PROCEEDINGS FROM

GRASSLANDS, TIMBER AND FIRE. A SYMPOSIUM

HOSTED BY

THE SOUTH AFRICAN NATIONAL BIODIVERSITY INSTITUTE – NATIONAL GRASSLANDS PROGRAMME

AND

THE GRASSLAND SOCIETY OF SOUTHERN AFRICA

14 AND 15 OCTOBER 2009

BISHOPSTOWE FARMERS' HALL

PIETERMARITZBURG

SOUTH AFRICA

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Grassland Society of Southern Africa – www.grassland.org.za
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WELCOME AND INTRODUCTION

Transcription

MR J DU TOIT Good morning, everybody, and welcome to this symposium on grasslands, timber and fire brought to you jointly by the Grassland Society of South Africa and the Grasslands Programme of the South African National Biodiversity Institute. My name is Justin du Toit. I, with Steve Germishuizen, Freyni du Toit and Barbara Styan, put this day together and it certainly is promising to look a very enjoyable and useful couple of days.

In terms of events there are five sessions over these two days. Each session comprises a keynote talk, followed by several other talks. There are further discussions and there will also be some breakaway discussions. I will explain all of that and exactly how we are going to run it after we have had our speech by our introductory speaker – our plenary speaker, and I will talk about that after tea in a bit more detail. The teas are at about 10 o'clock and 3 o'clock in the afternoon. There is lunch at about one and also at the end of each day the pub at the back will open and we have got a few fires outside, have a braai, and we hope that as many of you as possible will be able to say and join us for that. I hope that that will also encourage a lot of discussion and further networking and chatting amongst yourselves after the day as well as during the day.

This afternoon we will have also some poster presentations during the afternoon tea and what we will do is we will go and grab a cup of coffee or tea, and our poster presenters will stand around their posters and give us a few minutes on that.

You will notice that I am using a microphone. This has a dual purpose. The first one is obvious; it makes it easier for everyone to hear me. The second reason is that we are actually going to be recording all of the talks so that we can retain a record of what has been spoken about at this symposium. This is the speakers' talks and also any comments that come from the audience. We feel that this is important because an enormous amount of information comes out of these days but what usually happens is that it rests merely in the sort of ever lessening memories of the people who have actually been here, and it's very nice to actually keep a record. Speakers don't need to get worried about that. I am not going to publish anything without having sent it first to you afterwards and you can check. So if you say, "Justin is something of a palooka" during your talk and you feel that that's bad, you can change it to, "Justin is a complete palooka." So you will have a chance to edit it so if there are any concerns about that you don't need to worry but we are keeping a record of it. So when people talk and say things – nice if you use your name to begin with; if you don't, it's not serious but we keep a record of it and that is going to become the proceedings, which is going to then be sent out to all of you. It's also going to exist on the SANBI and GSSA websites.

The turnout to this symposium has been fantastic; thank you all very much for coming along. It's been an interesting response. At first there was sort of nothing and I had this terror that we might be having our 22 speakers and not many other people. But over the last few weeks it's really gone up and a few days ago it was at about 100 and in just the last few days, about three days or so, it's gone up to over 120. So that is why we have just pulled in a couple of extra chairs. In fact we had six new registrations just this morning. So we had seating for everyone that was registered about two days ago but there are a few more people so a little bit squashed but that's no worries, and there are a couple of extra chairs around the side there if you need them.

I would just like to also say thank you to our sponsors, Fire Alert, NCT Forestry, Pick 'n Pay and Sappi for helping us here.

Now I would like to invite from SANBI and Grasslands Programme Anthea Stephens to come and give a welcoming.

MS STEPHENS Thanks. I am not sure if that would be, "Justin, you are a complete palooka," or "Justin, you are a mug." Early morning humour, folks. Thank you for this opportunity to give the welcoming and a special word of thanks to GSSA for organising that has turned out be or hopefully will turn out to be a very productive and interesting couple of days and one that I know many of us are looking forward to having some detailed discussions on this topic and getting some answers that we can put into practice into the field.

It is certain a very timely symposium. Just yesterday I was in Cape Town giving a presentation at a mainstreaming workshop and one of the questions that came from the floor was, "So what is the right burning regime for grasslands?" And I said, "Well, ask me that question in a couple of days' time because we are going to spend two days with a lot of very smart and experienced people and hopefully be getting to the bottom of it with some answers." So I think it certainly couldn't be more timely and it is certainly a critical issue that when taking into practice and when looking at managing grasslands it's something that I know is a very critical issue. So this I know is a very impressive gathering of both practitioners, managers as well as experts and I hope over the next two days through presentation and detailed discussions we can really get to the bottom of some of the key issues and distil what are the important aspects for those of us that are involved in the field, that are practitioners that are involved in managing programmes. I think these are some of the key issues that we need to get to. So I certainly look forward to hearing what comes out of the next two days' discussions.

I think I extended my thanks to GSSA just for organising this event. It's certainly very impressive. Just to tell you a little bit about the Grasslands Programme for those who don't know, SANBI's Grasslands Programme started implementation last year in about March last year. It's initially a five-year programme. We have got funding for five years but will go on into the future. There is a commitment to having a national Grasslands Programme that will broadly provide a platform for sharing experience and lessons and knowledge and information on South Africa's grasslands biome.

The first five years of the programme is focusing very heavily on a mainstreaming programme and we are looking at working very closely with partners in the major production sectors operating on grasslands biome to that's the agricultural sector, forestry, coalmining and urban development and looking at how we can leverage biodiversity gains by working in partnership with the key players in those sectors. So I think this is a key issue and the management of grasslands within a production landscape is a particularly complex issue and I think the opportunity to come together with practitioners in the field, with experts, to discuss the issue of timber and fire in the grasslands is a huge opportunity. So thank you everybody for coming, for your time, again to GSSA and Steve Germishuizen from the forestry component of the Grasslands Programme which we are implementing in partnership with Forestry South Africa and I look forward to a very productive two days of discussions. Thank you.

MR S GERMISHUIZEN I am Steve Germishuizen. I am the forestry coordinator for the Grasslands Programme and thanks, Justin, for including me in the organising committee but I must be honest, I haven't done a huge amount in organising the venue and setting the thing up and I am really impressed with what has been achieved here. Thanks, Justin.

I just want to give you a bit of background into why we came up with this idea of this symposium and what our objectives are, just to set the scene so that we can know how we could best input to achieve these objectives. I am going to read this and it takes exactly five minutes so you know you are not in for a long dreary read.

Just to pick up on what Anthea said, the SANBI Grasslands Programme has a clear, unambiguous mainstreaming objective. What really this means is that we, as Grasslands Programme, work with key production sectors. And the idea is to jointly implement solutions, work with production sectors to find solutions and implement them. And this is a partnership between one organisation which is primarily a biodiversity objective, SANBI and with production sectors. And the idea there really is that the only way to achieve this is through trust and the best way to build up trust is through communication. And that was really the objective behind this, to begin communicating with a variety of sectors, with Government, Conservation and with Forestry.

The idea of the symposium really stemmed from another objective in the forestry component of the Grasslands Programme and this was to produce clear guidelines for grasslands management and these guidelines were to be relevant to the forestry industry. They take into account the difficulties and the challenges that face forestry in managing the grasslands.

The fact is that plantations have been established in the most fire prone areas of the landscape, fire being the very driver for the existence of grasslands. This makes managing these two components a very challenging proposition indeed.

Well, how did we arrive at this symposium idea? In discussions that we held with the Grasslands Forestry Task Team and other forestry managers, various questions have come up that we simply didn't have the answers for. Just incidentally, the Grasslands Forestry Task Team is a body that was set up to coordinate the design and implementation of the forestry component of the programme. This task team has really got a lot of say in what the Grasslands Programme projects look like and how they get implemented and it is comprised of a variety of sectors. We really have striven to get a balance between Conservation, Government and the Forestry sector on the group. It is about 14 members and I think we have achieved that.

The types of questions that we didn't have ready answers for were questions like, what is the impact of annual burning or a variety of burning regimes on biodiversity? What is the potential for grasslands to be rehabilitated and how does one do this? How can we monitor the impact on grasslands biodiversity? And so on. Many questions came up and when various experts were approached on similar questions, as always with ecologists, we got a lot of quite certain and direct answers but no consensus between the ecologists. Opinions varied widely, particularly the opinion on what is the greatest impact on grassland biodiversity on a plantation estate? It varied between – there was a generally held opinion, and this was sort of perpetrated through the FSE system, that annual burning of firebreaks was causing the biggest biodiversity concerns. But in closer examination and when looking at actual burning patterns on some plantations, we found that maybe under-burning is a problem, that the window burning period was too short and grasslands weren't actually getting burnt enough. And then others came forward with the idea that actually the impact of community cattle is the greatest concerned. And so these are all issues which we really wanted to get answers on and so we thought and the Forestry task team forwarded the idea and it was taken up by Justin du Toit that we could have a GSSA Grassroots Programme symposium aimed at these specific questions. So the programme was put together with that in mind, very specific issues and answers that we are looking to get.

Yes, so the symposium's programme was designed around identifying the key issues and it was important to get people who are involved on the business end of forestry, as well as those involved with the conservation sector, and also people that represent all scales of forestry here so that the real exchange and interchange of ideas can come.

From the other side of the partnership, it is important to understand what the conservation sector's requirements for the grasslands are and compare that to what forestry's demand of the grasslands in terms of fire protection and the biodiversity requirements from the forestry side are. And then we must understand that it's through a combination of these that we really get the needs and the values of the public at large expressed through a combination of looking at the production sector and the conservation sector.

So it's with this genuine spirit of enquiry that we approach this event and I can honestly say with a personal sense of excitement, seeing what is the base knowledge at the moment, what is the starting point. From this then, as Justin pointed out, we hope to capture these ideas in proceedings and these proceedings then can lead to a process in which we can come up with definitive guidelines on grassland management on forestry estates. And hopefully these guidelines then will have input from a broad enough sector that they can actually be implemented.

And then, lastly, we are really hoping that this symposium could be a catalyst for a future of greater communication. And with the right attitude I think we can build up a trust and a high level of trust between the forestry sector and the conservation sector. Thanks very much.

MR DU TOIT Thanks, Anthea and Steve. I now have pleasure to introduce our opening keynote speaker. Andrew Sullivan is the team leader of the Bush Fire Dynamics and Applications Group of the Sustainable Ecosystems Division of the CSIRO in Canberra, Australia. He conducts research in various areas on fuel dynamics, fuel availability, fire behaviour, fire impacts and fire management. He is also the co-author of a book, *Grassfires: Fuel, Weather and Fire Behaviour*. Many of you will know that book. Certainly many of us involved in teaching and so on will know that book well. It is certainly very valuable to us and when I thought about who should we have as our keynote speaker, I thought, well, let's look at the front cover of that book and there were two names there and the first name – well, I googled the two people and I saw Andrew Sullivan was still actively involved in these things and I thought, well, let's just give it a shot. Let's see if we can get him. So I wrote him an email and said, "Hi, would you like to come along and present at our symposium?" And Andrew's reply was, "Hi, that sounds nice. Ja, I will be there." So thank you very much for that and we are very happy to have you here.

Andrew is involved in various spatial fire spread prediction models and he also has informed government on the runaway bushfires that occurred in Canberra district in 2003 and it is something that he has an ongoing involvement with and in fact was pointing out that it's fortunate that he had this window of opportunity to come and chat to us because there are all sorts of things still going on in the follow-up from the enormous fires that they obviously have in Australia. So, ladies and gentlemen, a round of applause and welcome Andrew Sullivan.

OPENING KEYNOTE ADDRESS

FIRE BEHAVIOUR: THE AUSTRALIAN PERSPECTIVE

Andrew Sullivan

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Dr Andrew Sullivan is the Team Leader of the Bushfire Dynamics and Applications Group of the Sustainable Ecosystems Division of the CSIRO in Canberra, Australia. He conducts research on fuel dynamics, fuel availability, fire behaviour, fire impacts, and fire management. He has published widely, and is co-author of the book "Grassfires: Fuel, Weather and Fire Behaviour" with veteran fire ecologist Phil Cheney. He was involved in the development of various fire-spread prediction models, and has informed government on runaway bushfires that occurred in the Canberra district in January 2003.

Abstract

Australia is the only continent in which fire is endemic across the entire land surface. From the coastal strips through to the Alpine regions, the deserts to the wet tropics, bushfires are a natural part of the landscape. Many of the native species of flora in Australia have evolved with the frequent occurrence of fire and, indeed, in many cases require fire to propagate. The climate, vegetation, topography and weather of the continent are such that at any time of the year, bushfires will occur somewhere in the country. Where those factors of fire coincide with populations the potential for disastrous fire exists. When catastrophic fires do occur often little can be done until the weather moderates.

In Australia, a continent in excess of 7.6 million km^2 in area of which 61% is considered temperate and 39% tropical, over three-quarters of the land area is grassland of one type or another. While much of the country is arid or semi-arid, over half of the total land area has been established for agricultural purposes, primarily grazing of sheep and cattle for both food and textile production. This grazing is carried out in both native grasslands, mainly the savannahs across the tropical and sub-tropical north, and improved pastures in the temperate south.

Forested areas are generally restricted to the high rainfall zones in the south-west, south-east, and along the east coast of the continent and consist primarily of woodlands and open forests with grassy understoreys, dry forests, wet forests and tropical, sub-tropical and temperate rainforests. The predominant forest species are the *Eucalyptus*, *Angophora* and *Corymbia* genera with over 700 species, most of which have adapted to cope with and encourage fire. Other genera, such as *Banksia* and *Acacia*, have also adapted to fire and need the heat and smoke from a bushfire to prepare seed beds and open seed pods. Significant areas are also given to plantations of native and introduced wood crop species, such as *Eucalyptus bicostata/globulus* and *Pinus radiata*.

The fire season in Australia shifts from mid-winter to mid-spring in the north to late-summer to late-autumn in the south with occasional serious fires occurring to either side of these periods depending on antecedent conditions. It is estimated that on average 2.5 million hectares are burnt each year through unintentional occurrence of fire (i.e. wildfires). The behaviour of these fires varies greatly with weather, topography and fuel type. Systems have been developed for fire behaviour prediction in grass and forest fuels as the two predominant fuel types.

This talk will provide an overview of fire in the Australian landscape, from the weather and vegetation to the behaviour of fires and the methods used to mitigate them. It will discuss the systems that have been developed to predict fire danger for the purpose of suppression preparedness and fire prevention and those systems used to predict fire behaviour for the purposes using fire as a management tool (prescribed burning) and for fighting of fires. Discussion will include the assessment of fuel hazard and the issues involved in using fire in the landscape to meet diverse land management objectives.

Transcription

Thank you, Justin, for that warm introduction. I would like to thank the Grasslands Society of Society of Southern Africa and the South African National Biodiversity Institute for inviting me and also Justin and Freyni for arranging my trip here and looking after me so well.

Justin asked me to provide an Australian perspective on fire behaviour. So that's the title of the talk. As an overview of what I will present, I am basing it on what we call the fire behaviour triangle. So that's the three components that combine together to control the behaviour of fires. There is actually a fourth component. It's the fire itself in the middle. So we have got topography, that's the landscape, weather and fuel. And, as you know, in order to talk about fuel we need to talk about climate because vegetation is essentially based on climate.

Topography first. One of the unique features of the Australian continent is that it is the flattest. It's the smallest continent and the sixth biggest country. It's about 7,7 million square kilometres in size and covers quite a bit of latitude from 10 degrees south down to 43 degrees south. And as I say, it's flat. Less than 5% of the total area is above 600 metres and less than 1% is above 1000 metres. Most of that is on the Eastern Seaboard down the Great Dividing Range.

If we look at the average annual rainfall across the country, you can see most of it is very dry. The centre of the continent is very much less than 400 millimetres a year. The peak rainfall occurs in the tropical north and most of the rainfall is actually constrained to the Eastern Seaboard on the eastern side of the Great Dividing Range. If we have a

look at when that rainfall actually occurs, you can see that because of the size of the continent and the distribution across the latitude that it's constrained fairly locally. So the north is monsoonal, so that rain occurs during the wet season from about October through to February or March. As you move south, the rainfall becomes more winter dominant. There is a uniform rainfall zone in central New South Wales, but most of the southern temperate zone is winter dominant rainfall. What rainfall that does occur during summer is highly localised, a result of thunderstorms that produce very local rain events which are often associated with storm damage as well.

If we look at the average maximum temperatures that occur across the continent in January we can see that most of the centre of the continent has a maximum daily temperature in the high 30s. The eastern seaboard and the southern latitudes have a more coastal or maritime influence. And there is a common occurrence of sea breezes up to about 100 kilometres inland. I live in Canberra which is about 100 kilometres from coast and when there is a southerly blowing on the coast we can expect a sea breeze about seven or eight o'clock at night that comes in and cools things down and raises the humidity. This is quite common along the coastal regions. If you follow cricket you will know that when it is played in Perth, they talk about the Freemantle doctor. That's a very common sea breeze occurrence in the middle of the afternoon in Perth which helps swing bowlers.

The average temperature in July is very much different. Again the tropical north remains fairly warm and this coincides with their dry season. Further south temperatures are much, much lower and on the Great Dividing Range, particularly in the Southern Highlands, snow can fall on the higher elevations.

So taking into account the occurrence of when the rains come across Australia and the temperatures associated with drying of fuel, we have a spread of fire seasons across the country. The season starts in the middle of the year in the north and as the year progresses the fire season moves south so that in summer the fire season occurs right across the country from Perth through to Victoria and New South Wales and further south the fire season can even be delayed into late autumn occasionally. So that's the climate.

How does that then affect the vegetation? If we look at the morphology of the tallest stratum of vegetation that occurs, there is a good distribution of trees, tall, medium and what we would call shrubs. Hummock grasses and also tussock grasses occur throughout central Australia. The other herbaceous plants also include the crop species.

If we look just at the grass types that occur in Australia, the north is dominated by the tropical tall grasses and that is often in combination with woodlands and open forests. The centre of Australia is very much xerophytic tussock grassland, spinifex and low shrub components. Most of the native grasslands that occur in Australia are in the north. Pretty much all of the native grasslands that occurred in southern Australia were replaced in the 1800s and early 1900s with an improved pasturage for grazing and agriculture and that also impacted a lot on the native forests. Any of the native forests that were on flat ground were pretty much cleared and sown with an improved pasture type.

So here we can see, just as an example of the agriculture, a spread of where the wheat is being found. From south-western Queensland through central New South Wales on the western side of the Great Divide, through Victoria, South Australia and southern-western Australia are where the main wheat growing regions occur. Most of the wheat that is grown in this region and southern New South Wales is actually irrigated. So they use the water in the Murray Darling Basin to irrigate these farmlands.

Looking at the different grasses that occur across Australia, in the north, as I have said, we have got the tall tropical grasslands. There is also a growing infestation of gamba grass which is causing major problems there for management of the native grasslands.

We have got the Mitchell grass plains in lower north of Australia. These are quite extensive and continue through most of western Queensland and the eastern side of Northern Territory. In the centre we have got predominantly shrub fields but after good rains – and this is exactly the same site – after a good rain we have got the occurrence of short-lived grasses and forbs that provide a fairly continuous sward throughout most of the centre of Australia.

In central western Australia we have got the spinifex grasslands. These are fairly long-lived hummock grasses that contain quite a bit of dead fuel underneath the green veneer and can carry fire quite well. The only thing that dictates the spread of fire in these fuels is the separation of the hummocks but after a good rainy season enough fuel exists between the hummocks to can carry fire for quite some distance and for some time.

In southern Australia we have the improved pastures, mainly phalaris and subterranean clover that has been planted. This is used for carrying sheep and cattle mostly. And we have also got the croplands that have been planted.

If we look at the forests, about 20% of the total land cover is covered by forest or woodland. 60% of that is what we consider dry forest, 4% tall, wet forest, and that is primarily restricted to the highlands of Victoria and a bit in New South Wales and a bit in southern Western Australia. Rain forests occur in patches along the Eastern Seaboard in the north and a good patch in Tasmania.

Here we have a woodland with grassy understorey or open forest with grassy understorey. The plantations are pretty much restricted to southern Western Australia and south-eastern Australia. There are two main types: radiata pine, which is pretty much limited in the south-eastern part of Australia, including the green triangle around Mount Gambier and also patches in Western Australia. The other main plantation species is the blue gum which, as I understand, is a number of different species. Not being a forester, I just believe what I am told. There is eucalyptus saligna, I believe, and eucalyptus globulus. Most of them are globulus I think. And again they are relegated to the south parts of the country. There are a number of other plantation species but by comparison they are only fairly small components.

So 60% of the forests are dry eucalypt forests and there are a huge number of eucalypt species that comprise these dry eucalypt forests. I think in the order of a thousand in total species of eucalypt, but that's also including some

other genera– they split the genus apparently for some reason so there is corymbia and one another genera of eucalypt, the name of which escapes me for the moment.

In the alpine areas we have a different subset of eucalypt species with a totally different understorey and morphology. In the west mountain areas we have the tall forests. This is the mountain ash forests of Victoria and Tasmania. We have also the rain forests and these do occur in combination with button grass moorlands which are restricted to Western Tasmania.

Then in addition to those sort of fuel complexes, we have also the Mallee heath complex of vegetation. This is a map of the extent of the Mallee heath fuels. So the heath fuels are dominated by low shrubs and they occur in most coastal regions along the eastern seaboard of Australia but they also occur in combination with the Mallee eucalypt species. This is a multi-stemmed, fairly short– they only grow to three to five metres in height – eucalypt species. One of the key differences between the Mallee heath fuel complexes and the other eucalypt species is the relative lack of surface fuel in these vegetation complexes. There are considerable patches of bare ground between the shrubs and trees. Because of the distribution of the Mallee clumps, the leaf fall isn't continuous and provides fairly large areas of bare ground where other species in the heath complex can come through.

We'll take just a quick look at plantations. As I said before, there are two main types of plantation species grown in Australia, the radiata and blue gum. These have often been established on old agricultural land. The big plantation companies have come in and bought up old farms and then planted out the farms with these plantation species.

There is another much smaller type of plantation, what we call farm forestry. These are the farmers that didn't sell to the plantation companies but have decided to actually grow the trees themselves, so replace the general cropping regimes with the trees.

There has been a recent increase in the number and area of the plantations that occur in Australia, primarily as part of what was called the 2020 vision to treble the area of planted forests in Australia. But this comes at a cost in terms of the skill basis available for fighting fires in these plantation types. With the removal of traditional agricultural farming practices there has been a decrease in rural populations and an increasing expectation from communities that fire protection be provided for. In the late 1990s many State Governments decided to not be in the plantation industry and sold these assets to large companies. The companies themselves, as part of the sale terms, have a requirement to provide some fire protection but in the end most of them rely upon insurance companies or the under-insurers overseas to actually protect their investments. Just recently there was a development where two of the biggest plantation companies have actually gone under. As a result there are large areas of Australian plantations that are in the control of receivers rather than foresters who have an interest in protecting their investments.

The big issue that plantations represent for Australia is the change in the fuel type over time since the plantation was established. The trees, as you know, are extremely sensitive to damage very early on when they are just getting established. Because they have mostly been planted in old agricultural land, it's predominantly a grass fuel in which they have been planted, so as the plantation ages the fire regime changes from a grass dominated fuel to a forest dominated fuel. And if the plantations have been managed for saw logs or using a rotation that is greater than ten years, this can actually represent a big change in the amount of fuel that is present. This image is a good example of a blue gum plantation that is more than ten years old and has a significant amount of fuel on the ground and potential for the presence of ladder fuels to take fire up into the canopy.

Here is just a chart of the fuel dynamics showing the transition of the predominant fuel on the ground of these plantations from planting where there are large areas of bare ground and grass, through to maturity. As the plantation ages, the amount of bare ground and grass decreases and you end up with predominant forest fuel. As a result, the type of fire that will burn through a plantation changes, depending on how old the plantation is.

Now we have done the fuel and the topography. We can now discuss the weather. Pretty much regardless of where you are in Australia, because there is a fire season for some part of the country at some time of the year, the factor that dictates the occurrence of a bad fire day is a weather pattern that will draw the hot, dry air out of the centre of the continent towards the coast. Here we have a synoptic weather pattern for January 2007 with a low pressure system located in the north of the continent. That is directing an easterly wind across Western Australia. So in Western Australia this is associated with a bad fire weather scenario.

In eastern Australia we have a low pressure system in the southern ocean with wind that is now directing a westerly flow out of the centre of the continent to the eastern side of the continent.

And for south-eastern Australia---this is the big one, the main weather pattern that causes problems for fire---it is a high pressure system that resides in the Tasman Sea for anywhere from a week to ten days, what we call a blocking high. It stays there for that length of time directing the hot dry air out of the centre of the continent down across south-eastern Australia. That is then complicated by the approach of a cold front. As that cold front approaches out of the Southern Ocean, it tightens up the isobars and increases wind speed and that's when we have the occurrence of a very bad fire day.

So we have got the weather, fuel, topography. Now we have deal with ignitions, the starting of a fire. In Australia the predominant source of ignitions is from lightning, mainly from dry thunderstorms. They are common pretty much throughout the fire season wherever you are in Australia. So in the south it's during summer, in the north it's late in the dry season.

This is a picture showing the number of lightning strikes that occurred on January 8, 2003. Out of this 800 odd lightning strikes there were 72 fires that started in Victoria. Of these, all but three were contained. Those three fires then burnt out something like 2 million hectares. At the same time a number of fires occurred in New South Wales. Two of

those merged in ACT and one that occurred in New South Wales actually burnt across into the ACT and it was this fire that hit Canberra on January 18.

Other sources of ignition are of course arson and also unintentional ignition. These are fires that accidently start by people carrying out some agricultural or other operation, such as welding or grinding operations.

There are also fires that start from power lines. Now the power companies have been working fairly hard since 1977, when they were identified in causing a large number of fires with power lines clashing and causing sparks, to come up with methods to reduce the potential for power lines to start fires. They had done pretty well, except one of the fires that occurred in February this year was reported to have occurred from a power line breaking.

We also have two other sources of ignition of fires. These are fires that have escaped containment and are burning out of control when the bad fire weather arrives and pre-existing fires, which have been contained but are still burning. Often what will happen is that a pattern of fire weather comes through, and fires start. It will then move on. Those fires that started will burn for some time and may well be controlled, contained, or blacked out. When the next pattern of fire weather occurs, fires can escape or spot out of the contained area and result in essentially a new fire.

In Australia, despite the fact that we have a large variety of different fuel and vegetation classifications, we generally talk about fires as being one of two types: grass fires or forest fires. The grass fires are anything that has grass as the predominant surface fuel, which includes woodlands and open forests in the north. Forest fire is pretty much limited by definition to those fires burning through a leaf litter as the dominant surface fuel.

Since the mid-1960s there have been two systems for determining what we call fire danger. These are forecast models for determining what suppression planning and warnings should be undertaken. So we have the grassland fire danger meter and the forest fire danger meter where we take various components of fuel and weather variables which are combined to produce an index of relative fire danger from 1 to 100. These are separated into fire danger rating classes from low, moderate, high, very high and extreme and these are put on the roadside boards and issued in daily weather forecasts. Under a low fire danger fires are easily controlled. Under a fire danger of extreme fires are pretty much unstoppable. When the systems were first designed, a value of a hundred was determined to be the worst possible combination of conditions. Since that time, however, we have found that conditions can be much worse than the ‘worst possible’ so we have opened up the scale beyond a hundred. Once fire danger reaches a value of 50 is reached, a total fire ban is called where all operations that may lead to the start of a fire are halted. Places like national parks and state forests are shut so nobody can gain access to them in order to try to restrict the potential for a fire break out.

Originally these systems were used to predict both the fire danger for warnings and suppression planning and also fire behaviour in terms of rate of spread. But we have found is that these systems were under-predicting the speed of fires. So a decision made in the '90s to separate the calculation of fire danger from the prediction of how fast that fire would spread.

Here we have two relatively new systems for determining the rate of spread of fires in grasslands: the grassland fire spread meter and the fire spread meter for northern Australia. In 2007 we released an interim version of a new national forest fire behaviour prediction system from Project Vesta which is fairly complex, much more complex than the grassland fire spread prediction system and comes in the form of a book of tables.

If we look briefly at grass fire behaviour, grass fuels burn extremely quickly because of their fineness. The fires can build up very rapidly in size and speed and they can reach very, very rates of spread. They can be greater than 20 kilometres an hour. The fastest reliably recorded rate of spread for a grass fire is 27 and a bit kilometres an hour. There have been reports of fire spreading during the Wangary fire in 2005 close to 30 kilometres an hour for short periods. But it's very difficult actually to determine the veracity of those observations.

And because they spread very fast, they can burn very large areas in a single day and they can start somewhere and spread to somewhere else extremely rapidly and impact a long way away from where they start. Because of the fact that the fuels burn out relatively quickly, they are very responsive to changes in the wind in terms of speed and direction. And because the fuels are relatively low, the flames that result from them are also relatively low, about one to eight metres, depending on the intensity of the fire.

Here is an animation of the spread of an experimental grass fire that was conducted in woodlands in the Northern Territory during the 1970s. In red you can see a fire perimeter that was surveyed in from tags that were being dropped every two minutes at the location of the fire perimeter. And you can see wind vectors on either side of this ignition illustrating relative speed and direction of the fire.

You can see that the fire takes a bit of time to develop. As the wind varies, the size of the fire increases. But also what happens is as the size of the fire increases, the speed of the fire increases as well. So the first 20 minutes the fire remains relatively small and the rate of spread is relatively low but as the fire continues to grow in size and the wind varies around as it does, the fire grows bigger and moves faster.

If we plot the speed of the fire against the time from ignition, we can see that the fire's speed goes up and down on a small scale but then as the size of the fire - and this is noted by these dashed lines – as the size of the fire increases, the average speed of the fire also increases. But the mean wind speed doesn't increase an awful lot so there is no relation there between the speed of the fire and the speed of the wind, but there is a complicated relation with the size of the fire and the speed of the fire and the wind.

So just as an illustration of what this means for suppression, fire danger from low to high generally results in low flames, half a metre tall. Suppression is relatively easy and the fire will be stopped by tracks. It can even be stopped by animal tracks. As the fire danger increases, the intensity of the fire increases and the size of the flames increase. Under

an FDI that is moderate, grass fire results in about one metre tall flames, suppression is easy if you have got water to spray on them. But as the fire danger increased, the suppression difficulty also increases. So once you reach high fire danger, you have flames that are pretty tall, three metres and suppression is difficult. Under very high fire danger conditions you will only ever be able to actually undertake direct suppression in light fuels and with favourable topography. So if the fire is going up a slope there is no chance. And under extreme conditions it is impossible to attack the head fire and expect it to be successful. You can only undertake attack of these fires from an anchor point starting at the back of the fire and work along the flanks.

Forest fire behaviour characteristics. In contrast to grass fuels, forest fuels are much more coarse and burn out much more slowly: we are talking about two to five minutes for a patch of fuel to be fully consumed compared to about five seconds in grass. Larger material such as logs will take more than an hour to burn. As a result the fires develop relatively slowly and take hours rather than minutes. The speed of the fire will be much less than what you would see in a grass fire, mainly because the wind that drives the fire is actually being restricted by the presence of the trees themselves. So the burning in the surface fuel isn't receiving the full strength of the wind as you would get in a grass fire.

The flame heights, however, can be much, much higher because you have a fuel component that can be much, much higher. So as the intensity of the fire increases it involves more and taller fuels, the flames can be much, much taller. And if it involves the whole canopy, which is fairly rare in a eucalypt forest, you can have flames that are two to three times the height of the canopy.

Australian fdrests are pretty well developed to cope with fire and indeed to need fire to survive and have developed mechanisms that assist in the propagation of fire, one of which of course is the leaves that take a good time to decay and so build up over a number of years, and also bark that acts as a perfect firebrand that once ignited by the fire can be lofted in the convection column of the fire and dropped down wind of the main fire to start new fires. Because of the amount of fuel that is present in most forests, the intensity of the fires can be very high so they can range from low intensities of about 50 kilowatts per metre up to about 100 000 kilowatts per metre.

Here I have a video from an experimental fire that we did in jarrah forests in Western Australia. This is in a 16-year old fuel, that is one in which it has been 16 years since there was fire in this forest. This forest type has a fairly significant shrub component which makes a big difference in how the fire behaves and interacts with wind. What we have is a camera that is pointing downwind. The fire was lit about 70 metres from behind where the camera is located and the fire is spreading with the wind coming up behind the camera. So you can see lots of things falling. These are bits of bark that are burning. These fall and are starting spot fires.

As the fire approaches you can actually see a lot of the smoke is actually being drawn back into the fire. So these spot fires don't do much in terms of propagating the speed of the fire but they assist the fire to actually spread forward. These are developing relatively quickly, smoke is being drawn back towards the main fire and then very soon the main fire front arrive, here it comes. This has flames that are about two to three metres tall and they last for about ten seconds. If you were caught in this, you wouldn't even get to this point; you would have been dead a long time ago.

An interesting thing to note here is the amount of time it takes for the fuels to be consumed. We are talking about 15 to 18 tons per hectare of litter fuel on the ground. So the fire has spread across the top of this litter fuel and then takes a good amount of time for the fire to actually burn through the fuel. The other thing to note is the amount of turbulence that is present behind the fire front. So you can see the flames reacting to changes in wind direction behind the fire.

Just as a contrast, we have an experimental fire that we did much more recently in Mallee eucalypt forest. I can't play it in Powerpoint because the world will end so I have to swap to another program. So this one is looking towards the fire. The fire is coming towards us. It's burning in about 35 degree temperatures. Relative humidity is about less than 10%. These trees are about 2 and a bit metres tall. It's a three metre tower that's in there and you can see large gaps in the surface fuel. So the fire is actually bridging a lot of the gaps in the surface fuel. And then, because there isn't that much surface fuel, the depth of fire that we actually see behind the fire front is very thin and within a minute there is nothing left burning. It has consumed all of that fuel and is spreading quite rapidly under those conditions.

If we look at the suppression difficulty of forest fires, again we have the fire danger down the of the chart from low to extreme. Flame heights are a little bit more higher than what we saw in grasslands. Because the fires are spreading much slower than grasslands you can deal with a higher height of flame. Against a fire with flames of about 1.5 metres you can still undertake direct suppression with hand tools--this is cutting a fire line, raking the fuel away from where the fire is. Up to moderate you have reached the maximum limit for bulldozers and air tankers. Basically what happens here is spotting will bridge any gap that is created. In fire danger ratings of high you can only undertake suppression in light fuels and on lee slopes. So once you are on a windward slope there is very little that can be done. Beyond very high you can only undertake suppression when the fires are very small, before they have actually developed. And under extreme conditions direct attack on fires is impossible and most fire agencies fall back to asset protection.

If we look at where fire actually occurs in Australia, looking at this map you can see that most of it occurs in the north and a lot of that is actually driven by rainfall. So when you get a good rainy season and you get that grass growth that bridges the gaps between the perennial fuels, you can get very large extensive fire burning across Australia. Here is the fire history of about seven years showing most of the fire occurring in the north. We do, however, have a couple of fires down south. This is the 2003 fire that burnt through the alpine region in Victoria and New South Wales and the fire that burnt into Canberra and some other significant fires up the East Coast. But if we consider what those fires actually mean for the potential for disastrous impacts we have a much different view.

This is a map that illustrates where there is potential for disastrous fires. For most of the country you don't have any potential, mainly because the fuels that are there are fairly low and there isn't much in the way of topography and there isn't much in the way of things that are actually under threat. But as you move to the south-eastern and south-western

side you move into topography, you move into taller fuels in terms of forests and you also move into larger population areas. So the potential for disastrous bushfires is pretty much limited to south-eastern Victoria, a little bit in Tasmania and a bit in south-western Western Australia.

Just a brief discussion of how fire is actually managed in Australia. Pretty much all of the responsibility for fire falls on the states because it's the states that actually own the land and the resources. There are two types of land: there is the publicly-owned land management by the government and there is private lands. State land management agencies have the responsibility for managing fire in public land and they have the responsibility for fuel management as well. So the planning and response to fires, managing the fuel itself, is state agency responsibility, and the use aircraft is also a state agency responsibility.

On private lands we have the state fire services. So this includes both metropolitan fire brigades which are fairly much restricted to urban fires. In the peri-urban and rural areas reliance is upon volunteer fire brigades. In Australia we have about 300 000 volunteer fire fighters spread across the nation and it's pretty much in their hands for controlling and responding to fires that occur on private lands. They don't have responsibility for fuel management as such.

The plantations. The main aspect of plantations that was established as a requirement when the state governments handed over responsibility of the plantations to private companies is what we call industry bush fire brigades. These are essentially professional seasonal fire-fighters that are funded by the plantations whose sole job it is to protect those plantations from fire but they fall under the auspices of the state fire service. So essentially they become a brigade in the volunteer fire brigade.

The Commonwealth, although it doesn't have responsibility for land, does provide assistance to those state agencies in the form of the Bureau of Meteorology who undertakes the fire weather forecasting and the issuing of fire danger warnings using the fire danger rating systems. There is also Emergency Management Australia whose job is to coordinate a response to emergencies. This includes cyclones, floods and also fire. And they also coordinate the military response, but often that occurs afterwards so it's actually a recovery component rather than a fire-fighting component.

We also have a relatively new entity called the National Aerial Fire-fighting Centre that was developed after the 2003 files, whose role it is to coordinate the use of additional aircraft across the nation. Each state has its own aircraft, mainly on contract. NAFC have additional aircraft that they can move around the country as the fire weather shifts and needs dictate.

If we look at bush-fire disasters, there is a saying that 5% of the fires cause 95% of the loss and damage. There have been some very significant fire events in Australia's history dating back to 1851 with the Black Thursday fires. The biggest fires that we saw were the 1939 fires called Black Friday. But more recently we have had a number of other fire events. 1967 was the Hobart fires where there were a hundred plus fires in the city of Hobart itself which caused 62 fatalities. In 1983 was Ash Wednesday, February 16, 1983, where 76 people died across Victoria and South Australia in a number of fires. In 2003 there were four deaths associated with the fire that burnt into Canberra. Most of those were not actually related to the fire itself but other aspects such as people having heart attacks. There was one fatality who died in a house that burnt down. 2005 was the Wangary fire where nine people were killed in a very, very large grass fire that burnt for two days. And in 2009 of course there was the Black Saturday fires where there was an unprecedented amount of destruction and 173 people lost their lives. I will talk a little bit more about Black Saturday fires later on.

So what sort of things are being used to try to mitigate the occurrence of fire? Of course the first one is fuel management. Hazard reduction burning is undertaken in most of the forests across Australia with the aim of reducing the fuels. That's the height and the structure and the amount of fuel that is present. It also reduces potential for spotting through the consumption of bark. Other methods may include mechanical means of removing fuel but this doesn't actually address the issue of bark hazard that leads to spotting.

Hazard reduction burning increases the potential for control of fires under a wide range of weather conditions. It's intended to decrease the intensity of fires that occur which has a reduction in the impact on the ecology and biodiversity of those regions, but there is the question of changing the fire frequency that may also have a deleterious impact on the ecology and biodiversity. So there is a complex issue there in trying to address mitigating fire threat and understanding the impacts of those fires on biodiversity.

In grasslands hazard reduction burning is not widely used anywhere but in the north and it comes historically from the indigenous and cultural burning that was undertaken by the Aboriginals. This was used to reduce the fuels which we understand aimed to reduce the extent of large fires burning across the country. It was also used to create safe passages for them when these fires did occur, and also to create and protect green, fresh vegetation that attracted mammals that they used for food. However, in recent years fuel management fires have also been used in the north in an attempt to reduce the amount of greenhouse gases that result from late season wildfires that burn in the north. The idea is to light fires earlier in the dry season when the fuels are not yet fully cured. These fires are less intense and aim to burn the same sort of area but don't release the same amount of smoke and greenhouse gases and reduce the potential for that area burning later in the dry season under more intense fire conditions. Again we have the question of how this burning affects the biodiversity and ecology.

The other aspect we have for mitigating bushfires is suppression. Fire-fighter safety is paramount in all fire suppression activities and under severe weather conditions initial attack is the key – pretty much the only thing that can restrict the size of fires that occur. This involves rapid detection of the fire and rapid initial attack--that is sending crews out as quickly as possible so they arrive at the fire before the fire has got too big. And this requires good access to most of the areas where fires are going to occur and that relies upon maintenance of tracks and fuel breaks in those areas. It also needs the right tactics for specific conditions and the right equipment for that tactic. I will talk a little bit later on about

the trend pretty much across the world of going to bigger and better in order to try to fight fires, but which may not actually be cost effective.

So training of fire-fighters is crucial here. Understanding fire behaviour is critical in order to achieve the fire-fighter safety that we need. Putting people in positions where they are in danger is one of the worst things that can be done. This requires an understanding both at the level of the strategy and the tactic that has been deployed and also at the fire-fighter level of where they try to employ that tactic. This requires good information about fire weather forecasts and the planning for the suppression. I will talk a bit later about aircraft and VLATS. If you haven't heard of VLATS, you probably soon will.

So just a brief discussion of the Black Saturday fires on February 7, 2009. These were preceded pretty much by a 10 to 12-year drought throughout most of eastern Australia. Here we have a map of the rainfall deciles up to 2007 showing that most of the eastern side of Australia was suffering from drought, some specific areas more than others. Drought in eastern Australia has been shown almost to be correlated to the El Nino/Southern Oscillation index. And in Western Australia there was also a significant rainfall deficit that began in the 1970s.

If we look at the 12 months prior to February 2009, the rainfall deficit was pretty much limited to south-eastern Australia and pretty much limited to where the fires occurred. The synoptic situation on February 7, this is at 11 am, we have our blocking high pressure system that has been sitting in the Tasman for at least four days. It has been directing very hot, dry air across south-eastern Australia and we have a cold front approaching from the south-west. So alarm bells were set off on the Thursday before Saturday and calculations were that the fire danger index was going to be off the scale, it was going to be worse than Ash Wednesday. So people were aware that it was going to be bad, but nobody knew that it was going to be as bad as it was.

One of the things that made it as bad as it was was the fact that the week prior to February 7 there was actually a very long heat wave that lasted about 15 days and during the period from 27 to 31 January there were three consecutive days above 43 degrees in Melbourne. There were 374 deaths above the normal death rate during that period, just because of the heat. So if we look at the temperature anomaly map for that period, we can see that most of Victoria was sitting at greater than 15 degrees for that whole period. This was an extreme drying event that hadn't occurred before.

On the day of February 7, the maximum temperature in Melbourne was measured at 46.1 degrees, the relative humidity was about 3% to 4%, the mean wind speeds prior to the arrival of the front were about 50 to 70 kilometres an hour but there were gusts up to 120/130 km/h, depending on where you were. 592 bush fires occurred on that day including about 20 that were pre-existing. 47 of those fires were determined to have the potential to become severe and 14 of those fires became major fires. There were fatalities in five of these.

Here is a map showing where those fires occurred in Victoria –these are the 14 major fires. The ones that involved fatalities were the Bendigo fire which is actually a fire which burnt pretty much through backyards and the fatality there was an invalid who couldn't get out of his house. The Kilmore East fire that resulted in 130 deaths. What is called the Murrundindi fire was the fire that burnt through Marysville and that killed about 30 people. There is the Bundip fire. There were no fatalities there. There was a fire called the Churchill fire down in Gippsland where there were nine fatalities and I think there were two at the Beechworth fire.

The Churchill fire was an arson event where they actually found the guy soon after he lit the fire. It burnt through mostly blue gum plantation before then getting out of the plantation and impacting upon people's houses. The Kilmore East fire started from a power line that apparently broke and burnt most of its first two or three hours through grasslands along the bottom of the Hume Range escarpment. It then got into stringybark forest along the Hume Range and began spotting quite severely.

The Murrindindi fire was also an arson event that was started in grassland near a disused wood mill and burnt for two or three kilometres before getting into a large forested area and then impacting upon towns.

This is a satellite image from about 3:30 pm on Saturday. We actually see the cold front approaching. Here we have the main smoke plume from the Kilmore East fire. This is the smoke plume from the Bunyip fire burning in national park and this is the smoke plume from the Churchill fire. By coincidence they all line up.

There is also the smoke plume from the Murrindindi fire that burnt through Marysville. You can see that it's relatively small at this point. That fire is understood to have been started at about three o'clock in the afternoon. We zoom in on that. So this fire at this point is probably only just getting into the stringybark forests and fairly steep topography. Once it got into these forests, it began to spot severely and was throwing spot fires, about 20 kilometres away from where that fire was, starting new fires. The fire hasn't got there at this point. At about 4.30 the fire came across from Mount Disappointment, which is an aptly named mountain, to Sugar Loaf Mountain and began to spot heavily into a town called Strathewen. That town essentially was just deluged in spot fires and burnt almost instantaneously because of the number of spot fires that were there. As the cold front came through, the fires then burnt in a north-easterly direction and that actually took the fire up the escarpment. So we had a windward escarpment which the fire spread up. At the top of that escarpment was a range of towns such as Kinglake, and Kinglake West. Further on there was Flowerdale. Those towns suffered major damage. And similarly with the Murrindindi fire that burnt down to about here, both these fires were long, thin fires. As the change came through from the south-west, it then took that whole flank and turned that into a head fire. And it was at that point that the fire burned into and destroyed the town of Marysville.

173 people were killed. More than 2 000 houses were destroyed, 78 townships were totally destroyed or severely impacted. Thousands of people were displaced and there were about 22 000 people who registered for assistance following those fires.

You can see here the significant number of cars caught in the fire, people trying to flee at the last minute and unable to escape. There was a surprisingly low number of people who actually died in vehicles, mainly because they got out to try to escape and then died.

This is an interest photograph taken from the city of Melbourne. You can see the moonlight shining through the clouds here, showing the Hume range and the fires burning across it. It's a very eerie photo.

To try to compare the fires that occurred on Black Saturday with other fire events, this is the area that was burnt during the 1938/39 fire season and, as you can see, Marysville copped it then too. Pretty much most of the area that was burnt on Black Saturday had been burnt in 1939 and that was the last time that it was burnt. So there was a significant amount of fuel there. Most of these fires had been burning for some time during late 1938 and early 1939. On January 3, 1939 the conditions were pretty much the same as what happened on February 7 and also preceded by an extended heat wave. So a significant amount of country burnt here. Still, this is not as much as was burnt in 1851.

The 1983 Ash Wednesday fires. Certainly many more fires occurred on that day. 76 people were killed, most in this fire here at Anglesea, also the Trentham fire and Beaconsfield fire which is on the outskirts of Melbourne. A number of fire-fighters, something like 26, were killed. The interesting thing about Black Saturday was no fire-fighters were killed during the fires themselves. And this big fire over here was burning for about a month before Ash Wednesday occurred.

This is the area that was burnt during the 2003 fires. As I said, here is about a million hectares that were burnt but it's part of a larger complex that went into New South Wales that totalled up about 3 million hectares.

In summary – I have probably gone long over time – all of Australia is pretty much prone to the occurrence of bush fires at some of the year. We suffer periodic and extensive drought throughout most of the country, particularly where there is fuel. Most of the native flora that we have is adapted to frequent bush fire and indeed needs fire to propagate. We have abundant build-up of litter fuel in our forests and also bark that is perfect for generating spot fires. We have frequent occurrence of what we call bad fire weather days. That's synoptic patterns that bring the hot dry air out of the centre of the continent towards the coast. And we have widespread potential for ignition of fires during the fire season. We have annual widespread fires in the north, primarily during the late dry season. Then we have less frequent but potentially more disastrous fires in the temperate south.

What has been happening in Australia for the last 30 years is that there has been an increase in the exclusion of fire from daily life. Many people aren't allowed to light fires in their backyard to burn off trash. So there has been a loss of experience of fire. There are a number of restrictions that are applied to the hazard reduction burns that are conducted by land management agencies that reduce the potential for them to actually implement hazard reduction burning programmes.

There has also been, and this has probably been propagated by the fire agencies themselves, an increased reliance by the community on the agencies to respond to a fire. So there is an expectation that warnings will be issued and fire trucks will appear. The problem is that there is also a loss of experience in those fire agencies to actually deal with those situations. And there has been, since the 1990s, pretty much a shift towards response rather than responsibility. The land management agencies are being overrun – perhaps it might be too strong a word – by the fire agencies whose job it is to buy trucks and aircraft and put fires out rather than actually manage the potential for fires. As an example in New South Wales during one year, 2007, they spent 100 million dollars on aircraft alone. By comparison, following Black Saturday, the Premier of Victoria promised an extra 20 million dollars for fuel management in Victoria.

The bottom line is that Australia is a fire continent, fire is part of Australia’s landscape, and Australians have to learn to live with fire as part of their everyday life. Learning to live with fire is the first step in learning how to manage fire. Thank you.

SESSION ONE: FIRE

INTRODUCTION

Chaired by Justin du Toit

Transcription

Earlier I said I was going to mention a bit later how we are going to run the break-away sessions. Obviously that's not right now, that's a little bit later at the end of the session. The trouble with break-aways is that sometimes you end up sitting with a whole lot of people you don't really want to sit with talking about a topic you are not really interested in. So sometimes they are perhaps less useful than they could be.

What we have decided or what we have thought about – Steve and I sat down the other day and we decided it's really useful to have discussion amongst people and break-aways and so on. How do we do it? So what we have got is that at the end of each session we have a discussion session and what we are going to do is just allow discussion to continue in this plenary session for as long as it is useful. So while we are talking about interesting things and people are asking interesting questions and interesting debates are going on and so on, we will continue it for as long as we want to. Thereafter, when things start running a bit dry and people start sort of looking at the ceiling a bit, what we will do is ask people to wander off, go outside or grab a cup of tea or whatever and, on your own or form into groups and discuss amongst yourselves something interesting that has come up and come back and present that as an idea or write it down as an idea.

So it might be that you have identified – during the talks you thought, "Wow, this is a really interesting research need. We need to set up research in this area to work out what is happening." Or someone might say, "I don't think that the correct people are involved in this," or, "Government needs to work on it." Whatever it is, it doesn't matter. It's your little sparkly idea, something interesting that has emerged from the discussions and the presentations. It's something that you would like to have put down and have recorded, because that's what this is all about. It all gets recorded so it actually stands into the future. And then we will have a little bit of time for some report-backs if people want to come and talk about the interesting things that they have thought about or the interesting research needs, etcetera, that they have identified. Alternatively, you have all got a pad and paper, you can jot it down, write it down and say, "These are the things that I think are important and these are the things that need to be looked at in the future." And those will get recorded and those will be in the proceedings.

So it's designed that way to try – instead of necessarily generating an outcome right from groups on a pre-existing topic, it's rather to allow you to think and to write down what you think and record what you think is going to be important and necessary and interesting into the future.

So that's the way we are going to run these break-away sessions. It's a sort of a novel way of doing it I think. I hope you are going to find it enjoyable and I hope that a few interesting things come out of it.

The scope of this upcoming session is the fire session. I will be chairing it. The main thrust of the session is getting to grips with fire itself. We have had an opening address on fire and we are going to have a few people talking about various aspects of fire, ranging from biodiversity to actually being physically prepared for fire. So we are going to have these talks now, then we are going to have a discussion, and we are going to have the break-away groups that I have talked about, and that will end the session and after that it's lunch. However, one of our speakers, Edgar Redinger, part of his speech is an actual display or it's a demonstration should I say, and that is going to take place outside. So what we will do is instead of actually breaking for lunch, right at the end once we have had our discussions and so on, we will toddle outside and he will give us his demonstration which would last for about five minutes and after that we will have lunch.

The first of our speakers is from the Hudson Crane Forestry and that is Willem Olivier who is going to be talking about unplanned plantation fires.

UNPLANNED PLANTATION FIRES

Willem Olivier

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Willem Olivier studied forestry at Stellenbosch and worked for 30 years for the Dept of Forestry, Bonuskor and Sappi Forests - mostly as a manager of forestry operations in the Mpumalanga Province. He was involved with the formation of the LFPA in Nelspruit in 1986 and later the umbrella organisation, Forest Fire Association. Over the past 12 years he advised forestry companies in South Africa as well as investors in forestry in African countries.

Abstract

Legislation

The first formal legislation regarding arson was probably the 77th Article of the "Placaat" of 1740 of the Cape of Good Hope. Since the first proper Forest Act was accepted by the Cape Parliament in 1888, forest fires received special attention in the succeeding acts in South Africa. Our law environment work on the principle of "not guilty, until proven guilty", but when it comes to damage caused by spread of fire, it is assumed that a landowner acted in a negligent way and innocence must be proven.

Fire Protection

As the 1,257,000 ha of plantations are very valuable and contribute greatly to the RSA economy, every precaution must be taken to protect our national asset. Over the last three decades pests, diseases, adverse climate and fires have, on average, damaged some 31,300 ha per year. Of this area unplanned fires affected 18,200 ha.

To prevent damage by fires, the industry spends approximately R250 million on fire protection and R30 million on fire fighting per year. In total this is about 8% of plantation expenses in South Africa.

Fire protection in the summer rainfall and grassveld areas is done by burning firebreaks and open areas. This is usually done in the period from the first frosts in the winter until the end of July, although foresters try to finish the bulk of grass burning by the end of June. This practice is at odds with what nature requires. Grass should be burnt towards the end of winter or early spring.

Importance of Fires as a Threat to Plantations

If we know this, then why continue with the practice? Simply, because plantations are so irreplaceable to all of us. The forest products industry contributes 10% of the national GDP.

The ForestrySA statistics for 1979/80 to 2007/08 on the occurrence of fires reads like a thriller. Nationally, the areas burnt every year have moved from an average of 8,000 ha in the 1980s, to 14,400 ha in the 1990's and to 33,800 ha since 2000. These figures exclude Swaziland.

