Ethnobotanical survey of problem weeds, alien invasive plant species and their roles in Nzhelele, Makhado Local Municipality, Limpopo Province, South Africa.

By

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Declaration

I, Luambo Jeffrey Ramarumo of student number: 11575297 (UNIVEN), declare that the dissertation on Ethnobotanical survey of problem weeds, alien invasive plant species and their roles in Nzhelele, Makhado Local Municipality, Limpopo Province, South Africa, submitted for the purpose of Master of Science (Botany) degree at the University of Venda is my own original work and has not been submitted for any degree at this or any other Institution of Higher Learning, in South Africa or elsewhere. This dissertation does not contain other scholar’s writings except where otherwise stated and referenced accordingly.

Student Signature:................................................................. Date:..............July 2017

Mr Luambo Jeffrey Ramarumo (11575297)
Dedications

This work is dedicated to two (2) sophisticated gurus whom by then used their philosophical potential to uncover the hidden eager. The University of Venda, Department of Zoology, retired Professor, Dr Ben van der Waal – the man who discovered my research interest. “The greatest way to envisage your future is to construct it”. And also to the University of Venda, Department of Botany, the late Professor, Bhat Ramakrishna – the man who has invigorated and shaped my research eager. “Courage is not a lack of anxiety, hence it is the ability to act while facing anxiety”, may his soul rest in peace.
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Abstract

**Background:** Problem plants and alien invasive weed species are part of today's ecological transformation. Ethnobotanical literature on ecological prominence and ethical values of problem alien weeds is scant and should be documented to avoid loss of valuable species.

**Aim:** The study was aimed at documenting problem weeds and alien invasive plant species considered to be beneficial in deep rural communities.

**Materials and method:** Purposeful triangulation research methods were used to ensure the proper gathering of both qualitative and quantitative data sets.

**Results and conclusion:** Some problem weeds and alien invasive plant species are being utilized by local people to maintain their livelihood. A total of 78 plant species from 33 families were recorded. These plant species belonged to diverse growth habits, namely: climbers, herbaceous, succulents, shrubs, trees as well as creepers. Recorded problem weeds and alien invasive plant species were contributing towards ecological, medicinal and social values. These included being utilized as a source of food (14), fruits (4), medicinal (31), ornamentals (7), firewood (3), social (2) and multiple purposes (17). The main utilized families were Asteraceae (14.1%) and Solanaceae (14.1%). These families were mostly utilized for the purpose of medicinal and food. Plant species that were widely used are as follows: *Achyranthes aspera* L., *Agave sisalana* L., *Amaranthus spinosus* L., *Anredera cordifolia* L., *Canna indica* L., *Centella asiatica* L., *Chenopodium album* L., *Chenopodium ambrosioides* L. and *Chromolaena odorata* (L.) R. M. King and H. Rob. The dominant category for problem weeds and alien invasive plant species was 1b (44%) followed by weeds (35%), category 2 (9%), invaders (5%), category 3 (4%) and 1% for both category 1, 1a as well as X3. The results revealed that the legislative listing of plant species as problem weeds and alien invasive species was based on single knowledge basis system, rather than on multi-dimensional knowledge systems. Therefore, this study recommended that for judgment to be considered in decision-making, it should be based on species-specificity as well as multi-dimensional-knowledge basis. The reconciliation of inherent grapples among scientific and indigenous knowledge systems could possibly be underpinned by equal legislative consideration for the aforementioned knowledge systems especially in the establishment and implementation of environmental regulations. This could also aid with the provision to support transformation in South Africa and worldwide.

**Key words:** Ethnobotanical, Alien invasive species, Indigenous knowledge, Problem weeds and Scientific knowledge.
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List of abbreviations

Ca – Calcium
CARA – Conservation of Agricultural Resource Act
Cu – Copper
Fig - Figure
Mg – Magnesium
NEMBA – National Environmental Management: Biodiversity Act
PRA – Participatory Rural Appraisal
RSA – Republic of South Africa
SA – South Africa
SADEC – Southern African Development and Economic Community
Spp – Species
STI – Sexual Transmitted Infections
TB - Tuberculosis
UN – United Nations
Chapter One

1. Introduction.

1.1. Thematic background.

Problem weeds and alien invasive plant species can alter the ecosystem on both the ecological and social level, therefore, the alteration effects can be less negative than undesirable effects (Vitule et al., 2012). There has been no detailed quantitative evaluation for negative alteration of problem weeds and alien invasive plant spp worldwide (Molnar et al., 2008). It is, therefore appreciated that some problem weeds and alien invasive plant spp are beneficial to both ecological and social level (Vitule et al., 2012). Problem weeds and alien invasive plant spp are part of today’s ecological transformation (Tassin and Kull, 2015). The functionality of the ecosystem and its biodiversity increases with the rapid spread and impact of alien invasive weeds (Rejmánek and Richardson, 2013).

Some problem weeds and alien invasive plant spp are of economic prominence and they aid with the provision of approximately 98% of global food supply (Pimentel et al., 2001). Many problem weeds and alien invasive plant spp could contribute significantly in restoring degraded ecological processes within the ecosystem (Funk et al., 2008), and they can be a prominent tool in preventing invasion of higher degree as well as maintaining their aggressive spread (Jiménez–Valverd et al., 2011). Problem exotic plant spp could also contribute to cultural services and aesthetics (Prévot–Julliard et al., 2011). It is possible that the numerous diversity of problem weeds and alien invasive plant spp increases in response to the environmental modifications (Maskell et al., 2006), which have displaced the intolerance of native plants.

According to Flory and Bauer (2014), alien invasive weeds can reduce the predation of native plant species by facilitating across the trophic level and as food for herbivores and they can maintain ecosystem services (Tassin and Kull, 2015). Biological invasions are regarded as one of the main causes of biodiversity loss (Garcia-Llorente et al., 2011). The eradication of problem weeds and alien invasive plant spp without considering their potential role within the ecosystem can be devastating since it could open gaps for other invaders to degrade the niches (Zavaleta et al., 2001). The elimination of problem weeds and alien invasive plant spp that subsidize either social or ecological livelihood could greatly impact their wellbeing and reduce the functionality of ecological integrity (Plenkowski et al., 2015).
1.2. Problem statement.

The justification for action against invasive problem plants has been invoked (Carruthers et al., 2011), and therefore, it does not include biocentrism and ethical reservations. Ethnobotanical literature about the ecological prominence and ethical values regarding problem weeds and alien invasive spp is scant and it should be documented to avoid loss of valuable plant spp (Semenya et al., 2013). Most South African scholars paid great attention to the negativity and impact posed by problem weeds and alien invasive plant spp to environmental biodiversity and therefore, the potential benefits of these spp never received enough considerations (Pienkowski et al., 2015). Too many plant spp were been declared weeds, alien invasive spp, problematic plant spp and unwanted plant spp, under Regulation 15 of the South African, Conservation of Agricultural Resource Act, Act 43 of 1983 (CARA) and Section 70 (1)(A) of the National Environmental Management: Biodiversity Act, Act 10 of 2004 (NEMBA), without considering folk knowledge, ethical beliefs and their ecological role. In South Africa there is an inherent grapples as well as controversial issues about problem weeds and alien invasive plant spp that are ethically important; commercially benefiting, ecological prominent and environmental altering (Carruthers et al., 2011).

1.3. Justification of the study.

Conducting this study was important to both traditional knowledge holders and scientific experts, since it could aid with the provision of mitigations on the existing grapples and controversial issues. This study could expand the understanding of problem weeds and alien invasive plant spp. This could also contribute prominently by providing the convenient insight information for both natural scientists, social scientists, traditional knowledge holders and policy makers (Carruthers et al., 2011). Nowadays dwellers, in rural communities are moving from subsistence way of living to the economic kind of lifestyle. Thus, this study could lead to the establishment of green-economy by disclosing alien invasive plant spp of high socio-economic and medicinal values to meet the livelihoods of previously disadvantaged people. This study is crucially relevant at this moment of economic collapse-down in South Africa (SA), since it could possibly lead to the reduction of government budget allocated for the elimination of problem weeds and alien invasive plant spp by exposing the economic importance, social uses and ecological roles of these spp.

1.4. Research aim.

The aim of the study was to make an inventory of some valuable, problem weeds and alien invasive plant spp used by the Vhavenda tribe in Nzhelele Region, Vhembe District, Limpopo Province, South Africa.
1.5. Main objective.

The main objective of this project was to ascertain and document information on social, ecological and economic uses of problem weeds and alien invasive plant spp.

1.6. Specific objectives.

The specific objectives of the study were as follows:

i. To acquire and document information on valuable problem weeds and alien invasive plant spp.

ii. To record the traditional uses of problem weeds and alien invasive plant spp.

iii. To resolve the inherent grapples and controversial issues between scientific fundamental and traditional views with regard to some declared plant species as problem weeds, unwanted plants and alien invasive plant spp.

iv. To provide possible mitigations that could promote the sustainable use of problem weeds and alien invasive spp.

1.7. Research hypotheses.

1.7.1. Null hypothesis.

Some problem weeds and alien invasive plant spp are not valuable and could not be considered as having economic, social and ecological benefits to rural communities.

1.7.2 Alternative hypothesis.

Some problem weeds and alien invasive plant spp are valuable and could be considered as having economic, social and ecological benefits to rural communities.

1.8. Research questions.

i. Do problem weeds and alien invasive plant spp contribute to the socio-economic upliftment of rural communities?

ii. Do traditional healers prefer the use of problem weeds and alien invasive plant spp’s remedies in the treatment of variety of ailments?

iii. Does the CARA or NEMBA regulations for listed problem weeds and alien invasive plant spp recognize the needs of dwellers in rural communities?

1.9. Project organization.

(a) Chapter one and two deal with the introduction and literature review respectively.

(b) Chapter three provide methodology of the project.

(c) Chapter four and five have been written in the form of manuscripts, there may be repetition of some aspects.

(d) Chapter six (6) provides an overall conclusive statement of the entire project.
1.10. References.


Chapter Two

2. Literature review.

2.1. General overview.

It is evident that problem weeds and alien invasive plant spp negatively modify the natural ecosystem (Obiri, 2011). The integral role of plants, regardless of their invasion or exotic status can be viewed best from being pioneering, restoring and reshaping the natural ecosystem better (Sax et al., 2007). The introduction of problem weeds and alien invasive plant spp has been occurring since the 17th century as a result of development of human settlement and migration of people (Baret et al., 2006). The aggressiveness of the problem weeds and alien invasive plant spp towards native plants within the same niche area can be viewed through competition for resources such as sunlight, water and nutrients (Worku, 2010). The generalist survival mode of problem weeds and alien invasive plant spp enabled them to take advantage of any environmental condition and out-competed the native plants within the niche area (Obiri, 2011). The invasion of problem weeds occurs in many different stages within niche areas and those stages include introduction, naturalization and rapid distribution (Maroyi, 2012).

