

Placement/location of fire belts

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Chapter four of the National Veld and Forest Fire Act (NVFFA - Act 101 of 1998), instructs landowners to prepare firebreaks on their boundaries: 12. (1) Every owner on whose land a veldfire may start or burn or from whose land it may spread, must prepare and maintain a firebreak on his or her side of the boundary between his or her land and any adjoining land.

Because these boundary firebreaks are usually planned and then constructed, they are referred to as fire belts. The purpose of a boundary fire belt is clearly to prevent a fire from either escaping or entering a property. Unfortunately, extreme fire events do not respect fire belts or boundaries and often jump over fire belts into neighbouring properties. One may therefore argue that no fire belt will ever be constructed in a manner that it provides 100 percent protection from veldfires.

This may be true but the effectiveness of fire belts is subject to what is reasonable. A fire belt should be effective enough to provide a reasonable chance that it will stop a fire under reasonable environmental conditions such as weather, vegetation and topography, from escaping from or entering a property. As fire belt construction is very expensive, it is often not done effectively.

It stands to reason that if a fire belt is constructed in such a way that it does not give the landowner a reasonable chance to stop a fire, it does not meet the minimum criteria of an effective fire belt. If it can be proved that a fire belt does not meet the minimum criteria, the landowner can be judged as being negligent. Negligence arises where someone acts without taking proper care; they have not acted as a "reasonable person" would have acted. In addition to boundary belts, landowners also prepare internal belts that divide the property into smaller units.

Reasons why fire belts fail include:

- Not prepared on time (too early in the fire season)
- Poorly prepared (not clean enough)
- Too narrow
- Wrong location
- Wrong orientation

This article will aim at providing landowners with some alternatives that might assist them to construct more effective fire belts at a possible lower cost.

The departure point for all fire management decisions is a firm knowledge of the local fire environment such

as fuels, weather and topography, as well as typical fire behaviour in the area ie the manner in which fuels ignite, the rate of its spread, fire intensity, flame height and its ability to cause spot fires ahead of the fire front. Critical information to consider when choosing a location for a fire belt will therefore include the following:

Can I use the topography to my advantage?

A fire belt located across a slope is always less effective, as fire spread faster up-slope with taller flames than on a level area. For a belt to be effective in a steep slope situation, it must be two to three times wider than a belt located in a level area. This will not only come at an extra cost but will make the belt area more vulnerable to erosion. It is therefore always better to locate a belt at the bottom of a slope or on the down-wind side of the crest/ridge of a mountain.

In Figure 1 the dominant wind direction is indicated with black arrows. When the dominant wind blows it will be affected by the mountain ridge and a wind-eddy will form on the downwind side of the crest, indicated with the blue circle. This will cause an opposite wind direction in relation to the dominant wind. A fire driven by the dominant wind will therefore be met by an opposing wind once it reaches the ridge of the mountain. In addition to the opposite wind, the spread rate of the fire will also slow down as it starts to burn down-slope. The black line in Figure 1 therefore indicates the ideal location for a belt. Figure 1 may be an extreme example of a sharp ridge but the science holds true for all mountainous terrain. ▶

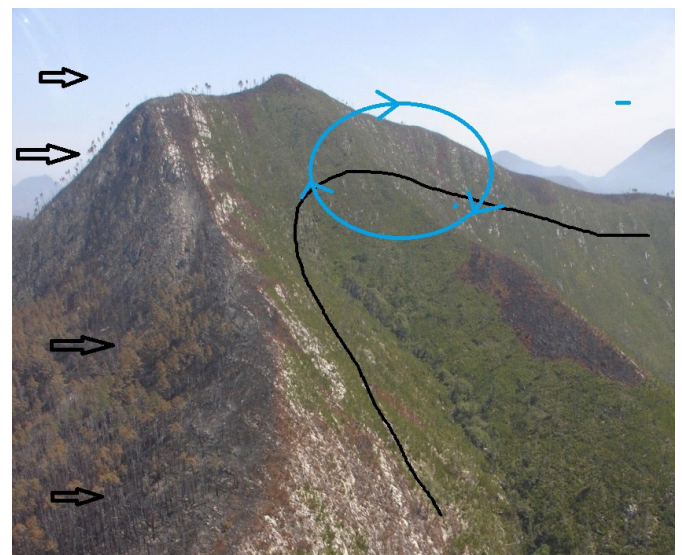


Figure 1: Down-wind side of a mountain crest

Wildfires: Firebreaks

- ▶ Another option to consider when locating a fire belt, is to construct the fire belt parallel to the slope direction (Figure 2). Although this pose a higher risk to soil erosion, the logic behind it is that the belt will encounter a flank fire when a fire burns upslope. The head of the fire will spread fast upslope but slower on the flanks where the belt can stop it.

