Social Sciences, Humanities and Education Journal (SHE Journal)
Volume 3 (3) 306 – 312, September 2022 | ISSN: 2720-9946 (Online) ISSN: 2723-3626 (Print)
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CLIMATE CHANGE THREATS ON INDIGENOUS PREVENTIVE MEDICINE AND INITIATIVES FOR THE SPECIES' CONSERVATION IN LIMPOPO PROVINCE, SOUTH AFRICA

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Abstract: Indigenous plants are significant sources of medicines used to address basic health care requirements. Most significantly, the medicine is utilised as a preventative measure. Disease susceptibility is reduced by administering native plant products. Recent years have seen a decline in the number of indigenous plants gathered for preventative medicine due to the negative effects of drought and altered temperature patterns. The current research examined the state of indigenous plants used to make preventative medicine, the possible effects of climate change on the species, and traditional techniques employed to preserve the species for future usage. One hundred and six participants reported that they have knowledge of preventive care, which is accomplished through the administration of indigenous plant-derived remedies. Preventive amulets and salves are created from the roots, leaves, bulbs, bark, and stalks. Unfortunately, some plant species are endangered or extinct as a consequence of drought and rising temperatures. Participants demonstrated that they continue to use traditional conservation strategies to ensure the survival of rare species. This research recommends that the plant species identified by participants be added to the IUCN Red List in order to ensure their continued availability and usage in preventative care.

Keywords: Preventive care; primary health care; native plant-derived medicine; climate change; COVID-19

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Citation: Rankoana, S.A. (2022). Climate change threats on indigenous preventive medicine and initiatives for the species' conservation in limpopo province, south africa. *Social Sciences, Humanities and Education Journal (SHE Journal)*, *3*(3), 306 – 312. DOI: 10.25273/she.v3i3.13918.

INTRODUCTION

Indigenous plant-derived medicine is a critical component of traditional medicine, which is still used to satisfy basic health care requirements among people who are familiar with the plants' qualities and health potential. Many of these medicinal plants are essential sources of preventative medicine and raw materials for the production of traditional and contemporary medicine (Phondani et al., 2014). De Wet et al. (2012) estimate that more than 70% of South Africans utilise plant-derived medication for curative and preventative health care. The use of indigenous plant- derived medicine is contingent upon the accessibility and availability of medicinal plant components. The Intergovernmental Panel on Climate Change (IPCC, 2013) agrees that climate change is wreaking havoc on biodiversity worldwide as a consequence of recent drought and rising temperatures.

Climate change-related changes, manifested as droughts, decreased rainfall, and rising temperatures—are responsible for the depletion of plant materials as critical sources of food, stock feed, habitat for wild animals, and medicine. Over the previous 50 years, the average temperature of the South Africa's climate has increased by 1.5 degrees, along with an increase in droughts and decreased rainfall (Ziervogel et al., 2014). This has resulted in the country's biodiversity declining to the point of extinction, which implies that a large number of diverse species are at risk of extinction as the earth heats and the environment change faster than they can adapt. According to the IPCC (2013), drought and increasing temperatures are anticipated to have an influence on plant ecology, resulting in increased plant deaths and extinctions in a number of locations. By
2100, the temperature is anticipated to climb from 1.40 to 5.80 degrees Celsius. This will likely have a significant influence on biodiversity, since it is already compelling biodiversity and ecosystems to relocate, alter their life cycles, and acquire new physical characteristics (Harish et al., 2013). Climate change has had a significant effect on the life cycles and distributions of plants worldwide, especially medicinal plants (Maikhuri et al, 2018). Due to current and predicted climate change, medicinal plants are in risk of extinction (Tangjitman et al., 2015), and may result in the extinction of essential species (IPCC, 2013). Small species, such as herbaceous plants mostly harvested for medicinal purposes, would be among the first to be impacted by climate change, particularly in temperate regions (Maikhuri et al., 2018).

The present study examined the effects of climate change on indigenous plants that are used to make preventative medicine by the members of a rural community in South Africa's Limpopo Province. The research's primary aim was to identify indigenous plants picked for the purpose of preparing preventative medicine, as well as their present state and sensitivity to irregular rainfall, drought, and altered temperature patterns. A secondary purpose was to describe traditional conservation measures for these plants. The Alma Ata Declaration's call for the use of traditional medicine in primary health care informs this research. Preventive care is a critical component of primary health care, which places a premium on reducing vulnerability to different types of illness. This research demonstrates the use of indigenous plant-derived medication to deflect and prevent illness susceptibility, which could be essential in the prevention against COVID-19 pandemic.

METHOD

The study was conducted in the Capricorn District of Limpopo Province, South Africa between 2017 and 2019. The study explored the potential impacts of climate change on native plant materials used to make preventive medicine and the conservation practices adopted to sustain the plants. Participants were twelve (4 males and 8 females) traditional health practitioners purposely selected. A hundred and twenty (120) community members (65 males and

55 females) were randomly selected to participate in the study.