2.2. Geographical distribution of problem weeds and alien invasive plant species.

The main challenge of the global community today is biological invasion and its implications and the distribution of alien invasive weeds even today is not yet restricted (Semenya et al., 2012a). Problem weeds and alien invasive plant spp are widely spread in South Africa and worldwide due to rapid increases of international tourism (Semenya et al., 2013a). The distribution of some problem weeds and alien invasive plant spp occurred accidentally (Riaz and Javaid, 2011), and their rapid spread has been due to natural disasters (Holmes et al., 2008). The spread of problem weeds and alien invasive plant spp worldwide is being altered by global warming and change in climate (Prévat–Julliard et al., 2011). Distribution of exotic alien spp in protected areas such as in national parks might be due to wind, wildlife, human beings or water (Maroyi, 2012). Despite the fact that dispersal of alien species is not necessarily due to human activities (Valéry et al., 2009), human disturbance is still widely known to be the major factor in the alteration of invasion by problem weeds and alien invasive plant spp (Semenya et al., 2012b). Global climatic change such as floods, high temperature, and high concentration of carbon dioxide emissions in the atmosphere influence the occurrence of invasion by problem weed spp (Bradley et al., 2010).

2.3. Ethical beliefs towards the use of problem weeds and alien invasive plant species.

In South Africa the majority of people still prefer to use medicinal plants (Thring and Weitz, 2006), as another way of accessing primary health care, and some of these plant spp used
are alien invasive plant spp. Human-beings mostly depend on plants regardless of their invasiveness or nativeness status, for various purposes such as traditional medicine, food, shelters, aesthetic as well as cultural identity (Semenya et al., 2012a). There has been existing conflicts of interest in terms of plant spp that have value to some local communities, but regarded as problem weeds and alien invasive plant spp by either South African Conservation of Agricultural Resources Act (CARA) (Dold and Cocks, 2000) or National Environmental Management: Biodiversity Act (NEMBA). Problem weeds and alien invasive plant spp have been considered the most regularly used plant spp (de Wet et al., 2010) in rural communities. About 2942 medicinal plants found in Southern Africa are being used in the treatment of various human diseases and thus diversity, signifies valuable resources, not only for the commercial purpose or development, but for the basic studies, cultural values as well as intrinsic values (van Wyk, 2008).

The use of both aliens, invasive spp and native plant spp for medicinal purpose has demonstrated African traditional healing as both static, vigorous and adaptive (Dold and Cocks, 2000). Most of the remedies, especially aliens invasives are considered as general health tonics and are used to treat various diseases (van Wyk et al., 2008). Some alien invasive spp are beneficial and provide more than 98% of the world’s food supply (Pimentel et al., 2001). It has been revealed that invasive spp play a prominent economical role in hosting natural enemies used in the control of crop pests (Lewu and Afolayan, 2009). Local people in poor communities have adapted to biodiversity changes in terms of alien plant spp establishment, especially those species that have become integral part of their way of life. Villagers in local communities do not perceive alien invasive plant spp as a separate category, but as an essential component of their landscape (Shackleton et al., 2011). The commercial use of problem weeds and invasive alien plant spp play an essential role in terms of uplifting the economic status of poor rural communities. The use of alien plant spp as a substitute for indigenous medicinal spp could limit the harvesting pressure on native indigenous medicinal plants (Semenya et al., 2012b).

2.4. Potential values arising from problem weeds and alien invasive plant species.

The use of plant remedies either native or alien weeds for treating various ailments has been steadily resurgent (Ndawonde, 2015). Both natives and non-native plant spp have economic, ecological and social benefits (Semenya et al., 2013b). Various deep rural communities use edible exotic weed plant spp as a survival strategy, their nutritional and medicinal properties contribute prominently to food security as well as maintaining a healthy diet in rural inhabitants (Maroyi and Mosina, 2014).
2.5. Factors that influence the elimination of problem weeds and alien invasive plant species.

Problem weeds and alien invasive plant spp are being targeted for elimination worldwide to mitigate their threats on environmental biodiversity, ecosystem and economy (Simberloff et al., 2013). The economic collapse-down in most countries, especially in the agricultural sector, was crucially being influenced by the impact of problem weeds and alien invasive plant spp (Eiswerth et al., 2011). The existing disruption of problem alien weed spp to environmental biodiversity has attracted the interference of human to maintain the integrity of natural ecosystems (Sharp et al., 2011). Invasion by the problem weeds and alien invasive plant spp is a threat to the global environment (Bremner and Park, 2007).

The empirical reason behind the eradication of problem weeds and alien invasive plant spp attitudes, can be either economic or non-economic motives (Martin-López et al., 2007), with the essential ideology of maintaining the sustainability of an environmental biodiversity (Larson et al., 2011). The eradication of problem weeds and alien invasive plant spp has been declared the best tool of all proactive management options for mitigating and preventing the impact of weeds on natural environmental biodiversity and the global economy (Bremner and Park, 2007). Modifications of ecosystems within biomes by problem weeds and alien invasive spp are prominently influential on globally eradication policies and their implementations (Selge et al., 2011). Since, some problem weeds and alien invasive plant spp contribute substantially to the reduction of surface water runoff quantity and ground water recharge worldwide, it is therefore crucial to eradicate those plants for the riparian zones to maintain the runoff quantity (van Wilgen et al., 2008).

The SA Conservation of Agricultural Resource Act of 1984 and National Environmental Management: Waste Act, Act 59 of 2008 has crucial influence on environmental managers and policy makers to practice and implement government policies on eradication of problem weeds and alien invasive spp from natural and agricultural environment (Larson et al., 2011). The use of natural enemies in the management of invasions is complex, controversial, too expensive and time consuming, therefore, the eradication method is not optional, but pivotal in the executing of biological invasions (Schüttler et al., 2011). Since invasion by exotic problem plant spp is influenced by human beings, therefore, it is the human responsibility to use effective managing method in mitigating the impact of invasion on environmental biodiversity (Kueffer, 2010).
2.6. References.


Chapter Three

3. Description of the study area.

The study was undertaken in deep rural areas of Mauluma and Matshavhawe villages, Nzhelele region, Makhado Local Municipality, Vhembe District Municipality, Limpopo Province, South Africa. The Mauluma village is located between Maangani and Tswime mountains, hence the Matshavhawe village is located on top of Maangani mountain. Both Tswime and Maangani mountains form part of the Soutpansburg range. Both Mauluma and Matshavhawe Villages are dominated by black ethical group of the Vhavenda tribe and therefore, almost all the village dwellers speak Tshivenda as their first language. The majority of villagers in both villages are unemployed youth, middle-aged and old-aged and they have no source of income.

3.1. Flora and fauna.

The region has rich biodiversity of flora and fauna. The largest portion of the district is classified as savanna biome, widely known as Bushveld (Luseba and Tshisikhawe, 2013), with some patches of grassland and forest biomes. All these biomes are interconnected by the unique and favorable ecological niches that promote diversity of both flora and fauna within the district. Regardless of the fact that the Vhembe Biosphere Reserve is in Vhembe district, almost half of the district is still natural with limited development.

3.2. Study site map.

![Vhembe District Municipality map](image)

**Figure 1:** Vhembe District Municipality map.

Vhembe District Municipality is located in the far northernmost region of the Limpopo Province, South Africa within the latitude 22°93'33" South and longitude 30°46'67" East. It consists of four local Municipalities known as Thulamela, Makhado, Musina and Mutale. The
District covers an area of approximately 25 597 Km² with the total population of approximately 1 293 783 people (Statistics South Africa, 2012).

Figure 2: Mauluma and Matshavhawe Villages.

Mauluma village is located within the –22°55’00” South latitude and 30°07’00” East longitude. It covers an area of approximately 2.21 km². The total population of the Mauluma village is approximately 3 413, of which females constitute 54.70% of the population, while males constitute 45.30% (Statistics South Africa, 2012). The total sum of households in Mauluma village is approximately 800.

The geographical coordinates of Matshavhawe village lies between –22 °58’00” South latitude and 30°07’00” East longitude. It covers a total distance area of roughly 1.62 km², with the population size of approximately 1 735 (Statistics South Africa, 2012). Females in Matshavhawe village constitute 55.45% of the entire population, while male constitute 44.55% (Statistics South Africa, 2012). There are approximately 420 households in Matshavhawe village.
3.3. Materials and method.

3.3.1. Justification of the method.

Since the study involved indigenous people and their traditional knowledge on the usage of problem weeds and alien invasive plant spp, purposeful triangulation techniques were appropriate for ensuring proper gathering of both qualitative and quantitative data. Triangulation technique refers to the rigorous data gathering technique that synergistically combine both qualitative and quantitative research methods flawless (Cassim, 2011). Triangulation research technique delves both datasets unambiguously while allowing the use of single research method to validate the findings for other research method (Onwuegbuzie and Leech, 2005).

Purposive sampling method refers to the research tool used for participants selection, since it is the most effective research technique that reaffirm gathering of ethnobotanical information. Questionnaires were developed based on the investigation that can steadily garner substantive and accurate information. The sample survey was organized into different sub-headings which included provision of instructions; length of questionnaires; types of questions; observations; questionnaire construction; interview and systematic sampling (Khorommbi, 2001).

3.3.2. Ethical deliberations.

Since the study was all about Participatory Rural Appraisal (PRA), the endorsement letters for continuing with the study were obtained from both the University of Venda Ethics Committee and Vhembe District Counsel for Traditional Healers. Letters were used to negotiate access for proceeding with the study in the traditional authorities. Ethical principles such as recognition of all the participants, participant’s autonomy, participant’s beneficences and justice were considered.
3.3.3. Provision of instructions.

Figure 3: Traditional healer interviewed during data gathering.

The purpose and objectives of the survey were explained to all the informants while considering their level of education. All informants were given the opportunity to participate in the survey willingly. Informants were given equal participatory opportunities to impart and convey their knowledge. Different age groups, such as old-aged, middle-aged and youth, were targeted to evaluate their level of knowledge with regard to the uses of problem weeds and alien invasive plant spp.

3.3.4. Observations.

In some instances, informants were requested to observe and identify problem weeds and alien invasive plant spp within and in a way adjacent to their homesteads. Naked eye observations were substantive in the identification of some ecological prominent problem weeds and alien invasive plant spp within the biodiversity ecosystem. Field guide books for problem weeds and alien invasive plant spp were integral for the validation of the identified plant spp.

3.3.5. Interviews.

Face-to-face interviews were conducted and were recorded using cell phone and a tape recorder for the rigorous validation of the information. Both structured and semi-structured
questionnaires were administered based on the informant’s level of education and expertise. Structured interview involved requesting a group of selected informants to respond to similar questions, whereas semi-structured interview involved randomly requesting informants to rank, categorize, identify or choose the answer of their options (Dolores and Tongco, 2007).

3.3.6. Pilot survey.

Figure 4: Administration of pilot survey.

Two months pilot surveys were conducted. The objective of the pilot survey was to seek permission for conducting a study within the traditional authorities and to test the vitality and reliability of questionnaires, interview schedules and sampling method. Participants gathered during the traditional Indaba “Khoroni” and were informed about the purpose of the study.

3.3.7. Systematic sampling.

One hundred informants, including traditional healers, herbalists and other community knowledge holders were identified and sampled based on community dwelling status, level of education and their expertise. Fifty informants of different genders were sampled in each village. Sampling survey was carried out in both groups and at the individual level, to validate information. Field guides for plants were integral for verifying the status of whether plants were categorized as either indigenous plants or problem weeds and alien invasive spp.
3.4. Data analysis.

