Using nature to minimise the risk of FOREST FIRES

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Do we understand bergwind flow patterns in the landscape to help us to control fires in our plantations, asks Dr Coert Geldenhuys?

I read with interest some of the items in *SA Forestry* of September/October 2007 that relate to fires and the devastation caused by fires during 2007. Peter Briscoe suggested that we plant natural forests as firebreaks because as he thinks ' natural forests growing on the southern and eastern slopes of the high rainfall areas ... are fire resistant and have obviously adapted to a fire regime over time'.

Dr Neels de Ronde, in his article 'Why integrated fire prevention can reduce wildfire damage' asks the question: 'Where have we gone wrong?' and then lists a number of points that should be considered.

My suggestion is that we went wrong because we do not understand fire behaviour patterns at the landscape level and we do not know how to read the patterns of the natural vegetation in the landscape that were caused by these landscape level fire patterns.

A forest patch near Swellendam naturally protected against fires in the fynbos.

The forest at Storms River bridge scorched on the edges during an extreme bergwind fire (only the forest areas that expanded since the previous major fire got burnt back to the natural forest limit).

Some years ago I made a study of the location pattern of the natural forests in the southern Cape landscape, particularly in the Tsitsikamma (see Geldenhuys, C.J. 1994. Geldenhuys, C.J. 1994. Bergwind fires and the location pattern of forest patches in the southern Cape landscape, South Africa. *Journal of Biogeography 21*, 49-62). I have never been in a situation of managing a controlled or a wild fire but I only looked at the scars left in the landscape after such fires, and some very devastating ones, and developed my own ideas on this.

I agree with Peter Briscoe that in most cases the fires stopped at the boundary of the natural forests, not only in the southern Cape, but in all forestry areas throughout South Africa, and even in the tropics of Africa. I see the same patterns in the natural vegetation, with some sharp transitions between the fire-adapted grassland, fynbos and woodland on the one side, and the natural forest on the other side. I have seen large areas of plantations being burnt in total, with the natural forests within that burnt plantation area left behind totally intact, or with some fire scars where the forest has expanded into the plantation area, or where fires spotted into the forest and caused small burns of a few square metres to several hectares.

I disagree with Peter Briscoe and would say that natural forest is as vulnerable to fire, and even more, than the other vegetation formations and the plantation stands. He would gain nothing by planting fire breaks of indigenous forest species – just a lot of effort and costs! I would take the following important points from what Dr Neels de Ronde said in his article: first consider the wildfire history at a regional scale (like the Tsitsikamma), and I would add, also the landscape scale (forestry estate) within that particular region. Secondly, identify hazardous areas through a region (or landscape) – specific fire hazard classification. When I look at fire breaks, in relation to the fire-vegetation patterns I see in the landscape, then they are not appropriately placed. Thirdly, with the level 1 and level 2 evaluations, do wildfire simulation through wind flow dynamic studies with consideration of the topography of the terrain.

But why and how?

Let us first consider the why:

- Within a high-rainfall area we have areas of grassland (or shrubby fynbos), woodland and patches of forest. This relates to fire frequency – with more frequent fires we have grassland, and with very sporadic fires we will have closed woodland to evergreen forest. Where were most of the plantations established? In the grassland and fynbos areas!
- Fire is moved along with the flow of the air (wind) around and over barriers, causing a fire pathway. This movement is also directed by the fact that hot air moves up (a fire runs quickly up a slope), and that a strong wind cannot suddenly change direction and blow down a steep slope (fire moves very slowly down a slope and tends to jump back upslope). When we look at the forest patches in a landscape – where do they occur? Most forest patches occur in broken landscape, not on flat areas unless they are surrounded by topographic barriers to the wind movement (and therefore fires).

A series of forest patches in the Cathedal Peak area, Drakensberg, showing the wind-fire direction from the back left to the right.

The plantation burnt in total during a bergwind fire in the Weza-Kokstad area but the natural forest was left untouched.