The recent damage by fires to plantations, tragic lost of lives and enormous financial losses are unprecedented. It is possibly not an exaggeration to say it is a national catastrophe. Using an average tree value of R10,100 per ha, we lost some R700 million per year over the last two years. With less timber available, it not only affects the revenue of plantations, but also the economy down the value chain.

Why did Fire Damage Increase?

The increase in areas damaged by fires is disturbing. What changed if the planted areas did not drastically expand and the exposure is thus more-or-less the same? The effect of global warming is sometimes mentioned, but the measured climatic conditions do not support this thinking.

The technology to prevent and combat unplanned fires improved dramatically. We have come a long way since the first lookout was built near Knysna, or the first telephone was installed in a lookout at Tokai or eucalypt firebreaks were planted between pine stands in Tsitsikamma by the end of the 19th century. It is no longer necessary to check the dew on the bonnet in the morning to guess the fire danger for the day. We have accurate daily forecasts, satellite images, surveillance cameras, computers, cell phones, aeroplanes and helicopters.

The approach to fire management became very scientific. The industry collectively gathered an enormous wealth of knowledge about fire forecasting, behaviour, training and fighting. The use of aerial fire fighting is well entrenched. The government got involved in a way that was previously unimaginable. Working on Fire has a (very) large budget and the teams are deployed, mostly, in the forestry areas of South Africa. Fire crews are well trained and equipment is superior to what we had only two or three decades ago.

With this in mind one would reasonably think that the number of plantation fires and areas damaged would have decreased. But it did not.

A possible reason could be the change in the way that we manage our plantations. The large companies have moved from small, intensively managed plantations to very large, extensively managed plantations. Outsourcing silviculture operations to contractors, better technology and the need to reduce overheads brought this about. Fire fighting is mostly left in the hands of outsiders, such as contractors and Working on Fire. The continuity, intimate

knowledge of the plantation and ownership is not there anymore. The result is that the money saved on direct plantation expenses, is now going up in smoke. Or is it?

A scientific investigation to establish the true reasons is required.

Transcription

According to the scientists, fire was used by man about 250 000 years ago and about 90 000 years ago man made the technological breakthrough to actually start a fire. Since then we have had this love-hate relationship with fire, especially in forestry.

In 1740, the Cape Government brought in a regulation that should you damage crops by starting a fire, you were "heavily scorched by fire" for the first offence and the second time around you were condemned to death. Elsewhere in the history, Lobengula had the same rule. If you started a fire and it caused damage, you were actually burnt by that same fire. I wish we still had these rules, because then, I am pretty sure, we would have had very little fire damage to plantations.

The first Forest Act was published in 1888 in the Cape and it was based on the Indian Forest Act. Since then, all the Acts that followed specifically dealt with fires, spread of fires and damage caused by spread of fires. In our law environment it is normal that if you are accused of something, you are innocent until proven guilty. As far as fire damage and spread of fire is concerned, it's different. It is assumed that you are negligent unless you can prove otherwise. It's a very strong way of expressing the importance of fires and not doing damage to your neighbour's property.

Farmer Associations, over the years, have petitioned Government about various things. In 1933, the Lowveld Farmers' Association actually petitioned that the headwaters of the Escarpment had to be planted by trees to protect the indigenous forest against fires and thereby protecting the flow of water into the Lowveld. The next year, even in a remote area like Prince Albert, a similar petition was sent to Government, because it was thought that the fires in the mountains of the Swartberg were damaging the indigenous forests and thereby the flow of water to the farmers. I remember reading that by about 1946/1947 the farmers in the Lothair area asked Government to regulate that plantation slash could not be burnt after the end of June. This regulation is still in place today.

From Government's side there is thus a very strong legal assistance to the forestry environment about fires and the damage caused by fires.

We have a history of Big Fires. On 10 February 1869 sporadic fires started from Swellendam in the Southern Cape all the way up to Addo. Enormous damage was done to the natural forests because uncontrolled harvesting took place and lots of debris or slash was left behind. Large tracts of natural forest burnt out. The editor of *The Argus* observed and wrote what he experienced. (By the way, it was on a Wednesday, so maybe it was also "Ash Wednesday".) He wrote in *The Argus*,

"As the morning advanced, denser and denser grew the smoke and brighter and brighter the glare of the fire while the thermometer rose higher every minute. The wind too increased rapidly in violence. At first there was nothing to be seen but the rushing and the raging of the wind and the fire. But presently above the smoke, I saw the liquid fire pouring."

"The liquid fire poured over the krantzes and in the fields the great stream of fire surging along in the dry grass at inconceivable rapidity. The Last Day itself can scarcely be more dreadful. This was a clean sweep of everything, houses, trees, gardens, orchards, and forests, all gone. I took a long walk along the river bank, not a sign of life except an old baboon crooning over the desolation."

We have 1,26 million ha of plantations in South Africa. Over the last 29 years we have had just over 31 000 ha damage to trees by climate, fires, insects and diseases on average per year. Of this area, 18 000 ha is due to fires. That in itself is massive.

According to FES, if I calculate the direct cost, we are spending about R 250 million per year on fire protection, with fire fighting at R 30 million. This doesn't include all the overheads. You can more or less double that figure if you want to include overheads too. It is about 8% of what we spend on plantations, which is quite substantial.

Why is it important that we must protect our plantations? I want to remind you that the forest industry from the tree till the final product make up about 10% of the GDP, R 22 billion per year is being generated on 1% of the country's land. It's very important to remember that if we lose an area to fire the effect downstream is huge on the industry and South Africa.

As far as protection is concerned, burning of grassveld is the most important tool that we have to protect our forests. On average about 70% of forestry land is planted and about 30% are open areas, mostly grassveld. We burn from the first frost, say beginning of May and we always try to be finished by about end June. A little bit of burning still happens in July. However, September/October is really the right time to burn. Professor Braam van Wyk addressed a symposium in Nelspruit a couple of years ago and said that Forestry are burning at the wrong time of the year.

The FSA statistics of areas damaged by fire since 1979/80 indicate a very specific upward trend. If we look at it by decade, the average area damaged by fire was 8 000 ha during the first ten years. The next ten years, it's 14 400 ha, and the last nine years, 33 800 ha. More than 70 000 ha have been damaged per year over the last two years. The question is: Why?

The number of fires that have been reported shows a very similar trend. During the first ten years we had about 900 fires, then it jumped to 1 250 and finally to 3 100 fires per year on average.

If we look at the area damaged per fire, there is actually a decrease, if it wasn't for the huge fires over the last two years.

So what does this tell us? The areas damaged increased, the number of fires increased, yet the area per fire did not increase.

When I got into forestry we did not measure fire danger. It is now measured in various categories. A very low fire danger is classified as Blue, followed by Green, Yellow, Orange and Red. Orange and Red are the very dangerous days with an index of 60 to 100. These are the days we have massive fires, fires that do the extreme damage. Measurement changed the way we were thinking about fighting fires, because if we know the rating or the index for the day, we can act accordingly. It was a major step forward.

From statistics that Lizette Heine kept at Nelspruit from the start of the LFPA in 1987, the really dangerous days are about 10% of the roughly 150 days per fire season. We know seasons are different, but there was not really a dramatic increase in the number of Orange and Red days. From Simon Thomas, I got the same information for the KZN Midlands for the years since 1998. The Orange and Red days are just over 9% for the period.

I then took the days that have been recorded by these two centres and expressed fire danger as a “severity rate” by allocating a value to each day. Let's say a Blue day is from zero to twenty, so I used a value of ten. What this tells us is that seasons do vary in fire severity, but there is not really a major upward trend or a downward trend in terms of the fire weather. It does not explain why have we had such a large increase in damage over these decades.

Last year I asked Tiaan Pool at Saasveld whether they can't get a student to do an M-thesis to analyse the fire statistics and come up with some better scientific reasoning why the fire damage areas increased. I think industry can really do more about analysing the reasons for fires. If you read the latest *Wood SA,* it says that we do not know the causes of 85% of the fires. We do not really know why we have more fires.

What happened from 1980 until now? Why have we had an increase in fires? I have shown you the facts, but what I am going to say is just speculation.

Is it because the planted areas have increased? The answer is: No. In 1980 we had 1,16 million ha. That steadily grew to 1,3 million ha and, because of environmental and other reasons, it has come down to 1,26 million ha. The planted areas did not increase.

Did the weather patterns change? In discussions last year about the big fires it was said: "Its due to global warning." I think it is not global warming because the severity of the seasons rather decreased but let's say, for all practical purposes, it did not change.

What happened to the technology in forestry? Fire technology dramatically changed. I got into forestry towards the end of the 1960s and at that time a wonderful thing happened when radios were introduced into forestry. You could actually talk to someone on the radio when fires had to be fought. The radios didn't work very well at that time, but at least we had radios. The best fire fighting equipment you had on a plantation was a hanging water tank of 3 000 to 5 000 litres, which took a long time to load onto the back of a truck. The aim was to spot a fire quickly and attacked it with lots of labourers who normally arrived with branches and beaters. That was the technology that was applied to fighting fires in the 1960s. Today we have computers, satellites, surveillance cameras, cell phones, helicopters and bombers. I was absolutely amazed to see the technology and the nice equipment that we have nowadays when I visited the Working on Fire office in Nelspruit.

Our Government always had a bit of a hands-off approach to fighting fires in the past. The budget of Working on Fire, as reported by *Wood SA,* in 2011 is expected to be R 250 million. It is absolutely unheard of. The fact that the damaged area per fire has not increased, I think, is due to better technology to suppress the fires.

The next factor is the outsourcing of operations. In a recent fire symposium the next two points were discussed:

Outsourcing of fire fighting.

Up to the end of the 1980s the big companies, Sappi, Mondi, HL&H and Government had about 80% of the plantations under their control and started outsourcing operations. In the 1990s this process was more or less finished and since 2000 all silviculture operations are mostly outsourced. Initially, when we talked about contracting, it was said that contractors should not run nurseries, they should not plant trees and they should not do the fire protection and fire fighting. In the beginning those operations were excluded from contracting out. Today virtually every operation is contracted out.

Outsourcing caused a change in ownership.

Because of the outsourcing process, companies could employ fewer foresters managing larger areas. In the past we had plantations of 2 000 or 3 000 ha at most, today we have plantations of 10 000 to 15 000 ha. I think that was the major negative change. We have outsourced and I think we have moved from intensive forestry management to extensive forestry management.

Am I saying that the foresters are bad today? Am I saying the contractors are bad? No, I am not saying that. I am saying the system is the problem - not the people. I think the foresters today are far better trained than decades ago. I think the contractors are far more professional than what they used to be, but they are locked into a system of little ownership. That's the challenge to forestry in South Africa to get ownership back.

I have been talking about forest fires but this symposium is about how must we manage grassvelds. If we want to change, there are really two things that we need. Firstly, the external pressure from bodies, agents, government making

laws, etcetera is required. Secondly, we need some change agents inside the forestry companies and inside the organisations.

Let me first talk about external pressure. We have got a problem in forestry in South Africa that we have external people having lots to say about the forest industry and often talking absolute nonsense. The problem is when they talk nonsense your natural tendency is to shut off and say, "Well, this person talks nonsense" or "They don't understand or they are not informed." And we tend to shut off and ignore the rest of the messages they are giving. Don't worry about the nonsense that is spoken. What you should do is to listen to the message, the principles, and then try to interpret it.

The next aspect is the role of the internal change agents. We do not really have them in forestry because the people in charge mostly – I talk about myself being a line manager – tend to do our own thing. We tend not to listen to what other people say. We need internal change agents to make the difference. I asked Graham Rusk a couple of years ago, "When FES does the annual cost surveys and you present it to the companies, what are the reactions of the managers?" He said to me, "Less than 5% ask what can they do to change? 10% to 15% will actively try to prove the figures are wrong and the rest of them will just ignore it."

This symposium today and tomorrow will be a total waste of time if what is said here, is not implemented. To the forestry people, use those pens and paper, write down the things that you hear and implement them. Please take note of what the outsiders are saying and actually do it.

I thank you.

FIRE RISK MANAGEMENT

Ben Potgieter

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Ben Potgieter is currently Sappi's Fire risk manager for KZN. He is involved in Forestry for 27 years. His major role is to facilitate the fire risk management process on an operational level to reduce potential losses cause by wild fires in plantations. His main strategy is fuel load reduction in commercial plantations to reduce fire intensity and to create low fuel load zones that serve as buffer zones.

Abstract

Veld fire risk management involves identifying the level of risk posed by veld fires to assets, and establishing strategies to protect these assets from the adverse effects of veld fires.

The purpose of veld fire risk management is to protect the community and its values (which could be social, economic or environmental) from the adverse affects of veld fire.

The risk management strategies must be appropriate to the level of risk determined, and must match the options available for managing the risk. The purpose is to achieve better integration of community preparedness, prevention, and suppression and recovery strategies as key elements of veld fire management.

In order for there to be a risk there must be some asset that is exposed to a hazard. For a given likelihood:

- there is no risk if there is no consequence
- there is a very high risk if the consequence is very great.

For a given magnitude of consequence:

- there is low risk if the likelihood of the hazard eventuating is small, that is, the event is very unlikely
- there is a high risk if the likelihood of the hazard eventuating is big, that is, the event is frequent.

Risk management is the logical and systematic method of:

- establishing the strategic context to veld fire risk management within the area identifying the veld fire hazards
- identifying the assets exposed to the hazards
- identifying, analysing, evaluating, treating, monitoring and communicating risks so that landowners can minimise losses and maximise opportunities.

The challenge is to incorporate fire risk management

- across boundaries
- have the same standards, procedures and systems in place
- work together to mitigate risks on a regional basis
- pool fire management resources to improve overall effectiveness and capacity to deal with wild fires

This presentation covers the risk management system used by Sappi Forests and discusses the different methods and system used in fire risk management.

FIRE MANAGEMENT ON PRIVATE TIMBER FARMS

Craig Norris

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Craig Norris is employed by NCT Forestry Co-operative as a manager of the Forestry Technology Services Department. NCT has a membership base of 2000 independent timber growers owning in the region of 300 000 ha of plantations. The Department offers a range of services to independent timber growers including certification, tree improvement, technology transfer and mapping/planning services.

Abstract

NCT Forestry Co-operative represents over 2000 independent timber farmers in southern Africa. The membership base is extremely diverse including small (0.5 ha) to large (5000 ha) scale operations. Fire management on the various farms is as diverse as the membership of the organization.

NCT has developed a Management System based on best operational practices that enables members to achieve FSC certification. Fire management in this system is covered in three ways, namely:

1. Fire protection, which includes firebreaks, controlled burning and fire management (action plans).
2. Plantation residue management. This is an important aspect of maintaining productivity of plantations and also managing fire risk.
3. Conservation and biodiversity. Most farms have significant areas that are not managed for timber production; this land would include riparian areas, grassland and other representative ecosystems. Fuel loads need to be carefully managed in these areas to reduce the risk of uncontrolled fires.

Through implementing the recommended management practices Members are able to reduce the risk of uncontrolled fires destroying their livelihood. At the same time they can also reduce many of the environmental impacts associated with the growing of exotic timber plantations.

Transcription

Good morning, ladies and gentlemen. My presentation will cover fire management practices on private farms. I would like to start off by introducing you to NCT as an organisation because this will give you a good idea of how private farmers are organised in the industry. I will then state the obvious and talk a little bit about the important of fire protection on private farms. The bulk of my presentation will focus on management of 'open' areas on private timber farms. Management of plantation residues and certification as a management tool will be discussed briefly.

NCT is a true cooperative. In other words we are owned and run by our members. We have approximately 2 000 members owning about 300 000 hectares of wattle, pine and gum plantations. This is quite a significant area. It makes up over 20% of the plantation area in South Africa. Associated with these plantations are large unplanted areas that play an important role in fire protection and conservation.

Our membership base can be divided up into three categories. We have large commercial farmers who tend to be pure timber farmers, owning over 500 hectares of timber. We then have our medium scale operations which tend to be mixed farming operations where you would have between 50 and 500 hectares of timber and a variety of other land users on these management units. The small growers tend to operate in communal areas and can own anything between half a hectare up to 50 hectares. Collectively they supply significant tonnages of timber through the organisation.

Fire and fire protection: We all know that fire is one of the main threats to sustainability of plantation forestry in this country and that any management recommendations that we come up with, particularly around open area management, have to take fire protection objectives into consideration.

FSA statistics show that fire is having a huge impact on the sustainability of the industry. Fires devastate plantations. Over the past five years we have seen a heavy toll in lives, loss in livelihood, devastation of infrastructure, and of course open areas and associated wildlife are also negatively affected by devastating hot fires.

Fire protection and management practices on private farms:

Management of plantation residues: Residues left infield after a harvesting operation form a significant fire risk. They also need to be managed to allow access to a compartment for re-establishment. Irresponsible management of these residues can also have a negative environmental impact. An example is a farmer in the Dargle area who decided to implement a control burn in a gum compartment on a very hot day. He wanted a nice clean burn to reduce fuel loads. Two days after implementing the burn a big thunderstorm hit the farm. The top right-hand picture illustrates the loss in topsoil due to surface wash. We inspected the stream below that compartment and measured a metre of topsoil and that sedimentation that had been deposited in that stream. This load was evident along a 2 kilometre stretch of river. This level of environmental impact is unacceptable and we need to implement practices that balance fire protection needs with environmental considerations.

Brush Management options:

Broadcasting of residues: This is an expensive option and fire risk is high. A large fuel load is spread over an entire compartment and it is an expensive operation.

Bush piling of residues after clear felling is a common practice but there is a high fire risk associated with leaving brush piles intact. From a fire risk point of view it is a better option is to burn brush piles, particularly if they have been placed across the contour. Burning brush piles that run up and down the slope can result in severe erosion.

A practice that we encourage is to only burn residues when conditions favour a 'cool burn'. The burning is carried out when soil moisture levels are quite high and on a cool, overcast day. This results in a patch burn that does not impact on the litter layer or mineral soil.

The brush management operation that I prefer is mulching. However, slope gradient and surface rocks limit implementation on many sites. A good example of effective use of mulching is a farmer in the Paulpietersberg area where the farmer implements the mulching operation immediately after clear felling. The residues are green allowing for a more efficient operation resulting in a very good compacted mulch layer. Timber is extracted the day after mulching, this means that the extraction equipment can work over the organic residues, reducing compaction. The farmer is able to replant his compartment within two weeks of clear felling. Benefits from this system are: Soil protection, reduced compaction, efficient nutrient recycling, good seedling establishment and reduced fire risk. I think this is an operation that we need to look at more carefully in the industry.

Management of open areas:

Some open areas have to be burnt annually. This would include your fire-breaks, strategic valleys which would form part of your fire protection plan and some high fire risk grassland areas. (Northern boundaries and areas adjacent to communities or tribal land). Grass under power lines also need to be burnt annually and these areas often form very good internal breaks on farms.

Riparian areas make up a big part of open areas on farms. With the forestry delineation procedure farmers have had to open up many valleys that run through timber compartments resulting in a network of open areas. These riparian areas are managed in different ways. Valleys that form part of the annual fire protection plan are burnt annually. Patch burning is a common practice. It's not really intentional but because these valleys are often very narrow and they are shaded by the surrounding plantations, you don't get a clean burn. You tend to get a mosaic burn providing a variety of habitats.

Rotational burning is also a common practice in open areas, and then some valleys are not burnt at all.

This photograph illustrates a valley that is burnt on a rotational basis, with the upper portion being burnt on alternate years with the lower valley. Quite often valleys are divided, using a stream or river and then burnt either side of that valley on alternate years.

Certain valleys are not burnt at all, particularly if there is some indigenous bush or forest developing in these valleys. A lot of farmers would like to get the narrow valleys back to indigenous forest or indigenous bush and these areas would then form internal green firebreaks.

Some valleys are not burnt because of perceived fire risk. On this particular farm in the Midlands these valleys haven't been burnt for a number of years. The valleys are surrounded by pine which is very flammable. As illustrated by this photograph, when the area is eventually burnt the heavy fuel load results in an extremely hot fire which can result in damage to the vegetation and to soils.

As far as significant compartments of grasslands go, we are limited to the time of year when we can burn these areas. Generally the Forestry fire season begins towards the end of July/ beginning of August and all controlled burning has to be completed by then. Within this window period of implementing controlled burns (May to July) we encourage farmers to burn their grassland as late as possible.

Some farmers use other methods to reduce fuel loads in grasslands. Mowing of grasslands is a fairly common practice and the mowed grass is then bailed for winter feed. Some farmers use grazing quite effectively. One good example is a farmer in the Greytown area who actually buys in cattle in autumn. He has divided up his grasslands into camps and he grazes on a rotational basis. The camps are grazed very heavily to reduce fuel loads and at the start of spring he sells off the cattle.

Rotational burning is a common practice on larger pieces of grassland. Generally, a grassland area would be split and alternate burning would be practised in that grassland. The photograph on this slide illustrates quite an interesting system that one of our members has implemented where he has divided his grassland into four quadrants. He does an early burn in one quadrant, late burn in the other two, and leaves one quadrant un-burnt. Every year a quadrant would receive a different management practice. This system provides a variety of habitats for wildlife but is most probably not a practical system for most farmers.

Certification as a management tool: NCT has developed a FSC group certification scheme which allows members to become certified under our umbrella. We have developed a management system which includes best management practices. NCT provides training and extension to Members to assist them to comply with the standard. Annual audits are conducted and Members are expected to monitor the impact of their operations. We have found it to be a very effective tool for influencing and improving management practices on farms.

Unfortunately the benefits associated with certification from a financial point of view are quite limited. The industry does pay premiums for certified timber but unless you are a fairly big operator, owning probably more than 300 hectares of timber, the costs of maintaining the system exceed the price premiums paid.

In summary then, private timber growers do own significant areas of land. Associated with their timber plantations are large unplanted areas which need to be managed. Fire protection is an important consideration when developing

management practices, particularly around open areas. Scientifically tested best operating practices are not always available for managing these open areas.

NCT has developed a management system which complies with the FSC certification requirements and includes what we consider to be best operating practices for open areas. From this two-day symposium we certainly would hope that new information would be made available that will allow us to revise recommended best practices and influence management practices on farms.

Certification for us has been a very useful tool to influence management practices on farms. It is the only tool that allows us to go onto a farm and basically tell a farmer that he is implementing poor practices. The challenge is to make certification systems more relevant and accessible to smaller operations.

BURNING FOR BIODIVERSITY IN A TIMBER PRODUCTION LANDSCAPE

Roger Uys

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Dr Roger Uys is the Regional Ecologist South Coast with Ezemvelo KZN Wildlife, providing scientific advice to support nature conservation in the terrestrial area between the Umfolozi and Umtamvuna Rivers. Roger has specialized in rangeland plant diversity focussing on patterns of wild flower diversity and how this biodiversity responds to disturbances across the environmental gradients. His research and occupation have given him unique insight into the practical management of fire and herbivore populations, the primary ecosystem drivers responsible for the maintenance of biodiversity in our rangelands.

Abstract

Biodiversity is created and maintained by ecological processes, of which fire is arguably the most important one that we can manage in our grasslands. As a major land owner in the grassland biome, the South African timber industry has the opportunity to make a significant contribution to biodiversity conservation through the way it manages fire in its natural areas. In recent years, however, there have been a number of extensive uncontrolled fires that have threatened the core business of this industry, increasing the need for plantation forestry to mitigate against the threat of unplanned ignitions. Meeting this call for increased fire protection need not be in direct conflict with fire management for biodiversity objectives. The challenge is to examine the principles of burning for biodiversity and burning for threat mitigation and to find common ground.

The background to burning for threat mitigation is fairly straight forward. High-tech fire danger rating systems tell us when we should be worried about runaway fires and there is realistically little we can do to control the threat of unplanned ignitions. So of the three things that a fire needs to get started, most of our emphasis in fire risk mitigation falls on reducing the availability of fuel. Keep your fuel load down and even if fires do start, they are easier to manage.

With biodiversity conservation we need to consider a broad range of objectives from the individual species scale through to the management of landscape scale ecosystem processes. Most of the research in this field has focussed on producing fat, happy cattle which has given us a good understanding of how the dominant palatable grasses respond to different burning regimes. As these grasses constitute most of the biomass in our rangelands they are also responsible for driving some of the major ecosystem processes that operate at a landscape scale, like soil formation and water retention. Thus, by maintaining a healthy basal cover of palatable species we can be assured of maintaining these ecosystem processes at the same time. What we are not sure of is whether management recommendations for these dominant grasses are also good for biodiversity and thereby the best way to manage communities and populations of various species.

The problem we encounter is that although grasses dominate the biomass of these ecosystems, they only represent a small fraction of the species richness. The invertebrates and wild flowers that make up most of the biodiversity of our grasslands have been traditionally ignored by ecologists, partly because they were believed to play little role in agricultural production and partly because they can be difficult to identify. In nature conservation we have assumed that if we get these landscape scale processes right, communities and populations will be ok. This however has been more of a desperate hope than a principle supported by good science. Nevertheless, the last decade or so has seen this situation changing and although our understanding of species responses is still limited, a number of broad principles have emerged.

1. The reality of today's transformed landscapes is that ecological processes need to be managed to ensure biodiversity conservation. This is best achieved through a network of fire breaks and burning blocks.
2. The wide diversity of species inhabiting our grasslands require a broad range of burning conditions. These are best achieved by creating a patchwork mosaic of burnt and unburnt areas of different ages.
3. Soil formation, water retaining and carbon storing ecological processes all benefit from maximising the basal cover and root mass. Grasses dominate the biomass and the growth of the palatable grass species is typically promoted by frequent burning. This however needs to be offset by other concerns.
4. If you burn grasses too frequently (e.g. annually) you ultimately reduce their productivity. Similarly, there is good evidence to suggest that frequent burns homogenise the invertebrate and wild flower communities, leaving only the most fire tolerant species. Annual burning may seem unavoidable in some areas (e.g.

firebreaks), but often there are compromises that can achieve the same effect (e.g. burning a fire break on alternative sides of a fence between years).

5. If you burn grass too infrequently (>5yr fire return intervals) tufts become moribund, smothering themselves with their own leaves, so leading to decreased production, greater inter-tuft distances and thereby lower basal cover.

6. To reduce soil and water loss, the time between burning and the first spring rains should be kept to a minimum. This is often difficult to do in a timber production landscape where the emphasis falls on having manageable fires and reducing fuel loads as early in the season as possible. A more formidable network of fire breaks (i.e. wider breaks) and early morning or late afternoon to early evening burns make fires easier to contain.

7. The limited autumn burning that is required for meeting specific conservation needs (e.g. winter feed for oribi) is typically achieved by the fire break network, with no additional early season burning required.

8. Most of our grassland plant species have evolved with fire or have been filtered out with increasingly frequent burning over the last century. Within all plant and animal communities, however, there remain elements that cannot tolerate frequent fires and need some measure of fire protection (>10yr protection) to survive in the landscape (e.g. forests and fynbos). This is obviously difficult to achieve in a timber production landscape, but selecting the areas for protection based on features of the landscape (e.g. steep sided valleys) that create natural fire refugia improves your chances of success. The point to remember is that these refugia do not have to be big; they just have to be there.

9. While it is very tempting to use rivers as fire breaks, these are important features in the landscape and the vegetation on their banks is essential to their health. Therefore, whenever possible try not to burn out both banks of a stream.

10. Alien invader plants increase fire risk. Get rid of them!

Transcription

Thank you, Justin. Hello, everyone. I am the Ezemvelo KwaZulu-Natal Wildlife (EKZNW) Regional Ecologist, South in the Coast Region ; which means that I cover the terrestrial portion of the coast from the Mfolozi River down to the Mtumvuna River. I have also worked in the Midlands and the Berg and basically my job is to summarise science for managers; but not only managers within KZN Wildlife, anyone that is involved in nature conservation in the province. So what I am going to try and do here is to give you an overview of the type of advice that we provide to our managers and anyone that is interested in burning for biodiversity on their land. I have tried to reduce this down to a couple of basic principles which hopefully you can use.

The first principle (**Principle 1:** Fire is a natural ecosystem driver that is necessary to maintain biodiversity however, because we are no longer dealing with natural ecosystems, fire needs to be managed!) is obviously not a difficult concept to sell to the plantation forestry industry because you understand fire from bitter experience. Within our livestock industry, however, there are still people that think that fire needs to be excluded rather than used as a tool to manage the environemnt. This is quiet a scary thought because fire is a natural part of these ecosystems and one of the key drivers of biodiversity.

The ecosystems we deal with are unfortunately not in a natural state any more. They have been divided up into much smaller properties and subsequently fire management cannot be left to occur by natural means. Fire needs to be managed. So how do we do it? Well, the overriding principle (**Principle 2:** The fauna and flora of our rangelands represent a wide range of fire tolerance levels and habitat requirements. Heterogeneous burning regimes are recommended to meet these requirements. This is achieved through creating a patchwork mosaic of burnt and unburnt areas of different ages.) that we try and convey to managers is to create a patchwork mosaic of burnt and unburnt areas. We can debate for a long time what the natural fire regime would have been but we don't actually know the answer and, even if we did, we can't necessarily apply the answer in the transformed landscapes of today. So the solution for us is to look at how the fauna and flora and the ecosystems at large respond to different burning regimes, to what their living requirements are, and then to try and replicate these through our managements as best possible.

We don't want to manage for individual species because when you do, you realise that there is actually quite a wide range of conflicting of fire requirements. Instead, by creating a patchwork mosaic of burnt and unburnt areas we hope to achieve the range of conditions that are required to support the all of species we are dealing with. We also don't want to focus on individual species at the cost to the environment, and so what we try to do is to put the habitat first because we believe that if you maintain the habitat, the species will come with it. The main way of achieving that is by supporting ecosystem processes (**Principle 3:** Species need their habitat to survive and habitat health is directly linked to the maintenance of ecosystem processes [e.g. soil formation, water production, nutrient cycling and carbon storage]. So, whatever fire regime you choose to apply, it first and foremost has to support ecosystem processes. This is achieved by maintaining a cover of vegetation and its litter on the soil.). That simply boiled down is best achieved by maintaining a cover of vegetation and its associated litter on the ground. So how do we do that? It's what I like to call the Goldilocks principle because just like the little girl that didn't like her porridge too hot or too cold, she liked it just right, we don't want to burn too frequently or too infrequently in our range lands (**Principle 4:** Don’t burn too frequently! - Annual burning of rangeland is detrimental to biodiversity, productivity and ecosystem processes) [**Principle 5:** Don’t burn too infrequently! - Rangeland left for more than five years without fire begins to experience a shift in composition and structure.]

. Now I am particularly talking about natural grassland areas here and this is very relevant to the forestry industry because you are one of the largest landowners in the mesic grasslands, the high rainfall grasslands, and, as we saw in previous talks, there are considerable areas of natural grassland under your control.

So why don't we want to turn too frequently? Well, frequent burning does encourage better grass cover but if you burn annually you actually find that grass production declines. This is a well-known phenomenon within the livestock industry. You also tend to weed out all those species which are not able to tolerate frequent fires and so within the wildflower and the invertebrate communitiess you land up with a subset of the total biodiversity which can handle frequent burning. If you leave a grassland for too long (this is ecosystem dependent but not more than five years) it becomes moribund, the grass production again dies off because tillers get smothered. From the wildflower's perspective (wildflowers make up most of the plant diversity in these ecosystems) the accumulation of dead grass material prevents them from emerging from their winter dormancy and so the pollinators don't have access to the flowers and eventually those plants, despite them having large underground storage organs from which they can re-sprout, die off and are lost to the system. And I will get on to what that means a little later.

The next principle (**Principle 6:** Don't burn too early! - The longer the soil is exposed the more erosion and water loss occurs. Autumn burning reduces grass productivity.) [**Principle 7:** Don't burn too late! - Burning after the full onset of spring growth reduces sward productivity and results in undersirable shifts in composition.] is that once you have gotten your fire frequency right, you want to get your timing right. If you burn too early, you leave the soil exposed to the elements for long periods of time before the rains come or the temperatures warm up (whatever the growth cue is, depending on your environment) and the grass builds up to protect the soil. Vegetation cover protects the soil from run-off and wind erosion, and without it you lose your soil and ultimately degrade the environment. If you burn too late, you land up damaging many of the wildflowers which are in the middle of their flowering and, not to over-state this point, in a tenth of a hectare of grassland you are looking at between three to five wildflower species for every species of grass.

So when we talk about fire regimes we typically talk about the frequency, the season and then people tack on the intensity although this is often quite difficult to manage at a landscape scale. That really comes down to principle eight (**Principle 8:** Not all animals and plants can tolerate fire, some only survive by avoiding it. These species contribute to the overall biodiversity of the landscape. Fire refugia therefore make a critical contribution to biodiversity.) which is where I bring in the woody species. The grasslands are adapted to frequent fire and their floras can tolerate it - although they do prefer slightly longer burning regimes and annual burns. Woody species however, can't tolerate intense fires and it is particularly those fires where the flames get right up into the crowns and damage the apical buds of trees and shrubs that can kill them.

And so within your broader landscape there are a number of plants and animals which are not able to tolerate fire. They avoid it and they do so by living in out their lives in fire refugia, like this little forest patch (in the slide) that is limited to a cool moist valley that typically doesn't burn. These species are an important component of the overall diversity of these ecosystems and it is important that we maintain them within the landscape.

So where are we going with this and how do we apply this to management? The reality for forestry companies is that you grow timber to make money. Timber burns and you obviously want to avoid that. The starting point for any of our advice given by nature conservation is to get people to put in their boundary breaks. It is a legal requirement yet it's amazing how many landowners, particularly smaller landowners, do not do this and they are just opening themselves up to be liable if fires do pass from their property to a neighbouring one. Wherever possible these breaks should be put in as early as possible and in some areas they need to be maintained through the season because subsequent re-growth can carry fires across breaks and allow them to spread.

Breaks don't just stop at the property boundary and by dividing the property up you create a series of management blocks which you can then do control burns in. This that allows you to create your patchwork mosaic of burnt and unburnt areas.

Within each of these blocks we try and encourage people to start by looking at what the key environmental features are that need to be taken into account before you put in the fire. And so if you have a wattle crane nest there you may want to remove the eggs, or, if you have a power line, you may want to reduce the amount of fuel underneath it so that you don't burn out the cables, and to plan for this before you just drop the match.

Having identified the key features you want to make sure that the burns are structured such that you achieve a patchwork mosaic. So you don't want to burn blocks adjacent to each other to create extensive areas of burnt veld. You also don't want to burn very small areas that will encourage animals to pack onto them and overgraze them.

In general what we are aiming for is not to burn more than 50% of a property in any one year. When you are dealing with an extensive network of firebreaks this might seem really difficult. We heard that – I think it was Sappi is burning 40% of their property in firebreaks alone. In the uKhahlamba Drakensberg Park World Heritage Site EKZNW is annually burning between 8% and 10% of the mountains in firebreaks alone. One of the ways to achieve your burning targets is to realise that across your entire property there are portions that you need to set aside as fire refugia which then offsets that total percentage. Another way to do it is not to burn your firebreaks in the same place year after year. If you have the opportunity to burn on opposite sides of the fence, for example, it means that that fire break is actually receiving a biennial burn rather than an annual burn. There is also the opportunity, if you can't burn on the other side of the fence, to move your break a little bit inwards and then alternate between being against the fence or slightly in from it to give the veld a bit more of a rest.

We live in a landscape, particularly on the east coast, where arson is a reality. And a lot of our burning, particularly in our protected areas, is dictated by other people starting fires. Some of these we get to control, others run away and in EKZNW we try and build that into our management and adapt through the season as we go. One of the ways to try and

counter arson is to keep records and the bigger forestry companies, as we heard today, are already picking up trends in the arson fires. By recording where and when fires start, over time you build up a history of these unplanned burns, which then allows you to reconfigure your fire breaks and reallocate the blocks that you plan on burning in each season so that you can create a buffer to supplement your firebreak system in controlling run away burns.

And then, lastly, the reality for many of us is that some blocks are going to have to be sacrificed when it comes to burning too frequently. But these are often on the boundaries of your property and the challenge is to try and find core areas that you can offset this with by having slightly longer burning intervals in those areas where you can create that patchwork of burnt and unburnt areas to support the wider range of biodiversity. Thank you.

FIRE PREPAREDNESS

Edgar Redinger

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Edgar holds an Agricultural Management degree from the University of KwaZulu-Natal, Pietermaritzburg. He has been farming sugar cane and timber in the Dalton area of the Natal Midlands for the past 30 years. Due to a devastating fire in 1979 which destroyed large areas of plantations, sugar cane and taking a life, Edgar made fire control a priority in his farming practises. He has lectured on the subject of controlling cane fires at the South African Sugar Research Institute to students doing the Senior Certificate Course in Sugar Cane Agriculture for the past 20 years.

Abstract

1. Fire environment
2. Factors affecting rate of spread of fires, fuel, weather and topography
3. Fire breaks
4. Strategic harvesting
5. The use of Acacia mearnsii as a buffer
6. Early detection
7. Fire fighting equipment
8. Filling points
9. Incident command system
10. Wild fires

Transcription

Ladies and gentlemen, my core business is to produce sugar cane and raw timber materials which are supplied to local mills. Sugar and timber plantations on their own, are a fairly sterile environment. The wide variety of fauna and flora that my farms support can thus be accredited to the vital role that grasslands and wetlands play. Conservation areas fulfill two major roles. Firstly they provide the necessary habitat for natural fauna and flora and secondly they can be used very effectively in creating fire breaks to prevent the development of wild fires in the adjoining timber and sugar plantations.

My farms lie in an altitude range of 860m to 1060m. The typical land use layout is to have all the conservation areas in the valleys. As one moves up the slope i grow pine in the very cold areas. Pine is followed by eucalypts and then wattle. Sugar cane plantations take up the high ground which is least susceptible to frost.

In order to plan and prepare for the most dangerous part of the fire season in the natal midlands, ie june to october, one needs a very clear understanding of the fire environment. For combustion of fuel to take place, three factors have to work together namely heat fuel and oxygen. If any one of these factors is removed then combustion cannot take place. You have certainly realised that i am referring to the well known ‘fire triangle’

To prevent combustion, several options are available. To eliminate heat, pump water onto the fire. To remove fuel, prepare fire breaks . To cut off the oxygen supply, apply foam over the fuel.

Fire behaviour can be defined as the manner in which fuels ignite, flames develop and fire spreads. The three major components of the fire environment are the type of fuel that is burning, local topography and the current weather conditions. Let us briefly look at these components.

Fuel

If fuel moisture is high – no fire. Fuel moisture is low – fire burns readily. Allow me to introduce you to the concept of time lag fuel categories. Fuels are divided into several size categories. These size categories correspond to the time taken for fuel to reach equilibrium or fuel moisture content that would be relative to the surrounding environment. Fuel time lag categories respond to their surrounding environment, namely relative humidity and temperature. The rate at which a particular fuel is able to do this is dependant on its size.

Time lag fuel categories

1 hr time lag fuels = 0 – 6mm in diameter. Fine fuel

10hr time lag fuel = 6 – 25mm in diameter. Light fuel

100hr time lag fuel = 25 – 75mm in diameter. Medium fuel

1000hr time lag fuel = 75 – 200mm in diameter. Heavy fuel

Fine fuels are a fire fighters biggest headache. It is the fine fuels that burn most readily. Examples of these are cane leaves and trash, grasses, reeds, pine needles, twigs and similarly other timber species leaves and small branches.

Topography

Fire spread is more rapid up a slope compared to a fire burning on level ground or down a slope.

Weather

High temperature combined with low relative humidity and strong winds cause high fire danger. Thunderstorms often cause lightening strikes in plantations resulting in fires. Hot dry berg winds are a major problem to us in the fire season

Fire breaks. Tracer belts in grassland areas are sprayed with gramoxone and allowed to dry for two weeks. These tracer belts are then burnt while the surrounding grass is still green. I do not use glyphosate to spray tracer belts as it kills the grass roots and leads to soil erosion. Bear in mind that you spray a perimeter tracer belt for a block burn or a double tracer belt for creating a fire break after the frost has killed off the grass between the tracer belts. Hoed or other mechanically prepared breaks are created between may and the end of july. If there are early frosts or a particularly large fuel load within a given season then fire breaks must if possible be completed as early as the end of june.

Strategic harvesting is a concept that is commonly used in sugar farming where cane panels are identified and harvested early in the milling season, before the start of the main fire season, to create open fronts at many different locations on the farm. While on the subject of fire breaks, acacia mearnsii that is planted and kept clean forms one of the best fire breaks available in forestry. A good plantation road network with intervals inside compartments of not more than 60m apart allows for highly improved access and quick suppression of fires.

Fire lookouts

The early detection of fires remains one of the critical factors to allow a quick response and suppression of fires while they are still small. The use of surveillance camera systems is gaining popularity . Fire watch towers remain important and security patrols especially at night are of great help. Good labour and neighbour relations especially on tribal trust boundaries are very important to win over the support of the local community to report fires on both sides of the common boundary.

Fire fighting equipment

Fire fighting vehicles can be divided into three main categories.

1. Light rapid attack vehicles such as bakkie units

2. Main attack truck fire tenders and tractor drawn rigs

3. Mother tankers

My own equipment falling into the initial attack category, consists of a toyota landcruiser 4x4 with a 600l tank.

The main attack fire tenders consist of 2 mecedes benz 4x4 fire tenders. The first carrying 6500l and the second 5oo0l. Special attention has been paid to design the operation of these two trucks around the driver. In most instances the trucks can be used to extinguish fires single handedly.

In this category there are also 3 tractor drawn tankers totalling another 11500l. To support the main attack tankers there are two tractor drawn mother tankers totalling 15100l. This gives a total of 38700l on wheels. I use 450m of 25mm fire hose with geka couplers and 150m of 38mm lay flat hose with 65mm instantaneous couplers. We carry a wide range of nozzles including foam generating branches. Knapsacks and mist blowers are also used for low intensity veld and forest fires and for burning fire breaks.

Filling points

Water filling points are positioned strategically at various easily accessible places on the farm. When tankers run out of water during a fire fight it is essential to get them filled and brought back into action as quickly as possible.

Fire management

The american developed incident command system is my management system of choice for controlling fires. It covers the following functions: planning, logistics, operations, administration and finance. The beauty of this system, is that you can keep it very simple at small fires, or develop it to cater for complex management demands at large fires.

Fighting wild fires

To bring wild fires under control one has two main options, namely a direct attack or indirect attack. The direct attack consists of starting to extinguish the fire from an anchor point on the rear of the fire line and working forward along

both the left and right flanks and closing up on the head of the fire. The indirect attack consists of focussing on back burns in which you burn fuel ahead of the main fire and its flanks to create a burnt fire break ahead of the wild fire to starve it of fuel. The major challenge here is to keep the back burn under control. If control is lost one is normally faced with a much longer fire line to extinguish and the possibility of creating multiple heads.

DISCUSSION: FIRE

Transcription

MR J DU TOIT So I suppose you have your fire-fighting gear and then if someone sets a fire it's also important to have your arson gear. Sorry, that was actually a dreadful joke.

I am going to now open the floor to questions. So from our introductory talk to the talk on fire preparedness and everyone in between, questions? Are there any questions around? As I said, just so that we can keep a record of what is going on, you can just speak into the microphone.

UNIDENTIFIED VOICE First question is just to Ben. In terms of the fire risk management, have you done a test or an evaluation just to test how accurate your risk assessments have been? So when the fires have gone through for a season, do you go back to the risk assessments and see whether there was a relevant level of accuracy and the investment to resource was correct? Or do you need to go back and improve upon the models or the calculations or the mapping that you have been doing or the assumptions you have made so you can improve the risk assessment methodology along the way?

MR B POTGIETER Our experience is – we are only busy with this process now for the second year – it is fairly accurate but every year you go back and you revisit. Sometimes it takes you five years to remove a risk – to treat a risk. But, ja, we go back and it's fairly accurate.

UNIDENTIFIED VOICE My question is also for Ben. We just had a talk by the private timber sector. Is there any chance of rolling that model out to members of NCT and other smaller operators who don't have the resources of a major timber company?

MR B DU TOIT As Sappi we will have to share that with the rest of the industry because if you manage your risks, we also are safer. So any time, through the FBAs, that is the vehicle. So on the FBA level and … [indistinct] levels we can arrange for that.

MR J DU TOIT Any further questions?

UNIDENTIFIED VOICE Just a question for Craig Norris who – I think it was who showed us a timber grower who divided a patch of grassland into quarters and had a variable sort of burning policy. What was the reason for that system?

MR C NORRIS I think the main reason was to try and create a variety of habitats. You know the early burn we certainly wouldn't agree with. I think from our point of view we would rather see that grassland divided in half and just rotational burning, burning half one year and leaving the other half. But you know it's quite difficult when a chap is very enthusiastic and believes in a particular system, to tell him that maybe it's not the best system. But certainly within our best management practices in our certification meantime system, we recommend alternate burning, dividing those sort of camps into two halves and doing alternate burning. But we are also open to suggestions. Certainly on the environmental side we have got a lot of learn. So we are hoping out of this workshop, this two-day symposium, we will learn a lot.

MR S GERMISHUIZEN I have got a question for Willem Olivier. I was interested in this idea that possibly contracting out operations could be responsible for a reduction in fire protection or an increase in fires. Is there any way of testing this? In other words comparing smaller growers that don't use contractors, their fire frequency with large companies that use contractors. Has that been done and can we do that?

And the second question is what aspects of the contract of fire protection is not working? Are contractors not responding quick enough? What reason are they not as effective as private operations in controlling fires?

MR J DU TOIT Can the speakers just come up all to the front I think?

MR W OLIVIER Ja, two answers. The one is a quick one and the other one is a long one. The quick one is I don't know. And the long one is the following – I don't think we have got enough knowledge of what's really happening out there but let me use the Piet Retief area as an example. I have been involved in the Piet Retief area for quite a while now. If you look at the fires in the Piet Retief area say for the last ten years, it's not really with the small farmers; it is with the big companies. It's unknown – if I can go a little bit to the north – the big fires in the Sabie area, Sabie being the more safe areas or less severe areas. Piggs Peak had been there, Peak Timbers have been there since 1948. they had a fire of 18 000 hectares, virtually the whole place burnt down. Usutu last year had 22 000 hectares. They have been there since 1949.

If you look at the Piet Retief area itself, the big companies had the big fires and the small guys had the small fires. I think the reason is the farmer on the property knows his farm, he knows his labour, he knows the situation and he has got ownership. The big companies, they don't have that. And I just want to qualify again, nothing against the foresters, nothing against the contractors.

In the Piet Retief area, for example, one that I know personally, the contractor arrived at the big fire, he opened up the map and he looked at the map and he had to find himself on the map. The company foresters were not present. So

the contractor looked at the map and he tried to find himself, then decide the strategy how to fight the fire. And, as it was said, under difficult conditions once the fire starts and you don't kill it immediately, that is it. Then you have a big fire.

I did not allude to it but why do we have on average smaller fires but we have more fires? I think what is happening, and I think, I think it's fires that started in the past where it was immediately killed and it's not reportable. Now we have the fires starting up and if I must cover an area of 15 000 hectares or so, you get to fires much later and the fire actually becomes reportable. I don't think we have got more fires; I think we have got more reportable fires. What was the second question?

MR S GERMISHUIZEN I was wondering if this could be tested simply. I mean how many fires occur on small grower land or people that aren't using contractor services for fire control versus the contractors, and then finding out what are the issues with contractors fighting fires.

MR W OLIVIER I have said that. You know I spoke to Tiaan Poole and I said to him maybe a type of an M thesis, someone just to focus on why do you we have the situation that we have now. These are the things I think we must try and find out.

UNIDENTIFIED VOICE This is more of a comment, a friend of mine who has just finished her Masters in looking at big fires in the Western Cape and she was interested in the synoptic – the weather patterns. A number of people have shown that the fire danger indices – the number of days with high FDI conditions hasn't increased but the synoptic conditions associated with big fires has. And she certainly has shown that for the fynbos for the Western Cape and I am pretty sure that it's happening here. So it's not just independent days but it's the build-up to those days you need the long conditions of drought, etcetera, etcetera. So it's not just the high FDI days but it's everything else as well.

UNIDENTIFIED VOICE Just a question to Roger Uys – do we really know what the effect of the early winter burning regime that we employ in forestry, what that is on biodiversity? Is it positive, is it necessary, negative, do we know? Are we going to find out later during the symposium?

DR R UYS In general, the specific effects of burning are poorly understood at the species level, particularly for the key elements that make up biodiversity, namely the wildflowers and our grasslands and our invertebrate faunas. We have a very good understanding of the impacts that different seasons of burn have on grasses and particularly the frequencies, but the broader biodiversity, there are still many gaps in our understanding.

UNIDENTIFIED VOICE I would like to pose my question to Ben, where he made comparison in the causes of fire between this area and Zululand whereby he was saying communities are the causes of fire, 80% around here and lesser in Zululand, whilst you said that only 9%, if I can remember correctly, that is caused by the social issues. And I wonder if you can distinguish between the community issues and the social issues because I can't believe that you can have 80% of the fires caused by the communities whilst you have only 9% social issues, unless really you can distinguish between the two.

MR B POTGIETER I didn't show you the detail for the social issues but mostly like grazing where they burn outside for grazing or where they collect firewood or they hunt for bees. That's very little compared to 80% in this area, community-related problems. It's also about arson fires. You can see all our cases that we reported to the police station are arson fires. And you know what's real issue in specifically Severn area is about land claims. It's directly related to it. You still remember my other table, Braemar D Block. If you analyse it further you will see D Block is associated with that community who have claimed that land. So the frequency of fires definitely that 80% is about directly conflict with the community and the company or other issues. Did I answer your question in full? [no audible reply]

UNIDENTIFIED VOICE My question is directed to Craig, NCT. Well, honey hunting is one of the causes of fires and as for NCT the growers are the communities I believe and I am just wondering if you do experience fires from bee hunting. Since they are the owners they can't just leave fires after hunting the bees just like that. Do you experience any fires from bee hunting.

MR C NORRIS Certainly. You know we have got such a diversity of members from people living in communal land to large commercial farmers but certainly on the larger commercial farms bee hunting, honey hunting is a big problem. It's a big problem with fire starting, usually unintentional. Someone robs the hive and it might be a few days later, wind picks up, orange conditions and it turns into a major fire. But on the commercial farms it's a big problem.

UNIDENTIFIED VOICE Just more comments. I think on what Willem was saying about fires getting bigger, I think part and parcel of the problem from when companies had our own ops, they had villages, they had a lot of people living in those villages. So their ability to source a lot of labour quickly was a lot easier than it is today. And I think that is one of the things from the contracting scenario where you have only basically got your proto teams available and to a sense it's probably not planning ahead for in case of trying to get more people available for that.

Secondly, just a comment which we found very helpful in our area is that the motto for our fire protection is that any fire is your fire. So if you are driving down the road and you see a fire, you don't phone the relevant forester or try and get hold of the company, you react to that fire yourself as if it's your own fire. And that has changed the size of our fires quite significantly because even the farmer next door is getting to the fire before the forestry company is getting to the fire and putting that fire out. And I think it's a case of a mindset change that any fire should be put out by whoever is closes as quickly as possible.

UNIDENTIFIED VOICE This is a question I think almost for everybody that has spoken but perhaps Craig might be somebody who could answer it. And it's also sort of in response to both Roger and Craig's talks about your fire management patterns, if you like, on a relatively small farm. And that is that at the scale of a whole district it starts to make sense. Now do fire protection associations manage all of their membership as one? Or can they? Do you think it's

feasible for fire protection associations to start managing their areas as one because then the scale becomes very different, the scale of the veld that you burn? Roger's concerns about biodiversity start to become manageable because on a 300 hectare property burning a patch mosaic doesn't really make sense, but on 300 000 hectares with a number of different members, it does start to make sense.

MR C NORRIS I think Edgar might be the right person to answer this one. He is very involved in the local FBA but certainly that's the way people should organise themselves. Amongst our membership base in the areas where we have a lot of commercial farmers operating, they work very well together. It's often not a formal organised association but certainly they work together in all respects. But I think, Edgar, maybe you can comment on this question.

MR E REDINGER To that question, ladies and gentlemen, I believe that to know your ground well is probably one of the big tricks in being efficient and extinguishing fires. Now if we are going to deal with a huge area where you are dealing virtually with an entire district or even more or two districts, we might have common purpose in preparing large scale buffer zones, but what I am scared of is that we are still allowing that fire to gather momentum and it will get going. Once it has done that, you have lost the plot. You have got to stop that thing in double quick time. It's good to have those large-scale plans.

And the other thing that we haven't really heard about in detail is why haven't we spoken more about using acacia mearnsii as a natural barrier? Maybe can answer that for me. Thanks.

MR J DU TOIT Thanks, Ed. Roger?

DR R UYS Alan, just to follow up on your question about size, what I was trying to get across with my talk is that there are principles about how we burn for biodiversity. Whether you are doing it on a 300 or a 3 000 hectare property, the principles remain the same that whether it's operating at an individual scale or at a landscape scale, we still need to retain fire refugia. So if a property has a forest on it that needs to be protected up front and fire breaks need to be put around it, if it's going to be threatened, and ideally burning should be started at the forest margin and done away.

Even a 300 hectare property can be divided in half and, rather than burn out the entire property every year, alternate between blocks. If everyone does that at a landscape scale you will still achieve your patch mosaic of burnt and unburnt areas and that will piece by piece contribute towards maintaining the broader biodiversity.

MR J DU TOIT Thanks, Roger. Ben has something to add to that.

MR B POTGIETER I think it's a very important question this, because to be effective in an area you must have regional plans and the vehicle FBA is the right body to coordinate plans like this, as we have started this year in the Richmond area and there are a few guys from that area and it's worked very effectively. There is one big plan for Richmond, 100 000 hectares. There is the FBA of Richmond. He can actually give you more detail. But, ja, I think that is the ideal and in the next year we will try to establish a technical committee or operational committee on the umbrella level so that we start rolling out this principle, the cross boundaries, so that we are more effective in the fire prevention strategies.