Data were analyzed statistically and qualitatively. Quantitative data were analyzed statistically using Microsoft office, on Microsoft excel. Qualitative data were described and interpreted in the form of groups of related information. Other convertible qualitative data were converted into quantitative and then analyzed statistically using Microsoft excel.
3.5. References.


Chapter Four

The utilizations of problem weeds and alien invasive plant species and their roles in Nzhelele, Makhado Local Municipality, Limpopo Province, South Africa.

Abstract.

Background: Regardless of the fact that problem weeds and alien invasive plant species have negative impact towards biodiversity ecosystem and economy, some of these plant species have been utilized by indigenous people for maintaining their livelihood.

Aim: The focus of the study was to document and assess village dweller’s knowledge on the benefits or losses derived from problem weeds and alien invasive plant species.

Materials and method: Triangulation research techniques were applied for the purpose of data collection.

Results and conclusion: About 89% informants were more knowledgeable about the benefits or losses derived from problem weeds and alien invasive plant species. It has been revealed that village dweller’s knowledge on utilization of problem weeds and alien invasive plant species increased with an increase in age. A total of 78 problem weeds and alien invasive plant species from 33 families were being utilized by villagers for various purposes. Among the 33 families, Asteraceae and Solanaceae were dominantly utilized (14%) followed by Amaranthaceae and Fabaceae (9%). About 31 problem weeds and invasive alien plant species were used for medicinal purpose and these species belonged to the following categories: 1b, 2, invaders, weeds and X3. A total of 17 problem alien weed species were utilized for multiple purposes and these plant species belonged to categories such as 1b, invaders, 1, weeds, 2 and 3 whereas, the rest were utilized for food, fruits, ornamental, social and fire wood and they belonged to the following categories: 1a, 1b, 3, weeds, 2 and invaders. Folktales were used as a legitimate means for preserving folk knowledge on plant uses. The dynamic of indigenous knowledge system about utilization of plant species should be seen as a tool to resolve current challenges. The use of problem weeds and alien invasive plant species as substitute for rare and disappearing indigenous plant species could be perceived as a conservation strategy.

Key words: Alien invasive plant species, Problem weeds, Utilization and Indigenous knowledge system.
4.1. Introduction.

Problem weeds and alien invasive plant spp are regarded as biodiversity threatening (Roy et al., 2014). Despite the fact that problem weeds and alien invasive plant spp have negative impact towards biodiversity ecosystem and economy in general (Zhu et al., 2016), some of them have been utilized by both indigenous and modernized people for maintaining their livelihood (Rahman and Roy, 2014). Some problem weeds and alien invasive plant spp have been introduced worldwide purposefully (Shackleton et al., 2014), to improve the ecosystem and social services such as erosion control, flood attenuation, fiber and timber production (Dickie et al., 2014). Ecological fusion among natives and alien invasives can aid with the provision to create dynamics within a niche area (Rotherham, 2017). Some alien invasive plant spp can be used alternatively as indicators, for implementing a proactive management plan as well as risk assessment (Novoa et al., 2015). Some problem weeds and alien invasive plant spp are regarded as fodder, especially to low and middle income rural dwellers (Das and Duarah, 2013). Problem weeds and alien invasive plants aid with the provision of diverse services, from economic, medicinal, social and ecological services (Adli et al., 2017). Surface water contamination can lead to the deterioration of freshwater quality (Wang et al., 2016), thus, some exotic alien plant species potentially serve with the provision to control excess mine water (Dye et al., 2017). Problem weeds and alien invasive plant spp, aid with the provision to increase soil and nutrient cycle (Gaertner et al., 2014).

The listing of some plant spp as either problematic weeds or alien invasives has mainly been based on the opinions (Wilson et al., 2014), rather than facts. Human perceptions of traditional values derived from problem weeds and alien invasive plant spp are less understood as compared to environmental aspects (Shackleton et al., 2015). Thus, there is a need to understand the potential contribution of plants considered as problematic weeds and alien invasive spp towards solving present challenges to sustain the present and future livelihood needs. Without any reasonable doubt, invasion biology has already advanced knowledge and understanding of invasion by exotics, but the knowing-doing-loophole, seems to be practically un-applicable in terms of implementation of the management action of plans (Matzek et al., 2014). It still remains bias to be fastidious about the negative impact of biological invasion only, whereas, some problem weeds and alien invasive plant spp are considered to be ecosystem transforming and mutualistically benefiting their co-existing natives (Nuñez and Dickie, 2014). Despite the origin or invasiveness status of the plant spp, Mahmood et al. (2013), reported that documentation of indigenous knowledge about plant spp can lead to several discoveries. There is an imperative need to better understand the utilization of problem weeds and alien plant spp by rural dwellers in maintaining their livelihood. This could be conceived as an alternative mechanism which could solve present biodiversity and human-development challenges while considering principles of sustainable
development as an essential need of all. The primary focus of this study was to assess village dweller's knowledge on benefits of utilizing problem weeds and alien invasive plant spp, with the objective of documenting their traditional uses.

4.2. Materials and method.

The objectives of the study were unambiguously explained to 100 participants during the pilot survey. Participants were sampled based on their knowledge of expertise, dwelling status, educational level and this included: traditional healers, herbalists, farmers and knowledgeable village dwellers. Participant's knowledge on the benefits of problem weeds and alien invasive plant spp was assessed using questionnaires. The same questions were asked to the participants for the purpose of testing their response's veracity. The acquired data were rigorously analyzed quantitatively and qualitatively. Thus, both qualitative and quantitative techniques were complementary since they provide expected outcomes (Choy, 2014). The diversity of research techniques in single study seemed to be crucial for reconciling the outcomes and development of utmost insights (Antwi and Hamza, 2015). Some qualitative data were converted to become quantitative for statistical analysis purpose. Quantitative data were analyzed on Microsoft Excel using Anova: Single Factor and t-Test: Paired Two Sample for Mean whereas, qualitative data were presented in table and graph forms.
4.3. Results.

4.3.1. Participants profile.

The total number of 100 participants of opposite genders and age discrepancy were interviewed in relation to the utilization of problem weeds and alien invasive plant spp.

Figure 5: Overall participant’s profile in terms of their age group and gender.

Among the 100 informants interviewed, 81% of them were females, hence 19% were male participants. The percentage of female respondents in all five age groups was significantly higher than the male participants. The results also showed that percentage of both male and female participants increased slightly with an increment in age group, especially within the age groups of 25 – 35 years and 45 – 55 years. Within the category of 45 – 55 years, participant’s percentage started to decline with an increase in age and vice – versa. Female informants were found to be participating in a large number under the age category of 45 – 55 years. The male informants were found participating in a large number under the age category group of 25 – 35 years.

4.3.2. Recognition of problem weeds and alien invasive species.

Total number of 100 informants were interviewed about recognition of some useful weed plants and alien invasive spp. Among the 100 informants, 11 of them were traditional healers, 19 herbalists, 28 farmers as well 42 village dwellers.
Table 1: Recognition of problem weed plants and alien invasive plant species.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Traditional healers</th>
<th>Herbalists</th>
<th>Farmers</th>
<th>Village dwellers</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>B</td>
<td>1</td>
<td>5</td>
<td>5</td>
<td>12</td>
<td>23</td>
</tr>
<tr>
<td>C</td>
<td>3</td>
<td>8</td>
<td>14</td>
<td>19</td>
<td>44</td>
</tr>
<tr>
<td>D</td>
<td>8</td>
<td>4</td>
<td>6</td>
<td>7</td>
<td>25</td>
</tr>
<tr>
<td>Total number of participants</td>
<td>11</td>
<td>19</td>
<td>28</td>
<td>42</td>
<td>100</td>
</tr>
</tbody>
</table>

**Keys**: A – Availability, Growth rate & Competition, B – Availability, Abundant & Competition, C – Recolonization rate after being eliminated, Abundant, Growth rate & Competition; D – Availability, Recolonization rate after being eliminated, Abundant, Growth rate & Competition.

It is evident that 44% of informants recognized problem weeds and alien invasive plant spp using the following characteristics: availability of plants; rate upon which plants recolonized the niche area after being exposed to certain disturbance, abundance of certain plant spp within the niche area and also flourishing to compete with other spp in the ecosystem or niche area. Hence 9% of informants used characters such as availability, growth rate and flourishing as their recognition mechanism for weeds and alien invasive plant spp. It was found that 25% of the participated informants recognized problem weeds and alien invasive plant spp using several characteristics than other participants. Their recognistic mechanisms included, plant availability, recolonization rate after certain disturbance, abundance of spp, growth rate as well as flourishing to out-compete other spp in both agroecosystems and natural ecosystems. About 23% of all the participants used only three characters to recognize problem weeds and alien invasive plant spp, those characters included: availability, abundance and flourishing.

4.3.3. Informant’s knowledge on the Conservation of Agricultural Act, National Environmental management: Biodiversity Act, negative impact and benefits derived from problem weeds and alien invasive plant species.

Participants’ knowledge on either legislation, benefits or devastating impact of problem weeds and alien invasive plant spp was determined.


Table 2: Informant’s knowledge on negative impact and benefits of problem weeds and alien invasive plant spp.

<table>
<thead>
<tr>
<th>Responses</th>
<th>Participants</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Traditional healers</td>
<td>Herbalists</td>
</tr>
<tr>
<td>Yes</td>
<td>10</td>
<td>16</td>
</tr>
<tr>
<td>No</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Not sure</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total number of participants</td>
<td>11</td>
<td>19</td>
</tr>
</tbody>
</table>

Table 2 illustrates that the majority of participants responded positively to the question asked and more than two third of all the participants were instructive in terms of either benefits or loss derived from problem weeds as well as alien invasive plant spp. The total percentage of 89 participants were ubiquitously familiar with both legislation, losses as well as benefits of problem weeds and alien invasive plant spp, whereas the 8% of informants indicated that they were not familiar, hence less than 3% of participants were not familiar with both regulations, negative impact and benefits of those plants.

Table 3: Statistical analysis of participant’s responses on whether they were familiar, not familiar or not sure, with the negative impact and benefits of problem weeds and alien invasive plant spp.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Count</th>
<th>Sum</th>
<th>Average</th>
<th>Variance</th>
<th>F</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>4</td>
<td>89</td>
<td>22.25</td>
<td>140.25</td>
<td>12,2078</td>
<td>0,00273</td>
</tr>
<tr>
<td>No</td>
<td>4</td>
<td>8</td>
<td>2</td>
<td>0.6666667</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not sure</td>
<td>4</td>
<td>3</td>
<td>0.75</td>
<td>2.25</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

There was high \( p<0.05 \) statistically significant difference between participants who were familiar and those not familiar as well as those who were not sure about the negative impact and benefits of problem weeds and alien invasive plant spp. The statistical significant difference between all the participant’s responses were \( p=0.00273 \). Therefore, there was significant statistical difference among participant’s response in terms of their knowledge of negative impact and benefits derived from problem weeds and alien invasive plant spp. The average mean for participants who said “Yes”, were familiar with the negative impact and benefits of alien invasives and weed plant spp was 22.25, whereas, the lower mean average of 2, was for those who said “no”, they were not familiar and therefore, the lowest 0.75, was for the participants who said they were “not sure”.