Data were collected through semi-structured interviews with traditional health practitioners and focus group discussions with community members. The main research questions were: i) Which indigenous plants are used for preventive health care? ii) Describe their distribution and accessibility. iii) Describe how the current change in rainfall and temperature has affected the plants' distribution and accessibility. iv) Which indigenous conservation methods are practised to conserve the plants for future use? Prior informed permission was obtained by describing the study's purpose to local authorities, who then permitted the conduct of focus group discussions. By completing the consent form, participants volunteered to participate in the research, and their names and identities remained anonymous throughout the study. The researcher obtained ethical permission from the Ethics Committee of the University of Limpopo. Increased credibility, transferability, confirmability, and dependability were used to assure the quality of acquired data. Through sustained involvement with participants during focus group conversations, credibility was enhanced. Purposive sampling was used to create a stratified sample of ordinary men and women, as well as traditional health practitioners. Dependability was assured by conducting rapid assessments of the data with participants to verify that the data accurately reflected their perspectives rather than the researcher's. Confirmability was assessed by interpreting, concluding, and recommending results from the research in the form of field notes collected from interactions with participants.

RESULTS AND DISCUSSION

Medicinal plants used in preventive health care

Distribution and availability

Six indigenous plant species belonging to six families were identified as sources of preventive medicine. The plants grew on well-drained soils in woodlands and along drainage lines in most parts of the Limpopo Province. They were summer plants, with the exception of *Kleinia longiflorus*, which is perennial. The species were harvested during the summer months when they were easily distinguished from other species. The main growth forms of medicinal plants were herbs and shrubs.

Indigenous plant-derived preventive medicine

Preventive medicine neutralizes the potency of harmful substances that are aimed at causing disease or any ill-health condition. The most commonly used protective medicine; *tšhidi* (protective medicine), was identified by traditional health practitioners and 72 participants. This medicine was prepared from the species *Berchemia discolour, Cotyledon orbiculata and Drimia robusta*. The roots were burnt and mixed with animal fat to be rubbed into the body to stave off disease. Another protective measure that was used for immunization against infectious diseases was the *dupa* (a protective charm). Dupa was identified by all traditional health practitioners and participants as a preventive product prepared from a mixture of *Amaranthus hybridus, Kleinia longiflorus* and *Siphonochilus aethiopicus.* The concoction was wrapped in fabric, sewed, and worn around the neck of a kid or adult to guard against infection from infectious illnesses such as the flu, cough, measles, and whooping cough. *Siphinochilus aethiopicus* rhizomes were chewed to form a paste that was smeared on the body to defend against ritual defilement (spiritual impurity), which causes ailments such as stomachaches. Traditional healers demonstrated that preventative medicine is used to strengthen the self and fight off bad spirits that might predispose individuals to sickness.

Impacts of climate change

Table 1: List of plant species and the extent of climate change impacts on their distribution and availability

Species name	Impact (Drought)	Impact (Rising temperature)
Amaranthus hybridus L	Scarce	Poor growth
*Berchemia discolour (*Klotzsch Hemsl.)	Declining	Poor growth
Cotyledon orbiculata L.	Vulnerable	Poor growth
Drimia robusta Bak	Critically scarce	Poor growth
Kleinia longiflorus	Scarce	Poor growth
Siphonochilus aethiopicus (Schweif) B.L. Burt	Endangered	Extinct

The species *Amaranthus hybridus, Berchemia discolor, Cotyledon orbiculata, Drimia robusta, Kleinia longiflorus* and *Siphonochilus aethiopicus* were rarely encountered in the communal land. Where they were found, the species were characterized by poor growth and morphology. This was because the species' development and survival were reliant on favorable climatic circumstances with enough rainfall. Participants confirmed that the species were highly endangered communal land as a consequence of continuous drought and overharvesting. The species' scarcity has been exacerbated by a lack of rainfall. It was also noted that anytime the plants exist, they were overharvested in order to assure availability during times of drought. Increased temperature trends combined with little or no rainfall were causing the species to wither before reaching maturity. It was believed that the surviving plants would go extinct in the near future, affecting their understanding and practice of indigenous preventative care. The IPCC (2014) supports the present state of the species by stating that medicinal plants are significantly impacted by changes in surrounding environmental elements such as temperature and rainfall. SANBI (2017) confirms that drought and changing climate patterns are contributing to the overexploitation of endangered medicinal plants on community lands. Numerous wild medicinal plants have already gone extinct as a result of the influence of climate change, and others are threatened with extinction (Ziervogel et al., 2014). For example, temperature has a profound influence on plant growth and development (Phondani et al., 2014; Hatfield, 2015). High temperatures harmed the development and production of essential medicinal plants (Giri, 2013). According to the IPCC (2013), the global temperature at the Earth's surface has increased more than any previous decade since 1850, and these changes are expected to influence plant ecology directly via drought and heat wave effects on photosynthesis, respiration, transpiration, and phenology.

