Shift in Fire-Ecosystems and Weather Changes[1]

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Abstract

During recent decades too much focus fell on fire suppression and fire engineering methods. Little attention has been given to understanding the shift in the changing fire weather resulting from the global change in weather patterns. Weather change have gradually changed the way vegetation cover respond to fire occurrence and brought about changes in fire behavior and intensity . In the past two decades there has been an increase in the occurrence of catastrophic fires, fire fighters has lost their lives in the line of duty, the environment was degraded and the livelihood of many people has been damaged or destroyed. Fire season also seems to extend beyond the normal fire season making it difficult to confirm the duration of fire season. According to observations and recent reports across the globe, it was revealed that most wildfires managed to escape while fire fighters perceived that they had them under control. Some fires that escaped also resulted as a result of shortage of water and other basic resources. It is time to transform firefighting techniques and devise new strategies that will enable fire managers to prevent and take control of out of control fires. This should lead to savings on suppression costs and allow better application of money earmarked for fire management. Efforts to offset the results of wild fires should be refocused by adjusting fire activities to synchronize with changes in weather and to deal more effectively with an altered vegetation cover. Water is a scare resource with significant impacts on some countries in Africa such as South Africa, Morocco and Kenya; there are also other countries which are becoming water stressed at an increasing rate. These countries include the United Kingdom, Cameroon and Nigeria. Dry and wet seasons are becoming longer in some regions, resulting in vegetation cover that is starting to adapt and change. These changes might vary from a drier flashier vegetation where plants adapted to survive in drier conditions become more dominant (usually woody weeds), to a denser vegetation cover with a higher fuel load in wetter areas.

Key words: Climate change, fire management, vegetation covers

Introduction

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The occurrences of catastrophic fires around the globe are starting to raise a serious concern. Global climate change has a significant influence in which way fires are behaving, spreading and occurring. Scientific report has shown that water availability will become a scarce resource (United Nations Global [UNGC] 2009). Vegetation cover is also impacted by climate change and forests are believed to be there ones which are going to be severely be impacted and there will be a shift in their ecosystem (Food and Agriculture Organization [FAO] 2012). Fire plays a significant role in maintains of biodiversity and ecosystem. Changing weather is altering fire benefits by altering favorable conditions to results in a high number of catastrophic fires which are resulting in loss of lives and environment destruction (Fried and others 2004). Climate change does not only have an impact on environmental factors but also has a significant impact on economy. To be able to obtain a quantified impact on economy, it is necessary to calculate the physical impact and convert it into its economic value (Tol 2009). The most important firefighting basic recourse; water is also badly impacted and some countries are facing water scarcity and thus other are facing water stress.

Weather changes and its significant impact

The change in weather patterns has resulted in change in vegetation and has a significant influence in the way wildfires are continuously occurring and the destruction they are causing. Ecosystems and biodiversity are changing and degrading to the extent of value loss. Some parts of South Africa will experiment a severe impact of climate change to an extent that some of the species will be lost through extinction (Stefik 2006). The ecosystem will shift and so thus the fire-ecosystems will change to certain degree. The distribution of flora and fauna is influenced by the environmental climatic patterns. These species are only occurring in areas which are rich in biodiversity, thus have different maintenance requirements and if there is a shift in weather patterns might lead to an extinction of some species (Stefik 2006). In the figure below, they illustrate the fire ignition sources and the possible future changes (Trollope 2012).

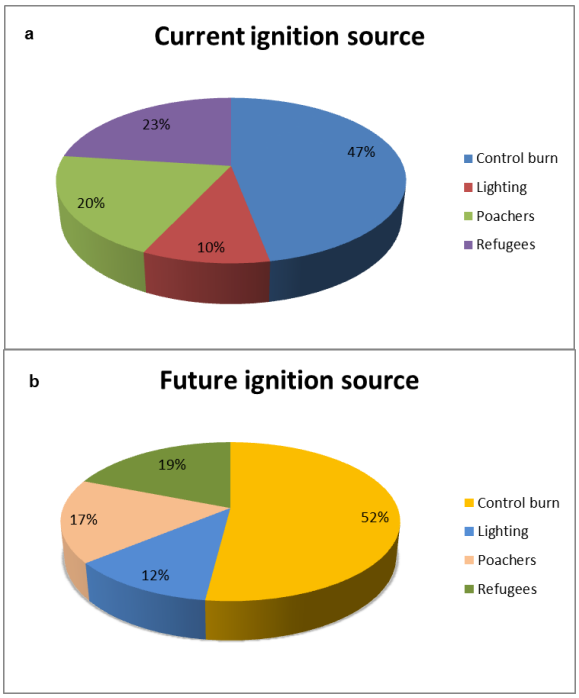

Figure 1—The ignition source assessment of Kruger National Park in South Africa (Trollope, 2012), 1a illustrate the current fire status while 1b illustrate future scenario