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4.3.4. Informants perceptions about benefits and losses derived from problem weeds and alien invasive plant species.

The total number of 89 participants who answered “yes” on above statement were allowed to respond to it. Among the 89 participants, there were 11 traditional healers, 16 herbalists, 28 farmers as well as 37 village dwellers.

![Bar chart showing participants' perceptions of benefits and losses]

**Figure 6**: Participant’s perceptions with regards to the benefits and losses of problem weeds and alien invasive plant spp.

All participants agreed that problem weeds and alien invasive plant spp had benefits and losses in ecological, social, medicinal and economical. Among the 89 participants, 53 informants agreed that some alien invasive plant spp have benefits, while the remaining 36 strongly disagreed. Amongst them, 24 were farmers and their perceptions were highly negative as compared to other categories. Thus, more than two third of participants under farming category were aware of the loss caused by invasion of problem weeds than the benefits derived from those plants. Perceptions among other participants categories, seemed to be likely positive about the benefits derived from problem weeds and alien invasive plant spp than the losses.
4.3.5. Benefits of problem weeds and alien invasive plant species.

A total of 53 participants who agreed that they perceived problem weeds and alien invasive spp as having benefits were interviewed further and were classified under four categories: traditional healers, herbalists, farmers and village dwellers. Their response included social, medicinal, ecological and economic benefits.

![Figure 7: Illustration of benefits derived from problem weeds and alien invasive plant spp.](image)

Almost all participants except farmers, agreed that some problem weeds and alien invasive plant spp had medicinal benefits, whereas, few farmers agreed that those plants had some ecological benefits. Dwellers category had more knowledge and understanding about the benefits derived from problem weeds and alien invasive plant spp.
4.3.6. Inventory of problem weeds and invasive alien plant species.

Table 4: Traditionally useful plant species, but considered as a problem; aliens and invasive weeds in terms of Regulation 15 of the South African, Conservation of Agricultural Resources Act, Act 43 of 1983 and Section 70 (1)(A) of the National Environmental Management: Biodiversity Act, Act 10 of 2004 (Bromilow, 2010).

<table>
<thead>
<tr>
<th>Botanical name (Family)</th>
<th>Local name (Growth habit)</th>
<th>Harvesting categories</th>
<th>Plant parts and their uses</th>
<th>CARA / NEMBA Catetory</th>
<th>Documented literature</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Acacia decurrens</em> Willd. (Fabaceae).</td>
<td>Mutshititshiti (Tree).</td>
<td>Wood.</td>
<td>Used as fire wood.</td>
<td>2.</td>
<td>Used in the production of wattle gum and is ornamental (Maslin and McDonald, 2006).</td>
</tr>
<tr>
<td><em>Achyranthes aspera</em> L. (Amaranthaceae).</td>
<td>Mukuluvhali (Herbaceous).</td>
<td>Ecological, Social and</td>
<td>Fresh flowers are burned in fire for weather predictions. Dried leaves are</td>
<td>1.</td>
<td>Asthma, headache and wounds (Vijayaraj and</td>
</tr>
</tbody>
</table>
Agave sisalana L. (Agavaceae). Tshikwenga (Succulent).
Ecological and medicinal. Smoked to treat lung diseases.

Ageratina adenophora (Spreng.) King & H. Rob. (Asteraceae).
Makhulu-wa-thugwi (Herbaceous). Medicinal. Infusion of leaves and roots is taken orally to treat snake bite and bee bite.

Alternanthera pungens Kunth (Amaranthaceae). Tshigwanda (Herbaceous). Medicinal. Plant parts burned, ashes are mixed with other medication for treating genital warts.

Amaranthus caudatus L. (Amaranthaceae). Vowa (Herbaceous). Food. Eddible. Weed. Source of minerals such as Ca, Mg and Cu (Bhat et al., 2015).

Amaranthus spinosus L. (Amaranthaceae). Tshitshava-misisi (Herbaceous). Ecological, Food, social and medicinal. Soil anchor to prevent erosion and edible. Dried stem is burned and its ashes are mixed with snuff to add flavor. Decoction of the whole plant is

Vidhya, 2016).


1b. Antioxidant and antifungal activities (Ralte and Lallianrawna, 2014).

Weed. Leaves have antibacterial, antidiabetic and antidyslipidemic properties (Olugbemiga et al., 2016).

Cooling, stimulating appetite and also toothache (Rahman and Gulshana, 2014).
Amaranthus thunbergii L. (Amaranthaceae).

Thebe (Herbaceous).

Food. Eddible. Weed. Leaves are considered to be highly nutritious (Bvenura and Afolayan, 2014).

Anredera cordifolia (Ten.) Steenis (Basellaceae).

Vhutungu (Climber).

Ecological, ornamental and medicinal. Used for decoration. Boiled leaves taken orally for chest pains, heart and kidney diseases.

1b. Wound treatment (Lestari et al., 2015; Miladiyah and Prabowo, 2015).

Argemone ochroleuca Sweet (Papaveraceae).

Shashe (Herbaceous).

Medicinal. Burned leaves and steam form mixture of medication to treat genital warts in women.

1b. Antifungal activities (Moustafa et al., 2013).

Argemone Mexicana L. (Papaveraceae).

Shashe (Herbaceous).

Medicinal. Burned leaves and steam form mixture of medication to treat genital warts in women.

1b. Tumors, warts, skin rash, inflammations, leprosy, microbial and malaria (Brahmachari et al., 2013).

Asclepia fruiticosa L. (Apocynaceae).

Mumentshisi (Shrub).

Medicinal. Decoction of root taken orally to treat stomach constipation and dried grounded leaves are smoked for fine powder is used for treating nose diseases and boiled leaves used.
treating asthma, headache as well as nose pain.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Family</th>
<th>Habitat</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bauhinia variegata</strong> L. (Fabaceae)</td>
<td>Orchid tree (Tree)</td>
<td>Ornomental</td>
<td>Used in home gardens as decor. Leaves are boiled and taken orally for the treatment of diarrhoea and body pains.</td>
<td></td>
</tr>
<tr>
<td><strong>Bidens pilosa</strong> L. (Asteraceae)</td>
<td>Mushidzhi (Herbaceous)</td>
<td>Food.</td>
<td>Edible</td>
<td>1b. Its leaves are used to treat chest pains (Gautam, 2012).</td>
</tr>
<tr>
<td><strong>Caesalpinia decapetala</strong> (Roth) Alston (Fabaceae)</td>
<td>Luanakha (Shrub)</td>
<td>Medicinal.</td>
<td>Root is burned and its ashes is used to form mixture of medication used for treating genital warts in women. 1b. Cold (Wei et al., 2013).</td>
<td></td>
</tr>
<tr>
<td><strong>Canna indica</strong> L. (Cannaceae)</td>
<td>Mupupulo (Herbaceous)</td>
<td>Ornamental, cultural and medicinal.</td>
<td>The plant is grown in gardens as decor. The seeds are used for making beads. Decoction of rhizome is used to treat stomach constipation. 1b. Decoction of zhizome used in the treatment of gonorhea (Darsini et al., 2015).</td>
<td></td>
</tr>
<tr>
<td><strong>Cannabis sativa</strong> L. (Cannabaceae)</td>
<td>Mbanzhe (Herbaceous)</td>
<td>Medicinal.</td>
<td>Decoction of fresh leaves is taken orally to treat asthma and TB. Dried leaves are smoked to treat headache. Weed. Cancer treatment (Mujuru and Sekhejane, 2014).</td>
<td></td>
</tr>
<tr>
<td>Plant Name</td>
<td>Common Name</td>
<td>Use</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>-------------------</td>
<td>---------------------------------------------------------------------</td>
<td>-----------</td>
<td></td>
</tr>
<tr>
<td><em>Cardiospermum grandiflorum</em> Sw.</td>
<td>Murungudane-wanova (Climber)</td>
<td>Leaves are used to treat skin burn and snake bites.</td>
<td>1b.</td>
<td></td>
</tr>
<tr>
<td>(<em>Sapindaceae</em>)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Catharanthus roseus</em> (L.) G. Don</td>
<td>Oldmaid (Herbaceous)</td>
<td>Boilled roots are used to treat diabetes.</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>(<em>Apocynaceae</em>)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Centella asiatica</em> L.</td>
<td>Sikeketjane</td>
<td>Prevent soil erosion in river banks and edible. Fluid from crushed fresh leaves is used for treating wounds and infusion of boiled root is taken orally to treat high blood pressure.</td>
<td>Weed</td>
<td></td>
</tr>
<tr>
<td>(<em>Apiaceae</em>)</td>
<td>(Herbaceous)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Chenopodium album</em> L.</td>
<td>Musala-marubini</td>
<td>Serve as pioneer and it is edible. Infusion of all parts is taken orally to treat high blood pressure.</td>
<td>Weed</td>
<td></td>
</tr>
<tr>
<td>(<em>Chenopodiaceae</em>)</td>
<td>(Herbaceous)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Chenopodium ambrosioides</em> L.</td>
<td>Muthatha-thuri</td>
<td>Serve as pioneer in disturbed area. Whole dried plant is burned to repel thunderstorm and lightning. Used to treat the symptoms of cancer and wounds, pneumonia, eczema and fever.</td>
<td>Weed</td>
<td></td>
</tr>
<tr>
<td>(<em>Chenopodiaceae</em>)</td>
<td>(Herbaceous)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Chromolaena odorata</strong> <em>(L.) R.M. King &amp; H. Rob. (Asteraceae)</em></td>
<td>Paraffin weed.</td>
<td>Ecological, medicinal and social.</td>
<td>Provision of pollen to honey bees. Fluid from crushed fresh leaves is used to treat wounds. Dried plant is used for initiating fire and as fire wood.</td>
<td><strong>1b.</strong> Antimicrobial activities (Hanphanphoom and Krajangsang, 2016).</td>
</tr>
<tr>
<td><strong>Cleome gynandra</strong> L. <em>(Capparaceae)</em></td>
<td>Murudi (Herbacous).</td>
<td>Food.</td>
<td>Edible.</td>
<td><strong>Weed.</strong> Intestinal parasites (Fouche <em>et al.</em>, 2016).</td>
</tr>
<tr>
<td><strong>Cynara sumatresis</strong> L. <em>(Asteraceae)</em></td>
<td>Nyantse (Herbaceous).</td>
<td>Social.</td>
<td>Dried stems are used for building chicken run.</td>
<td><strong>Weed.</strong> Used to treat stomach sickness (Shaha <em>et al.</em>, 2012).</td>
</tr>
<tr>
<td><strong>Corchorus trilocularis</strong> L. <em>(Malvaceae)</em></td>
<td>Delele (Herbaceous).</td>
<td>Food.</td>
<td>Edible.</td>
<td><strong>Weed.</strong> Antimicrobial, anticancer, diuretic and anti inflammatory (Dhanalakshmi and Manavalan, 2014).</td>
</tr>
<tr>
<td><strong>Cucumis myriocarpus</strong> E. Mey. ex Naudin <em>(Herbaceous)</em></td>
<td>Tshinyagu</td>
<td>Medicinal.</td>
<td>Decoction of root or tuber is taken orally to stimulate fertility in women.</td>
<td><strong>Weed.</strong> Edible (Nkgapele <em>et al.</em>, 2011). gonorrhea</td>
</tr>
<tr>
<td>Species</td>
<td>Family</td>
<td>Common Names</td>
<td>Uses</td>
<td>Notes</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>-----------------------------</td>
<td>---------------------------------------</td>
<td>-----------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td><em>Datura ferox</em> auct. Non L.</td>
<td>Solanaceae</td>
<td>Gwanda (Herbaceous)</td>
<td>Dried crushed leaves are smoked to treat asthma.</td>
<td>Contains natural tropane alkaloids (Alexander, 2008).</td>
</tr>
<tr>
<td><em>Datura stamonium</em> L.</td>
<td>Solanaceae</td>
<td>Gwanda-Zavhazavha (Herbaceous)</td>
<td>Dried crushed leaves are smoked to treat asthma.</td>
<td>Chest pains and wounds (Sayyed, 2014).</td>
</tr>
<tr>
<td><em>Erucastrum austroafricanum</em> Al-Shehbaz &amp; Warwick</td>
<td>Brassicaceae</td>
<td>Ndevhe-dzampopo (Herbaceous)</td>
<td>Fluid from crushed fresh leaves is used to treat ear problems.</td>
<td>Weed. No record.</td>
</tr>
<tr>
<td><em>Eucalyptus camaldulensis</em> Dehnh.</td>
<td>Myrtaceae</td>
<td>Mubomo (Tree)</td>
<td>Used to treat cold flu and headache. Stem and branches are used as fire wood.</td>
<td>Economically important in timber industry (Raath, 2015).</td>
</tr>
<tr>
<td><em>Eucalyptus grandis</em> W. Hill ex Maiden</td>
<td>Myrtaceae</td>
<td>Mubomo (Tree)</td>
<td>Used to treat cold flu and headache. Stem and branches are used as fire wood.</td>
<td>Used for making electrical transmission power pole (Langat et al., 2015).</td>
</tr>
<tr>
<td><em>Gomphrena celosioides</em> auct. non Mart.</td>
<td></td>
<td>Tshigwanda-tshitsuku</td>
<td>Burn ashes are mixed with other medication for treating genital warts.</td>
<td>Weed. Used for accumulating heavy metals in mining industry (Mganga,</td>
</tr>
<tr>
<td>Scientific Name</td>
<td>Local Name</td>
<td>Family</td>
<td>Use</td>
<td>Property</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-------------------------</td>
<td>----------------</td>
<td>----------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td><em>Hibiscus trionum</em> L. (Malvaceae)</td>
<td>Delele-mukhwayo</td>
<td>Malvaceae</td>
<td>Food.</td>
<td>Weed. Leaves are used as substitute for spinach (Essiett and Iwok, 2014).</td>
</tr>
<tr>
<td><em>Jacaranda mimosifolia</em> D. Don (Bignoniaceae)</td>
<td>Mudzhagarannda</td>
<td>Bignoniaceae</td>
<td>Ornamental. Used as home gardens decor.</td>
<td>1b Antimicrobial activities (Nisar <em>et al.</em>, 2014).</td>
</tr>
<tr>
<td><em>Jatropha curca</em> L. (Euphorbiaceae)</td>
<td>Mafura-donga</td>
<td>Euphorbiaceae</td>
<td>Medicinal. Infusion of rhizome is used for sexual stimulation and blood purification.</td>
<td>2 Nuts are used in the biodiesel production (Kivevele and Huan, 2015).</td>
</tr>
<tr>
<td><em>Lantana camara</em> L. (Verbenaceae)</td>
<td>Tshidzimba-mbule</td>
<td>Verbenaceae</td>
<td>Food. Fruits are edible.</td>
<td>1b Defoliated leaves improve soil fertility</td>
</tr>
<tr>
<td>Common Name</td>
<td>Scientific Name</td>
<td>Family</td>
<td>Uses</td>
<td>Notes</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>----------------------------------------</td>
<td>------------</td>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Ligustrum japonicum</strong></td>
<td>Thunb. (Oleaceae).</td>
<td>White wax tree (Shrub).</td>
<td>Ornamental. Planted in home gardens as decor and wind-breaker.</td>
<td>(Chikuvire et al., 2013). Used as bioindicator for heavy metals monitoring (Youssef et al., 2013).</td>
</tr>
<tr>
<td><strong>Lippia javanica</strong></td>
<td>(Burm F.) Spreng (Verbenaceae).</td>
<td>Musudzungwane (Shrub).</td>
<td>Medicinal and catalyst. Fresh leaves are used as green tea for losing weight.</td>
<td>Invader. Extract from leaves are used in the synthesis of silver nanocolloid antibacterial (Kumar et al., 2015).</td>
</tr>
<tr>
<td><strong>Nicandra physalodes</strong></td>
<td>(L.) Gaertn.</td>
<td>Murungudane-wanowa</td>
<td>Medicine. Dried powdered leaves are smoked to treat asthma and headache.</td>
<td>1b. Insect repellent (Yadav et al., 2016).</td>
</tr>
</tbody>
</table>
Nicotiana glauca L. (Solanaceae).

