro (Cyperus latifolius)* (H) et *vakoana (Pandanus* sp.) (A) sont utilisées pour fabriquer les nattes qui servent à envelopper le cadavre.

### Les plantes et la vie quotidienne :

- Les plantes médicinales : les hôpitaux sont loins (environ 4 heures de marche) mais la forêt, plus proche, permet de s'approvisionner et de récolter les plantes médicinales et de ce fait mérite d'être protégée ;
- Les plantes servent d'ustensiles dans la vie quotidienne : manches d'outils, mortiers, pilons, etc.

### Les plantes utilisées durant les activités culturelles : par exemple celles qui apportent le bonheur (beaucoup d'enfants, de nombreux zébus et une bonne santé), comme *hazomanga (Ravensara aromatica)* (A) :

- Les plantes pour la construction sont toutes d'origine forestière : *rotra (Eugenia emirnensis)* (A), *vitanona (Calophyllum parviflorum)* (A), *lalona (Weinmannia rutenbergii)* (A) et *lambiana (Nuxia capitata)* (A).

### Ambendrana Rakotomaro (Ambendrana) donne les explications suivantes sur les plantes protégées par les populations locales :

- L'*aviavy (Ficus trichopoda)* (A) et le *hazomanaga (Ravensara aromatica)* (A) sont utilisées pour apporter le bonheur et chaque ménage après le mariage doit les avoir ;
- L'*aviavy (Ficus trichopoda)* (A), est rare dans la région et dès qu'il y a des plantules dans les terroirs agraires, les gens les entretiennent et les protègent ;
- Le *voara (Ficus tiliifolia)* (A) est une plante qui était déjà protégée par les ancêtres. Sa coupe peut apporter le malheur.
- Le *nonoka (Ficus reflexa)* (A) était planté auparavant par les rois et ne peut être coupé.
- L'*amontana (Ficus lutea)* (A) est un symbole de royauté et personne n'ose le couper.

Les méthodes utilisées localement pour entretenir ou protéger les plantes sont le désherbage, effectué manuellement et régulièrement. Il ne faut pas les couper et laisser la pluie les arroser.

Les plantes utilisées quotidiennement aussi sont protégées, comme les plantes médicinales (*fanerana (Psorospermum fanerana)* (A) pour soigner les migraines, *fanazava (Calantica cerasifolia)* (B),…), etc. ainsi que les plantes utilisées dans la riziculture (manches d'outil), celles pour fabriquer les nattes.

### Jean Fidèle Rafanomezantsoa (Amindrabe) :

En plus de celles qui ont déjà été énoncées par les autres participants, certaines plantes sont inséparables de la vie de tous les jours. Par exemple les plantes médicinales telles que les plantes pour soigner les ictères : *rambiazina (Helichrysum gymnocephalum)* (B), *silimainty (Croton hovarum)* (B) et les plantes liées aux ancêtres tels que les figuiers, *Ficus* spp. sont indispensables.

Les plantes sont aussi utilisées pour se protéger de façon magique contre la grêle tel que *mandriona (Dilobeia thouarsii)* (A), ou contre les voleurs de zébus tel que *tsaramady (Ficus polita)* (A).

### ▶ Emmanuel Rasabo (Amindrabe) confirme la nécessité de protéger les plantes utiles déjà citées précédemment :

Plantes médicinales, plantes sacrées ou liées aux ancêtres. Les plantes sacrées comme le *hasina (Dracaena* sp.) (B) sont aussi plantées dans le village par bouturage.

### ▶ Roger Rakotozafy (Sahabe) :

Les plantes précieuses et protégées localement poussent sur les sols fertiles. Elles ne poussent jamais sur les sols ferralitiques. Ce sont aussi des plantes à usages multiples et fréquents tel que *tsaramady (Ficus polita)* (A) (plante médicinale, protège les parcs à zébus, les feuilles servent de thé), *kinagna (Ricinus communis)* (B) (haie vive des parcs à zébus, la racine est médicinale, les graines sont oléagineuses, protège de la sorcellerie sur les cultures et la grêle), *dandemy (Anthocleista* sp.) (A) (protège de la foudre) (**Photo 7.3**)…

V. Rafidison

**Photo 7.3** *Dandemy : Anthocleista* sp

V. Rafidison

**Photo 7.4** Plantule de *Ficus tiliifolia* préservée avec quelques herbes pour assurer l'ombrage après le débroussaillement du champ

Outre les présentations faites ci-dessus par chaque participant, les discussions ont généré les éléments suivants concernant différents grands types d'usages et des méthodes d'entretiens des plantes.

### Les plantes de la vie quotidienne :

Les plantes utiles dans la vie quotidienne sont rares dans la nature. Elles sont conservées par la population locale. Les exemples évoqués sont :

- *Voafana* ou *voa vagnana (Piptadenia chrysostachis)* (A) : les graines de cet arbre sont utilisées par les devins en cas de maladies graves. Elles sont utilisées pour entrer en relation avec les ancêtres qui donneront la solution, le remède selon la pharmacopée traditionnelle, ou la marche à suivre pour résoudre le problème. Les feuilles et les branches sont médicinales. La plante se trouve généralement dans la forêt mais lorsque des plantules poussent dans les terroirs agraires, les habitants les conservent et ne les coupent pas ou les transplantent dans un endroit bien protégé.
- *Ariandro (Pterocaulon decurrens)* (A) : cet arbre pousse aussi bien dans la forêt que dans les terroirs agraires. C'est une plante médicinale qui soigne l'épilepsie chez les enfants. Les habitants ne le coupe, ni le déracine sur le lieu où il pousse.

- *Varongy (Ocotea laevis)* (A) : cet arbre forestier sert à fabriquer la mesure pour le riz et le lit pour déposer les cadavres dans les tombeaux. Lorsque les habitants pratiquent la déforestation, ils ne coupent pas cet arbre mais le préservent.

### Les méthodes d'entretien des espèces protégées localement :

Il n'y a pas de méthodes de conservation spécifiques pour chaque espèce ; l'entretien est identique pour toutes les espèces conservées. Les plantules conservées sont gardées sous l'ombre jusqu'à l'état adulte. Généralement, on ne fait pas de désherbage pour assurer l'ombrage mais si l'ombre est trop importante, on le fait manuellement et non avec la bêche (**Photo 7.4**). On n'arrose pas car la pluie suffit.

### La méthode de transplantation des plantules :

Les plantules peuvent être transplantées avec les mottes de terre qui entourent les racines. On crée de l'ombre jusqu'à la poussée des mauvaises herbes servant d'ombre. L'arrosage se fait suivant l'exigence de la plante et le climat existant.

## Thème 2. Savoirs locaux : la fertilité ou la stérilité des sols

Localement les sols fertiles sont appelés *tany lonaka* et les sols stériles *tany simba*.

### Espèces indicatrices de la fertilité des sols

Les espèces indicatrices de la fertilité des sols peuvent être rassemblées en deux groupes (**Tableau 7.1**) :

- les espèces des terroirs sur le sol en jachère ;
- les espèces forestières.

**Tableau 7.1 :** Les espèces indicatrices de sols fertiles

| Espèces des terroirs agraires | Espèces forestières |
|---|---|
| *Seva (Solanum auriculatum) (B)* | *Voara (Ficus tiliifolia) (A)* |
| *Harongana (Harungana madagascariensis) (A)* | *Lambinana (Nuxia capitata)* |
| *Vakoka (Trema orientalis) (A)* | *Kimba (Symphonia madagascariensis) (A)* |
| *Dingana (Psiadia altissima)* | *Tavolo (Cryptocarya cf lucida)* |
| *Trakavola (Bidens pilosa) (H)* | *Fanilo* |
| *Maintso ririnina (Erigeron naudinii)* | *Lalomaka (Weinmannia rutenbergii) (A)* |

Les champs qui présentent *Seva, Solanum auriculatum* et *Harongana, Harungana madagascariensis* sont plus appropriés pour la plantation de plantes à tubercule telles que le manioc.

### Les espèces indicatrices de sols stériles :

Localement on considère qu'un sol est stérile quand aucune végétation forestière ne peut s'y développer. Dans les terroirs agraires on peut trouver des sols stériles. Les espèces indicatrices de ces types de sols sont :

- *Anjavidy (Philippia* sp.) (B) ;
- *Rambiazina (Helichrysum gymnocephalum)* (H) ;
- *Kandafotsy (Vernonia moquinoides)* ;

- *Fandramanana (Aphloia theiformis)* (B) ;
- *Ampangandrano (Sticherus flagellaris)* ;
- *Katoto (Weinmannia* sp.) (A) ;
- *Tsiafakandriana (Ageratum conizoydes)* (H) ;
- *Ampanga lahy (Pteridium aquilinum)* (H).

Pour améliorer la qualité du sol, on pratique la plantation de manioc suivant les courbes de niveau ou on utilise des engrais organiques ou des composts. Il y a des plantes qu'on ne peut pas utiliser pour faire les composts. Les feuilles de *anjavidy (Phillippia* sp.), de *pin (Pinus* sp.) ou d'*ampangalahy (Pteridium aquilinum)*, se compostent mal.

Les plantes les plus appropriées pour fabriquer les composts sont *seva, Solanum auriculatum, radriaka, Lantana camara, haronga, Harungana madagascariensis, tanamasoandro, Helianthus annuus* et *Taretra Fourcroya* sp.

## Thème 3. Les savoirs locaux associés aux changements climatiques

### D'après Roger Rakotozafy (Sahabe) :

La riziculture commence avec la floraison de *Ambiaty (Vernonia appendiculata)* ; les habitants ne suivent pas dans ce cas le calendrier agricole, ainsi que les floraisons des plantes.

### Selon Emmanuel Rasabo et Jean Fidèle Rafanomezantsoa (Amindrabe) :

Généralement les habitants suivent le calendrier en plus de la floraison des plantes pour faire la culture. Actuellement, elles perçoivent des changements sur la période culturale. Par exemple, si auparavant, on semait le riz au mois d'août, actuellement on le fait au mois de juin.

### Ambendrana Rakotomaro :

Auparavant, les fleurs de *goavintsinahy (Psydium cattleyanum)* (A) apparaissaient jusqu'au mois de janvier mais actuellement, elles n'apparaissent qu'au mois de mars.

### Augustin Ralaha :

Auparavant, les fleurs d'Eucalyptus apparaissaient au mois de janvier. Actuellement, elles n'apparaissent qu'au mois de mars et retardent l'arrivé des abeilles.

V. Rafidison

**Photo 7.5** Les participants de l'atelier du 25 au 27 janvier 2016. En haut de gauche à droite: A. Rakotamaro, B. Rakotoanadahy, A. F. R. Ralaha. En bas de gauche à droite: E. Rasabo, R. Rakotozafy, V. Rafidison, J. F. Rafanomezantsoa

## 7.4. Usages et valeurs des *Ficus* des terroirs agraires

Neuf espèces de *Ficus* ont été recensées dans les terroirs agraires de la lisière ouest du corridor, dont sept espèces se trouvent à la fois dans la forêt et dans le terroir : *fompoha (Ficus botryoides), kivozy (F. pachyclada), amontana* ou *amonta (F. lutea), nonoka* ou *laza (F. reflexa), voara* ou *ara (F. tiliifolia), kivozy (F. politoria)* et *fompoha (F. trichoclada)*. Par contre, deux espèces *tsaramady (F. polita)* et *aviavy (F. trichopoda)* sont uniquement plantées dans les terroirs par les paysans.

Dans la vie des Betsileo, ces *Ficus* des terroirs représentent des arbres à usages multiples, pouvant être regroupées selon les différents usages suivants :

### 7.4.1. Usage agricole

C'est le cas de *voara* ou *ara (Ficus tiliifolia)*. Les paysans considèrent que la présence de *voara* dans les terroirs agraires est un acte divin (**Photo 7.6**) car les feuilles décidues fertilisent les sols et leurs racines attirent l'eau. Ils sont ainsi très favorables aux cultures environnantes comme il est énoncé ci-dessous : *Leha mipika ny raviny de lasa zezika mahambo tany, ny vahany misintondrano de manome rano sy hamandoana aza izy ny tanimboly itsiriany* (« Quand les feuilles tombent, elles fertilisent le sol, et leur racine attire l'humidité et la fournit aux cultures environnantes »).

Y. A. Thomas

**Photo 7.6** *Voara* ou *ara (F. tiliifolia)* au premier plan, dans les terroirs agraires

V. Rafidison

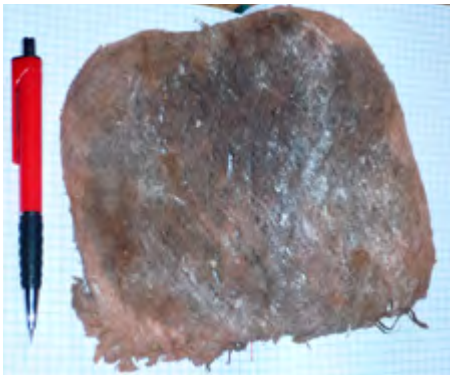


**Photo 7.7** Tissu fabriqué à l'aide de l'écorce de *F. tiliifolia*

En outre, les habitants n'osent pas couper les *voara*, ce qui entraînerait selon leurs dires « le tarissement des larmes des enfants » ou, dans le cas contraire, les larmes des enfants ne cessant de couler « comme l'écoulement du latex après la coupe » ou, dans le cas contraire, les larmes des enfants ne cessant de couler comme l'écoulement du latex après la coupe. Ceci établit une analogie entre le corps humain d'une part et la physiologie de l'arbre, qui donne lieu à une pratique spécifique. Pourtant, actuellement, avec l'insuffisance de surface cultivable, certaines personnes n'hésitent pas à couper des *voara* lorsque leur ombre dérange la riziculture. D'après eux, Dieu peut comprendre qu'ils ont besoin de riz pour vivre.

### 7.4.2. Usages médicinaux

L'identification des plantes à usages médicinaux est le résultat du travail des *ombiasy* (tradipraticiens) qui communiquent avec les esprits des ancêtres. A part *Ficus pachyclada* et *Ficus politoria*, toutes les espèces de *Ficus* des terroirs ont des usages médicinaux, par exemple *nonoka (F. reflexa)* est utilisé par les tradipraticiens pour son effet lactogène après l'accouchement. D'après leurs dires, il « libère du latex qui ressemble au lait maternel » et de ce fait, « il fait monter le lait » (*de izy io mandronono io de tena mahabe nono azy*). Nous observons ici le même processus analogique que précédemment. En outre, les lieux spécifiques où pousse *nonoka* indiquent la force et le pouvoir que possède cet arbre. Les plantes qui poussent sur les rochers sont les plus efficaces. *Tsa handika vato misy nonoka*.

*Manana ny heriny izy matoa afaka mitsiry eo ambony vato* (« on ne traverse pas un rocher où pousse un *nonoka*. Ce dernier a son pouvoir, c'est pour cela qu'il peut pousser sur un rocher »).

### 7.4.3. Usages techniques anciens

L'écorce de *voara (Ficus tiliifolia)*, avant l'arrivée des tissus en coton sur les marchés et pendant la période de barrage des routes en 1942 lors de la colonisation, était très recherchée pour fabriquer un tissu appelé *fato* (**Photo 7.7**). A l'époque, un pardessus confectionné à partir de l'écorce de *voara* pouvait être échangé contre un zébu. La préparation des tissus en fibre de *voara* est difficile et le tissu n'est pas tout à fait souple. Les tissus fabriqués sont utilisés essentiellement comme cache-sexe pour les hommes.

Auparavant également, l'écorce de *Amontana* ou *Amonta (F. lutea)* qui contient des fibres était utilisée pour coudre et assembler les différentes plaques nécessaires à la fabrication de nattes. Avec l'arrivée des cordes en Raphia, cette pratique a été délaissée.

### 7.4.4. Usages symboliques

Certaines espèces représentent la royauté, symbolisent l'abondance, la puissance et la grandeur. C'est notamment le cas de *amontana* ou *amonta (Ficus lutea)*. Sa plantation est réservée aux rois (*Hova*). *Zavatra saro-pady be fa tsa mitsiritsiry ho azy, tsa misy anio raha tsy Tanana misy Hova* (« C'est un élément précieux qui ne pousse pas spontanément, il ne pousse que dans les cours des rois »).

L'arbre possède un pouvoir symbolique signifié par son nom : *amonta*. *Lo amonta io nambolen'ny hova taloha mba hamonta, ho maro sy hatanjaka ny vahoaka* (« L'amonta était planté par les rois pour que leurs peuples aient une vie faite d'abondance et qu'ils soient puissants »). *Amonta* est utilisé pour apprendre aux enfants à compter : *Isa (1) ny amontana , roa (2) ny aviavy, telo (3) fangady* : le chiffre 1 correspond à *Ficus lutea (amontana)*. Ceci signifie que seul le roi (Hova) plante l'amonta. Il est le premier et personne ne peut le précéder.

Les espèces de *Ficus* sont à usages multiples mais l'arrivée des espèces introduites et la technologie moderne ont diminué leur usage. Toutefois, la valeur symbolique des *Ficus* est toujours forte, ce qui favorise leur préservation et leur distribution abondante dans les terroirs.

### 7.4.5. Pratiques spécifiques favorisant la préservation des *Ficus* dans les terroirs

Outre leur dissémination naturelle par les oiseaux et les chauves-souris, les communautés Betsileo favorisent la préservation et la distribution des *Ficus* dans les terroirs. Parmi les raisons invoquées, certains *Ficus* apportent du bonheur, en relation avec leur capacité à se régénérer facilement par bouturage (*Ficus reflexa* et *Ficus lutea*). Les *Ficus* sont plantés dans les endroits les plus fréquentés. Au cours des périodes historiques, les Betsileo pouvaient s'installer sur le bas versant, le mi-versant ou le sommet des collines, favorisant ainsi la distribution des *Ficus* dans différentes parties des terroirs agraires. Par ailleurs, la mise en place des vergers, des arbres et des stèles constitue un facteur favorisant l'existence de *Ficus reflexa* et *Ficus lutea*. Les vergers attirent les animaux frugivores disperseurs de graines. Les Betsileo les ont ainsi maintenus et favorisent leur propagation. Les stèles et les tombeaux sont des éléments persistant au cours du temps, et où les animaux peuvent se percher. Des graines de *Ficus* germent facilement sur ce type d'édifice. Dans les perceptions locales cependant, ce sont les esprits qui les ont amenés dans ces endroits très respectés. Par ailleurs nul ne coupera jamais un *Ficus* ayant poussé sur ces éléments du paysage rappelant la mémoire des ancêtres.

Les facteurs écologiques qui contribuent à la présence des figuiers sont l'humidité et la présence des rochers.

Les facteurs socio-culturels qui favorisent leur présence sont :

- les analogies du latex avec les larmes humaines ;
- le fait que ces arbres attirent et retiennent l'eau ;
- le respect des ancêtres et de la volonté des dieux.

Certains éléments du paysage comme les falaises sont des habitats très favorables aux espèces de figuiers (**Photo 7.8**). On y trouve également parfois des tombeaux. Les zones de falaises ont été aussi par le passé des zones anciennes d'implantation où étaient installés certains anciens lignages royaux (*Hova*). La combinaison falaises/anciens villages/anciens tombeaux constitue un exemple de zones où l'on trouve beaucoup d'espèces de *Ficus* dont certaines comme *F. Lutea*, très représentative des lignages royaux et qui ont été plantées pour marquer leur présence et leur pouvoir.

Y. A. Thomas

**Photo 7.8** Divers espèces de *Ficus* protégés aux pieds des falaises, sur les lieux d'anciens tombeaux, Sahabe

V. Rafidison

**Photo 7.9** Parc à zébu avec une haie vive de *Ficus reflexa*

Dans les villages actuels, les parcs à zébu sont des zones où les figuiers sont très abondants (**Photo 7.9**) car ils sont bouturés pour former le pourtour des parcs où ils ont un rôle symbolique de protecteur du bétail contre les esprits et les voleurs. Près des maisons ils sont aussi plantés car ils apportent de l'ombre et protègent contre la foudre et la grêle.