- Look at the pictures of forest location pattern (left), then look at the forest location pattern in the Tsitsikamma landscape determined by bergwind fires (Figure 1) and finally the bergwind fire model and how that determines where forests occur in the landscape (Figure 2). Where did we establish our plantations? In the fire pathway of the landscape where we have no forests (red arrows in Figure 2), and therefore have to consider the fire pathway if we want to protect our plantations against the severe fires that naturally run along that pathway!

Now we can consider the how:

1. This pattern can be evaluated at the regional or landscape level by looking at the location pattern of the natural forest patches in the landscape.
2. You can take an aerial photograph of an area and look at the shape of the forest patches on slopes and in gullies, and determine the direction of the prevailing wind direction during the dry season that would also determine the most likely pathways of the devastating fires.

Figure 1

Forest location pattern in the Tsitsikamma landscape caused by bergwind-driven fires.

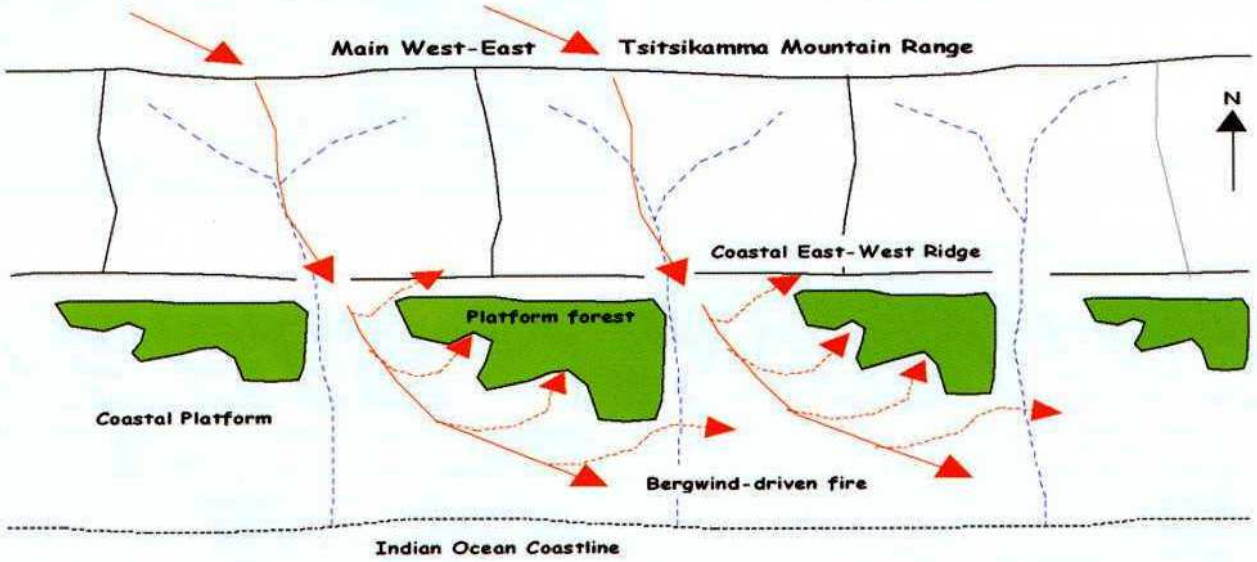
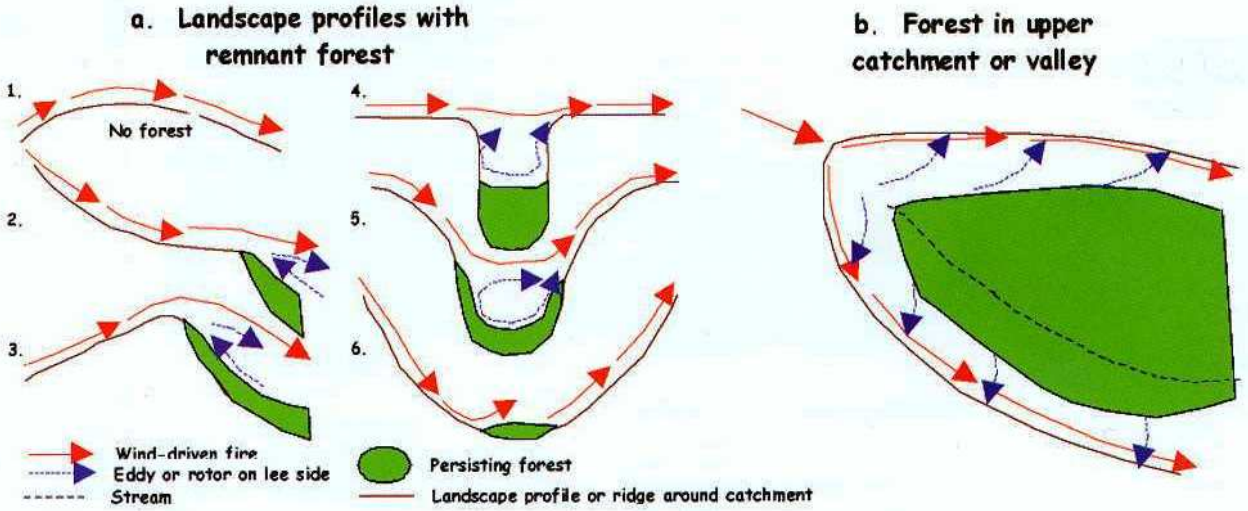