**Bulara or fola ja thịtaka (Tree).**

Dried powdered leaves are smoked as cigarrete or taken as snuff.

1b. Epilepsy and genital warts (Molefe, 2013).

*Opuntia ficus-indica* (L.) Mill. (Cactaceae).

**Mudoro (Secculent).**

Fruits.

Fruits are edible.

1b. Fruits are highly nutritionous (El-Mostafa et al., 2014).

*Opuntia monocantha* (Willd.) Haw. (Cactaceae).

**Mudoro (Secculent).**

Fruits.

Fruits are edible.

1b. Urinary diseases (Kifayatullah and Waheed, 2013).

*Paraserianthes lophantha* (Will.) I.C. Nielsen (Fabaceae).

**Muluwa (Tree).**

Wood.

Used as fire wood.

1b. Ornamentally used for making shade (Brown and Gardner, 2011).

*Physalis angulate* L. (Solanaceae).

**Murungudane (Herbaceous).**

Fruits.

Fruits are edible.


*Phytolacca octandra* L. (Phytolaccaceae).

**Muikhi (Herbaceous).**

Ornamental.

Liquid from crushed fruits used for nails coloration.

1b. Bilharzia (Kariuki et al., 2016).

*Plectranthus comosus* Sims (Lamiaceae).

**Tshiololwi (Shrub).**

Medicinal and ornamental.

Leaves are used to treat tuberculosis and as snake repellent.

1b. Infusion of leaves are used to treat herpes (Enyew et al., 2014).
**Psidium guajava** L. (Myrtaceae). Mugwavha (Tree). Medicinal and fruit. Decoction of root is used to treat STI. Fruits are edible.

2. Typhoid fever, gastroenteritis as well as enteric fever (Taura et al., 2014).

**Ricinus communis** L. (Euphorbiaceae). Mupfure (Shrub). Medicinal. Decoction of root and fruits are used to treat STI. Dried powdered leaves are smoked to treat asthma.

1b. Improve fertility in women (Inayor and Ibraheem, 2014).

**Rivina humilis** L. (Phytolaccaceae). Muiki (Herbaceous). Ornamental. Liquid from crushed fruits is used as nail color.

1a. Pesticide (Arumugam et al., 2015).

**Rubus fruticosus** L. (Rosaceae). Munambala (Shrub). Fruit and ornamental. Fruits are edible and also used by ladies for colouration of lips.

2. Use in the treatment of anxiety problems (Riaz et al., 2014). Fruits are taken as antioxidants (Verma et al., 2014).

**Salix babylonica** L. (Salicaceae). Mubibiri (tree). Medicinal. Steam from boiled fresh leaves used to treat flu and cough.

2. Liquid from crushed leaves used to treat ear diseases (Khan et al., 2013).

**Senna didymobotrya** (Fresen.) H.S. Irwin and Barneby Munembe-nembe (Shrub). Medicinal. Bark decoction are used for blood cleansing in men and treating of STI. Infusion of fruits is used for stimulating fever and malaria (Amuka et al., 2014).
<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Common Name</th>
<th>Category</th>
<th>Uses</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Viv.) H.S. Irwin and Barneby (Fabaceae).</td>
<td>Shrub.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Malvaceae).</td>
<td>(Herbaceous)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Solanum betaceum</em> Cav.</td>
<td>Muindia-tamatisi</td>
<td>Food</td>
<td>Fruits are edible and also used in vegetable for adding flavor</td>
<td>3. Serve as bioactive peptides for human health (Ordóñez <em>et al.</em>, 2011). Fruits are mixed with other vegetable for making of green salads (do Nascimento <em>et al.</em>, 2013).</td>
</tr>
<tr>
<td>(Solanaceae).</td>
<td>(Tree).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Solanum chrysotrichum</em></td>
<td>Mushulwa</td>
<td>Medicinal</td>
<td>Leaves are used to treat inflammatory response on skin and swelling. Decoction of root is used to treat STI.</td>
<td>Invader. Viginal thrush (Herrera-Arellano <em>et al.</em>, 2013).</td>
</tr>
<tr>
<td>Schltdl. (Solanaceae).</td>
<td>(Tree).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Solanum</em></td>
<td>Mututulwa</td>
<td>Medicinal</td>
<td>Fruits are used to treat tapeworms in 1b. Insecticides (Hamouda</td>
<td></td>
</tr>
<tr>
<td>Scientific Name</td>
<td>Common Name</td>
<td>Category</td>
<td>Description</td>
<td>Notes</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>----------------------</td>
<td>---------------------</td>
<td>----------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------</td>
</tr>
<tr>
<td><em>Elaeagnifolium</em> Cav. (Solanaceae)</td>
<td>(Herbaceous)</td>
<td>live stocks. Crushed leaves are used to treat wounds.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Solanum incanum</em> L. (Solanaceae)</td>
<td>Mututulwamuhulwane</td>
<td>Medicinal.</td>
<td>Fruits are used for treating tapeworms in live stocks. Crushed leaves are used to treat wounds.</td>
<td>Invader. Wounds, stomach constipation and headache (Mwonjoria et al., 2014).</td>
</tr>
<tr>
<td><em>Solanum mauritianum</em> Scop. (Solanaceae)</td>
<td>Mubongabonga</td>
<td>Wood.</td>
<td>Used as fire wood.</td>
<td>1b. Toothache (Semenya et al., 2013a).</td>
</tr>
<tr>
<td><em>Solanum nigrum</em> L. (Solanaceae)</td>
<td>Muxe (Herbaceous)</td>
<td>Food.</td>
<td>Edible.</td>
<td>1b. Roots are used to treat of vomiting disorder and tetanus following abortion (Muhammad and Shinkafi, 2014).</td>
</tr>
<tr>
<td><em>Sphagneticola trilobata</em> (L.) Pruski (Asteraceae)</td>
<td>Tshishengelapofu (Herbaceous).</td>
<td>Ornaments.</td>
<td>Used in home gardens as decor.</td>
<td>1b. Leaves are used for making tea (Trojan-Rodrigues et al., 2012).</td>
</tr>
<tr>
<td><em>Striga asiatica</em> (L.) Kuntze</td>
<td>Vhuri (Herbaceous).</td>
<td>Medicine.</td>
<td>Boiled roots are used to treat urinary infections. Liquid from crushed leaves Haemorrhoids, wounds and haemorrhoids (Mahwasane et al., 2013).</td>
<td></td>
</tr>
</tbody>
</table>

et al., 2015).
<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
<th>Family</th>
<th>Use</th>
<th>Method</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Orobanchaceae</em></td>
<td></td>
<td></td>
<td>Used to treat wounds.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Tipuana tipu</em> (Benth.) Kuntze (Fabaceae).</td>
<td>Munanga (Tree).</td>
<td>Medicinal and ornamental.</td>
<td>Decoction of barks used to treat cough and pains. Also used as shade.</td>
<td>3.</td>
<td>Diarrhea and menstrual pains (Amen <em>et al.</em>, 2013).</td>
</tr>
</tbody>
</table>
A total of 78 problem weeds and alien invasive plant spp were used by village dwellers for maintaining their livelihood. The plant spp belonged to 33 families. Among the 78 problem weeds and alien invasive plant spp, 34 spp belonged to category 1 whereas, only 1 spp belonged to category 1a.
Figure 8: Problem weeds and alien invasive plant spp per family percentage.