Participants' observations of the adverse effects of drought and rising temperatures on the species match the South African Country Study on Climate Change's forecast that the most severe reactions to climate change would occur in the biodiversity and human health sectors (Ziervogel, et al., 2014). By 2050, the area suitable for South Africa's seven present terrestrial biomes might decline by 40% (IPCC, 2014). As a result, Phondani et al. (2014) suggest that the indigenous health care systems and indigenous knowledge about medicinal plants are deteriorating and, in some instances, disappearing entirely. According to the IPCC (2014), rises in surface temperature by the end of the twenty-first century are anticipated to have an effect on the ecosystem, species distribution, and habitat. Precipitation and temperature changes are significant variables affecting the distribution of the majority of medicinal plant species (Lenoir & Svenning, 2015), whose distribution has shifted throughout time (Maikhuri et al., 2018).

Conservation practices

Red-listed native plants

None of the six therapeutic plants discovered in the research is included on the South African National Red Data List of plants (SANBI, 2017), despite their status as rare, vulnerable, or extinct. The participants were unaware of any regulation governing the protection of medicinal plants, despite the fact that species collected for medicine were under threat from the adverse effects of climate change. According to SANBI (2017), these are species that are threatened with extinction and are either regionally extinct, non-existent in the wild, or fully extinct. This is despite the fact that in 2009, South Africa completed evaluations of 20456 indigenous vascular plant species for the IUCN Red List (Crouch, 2013). Throughout the procedure, medicinal plant species were identified to analyze the possible extinction hazards presented to these species. The identifying criteria were the harvesting techniques and market needs for the species. The bulk of the South African plant species included on the Red List are highly exploited (Williams et al., 2013).

Conservation of these species is performed in the research by indigenous conservation techniques, which are important to assure the plant materials' future availability. Conservation techniques include the following:

Harvesting methods

According to the participants, the harvesting techniques they use were dictated by the type of plant materials they need to gather in order to make medication. It was reported that, root harvest of *Amaranthus hybridus* and *Berchemia discolor* was limited to thin roots, after which the soil was replaced to sustain the plants. The bulbs of *Siphonochilus aethiopicus* were collected by uprooting the whole plant. Only a few leaves of *Cotyledon orbiculata* and *Drimia robusta* were picked, whilst only a fraction of the stalks of *Kleinia longiflorus* were harvested, ensuring that the plant is not destroyed during the harvesting process. According to participants, it was considered impermissible to destroy *Cotyledon orbiculata, Drimia robusta*, and *Kleinia longiflorus* during the process of gathering the resources. As a consequence, gathering plant resources was done with care; only harvesting a portion of the required materials with due regard for the spirits that inhabit the species. Failure to heed the taboo would invoke wrath that manifests as ineffectiveness of the medicine prepared for preventive care. Semenya and Maroyi (2019) cite similar beliefs and harvesting limitations, stating that adhering to taboos around medicinal plant harvesting maintains the efficacy of treatments created from obtained materials. Tshisikhawe (2012) finds that medicinal plant harvesters have an incentive to conserve plants in order to maintain the viability of their traditional therapeutic techniques. Tshisikhawe (2012) adds that the existence of methods and rituals for harvesting medicinal species since the plant species contain the life energy of living beings and that life may be reproduced from the species. Ullah and Rashid (2014) corroborate that since people living in distant and rural regions depend on plants and their products for food and medicine, it is therefore, imperative to conserve the species for future use.

CONCLUSION

The goal of this research was to determine the current state of indigenous plants gathered for preventive health care, as well as the possible effects of drought and rising temperature on these plants. It highlights the indigenous adaption strategies that guarantee the species' long-term viability. The study's findings indicate that indigenous plant-derived medication is used in primary health care for preventative care. Traditional health practitioners and ordinary community members have the knowledge and ability to avoid illness susceptibility through administration of plant-derived medicine in the form of amulets and salves. The majority of illnesses averted are contagious in nature and are associated with ritual impurity. Regrettably, preventative medicine supplies are becoming sparse or extinct in community areas as a consequence of drought and rising temperatures. Despite these negative effects of climate change on medicinal plants, community members adhere to regulations governing the procurement of plant materials for

preventative care, such as harvesting limitations and cultural taboos. This type of preventative therapy is both economical and culturally unique, and it is now being utilized to reduce susceptibility to infectious diseases such as the flu and cough, which are some of the symptoms of the COVID-19 pandemic. Use of these therapies might aid in limiting the pandemic's spread within local groups, particularly given the limited chances of a cure. This research recommends that the species identified by participants be added to the IUCN Red List in order to ensure their continued availability and usage in preventative care.

Author's Contributions
I wrote the whole text.

Conflicts of Interest
I thus declare that I have no potential conflict of interest.

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