Figure 2

Schematic model of bergwind-driven fire patterns in landscape and how that determines where forests can persist and where the fire pathways are.



3. Those with GIS skills can use a digital terrain model and superimpose a wind-flow model of the prevailing winds during the dry season, over the landscape. This wind-flow pattern, in relation to the location pattern of the natural forest patches, and eventually with the historical wildfire patterns, would guide you to identify fire hazardous areas to concentrate fire prevention and fire protection effort.
4. If this model is operational, you could perhaps also model the wind during an actual wildfire to direct the operations of the fire fighting teams as the fire progresses.

Natural forests are therefore not resistant to fire – they just persist in what we call 'wind-shadow' areas in the landscape. However, the location pattern of the forest patches can help us to determine how the fires run through the landscape that we have to manage, and where to concentrate our effort, both in terms of fire prevention (long before the fire) and fire control (during a fire). ▮

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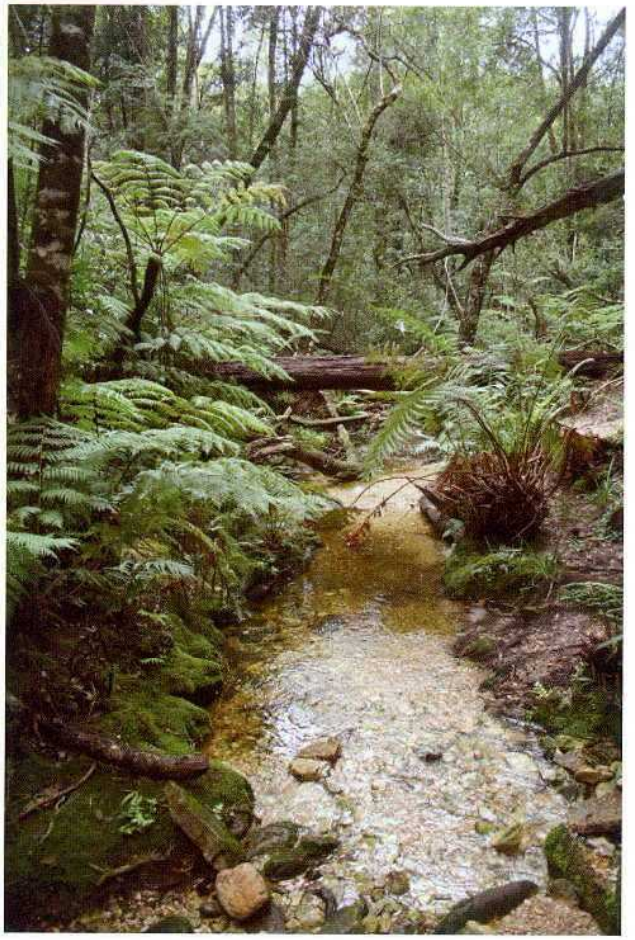

Indigenous forests, like this one in Diepwalle west of Knysna, grow in areas naturally protected against wild fires.