UNIDENTIFIED VOICE Mine is not necessarily a question but a submission relating to the Sappi ones. I happened to conduct a fire awareness in Mpumalanga areas wherein I had small scale farmers where they mentioned issues relating to the lack of integrated farm management where they said they wanted to do prescribed burning on their farm and they were looking for a Sappi representative and they didn't find any. They end up burning without one and I see that might cause a problem.

Number two, relating to the contractors – in one other case I was doing another fire awareness and I wanted to check what were the causes. They seemed not to know what were the causes but the employees end up saying, "Once we respond to fires we are paid well in terms of hours. So if there is any fire burning we would make sure it goes on and on so that we are paid well." I thank you.

UNIDENTIFIED VOICE My question is to Ben. I just want to find out – I am a bit concerned that the fire rating index is not picking up the changes in global warming. Maybe if the fire danger index needs to be revised, the parameters that determine the rating of the fire danger index – what are the factors?

DR B POTGIETER Gerhard, you mean the FBI index? It should actually automatically incorporate that but the trends should show us then there are more orange days. That is my interpretation and we actually do not experience that at the moment. How else are we going to incorporate the global warming into that system?

UNIDENTIFIED VOICE There was a statement made that the changes in temperature where some of the talks were saying that even though the fire index was not showing any serious changes, there is an increase in fires. And I am just saying that maybe the way that we are sort of rating the fire danger index is there are some factors that we are missing.

DR B POTGIETER I think the big factor that I would like to see there is fuel moisture content. I think that is the big issue that we must – in predicting fire behaviour – we do not measure in South Africa fuel moisture content. And if you can have five days with what hot winds and sun and you dry out, dry out and dry out and suddenly there is a fire, that's where we create problems. Or you can get regular showers so your fuel moisture content stays higher so your fire behaves totally different. It's a very complex issue. I also would like to see that we are more proactive in that. I don't have the right answer for you.

UNIDENTIFIED VOICE Thank you. Ben I can probably help you a little bit. We have to one factor that we are not taking into account and that's drought factor as in a long-term drought factor. It obviously comes in with fuel moisture content but like for example now we are on the back of a third year drought cycle. That has made a massive impact on

the last two years and will still affect us further on, even if we get a wet cycle let's say next year, which we all hope for, we don't take that into cognisance that we are just to incredibly dry and the water table is right down. I think that's one thing we have to get in.

UNIDENTIFIED VOICE I have a question for Andrew and it's something that I have had a long-standing debate with. You showed very conclusively and clearly that you get spotting from bark and leaves and so on. Do you know if you get spotting in grasslands from grass?

DR A SULLIVAN The occurrence of spotting in grass is pretty much limited to seed heads but also, in areas where there has been grazing, in dung. But the distance that these things can travel is very much less than bark as a firebrand because bark has much better flight characteristics and can travel much further. And in conjunction width the intensities of forest fires they can be lofted to greater heights and therefore travel much further as well. So, yes, spotting does occur but it's only a very short distance, but it will enable fire to cross a road. Things like that.

MR J DU TOIT Okay, I think we are up to our last question.

UNIDENTIFIED VOICE Talking about spotting from grass fires, I had a case where lightning strike in the middle of a paddock, burnt and with a howling north wind, that grass spotted into the adjacent pine plantation about 300 or 400 metres away from the boundary which was – and the fire from which that spark came was at that stage about 100 metres away from the boundary on the fire side. So that spotting went at least 400 metres.

MR J DU TOIT Right. Thank you all. We are going to have lunch and also look at Ed's demonstration. I would like to say thank you to all the speakers, Andrew and then the follow-up speakers as well, for setting a wonderful field in terms of fire and we are going to take it forward from there into all sorts of other regions. Thank you all for that.

SESSION TWO: BIODIVERSITY

INTRODUCTION

Chaired by Brent Corcoran

Transcription

My name is Brent Corcoran. I am WWF's grasslands projects leader. I oversee WWF's grasslands projects work mainly up in Northern KwaZulu-Natal and in Southern Mpumalanga. But we are also involved in various national and regional level policy work Ezemvelo KZN Wildlife and Mpumalanga Tourism and Parks Agency. We are mainly an implementing partner as well in SANBI's grasslands programme and provide support to Steve Germishuizen and the forestry task team in mainstreaming grasslands into the forestry sector.

So good afternoon and welcome to the afternoon session on biodiversity. Moving into session 2, I trust everybody had a good lunch. I also trust that we will not have heavy eyes and people will be able to stay awake for this session. So we are going to have to rely on the speakers to keep us going but it's good to have everybody with us.

This afternoon's session is on biodiversity. We have had one presentation earlier already directly on biodiversity and Dr Roger Uys did a great job in painting the picture of some of the management requirements for biodiversity and what is practical to do and where it's practical to do that. Going into this afternoon's session we get an opportunity to go into a bit more detail on biodiversity and then back tomorrow again we may go out a bit broader and zoom out a bit broader again, go into vegetation dynamics and various other aspects of grasslands, the biodiversity component, ecosystems services work and trying to make it work within the plantation landscape. So without further ado, I am going to introduce Professor Dr Tim O'Connor. Tim is the research head of the SAEON initiative and Tim is going to be talking to us on biodiversity in timber grasslands.

KEYNOTE ADDRESS: BIODIVERSITY IN TIMBER GRASSLANDS

Tim O'Connor

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Prof Tim O'Connor is an observation science specialist at the South African Environmental Observation Network and an Honorary staff member in the School of Animal, Plant and Environmental Sciences at the University of the Witwatersrand. His extensively-cited research papers have focused mainly on the ecology of savannas, shrublands, and grasslands, plant/ungulate interactions, and the influence of rainfall variability in rangeland dynamics. Recent research has focused on the influence of land-use on phytomass and on biodiversity integrity in moist grasslands in South Africa.

Abstract

Assessing the impact of a land use on biodiversity comprises four main elements. First, biodiversity integrity is the only valid basis; general diversity indices are eschewed. Second, impact of a land use on grassland biodiversity integrity of grassland is assessed using the spatial unit of transformation, a property. The “vegetation landscape” of a property is formulated to consist of three main components, namely matrix, island and linear, that are affected differently by land use. The “animal landscape” is similar for more sedentary taxa but has to accommodate scale-related (dependent on body size and mobility) ecology. Third, a land use has direct, on-site and indirect, off-site effects on biodiversity. Impact of a land use therefore requires a landscape context. Fourth, use of biodiversity integrity emphasizes not only impact on habitat and species but also impact on landscape structure and ecosystem functioning. For impact of afforestation on vegetation, the grassland matrix experiences the greatest direct impact; linear drainage components experience a conspicuous indirect impact, whereas persistence of island units of rocky outcrops and wetlands are possibly least impacted owing to effective plant dispersal. Animal organisms further experience increasing dysfunctionality in relation to their spatial scale of operation. The importance of landscape or regional context is highlighted by the constraints posed by afforestation on the redistribution of species and communities in response to climate change. Empirical assessment of this approach is wanting for most except hydrological functioning and some selected animal taxa.

VELD CONDITION ASSESSMENTS AND HERB DIVERSITY IN HIGH CONSERVATION VALUE GRASSLANDS

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Mrs Peta Hardy is an Environmental Manager for Sappi's plantations in Mpumalanga and for Sappi Usutu in Swaziland. She has an MSc in Botany from the University of Cape Town and has spent a number of years managing an environmental monitoring programme for unplanted open areas on Sappi plantations. She has developed a keen interest in forb diversity in Highveld grasslands and how it relates to the natural environment and veld condition.

Abstract

Forest certification requires that important conservation areas are monitored on a regular basis to determine species composition and enable appropriate management to be implemented. Subjective judgement has been used to identify important grassland areas. Criteria used include size, past management history, management observations on floral diversity and actual observations on the presence of red data plant species, and the absence of obvious signs of disturbance.

Veld condition assessments have traditionally been used to evaluate grassland condition and determine management recommendations for forage production, with little attention given to the herbaceous component of grasslands. In forestry areas, forage production is not necessarily the primary aim for conserving grasslands. In this study, the herb species composition of grasslands in Mpumalanga and Swaziland have been assessed in relation to the environmental factors of underlying geology and altitude. The Mpumalanga data-set has also been compared to the veld condition of the grass component. Veld condition scores were not based entirely on forage production characteristics, and included reference to species desirable for catchment management potential and species diversity.

In both the Swaziland Highveld and in grasslands of Mpumalanga there were significant differences in herb species composition on different geologies. In both studies, however, there was great variability within sites located on the same geology. In both study areas, there was a highly significant correlation between herb species composition and altitude. In Mpumalanga, no significant relationship was noted between the number of grass and herb species recorded per plot and the veld condition scores. Some sites having a high species diversity had relatively moderate veld condition scores and some sites having low veld condition scores were relatively species rich.

There was a significant change in herb species composition along a veld condition gradient. Herb composition was similar on most good sites but appeared to diverge as veld condition deteriorated. This divergence could be related to altitude. Thus herbs present in degraded sites differed between high and low altitude.

Veld condition assessments remain an important tool for determining trends in grass species composition and for managing fuel-load. Decisions relating to diversity management must however be made in conjunction with a more detailed floristic survey, taking into account herb species composition. Underlying geology can be used as a guide to determine areas that may be more species rich than others, but this should not be used exclusively to determine important areas for conservation.

Transcription

First of all I would like to acknowledge the assistance of the following people: Mr Francois de Wet who is a grasslands specialist. He has helped me over many years carry out the veld condition assessments. Secondly, Dr Ara Manadjem from Uniswa in Swaziland. He set me on the road to analysing the data that I have collected. And Mr Craig Morris from the ARC gave of his time and expertise to help analyse the data. This is many years of data that I have collected and it was considered a sin not to actually do anything with it. So I have finally managed to put some perspective on all the work that has been undertaken over the years.

To give you a bit of background: what I am going to talk about is two data sets,. The first data set was collected in the mid-1990s in the Swaziland Highveld. When I worked there I noticed that each spring some firebreaks were awash with flowers and others were not. So I set about compiling species lists of the herbs on the different firebreaks.

The second set of data was compiled on Sappi plantations in Mpumalanga where I have worked for the last ten years. The primary aim was to determine the veld condition for veld management purposes. But at the same time that Francois de Wet was collecting the veld condition data, I collected herb species information that were present in the area.

To put into perspective: a map of the location of sites, the blue areas are Sappi properties and they extend from Piet Retief here down in the south right up to Graskop up in the north. On the western highveld of Swaziland is Sappi Usutu where I originally collected the first set of data.

In the first session we heard several speakers talking about fire management in timber plantations and traditionally the terms firebreaks, fire protection measures, are the first things that come to mind when you think of open areas within plantations. But there is also a very common perception that all grassland areas on forestry estates are planted up. This was alluded to by Tim O Connor when referring to the northern Richards Bay area. This is not actually true. In

Mpumalanga, of the total area owned, there is approximately 37% which is unplanted and of that 37% is covered by grasslands. So there is a significant amount of grassland that is left unplanted on forestry land.

Another reason for taking a closer look at grassland relates to forest certification. There are at least three principles within the ten principles that refer to responsible environmental management. Principle nine refers to high conservation value forests and within Sappi, we extended that concept by not limiting it to forests but also including other conservation areas such as grasslands.

So what makes one grassland area more important than others? Obviously they are all important but some are more important than others. When trying to identify what was important to be managed on a rigorous basis, we used the following criteria: size, disturbance, weeds and the presence of red data species.

From the above I am not suggesting that small areas are not important. However, if a forester needs to prioritise the allocation of resources, we felt that we needed to rank areas and furthermore, there might be some special management requirements for red data species that need to be taken into account.

In Sappi Mpumalanga we have identified approximately 30 areas that we consider to be very important. I would like to show you some of these examples. In the Highveld in the Lothair district we have these large grassland areas. This is more of a moist grassland. In the Badplaas Highveld area we have areas which were previously natural heritage sites that have been left unplanted. And near Barberton we have a number of sites that are very extensive grassland areas.

In the Highveld of Mpumalanga near Lydenburg we have extensive grasslands on the Helvetia plantation and on Elandshoogte. Near the N4 we have a very large area. On Sappi Usutu there were 16 firebreaks which totalled 850 hectares which are also considered to be important areas.

I have now given you an idea of the habitats available for monitoring and why it's necessary to do it. I am now going into the second stage of my talk which will deal with the results and conclusions of the data that I have collected over the years.

Firstly the methodology. One of the reasons why I didn't really look at the data earlier on was that I was feeling that it wasn't collected in a rigorous scientific manner – the herb data that is. What we did was I looked at presence/absence of species. I spent approximately one hour collecting data and I covered more or less 100 square metres. I did not use a fixed plot approach.

The grass data collection was more conventional. We did 100 point transect methods, quantitative data, and we did a fuel load assessment.

When undertaking the data analysis, we looked at a number of different ways of interpreting the species information that we collected. For the Usutu herb data, first of all we took the three sites that were located on the three dominant geological substrates. In the Highveld of Swaziland it's mostly gabbro, granite and gneisses. Gneisses are generally in your lower altitude areas. And we found that overall, there were highly significant differences in herb species composition between the different geological substrates. So, for example, the gabbros and the granites were very different, and so were the gabbros and the gneisses, but there was no difference between the granites and the gneisses.

In general, we found that there was a relationship between species composition and underlying geology, but when we looked at species richness, there was great variability within those three sites. So we could not say for certain that there were differences between the geologies. There were differences in species composition but you couldn't predict with certainty that they would be different all the time.

If we look at the Mpumalanga data set, we find that herb composition on different substrates differed significantly. Those sites located on granites were different from all the rest and this was also shown by the cluster analysis.

Again the same trend as with the Usutu data: there was significant variability within sites on the same geology. Thus a similar pattern emerged from the two different data sets.

When we looked at grass species richness ie the number of grass species, and compared how many grass species we got at a site with how many herb species, we found that there was no significant relationship between the diversity at the same site. I was a bit surprised at this because we felt intuitively that if there were a high grass species number we would also find a high herb species number. There was this trend but it wasn't statistically significant.

We looked at total species present against the veld condition score produced from the veld condition analysis. The statistics showed a no significant relationship between the number of species and veld condition score. Before continuing, it's worthwhile discussing how we determined the veld condition score. We used a model called ISPD. This is used as a management tool. Our main aim for doing veld condition monitoring is to determine trends from one year to the next, to determine whether veld condition is improving or declining. This graph shows a linear relationship but actually you want to be in the central B region which is well managed. If you go into over-rested condition, you are not in a good situation.

The over-rested condition is where quite a few of our Sappi plantation grasslands lie. We are in favour of burning the grasslands more often in order to reduce the fuel load and improve the condition of the veld. So the veld condition score is related to a succession of gradients along the X axis.

Finally, we did an interesting analysis, assessing changes in herb composition – Craig analysed the data, looking at a compositional gradient from good to poor, using the veld condition scores. And what we found was that there was a significant change in herb composition along this gradient and a very strong correlation between the veld condition scores and the herb species composition.

So this tells us that the veld condition at good sites was relatively similar, but when veld condition deteriorates, it changes in composition and this varies at high altitudes and low altitudes. So there was an interesting pattern emerging with change in veld condition.

To sum up: both studies showed that there was a clear relationship between underlying geology, altitude and herb species composition. That might be common sense but it has been supported by the data analysis undertaken. There wasn't any significant relationship between grass species and herb species richness at the same site and there was also no significant relationship between total species and veld condition scores. The last point to be made is that veld in poor condition has a different suite of species to good veld.

In conclusion, the importance of using veld condition as a tool to predict species diversity needs to be explored further; the data presented here represents the start of a number of ways in which we can explore diversity issues within the grasslands. Thank you very much.

DISTURBANCE AND DIVERSITY - AN ANALYSIS OF GRASSLAND DEGRADATION IN A TREE FARMING REGION

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Rob Scott-Shaw is a Principal Nature Conservation Scientist with KZN Wildlife and curator of the Killick Herbarium in Pietermaritzburg. A well-known taxonomist with extensive knowledge of local flora, he is one of the few ecologists studying the impact of disturbance (fire, but particularly grazing) on the plant species diversity of grasslands in South Africa. A key research focus area is attempting to link traditional assessment of rangeland condition to diversity, and identifying key indicator forb species to use in biodiversity assessments. He is the author of the book Rare and Threatened Plants, and contributed the book The Vegetation of South Africa, Lesotho and Swaziland.

Abstract

It is widely accepted that the moist grasslands of South Africa's east coast have evolved in an environment of seasonal irregular defoliation caused by grazing and fire. Most of the grasslands remaining in the patchwork pattern of transformed areas are subjected to extremes of these two forms of disturbance. As timber estate managers, extension officers, or rangeland ecologists, we need to recognize when grasslands show signs of degradation. In other words ecosystem integrity needs to be monitored and remedial action identified. This paper provides an overview of plant diversity studies in this region with a focus on the impact of cattle grazing and potential ecological indicators.

WHAT DO BIRDS TELL US ABOUT GRASSLAND MANAGEMENT ON TIMBER PLANTATIONS?

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Dr. David Everard is the Divisional Environmental Manager for Sappi Forests. He has also been appointed as a member of the Sappi Group Sustainable Development Council which is responsible for providing leadership in setting policy and objectives on sustainable development for Sappi as a group. Before joining Sappi in 1998 he was a Business Area Manager at the CSIR where he studied ecological processes in terrestrial ecosystems, with the aim of implementing sustainable management systems. David Everard is also an associate editor of Southern Forests, a Journal of Forest Science.

Abstract

Over a ten year period (1997 -2006) Sappi Forest's held an annual week-end birding event on many of its estates. During this week-end teams of bird watchers were invited to record the bird species they sited on the estates. Typically, between 60 and 70 teams of 3 to 4 people were hosted on about 20 different estates every year. The data collected shows that timber estates have a remarkably high diversity of bird species, with over 450 species having been recorded. Analysis of the habitat preferences of the recorded species show that many species that are restricted to specific habitats are still found on the estates. For example, of the 202 bird species that are regarded as specifically grassland species in South Africa, 129 or 64% have been recorded on Sappi timber estates. This result emphasizes the importance of conserving patches of grassland and other habitats in transformed landscapes such as timber lands, and also shows that managing to maintain these habitats in a healthy state does significantly contribute to the conservation of birds in South Africa.

Transcription

Good afternoon, everybody. Time is short so I will whip through this presentation. Let's start.

The first thing we need to look at is: we are converting landscapes that might look something like this (see picture) to landscapes that look like that (see picture). And I think Professor O'Connor made it quite clear, we must impact

biodiversity. I think it is really important for this meeting to come out with a clear understanding of what our objectives are when we talk about mainstreaming biodiversity into the timber industry.

Are we trying to conserve biodiversity integrity that was in a grassland type of landscape in a landscape that is now dominated by plantations, which I think is what Professor O'Connor was saying. We have a big impact and having a few fork-tailed drongos and golden breasted buntings is not really biodiversity. We want the grassland species. If that is what we are trying to achieve, I don't think we are going to get there. So we really need to be quite clear on what we are trying to achieve. My view is that we are trying to achieve biodiversity conservation in a converted or transformed landscape? There is a lot we can do and a lot of improvements one can do in a landscape like that but I don't think – if our objective is to maintain biodiversity integrity of a grassland, that we are going to succeed. I know you probably didn't mean it to that degree but it is an important when talking about mainstreaming – that we really understand what our objectives are.

Conversion of landscapes dominated by grasslands or trees must have an impact. How much actual information do we have. I had a look at bird information and there is very little published data on the impact this kind of conversion has had on bird species richness and bird diversity. There was a publication in 1997, and one of the authors is here, where they had a look at the South African bird atlasing project data from the first round where they assessed bird diversity in quarter degree squares that were afforested and tried to compare them with 40 degree squares that were not afforested, but in similar types of landscape. In this analysis they created four lists of species, a list of grassland and marshland birds, and then from that list, a subset of globally threatened species, near threatened species and then they also developed a list of birds that they thought would be benefited by forestry. They concluded, after having a look at those lists and then looking at how often they were recorded in the different quarter degree squares from that 90 species were less often recorded in afforested areas and 60 species were more commonly recorded. And they also found that more threatened species were detrimentally impacted by afforestation than not. So their conclusion is that afforestation has an impact on biodiversity.

In Sappi over a 10 year period we had an event where we invited teams of birdwatchers onto our plantations for a weekend. They were asked to record all the bird species they could during that weekend on a particular plantation. Through this process, I think we have built up quite a comprehensive list of bird species that are recorded on our plantations.

This data was interrogated. Overall if we just look at the total list of bird species recorded on plantation estates it comes to 453 species. That is just about half the species that you can record in the whole country, which is incredibly high. I mean it's astoundingly high when you think about the percentage of land under ownership of Sappi.

What is also interesting is that by looking at the numbers of new species we accumulated each year it shows we have a pretty complete list and that if we go and do this over and over again, we are not going to find many new species. I think we found the species that are there and we have recorded them. Occasionally you might get one or two new ones. This just shows how many species were recorded every time and how many species were recorded only once. I don't know where you want to draw the line but species that commonly occur on plantation estates probably have been recorded five or more times. And that was 63% of the species that we recorded, 63% of the 450 odd species are recorded regularly on plantations.

If we look at critically endangered, near threatened, rare and vulnerable species, these are the numbers that we recorded in each year of the assessment. A lot of people will say, "Oo, look there, they are going down sudden." - what happened in 2002? What happened was that we changed the format of the event in that we were covering all our plantations before 2002 and then from 2002 did the event province by province so we were covering twice as many plantations beforel 2002 and then we did province by province. This table just shows these were the total numbers of species recorded for that event. They do drop off when you halve the sample size.

When we look at the endangered and the vulnerable species regularly recorded, there is still quite a range of species that we do find. Obviously these two are the critically endangered and I mean we have got sites where they breed on plantations. We monitor some of these species.

But what does this tell us about habitat, where are the birds, what is going on in the plantations? I used the Roberts Multimedia programme - some of you might know it, it's really quite neat - to generate lists of bird species that occur in different habitats. So I generated lists of species that occur in forests, woodland, grassland and all these different habitats. I then took the list of species that we have recorded on Sappi estates and classified them into a range of habitats. They don't tie up with these because when you generate a list of forest species out of this programme and you generate a list of woodland species, there are a certain number of species that overlap. So some species can occur in forests and woodlands, but there are also some species that you don't find in woodlands and only find in forests. I allocated these species to broader combined habitats so the more generalists are taken care of. What I was really trying to do was identify the specific habitat preferences of certain species.

When one looks at the total number of species that they say you can find in forests - in this country is it is around 183 species we find that on Sappi estates 110 species, which is 60% of the forest species have been recorded. What we are interested in this meeting, is grasslands. 202 species occur in grasslands. 129 of these have been recorded on Sappi estates which is 64% of the grasslands species.This is just a diagram – unfortunately I haven't got comparisons percentage-wise but these are breaking it down to the specifics. So of the species that only occur in forests, 30 have been recorded on Sappi land, 72 forest and woodland species and so on. What is interesting is we recorded more bird species in landscapes with trees on such as Forest, woodlands, forests and woodlands etc. But if you also look at the grasslands, the grasslands and wetlands and wetlands (habitats with out trees), there is still quite a big range of species that are found on plantations.

Just to put it in perspective, of our unplanted land which is somewhere around 130 000 hectares, 55 000 hectares or 48% is grassland. So there is still quite a lot of untransformed land on timber estates. Some of the unplanted land is transformed such as transitional, weedy areas - these would be areas that have been withdrawn from timber or are under management to get them to some sort of decent state - and some unclassified land - that would be land that would be pastures or around homesteads, around infrastructure, or road verges. But the majority of our unplanted land is grassland and that is why we get a lot of grassland species.

The conclusions really from a data set like this – and one could debate – plantations do provide a wide range of habitats for a very diverse set of bird species. Is biodiversity increased or decreased? Certainly species richness is increased. We might find, if you want to start looking at frequency of certain species that some have decreased but others have increased. The question is: do we write off fork-talked drongos and golden breasted buntings or now that we have got them, is it a good or bad thing? I think that this is the kind of question that we really need to answer.

Plantations do play a significant role in the conservation of some rare endangered species. And certainly we have breeding populations of blue swallows, wattle cranes and other cranes. Of the 90 species that Alan *et al* indicated were negatively affected, 48% are still regularly recorded on Sappi plantations. 27 have occasionally been recorded and only 20 have never been recorded. A lot of these species are species that I wouldn't expect to record or are very difficult to find, species like White-winged Flufftail, Rudd's Lark, Botha's Lark and some of the really rare species. So, are we doing a bad job or not?

Of the 55 odd thousand hectares of grassland management by Sappi, it shows that they are important for biodiversity conservation. Whether they have the full integrity of original biodiversity or not might not be the question, but they do provide habitats and I think the bird data shows this.

It also puts pressure on us the plantation owners and managers to manage these areas appropriately as they are important habitats for biodiversity. Thank you.

FIRE, BIODIVERSITY AND SOIL IN THE DRAKENSBERG: TWENTY YEARS OF RESEARCH ON THE BROTHERTON BURNING TRIALS

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Abstract

Fire is a crucial part of the ecology of the Drakensberg Mountains, and understanding the role of fire on hydrology, animal ecology, and the response of grasses and woody plants has long occupied researchers in the moist grasslands of southern Africa. In more recent years, the importance of fire to biodiversity in general and plant diversity in particular has received more attention. The Brotherton trial at Cathedral Peak in the central Drakensberg was established to address some of the questions around long-term burning treatments on sward dynamics, but has also received additional attention from researchers interested in the response of other variables to fire. The Brotherton burning trial was established at the former Cathedral Peak research station in 1980 by Dr Ed Granger, in order to examine the effects of various fire regimes on the grass sward. The trial is located on the plateau of the Brotherton Ridge, in the central Drakensberg, at an altitude of 1890 m. The rainfall is 1380 mm, falling mainly in summer with occasional snowfalls in winter. The trial consists of three blocks of 25x25 m plots, with various combinations of season and frequency of burning. Terry Everson conducted her PhD research on the trial, examining tiller dynamics of *Themeda triandra*, fuel loads, and fire behaviour. Biennial 200-point assessments were conducted on each plot, identifying the nearest plants (including forbs) to each point and monitoring trends in species composition from 1980 to 1990. Alan Short followed up their research a decade later with a survey of five of the treatments. Roger Uys conducted part of his MSc on the plant diversity of several of the treatments. Both Uys and Short found that the no-burn treatment showed the greatest change in species composition, with minimal difference in species composition between the other treatments. *Themeda triandra* started to decline from the five-yearly treatment, and basal cover declined with decreasing burning frequency. In 2004, a group of scientists and technicians revisited the trial to measure the effect of burning treatment on plant, sward, soil and invertebrate characteristics. Uys and Hamer found little effect of burning treatment on invertebrate species richness, and diversity did not appear to respond to fire regime. They concluded that the invertebrate community was well adapted to cope with fire and would not be significantly affected by fire. It is also likely that fire effects on invertebrates are less likely to be observable at the small plot scale. Manson, Jewitt and Short examined the effects of fire regime on soil characteristics. Burning effects were greatest in the top 5cm of the soil, declining with increasing depth. Bulk density was very low in all treatments (approx. 0.6 $g.ml^{-1}$), with the annual autumn and no-burn having the highest bulk densities. The no-burn treatment has the lowest C:N ratio but there was no effect of treatment on %C. Treatment significantly affected K, Mg, Ca and acidity of the soil. Landscape Function Analysis (LFA) Nutrient Cycling and Infiltration indices declined with increasing burning frequency, but Stability index was unaffected by treatment. There were some surprising correlations between LFA indices and soil physical and chemical characteristics.

Transcription

Good afternoon, everyone. I just realised something - that I am never going to be a Nobel scientist. The title of my talk is “20 years of research in the Brotherton burning trials”. The trials were established in 1980 so it's actually nearly 30 years of research. A good part of that time was fairly dormant so that will be my excuse.

This is a review, if you like, of the work that has been done by quite a few people on the Brotherton burning trials and I will explain what those trials are in a moment for those of you who aren't familiar with them.

A good number of the people that I am going to be talking about are actually sitting in this room today so if I say anything wrong please just jump up and correct me.

Just a little bit of background about what I mean when I am talking about Brotherton. The Brotherton burning trial is a long term experiment; a formal experiment that was set up at what used to be the Cathedral Peak Research Station and is now part of the Ukhahlamba Drakensberg Park. Cathedral Peak was a research station that was renowned for fantastic work over many decades on a number of topics in ecology and hydrology.

And just to do the standard Google Earth aerial photograph, that's Cathedral Peak from the air. For those of you who know Cathedral Peak, that's the Cathedral Peak Hotel over there somewhere. That's the new Didima Camp; Mike's Pass. And this over here is the Brotherton Ridge which comes out from the Lesotho border just over here; the escarpment; and that little firebreak around there is surrounding the Brotherton burning trial.

Cathedral Peak: I think there is one thing to be very clear is that the conclusions or the results of the experiments and the research that was done on Brotherton are applicable to quiet a unique environment. It's very high rainfall for South Africa. It's nearly 1 400 millimetres of rainfall. It's high altitude, 1 800 metres, so obviously fairly cool, in fact cold, short highland sourveld grassland. Brotherton was established in 1980 by Dr Ed Granger. Those of you who remember Ed, you are not going to forget him in a hurry. It was managed by Colin and Terry Everson and surveyed by them for a decade, the first decade of its life.

Around 1990 Ezemvelo, then the Natal Parks Board, took over management of the Drakensberg, including the running of the Brotherton burning trial and the Cathedral Peak catchments, or some of the Cathedral Peak catchments, experiments. For the next decade or so there was very little normal research was conducted on those trials apart from part of Roger Uys' MSc, and I did an honours up there. So there were some threats to close the trial. Obviously a great deal of time and effort and money was being spent on maintaining an experiment where very little research was being conducted.

Just a little summary of some of the work that has been conducted on the trial, on the left-hand side you can see a list of the treatments so there is a range of seasons of burn and frequencies of burn ranging from no burn or fire protection treatment to a range of spring treatments, one summer treatment biennial summer, various autumn treatments. That annual gromoxone then burn in autumn was to mimic the tracer lines for firebreaks. Tracer lines were first sprayed with gromoxone before being burnt. There is an 18-month cycle and then two winter burns. And I am going to be referring mainly to four studies that were conducted up there and in particular Craig Morris, Harvey Dicks and the Eversons put together a report in 1990 where they summarised all of the replicated treatments. These 21 treatments I think, if I can count, are the replicated treatments. There were a number of unreplicated treatments such as an eight-year rotation which I am not going to be referring to.

Roger Uys, who has already spoken this morning, did part of his MSc up in Brotherton and surveyed quite a few of the treatments. You will see the little question mark there. There were two biennial spring treatments, one hot and one cool and I am not quite sure which one – the hot one? Okay, thanks, Roger. I did the same one in 2001 and in 2004 a whole crowd of us went up there again to resurvey the trial. I will be talking about that in a minute. Terry will be talking about her PhD so I am not going to be going into that.

The 2004 re-survey was a group of us got together under the threats that the Brotherton trial was going to close. A group of us got together to go up there and survey and gather as much information as we could from the trial before it closed. So there were four studies as a part of that. Soil properties which myself, Alan Manson and Debbie Jewitt were involved in. Charmaine Uys and Michelle Hamer were looking at invertebrate composition and diversity. Plant species and key species: that was Rob Scott-Shaw and Roger. And then the compositional trends over time: that was Colin and Terry. So a whole group of us working for about a week or ten days in total and, as you can see, science is very hard work. So basically the point of this talk is to try and look over the last 30 years, 29 years and see: what have we learnt from the different burning treatments that were applied on the Brotherton trial?

Looking at species composition, to a certain extent we will be looking at diversity and richness, looking at some of the trends over time and briefly looking at soil chemistry and landscape functioning.

So for those of you who are not familiar with multivariate analysis, don't worry. What I am showing you here is various graphs from four different studies of the composition of the Brotherton trials and the main thing that you need to see is that in every single study the fire protection treatments came out at very different composition from all of the other treatments. That's what those graphs are showing you -that the no-burn treatment is separated from all of the other treatments that were surveyed in each case.

Rob's work was looking at very much like what he has just been describing now, looking at trying to identify indicator species. They can give you a good idea of the state of health of the grassland and, just to give you an example, those are some of the treatments at the bottom of the graph there. So, for example, you have got no burn on the left, then there is the five-year treatment, five-year rotation that was in spring, biennial spring, annual spring, alternate spring and autumn so that was very eighteen months biennial autumn and annual autumn. For example, *Hesparantha baurii*

seems to have quite a distinctive response to different burning treatments. So does *Senecio* which only occurred in the infrequently burnt treatments, the no burn and the five-year rotation. *Helichrysum aureum* seems to have exactly the opposite response but the *Helichrysum aureum* preferred the frequently burnt treatment.

Plant richness: two studies using the same technique; that was my honours and the Eversons in 2004. And what is quite interesting there is that the bars that I have highlighted there in red are the five-year rotation and the no burn treatment again and there doesn't seem to be much difference between the richness of those treatments and the richness of all of the other treatments. This was presented by Colin Everson in 2005 Grassland Society Congress but I think the work was done by Rob, if I am not mistaken. The five-year and no burn treatments seem to be much lower. That was using a different technique. And then finally if we look at Roger Uys' masters degree, that is the five-year and no burn again where the richness of those two treatments is a little bit lower than the other two.

One interesting thing to point out is that the annual winter treatment which is essentially equivalent to firebreaks in my study was much lower than in any of the other treatments. It wasn't surveyed in 2004. If you look at this graph here there is no annual winter treatment. We didn't have the time or resources to survey all of the plot and we didn't survey annual winter. In Roger's master's treatment the annual winter actually came out pretty high diversity. So I think if you are thinking there seem to be contradictory results here, my personal feeling is Roger's masters is probably the most reliable in terms of understanding plant richness. He used a technique which was specifically designed to gather as much information on plant richness as possible, as opposed to the other methods.

Invertebrate richness – this isn't going to take very long. Michelle Hamer and Charmaine Uys' work is that they couldn't find much difference between the treatments in terms of richness or composition. I think probably one main reason there is that those plots were too small. They are only 25 by 25 metres. That's one factor. And I think if you want to understand invertebrate diversity and invertebrate response, you probably have to study over a period of time rather than just a one-off survey.

Looking at some issues about landscape functioning and structure of the grasslands: three separate measures of basal cover and once again the major issue there is that the five-year spring burn and the unburnt treatment came out much lower – significantly lower than the other treatments and that was across all three studies.

Looking at some of the effects on the soil: a couple of important factors. Most of the significant effects on soil chemistry and soil physical properties happened in the top five centimetres. We measured at five centimetre increments from five, ten, 15 down to 20 centimetres and most of the effects are at the top five centimetres. Interestingly enough, there was no effect on soil organic matter. We couldn't quite explain this but the bulk density was much higher in the annual autumn treatment. We had a couple of guesses as to why that might be. The carbon to nitrogen ratio was much lower in the fire protection treatment but, as I have already said earlier, there was no difference in organic matter and hence no difference in carbon on its own. So in other words the difference was in the nitrogen.

The frequently burnt sites had lower acidity and the infrequently burnt sites had much higher potassium, magnesium and calcium. So just looking at bulk density for instance, that's not a real trend line. I just drew that in this morning but the reason for that, if you look at annual autumn, there is much higher bulk density than the other treatments but if you ignore the annual autumn there is quite a big and it is a statistically significant effect of fire frequency where the no burn treatment and the annual autumn treatment for some reason had significantly higher bulk densities than the other treatments.

Carbon sequestration: total carbon in the top 20 centimetres of the soil is around about 122 tonnes per hectare. If you read the paper, we wrote it as megagrams, which is a capital Mg per hectare, and the editor changed it to small mg per hectare so it says 122 milligrams of carbon per hectare. It's not. It's supposed to be 122 tonnes of carbon per hectare. And does that mean then that the total carbon in the entire soil profile is possibly in excess of 200 tonnes per hectare.

Looking at landscape functioning, those of you who have heard about David Tongway's Landscape Function Analysis: that's also something we did there. If anybody wants to know more about it, come and chat to me afterwards but the infiltration index is quite high at infrequently burnt sites and decreases at more frequently burnt sites, and the same pattern with the nutrient cycling index. No effect on the soil stability index.

So after all those graphs and statistical values, what is the bottom line? The main thing is that almost all of the effects of burning happened at burning intervals of five years or longer. So the frequently burnt sites, there were very little differences in composition, structure, bulk density, a number of soil physical and chemical properties between any of the frequently burnt treatments; in other words any of the annual or biannually burnt treatments.

So frequent burning appeared to maintain a stable system in this environment. Just remember that grazing is not a factor here, other than a handful of small buck. It's very, very low stocking densities in that environment. Infrequently burnt treatments dramatically change the species composition of the plants and very low bulk density so very high water infiltration potential which underlines the important of the Drakensberg as the catchment area for the country and high carbon storage potential.

I would like to thank a huge long list of people who were involved in all of this research. Thank you.

THE MERITS OF USING INSECT COMMUNITIES IN THE BIOASSESSMENT OF GRASSLAND ECOLOGICAL INTEGRITY

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Falko Buschke has a background in zoology and entomology, and is currently doing a Masters in Environmental Management at the University of the Free State. His current research project is the development of the South African Grassland Scoring System (SAGraSS), an insect-based, rapid bioassessment index for grassland ecological integrity.

Abstract

Considering that 47 of the 80 vegetation types in the Grassland Biome have been classified as vulnerable, endangered or critically endangered, it becomes pertinent that conservation strategies are urgently applied within this biome. Aquatic ecologists have for a long time believed that the most effect methods of conserving freshwater ecosystems is through the implementation of policy and management strategies guided by ecological integrity rather than some other less comprehensive aspect of biodiversity. This synecological approach could be applied to grasslands if suitable ecological integrity indicators could be identified and developed. This study investigates the merits of using insect communities as biotic indicators. One hectare of grassland at the Free State National Botanical Gardens was subdivided into 30 randomly positioned plots where sampling of both vegetation and insect communities was carried out. Plant communities were surveyed by the Braun-Blanquet method within a 5m x 5m area. Insects were sampled by 100 sweeps with a standard sweep net over a 7m x 7m area at each plot. Plots were tested for similarity in terms of both plant and insect communities using the Bray Curtis similarity measure and presented by non-metric multidimensional scaling. Results indicate that the plots showed a greater degree of similarity in terms of insect communities than vegetation communities. In addition it was also found that insect communities exhibited a greater degree of temporal variation than the more constant vegetation communities. These results suggest that insect communities may have potential as ecological integrity indicators considering that communities seem to be more uniformly distributed across an area providing a more reliable representation of grassland conditions than the more patchy vegetation communities. A greater degree of temporal variation in insect communities also suggests that fluctuations in grassland integrity could more rapidly be reflected in insect communities than in vegetation communities. It is suggested that attention should be drawn to the development and establishment of a standard, reliable and convenient insect-based index of grassland integrity to guide policy directives and management strategies in grassland conservation.

A QUALITATIVE SURVEY OF LEAFHOPPERS (CICADELLIDAE: HEMIPTERA) FROM NATURAL AND REHABILITATED GRASSLANDS AT A COAL STRIP MINING OPERATION

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Michael Stiller, studied at Stellenbosch, where he was introduced to leafhoppers of the Fynbos Biome. Now he works on leafhoppers of the Grassland Biome and other biomes, and is the only taxonomist in South Africa, and possibly Africa. The work presented in the poster was done over three years and more recently field work has revealed a very high diversity of leafhoppers in the Grassland Biome.

Abstract

A qualitative survey of leafhoppers (Cicadellidae) was conducted in grassland habitats rehabilitated by seeding, spontaneous natural seed regrowth and by translocation. The 9m^2 study sites were at the Wonderwater strip mining operation, Sasolburg, Free State Province, with natural grassland serving as the control and located outside the perimeter of the mine. Sites were examined eight times mainly during summer spring and autumn, between 1997 and 2000. The objective was to determine differences in species composition between these habitats. Habitats consisted mainly of grass, but also sometime forbs and shrubs, but these plants were not sampled actively. Provisional results indicated that there were differences between these habitats. In total 39 leafhopper genera and 78 species were collected over the duration of the survey (Table 1). About 15 of these species probably feed on forbs and shrubs. Natural vegetation (58 species of leafhopper) and translocated rehabilitation (54 species) produced a higher species number than seeded (42 species) and spontaneous regrowth (33 species). In natural vegetation and translocated rehabilitation there were four possible indicator species for climax grassland conditions. These are the wingless leafhoppers such as *Basutoia brachyptera* Linnavuori*, Chiasmus hyalinus* (Evans), *Pravistylus* sp.n. and *Tzitzikamaia silvicola* Linnavuori. Colonization of grasslands by these species is probably a long process, and in this study was possibly facilitated by their introduction into the translocated rehabilitation as eggs, nymphs or adults on plant material. Wetland grasses and sedges contained three dominant leafhopper species in very large numbers. Many of these species of leafhoppers associated with grasslands appear to be restricted to the Grassland Biome of South Africa, but other species of *Elginus*, *Pravistylus* and *Vilargus* indicated varying degrees of endemism (Stiller, 2009). A number of species are widely distributed throughout Southern Africa and feed on a wide range of grasses (Stiller, 2009). This high diversity of leafhoppers at Wonderwater confirms their significance in grassland habitats, as also suggested by Biedermann (2005).

Table 1: Leafhopper species collected in natural and rehabilitated grasslands at Wonderwater strip mine, near Sasolburg, Free State Province, South Africa.

Genus	Species	Author	Family	Tribe	Distribution	Habitat
Aconurella	*aethiopica*	(Cogan)	Deltocephalinae	Doraturnini	Grassland and Savanna Biomes	Grass-feeding
Aconurella	*compta*	(Naude)	Deltocephalinae	Doraturnini	Grassland and Savanna Biomes	Grass-feeding
Aconurella	*shaba*	Ghauri	Deltocephalinae	Doraturnini	Grassland and Savanna Biomes	Grass-feeding
Austroagallia	*cuneata*	(Cogan)	Agalliinae	Agalliini	Grassland and Savanna Biomes	Grass- and shrub/tree-feeding
Austroagallia	*nigrasterna*	(Cogan)	Agalliinae	Agalliini	Grassland and Savanna Biomes	Grass- and shrub/tree-feeding
Balclutha	*auranticula*	(Naude)	Deltocephalinae	Balcluthini	Grassland and Savanna Biomes	Grass-feeding
Balclutha	*fumigata*	(Naude)	Deltocephalinae	Balcluthini	Grassland and Savanna Biomes	Grass-feeding
Balclutha	*hebe*	Kirkaldy	Deltocephalinae	Balcluthini	Grassland and Savanna Biomes	Grass-feeding
Balclutha	*rosea*	(Scott)	Deltocephalinae	Balcluthini	Grassland and Savanna Biomes	Grass-feeding
Balclutha	*rubrocincta*	(Melichar)	Deltocephalinae	Balcluthini	Grassland and Savanna Biomes	Grass-feeding
Basutoia	*brachyptera*	Linnavuori	Deltocephalinae	Athysanini	Grassland Biome	Grass-feeding
Chiasmus	*hyalinus*	(Evans)	Deltocephalinae	Chiasmusini	Grassland and Savanna Biomes	Grass-feeding
Chiasmus	*undulatus*	Theron	Deltocephalinae	Chiasmusini	Grassland and Savanna Biomes	Grass-feeding
Chloropelix	*canariensis*	Lindberg	Deltocephalinae	Hecalini	Grassland and Savanna Biomes	Grass-feeding
Cicadulina	*anestae*	Van Rensburg	Deltocephalinae	Macrostelini	Grassland and Savanna Biomes	Grass-feeding
Cicadulina	*mbila*	(Naude)	Deltocephalinae	Macrostelini	Grassland and Savanna Biomes	Grass-feeding
Elginus	*vulgaris*	Stiller	Deltocephalinae	Deltocephalini	Grassland Biome	Grass-feeding
Exitianus	*capicola*	(Stal)	Deltocephalinae	Athysanini	Grassland and Savanna Biomes	Grass-feeding
Exitianus	*nanus*	(Distant)	Deltocephalinae	Athysanini	Grassland and Savanna Biomes	Grass-feeding
Exitianus	*natalensis*	Ross	Deltocephalinae	Athysanini	Grassland and Savanna Biomes	Grass-feeding
Exitianus	*okahandia*	Ross	Deltocephalinae	Athysanini	Grassland and Savanna Biomes	Grass-feeding
Exitianus	*zuluensis*	Ross	Deltocephalinae	Athysanini	Grassland and Savanna Biomes	Grass-feeding
Goniagnathus	*agenor*	Linnavuori	Deltocephalinae	Goniagnathini	Grassland and Savanna Biomes	Grass-feeding
Grammacephalus	nymph		Deltocephalinae	Scaphoideini	Grassland and Savanna Biomes	Grass-feeding
Hecalus	*dubius*	Melichar	Deltocephalinae	Hecalini	Grassland and Savanna Biomes	Grass-feeding
Hecalus	sp.		Deltocephalinae	Hecalini	Grassland and Savanna Biomes	Grass-feeding
Hecalus	*virescens*	(Distant)	Deltocephalinae	Hecalini	Grassland and Savanna Biomes	Grass-feeding
Hengchunia	*gaiseri*	(Webb & Heller)	Deltocephalinae	Paralimnini	Grassland and Savanna Biomes	Grass-feeding
Jannius	*mecus*	Theron	Deltocephalinae	Paralimnini	Grassland Biome	Grass-feeding
Kosasia	*typica*	Distant	Nirvaninae	Nirvanini	Grassland and Savanna Biomes	Grass-feeding
Mapochia	*collaris*	Distant	Eupelcinae	Paradorydiini	Grassland and Savanna Biomes	Grass-feeding
Modderena	*nkomati*	Theron	Coelidiinae	-	Grassland and Savanna Biomes	Shrub-feeding
Naudeus	*bivittatus*	(Naude)	Deltocephalinae	Deltocephalini	Grassland and Savanna Biomes	Grass-feeding
Naudeus	sp.n.		Deltocephalinae	Deltocephalini	Grassland Biome	Grass-feeding
Nephotettix	*erythrocephala*	(Ferrari)	Deltocephalinae	Athysanini	Grassland and Savanna Biomes	Grass-feeding
Nicolaus	*distincta*	(Linnavuori)	Deltocephalinae	Paralimnini	Grassland and Savanna Biomes	Grass-feeding
Nicolaus	*virgator*	Stiller	Deltocephalinae	Paralimnini	Grassland and Savanna Biomes	Grass-feeding
Opsius	*stactoglans*	Fieber	Deltocephalinae	Opsiini	Grassland and Savanna Biomes	Shrub-feeding
Orosius	*albicinctus*	Distant	Deltocephalinae	Opsiini	Grassland and Savanna Biomes	Grass-feeding
Parabolocratalis	*apicalis*	Linnavuori	Deltocephalinae	Hecalini	Grassland and Savanna Biomes	Grass-feeding
Paradorydium	*aurantium*	(Naude)	Eupelcinae	Paradorydiini	Grassland and Savanna Biomes	Grass-feeding
Paradorydium	*quadrigonum*	(Naude)	Eupelcinae	Paradorydiini	Grassland and Savanna Biomes	Grass-feeding
Paradorydium	sp.		Eupelcinae	Paradorydiini	Grassland and Savanna Biomes	Grass-feeding
Paradorydium	*transvaalense*	Linnavuori	Eupelcinae	Paradorydiini	Grassland and Savanna Biomes	Grass-feeding
Pratura	*graminea*	Theron	Deltocephalinae	Deltocephalini	Grassland and Savanna Biomes	Grass-feeding
Pravistylus	*eductus*	Theron	Deltocephalinae	Paralimnini	Grassland Biome	Grass-feeding
Pravistylus	*exquadratus*	Theron	Deltocephalinae	Paralimnini	Grassland and Savanna Biomes	Grass-feeding
Pravistylus	sp.n.		Deltocephalinae	Paralimnini	Grassland Biome	Grass-feeding
Ragia	*flavoalbida*	Theron	Deltocephalinae	Deltocephalini	Grassland and Savanna Biomes	Grass-feeding
Recilia	*aulonias*	Linnavuori	Deltocephalinae	Deltocephalini	Grassland and Savanna Biomes	Grass-feeding
Recilia	*schaeuffelei*	Heller & Linnavuori	Deltocephalinae	Deltocephalini	Grassland and Savanna Biomes	Grass-feeding
Recilia	*cotula*	(Cogan)	Deltocephalinae	Deltocephalini	Grassland and Savanna Biomes	Grass-feeding
Samuraba	*elegans*	Linnavuori	Deltocephalinae	Deltocephalini	Grassland and Savanna Biomes	Sedge-feeding
Scaphoideus	*unimaculatus*	Webb & Viraktamath	Deltocephalinae	Scaphoideini	Grassland and Savanna Biomes	Grass-feeding
Stirellus	*flavovirescens*	(Stal)	Deltocephalinae	Stenometopiini	Grassland and Savanna Biomes	Grass-feeding
Stymphalus	*modestus*	Linnavuori	Deltocephalinae	Scaphytopiini	Grassland and Savanna Biomes	Grass-feeding
Tetartostylus	*brevistylus*	Theron	Deltocephalinae	Tetartostylini	Grassland and Savanna Biomes	Grass-feeding
Tetartostylus	*phaeometopus*	Theron	Deltocephalinae	Tetartostylini	Grassland and Savanna Biomes	Grass-feeding
Teyasteles	*divisifrons*	(Naude)	Deltocephalinae	Macrostelini	Grassland and Savanna Biomes	Grass-feeding
Typhlocybinae	14 morphospecies		Typhlocybinae		Grassland and Savanna Biomes	**2-3 morpho-species grass-feeding, other feed on forbs & shrubs**
Tzitzikamaia	*silvicola*	Linnavuori	Deltocephalinae	Athysanini	Grassland Biome	Grass-feeding
Vecaulis	sp.n.		Deltocephalinae	Deltocephalini	Grassland Biome	Sedge-feeding
Vilgarus	*pumilicans*	(Naude)	Deltocephalinae	Paralimnini	Grassland Biome	Grass-feeding
Xestocephalus	*ethiopicus*	Melichar	Xestocephalinae	Xestocephalini	Grassland and Savanna Biomes	Grass-feeding

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THE ENDANGERED WILDLIFE TRUST AND FORESTRY: WORKING TOGETHER TO CONSERVE ORIBI, BLUE SWALLOW AND CRANES

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Abstract

The Endangered Wildlife Trust (EWT) is a non-governmental, non-profit, conservation organisation, founded in 1973 and operating throughout southern Africa. The EWT conserves threatened species and ecosystems in southern Africa by initiating research and conservation action programmes, implementing projects which mitigate threats facing species diversity and supporting sustainable natural resource management. The EWT furthermore communicates the principles of sustainable living through awareness programmes to the broadest possible constituency for the benefit of the region.

As a leading high-profile player amongst the large number and variety of conservation organisations in South Africa (governmental and civil society), the EWT fills the key niche of conservation action, through applied field-work, research and direct engagement with stakeholders. With specialist Working Groups and a large team of skilled field staff deployed throughout southern Africa, the EWT's work supports the conservation of threatened species and ecosystems. Priority interventions focus on identifying the key factors threatening biodiversity and developing mitigating measures to reduce risk and reverse the drivers of species extinction and ecosystem degradation. Through a broad spectrum of partnerships and networks, the EWT responds to the key threats driving species and ecosystem loss by developing innovative methodologies and best practice guidelines which support reduced impact, harmonious co-existence and sustainable living for all.

Forestry companies around the country own substantial amount of land, a lot of which is open areas of grasslands and wetlands. In many instances these open areas are home to several endangered species, and of particular interest to the EWT, these species include Oribi, Blue Swallow and all three of SA's Crane species. The management of both the wetlands and grasslands on these companies' estates is vital for the protection of the above mentioned endangered species and the EWT interacts with forestry companies in KZN and the Eastern Cape, that have one or more of these species on their estates, in order to ensure the protection of the species breeding and/or feeding sites.

Transcription

Good afternoon, everyone. My name is Tanya Smith with the Endangered Wildlife Trust based in the Southern Drakensberg of the Eastern Cape. I did this poster in conjunction with my colleague André Rossouw, of the EWT's 'Threatened Grassland Species Programme'. Both of us work with Forestry companies in KZN and the Eastern Cape to conserve five key grassland dependent species: Oribi, Blue Swallows and South Africa's three crane species.

The poster just gives a bit of a background to the EWT and the work we do and a bit of a background of each of the above mentioned species namely: Oribi, Blue Swallow, Grey Crowned Crane, Blue Crane and Wattled Crane. As well as about how we work with Forestry to try and help conserve these species.

As we have heard today, Forestry has large areas of open grasslands and wetlands. So we work with Forestry in terms of monitoring the species on their properties. Forestry also assists with helping in preventing poaching – oribis are highly susceptible to poaching in KZN – and also improve management of their lands.

DISCUSSION: BIODIVERSITY

Transcription

MR B CORCORAN We are now moving into our question and discussion session. As Justin alluded to earlier, we are doing things slightly differently, depending on how it goes. Depending on how the questions go, we will spend most of the time in plenary. If we find there is a natural break we will move into whatever natural groups we come together on and whatever topics we discuss, and we will be able to pick up some suggestions from you out of that but let's start off in plenary. Do we have any questions for the speakers, the main speakers and the posters. I see amongst the posters we

had two looking at using insects as indicated species and also obviously the work of EWT in working with Forestry. So just out of those we have a range of presentations we had on biodiversity. Are there any questions to start off with? Please don't all rush. I know it's difficult. Questions? Donovan in the front and then Jackie.

