Dealing with invasive species in Hawston/Fisherhaven

by Michael Austin M Sc Agric

"People most vulnerable to loss of access and degradation of ecosystems are indigenous peoples, minority groups and the poor who all depend more directly on ecosystems for their food, water and culture."

Dr Claudia Ituarte Lima: United Nations Human Rights Council 2017

1. Introduction

The invasion of exotic species into the Hawston/ Fisherhaven area has generally been neglected over time, especially in the last decade. This has resulted in some extremely dense stands of invading species in some areas

At some point in the near future we will reach the point of no return (tipping point) for this environment, and will run out of resources to which we have become accustomed. That is an unstable future for our children and they may not survive.

I have tried to summarise and simplify the complex factors which are involved and present some straight forward and simple proposals to move forward. **Timing has become critical for the urgent implementation of a plan of action.** We need to sway the competition between exotic and indigenous species in favour of the latter in order to ensure a stable and aesthetically pleasing environment.

Below we will examine the main invasive species in the Hawston/ Fisherhaven area. They are:

Port Jackson (Acacia saligna), Rooikrans (Acacia cyclops, limited in this area),
Australian Myrtle (Leptospermum laevigatum),
Gum Trees (Eucalyptus spp.),
Reeds (both Typha capensis (bullrushes) and Phragmites australis).

2. General Background

The Hawston/ Fisherhaven area falls within the Fynbos biome which consists of a) Rhenosterveld and b) Fynbos veld, as per the original Acocks classification.

a) The original definition of the Rhenosterveld was where the **Rhenoster bush** tended to dominate the species mix. The rhenoster bush occurs where there is generally higher fertility, with more of a grass component in the mix than in Fynbos. It supported a large game component. Many of the same species occur in both Rhenosterveld and Fynbos, with changes in the dominant species in different locations. The Rhenoster bush tends to take over where areas have become degraded from farming practices, primarily from overgrazing from the early Hottentot settlers. Estimates are that 80-90% of the original Rhenosterveld has been destroyed, by ploughing to grow wheat and other crops because of its higher fertility.

b) The **Fynbos** areas have been subdivided into various categories depending mainly on composition changes of species which primarily occur because of different soil types, rainfall, slope and frequency of fire. This leads to over 60 types of sub-classifications of Fynbos. This is based on structural adaptations of the more than 7000 species which occur in the Fynbos biome. It is very difficult to distinguish and separate these on a map. In the short term, the frequency of fires can also have a major impact on defining the vegetation structure and species composition. The Fynbos generally has:

- a restionaceae component, i.e. the Cape reed family of sedges and many grasses,
- an ericoid or heath component and,
- a proteoid component.

There are very few animals in Fynbos because the high carbon to nitrogen ratio of most plant species precludes browsing by animals. A few animals, such as ants burying seeds of some plant species, do play a role in seed distribution, but a minor role in vegetation structure and composition.

Fire plays a major role and, with infrequent fires in some areas, it can lead to senescent forest (forests dying off) or thicket invasions developing.

Fynbos has very low productivity, due mainly to infertile soils, and was little utilised for agriculture. Now, of course, the fertility problems have been overcome with high fertilisation and much of the Fynbos area has changed to fruit and vine production in the better rainfall areas, especially with the advent of irrigation.

The major uses of Fynbos are for recreation, water catchment and exotic plantations with a small but growing component for cut flowers. The main problems are alien encroachment, urbanisation and wild fires. There are over 8 000 plant species in the Fynbos versus only about 1 400 species in the whole of Britain. **We need to conserve the vast amount of genetic material for future cultivar selections.**

3. The Hawston / Fisherhaven environment

The Fynbos, which traditionally covered the whole Fisherhaven/Hawston area, consists of well-leached, infertile soils in which fire has played a prominent role in the past. There has been major alien encroachment, primarily Port Jackson within this area and Rhenoster bush often dominates disturbed areas such as roadsides.

The exotic invasive species generally outcompete the indigenous species except where there is a healthy growth of indigenous species which are well-adapted to the low phosphorous, dry, sandy environment. The Port Jackson exploits open spaces caused by humans, such as overgrazing, other poor management practices and mechanical removal, by naturally open spaces made by rats, fire, etc. or by natural die-off of indigenous species.