## Conclusion

L'atelier d'échange et de discussion avec les représentants des villages de Sahabe, Amindrabe et Ambendrana, a permis de mettre en évidence un ensemble d'usages des plantes et des pratiques qui favorisent leur présence dans les terroirs agraires Betsileo. Des pratiques très précises de protection et de transplantation ont été recensées, montrant le rôle actif des Betsileo afin de favoriser leur présence. Les usages multiples, à la fois matériels et symboliques de la majorité des plantes en font des éléments participant activement au collectif des hommes et de leurs zébus. Alors que les *Ficus* tels que *Ficus reflexa* servent à construire le parc à zébus, la présence de ces

arbres protège symboliquement tout autant les hommes que les zébus des esprits, mais aussi des voleurs de bétail. D'autres usages des espèces de *Ficus* montrent leur rôle majeur à la fois comme marqueur historique et spatial, étroitement associé à des villages abandonnés, des tombeaux et des stèles, éléments permanents de ces territoires dont la présence règle la vie quotidienne des Betsileo. Ce travail fondé à la fois sur une démarche ethnobiologique de longue haleine et des échanges avec les représentants des villages Betsileo de nos sites d'étude, utilise une démarche hybride d'ethnobiologie et de sciences participatives, permettant d'associer pleinement les détenteurs des savoirs locaux à nos travaux de recherche.

## Remerciements

Ce travail a été soutenu par le programme ECOFOR MEDD, l'Ambassade de France à Antananarivo et le Groupe de Travail sur les savoirs autochtones et locaux de l'IPBES. Nous remercions tous les habitants des villages de Sahabe et d'Ambendrana pour leurs apports, ainsi que le Professeur B. Rakouth (Université de Antananarivo), Dr. F. Kjellberg et Dr. M. Hossaert-McKey (CEFE, CNRS, UMR CEFE 5175) pour leurs apports à nos réflexions.

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# 8. Traditional knowledge associated with desert ecosystems in Egypt

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## 8.1. Introduction

People perceive and interact with nature in different ways, thus building unique indigenous knowledge and forming specific cultures. Natural ecosystems cannot be understood, conserved and managed without recognizing the human cultures that shape them; because biological and cultural diversities are mutually reinforcing and interdependent. Together, cultural diversity and biological diversity hold the key to ensuring resilience in both social and ecological systems. Besides biological erosion, arid lands are exposed to erosion of indigenous knowledge as well as of traditional cultivars and rangeland species. Erosion of traditional knowledge adds to the problems of biodiversity conservation in arid lands. The erosion of biodiversity and indigenous knowledge has many implications for biodiversity conservation efforts. This knowledge is always neglected, misunderstood, or considered inferior by researchers, educators, developers, resources mangers and decision makers.

Biodiversity loss is mainly caused by inadequate involvement at a grassroots level of the local and indigenous people who are directly affected by and harmoniously interacting with nature. Indigenous and local communities are environmental managers with immense ecological knowledge and they are crucial partners in both conservation and sustainable use of biodiversity. Despite worldwide efforts, biodiversity conservation has remained a challenge that needs collaborative effort to attain sustainable biodiversity use. Erosion of traditional knowledge, traditional cultivars and rangeland species adds to the problems of biodiversity conservation in arid lands. Without an adequate understanding of their own natural resources, future rural communities and individuals will fail to maintain these resources (Grainger 2003; Solh *et al.* 2003).

In the following sections we investigate the socioeconomic value of desert ecosystems and the indigenous knowledge developed by communities living in the vicinity of these desert ecosystems in Egypt. We emphasize the traditional knowledge associated with native plant species, especially medicinal plants. The information provided here has been collected through surveys of traditional uses and the relationships between native species and the local inhabitants in different desert ecosystems over field excursions to Omayed Biosphere Reserve and Moghra Oasis in the north-western coastal desert of Egypt; northern Sinai; and to Wadi Allaqui Biosphere Reserve and Dungle Oasis in the southern part of Egypt. Information was also documented through the activities of the workshop on "Ethnobotany and assessment of indigenous knowledge in the Egyptian Western Desert" held in Alexandria, Egypt from 16 to 19 January 2016. Observations, structured interviews, and in-depth unstructured interviews were undertaken during the workshop and the follow-up field-work. We also compile here some of the case studies from the desert ecosystems that illustrate the value of indigenous knowledge and its contribution to the livelihood of the desert's inhabitants.

The objectives of the current study were to identify: 1) the goods and services provided by desert ecosystems; 2) the link between the goods and services provided by desert ecosystems and socioeconomic benefits and values for the local communities; and 3) the main stresses and threats to the ecosystems that may restrain the sustained delivery of the goods and services, and influence the ways through which the knowledge can be sustained and transferred to the future generations.

## 8.2. Materials and methods

For identifying the main goods and services provided by desert ecosystems, data were collected from different parts in Egypt including the northwestern desert of Egypt extending from Burg El-Arab to El-Salloum, Moghra Oasis, Burullus Protected Area, Zaranik Protected Area, North Sinai, Upper Egypt, and Wadi Allaqui (**Figure 8.1**). Plant specimens were collected for identification. Specimens were pressed and herbarium sheets were then prepared for later identification of species. Identification and the nomenclature of plant species are according to Boulos (1999, 2000, 2001, 2004, 2009).

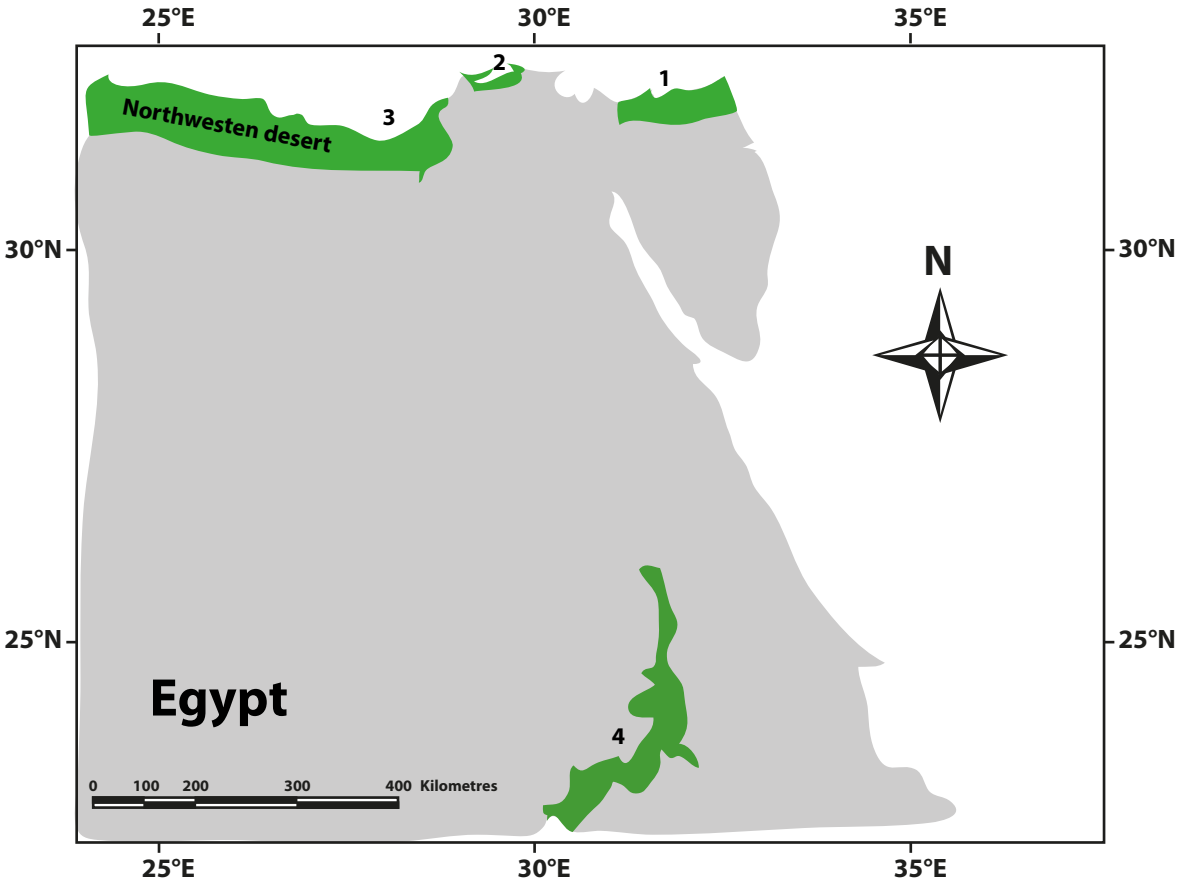


**Figure 8.1** Map of Egypt showing location of areas surveyed and sampled. Green areas represent areas studied, 1=north Sinai and Zaranik protected area, 2=Burullus protected area, 3=northwestern coastal desert, 4=Wadi Allaqui and Aswan.

In addition to compiling data from the literature, existing knowledge regarding the services provided by the native species and their uses was assembled through interviews with local inhabitants in different parts of Egypt through number of field visits conducted between 2010 and 2016. We focused on the elders, herders and those known to own the knowledge or regularly handle and use plants for medicinal or other purposes. Interviews were carried out in local inhabitants' houses, in fields, and in herbalists' shops, where informants were asked to show the researchers the native species used for diverse purposes (**Photo 8.1**).


Marwa Halmy

**Photo 8.1** Interviewing deserts' local inhabitants in different locations
a) in their houses
b) in herbalists' shops
c) herders during herding trips
d) in the field while collecting plants
e) a herbalist preparing a recipe, and
f) explaining how to administer the recipe for consumers

We documented traditional knowledge held by the local inhabitants, and compiled information about the native plant species growing in their surrounding ecosystems, the uses and the value these species provide to them and the dependence of the community on these plants for economic activities and other traditional uses. The healers, elders and herbalist were asked about the medicinal uses of plant species, what parts of the plants are used, what are the different treatments, methods of preparation for the different treatments, administration procedures, and any other information. Local inhabitants were also asked about all the uses and information they know regarding the species in the surrounding habitats. They were asked to identify all the stresses and threats that influence existence of these species and the sustainability of provisioning of services and goods by the desert ecosystems.

## 8.3. Results and discussion

### 8.3.1. Traditional knowledge and identification of the goods and services provided by desert ecosystems

Deserts, like all other natural ecosystems, provide numerous services and goods that support human well-being and survival. Benefits derived from deserts not only meet the demands of the local communities that dwell there, but also support those of the urban and suburban communities in the surrounding areas. These benefits include, among others, provision of sources of food, shelter, medicine and numerous raw materials. For many, deserts are considered as remote, uninhabitable, inaccessible, valueless areas; however, these ecosystems have supported large populations of Bedouin and trans-nomadic communities for millennia. The value of desert ecosystems can be highlighted through identifying the goods and services offered by these ecosystems to the local inhabitants. The information available about the services and goods provided by these ecosystems are not well-documented (Bidak *et al.* 2015). That has led to neglecting deserts in many ecosystem valuation studies. Although vegetation is considered low in desert ecosystems compared to other natural ecosystems, it is an important component upon which the livelihoods of the local communities depend. The results of the current study have revealed that species inhabiting desert ecosystems – especially native plant species – provide numerous direct and indirect services (**Figure 8.2**). The surveyed local inhabitants in different parts of Egypt have emphasized the importance of vegetation and native plants to them both historically and currently. The knowledge about how 482 native plant species recorded in the studied sites are used by the local inhabitants was compiled and is presented in **Table 8.1** (Appendix).

#### ▶ Food, medicine and energy

The results revealed that there are many direct services provided by native plants living in desert ecosystems. The plants are a source of medicines, grazing and fodder, fuel and human food (**Figure 8.3**). The plant species are also used for other purposes included tanning, fencing and windbreak construction, ornamental purposes, handicraft materials, detergent, rope fibers, thatch and shelter materials (**Figure 8.3**). About 57% of the studied species were reported by the local inhabitants to have multiple uses and the remaining 43% have at least one known use (**Figure 8.5**). Some species such as *Acacia ehrenbengiana, Acacia nilotica, Acacia tortilis, Balanites aegyptiaca, Deverra tortuosa*, and *Phoenix dactylifera* were considered very important to the local communities as they were reported to have more than five uses.

The use of desert species in medicine tops all the other reported uses of the species (**Figure 8.3**); of the species recorded in the study area, 348 (almost 72% of the species studied) were used for medicinal purposes (**Table 8.1**, **Appendix**). Many species are used for medicinal purposes along with other uses. A considerable proportion of the native plant species constituting the Egyptian

flora is used for medicinal purposes. A large number of medicinal plants in the Egyptian desert is reported in the literature, for example Bidak *et al.* (2015) reported 236 plant species to have medicinal uses in the northwestern desert.

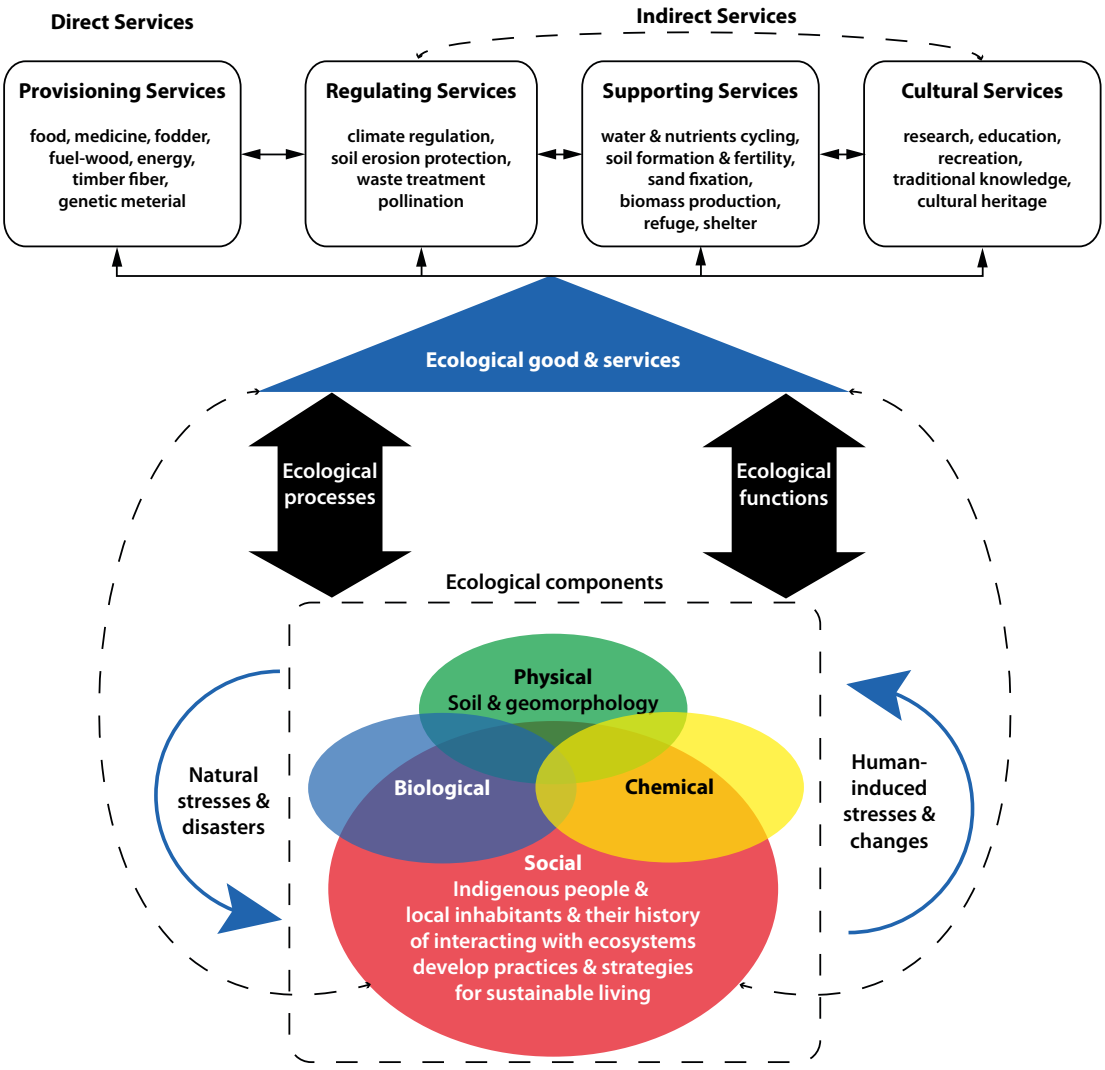


**Figure 8.2** Traditional knowledge forms part of the components of the desert ecosystems, and its development as a result of the interaction of local inhabitants with different components of the ecosystem (adapted from Bidak *et al.* 2015).

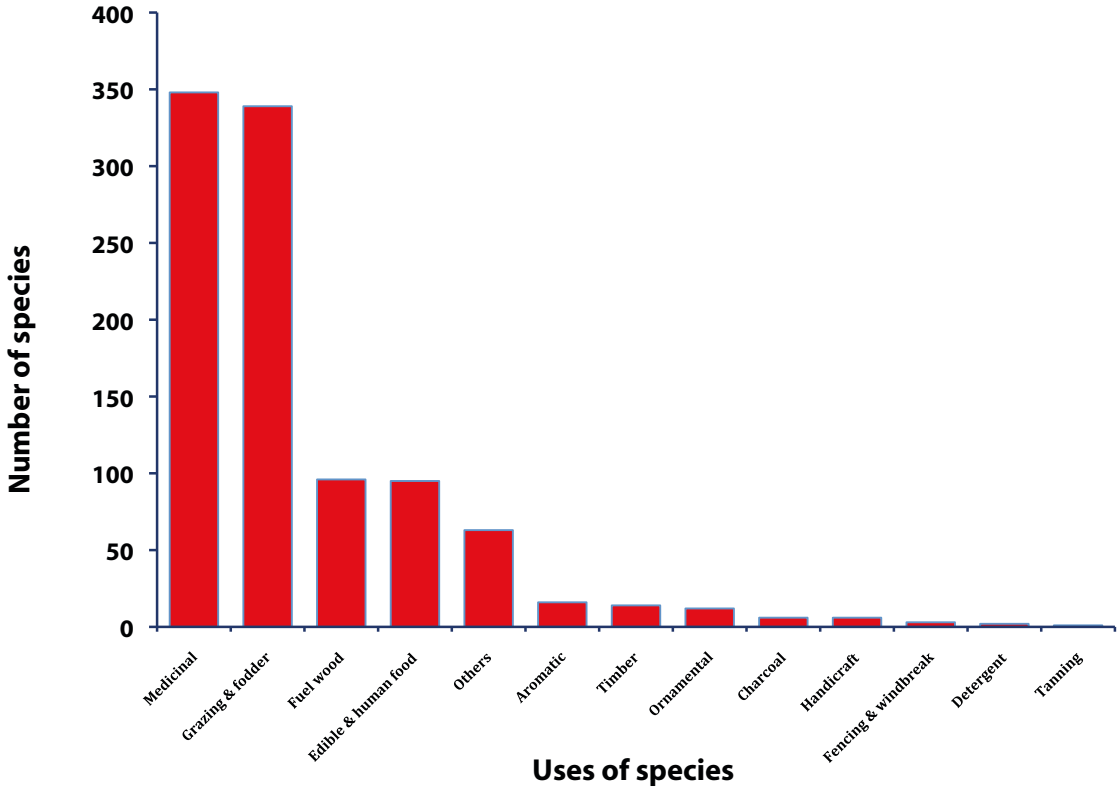


**Figure 8.3** The main uses of plant species in the surveyed areas as reported by the desert's local inhabitants, and the number of species utilized for these different uses.