MR D KOTZE[?] I have got a question for Alan. Just thinking in terms of your final summary of the results from the Brotherton and particularly relating to the soils that aside from the very infrequent burn the other treatments, say the spring or autumn, there wasn't much difference between those treatments. So the immediate question – and you did say one has to be careful about to what extent one can take these results and apply the lessons elsewhere. So I am just wondering, thinking now because that trial is very useful and we have heard the question raised several times in relation to Forestry, the whole question of early winter burns, does it really make much difference to the functioning of the system?

So finally to get to my question, as kind of background, what I seem to pick up is that that site is quite flat and I am just wondering to what extent – if one had a much steeper slope, you might be picking up some processes, particularly seeing that there were indications that infiltration was higher in some of the treatments than others, whether that might be – well, you could say a key limitation in saying to what extent could we generalise these results? Is the fact that it is a very gently sloped site.

MR A SHORT I think that is a good point and it applies to a lot of these sort of trials, small scale trials on flat slopes like Gugalinga[?] and a couple of others. Unfortunately we didn't do the annual winter. In the 2004 re-survey we didn't survey annual winters so we don't have figures - from that particular study we don't have figures from the annual winter treatment. As I said earlier, we didn't have time or resources to survey all of the treatments and annual winter was one of the ones that was left out.

In terms of infiltration and cover and a few other things like that, Colin unfortunately isn't here but I don't know if Terry might be able to help because a lot of work was done on the catchment trials at Cathedral Peak which are obviously much larger scale at catchment scale. Roger, in your masters you specifically compared the firebreaks on those catchments. Looking at plant diversity and plant composition you specifically compared the firebreaks to the catchment treatment and I wonder, do you have any comments on that?

MR R UYS When I worked up at Brotherton I also worked at the Ukhalinga[?] trial and at the University of Fort Hare. And to answer Donovan's question about the results being more widely applicable, the no burn treatments in all three trials were significantly different from the burns but we couldn't see clear differences between the annual, biennial or triennial, or, in the case of Fort Hare, even the four year rotation in terms of species richness but there were very clear trends in the dominant grass species. So you can see … [indistinct] increases with more frequent burning and things like … [indistinct] decrease with more frequent burning.

To come back to Brotherton, I not only worked on small plot trials but looked at the larger research catchments where whole valleys on the side of the mountain were burnt in different years and different seasons. But because they covered different altitudinal ranges, had different aspects, different slopes, etcetera, etcetera, I needed to standardise to compare between them. So I compared all the treatments inside the catchments to the firebreaks. And without question, biennial burning, eight year or no burn treatments were always more diverse than the annual burns. So annual burning is not good for species richness.

There was a full set of four different seasons of biennial burn which is summer, autumn, spring. The summer and autumn burns had lower species turnover than the winter and spring burn. In reality the winter burn was done as a late winter burn and a spring burn was done as an early spring burn. So the treatment was they weren't that different. But the real point is that at a landscape scale early burning, in other words autumn burning, was not good.

The eight year fire protection treatment, interestingly had fairly higher species turnover across the landscape and so the longer fire protection intervals actually managed to support a wider range of fire tolerant strategies. Although the individual plants were not as abundant or the individual species were not as abundant, there was more of them. So frequent burning is bad. Longer burning intervals may support a wider range of bio-tolerant strategies but you get the species turnover. At somewhere between five and ten years you see a different suite of species come in. And those are typically more woody species and so you are no longer dealing with a grassland, you are dealing with something else.

MR B CORCORAN Any other questions at the back? Roger, did you have another question or was that in answer? Okay. And then back to the front.

UNIDENTIFIED VOICE I just wonder if someone from the FBA could maybe say what is the possibility of allowing the forestry companies to burn early spring because at the moment it's in a burning prohibition period.

MR B CORCORAN Okay, anybody from FBA is willing to answer that?

MR B POTGIETER I think out of historically we stop burning because of the time period because I believe we should follow the burning index or FDI. Like now in September after this good rains. And now we cannot so for the future I bundle we should change that. It must be based on FDI and not between this month and that month.

MR B CORCORAN Any response to that, Alan?

MR A SHORT I am going to stick my neck out a bit here and more informed people can shoot me down. But there is a reason why … [indistinct] for burning now and that is because burning in spring causes damage, if I am not mistaken, to the veld. Winter burning may not be safer but it certainly is healthier, despite what Roger might say.

The basal cover for example, there was no difference in basal cover between the winter burning treatment and any of the other frequently burnt treatments. And Terry Collins, the Collins thesis, the run off in infiltration from the winter

burning treatments were the same or in fact the soil loss I think from winter burning treatments was less than spring burning treatments. I am sticking my neck out though. For the simple reason that the winter burning treatment can recover. As soon as the temperature reaches a sort of critical point, the grass can start growing again. The grass sward can recover and by the time the thunderstorms come there is already a cover of grass on your soil to protect the soil from erosion.

MR B CORCORAN Any response to that? John, are you going to respond to this one? Please come up. We just want a microphone over. Roger, we want to give you a chance to respond if you want to as well. I think Gerhard on the left here as well.

MR J SCOTT It's probably not a question *per se* but more sort of observations on the discussions that have been going on today here around burning is best and when is burning best. But I ask the question, best for what? And if we can't answer that question – are we burning for basal cover or are we burning for species composition or are we burning for fire protection? So I think we need to be clear in the first instance what we are burning for. What objective? And in my view there is absolutely no problem in burning your grassland every year as an annual burn. I tell you why is that if you burn in June, every June is going to be different in terms of the rainfall that you have had prior to that, the treatment that you have had prior to that, and if your main objective is to secure your property, whatever that property or land might be and you need to burn in June, you can actually burn a lot earlier than that, if the frosts come early, if you have early snowfalls. And so each year it's not the same in terms of the weather conditions. So I don't believe you are giving the same treatment to the same piece of ground year after year because of that variability in climate.

I want to give you another example. If it rains, as it did this year, 28 millimetres on 1 August, is that a spring burn? 24 hours after that you can burn. Or is it a late winter burn or what is it? In my view, again you follow the FDI which I think Ben has suggested as a way to go on that. We also seem to be falling into the trap, more biodiversity is the best, but the best for what? And I just think these are the questions we should be asking ourselves when we say what is best.

What reference point are we using to make those kind of claims? Is it spring burn that we say will – if we burn in spring and we burn in winter the spring burn gives a better biodiversity but what reference point are you using to say it's better? So I am asking the questions of everybody here but I think it's important that we, in my view anyway, that we think about those when we ask questions around annual burns or spring burns, as the case may be.

MR B CORCORAN There are a couple of answers. We have got one person waiting for a new question so we are going to just hold there while we finish with this discussion. In response to Alan's statement, was there anything Gerhard? Was it a response to Alan's statement or question statement or a new question? [no audible reply] Was it a new question? [no audible reply] On the spring burns? Quick comment over there and then Roger would you have any response? No response? [no audible reply] Are you happy with Alan's statement? [no audible reply]

UNIDENTIFIED VOICE (GERHARD?) It's just that in spring burns in some of the reports on amphibians and reptiles that that's the period when they start moving around and that. So they are quite severely affected by spring burns.

MR B CORCORAN We had a response at the front here. Comment? Another comment from Craig Morris at the back as well.

UNIDENTIFIED VOICE It really depends what we are trying to – what the aims of the burning are, but if we are trying to burn to mimic what happened historically, historically fires always happen generally on the hottest days with the high winds, etcetera, etcetera. So we should be burning on the days with the highest FDI. I know that's not what foresters want to hear but certainly that's when fires historically used to happen.

MR B CORCORAN Just a comment on this one. There is another comment on the fire issue.

UNIDENTIFIED VOICE I have a problem with some of the discussion here. With the last blocked in burn up in the Drakensberg where they kept the grass for ten years or something, in our veld down here in the Karkloof, if you leave your grass for three years without being burnt, you have a mat of thick, thick, thick grass and I don't know how anything can come through it. One of the earlier speakers earlier today spoke about the chances of forbs and flowers coming through the grass if it's too thick and hasn't been burnt. So I am having a bit of a problem with the species diversity. As John Scott just said, "What are we looking for?"

MR B CORCORAN Comment from Craig Morris at the back as well?

MR C MORRIS I think the very long term date actually bears out or supports what the foresters are doing. For over 60 years of burning in autumn, winter, sprint, you really can't tell the difference in composition between those seasons and in cover and diversity. So there is no real reason why one should burn in spring or autumn or winter. And also really those grasslands look very much like it was at the start. The integrity has been maintained over the last half century with those different practices.

I think perhaps a tactical approach is quite useful if your fuel builds up to a certain level in certain years you burn. I drought years you may not have that fuel. And also tactically with regard to the weather. So one may find that in these areas you will have to burn quite frequently because the fuel builds up regularly whereas in dry years in drier regions you may not do so. Certainly we don't have the confidence to be able to say that the foresters are doing wrong by burning winter, and spring would be better in terms of very long term effects, diversity, cover, integrity, all of those things.

MR B CORCORAN Okay, Roger and then coming back to Clive Bunting.

UNIDENTIFIED VOICE (ROGER) What I was saying was Brotherton, is that the scale at which you look at these questions really matters and I think a lot of the data that you might be referring to, Craig, would have come from small

plot studies. And when you look at it at a landscape scale, although you may not see differences in something like the Brotherton of Ugulengu[?] trials, you do find less turnover in autumn burns at the landscape level. So that's something to consider.

To answer John's question about how we measure biodiversity, I think that's pretty clear. There are three measures, there's the number of species, the abundance or which they are distributed and the composition. Do we have a hundred species of earwig or do we have a diversity of different invertebrates that we are dealing with. And it really comes down to what you are trying to manage for. If you are talking about biodiversity, then I would feel very uncomfortable with burning every year. If it's solely fire protection, or risk aversion, well then maybe that's what you have to do. But I still believe that there are ways of configuring the spread of burns within your landscape to give you enough risk aversion to allow you to continue your production operation while still meeting some biodiversity targets in the landscape.

MR B CORCORAN Just to make a note, the reason why Forestry South Africa and the forestry companies are in partnership with … [indistinct] Grasslands Programme is to find out how we can be partners or how the forestry sector can be partners for grasslands conservation, the conservation of biodiversity in grasslands going forward. At this stage we are looking at two approaches or two main objectives, if you want to call it that. The one is … [indistinct] biodiversity stewardship agreements for specific sites on some of the plantation estates. The size of those sites will vary. The areas in which they are located will change. We will hear tomorrow about some of the conservation planning tools that have been used that are … [indistinct] been developed by the forestry component of the Grasslands Programme to assist the companies to identify which parts of the plantations are more important than others to contribute to targets. And in those areas where there are stewardship sites, voluntary agreements to set aside land for very specific particular biodiversity objectives, then you adapt the fire management and the grazing management by cattle within the system and other sort of management issues accordingly.

In the bigger sort of context of the open areas in the rest of the plantation estates what is possible in the midst of practical cost-efficient management of the systems and what are those objectives for the rest of those open areas? Are they going to be just fire protection or is it going to be fire protection with water? And can we include biodiversity as part of that. Is the way to adapt things in that sense that allows those primary objectives to be achieved and biodiversity is a secondary objective to be achieved with that.

So that's really the approaches we take and we are doing the same thing in the agricultural sector where we are asking the same questions. And the stewardship sites, very specific objectives, very specific management approaches to try and achieve those objectives while retaining some production by carrying equal weight as objectives. But in the broad agricultural grazing landscape or grazing on natural grasslands what can we achieve? What is the best possible return where it is not explicit and there are no contracts bound towards setting those areas aside for biodiversity purposes.

Is everybody happy with that explanation as well? I think this issue of setting objectives, understanding that grassland systems are very complex the way they respond, the conditions from year to year do change because of rainfall and various other things. But it's clearly coming out that some form of mosaic at a landscape scale is important for biodiversity to persist into the future. And Roger I think made some good recommendations this morning on principles for management about not too frequent, not too infrequent and then the intensities and various other things that go with that.

Are there any other comments or questions? We had another hand at the back and then we have got –sorry, Clive, I forgot about you. We will go Clive first and then we will go right to the front to … [incomplete]

UNIDENTIFIED VOICE (CLIVE) As a livestock producer, I think the most important of view of … [indistinct] of veld is to get it burnt early, so from 1 August is the ideal time for us and we find that better for the composition over the longer term.

MR B CORCORAN Is that in terms of grass composition or in terms of the full species composition?

UNIDENTIFIED VOICE (CLIVE) Well, we have had changes in the grass composition since introducing that but basically to the better.

MR B CORCORAN At the back right there? These are great discussions for 04.30 on the first day. You guys are doing really well.

UNIDENTIFIED VOICE Just also an attempt to answer I think what Jackie's question with Fire Protection Association, I think if we realise that WAF has been the governing body of anything to do with burning and as the FPAs are growing and as more FPAs are becoming stronger I think and there's only about five full-time FPOs within the FPAs of however many there are at the moment. So until the FPAs are registered and have full-time FPOs where they can start calling the shots, DWAF will make no decisions. So it's very hard for them to go area by area to say you can burn in that area, you can't burn in that area. And I think once the FPAs get stronger more and more power will be released to the FPOs to make those decisions. This is starting to happen but at this moment in time it becomes an illegal battle. As DWAF said you can't burn so insurance won't pay out. And I think that is where we are heading in the future, hopefully in the next couple of years where the FPOs will be out to make those decisions per area.

MR B CORCORAN Thank you. I think we also note that tomorrow there is going to be a presentation from the assurance industry itself so that will be great to get that perspective as well.

STEVE GERMISHUIZEN[?] One of our key objectives of this biodiversity session was to try and investigate whether there are monitoring techniques that we can do in grasslands that would more accurately reflect the goals of biodiversity. And I suppose I am directing this at maybe Rob but also looking at Peta Hardy's data, it was interesting to see that there isn't a clear relationship now between veld condition and overall species richness reflected.

So what I would like to know from Rob or Craig or Peter is can we assume that that is the actual case or do we need more studies to confirm that these are independent or there is no clear relationship between species richness and veld condition. And, secondly, how soon can we have a technique that we can use quite easily to measure and maybe monitor grasslands for biodiversity.

MR B CORCORAN Go to Rob for a first answer and then we had a hand up for Alan to respond as well.

MR R SCOTT-SHAW Don't forget that the purpose of a veld condition assessment is quite different to that of a biodiversity assessment if we look at plant diversity, like you have been demonstrating this afternoon. We are just grasping at straws really saying, "Look, there are so many veld condition assessments out there, a lot of people know them and do them. Can't we gain something from that information?" So I think that's what we are just trying to say there. No, no ways must we – well, Alan could offer some comment about that but veld condition assessment is very much a simple assessment of what that grass composition is at that moment in time. And that's not going to be good enough to come back to year after year and say how things are changing, even for the grass species only.

UNIDENTIFIED VOICE Can we assume that there is not a relationship?

MR B CORCORAN Can we say that we are fairly certain that it's a tenuous relationship at best, I mean that we can't use the veld assessment data to infer species richness. I think that's … [intervention]

UNIDENTIFIED VOICE I am out of my field now but there are other forms of veld condition assessment where you use the old Tainton index where the weighting of species is quite different to the ones that we have been using, the standard Department of Agricultural one where there are limited thresholds of species. That would change the veld condition assessment score, so if we tried a different veld condition assessment method then … [indistinct] We would like to answer you after we have done that. And we do need someone to go out there and do that a year ahead.

MR B CORCORAN Okay, there is a response from Francois at the back left there. Francois de Wet who is the … [indistinct] in the work in the Sappi grasslands areas.

MR F DE WET I just want to comment that the areas that we have been visiting specifically with Peter, the grassland areas, were mostly in a very good condition, pristine condition. Obviously you had some variation and more overgrazed, not necessarily overgrazed but degraded veld. But I have seen grassland areas in a much poorer condition and I think that that's the one thing that one needs to – when you start comparing your diversity, you must look at wide range to get a proper relationship and then conclude about that. And then the other thing is also – we use different models for - … [indistinct] models for for instance your cress[?] on granite or whatever the geology in the soils were. So you have to look within each model and then compare it within each. So I think it's just important to note that you need to compare apples with apples you know and just get more soil based information.

MR B CORCORAN Another response from Alan or comment?

MR A SHORT At Brotherton there was a pretty good relationship between the quantity – the abundance femedia[?] and the richness of forbs.

MR A SHORT Then we move on into the next question and finish up the session.

MR F DE WET Just another point about comparing veld condition. It's not a linear – if you look from the climax down to the severely degraded areas, it's not a linear line that you are following. It's actually peaking somewhere around where the decreases are and then slightly into the climax. And then you get a drop again in your species richness and that because – and you get poorer cover. It's like Roger also mentioned that you get poor cover both sides where the veld is infrequently burnt or not burnt, you get also loss in cover. And the same with the far extreme climax. So you must be careful just to make a simple comparison. Because our gut feeling is definitely that there is a correlation. I have always felt and I have always seen it. We have seen it time again and as soon as you start to bring in the statistics, you can have problems. Not that I say statistics is wrong but it's just how you compare them.

MR S GERMISHUIZEN I just want to go back to – the second part of my question was would be able to have a system to monitor grasslands for biodiversity goals? In other words as we discussed you know looking at forb richness or transect that could be used by forestry. Can I ask another … [intervention]

MR B CORCORAN No, you can't ask another question. Before it carries on there, one of the things that came out of the GSSA special session that we ran at the congress this year was to look at this issue of the links between grazing management practices and in livestock production systems and species diversity and so on. One of the key research questions that came out of that was to dig a bit deeper into this relationship between veld condition and species richness. But in the meantime I know that in the … [indistinct] programme in KZN they are trying to do both veld condition assessments and a floristic diversity score or assessment, as I understand. And so that is happening in the meantime to try and understand whether – just as this stage you can't make the assumption that there is definitely a correlation so they are doing both. It's part of their link to the … [indistinct] programme.

If you do want to dig a bit deeper, apparently there are a whole lot of research trials could be resampled with this question in mind and actually some final results that come out, which we are going to trying to answer with the benefit of the .. [indistinct] Grasslands Programme funding that they have got.

John and Justin and Roger.

MR J SCOTT[?] I just would like to pick up on Alan's point on species composition that themeda[?] – just the presence of themeda[?] and the extent of its abundance as a good indication of floristic – well, the non-grass species – well the numbers of them, species composition thereof. And I know there has been a lot of criticism levelled at the Agricultural Research on Veld Condition that it's not really relevant but it's focused on a very specific type of land use.

Therefore one should look at it from a biodiversity point of view, what else can one monitor. But there is something to be said for looking – in wanting to implement this. We mustn't forget, if we are going to make this practical, how do you actually implement it at the end of the day? And there's very few people in this audience who would be able to go out and identify in one square metre all the species that are present in that one square metre plot or even when using a Tidmarsh wheel or whatever kind of point source you measure. If you can identify themeda trianda[?] and you have got 60% themeda trianda in your Highveld grasslands or Highland sourveld grasslands, you have probably got veld that is in good condition and has got a reasonable species composition. And that is one way to get over this business of how do you determine trends. I think Alan's point was not lost on me.

MR A SHORT Okay, thanks. Justin?

MR J DU TOIT My question to Rob and following on partly what John has just said, how likely do you think it is that we can in fact derive a simple biodiversity veld condition assessment based on the two facts? One is that most people can't actually identify even a small proportion of the plants out there and, secondly, that at any one time during the year you are unlikely to be able to identify. You know grasses are easy but at any one time of the year you are unlikely to identify more or find more in some sourveld grasslands more than about 50% or 60% of the species. So with those two huge constraints, do you think that there is actually a chance of being able to develop some sort of simplified method?

MR R SCOTT-SHAW Justin, definitely yes. Look, in defence of that, let's remember we have got so many visual aids now with digital photography and pre-prepared lists and benchmark tables and things like that, given that, especially in an area – high rainfall grassland types that are relatively well known, within a short space of time you could give these future monitor people kits that give quick guides to the species that you do have to know, or even those that you only have to know by genus, which is a lot of them. You don't need to know the species. The point that I am just making is things can be so packaged these days with computers and digital imagery, I think you can. The hard work would come in setting it up, in creating benchmarks that apply to certain soil types and slopes and obviously vegetation types. So you can't think of this as a country-wide or a summer rainfall-wide solution.

I would like to think it is surprisingly simple and something that everyone can manage. To quote an example, Keith Cooper, who is a pensioner, previously head of the Wild Life Society Environmental branch, has a weekend cottage up at Mboni Estates which is also one of the forestry stewardship sites. Obviously he has got the time to put in a square metre and on his walks go and do some sampling. He just recorded what is different and very quickly he was tuned in to the fact that there was about 20 or so common species that were useful. And whether he counted the others or not or knew their names or not didn't really make any difference. Month after month he sent these in to me and I have still got the spreadsheets. So it's cases like that where I think we can. But it is up to guys like me to do the groundwork.

MR B CORCORAN So next week Rob will have the first one ready.

MR R SCOTT-SHAW Yes.

MR B CORCORAN Okay. Thank you. Noted for the symposium proceedings.

MR R UYS I would like to make an observation about the difference between veld condition assessments and dealing with wild flowers. The thing about veld condition assessments is that they deal with grasses and the technique was designed to look at the impacts of livestock grazing on grass composition so that you could determine what the stocking rate is. If you overstock, your veld condition theoretically goes down, and if you rest, it theoretically comes back. The grasses have the ability to do that, to increase and decrease fairly rapidly. The wildflowers, however, particularly in our mesic grasslands, are all perennials. There are few to no annuals or biennials in the high rain[?] for grasslands which is where you find most of our timber grown. It's only when you drop below about 700 mls of rain that you start to see the short-lived taxa[?] coming in and forming part of the system. What we suspect and what we are investigating now is that many of these wildflowers could be decades old. Individual plants could be decades old. The speaker on the other side spoke about – I believe it was the Dargle area and after three years, there had been rank grass and not seeing anything coming through it, when you burn that grass you see a flush of flowers and the reason you see that is because most of these plants in the mesic grasslands have got enlarged underground storage organs of one form of another which allows them to recover from fire or grazing and allows them to respond very rapidly so that they can come up and flower before the grasses but on biomass. And that's an important strategy for the wildflowers to be able to exist in a grass dominated landscape. Probably the overriding image that sits with us when we think of grasslands is a sea of grass. And it's really only when you go into that sea of grass that you start to find the true diversity in these systems.

The problem with these wildflowers is that if you knock them out of the system, they are not designed to come back in because the grass is so dominant and because there are so few opportunities to recruit into a dominant grass sward. And the higher the rain, the greater the grass production and so the greater the grass dominance. And so if we do manage to develop a simple technique to identify biodiversity or link biodiversity to a veld condition assessment, it's only going to be able to tell us about systems heading in one direction, and that's degradation. It won't be sensitive enough to show us where systems are improving because they improve so slowly. It's very easy to destroy a mesic grassland but it's near impossible to put it back together again. It's just something to take into consideration.

MR B CORCORAN that's great. So we need to close off this session. Just some summary comments then and we are going to be hearing quite a bit more tomorrow about some of the practicalities or trying to make fire management and other management work within plantation estates. And I think we need to keep grounding themselves back into that reality. So we have got this complex grass in systems including the complexities of how they respond to some form of disturbance, whether it's fire disturbance, whether it's invasive alien plants, whether it's grazing and the added effect of tramping to go with that grazing. We have got these amazing complexities to deal with. But at the same time the results are shown to be similar across different treatments. So it becomes interesting to try and implement that. But let's keep our eye on the ball. Let's keep focus on the fact that we are working with forestry as a partner for conservation and we

are trying to make this work in a context where fire is a huge issue. It's a big risk to the asset and the business, the core of the business of the forestry sector and how do we make some of these a reality. I think we have got some good ideas or recommendations. We got some good ideas today of some of the research gaps. We got some ideas of maybe some of the tools, the monitoring tools can go in and give us some indication of what is happening with the complex systems we are dealing with. And how we actually work those tools out and into practice and move them out into the landscape is going to be interesting. That's just my quick summary. Thank you, everybody for the speakers and for the presentations we had. I think the debate is going and we are going to continue this tomorrow with the debates on vegetation dynamics, discussions there, designer management and policy and planning. We are going to have five minutes now from Fire Alert. It's your slot, Mr Fire Alert to have a quick slot and just to talk a little bit about the products you have got and what they do. And then we are going to have a closure from Justin and Anthea for the day, according to the programme. Most probably Justin.

CLOSING FOR DAY ONE

Transcription

MR S GERMISHUIZEN Now you are going to have the joy of having me sum up every talk and great detail and draw my conclusions and editorialise about it. At the moment burning in spring has two points and burning in winter two points. So I am going to do a census during the pub session and I am going to clear this up because I think we can get consensus here eventually.

I am not going to sum up in great detail at all. I think Brent already summed up all the key issues. Thank you very much. I just want to say I am absolutely delighted with the response and the way the talks have turned out and the type of debate that has arisen from this. It has lived up to my expectations and I think my early optimism wasn't misplaced.

I am really going to put a lot of effort into the discussion sessions and during meal breaks and tea-breaks just to talk to most of you that have come here and try and get some conclusions and try and decide where we are going to go in terms of developing the guidelines for forest management. Remember we want to put together a panel and that panel is going to be taking most of the key ideas that came from this symposium and the knowledge of the experts here to develop guidelines for forestry to use for their grassland management specific guidelines. So that is going to be something you will see me buzzing around and trying to get this panel convened. Further than that, I have nothing more to say except really a warm thanks for all your efforts.

SESSION THREE: VEGETATION DYNAMICS

INTRODUCTION

Chaired by Steve Germishuizen

Transcription

Good morning and welcome to day two. I see that you have come back for more. This is very encouraging indeed. I was expecting at least a few people to wake up sick this morning but it's great and I think we had a very productive day yesterday. In discussions generally if people are being honest, they are saying they are learning things and we seem to be getting the kind of products that we want out of this. Controversy, lack of consensus, these sort of things, so that we can kind of consolidate these ideas.

One thing that we are going to do – just to emphasise because it seems like some people have missed this point – everything that is said here is being recorded. So I suppose maybe that's why some people are quite circumspect in what they say. Maybe they do realise this. But this stuff will be transcribed into a document which will be sent out to everybody before it's published so that people can edit what they said or sort of retract things that they maybe thought were out of context, etcetera. These proceedings then will be published and distributed to everybody that was here, plus more widely than that. So this can become a resource document and, as I mentioned in my introduction, this document will form a foundation of the development of clear guidelines specifically for forestry and the management of grasslands in forestry.

These grasslands will actually get incorporated into the Forestry South Africa environmental guidelines for plantation – for environmental management in plantations in South Africa. We will find a short name for that I am sure. And we will also do a revision of those entire guidelines with the view that if any changes we have made by inserting a chapter on grasslands, they may reverberate throughout the system, throughout the guidelines and require changes in other aspects, other sections. And also because they are in need of revision. We have learnt a lot since then and a lot of stuff from yesterday already has come out that would need revision and looking at more emphasis in environmental guidelines. So that's where we are going with that.

The other innovation that Justin came up with now and I think will be very useful – if there is anything that you have been burning to say or an opinion that you have that you haven't expressed here, either that you haven't had the opportunity or you have been reticent to do so or you didn't want to offend someone or whatever, please write it down and hand it to the session chair at the end of the session or at the end of the day you can hand it to us so that we can capture these ideas and you may feel they are controversial or you are out on the left field or nobody listens to you. Just give it to us and we can see. Maybe it's a very good idea indeed.

So that's something we want to get going and we hope that we can get some good ideas from that. Also any right ideas that you might have, little innovations, models, thinking that you have had which will help our understanding.

Having said that, I am chairing the first session on vegetation dynamics and I am just trying to find the list of speakers. I want to introduce the keynote speaker which is Brian van Wilgen. He is from the CSIR. I am just going to read straight from here. Dr Brian van Wilgen is the chief ecologist at the CSIR specialising in fire ecology and the ecology and management of invasive plant species. He is the chair of the CSIR Natural Resources Advisory Committee and a core team member of the DSTNRF Centre of Excellence for Invasion Biology. His research has been focused in three main fields: ecology and management of invasive alien plants, the ecological and atmospheric effects of vegetation fires and the use of fire in eco-system management and the conservation of biological diversity.

So without any more ado, let me introduce you to Brian van Wilgen.

KEYNOTE ADDRESS: GRASSLANDS, TIMBER AND ALIEN INVASIVE PLANTS

Brian van Wilgen

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Dr Brian van Wilgen is a Chief Ecologist at the CSIR specialising in fire ecology and the ecology and management of invasive alien plant species. He is the Chair of the CSIR Natural Resources Research Advisory Committee and a core team member of the DST/NRF Centre of Excellence for Invasion Biology. His research has been focused in three main fields – the ecology and management of invasive alien plants; the ecological and atmospheric effects of vegetation fires and the use of fire in ecosystem management; and the conservation of biological diversity.

Abstract

Pine trees from Europe and North America have been planted in South Africa for a range of purposes for over 300 years. The introduction of alien pines has brought many benefits but has also resulted in many unforeseen problems. Their management has evolved in response to emerging problems, changing values and markets, and the realities of a new and largely irreversible ecological order brought about by invasive alien pines. Currently, we are faced with a conflict

of interest, in that pines bring significant value, but are also invasive. These invading pines reduce surface water runoff, impact negatively on biodiversity, and destabilise catchment areas by increasing fire intensity and causing erosion. These problems need to be addressed through a combination of responsible plantation management, co-operative fire management of invaded areas, and biological control. Economic studies are also needed to inform sound decision-making regarding these options.

Transcription

Good morning, everyone. It's really a pleasure to be here. It's not a part of the world that I get to often. I think this is an important meeting.

The first confession I have to make is that I can't claim at all to be an expert on grasslands. I know something about fynbos which is an area where I have worked and savannas. I know about fire ecology and I know about aliens but grasslands is not a field of specialisation of mine at all. So I might be stepping outside of my field of expertise. I might say a few things that aren't correct but this is a workshop so you can correct me.

Forestry is an important industry and it brings many benefits but I am not going to be speaking about the benefits. I take them as read. Forestry has grown quite a bit over the past century, particularly in the first half of the 20th century we saw a significant growth in forestry. And then towards the middle of the latter part of the 20th century, forestry was restricted for a number of reasons, mainly because of its impacts on stream flow. So the area under plantations has remained constant over the past 20 years or so. In fact I think it's even gone down a little bit.

If we look at the Mpumalanga Province, you see where the forestry is situated. These are the highveld grasslands over here and then on the escarpment is where forestry is concentrated. This is the obligatory Google Earth shot. It's a fantastic tool, isn't it? It's just wonderful. But this is a really interesting picture here. This is the highveld grasslands over here and then as you get to the escarpment you see that the landscape is dominated by forestry over here. And then as you go further eastwards you see the area between Nelspruit and Hazyview, particularly densely populated and you can see the effect on the area there. And then you get into the Kruger National Park over here which is pristine vegetation.

The impacts of forestry – the first thing I want to say here is that foresters have always considered themselves to be conservationists and they have always taken an interest in the well-being of the eco-systems that they manage. And as far back as 1936 the Forestry Department started these experiments in Jonkershoek and later expanded them to the Natal Drakensberg and to the escarpment of Mpumalanga to look at the impacts of forestry on water yield. And what I have done is to take forestry as a surrogate measure for what invasive aliens might do if they were to invade and form the same kind of dense stands that forestry plantations form over here.

So the kinds of results that we get out of these experiments, 82% reduction in stream flow 20 years after afforesting grassland with *pinus patula,* 55% reduction in stream flow in fynbos. I must stress that these are maximum values and the foresters will point out that they don't just grow trees all at the maximum age so there is a range of ages there. So the actual reductions are a little bit lower than that from the landscape. But, as I say, we used these experiments to estimate the use of water. And I want to just show you how that model looks.

What we did in the fynbos areas is we took the different experiments, so each one of these dots represents an experiment, and we looked at the stream flow reduction when the vegetation was at its maximum age versus its bio-mass. And as the bio-mass goes up the stream flow reduction goes up as well. And so you can see that fynbos doesn't get to a high bio-mass so it doesn't use as much water but the area afforested with pines to use a lot more water.. So that's a simple relationship based on bio-mass and the eco-physiologists will tell you that's not the way to do it but it's a crude model. We then took this model and we had a look at the spread of aliens. So this is the Koegelberg area around False Bay in the Cape. Here is a pine plantation on the edge here and the pines were escaping from the plantation there and there were some scattered pines around here. And every time there is a fire the model spread the aliens a bit more. So these are scattered invasions and these are dense invasions. So if you did nothing to stop them, that's what it would like after a hundred years.

And you then use that bio-mass relationship to have a look at what it does to stream flow coming out of that area. So when you burn an area, the stream flow goes up because there is less vegetation. And as the vegetation re-grows, the stream flow goes down, then you burn it again and it goes up and so on. And if you repeat this at 15 years intervals in fynbos then you get more or less a steady line going along there. But if you introduce aliens into it, every time that you have a fire the aliens spread a little further and the stream flow reduction is greater. And so you get a downward trend over there. That's it. That's the basis of the working for water programme. This is extrapolated from fynbos and pine plantations and it's been used all over the place to estimate water reductions.

The other impact that forestry and alien invasive do have on the environment is to impact on the soil where you get fires in areas like this where you have been clearing pines, for example, and you have a much higher bio-mass. It forms a water repellent layer in the soil and that erodes over here. And this is an area that has been invaded some 20 years ago and been cleared of hakeas and they had a fire in there and that's what it looks like today.

The final thing that I am going to say about forestry is around birds. Dave Everard spoke about birds yesterday and I don't think anything that he said is different from what I said. The point is that there are bird species that are negatively impacted by forestry and there are bird species that are positively impacted by forestry.

What we did in this study was to take the quarter degree squares and have a look at the percentage afforestation in that quarter degree square. And we then correlated it with bird abundance. So the more forestry there was in a quarter degree square, the more of these birds and the less of these birds. But the point is, as the birds become more special and more rare, they are tend to be more negatively impacted by forestry. So 25 of the globally threatened bird species were impacted negatively by forestry and none positively. What Dave said yesterday as well is that you find these often

on forest estates. I am not surprised really. They have got nowhere else to go. But the point is that where you have a globally threatened species and its numbers are reduced and something was to hit that population, you may drive it to extinction a lot quicker than what would have happened normally and then you lose another species.

I would like to turn my attention now to invasives in general and there is this fantastic database called the South African Plant Invaders Atlas (SAPIA). It has been created and maintained by Leslie Henderson of the PPRI for over 30 years. This is just taken from one of their newsletters and it really is a nice resource to have. And what we did was we took SAPIA records things by quarter degree squares so we overlaid the quarter degree squares over the grassland extent and we identified all of the invasive species that occupied at least 10% of the quarter degree squares in the grassland biome.

This is the list of species that you have as important invaders, in other words occupying more than 10% of the grid squares in the grassland biome. And, as you can see, these aren't in any particular order. As you can see there are several of these plants that are also forestry trees. The Acacias, the eucalypts and the pines. We held a series of workshops here in Pietermaritzburg last year where we got people in to help us try to prioritise these weed species. So if you were to tackle the weed species, which would be the most important that you tackle first and so on.

And in order to do that we first had to decide on criteria. This is the same technique that Tim O'Connor was talking about yesterday. It's called analytical hierarchy process. It's a multi-criteria decision analysis where you get everyone's wisdom together. These are the criteria that that particular workshop came up with so they said that these criteria impacts on eco-system services, biodiversity, fire hazard, lack of benefits is acknowledging that invasive species also at some times have a use. For example black wattles as firewood and if you cleared them you would lose that particular use. And here is the weights given. There was a big emphasis on water in this particular set of criteria. Harvested products, biodiversity counting 22% and the others counting about 10% each.

What you have got to do in analytical hierarchy process is you have got to compare each species to each other species with regard to each of those criteria. So you take species No 1 and you compare it to species No 2 and you say does this one use more water or less? If it uses less water, how much less? And you go through this set of comparisons. If you work it out you have got 32 species multiplied by 31 of each of the other species multiplied by five criteria gives you about 5 000 cross comparisons that you have to do. This can get tedious and you can start making mistakes. It keeps you honest. That's the nice thing about this software. If you said somewhere that A is bigger than B and B is bigger than C, then you can't go somewhere and say that C is now bigger than A. It gives you a consistency score and you can go back and correct yourself where you have been inconsistent.

So we did this for all the invasive species in the grassland and this is the list that we came up with. So No 1 weed in the country and in the grassland here is *Acacia mearnsii,* according to that set of criteria. *Eucalyptus camaldulensis* is not a forestry tree. It's a tree called Red River Gum that invades down rivers. It's one of the few eucalypts that is in fact invasive.

And then there are the two pine species. *Eucalyptus sineria* I don't know. I have never heard of it. It came out in the workshops. Anyone heard of that? There was someone in our workshop that informed me that it was an important weed in grasslands but okay.

If we look at these top species, it's quite obvious that black wattle is something that can dramatically alter the nature of grasslands where it invades and it's very invasive. So you get big alterations in grasslands there. Eucalypts on the other hand are not strongly invasive. There is one eucalypt in the fynbos called spider gum that you used to be called *lehmannii* but they found out it was called *Eucalyptus* something else. And there is *camdulensis* which is not a forestry tree but the eucalypts that forestry uses are not strongly invasive species. But pines are invasive, and pines are a big problem. And when I came to this workshop I thought well I actually don't know how big a problem pines are in grasslands. But I can tell you when you get to the grassy end of fynbos they are a huge problem.

This photograph we took from a helicopter in the mountains just behind Plettenberg Bay. It's miles from anywhere. It's not as though the species has been planted there. It's just invading because the seeds can travel a long way on their little wings and every time there is a fire it densifies again. Another two or three fire cycles here, you are going to have one solid pine plantation up there in the mountains that nobody can get to.

So if we were going to do some stargazing here and try to look at what is going to happen in the future, we have, as I say, the SAPIA database. It shows us in this instance where the pines are recorded as invasive species. So in the grassland you have *Pinus elliottii and Pinus taeda and Pinus patula.* I think the reason they combined elliottii and taeda here was that people who were recording it couldn't tell the difference in the field. But that is currently how widespread they are.

Matthew Rouget and his colleagues did a climatic modelling exercise, climatic envelope so they looked at where these species currently occur and where similar climates occur so where they could potentially spread to if they occupied the same climate area. So this species here currently occupies the blue grids and the dark red areas are areas that are suitable for it to spread to. The lighter areas are less suitable and so on. So this particular species is currently in those areas but it has a long way to go still.

Together with some colleagues at CSIR we used this kind of modelling to do a biome scale assessment of the impact of invasive alien plants on eco-system services. Now this graph here shows you the top 50 species in the grassland biome, and this line here shows you their current distribution. So what this dot over here says that the most widespread species currently occupies just over 40% of the biome. The next most common species currently occupies about 38% of the biome and so on.

Now if you were to assume a scenario where each one of those species spread to its full extent, this is what would happen. The most common species would occupy over 90% of the biome and so on. That species need not be that species; it might be this species moving up to there, for example. But that picture says that if we don't do something about invasive alien species, the entire grassland biome is going to disappear under invasive aliens.

This is a new one that has reared its head. It's pompom weed. Is it here yet?

UNIDENTIFIED VOICE Ja.

DR B VAN WILGEN I saw somebody giving slides yesterday of this beautiful area and it had all pink in it and I wondered if it was this. But anyway. These things are new invaders and they are spreading fast. We then looked at the impact of those invaders on Eco-system Services. Now don't worry about the other biomes. Just have a look at grassland here with regard to water. This clear graph here says that's the amount of water that you would get out of grassland eco-systems if they were not invaded at all. So you would get 26 thousand million cubic metres of water out of the grassland biome if it were not invaded. Currently, because if invasions, you are losing about a thousand million cubic metres of water. But if these invasives were to spread to their full potential, the water run off would go down to 13 thousand million. So in other words about half of the water the grassland biome is at risk from invasive species.

Similarly if you look at grazing at the moment there is hardly any impact really on grazing because of invasive species but if you allow them to go to their full extent you are going to lose more than three-quarters of your grazing value of those biomes. And grassland is the biome that came out as being most at risk from invasions. Fynbos is currently the most invaded biome but the one potentially is grassland. And the really scary thing is that we don't have water to play with. The water is already fully allocated and we can't afford to lose any more really.

I would just like to say something about forestry and biological control as well. In my view biological control is really the answer. I am a strong supporter of it. I believe it's safe. It's the only solution that is actually sustainable in the long term. Any attempted mechanical clearing or chemical clearing of invasives will never actually eradicate those species. There will always be some left. As soon as you take your foot off the pedal they are going to invade again.

So biological control is a really important tool in the armoury and I believe we need to use it as much as we can. This hasn't been an easy ride because initially there was a lot of resistance, understandably so I guess, from the forest industry and others for using biological control. This was a paper published by Stubbings who was director of the Wattle Research Institute in 1977. The title of his paper was an acronym ACACIA. It stands for A Case Against Controlling Introduced Acacias. And if you read here, this is what he said,

"Conflicting research and industry concern arising from the ill defined and largely unsubstantiated status of black wattle as a weed."

So they were claiming it in those days that actually it wasn't a problem. And in the same issue of the South African Forestry Journal there was already a response to this from a guy called Luckhoff who was chief director of Forestry saying, "Hang on, it is a problem in some areas."

And going from that basis of having a lot of resistance, I would say that an enormous amount of progress has been made with Acacias. We currently have eight Acacia species under biological control, mainly from seed feeding and gall forming wasps and flies which reduces their seed output and makes them a lot less invasive than they would have been.

This is *Acacia longifolia* with a gall forming wasp. This is *Acacia cyclops* with a little fly that forms galls. And this thing hardly produces much seed at all any more. So really good progress and the wattle industry has accepted that seed feeding insects are okay and they have been released in KwaZulu-Natal as well now.

We can't say the same for pines though. We did initiate a biological control research programme about ten years ago for pines and we were really gung-ho about this. We said we would look at the Mediterranean pines first. Most of the forestry trees – pines are from North America. We looked at a little seed feeding weevil. Unfortunately the work had to be stopped. This is a paper just published in this journal Biological Control setting out the reasons why it was stopped. But this is the gogga and that is the damage it does. So it's the larvae of this beetle that bores into pine cones and eats out the seeds. But unfortunately the adult also may nibble a little bit on the pine leaves and this may provide an opportunity for pitch canker to get in. So the project has been stopped. It was a very promising project.

I would just like to look at some management challenges now. This is again from the grassy end of the fynbos. This is a pine plantation in an area where I believe pine should never have been planted. A fire went through that plantation. It is completely destroyed and now it has been what they call exited. So the land has been handed back to the conservation authorities and they have to clean up the mess. And if you see part of the mess over there is the pine trees escaping from this plantation and getting into the rest of the catchment area.

So there is a huge challenge in dealing with forestry areas that have to be rehabilitated. This is my own backyard in February this year. I live just over there somewhere. And this is the Jonkershoek plantation. About 50% of the plantation was lost to a fire. Fires are an enormous problem I believe for the forest industry but they also exacerbate, particularly with pines, they exacerbate the spread of invasives because the pine trees release their seeds after fires like this and the seeds spread far and wide. So again this is where I am on thin ice but managing grasslands adjacent to pine plantations probably requires regular burning, one every two years. If you do that regular burning, you will probably eliminate the pines because they can't mature but I am not sure to what degree that is being done.

This is just some data on the extent of fires in forestry plantations. This is from the Forest Owners Association from 1980 to now and you can see there has been a recent marked increase in the area burnt in fires. 70 000 hectares, that's about 10% of the forest estates in the country.

These data here are from Modus, the satellite data. They tend to confirm that trend as well. Dave Everard told me yesterday that you had a good this year, that you didn't have a lot of areas lost in fires in the winter but in the Western Cape they did lose a lot of areas.

Then there is the Conservation of Agricultural Resources Act which also guides how you should deal with invasive species. And, as you probably know, there are three categories of weeks, category one, category two, category three. Category one weeds are the weeds that nobody wants. Everybody agreed that they are bad and we should get rid of them. Category two is the weeds that also have commercial value so they are both valuable and they have a tendency to spread. And these species you can keep but they must be confined to what they call demarcated areas. The third category for ornamental trees like jacarandas in Pretoria, it's an iconic tree. It's always a source of amusement to me that they have Radio Jacaranda named after an invasive species. Similarly you have the Mynah bus. Do you still have those Mynah buses in Durban which are named after an invasive bird? But they become iconic and people don't want to get rid of them.

This is what the Conservation of Agricultural Resources Act says that you must do. First of all most, if not all, of the commercial forestry trees are actually category two invaders as well. And category two invaders may not occur except on any land other than a demarcated areas and a water use licence for stream flow is taken to be a demarcated areas. This is really the crux if the story. All reasonable steps are taken to curtail the spreading of propagating material of plants outside of plants outside of the demarcated area. It's almost like asking somebody to take all reasonable steps to stop the tide coming in. It's a really big job.

This is again in the Eastern Cape Tsitsikama region and there is a plantation and I would imagine that would be the demarcated area. And then outside of the demarcated area you have pine trees spreading all over the place. It's a huge problem, particularly in that region. My question to this workshop is what is the understanding of the way the Cara Act should be implemented? Are these guys responsible for stopping the spread over this area over here? It's a huge ask but if we don't do something about it, it's going to be a disaster.

So my conclusions – in terms of forestry species, the wattles and the pines are the greatest threat, not the eucalypts, but we have made a lot of progress in dealing with wattles through being able to get biological control agents in and working with the forest industry to make that work.

The issue of fire management of grasslands adjacent to plantations I think is needed to control invasions. The question is how far does that responsibility extend from the boundary of the forestry plantation and into the grasslands? But to my mind I think there is room for Forestry to take a little more responsibility for the large areas outside of the plantations rather than just looking after their land that they own. And I strongly believe we need to reconsider this decision to suspend research into the bio-control of pines. I think it can be something that both Forestry can live with and can help in controlling these invasives.

So that's my story. Thank you very much to the organisers for making it possible for me to get here.

DISCUSSION

Transcription

MR S GERMISHUIZEN Thank you very much, Brian. We are a bit ahead of time in terms of how long Brian was going to take on his talk and I expect there will be a lot of questions around this so let's take questions now.

UNIDENTIFIED VOICE (GERHARD?) Just about that comment on the *Eucalyptus* not being as invasive. In your lowveld regions and sort of below the escarpment, *Eucalyptus* is the main weed infesting those areas. It's not a problem higher up in the escarpment itself but lower down in the escarpment that's a problem.

DR B VAN WILGEN There has been very little research actually on eucalypts as invasives so very little is known about them. It's my impression that when you compare *Eucalyptus* to things like pines and wattles, there is no comparison. I mean they may invade but I don't think they are as aggressive as the others. So I think it's a question of prioritising. If you were to go for something that's the biggest problem it wouldn't be eucalypts for me.

UNIDENTIFIED VOICE (GERHARD?) If you go to areas like Swaziland, Peak Timbers and those areas, the …. [indistinct] zones are dominantly dominated by – Eucalyptus trees are invasive. So I think it depends on sort of the region that you are in.

DR B VAN WILGEN Ja, as I said, I can't claim to be an expert on grassland so if you guys are on the ground and you are telling me that then I will believe you.

MR D EVERARD Ja, Brian, you said you prioritised the importance of weeds based on their water use. Well, that was one of the main criteria. Did you have actual figures or was it just based on bio-mass and a sort of extrapolation?

DR B VAN WILGEN It was using this AHP approach. It's based on – we tried wherever possible to use data to actually inform the analysis, but with regard to water it was simply the collective wisdom of that group of people. So if I said, "Here is pompom weed compared to wattle," you would say, "Pompom weed uses less than wattle because it's a much smaller plant," and so on. I don't know if that answers your question.

UNIDENTIFIED VOICE This is actually a question for the forestry industry and I would be interested to know what efforts are being made to research either alternative crops or hybrids or breeding varieties that are not as invasive because it seems that the non … [indistinct] industry is spending millions on trying to research and manage the problem

that is caused by category two plants escaping from the demarcated areas. And I know obviously the forestry industry does try to contain it but we are still using the same three crops or the forestry industry is still using the same three crops to produce those timber products. Are there any efforts to find alternative crops?

DR B VAN WILGEN You might want to look for a volunteer from the forestry industry to answer that but if I can say something about this as well and maybe add to your question. I know there has been a lot of talk about using sterile trees that do not produce seeds. That would go a long way to solving the problem but it's not going to solve it entirely because a lot of those weeds are now out there already. And even if you plant sterile trees we would still have a problem.

UNIDENTIFIED VOICE On behalf of the wattle industry, just a couple of things that are happening. The one is quite a lot of money is being invested in developing sterile wattle, looking at a couple of different options. So that's something exciting for the future. The other thing is wattle – we are not aware of any alternative trees to black wattle. It's extremely valuable to private timber farmers because of the bark and the timber. You are probably for a private farmer generating double the income compared to something like pine. So it's a very valuable crop for timber farmers.

What we are trying to do in the industry is encourage people to become FSC certified and we are working on the marketplace to pay premiums for certified timber. If a farm is certified then we are able to ensure that the wattle is contained within demarcated compartments, riparian areas are kept clean and a lot of money is invested in containing the spread of wattle. So those are probably the three areas we are working on – profitability, certification and developing sterile wattle.

UNIDENTIFIED VOICE I can't say much more about the wattle. I think you have summarised that. I breed the other two species, the other two genera: eucalypts and pines, and quite frankly at this stage that is not a selection criteria in terms of we are not actually looking for – we wouldn't be selecting to try and reduce flowering or the amount of seed that a particular species produces. So it's not really by design something we are looking at at this stage. What I can say though is with some of the hybrids, because it's going the hybrid for both eucalypts and pines, certainly in pine some of the hybrids are going to be less precocious in their seed production than classically *patula* and *radiata* and … [indistinct] But that is not by design in terms of the breeding as such.

UNIDENTIFIED VOICE I just want to throw an idea out there and possibly something that the forestry industry – I don't know if they are aware of – is that the new Waste Management Act – and one might be able to invoke the "polluter pays principle" where waste is defined as organic and inorganic and something that is destructive to the environment. So therefore are they not responsible – is the spreading of alien plants not polluting the environment and classified as a waste and therefore we can invoke the "polluter pays principle".

DR B VAN WILGEN That's an interesting idea but it's exactly the same as what the Cara Act says. The Cara Act says category 2 plant, you must stop it from spreading. The Waste Act might just add another piece of legislation. But in practice how do you do that and where do you draw the line? I mean some of these pine trees are maybe 30/40 kilometres from the source. How far does that responsibility extend? And what is reasonable to ask? That's an interesting idea but I don't know how far it's going to go to actually solving the problem in practice.

UNIDENTIFIED VOICE As you said, where do you put the blame? And if one goes back to the 1930s when conservation was active in the Drakensberg, the idea was to have trout in the rivers and the monthly reports on the range there will tell you that they walked around with wattle seeds in bags, spreading them into the rivers to create shade for the trout in the rivers in the higher areas of the Drakensberg. So when we come to say who is going to take responsibility, I don't think pointing fingers is going to be the answer. It's actually a national problem. And that's where I think the Working for Water programme is having an effect.

???? Good morning, I am Vuyani … [indistinct] from Rands Timbers … [indistinct] I am not answering on behalf of Rands Timbers. We are not doing any research but recently on a ministerial forestry indaba that was organised by Water Affairs and Forestry down at Eastern Cape Port Alfred, we had researchers from the University of Stellenbosch that gave a briefing on the hybrid stud they are busy researching on for the alternatives in terms of *patulas* and … [indistinct] Then secondly on the Waste Management Act that has been raised, we were made to believe that in forestry now they are introducing what they call bio-fuels to get more energy out of the resources. So you are not going to see much waste from forestry any more because from forestry side what you regard as waste is something that is going to be generated into energy to cut your costs at about 70% on an increase now against what was last year with Eskom.

So as much as it seemed a little bit negative, there are other things that can happen to change the course. So we are just going to look on both sides of the coin instead of the one side. Thank you.

DR B VAN WILGEN I think that what you have described as waste which might be sort of bits of the trees that forestry doesn't use and just leaves lying on he ground – I don't think that's what you were referring to over there. What you were referring to was the offspring of those trees, the children of those trees getting out into new areas outside of the plantation and whether those should be considered as waste. Is that what you were saying? [no audible reply] Ja.

????? Thank you. Basically even those. Currently we are running short to timber in the country and as the industry what we do, we are getting even beyond our management areas to get to assist communities that have seen those pines being – their offsprings or what you call – we call them opslag[?] where we come from. We even go there and assist people to manage those because we need timber. We are not given afforestation permits any more for that sake of saving water, but what is already there has already been taking water. So you save it and improves lives of the communities. So they said we should be starting to discuss on triple P, which is public private partnership, and we use those because there are no new afforestation permits coming through. So basically it's working on both ends.

DR B VAN WILGEN I am sorry to keep engaging you but this area here is miles from any road. I can't imagine that any person is going to hike up there to carry the pine trees out on their shoulders. It's such a problem with the inaccessible areas like this.

UNIDENTIFIED VOICE I think the National Waste Act as it stands deals with waste and not with living plants. Even the National Environmental Management Act, that's where the Pluto Pace[?] principle was originally enacted in South Africa. So forestry companies are responsible for escapees but there is a bit of a problem with the legal – the liabilities that comes with that. If you degrade your neighbour's land, then you must fix that. I think that is the basis of it. An FSC certification is very strict on this matter.

MR S GERMISHUIZEN I think it's a good time to cut the questions and if you have more questions for after this session for Brian, then I think we can take those. I just want to make one or two comments about that myself.