Our objective is to balance this plant competition more in favour of the indigenous species and allow them to dominate the area. Where such domination occurs, the *seed bank of exotics* naturally deteriorates over time and so become less of a problem; as a result the area is easier to maintain.

Occasional fire is a natural force in the area – there is still some debate as to how often it should be used. In fact, some species require fire for the seeds to germinate; some can coppice (grow from the base) or recover quickly from a burn; others are induced to germinate from the smoke: these are mostly succulents. The best approach is to utilise fire at the start of the wet season, preferably with damp soil. The idea is to use a cooler fire. There is evidence that a hotter fire, which results from burning when conditions are dry, is more effective in promoting a wider range of Fynbos species and

that the continued use of cooler fires leads to a different mix of species than was traditionally present.

Port Jackson

The exotics such as Port Jackson add additional fire load to the area when they are growing and are full of flammable oils. As soon as they are cut down, they reduce the fire load considerably; once cut down, they lose their leaves in a few days and the fire load is further reduced (as much as 75%). The dead exotics and indigenous vegetation do not add so much to the fire load as such, but do increase the heat of the fire (which is not necessarily bad for a burn).

When Port Jackson grow in this poor environment, they absorb a considerable amount of the scarce nutrients available in the soil; **if the dead trees are removed, the nutrients still in the trees are removed, therefore impoverishing the poor environment further**. The removal of dead Fynbos and the bulk removal of Buffalo grass does decrease the fire heat and fire load and makes the area look prettier. However, this impoverishes the poor environment and removes soil protection. The debris from the chopped down exotics limits wind erosion and the debris and organic matter resulting from it provides a micro environment which is more suitable for seed germination.

While some nitrogen is utilised in the decomposition of the Port Jackson, most remains behind – the organic matter in the Port Jackson adds nutrients to the soil. In addition, this process increases the water-holding capacity of sandy soil, critical in a low rainfall area.

The Port Jackson's root system is large and vigorous and penetrates well into the hard sub-soil. When the tree is cut off and poisoned, the roots provide channels for water penetration and also release nutrients deeper into the soil profile – all good for other plants to grow. There is much evidence to suggest using trees to help rehabilitate a spoilt environment, especially where nutrients exist in the subsoil, or have been buried there by soil movement. **It is not suggested that we plant Port Jackson, but rather that we use the fact that they have invaded to our advantage as much as we can when we remove them.**

Studies have been done in the Rhenosterbosveld and Fynbos veld which show that a surprisingly high percentage of the nutrients in the burnt vegetation are returned to the soil after a fire. Nitrogen in the burnt material volatilises and is lost to the air.

Nitrogen cycle in Fynbos

Very few studies have been done on the nitrogen cycle in Fynbos. It is generally accepted that increasing the nitrogen cycle leads to better plant growth. The invasive leguminous species such as Port Jackson (Acacia saligna) and Acacia cyclops (Rooikrans) do lead to increases in nitrogen in the soil profile primarily due to litter drop. These are long term effects.

There is some evidence which suggests that an increase in the nitrogen cycle inhibits the germination and of Fynbos seedlings. These effects were measured mainly in long term invaded areas 20-25 years of dense stands of invaded Acacia species. Soil type also has an effect and some studies have not indicated a significant difference, the studies which showed a significant effect on Fynbos germination were conducted on acid sand plain lowland Fynbos.

The grass component, both indigenous and invasive grass, will respond to increased levels of nitrogen and the other increased nutrients in the soil after a burn.

The burning of such densely invaded areas volatises the nitrogen component to a large degree and there may be some merit in a repeated burn in very densely- invaded areas. The idea is that the young plants have taken up considerable nitrogen which can then be volatised by a repeated burn. The problem is that there is a reduced seed bank of Fynbos in these areas and what few Fynbos plants that do germinate after the first burn, have not been allowed to seed themselves. The second fire may do more damage than good.

Much of the dense stands of Acacia in the Hawston/ Fisherhaven area are relatively recent so the nitrogen cycle may not have increased enough to have a significant effect on Fynbos germination and the main problem is probably a reduced seed bank of Fynbos in these areas. Re-establishment of Fynbos will be longer term in the very densely- invaded areas and may require some help with introducing seed back into these areas after initial clearing of invasive species.