Also take note of the change of the aspect in Figure 2 where this belt was constructed. Orientation on a slope refers to the direction it is facing. In this case, it is important to note that there will be a change in wind direction if it blows across the area where two slope aspects come together. This can be used to the advantage of the fire manager because if a fire jumps across this belt, it will change direction.



Figure 2: Fire belt constructed parallel to the slope but where two slope aspects meet

Areas that should be avoided when constructing belts are features like chutes and saddles. Wind is accelerated when it encounters these topographical features and a belt constructed across them, should be much wider to prevent fire jumps. Culverts of roads should also be considered when planning a fire belt because wind is funnelled and accelerated through them. There are many examples of fires crossing to the other side of a road by blowing sparks and embers through a culvert. The culvert acts a chimney and causes a venturi draft effect that sucks the fire through.

Can I use the dominant wind direction to my advantage?

Wind is the single most influencing force in nature that changes fire behaviour. Fire managers not only have to constantly be aware of wind speed but also wind direction when either suppressing fires or when planning the location of fire belts.

Before choosing the location of a fire belt, the dominant wind direction during high fire season must be identified. In the biggest part of South Africa, the north west (NW) wind is the nemesis of fire managers. The berg-wind that drove the 2017 Knysna Fire as well as the 2018 Herold Fire, which killed several people in the Farleigh Village, is proof of this. August is also known as the 'windy'

month in many regions. In other parts of the country the dominant fire-wind direction may differ and in the Cape Peninsula the south easter (SE) wind is responsible for many extreme fires. The local topography will, however, influence the general wind direction and ultimately determine the dominant wind direction.

Most veldfires tend to burn in the same areas from time-to-time and they follow the same pathway in doing so. The path that a fire will follow is determined by the combined effect of topography and wind. This knowledge should guide fire managers when they select a location and orientation of a fire belt.

The most effective fire belt should be orientated to intersect a fire path at a 45 degree angle. Figure 3 explains the logic of this statement. It is clear from this sketch that the smaller the angle between a fire path and the belt, the longer the distance that the fire must jump to cross the belt. Changing the orientation of a belt can, however, be challenging as it may result in a much longer belt (higher cost). Sound judgement is therefore required to determine the location, orientation and width of a fire belt.

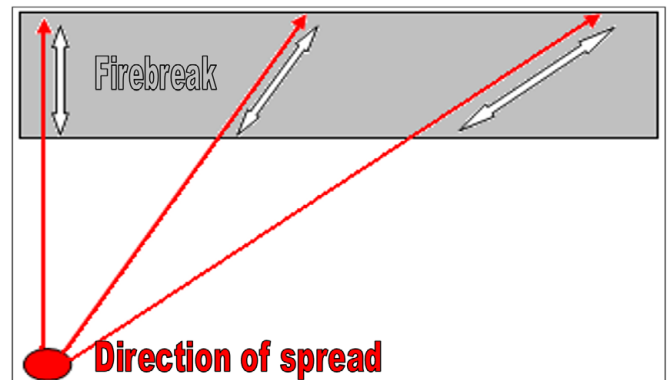


Figure 3: 45 degree orientation of belts in relation to dominant wind

In cases where an angled fire belt is not possible, a parallel fire belt may be considered. A parallel fire belt is constructed as part of a belt system and belts are orientated to be parallel to the dominant wind direction (Figure 4). As in the case with the belt constructed parallel to the slope (Figure 2), the science behind a parallel belt system is to box the flanks of the fire in and keep the head narrow. A cut-off belt can then be constructed and used for a counter fire or a defensive fire suppression action.