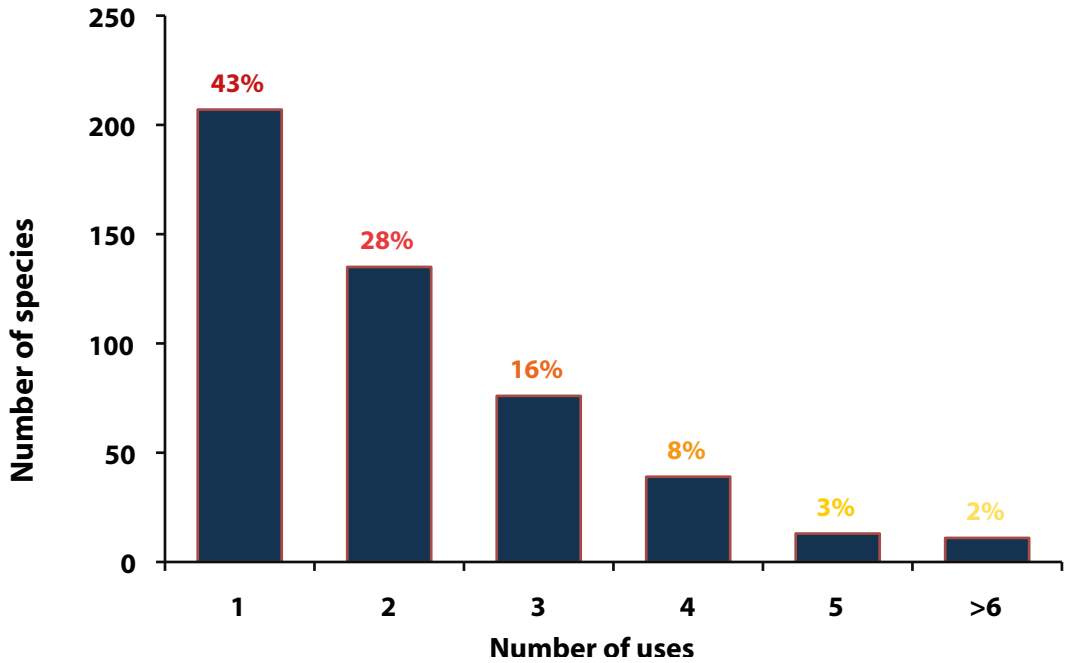


**Figure 8.4** Number of recorded species exploited by desert communities for single or multiple different uses.

The local inhabitants collect medicinal plants for personal use or for living. Collecting medicinal plants in the Egyptian desert used to be a source of income especially in the northwestern coastal desert. Collecting these plants used to be one of the major economic activities practiced by the local inhabitants in the northwestern coastal desert (Bidak *et al.* 2015). We have complied the medicinal uses of about 103 species, the parts used and the preparations made out these plants and the treatment the plant are used for as mentioned by the local inhabitants were assembled (**Appendix, Table 8.2**).

The study revealed that about 96 plant species recorded in the studied sites are reported by the local inhabitants to be used as firewood (**Figure 8.4**). Those harvested by local communities as fuel wood species are mainly woody perennial small trees, shrubs and subshrubs (**Appendix, Table 8.1**). Both men and women are responsible for securing the firewood for domestic use. The local inhabitants are aware of the need to keep the species they use for firewood sustainable so when they collect firewood plants they take only the dry and dead parts. It is not desirable to collect any green parts. Also, not all the woody plants are considered suitable as firewood; local communities collect species that are known to yield the strongest flame and those that burn for a longer time. Of the species preferred by local inhabitants for their quality firewood are *Acacia ehrenbergiana, Acacia tortilis, Balanites aegyptiaca, Calligonum polygonoides, Gymnocarpos decanderus, Lycium europaeum, Anabasis articulata*, and *Thymelaea hirsute*. Over-collection and overharvesting of these species put them under pressure and may lead to reduction in their distribution (Bidak *et al.* 2013, 2015; Halmy & Salem 2015).

The study revealed that about 95 species are consumed by the local inhabitants as a source of food (**Appendix, Table 8.1**). That included eating some species raw, dried, used as spices and condiments, or used for preparing refreshing drinks. *Mentha longifolia* and *Thymus capitatus* are used as spices and condiments and also used for preparing refreshing drinks. The tubers of *Cyperus rotundus*, and the fruits of *Hyphaene thebaica, Lycium europaeum* and *Nitraria retusa* are collected and eaten by local inhabitants. Some species are cooked in stews and hotpots such as *Portulaca oleracea* and *Malva parviflora*. Some species are used and consumed directly as green herbs or added to salads such as *Brassica tournefortii, Cichorium endivia, Deverra tortuosa, Rumex pictus* and *Sonchus oleraceus*. The dried roots of *Centaurea pumilio* are used as a fattening agent. A fungus species known as *Terfezia claveryi* is edible and also used as aphrodisiac, which makes it of high economic value. It is known to be found underground in sandy habitats and associated with *Helianthemum lippii* species. For its relatively high monetary value (US$10.50/kg; Bidak *et al.* 2015), some of the local inhabitants have specialized in searching for and collecting that species.

### ▶ Other uses

Many species have other traditional uses, such tanning (e.g. *Calligonum polygonoides, Cistanche phelypaea*), detergent making (e.g. *Anabasis articulata*), rope making, handicraft supplies (e.g. *Juncus acutus, Juncus rigidus, Lygeum sparntum, Medemia argun, Phoenix dactylifera, Typha domingensis, Thymelaea hirsuta*) and in the making of thatches and shelters. We have found that some of these species are very rare and over-collection of the species by the local inhabitants threatens the existence of these species. For example *Medemia argun* (**Photo 8.2**) is a rare fan palm that suffers from overexploitation by the local communities in Wadi Allqui and the southern part of Egypt. The largest population of this species in Egypt occurs in Dungle Oasis. The field trip to the oasis conducted by the team on 15 February 2016 found that the population declined from 25 individuals with three females, four males and 18 juveniles according to the survey by Ibrahim (2010), to only 18 living individuals with three females, four males and 11 juveniles. The population was recorded in 1998 to have 29 juveniles, four males and one female surviving (Bornkamm *et al.* 2000). Local inhabitants favor the use of the leaves of the plant for making mats and ropes; the ropes made of the pant leaves are preferred for their strength and durability. The local communities not only harvest the leaves off the trees, they would cut down trees to use their leaves.

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**Photo 8.2** Above: one male palm tree of *Medemia argun* recorded in Wadi Quleib a tributary of Wadi Allaqui in southern part of Egypt. It can be noticed that all the fronds of the leaves have been cut completely. This individual is the only individual recorded in Wadi Quleib, but this did not stop the local inhabitants from cutting it.

**Photo 8.3** Left: a fruiting female palm tree, one of the only three female trees of *Medemia argun* population in Dungle Oasis visited by the team in 15/2/2016.

Some plants are used as an aromatic source for fumigation and as pastille (e.g. *Teucrium polium, Marrubium vulgare, Prasium majus, Salvia aegyptiaca, Salvia lanigera, Seriphidium herba-album, Thymus capitatus*, and *Deverra tortuosa*). Some plants are used for production of charcoal, which is used locally or transported to other places across Egypt to be used (e.g. *Acacia ehrenbengiana, Acacia nilotica, Acacia tortilis* ssp. *raddiana*, and *Balanites aegyptiaca*). Other uses include using plants for their timber, in making fences and windbreaks, and making thatching.

Besides their utilitarian importance, the native plants in the deserts play very crucial ecological roles, such as supporting sand fixation, and increasing soil fertility (Heneidy & Waseem 2007, 2009). *Panicum turgidum*, for example, is one of the species that was found to fix sand and increase soil fertility. Local inhabitants in northern part of Sinai have mentioned that they prefer to grow some crops near the cushions of *P. turgidum*, because they have noticed that growing crops near these plants provides good yields. The local inhabitants determined that they collect the seeds of that species to propagate it and increase its distribution in their lands and they also try to propagate it in vegetative way by rhizome. The species was reported to have a mycorrhizal association (Hashem *et al.* 2015); the fungus associations help provide nutrients needed for the species and enhance the soil conditions in the vicinity of the plant. This explains why crops grown by local inhabitants near the species do well. Some species enhance soil formation, decreasing soil erosion, and have the ability to tolerate high soil salinity (e.g., *Arthrocnemum macrostachyum, Halocnemum strobilaceum, Haloxylon salicornicum, Nitraria retusa* and *Tamarix nilotica*). Some salt tolerant species form phytogenic mounds, which facilitates fixation of sand and serves as refuge and shelter for many other desert species (Bidak *et al.* 2015).

## 8.3.2. The value of traditional knowledge

The value of traditional knowledge is not only in how it describes the link between goods and services provided by desert ecosystems and socioeconomic benefits for the local communities, but in the fact that this knowledge provides us with the solutions for some of the uncertainties we face in the future. The desert communities follow a hierarchical social structure. In a large swath of desert all the dwellers of the area will likely belong to the same big tribe (e.g. Awlad Ali tribe in the western Desert, Ababda, Basharia in the eastern desert and the southern part of

Egypt). The big tribe branches into a number of sub-tribes, each known as *Aila* (which in Arabic refers to "family"). Under the family there can be many *bait*, (referring to "house"), which is an extended family that may or may not live in a single household. Each *bait* can contain on average between 14 to 17 individuals ranging from infants to adults and seniors (Bidak *et al.* 2015). For the local inhabitants the desert lands are considered to be the main resource and asset of each family. Each tribe and sub-tribe knows and defines the borders of their land ownership and these borders should be known to all the other sub-tribes and to the entire community. Tribal laws and legislations that were developed in the traditional system govern how conflicts regarding the land and use of the resources in the land are resolved. Those include the use of the land for grazing and collection of medicinal plants, collection of fuel wood and extraction of any material from the land, and recently trade in the land itself for investors.

For millennia the subsistence of the communities dwelling in deserts relied on tapping the resources available in the desert and the sustainability of the goods and services provided by desert ecosystems. Both natural and human-induced changes have exerted some pressure on the societies located in deserts. These societies have started to suffer from low income and high unemployment due to a decline in the natural resources. The local inhabitants practice a number of economic activities to secure a living, that include grazing; rain-fed agriculture; collection of medicinal plants and practicing folk medicine; and some localities practice hunting and fishing. Grazing and farming are still the most important forms of land use in the Egyptian deserts. The contribution of grazing to the livelihood of the desert local inhabitants decreases as an economic activity as we get closer to the urban and suburban areas (Bidak *et al.* 2015).

### ▶ Herding

Grazing is still a basic economic activity for the desert communities and owning a large flock of animals, especially sheep and goats, is considered prestigious. The size of the flock owned by the "family" defines the wealth and social status in the tribe. Now the head of the family no longer practices grazing himself, but can either commission a son or a relative for the task or hire someone from the family to do the job. Meanwhile, the head of the family supervises the grazing process from time to time, especially when the flock is moved in a long herding trip to a distant rangeland. This is now facilitated through the use of vehicles and the availability of four-wheel drive cars. When the vegetation dries out in the rangelands in their vicinity, local inhabitants move with their herds composed of sheep, camels and goats (*alsaai* is the local word for the herd) in long herding trips in search for areas with natural vegetation cover. In the past the whole family used to move in search for the vegetation, but nowadays only those working as herders or commissioned by the head of the family go on the long herding trips that might last for up to three months. In the northwestern coastal desert, herders move southward to areas where natural vegetation is high and supported by underground water such as Moghra Oasis (Salem & Waseem 2006). South of Egypt, herds are moved from Wadi Allaqi in winter months to grazing in the hill areas to the east and south; this allows the vegetation in Wadi Allaqi time to recover (Briggs *et al.*, 1999).

About 339 species (~71%) of the surveyed species are reported by the local inhabitants to be palatable grazing plants. Generally, raising animals in the surveyed areas depends mainly on the natural vegetation cover and the native plants; however, they supplement that with fodder in the dry season and the dry years. Local communities know where are the most palatable species can be found in their vicinity or in the far distant areas. Of the plants recorded in the surveyed sites, those reported by the local inhabitants as highly palatable are *Acacia ehrenbergiana, Acacia tortilis, Balanites aegyptiaca, Calligonum polygonoides, Deverra tortuosa, Echiochilon fruticosum, Gymnocarpos decanderus, Panicum turgidum, Plantago albicans*, and *Malva parviflora* (**Appendix, Table 8.1**). The plants reported in **Table 8.1** as grazing plants support both domesticated and wild animals. For example, *P. turgidum* is a perennial grass species commonly distributed in the Egyptian deserts. The study by Heneidy & Waseem (2007) has indicated that the species is preferred to other plants by all animals during its flourishing time, and is also preferred by some of the wild animals

(e.g., hares and gazelles) over other species. The local communities consider its existence as an indicator on the occurrence of gazelle species. *A. ehrenbergiana* is another example of a perennial large shrub common in the wadis of the southern part of Egypt and is highly preferred by the Egyptian Gazelle. The species is also used by the local inhabitants in the south as an as indicator for the occurrence of gazelles.

The highly palatable species are under high pressure from overgrazing for two reasons. First, the increase in the flock sizes due the rise in the standard of living especially in the northwestern coastal desert (Halmy *et al.* 2015a, 2015b). Second, the natural changes in the climate and the increase in the dry season, shrinkage of the rainy season and decrease in precipitation. The herders have maintained that some of the species of low palatability especially halophytes such as *Arthrocnemum macrostachyum, Halocnemum strobilaceum*, and *Haloxylon salicornicum* are good for the animals that suffer from some illness such as gastrointestinal problems. Also, they have mentioned that the diet of the animal affects the taste of the meat, so they make sure to feed their animals specific plant species to assure the good taste of the meat.

### ▶ Medicinal herbs collection & traditional medicine

Native plants used for medicinal purposes in the desert provide a source of income for the local communities. Collection of medicinal herbs and the trade in medicinal herbs have been considered one of the major economic activities supporting these communities. Members of the local communities commonly used to collect medicinal herbs to sell them to herbalists and sometimes to pharmacognosists. This is practiced as a side activity complementary to other activities such as grazing and farming. In some desert areas (e.g., the northwestern coastal deserts) where some demographic changes have taken place, this activity is no longer practiced with the same enthusiasm. This is because the financial return from this activity is not rewarding compared to the other new activities emerging in the area. In general, herb collectors are adults with enough experience of the plants and where they can be found. The youth are encouraged to join the herding trips with others to learn about the plant names, and the ways to collect and handle medicinal herbs, but they do not find working in this activity appealing and they prefer working in other professions.

The consumption of the medicinal herbs in the market is not confined to the desert communities and rural areas, but they are consumed in urban areas. We have compiled a list of some of the species that are collected and used for treating many diseases in both local communities and in urban areas of Egypt (**Appendix**, **Table 8.2**). The methods of administration and preparations are assembled; however the authentication of the merit of using these treatments and preparation needs intensive and extensive scientific work. A survey by Bidak *et al.* (2015) found that some species very popular in the market of medicinal herbs included *Colchicum ritchii, Ecballium elaterium, Deverra tortuosa, Seriphidium herba-album, Urginea maritima*, and *Atractylis carduus*. The study revealed that on average a collector can round up 200 kg of *Seriphidium herba-album* (worth approximately USD $35), 130 kg of *Terfezia claveryi* and 100 kg of *Ecballium elaterium*. The monetary value of the medicinal herbs varies according to the season, supply and demand, the location from which the herbs were collected, and the quality of the collected material.

Medication and therapy in the desert communities still depends on folk medicine, which is considered one of the main traditional activities in the desert ecosystems. The healers and those using their traditional knowledge in treating medical problems object to calling folk medicine an 'alternative' medicine, they insist on calling it the original medicine, referencing the early reliance of the humanity on that type of medication for millennia. Folk medicine in the desert communities depends mainly on the use of native plants in treating most of the diseases and aliments. The local inhabitants maintained that they use plants in medical treatments because they think that depending on plants for medication is safer than prescribed medications. The other reason is that therapy using medicinal plants is significantly cheaper than prescribed

medications. Moreover, they can get the medicinal plants very easily either from herbalist shops available in their vicinity or they can get them from the natural habitats surrounding them.

In each tribe and sub-tribe there are elders who own the knowledge of the medicinal plants, their remedial usefulness, and how they have to be administered for each case of illness. This knowledge is inherited from generation to the next.

Due to the recent developmental changes and the expansion of some urban and sub-urban regions in the surrounding deserts, the local desert inhabitants now practice new forms of economic activities, especially the younger generations. The local inhabitants in the western coastal desert of Egypt for example are now involved in the construction of coastal resorts, real-estate businesses, intensive agriculture, and quarrying activities (Bidak *et al.* 2015; Halmy 2012; Halmy & Gessler 2015; Halmy & Salem 2015; Halmy *et al.* 2015a, 2015b). Women are active participants in the economic activities through engagement of in some income generating activities that include their involvement in raising livestock, grazing activities, manufacturing of handicraft made of wool that are sold in specific shops (**Photos 8.4 & 8.5**).

### ▶ Traditional knowledge and management of desert ecosystems

Traditional knowledge can help in allowing us to gain more influence on how to manage the natural landscape. Studies have revealed the merit of establishing the management of rangeland and the rehabilitation of degraded ecosystems on the basis of traditional knowledge identified by local inhabitants (Heneidy, 1991; Heneidy & Waseem, 2007; Heneidy & Halmy, 2009). A study by Heneidy (1991) on using native plants as fodder species involved watching and observing the herders, and joining the herding trips with local inhabitants for few years. Through the study information was collected from the herders. The animal herds were observed while browsing the wild native plants, whereby the palatable native species were identified and the seasonal preference of plant species was observed. The study then compared the nutritive values of the palatable and preferred species to the common commercial fodder species and recommended some of these species for propagation by local communities.

For using native species in rehabilitation of degraded coastal Mediterranean rangelands, Heneidy & Waseem (2007) have used *P. turgidum*, a native perennial grass, in an experiment to test its merit in rehabilitating the coastal Mediterranean degraded rangeland. The species was chosen based on information collected from the local inhabitants. The study investigated the socioeconomic value of this species through documentation and survey of its traditional uses in different places in Egypt. The local inhabitants reported that the species is preferred is by all animals during its flourishing period. The study illustrated the importance of *P. turgidum* for the local inhabitants as a very important fodder plant, for both domestic and wild animals. In addition, it highlighted the main benefit from propagating this plant to increase the grazing potential in the coastal rangelands and reduce of the use of artificial feed. The study investigated the most suitable methods for the propagation of the species in the coastal Mediterranean rangelands and tested the possibility and capacity of germination and growth of different populations of *P. turgidum*. The results of the study showed that in this region the most suitable method for propagating it is by grains and the best time is the first week of June. The study highlights that we are in need of the traditional knowledge to decide which species to use for rehabilitating degraded ecosystems.

## 8.3.3. The evaluation of traditional knowledge

The relationship between scientific knowledge and traditional local knowledge is not well-established. Attempts should be made to evaluate and validate the scientific basis of traditional knowledge. There is indeed some contribution of traditional knowledge to science, but this has to be more studied, documented and acknowledged by scientists. Some scientists are aware of the importance of ILK and have already started to evaluate the scientific basis of some aspects of it; for example, evaluation of the medicinal plants and the extraction of the active ingredients form

some plants based on the knowledge obtained from indigenous peoples. Another example is the evaluation of the nutritive value of some of the wild species known by the natives to be palatable and preferred by their livestock. A study by Heneidy & Halmy (2009) assessed the nutritive value of the perennial grass *P. turgidum* reported by local inhabitants as a platable grazing plant. The nutritive value of the plant was compared to the commercial fodder plants. Another study by Heneidy (1991) identified the most beneficial pasture species and which species are more preferred by grazing animals. Those species identified as palatable based on the ILK and field observations were evaluated for their nutritive value and compared to commercially known fodder crops.

Another attempt by Abdel Aal and Diab (2013) to assess the compatibility of the traditional knowledge and scientific knowledge in the field of animal husbandry found that there is a high compatibility in the field of breeds, watering, grazing, reproduction, and newborn care, while there is incompatibility in the field of health care. To determine the confidence level of the local inhabitants in their traditional knowledge compared scientific knowledge the study found that local inhabitants consider their knowledge more important than scientific knowledge in all aspects of animal husbandry and grazing, while they consider that scientific knowledge as important as traditional knowledge regarding health care.

Studies conducted in the coastal deserts in Egypt have shown that the management and rehabilitation of natural rangeland should be based on the indigenous knowledge of the local inhabitants in these ecosystems. In future we need to rely on indigenous knowledge on what species to use on degraded ecosystems.