Generally the grasses which grow after clearing at least cover the area, especially those that are prone to wind erosion with the extremely sandy soils. Proper follow-up clearing is required and areas need to be monitored and the management adjusted, if necessary, in certain sections of the general area.

Therefore ...

a) In terms of the law, invasive species need to removed.

b) The objective of removing invasive species in the Fynbos is to create a mixed species environment which is much more stable and as close as possible to the original, historical species mix.

c) Management practices need to promote species diversity, biological diversity and finally ecosystem diversity.

d) Management practices should also make the indigenous Fynbos areas aesthetically pleasing.

e) A mixed indigenous species area will be much more stable, and provide more services to the community. This is particularly relevant when we consider the estuary environment, hugely affected by what happens on its borders and throughout the catchment area of the estuary.

f) The amount of water extracted from the environment by the invasive species is so much more than the indigenous species: of the order of 3-12 times as much. The clearing of exotics will promote more infiltration into the soil and substantially increase the clean fresh water in the numerous seeps throughout this area.

4. Dealing with exotics

There exist many reports dating back to the 1980s which essentially call for the same solutions over and over again. However, over the years, the infestation of exotics has simply become worse. In limited areas, for short time periods, some areas have been cleared. With limited follow-ups and

misguided operations, there is now a vastly bigger problem of invasive species. A great deal of the indigenous seed bank and many of the species which occurred throughout the area have been lost. Much scientific data is available on control measures, effects of fire, increases or decreases of water (both surface and underground), etc. (van Wilgen B W, Wilson J R U, amongst others; SAEON; CSIR; reports commissioned by Overstand, CSIR, bodies connected to Kogelberg Biosphere Reserve).

The gist of all this information is that invasive exotics need to cleared, and management should try to recover the large number of indigenous species in a well-balanced mix which leads to a more stable environment. This will deliver numerous benefits in the whole ecosystem of the Bot, Afdaks and other smaller rivers within this ecosystem.

The aim should be for the **original mix of species**, adapted to an environment developed over thousands of years, before the advent of large numbers of humans destroying and unbalancing the environment. This aim will probably be never quite achieved, because of the impact of humans on the environment.. Further destruction cannot continue and needs to be halted. If we do not do this, we will no longer be able to exploit the resources, albeit limited, which this environment can provide. As stated in the introduction, timing has become critical for the urgent implementation of a plan of action.

Plan of action within the Hawston/Fisherhaven Fynbos area

Within the Hawston/Fisherhaven area, which includes the catchment area from Hoek van die Berg, along the mountain tops to the Afdaks River and includes the Bot river estuary, we need to divide the area into management areas. These include severely infested areas, partly-infested areas and waterlogged or wetland areas.

Very dense areas of invasive species

One tool that we can use is fire for extremely dense stands of invaders, primarily Port Jackson, Myrtle and Pine. These dense areas are, in any case, extreme fire hazard areas. Immediate results of a burn are apparent: destruction of seeds, increases in water and removal of the invasives to give the indigenous species some chance of growing in the area. After the fire we can much more easily control the re-growth of exotics since there will be better access and a much smaller volume of vegetation to deal with.

After a fire in these dense stands, huge numbers of the exotic seeds will germinate in the bare areas, especially Port Jackson. Within a small patch, say 25 x 25 mm as many as 50 Port Jackson seeds will germinate, they then compete with each other and only 2 or 3 may grow to 50cm high, these are easy to pull out. The seed bank in the soil is therefore been rapidly reduced. This does need follow-up within months of a fire, rather than letting it all get away again. Fire also promotes the germination of the exotic invaders, much easier to deal with when they are still small. This will lead to significant reduction of the exotic seed bank over time; after seven or eight years the exotic seed bank will have been severely reduced. Continued invasion from seeds brought in from the surrounds are then the main problem.

Invaded areas

Management needs to remove the invasive species, preferably using pullers to remove the roots. Stumps should be cut and treated with poison immediately, with some ring barking which assists the effectiveness of the poison. We need, however, to limit the use of poisons as much as possible, especially because of their long residual effects.