The first is that wattle timber is an extremely useful product and I think that we need to be thinking about wattle spread in terms of using the products. And I know that it's the gist of the Working for Water programme, but with such an incredibly useful product both at a large industrial level but also at a local community level, we have got to be thinking of wattle as a resource and keeping it in control with that in mind, how can we use this resource and make sure it doesn't spread into the valuable eco-systems.

The other thing that I picked up in terms of the criteria that we use to decide which weeds are the most important, do you include things such as virulence and spread, rather than just the total impact? Or the threat, as a criteria to decide on which weeds to work with?

DR B VAN WILGEN … [inaudible]

MR S GERMISHUIZEN But it didn't include risk of spread and virulence.

DR B VAN WILGEN No, I didn't. If you added that as a criterion, it may change the ranking. The useful thing about that AHP is, you can see, it's transparent, you can see what the criteria, what the weights were given, and if you think another one should be added, you can go back and add it. And you give it a weighting and it readjusts all the other weightings. And then you have got to go through the whole process again.

MR S GERMISHUIZEN Thanks because I think with the risk of spread and also with the usefulness of wattle, one can use that as a control mechanism. In other words make sure that it gets channelled to useful ends.

Then there is another thing I just wanted Brian to answer while we are just bridging. The scenario has been painted, if we do nothing this is going to be the effect on the water resources but what is the impact of the things that we are already doing. Are we winning the war on aliens generally speaking and is there a way of monitoring this?

I just want to follow up on this as well. When we look at the main attack on alien species, it's the use of expensive herbicides repeatedly, year after year. Is this a sustainable strategy in the face of global economic change where suddenly timber becomes less profitable, there is less in the benefit for weed control, and is it sustainable – and fuel prices go up, then herbicide prices go up. I know that we are talking about a multi-dimensional attach on aliens, looking at bio-control. But up till now I know that in forestry it forms a very small component of the alien plant control system is bio-control or other innovative technique.

Brian, do you see room for that and do you see that there is a problem in terms of the sustainability of our current approach? So there are three things: one, are we getting ahead of it? Are we winning? Two, our current approach of herbicides repeatedly? Is it sustainable and is it going to do the job and what innovative techniques can we come up to solve that?

DR B VAN WILGEN Okay, are we winning the war? I think that I am very encouraged by the progress that has been made with wattles and if we can foresee a scenario where we have people growing sterile wattle trees and we have bio-control and we have Working for Water programme doing the clearing, I think we will get on top of the problem.

With pines I don't think we are anywhere close to winning the war. I don't know how much of a problem pines are in grasslands but certainly in the fynbos it's a huge problem.

Your second question, is it sustainable in the long term? No. Mechanical and chemical control are holding actions. You will never ever eradicate totally those species. And as soon as you stop doing it, they will start invading again. If you look at the amount of money that is spent by the Working for Water programme, for example, on herbicides, it's enormous. They spent R500 million a year on the programme. I think they spent something like R30 million of that on herbicides and they spend R10 million a year on biological control research. I think it should be the other way round.

What was your third question? Innovative ways?

MR S GERMISHUIZEN What can we use now as innovative – systems that would be totally different maybe and more sustainable in keeping suppressing weeds rather than … [incomplete]

DR B VAN WILGEN Off the top of my head I can't think of any. You can have innovative ways of getting communities and land owners to perhaps work together to address the problem. Perhaps we haven't explored that fully yet. It's not a question of pointing fingers and saying who is to blame and what people did a hundred years ago started the problem so it's not my problem. It is our problem. And we have got to work together to find ways of doing it.

MR S GERMISHUIZEN Thanks very much. I think we have run out of time for that session. What I am going to do now is I just want to introduce the next speaker and he is going to be addressing the question of forest encroachment in grassland. Apparently he has changed the title of his talk. He will tell you about that. And Hylton Adie from the University

of KwaZulu-Natal. We have got Mike Lawes and Kevin Kirkman co-authored this paper. If I can just introduce Hylton. He is a post-doctoral research fellow associated with the Forest Biodiversity Research Institute in the School of Biological and Conservation Sciences at the University of Natal and his current research interests include the structure and dynamics of Afrotemperate forest and the competition and co-existence of conifers and angiosperms in these forests.

FOREST ENCROACHMENT IN GRASSLANDS

Hylton Adie, Mike Lawes and Kevin Kirkman

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Hylton Adie is a post-doctoral research fellow associated with the Forest Biodiversity Research Unit in the School of Biological and Conservation Sciences, University of KwaZulu-Natal. His current research interests include the structure and dynamics of Afrotemperate forest, and the competition and co-existence of conifers and angiosperms in these forests.

Abstract

The grassland matrix presents a hostile environment for the establishment of woody plant species. Not only is grass a formidable competitor but frequent fires kill most forest tree species. In South Africa, long-term fire exclusion sites in temperate grasslands show a successional trend towards forest. Yet, certain sites in Drakensberg grasslands appear to be encroached by woody species in spite of sustained burning. In this project, we test the hypotheses that (1) bracken fern (*Pteridium aquilinum*) facilitates the establishment of woody species by suppressing the competitive effects of grass and (2) that bracken fern alters the behaviour of fire in favour of woody species.

Transcription

Today I will talk about a project we intend starting next year. The proposed study follows directly from our forest research in the Drakensberg. We ask a seemingly simple question: how do forest trees establish in grassland? I will start this presentation with a brief background explaining what stimulated our research question. Next, I will talk about what limits forest trees in grassland and then move onto some of the models explaining forest expansion into grassland. Following this, I consider mechanisms explaining tree establishment in grassland. I will finish off by talking specifically about bracken fern, *Pteridium aquilinum*. We propose this plant has an important role initiating successional processes in Drakensberg grasslands.

We have studied regeneration in Afrotemperate forest for the last three years. One clear result from this research is the poor regeneration by angiosperm canopy species in shaded environments. We have also found that rapid colonisation of canopy gaps by fast growing grasses, shrubs and ferns inhibits angiosperm establishment in gaps. Given that angiosperms are a dominant component of Afrotemperate forests, what maintains angiosperm diversity at the landscape scale? Very simplistically there are two options. Firstly, catastrophic disturbance destroys forest resetting the successional process. Stand-destroying disturbance is an important component of similar temperate forest types in New Zealand and South America but there is no evidence for similar processes occurring in Drakensberg forests. The second option, and what we intend pursuing in this project, is the establishment of new forest in grassland. Supporting this notion are the observations that existing forests in the Drakensberg are expanding and new forest, identified as a thicket vegetation type, is prevalent. Our interest in bracken and its role in initiating forest succession in the Drakensberg is stimulated by the observation that seedlings of forest tree species such as *Euclea crispa* and *Rapanea melanophloeos* are frequently noted in bracken infestations adjacent forest. Bracken is widespread in Drakensberg grasslands and especially common in drainage lines and south-facing slopes.

What limits forest tree establishment in grasslands? There are several factors responsible for suppressing trees in grasslands but we have identified grass and fire as the most important. Grass is a formidable competitor for below-ground resources. It is very difficult for woody tree species to establish in intact grassland. Fire has a pervasive role in grass-tree interactions. It is well known from several long-term experiments in South Africa that withholding fire causes a successional trend towards forest. Our forest research has also shown that shade limits most of our forest angiosperm species. It is not surprising, therefore, that almost all forest tree diversity in the Drakensberg is captured on fire-safe topographic refugia that are distributed in the grassland matrix.

There are three basic models explaining forest expansion or the colonisation of matrix by forest trees. First, nucleation occurs where an isolated tree positioned in the matrix becomes a focal point for dispersal vectors such as birds. Provided post-dispersal seed mortality is reduced and herbivory is limited, trees will establish beneath the focal plant to create a bushclump. There is very little evidence for this effect in the Drakensberg, probably due to the impact of fire and grass. Margin expansion is important in the Drakensberg and we see a lot of evidence for this phenomenon. *Buddleja salviifolia* and *Rhus tomentosa* are common tree species that characterise an extended forest edge. Finally irruption occurs when vegetation establishes in the matrix with no association to the forest edge or other vegetation structural features. The widespread distribution of bracken fern in Drakensberg grasslands may be explained by irruption.

For these processes, fire and grass remain the important limiting factors on tree establishment in the matrix. What mechanism accounts for the expansion of trees into the matrix? We know from long-term studies that withholding fire leads to a successional trend towards forests. It has been proposed that the accumulation of moribund material kills grass resulting in gaps for woody plant establishment. The competitive effect of grass is reduced over time leading to tree establishment. It is unknown whether this mechanism accounts for woody establishment in Drakensberg grasslands.

Fire is an important management practice in the region with grasslands burned on at least a three-year rotation. The widespread management burning would suggest a mechanism other than the “grass mortality” hypothesis that accounts for woody establishment in these grasslands. As an alternative we propose bracken fern facilitates the establishment of these woody species by removing the competitive effect of grass and altering fire behaviour in favour of woody plants. This proposition forms the basis of our study which we aim to test by manipulative experimentation.

Bracken is considered by some to be the most well studied taxon at a global scale. What do we know from this extensive body of research? The results are equivocal. Correlative studies have shown that bracken facilitates the establishment of forest trees but the fern is also a strong suppressive agent on tree establishment. Ecological research has been dominated by studies in the United Kingdom and Europe where fire is not an important component of ecosystem function. Manipulative studies examining the role of fire and bracken on regeneration are understandably sparse.

We ask fairly simple questions. Does bracken shade out grass? Does bracken suppress trees and if so, is it an above- or below-ground effect? Does removal of grass competition facilitate tree establishment? Does bracken alter fire behaviour as we are suggesting? And, at what age do trees become fire tolerant? In this study we hope to tease apart the fine-scale interactions that are part of the three-way grass-tree-bracken interaction. The challenge is to understand the overriding, and pervasive, influence of fire on the proposed three-way interaction.

Our ideas on fire are speculative and based purely on observation. Bracken, strangely enough, does not always burn. KZN Wildlife Managers comment that under certain conditions bracken requires some encouragement to burn thoroughly. Under warm and windy conditions the plant is capable of explosive ignition but may not burn at all in cooler weather. Bracken infestations are identified clearly by SPOT 5 satellite imagery. At a landscape scale such imagery has revealed bracken infestations that fail to burn in one three-year rotation. For those patches there is a six year window of opportunity before the next fire for forest tree establishment in grassland.

What lessons have been learnt from global bracken research? First, the fern has global economic importance impacting the agricultural and timber industries in particular. Bracken is carcinogenic to humans and highly toxic to stock. The taxon tolerates a wide range of soil types and moisture levels but cannot survive waterlogging. Bracken is supremely dominant once established and has been referred to as a “native thug” given its’ suppressive impact on associated vegetation. A universal trend is that associated floras become progressively depauperate with the increasing dominance of the fern. The species survives fire well by reprouting from a large below-ground rhizome. Fire is thought to drive the spread of bracken. Yet, in spite of this species ability to dominate vegetation types, it is considered a ruderal species in New Zealand. Frequent fire drives bracken dominance.

Given this information what can we expect for our high altitude grasslands? In KwaZulu-Natal bracken extends from sea level to highland temperate grasslands, where it is particularly successful. It survives well above the Cave Sandstone belt at 1800 to 2000 m above sea level. Long-term studies have shown how difficult it is to successfully eradicate the fern so we cannot expect infestation levels to decline. In our experience bracken is a proving to be a successful vehicle for alien plant establishment and severe erosion beneath bracken infestations. Soil chemistry is known to change with long-term infestations. We argue that bracken will play a pivotal, and far-reaching, role in plant community structure by directing plant community development down alternative, and irreversible, successional pathways.

DISCUSSION

Transcription

MR S GERMISHUIZEN Thanks, Hylton, for what I think was an extremely relevant and interesting topic. It's something that I am sure the … [indistinct] will be waiting for results from this research. It's an issue we have all encountered on forestry estates and an issue we have grappled with for a long time. I have contacted many people and I have been referred to this quagmire or literature from all over the world. And so thanks very much for that. I think we are going to take questions immediately after the sessions but we are not going to have a discussion session afterwards. So I am quite convinced there's quite a lot of questions on this. Anything you want to direct directly to Hylton now?

MR D EVERARD Just a point of clarity. In the beginning you said there's a failure of angiosperm regeneration. Is that in the Drakensberg forest only? It kind of contradicts everything else you were saying that if you get bracken then you get woody expansion and regeneration of angiosperms.

DR HYLTON ADIE Dave, in the forest, certainly in the Drakensberg forests, broad-leafed angiosperms, the non-conifers do not regenerate beneath the canopy.

UNIDENTIFIED VOICE Just a comment. At Cedara about 50 years ago, the farm manager planted a bunch of little pockets of indigenous forest over the grassland. It might he worth having a look at them and finding out more about how they were managed.

DR HYLTON ADIE Ja, I am aware of those.

MRS PETA HARDY Hylton, many years ago I did quite a lot of research on the expansion of indigenous forests into fynbos. And one of the things that came up was also looking at the soil moisture levels on the edges of forests and how that relates to expansion with fire protection. Because I looked at different ages and different expansion dynamics. And it was very clear that on certain slopes, even with fire protection there no expansion and yet on other slopes that were more moist there was quite a lot of expansion. So the adaphic[?] factors are quite as important as well I think to look at.

DR HYLTON ADIE Certainly and we suspect moisture is going to be important for bracken establishment.

PROF TIM O'CONNOR[?] Hi, Hylton, I would suspect that *Pteridium* has all the credentials to benefit from CO2 fertilisation and I have touched on this issue with you before. You don't list it as an issue therefore you must have good reasons not to. Could you please just explain why you don't see it as possibly the key factor that would account for a global expansion of a species in a range of different environments? Surely there is a common denominator to it?

DR HYLTON ADIE Tim, the first reason I haven't included carbon is my ignorance of the topic. So my apologies on that. We can't not embark on this project without considering carbon. Certainly all the research that William Bond has been doing – Roger tells me he is about to publish a paper dealing specifically with this. We will need to touch on this. The only reason I haven't dealt with it is my ignorance of it. Also I suspect carbon is important in the recruitment phase whereas we are targeting the establishment phase. So from germination through to that young seedling phase. Whether I am sticking my neck out by making that comment, I don't know. We simply don't know enough about this project or I don't know enough about this project to make a clever comment on that. I will listen to any advice.

MR S GERMISHUIZEN I think that ends the questions. Thanks very much, Hylton.

One additional editorialisation on this – you know in forestry we are often faced with a choice in our open areas. What vegetation type we want. In many of these narrow corridors it would be useful for forestry to have indigenous forest patches which forms natural firebreaks and difficult to maintain grasslands in narrow, isolated corridors. And so understanding the dynamics and how to best get the conditions for forestry generation is going to be a very useful product and something that we can pick up.

Without any more ado then, let's move on to our next talk. We have got Julia Wakeling currently managing the Zululand tree project. She is with the University of Cape Town and she is talking on why grasslands aren't savannas.

WHY GRASSLANDS AREN'T SAVANNAS

Julia Wakeling, William Bond and Michael Cramer

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Julia Wakeling is currently managing the Zululand Tree Project. This is a University of Cape Town (UCT) research project based in Hluhluwe-iMfolozi Game Reserve, aimed at understanding more about savanna vegetation dynamics. She has recently graduated with a masters from UCT, and will present a summarised version of her results in this symposium. Julia is interested in the ecology of a broad range of systems.

Abstract

The Highveld grasslands are one of many grassland areas from throughout the world that may support a woody biomass if fire is suppressed. It is puzzling that fire-tolerant savanna trees do not grow in these grasslands. Hypotheses including fire, human intervention, grass competition and various attributes of soil have been proposed to explain the tree-less nature of the Highveld grasslands, but they have mostly been discounted. In this study it was hypothesised that cool temperatures or low nutrient availability would result in slow growth of saplings in grassland areas that would subsequently not be able to escape frequent fires.

A seedling transplant experiment of savanna tree species of the Acacia genus, into grassland and savanna areas arranged across an altitudinal gradient, was used to compare growth in these varying climates over one growing season. Soils were collected from grassland and savanna regions to establish if nutrients varied between these areas, and seedling growth was measured in a pot experiment including these different soils.

Higher altitude grassland areas were cooler, and the grassland soils that were collected were nutrient-poor, relative to the savanna equivalents. Growth was well correlated to both temperature and nutrient availability, and in general there was slower growth in grassland climates and grassland soils compared to in savannas. These seedling growth rates were extrapolated to the growth rates of saplings in natural environments and the time it would take saplings to reach a height above flame height was calculated. This showed that although there were significant differences between growth rates in grassland and savanna soils, the magnitude of these differences was not large enough to prevent saplings from growing into adults in grassland soils. Differences in growth due to temperature variations, however, were large enough to suggest that saplings in grassland climates would grow too slowly to ever reach escape height between frequent fires.

There has been much discussion about the tree-less nature of the Highveld grasslands, but very little experimental work to back it. Neither temperature nor fire alone can explain the lack of trees. This study provides empirical evidence that slow growth due to low temperatures in combination with frequent fire could exclude savanna trees from the grasslands. The barely recognised savanna tree-line deserves attention, as savannas continue to invade grasslands in a warming world.

Transcription

Good morning, everybody. It is a pleasure to be here. I would like to present a very brief summary of my masters. [This is the other end of the scale, a project that is finished and it feels really good when it's done.] I'm interested in why grasslands aren't savannas, work with William Bond and Mike Cramer. What I mean by this is why are grasslands beautiful wide open expanses and why do savanna trees, which manage to survive perfectly well in a glassy layer in savannas, not grow in these grasslands?

The first reason that people often give is that it's too cold. Well, it's a pleasure to have an audience who actually know that trees do grow in grasslands. In fact you grow them all the time. They grow perfectly well in plantations and towns in grassland areas, which shows that they can survive the climate. It is not too cold for these trees to grow. You even get indigenous trees growing in certain places, in kloofs and on hillsides. Trees can grow there.

I would like to take a step back and tell you that the Highveld grasslands of South Africa are not unique. You get grasslands like this all over the world. Zimbabwe, Malawi, all the way up to Kenya, Tanzania, and Madagascar. [That looks like the Highveld grasslands if you ask me.] Tall grass prairies of North America; also there are things called balds in the Appalachian Mountains in North America and in Australia, and the Campos grasslands in South America. They all look very similar. In all of them trees can grow, in forest patches, showing that trees can survive the climate in these grasslands.

Another reason that people give is that it's fire. Yes, but savannas burn all the time and trees have adaptations to survive these burns. They can tolerate fire as they have the ability to resprout.

People have been thinking about this for a long time. I am going to run through a few of the hypotheses that have been thought about. Acocks said that man cut them down in the last thousand years. Well, the grasslands are more than 10 000 years old so that certainly isn't true. There are several soil-related hypotheses; a shallow impervious layer in the soil results in a lack of rooting space, but if you exclude fire in these areas trees can grow. Also, a shallow impermeable layer causes seasonal water logging and desiccation, but once again where fire is excluded, trees can grow. All of these factors may be important locally, but not the entire grassland biome.

A more recent hypothesis by Mills et al., (2006) said that there is more moisture in the top layer of soil. This allows continuous mineralisation of nutrients in this top layer of soil and because that's where the grasses have their roots, they manage to pick up the nutrients faster than trees. This allows them to be exceptionally competitive. This still needs to be tested.

Our idea is that trees grow too slowly to escape fire in the grasslands. This comes from the escape hypothesis in savannas which says that trees need to grow taller than the flames of fires in order to be relatively immune to the effects of fire, become adults and reproduce successfully, which of course is the aim.

Trees grow in height with time and if they are still within the flame zone when a fire comes along they get top killed and have to re-sprout from the ground. This may happen several times until they grow fast enough, and there is a long enough gap between fires, for them to escape and become adults. Our idea is that perhaps in grasslands the trees grow too slowly. And what's limiting this growth is that the grasslands are cooler than savannas, or there may be a lack of nutrients. The grasslands are on an ancient land surface that has been highly leeched over time and perhaps there are relatively fewer nutrients in the grasslands than in savannas.

To test these two ideas, I measured Acacia seedling growth. We looked at acacias because they are savanna trees that can tolerate fire and survive within the grass layer. These are the kind of trees that we would expect to grow in grasslands. I used indigenous trees as well as Acacia mearnsii. I measured growth in grassland and savanna soils and temperatures across the study area in northern KwaZulu-Natal and southern Mpumalanga.

There were two experiments. In the first one, I collected soils from all those different sites. I took them back to one area and I planted two different species of Acacia in them in bags and monitored their growth over a growing season. In the second experiment, I planted six species of Acacia at each site, which had different climates. I tried to control the soil by planting them in bags in the same soil. There were holes in the bags so they weren't going to get pot bound and we also gave them slow release fertiliser so they shouldn't have been limited by nutrients. In both experiments, the plants were watered. I didn't want to have my experiments fail because there was a drought, and in fact there were a few very dry months. I also protected them from animals and fire and controlled for grass by eliminating it. I measured the plants a number of times over a year.

First I would like to show you the results of soil analyses between grasslands and savannas. The ph, which influences the availability of nutrients, is on the left axis and exchangeable cations summarised as the T-value is on the right. The higher altitudes are grassland areas, which had lower nutrients than the savanna areas, all at lower altitudes. The one exception was the lowest altitude site, which had surprisingly low nutrients. These results show that we do have a general trend for relatively poor grassland soils.

We expect the grasslands to be cooler, as they are at higher altitudes, and in fact have fewer growth days [right hand axis], and fewer heat units [left hand axis], which are an accumulation of temperature. So the grasslands are cooler. This is a good starting block. Now we know what we are dealing with. And how do the plants respond? Looking at the T-value once again (as that was one of the best indicators of plant growth and was well correlated with altitude), we see with more nutrients, we got better growth. With temperature on the x-axis, we can see there was more biomass accumulated by plants grown in warmer temperatures.

Let us summarise this all neatly and compare grasslands and savannas to make it simpler. Trees in savanna soils grew faster than trees in grassland soils but only a little bit faster. There was a difference, and the trees did respond to the nutrients, but the difference was small compared to that due to temperature. Trees in savanna temperatures grew really well and those in grassland temperatures grew surprisingly badly.

Okay, so what does this mean for our little tree trying to escape the fire trap? This is a pot experiment and was watered, had grass removed, etcetera, etcetera: not a natural situation. I am going to relate our biomass accumulation to data collected in Hluhluwe-iMfolozi Park (HiP) of trees growing naturally in a grass layer. In HiP we have seen that savanna trees can reach an escape height of three metres in say six years. Escape height varies depending on the fuel available and the weather conditions on the day of the fire, but for the purpose of this talk I will use a three metre escape

height. Given that trees in grassland soils grow slower, they will take a little bit longer, say nine years to reach escape height. That's not much slower than trees grown in savanna soils, and trees grown in both grassland and savanna soils would certainly escape fire. Trees grown in grassland temperatures on the other hand would take more than double, in fact almost triple, the length of time to reach escape height than those grown in savanna temperatures.

In conclusion, the relatively poor grassland soils did not have a large enough effect to result in a lack of trees in grasslands. Temperature on the other hand had a massive effect and in combination with fire could certainly prevent trees from growing in grassland areas. I don't need to convince you but I would like to remind you that fire is essential. Fire is really, really important, but it also can't keep grasslands open alone. Seedlings also need to grow slowly if they are going to be caught in the “fire trap”. I found temperature to be the major factor limiting tree growth. As the climate warms it will certainly be easier for trees to encroach into grasslands, and our use of fire will be even more important in areas we would like to maintain as open grasslands. Additionally, and perhaps alternatively, I would like to reiterate Tim O'Connor's point that we need corridors to allow species distributions to shift as the climate changes.

I would like to say a huge thank-you to the many people who helped with this project.

DISCUSSION

Transcription

MR S GERMISHUIZEN Thanks very much, Julia, that was very interesting. Can we take some questions from the floor? Christie at the back?

MR CHRISTIE POTGIETER Julia, just a question on where you got the seed from for the trees that you planted in the highveld, because in the case of *Acacia karoo* where it occurs over such a wide variety of growth sites, you will have to take seed from a fairly similar type of climate zone.

MS JULIA WAKELING I actually used two varieties of *Acacia karoo*. I used the Hluhluwe variety which is a tall spindly looking thing and I used seed from Bloemfontein. And actually that subspecies survived really well through the cold climate. So I also looked at this through the frost of the winter. And the variety from Bloemfontein actually survived better than any of the other varieties. So, yes, we did look at that.

UNIDENTIFIED VOICE In terms of the relationship between temperature and coastal grasslands because obviously the coastal grasslands are warm.

MS JULIA WAKELING They are indeed. They also tend to be quite waterlogged, do they? I don't know. I am not an expert on coastal grasslands. Who knows about coastal grasslands? Roger come and answer this question.

MR ROGER UYS Our coastal reserves along KZN's coast generally have very sandy soils although there are areas of clay and they are being invaded quite rapidly by Acacia and *dicrastakis*[?] which are moving out into the grasslands and which we are working to control.

MR S GERMISHUIZEN I have got two questions. To what extent do you think natural fire frequency in the grassland areas would be greater than the natural fire frequency in the savanna areas so that would allow a greater escape time which might nullify that hypothesis.

And the other thing is what about rainfall being a limiting factor in the savanna areas for tree growth?

MS JULIA WAKELING Fire frequencies, you get savanna areas and grassland areas that burn very frequently and you get savanna and grassland areas that burn extremely infrequently, in fact almost never. So the range of fire frequencies is enormous in both.

What we have seen in savannas is that trees get caught in the fire trap. So you get trees which can be less than a metre tall that are decades old and they have a huge tuber below ground. So they certainly get caught in the fire trap. They manage to escape and recruit and become adults in cohorts when the conditions are correct. So what will happen is all of a sudden something will happen that there will be a longer gap between fires and all of a sudden you will get a whole cohort of trees coming through. So that would be the same in grasslands as well. So it's not easy in savannas. I am not saying that it's a joyride in savannas. It certainly isn't. It's still very difficult. Does that answer your question?

MR S GERMISHUIZEN The other thing is that you know if you are not watering your plants in the savanna area … [incomplete]

MS JULIA WAKELING So the rainfall question. Are trees limited by rainfall in savannas? No. There's plenty of trees in savannas. They grow really well.

MR S GERMISHUIZEN But the question is if you are watering your trials equally, then naturally your savanna areas have lower rainfall. The question is that the rainfall is an aspect to consider when you are trying to grow commercial areas. Trees for example in a savanna area. We can't seem to establish them in savannas.

MS JULIA WAKELING Okay. William has done projects in Kruger National Park where he gave seedlings the normal rainfall, he gave them 50% of the normal rainfall and 150% of the normal rainfall. The difference in growth was minimal. It's really not that big a factor.

UNIDENTIFIED VOICE The frost intensity or the fire intensity after frost, surely that must make a difference in the tree's survival?

MS JULIA WAKELING Sure. I think frost has a huge role here. I think trees get caught in a frost trap as well. So frost – what I saw was – I didn't manage to speak about it here because I didn't have long enough. But trees get top killed by frost but they can survive. So I got trees being top killed by frost but they re-sprouted. So it behaves very similarly to fire. I don't know if a tree can differentiate between frost and fire. If it's going to top kill it, it's almost like the same thing. The tree comes to winter and it knows it's going to get hammered somehow. The actual effect of it is – ja, I am not so sure. I don't know if I answered your question.

MR S GERMISHUIZEN Are there any more questions? [no audible reply] Thanks very much, Julia.

MR S GERMISHUIZEN Our next speaker is from the University of KwaZulu-Natal in Pietermaritzburg. It's Terry Everson and she is going to be speaking on the life and times of *Themeda triandra*. Terry, thanks very much.

THE LIFE AND TIMES OF *THEMEDA TRIANDRA*

Terry Everson

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Dr Terry Everson is a lecturer at the University of KwaZulu-Natal in Pietermaritzburg. She has spent 18 years researching the population dynamics of montane grasslands in response to fire and disturbance. Her current research is on community involvement in natural resource management. This focuses on community participation in integrated catchment management, rehabilitation of degraded rangeland, and the development of technologies to promote sustainable use of resources.

Abstract

In South Africa the restoration of indigenous grasses such as *Themeda triandra* is highly desirable to conserve biodiversity and increase productivity for subsistence and commercial farming activities. The success of grassland restoration programmes will depend on the availability, viability, dispersal and establishment of seeds of *T. triandra*. The results of this study support the hypothesis that in moist montane grasslands, seedling recruitment plays a minor role in regeneration of *T.triandra*. The optimum burning regime for increasing seed production of *T. triandra* is a biennial spring burn (267 seeds m^{-2} $annum^{-1}$) which was significantly higher than an annual winter burn (21 seeds m^{-2} $annum^{-1}$). In the five-year burn seed production was variable with the number of seeds approximately doubling from two yrs after burning to three yrs after burning, but then decreasing in the fourth year of no burning. High predation of seeds (70-98%) and low viability (37% in 15 month-old seeds) contributed to the poor representation of *T. triandra* in the seed bank (<1.2%) when compared to the above-ground vegetation (<29.2%). While losses to predation can be overcome by using seedling plugs instead of seeds for rehabilitation, it is evident that the seed bank will play a limited role in the restoration of the grasslands in the degraded areas.

Transcription

The focus of my talk is going to be *Themeda triandra* which can be seen in this slide showing a rich diversity of grasses. This grassland would probably qualify as a bench mark site for biodiversity integrity which was referred to earlier by Tim O'Connor. On the other side of the fence is degraded grassland where you have not only lost your biodiversity, but you have also lost your top soil. In terms of catchment management, these degraded areas have a major problem in terms of ecosystem function, because they can no longer deliver good clean water. Once you reach a situation like this, it's a major disaster.

The question is can degraded grassland like this be rehabilitated to restore the ecosystem function of provision of good clean water? We have had some success in rehabilitating degraded communal areas which has resulted in a higher basal cover which promotes water infiltration. Here you can see Kikuyu grass established successfully on eroded areas. However, there is a problem in terms of planting exotic plants especially in conservation areas. In the KZN wildlife areas *Eragrostis curvula* is a popular grass for rehabilitation. This particular slide shows *E. curvula* used for rehabilitation in a Cathedral Peak catchment after a fire burnt through an experimental pine plantation. *Eragrostis curvula* is a popular grass for rehabilitation because it is very productive in terms of biomass and it produces a lot of seeds. But the major problem is that it is very persistent. This slide was taken five years after seeding and you can see that there is very little evidence of the indigenous grasses coming back to this particular site. This study focused on the potential of an indigenous grass, *Themeda triandra*, for rehabilitation and in particular on the effect of different burning treatments on the seed dynamics of *Themeda*.

The study took place at Brotherton Burning Trial which Alan Short has described in detail. I focused on four treatments: an annual winter burn to represent the fire breaks that are burnt annually (in this slide you can see a firebreak around the Brotherton trial; a biennial spring burn which represents the prescribed burning treatment for this area; a biennial summer burn which is generally not recommended but is practised by the neighbouring communal land owners; and lastly a five-year burn, to determine the effect of a longer burning rotation on seedling dynamics.

If *Themeda* is to be used in a rehabilitation programme, the first thing that is required is a knowledge of seed production. Our study showed that the annual winter burn was detrimental to seed production (38 seeds m^{-2}). The reason for this is that the vegetative tillers of *Themeda* need two years to mature to produce inflorescences and seed. If you burn annually you prevent your inflorescences from maturing. The biennial summer burn was also detrimental for seed production (52 seeds m^{-2}) and the reason for this is once the apical meristem starts elevating it is very vulnerable to

damage. If you burn in summer you are going to damage this aerial portion of the plant and this is going to impact on inflorescence development and seed production.

The biennial spring burn had high seed production (274 seeds m^{-2}). The reason for this is that the spring burn is put in before the elevation of the inflorescences so the damage to the apical meristem is minimal and seed production can take place. The five-year burn was also fairly productive (287 seeds m^{-2}). The study was four years after the burning treatment.

If we look at dispersal distances of *Themeda triandra,* 94% of the seeds are dispersed within half a metre of the parent plant and the maximum dispersal distance was one metre. When we simulated very windy conditions in the laboratory, the maximum seed dispersal was 1.75 metres. This has important implications for rehabilitation programmes since if your degraded area is more than two metres away from your seed source, natural seedling establishment is unlikely to take place. In addition, the larger the area that you are trying to rehabilitate the greater the need to bring in seeds from another seed source, as seeds from parent plants will not disperse to areas beyond 1.75 m.

Once the seeds are produced, they go through a dormancy period. In our study we found that this was about nine to ten months. What is really interesting is that the viability of the seed decreases during the dormancy period. Fresh seeds were 90% viable but ten-month old seeds were only 60% viable. If seeds of *Themeda triandra* are to be used for rehabilitation programmes more research is needed to look at ways of maintaining viability of seeds during this storage period.

A knowledge of the seed bank is necessary to determine the potential of natural seeding establishment in disturbed areas. Soil cores were taken from each burning treatment and the germination technique was used to determine the soil seed bank composition. Although *Themeda triandra* dominates the above-ground vegetation we didn't find any seeds in the seed bank of the different burning treatments. In the no-burn treatment, the maximum contribution that *Themeda* had to the seed bank was less than 2%. This means if we are going to rely on soil seed banks for rehabilitation, we are going to be wasting our time. In contrast, *Eragrostis curvula* was virtually absent in the above-ground vegetation but contributed significantly to the seed bank. This is why it is a popular plant for rehabilitation.

One of the reasons for the poor representation of *Themeda* in the seed bank is the high level of predation. In a cafeteria type experiment, 600 seeds were placed in the grassland over three periods: November - before natural seed dissemination; December - the time of natural dissemination; and January - the month after natural dissemination. In the trial 70-98% of seeds were removed within two to six days. Predators observed were mainly ants and there was some evidence of predation by rodents. One of the possible reasons for the high predation of *Themeda* seeds is that if you compare a *Themeda* seed to an *Eragrostis* seed, it is larger and has a bigger endosperm that is more nutritious. This means that we need to look at other options besides using *Themeda triandra* seeds in rehabilitation programmes. Justin du Toit will give us insight into some of his research to address this problem.

I also looked at survival of natural seedlings established in the different burning treatments over a period of four years. I used a pantograph to map all the vegetation in quarter square metre quadrats and produced a life table for a particular cohort of 321 seedlings (N_x). The survivorship (l_x) was scaled up to an initial cohort of 1 000 seedlings and the life expectancy (e_x) was calculated for those particular seedlings.

It is apparent that survivorship decreases dramatically over the four-year period. The first seeds had a life expectancy of 0.74 which translates to about nine months of the year. What is interesting is that if the seedlings make it through to the third year, the life expectancy increases to about 15 months. This may be a survival strategy whereby the seedlings that do survive are able to persist until an opportunity such a disturbance happens, and they then have the ability to establish and develop into a tuft.

The next slide illustrates some of the maps from the pantograph study. The top maps were taken at the beginning of the study and the bottom ones two years later. If you look at how the tufts change shape and how species diversity changes, it is apparent that we are dealing with very dynamic grasslands here. If you have a look at the biennial spring burn, the cross hatch represents *Themeda*. You can see that *Themeda* dominates this particular burning treatment. The stars represent the seedlings that were recorded in the plots. It is apparent that these seedlings will have to compete with the large grass tufts and this may be a reason for the high seedling mortality. These seedlings cannot compete with the well established grass tufts which have deep roots which can access nutrients.

An interesting observation is that in the biennial summer burn, *Themeda* has virtually disappeared. Summer burning damages elevated apical meristems resulting in the loss of this species.

In the five-year burn the tufts tend to be bigger, but there is evidence of low basal cover. With the build up of moribund material, smaller tufts get shaded out resulting in large bare areas.

The results of this study were used to draw up a seed budget for *Themeda*, based on a square metre of ground. From 250 seeds produced per square metre, I took a conservative estimate of predation of 70%. Thus the seed rain on the soil is 75 seeds per square metre. Once these seeds have gone through their dormancy period, only 60% will be viable. If we add five seeds coming in from previous years, the seed bank will be fairly low at 50 seeds per square metre. The high percentage germination of these seeds will result in 40 seeds establishing. However, the high mortality of these seedlings will result in only eight surviving seedlings. If we are going to look at ways to use *Themeda triandra* in rehabilitation programmes, the high seedling mortality is one of the key things that we need to address. Again I think Justin will be talking about some innovative ideas to overcome this problem. In conclusion, it is apparent that *Themeda* has a low potential for seedling establishment in degraded grasslands. However, there is evidence that there are windows in the life cycle where research may increase the potential of seedling establishment. For example, are there ways to reduce losses to predation? We have had some attempts at using seed plugs but these are very expensive. Why is seedling mortality so high? Maybe competition experiments will give us more insight into this? Another area of

research may be to repeat this study on other species that possibly have a greater potential than *Themeda triandra* (a fire climax grass) for rehabilitation programmes.

DISCUSSION

Transcription

MR S GERMISHUIZEN Thanks very much, Terry. I think that's going to be very interesting to link that up with what Justin has got to say later in terms of rehabilitation techniques that we want to be thinking about in grasslands. Are there any questions for Terry before the next speaker?

UNIDENTIFIED VOICE Thanks, Terry, for a fantastic talk. This is more of a comment than a question. One of my colleagues has been doing some work on seedling germination in some of the coastal grasslands and they have had very poor germination and seedling survival.

DR TERRY EVERSON Of *Themeda?*

UNIDENTIFIED VOICE No, no, of forbs. And one just wonders if it's not a common pattern in grasslands that seedling survival is naturally extremely low.

DR TERRY EVERSON Yes. I mapped all seedlings, not just *Themeda* and it certainly is a problem. And I think we know that in these high rainfall areas tufts or tiller development is the major means of reproducing.

MR ROGER UYS Terry, those *Eragrostis curvula* sown patches that you were showing, just out of interest, we looked at them with Ed Grainger quite a long time ago and at the time they were 25 to 30 years after having had been sown by Forestry and nothing had recruited into them besides a bit of bracken, bramble and the odd oxalis plant. So it really does go to show that *Themeda* which was the dominant grass in the surrounds just does not recruit into those areas. And so if you destroy a grassland, there is very little opportunity, particularly in the mesic areas, for it to come back.

DR TERRY EVERSON I think that's true. In this particular – in catchment 2 we did find after quite a few years that there was some invasion right on the edge but that was it. It didn't expand further into the catchment.

UNIDENTIFIED VOICE [JOHN?] Did you look at any of the soil qualities at all? The amount of calcium magnesium, etcetera in those degraded areas?

DR TERRY EVERSON No, sorry, no.

UNIDENTIFIED VOICE [JOHN?] In the Drakensberg we did analysis of some of the old eland licks that they used to put out because nothing was growing there and we found a very, very high level of aluminium in those soils which would indicate that nothing was going to grow in there because of the aluminium toxicity or potential for aluminium toxicity. So it may be useful to look at the soil and see what is happening there.

DR TERRY EVERSON In fact these grasslands – I don't know if you remember, John, those areas – they were going to plant pines but then because of the results of the other experiment they actually stopped it but they had already removed the vegetation in those patches. There are no weedy – even weeds don't come back in those grassland areas and I think it probably is related to this aluminium toxicity. If you compare it to, for example, a *Eucalinga tabera[?]* patch, within a short time you would have weeds anyway establishing.

MR ROGER UYS Just a follow-up observation on that. I did some work looking at *Themeda, Eragrostis* and *Hyperenia*[?] in those acidic subsoils, adding nitrogen and *Themeda* doesn't like it and it doesn't grow well at all. But the *Eragrostis* and *Hyperenia* do take off if you remove their nutrient limitation. So you can get stuff growing in them but it needs a little help.

DR TERRY EVERSON Thanks.

MR S GERMISHUIZEN I have one question, Terry. This is generally grassland species, they are setting a lot of seed and wouldn't there be evolutionary pressure in the long run if the seed – I mean what's the function of the seed? Wouldn't there be evolutionary pressure to produce less seed over time if the seed has not really been germinating and spreading? Not a major reproductive requirement from seed?

DR TERRY EVERSON I think that's a good question but if you compare it to *Eragrostis curvea* where the seed production is about 50 000 seeds per square metre and we have got like 250, there is a lot less energy. And I think maybe, because what we did find is when we cleared areas, we had some patches, those seedlings that did establish actually took off better without competition. So without competition from … [indistinct] Maybe that's the reason they kind of hang in there to make a window of opportunity. I don't know.

PROF TIM O'CONNOR The whole point about evolutionary pressure, you can only ask it in the context of the longevity of the plant and now you are dealing with a vegetative propagating thing that will eventually have circumstances in which sexual propagation will be needed. The intriguing question you have just raised is how long do some of these clones out there live? Some of the studies on clonal species, clonal grasses elsewhere in the world have indicated all of the centuries is not possible. It's probably unlikely for *Themeda* but the fact is decades is highly probably for a lot of the large tussocks that you are getting in places like the Drakensberg whereas in lower rainfall environments tussocks are turning over far, far more rapidly.

MR S GERMISHUIZEN We are going to have a tea-break because it has taken a bit longer than we thought so we will have our tea-break directly after this and then the last three talks of the session after tea.

UNIDENTIFIED VOICE [ISABEL?] I am sorry, this is just a follow-up from Tim's comment. As far as I understand *Themeda* produces seeds apermectic[?]. In other words there is very seldom fertilisation, that the seeds are parthinogenically produced. So the evolutionary pressure really is not getting there.

MR S GERMISHUIZEN One more comment to make about that. One of the themes that is coming up a lot is the ability of grasslands to be rehabilitated or to recover after a severe disturbance. And there is a school of thought that this is impossible and grasslands do not recover. Now again I think it's a matter of time and what Tim was saying just now was talking about the time scales that we operate and the time scales that these grasses might be operating their cycles at could be very, very different, and it's something that we need to consider. On that I think we have tea now and then we will adjourn in 20 minutes or try and keep it to 15 if possible.

Thanks very much.

NEW APPROACHES TO GRASSLAND REHABILITATION

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Justin du Toit is a lecturer in Grassland Science at the University of KwaZulu-Natal. His research interest is rehabilitation ecology, with a focus on reintroducing locally extinct grass species to degraded grasslands.

Abstract

Transformation of many South African grasslands seems to be an irreversible process. Following, for example, cultivation or afforestation with exotic timber species, disturbed areas become colonised (through 'succession') by vegetation communities that bear little resemblance to undisturbed grasslands. Anthropogenic rehabilitation efforts do not fare much better. Underlying reasons may include a) changes in soil properties, b) an absence of propagules of historically-dominant species, c) invasion by alien plants, and d) colonisation by pioneer species that form stable communities unlike the undisturbed grassland.

Rehabilitation efforts that purport to return grasslands to something akin to their original condition should, therefore, focus on establishing original grassland species and precluding colonisation by invasive (indigenous and exotic) species. Sowing with common pasture species is not adequate.

One approach is vegetative propagation and subsequent planting of grasses. In a study held on Blue Crane Farm in the Nottingham Road district on a cleared pine plantation, twelve grass species were propagated by fragmenting locally-collected tufts into single tillers. These were planted at twelve sites within the old plantation. Plants from all species survived, with survival rates ranging from 39% for *Eragrostis obtusa* to 92% for *Eragrostis curvula*, and the keystone *Themeda triandra* was 82%. The results indicate that many grass species can be re-established in areas where they are locally extinct, using vegetative propagation.

This technique was used to reintroduce a single species – *Themeda triandra* – into arable lands that had until then been planted to soya. Approximately 90% of the 16 000 plants survived, and after two years had on average increased in size from 1 to about 250 tillers per plant. Weeds germinated prolifically in the area because of the high residual fertility levels in the soil, and were controlled using herbicides and mowing. Nutrient-deficient siols, such as cleared timber plantations, appear not to experience the problem of competition from weeds.

Intact grasslands can also be transplanted successfully, and initial results indicate that very few plants, including forbs, perish in the process. Because of the ancient and irreplaceable nature of our grasslands, this is a very promising rehabilitation technique in areas where the upper layer of topsoil (about 20 cm) is not needed (e.g. roads, industrial developments, etc), or can be replaced afterwards (e.g. on pipelines, borrow pits, temporary roads, etc).

Transcription

I want to talk about today a couple of new approaches to grassland rehabilitation that we have been looking at. So, why do you want to rehabilitate something?

Sometimes we actually have a genuine desire to return an area to what it hopefully was historically. That is probably the idea in the back of everyone's mind as to what rehabilitation is about. You might want to do this from an aesthetic perspective, you might want to do it from a conservation perspective but you actually really want to get it back to what it was. Alternatively we might have a pragmatic reason or legal obligation, for example to stop soil erosion. Perhaps we want to change it from a weed dominated bare area to a grassland. So the product is a grassland inasmuch as it's dominated by grass.

As Terry earlier clearly pointed out that is often very easy. You can usually create a seed bed in some way. You can put down some sort of pasture grass which has a very high viability, they germinate very quickly, they are highly aggressive and persistent. *Eragrostis curvula* was the example that was used. Chuck down a bit of fertiliser and you get your grassland. So the second objective is not a difficult one to achieve, usually. People sometimes use some quite fancy techniques, for example hydro seeding where you actually spray a cellulose-based gel over things. Mine-

rehabilitation sometimes uses that type of approach. You can get a grass layer. That doesn't mean that you have necessarily returned it to what it was in the past.

The basic idea here is – and we have heard this emerge several times – that sourveld grasslands cannot rest recover following transformation. And I think that most people would accept that. Arid grassland is probably different because they are far more dependent on propagation through seed following, for example, drought. And here I just want to describe what I mean by transformation and it is the mortality of living plants, be they actual plants or be they seeds, in an area. And it does not necessarily mean cultivation. For example, timber plantations which are not actually cultivated, are included. However, it is complete transformation because all of the seeds die and all of the adult plants die. So when I talk about transformation that is what I mean.

Therefore, because they don't naturally come back, if you want to call it real, getting it back to what it was, something similar to what it was, real rehabilitation efforts need to focus on the reintroduction of propagules into the system. It can be a tiller, it can be a rhizome, for example, kikuyu or stolon, it can be a seed. But the point is that you actually need to reintroduce these things into the environment, into the landscape, and then they have to in turn grow and hopefully disperse later on.

So the notion that we can rely on succession processes to create a real grassland after we have chucked a bit of pasture seed down is inadequate. Let's take an example. This is from Weenen Game Reserve, some work that Keenan Steers, Craig Morris and I have been involved in. Now Weenen, as some of you might know, was very heavily over-grazed, about 60 years ago. It was expropriated from the farmer who over-grazed it. It underwent a process of rehabilitation, with the focus on controlling soil erosion, not re-introducing propagules. It's not exactly a sourveld grassland in the classic sense but the top areas are certainly a solid uniform grass layer, with occasional acacia trees.

Interspersed within the Weenen farm, were cultivated fields. Now let's compare the extremely heavily over-grazed lands with the previously cultivated fields, remembering that it was expropriated because of the over-grazing, not because of the cultivation. And what we see is – this is after 60 years - on the old lands is a lot more bare ground than the veld. Species richness is actually relatively similar across the old lands and the veld. Veld condition score, because it's based on palatable seed species and so on, is higher on the veld but here is the interesting one, how similar is it to what Acocks described as the benchmark species composition. We can see that the extremely heavily over-grazed veld is actually far more similar to the bench mark condition and the old lands are very, very dissimilar from that bench mark veld. And this manifests itself in two main ways. These are contours of abundance. The black dots are species composition, quadrats so to speak, on the old cultivated lands, and the open ones are in the over-grazed veld. You can see that essentially what has happened is that hyperaemia has come in and has dominated most of those old lands.

In contrast Themeda is very strongly associated with the very heavily over-grazed veld and not with the old lands. So even though the veld was phenomenally heavily over-grazed and it was in fact expropriated because of that, that veld is today in much better condition than the cultivated area.

So how do we go about introducing propagules into degraded areas? There are a few options. For example you can put down seed itself through thatching. Other people are involved in that. Terry mentioned that people have been using plugs - you plant a seed in a speedling tray, you allow it to grow and you then transplant it out. The trouble with that is what you have to collect lots of seed and that is quite a tricky thing, it's not as easy as one might think.

The technique that I want to talk about today is essentially replanting also using plugs but plugs that are derived from tillers. This is an *Eragrostis curvula* plant. It's got probably about 100/150 tillers. Each of those tillers can become a grass plant. Each of those tillers has the ability to be broken off its parent plant, grown and actually planted out into the soil and it will grow.

There is an example of some *Themeda* that has been planted out. That's after a few weeks being planted and it grows happily enough. The nice thing about this approach is that living specimens are usually available nearby, maybe on a nearby farm or conserved area. The potential rate of reproduction of these species or this approach, should I say, is actually very high, not for all grasses but for most of them. Many of them are around 100 times per year. So if you start out with one tiller at the beginning of this year, you should have a hundred plants by the end of the year and if each of those hundred plants are propagated, you will have 10 000 plants by the end of the second year. And we have done this. You can propagate plants pretty rapidly over a time span of a couple of years you can have increased your parent material by 10 000. If it's over three years say you can have increased it by a million-fold. It's independent of collecting seed which, as I said, is often a bit of a hassle because different species seed at different times of the year and trying to catch it at just the right sort of time can be tricky. Terry has outlined some of the issues with *Themeda* seed, such as its dormancy. We don't know much about many of the other seeds. We know a little bit about *Eragrostis* but many of the other ones we actually have probably no idea of whatsoever.

We planted out 12 different species of grass in an old pine plantation up in the Nottingham Road district. And the species that we chose were those that were abundant in a piece of nearby pristine veld. *Eragrostis curvula*, *Hyparrhenia, Themeda, Brachiaria serrata, Trachypogon spicatus, Loudetia simplex, Tristachya leucothrix, Aristida junciformis, Eragrostis capensis, Harpochloa falx, Alloteropsis semialata, and Eragrostis obtusa.* So a wide range of sizes, some very big ones, some very small ones, and all of them survived. So this approach does seem to work for a very wide range of species. Survival rates do differ. Interestingly enough it's a direct relation between size and survival. The larger the species is, the more likely it is to survive. So we can plant these things out and we can actually get them to grow.

The next question is does it work on a larger scale and the answer to that is – well, it is 'yes'. Certainly in one case and it appears to be yes in the others. Up in Howick we planted out about 16 000 of these plants and after a few months they had actually developed into relatively large tufts. So you can reintroduce them. We planted out on a larger scale –

this was actually from seed derived ones, not tiller derived ones. We planted out 120 000 plants and they are now very large, robust, strong, healthy plants.

These pictures here are from a project that is currently under way up on the VRESAP pipeline which is a pipeline from the Vaal River to Secunda I think it is. It's a very big pipe, about two meters in diameter. They have buried it about three metres underground and while they are doing this they dig up areas, take shale or stone or whatever out of them, then use that for their pipeline. These are called borrow pits. They then cover them over and they have got to do something with them afterwards. And some of the farmers said, "No, we are not interested in just having *Eragrostis,* teff and *curvula* put down afterwards. Let's trying something a bit better." So we produced 120 000 plants and delivered them up there and they were planted out. It's obviously a very time consuming process, labour intensive process, which can be a good thing because they in fact ended up getting the local communities involved. These were planted out and they irrigated for the first couple of weeks and they seemed to be doing quite well. So that is under way at the moment. So we have had these relatively large scale plantings and from our results so far it appears though Themeda, which is the one we focused on of course, reproduces at about 200 tillers per year up to about 450. Some of the big plants have about 450. So they really do grow pretty fast.

The bulk scale production cost, if you were to get a nursery to do it or to set up a nursery or something, is probably in the region of about 50 cents per plant. If you are planting at ten plants a square metre that's R50 000 a hectare. But the interesting thing here is – and what Terry again alluded to is that what scale would you need to plant these because if it turns out that Themeda, for example, can move along the ground at a rate of a metre or two metres per year, it could be that maybe you can introduced these propagules at a scale of maybe one per square metre or less, so maybe it's a couple of thousand plants per hectare. We don't know. That we still have to do, we still have to look at.

This is a nice little grassland. You can't really see but it's very diverse. It's got a little aloe in there; there are many species, very healthy, many species of forbs. So it's obviously a pristine grassland, interestingly enough, not your normal pristine grassland. That was lifted. This is another approach that I am talking about now. That entire grassland was lifted up with a TLB. It was broken into chunks about a meter squared and replanted and after a year there has been 99 point something percent survival of all the plants. So it's just a single experiment, it's not replicated. But all of these plants are surviving. This is another new approach to rehabilitation. Grasslands can in fact be lifted and this could be a very useful approach where you need to remove a grassland and replace it, for example on a pipeline. So instead of just digging over the soil and churning it in and then trying to rehabilitate it, you can actually lift it off, move it to the side and then put it back. Also in areas where, for example, buildings are being put down on very, very high conservation value grasslands, those could actually be moved off somewhere else and at least you keep the genetic material and in areas like open cast coal mining where instead of ploughing it over and just destroying it and storing the topsoil, the entire grassland could be lifted off and put somewhere else. The costs might be very high, but I wouldn't be at all surprised in fact if the costs in the long term are low. There is only really the transportation cost. There is not a rehabilitation cost, there isn't anything else. There is no hydro-seeding, no fertilisation, no digging, nothing. It's just the moving. That's the only cost that you are actually incurring.

The last thing that I want to talk about in the last minute is my last slide and this is something that Hylton touched on earlier and that is the question, a more sort of philosophical question I suppose at the base of it. In these grassland forest mosaic areas, if you reduce to bare soil, isn't it worthwhile allowing forests to come back rather than trying to get grasslands back? Wouldn't a forest be more useful than maybe Eragrostis *curvula* grassland? Mike Lawes who is a colleague of mine at the university, he loves forests and he says, "Forests are winners. They are really winners. They are so competitive. They really are winners." And they really are. They are competitive and it's relatively easy to introduce them, to get trees to grow. And if you think of it from a rehab perspective you might have to plant one tree for every 10 000 grasses. So I think that that is another area that people can think about in terms of rehabilitation of grassland or grassland areas. Thank you.

