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Full Length Research Paper

Invasive alien plant species: A case study of their use in the Thulamela Local Municipality, Limpopo Province, South Africa

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The spread of plants from one country to another through intentional and unintentional human activities is a serious threat to the world's biodiversity; second only to habitat destruction. However, a number of studies have shown that invasive alien plant species can positively contribute to rural economies. This paper is an attempt to document a few of these species 'positive contribution to rural inhabitants' well-being in and around Thulamela Local Municipality in Vhembe District of South Africa. Information on the uses of invasive alien plant species were obtained in 2010 through interviews with local inhabitants and traditional healers. Twenty one plant species, from 15 families, were found to be utilized by rural inhabitants. These species are important sources of food and medicine, provide firewood, and are of aesthetic value. They have become alternative sources of utilization, where the indigenous vegetation has been decimated by overexploitation. This study postulates that their extensive use, under careful management, could form part of a strategy for social upliftment and environmental management in poor rural municipalities.

Key words: Invasive alien species, Thulamela Local Municipality, utilization.

INTRODUCTION

Invasions by alien plant species are considered to be one of the largest threats to the ecosystems of the earth, and the services that they provide to humanity (Kaiser, 1999; Randall, 1996). Studies from Canada (Colautti et al., 2006), United States (Roxana et al., 2007), Britain (Williamson, 1996) and India (Sekar, 2012), highlighted this. Pimental et al. (2001) estimated the total costs of alien plant invasion in these countries to be more than US$336 billion per year. Africa studies from Tanzania (Wakabira and Mhaya 2002) and Kenya (Swallow and Mwangi, 2008) emphasize the impact of alien plant invasion.

Southern Africa is severely affected by alien invasions, and has one of the biggest problems with invasions than any area in the world (Macdonald et al., 2003). According to these authors, alien invasive species are widespread especially in the rural areas of South Africa. At least 161 species cause serious problems in natural and semi-natural systems (Henderson, 1995), impacting on approximately 80% of the country or roughly 20 million hectares (Le Maitre et al., 2000). Nel et al. (2004) noted 117 alien plants as well-established, major invaders that are more widespread in South Africa. These authors suggested that widespread alien invaders should be managed at national scale. (Mooney and Hobbs, 2000) However, to clear 20 million hectares of invasive alien vegetation would cost a "conservative" estimate of R 34 billion over the next 25 years. This cost is further compounded by follow up clearing programmes (Marais et al., 2004).

Invasive alien plants are widespread in the Limpopo Province, both in cultivated areas and in natural and semi-natural vegetation. The majority of these species

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pose an immediate and significant threat by virtue of their invasiveness. They have the capacity to invade natural habitats and overwhelm some, or even all of the indigenous vegetation (Dogra et al., 2010; Working for Water, 2004). Left untouched, invasive alien vegetation would spread at an average rate of 1% per annum in South Africa. The impact associated with invasive alien plants include reduced surface water runoff and groundwater reserves, increased biomass and fire intensity, markedly reduced biodiversity and several economic consequences (Dogra et al., 2010). According to Van Wilgen et al. (2008), an estimated reduction in surface water runoff as a result of current infestations of invasive alien plants ranges from 0.4 mm (rainfall equivalent) in the dry Nama Karoo, to 15, 2 mm in the fynbos shrublands. These amount is over 3000 million m^3 of surface water runoff annually, most of which is from the fynbos and grassland biomes. The estimated potential reductions in groundwater recharge are 26 million m^3 annually in the fynbos biome (Van Wilgen et al. 2008).

Several studies (Njoroge et al., 2004; Zhang, 2010) have shown that invasive alien plants also have positive economical, social and ecological contributions and that these need to be considered when assessing the costs resulting from invasions. It has also been recorded (Le Maitre et al., 2000; Richardson and van Wilgen, 2004) that invasive alien plant species can be used in agroforestry for functions and services that cannot be provided by native species (Richardson et al., 2004). These services include rapid biomass accumulation, nitrogen fixation, and reforestation of degraded land, improved fallows and contour hedgerows (Crooks, 2000).

Invasive alien plants around the Thulamela Local Municipality (TLM) in the Limpopo Province of South Africa, similar to the rest of South Africa (Richardson et al., 2004), have become a focal point in the conservation of indigenous plants. The 2004 report by the Working for Water group, estimated the invasive alien plant cover in the TLM on nearly 5%. These plants incur a tremendous cost in labour expenditure to eradicate them, a cost that a poor rural municipality such as Thulamela cannot afford (Magadzi, 2008).

Therefore, this study investigated the utilization of invasive alien plants by residents of TLM, their economic and social benefits to this community and if their utilization can be a seen as a possible “control” strategy for rural poor municipalities.