Where a single indigenous species such as the buffalo grass has taken over large areas, we can spot-poison it with a systemic herbicide which will sway the balance in favour of other species and return this area to a mixture of species which is much more stable and aesthetically more pleasing.

Cleared areas

Follow-up clearing, initially at least every year, is extremely important. There is a massive seed bank of invasive species and it takes time for the indigenous species to re-establish themselves, grow to maturity, seed themselves and build up a good competitive cover. If the invasive species are not allowed to seed themselves the balance gets swayed more and more in favour of the indigenous species.

Fires, which will probably occur more often than desired in this area, will be much less expensive to control and will cause much less damage to infrastructure.

Control burns will be required in some areas to both maintain healthy Fynbos and a wide range of species. These can also be strategic to help reduce the spread of wild fires throughout the area.

Reeds in wet areas

The reeds, both bulrushes Typha capensis and Phragmites australis, are indigenous to the area and serve many good purposes. However, for various reasons, there has been a massive expansion of the reeds and a great reduction in the amount of open water within the area in just the last 10 years. The system has become unbalanced with a huge loss in bird numbers, a variety of other species such as fish, frogs, etc.

The main reasons for the expansion of reeds are:

- pollution in various forms and
- the impact of humans on the wetlands themselves and in the surrounding areas.

Our management practises have reduced the flow of water, caused more silting up of traditional open water areas and the huge extra load of decomposing organic matter from the reeds. This causes changes to the water body, leading to more pollution. The reeds advance further into the open water, compounding the problem.

We need to therefore return the extent of the reeds to their former areas, or at least to what they were 10-15 years ago. This can be done by:

- increasing the water flow into these wetlands primarily by removing invasive exotic species in the primary watershed areas initially and eventually within the whole catchment area.

- reducing the pollution from built-up areas with changes in these areas, and conducting necessary simple engineering works to reduce or eliminate glass, plastics and other pollutants.
- removing building rubble and waste dumped into the wetlands, and by not adding more pollutants, especially sewage.
- leaving some reeds to act as barriers and filters, to consume pollutants in the water such as phosphate and nitrogen
- possibly deepening the water, especially near the banks of open water to hinder the further invasion of reeds.

Privately-owned areas versus publically owned areas

Much of the privately-owned land within the Hawston Fisherhaven area is farming area, which is not being used for active farming and is instead very badly invaded with declared noxious weeds. We need to encourage the landowners to comply with the laws and to clear these areas. In the event that government funds are used to clear these areas, we need to keep the landowners responsible as the value of their land has increased considerably as agricultural land. The problem is that there is a much greater increase in value of the land, should it be declared suburban area, but much of this land should never be built on as it will be environmentally disastrous. It is an issue which needs attention and landowners should be encouraged to declare most of these areas as nature conservation areas of some sort.

The privately-owned areas that are within suburban areas should have the laws applied to remove the invasive species or at least pay to have them properly removed. That is the roots need to be removed or poisoned; there is not much point in simply cutting off the exotics at ground level.

The privately-owned areas that may become suburban areas in the future should not be allowed to deteriorate simply because they will have roads and houses built on them at some time in the future. There is already a plan to extend Hawston and Fisherhaven by 200-300% although this is unlikely to happen in the next 50 years. These areas are generally covered in extremely dense stands of invasive species, generating massive amounts of seed into surrounding areas and reducing water flow from these areas. This critically affects down-slope areas, especially natural seeps and underground water, the wetland areas and the open water bodies such as Paddavlei and the Bot estuary. These owners need to be held to account and not be allowed to impact the rest of the community.

Publically-owned land: there are a few reasonably well-looked-after small pieces of publically-owned land within the suburban area, often taken care of by private citizens. The rest, however, is mostly severely invaded with noxious weeds and much of it adjoins suburban areas and poses an extreme fire hazard to private and public infrastructure. These also cause damage to surrounding areas and especially down-slope of these areas with severe impacts on the rest of the community. They need to be urgently attended to by local government or removed from their control as in the past they have not been able to apply the laws and measures which they are obliged to have been applying to the publically-owned areas, never mind the privately owned areas.

5. The Soil Carbon Cycle

Soil carbon is an extremely important measure for healthy soils, primarily in its effects on soil microbe populations. It has always been known that organic matter promotes plant growth but the role of soil microbes has often been neglected. Both scientists and agriculture in general aim to feed plants directly and many agricultural systems have failed because they were not primarily feeding the soil microbe population.