DISCUSSION

Transcription

MR S GERMISHUIZEN Thanks very much, Justin for that somewhat subversive suggestion at the end there. But in fact it was what I was alluding to earlier. You know in many forestry situations one must make the decision on what cover is going to be there. And it may be better in many of these situations where you can't restore functioning grassland to put forest patches there and that's the problem sometimes that foresters face.

I have got quite a lot of questions myself but I think we are short of time so let's take three questions from the floor.

MR ALAN SHORT Justin, you mentioned the option that it may be possible to actually reduce the density of grass tillers planted into a rehabilitation project. It might be interesting to try if you haven't or are you going to try and say something like a combination of teff for the first year and your perennial tillers.

JUSTIN DU TOIT Ja, very much so. I think that one can look at nurse crops, teff, even give it a very, very – get it growing, very light application of glyphosphate[?] at tenth of a percent, twentieth of a percent, just to dampen it down. You have got a matrix to plant into that won't allow weeds and so on. So, ja, there are all sorts of options in that regard.

UNIDENTIFIED VOICE Justin, with your splitting of the tillers do you have to go through the stage of putting them into a nursery environment or in the field could you rip up a plant and plug it in the ground?

JUSTIN DU TOIT You can tip up a plant, you can plant it in the ground, it will be fine. Obviously then you are on a one to one. Okay, split it up then you are on maybe to 50 to one or so. So to propagate large numbers it's better to do it

through the nursery position. If you are just going to harvest tufts out of an area that's being destroyed or something, it's usually a good idea to trim it back a bit first so that you don't have too long and straggly.

MR S GERMISHUIZEN Thanks very much, Justin. We have got a situation here where the next speaker on the list is Don Kotze. Where is Hylie Olivier? Hylie, are you ready to do your talk right now? Because it follows on rather neatly after Justin's talk. So let's just do that change. Sorry, Don. Are you agreeing to this? Can we just find Hylie's talk? Hylie Olivier has done her work on the composition of natural and disturbed grasslands following removal of pine plantations in Mpumalanga. This works from Mpumalanga, I apologise, okay.

THE COMPOSITION OF NATURAL AND DISTURBED GRASSLANDS FOLLOWING THE REMOVAL OF PINE PLANTATIONS IN MPUMULANGA

Hylie Olivier

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Hylie Olivier is currently a stay-at-home mom with their 9 month old daughter. She does environmental consultation work for a forestry company as well as the private sector. She recently completed her masters in Environmental Management and her thesis looked at the recovery of previously afforested grassland.

Abstract

Many grasslands in South Africa have been afforested with commercial timber plantations. After clearfelling compartments, some areas are excised and left to recover naturally. The question is raised whether these excised areas will ever recover to a natural grassland state again. Little research has been done to answer this question, but many perceptions and opinions amongst both foresters and scientists exist. This study, done on Elandshoogte plantation within the Lydenburg Montane Grassland which lies on Mpumalanga's escarpment, floristically compared six natural (benchmark) grasslands to six disturbed grasslands at different ages, ranging from 1,5 years to 18,5 years, after excision.

Figure 1: Graph showing the successional projectory between age of sites since excision against the similarity of each site to its benchmark grassland (similarity analysed using Bray Curtis index of similarity).

The Braun-Blanquet and Disk Pasture meter methods were used to collect field data from 120 sample sites. Data was statistically analysed by means of the software packages *EstimateS* and PRIMER. The floristic structure of life forms was also used in order to measure the recovery status of the excised areas. Significant differences were found between natural benchmarks and disturbed grasslands in terms of species richness and biodiversity indices, and similarities between these areas were found to be low. The slow speed of recovery may be influenced by a number of variables, i.e. high altitude, soil type and depth, fire, rockiness and age, but further tests and studies would have to be done to verify this. A trend in terms of rate of succession could not be confirmed amongst the different aged sites by means of floristic life forms, and it is also not clear whether burning promotes faster recovery. It is concluded that further studies need to be done with regards to the influence of environmental variables on the rate of grassland recovery, and to not only repeat this specific study, but to also replicate the study in other areas. It was also found that 18,5 years is not sufficient for a grassland on Elandshoogte Plantation to recover to its natural state.

Transcription

Hi, everyone. I am Hylie Olivier. I had to decide on a topic for my thesis in environmental management that I recently completed. I am married to a forester and we stay on Elandshoogte Plantation in Mpumalanga. On plantations I have seen areas afforested, areas that have been replanted, areas that have been excised and I have also seen areas that are busy recovering. This is how I got to the topic of 'doing a floristic comparison between natural and disturbed grassland following the removal of pine species'.

The big question I had to ask myself was can a grassland restore to its natural state after some time - following the removal of pine species? Prof Braam van Wyk made a statement that once a grassland is transformed through afforestation, the change is permanent. I do not agree with that and we have heard many comments here already. How I tested this was to compare the natural grassland with the excised grassland at specific ages after the excision took place.

Just for some background information, let us first look at grasslands. As you know one out of every six grassland plants is actually a grass. All the other plants are forbs, sedges, shrubs and grass-like plants. Fire is also critical in both the management and the conservation of these grasslands.

When we are looking at forestry, I mentioned the word excision a bit earlier. A number of years after afforestation, an area gets harvested and then gets replanted. In certain instances some areas are not replanted and are then excised. These areas are usually left to recover by itself. Earlier Justin talked about passive and active restoration; in this case of mine passive restoration is taking place in the excised areas. Some of the reasons why areas are excised include, firstly, the recommendations that DWAF released regarding the delineation of wetlands and riparian areas. The second reason includes rocky areas where insufficient soil depth causes poor tree growth. A third reason includes any management considerations such as where new firebreaks need to be put or where new infrastructure has to be made. Also of course the grasslands that we are talking of – in the forestry sector - are in between the tree compartments. Even though we are looking at grasslands that are linked, and not small pieces of fragmented grassland, these grasslands still need specific conservation and special management.

In terms of restoration and succession, Rostagno found that grazing and fires both have a large influence on grassland restoration; and of course restoration cannot be achieved without succession. The disturbed habitats are colonised mostly by weeds and indigenous pioneer plants.

The study area is in Mpumalanga. It's about 80 kilometres to the west of Nelspruit, and between 20 and 40 kilometres north-east of Machadodorp. The two research areas are Buffelskloof Private Nature Reserve and Sappi's Elandshoogte Plantation. Peta Hardy referred to it yesterday. These areas are both on the Mpumalanga Escarpment and in the mist belt. It's situated in the Lydenburg Montane Grassland GM18 according to Mucina and Rutherford. Both these areas are at elevations between 1 700 and 2 100 metres so we are looking at a very high altitude here.

The methodology - I made use of field surveys, statistical analysis and then I also did a floristic comparison of the life forms that were present. In terms of the field surveys I had six research areas that I chose, each of which had to have two adjacent grassland sites, one excised area and one natural area. The excised areas ranged anything from two years to about 18 years. That is what was available on the plantations that I worked in. The lowest altitude site was 1 669 metres above sea level, while the highest one was at 2 064 metres above sea level. I did ten sample plots in each of the natural grassland and the excised areas. The sample plot sizes were two by two metre quadrants and I had a total of 120 sample plots. I statistically analysed the data gathered by means of software packages PRIMER and *EstimateS*. As said earlier, I also floristically compared the life forms that were found.

Here are two examples of what my research areas look like. Firstly waste site. The photo on your right side is the natural grassland. In the background notice the excised area adjacent to it – this is also the photo on your left – this area was dominated by *Hyparrhenia cymbaria* (thatching grass). The natural grassland was dominated by *Themeda triandra*. Keep the excised area in mind; this 12-year site never had big trees on it. This area was replanted about five times and every time it had difficulty growing and was damaged by rodents. So this area never actually had big trees on it.

The second example I want to show you is this Taljaardsvlei site, the 16-year old one. Again the photo on the right is the natural grassland and this area was dominated by *Rendlia altera*. In the photo on the left side you can still see, even after 16 years, some tree stumps, and some open ground and bare patches. This area was dominated by *Eragrostis curvula*. As you can still see the tree stumps and the open areas even after all these years, and the fact that this area was never burnt after it was excised, I believe it shows that fire does have a big influence on the speed of restoration and recovery. The first time this area was burnt was in 2004 and it is since burnt in rotation. It is now also practice to burn areas directly after excision. The fact that fire releases nutrients back into the soil for uptake by the plants can especially aid in faster restoration.

Just to overview some of the results. A great diversity was expected between the natural and the excised areas and it was also verified. The rate of succession seems to be very slow. Possible reasons for this: the majority I am thinking of include environmental variables such as high altitude compared to low altitude; soil type and soil depth; and also fire frequency. My study however was not focused on soil types or depth and rather looked at the high altitude and also the fire factor. A weak successional trend was identified amongst the different aged sites. Lastly, as I said earlier that it wasn't studied, but it does seem that fire promotes faster restoration.

A few of the results from PRIMER. Here you can see the degree of succession in the plantation vegetation plots. The area in the middle, the solid blue triangles, is all the natural grassland sites. They are very much clumped together, all very close to one another and we can therefore say that it is definitely areas in the same veld type with very much the same composition and type of plants. If you look at the excised areas, all the open triangles, they are quite far apart and

spread about. By means of the arrows you can see there needs to be quite a strong inwards move i.e. greater succession of the excised areas before it can actually be similar to the natural grassland sites.

A second test we did was the Bray Curtis similarity index. I tabulated the results on the left. Our oldest site, the 18 and a half year site was in fact also the most similar to its natural grassland area with only 45% similarity. I did expect the similarity to be higher, however keep in mind once again the high altitude factor. Buffelskloof 17 year site was 14% similar to its adjacent site. Taljaardsvlei 16 years was 12% similar. Waste site 12 years with 26% similarity, but remember what I said earlier, this area was never covered with big trees. Taljaardsvlei, two and a half with 11% similarity and Dams one and a half year site with 13% similarity. Here you can see the graph and note the weak successional trend that I spoke of earlier.

In terms of species richness. Note Taljaardsvlei, the two and a half years site actually had the highest amount in all the excised and the natural grassland sites. 49 species were found in the natural grassland site. Taljaardsvlei 16 years, had the lowest amount of 10 of all excised sites. Once again we can ask if this is due to the lack of fire after excision? We can't say for certain but it seems so.

I also used the Disk Pasture meter to determine the fuel loads of all the different areas. Remember we usually say that an area needs 4 000 kilograms per hectare before it is deemed to be sufficient to burn. Notice that Taljaardsvlei 16 year site had the lowest amount. Once again, is this due to the lack of fire after excision? Dam's site had the highest amount. All of these areas are currently burnt in rotation.

Lastly I did the comparison of the floristic structure of life forms that were found in the grasslands. I took the list of all species that I found on all the natural grasslands and classified them according to their different life forms. Nine different life forms were found – as you can see herbs, graminoids, dwarf shrubs, geophytes, cyperoids, succulents, climbers, shrubs and bryophytes. We can therefore say is this is a representation of what a Lydenberg Montane grassland on this altitude looks like. We did exactly the same with all the excised areas, but first we divided it into two groups, the three younger sites, where eight life forms were found, and the three older sites, where seven of those life forms were found. The two life forms not present in the younger site group were bryophytes and succulents. You will also see a tree life form there, which was a pine seedling. A tree life form should of course not be present in the natural grassland sites. Note also that almost half of the pie comprises of herbs. This was due to the presence of a few weeds and many indigenous pioneer species that colonised the areas. The younger sites are therefore dominated by herbs. Graminiods with almost a third of the pie were mostly *Hyparrhenias,* with some *Aristidas* and *Paspalums* also. Note the division of all the others life forms.

In terms of the three older sites, we also did exactly the same. The two life forms that were not present here were shrubs and succulents. Here you can see the herbs started decreasing slightly to 37%. Graminoids increased slightly, as did most other life forms, but climbers stayed the same. We can also see that even after roughly 20 years succulents still have not come back. The succulents that were found in the natural grasslands were *Crassula compacta* and *Senecio oxyriifolius*.

This is then how I compared the younger and older excised areas floristically to the natural grassland by means of the life forms.

To conclude, the excised areas that were available for this study were not old enough. Therefore other studies definitely need to be done, especially on older sites but also at different altitudes. The fact that this area is at a high altitude and it is in the mist belt means it is cold and wet. Decomposition will therefore take much longer, nutrient release and nutrient uptake is also going to be much slower and therefore restoration will be much slower. Whereas in low altitude areas I believe that whole process will be much quicker and recovery will also be faster.

It would be ideal to replicate this specific study to see what the successional and the restorational progress is over time, and further investigation definitely needs to be done to see what the influence of fire and burning is on restoration and succession. All of the abovementioned will definitely help managers and foresters to make better decisions. Lastly, yes, we can clearly say that grassland restoration will take a very long time, but I am still not satisfied nor prepared to say that it will never happen. Thank you very much.

DISCUSSION

Transcription

MR S GERMISHUIZEN Thanks very much, Hylie. Before you dash away let's just take one or two questions from the floor.

MR ALAN SHORT Thanks, Hylie, that was really interesting. Do you have any information from those sites about grazing, firstly, and, secondly, about other management interventions like weed control or alien plant control?

MS HYLIE OLIVIER No grazing is allowed in those areas so there is absolutely no grazing – I mean cattle-wise. There are some wild life there but no cattle. Other management things like you asked, not really. Peta, those areas are weeded, hey? Ja, they are weeded, ja.

MR S GERMISHUIZEN Thanks very much, Hylie. Just something I would like to – this is a good opportunity to just mention some of the questions that have come around rehabilitation in our sort of forestry task team meetings and deliberations. One thing that continually has come up that we don't have an answer for, and maybe someone here can answer, at what percentage of the bench mark of a particular vegetation type can we say that that site is contributing to the conservation of that vegetation type? In other words at what level of degradation can we no longer say that that piece

of grassland represents a particular vegetation type? And linked to that – when we get involved in the rehabilitation effort, if we can assume that we are not going to get to complete floral composition of a particular grassland. What does that suboptimal piece of grass contribute to biodiversity. Most of the studies and the emphasis on plants and the plant composition, but what do those suboptimal grassland patches that are being rehabilitated contribute to animal, insect ecology. And so what true value do they have to the biodiversity on the overall estate. I don't know if there is anyone who wants to comment on those remarks that I made.

MR ROB SCOTT-SHAW Steve, your question about how they resemble the vegetation type, do remember that a vegetation type – if we are talking about the vegetation types that are commonly mapped and … [indistinct] type of things are very broad country-wide scale of things and they only have a description of a few paragraphs and in those few paragraphs, even if they were pages, you would not be able to meaningfully, usefully describe the vegetation in a far more ... [indistinct] specific scale. And Hylie achieved that by doing that on the nearest possible sites and there I think it works well.

The second point about how bad must things get, to change your wording slightly, we use a figure – if there is 60% of your natural species composition in a grassland – high rainfall grasslands have been lost, there is little hope of doing anything with it for any kind of conservation reason. I won't try and go into the background of why 60% is, but it is the kind of threshold that is bandied around or indicating areas that should really not be interested or what you want to do. If you have got the resources to rehabilitate to really kick into gear some major restoration programme to bring back that lost 60%.

MR S GERMISHUIZEN What we have been hearing as well is that through natural succession or just removing the pressures on that grassland, we are unlikely to reach that 60%. That's probably reasonable to assume. But the other question is about looking at the other components of the biodiversity and whether, if we rehabilitate in forestry areas, rehabilitate former timber areas and we are able to only get to 30% or 40%, would these areas support significant faunal diversity and be worth the effort?

So it's worth keeping that in mind, particularly when we talk about redesigning the ecological networks and considering areas that would need to be rehabilitated if we were to do that.

If there are no more comments on that, then I will introduce our next speaker who is now in a reasonable sequence and that's Donovan Kotze. The title of his talk is Fire on the Water, the Effect of Burning on Wetlands, and he is from the University of KwaZulu-Natal.

FIRE ON THE WATER: THE EFFECT OF BURNING ON WETLANDS

Don Kotze

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Donovan Kotze is an honorary research fellow at the University of KwaZulu-Natal. The focus of Donovan's training and professional work over the last 17 years has been on wetland ecology and the sustainable use of wetlands. He has gained much experience in working in a great variety of wetlands under many different land-uses, from communal traditional use to intensively used private land. He is especially interested in wetlands within an agricultural context, and collaborates with many different government and non-government organizations involved with wetland management issues.

Abstract

In the grassland biome, wetlands evolved under a burning regime, and these wetlands are overwhelmingly dominated by herbaceous, fire-adapted plants, mainly sedges and grasses. Burning of these wetlands has several potential positive effects, including: (1) maintaining native fauna and flora; (2) assisting in alien plant control; (3) increasing plant productivity by removing standing dead material; (4) improving the habitat value for wetland dependent species (e.g., flufftail species) and (5) improving grazing value.

However, burning may also have several potential negative effects: (1) the young of wetland-dependent species, e.g. wattled crane (*Grus carunculata*), are vulnerable to the direct effects of heat and asphyxiation; (2) fire may contribute to increased levels of erosion, especially where burning is every year and attracts high concentrations of grazing animals; (3) burning at the beginning of the dry season in wetlands subject to severe frosts results in an absence of loose surface and standing plant litter for the entire winter, thereby increasing the evaporative loss of water (particularly from permanently wet areas) and reducing the cover for wetland-dependent fauna; and (4) soil organic carbon levels may be depleted when the burning frequency is high, particularly if burning results in prolonged exposure of the soil, as described in (3).

It is important that burning of wetlands be seen in relation to key physical constraints to plant growth, e.g. soil anoxia (waterlogging) and climatic temperatures; as well as in relation to other disturbances (e.g. grazing) that may potentially interact with fire. For example, it would appear that fire acts as the strongest determinant of vegetation structure and composition in wetlands where climatic temperatures are mild and the level of soil anoxia is low. In the absence of fire, these wetland areas most readily become dominated by woody plants. Where climatic temperatures are low, and particularly also where soil anoxia is high, these determinants themselves appear to have an overriding, constraining effect on woody plants. Fire may have a strong interactive effect with anthropogenic factors which desiccate

wetlands, resulting in burns which would otherwise have negligible effects on the carbon balance of a wetland, initiating extensive ground fires and the dramatic depletion of accumulated carbon stores.

Management guidelines have been developed for the burning of wetlands, designed to enhance the positive effects and minimize the negative effects described above. These guidelines are based on available research, best professional judgement and a modification of existing guidelines developed for mesic grasslands. The assumptions on which the guidelines are based are given (some well supported with empirical research but many poorly supported) which highlights some key research needs. With growing concern over deteriorating water quality, both globally and in South Africa, and emissions contributing to global climate change, there is a need to better understand the effect of wetland fires on biogeochemical cycling. Even in the US, with its vast body of research on wetlands, research on wetland fires and biogeochemical cycling is limited.

SESSION FOUR: DESIGN AND MANAGEMENT

INTRODUCTION

Chaired by Dave Everard

Transcription

Gentlemen, it's just about good afternoon. If you can take your seats, I think we are now getting into the integrating time of the whole symposium so I am quite excited about this session. We have run on a bit so we will try and up the energy levels. We will play it by ear whether we get through four talks now or three talks, depending on how things go. So lunch will still be round about quarter past one.

The first talk is designing ecological networks. It's by professor Michael Samways. Most of you know Michael. He is professor and chair of entomology and conservation ecology at Stellenbosch University. I am not going to go through their CVs. You have got it on your programmes. Have a look there if you don't know the guys. Mike, over to you.

KEYNOTE ADDRESS: PROVISION OF ECOSYSTEM SERVICES BY LARGE-SCALE CORRIDORS AND ECOLOGICAL NETWORKS

Michael Samways, C Bazelet, James Pryke and Lize Joubert

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Michael Samways is Professor and Chair of Dept Conservation Ecology & Entomology, Stellenbosch University, and a Fellow of Royal Society of South Africa, and Member of the Academy of Science of South Africa. He is a John Herschel Medallist of the Royal Society of South Africa, Senior Captain Scott Medallist of the South African Academy of Sciences and Arts, and Gold Medallist of the Academy of Science of South Africa. He has published eight books, three Special Issues, 43 book chapters, and 226 peer-reviewed scientific papers. Michael is very involved internationally, especially representing invertebrates. His research is mainly aimed at designing landscapes for the future.

Abstract

Large-scale landscape transformation and subsequent habitat loss are among the greatest threats to ecological integrity and ecosystem health. One of the mitigation approaches used to deal with these pressures is the leaving of interconnected corridors and nodes as set-aside land (ecological networks, ENs) within the transformed landscape. The South African forestry industry has already allocated 500 000 ha, one third of the plantation holdings, mostly natural grassland, as ENs among and within timber plantations. These ENs aim to maintain structural, compositional and functional biodiversity. However, little scientific research is available on the effectiveness of these huge ENs for biodiversity conservation and maintenance of natural ecosystem function, although initial findings are encouraging. While the local adverse effect of alien plantation trees on functional biodiversity is not in dispute, it is at the scale of the whole landscape where there is much interest in determining how effective these ENs are in maintaining a transformed area in a close-to-natural state. As these ENs are extensive, beta diversity is a consideration in addition to alpha diversity. Initial findings reveal a diminished effect of narrow corridors due to the adverse edge effect from the plantation trees into the margin of the EN. Quality of the ENs is of great importance for maintaining functional diversity, with human disturbance reducing their effectiveness. First findings, and their application to the Framework for Ecosystem Service Provision, suggest that these ENs may play an important mitigating role both for biodiversity conservation and for provision of ecosystem services. Nevertheless, still much more research is required on a greater range of taxa, and their interactions, to improve the design of these ENs at evolutionary as well as ecological time scales, and to accommodate quality ecological integrity and functionality in the face of climate change.

Transcription

Thanks, Dave. Okay, we will keep it punchy. First of all, now we are going on to life beyond plants. I would like to just briefly acknowledge WWF who really had faith in the idea of designing ecological networks. This is quite a few years ago. And then recently Mondi has enabled us to expand the programme substantially and I really appreciate the financial and logistic input that Mondi has given us and it links with RUBICODE which is an EU project so we are actually linking this research with the European Union. It is all to do with, as I will say later, the export of timber.

Designing for the future. Of course designing with the landscape is not like designing a car or designing a house. One is designing for fluxes and interactions and so on. So let's just have a look at some of the basic sort of principles of ecology that we need to consider when we are designing. Obviously there is a historical past which we have got to always consider. It's always a time context. And then let's remember as well that humans have been impacting on biodiversity for quite a long time. We don't hear so much of it down here but when we do talk about ‘pristine’ we must remember that there was a pre-industrial age when there was nevertheless human impact on these grasslands here. So let's not forget that when we mention words like ‘pristine’.

These beetles are actually from a lake in France and it's the remains and it's the proportion of species relative to different types of plant communities over time. But don't worry about the details, the point being here is look how communities change and this is obviously pre-human. There is this considerable coupling, decoupling, interaction, changes of relationships, changes of food webs over time. So it's very much about the dynamics of the past.

Now there are a couple of things that come out of this and I would like to underscore what you were saying yesterday, Tim, about the fact that we must think regionally, …we must think in terms of productivity. We have got to allow these sorts of dynamics to take place across the wider landscape. Also when you look at this, when you relate it to fire, I wonder sometimes with the fire we are trying to find sort of finite end points when in fact it's a whole range. When you start going across different spatial scales, it's a whole range of successional interaction trajectories that are taking place across the landscape. Certainly that's what our results have shown in recent years.

It's a complex picture this but let's just concentrate. This is minimum patch occupancy – in other words survivorship. This is from the models of Travis, rate of climate change, the generalist, the specialist and here are different level of fragmentation. This is a very interesting model for us and the sort of work we do. Very interesting because what Travis is saying here is that if you take a specialist in comparison with a generalist and with high fragmentation, specialists do not do well when they are synergists. Now the point I am underlining here is we so often tend to think of a single impact or we are working on a single impact but actually it's multiple. Even fire is a multiple impact. It's obviously going to interact with rain and it's going to interact with many other things.

So we must bear these sort of interactions that take place. So as we move on we are all familiar with these biodiversity hotspots. I won't dwell on this but what I really am underscoring of course is the fact that we haven't had a glaciation for a very long time. And we must remember that's the sort of dynamics that we are working against. So these historical perspectives, synergistic impacts are really important. The other things that are really important that we have still got on our landscape that has been lost – for example from a lot of other landscapes is mega herbivore impact. I won't go into the details but it has a major influence on the vegetation and certainly on the insect fauna and many other faunal components.

In fact a bit of work we did up in Botswana – in fact if you take elephants, they completely change. They completely change the dragon fly assemblage for example. As they put down their clomping great feet all over the place, this actually literally changes the habitat substantially.

Then we have an interaction of topography. Topography plays an extremely important role in the interactions between the various components on the landscape. And then topography interacts with fire. It, for example, enhances cold air drainage and these sorts of areas at the top here, these hilltop refugia are extremely important for biodiversity. And this comes out of Killick's early work of course back in the 1960s up here in Cathedral Peak. And it's the same for the insects, the lizards, the birds and so on. And also it's the fire refugium in and amongst these boulders at the top, these old krantzes. So these are the sort of interactions that are really important. And temperatures on this can be as much as 30 degrees C difference at say ten o'clock in the morning mid-winter. There is a huge amount of difference in soil temperature as you go round. And then you can have – up here soil temperature can be as much as 30 degrees and it can be actually minus down the bottom of the same hill. So we have got these huge variations again which emphasise the … [indistinct] of the landscape.

Then as we have heard very often – I won't dwell of this of course – it's the interaction with fire. And then there are other things that come into play and that is behaviour and you get, for example, hilltopping behaviour plays a very important role, for example, in the Drakensberg, particularly in the Little Berg.

So considering these interactions and their emergent properties, we will talk about that some more a bit later. It's a bit like when you start putting things together you get something new out of it. You put hydrogen together and you put oxygen together, you get water with a different property.

So what we want to do is we want to sort of sense this complexity and when you think that a typical Canadian lake will have a 1 000 species and that's actually equivalent to half a million potential interactions. So we are actually managing for a huge amount of complexity, much of which we don't understand. So how do we do it?

I had the opportunity to write a book and work through quite a few thousand research papers and out of that sort of started to emerge some premises. And the first premise is we need to maintain natural reserves. They need to be as large as possible and the point is they are very important for specialist species. We need to maintain quality habitat heteronaity[?]. We want to maintain a variety of spatial scales. We want to maximise the opportunities. This is what it's about. When we design planning for the future we want to maximise opportunities. Then obviously it includes suppression of aliens and its recognition, which we have touched on as well in the symposium so far, meso filters. In other words special features of the landscape. It might be a small wetland, it might even be a damp patch of grass that actually plays a role in itself. It is so complex, the landscape in reality when you start getting down into it and all those interactions that are taking place that we need to cater for those.

Reducing contrast between the disturbed areas and the adjacent areas, this increases variety of habitat, the reason being that as conditions are adverse, say it's really dry, there may be shelter on this side but then it might be a very year and there might be shelter on this side and so on and so on. It gives opportunities for organisms to interplay within this ecoturn[?] which is much better than have a sharp edge.

Then our site reserves maintain as much undisturbed land as possible. This is where conservancies come in. Agro environment schemes and so on. This actually increases the quality of habitat and work we have been doing in the Cape. The agricultural context is much richer than actually we originally thought which is really exciting. It improves the area of occupancy for a lot of organisms so obviously it's better for their genetics. It improves connectivity. So even if there are stepping stone habitat there is still value. They may not be full blown corridors but there is still value. And that

simulates natural disturbance and that involves the combination of features. Just remember synergisms again. We need fire and we need grazing animals on the landscape. We need to maintain that original condition. And I will mention more about the patch burning in a moment.

We want to link. Linkages are extremely important. Connectivity. Now obviously these are not hard and fast time scales but they are conceptual time scales, ecological and for movement and then obviously evolution. We want to maintain genetic viability.

So we all the time are thinking of long term connectivity and good quality connectivity on the landscape. Then running through all this is the golden thread of meta population dynamics. All the time you want to maintain a large patch size, good patch quality and reduce path isolation. We think of these principles all the time. It's critical that we have those to maintain that viability of the landscape.

We do this landscape planning but of course we are not ignoring the fine filter species level conservation. There are going to be particular species that need particular care. They might be registered species but they might also be keystone species. They may also be a particularly significant species in one way or another. They might be cultural species even. So development of ecological networks. Personally I really do think is definitely without doubt 21st century conservation. This is really the way conservation is going to be in the future because it addresses a lot of those basic premises that we look at in conservation biology that we seek for.

All the time we recognise natural reserves. We need those source habitats. If we are restoring here then we need those sources habitats all the time. We need – we must maintain without doubt as many reserve areas as possible. And these are really, really important. This is where it's like the nub and as long as those are large areas, good quality and obviously not isolated. So we want to maintain that quality habitat heterodaniety[?] because we are looking at this diversity across the landscape which not only is huge in itself with all those interactions but it's ongoing and highly dynamic. And in the talk after me, James will be talking about some of the work Corey Bazelet who couldn't be here, is doing and she is showing just how dynamic the interactions are that are taking place on that landscape.

So within that quality habitat heterodaniety, that is where we consider topography and it doesn't just mean necessarily big hills. It might be small hills and little changes and the undulations that we don't even see in the eye, the undulations of the bedrock.

Then of course the actual boundary. We have got inside the forest, we have got outside the forest and this is some of the work of Sarah Pryke that if you have got natural forest the number of species, proportion of species, in this case butterflies, are far less in pine than natural forest. We ideally need to get away from this hard boundary but I will mention more of that in a little while.

At least the areas we work in, it's more or less – I know we had this debate yesterday on the exact amount of land but a third of the land is set aside. The point is what we are really interested in is not that amount so much but how much of that is really quality landscape. I just put there, Lisa Joubert – in fact she is presenting a talk right now at the Diversity Conference in Cape Town – she is looking at this idea, we have asked the question, are these high quality corridors, the bigger ones, are they equivalent to a nature reserve. So in other words we are getting an idea of equivalents in quality.

What is really important is we need those sort of natural disturbance and, for example, allowing game to infiltrate the webs. I will talk about the fire management in just a moment. And the … [indistinct] on some buffalo, one of James' pictures, you see there itching to get into the ecological networks. They are rushing to get there, who can get there first? The wildebees are not quite so keen. They are waiting to see what happens.

So what we are really looking at, this is Good Hope which is one of these really large corridors. They really are superb. And without doubt we know this sort of size is really important. Obviously we want conduit which of these small corridors and they are not without value, even power line servitudes. That's what we are striving for but they do have, believe it not, some add-on value from the organisms we have looked at. But they are not a goal and let's not confuse the issue between this is what we are really looking for in design. We would do better to spend much more effort concentrating on these big corridors than the very small ones. Obviously we don't want barriers. All the time we are looking for source habitats and we want to avoid the syncs and these narrow corridors are definitely syncs.

And in fact Sarah Pryke showed that butterflies on average fly 13 times faster through the ugly little corridors than they do through these because they basically dawdle on the big[?] because that suits them as a habitat.

Another thing with corridors, we tend to actually think of them as something like a linear piece of land, which they are of course. But what we want to do is we want to think of them conceptually as functioning as they would function in the context of a natural area completely, even though this you see ideally. Of course it's a bit more complex than that.

Back to merging property for example – another example of merging property when you put insects and people together, you get an entomologist. And if we look at an ecological network and how it works and let me just point out a little bit of wording here. When you are standing on this side, looking to the trees, this is an edge zone because trees have an effect on the edge which obviously is going to affect any restoration of the edge through delineation. These actually – it's called … [indistinct] servitude but you can call it a movement corridor but of course when you are looking from this side, looking this way of course it's a buffer zone. So let's just clarify that terminology because the function is different.

So this is what we are doing. This is the sort of emergent properties we are looking for, to bring all these features in so that we have a functioning whole. And we need these complimentary – it might be the butterfly adults might need to hilltop and mate there but they have reposition sites here and so on and so on. And obviously large animals, they might need to drink, they may wander through and so on.

Then ideally of course we want to remove this boundary here which is what has happened up at iSimangaliso which is really great. So this is what we are striving for. This is the ideal sort of network which we have this huge connectivities, a very big corridor running here and this where they have got preserves in the background and ideally sort of soft farming along the edges. This is the sort of thing, even though we have a big block and nobody is denying – of course we know the impact upon – we don't need to go down that route any more but the point is we are focusing on these areas, we are focusing on the complimentary aspect.

Now just to mention the fine filter, a very good example of that of course is the Karkloof Blue and Sappi moved back the trees here and of course I am sure most of you know that it's very much a specialist species, although it does have actually very good powers of flight. It's got a very special food plant. It's a prostrate form, it's highly specialised so this is not an example of the fine filter overlaying the coarse filter landscape.

Now when we put these together, how are we doing with ecological network design? Well, the reserves – we are walking towards it. We want to connect those and obviously the quality linkages are really important and every single study we have done, it hasn't been interior nests that's been the adverse factor, it hasn't been other things like even mild to moderate levels of grazing. It's disturbance. It's high levels of grazing, high levels of mowing, all those sorts of features, disturbances come out in every single interaction we have looked at. When Sandra Bullock looked at plant/insect interactions, it doesn't matter which … [indistinct] you look at, disturbance is the tough one.

So linkages, now reducing contract – let's just relate that to fire because obviously we are not doing well on that side but this is possibly something for the future, this is something where ideally, the ideal situation would be to soften the edges by having fire retardant plants. And certainly from our biodiversity work there is no reason why, and there has got to be. There has got to be – the fire management for protection of the plantation has got to come first, which also emphasises the point we want large linkages and that benefits both those aspects. So we have got to have priority in fire management there. But what we can do, we can think and this is probably the next stage is actually think of fire retardant vegetation that can be used both within the pine area and in the natural area. It could be busy or whatever to soften those ecotones.

Fire, simulated disturbance, I really do think we need to rethink how we look at fire. It's not about years and this sort of thing. We saw it with Andrew's talk and the lightning strikes in Australia. They are very clumped and then you have got all these interactions taking place, you have got a mosaic succession. I think we are trying to strait-jacket something when it's highly dynamic. So I think we need to think of more ways – there is no time to discuss it now but more ways of having that fire. I mean obviously we have got the short rotations but we can have different types of rotations in different types of corridors.

Now we have got a nice dragonfly Baltic index which is more sensitive than SAS which is working extremely well and Mondi is beginning to put that into place and it's quite interesting the Venezuelans are now using it, the Swiss are using it, the Argentineans are starting to use it and it works really well. But the point I wanted to make is that we want a terrestrial index and James is going to tell us a moment of Corry's work on grasshoppers. Grasshoppers and grasses, as one would expect, very complementary and work out as really good indicators, at least up here in KZN. Paul is going to tell us in a few moments this really exciting development of acoustically profiling the landscape so you don't have to find anything. You can basically listen to the landscape, you can see the quality of the landscape by the songs that are produced and the initial results are fantastic. It's a big like eco-sounding across the landscape. It's the same sort of principle in a way if you like.

And then James is going to tell us just now, he is investigating the possibility of a range of indicators that are user friendly. That is based a lot on the work up here and down in the Cape. That's really developing very nicely.

So let me just finish up here. This looks a bit complex but let's just go round this first square first. The SES stands for socio-economic systems. Let's just start up with the drivers. This is known as the Framework for Ecosystem Service Provision. It's turned out to be very valuable for looking at landscape design because we can continually interrogate ourselves. We have the drivers and these are obviously demands for wood and so on, globally economy and so on. .

And then we have the pressures which is the fragmentation of land use that we have heard a lot about the last day and a half. And then we want to look at the state and the ideal thing and this is where FSC is important. We are looking at having ecological networks that make that timber highly exportable. And so we have ecosystem beneficiaries and we have the ecosystem providers which are the organisms, the ecological integrity that is making up the biodiversity integrity and the health and all the interactions that are making that up. And that is leading to the beneficiaries which are the human communities in the area. So we need basically to look after all the plants or the invertebrates and so on in order for us to benefit from that.

Now when you start interrogating that and going round, all the time we are aiming to maintain that compositional biodiversity because the more we do that the more we maintain the function of the system. So as we go round the service providing units, which are the individual aspects of compositional biodiversity, the delivering the services, whether it be pollination whether it be conversion of vegetative material into nutrients and so on. Grasshoppers play a very important role for example and you have got herbivores and so on. So all the time we are looking for high ecological integrity. Then obviously that then will move into valuation and, as Peter Gardener said when I was asking him, "Well, what is actually the value of FSC certification?" And Peter said, "It's quite simple. We need certification to get the markets."

So obviously there is this cycle of certification and valuation of services and then how do we improve that certification? So we go round this circle here and we look but all the time we are well aware of the various trade-offs and fire is a trade-off within a trade-off that we always have to work on.

Then of course we have got the responses and we have now got this response system. We are working with Mondi feeding into design and Steve is going to tell us more about this in a little while. And that design then goes into researching that design, what's working and what is not.

So then we have got obviously there's changing dynamics, we have got to accommodate other socio-economic systems which are obviously local human communities and so on, and I have got compromising burning regimes up there. But actually maybe compromising is not quite the right word. Maybe it's a question of opportunities.

I just end up quickly, this is part of a new project funded by SAMBI Grasslands Programme on looking at climate change. John Simaika is looking at it so I just mention it by way of – it's just starting. Obviously what we want to do is mitigate climate change and these are a couple of slides that John gave me. He is also giving a talk at the Biodiversitas Conference and the point is that we need these buses. We need to maintain. We have all the time and I really concord with you, Tim, about this. We must think regional. It's critical. But actually I am not denigrating the small scale because obviously that's the level of management and that could be extremely important, particularly with fire management, but we must think of the bigger scale because we must maintain these processes, these ecological, evolutionary processes. These sorts of things speak for themselves intuitively and obviously we are concerned, as Brian was telling us, invasive aliens which are a critical issue. Certainly most of the networks – I mean apart from the bramble but certainly there are really ugly ones. The difficult ones are largely being – I am not saying that's the general – of course it's not the general case but the point is let's emphasise the fact – if we look at synergisms we don't want aliens because not just the impact you are telling us about, Brian, but also because they aggravate many other things and you get changing food webs.

So we are going to use the dragonflies, we started on it now, and how we are able to actually look at how we connect these food webs across the landscape in a climate change scenario. And then we will work with Steve on this and develop the whole climate change scenario. So I am just mentioning this by way, just to let you know what we are doing here.

So this doesn't stand in isolation, if gives us another view of how to design these networks and it's a challenging one because it's designing them given the sort of change that's inevitable.

So we are particularly interested obviously in the low dispersers. We saw that when we went right back to that module we looked at at the beginning, Travis' model. We are particularly concerned about these and the specialists and that will obviously be built into the monitoring system because those specialists are going to be the early warning system.

And all the time, everything about mitigation is all the time we are thinking of adverse conditions. We don't plan for average conditions. We always plan for the adverse. We plan to mitigate, we plan to deal with the worst drought condition, with the wettest conditions, the coldest conditions, the hottest conditions and so on. It's the only way to have that sort of resilience that we need for the future.

So anyway this is the way the work for this is going to take place and I will leave it there. Okay. Thanks very much. Thank you.

DISCUSSION

Transcription

DR DAVE EVERARD Thanks, Mike. There is so much in there, there must be thousands of questions. We have got a little bit of time. Let's have a few questions. Anybody? You have obviously stunned us all. There's a lot to think about. Are these presentations going to be sent round to everybody? There is a lot to see and mull over and a lot of things we can use

Last chance, any questions for that one?

PROF TIM O'CONNOR Mike, just sketch a little bit. The word design to me often implies a new venture whereas I gather you are actually implying fixing up what is already there. Do you see these principles – in other words altering the configuration of current estates and that being successful?

PROF MICHAEL SANWAYS No, it definitely is about that circular process of getting results from what is there, using different components and then building that in. I mean we have seen, for example, how actually not having a fence between a nature reserve, to name one example, it's Mangalisa, really works. It's seen, for example, how important it is to remove particular aliens in a particular way and so on and so on. So one can actually then use it to actually have perhaps the next generation of ecological networks which may or may not be on the same land because we do have these sort of issues of restoration which are not easy to deal with. But the point is if we have an opportunity to design something completely from scratch now, I think we have got much more information, we have got much more sense of how to do it than we would have had a few years ago.

PROF TIM O'CONNOR I don't think that's being contested here. What I am really interested in is getting to altering the configuration of a current estate where you are actually talking about taking away plantation … [intervention]

PROF MICHAEL SANWAYS Oh, right, yes.

PROF TIM O'CONNOR And whether that is actually going to be a rewarding exercise in terms of biodiversity returns that would warrant the effort.

PROF MICHAEL SANWAYS Yes.

PROF TIM O'CONNOR Considering the quality of the habitat, we have just seen a presentation on rates of natural establishment of vegetation, etcetera.

PROF MICHAEL SANWAYS Yes.

PROF TIM O'CONNOR And despite the antipathy to plants a lot of insects do actually eat on them so these things are all related.

PROF MICHAEL SANWAYS Definitely. I mean we are nicknaming them the highways. What are really important are those big – sort of messing around with little bits of delineation here and there is a lot of PT. And things like management of very small corridors is probably not adding on very much. I appreciate that power line servitudes have to be dealt with and there has got to be fire management but one consider those add on. But the thing to do now is to make sure the really good quality areas are increased in size. And that includes obviously bringing back hydrological process which does indeed of course feed into delineation. But when one thinks oh there might be succession taking place in a narrow corridor, from a biodiversity point of view one could say I am excluding now fire because that's another issue, protection of plantation. But let's not worry about those because we know they are only very low add on value. Let's concentrate our efforts on the really good quality big, if you like, habitat corridors, the highways. That's really where they add-on value is.

UNIDENTIFIED VOICE [JOHN?] I think a very pragmatic approach is going to have to be taken when one starts redesigning existing plantations. I mean we have seen, as you alluded to just now, the costs of restoration. And I think within the forestry industry we have had this talk about these narrow corridors and what do they actually serve a purpose for? Is there not some way that they should in fact be planted up and therefore easier to manage and you compensate for that by having wider mega-corridors, as you have indicated. But we need to look at the value of the timber that you are going to gain by planting up smaller areas against the costs of rehabilitating so that you get wider corridors. The impacts on the hydrological system in terms of steam flow reductions. All of those things would also need to come into it and it's just a great pity that we didn't know 50 years ago what we know now in terms of corridors. But we have got a situation and I think there is going to be some scope for it, certainly in any new afforestation which is also very limited in its scope, but these ideas are certainly coming from the kind of work that you have been doing.

Personally I think there is going to be a bit limited but where we can apply it, let's do it. You have got to look at the costs as well.

PROF MICHAEL SANWAYS No, I agree but if we take the ecological principles where the value might be real add-on. For example, to make a big corridor right next to a really good reserve area. So we have got a source for all he propagills[?] both plant and animal in that area. These are the sorts of things would be better than say the same corridor at the other end that is far removed. Let's really try and get stuff into that area. To get those … [indistinct] is also to sort of buffer these adverse conditions and so on. But I agree this cost area is quite an interesting one. That obviously – I mean it depends on economics at the time and so on. But I think when we have, if you like, the ecological premises in place, we know the principles that we are looking at. One can at least then say, "Okay, that costs A, that costs B." They are very similar but actually the ecological benefit would be much greater here doing this. And if it feeds into the FSC certification process, then that is the ideal situation.

Now one might say, yes, but that's not really quite – that's about the schoolteacher telling us we have been good. You know what I mean? It's that at the end of the day. But we do know in our heart of hearts that we are trying to do good ecology and it's been translated into economic terms through FSC certification. So I think we just need to be a little bit more creative actually, John, but a good point taken.

DR DAVE EVERARD Thanks, Mike. I think in the interests of time – I know there were one or two other questions. Take home messages for me here are we have got to think big, more than just the estate, the landscape. We have got a problem with the sins of the past. How do we address those? And the other big problem we face is time, especially with global climate change coming up. We could do these things over time but have we got that time?

On that note, our next talk is by James Pryke. He is also from the University of Stellenbosch.

ECOLOGICAL NETWORK DESIGN RESEARCH AT STELLENBOSCH UNIVERSITY

James Pryke, Michael Samways, C Bazelet and Lize Joubert

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James Pryke is a Research Associate working on the Mondi Ecological Network Project within the Department of Conservation Ecology and Entomology at Stellenbosch University. This project aims to develop designs for future instigation of Ecological Networks within plantation forestry, with the specific aim of maximizing biodiversity conservation in the production landscape. He is currently researching the multi-taxa approach to determine the optimal design for Ecological Networks to maximize biodiversity.

Abstract

Globally, natural ecosystems are being rapidly transformed and fragmented, with agroforestry production dominating many landscapes. Even the largest of natural reserves cannot ensure species' survival in the face of these impacts, and so mitigation measures are being sought. Ecological networks (ENs) are such a mitigation measure, and aim at stemming biodiversity loss. The Ecological Network Programme, Stellenbosch University currently has three

research projects funded by Mondi underway as well as a few other satellite projects, all of which ask specific questions about ENs and how best to optimize them for biodiversity conservation. The first project is: “Evaluating Ecological Networks Using Grasshoppers as Bioindicators.” The objectives of this project are to assess EN efficacy for biodiversity conservation, while developing a bioindication system for continuous monitoring of South Africa’s ENs. This project to date has shown that management practices such as maintenance of short grass and winter burning had a greater impact than design related variables such as shape, size and isolation of EN patches in determining grasshopper assemblages at one point in time. Design variables, particularly degree of isolation and edge effects associated with shape of a site, have a large impact on grasshopper assemblage changes over time. The second project is: “The Conservation Value of Ecological Networks in Afforested Areas, KZN, South Africa.” Here the objective is to ascertain if ENs in commercially afforested areas extend species’ habitat beyond the borders of nature reserves, by determining the conservation value of ENs relative to nature reserves (Fig. 1). A multi-taxa approach using conspicuous and easy to identify groups (plants, birds, mammals, herpetofauna and butterflies) was used. These data will also help to establish a rapid assessment tool for these ENs. Although this project is in the very early stages of analysis, preliminary results are showing that different taxa are using the ENs differently. The third project is: “The Design and Management of Ecological Networks to Optimize Biodiversity.” This will be achieved by initially determining the size of buffer zone for different forest types (*Eucalypt*, *Pinus* and Natural) in different areas (Midlands and Zululand) (Fig. 2). Followed by the assessment of the edge-effects of plantations on corridors versus reserves (determining ideal versus realized biodiversity), while also ascertaining the minimum corridor width for maximum biodiversity. Finally it looks to establish whether plantation age affects the ENs biodiversity. Preliminary results show that although there was greater diversity and greater habitat quality outside the ENs, many groups and species are using these ENs. Furthermore, 250 m corridor widths established from previous studies appears to be a fairly robust figure for the minimum size of an effective corridor. Future projects will look into the effects of disturbance particularly those caused by alien vegetation, its removal and restoration, as well as the effects of fire and grazing.

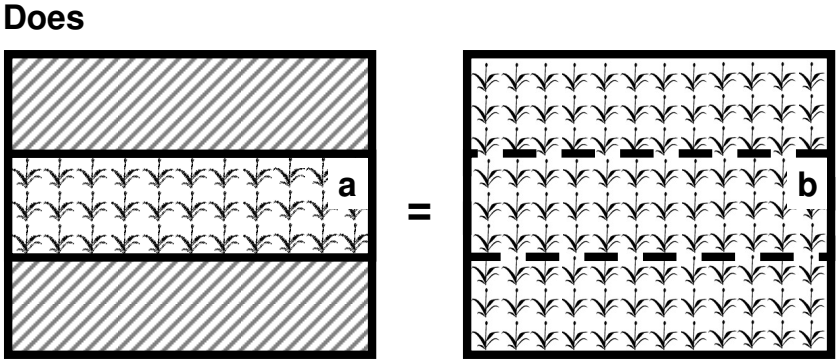

Figure 1 Diagram showing the conceptual approach underpinning the introduction of ecological networks in South Africa. The corridor is considered not just simply a linear landscape element in a disturbed afforested landscape (a) but a functional section of an extensive natural landscape (b) (hashed areas represent a transformed landscape, plants a natural untransformed area).

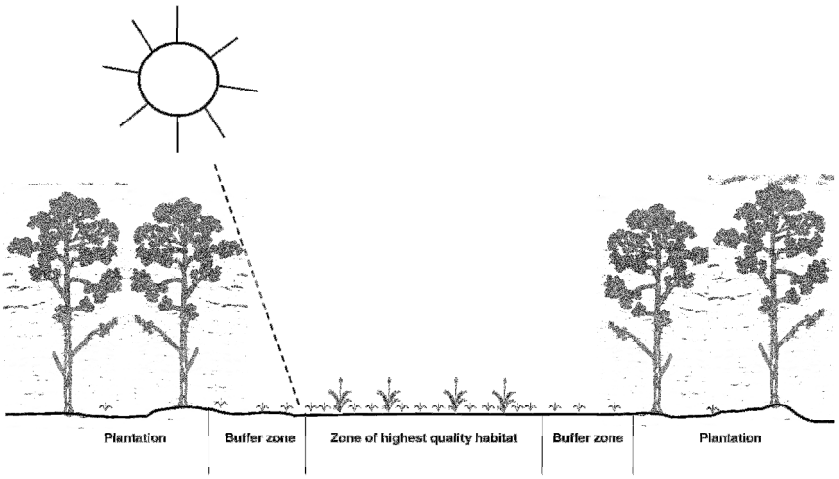

Figure 2 Cross-section of an ecological network showing the buffer zone between the plantation stand and the high quality habitat. In this example, habitat quality is reduced on the edge of the ecological network by the shading effects of the alien trees, thus creating a buffer zone. Other variables, both direct and indirect, may add to this edge effect.

Transcription

Hello, everyone. I am following on from Michael's talk, and I am just going to give you a very quick overview of what sort of research we are currently doing at Stellenbosch University on ecological networks.

We have five people working on five ecological networks projects from Stellenbosch. Michael has already mentioned John Simaika's work so I am not going into that project. Paul Grant actually follows me on the schedule here today so again I am not really going to talk about his work.

Today, I am going to talk about three talks which are Corey Bazelet's, Lize Joubert's and my own work, all of which are funded by Mondi. Corey's and my work are centred on the design concepts where Lisa's is looking more at measuring the effectiveness of these ecological networks compared to natural areas. I am going go through each of these three projects very quickly, despite these projects being quite comprehensive.

Corey is the grasshopper lady. She is looking at evaluating ecological networks using grasshoppers as bio-indicators. This is actually the structure of her PhD as it stands right now. The first part of her thesis is looking at grasshoppers as ecological indicators, seeing how they relate to the environment and how good they are at telling the full story. Chapter 2 is actually looking at grasshoppers as bio-diversity indicators by determining how much these creatures represent other biodiversity.

The third chapter is trying to get a bio-monitoring system together, hopefully easy to use, while chapters 4 and 5 are to do with movement and taxonomy. But for the purpose of this talk I am just going to concentrate on the first chapter and to narrow it down even more I am only going to talk about her work in Zululand at Kwambanombi, Dukuduku and Umlazi estates. Since Michael's talk introduced the subject I will go straight into results. What you see from a cluster analysis for all the sites across all three plantations is that the reference sites (which represent the biggest elements or biggest grasslands within those plantations) cluster together. You can also see that there are three general clusters which separate out. These grasshoppers are not clustering according to the plantations which suggest no beta diversity effects, which is often a problem with insect studies. In fact the one group seems to be very strongly correlated to power lines. This due to the fact that there is short grass in the power lines and certain grasshoppers are attracted to short grass. In another group, which represents the bigger patches you have more rare species coming in. These are species which you don't find at the other sites at all. Whereas this massive clump at the bottom is associated with the common species.

Corey looked at some species specific response to design by selecting 15 sites, with six above the reference site and eight below the reference site. She sampled in each of the sites in 2007 and again in 2008. Here is an example of a species which has completely shifted from one site to a couple of others, while here is another example of a species which was found in the reference site in 2007 and in 2008 as well as an extra site thus showing a partial shift. The first thing you notice is that there is this big clump at the back these are very common species which for these purposes are excluded, as well as a species which were found at the same site in both 2007 and 2008. This leaves us with nine partial shift species and four complete shift species. So then what design variables are causing these species to shift? The first one looked at was the distance from the sites to the reference site. You can see there was only a very week correlation between the distance and that's only for the partial shift species. If you look at the shape index now (which is how much or the shape of your patch conforms to a circle) there is a very strong correlation between the shape of a patch and the number of shifts you get in the complete shift species. This shows us just how complex some of these interactions between species and their environment are, particularly when looking at insect groups. When you look at them they do some extraordinary things sometimes. Then Corey looked at the size of the patch and there was no relevance to the number of shifts versus the size of the patch. The conductivity, how much within a 500 metre area around the patch (how much of it involved ecological network elements) got weak correlations.

To conclude Corey's work: there was a strong correlation between the patch or the grasslands while the grasshoppers themselves and they do seem to be quite robust indicators of ecological and spatial changes. In terms of management she has shown that winter burns did seem to benefit the rarer species. Also the short grasses for have a separate species composition.

Lize Joubert – she is currently an MSc student at Stellenbosch University. She is looking at the conservation value of ecological networks. Again I have time to only look at the Zululand work although she also worked in the Midlands. She is asking the question, do ecological networks in afforested areas extend species habitat ranges and what are the benefits of these ecological networks essentially? To illustrate the point here is a diagram that Michael also showed, and Lize is asking how much does A equal B?

Animal species showed two grouping ecological networks (left-hand side of the dotted line) and nature reserve (right hand side) each of these sites pair up with the same habitat type. There is only one instance where the ecological network (in a recently burnt area) where there was higher animal species richness in the ecological networks than there were in the natural areas.