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**Photo 8.4** Handicrafts woven by women in the western coastal desert

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**Photo 8.5** A shop in El-hamam region in the western coastal desert specialized in selling wool hand-made handicraft, made by women in the western coastal desert

### 8.3.4. The main stresses to desert ecosystems and how that threatens ILK

Bidak *et al.* (2015) identified the main stresses and threats to desert ecosystems as the overharvesting of woody plants for fire wood, over-collection of medicinal plants, overgrazing, urban development, intensive agricultural practices, invasive species, and other activities. These threats to ecological services not only may hinder the sustained delivery of the goods and services, but may also affect the sustainability of traditional knowledge. The change in the traditional nomadic lifestyle of local inhabitants taking place in some areas in the desert ecosystems threatens the sustainability of the traditional knowledge. For example the western coastal desert of Egypt has faced changes due to number of development projects over the last three decades. These projects include resorts construction, quarrying and intensive agricultural projects (Halmy *et al.* 2015a, 2015b; Halmy & Gessler 2015). These activities are taking place in areas inhabited by the desert local communities and have exerted pressure on the natural resources of the region and influenced the demographic structure and the nomadic lifestyle of local inhabitants (Bidak *et al.* 2015).

The fact that the local and traditional knowledge is mainly oral and held by elders and aged adults of the communities, and it is mostly stored in the elders' memories and is rarely documented, reveals the threats the changes in these societies pose on the continuity of the knowledge. These changes may have resulted in the decline of the number of local inhabitants holding traditional knowledge, especially those who know the uses of the native plants, what are the most important medicinal herbs and the other traditional uses. It became obvious that the younger generation of the local inhabitants feel less interest in acquiring traditional knowledge. The younger adults interviewed have maintained that they prefer working in the coastal resorts and quarries to working as herders and collectors of medicinal plants. This means that in the future, this knowledge is at risk of extinction and may disappear. It is clear that traditional systems are subjected to changes, but not clear how the systems need to be able to resist and be flexible in the face of the change, including keeping their knowledge alive. There is therefore an urgent need to document and validate the existing local and traditional knowledge in order to keep it for future generations, as part of a social heritage and as a component of biodiversity protection.

## Conclusion and recommendations

Although deserts are fragile and support low levels of productivity, they provide a variety of goods and services, the continuity of which is contingent upon the adoption of rational land management practices. It became more evident that local and traditional knowledge owned by local inhabitants in different parts of Egypt could provide innovative ways management of these fragile ecosystems. Changes in land use and recent ill-managed human activities may influence the availability of these services and strongly impact biodiversity and habitat availability including influencing the traditional knowledge associated with these ecosystems. This knowledge offers educational and scientific research opportunities. Scientists, natural resource managers and development practitioners need to not only recognize the importance of local and traditional knowledge, but also to consider it in all efforts directed towards managing the natural ecosystems. Efforts should be made to encourage involvement of the local communities in any management plan to ensure sustainable use of the natural resource. Traditional knowledge of the local inhabitants is an integral part of the desert ecosystem, its maintenance should be considered as a priority integrated with the effort of the conservation of biodiversity and ecosystem services. The status of the holders of the indigenous knowledge in the different local communities should be assessed and lists of these holders should be documented. Non-intrusive approaches should be followed for harvesting of the information these holders own; otherwise erosion of this knowledge will be faced.

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# Appendix 8.1

**Table 8.1** List of species recorded in the surveyed sites; their taxonomic position;
**commonness** (cc= very common, c= common, Fc= fairly common, Fr= fairly rare, r= rare, rr= very rare);
**life span** (Ann= Annual, Bin= Biennial, Per=Perennial); growth form (Ph= phanerophyte, Ch= cheamophyte, Hc= himecryptophyte, Gh= geophyte, Hh= hydrophyte, Th= Therophyte);
**uses by local inhabitants** (Ar= aromatic source, Cr= for producing charcoal, De= detergent, Ed= edible and used in human food, Fu= fuel wood, Gr=Grazing plant or used as a fodder, Ha= used in making handicrafts, Md= has medicinal value, Or= ornamental, Ta=Tanning, Ti= Timber, Wb=fencing & windbreak, and Ot, other uses such as rope making thatching and as shelter materials); and
**sites where the species recorded** (ND= Northwestern Desert, NS= North Sinai, BA= Burullus Protected Area, UE=Upper Egypt, WA= Wadi Allaqui, ZA=Zaranik Protected Area).

**Table 8.2** Native plant species used by desert local inhabitants for medical purposes.



| Species | Family | Commonness | Life Span | Growth Forms | Uses | Site |
|---|---|---|---|---|---|---|
| *Abutilon pannosum* (G. Forst.) Schltdl. | Malvaceae | c | Per | Hc | Cr, Fu, Gr | WA |
| *Acacia ehrenbengiana* Hayane | Fabaceae | rr | Per | Ph | Cr, Fu, Gr, Md, Ti, Ot | ND. WA |
| *Acacia nilotica* (L.) Delile | Fabaceae | c | Per | Ph | Cr, Fu, Gr, Md, Ti, Ot | WA |
| *Acacia pachyceras* O. Schwartz var. *najdensis* (Chaudhry) Boulos | Fabaceae | c | Per | Ph | Md | NS |
| *Acacia tortilis* (Forssk.) Hayne subsp. *raddiana* (Savi) Brenan | Fabaceae | c | Per | Ph | Cr, Fu, Gr, Md, Ti, Ot | WA, NS |
| *Acacia tortilis* (Forssk.) Hayne subsp. *tortilis* | Fabaceae | c | Per | Ph | Cr, Fu, Gr, Md | WA, NS |
| *Achillea fragrantissima* (Forssk.)Sch.Bip. | Asteraceae | c | Per | Hc | Md | NS |
| *Achillea santolina* L. | Asteraceae | r | Per | Th | Fu, Gr, Md | ND, NS |
| *Adiantum capillus-veneris* L. | Adiantaceae | c | Per | Hc | Md | ND |
| *Adonis dentata* Delile | Ranunculaceae | cc | Ann | Th | Gr, Md, Ot | ND, BA, NS |
| *Aegilops kotschyi* Boiss. | Poaceae | c | Ann | Th | Fu, Gr, Md | ZA, ND |
| *Aeluropus lagopoides* (L.) Trin. ex Thwaites | Poaceae | cc | Per | Gh | Gr, Hf | BA |
| Aeluropus littoralis (Gouan) Parl. | Poaceae | rr | Per | Gh | Gr | BA |
| *Aerva javanica* (Burm. f.) Juss. ex Schult. | Amaranthaceae | Fc | Per | Ch | Hf, Md | NS, WA |
| *Agathophora alopecuroides* (Delile) Fenzl ex Bunge | Chenopodiaceae | r | Per | Ch | Gr, Md | BA, NS |
| *Aizoon canariense* L. | Aizoaceae | cc | Ann | Th | Gr, Fu, Hf, Md | ND, WA |
| *Ajuga iva* (L.) Schreb. | Lamiaceae | cc | Per | Hc | Md | ZA, BA, ND |
| *Alhagi graecorum* Bioss. | Fabaceae | Fc | Per | Ch | Gr, Fu, Md, Hf | BA, ND, NS, WA |
| *Allium roseum* L. | Alliaceae | r | Per | Gh | Gr, Hf, Md | BA, ND |
| *Alternanthera sessilis* (L.) Dc. | Amaranthaceae | Fc | Per | Gh | Gr, Hf, Md, Or | BA |
| *Amaranthus graecizans* L. | Amaranthaceae | cc | Ann | Th | Gr | WA |
| *Amaranthus hybridus* subsp. *hybridus* L. | Amaranthaceae | Fc | Ann | Th | Md | BA |
| *Amaranthus lividus* L. | Amaranthaceae | r | Ann | Th | Hf, Md, Ot | BA |
| *Amaranthus viridis* L. | Amaranthaceae | cc | Ann | Th | Hf, Md | BA |
| *Ambrosia maritima* L. | Asteraceae | c | Bin | Hc | Md | UE |
| *Ammi visnaga* (L.) Lam. | Umbelliferae | c | Ann | Th | Md, Ot | BA |
| *Ammochloa palaestina* Boiss. | Poaceae | Fc | Ann | Th | Gr | ND |
| *Ammophila arenaria* (L.) Link | Poaceae | cc | Per | Th | Fu, Gr | ND |
| *Anabasis articulata* (Forssk.) Moq. | Chenopodiaceae | c | Per | Ch | De, Fu, Gr, Md | ZA, ND, NS |

| Species | Family | Commonness | Life Span | Growth Forms | Uses | Site |
|---|---|---|---|---|---|---|
| *Anabasis oropediorum* Maire | Chenopodiaceae | cc | Per | Ch | De, Fu, Gr, Md | ND |
| *Anabasis setifera* Moq. | Chenopodiaceae | c | Per | Ch | Hf, Gr | ND |
| *Anacyclus monanthos* L. | Asteraceae | cc | Ann | Th | Fu, Gr | ND |
| *Anagallis arvensis* L. | Primulaceae | c | Ann | Th | Gr, Md | BA, ND, NS |
| *Anastatica hierochuntica* L. | Brassicaceae | c | Ann | Th | Md | NS |
| *Anchusa hispida* Forssk. | Boraginaceae | c | Ann | Th | Gr | ND |
| *Anchusa humilis* (Desf.) I. M. Johnst. | Boraginaceae | c | Ann | Th | Gr | ZA |
| *Andrachne aspera* Spreng. | Euphorbiaceae | c | Per | Hc | Md | NS |
| *Andropogon distachyos* L. | Poaceae | Fc | Per | Gh | Gr | WA |
| *Anethum graveolens* L. | Umbelliferae | Fc | Ann | Th | Hf, Md | BA |
| *Anthemis microsperma* Boiss. & Kotschy | Asteraceae | c | Ann | Th | Gr, Md | ND |
| *Argyrolobium arabicum* (Decne.) Jaub & Spach | Fabaceae | r | Ann | Th | Gr, Md, Or | ND |
| *Argyrolobium uniflorum* (Decne.) Jaub & Spach | Fabaceae | Fr | Per | Ch | Fu, Gr, Md | ND, ZA |
| *Arisarum vulgare* Trag. & Tozz. | Araceae | c | Per | Th | Gr, Hf, Md | ND |
| *Aristida adscensionis* L. | Poaceae | cc | Ann | Th | Gr | WA |
| *Aristida funiculata* Trin. & Rupr. | Poaceae | cc | Ann | Th | Gr, Md | WA |
| *Aristida mutabilis* Trin. & Rupr. | Poaceae | cc | Ann | Th | Gr, Hf, Md | WA |
| *Arnebia hispidissima* (Lehm.) DC. | Boraginaceae | cc | Ann | Th | Gr, Hf | WA |
| *Artemisia judaica* L. | Asteraceae | c | Per | Ch | Md | NS |
| *Artemisia monosperma* Delile | Asteraceae | Fc | Per | Ch | Fu, Gr, Md | ZA, ND, NS |
| *Arthrocnemum macrostachyum* (Moric.) K. Koch | Chenopodiaceae | c | Per | Ch | Fu, Gr, Md, Ot | ZA, BA, ND |
| *Asparagus aphyllus* L. | Liliaceae | Fc | Per | Ch | Fu, Gr, Md | ND, NS |
| *Asparagus stipularis* Forssk. | Liliaceae | r | Per | Ch | Fu, Gr, Md, Wb | ZA, BA, NS, ND |
| *Asphodelus aestivus* Brot. | Liliaceae | cc | Per | Th | Fu, Gr, Md,Ot | ND |
| *Asphodelus tenuifolius* Cav. | Liliaceae | cc | Ann | Th | Hf | WA |
| *Asphodelus viscidulus* Boiss. | Liliaceae | r | Ann | Th | Fu, Gr, Md | ZA |
| *Aster squamatus* (Spreng.) Hieron ex Sod | Asteraceae | Fr | Bin | Th | Gr, Md | BA, ND |
| *Astragalus annularis* Forssk. | Fabaceae | c | Ann | Th | Gr, Md | ZA |
| *Astragalus annularis* Forssk. | Fabaceae | c | Ann | Th | Gr, Md | ND |





| Species | Family | Commonness | Life Span | Growth Forms | Uses | Site |
|---|---|---|---|---|---|---|
| *Astragalus boeticus* L. | Fabaceae | Fc | Ann | Th | Gr, Md | ZA, BA, ND |
| *Astragalus camelorum* Barbey | Fabaceae | rr | Per | Ch | Gr | ZA |
| *Astragalus eremophilus* Boiss. | Fabaceae | cc | Ann | Th | Fu, Gr, Md | WA |
| *Astragalus fruticosus* Forssk. | Fabaceae | r | Per | Hc | Gr, Hf | ZA |
| *Astragalus kahiricus* DC. | Fabaceae | r | Per | Hc | Gr | ZA |
| *Astragalus peregrinus* Vahl. | Fabaceae | Fc | Ann | Th | Md | BA, NS |
| *Astragalus spinosus* (Forssk.) Muschl. | Fabaceae | c | Per | Ch | Gr Md | ND |
| *Astragalus vogelii* (Webb) Bornm. | Fabaceae | c | Ann | Th | Fu, Gr, Md | WA |
| *Atractlyis carduus* (Forssk.) C. Chr. | Asteraceae | Fc | Per | Ch | Gr, Md | ZA, ND |
| *Atriplex canescens* (Pursh) Nutt. | Chenopodiaceae | r | Per | Ch | Md, Ot | BA |
| *Atriplex halimus* L. | Chenopodiaceae | Fc | Per | Gh | Fu, Gr, Hf, Md, Or, Ot | BA, ND, NS |
| *Atriplex leucoclada* Boiss. | Chenopodiaceae | r | Per | Ch | Gr | BA, ND |
| *Atriplex nummularia* Lindl. | Chenopodiaceae | r | Per | Ch | Fu, Gr, Md | BA, ND |
| *Atriplex portulacoides* L. | Chenopodiaceae | Fc | Per | Ch | Gr | BA |
| *Avena barbata* Pott ex Link | Poaceae | cc | Ann | Th | Gr, Md | ZA, NS |
| *Avena fatua* L. | Poaceae | cc | Ann | Th | Gr | BA, ND |
| *Avena sativa* L. | Poaceae | cc | Ann | Th | Gr, Hf, Md | ZA, BA, ND |
| *Azolla filiculoides* Lam. | Azollaceae | Fc | Per | Hh | Gr, Md, Ot | BA |
| *Balanites aegyptiaca* (L.) Delile | Zygophyllaceae | Fc | Per | Ph | Cr, Fu, Gr, Hf, Md, Ot, Ti | WA |
| *Ballota undulata* (Fresen.) Benth. | Lamiaceae | Fc | Per | Ch | Md | NS |
| Bassia indica (Wi4t) A. J. Scott | Chenopodiaceae | c | Ann | Th | Gr, Hf, Md | BA |
| *Bassia muricata* (L.) Asch. | Chenopodiaceae | c | Ann | Th | Fu, Gr, Md | ZA, ND, NS |
| *Beta vulgaris* L. | Chenopodiaceae | Fc | Ann | Th | Gr, Hf | BA, ND |
| *Blepharis edulis* (Forssk.) | Acanthaceae | Fc | Per | Th | Gr, Md | ND |
| *Boerhavia repens* L. ssp. *viscosa* (Choisy) Maire | Nyctaginaceae | c | Per | Ch | Gr, Md | WA |
| *Brachypodium distachyum* (L.) P. Beauv. | Poaceae | c | Ann | Th | Gr | ZA, ND |
| *Brassica rapa* L. | Brassicaceae | Fc | Ann | Th | Hf, Md | BA |
| *Brassica tournefortii* Gouan | Brassicaceae | cc | Ann | Th | Gr, Hf, Md, Ot | ZA, BA, ND |
| *Bromus catharticus* Vahl. | Poaceae | Fr | Ann | Th | Gr, Hf | BA, ND |

| Species | Family | Commonness | Life Span | Growth Forms | Uses | Site |
|---|---|---|---|---|---|---|
| *Bromus rubens* L. | Poaceae | Fc | Ann | Th | Gr, Md | ZA |
| *Bupleurum semicompositum* L. | Umbelliferae | Fc | Ann | Th | Ar, Fu, Gr, Hf, Md, Ot | ZA, ND |
| *Cakile maritima* Scop. | Brassicaceae | Fc | Ann | Th | Gr, Md, Ot | ZA, BA, ND |
| *Calendula arvensis* L. | Asteraceae | cc | Ann | Th | Gr, Md | BA, ND, NS |
| *Calligonum polygonoides* L. ssp. *comosum* L'Her. | Polygonaceae | Fc | Per | Ch | Fu, Gr, Md, Ti, Ot | ZA, ND |
| *Calotropis procera* (Aiton) W. T. Aiton | Asclepiadaceae | Fc | Per | Ch | Md, Ot | WA, NS |
| *Capparis decidua* (Forssk.) Edgew. | Cleomaceae | Fc | Per | Ch | Md, Hf | WA |
| *Capparis spinosa* L. var. spinosa | Cleomaceae | Fc | Per | Ch | Md | NS |
| *Capsella bursa-pastoris* (L.) Medik. | Brassicaceae | cc | Ann | Th | Md | ND |
| *Carduncellus eriocephalus* Boiss. | Asteraceae | c | Per | Th | Gr, Md | ND |
| *Carrichtera annua* (L.) DC. | Brassicaceae | c | Ann | Th | Gr, Md | ND |
| *Carthamus lanatus* L. | Asteraceae | c | Bin | Th | Gr, Md | ND |
| *Cenchrus ciliaris* L. | Poaceae | rr | Per | Th | Gr | ND |
| *Centaurea alexandrina* Delile | Asteraceae | cc | Bin | Th | Fu, Gr, Md | ND |
| *Centaurea calcitrapa* L. | Asteraceae | cc | Per | Ch | Gr, Fu, Md, Hf | ZA, BA, ND |
| *Centaurea glomerata* Vahl | Asteraceae | c | Ann | Th | Gr, Fu, Md | ND |
| *Centaurea pumilio* L. | Asteraceae | c | Per | Hc | Md | ND |
| *Centaurium spicatum* (L.) Fritsch | Gentianaceae | cc | Ann | Th | Md | ND |
| *Centropodia forsskaolii* (Vahl) Cope | Poaceae | Fr | Per | Gh | Gr, Md | ZA, ND |
| *Ceratophyllum demersum* L. | Ceratophyllaceae | c | Per | Hh | Gr, Md | BA |
| *Ceratophyllum submersum* L. | Ceratophyllaceae | rr | Per | Hh | Gr | BA |
| *Chenopodium album* L. | Chenopodiaceae | cc | Ann | Th | Hf, Md | BA, NS |
| *Chenopodium ambrosioides* L. | Chenopodiaceae | cc | Ann | Th | Md | BA |
| *Chenopodium murale* L. | Chenopodiaceae | cc | Ann | Th | Hf, Md | BA, ND, NS |
| *Chenopodium opulifolium* Schrod. ex Koch and Ziz. | Chenopodiaceae | rr | Ann | Th | Hf | BA |
| *Chiliadenus montanus* (Vahl) Brullo | Asteraceae | Fc | Per | Ch | Md | NS |
| *Chrozophora tinctoria* (L.) Raf. | Euphorbiaceae | cc | Ann | Th | Md | WA |
| *Cichorium endivia* subsp. *pumilum* (Jacq.) Cout. | Asteraceae | cc | Ann | Th | Hf, Md | BA |