Changing response in South African biomes

The South African biomes are distributed according to weather patterns and climate variation. These biomes are not only distributed in manner of climatic characterization but also soil properties play a significant role. Favorable conditions for fire occurrence and spread are determined by weather and vegetation state (Thonicke 2010). Too much fire frequency and intensity results in short fire returns intervals and that might cause a severe damage to the ecological progress of the biome. South African biomes are expected to change and be compacted to the eastern part of the country, and it is expected that the western part will have an increase in acidity and there will be an introduction of a new biome up to northern certain parts (Stefik 2006). Figure 2 illustrates the present fire-ecosystems in South Africa and the predicted shift in the fire-ecosystems.

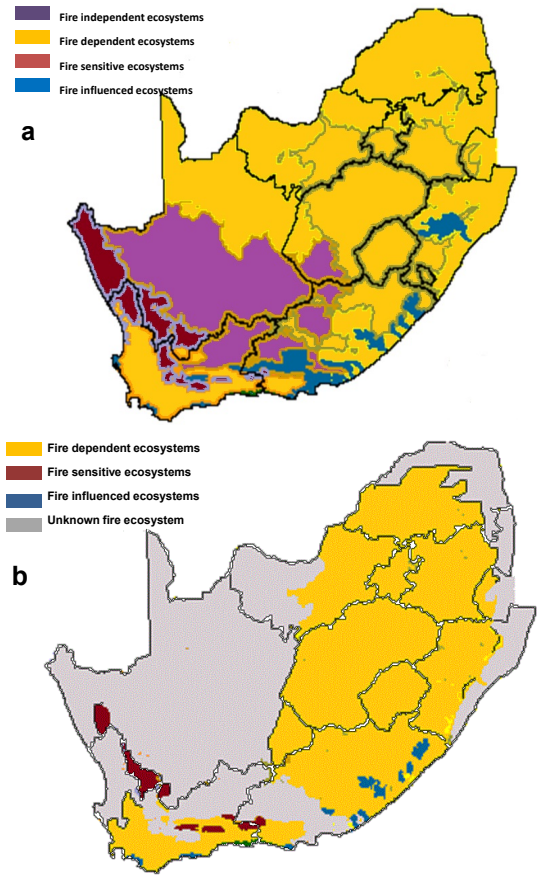

Figure 2—The current fire-ecosystems in South Africa and the predicted future changes due to the climate change (Turpie, 2003), 1a shows the current distribution of fire-ecosystem and 1b shows future change as a results of climate change

Grassland –

Fire is required in South African grassland biome to maintain its biodiversity and ecological functionality. The fire management system is recognized within South Africa, for domestic and wildlife management purpose (Trollope 2012). To maintain grass palatability, fire occurrence or application is required. Fire is perceived as a primary tool to manage rangelands to sustain the demand from wildlife and domestic livestock (Trollope 2012). Grasslands are situated in summer rainfall areas. Climate change has a potential of altering precipitation patterns and that may leads to less productivity of these areas and may significantly affects the botanical composition, ecological status and basal cover. The types of classes which will be affected are (Trollope 2012):

- Decreaser Species: the grass and herbaceous species which decrease when the area is under or overgrazed.
- Increaser I Species: grass and herbaceous species which increase when the area is under grazed.

- Increaser II Species: grass and herbaceous species which increase when the area is over grazed.

Savannah –

Savannah biome is believed to be affected by the climate change in areas around the equatorial belt and the forest biome is been replaced by savannah (Favier and others 2003). The vegetation behavior is not entirely driven by the climate change but also by the human burning activities. Natural forest expansion into savannah ecosystem is restricted by the use of fire, either too frequently or at highly intensity (Favier and others 2003).

Forest –

Present areas which contain forest biome are expected to shrink and some of commercial species are said to be not adaptive to such weather changes. The survival and growth of is influenced by climate condition, some of species are more adaptive than others and that might results in extinction of some species (FAO 2012). Forest behavior and respond to the changing weather is said to have an impact on species level not on forest level. The shift in the forest ecosystem is entirely influence by the adaptability of species to environmental change. It is also been perceived that most species have a tendencies of moving to the higher altitudes or higher latitudes (FAO 2012). Climate change does not only impact on forest tree species but also impact on non-timber forest plants and animals. Forest habitant is altered and becomes not favorable for the survival of other species especial those which does not easily or does not at all adapt to changes.