Fungal species richness actually seems to quite be higher in ecological networks. Whereas with plant species richness, you get a similar result to the animal richness except for that the vegetation type where you have high species richness within the nature reserves is, I believe, pristine grassland.

Then if you put these data into a correspondence analysis, the first thing you notice is that there are four groupings based more on the vegetation type than whether they were found in the ecological network or nature reserve. Within each of those groups there is a second separation which I don't have time to show you now, but they do sometimes separate out a little bit more in terms of whether they were from nature reserve or from an ecological network. The animal species richness on the other hand just showed very little in terms of composition similarities.

So the conclusions of Lize's very preliminary results show that although species richness is high in reserves for some habitat types, actually overall we are not seeing a huge reduction in biodiversity as we go into these ecological networks. What is most interesting is that composition of these communities were more similar between ecological networks and reserves. This to me actually suggests that maybe we should be looking at trying to conserve more habitats within ecological networks as opposed to worrying too much about how much we are matching up between reserves and ecological networks.

Here is my own work. First of all I am taking a multi-taxa approach, as we know that a multi-taxa approach to measure biodiversity is better because you can look at the same areas but with different glasses on, as the term goes. I am looking at spiders, scorpions, grasshoppers, beetles, reptiles, frogs, butterflies, dragonflies, ants, while using plants as an indicator of habitat quality.

The aim of the work is to use these taxa to determine how best to design ecological networks to maximise conservation biodiversity. The only results I am going to show you today are the results from the dragonflies and butterflies as they are the only groups identified to date.

Initially what we are really trying to look at is this whole concept of the edge line. We know that as you get closer to a plantation you get the more the influence you notice from that plantation. These are the edge zones we are talking about. So how far do you need to go from the plantation before that edge zone sort of disappears? Also do different edge zones distances differ between different habitats and plantation type. Here is a diagram showing the sampling design. A transect was set up with three sampling stations inside the plantation, one of the edge and five increasingly farther away from the plantation edge. Sampling consisted of pitfall trapping, diurnal and nocturnal transects and sweep netting. We are also looking to compare edges between eucalypts and pines, differences between young pines, medium age pines and old pines, edges in the Midlands versus Zululand, edges bordering reserves and those bordering corridors and natural indigenous forests edges.

Here is the total species richness for each of the type of habitats samples. Blue bars are from Zululand and yellow are from Midlands. Zululand has higher species richness, which is not surprising as we know that Zululand has a much higher abundance of butterflies. You can also see that the natural forest and the young forest, the very young little trees, had higher species richness.

The next diagram shows the species richness along transects for various habitat types. The vertical line represents the boundary between the forest and the grassland. The natural forests have higher species richness within the forest and so elevating at their overall species richness in the bar graph I just showed you. When you look at the different age groups of pines you see something similar with high species richness among the young pines. This is probably caused by butterflies being attracted to the higher number of herbaceous plant species. Once you leave the forest or plantation edge there is very little change in species richness. This is probably due to these being the two most mobile groups that I am looking at. This is just looking at species richness things may get more interesting when we look at rare and infrequent records. I haven't really had time to do that yet unfortunately.

An MDS for the Zululand sites, with spare blocks representing plantations, the circles are the edge stations and the triangles are those within the networks or reserves. The forested areas are dissimilar to the open areas but edge stations have no difference in similarity between either. Again this is something that needs to be pulled apart a little bit more.

A Factorial GLM shows significant differences between station distances although there was also interaction. The environmental score is based on the plant species and their particular environmental niche. I unfortunately do not have time to go into details. There is interaction between environmental scores and the amount of vegetation cover, which I suppose are not really surprising. There is also an interaction between the environmental score and distance away from the plantation edge. So we don't know if it's the quality of the habitat that is improving as you move away or if it's the direct impact from the plantation edge at this stage.

So to conclude these preliminary results, we know that natural forests and young forests have a higher species richness of butterflies and dragonflies within them. Species which do not actually decrease as you approach the forest edge, which suggests that they are present throughout the corridor although this is based on the most mobile creatures.

In the future we are going to be looking at the value of heterogeneity within the corridors. If we have corridors with hills in them or wetlands in them, are they doing better than those which are just plain grasslands? We are also looking at temporal effects, by back to the same corridors and see how species richness and composition changes between years. We also want to look at natural forest to plantation edges as it would be interesting to compare areas with similar vegetation structure.

Paul is going will look at delineations, but as he is about to talk I won't go into that. Lize, once she has finished her current project, she is hoping to look at fire and how it affects biodiversity within corridors. We are also looking to get a new student to look at the effect of alien within corridors and more specifically the removal of alien invasive species and how that is influencing invertebrate diversity. Thank you very much.

DISCUSSION

Transcription

DR DAVE EVERARD We got a special deal there, three for one. Any quick questions? Brian?

UNIDENTIFIED VOICE [BRIAN?] You found a difference between younger plantations and older plantations but did you differentiate at all between first rotation young and second rotation young and so on? You would expect that the first time round you would get more diversity and then after that it might – that effect might disappear.

MR JAMES PRYKE No, I think they are all old plantation blocks which have never been planted actually. But, no, sorry, we didn't.

UNIDENTIFIED VOICE James, it will be interesting to see if you added earthworms to your study. I am sure there is a big difference as you get from the plantation as you get further away.

MR JAMES PRYKE Definitely but we don't really have anyone working on earthworms right now so we actually don't have anyone to ID them for us. They all look like little worms to me. But, ja, it would be interesting. Certainly these big eco-system functioning groups like earthworms, pollinators, those sort of things would be very interesting to look at across the landscape.

MR ALAN SHORT James, I saw on that last slide you said that size was part of your study but you didn't mention because we just saw Michael showing us how the size and design of ecological networks was crucial. Are you factoring that in and are you finding effective size and design?

MR JAMES PRYKE Ja, I think that's just an element of having four minutes to talk about your entire stuff. Ja, we are. I am going to look at size of corridors and compare them to – big corridors versus small corridors, how much are we losing as you get smaller and smaller basically. So definitely yes. But it's a knock on for later.

DR DAVE EVERARD Thanks very much, James. We are having a bit of information overload so last talk before lunch. I am sure you are all getting a bit hungry and a bit tired to this. The last talk before lunch, Paul Grant is going to be talking about acoustic signatures. Those of you who do bird-watching and frog watching know that it's a very useful tool so we really look forward to this.

ACOUSTIC SIGNATURES OF GRASSLANDS AROUND PLANTATION TREE PATCHES

Paul Grant and Michael Samways

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Paul Grant is a PhD student with the Department of Conservation Ecology and Entomology at the University of Stellenbosch. His current research interests include katydid acoustics and the value of acoustic profiling for mitigation measures and remote monitoring.

Abstract

Orthoptera, including katydids (Tettigonioidea) are well-known as sensitive indicators of quality grassland in ecological networks in and among timber plantations. Furthermore, Orthoptera exhibit a rich and complex variety of songs which are species-specific. Katydids show the greatest diversity of songs, which cover a wide spectral range. These acoustic signatures of the landscape provide a useful, non-invasive tool for monitoring katydid diversity and are practical indicators of habitat quality in remnant grasslands and where there has been delineation. We undertook a preliminary assessment of the value of acoustic profiling for mitigation measures for plantation forestry. First results suggest that grassland vegetation around plantation tree patches have distinct acoustic signatures, depending on vegetation type and quality. Hydromorphic soils, and its associated vegetation also had distinct acoustic signatures, reflecting the high value of moist grass areas in ecological networks. As katydids are cryptic, yet sensitive indicators, acoustic surveys provide an additional assessment window that allows us to observe patterns and priorities not readily observable.

Transcription

Good afternoon, everyone. My name is Paul Grant and this afternoon I am going to be talking about acoustic signatures of cicadas without grasslands around plantation tree patches. There is a study or erosion and biodiversity happening in genes, species and eco-systems which is leaving natural areas as islands in a sea of encroaching anthropogenic change. In our wake we leave great swaths of ecological footprints which are rapidly infringing on these last domains.

This situation dictates a growing need to not only identify these critical source areas but also to develop effective mitigation measures and also to develop tools and effective monitoring techniques to help stem this loss of biodiversity.

. One of the most effective ways to look at identifying critical areas and to monitor change is by looking at the insects. Now among insects the orthoptera actually contribute to a major portion of biodiversity and play a vital role in

maintaining ecological systems. Among the orthoptera, katydids are actually very, very sensitive habitat indicators. Predation risk within this group has proved to be a major influential driver behind such things as anti-predator behaviour. So it raises the question, if these organisms are so camouflaged and so cryptic and so difficult to detect, what value do they have as an indicator species. What is special about this group is that in order to succeed in the Darwinian struggle, they announce themselves acoustically. And these species actually have a very rich and complex variety of very species specific calls. Now by shifting your focus away from the visual spectrum that most of us are familiar with to the acoustics spectrum, you can actually pick up, identify and classify a lot of these very, very cryptic species. So acoustic profiling actually provides an additional assessment window to monitor change and to monitor species and threatened habitats.

As I have mentioned, katydids have a very, very rich and complex variety of species specific calls. Often these calls have a very broad spectral range that enters the ultrasonic. Sound is produced on the closing of the forewings as a row of teeth on the underside of the upper wing is rubbed against a hardened edge on the lower wing causing the mirror in katydids to resonate at a particular frequency. These frequencies differ per species and so does the call structure. These calls can be recorded and analysed by a variety of sound analysis programmes and produce graphs represented as you see here as spectrograms. The components of these spectrograms can be analysed in terms of their acoustic properties such as wave length, amplitude, interval length and a host of other degrees. Essentially this gives species a barcode identifier so every time that you encounter that species in future acoustic surveys you immediately know what that is.

These are two examples of spectrograms taken from two katydids within the Western Cape. As you can see, the call structure is very different between the two of them. And if it was possible to play the sound for these, you would hear very, very distinctive calls and this is true for all katydids. A lot of them within the same genus may have similar calls but all the calls within the species are very, very different.

Now to give you a quick background on some previous work on acoustic profiling that was done, I am going to briefly talk about one area where acoustic profiling was conducted. Now this was in the tropical threatened forests of Borneo far from the grasslands of southern Africa, yet these natural forests are surrounded by encroaching oil palm plantations. Therefore it provided an idea testing ground to test acoustic profiling in a very architectural, complex and very diverse environment.

One of the other projects that I was involved with looking at the vertical stratification of calling katydids within a forest – as you can see here there is a 50 metre metal scaffold tower that extends from the ground obviously to the top of the canopy. And it has walkways extending out from the tower to surrounding trees at varying heights. Now although this tower had remained unused for ten years and was somewhat overgrown with trees growing out of the accumulated leaf that are on the walkways, and some walkways had questionable structural integrity, it nevertheless provided an idea opportunity to look at stratification of calling katydids.

If you think of acoustically communicating animals, it's kind of akin to radio stations competing for acoustic broadcast frequencies and time. So frequencies are a very well defined resource for many species, very similar to light for plant communities. So there is very strong competition for acoustic yields and therefore there are definitely mechanisms to avoid acoustic interference. One mechanism is calling at different frequencies. Temporal separation has been another mechanism and again separation either vertical or horizontal space is another mechanism to reduce acoustic interference. So to determine what method katydids are actually employing, this research tower was divided into three sections, the ground level, mid level and at 50 metres at the top of the canopy. Calling katydids were recorded at each level for 20 minutes continuously from 7 pm to 7 am and this was conducted for three full non-consecutive evenings. The number of recording periods was really limited due to the large amount of evening lightning storms in the area. But nevertheless there is a distinct vertical separation of these katydid species and while there is some overlap between some of the different elevations, each height had its very unique species assemblage. In addition, temporal separation did not occur within these katydids at all. In fact they relied solely on separation in different frequencies and vertical separation.

Another project in which acoustic profiling was utilised was looking at katydid diversity along altitudinal gradients. Now this project was conducted on bukit belalong which is the largest mountain in the Temberong National Park in Borneo This mountain was about 1 000 metres in elevation and this project was made a little bit more interesting by the high number of forest leeches that were present. I won't go into too much detail here but essentially at various altitudes we set up three plots of 20 metres squared and katydids were recorded in each plot continuously from 7 pm to 7 am for 20 minutes. Basically the results indicate that species richness was uniform from the base all the way to the summit and there was distinct altitudinal zonation of katydids. So at each altitudinal zone there was a distinct assemblage of katydid species.

Given that altitudinal gradients are very similar and very correlated to temperature gradients, it's very likely that given a higher mountain with greater temperature gradients there would be a decrease of species richness the further that you go up. And this is something that is being conducted currently within the Western Cape of South Africa.

The point that I want to emphasise with these studies is that acoustic profiling has been tested and has proven very, very successful in a very diverse and very architecturally complex environment.

Moving to South Africa, acoustic profiling has also been conducted within ecological networks. Plantation forestry companies such as Mondi have set aside natural grasslands as a mitigation measure to conserve biodiversity. Obviously the optimal design of some of these networks is still being investigated. What we have to realise here that within a production landscape the goal is to balance economic and efficient timber production with conservation. And having ecological networks which actually link areas of high grassland quality is to my mind a very successful way to perform this kind of conservation triage.

To help answer the question of optimal design, acoustic recordings were taken in a variety of different habitats of different sizes and different vegetation quality and so forth to try to help answer this question. If you will bear with me for a moment, I am going to present a visual analogy to help conceptualise acoustic recordings from a landscape. If you can imagine this picture as being an acoustic recording, individual stars within this picture would represent individual calling katydids. Stars of different frequencies of light or different wavelengths of light would represent different species of calling katydids. Within space there are different compositions of stars. This is another example of that, these four different photos. Basically these photos represent four different habitat types and you can see they are very, very different and it's the same thing happens with acoustic profile. In different habitats you get a very different acoustic signature even within different vegetation types, different vegetation within grassland and hydromorphic soils and associated vegetation without. You get very, very distinctive acoustic signatures and very distinct indicator species along with those.

So when moving to these ecological networks and some of the grasslands, this is an example of some of the spectrograms that were taken. On the left-hand side you have frequency. Along the bottom you have time in seconds so the top one is a spectrogram taken from a natural grassland reserve site.

Just to quickly go through, I will highlight a few species. There are quite a few species that are calling within this. All of them have very different call structure and you can measure those. Down below we have an example of a very poor quality grassland site that is inundated with a high number of invasive plants. As you can see, it's dominated by one calling species and the species isn't really found in great abundance in high quality grassland areas.

We have two acoustic spectrograms and these are taken from within ecological networks within Mondi plantation lands. As you can see, there are a fair number of species that are actually using these large corridors. I won't go into detail and pull out all of the species that are calling but they are actually utilising these large corridors quite effectively. There is one species here, another here down below and this is just to highlight a few very obvious ones. But they have very, very distinct acoustic signatures that you can measure.

Here we have two spectrograms of katydids calling from areas that have hydromorphic soils and their associated vegetation type. As you can see, the call structure and the species associated with these areas are very different.

So in order to have an effective conservation plan, you really need to incorporate not only wetlands but grasslands. Both of them have very complimentary species associated with them. Basically spectrograms are just to emphasise a point that within different vegetation types, different habitats there are different species and very different acoustic signatures that you get.

Wetlands are very, very important. They serve a variety of very important functional ecosystem roles. And there are a lot of species that are very dependent on wetlands as you could see from spectrogram there, the species that are found solely within wetlands and are dependent on wetlands for their survival. Yet around the world wetlands are on one of the most endangered habitats. Within South Africa it's estimated that 50% of wetlands have been destroyed through anthropogenic impact through drainage, urban development or a plantation of alien trees which absorb a large amount of water.

Some of the forestry companies such as Mondi have taken a very proactive approach to identifying and conserving some of these sensitive wetland areas. Basically this means going out, delineating and removing some of the alien trees from them.

Given that some of these wetland areas have a very distinct acoustic signature to them, leads into future research on delineation. And basically because there is so much time and effort and resources put into delineating these small wetland patches, what is the biodiversity value of conserving very small wetland patches, and what is the acoustic signature of these very tiny little wetland patches versus larger wetlands, natural wetlands and even grasslands.

In conclusion insects are excellent indicators of habitat quality that announce themselves acoustically. Acoustic profiling therefore is a very powerful non-invasive tool that one can use to measure and monitor species that are present in the environment. Despite these advantages, acoustic profiling surveys are very, very under-exploited. Yet the potential, the untapped potential for remote monitoring of areas is huge. And this is expressly coupled with sound recognition programmes that you feed in a specific sound clip and it pulls out exactly a species list of what is calling within that sound clip.

So our world is not static. It's constantly changing. It always has and will continue to undergo various environmental and climatic changes. Acoustic profiling as a tool may help prevent some of these species from sliding into extinction, unnoticed or at least unheard by us.

I would like to acknowledge the following people and that concludes my talk.

DISCUSSION

Transcription

DR DAVE EVERARD Thanks, Paul. Questions?

MR S GERMISHUIZEN I see there is a cacophony of these species calling at different levels. How did you isolate which ones were at the bottom and the top? Surely there is a lot of interference when you are recording these.

MR PAUL GRANT There is but when you are the bottom or the middle or the top you get certain acoustic spectra and you can hear a certain species calling within that. You hear species calling at the bottom of the canopy that you

won't hear at the top. So as soon as you go up the tower, the whole acoustics signature, the whole sound changes. So it's a very distinct change. You get very distinct species that you hear calling. You won't hear them calling anywhere else except at the top. And because the vegetation is so thick that there is a lot of attenuation of signals, so the signals don't actually travel down through the canopy. So calls that are happening at the bottom are not going to reach the top of the canopy and vice-versa.

MR S GERMISHUIZEN Then just one more – in the South African context – you have moved away then from looking specifically at katydids or groups, am I correct? You are looking more at other species or other authoplins[?] or are you also including things like that frogs and that in those signatures that you are showing there?

MR PAUL GRANT Those signatures were pretty much predominantly katydids, the lower frequencies, because katydids call higher frequencies than a lot of the frogs. The work that I will be doing in wetlands, I want to actually include frogs into that so not only focus on katydids but have a two-taxa approach and therefore be able to compare the two taxa as well.

MR ROGER UYS Are we at the point where we could put a sound recorder out in the field and leave it overnight, come back the next morning and plug it into a computer and press download and get a species list?

MR PAUL GRANT The technology is there. It is available and it's quite easy to get. The only thing that we are lagging behind is the actual database of species calls for katydids. For frogs it's there. I mean we all know what the frog calls are and the bird calls. For katydids it's still a little bit unknown and that's one of the things that I am trying to do is build up that species list and therefore it would be a simple things of putting out a recorder, taking it down or having it downloaded and just generating that species list. So you can see the potential for remote monitoring over time is quite huge.

MR DONOVAN KOTZE Just in terms of wetlands, the possibilities look very exciting and I was just wondering, you spoke about comparing what was a good condition site with one I think heavily invaded by alien plants. I am wondering to what extent have you represented sort of a gradient of disturbance, so not just the extremes. It would be very interesting to see maybe you get sort of threshold how those signatures change along that gradient.

MR PAUL GRANT Yes, absolutely, I agree, and this is some very preliminary results. There has been a whole host of acoustic recordings I still have to go through and actually put in where they all fall out but looking at that gradient of changes it's one of the things.

DR DAVE EVERARD Any more questions? No? Good, thanks. Right, gentlemen, ladies, I think it's time for lunch. Lunch is served. We will be back at quarter past two sharp please.

REDESIGNING FORESTRY'S OPEN SPACES: PRACTICAL IMPLICATIONS

Steve Germishuizen

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Steven Germishuizen is the forestry coordinator for the Grasslands Programme and works under the administration of Forestry South Africa. An environmental consultant based in KZN, most projects have been in the grassland biome with a focus on environmental management within the forestry industry, and biodiversity conservation and ecosystem integrity. He has been involved with forestry at scales from community based forestry to large corporate entities. He was a member of the FSC's plantations review expert team dealing with ecosystem integrity.

Abstract

There is currently much research into the theoretical aspects of the design of Ecological Networks for the optimal delivery of ecosystem services. This work is focused primarily on biodiversity conservation. The practical implementation of this body of theory remains largely untested. South African plantation forestry has an open area network which occupies approximately 500 000 hectares of unplanted land. The configuration of these areas is a product of wetland delineation, areas not suitable for timber production, power line servitudes, firebreaks, indigenous forest patches and dedicated conservation areas.

The challenge now is to reconcile these bi-products with optimal design. In redesigning the Ecological Networks in South African forestry the following factors need to be considered; the requirement for water conservation, the need to maintain economic viability, identification of priority areas, the policy and legal framework and the commitment of forestry organizations. There are a number of possible benefits of an improved design of the ecological networks which include; improved biodiversity and ecosystem functioning, economic benefit to forestry organizations through a reduction in the management costs of unplanted areas, and possible hydrological benefits as many of the narrow corridors support high water using invasive alien species. In water stressed South Africa, the hydrological implications of any new configuration is pivotal.

The SANBI Grasslands programme has partnered the forestry industry in producing a spatial tool to assist in the prioritization of unplanted within the plantation estates by categorizing areas according to their biodiversity value. This tool could be used to assist in designing the optimal networks and guiding implementation. Furthermore, the programme is engaging with the relevant government organizations and with the FSC national initiative to navigate the policy and

legal waters. The Grasslands programme is looking for to fund research projects into rehabilitation and restoration of former timber areas which a key aspect of the success of redistributing timber on a forestry estate.

Transcription

In this brief presentation I am going to attempt to examine the barriers and constraints to implementing ecological network theory and some possible solutions.

There are two scenarios where redesigning the ecological network might apply. Firstly it could apply to a new landscape that we want to afforest or it could apply changing the configuration of existing forestry. Currently plantation forestry is reducing in area, primarily due to wetland delineation and there is no significant threat of large-scale forestry expansion in South Africa. Contrary to the perception in some sectors, most of the area suitable for forestry has been planted already. In order for this approach to have a significant impact it must apply to existing forestry. In order to get a picture of the optimal layout one can ask the question; if we could start again, how would we design existing plantation layouts so that they can deliver optimal eco-system services and produce the timber resources and fire protection that we need.

I would like to present a brief overview of the forestry component of the grasslands programme. The primary objective is to ensure that the forestry sector contributes directly to biodiversity. There are three outputs: one is the management of the grasslands on the forestry estate generally. In order to support improved management we are providing tools, support and guidance to the forestry industry. An example is this symposium. The second one is aimed at setting up formal conservation agreements for priority areas through the EKZN-Wildlife's Biodiversity Stewardship Programme. We have identified about 40 critically important grassland areas for inclusion, as protected environments or nature reserves, into the formal protected area estate of the country. And then the third output is aimed ensuring that the planned expansion of emerging plantations in the Eastern Cape and KZN is underpinned by biodiversity considerations.

Towards output one, we have been developing a conservation planning tool which Richard Lechmere-Oertel is going to be explaining to us in the next presentation. We have been working with forest certification, in an effort to make it more relevant to the plantation environment and more applicable to the full range of scales of timber growers. At the moment many of the certification standards are not suitable for the small and medium growers making it difficult for them to comply.

We planned this symposium as the starting point for the development of guidelines for grassland management in plantation estates. We have been involved with funding research in various areas and we have had a fairly rigorous communications and awareness programme.

Let us return to the topic at hand. The configuration of ecological networks in South African forestry has not been optimally designed with biodiversity in mind. They have arisen from, primarily, the need to delineate 40 metre wide buffer zones around streams for water conservation. This process has been in place for 12 to 15 years where forestry has been delineating areas and removing timber from their stream sides and wetland areas. Timber as also been removed from areas that are not viable for timber. These include rocky outcrops, shallow soils and other areas that would not support commercial forestry. Other areas which are included in the unplanted areas include power lines servitudes and firebreaks. Patches of indigenous forests, which have been completely protected by law for a century, form an important component of the network. There are also other areas that have been set aside specifically for biodiversity, in more recent times. The challenge then is to reconcile these by-products with optimal design underpinned by the optimal design features that Profession Samways was talking about earlier.

So what are the factors that we need to consider when we attempt to redesign the entire arrangement of South African forestry. Foremost, there is a need to maintain economic viability. Given that over the last 12 to 15 years forestry has been losing area to wetland delineation and given the recent down turn in the market, any re-organisation that caused a loss in forestry profits would be difficult to sell to the timber industry. In order to maintain the same productivity it would necessitate a transfer of timber from high value ecological areas to low value ecological areas in order to consolidate the ecological network.

Furthermore, there must be no additional fire risk and hopefully we could demonstrate that there would be improved fire protection will result from improved design of the unplanted space. Forestry would need support in identifying which are the priority areas from a biodiversity perspective and currently there is plenty of research to support this approach.

Forestry is the most highly regulated land use in South Africa and SA has one of the most highly regulated forestry industries in the world. This results in a number policy and legal hurdles that restrict the movement of timber on forestry estates. This is one of the main challenges. Furthermore, success depends on cooperation from the forestry organisations. They need to see clear benefits in redesigning the networks before they are willing required resources in. The hypothesis is that there will be a net economic benefit to doing this but initially there would need to be an investment.

What are the possible benefits of improving the ecological network towards larger high quality corridors linking substantial nodes? Professor Samways pointed out the potential biodiversity and ecosystem functioning benefits and this is supported by research.

What are the potential economic benefits to forestry organisations of a less fragmented ecological network? I think it's clear to forest managers that it would be cheaper and easier to maintain large consolidated areas, easier to implement good ecological practice like block burnings or biennial burnings, and easier to keep areas weed free. A lot of the weedy areas and the areas that are difficult to manage are narrow corridors, high up in the catchment often in A and B zone streams. These potential economic benefits need to be demonstrated.

The impact on water production is the linchpin of the approach. Delineation's main objective was to improve water yield and therefore any modification of the plantations would have to be hydrologically neutral or beneficial. The net effect on the hydrology would have to be modelled. The hypothesis would be that the water yield would improve if many of these narrow corridors which currently support alien plants were consolidated into larger well managed areas. This would have to be modelled and field tested.

This is an illustration just to show that – currently narrow corridors between plantations cannot always be appropriately managed. This is a buffer, probably less than 40 metres wide, between pine plantations. The vegetation here is rank, not very diverse. This area hasn't been burnt for eight to ten years. And here is a very similar area. This area had timber in previously. It was delineated. The timber was removed eight or ten years ago and you can still see the stumps. Then the area was burnt. The result is quite a dangerous area in terms of ecological damage. There is huge potential for erosion, there is very poor basal cover and the reestablishment of grass cover is very slow. This was burnt in the dead of winter, so at the first rains we can expect most of the silt to end up in the stream below.

Many of these narrow areas are difficult, if not impossible to manage towards grassland or to ensure soil protection or towards a useful functional ecosystem. Difficult decisions had to be made on how to manage these areas.

This slide shows an area that has been burnt along with this sugar cane, every second year and while not perfect, this photograph, taken straight after the indicates that already there is better basal cover and better protection for the soil.

So how does ecological network theory get put into practice? There are so many conflicting demands and conflicting issues that need to be considered, such as timber production, fire control, neighbouring communities and cattle. All these issues need to be considered and the forestry industry needs support in doing this.

Is it possible to strike a compromise that benefits biodiversity, hydrology and biodiversity? This is obviously a gradual process that will take place over several rotations of timber. Forestry companies would need the tools and support to make the right decisions. This would include the backing of the research and there would need to policy changes to facilitate this.

The other key issue is the ability of former timber areas to be rehabilitated. What services will the rehabilitated areas deliver and are they worth the effort?

The grassland programme has developed a tool to identify areas of ecological importance and this is what Dr. Richard Lechmere-Oertel is going to be talking about. In summary it is a blueprint of the unplanted areas on the forestry estate, indicating which areas are important to conservation. I am not going to deal with it at all because Richard is going to tell us all about it. With this tool having we would be able to identify the ecologically important areas and use it to assist in design the idealised network from a biodiversity perspective.

We are designing a pilot project to test this. It would start off with a desktop study in which we apply these principles to a piece of forestry land and generate a hypothetical ideal network based on biodiversity, hydrology, management ease and cost. We propose using this conservation planning tools to do this.

The next step would require modelling the hydrological output, followed by the economic impact. This blueprint would be presented to decision-making bodies such as DAFF, DWEE and the conservation agencies to get and understanding of the policy and regulatory requirements to make it work. Currently the administrative burden around movig a block of timber One possibility is that a general authorization could be issues to an estate that has a comprehensive plan that can demonstrate the hydrological, economic and biodiversity benefits. Every time a block comes up for planting, re-organise the estate according to this because at the moment the barrier is for each time you move a block of timber from one area to another, you have to make a new application for a stream flow reduction licence or you need to apply to the authorities. And this makes the process very slow. So if one had a general authorisation based on a sound plan which is buy-in from a hydrological perspective, biodiversity perspective as well, and one had buy-in, then one could have a blueprint sign and one could go and exercise. How this gets monitored is another question. This needs then to be monitored that in fact the blueprint is going according to plan and one could incorporate this into the FSC system to monitor.

The question is if one wanted to do this and one felt that it was worth doing, at what scale do you do it? This opens up a lot of interesting questions. I mean you could do it at the estate level. Maybe more interesting to do an entire catchment or follow an over-subscribed stream such as the Mvoti River system and work with the plantation estates along the stream.

So that is the sort of decisions one would make and in which area could we do it? At the moment it's a conceptual thing, it's an idea. I am sort of throwing it out there. I would really like input on this and it's something that Grasslands would be happy to support and we are looking for some volunteer estate, volunteer companies or groups of land-owners to do this.

And I think that's all I have got to say on the topic.

DISCUSSION

Transcription

DR DAVE EVERARD Who has got a very difficult question for Steve? Nobody? Have you got a question? Comment?

MR ALAN SHORT I think what is really interesting is Ben Potgieter's talk yesterday and your talk and Michael Sameways' talk – there is an obvious overlap between all of them, planning – in Ben's case it was for fire protection and fire management and in your case it's for biodiversity and hydrological aspects. But there is obvious overlap.

MR S GERMISHUIZEN If I can respond to that. Alan that's a very good point. I was excited to hear about Ben's idea of doing a lot of their fire control under the canopy, which allows more flexibility in managing the open areas and working in collaboration with their planning system. I think one comes up with a very interesting management system – management plan for that.

DR DAVE EVERARD Any other questions? Comments? So when are you starting your pilot study?

MR S GERMISHUIZEN Very, very soon.

DR DAVE EVERARD I think it's important that there is a lot of baseline information – sort of information that we need to gather on things like cost and the implications and all that, which a pilot study will put in place for us. So it's really important that we look at getting a pilot study done.

The next talk, as you can see it's also on biodiversity prioritisation and Richard Lechmere-Oertel will be presenting. Thanks, Richard.

FINE-SCALE BIODIVERSITY PRIORITIZATION IN THE FORESTRY ESTATE

Richard Lechmere-Oertel and Grant Benn

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Dr Richard Lechmere-Oertel is a biodiversity planner and ecological consultant based in Hilton, Pietermaritzburg. He has worked extensively in the grasslands of KZN and the Eastern Cape, primarily in the Drakensberg. He is contracted to the FSA / Grasslands Programme partnership to conduct biodiversity prioritisation within the unplanted plantation forestry estate, and recently completed a biodiversity pre-screening for forestry development in the Eastern Cape.

Abstract

The Forestry industry owns or leases almost 600,000 ha of unplanted land that is potentially contributing to provincial and national biodiversity targets. Some of this land is highly significant for conservation and deserves preferential management intervention, either by the landowner or the conservation authorities through the various interventions such as stewardship.

Biodiversity prioritisation provides data that focuses the land management and conservation efforts. Companies can focus their limited management budgets on areas where the biodiversity is contributing significantly towards provincial targets. Similarly, the conservation management and stewardship programmes can use the results for developing and focusing their work efforts.

The biodiversity prioritisation process has been developed using a combination of GIS and Excel models that integrate the provincial-scale Biodiversity data with local-scale plantation and biodiversity data to identify those sites that are contributing most towards the provincial biodiversity targets. The system is based on the company's open areas GIS database, where each open area is represented by a polygon that can be identified on the ground by the estate manager. These management units become the planning units of the tool. These management units are intersected with the provincial biodiversity databases, including the systematic conservation plans, wetland layers, vegetation maps, species databases, and so on, building an attribute database that records all the biodiversity data for each polygon. These data become the basis for the Excel scoring system, where user-defined weights are applied to each of the variables and a biodiversity score calculated for each polygon. These results viewed in GIS to present a picture of the important biodiversity sites within a company's landholding.

A problem with all modeling efforts is that the on-the-ground reality can be very different, leading to disillusionment by end users in the industry. To avoid this, forestry estate managers were involved in a rapid ecological integrity assessment for each polygon in their estate. The modeled results are moderated by this data in a way that reduces the biodiversity value for damaged or transformed areas. This approach includes an assessment on weed infestation.

This whole system is then installed on the company GIS system and can be updated by the conservation officer with little effort. It is envisaged that this system will be contribute towards the certification auditing and general conservation management by providing explicit and spatially-defined conservation goals for a company. It can also

inform the conservation authorities about which areas should be the focus of stewardship efforts and other conservation initiatives.

Transcription

Hi, everybody. I would like to just give some feedback as to this project we have been running through, this partnership between Forestry South Africa and the Grasslands programme where myself and a colleague Grant Benn were contracted to develop a method of prioritising biodiversity on the plantation estate. The rationale for wanting to do this work is that we have a large landowner in the form of the forestry sector which is operating on a large portion of South Africa, of which at least one third is not planted to trees and is potentially available to conservation. Some of these conservation areas or open areas can contribute significantly to the provincial conservation efforts.

Each province has a conservation plan with targets and they have a range of implementation options to try and achieve those biodiversity targets, such as formal protected areas, stewardship sites, management agreements and so on. The forestry sector can potentially contribute quite a lot towards these targets, and it is quite well regulated and institutionally accessible because it comprises relatively few, but well organised, companies. It's an easy industry with which to engage.

So one of the questions that arises fromthis sort of thinking is how do we focus the resources that are available for conservation management that come from within the forestry companies, and which are constantly under threat of budget cuts. The same question applies to theconservation authorities who have limited budgets to implement their various interventions. There is a very strong argument for developing some form of prioritisation analysis to take those limited resources and use them for effective implementation.

From that background Forestry South Africa and the SANBI Grasslands programme have formed a partnership to assist all of the major forestry companies with their prioritisation and management. We have developed a GIS / Excel based analysis which will help the conservation officers within the companies to prioritise their unplanted lands for conservation.

The focus has beens to try and work within the existing companies systems. We have used the company GIS management systems and work closely with the conservation officers and other relevant people within the company to try and take this body of thought and analysis tool into their system so it becomes something that is retained within the company and doesn't require an external impetus to keep it going.

So how do we prioritise biodiversity?

The provinces, those that have forestry within them, primarily Mpumalanga, KZN and the Eastern Cape, all have provincial conservation plans where significant effort is being made to try and understand the pattern of biodiversity within the province, resulting in spatial biodiversity plans that include provincial corridor networks and so on. Our work makes use of all this existing information and spatial design, and is thus nested within these existing plans.

In addition to that, there is a lot of local-scale data that emerges out of the company systems. For example, there are species data lists (where they maintain them), special habitats and high conservation value (HCV) areas. Importantly, our analysis relies on the local knowledge of ecological integrity; where the conservation managers and estate managers have a lot of information in their heads about what state any one particular piece of land is in. There are issues of space and boundary, including area, perimeter, area-perimeter ratios, adjacency, and so on. These are all local-scale pieces of information which can contribute to our understanding of what is important biodiversity.

One of the problems that comes with trying to integrate these data sets is that much of the provincial or national conservation planning takes place at a scale that at its finest is 1:50 000, but more often is 1:250 000 scale. It is very reliant on modelled distribution data, which are often remotely sensed. The converse it that forestry is a production sector where planning takes place often at a 1:5 000 or 1:10 000 scale, and the average management unit is three hectares. The prioritisation process integrates these different spatial scales in a way thatallows the user to emphasise or de-emphasise different data variables depending on their confidence in them. There are some data sets at a provincial scale that one would not want to over-emphasise because the data are very good at a finer-scale.

So, for example, lets look at the provincial corridor network in the Eastern Cape. The PG Bison estate overlaid on this corridors shows anexample where there is a conflict of the scale and where almost 90% of the estate is captured within a provincial corridor. One cannot just apply the corridor network at the planning scale of the plantation because it wouldn't be meaningful. Yet on the other hand we have a whole lot of data from the provincial analysis and, although the aim is to improve them over time, we work with that which we have at the moment.

Our analysis tool takes all of the biodiversity data from the provincial and national biodiversity scale, including the critical biodiversity areas, irreplaceability of the various forms of biodiversity, the corridor of protected area networks, species and habitats, data sets, and so on. It also includes the plantation-scale data such as weed threats, ecological integrity, intended purpose, the size, adjacency to a protected area, and so on. An additional dataset that was developed was a plantation corridor network which links neighbouring open areas. Using a non-technical (i.e. human eye) approach I came up with a network of corridors that connected the surrounding landscape across any one estate.

A key step in the analysis is the use of ecological intergrity, and it's such a key step because any sort of data set that is derived remotely or extrapolated in any way, very quickly loses reality on the ground. We had examples of this in our earlier efforts where we took the results back to the company and we were showing them all these nice pieces of important biodiversity on their estates and the response was, "No, that's our factory." We just didn't know that that piece of open land happened to be under a factory and had highlighted as particularly important biodiversity. So this step of having ecological integrity is such a key part of this analysisTo determine ecological integrity is ideally based on

exhaustive fuel surveys that generate species maps, lists and veld condition scores. However, this is costly and time-consuming and very unlikely to happen across a whole estate, which is what is needed. We approached the people who know the land well, such as the estate managers and conservation managers, and asked them to assign an ecological intergrity score for all of the open area polygons. The ecological integrity classification was based on mutually-exclusive classes, such as infrastructure or maintained, an old arable field or an improved pasture, very bad erosion, weed infestation , or heavily impacted by grazing or fires. Each class was assigned a score rating from zero to one, which was used to moderate the biodiversity values of the land parcel by multiplying it by the score. Thus anything that is infrastructure is not contributing to biodiversity so its biodiversity score just gets zeroed. Conversely, anything that is relatively pristine get multiplied by one and carried through its full biodiversity value.

Another consideration in the analysis was space and size. Very basic conservation ecology theory is that large chunks approximately circular land are preferred over small and skinny areas to avoid edge effects where plantation shading and weeds can be problematic ..

The analysis works using the company open areas system intersected with the provincial and national scale conservation planning data. Every one of the plantation management units is attributed with the underlying biodiversity data. The area, perimeter, adjacency and other spatial data are added and a GIS database of biodiversity and conservation data is built. These data are exported toa spreadsheet where we all of the variables are been weighted . Each polygon is scored additively according to the amount of each biodiversity feature multiplied by its weight, adjusted by the weed threat and the ecological integrity. The resulting biodiversity score is sent back into the GIS environment for colour coding and the conservation manager in the company can identify which areas are important for biodiversity.

Weighting the variables is quite a key step. The analysis allows each variable to have a relative weight, so the user can emphasise or de-emphasise any of the variables. This allows the user to test scenarios and the sensitivity of the model to different data sets, and it's very open and explicit. The exact variable and weights are all recorded in the model analysis report.

In many instances the companies have an intended purpose for every one of their open areas, such as conservation, aesthetics, fire protection and maintained. This information about the long-term intention of the land can be used to influence the likely biodiversity values of the open area. For example, an open area used for fire protection is probably being burnt on an annual basis, so it carries much of its biodiversity value, but is slightly reduced to 80%.

The analysis generates a series of fairly basic summary statistics which the company can use as part of any auditing process. For examplethere may be 165 management units totalling that much area which 35% of the area that are scored very high value.

This example from is from the Amatola area. All the big indigenous forest patches stand out. If you rerun the analysis without forests in it, the grassland patches that are now orange get highlighted as really important. Such a map would be useful for the estate or conservation manager to allocate resources towards the high priority areas.

So just in conclusion then, how can we use this data set for every company? The idea would be that we would be able to focus whatever effort is going to be made on conservation into higher the priority lands. There are a range of implementation options, including stewardship in the larger areas. The results can be used to allocate resources and to report what is their contribution towards the provincial biodiversity targets and that over time could be part of the certification process. The results can also be used in a proactive way. If a company is planning on a new planting, they could take this analysis and use it to avoid conflict with high biodiversity areas. and the whole analysis can be integrated into the certification auditing process - initially as the baseline - and then into the ongoing monitoring of the conservation objective.

DISCUSSION

Transcription

DR DAVE EVERARD Any questions for Richard?

PROF MICHAEL SANWAYS Richard, how did you arrive at those concentrated values for the ecological integrity? How did you get that score? And the second question which is related, do you use threatened species – rare species in your planning? Because I would have thought they would be fairly easy to get data and, secondly, they are flagships.

MR RICHARD LECHMERE-OERTEL The first answer with regard to the scoring of the ecological integrity was based very much on dialogue with the ecological community that I am most in contact with, which is KZN Wildlife. So it was put out to comment and I came up with what I thought was a good first guess and I emailed out for comment and then integrated those comments. And it's been subject to comment also in the Eastern Cape Conservation Authority. And my thinking behind that was in many instances that this is emerging out of a partnership between conservation and forestry so I wanted the dialogue to reflect something of that. But the model allows you to change it. You can rerun it with different settings.

The threatened species are normally integrated initially through the Provincial Conservation Plan. So where there is a provincial conservation plan that has already taken those into account, I didn't use them because it would be double the counting. Where the company had a database of threatened species or just even important species, I would use that. And where there is a species that has not been included in the Provincial Conservation Plan, it does get brought into the analysis.

So the analysis is also set up in a way that the majority of the variables are not defined in advance. The user can define them. So one of the companies had a very good data set on the fogs, which none of the other companies had. So that was brought in as a variable. So it's that principle of use the data that you have and you assign the weighting and then the analysis will take place thereafter.

UNIDENTIFIED VOICE Going back to your corridors and stuff like that, I think part of Ben's presentation was buffer zones from a fire protection point of view. And I see the two knitting together where the buffer zones and the conservation areas can work together where we are going through, like for instance in the Richmond area where all the companies are working together to create strategic buffer zones through company farms, through private farms and stuff like that. So it's a wonderful thing that maybe we can work together with, pooling data to draw that on the maps and get it through the areas.

MR RICHARD LECHMERE-OERTEL Ja, I think what's emerged for me out of listening to this morning's talks is that thinking on networks needs to be taken out of any one sector and actually looked at almost at a fine scale but at a provincial level where you try and design a network that links up all the land uses and goes around them or however it works, but it can't be done in isolation. So I think these things will come over time.

MR ALAN SHORT I can understand why a lot of this is done as desktop exercises but that doesn't eliminate the need ultimately for field work. Are there any plans to do field work, for example to look for flagship species or simply to do basic veld condition surveys to actually see whether your valuation is valid?

MR RICHARD LECHMERE-OERTEL The answer would lie very much with the companies involved. In other words I don't think the grassland programme necessarily will undertake that field but what we had anticipated was that we would work with the companies in the generation of an initial analysis, in the process teaching them how it all works and mainstreaming the system onto their GIS management unit systems. And then over time they would take that initial result and start a process of verification in the field of the results and where there are discrepancies you would obviously try and understand why and modify the data sets accordingly. So the ideal is that that would happen over a period of time and I think people like Peta Hardy who are so prolific in their field work would be able to take something like this and start a process of just checking the results. And there may be opportunity for partnership with the conservation agencies, certainly on the stewardship scale sites to work with that, to try and do more of that.

DR DAVE EVERARD Perhaps I could just comment there. Richard is absolutely correct. There is already field work being taken in some of the monitoring that we do do on the plantations. But another avenue where there could be a lot of synergy is this kind of approach and the results from a study like this could direct us on where proper monitoring should be done as part of FSC requirements, which has to be done. So there is a lot of synergy that can come out.

PROF MICHAEL SANWAYS Can I just pick up? Your comment about going larger scale for a moment. I appreciate you are working with forestry but what opportunities do you see with other agricultural sectors for continuing in these networks. I mean in some areas there is some sort of connection with sugar and down in the Cape of course we have the biodiversity in wine initiative. How are things looking cross-sectorially?

MR RICHARD LECHMERE-OERTEL I am not well qualified to answer that question, other than to give my opinion that I would guess that you would want to start off working with those industry or production sectors that are organised. So you are not working with endless landowners which just delays the process as it takes so much time. So I would guess that something like the sugar industry which is well organised and in essence has a very similar impact to plantation forestry, one could start inroads but I have not done it myself. I am not part of any process that does that or body that does that. So it would be the ideal I think. Maybe Steve would be better qualified to help.

DR DAVE EVERARD Steve, do you want to comment just on that?

MR S GERMISHUIZEN We were embarking on a process to have a meeting with SANBI to see how SANBI wants to use this because the grasslands programme is interested how it would be applicable to the other sectors, the agricultural, urban sector, and also how SANBI could use this approach. So we are definitely thinking about other land uses and a broader application of this fine scale planning approach.

UNIDENTIFIED VOICE It seems that there is a very important step missing. We hear of the privatisation of the areas, the identification of the areas and that sounds really good and then we hear of monitoring but what are we monitoring for? I would assume that the next step after identifying and prioritising would be then identifying the management objectives for those areas. Obviously the overall assumption is that we are conserving grassland biodiversity, but there might be target species that you need a particular type of management to be applied, etcetera. So I would assume then that the next step would be to go through a rigorous management planning process which you could then base your monitoring on.

MR RICHARD LECHMERE-OERTEL I didn't have the time to go into the detail of it but one of the easy data results that comes out of the tool is for any one area you can click on a polygon and it will very quickly generate a list of why it's important according to the desktop analysis which then becomes the basis of any strategic field work. You can go and see if that stuff is actually there, if it's species or habitats or whatever it may be. Ideally you are right, I think it has to go then the next step to say, well, if this is a crane nest – and I think, to be honest, a lot of that is around where there is known biodiversity. The management plans that I have seen often reflect that that they will be managing for that species or that habitat, it will be a wetland or whatever. So I think the thinking is there. It will just need to be taken that next step.

DR DAVE EVERARD Thanks, Richard. Let's move on to the next talk, the last talk before tea. It's all about developing cattle, commercial cattle projects. Who is presenting? Is it you, Rory? Over to you.

DEVELOPING COMMERCIAL CATTLE FARMERS AND PROMOTING SUSTAINABLE RESOURCE UTILISATION WITHIN FORESTRY PLANTATIONS IN MKHONDO, MPUMALANGA, 2006 – 2009

Richard Dladla (replaced by Rory Mack)

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Richard is an agricultural economist involved with the Mondi Livestock Commercialization Development Programme in Mkondo Municipality Mpumalanga Province. He has spent the last 10 years working as an Agricultural Development consultant based at Zakhe Training Institute in KZN. He has work on a variety of projects in the agricultural fields dealing with livestock and crops. His interest is in the developing agriculture and forestry sectors, trying to link emerging farmers in to the main streams of commercial farming.

Uncontrolled and unplanned livestock grazing and browsing is an ongoing problem in forestry plantations within South Africa. Damage to newly planted compartments, overgrazing, disease, water pollution and incidence of fire are all associated with livestock, whose owners see the grassland and bush areas as a valuable resource. These owners are either tenants on the land in question or from neighbouring communities. Other than tight control linked to security measures and vigilance no real solution has been found to effectively deal with this problem, both at an environmental and social level. It is within this context that Mondi in Mpumalanga embarked on a programme to look at ways and means of dealing with this issue based on social and environmental principles.

The specific issue being dealt with is that of cattle grazing on Mondi plantations in the Piet Retief and Iswepe areas of Mpumalanga. There are some 7000 head of cattle utilizing grasslands between plantations under no formal cattle management programme. The farm tenant owners generally own the cattle as a cultural asset with minimal commercial transactions and no realization of economic potential.

In order to deal with this issue a plan was derived that took into account the cattle owners and what could benefit them, thereby moving towards improving the utilization of natural resources. In dealing with this there would be a natural solving of problems affecting plantation management and possible gains in areas such as fuel load management, resource management and fire risk.

The process looked at social surveys of farm tenants in general and specifically cattle owners. This helped establish social dynamics and prepared for matters related to spatial representation, cattle concentrations and skills levels. A social responsibility programme was initiated by Mondi in association with a local service provider to engage with cattle owners in Iswepe to assist with basic value add support in the form of cattle dipping, branding and ear tagging. In the course of this work other livestock related issues were dealt with on an extension type basis resulting in a building of confidence between Mondi and the cattle owners.

All related issues linked to cattle farming were identified and a process of moving in the direction of commercializing the cattle developed. Naturally the link between cattle numbers and available grazing has been made as well as water provision. Grassland composition, state and management for grazing still need to be quantified and mapped. Together with this goes formal fodder flow management and rotational grazing. Currently the need for institutional development is being addressed , linked to which a cattle forum has been established with key stakeholders representing government, commercial farmers, Mondi and cattle owners represented. Capacity building is a key success factor and this is being supported by the Agriseta and Fieta. More of a research focus is needed to accurately capture the methodology, trends and success measures for future replication.

The success and learning from this programme will undoubtedly lead to a ground breaking plantation based livestock management model that will impact positively on the livelihoods of emerging cattle farmers, multiple resource sustainability including the lowering of fire risk.

DISCUSSION

Transcription

DR DAVE EVERARD Thanks, Rory. Any questions?

UNIDENTIFIED VOICE Rory, you spoke about cattle. Have you used goats in any way perhaps to control alien invasives?

MR RORY MACK Ja, we started off on cattle. There are sort of three different animals that potentially impact on forestry, cattle being the highest number, goats and horses. Goats we haven't tackled yet but if people recall in the old days they were utilised quite heavily in controlling weeds under canopy and within open areas. We can actually get away from a lot of this chemical kind of control and reduce costs by implementing things like that.

DR DAVE EVERARD Any other questions?

DR TERRY EVERSON Rory, you mentioned you have got a monitoring programme going. Is that monitoring – what do you monitor and are the community members involved in that or is it separate?

MR RORY MACK Well, there are two levels of monitoring. One is really around what's happening with the cattle owners in terms of number of head, what we are doing in terms of dipping and branding and various things like that. The

social part, we are looking at committees and monitoring how they perform and how they interact with their members in order to set up a more commercial business structure. But in terms of the natural resource management framework, within that area we are still relying on the little bit of information that we get from static monitoring sites within Mondi which really isn't enough. And through the Department of Agriculture in Mpumalanga we have started on let's say an area by area basis where we are ready to commercialise with a specific community or village. We get them to do veld assessments so we can start establishing what sort of conditions there are.

There are more heads of cattle than there is grazing available. That we have determined. There are other things that go with that. For example most of the herds are carrying cattle that are way too old and not being productive. Essentially they should be selling off nine-month-old wieners but they are keeping oxen to about five or six years. And those are the kind of interventions that we are trying to put in place to reduce numbers. And people are seeing the sense in that.

And in fact at the auction where a five- or six-year-old ox that was pretty huge was sold for R6 000 and a nine-month-old wiener came in and went for about the same price, people were quite shocked and really that brought the reality home to him that one can get around these sort of things.

UNIDENTIFIED VOICE Two comments. One, I think five years, you are being highly optimistic. Personal experience. You must have a more co-operative bunch of people than what I have got.

DR DAVE EVERARD Have you got a comment on that?

MR RORY MACK No, I think farmers have been engaging in this sort of thing for a while. This is not new to the farming community. Farmers naturally graze their areas and within forestry estates that is going to become the norm with the whole land reform scenario because the land reform beneficiaries are not just looking at tree growing. They want to do animals, crops, etcetera.

MR ALAN SHORT[?] I was a bit concerned by your auction figures because there was an exponential decline in the number of animals and the number of owners selling animals. Your first auction was in I think November last year and the last one that you had on the table was April this year.

MR RORY MACK Ja.

MR ALAN SHORT What have the figures been like in the last few months? Was it just an initial spurt of interest which then fizzled away or are people going to get more stuck into commercially selling their animals?

MR RORY MACK No, there are certain market dynamics in terms of selling animals for Christmas and for Easter that play a huge role in terms of pricing and demand. Obviously in winter you start tailing off because the animals lose condition and it's preferable to sell them in the spring. So those are some of the dynamics around it. The fact is that we are consistently still getting more and more cattle being sold.

MS JULIA WAKELING First of all I think that this is a fantastic thing and incorporating the community is the only way to go, but I don't think there has any data presented in the last little while but the general impression I get is that cattle aren't good for biodiversity. So despite the fact that you have grasslands in between your forests, it's not actually useful from a biodiversity perspective.

MR RORY MACK I wouldn't know. We haven't monitored all those grasslands to actually determine whether that's necessarily the case. So I think it's a bit of a subjective remark.

MR S GERMISHUIZEN I just wanted to make a comment. We are aware that this is inevitable that eventually communities will be taking portions of the land and this just makes this prioritisation tool even more important because we are able to identify the critical areas and then also reconfigure it in terms of which areas are important for grazing. So I think it is very useful in that context.

DR DAVE EVERARD Thank you, I think that is the end of this session.

SESSION FIVE: POLICY AND PLANNING

INTRODUCTION

Chaired by John Scotcher

Transcription

Good afternoon, ladies and gentlemen. I am your chairman now for the last session. My name is John Scotcher. It just amazes me that the organisers saw fit to put the legal issues right at the end of the programme. I mean, for goodness sake, they come up with all these wonderful ideas and now the law tells us what we can and what we can't do. However, as laws were made by humans, if you can regard lawyers as humans, the laws in fact can be changed. But we come to the end of this two-day programme and we have taken in an awful amount of information, probably retained only some of it. It's also that time of the day, time is ticking on, it's nearly four o'clock, when we need to get back to our dogs and our homes and our wives, in that order, which leaves me to express a personal view on wives. You know I have had bad luck with both my wives. The first one left me and the second one didn't. But if a man steals your wife, there is no better revenge than to let him keep her. You will judge from that that my wife actually isn't in the audience.