| Species | Family | Commonness | Life Span | Growth Forms | Uses | Site |
|---|---|---|---|---|---|---|
| *Cistance tubulosa* (Schenk.) Hook. f. | Orobanchaceae | c | Per | Hc | Md | ND |
| *Cistanche phelypaea* (L.) Cout. | Orobanchaceae | c | Per | Th | Md, Ta, Hf | ZA, BA, ND, WA |
| *Citrullus colocynthis* (L.) Schrad. | Cucurbitaceae | c | Per | Gh | Gr, Md | WA, NS |
| *Cladium mariscus* (L.) Pohl | Cyperaceae | Fc | Per | Gh | Md | UE |
| Cleome amblyocarpa Barratte & Murb. | Cleomaceae | cc | Ann | Th | Ar, Fu, Gr, Md, Ot | ZA, NS, ND, WA |
| *Cleome chrysantha* Decne. | Cleomaceae | c | Per | Hc | Md | WA |
| *Cleome droserifolia* (Forssk.) Delile | Cleomaceae | c | Per | Hc | Md | WA |
| *Clerodendrum acerbianum* (Vis.) Benth. & Hook. f. | Verbenaceae | rr | Per | Ch | Ot | BA |
| *Cocculus pendulus* (J. R. & G. Forst.) Diels | Menispermaceae | r | Per | Ph | Hf, Md | WA |
| *Colchicum ritchii* R. Br. | Colchicaceae | Fr | Per | Th | Md | ND |
| *Colutea istria* Mill. | Fabaceae | Fc | Per | Ch | Md | NS |
| *Convolvulus althaeoides* L. | Convolvulaceae | c | Per | Th | Gr, Md | ND |
| *Convolvulus arvensis* L. | Convolvulaceae | cc | Per | H | Fu, Gr, Md | BA, ND |
| *Convolvulus lanatus* Vahl | Convolvulaceae | cc | Per | Ch | Fu, Gr, Md | ZA, BA, ND |
| *Convolvulus oleifolius* Desr. | Convolvulaceae | Fc | Per | Hc | Md | NS |
| *Convolvulus prostratus* Forssk. | Convolvulaceae | c | Per | Hc | Md | WA |
| *Conyza bonariensis* (L.) Cronquist | Asteraceae | c | Ann | Th | Fu, Gr, Md | BA, ND |
| *Coriandrum sativum* L. | Umbelliferae | Fc | Ann | Th | Md, Hf | BA |
| *Cornulaca monacantha* Delile | Chenopodiaceae | Fc | Per | Ch | Hf, Md | ZA, BA, ND, NS, WA |
| *Cotula cinerea* Delile | Asteraceae | cc | Ann | Th | Fu, Gr, Md, Ot | ZA, WA |
| *Cressa cretica* L. | Convolvulaceae | cc | Per | Hc | Fu, Gr, Md | ZA, BA, ND |
| *Crotalaria aegyptiaca* Benth. | Fabaceae | c | Per | Ch | Gr | WA |
| *Crucianella maritima* L. | Rubiaceae | c | Per | Ch | Md | ND |
| *Crucianella membranacea* Boiss. | Rubiaceae | r | Ann | Th | Md | ZA |
| *Cucumis prophetarum* L. | Cucurbitaceae | r | Per | Hc | Gr, Md | WA |
| *Cullen plicata* (Delile) C. H. Stirt. | Fabaceae | Fc | Per | Hc | Gr, Hf, Md | WA |
| *Cuscuta planiflora* Ten. | Convolvulaceae | cc | Ann | Th | Md | ND |
| *Cutandia dichotoma* (Forssk.) Trab. in Batt. & Trab. | Poaceae | Fc | Ann | Th | Gr, Md | ZA, BA, ND |
| *Cutandia memphitica* (Spreng.) K. Richt. | Poaceae | cc | Ann | Th | Gr | ZA, BA, ND |

| Species | Family | Commonness | Life Span | Growth Forms | Uses | Site |
|---|---|---|---|---|---|---|
| *Cymbopogon schoenanthus* (L.) Sprenge. *spp. proximus* (Hochst. ex A. Rich.) Maire & Weiller | Poaceae | c | Per | Gh | Gr, Md | WA, NS |
| *Cynanchum acutum* L. | Asclepiadaceae | cc | Per | Ph | Gr | BA |
| *Cynodon dactylon* (L.) Pers. | Poaceae | cc | Per | Gh | Fu, Gr, Hf, Md | ZA, BA, ND, NS, WA |
| *Cynomorium coccineum* L. | Cynomoriaceae | Fr | Per | Gh | Gr, Hf, Md | BA |
| *Cyperus alopecuroides* Rottb. | Cyperaceae | cc | Per | Gh | Ot | BA |
| *Cyperus articulatus* L. | Cyperaceae | c | Per | Gh | Md, Ot | BA |
| *Cyperus capitatus* Vand. | Cyperaceae | Fc | Per | Gh | Gr | BA |
| *Cyperus conglomeratus* Rottb. | Cyperaceae | c | Per | Gh | Gr, Md | ZA, ND |
| *Cyperus difformis* L. | Cyperaceae | c | Ann | Th | Gr | BA |
| *Cyperus laevigatus* L. | Cyperaceae | cc | Per | Gh | Gr | ZA, BA |
| *Cyperus maculatus* Boek. | Cyperaceae | c | Per | Gh | Md | UE |
| *Cyperus michelianus* (L.) Delile *ssp. pygmaeus* (Rottb.) Asch. & Graebn. | Cyperaceae | c | Ann | Gh | Gr, Md | WA |
| *Cyperus rotundus* L. | Cyperaceae | cc | Per | Gh | Gr, Md | BA |
| *Dactylis glomerata* L. | Poaceae | Fc | Per | Th | Gr, Md | ND |
| *Daucus littoralis var. littoralis* Sm. | Umbelliferae | rr | Ann | Th | Gr, Md, Ot | ZA |
| *Daucus syrticus* Murb. | Umbelliferae | cc | Ann | Th | Gr | ND |
| *Deverra tortuosa* (Desf.) DC. | Umbelliferae | cc | Per | Ch | Ar, Fu, Gr, Hf, Md, Ot | ZA, ND, NS |
| *Deverra triradiata* Hochst. ex Boiss. | Umbelliferae | Fc | Per | Ch | Md | NS |
| *Dichanthium foveoulatum* (Delile) Roberty | Poaceae | cc | Per | Gh | Gr | WA |
| *Diplotaxis acris* (Forssk.) Boiss. | Brassicaceae | c | Ann | Th | Md | NS |
| *Diplotaxis erucoides* (L.) DC. | Brassicaceae | c | Ann | Th | Md | NS |
| *Diplotaxis harra* (Forssk.) Boiss. | Brassicaceae | c | Per | Hc | Md | NS |
| *Dipterygium glaucum* Decne | Capparaceae | c | Per | Hc | Gr, Md | WA |
| *Ebenus armitagei* Schweinf. & Taub. | Fabaceae | Fr | Per | Ch | Gr, Md | ND |
| *Ecballium elaterium* L. A. Rich. | Cucurbitaceae | Fc | Per | Hc | Md | ND |
| *Echinochloa colona* (L.) Link | Poaceae | cc | Ann | Th | Gr | BA |
| *Echinochloa crusgalli* (L.) P. Beauv. | Poaceae | c | Ann | Th | Gr | BA |
| *Echinochloa stagnina* (Retz.) P. Beauv. | Poaceae | c | Per | Gh | Gr | BA |





| Species | Family | Commonness | Life Span | Growth Forms | Uses | Site |
|---|---|---|---|---|---|---|
| *Echinops hussonii* Boiss. | Asteraceae | rr | Per | Th | Gr, Hf, Md | ND |
| *Echinops spinosus* L. | Asteraceae | cc | Per | Hc | Fu, Gr, Hf, Md | ZA, BA, ND, NS |
| *Echiochilon fruticosum* Desf. | Boraginaceae | Fc | Per | Ch | Fu, Gr, Hf, | ZA, ND |
| *Echium angustifolium* Mill. | Boraginaceae | c | Per | Hc | Fu, Gr, Md | ZA, ND |
| *Eclipta alba* (L.) Hassk | Asteraceae | c | Ann | Th | Md | BA |
| *Eichhornia crassipes* (Mart.) Solms-Laub in A. DC. | Pontederiaceae | cc | Per | Hh | Gr, Ot | BA |
| *Elymus farctus* (Viv.) Runemark ex Melderis | Poaceae | Fc | Per | Gh | Gr | BA, ND |
| *Emex spinosa* (L.) Campd. | Polygonaceae | cc | Ann | Th | Gr, Hf, Md | BA, ND |
| *Eminium spiculatum* (Blume) Schott | Araceae | Fc | Per | Hc | Md | NS |
| *Enanthrocarpus strangulatus* Boiss. | Brassicaceae | c | Ann | Th | Ar, Gr, Md | ND |
| *Ephedra alata* Decne. | Ephedraceae | c | Per | Ch | Md | ZA, NS |
| *Eragrostis aegyptiaca* (Wild.) Delile | Poaceae | c | Ann | Th | Md | WA |
| *Eragrostis ciliaris* (L.) R. Br. | Poaceae | c | Ann | Th | Gr | WA |
| *Eremobium aegyptiacum* (Spreng.) Asch. & Schweinf. | Brassicaceae | cc | Per | Hc | Gr | ZA |
| *Erodium cicutarium* (L.) L'Hér. | Geraniaceae | Fc | Ann | Th | Gr, Md, Or | ND |
| *Erodium crassifolium* L'Hér. | Geraniaceae | c | Per | Th | Gr, Hf, Or | ND |
| *Erodium laciniatum* (Cav.) Willd. | Geraniaceae | Fc | Ann | Th | Gr, Md | ZA, BA, ND |
| *Eruca sativa* Mill. | Brassicaceae | c | Ann | Th | Md | NS |
| *Erucaria hispanica* (L.) Druce | Brassicaceae | c | Ann | Th | Gr | ZA |
| *Eryngium campestre* L. | Umbelliferae | c | Per | Hc | Md | ND |
| *Eryngium creticum* Lam. | Umbelliferae | c | Per | Hc | Md | ND |
| *Euphorbia granulata* Forssk. | Euphorbiaceae | cc | Ann | Th | Gr, Md | ZA, WA |
| *Euphorbia helioscopia* L. | Euphorbiaceae | cc | Ann | Th | Md | ND |
| *Euphorbia hierosolymitana* Boiss. | Euphorbiaceae | r | Per | Ch | Md | ND |
| *Euphorbia paralias* L. | Euphorbiaceae | c | Per | Ch | Md | ND |
| *Euphorbia peplis* L. | Euphorbiaceae | rr | Ann | Th | Md | BA, NS |
| *Euphorbia peplus* L. | Euphorbiaceae | cc | Ann | Th | Md | ND |
| *Euphorbia retusa* Forssk. | Euphorbiaceae | c | Per | Hc | Md | NS |

| Species | Family | Commonness | Life Span | Growth Forms | Uses | Site |
|---|---|---|---|---|---|---|
| *Eurca sativa* Mill. | Brassicaceae | cc | Ann | Th | Gr, Hf, Md | BA, ND |
| *Fagonia arabica* L. | Zygophyllaceae | Fc | Per | Ch | Fu, Gr, Hf, Md | ZA, BA, ND, NS |
| *Fagonia bruguieri* DC. | Zygophyllaceae | c | Per | Hc | Gr, Md | WA |
| *Fagonia cretica* L. | Zygophyllaceae | c | Per | Ch | Md | ND |
| *Fagonia glutinosa* Delile | Zygophyllaceae | c | Per | Hc | Gr, Md | WA, NS |
| *Fagonia indica* Burm. f. | Zygophyllaceae | c | Per | Hc | Gr | WA |
| *Fagonia mollis* Delile | Zygophyllaceae | Fc | Per | Hc | Md | NS |
| *Faidherbia albida* (Delile) A. Chev. | Fabaceae | Fc | Per | Ph | Gr, Md | WA |
| *Farsetia aegyptia* Turra | Brassicaceae | cc | Per | Ch | Gr, Md | ND, NS, WA |
| *Filago desertorum* Pomel | Asteraceae | cc | Ann | Th | Ar, Gr, Md, Ot | ZA, BA, ND |
| *Fimbristylis bisumbellata* (Forssk.) Bubani | Cyperaceae | cc | Ann | Gh | Gr | WA |
| *Frankenia hirsuta* L. | Frankeniaceae | rr | Per | Hc | Fu, Gr, Md | ZA, ND |
| *Frankenia pulverulenta* L. | Frankeniaceae | c | Ann | Th | Md | ZA, BA, ND |
| *Frankenia revoluta* Forssk. | Frankeniaceae | Fc | Per | Hc | Hf, Gr, Md | BA |
| *Fumaria densiflora* DC. | Fumariaceae | cc | Ann | Th | Md | ND |
| *Glebionis coronaria* (L.) Tzevlev | Asteraceae | Fc | Ann | Th | Md, Or | BA, ND |
| *Glinus lotoides* L. | Molluginaceae | cc | Ann | Th | Gr, Md | WA |
| *Globularia arabica* Jaub. & Spach. | Globulariaceae | Fc | Per | Ch | Fu, Gr, Md | ND, NS |
| *Gomphocarpus sinaicus*Boiss. | Asclepiadaceae | c | Per | Ch | Md | NS |
| *Gymnarrhena* micrantha Desf. | Asteraceae | Fr | Ann | Th | Gr | ND |
| *Gymnocarpos decanderus* Forssk. | Caryophyllaceae | cc | Per | Ch | Fu, Gr, Md | ZA, ND |
| *Gypsophila capillaris* (Forssk.) C. Chr. | Caryophyllaceae | c | Ann | Th | Md | NS |
| *Halocnemum strobilaceum* (Pall.) M. Bieb. | Chenopodiaceae | c | Per | Gh | Fu, Gr, Md, Ot | ZA, BA, ND, NS |
| *Haloxylon salicornicum* (Moq.) Bunge ex Boiss. | Chenopodiaceae | cc | Per | Ch | Fu, Gr, Md, Ot | ND, NS |
| *Haloxylon scoparium* Pomel | Chenopodiaceae | r | Per | Ch | Fu, Gr, Md, Ot | ZA, NS |
| *Haplophyllum tuberculatum* (Forssk.) Juss. | Rutaceae | cc | Per | Ch | Gr, Hf, Md, Ot | ZA, NS, WA |
| *Helianthemum kahirikum* Delile | Cistaceae | cc | Per | Ch | Fu, Gr, Md | ND |
| *Helianthemum lippii* (L.) Dum. Cours. | Cistaceae | cc | Per | Ch | Fu, Gr, Md | ND |





| Species | Family | Commonness | Life Span | Growth Forms | Uses | Site |
|---|---|---|---|---|---|---|
| *Helianthimum stipulatum* (Forssk.) C. Chr. | Cistaceae | c | Per | Ch | Fu, Gr, Md | ZA |
| *Heliotropium arbainense* Fresen. | Boraginaceae | r | Per | Ch | Gr | ND, NS |
| *Heliotropium bacciferum* Forssk. | Boraginaceae | cc | Per | Ch | Gr, Md | ND, WA |
| *Heliotropium curassavicum* L. | Boraginaceae | rr | Per | Ch | Gr | BA |
| *Heliotropium digynum* (Forssk.) Asch. ex C. Chr. | Boraginaceae | cc | Per | Ch | Gr | ZA, ND |
| *Heliotropium strigosum* Willd. | Boraginaceae | r | Per | Ch | Md | ND |
| *Heliotropium supinum* L. | Boraginaceae | c | Ann | Th | Md | WA |
| *Herniaria hemistemon* J. Gay | Caryophyllaceae | c | Ann | Th | Gr, Md | ZA |
| *Herniaria hirsuta* L. | Caryophyllaceae | Fc | Ann | Th | Gr, Md | ZA, ND, NS |
| *Hippocrepis areolata* Desv. | Fabaceae | c | Ann | Th | Gr, Md | ZA, ND |
| *Hippocrepis cyclocarpa* Murb | Fabaceae | Fc | Ann | Th | Gr, Md | ND |
| *Hordeum marinum* Huds. | Poaceae | c | Ann | Th | Gr | BA |
| *Hordeum murinum* L. | Poaceae | cc | Ann | Th | Gr, Md | ND |
| *Hordeum murinum* subsp. *Leporinum* (Link) Arcang. | Poaceae | cc | Ann | Th | Gr, Md | BA |
| *Hordeum vulgare* L. | Poaceae | cc | Ann | Th | Gr, Md | BA, NS |
| *Hyoscyamus muticus* L. | Solanaceae | Fc | Per | Ch | Ar, Md | ND, NS, WA |
| *Hyoseris radiata* L. | Asteraceae | cc | Per | Th | Gr, Md | ND |
| *Hyoseris scabra* L. | Asteraceae | Fr | Ann | Th | Gr, Md | ND |
| *Hyphaene thebaica* (L.) Mart. | Palmae | Fc | Per | Ph | Hf, Md, Ot, Ti | UE, WA |
| *Iflago spicata* (Forssk.) Sch.Bip. | Asteraceae | c | Ann | Th | Gr, Md, Ot | ZA, BA, ND, WA |
| *Imperata cylindrica* (L.) Raeusch. | Poaceae | cc | Per | Gh | Gr, Ha, Md, Ot | BA, ND, NS, WA |
| *Indigofera hochstetteri* Baker | Fabaceae | c | Ann | Th | Gr | WA |
| *Iphiona mucronata* (Forssk.) Asch. & Schweinf. | Asteraceae | Fc | Per | Hc | Md | NS |
| *Ipomoea carnea* Jacq. | Convolvulaceae | Fc | Per | Hc | Gr, Md, Ot | BA |
| *Iris mariae* Barbey | Iridaceae | r | Per | Gh | Md | ZA |
| *Juncus acutus* L. | Juncaceae | c | Per | Gh | Gr, Ha, Md, Ot | BA, ND |
| *Juncus bufonius*L. | Juncaceae | c | Ann | Th | Md | BA |
| *Juncus rigidus* Desf. | Juncaceae | cc | Per | Gh | Gr, Md, Ot | ZA, BA, ND, NS |
| *Juncus subulatus*Forssk. | Juncaceae | c | Per | Gh | Gr | BA |

| Species | Family | Commonness | Life Span | Growth Forms | Uses | Site |
|---|---|---|---|---|---|---|
| *Juniperus phoenicea* L. | Cupressaceae | r | Per | Ph | Md | NS |
| *Kickxia aegyptiaca* (L.) Nábelek | Scrophulariaceae | cc | Per | Ch | Fu, Gr, Md | ND |
| *Lactuca serriola* L. | Asteraceae | Fc | Bin | Th | Gr, Md | ND |
| *Lathyrus marmoratus* Bioss. | Fabaceae | Fc | Ann | Th | Gr, Md | BA, ND |
| *Launaea capitata* (Spreng) Dandy | Asteraceae | cc | Ann | Th | Gr, Hf | ZA, BA, ND, WA |
| *Launaea fragilis* (Asso) Pau subsp. Fragilis | Asteraceae | Fc | Per | Hc | Gr, Md | ZA, ND |
| *Launaea mucronata* (Forssk.) Muschl. | Asteraceae | c | Bin | Hc | Md | WA |
| *Launaea nudicaulis* (L.) Hook. F. | Asteraceae | cc | Per | Hc | Gr, Md | ZA, BA, ND |
| *Lavandula pubescens* Decne. | Lamiaceae | Fc | Per | Hc | Md | NS |
| *Lemna gibba* L. | Lemnaceae | c | Per | Hh | Gr, Ot | BA |
| *Lemna perpusilla* Torrey | Lemnaceae | rr | Per | Hh | Gr, Ot | BA |
| *Leptadenia pyrotechnica* (Forssk.) Decne. | Asclepiadaceae | Fc | Per | Hc | Md | WA |
| *Limbarda crithmoides* (L.) Dumort. | Asteraceae | c | Per | Ch | Hf | BA, ND |
| *Limoniastrum monopetalum* (L.) Boiss. | Plumbaginaceae | Fc | Per | Ch | Fu, Md | ZA, BA, ND |
| *Limonium pruinosum* (L.) Chaz. | Plumbaginaceae | Fc | Per | Ch | Gr, Md | ZA, BA, ND |
| *Limonium tubiflorum* (Delile) Kuntze | Plumbaginaceae | c | Per | Hc | Fu, Gr | ND |
| *Linaria haelava* (Forssk.) Delile | Scrophulariaceae | c | Ann | Th | Gr | ZA |
| *Lobularia arabica* (Boiss.) Muschl. | Brassicaceae | Fc | Ann | Th | Gr, Md | ZA, BA, ND |
| *Lobularia maritima* (L.) Desv. | Brassicaceae | Fc | Per | Ch | Md | ND |
| *Lolium multiflorum* Lam. | Poaceae | Fc | Ann | Th | Gr | BA, ND |
| *Lolium perenne* L. | Poaceae | cc | Ann | Th | Fu, Gr | BA |
| *Lolium temulentum* L. | Poaceae | c | Ann | Th | Fu, Gr | BA |
| *Lotononis platycarpa* (Viv.) Pic. Serm. | Fabaceae | c | Bin | Hc | Fu, Gr, Hf, Md, Ot | WA |
| *Lotus arabicus* L. | Fabaceae | Fc | Ann | Th | Gr | BA, ND |
| *Lotus creticus* L. | Fabaceae | c | Per | Hc | Gr, Md | ND |
| *Lotus glaber* Mill. | Fabaceae | c | Per | Hc | Gr, Md | ND |
| *Lotus halophilus* Boiss. & Spruner | Fabaceae | cc | Ann | Th | Gr, Md | ZA, BA, ND |
| *Lotus polyphyllos* E. D. Clarke | Fabaceae | c | Per | Ch | Gr, Md | ND |