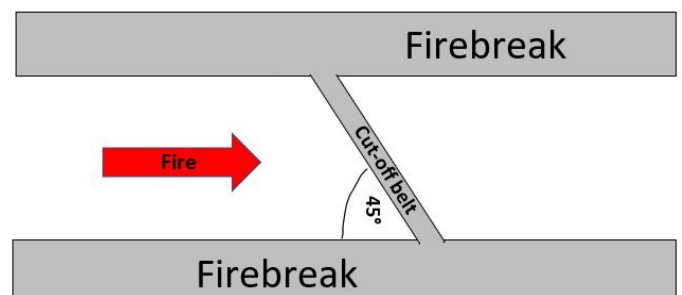


Figure 4: Parallel fire belt system with cut-off belts

Locating a belt according to the fire path

Prof Coert Geldenhuys did ground-breaking research on the occurrence and shape of the indigenous forests in the Tsitsikamma and Southern Cape (Figure 5). His studies concluded that:

- A. Indigenous forests exist where they are sheltered from the dominant wind that drives veldfires (wind shadow).
- B. The shape of the forests is determined by the path that veldfires follow through saddles and gorges in the mountains.

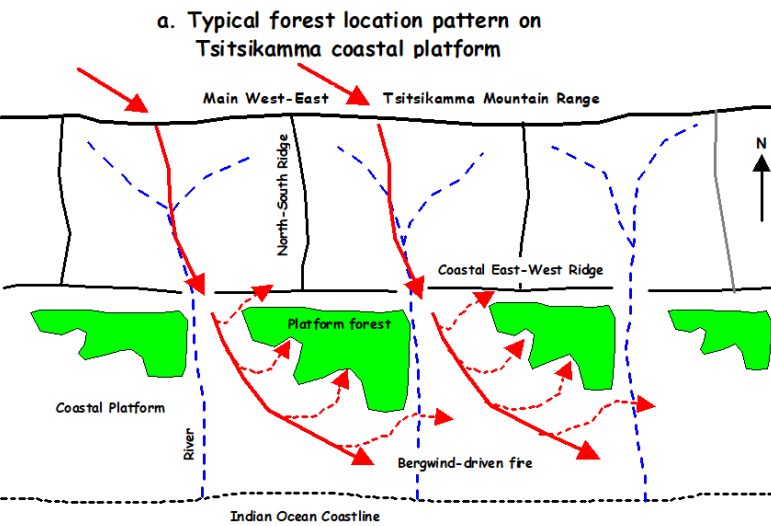


Figure 5: Fire paths in the Southern Cape (Geldenhuys, 1994)

From the research of Prof Geldenhuys it becomes clear that the shape of the land (topography) has a significant influence on the path that fires follow and where they burn or don't burn. In Figure 6 the fire path as determined by the dominant wind and the shape of the terrain is explained.

If one studies the landscape and identifies areas where vegetation that does not normally burn in veldfires exist, it becomes easy to determine fire paths. Figure 6 also indicates where/how the fire usually jumps across the fire independent vegetation. It now becomes clear that the area where spot fires usually land are the logic place to locate a fire belt.

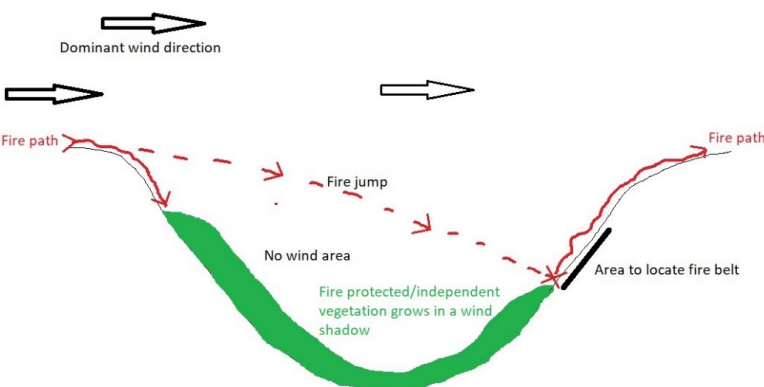


Figure 6: Shape of the land determining the fire path.