We have three speakers this afternoon. We are going to be talking about fire in timber areas, insurance requirements and the innovative stewardship programme. It always worries me that when you talk to insurance people about a fire you had in the plantation and they say to you, "Well, what happened?" and you say, "Well, you know we were burning this grassland for biodiversity reasons in the plantation." And they say, "You did what? And the plantation burnt down and you were burning it and now you want to claim from us?" So we will hear a bit more about how that actually works in practice. But our first speaker this afternoon is Trevor Wilson. Trevor has been involved in the veld and forest fighting business for a long time, since 1995. He has had extensive training and experience in this country, South Africa and in Portugal and he is currently the fire protection officer for two fire protection associations in Zululand covering an area of 1,5 million hectares.

KEYNOTE ADDRESS: LEGAL ASPECTS OF FIRE IN TIMBER AREAS

Trevor Wilson

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Trevor Wilson has been involved with the Veld and Forest fire Fighting industry since 1995, both in his capacity as a commercial pilot, flying fire fighting command and control aircraft, and with ground fire fighting operations. He has received extensive training and experience in South Africa, in the USA and Portugal. Is currently the Fire Protection Officer of 2 Fire Protection Associations in Zululand, covering 1 500 000ha.

Abstract

1. Don't shoot the messenger!
2. Summary of the Act 101 and the rationale behind it
3. What does all the legal jargon mean to the landowner?
4. What are the landowners' responsibilities with reference to fires?
    a. Prediction
    b. Prevention
    c. Preparation
    d. Operational management
5. What are the possible consequences of not taking heed of the responsibilities?
6. What does the 'presumption of negligence' clause really mean?

Transcription

A very good afternoon, folks. I see the die-hards have been left behind. The attrition rate here was worse than the last grass species. I feel a little bit inadequate standing up here after all the very learned people that have been talking.

This really is the graveyard session. I mean after lunchtime is bad but this time is even worse. Let's go through the legal aspects of the Act 101 and try and glean something out of it that might be useful to you guys. When I say the Act, I am actually meaning the National Veld and Forest Fire Act 101 of 1998. I am not going to do that mouthful 50 times; it will be "the Act".

First of all we have got to see where this thing comes from because everything has got some sort of rationale. Way back, long before the settlers came and checked out the mountain, they were cruising up and down the coast and they

named Africa the land of fire. There was always smoke in the hills as there were always fires burning out there. Africa is a very fire specialised continent. But in 1859 the settlers at that time said, "Listen, we can't have all these grapes smelling smoky all the time. We need to do something about this and they started putting in statutes stopping fires from happening, and decrees. They were very basic but they were there anyway. The 1st statutes were called the Herbage Preservation Act.

Then the Forest Act of 1888 came along and it also had a whole bunch of clauses in there for preventing and combating veld fires. Once again the grapes were getting smoky, it wasn't cool. Then the firebreaks started coming in after the Great Trek. When the settlers got to Natal they had exactly the same issue but it wasn't the grapes this time, it was for grazing.

In 1895 the Natal Act now started putting in stipulations of distances and also widths. They said 30 feet wide is a pretty good idea. The fire prevention and mitigation laws were slowing evolving. That carried on all the way through to the Soil Conservation Act of 1946 which was then superseded by the CARA Act and the Mountain Catchment Areas Act which we still operate under now.

South Africa basically is becoming incredibly vulnerable to veld fires because of urbanisation. The fires have always been there and the fires actually weren't the issue. Its just that people are now getting in the way. Historically fires happened naturally through lightning or through tribal management plans. In Zulu culture there is a thing called ilembe. You have got to go to Tribal Council and you have got to ask them to burn for grazing. The Tribal Council were always the older folk because they had the wisdom and they knew the history of the area and its needs. They had a very well-defined system where they would keep the grazing burning regimes controlled. They were definitely the 1st folk to get mosaic burns on the map. In Chaka's time, if you burnt on his land without permission you were going to feel the end of a sharp point. It wasn't a good idea. There were very good systems in place.

The Act applies to the open countryside beyond the urban limits and there are whole bunch of stories to do that. This is an example of an urban fringe. This is outside Richards Bay. And if that wind hadn't shifted we probably would have lost the first row of those houses. It was a pretty ugly day and this is a classic example of now suddenly this fire is not just an issue with the timber grower but a threat to life, limb and property in the urban fringe. None of us on the fire were worried about the trees any more but we were desperately worried about the people. This fire got pretty close.

Same thing there. It looks like a veld fire. Over there is some palooka who was burning sugarcane trash, it jumped across this little riparian area and it went into more sugarcane and it's going through "veld". Let's look and see what's inside that veld. That's not exactly veld any more. Now we have got three houses burning. One person has just died inside there. That's an example of why this Act is in place and why we desperately try to keep it together.

There are nine chapters to the Act. We are going to go through some of them quickly, some of them a little bit slower, but the reason why I have to go through each one is that they have each lot legal aspects that tie into the others.

Chapter one is the whole story about what this thing is all about. What is the Act there for and how are we going to do it? And there were a whole bunch of interpretations and definitions and some of these are pretty important. For example, landowner. Now the actual title for this presentation was meant to be 'fires in timber'. It's a little bit of a misnomer because fires don't really care what they are burning and grasslands are actually even more important because grasslands are historically the most fatal or the most potentially fatal fires that you can get for people.

So landowner.

An owner has its common law meaning and includes a lessee. Let's stop right there. If you have got a lease on that land, done, you are the landowner. It doesn't matter who else is involved and that is the one thing out of all that bumf that goes all the way down the bottom, if you have got a lease or a contract on that land you are a landowner. That will come back to you later on with a whole bunch of pre-requirements that you have to have.

This is where it starts getting really, really tricky. The Act was built for South Africa so there are some South Africanisms in there. For example Veld as defined in the CARA. Veld is land which is not being or had not been cultivated and on which indigenous vegetation or other vegetation which, in the opinion of the executive officer, is or can be utilised as grazing for animals occurs.

The big trouble there is the last four words, 'grazing for animals occurs'. This was severely tested and before you even go to this one, the strength of an Act is in its testing and this Act is surprisingly untested. We have had some good testing's and we have had some really bad testings. Here is an example of a bad testing. Veld fire means a veld, forest or mountain fire. Once again that little word veld is in there. Forest is obviously not plantations, it's natural forest, and then mountain fire is on the mountain.

In March 2005 the Supreme Court of Appeal handed down its decision with the Gouda Boerdery v Transnet. A fire broke out and spread from the grass on the edge of a Spoornet railway line. Nice and simple. We can all picture that one. In a rail reserve, causing damage to a farm, quite a bit of damage too. If the grass had been veld in terms of the National Veld and Forests Fire Act, Spoornet as the owner of the land should have had firebreaks. They didn't have firebreaks. The Court in its wisdom said that the veld in the rail reserve it not veld because it's not for grazing.

Now this was like one humungous kick in the left knee. It took us all right off our feet because that was it. If you didn't have veld, which took everything from National Roads Agency, Spoornet, Transnet, Eskom, Telkom, there are probably a couple more "koms", that's it. Done deal. We haven't got Veld and don't need fire breaks. So this was a big one. It took a little while to get everything fixed up but on 27 November 2007 the Act was amended but it hasn't been promulgated so things happen slowly. Don't shoot the messenger.

Now we know what Veld is but what about veld fire? Now we go back to the veld fires or veld, forest or mountain fire. The definition is any fire on any area of land whether cultivated or uncultivated, (let's kill that one), including any building or structure or adjacent thereto and a respective area not where the Fire Brigade Services Act does not apply. They could not change the CARA Act because now they have got to change two Acts. So all they did was make an addendum inside this one. They closed the loophole in this way. The problem is we still can't use this because it hasn't been promulgated. So it's another one of those kicks in the other knee this time. But that's an example of legal testing. Legal testing can be very, very good for you and in the same breath it can really, really hurt.

Chapter 2 is all about fire protection associations. The challenges started in 1994 when the Demarcations Act came out. Let's use Pietermaritzburg as an example. Pre 1994 they had a fire brigade and they were only worried about the houses in Pietermaritzburg. Even Hilton didn't really exist. Anything outside of that borough, board or that town board did not exist. It's a horrible thing to say but it's a fact. Suddenly they had this Demarcations Board that said, local municipalities this is where they are going to be and the fire brigade will be responsible for that entire area. Let's see what happens. Chaos reigned. So then they said, what is actually out there? Obviously we have got the Forests Act of 1984 and that had places in there for fire control areas and fire control committees. They went out and they looked for was out there already without re-inventing the wheel. All we had to do was use the existing structures.

So the act says that FPAs should be formed or may be formed where there are regular veld fires. Obviously is there is no risk of veld fires then what's the point, relatively uniform risk gets in there as well, relatively uniform climate and uniform types of forest or vegetation. Nice and easy. You can't have two areas of very different climates, otherwise you are not going to have the same sort of fire behaviour.

Then they said let's get clever and let's take the fire control committees and/or conservation committee, nature conservancy, whatever was actually out there, let's make them want to become fire protection associations and to help us out. This was just basically using what was there instead of re-inventing the whole wheel.

Only one FPA can be registered in any one area. That's pretty simple, otherwise you will have serious boxing matches, even though that still happens anyway. All owners, as in private land owners, may join the FPA. They have a right to join. You can't force them to join because of the freedom of association section in the Constitution. But the Act says very clearly that any state land and/or municipal land must join the fire protection association. This is one of our worst bugbears because we haven't really got this right at all.

FPAs have got FPOs, fire protection officers. We will get onto what they are just now. And if a municipality is a member then the chief fire officer was the one who was originally delegated, once again to keep costs down.

The FPO can delegate some of his duties, except for arrest and search and seizure.

Duties of the fire protection association. Here are some examples of what they have to do. First of all they have to predict fires, they have got to prevent fires and obviously they have got the actual operational side of it as well.

These are the two FPAs that I have the pleasure of cruising around in. We have got the Zululand Fire Protection Association – that's the sea by the way – and this is the inland one, the whole bunch of local municipalities. The Act was actually designed for a single local municipality but these two fire protection associations have been there for a very long time. For example the ZFPA has been going since 1954 and it was as a fire control committee. This has been going since 1994 where it was the same thing, a fire control area. And they allowed us to keep such big FPAs because we had a very strong historical history in it as we had proved that we could do it. It's still an absolute nightmare. Trust me there are a whole bunch of areas that I haven't been to yet.

And when they say the FPAs must also predict fires, a bit of an interesting graph. The top side is rainfall. Let's look at that first of all. There is our 77-year average rainfall. It's 15-year average through these here. We have got the ups and the downs and the ups and the downs we just did a straight linear projection. We have definitely got a trend of rainfall decreasing and it's not at short term, the more data I put behind here – and I have got data since 1934 – the steeper that line gets. We have got a definite trend of less rainfall on the Zululand coastal area. This is from one station and some stations are worse and some stations are a little bit better. We need to know this. If we don't know this, we are the blind leading the blind like that bat cruising around earlier on.

The bottom section is fires, exactly the same scenario. I can go right back to 1980 on the fires but on a very short section from 1995. The red line is our average over that period. The columns are the actuals. Draw a line and it does exactly the same thing. We also have had a very good year. I have had just below average amount of fires. That's not a bad thing. The fires are increasing, rainfall is decreasing. Heads up, we need to do something about it if we can.

Another example is monthly prediction of the ignitions. We have that horrible thing that Ben alluded to yesterday called the honey season. Zululand is very, very unique. We burn right the way through the year because of our dry, sandy soils and we get pretty hot down there. Anybody that's been down there will understand. So we have two fire seasons, we have a honey season and we have a formal fire season. Those are all the FDI days. We will get into that shortly. And this is where our rainfall should be. This is on a short cycle again. 1995 to 2009. That's our driest time of the year. Honey fires come with a long story but basically lots and lots of people rob hives. We have a massive influx of wild swarms that come in from March, April, May or February, March, April. It's always three months. It can be earlier or later. The bees hive in old stumps and in the ground and all over the place. Then they are smoked out by honey hunters. The smoking out is what causes us run our tails off. And it's not the honey – I mean the honey they can take, it's worth hundreds of thousands of rand and tons of the stuff. It's the fires that happen before.

So we have lots of social impact studies and lots of things that we do about that but it's still there. The beauty of this section here is that we know exactly what time the fires are going to start because they happen early morning and they happen again late afternoon. We have developed specialised stand-by times for those periods It makes it a bit exciting.

This is this year as in monthly how we have been going according to average. The blue dotted line is our average rainfall, the shaded background is what actually happened, the dotted red line is our average fires, the solid red line is the actual fires. So January we got a bit of a hiding. We had like double the amount of fires but rain wasn't too bad. February was stunning. We had lots of rain. Fires dropped back to average. Remember that fires don't happen by themselves. They aren't spontaneous combustion like a flash of light. They are going to happen anyway. But nature decides what the fire is going to do after ignition. And that's a typical honey season where even though you have a lot of rain, you still have fires on average.

And then for some reason things like didn't happen for a little while and then we had a bit of a late honey season, rainfall dropped down, that affected that. There's a whole bunch of things that tie up into it. And then we had a very good August as well, and September we got given a bit of a hiding. We basically track it daily because from this I can work out fire behaviour number one. I can work out risk areas. There are a whole bunch of things that an FPA needs to do to be able to help its members.

Enough graphs now. The fire protection associations are also involved with awareness and this is our Happy Bushy. We used to have Bokkie and I have got Annelise here who has still got Bokkie. But we needed something that wasn't quite as girlie as Bokkie. We needed something that was very unique to us and that we would really understand. This is Happy Bushy. Happy Bushy is when it's raining and Happy Bushy has got the look that he actually wants to go and find Bokkie and maybe make her a little bit happy. Then we have Worried Bushy. Worried Bushy is when the wind is blowing and we all hope that no one starts a fire. That's Worried Bushy's face. Then we get Sad Bushy. Sad Bushy is if we burn. I think he says it all. There is Bokkie and it's also a very effective tool. In fire awareness ignorance is our worst enemy.

Then we have got instant command centres or ops rooms. We also have a large network of electronic fire detection cameras. This is where everything happens. Everything gets coordinated around a central command centre.

Fire danger rating. This is Chapter 3. There is a small trouble with Chapter 3 because it has yet to be promulgated. So I am just going to go through it very briefly. The Minister must give the people weather data. He must communicate it out and must publish the warnings when the fire danger rating is high in any region. Now anybody that knows wild fire fighting will know that the high FDIs are not the one you worry about. It's the one leading up to the high FDIs and what's happening after that. So unfortunately this has got a whole bunch of beating still to do and a whole bunch of work. But when you see ETV, 1, 2 and 3, you see that big red core and it says Danger, that is basically the Minister's attempt at working with Chapter 3.

The FDI system as we have now is not perfect, not even close. It's like we said yesterday, it's missing one vital component and that is drought factor. Fuel moistures massively govern fire behaviour. And that's one section we haven't got in there.

Another example of the FDI sheet. We all learnt yesterday about FDIs so I am not going to go though it again but everybody is pretty standard on what the FDIs are. One big thing, if anybody has got any misconceptions about an FDI making fires, they don't. FDI's are a pretty good indication of what is going to happen to a fire after ignition.

The wind, for example, can be doing 200 kays an hour and the humidity can be 4% and the temperature can be 46 degrees. If no one starts a fire, guess what? We all go to the pub. There is no correlation between ignition and the fire danger index. Nothing at all. We have got different colours and they all mean specific standpoint references to fire fighters.

Chapter 4, we start getting into the nitty-gritty. This is the veld fire prevention through firebreaks and here is where a whole bunch of very strong prescriptions come in. Very briefly…

The first one, every landowner on whose land a fire may start and spread to or from must have firebreaks done. There is no maybe if you feel like it, no maybe if you have got some money to do it. It's a very clear cut prescription. And this is one section that has been tested in the Act and been proved to be pretty strong. They have got to have firebreaks done.

And neighbours have got to work together. It doesn't say you have got to go and have a letter with your neighbour but they have both got to be there and there must be an agreement. That's a very simple reason for that. If you have got two landowners next to each other and one decides that one metre is good enough and the other one says no, three metres is what he reckons is going to be good enough. After much deliberation they agree to use five metres. Immediately they absolve each other of liability because they are both there, they both decided that five metres was cool. So don't come to me afterwards and say, "But the fire jumped because the firebreak was too narrow." A pretty clever clause. It quietly and around the back door makes the liability between landowners much easier to manage. They keep on mentioning burning but they forgot to work out that you don't only burn firebreaks. You can hoe firebreaks as well and you can also obviously mow. On the Zululand coastal area we don't burn firebreaks, we mow them.

Then they obviously say that you can't burn a firebreak if the FPA doesn't want you to or if a warning has been published or if it's going to be too dangerous.

Then they got even cleverer. They said that when you are doing this firebreak make it long enough and wide enough. And everybody said, "My word, this is just lovely. Long enough and wide enough means what?" Very simple. If the Act had prescribed distances and widths, guess who you would sue first? The government…because they said 10 meters was wide enough! It's much 'safer' get both landowners get together and let them work it out.

But they also made one other mistake here. They took a firebreak as meaning a non combustible line that is going to stop a fire. We heard yesterday about Australian fires spotting 17 000/18 000 metres. I have personally see them

going 5 000 metres. How wide has your firebreak got to be? All a firebreak actually is is an area from which you fight from. Make it long enough and make it wide enough and you guys work it out. But it must not cause soil erosion and it must be reasonably free of flammable material. That one goes without saying.

Funny enough, operationally, as in fire science-wise, the minimum width of a firebreak is double the distance of the height of the closest fuel. So let's say you have got 2 metre tall grass on your left-hand side. The break should then be at least 4 metres wide. That is purely because the flame height can go to 1,5 times of the fuel. It's called slopping over. If the wind blows the flame flat it should still be short of the other side of the break.

That was Chapter 4. Chapter 5 is every landowner on whose land a fire may start, spread to or from, must have fire fighting equipment. You have got to have fire fighting equipment. You have got to have PPE. One of those criteria that is just not negotiable. And you have got to make sure that if you aren't there, somebody else is that can handle your responsibility as a landowner.

If you have got a fire or you see a fire that's on your land or the land next door, you have got to do something about it. They are trying desperately to get that social responsibility back in again. We don't just drive past and say, "Well, I don't know who that is so just carry on regardless." You have got to let the FPO know because the FPO is meant to go and fight thing or go and take it over. And the owners of adjoining land. Basically you don't want that thing to spread. You don't want it to become catastrophic. You want to get to it when it's as small as humanly possible. And you have got to try and do everything in your power to stop it.

Chapter 6 is a whole bunch of administration, it's not an issue. Chapter 7 is where all of the actual penalties go into. There is a whole bunch of them, and we are running out of time rapidly but here is an example of 1. If the owner, occupier or person in control of the land fails to take reasonable steps to put it out, to confine it to his or her land or to prevent it from causing damage, they are guilty of a criminal offence. It’s a category 1 offence that carries a penalty of a fine and /or jail for up to 2 years. Pretty harsh? Not when you see the damage a fire can do! If you want them all just, email me, I will send you the whole lot.

Chapter 8 is enforcement. .

The most important part of the Act that everybody always quotes is 34(1) which is the Presumption of Negligence Act. This is a piece that we thought was going to be tested first and then thrown out of court. It however has stood up very well. Basically what it says is that if you are a member of a fire protection association, you are immediately deemed innocent of any negligence. If you are not a member, you are immediately deemed negligent. That might sound like a whole bunch of not so important words but it is incredibly important when it goes to civil court. The reason is that civil court uses a term, delictual liability. I am going to go through it quickly but it really is important because a lot of guys are falling back on that section 34(1) and they are saying, "But I am a member of the FPA. You can't touch me." It's not true. And there have been a couple of guys that have been recently sued and this is where it comes from

There are elements of a delictual action. In civil court you want money. You have suffered damage and want compensation. Civil court doesn’t put people in jail it just compensates damages. In a civil claim you need to prove, or disprove the following:

Number one, you have got to prove conduct. Something was done or not done. Then you have got to prove wrongfulness. There must be a legally wrongful thing. So, for example, not having a firebreak is legally wrongful, bang. You put a little tick over there. But there are defences to it. For example, self-defence. If someone comes into my house to do some shopping at two o’clock in the morning and I shoot him dead, I am not allowed shooting him dead but as he had a gun in his hand, it's called self-defence, Impossibility – I cannot burn or mow through the wetland. Superior orders – if I was told to go and burn that firebreak by my boss etc

Fault. The conduct must have occurred intentionally or negligently. This is the negligence part of it. And everything here is taken back to the reasonable man. A reasonable man is the average man or woman, not reckless or over-cautious and aware of their surroundings and the dangers inherent in the various activities.

Now should the person involved have specialised experience, he will be judged much harsher against the law. For example myself – if I go and burn garden refuse in the back of my yard on a Sunday afternoon and it jumps out and burns down Mondi they are going to eat me alive because I should know better.

The third section is fault. The fourth is causation as in it's got to be a what for test, as in if he was not burning that firebreak the fire would not have started and burnt me to the ground. Another one also is if it's too far removed. Let's say there are five landowners all in a row. Landowner No 1 has a fire. It leaves his land and burns out landowner No 2. It goes 3, 4, 5. 5 can't sue 1 because 1 is too far removed as in what happened to 3, 4 as in 2, 3 and 4. If they had stopped the fire, 1 would not have been the cause of my fire, I can't sue him. It's the cause and effect. You always sue the neighbour whose land the smoke came from.

And then harm. It's got to be legally recognised damage. Having your Maltese poodle mentally distraught by the smoke will not be as good as having all your trees burnt down.

So just in a quick summary, if you are not a member of the FPA, the person who is now suing you, wanting your money, must prove that your conduct was wrong. He must prove the wrongfulness of it. He cannot prove that you were negligent because you weren't. Done deal. Harm and then causation. So if that lawyer goes to court, he only has to prove four things because you are immediately deemed negligent. This person goes to court, they have got to prove all five. This is one of the reasons why insurance companies took one look at this one and said, "If you are not a member of the fire protection association, we will no longer insure you. Too bad. Have a good day." Exactly this. They don't want to

go to court as immediately being negligent because that's going to be ugly. That's where that comes in. But it's not as simple as being, "I am a member of the FPA, you cannot touch me."

We still haven't got it right. 31 August 2008, a friend of mine died on one of those little blobs over there. This was one of those days. Even if though we have got these Acts we are still losing it periodically.

And the last one, a bit of an interesting picture. It's not just a picture of a nice fire. That is a national road. On that national road is a truck carrying grapefruit. Truck carrying grapefruit had a binding back left break. A truck carrying grapefruit didn't have a fire extinguisher. A truck carrying grapefruit made a fire which burnt into National Roads Agency who had no firebreak. National Roads Agency fire burnt into farmer B who had no firebreak either, burnt across his land. This is now farmer D coming out of C. It went through four more landowners in this fire sequence. This was in 2007 and when it goes to court it's going to be properly interesting because there's a whole bunch of sequences that were involved in there. Are there any questions?

DISCUSSION

Transcription

MR JOHN SCOTCHER Well, if you are not frightened, you should be. Are there any questions for Trevor? He has taken us through the Act and all the issues. Alan?

MR ALAN SHORT Trevor, can you clarify the relationship between CARA and Act 101 because Act 101 very explicitly states it's the prevention and combating of veld and forest fires. Now we all know that veld fires are the hugely important part of managing our veld.

MR TREVOR WILSON Yes.

MR ALAN SHORT Ecologically and for livestock production. Now CARA states when you can do your block burns and so on or how you may do your block burns. And Act 101 I think specifically only refers to firebreaks and so on. But it's always concerned me, that statement about it's about preventing your veld fires. I think there is a major perception in the general public including in Pretoria that fires are just bad, totally bad.

MR TREVOR WILSON Thanks, Alan. It's actually very, very nice and simple. In the CARA Act there are certain times when they say you should be burning grasslands. Funny enough, the Veld and Forest Fire Act links up with the burning prohibitions which is a whole different Government Gazetted section and it's got a whole bunch of things where you may not burn from this to that. The CARA in those cases supersedes it. If the FPA is involved very, very closely – for example obviously I have got Ezemvelo at the bottom there and just get this right – you can burn the moist grasslands from 15 September to 15 October within 24 hours after 15 mls of rain have fallen in the last five days. That's what the actual CARA Act says. And we allow guys to burn under the CARA Act inside. The only problem is that that is the peak fire season time normally. So it's got a whole bunch of common logic and a whole bunch of logic.

And the relationship between Ezemvelo and the landowners is exceptionally good. We don't ban burning. We don't like that at all. Certain areas battle with it. The CARA act is just as important as the Veld and Forest Fire Act, in my opinion.

MR JOHN SCOTCHER Does that answer your question? I will take one more question if there is one more question. Yes, sir?

UNIDENTIFIED VOICE … [inaudible] CARA, you can't burn … [inaudible]

MR TREVOR WILSON Oh yes, correct. Under certain conditions obviously it would be *dof*. The fire protection officer will have the final say. So get good grips with the fire protection officer, give him some whisky or beer and everything is cool.

MR JOHN SCOTCHER I will take one final question from Roger who is champing at the bit.

MR ROGER UYS Thanks, John. From Nature Conservation's perspective, we would love to be able to burn on a few orange days to try and control bush but every time we put this idea forward our FPAs jump down our throats. Our National Biodiversity Act says that we can conduct management for biodiversity and that overrules any other Act besides the Constitution. This obviously hasn't ever been tested. Where do you think we would stand legally if we were doing a burn on an orange day – we would probably be stupid to do it on a red day – for biodiversity purposes and it escaped? With all the firebreaks, etcetera in place.

MR TREVOR WILSON You would be in so much poo, you wouldn't want to be there. The simple thing is that yes, the Act understands very much biodiversity. It's very, very important but there is also a point where is biodiversity as important as losing 35 lives. For example last year it didn't have anything to do with Ezemvelo but 34 people died for burning grazing. You have got to take one and the other. You have got to be incredibly careful where game reserve or nature reserve is on the boundary with commercial timber. High, high value, incredibly volatile. If the fire jumps into there they are going to take you on without a shadow of a doubt because it will go back to the reasonable man, saying, listen, are your little frogs more important than R25 million worth of trees? It's going to get interesting, trust me. It will get properly interesting.

But it doesn't mean that you mustn't do it. With the right things in place, I believe you can burn on a lower orange. I wouldn't push high. That could be interesting. Untested, put it that way.

MR JOHN SCOTCHER I think Trevor has given us a new understanding of the term mainstreaming biodiversity concerns. Trevor, thank you very much for an excellent presentation.

Our next speaker is Ruth Bezuidenhout from Sapphire Insurance Company. Ruth has been around a while in places like NCT and Brokoop. When I say she has been around a little while, you probably think she is very old so I am going to cop it, but she is not.

She has headed up the plantation department in Sapphire and it's now seen Sapphire grow from a small co-operative dealing only with plantation fires to a fully fledged licensed and compliant insurance company providing a full range of insurance products. And Ruth has said she is going to buy me a drink for saying that. Over to you, Ruth.

INSURANCE REQUIREMENTS AND GRASSLAND MANAGEMENT

Ruth Bezuidenhout

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Ruth Bezuidenhout was first involved in the Financial Sector, making a change in 1989 to join NCT where she at last felt she had found her perfect environment. She left in 1990 to have her second child and returned to the Forestry Sector when she was asked by NCT to investigate the potential of developing a special markets division. She worked with Pat Hutton on this and it now forms an important part of NCT. She then moved to Brokoop, who were the marketers of the old CTFP Fire Policy. She was involved in the administration of the insurance till 1995 when they went independent and changed their name to Safire. Ruth was requested to head up the Plantation Department where she has achieved both personal and professional satisfaction. It has given her great pleasure to see how the company has grown from a small Co-operative dealing only in Plantation Fire Insurance to a fully fledged, licensed and compliant Insurance Company providing a full range of insurance products.

Abstract

1. How and why Safire was formed and what is our philosophy.
2. Our importance in the Agricultural Section.
3. Effect of fires on grasslands and other areas.
4. How Safire has responded to grassland protection.
5. What we see as part of our responsibility going forward with new emerging growers.

Transcription

Thank you, John. Thank you, Steve, for inviting Safire to participate in this seminar. Talking at an event of this nature is a new scenario for me and rather intimidating. Many new faces, highly competent people in their own fields and areas to which I have not previously been exposed to, a very different platform for me. Normally I am in the position where I am explaining what our insurance policy covers, what our requirements are and going through warranties and procedures. So to explain Safire's involvement today I thought that as there is such a new group of people here and many that may not have heard of Safire, I should briefly go through the history of Safire. How and why we came about.

In 1987 private timber growers who were involved in forestry were subjected to massive increases on their insurance policies as a result of global timber losses. The private growers felt that they were being adversely affected by the losses that were being experienced by Corporates or larger companies globally. They decided to approach the reinsurance market directly to see if they could negotiate better rates.

They were very successful in doing this and operated under the name of Central Timber Fire Protection Co-operative and from the offices of the old CTC. In 1995 we became independent and operated from our own offices.

An area we had identified that private landowners were really having a problem with was liability insurance. A lot of private growers had corporates on their boundaries and they were only able to obtain a limited amount of liability cover for spread of fire from the traditional markets. So once again we went back to the Re-insurers, with the motivation that private growers are certainly not a liability to the reinsurance world, that they are in fact very responsible landowners who are very proactive in fire prevention. We were again successful and were able to offer higher levels of cover and certainly at rates that had never been seen before in the market. This was the start and with the backing of Re-insurers we were able to grow and expand our product base

Farmers don't only own their farming operations, they have other assets that required cover for example beach houses. As a co-operative we were limited to only underwriting farming enterprises so in order to facilitate and provide a greater spectrum of insurance we changed to a fully licensed insurance Company in 2001.

What does Safire offer? Safire offers insurance for commercial timber plantations and sugar cane mainly to private growers. We also offer a full range of general short-term insurance. We prefer to remain in the agricultural sector. This is the sector that we understand and enjoy being involved in. It really is our niche market and our priority. We also provide court bonds and a full financial suite of products to attorneys and insolvency practitioners. We are continuously looking for new ideas and opportunities. When I talk I will refer mostly to the plantation side of the organisation as this is my area of expertise.

Safire has a very different philosophy to that of other insurance companies. We believe that there is a triangular arrangement between Re-insurers, clients and the company itself. We don't like to see that any one of those sectors is benefiting unfairly. It is essential for us to ensure that there is absolute transparency to Re-insurers and a lot of work in calculating what we call PML's, Potential Maximum Losses, and on which Re-insurers are reliant, are accurate and that Re-insurer's are kept fully up to date with what is happening in the industry.

Our clients are also represented by ourselves in many areas. We are involved in various organisations and that gives us the ability to be able to assist our clients in insuring correctly and complying with the many requirements that are put upon them as land owners. Through this we are then able to manage and grow Safire in a responsible manner.

Many people think that insurance is really just all about price and I would like to change this way of thinking. Insurance should be about price, claims and service. And for me, if I had to choose the most important aspect of insurance it would be claims. You want to know that you are paying a premium and that you are getting good service, but most importantly when you need compensation for a loss your insurance company is there to compensate and provided guidance throughout the process.

Our role in the forestry industry is extremely important as we are currently the sole providers of timber insurance. There have been many other providers over the years but because they have not done the in-depth risk assessing that we do and have not kept totally up to date with the whole industry, they have lost their reinsurance facilities. Farming is not a lifestyle, it's a business, it's a vitally important business and it provides essential employment in rural areas and contributes positively to the GDP. Insurance of these assets is essential to provide financial security. There are so many benefits down the line from growing trees. I am a great believer in the forestry sector and contrary to what a number of people think here, I think forestry is responsible, incredibly organised and a proactive organisation.

At Safire we assist in setting the rules of the FPAs. Trevor has been through the FPAs quite a lot. The reason why we are involved is that we do not want FPA's setting rules that are more onerous than our warranties, as it is a warranty of the policy that the insured adheres to the regulations set out by the FPA's. If an insured does not comply with the FPA's rules we will be unable to pay their claim,

We also do a lot of risk advising to our clients. We spend a lot of time on their farms with them pointing out fire risk and discussing in detail the responsibilities of landowners. We draw a lot of attention to the importance of the Veld and Forest Fire Act. Two weeks ago I spent an afternoon with two gentlemen who have leased a property. Department of Land Affairs acquired the property and in turn leased it to nine different members. It was really quite sad to sit with these gentlemen, who had now become responsible for land management only to discover that they knew little about the requirements of owning or managing land.. They had not heard of the Veld and Forest Fire Act, they had no idea what an FPA is, they had no maps and they had no idea as to who and how they could get assistance. We have taken it upon ourselves at this stage to play a role in this area and when spending time with landowners take the opportunity to discuss some of these details and provide them with names and numbers of responsible people who can assist them on landownership issues.

We have also been assisting landowners in preparing liability claims. As we are very involved with fire, we know which are the important facts and aspect to document from a legal point of view. We know what information needs to be collected immediately and we know how important it is to determine quantum. If you don't have a quantum you don't have a case in court.

Safire has a dynamic policy structure. Some of the warranties that were set in 1987 are still there but as and when through necessity things need to change, we are very happy to interact with the different organisations and implement changes that are reasonable to all parties. We are often criticised for our firebreak warranties not being onerous enough. We remind all that they are purely minimum guidelines and they provide a starting point for landowners.

A couple of the adjustments we made in the last couple of years and specifically from the environmental side of things is we never used to allow for grassed firebreaks. In Zululand where you have your soil sensitive areas we have seen the necessity to change our warranty which said all firebreaks should be cleared of any combustible material. Clearing of the grass would cause massive soil erosion. Breaks can be mowed in these areas. We used to insist that every single firebreak had to be clear of combustible material. We have now limited this to one in every 40 hectares and again as previously discussed, these don't necessarily stop fires but provide safe areas to move people and equipment around in, in the event of a horrific fire. Under normal conditions they do stop fires or at least slow them down providing time to respond to fires. I was caught in the fires in Richmond and I will tell you that, I was really grateful for some very good firebreaks. We were able to, and I was in a car, race through a plantation which was on fire and reach a safe place without being burnt or suffering any damage. So I promise I know firsthand the importance of these access routes. We allow strip burning in areas were the condition or quantity of material has been affected by repeated annual firebreak clearing.

We conduct risk surveys on the farms and a lot of the areas of the risk survey have been covered by different speakers. A major factor for us is looking at the land use, not only your own land use but that of the adjoining properties. We find that most of our clients do not suffer losses as a result of their own fires or, if they do, they are kept to a very small areas, but it's mostly as a result of spreading fire from adjoining properties..

Silviculture methods, road infrastructure, fire fighting equipment, communication, and fire detection are also very important aspects of assessing a risk. We have a minimum of a 9 metre firebreak on the boundary of a plantation and where this falls on the boundary of the property we are encouraging landowners to not share this firebreak anymore as there has been quite a large change in land ownership and where before you used to share that responsibility together, this is not happening and this could compromise a claim for own damages and yes, you may have recourse against your neighbour, but the problem is that liability claims take many years to settle. If you have complied, you will be

compensated and we will proceed with the recovery against the third party. Not being able to do this could financially ruin a farmer.

Yesterday it was asked “why is the planting of wattle not being encouraged”? We certainly do, and would like to see many more strategic plantings of wattle belts. We have seen on many occasions, particularly the big fires, where wattle has either, stopped, slowed down or protected entire areas.

There is a large amount of emphasis on global warming playing a major role in why there are bigger and more intense fires. In my opinion I can't say that is exactly true. Our findings indicate there are other reasons, one being high fuel loads. We have noticed that there had been an incredible shift to a no-burn situation after felling for conservation reasons. The 2007 and 2008 fires are going to change this way of thinking and in fact I have already started seeing decision makers rethinking this theory as the no burn of slash residue and large open areas caused such high fuel loads changing fire behaviour, causing a much higher level of damage to soil and all areas that were supposed to being protected by the no burn situation.

Some of the other contributing factors are a lack of untrained staff and management on Corporate and managed farms. Reaction was less immediately available and relying on contractors who were either not resident or familiar with the territory being in-affective. I don't believe that the contractor situation is good for fire prevention. It's all about knowing the farms, knowing the fire behaviour, knowing the terrain. Managers are moved regularly and don’t have the intimate knowledge on the farms. All these factors result in fires getting out of control far quicker. It's a pity because the fires are actually being detected quicker, but response in many cases is not what it should be.

I am also concerned about the fact that in the bigger companies they have very large blocks of timber and weeding has been neglected over the years hampering access. I am glad that Ben has said that this has been recognised as a problem and that Sappi realise that it's important to go back to maintaining plantations as they have seen that when a fire gets into theses big blocks invariably you can't send staff or equipment into the blocks to fight the fire as it is too dangerous. In this situation reliance on a small firebreak is unreasonable all you can rely on is “let's hope that cold front comes through quickly.. let's hope it's got moisture." And sometimes we have been wrong because it has come through, but it hasn't got any moisture or else it turns the fire in another direction causing a much bigger problem rather than back into its self were it will burn out.

Over the past few years, we have noticed that the larger fires have been accompanied by stronger winds that blow for longer periods. I’m not sure if this is due to global warming, but am happy to leave that to you scientists to prove.

These are our findings and going forward, I believe that Safire has an important role to provide financial security to private growers and to assist in finding solutions to ensuring sustainability of the forestry industry. By this I mean that we have a vital role to play in educating and assisting the new landowners of this country about the hazards of fire and being broadly involved on many levels to put our point of view and that of private growers forward to all involved parties.. We can help and assist on many levels. Thank you very much.

PROTECTION OF GRASSLANDS THROUGH STEWARDSHIP

Bheka Memela

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Bhekathina Memela is a Facilitator in KwaZulu-Natal Biodiversity Stewardship Programme (KZN BSP). Besides developing tools for KZN BSP, he has a high interest in Participatory Methodologies which he has been applying in various communities of KwaZulu-Natal. Before joining the KZN BSP he was involved the forest industry as a Community Engagement Facilitator for Mondi.

Abstract

Ezemvelo KZN Wildlife has a mandate for biodiversity conservation in the KwaZulu-Natal province. However some of the grassland biome and other biodiversity elements KwaZulu-Natal need to meet its biodiversity targets are in different forest companies’ lands, so they lie outside its Protected Areas. It is because of that reason that KwaZulu-Natal Biodiversity Stewardship Programme (KZN BSP) that is championed by EKZNW is partnering with different forest companies and the Grassland Programme to meet KwaZulu-Natal’s biodiversity conservation targets. KZN BSP’s responsibilities involve developing legal tools and management tools for grassland biome’s and, other biodiversity elements’, conservation in the province.

Transcription

Good afternoon, everybody. I will try by all means to be short although I am tall. Basically most of the things that I am going to talk about is in this KZN Biodiversity Stewardship Programme brochure. As you can see at the back it also has our contact details. So if people want more information about this programme that I will be presenting, they should feel free to contact us.

It's quite difficult on my side, but at the same time I think it's a privilege, to talk after we have had very good discussions, especially presentation from the experts. The main question is what is the next step after all these presentations? Because it's very easy to have these interesting discussions but the question is what is happening after this interesting symposium?

So that's why I would say in this particular province of KwaZulu-Natal, we are very lucky because we have this interesting programme that is able to take whatever innovations or ideas or research directly to the landowner so that you can be able to implement and reflect and see what's working and what is not working in the real world.

So that's why I think it's a good opportunity for me to present this particular programme which is called KwaZulu-Natal Biodiversity Stewardship Programme. It is quite interesting because it's not saying Ezemvelo KwaZulu-Natal Wildlife. The reason there is an emphasis on KZN Wildlife is because the organisation has been the champion of this particular programme but that does not mean other government departments and NGOs should not be actively involved in it. As you can see in my presentation most of the NGOs and government departments are actively involved.

To me presenting this programme is like playing jigsaw puzzle. I am not sure how many of you are familiar with jigsaw puzzle because it's a situation where we have to put two pieces together that initially look as if they exist independent of each other. So the first piece that I am going to look at is a citizen's right and responsibilities when it comes to environment. And the second one that I am going to look at it is KZN Wildlife's responsibility when it comes to national resource conservation in the Province. And I will also look at the problem situation that the Province is facing. I am talking about the KwaZulu-Natal Province.

And I will also check is it really possible in putting together piece A and piece B. My argument is the fact that the programme that I am presenting is trying to do exactly that. Let us just look at the first piece. South African Constitution is very proactive when it comes to environmental issues. For instance, if you look at section 24 of our Constitution it's stating that s citizens of this country we have rights but it is not only talking about our rights as the current South African citizens but it's also talking about the rights of the future generation. So it does not only focus on intra-generational transaction it also focuses on inter-generational transaction. So as much as it emphasises on our rights but at the time it puts some kind of a responsibility to us in terms of taking care of our natural resources for future generation.

But if we also look at NEMA 107 of 1990, section 2(3) which stresses that development must be socially and economically sustainable. This is quite interesting because it emphasises what different South African sectors, especially the forest sector, have been trying to focus on, specially in terms of their obligations to FSC certification. FSC certification focuses on three pillars which are social and economical and environmental. So that's why to me it's a situation where it is as if you are looking at a Zulu pot. How many of you have seen this Zulu pot? A Zulu pot has three legs. So if one of the legs is not functioning properly danger can happen. Maybe you should just try to cook porridge using a Zulu pot and break one of its legs and see what happens to your porridge. So that's why I am just feeling our responsibility is around there, trying to make this pot balance. But I know in reality it is not easy but that's why we need this particular dialogues and that's why we have this particular programme.

But let us look at the second piece which talks about the responsibility of EKZNW when it comes to the natural resources of KwaZulu-Natal Province. If you look at KZN Nature Conservation Act – Management Act of 1997, it states that KZN Wildlife has a mandate for natural resources of this Province. This is quite interesting because it's not only focusing on EKZNW's Protected Areas. This means that EKZNW cannot make an excuse of saying that it is only mandated to take care of its Protected Areas. But the main question is: So what?

Now let us look at the situation at the problem situation. Firstly, as much as KZN Wildlife has a mandate for biodiversity conservation in the whole Province the organization does not have enough resources needed to meet for it to meet the provincial conservation targets.

Secondly, there are no dedicated mechanisms for effectively engaging land owners. As I said before when I was looking at piece B, I stated that KZN Wildlife has a mandate for biodiversity conservation in the whole Province but there has never been clear mechanism for ensuring that you are effectively engaging with land owners that have biodiversity elements on their hands.

Thirdly, there are no incentives for motivating the landowners who commit their resources to biodiversity conservation. For instance, it's a situation where I would say in the past we were only coming up a stick but we not coming with carrots for encouraging good behaviour. And at the same time there were no clear mechanisms for ensuring that there was collaboration and involvement of different NGOs.

Fourthly, conservation initiatives outside Protected Areas have not been given seriousness they deserve. As much as conservancies are good mechanisms for conservation outside Protected Areas, you will find that there were no proper legal mechanisms for ensuring that there is a long term security of biodiversity in most of these conservancies. And the same time, there were no proper management tools for ensuring that we are channelling our energy to proper management of biodiversity in these conservancies. For instance, there were no management plans.

So these previous conservation initiatives were good starting point. But at the same time as any car model that you can think of, you would expect it these initiatives to change and improve over time. So this programme should be seen as an improvement to EKZNW's previous outside Protected Areas conservation initiatives.

So that's why I think in this particular programme it's like we are putting together piece A and piece B because in most cases we will have a situation where most of us because understand our obligation when it comes to natural resource management. We are doing very well as land owners. We are taking care of our grassland, we are removing alien plants. It's just that in most cases there has not been proper engagement that has come from EKZNW. This programme provides an opportunity for landowners to collaborate with EKZNW in meeting conservation targets of this KwaZulu-Natal Province.

So this is what this programme is all about. We are trying to be a vehicle that allows collaboration between the landowners and KZN Wildlife so that the organisation and each citizen can be able to assist in helping EKZNW meet biodiversity conservation targets of KwaZulu-Natal.

So let us just look at some of the principles of this particular programme. One of the things that we are looking at as a programme is the commitment from a landowner. But in this particular instance, let me be more specific because we are talking about forest sector in here. I mean the question that I have is around saying is the forest sector committed to biodiversity conservation? And looking at a number of the forest companies that are certified, one can conclude that in most cases the forest sector is committed to biodiversity conservation.

I am not an expert when it comes to FSC principles, but most forest companies have identified species of conservation target as part of complying to FSC principle 6. It really shows one that they are willing to really do something about environmental issues. But at the same time I do understand maybe because of the various discussions that you have had – I mean you will find that there are different theories around for instance how do you manage grassland. But at the same time there is a high level of commitment from the forest sector when it comes to environmental compliance.

Another area that you are looking at is around providing long-term security to biodiversity. For instance I have already indicated that the previous interventions were not looking at the element of security of biodiversity. For instance, one conservancy that would just give a sixty day notice if s/he wants to do a transformation to his/her property under a conservancy and that was undermining EKZNW's previous investments to the property.

At the same time the whole question of management. I think this one is also addressing the question of why do we have to burn? I mean if the management plan is saying we need this particular piece of grassland for biodiversity, automatically you need to invest resources for that particular objective. So that's why we need at least to have a system that allows management of that particular property for that particular specific objective which might be biodiversity conservation or whatever. A Management Plan is a tool that assist the landowner for appropriate resource allocation.

We also promote monitoring and auditing. I think most of the people from the forest sector is something that they are familiar with. I think the only difference is the fact that there will be more and systematic collaboration between the forest sector, EKZN and other stakeholders when it comes to doing monitoring and auditing.

At the same time the whole question of rewarding landowners. As I stated before, the previous intervention was around saying we only come with a stick. In this programme we are saying that let us consider carrots. Let us try to encourage and reward good practices in the forest industry and at the same time allow the company to share those good initiatives.

The last element of this programme is around promoting collaboration between NGOs and government departments. As I said before, like in most cases you will find that there will be lots of research taking place, there will be a lot of innovations taking place but there were no clear mechanism of how does one tap into that particular knowledge. There was no clear platform for different organisation of stakeholders to share ideas around good practices in conservation. This programme is promoting collaboration between different stakeholders.

Steve Germishuizen has alluded to the fact this programme is working very closely with SANBI Grassland Programme, when it comes to the forests sector. This programme is aiming to secure grassland and biodiversity element that are in the forest companies' hands. I think that's what partnership with the landowners that I was talking about focuses on. Currently we are working with fourteen forest sites which are under different companies. For instance we are working with Sappi, Mondi and private properties that work with NCT.

So far we have reviewed some of the sites and six of them have been given a nature reserve status which is a highest category in the programme. So basically we are in a situation where we have to prepare management agreements declaration agreements and management plans for each of those properties. Mount Gilboa site at the final stage of proclamation.

On the map there is Mondi Shanduka Newsprints' Excelsior, which is near Underberg. As you can see, it's just on the boundary of EKZNW's Coleford Nature Reserve, and there is also a community down there on the south by the name of Indawana community. This is an opportunity for EKZNW to work closely with Mondi Shanduka Newsprints not only for biodiversity conservation but at the same time in terms of sharing resources. Thank you.

DISCUSSION

Transcription

MR JOHN SCOTCHER Thank you very much. I will take a couple of questions for our speaker. Any questions for Bheki? Terry.

DR TERRY EVERSON Thanks very much. What are the rewards and do they differ, for example, if you are working with a timber company in a rural community.

MR BHEKI MEMELA Ja, I will say they differ but I think Kevin will add to this one because basically we are saying each of the agreement will differ from case to case but when it comes to, especially a nature reserve, a property rate rebate I think is something that is given because that is what municipal property rates is saying. If a property is declared a nature reserve, the property does not have to pay property rates. But there will be another instance – for instance the one landowner – I think it should different from one landowner to … [indistinct] One lawyer might say I might need some kind of assistance when it comes to management of this nature. So I think it will differ from case to case but Kevin might also come in. Maybe because communities in my area of interest and I will say specialisation, it's quite a challenging one. I will just give an example like in one of the properties that you are working on in Greytown, the committee have just been given land under land reform and a consultant prepare a very good business plan. So when we are coming in as an

agent or as an outsider, whether expectations are pronounced or not and mostly people tend to have some kind of high level of expectation. So I think as much as we can deliver on those expectations sometimes, but I think what is more important is to be very specific, especially when you come to communities and saying we can only lobby on their behalf. But I think when it comes to incentive, when it comes to communities, I think one needs to be very specific in saying – at least it is better to under-deliver than over-promise. Because otherwise if you don't deliver as you promise, you will be in big trouble.

PROF MICHAEL SANWAYS Are you targeting particular areas, farms and so on? Do you approach the people or do they knock on your door? What I am getting at is how strategic can you be? Can you, for example, aim at improving conductivity a lot across the landscape with this programme?

MR BHEKI MEMELA Yes, that's why I was quite interested in seeing the presentation by Richard but I think Steve will also call me because the site that you are working on is a site that – because most of the landowners were very proactive in saying they would like to work with us and Steve was responsible for identifying those sites. But of course we have also been using our KZN Wildlife C plan in identifying which are the biodiversity richness for those areas and all that. But I think the question of being more strategic in terms of looking at landscape level is quite interesting. I think Steve will … [inaudible]

MR JOHN SCOTCHER Kevin, would you like to say anything because I think that Michael has raised a very good point in terms of trying to create corridors through the stewardship programme.

MR KEVIN MCCANN Ja, thanks, John. I think that's an incredibly valuable question of where the whole stewardship programme is going because initially once it started, it's really just been an approach from the landowners – those that shout loudest actually get our attention because we didn't have a strategic approach up front. We were just developing the programme. But now I think we are really moving into a process where we are wanting to look at corridors and be able to look at these networks within the landscape and proactively approach certain landowners so that we can create that network within the landscape so that it is strategic. These specific forestry sites were selected through a kind of a prioritisation process. So they had biodiversity value or high biodiversity value. They weren't necessarily all nicely connected in the landscape but they were selected for their biodiversity value. But in the long run we need to move towards a lot more of a strategic approach where we are looking at connecting these properties, working adjacent to protected areas, creating these corridors and linkages in the landscape.

MR JOHN SCOTCHER Thank you for that. Kevin, I think importantly also that the programme that is currently running is piloting the stewardship programme because its recent legislation. And how do we actually get it to work and it's been quite slow because it's something that people aren't used to. So let's try and nail out all the bits and pieces and find out where the bottlenecks are and then hopefully in future it will be a lot quicker. But I think a particularly valid point. Any further discussions or questions from the floor before I shout oleo it's all over? Oleo, it's all over. Thank you very much. Justin is going to close up.

CLOSING FOR DAY TWO

Transcription

JUSTIN DU TOIT Thanks, this shouldn't take more than about an hour or so, I don't think. I think a round of applause for Brent not speaking. I am just going to ask Steve to say a couple of words just on closing and then I will just quickly finish off after that.

MR S GERMISHUIZEN I know Justin is going to thank almost everybody but I just quickly want to get a few thanks in. Really thanks to our GSSA partners, Justin, Frayne, Barbara, thanks so much for the really excellent work you put in to pull this thing together. Justin and I collaborated quite long on the scientific programme but Justin really gave really good insight on putting the whole thing together, getting the form and the shape of the programme.

The session chairs, thanks a bunch. I think you have done a really good job in drawing out the key points and keeping the thing flowing. The sound recording, transcribing type folk, hiding over there, thanks very much. And then the speakers, absolutely outstanding, the commitment, especially those that are still hanging in here till the very last. And just the level of discussion has been outstanding and I think just from my side – this is really the building blocks for really excellent future collaboration and work. I made a whole lot of contacts and already some projects are flowing out of this and it's exactly what the aim was.

The next step is going to be – and some of you will her from me – we are trying to convene a panel for the development of the guidelines and that is going to flow quite quickly. That's on the work plan for early next year to get the process of developing these very definitive guidelines for grass and management forestry. So really a big thanks. I sincerely believe that we have achieved almost everything that wanted to at this event. So thanks very much for your participation.

APPENDIX: POWERPOINT PRESENTATIONS

PRESENTATION
Opening Keynote Address: Fire Behaviour: the Australian Perspective, Andrew Sullivan
SESSION ONE: FIRE
Unplanned Plantation Fires, Willem Olivier
Fire Management on Private Timber Farms, Craig Norris
Burning for Biodiversity in a Timber Production Landscape, Roger Uys
SESSION TWO: BIODIVERSITY
Veld Condition Assessments and Herb Diversity in High Conservation Value Grasslands, Peta Hardy
What do Birds tell us about Grassland Management on Timber Plantations? Dave Everard
Fire, Biodiversity and Soil in the Drakensberg: Twenty Years of Research on the Brotherton Burning Trials, Alan Short
SESSION THREE: VEGETATION DYNAMICS
Keynote Address: Grasslands, Timber and Alien Invasive Plants, Brian van Wilgen
Forest Encroachment in Grasslands, Hylton Adie
Why Grasslands aren't Savannas, Julia Wakeling
The Life and Times of *Themeda triandra*, Terry Everson
New Approaches to Grassland Rehabilitation, Justin du Toit
The Composition of Natural and Disturbed Grasslands following the Removal of Pine Plantations in Mpumulanga, Hylie Olivier
SESSION FOUR: DESIGN AND MANAGEMENT
Ecological Network Design Research at Stellenbosch University, James Pryke
Redesigning Forestry's Open Spaces: Practical Implications, Steve Germishuizen
Fine-Scale Biodiversity Prioritization in the Forestry Estate, Richard Lechmere-Oertel
SESSION FIVE: POLICY AND PLANNING
Keynote Address: Legal Aspects of Fire in Timber Areas, Trevor Wilson
Insurance Requirements and Grassland Management, Ruth Bezuidenhout
Protection of Grasslands through Stewardship, Bheka Memela