| Species | Family | Commonness | Life Span | Growth Forms | Uses | Site |
|---|---|---|---|---|---|---|
| *Lupinus digitatus* Forssk. | Fabaceae | c | Ann | Th | Gr, Hf | WA |
| *Lycium europaeum* L. | Solanaceae | r | Per | Ph | Fu, Gr, Md, Hf, Wb | ND |
| *Lycium schweinfurthii* Dammer | Solanaceae | rr | Per | Ph | Fu, Ot | BA |
| *Lycium shawii* Roem. & Schult. | Solanaceae | c | Per | Ph | Fu, Gr, Hf, Md, Ot | ZA, ND, NS, WA |
| *Lygeum spartum* Loefl. ex L. | Poaceae | cc | Per | Th | Gr, Ha, Md, Ot | ND |
| *Maerua crassifolia* Forssk. | Capparaceae | Fc | Per | Ph | Fu | WA |
| *Malva parviflora* L. | Malvaceae | cc | Ann | Th | Gr, Hf, Md | ZA, BA, ND, NS |
| *Marrubium vulgare* L. | Lamiaceae | c | Per | Hc | Ar, Fu, Gr, Md | ND |
| Matthiola longipetala | Brassicaceae | c | Ann | Th | Gr, Md | ND |
| *Medemia argun* (Mart.) Württemb. ex H. Wendl. | Palmae | rr | Per | Ph | Ha, Ot | WA |
| *Medicago coronata* (L.) Bartal. | Fabaceae | r | Ann | Th | Gr | ND |
| *Medicago intertexa* v. *ciliaris* (L.) Heyn | Fabaceae | c | Ann | Th | Gr | BA |
| *Medicago polymorpha* L. | Fabaceae | c | Ann | Th | Gr, Md | BA, ND |
| *Medicago sativa* L. | Fabaceae | c | Per | Hc | Gr | ND |
| *Melilotus indicus* (L.) All. | Fabaceae | c | Ann | Th | Gr, Md | BA, ND, NS |
| *Mentha longifolia* (L.) Huds. | Lamiaceae | c | Per | Gh | Hf, Md | BA |
| *Mesembryanthemum crystallinum* L. | Aizoaceae | Fc | Ann | Th | Hf, Md, Or | ZA, BA, ND, NS |
| *Mesembryanthemum forsskaolii* Hochst. ex Boiss. | Aizoaceae | c | Ann | Th | Md | ZA, NS |
| *Mesembryanthemum nodiflorum* L. | Aizoaceae | Fc | Ann | Th | Hf | ZA, BA, ND, NS |
| *Minuartia geniculata* (Poir.) Thell. | Caryophyllaceae | Fr | Per | Th | Gr | ND |
| *Moltkiopsis ciliata* (Forssk.) I. M. Johnst. | Boraginaceae | Fr | Per | Ch | Fu, Gr, Md | ZA, ND, NS |
| *Moraea sisyrinchium* (L.) Ker Gawl. | Iridaceae | Fc | Per | Th | Hf, Md | ND |
| *Morettia philaeana* (Delile) DC. | Brassicaceae | c | Per | Hc | Fu, Gr, Md, Ti | WA |
| *Moricandia nitens* (Viv.) Durand & Barratte | Brassicaceae | Fc | Per | Ch | Fu, Gr, Md | ND |
| *Muscari bicolor* Boiss. | Liliaceae | rr | Per | Gh | Md | ZA |
| *Muscari parviflourm* Desf. | Liliaceae | r | Per | Th | Md | ND |
| *Najas marina v. armata* (H. Lindb.) Horn | Hydrocharitaceae | c | Per | Hh | Gr, Hf | BA |
| *Najas minor* All. | Hydrocharitaceae | Fr | Per | Hh | Gr | BA |
| *Neurada procumbens* L. | Neuradaceae | c | Ann | Th | Hf | ZA, ND |

| Species | Family | Commonness | Life Span | Growth Forms | Uses | Site |
|---|---|---|---|---|---|---|
| *Nicotiana glauca* R. C. Graham | Solanaceae | cc | Per | Ph | Md | ND |
| *Nitraria retusa* (Forssk.) Asch. | Nitrariaceae | Fc | Per | Ph | Fu, Gr, Md | ZA, ND, NS |
| *Noaea mucronata* (Forssk.) Asch. & Schweinf. | Chenopodiaceae | c | Per | Ch | Fu, Gr, Hf, Md | ZA, ND, NS |
| *Ochradenus baccatus* Delile | Resedaceae | c | Per | Ch | Md | NS |
| *Ononis serrata* Forssk. | Fabaceae | c | Ann | Th | Gr, Md | ZA, ND |
| *Ononis vaginalis* Vahl | Fabaceae | cc | Per | Ch | Gr, Md | ND |
| *Onopordum alexandrinum* Boiss. | Asteraceae | cc | Bin | Hc | Gr, Md | ND |
| *Orobanche cernua* Loefl. | Orobanchaceae | r | Per | Pa | Md | ZA, BA, NS |
| *Otanthus maritimus* (L.) Hoffmanns. & Link | Asteraceae | r | Per | Th | Gr, Md | ND |
| *Pancratium maritimum* L. | Amaryllidaceae | Fc | Per | Gh | Md, Or | ZA, BA, ND |
| *Pancratium sickenbergeri* Asch. & Schweinf. | Amaryllidaceae | r | Per | Gh | Md | ZA, ND, NS |
| *Panicum turgidum* Forssk. | Poaceae | c | Per | Gh | Gr, Hf, Md, Ot | ZA, BA, ND, NS, WA |
| *Papaver rhoeas* L. | Papaveraceae | cc | Ann | Th | Md | ND |
| *Parapholis incurva* (L.) C.E. Hubb. | Poaceae | rr | Ann | Th | Gr | BA |
| *Parapholis marginata* Runem. | Poaceae | Fr | Ann | Th | Gr | BA, ND |
| *Parietaria alsinifolia* Delile | Urticaceae | c | Ann | Th | Gr, Md | WA |
| *Paronychia arabica* (L.) DC. | Caryophyllaceae | Fc | Ann | Th | Gr, Hf, Md | ZA, BA, ND, NS |
| *Paronychia argentea* Lam. | Caryophyllaceae | r | Per | Hc | Gr, Hf, Md | ZA, NS |
| *Paspalidium geminatum* (Forssk.) Stapf. in Prain | Poaceae | c | Per | Gh | Gr | BA |
| *Paspalum distichum* L. | Poaceae | Fc | Per | Gh | Gr | BA |
| *Peganum harmala* L. | Peganaceae | c | Per | Ch | Md | ND, NS |
| *Pergularia tomentosa* L. | Asclepiadaceae | Fc | Per | Hc | Md | NS, WA |
| *Persicaria salicifolia*(Willd.) Assenov in Jordanov | Polygonaceae | c | Per | Gh | Hf, Md | BA |
| *Persicaria senegalensis* (Meisn.) Soják | Polygonaceae | c | Per | Gh | Gr, Hf, Md | BA |
| *Phagalon rupestre* (L.) DC. | Asteraceae | Fc | Per | Th | Gr | ND |
| *Phalaris minor* Retz. | Poaceae | c | Ann | Th | Gr | BA, ND |
| *Phalaris paradoxa* L. | Poaceae | r | Ann | Th | Gr | BA |
| *Phlomis floccose* L | Lamiaceae | Fc | Per | Ch | Fu, Gr, Md | ND |





| Species | Family | Commonness | Life Span | Growth Forms | Uses | Site |
|---|---|---|---|---|---|---|
| *Phoenix dactylifera* L. | Palmae | c | Per | Ph | Fu, Gr, Ha, Hf, Md, Or, Ot, Ti | ZA, BA, ND, NS |
| *Phragmites australis* (Cav.) Trin. ex Steud. | Poaceae | cc | Per | Gh | Fu, Gr, Hf, Md, Ot, Wb | ZA, BA, ND, NS, WA |
| *Phyla nodiflora* (L.) Greene | Verbenaceae | cc | Per | Hc | Gr | BA |
| *Picris asplenioides* L. | Asteraceae | cc | Ann | Th | Gr | ND |
| *Plantago afra* L. | Plantaginaceae | c | Ann | Th | Md | NS |
| *Plantago albicans* L. | Plantaginaceae | Fc | Per | Hc | Gr, Md | ZA, ND |
| *Plantago crassifolia* Forssk. | Plantaginaceae | Fr | Per | Hc | Gr | ND |
| *Plantago cryposides* Boiss. | Plantaginaceae | cc | Ann | Th | Gr, Md | ND |
| *Plantago major* L. | Plantaginaceae | c | Per | Hc | Md | BA |
| *Plantago notata* Lag | Plantaginaceae | r | Ann | Th | Gr | ND |
| *Plantago ovata* Forssk. | Plantaginaceae | cc | Ann | Th | Ar, Gr, Md | ZA, ND, NS |
| *Pluchea dioscoridis* (L.) DC. | Asteraceae | cc | Per | Ph | Md | BA, NS |
| *Poa annua* L. | Poaceae | c | Ann | Th | Gr, Md | ZA, BA |
| *Polycarpaea repens* (Forssk.) Asch. & Schweinf. | Caryophyllaceae | cc | Per | Ch | Md | ZA, NS, WA |
| *Polycarpon succulentum* (Delile) J. Gay | Caryophyllaceae | cc | Ann | Th | Md | ZA, NS |
| *Polygala erioptera* DC | Polygalaceae | Fc | Bin | Hc | Hf, Md | WA |
| *Polygonum equisetiforme* Sibth. & Sm. | Polygonaceae | Fc | Per | Gh | Ar, Gr, Hf, Md | BA, ND |
| *Polypogon monspeliensis* (L.) Desf. | Poaceae | cc | Ann | Th | Gr | BA |
| *Polypogon viridis* (Gouan) Breistr | Poaceae | cc | Per | Hc | Gr | BA |
| *Portulaca oleracea* L. | Portulacaceae | cc | Ann | Th | Hf, Gr, Md | BA, UE, WA |
| *Posidonia oceanica* (L.) Delile | Posidoniaceae | c | Per | Hh | Md | ND |
| *Potamogeton crispus* L. | Potamogetonaceae | cc | Per | Hh | Gr | BA |
| *Potamogeton pectinatus* L. | Potamogetonaceae | cc | Per | Hh | Gr | BA |
| *Prasium majus* L. | Lamiaceae | Fc | Per | Ch | Ar, Fu, Gr, Md | ND |
| *Pseudorlaya pumila* (L.) Grande | Umbelliferae | c | Ann | Th | Gr | ND |
| *Pseudowolffia hyalina* (Delile) Hartog & Pals | Lemnaceae | c | Per | Hh | Gr | BA |
| *Pulicaria arabica* (L.) Cass. | Asteraceae | Fc | Per | Th | Md | ND |
| *Pulicaria incisa* (Lam.) DC. | Asteraceae | c | Bin | Hc | Md | WA |

| Species | Family | Commonness | Life Span | Growth Forms | Uses | Site |
|---|---|---|---|---|---|---|
| *Pulicaria undulata* (L.) C. A. Mey. | Asteraceae | Fr | Per | Ch | Fu, Gr, Md | ND, NS, WA |
| *Pycnocycla tomentosa* Decne. | Umbelliferae | rr | Per | Ch | Ar, Fu, Gr, Hf, Md | ND |
| *Ranunculus sceleratus* L. | Ranunculaceae | c | Ann | Th | Md | BA |
| *Raphanus raphanistrum* L. | Brassicaceae | rr | Ann | Th | Hf, Md | BA |
| *Reaumuria hirtella* Jaub. & Spach | Tamaricaceae | c | Per | Ch | Gr, Md | ND, NS |
| *Reaumuria vermiculata* L. | Tamaricaceae | r | Per | Ch | Gr, Md | ND |
| *Reichardia tingitana* (L.) Roth | Asteraceae | Fc | Ann | Th | Gr, Md | ZA, BA, ND, NS |
| *Reseda alba* L. | Resedaceae | r | Ann | Th | Gr | ND |
| *Reseda decursiva* Forssk. | Resedaceae | cc | Ann | Th | Gr, Md | ND |
| *Retama raetam* (Forssk.) Webb & Berthel. | Fabaceae | Fr | Per | Ph | Fu, Gr, Md, Or | ZA, ND, NS |
| *Ricinus communis* L. | Euphorbiaceae | c | Per | Ph | Fu, Hf, Md, Ot | BA, NS, WA |
| *Roemeria hybrida* (L.) DC. | Papaveraceae | r | Ann | Th | Or | ND |
| *Rumex cyprius* Murb. | Polygonaceae | cc | Ann | Th | Hf | WA |
| *Rumex dentatus* L. | Polygonaceae | c | Ann | Th | Gr, Hf | BA |
| *Rumex pictus* Forssk. | Polygonaceae | c | Ann | Th | Gr, Hf, Md | ZA, BA, ND |
| *Rumex vesicarius* L. | Polygonaceae | Fc | Ann | Th | Gr, Hf, Md | ND, WA |
| *Saccharum spontaneum* L. | Poaceae | cc | Per | Gh | Gr, Md | BA |
| *Salix tetrasperma* Roxb. | Salicaceae | c | Per | Ph | Fu, Gr, Hf, Md | BA |
| *Salsola imbricata* subsp. *gaetula* (Maire) Boulos | Chenopodiaceae | c | Per | Ch | Fu | WA |
| *Salsola kali* L. | Chenopodiaceae | c | Ann | Th | Md, Hf, Ot | ZA, BA, ND |
| *Salsola longifolia* Forssk. | Chenopodiaceae | Fc | Per | Gh | Gr, Md | ND |
| *Salsola tetragona* Delile | Chenopodiaceae | rr | Per | Ch | Fu, Gr, Hf, Md | ZA, ND |
| *Salsola tetrandra* Forssk. | Chenopodiaceae | r | Per | Ch | Gr, Md | ND |
| *Salsola vermiculata* L. | Chenopodiaceae | r | Per | Gh | Gr | ND |
| *Salsola volkensii* Schweinf. & Asch. | Chenopodiaceae | c | Ann | Th | Md | ND |
| *Salvadora persica* L. | Salvadoraceae | Fc | Per | Ph | Fu, Gr, Hf, Md, Ot, Ti | WA |
| *Salvia aegyptiaca* L. | Lamiaceae | Fc | Per | Ch | Ar, Fu, Gr, Md | ND, NS |
| *Salvia lanigera* Poir. | Lamiaceae | Fc | Per | Hc | Ar, Gr, Md,Ot | ZA, ND, NS |





| Species | Family | Commonness | Life Span | Growth Forms | Uses | Site |
|---|---|---|---|---|---|---|
| *Sarcocornia fruticosa* (L.) A. J. Scott. | Chenopodiaceae | c | Per | Gh | Fu, Gr, Md | ZA, BA, ND |
| *Scabiosa arenaria* Forssk. | Dipsacaceae | r | Ann | Th | Gr | ND |
| *Schismus arabicus* Nees | Poaceae | cc | Ann | Th | Gr, Md | ZA |
| *Schismus barbatus* (L.) Thell. | Poaceae | cc | Ann | Th | Gr, Hf, Md | BA, ND |
| *Schouwia purpurea* (Forssk.) Schweinf. | Brassicaceae | cc | Ann | Th | Gr | WA |
| *Scirpus holoschoenus* L. | Cyperaceae | Fr | Per | Gh | Gr | BA |
| *Scirpus litoralis*Schrad. | Cyperaceae | cc | Per | Gh | Gr | BA |
| *Scirpus maritimus* L. | Cyperaceae | cc | Per | Gh | Gr | BA |
| *Scorzonera undulata* Vahl | Asteraceae | cc | Per | Gh | Gr, Hf, Md | ND |
| *Senecio glaucus* ssp. *Coronopifolius* Maire C. Alexander. | Asteraceae | Fc | Ann | Th | Hf, Md | ZA, BA, NS |
| *Senecio vulgaris* L. | Asteraceae | cc | Ann | Th | Md | ND |
| *Senna alexandrina* Mill. | Fabaceae | c | Per | Hc | Md | WA, UE |
| *Senna italica* Mill. | Fabaceae | c | Per | Hc | Md | WA |
| *Seriphidium herba-album* (Asso) Soják | Asteraceae | c | Per | Ch | Ar, Fu, Gr, Hf, Md | ND, NS, UE |
| *Sesamum alatum* Thonn. | Pedaliaceae | c | Ann | Th | Md | WA |
| *Sesbania sesban* (L.) Merr. | Fabaceae | c | Per | Ph | Fu, Gr, Md, Ot, Ti, | WA |
| *Setaria verticillata* (L.) Beauv. | Poaceae | cc | Ann | Th | Gr | BA |
| *Setaria viridis* (L.) P. Beauv. | Poaceae | r | Ann | Th | Gr | BA |
| *Sida alba* L. | Malvaceae | c | Per | Hc | Gr | BA |
| *Silene rubella* L. | Caryophyllaceae | c | Ann | Th | Gr | ND |
| *Silene succulenta* Frossk. | Caryophyllaceae | Fc | Per | Hc | Md | BA, ND, NS |
| *Silene villosa* Frossk. | Caryophyllaceae | r | Ann | Th | Md, Ot | ZA, BA, ND, NS |
| *Silybum marianum* (L.) Gaertn | Asteraceae | cc | Per | Hc | Md | BA |
| *Sinapis arvensis* subsp. *allionii*(Jacq.) Baillarg | Brassicaceae | Fc | Ann | Th | Gr | BA |
| *Sisymbrium irio* L. | Brassicaceae | cc | Ann | Th | Gr, Md | BA, NS |
| *Solanum elaeagnifolium* Cav. | Solanaceae | rr | Per | Ch | Md | ZA,NS |
| *Solanum nigrum* L. | Solanaceae | r | Ann | Th | Hf, Md | ND, NS |
| *Solenostemma arghel* (Delile) Hayne | Asclepiadaceae | Fc | Per | Ch | Md | UE, WA |
| *Sonchus asper* (L.) Hill | Asteraceae | Fr | Ann | Th | Gr, Hf | BA |