Fynbos –

The fynbos biome is one of the fire-dependent vegetation in South Africa to maintain its ecosystem and biodiversity. Fire occurrence or application stimulate seed germination and/or release from cone (de Ronde 2012), recently in South Africa there has been a series of worse fires in fynbos areas which to some extent manage to claim lives and damage to property (in press). The fynbos optimum fire rotation has been set at approximately 12 to 20 years and in drier areas range from 20 to 30 years. Human interventions have results to the reduced rotation to between 6 and 8 years (de Ronde 2012).

Karoo –

The succulent Karoo biome is believed that will also suffer the same faint as forest biome in terms of impact and loss of species, degradation of biodiversity (Hoffman

and others 2009). Some of the species are susceptive to drought (Hoffman and others 2009), which means as they dry up and die could results in the succulent Karoo to become fire adaptive vegetation.

Effectiveness of suppression methods

The present fire suppressing methods are becoming ineffective due to insufficient data on the shift response of vegetation cover. Vegetation response to climate change also influence the way in which will respond to fire in a manner that will facilitate the spreading effect and contribute to difficulties of fire suppression techniques (Midgley and others 2002). A number of challenges have arisen in fire suppression and fire fighters have lost their live in a line of duty. Most fires have managed to escape and cause a severe damage to the environment due to unforeseen change in basal cover.

Change in water quality and quantity

The number of escaped fires has started to increase in recent years and it has been said that most of these fires escape due to the shortage of water. Climate change will affect water in the following manner and will results in difficulties to proper control wildfires (UNGC 2009); increase water shortages, decrease natural water storage capacity from glacier/snow-caps melting, affects water supply capacity infrastructure, precipitation and flooding events will increase to extreme levels, and surface and groundwater will be contaminated due to sea-level rise.

Altered ecosystem –

Ecosystems are altered in terms of become more susceptible to fire and mortality rate is accelerated. The way in which vegetation respond to fire has start to shift to either long fire season or to catastrophic fires (de Ronde 2012). The impact will influence the change in physiology, productivity and growth, the distribution and abundance of species is also disturbed due to the shift of climate patterns (Midgley and others 2002). The figure below illustrates the present fire-ecosystems (GFI 2004); across the world and due to the impact of climate change, they are bound to shift as the natural vegetation cover will change in most parts of the world (FAO 2012).

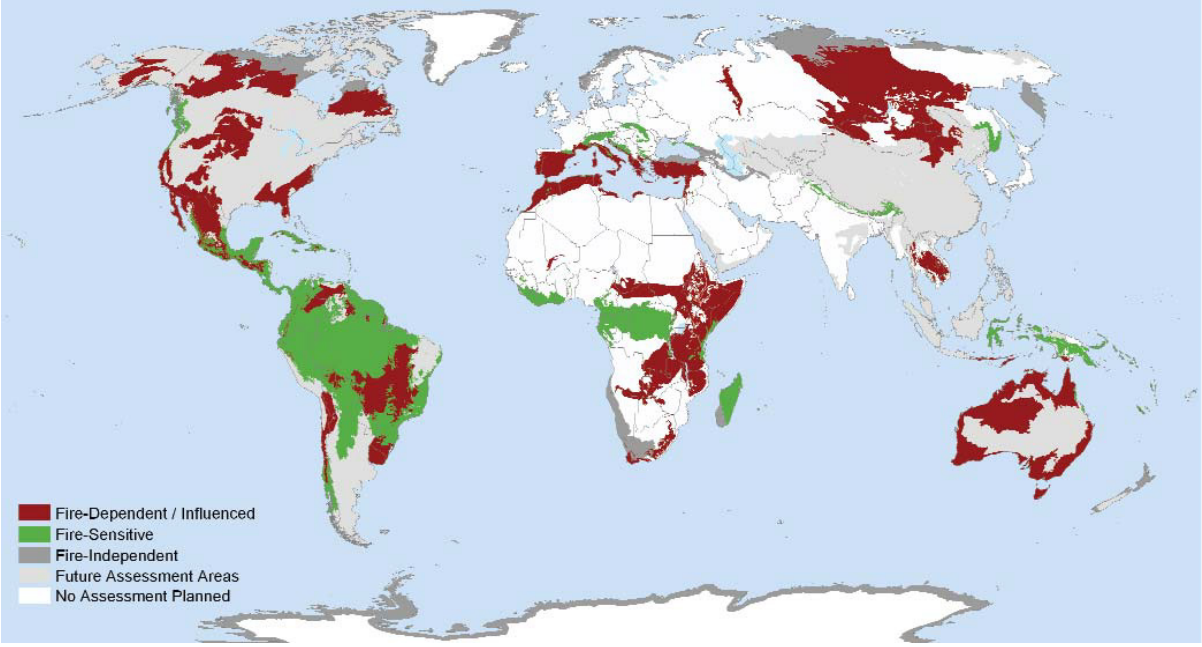

Figure 3—The classification of fire-ecosystems of the world (GFI, 2004)