MATERIALS AND METHODS

Description of the study area

The pilot survey was conducted in six rural villages within the TLM, situated in the north eastern part of the Limpopo Province, South Africa. The TLM is centred in the town of Thohoyandou which forms the heartland of the Venda people. The area is characterized by gentle to very steep slopes with narrow valleys. Ladislav and and Rutherford (2006) noted that this area, with an average precipitation
with very dry winters. Mean annual temperature is 20°C. The vegetation is classified as VhaVenda Miombo, and is heavily impacted by grazing (with grass cover virtually zero), wood collecting and slash–culture, agricultural activities, mainly the clearing for maize production, and a number of alien species.

The area has a total human population of nearly 1.2 million people organised into 264 891 households, 34% of which comprise traditional dwellings or huts. As is the case in other areas in the Limpopo Province, widespread poverty and high unemployment rates are characteristic of the rural communities in this area, with many households relying on subsistence agriculture, products from natural ecosystems, government grants and remittances from migrant workers (Statistics South Africa, 2002).

The Venda people have very resilient socio-cultural and traditional backgrounds (Lábbe et al., 2008). Traditionally, they grow subsistence crops and rely for their sustenance on wild food and medicinal species as well as cattle and goats (Venter and Witkowski, 2010). Indigenous knowledge accumulates over several generations (Kaniki and Mpahlele, 2002; Okorafor, 2010). It is also a useful socio-cultural resource base, instrumental in defining how communities respond and cope with adverse agro-ecological conditions in a context of environmental change (Lwoga et al., 2010). Unfortunately, knowledge of this kind being large undocumented is disappearing very fast (Dweba and Mearns, 2011).

Methodology

Data was collected from March to July, 2010 in either the local Venda language or English. Fifty community members from six villages were interviewed by means of focus group discussions using a semi–structured questionnaire regarding the general use of invasive species. This was supplemented by six traditional healers, one from each village, who were questioned on invasive alien plants species utilization for medicinal purposes. During field trips plants were initially identified by respondents by means of vernacular names. Voucher specimens of some of the species cited during interviews were collected and kept at the University of Venda Herbarium. Final identification was made with reference to field guide literature (Moran and Zimmermann, 1991; Macdonald et al., 2003; Bromilow, 2001; Henderson, 2001). For conclusive identification and classification, all specimens collected were named and verified by trained taxonomists at the University of Venda Herbarium, who were able to provide each species with both an English common name as well as a Latin name, in addition to the local indigenous name provided by the informants.

Data analysis

All the collected data were stored in Microsoft Excel 2007 programme and was later analysed for descriptive statistical patterns. The data collected were analysed in terms of those species that had been most frequently cited by informants. Percentages were calculated as the number of species per utilization category divided by the total number of species in all utilization categories and multiplied by hundred.

RESULTS

Utilization categories of invasive species

Twenty one species, from 15 families, were reported to

be used (Table 1). These species are mainly used for medicine (36%), ornamental (18%), shades (11%), food (7%), firewood (5%) and as lubricants (5%). Fencing, furniture, recreation, sweeping brooms, bath soaps, tea, windbreak, meeting areas and rituals each constituted 2% of usage.

Used plant parts

In most of the reported cases (25%), the whole plant was used, followed by leaves (21%) and roots (16%). Other parts such as stems (12%), fruit (12%), resins (5%), seeds (5%), branches (2%) and pine leaf needles (2%) were used to a lesser extent. Whole plants were mainly used as ornamentals in gardens and for the provision of shade. Other less prominent utilizations were for fire wood, hedging and traditional medicine (Table 1). Resin, roots, and leaves were used to prepare traditional medicine to treat blood pressure, diarrhoea, ringworms, sexually transmitted diseases (STDs), stomach complains, flu and fevers. Fruits were used for recreation, as a lubricant or lotion, and as a food source. Branches of trees were used for making sweeping brooms, while stems were used in the construction of security fences around homesteads, for carpentry, as fire wood, and in traditional medicine to treat STDs.

CARA-listed species

68% (n=18) of the species recorded in this study is listed under Regulation 15 of the Convention of Agricultural Resources Act 43 of 1983, Known as CARA (Table 1). Of these, 61% (n=11) are listed under Category 1, 17% (n=3) under category 2, and 22% (n=4) under category 3 (CARA, 1983).

Multiple use species

57% of the documented species had multiple uses, with *Eucalyptus paniculata* and *Lantana camara* as the species with the highest number of uses. The stem of *E. paniculata* was widely used as a source of fuel for household cooking, including for special occasions such as weddings and funerals. The whole plant was also used as an ornamental plant in gardens, and to act as windbreaks. In some villages, *E. paniculata* was planted in the ceremonial central area for the provision of shade for community elders discussing village-related issues.