Fig. 8 represents the percentage (%) number of problem weeds and alien invasive plant spp utilized per family.
Figure 9: Problem weeds and alien invasive spp utilized per harvesting category.

As shown on Fig. 9, 31% problem weeds and alien invasive plant spp were utilized for medicinal purpose. The rest were utilized for various purposes such as food; fruit; multiple use; ornamental; social and wood.

Figure 10: Growth habits of problem weeds and alien invasive plant spp.
Figure 11: Problem weeds and alien invasive plant species categories.

Fig. 11 illustrates categories of problem weeds and alien invasive plant spp uses in percentage, 44% plants were under category 1b, of the NEMBA regulations, 35% were weeds, 9% were category 2, of the CARA regulations, 5% were invaders, and 4% were category 3, of the CARA. The plant spp under category 1a of the NEMBA and X3 were both 1%.

4.4. Discussion.

Fig. 5 showed that more than two-third of participants were female participants. Howard (2016), reported that indigenous knowledge basis regarding utilization of plant spp is gender imbalanced. Fig. 5 also indicated that both male and female participants declined with an increase in age. This was due to the fact that older age participants for both gender groups were few in both villages. According to the Statistics South Africa (2016), the average male life expectancies in Limpopo Province is approximately 57 years old, whereas, the female average life expectancies are 60 years old.

Table 1 showed that indigenous people were able to recognize problem weeds and alien invasive plant spp using their behavioral characteristics. According to Ghasab et al. (2015), recognition of plant spp using their characteristic features has been essential and cost effective for reduction of taxonomic identification cost. Almost all participants categories
were more familiar with the legislative requirements for problem weeds and alien invasive plant spp, as well as their traditional cost and benefits. Various plant spp have been used for various purposes for many years ago (Joseph et al., 2013). Most of participants claimed that the legislative requirement has been biased since it did not consider their knowledge on utilization of problem weeds and alien invasive plant spp. Semenya et al. (2012), reported that some of the exotic problem plants are essential for the provision of traditional health care. Almost all participants claimed that their indigenous knowledge on the utilization of alien invasive weeds were being transferred to them by their forefathers through various ways of communications, one but not least being ancestral visit through dreams and visions. According to Paulin and Suneson (2015), knowledge transfer is considered to be crucial for learning and problem solving.

Zurba and Berkes (2014), reported that since indigenous people have different intrinsic relations with ecological environment, their indigenous ecological knowledge can also be communicated differently. The highly significant difference among informant’s knowledge on negative impact and benefits of problem weeds and alien invasive spp, demonstrated that the indigenous knowledge system is still vibrant and dynamic (Green, 2012). Perceptions among traditional healers, herbalists and dwellers on socio-economic benefits derived from problem weeds and alien invasive plant spp were higher, whereas farmers’ perceptions were higher with regard to the losses. This was influenced by their practical knowledge and experience about the uses of these plant spp in maintaining their wellbeing. According to Tengö et al. (2014), local indigenous knowledge can aid with the provision of understanding biodiversity, ecosystem for the benefits of human well-being. Farmers’ perceptions were based on the fact that they feared to lose economic benefits due to problem weeds and alien invasive plant spp (Morais et al., 2017).

Fig. 8 showed that the most preferred families for problem weeds and alien invasive plant spp utilized were Asteraceae (14%) and Solanaceae (14%), followed by Fabaceae (9%) and Amaranthaceae (9%). The following families were the least, but equally utilized namely: Agavaceae, Aizoaceae, Apiaceae, Araceae, Brassicaceae, Cannabaceae, Cannaceae, Cucurbitaceae, Lamiaceae, Meliaceae, Moraceae, Oleaceae, Orobanchaceae, Rosaceae, Salicaceae and Sapindaceae. Asteraceae and Solanaceae and some families have had fewer numbers of spp being utilized possibly because they are small families characterized by few spp. According to Maroyi (2013), large plant families are characterized by numerous and diverse spp. Participants especially traditional healers and herbalists reported that they collected medicinal plant materials separately, but mixed those plants when preparing medication for patients. According to Ngarivhume et al. (2015), African traditional remedies
administered by either traditional healers or herbalists are dynamically and continuously available at needy time.

Fig. 9 showed that 31 problem weeds and alien invasive plant spp were being utilized for medicinal purpose, followed by multiple-uses (17) and food (14). The rest of the spp were utilized for purposes such as ornamental, fruits, social and wood. According to Rankoana (2016), rural dwellers utilizes plant resources for the purpose of their well-being, food, firewood and shelters. Most of problem weeds and alien invasive plant spp were utilized for medicinal purpose, possibly because of their increasing need to serve as an alternative for the overexploited and disappearing indigenous medicinal plants in the traditional health care system. Bibi et al. (2014), reported that two-third of people worldwide prefer the use of herbal medicine. Indigenous medicinal plants are disappearing on a daily basis due to their expanded commercialization, an increase in human population, poverty and expensive western medication (Bodeker et al., 2014).

In Fig. 10, the mostly preferred growth habit was herbaceous (59%), followed by shrubs (17%) and trees (17%). succulent (4%) was the third, followed by climber (2%) and the least was creepers-climber (1%). High utilization of herbaceous spp was fostered by factors such as abundance and domestic values with regard to their uses as vegetables, decorations as well as rehabilitating agricultural soil. Wild plant spp have been playing an essential role in maintaining stability for food security (Chand et al., 2017). Kibar and Kibar (2017), reported that one billion rural dwelling people worldwide, especially in developing and underdeveloped countries consider wild vegetable as a cheap food source for their diet. According to Engemann et al. (2016), climatic factors have been influential to the dominance of plant spp. Herbaceous spp are essential for regulating and maintaining ecosystem integrity (Elliott et al., 2015). Other possible reasons for higher utilization of herbaceous spp might be due to their pioneering role and also their abundance on a seasonal basis. Blanco et al. (2016), reported that herbaceous plant spp are mostly abundant from December until April in subtropical countries.

In Fig 11, plant spp under category 1b (44%) (NEMBA listed problem weeds and alien invasive plant spp) were highly utilized, followed by weed category (35%), category 2 spp was (9%) (CARA listed problem weeds and alien invasive plant spp). Other moderately utilized categories of problem weeds and alien invasive plant spp were invaders (5%) and category 3 (4%) (CARA). The least but equally utilized categories were category 1a (NEMBA) and X3 (CARA). According to Bramilow (2010), category 1a (NEMBA) and category 1 (CARA) alien invasive spp are regarded as high management priorities and those spp should be compulsory eradicated in the ecosystem. Problem weeds and alien invasive
plant spp under category 1b (NEMBA) and 2 (CARA) are considered as invaders and they colonize biodiversity at a steady rate (Robinson et al., 2016). Their eradications are considered to be a national priority under the South African national management program for aliens invasive (Bromilow, 2010).

High utilization of category 1b, alien invasives could be possibly influenced by their abundance and availability. Almost all these spp were abundantly found on homestead fences, disturbed areas, along the village streets and along the banks main roads. Thus, rural dwellers who unambiguously understand their values could easily utilize them during the needy time, since these plants were abundantly found closer to their dwelling areas. Some of the participants (traditional healers and herbalists), during the sampling survey reported that they mostly preferred to utilize medicinal plant materials from spp that recovered rapidly after being harvested. This was influenced by the cultural belief that the rate at which the medicinal plant recover, indicates that patients could also heal rapidly.

Traditional healers and herbalists also reported that they constantly utilize problem weeds and alien invasive plant spp for medicinal purpose as a substitute for the disappearing as well as rare indigenous medicinal plant spp. Skalli and Jordan (2017), reported that traditional healing has been fostered by religious belief, cultural practices and tradition. The administration of traditional remedies by traditional healers has been essential and alternative for many people to access primary health care system (Sigidi et al., 2016). According to Allen et al. (2013), novel disturbance could foster the abundance of alien invasive plant spp. Staudhammer et al. (2015), reported that problem weeds and alien invasive plant spp found adjacent to the dwelling areas form part of essential ecological and vegetation structure. According to Pérez-Harguindeguy et al. (2013), the functionality of plant spp resembles the ecological strategies to respond to environmental catastrophes.

4.5. Conclusion.
The imbalance in gender participation remains the challenging factor. Bass et al. (2016), reported that balanced gender participation could provide a unique insight view. Problem weeds and alien invasive plant spp should not be conceptualized only as a threat, but as a tool to address challenges such as socio-economic, socio-ecological and biosecurity. Boillat and Berkes (2013), reported that the indigenous knowledge system could address existing and future biodiversity challenges. This study disagreed with the ideas that generalized problem weeds and aliens invasive plant spp as only threats. This study accepts that problem weeds and alien invasive plant spp have both negative impact and benefits towards biodiversity (Riddin et al., 2016). Discrediting the benefits derived from problem weeds and
alien invasive spp could harm their contribution towards maintaining the rural livelihood and biosecurity. In addition, this study supports the idea that the dynamics of indigenous knowledge system should be acknowledged (Boillat and Berkes, 2013). According to Tshisikhawe (2016), sustainable harvesting of plant resources should be conceived as a pillar for promoting good conservation practices. Further survey on the use of problem weeds and alien invasive plant spp. as substitutes for rare and disappearing plant spp could provide deeper insights. This could be conceived as a pathway for remedial action plan to help sustain and conserve rare indigenous medicinal plant spp by alternatively using problem weeds and invasive alien spp.
4.6. References


important agricultural polyphagous field pest, *Spodoptera litura* (Fab.) (Lepidoptera: Noctuidae). *Journal of Coastal Life Medicine, 3* (5): 389 – 394.


Chapter Five

The grapples among scientific and traditional knowledge holders with regard to benefits and losses derived from problem weeds and alien invasive plant species.

Abstract.

Background: Many scholars worldwide labeled problem weeds and alien plant invasive species as a global concern. There have been some inherent grapples between naturalists, social scientists and indigenous knowledge practitioners about the benefits derived from problem alien weeds.

Aim: The study was aimed at revealing the inherent fraught between scientifically believed fundamentals and indigenously practiced customs as well as folktales, with regard to utilization of problem weeds and alien invasive plant species.