| Species | Family | Commonness | Life Span | Growth Forms | Uses | Site |
|---|---|---|---|---|---|---|
| *Sonchus macrocarpus* Boulos & C. Jeffrey | Asteraceae | rr | Ann | Th | Gr, Hf | BA |
| *Soncuhs oleraceus* L. | Asteraceae | cc | Ann | Th | Gr, Hf | ZA, BA, ND |
| *Spergula fallax* (Lowe) E. H. L. Krause | Caryophyllaceae | c | Ann | Th | Gr | BA, ND |
| *Spergularia marina* (L.) Bessler | Caryophyllaceae | c | Bin | Th | Gr | ZA, BA |
| *Sphenopus divaricatus*(Gouan) Rchb. | Poaceae | Fc | Ann | Th | Ot | BA |
| *Sporobolus spicatus* (Vahl) Kunth | Poaceae | c | Per | Gh | Gr | ND |
| *Sporopolus pungens*(Schreb.) Kunth | Poaceae | Fc | Ann | Th | Gr | BA |
| *Stachys aegyptiaca* Pers. | Lamiaceae | Fc | Per | Ch | Md | NS |
| *Stipa capensis* Thunb. | Poaceae | cc | Ann | Th | Gr | ZA |
| *Stipagrostis ciliata* (Desf.) De Winter | Poaceae | Fc | Per | Gh | Gr | ZA, ND |
| *Stipagrostis obtusa* (Delile) Nees | Poaceae | Fr | Per | Gh | Gr | ND |
| *Stipagrostis plumosa* (L.) Munro ex T. Anderson | Poaceae | c | Per | Gh | Gr, Md | ZA, WA |
| *Stipagrostis scoparia* (Trin. & Rupr.) De Winter | Poaceae | Fr | Per | Gh | Gr, Md | ZA, ND, NS |
| *Suaeda aegyptiaca* (Hasselq) Zohary | Chenopodiaceae | cc | Ann | Th | Gr, Md | ZA, ND |
| *Suaeda maritima* (L.) Dumort. | Chenopodiaceae | Fc | Per | Ch | Gr | ZA, BA |
| *Suaeda pruinosa* Lange | Chenopodiaceae | r | Per | Ch | Fu, Gr, Md, Ot | BA, ND |
| *Suaeda vera* Forssk. ex J. F. Gmel. | Chenopodiaceae | c | Per | Ch | Gr, Md, Ot | ZA, BA, ND |
| *Suaeda vermiculata* Forssk. ex J. F. Gmel | Chenopodiaceae | r | Per | Gh | Gr | ND |
| *Tamarix aphylla* (L.) H. Krast. | Tamaricaceae | c | Per | Ph | Fu, Md, Or, Ot, Ti | BA, ND, NS |
| *Tamarix nilotica* (Ehrenb.) Bunge | Tamaricaceae | cc | Per | Ph | Fu, Gr, Md, Ot, Ti | ZA, BA, ND, NS, WA |
| *Tamarix tetragyna* Ehrenb | Tamaricaceae | c | Per | Ph | Fu, Gr, Md, Ot, Ti | BA |
| *Tephrosia purpurea* (L.) Pers. ssp. *apollinea* (Delile) Hosni & El-Karemy | Fabaceae | c | Bin | Hc | Gr, Md | NS, WA |
| *Teucrium leucocladum* Boiss. | Lamiaceae | c | Per | Hc | Md | NS |
| *Teucrium polium* L. | Lamiaceae | cc | Per | Ch | Ar, Gr, Md | ND, NS |
| *Thymelaea hirsuta* (L.) Endl. | Thymellaceae | cc | Per | Ph | Fu, Gr, Ha, Md | ZA, ND, NS |
| *Thymus capitatus* (L.) Link | Lamiaceae | r | Per | Ch | Ar, Fu, Gr, Hf, Md | ND |
| *Traganum nudatum* Delile | Chenopodiaceae | Fc | Per | Ch | Gr | ZA, ND |
| *Tragus berteronianus* Schult. | Poaceae | c | Ann | Gh | Gr | WA |





| Species | Family | Commonness | Life Span | Growth Forms | Uses | Site |
|---|---|---|---|---|---|---|
| *Tribulus mollis* Ehrenb. ex Schweinf. | Zygophyllaceae | c | Ann | Th | Gr | WA |
| *Tribulus pentandrus* Forssk. | Zygophyllaceae | c | Ann | Th | Gr | WA |
| *Tribulus terrestris* L. | Zygophyllaceae | cc | Ann | Th | Gr, Md | NS, WA |
| *Trifolium alexandrinum* L. | Fabaceae | cc | Ann | Th | Gr | BA |
| *Trifolium resupinatum* L. | Fabaceae | cc | Ann | Th | Gr | BA, ND, NS |
| *Trigonella laciniata* L. | Fabaceae | cc | Ann | Th | Gr | BA |
| *Trigonella stellata* Forssk. | Fabaceae | c | Ann | Th | Gr, Md, Ot | ZA, BA, ND, NS |
| *Typha domingensis* (Pers.) Poir ex Steud. | Typhaceae | cc | Per | Gh | Gr, Ha, Hf, Md, Ot | BA, ND |
| *Urginea maritima* (L.) Baker | Liliaceae | r | Per | Th | Md | ND, NS |
| *Urginea undulata* (Desf.) Steinh. | Liliaceae | Fc | Per | Gh | Gr, Md, Ot | BA, ND |
| *Urospermum picroides* (L.) F.W. Schmidt. | Asteraceae | cc | Ann | Th | Gr | BA |
| *Urtica pilulifera* L. | Urticaceae | cc | Ann | Th | Md | ND |
| *Urtica urens* L. | Urticaceae | Fc | Ann | Th | Md | ND, NS |
| *Vaccaria hispanica* (Mill.) Rauschert. | Caryophyllaceae | cc | Ann | Th | Md | ND |
| *Verbascum letourneuxii* Asch. & Schweinf. | Scrophulariaceae | Fc | Per | Ch | Gr, Md | ND |
| *Verbena officinalis* L. | Vebenaceae | c | Per | Hc | Md | ND |
| *Vicia sativa* L. | Fabaceae | r | Ann | Th | Gr, Hf, Md | ND, NS |
| *Vigna luteola* (Jacq.) Benth. in Mart. | Fabaceae | Fc | Per | Ch | Gr | BA |
| *Vossia cuspidata* (Roxb.) Griff. | Poaceae | rr | Per | Gh | Gr, Ot | BA |
| *Zilla spinosa* (L.) Prantl | Brassicaceae | c | Per | Ch | Fu, Gr, Md | ND, NS, WA |
| *Ziziphus lotus* (L.) Lam. | Rhamnaceae | Fc | Per | Ch | Fu, Gr, Hf, Md | ND |
| *Ziziphus spina-christi* (L.) Desf. | Rhamnaceae | Fc | Per | Ph | Fu, Gr, Md | WA |
| *Zygophyllum aegyptium* Hosny | Zygophyllaceae | rr | Per | Ch | Gr | ZA |
| *Zygophyllum album* L. f. | Zygophyllaceae | cc | Per | Ch | Gr, Md, Ot | ZA, BA, ND, NS |
| *Zygophyllum coccineum* L. | Zygophyllaceae | Fc | Per | Ch | Gr, Md | ZA, NS |
| *Zygophyllum dumosum* Boiss | Zygophyllaceae | c | Per | Ch | Md | NS |
| *Zygophyllum simplex* L. | Zygophyllaceae | c | Ann | Ch | Fu, Gr, Hf, Md, Ot, Ti | WA |

| Species | Part used/preparation | Use and treatment | Family |
|---|---|---|---|
| *Adiantum capillus-veneris* L. | The above-ground parts represented by the fronds | Diuretic, tonic, febrifuge; for treatment of obstructions of the liver & spleen | Adiantaceae |
| *Adonis dentata* Delile | The fruiting & flowering herb | Preserving strength & youth | Ranunculaceae |
| *Aerva javanica* (Burm. f.) Juss. ex Schult. | The plant | Remedy for toothache | Amaranthaceae |
| *Ajuga iva* (L.) Schreb. | Drenched plant | For treating sinusitis | Lamiaceae |
| *Alhagi graecorum* Bioss. | Drenched shoots | For rheumatism | Fabaceae |
| *Allium roseum* L. | The bulb | Diabetes and hypoglycemia | Alliaceae |
| *Amaranthus viridis* L. | The whole plant | Antipyretic, diuretic, emollient, expectorant, laxative, stomachic. To improve the appetite, for leprosy | Amaranthaceae |
| *Ambrosia maritima* L. | Decoction; the above-ground fruiting & flowering herb | Renal colic; rheumatic pain, asthma & to expel renal stones | Asteraceae |
| *Ammi visnaga* (L.) Lam. | Seeds | Spasmolytic and antispasmodic | Umbelliferae |
| *Anchusa hispida* Forssk. | Leaves | For rheumatism | Boraginaceae |
| *Anethum graveolens* L. | Decoction of fruits & seeds | Stomach, intestine pain and inflammation | Umbelliferae |
| *Aretmisia judaica* L. | Above-ground parts during the flowering stage | Stomachic & antispasmodic in intestinal colic | Asteraceae |
| *Arisarum vulgare* Trag. & Tozz. | The whole plant | Anti-poisoning | Araceae |
| *Asparagus stipularis* Forssk. | Decoction of seeds; drenched plants | Hemostatic and healing wounds; for jaundice | Liliaceae |
| *Asphodelus aestivus* Brot. | Juice or tincture from tubers and roots; tubers | For ectoderm parasites, and psoriasis; for treating sinusitis; for jaundice | Liliaceae |
| *Avena sativa* L. | The whole plant; extract of flowering plant | Healing wounds; for rheumatism | Poaceae |
| *Calligonum polygonoides* L. ssp. *comosum* L'Her. | The whole plant | Antimicrobial | Polygonaceae |
| *Capparis deciduas* (Forssk.) Edgew. | The bark extract; the pest of young leaves and branches | Anthelmintic, analgesic, aphrodisiac, carminative, diaphoretic, laxative; for asthma and cough; applied as plaster on boils and swellings | Cleomaceae |
| *Centaurea alexandrina* Delile | The whole plant | Diabetes and hypoglycemia | Asteraceae |
| *Centaurea calcitrapa* L. | Seeds and fruits; the whole plant | Febrifuge; healing wounds | Asteraceae |
| *Centaurea pumilio* L. | Roots | Used with ingredients as a fattening agent | Asteraceae |
| *Centaurium spicatum* (L.) Fritsch | The above- ground parts | Hypertension, kidney stones & healing agents for wounds | Gentianaceae |
| *Cistance tubulosa* (Schenk.) Hook. f. | Decoction of leaves | Urinary system and stones in kidney, diarrhea | Orobanchaceae |
| *Citrullus colocynthis* L. | Decoction from seeds; the seeds; drenched plant; fruit | Diabetes; paste made from seeds and honey used for treating constipation ; anti-poisoning; the fruit is heated and applied to the heals for treating rheumatism | Cucurbitaceae |







| Species | Part used/preparation | Use and treatment | Family |
|---|---|---|---|
| *Cladium mariscus* (L.) Pohl | Decoction | Colic and gastrointestinal problems | Cyperaceae |
| *Cleome amblyocarpa* Baratte and Murb. | Decoction | Antimicrobial used for bacterial infections and also for hypoglycemia | Cleomaceae |
| *Cleome chrysantha* Decne. | Decoction | Anthelmintic, antiseptic | Cleomaceae |
| *Colchicum ritchii* R. Br. | Seeds & corms | For rheumatism , abdominal colic, gastrointestinal problems & gout | Colchicaceae |
| *Convolvulus arvensis* L. | Decoction of roots; leaves and flowers; leaves | For treating skin problems, for clod, cough, and rheumatism; homeostasis; healing wounds | Convolvulaceae |
| *Convolvulus lanatus* Vahl | Decoction of roots | Haemostatic and healing wounds | Convolvulaceae |
| *Conyza bonariensis* (L.) Cronquist | Flowering branches | For rheumatism | Asteraceae |
| *Cressa cretica* L. | Leaves | For jaundice | Convolvulaceae |
| *Cuscuta planiflora* Ten. | Plant extract | For jaundice | Convolvulaceae |
| *Cynodon dactylon* (L.) Pers. | Decoction of rhizomes; drenched of whole plant | For treating skin problems, skin rashes, abscess; as diuretic and astringent; for treating urinary bladder problems; healing wounds | Poaceae |
| *Cyperus rotundus* L. | Powder of plant; rhizome, tubers; extract from the whole plant | Decreasing hair growth; tubers used for stomachic; sedative & analgesic and calmative | Cyperaceae |
| *Deverra tortuosa* (Desf.) DC. | Decoction of green parts of the plant and tender branches | Hypertension, and laxative | Umbelliferae |
| *Dipterygium glaucum* Decne. | The plant | For asthma, analeptic | Capparaceae |
| *Ecballium elaterium* L. A. Rich. | Fruit juice applied into the nose | For treating Jaundice, Sinusitis | Cucurbitaceae |
| *Echinops spinosus* L. | Decoction of roots; the whole plant | Haemostatic and healing wounds; diabetes and hypoglycemia | Asteraceae |
| *Emex spinosa* (L.) Campd. | The boiled leaf | Purgative and diuretic, and to stimulate appetite | Polygonaceae |
| *Eminium spiculatum* (Blume) Schott | The juice of the whole plant; the whole plant | Diabetes and hypoglycemia; anti-poisoning | Araceae |
| *Ephedra alata* Decne. | The shoots | Diabetes and hypoglycemia | Ephedraceae |
| *Erodium cicutarium* (L.) L'Hér. | Flowering shoots and inflorescence | Haemostatic and for healing wounds | Geraniaceae |
| *Eryngium campestre* L. | Roots | Expectorant | Umbelliferae |
| *Eryngium creticum* Lam. | Whole-plant decoction | Poisoning, anemia, infertility | Umbelliferae |
| *Euphorbia granulata* Forssk. | Latex | Anthelmintic, diuretic, purgative. | Euphorbiaceae |
| *Euphorbia helioscopia* L. | Latex | Abscess | Euphorbiaceae |
| *Euphorbia peplis* L. | The whole plant | Expectorant | Euphorbiaceae |
| *Euphorbia peplus* L. | The whole plant | Used for the lowering of blood pressure | Euphorbiaceae |
| *Euphorbia retusa* Forssk. | The whole plant | For coughs, asthmas, anti-asthmatic, expectorant, nervine | Euphorbiaceae |

| Species | Part used/preparation | Use and treatment | Family |
|---|---|---|---|
| *Haplophyllum tuberculatum* (Forssk.) Juss. | inflorescence and fruits; flowering and fruiting branches | Febrifuge; for rheumatism | Rutaceae |
| *Herniaria hemistemon* J. Gay | The whole plant | Diabetes and hypoglycemia | Caryophyllaceae |
| *Hyoscyamus muticus* L. | The whole plant; leaves | Antispasmodic, remedy for asthma, toothache and sea sickness, spasmolytic; sedative and calmative | Solanaceae |
| *Hyphaene thebaica* (L.) C. Martius | Decoction, entire fruits, powder | Hypertension, dyspepsia, cardio-tonic | Palmae |
| *Imperata cylindrica* (L.) Raeusch. | Rhizomes; flowers | Haemostatic and healing wounds; for pulmonary problems | Poaceae |
| *Lactuca serriola* L. | The whole plant | Spasmolytic and antispasmodic | Asteraceae |
| *Lavandula pubescens* Decne. | Decoction of leaf | Antimicrobial, yield essential and aromatic oil, headache and cold | Lamiaceae |
| *Lobularia maritima* (L.) Desv. | Decoction of flowering individuals | Febrifuge | Brassicaceae |
| *Lolium perenne* L. | Decoction of the whole plant | Haemostatic and healing wounds; for rheumatism | Poaceae |
| *Maerua crassifolia* Forssk. | The decoction of leaves | For toothache and intestinal diseases, febrifuge | Capparaceae |
| *Malva parviflora* L. | Paste of leaves, shoots, flowers; decoction of the plant | For sore skin, and healing wounds; for chest, pulmonary and intestinal problems | Malvaceae |
| *Marrubium vulgare* L. | The decoction of all the green parts of the plants | Anthelmintic, alterative, expectorant, stimulant; for coughs & chronic bronchitis, dyspepsia, jaundice amenorrhea, rheumatism & hepatitis, & diabetes | Lamiaceae |
| *Melilotus indicus* (L.) All. | Flowering branches | Spasmolytic and antispasmodic | Fabaceae |
| *Mentha longifolia* (L.) L. | Leaf extract | Remedy for cough and breathing problem | Lamiaceae |
| *Moltkiosis ciliata* (Forssk.) I. M. Johnst. | The whole plant | Haemostatic and healing wounds | Boraginaceae |
| *Nicotiana glauca* R. C. Graham | Paste from green leaves | For homeostasis and healing wounds | Solanaceae |
| *Papaver rhoeas* L. | Flowers extract | Sedative and calmative | Papaveraceae |
| *Paroychia argentea* Lam. | Decoction of the whole plant | Febrifuge | Caryophyllaceae |
| *Peganum harmala* L. | Seeds; decoction of the whole plant; green branches | Kidney stones; haemostatsis; for rheumatism | Peganaceae |
| *Phragmites australis* (Cav.) Trin. ex Steud. | Rhizomes | Abscess | Poaceae |
| *Plantago major* L. | Paste made from the leaves; extract of the whole plant | For healing wounds, abscess; for treating bronchitis | Plantaginaceae |
| *Pluchea dioscorides* (L.) DC. | Aerial parts | Epilepsy in children, carminative & remedy for cold | Asteraceae |
| *Polygonum equisetiforme* Sibth. & Sm. | Decoction of shoots | Diuretic, for Jaundice, as haemostatic and for healing wounds, skin problems, as remedy for sheep after sheep shearing | Polygonaceae |