L. camara due to its multi-coloured flowers was extensively used for ornamental purposes in gardens and indoors. Small branches were bundled together to make brooms. Cooked leaves were used as a traditional medicine to treat flu and fevers, and to increase milk production in cows. In some villages *L. camara* was used a firewood.

The stems and roots of *Caesalpinia decapetala* were used either in combination or singly to treat STDs. Cattle herders used the seeds as a source of lubricant and soap after swimming in rivers. The whole plant is furthermore used as a security fence around homesteads and kraals.

A concoction made from the root of *Melia azedarach* is widely used as a traditional medicine to regulate blood pressure. The whole plant is either used as an ornamental or for the provision of shade in household gardens. In some households this species is a sacred tree under which ritual are performed. For example members of a household usually circle *M. azedarach* three times every morning for good luck.

Pinus patula wood is highly desirable after for use in high–value carpentry items such as furniture and window frames. The green pine needles are used to make a tea, with the needles being further used as a traditional medicine in the treatment of a sore body through smoke inhalation. Roots are mixed with other species and used to bring good luck.

Fruit of *Solanum mauritianum* is pounded and used to feed domestic doves. An extract from the leaves are used as traditional medicine to treat piles and afflicted internal organs. In some villages the whole plant is pounded and used topically to stop injury-incurred excessive bleeding. It is also planted as an ornamental in gardens.

Seeds of *Ricinus communis* are used as a source of oil (Castor–oil). The fruit is used by children as slingshot balls. Leaves and stems are used either in combination or singly as medicine to treat stings and bites of insects. Pounded leaves are used topically to treat internal pains and injuries. A decoction of the root is used as a remedy for toothache.

DISCUSSION

Utilization of invasive species

Invasive alien plant species are being extensively used by inhabitants of TLM for a variety of functional and aesthetic purposes. This is in line with previous findings of Sattaur (1989), Prescott–Allen and Prescott–Allen (1990), Ewel (1999), Evans (1992), Altieri (1994) and Admasu (2008) in other parts of the world that have shown that humans are reliant on alien species for shelter, ecosystem services, aesthetic enjoyment, and cultural identity. However, this dependency must be weighed against the aggressive invasive nature of such species. It can be argued that using invasive species could contribute to their control while providing ecosystem services to poor rural communities.

Commercial use of invasive alien plant species can contribute in uplifting the economic status of poor rural communities. For example, brooms made from *L. camara*, if well promoted, would find a highly susceptible market in the TLM. Using invasive tree species such as *E. paniculata,* and *Jacaranda mimosifolia* in charcoal

Table 1. Utilization of alien species in Thulamela Local Municipality and their CARA category.

Species	Family	Used part/s	Utilization category	CARA category
Araujia sericifera	Apocynaceae	Whole plant	Ornamental	1
		Seed	Lubricant and soap	
Caesalpinia decapetala	Fabaceae	Stem	Fencing	1
		Stem and root	Medicine	
Catharanthus roseus	Apocynaceae	Root	Medicine	
Datura stramonium	Solanaceae	Whole plant	Medicine	1
		Leaf and resin	Medicine	
Eucalyptus paniculata	Myrtaceae	Stem	Firewood	2
		Whole plant	Ornamental and for provision of shade	
Jacaranda mimosifolia	Bignoniaceae	Whole plant	Ornamental, firewood and for provision of shade	3
		Whole plant	Ornamental and firewood	
Lantana camara	Verbenaceae	Branches	Brooms	1
		Leaf	Medicine	
Melia azedarach	Meliaceae	Whole plant	Ornamental and rituals	3
		Root	Medicine	
Mentha longifolia	Lamiaceae	Root and leaf	Medicine	
Nerium oleander	Lamiaceae	Whole plant	Ornamental	1
		Leaf	Medicine	
Opuntia ficus–indica	Cactaceae	Fruit	Food	1
		Stem	Carpentry	
Pinus patula	Pinaceae	Needle	Tea	
		Resin and leaf, root	Medicine	
Psidium guajava	Myrtaceae	Fruit	Food	2
		Whole plant	Shade	
Pyracantha angustifolia	Rosaceae	Root	Medicine	3
Rhus succedanea	Anacardiaceae	Root	Medicine	1
Ricinus communis	Euphorbiaceae	Seed	Lubricant	2
		Fruit	Recreation	
		Leaf and stem	Medicine	

Table 1. Contd.