Materials and method: Both qualitative and quantitative research techniques were purposeful applicable in data gathering.

Results and conclusion: About 45% participants perceived both CARA and NEMBA regulations as having critical and negative impact towards the provision of traditional health care and socio-economic upliftment of rural based communities. Approximately 24% participants agreed that both CARA and NEMBA regulations on weeds management have a serious and negative impact toward the provision of traditional health care and socio-economic upliftment of rural wellbeing. More than two-third of all the participants agreed that both CARA and NEMBA regulations have a negative impact towards maintaining the provision of traditional health care and upliftment of rural communities in terms of socio-economic and socio-ecological benefits. Only 10% of participants reported that they were consulted whereas the remaining 90% were not consulted about either the establishment or implementation of CARA and NEMBA regulations on listed problem weeds and alien invasive plant species. Even though problem weeds and alien invasive plant species have been seen to be contributing substantially towards traditional health care system and socio-economic upliftment of rural communities, their rapid spread has a negative impact on biodiversity and its biosecurity. The inherent grapples between scientifically believed fundamentals and indigenously practiced custom based tales could be mitigated by the establishment of radical integration among both knowledge systems for the purpose of reconciliation.

Key words: Alien invasive plant species; Inherent grapples; Problem weeds; Scientific narratives and indigenous knowledge system.
5.1. Introduction.

Many scholars worldwide labeled problem weeds and alien plant invasive spp as a global concern (Mostert et al., 2017). A small number of scholars agreed that the discipline of invasion biology itself contains inherent controversial (Pereyra, 2016). The fundamental patterns of spp diversity within the ecosystems are driven by the interactions between spp (regardless of nativeness or invasiveness), distribution and disturbance (Tsai et al., 2015). Thus, ecosystem services can be considered as a lifetime supporting tool that fortifies both socio-ecological, socio-cultural and socio-economic benefits towards human wellbeing and development in rural communities (Sakai et al., 2016). There has been some inherent grapples between naturalists, social scientists and indigenous knowledge practitioners about the value derived from problem weeds as well as alien invasive plant spp (Estévez et al., 2015). The collaboration between scientific scholars and indigenous knowledge practitioners could lead to the provision of sustainable solutions for inherent grapples, climate change and global warming (Williams and Hardison, 2013).

Most scientific scholars radically narrate only the negativities about problem weeds and alien invasive plant spp. Idström et al. (2015), reported that scientific narratives convey some elements of the phenomenon unambiguous with an exclusion of some potential and legitimate vantage insights to validate the holistic of their arguments. The narratives about negative impact of some problem weeds and alien plant invasive spp has been exaggerated (Thomas and Palmer, 2015). Morden scientific knowledge only accept indigenous knowledge system with the hidden capitalism motives (Briggs, 2013). Despite all the critics, African indigenous knowledge on utilization of plant spp has existed long before the discovery of scientific knowledge (Abah et al., 2015). Scientific knowledge depends on the basis of indigenous knowledge system especially in terms of identification of socio-economic values of certain plant spps (Flora et al., 2012). Understanding of the relationship between scientific view and fundamental societal issues of concern can steadily enhance the practices of sustainable development and good community governance (Clark et al., 2016).

The recognition of the needs for indigenous people on biodiversity benefits as well as equitable-sharing of societal benefits and ecological requirements, can enhance the practice of sustainability (Peterson et al., 2016; Walsh-Dilley et al., 2016).

Sustainable management of the ecosystem and its biodiversity can only be achievable by combining insights and knowledge basis derived from both knowledge systems (Tengö et al., 2014). This study aimed at revealing the inherent fraught between scientifically believed fundamentals and indigenously practiced customs as well as folktales, with regard to utilization of problem weeds and alien invasive plant spp. The objective of the study being to
elucidate and mitigate the inherent controversy scientific view and indigenous practices towards utilization of problem weeds and alien invasive spp for sustaining livelihood of local people.

5.2. Materials and method.

Both qualitative and quantitative research techniques were purposefully used. The total number of informants who participated in this study were 100. This included traditional healers, herbalist, farmers and dwellers. They were interviewed about the impacts of CARA and NEMBA regulations towards sustaining livelihood. Participants were also interviewed on whether they were once consulted about the establishment and implementation of either CARA or NEMBA regulations for listed problem weeds and alien invasive plant spp. Data were analyzed in table form, descriptively and statistically using Microsoft excel package.

5.3. Results.

A total number of 100 participants were interviewed. Among the interviewed participants, 11 were traditional healers, 19 herbalists and 42 dwellers as well as 28 farmers.

5.3.1. Impact of CARA and NEMBA regulations on suppressing rural socio-economic upliftment.

Table 5: Impact of CARA and NEMBA regulations on listed problem weeds and alien invasive plant spp toward suppressing the provision of traditional primary health care as well as, socio-economic upliftment of rural community.

<table>
<thead>
<tr>
<th>Impact classes per score %</th>
<th>Traditional healers</th>
<th>Herbalists</th>
<th>Dwellers</th>
<th>Farmers</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (90 - 100)</td>
<td>11</td>
<td>1</td>
<td>33</td>
<td>0</td>
<td>45</td>
</tr>
<tr>
<td>B (80 - 89)</td>
<td>0</td>
<td>18</td>
<td>6</td>
<td>0</td>
<td>24</td>
</tr>
<tr>
<td>C (60 - 79)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>D (40 - 59)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>E (20 - 39)</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>F (0 - 19)</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>Total number of participants</td>
<td>11</td>
<td>19</td>
<td>42</td>
<td>28</td>
<td>100</td>
</tr>
</tbody>
</table>

Net total %

**Keys:** A (90 – 100)% = critical and catastrophic impact, B (80 – 89)% = serious and outrageous impact, C (60 – 79)% = largely impacted, D (40 – 59)% = moderately impacted, E (20 – 39)% = limited impact and F (0 – 19)% = no impact.

From Table 5, CARA and NEMBA regulations for the listed problem weeds and alien invasive plant spp had a negative impact on the provision of traditional primary health care and socio-economic upliftment of rural communities. About 45% of all the participants perceived CARA and NEMBA regulations as having critical and catastrophic impact towards
the provision of traditional health care and socio-economic upliftment of rural based communities.

Approximately 24% of all participants agreed that both CARA and NEMBA regulations on weeds management have negative impact toward the provision of traditional health care and socio-economic upliftment of rural wellbeing. About 12% of all participants agreed that both CARA and NEMBA regulations for listed exotic alien weeds do not have impact on the provision of traditional health care and socio-economic upliftment of rural based communities. Generally more than two-third of all the participants agreed that both CARA and NEMBA regulations have a negative impact towards maintaining the provision of traditional health care and upliftment of deep rural based communities in terms of socio-economic and socio-ecological benefits.

5.3.2. Scientific narratives and provision of legislative regulations about listed problem weeds and alien invasive plant species.

Table 6: Scientific narratives and requirements for legislative regulations on the listed problem weeds and invasive alien spp.

<table>
<thead>
<tr>
<th>Legislative categories for listed plant species</th>
<th>Discription as per legislative requirements</th>
<th>Scientific narratives</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a Alien invasive plant spp that requires an obligatory control and they must be permanently eradicated from the environment.</td>
<td>Problem weeds and alien invasive plant spp have detrimental impacts on both socio-ecological and socio-economic benefit (Robinson et al., 2017).</td>
<td></td>
</tr>
<tr>
<td>1 Those plant spp are obligatory prohibited and they must be completely eradicated.</td>
<td>Problem weeds and alien invasive plant spp detrimentally impact the complexity of webs, including the functionality of biodiversity and its biosecurity, cultural and economic relations among environmental need and people’s requirements (Idström et al., 2015).</td>
<td></td>
</tr>
</tbody>
</table>
1b Invasive plant spp that requires obligatory control by management program and they must be permanently eradicated from the natural environment by all users.

Bellard et al. (2016), reported that biological invasion is regarded as the most threat to biological extinction.

2 Invasive plant spp that are controlled as per demarcation and therefore, permits are required for breeding, moving and growing those species. Most of the aforementioned spp are being commercially utilized.

In RSA, almost all commercial important exotic and invasive plant spp are considered to be ecologically transforming (Bennett and Kruger, 2013). However, problem weeds and alien invasive plant spp are known to alter socio-ecological functions negatively and also have negative impact on biodiversity as well as the local economy (Shackleton et al., 2016).

3 Those plant species are banned and they may not be planted in anyway, however, the existing one may remain, except within the riparian zonation. Most of those plant spp are utilized for ornamental purposes.

Human wants such as the need to have home gardens are known to be influential towards rapid spread of problem weeds and alien invasive plant spp (Vaz et al., 2017).
5.3.3. Consultation of local people with regard to the establishment or implementation of CARA and NEMBA regulations on listed problem weeds and alien invasive plant species.

Table 7: Articulation of local people consultations with regard to the establishment or implementation of CARA and NEMBA regulations on listed problem weeds and alien invasive plant spp.

<table>
<thead>
<tr>
<th>Consultation</th>
<th>Traditional healers</th>
<th>Herbalists</th>
<th>Farmers</th>
<th>Dwellers</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not consulted</td>
<td>11</td>
<td>19</td>
<td>24</td>
<td>36</td>
<td>90</td>
</tr>
<tr>
<td>Consulted</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>Total number of participants</td>
<td>11</td>
<td>19</td>
<td>28</td>
<td>42</td>
<td>100</td>
</tr>
</tbody>
</table>

It has been found that the majority of local people were not consulted about the establishment and implementation of either CARA or NEMBA regulations on listed problem weeds and alien invasive plant spp. Among all the 100 participants, only 10% of them reported that they were consulted whereas, the remaining 90% were not.

Table 8: Statistical comparison for local people consultation with regard to the establishment and implementation of either CARA or NEMBA regulations on listed problem weeds and alien plant invasive spp.

<table>
<thead>
<tr>
<th></th>
<th>Not consulted</th>
<th>Consulted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>22,5</td>
<td>2,5</td>
</tr>
<tr>
<td>Variance</td>
<td>109,6666667</td>
<td>9</td>
</tr>
<tr>
<td>Observations</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

Pearson Correlation

<table>
<thead>
<tr>
<th>Pearson Correlation</th>
<th>0,92308017</th>
</tr>
</thead>
<tbody>
<tr>
<td>P(T&lt;=t) two-tail</td>
<td>0,014302024</td>
</tr>
</tbody>
</table>

There was a high statistical significant difference (p<0.05) among the local people who were not consulted and those who were consulted about the establishment and implementation of both CARA and NEMBA regulations towards listed problem weeds and alien invasive plant spp. The statistical significant difference between the participants who were not consulted
and those consulted was, \( p=0.01 \). The number of local people not consulted and consulted was highly correlated with the correlation value of 0.92.