Influence on fire regimes

In the past decade fires used to occur in fire-dependent and fire-influenced ecosystems, and thus there were playing a vital role in maintaining these ecosystems (GFI 2004). Fire occurrence and application is beneficial for the biodiversity and thus it is said that it can be destructive to plants and animals which are not adaptive to fire. Humans have become a source of ignition more than the natural occurrence of fire and such action has significant contribution to the negative impact of climate change (GFI 2004). Fire regimes started to shift from the normal fire occurrence time to either, occur early and/or extend beyond the normal season. The shift in the fire regimes can be seen as the current fire occurrence patterns compare to the natural patterns (GFI 2004).

Adaptation and improved suppression methods

Fire managers are not only required to understand the effect of climate change to fire, but to adjust fire activities to synchronize with the change in environmental conditions. The appropriate approach is to have an understanding with how much shift or alteration in environment has taken place and which might be suitable anchor techniques and methods to effectively deal with matter at hand. The adjustment of suppression methods and adaptation is not a sole responsibility of an individual company or organization, the appropriate adaptation methods are to be developed at a

national level down to regional level (Lebel and others 2012). Development of strategies in isolation by a particular sector might not be in line with other strategies which are developed to adapt and that might influences the acceleration of severe impact to the environment and an increase of catastrophic fires. Adapting to the climate change does not necessary mean one has to use fire more often or not at all but to adjust to application methodology.

Manipulation of burning pattern

Fires are causing a serious damage to the environment to the environment and commercial forests. It is time for fire managers to devise or enhance firefighting strategies and tactics to control of fires to be able to restrict fires to areas that are supposed to burn and protect plantations. de Ronde (2012), has suggested that to avoid wildfire damages within the forest plantation, the fire manager will have to embark in prescribe burning within the compartment stands. The method is already been practiced in area with high number of wildfires and the problem with it is that it has negative impact on wood properties (de Ronde 2012); the significant impact on wood properties is still undertaken. Pool (2011), also recommends the practice of mulching as a form of fuel load management and according to his findings, mulching has a significant influence on fire behavior, intensity and rate of spread, (South African forester, in personal communication) argues that the method in some areas might present a number of problems, due to the fact that it results in difficulties to fight fires which are suspended on the ground as a results of compressed flammable gases.

Understanding adjacent vegetation

When it comes to fire management, in most cases the fire managers are only concern with preventing fire from spreading into the plantations and from within to beyond to the neighboring vegetation. The understanding of change in environmental response requires the studying of also the adjacent ecosystems and devise management strategies for both ecosystems. The importance of bring adjacent vegetation into picture is to avoid the repetition of severe damage which South Africa has gone through between 2007 and 2008, the loss of 25,000 hector in a single day due to extreme weather conditions (de Ronde 2012). Most wildfires start in adjacent vegetation into commercial plantation and these areas are mostly owned by communities, the ignition source is equivalent to the one of Kruger national park.

Integration of operations

The effect of climate change does not only affect fire suppression methods, it affects a number operation and thus it is utmost import to have a mainstream adaption planning in order to integrate operation and to also maintain the interconnection within the operations and environment (Lebel and others 2012). Operation integration should be adapted at a national level in order to have formality and to have operations systems which are interlinked.

Ultimate remunerations on economic dynamic

The forest companies are spending a lot money and basic on fire suppression and the costs are relatively increasing due to the influence climate change on vegetation. It is not a wise decision to spend more and/or less resources on fire engineering, thinking that will prevent and protect fires from destroying forest. With the understanding of an ecological biome value will result in taking necessary precaution steps and applying appropriate resources (Turpie 2003). To increase investment returns, it is of benefit to practice integrated management for both commercial and environmental conservation.

Conclusion

The evaluation of climate change impact on vegetation response to fire at this stage is hard to be quantified. Fire management has been a challenge at a global scale, the shift in vegetation response and adaption to climate change has made management more difficult. In South Africa, prescribed burning practices are becoming dangerous due to the high number of escaped fires during the operation. The diversity of weather patterns is also making it difficult to devise a strategy which will be applicable at a national level. When it comes to management of fires, it is utmost importance to take all affected factors into consideration in order to select an appropriate method which will be effective in bringing wildfires under control.

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