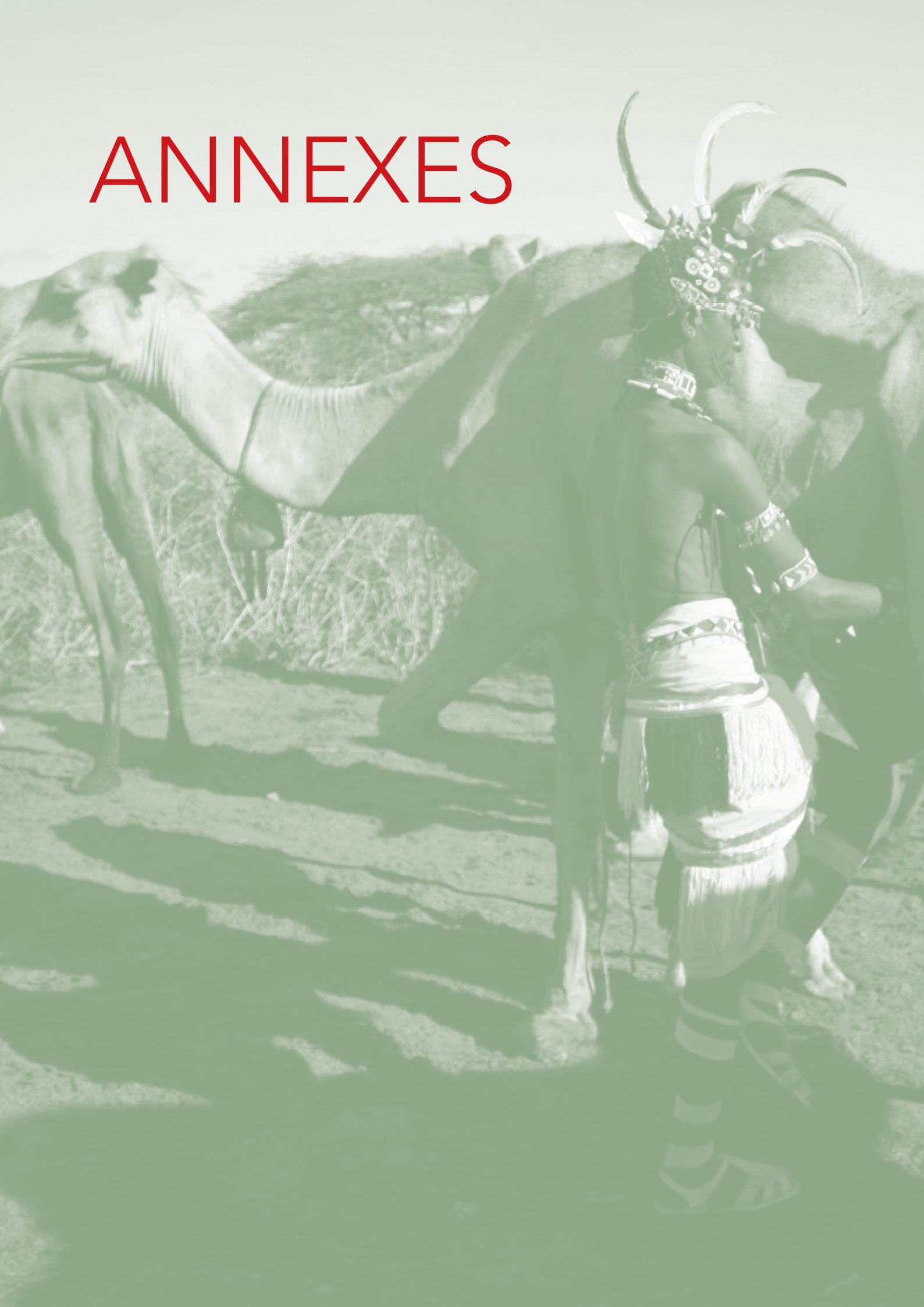


| Species | Part used/preparation | Use and treatment | Family |
|---|---|---|---|
| *Portulaca oleracea* L. | Steam of boiling leaves; Powdered seeds | Rheumatic pain; appetizer | Portulacaceae |
| *Posidonia oceanica* (L.) Delile | Flower & roots | Flowers used for headache, as heart tonic & roots for coughs & colds | Posidoniaceae |
| *Retama raetam* (Forssk.) Webb & Berthel. | The shoots and tender branches | Febrifuge and for healing wounds | Fabaceae |
| *Ricinus communis* L. | Seeds and green leaves | Purgative & emetic, treatment of scrofulous sores, boils and rheumatic swellings | Euphorbiaceae |
| *Rumex pictus* Forssk. | Leaves and tender shoots | Sedative, spasmogenic and antimicrobial | Polygonaceae |
| *Rumex vesicarius* L. | The entire plant; seeds are eaten for as cure of dysentery; the plant juice; the whole plant | Hepatic diseases & bad digestion, diuretic & astringent; stomachic; toothache & nausea and to promote appetite; for jaundice | Polygonaceae |
| *Salvia aegyptiaca* L. | The plant; seeds | Demulcent, in gastro-intestinal disorders, diarrhea, gonorrhoea and hemorrhoids | Lamiaceae |
| *Salvia lanigera* Poir. | The plant | Carminative, diuretic, antiseptic, indigestion | Lamiaceae |
| *Senecio vulgaris* L. | Flowering shoots and inflorescence | For homeostasis | |
| *Senna alexandrina* Mill. | Decoction | Laxative and for constipation | Fabaceae |
| *Seriphidium herba-album* (Asso) Soják | Decoction of leaves and inflorescence; extract of the whole plant | Colic and gastrointestinal problems and as febrifuge, haemostatic, for healing wounds; treating bronchitis and for rheumatism, sedative , calmative | Asteraceae |
| *Silybum marianum* (L.) Gaertn | Seeds extract | for treating bronchitis, for jaundice | Asteraceae |
| *Solanum nigrum* L. | Decoction of leaves; decoction of ripe fruits; the whole plant | Diuretic, cervic inflammation, sore throat; alterative, anodyne, cathartic, diaphoretic, expectorant, sedative; for jaundice, fever, diarrhea & heart diseases; healing wounds | Solanaceae |
| *Solenostemma argel* (Delile) Hayne | Infusion | Antispasmodic for renal colic | Asclepiadaceae |
| *Tamarix aphylla* (L.) H. Krast. | Decoction of leaves, tender shoots and barks | For diarrhea and for stomach & intestine pain | Tamaricaceae |
| *Teucrium polium* L. | Stems & inflorescences; plant extract | Steam bath for cold & fever, hot infusion for intestinal troubles; febrifuge, stomachic, vermifuge, also the plant used for treating hypoglycemia; healing wounds | Lamiaceae |
| *Thymelaea hirsuta* (L.) Endl. | Leaves | Expectorant | Thymellaceae |
| *Thymus capitatus* (L.) Link | Green & dried parts, inflorescence Decoction of leaves | For stomach diseases, intestinal troubles, and cough, used for oral problems and anthelmintic, toothaches; sedative and calmative | Lamiaceae |
| *Tribulus terrestris* L. | Flowers; dried stem and aerial parts; seed; extract of plant | For leprosy; scabious, skin diseases & psoriasis; anemia & coughs; spasmolytic and antispasmodic | Zygophyllaceae |

| Species | Part used/preparation | Use and treatment | Family |
|---|---|---|---|
| *Tyha domingensis* (Pers.) Poir ex Steud. | Rhizomes | For homeostasis | Typhaceae |
| *Urginea maritima* (L.) Baker | The bulb | Remedy for rheumatism, heart problems, expectorant, to get rid of moisture from the body | Liliaceae |
| *Urginea undulata* (Desf.) Steinh. | The whole plant | For pulmonary diseases; for jaundice | Liliaceae |
| *Urtica pilulifera* L. | The herb & seeds; decoction of leaves | Plant juice & oil for rheumatism; stomach, intestine pain and inflammation, cancer, for bed wetting | Urticaceae |
| *Urtica urens* L. | Aerial branches & leaves | For rheumatism, skin problems, eczema & diuretic | Urticaceae |
| *Vaccaria hispanica* (Mill.) Rauschert. | Roots | Abscess | Caryophyllaceae |
| *Verbascum letourneuxii* Asch. & Schweinf. | The whole plant | Expectorant | Scrophulariaceae |
| *Verbena officinalis* L. | Foliage infusion | Stomach pain, fever, menstrual cramps | Vebenaceae |
| *Vicia sativa* L. | Drenched plant | For rheumatism | Fabaceae |
| *Ziziphus lotus* Desf. | Decoction of bark and fruits used | For constipation and as laxative | Rhamnaceae |
| *Ziziphus spina-christi* (L.) Desf. | Decoction of leaves, fruits & bark | For cold, toothaches | Rhamnaceae |



# ANNEXES



# ANNEX 1
# Agenda of the ILK dialogue workshop

| Sunday, 13 September 2015 | | |
|---|---|---|
| Evening<br>from 7:00 | Informal preparatory gathering among indigenous and local knowledge (ILK) holders and experts, with ILK Task Force members (UNESCO as technical support). | ILK holders/experts<br>ILK Task Force<br>TSU |

| Monday, 14 September 2015 | | |
|---|---|---|
| 9:00 to 10:00 | **Opening Session** | Plenary:<br>ILK holders/experts,<br>Assessment co-chairs,<br>CLAs, LAs<br>ILK Task Force, TSU |
| 10:00 to 12:30<br><br>*Coffee/tea break at 11:00* | **Our Knowledge, Our Ways:**<br>**Indigenous and local knowledge about Biodiversity and Ecosystem Services**<br>○ land degradation & restoration<br>○ sustainable use & conservation<br>○ invasive alien species & their control<br>***… your experiences and concerns***<br><br>*Introductions by ILK holders/experts (in alphabetical order):*<br>*Ms Marwa Waseem Halmy (Egypt)*<br>*Ms Sabella Kaguna Julius (Tharaka, Kenya)*<br>*Mr Malih Johnson Ole Kaunga (Maasai, Kenya)*<br>*Mr Patrice Bigombe Logo (Cameroon)*<br>*Mr William Mala (Cameroon)*<br>*Mr George Gathuru Mburu (Kenya)*<br>*Mr Sadrak Ngally (Bagyeli Pygmy, Cameroon)*<br>*Ms Verohanitra Rafidison (Madagascar)*<br>*Mr Riziki Shemdoe (Tanzania)* | Plenary |
| *12:30 to 14:30* | *Lunch* | *Distribution of DSA* |
| 14:30 to 15:30 | **Overview of the African assessment report**<br>By co-chairs and authors | Plenary |
| *15:30 to 16:00*<br>*Coffee/tea* | | |
| 16:00 to 17:30 | **Collective identification of emerging themes/issues for dialogue sessions between ILK holders/experts and chapter authors** | Plenary |
| **18:00** | **Reception** | |
| Evening session | Finalization of themes/issues for dialogue sessions. Planning for Day 2 | ILK Task Force and TSUs |

| Tuesday, 15 September 2015 | | |
|---|---|---|
| 9:15 to 9:30 | Report back from Day 1 and Planning for Day 2 | Plenary |
| 9:30 to 10:15 | **Scoping ILK theme 1: ILK holders/experts outline major issues (problems, changes) on this theme**<br>*Brief reflections and comments by each ILK holder/expert* | Plenary |
| *10:15 to 10:30*<br>*Coffee/tea* | | |
| 10:30 to 12:30 | **In-depth Dialogue on ILK theme 1:**<br>*Dialogue among ILK holders/experts, Assessment report authors and Task Force members* | Break-out groups (2) |
| 12:30 to 12:45 | **Touch-back on process: is it working?** | Plenary |
| *12:45 to 14:00* | *Lunch* | |
| 14:00 to 15:00 | **Scoping ILK theme 2: ILK holders/experts outline major issues (problems, changes) under this theme**<br>*Brief reflections and comments by each ILK holder/expert* | Plenary |
| *15:00 to 15:30*<br>*Coffee/tea* | | |
| 15:30 to 17:30 | **In-depth Dialogue on ILK theme 2:**<br>*Dialogue among ILK holders/experts, authors and Task Force members* | Break-out groups (2) |

| Wednesday, 16 September 2015 | | |
|---|---|---|
| 9:15 to 9:30 | Overview of progress and planning for Day 3 | Plenary |
| 9:30 to 10:30 | **Scoping ILK theme 3: ILK holders/experts outline major issues (problems, changes) under this theme**<br>*Brief reflections and comments by each ILK holder/expert* | Plenary |
| *10:15 to 10:30 Coffee/tea* | | |
| 10:30 to 12:30 | **In-depth Dialogue on ILK theme 3:**<br>*Dialogue among ILK holders/experts, assessment report authors and Task Force members* | Break-out groups (2) |
| 12:30 to 13:30 | *Lunch* | Plenary |
| 13:30 to 14:30 | **Stock-taking of Dialogue Sessions** | Plenary |
| 14:30 to 15:30 | **Collective review of workshop outcomes:**<br>• *What was accomplished? What was missed? What still remains to be done?*<br>• *How to optimize ILK inputs from the workshop to the assessment report*<br>*Required follow-up* | Plenary |
| *15:30 to 16:00 Coffee/tea* | | |
| 16:00 to 17:30 | **Issues/questions to take back to ILK holders and communities**<br>• *Taking workshop outcomes and outstanding issues back to ILK communities*<br>• *Process to contribute ILK community inputs into the First-order Draft of the African Assessment Report* | Plenary |
| 17:30 to 18:00 | **Closing** | |

# ANNEX 2
# Participants list for the ILK dialogue workshop

## ILK holders and experts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# ANNEX 3
# Author bionotes

**Yildiz AUMEERUDDY-THOMAS** is a research director at the French National Centre for Scientific Research (CNRS). She is an ethnoecologist specialized on biocultural interactions and has worked successively on agroforestry in Central Sumatra for four years, local knowledge for biodiversity conservation in the Himalayas especially in Nepal and Northern Pakistan as main coordinator for the People and Plants initiative. Since 2005, she engaged in a worldwide comparative approach on interactions between human societies, rural forests and trees. Working in the Maghreb in northern Africa, she has focused much of her attention on fig and olive domestication. During that period she also developed studies on man and *Ficus* species relationships in Madagascar. She is currently a member of the Task Force on Indigenous and Local Knowledge of IPBES.

**Patrice BIGOMBE LOGO** is a political scientist, lecturer and researcher at the Administrative, Political and Social Researches Group (Graps) of the University of Yaounde II in Cameroon. He is also a researcher in geopolitics in Central Africa (FPAE) at the Fondation Paul Ango Ela and director of the Centre for Research and Action for Sustainable Development in Central Africa (CERAD). His research focuses on logic and nationalization processes, the recognition and survival of indigenous 'Pygmies' in Central Africa and public policy management of natural resources in Central Africa. He also teaches at the Faculty of Agronomy and Agricultural Sciences (FASA) of Dschang University, at the Faculty of Social Sciences and Management (FSSG) of the Catholic University of Central Africa (AFU) and at the Pan-African Institute for Development – Francophone Central Africa Region (IPD-AC) in Douala, Cameroon.

**Marwa Waseem A. HALMY** works as an assistant professor at the Department of Environmental Sciences-Faculty of Science- Alexandria University, Egypt since 2013. She got her PhD in environmental science from University of Idaho, USA in 2012. Currently she is a postdoctoral fellow at the Institute of Systematics and Evolutionary Botany, University of Zurich, Switzerland. Her research focuses on how human-induced changes including climate change have influenced critical areas in the deserts and arid lands; and the impacts on plant diversity in these understudied areas. She also studies the impact of land use changes on the distribution of plants and important habitats. Her particular interests lie in conducting valuation of the goods and services provided by the natural ecosystems in the arid lands using remote sensing and GIS techniques. She also, focuses on applying the concepts of landscape genetics to understand the pattern of gene flow among populations of endangered plants to implement efficient conservation measures to protect these important species.

**Sabella KAGUNA** is a Tharaka from Kenya. She is a custodian of culture and indigenous knowledge as well as a respected community leader. She has been involved in different eco-cultural processes through Institute for Culture and Ecology (ICE) and has been instrumental in the cultural affirmation process happening in her community. She has been very supportive of her community in using eco-cultural strategies (dialogues, eco-cultural maps and calendars) to strengthen local ecosystems.

**Johnson M. Ole KAUNGA** is the director of the Indigenous Movement for Peace Advancement and Conflict Transformation (IMPACT) and founder/advisor of the Maasai Cultural Heritage. IMPACT (Indigenous Movement for Peace Advancement and Conflict Transformation) is a peace building, human rights, governance, land rights, policy advocacy and community development organization working among and with pastoralist communities to address the major problems faced by minority and indigenous people in Kenya. In this regard, IMPACT has been keen to tackle first and foremost, the loss of land rights, historical land injustices, and exploitation of resources without participation or accruing benefits. The Maasai Cultural Heritage is working to document, protect and promote the broad and deep cultural practices, heritage and traditional knowledge of the Maa- speaking pastoralists. The Maasai cultural heritage has been collaborating with WIPO, ILO, National Museum of Kenya and several universities. Ole Kaunga has written and published on several topics touching on land, natural resources, education, human rights.

**William Armand MALA** is currently a senior lecturer at the University of Yaounde I in Cameroon. He holds a PhD in Forest Science from the University of Stellenbosch, South Africa. His areas of interest are community forestry, adaptive management, traditional forest knowledge, forest-agriculture innovations and, climate change and safeguards.

**Gathuru MBURU** is a Kikuyu and cultural ecologist working in Kenya. He has been involved in indigenous knowledge and cultural strengthening process around the world while working with African Biodiversity Network. He has been involved in the IPBES since its beginning engaging mainly from the Indigenous and Local Communities perspective. He is a member of the International Indigenous Forum on Biodiversity and Ecosystem Services (IIFBES) that is working closely with IPBES on ILK issues. He is currently supporting cultural affirmation processes in Kenya an specifically working with the community living on the eastern side of Aberdare Forest to initiate an agro-ecological movement working through Ngaatho Community Foundation (NCF).

**Paul Felix MIMBOH** was born in Lolodorf, Cameroon. He holds a Bachelor's degree and a Diploma in Development Studies. In 2000, after taking several courses in human rights and communications, he published, in the journal *Alternatives Sud*, an article entitled "Pygmies and deforestation in Cameroon". He has also published articles on the Pygmies in the *ICRA-Journal Suisse* and the *Bulletin on Trees, Forests and Rural Communities* of the FAO.

**Gilbert Aboushow NZIE** was born in Kribi, Cameroon. He graduated with a Master of Research in Anthropology at the University of Yaounde I. Concerned by the irreversible deforestation plaguing the forest of Lolodorf in southern Cameroon, where Bakola Pygmies/Bagyeli communities live, he is interested in the future of this forest people. Held in 2014, his Master thesis in anthropology, focused on "Deforestation and sociocultural dynamics in the Nkola–Ngyéli Lolodorf (South Cameroon): contribution to the anthropology of development". He is a member of the Indigenous Peoples' International Working Group (IWGIA).

**Nicholas OGUGE** is professor of environmental policy and director at the Centre for Advanced Studies in Environmental Law and Policy (CASELAP), University of Nairobi, Kenya. He is a member of the Scientific Review Committee (SRC) at the Socio-Environmental Synthesis Centre (SESYNC), University of Maryland, USA; and a Trustee at the African Conservation Centre (ACC) in Kenya. Professor Oguge is also the founding president of the Ecological Society for Eastern Africa (ESEA), and editorial board member of the *African Journal of Ecology*. He has expertise on a wide range of environmental issues including: climate change impacts, mitigation and adaption; biodiversity and ecosystem services; wildlife ecology; range ecology; environmental policy; strategic environmental assessment; and, spatial ecology.

**Jean Fidèle RAFANOMEZANTSOA** lives in Amindrabe, Madagascar. He is Forest police staff for the Ranomafana National Park, member and secretary of the basic local community (COBA), nurseryman and farmer.

**Verohanitra M. RAFIDISON** is a lecturer and researcher of quantitative and qualitative ethnobotany in the Department of Plant biology and Ecology, Faculty of Science at the University of Antananarivo, Madagascar. She holds a PhD degree in life sciences with the theme "Ethnobiology and ecology of Ficus in the agrarian territories of Betsileo and Ranomafana–Andringitra corridor", a DEA in plant ecology and a Certificate of Teaching Ability of Ecole Normale Supérieure (CAPEN) in natural sciences. She is also a member of the Scientific Authority in CITES Madagascar, of the "Groupe de Spécialistes des Plantes de Madagascar" (GSPM) and of the Organization for Social Science Research in Eastern and Southern Africa (OSSREA). Her main interest is to characterize the biocultural interactions related to local community practices.

**Augustin François Regis RALAHA** lives in Ambendrana, Madagascar. He is a member of the basic local community (also a former president), a local collaborator for the NGO International Conservation, a farmer and teacher at the Ambendrana Catholic school.

**Basile RAKOTOANADAHY** is, since 1984, laboratory technician and field assistant of the Department of Plant biology and Ecology, University of Antananarivo, Madagascar.

**Ambendrana RAKOTOMARO** lives in Ambendrana, Madagascar. He is president of the basic local community, Forest police staff of the Ranomafana National Park, nurseryman and farmer.

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**Emmanuel RASABO** lives in Amindrabe, Madagascar. He is member of the basic local community, and farmer.

**Ngally SADRACK** was born in Lolodorf, Cameroon. After his Certificate of Primary Education Elementals, the young Pygmy Bakola–Bagyéli has attracted the attention of several NGOs advocating for the development of Bakola communities. Educated in strategies to defend human rights, he is a now traditional health therapist, who advocates safeguarding the Bakola–Bagyéli pharmacopoeia threatened by deforestation.

**Riziki Silas SHEMDOE** is a natural resource management expert from Tanzania. He is currently a district executive director of Mufindi District. Before this position he worked as a senior research fellow in the Institute of Human Settlements Studies, Ardhi University. He has conducted several research projects and published on ecosystem services, climate change mitigation and adaptation, and traditional knowledge in managing natural resources. He holds a PhD in Applied Biological Sciences majored in Agro-ecology.

## SCIENTIFIC EDITORS

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**Nicolas CÉSARD** is a social anthropologist and associate professor at the Laboratoire d'Ecoanthropologie et Ethnobiologie (CNRS–MNHN), France. He has been carrying out research in Indonesia, Japan and France. For several years he has examined the interactions between societies and their environment, as well as the management of natural resources, through the field of ethnoentomology.

**Alfred OTENG-YEBOAH** is professor at the Department of Plant and Environmental Biology, University of Ghana, Legon. He is a founding bureau member and vice-chair of IPBES, representing Africa. His interest in biodiversity spans several decades of research in various subject areas, including local and traditional knowledge systems among his people in Ghana.

**Marie ROUÉ** is a social anthropologist and research director at the French National Centre for Scientific Research (CNRS) and the National Museum of Natural History (MNHN). She is currently member of the Multidisciplinary Expert Panel and the Indigenous and Local Knowledge task force of the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES). Her research interests include the indigenous knowledge and knowledge co-production amongst Arctic peoples. She has worked with Cree First Nations and Inuit in Canada and Alaska, and with Sami in Norway and Sweden for more than 45 years.

*Knowing our Lands and Resources* is a compendium of knowledge, practices and worldviews of indigenous peoples and local communities across Africa. It demonstrates the essential contribution that indigenous and local knowledge holders make to assessments of biodiversity and ecosystem services.

The papers in this volume have been prepared for the Author team of the IPBES assessment of biodiversity and ecosystem services for Africa. The objective is to assist the Author team with their task of grounding the African assessment in both science and indigenous and local knowledge (ILK). The papers complement existing sources of ILK in the scientific and grey literature, and contribute relevant ILK that might not otherwise be available to the assessment process.

This publication is available online at:
www.unesco.org/new/links/ipbes-pubs

ISBN 978-92-3-100208-3


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