5.4. Discussion.

It was revealed that either the establishment or implementation of CARA and NEMBA regulations on listing of problem weeds and alien invasive plant spp was done without proper consultation with rural communities. From Table 6, the difference in terms of participants score percentages (%) regarding the impact of CARA and NEMBA regulations on listed problem weeds and alien invasive plant spp was influenced by utilization of either benefits or losses among participants from dissimilar responsibilities in their respective community. Nomtshongwana (2016) and Taylor et al. (2016), reported that villagers from different community responsibilities depend on plant spp for various purposes to maintain their livelihood. According to Delgado (2016), traditional healers and herbalists are considered to perform the substantial roles and hold tremendous responsibilities with regards to provision of primary health care within their respective communities and therefore, they are also custodians of traditional cultures. About 12% of all the participants perceived CARA and NEMBA regulations towards exotic weeds as good regulations for monitoring the aptitude of exotics and not having negative impacts on socio-economic and eco-cultural benefits. This was due to the fact that almost all participants were farmers and therefore, invasive weed plant spp lowered the productivity in the agricultural industry and also caused loss of profit. Problem weeds and alien invasive plant spp are mostly severe limiting factor for agricultural production (Parameswari and Srinivas, 2017).

From Table 8, it can be seen that legislative requirements regarding exotic problem weeds, provide a massive and prestigious support towards scientific narrated evidence without considering perceptions and rights of indigenous people in rural village communities. South Africa is a member in good standing of the United Nation (UN) and it should abide by the UN declarations. Thus, Article: 2; 3; 8 (1)(2a); 9 and 11 (1)(2) of the UN Declaration on Rights for Indigenous People direct that indigenous people have the rights to freely practice their cultural activities and traditional customs (United Nations General Assembly, 2007), including their folktales without either being discriminated or neglected. Thus the legislative requirements towards listed exotic problem weeds were based on scientific narrated judgements without precision. According to Kueffer and Kull (2017), judgements without precision are based on emotions. Lichfield et al. (2016), reported that some scientific narrated perceptions towards detrimental impacts of problem weeds and non-native spp are regarded as foil-folk ideological based arguments.
Table 8 demonstrated that the decision for the establishment and implementation of CARA and NEMBA regulations on listed problem weeds and alien invasive plant spp was made without proper consultations with civil society and the custodians of indigenous knowledge system as well as other affected stakeholders. This was influenced by quick developing belief that says, the establishment and implementation of policies on either biodiversity values or loss, requires validations by only scientific knowledge practitioners (Nesshöver et al., 2016). According to Carmen et al. (2015), participatory rural appraisal could enable the lawmakers to gain an understanding about the motivations behind the utilization of problem weeds and alien invasive plant spp. Despite the origin and informality of indigenous knowledge system, knowledge can be also used to guide lawmakers about the benefits and loss of biodiversity (Livoreil et al., 2016).

The statistical results (Table 9) showed that there was a highly statistical significant difference between participants who were not consulted and those consulted with regards to the establishment and implementation of either CARA or NEMBA regulations on listed problem alien weeds. This was influenced by a high number of participants who knew the benefits derived from problem weeds and alien invasive plant spp. However, the participants were not consulted about the establishment and implementation of either CARA or NEMBA regulations against those plant spp. The consultations with interested and affected parties with regard to their own societal issues of concern either the law or policy-makers can promote the integrity of good governance practices (Costanza, 2015). Regardless of invasiveness or nativeness local people depend on all plant spp for their livelihood (Ghosh-Jerath et al., 2015).

5.5. Conclusion.

Even though problem weeds and alien invasive plant spp have been seen to be contributing substantially towards the traditional health care system and socio-economic upliftment of rural communities, their rapid spread have a negative impact on biodiversity and its biosecurity. Despite the inherent grapples among scientific and indigenous knowledge systems, those knowledge systems are both based on the trial-error practical experiments, although they may differ. Useful problem weeds and alien invasive plant spp should be utilized before their reseeding period. Both societal issues of concern and ecological needs must be considered as equal while making judgments about either their potential contribution to livelihood or biodiversity loss. The inherent grapples between scientifically believed fundamentals and indigenously practiced custom based tales could be mitigated by the establishment of radical integration among the both knowledge systems for the reconciliation purpose. The legislative consideration of scientific knowledge based evidence with an
exclusion of indigenous knowledge system could erode ancient and rare indigenous knowledge heritage and caused recoil in cultural diverse communities. An elaborately documented indigenous knowledge system could contribute significantly towards inventing model-resolution for steadily dealing with invasion challenge. However, further study involving multi-disciplinary subjects about invasion could be pivotal for systematical inventing a signified model-resolutions.
5.6. References.


6. Overall conclusion and recommendations.

6.1. Conclusion.

Despite the fact that a large number of rural population seemed to be emigrating towards urban areas due to economic constraints within their dwelling villages (Angelucci, 2015), rural village communities remain a hotspot of indigenous knowledge system. This was influenced by a large number of indigenous knowledge practitioners who are still dwelling in deep rural communities. The irony behind imbalance gender participation was influenced by factors such as cultural norms, traditional customs and tales that marginalize one gender by creating unequal responsibilities among womenfolk and menfolk in rural village communities. Balanced gender participation could have produced same outcomes in terms of either benefits or losses derived from problem weeds and alien invasive plant spp. Womenfolk were more knowledgeable in terms of plant uses as compared to their men folk counterparts. Carrillo (2015), reported that knowledge attributes are based on the capability to balance either family or community responsibilities. It has been concluded that the womenfolk are rich and hotspot-factories for indigenous knowledge system with regard to the uses of problem weeds and alien invasive plant spp. Despite the socio-cultural, socio-economic and socio-ecological benefits derived from problem weeds and alien invasive plant spp, it was noticed that some spp could also alter biodiversity and its biosecurity detrimentally. However, it could be biased and illegitimate to rely on one knowledge judgments with regard to the benefits or losses derived from problem weeds and alien invasive plant spp.

6.2. Recommendations

This study recommended that in order for judgment to be considered in decision-making, especially for the establishment and implementation of regulations involving people and their environment, it should be based on species-specificity and multi-dimensional knowledge disciplines. The reconciliation of inherent grapples among scientific and indigenous knowledge systems could possibly be supported by equal legislative consideration of both knowledge systems. This could aid with the provision to enhance knowledge transformation in South Africa.
6.3. References.

Appendix

7. Questionnaires

7.1. Interviewee particulars

7.1.1. Interviewer Surname & Initial:……………………………………………………………………

7.1.2. Study Area:…………………………………………………………………………………………

7.1.3. Interview Date:…………………………………………………………………………………………

7.2. Informant's general information

7.2.1. Tell us about yourself?

7.2.2. How old are you?

a. 25 – 35

b. 35 – 45

c. 45 – 55

d. 55 – 65

e. 65 – 75

7.3. Recognition of problem weeds and alien invasive plant species

7.3.1. How do you recognize problem weed and alien invasive plant spp / what do you look at? (Choose as many options as possible).

i. Availability all over

ii. Re-colonization rate after being eliminated

iii. Abundant

iv. The growth rate

v. Flourishing

Choose the suitable answers below:

A. i; iv & v

B. i; iii; & v

C. i; ii; iii & v

D. Both of the above

7.3.2. Are you familiar with the devastating impacts or benefits of problem weeds and alien invasive spp? Yes/ No/ Not sure.

7.3.3. If yes, what are the loss and benefits derived from problem weeds and alien invasive spp?

7.3.4. Do you consider all problem weeds and alien invasive plant spp as unwanted in your community? Yes/ No. And why?

7.4. Regulations
7.4.1. Are you also familiar with the South African Conservation of Agricultural Act and NEMBA regulations?

7.4.2. Rank the effects of the South African Conservation of Agricultural Act in the provision of traditional health care by giving the score % from 20 – 100, whereby 20, is low effects; 40 – moderate effects; 60 – large effects; 80 – serious effects; 100 - extremely effects?

a) 20
b) 40
c) 60
d) 80
e) 100

7.5. Uses of problem weeds and invasive alien plant species

7.5.1. Do you consider the use of both problem alien plant spp and indigenous plants as medicinal? Yes/ No. And why?

7.5.2. Are the medicinal uses of problem weeds and alien invasive plant spp, effective enough as compared to indigenous medicinal plants?

7.5.3. Which plants are scant medicinal plants between problem alien weeds and indigenous plants?

7.5.4. Rank the effectiveness of the following medicinal plants, by giving a score from 1 – 4, whereby 1, is not effective; 2, effective; 3, most effective; and 4, highly effective?

a) Problem weeds and alien invasive plant spp
b) Indigenous plant spp

7.5.5. Mention all the problem weeds and alien invasive plant spp that you use as medicinal plant?

7.5.6. What part of problem alien plants do you use for medicinal purpose?

i) Roots
ii) Barks
iii) Leaves
iv) Flowers
v) All of the above

7.5.7. Mention any other use of problem weeds and alien invasive plant spp that you know, except their medicinal uses?

7.5.8. Which (if any) indigenous custom inspires the use of problem weeds and alien invasive plant spp?

7.5.9. Do you consider problem weeds and alien invasive plant spp as valuable plants within your community? Yes/ No.

7.5.10. If “yes”, what value does they have?
7.5.11. What characters do you look at when selecting the useful problem weeds and alien invasive plant spp?

a) Abundances of the plants
b) Health of the plants
c) Location of the plants
d) Both of the above

d) Social values (ritual; aesthetic; shade; food; etc.)
e) Both of the above

7.5.12. Mention any problem weeds and alien invasive plant spp that you know?

7.6. Benefits and loss

7.6.1. What are the benefits and loss of problem weeds and alien invasive plant spp?

7.6.2. Are any of the aforementioned plant spp essential to ecosystem and its biodiversity?

Yes/ No.

7.6.3. If “yes”, tabulate the names of those problem alien weeds and their ecological roles?

7.6.4. Do you have any additional information with regard to the problem weeds and alien invasive plant spp (general)?

7.7. Impact of regulations

7.7.1. Rank the impact of CARA and NEMBA regulations for problem weeds and invasive alien plant species?

<table>
<thead>
<tr>
<th>Impact class</th>
<th>Descriptions</th>
<th>Score %</th>
<th>Number of informants %</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>CARA and NEMBA regulations towards problem weeds and alien invasive plant spp have critical and catastrophic impact on socio-economic benefits and to the supply of diverse traditional medicinal plant spp.</td>
<td>90 - 100</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>CARA and NEMBA regulations towards problem weeds and alien invasive plant spp, have serious and outrageous impact on provision of primary health care, socio-ecological and socio-economic benefits in rural</td>
<td>80 - 89</td>
<td></td>
</tr>
</tbody>
</table>
CARA and NEMBA regulations towards problem weeds and alien invasive plant spp., have largely impacted the provision of primary health care, socio-ecological and socio-economic benefits in rural areas.

CARA and NEMBA regulations towards problem weeds and alien plant spp., have moderately impacted the provision of primary health care, socio-ecological and socio-economic benefits in rural areas.

CARA and NEMBA regulations towards problem weeds and alien invasive plant spp, have limitedly impacted the provision of primary health care, socio-ecological and socio-economic benefits in rural areas.

CARA and NEMBA regulations towards problem weeds and alien invasive plant spp, have not negatively impacted the provision of primary health care, socio-ecological and socio-economic benefits in rural areas.

<table>
<thead>
<tr>
<th>Total number of informants %</th>
<th>100%</th>
</tr>
</thead>
</table>

| C | 60 - 79 |
| D | 40 - 59 |
| E | 20 - 39 |
| F | 0 - 19 |