Figure 7 is a picture frame of a landscape where fire usually burn and don't burn. Fire managers should use this information to locate fire belts where it will disrupt fire paths

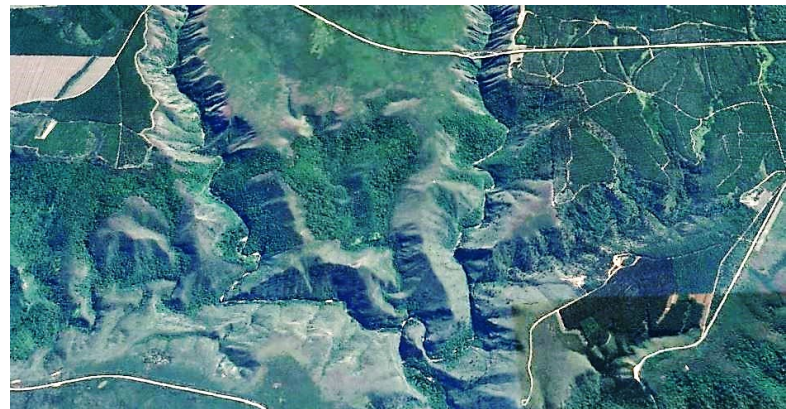


Figure 7: Fire independent vegetation in areas protected from the fire path (Google earth, 2021)

Other considerations before the location of fire belts should be decided include the following:

- As short and straight as possible to save on costs
- Accessible to vehicles where possible
- In conjunction with existing firebreaks (natural and man-made – Figure 8)
- Where it is easy to construct
- Where fuels are less hazardous
- Next to high risk areas



Figure 8: Fire belt constructed next to a road

Constructing belts across boundaries

A final question that needs to be answered is the one about locating belts on boundaries between properties. Although the National Veld and Forest Fire Act instructs landowners to construct belts on their property boundaries, these belts may be very ineffective because they are constructed in the wrong place. Moving a belt a short distance across property boundaries, may result in a much more effective belt. It may also reduce construction cost.

New association for wildland fire fighters launched



A new association for wildland fire fighters has been launched in South Africa. The Association for Wildland Firefighters (AWF) represents the wildland fire fighting industry and associated professionals in Southern Africa.

“Numerous investigations into some disastrous fires in Southern Africa highlighted the need for a formal body to represent the needs of the wildland fire fighter. The AWF aims to develop the knowledge, skills, understanding and competence of wildland fire fighting

in South Africa,” said Etienne du Toit, chairperson of the AWF.

Du Toit said the organisation aims to improve the standards of safety and the working environment for fire fighters in the sector in which its members operate.

The Association is a Non-Governmental Organisation (NGO) and is registered as non-profit generating or NPO. Any person or organisation associated with the Wildland Firefighting/Integrated Fire Management fraternity qualifies to be members.

Du Toit said when it comes to wildfires, climate change has resulted in a significant increase in risk, not only to responders but also to civilians. “Monetary losses and other damages as result of these fires annually exceed hundreds of millions. More needs to be done to address these risks. This is where the AWF comes in, an organisation that aims to share learning in such a manner that it promotes professionalism, reduces responder and civilian risk and at the same time allows for continuous

improvement in all aspects of integrated wildfire management.”

The new association specifically addresses the needs of the wildfire fraternity. “Until now, no other association specifically addressed the needs of the wildfire fraternity, there are similar associations but these are more focused on the structural fire fighting sector,” said Du Toit.

The founders of the organisation come from a variety of backgrounds, including the fire service/ forestry and conservation sectors and include business development practitioners with vast practical experience in these respective sectors. “This Association seeks to enhance synergies between the various entities responsible for wildfire and integrated fire management and one of the main aims is to professionalise the wildfire fighting industry in South Africa.”

Visit www.wildlandfire.org.za or follow them on Facebook <https://www.facebook.com/Association-of-Wildland-Firefighting-101802995515048>. 🔥

- ▶ In the spirit of integrated fire management, adjacent landowners should agree to construct ‘boundary fire belts’ in locations where they will be more effective. With the support and input of the local fire protection association (FPA) or local municipal authority, the merit of alternative locations for boundary belts should be agreed upon, documented and implemented.

If this practice is followed, it will improve fire protection across regions.

Conclusion

The value of a well prepared and effective placement and correct orientated fire belt has been proved many times. Climate change, economic pressure on landowners, political and social interferences is only

a few reasons amongst many others why the losses suffered as a result of unplanned veldfires are escalating in the global arena.

It is becoming clear that modern fire managers must do things differently. We can no longer dwell on expired practices from the past and trust that we will still be able to curb losses caused by uncontrolled fires. Fire management has become a scientific art form where fire managers must combine science, human resource management, technology, good communication and many other skills to make a difference.

By redesigning fire belt systems in our regions, we can move closer to fulfilling the ideology of integrated management. ▲