A more sustainable, and stable situation applies if we aim to increase soil carbon, which is what nature does in the long term. Many of our management practises lead to a depletion of soil carbon with all its attendant problems.

The following benefits apply to increased soil carbon:

-it acts as a growth stimulant, both for soil microbes and directly for plants

-it binds soil particles therefore less erosion

-it provides the slow release of N, P, K and S feeding soil microbes and ultimately the plants growing in the soil

-it holds more water in the soil and releases it as needed

-it binds nutrients such as K, Ca, Mg and prevents leaching of these to the subsoil

-the organic matter helps stabilize Ph and acidity

-it warms more quickly in spring promoting a longer growing season

-it ties up and absorbs pollutants which are then degraded by soil organisms

-soil organic matter is a major part of the carbon cycle. Soil carbon is twice times the plant and atmospheric pools of carbon.

Some points on fire control

It seems that the entire budget of the municipality for fire gets spent on putting out fires which have been put in maliciously or escaped from citizens burning rubbish, braaing, etc. Very few of these fires are started by natural means e.g. lightening.

Very little is done to prevent fires spreading. Certain areas have mowed breaks, usually a tractor slather with no effort made to remove the roots of invasive species. As a result there is a rapid re-growth from existing roots coppicing.

These mowed areas do provide a break for fighting fires or somewhere that a backfire can be put in. My experience with fires in this area is that no decisions get made to put in backfires with the result that fires spread across the breaks and they are therefore ineffective, especially where the fires get into older stands of invasive species, especially Port Jackson which has added such huge quantities of highly flammable material that the fire spots right across such breaks.

Controlled fires should in any case be used to burn out such dense infestations for two reasons;

a) that fires will get contained and will do much less damage to infrastructure. The risks are reduced and the control of wild fires will be much easier and cost very much less. Obviously the cost of damage will also be reduced and this can be in the R10s of millions which far exceeds the budgeted amounts for fighting wild fires.

b) From an ecological point of view, that fire is been used to clear these dense infestations and the rehabilitation process can then proceed with a much reduced bulk to deal with and Fynbos can be re-established with has a vastly reduced fire load and reduced heat load in the case of a wild fire.

In the long term the cost of fighting wild fires, which are inevitable in this built-up environment, will be reduced considerably and the massive savings can be diverted to eventually almost eliminating the Port Jackson and other declared invasive weeds from this area. This will lead to a host of benefits for the area in terms of aesthetics, much more water being available and a stable, sustainable environment.

Timing of burns in Fynbos

There is a very much greater variety of species in Fynbos than in other veld types in Southern Africa. Most other veld types occur over much larger areas than Fynbos does and therefore the areas are more uniform in terms of management strategies. Within the Fynbos area there large differences and the people who mapped the veld types have called attention to the fact that if we divided the Fynbos into different veld types it then becomes very difficult to map this as differences occur over such short distances. This then makes it much more difficult to recommend large scale management practises, with the result that the scientific literature is full of differing conclusions as to how best to manage Fynbos. In fact, Fynbos is almost unique in changing the species composition very rapidly over short spaces of time. A fire at a certain time of the season and the fire interval since the last burn can result in a very different species composition in the re-growth from a single burn.

Given all of the above, the decision to instigate a burn of a particular piece of Fynbos cannot be delayed by long decision times. A delay of 1 year can change the result dramatically. With wild fires decisions get made within minutes or hours primarily based on getting the fire put out, with very little regard to the ecology.

Typically, the decision, to for instance burn a particular piece of Fynbos for clearing invasive species on public land, takes far too much time to be made by government departments with the result that the initiative often gets lost and invasion continues to the point that the situation changes, resulting in more delays. This leads to nothing being done with a delayed and much more costly exercise, usually with the most damage being done to the Fynbos itself, leading to a further deterioration in the environment.

6. Conclusion

Timing has become critical for the urgent implementation of a plan of action: we need to conserve the vast amount of genetic material for future cultivar selections. Our objective is to balance this plant competition more in favour of the indigenous species and allow them to dominate the area.

7. References

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