Rubus cuneifolius	Rosaceae	Fruit Leaf	Food Medicine	1
Senna didymobotrya	Fabaceae	Leaf	Medicine	3
Sesbania punicea	Fabaceae	Whole plant	Ornamental and for provision of shade	1
Solanum mauritianum	Solanaceae	Whole plant Fruit Leaf	Ornamental Food Medicine	1
Xanthium strumarium	Asteraceae	Whole plant	Ornamental and medicine	1

production can create employment opportunities in communities. In the Afar region of Ethiopia, during a one year period, three cooperatives involved in charcoal production and sales of *Prosopis juliflora* were able to create 233,509 days of employment (Admasu, 2008).

The trade in traditional medicines in South Africa is estimated to be worth R2.9 billion per year, representing 5.6% of the National Health budget (Mander et al., 2007). However, excessive trade has resulted in a decline in high value indigenous species in the Limpopo Province of South Africa. Therefore, the use of alien medicinal species such as *Datura stramonium* (mental illnesses), *E. paniculata* (flue and colds), *L. camara* and *Senna didymobotrya* (STD's) as substitutes for indigenous medicinal species could alleviate harvesting pressure.

Household food security and nutrition issues are at the top of the planning agenda in many countries in sub– Saharan African countries (Singh et al., 2010). This study found a number of species as sources of food. The most notable of these are *Opuntia ficus–indica*. This study found that Venda people consume the fruit as part of their daily nutrition. The juicy pulp of this species contributes 60 to 70% of the total fruit weight (Barbera et al., 1994). The health benefits of *O. ficus–indica* fruits are well documented, as it is often used for its hypoglycaemic and hypolipidemic actions (Shedbalkar et al., 2010). *O. ficus–indica* is furthermore extensively used by various cultures in South Africa as a traditional medicine to treat a number of ailments. For example, Bapedi (Semenya, 2012) and Venda (Mabogo, 1990) traditional healers in the Limpopo Province use its roots to treat STDs, such as gonorrhoea, with the Venda further using it to treat toothaches. It is also reported that the Xhosa in the Eastern Cape Province use the roots to treat wounds (Grierson and Afolayan, 1999).

Used plant parts

In most cases either the whole plant was used or just the root. Harvesting of underground parts (roots, tubers and bulbs) or even the whole plants is so destructive that it may lead to loss of population cohesion (Dzerefos and Witkowski, 2001). Thus, the extensive use of roots in traditional medicine of *Catharanthus roseus* (to treat STDs), *Mentha longifolia* (chest complains), *Pyracantha angustifolia* (body pain) and *Rhus succedanea* (diarrhoea) could over the long term result in the decline of these species. This is even truer for *D. stramonium* and *Xanthium strumarium*, where the whole plant is uprooted and used in traditional medicine.

In the Afar region of Ethiopia (Admasu, 2008), collection and crushing of the seeds of *Prosopis juliflora* contributed to the reduction of seed load to the soil, ultimately negatively influencing the spread of the species into new areas. Similar to these findings, the utilisation of seeds of *Caesalpinia decapetala* (lubricant and soap) and *Ricinus communis* (lubricant) may reduce their dispersal capacity. The same can be said for *Solanum mauritianum* where fruits (with seed) are pounded and fed to domestic doves.

Leaves of exotic plants are usually green and available for most of the year (Albuquerque and

Andrade, 2002). Therefore, the continued nearly yearlong pressure being applied to evergreens such as *Rubus cuneifolius* (skin rash), *Nerium oleander* (ring worm) and *Senna didymobotrya* (STDs), through the medicinal usage of leaves, can inhibit their growth and eventually the ability of these species to spread.

The utilization of brightly flower-coloured exotic species as either ornamentals (*Araujia sericifera, Melia azedarach, Nerium oleander*, *Sesbania punicea* and *X. strumarium*), or quick growers as shade providers (*Eucalyptus paniculata*, *J. mimosifolia, Psidium guajava* and *Sesbania punicea*) in home gardens by the VhaVenda, is indicative of the urgent need for community awareness and involvement to develop proactive and concerted action to limit the use of exotic species to activities that would reduce their ability to spread.

In conclusion, the results obtained in this pilot study revealed that exotic species are extensively exploited in the TLM. In fact, some of these species have become imbedded in the daily lives of residents of TLM, through their use in traditional medicine. This wide use of invasive alien plant species is seen as imperative for their ultimate control and should form part of their management strategy. As part of this management strategy, land owners should be educated on the do's and don'ts of using alien invasive species, especially those listed in CARA, which should be managed differently depending on the Category. Ultimately, the use of exotic species, as part of a management strategy could allow the indigenous vegetation to recuperate thereby enhancing the regions biodiversity.

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