Burning of wetlands in timber plantation areas
Assessment criteria and guidelines

November, 2010

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Under contract to
The Mondi Wetlands Programme

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1 Introduction and purpose of the document

Together with clearing of alien plants, burning is the principle tool available to forestry management for its unplanted natural areas. Wetlands in the Grassland biome of South Africa evolved with fire, and fire is necessary to maintain the native vegetation of these wetlands (Kotze 2010). It is recognized that burning has the potential to have both considerable positive and considerable negative effects on wetland health and ecosystem provision, depending on its timing, frequency, etc. and on characteristics of the wetland. Therefore, the effect of burning on wetlands needs to be as well understood as possible.

Many wetlands in areas with tree plantations are burnt annually in early winter because of the fire risk that unburnt wetland vegetation poses to the trees. Livestock owners from neighbouring communities using wetland grazing in the forestry estates will also often burn wetlands in early winter to achieve an early flush, encouraging foresters to burn the wetland in a controlled fashion before the livestock owners can do it (Walters D, 2010, pers. comm.. Mondi Wetlands Programme).

In the mesic grassland areas of South Africa, early winter burning of wetlands is less favourable in terms of the hydrological and ecological benefits of wetlands than late winter/early spring burning. An important reason for this is that the removal of loose surface and standing plant litter at the beginning of the dormant season (winter) exposes the wetland (and wetland fauna requiring good cover) for an extended period before full re-growth takes place the following spring (Kotze 2010).

Based on the findings of studies such as Fynn et al. (2003), the effect of burning on grassland vegetation and soil is influenced more by timing of a burn than by burn frequency. However, this does not mean that burn frequency is of no consequence. If a particular timing of burning has a negative impact, e.g. through depletion of topsoil organic matter levels, then a greater frequency generally acts to amplify this effect.

At the other extreme, there are many herbaceous wetlands in forestry areas, likely to have evolved naturally under a burning regime, which become totally protected from fire by forestry management or are not burnt frequently enough. These wetlands are often to be found located in very narrow tongues of natural vegetation within unplanted forestry timber compartments, which are impractical to burn. In addition, many wetlands in forestry areas within the coastal zone, where, in the absence of fire, naturally herbaceous wetlands can quickly become succeeded by woody plants, are often not burnt frequently enough. Once succession has taken place from a herbaceous community (which burns more readily) to a woody community (which naturally only burns under extreme conditions) the area generally becomes naturally protected from fire.

Not all wetlands will be equally affected by these two burning regime extremes, namely annual early winter burning and complete fire protection or inadequate burning, but the affect will be determined by the specific natural features of a wetland, together with other disturbances (e.g. grazing) to which the wetland is subjected. The main purpose of Section 2 is to provide practical guidelines that highlight some key features to consider in assessing the likely impacts of these two regimes on a wetland, which are each considered in a separate section, and the criteria given in each section are derived from a review of the scientific literature relating to burning and wetlands (Kotze, 2010).

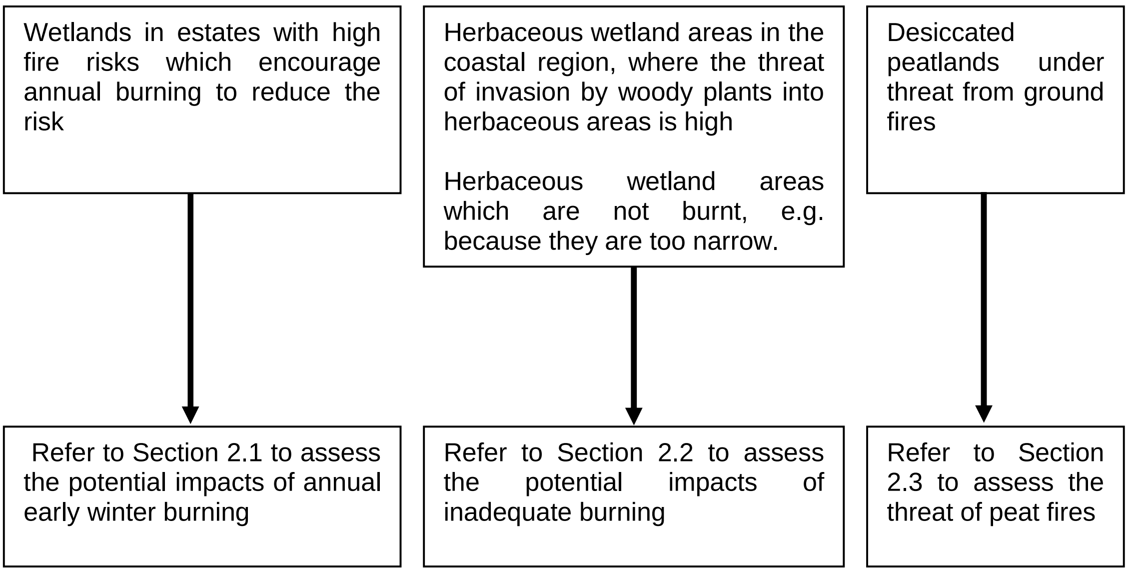
Finally, Section 2 concludes with a brief section dealing with those areas which evolved under burning, but which need special protection from fire. The most important of these are peatland areas which have been desiccated by plantation trees in their upstream catchment, making them very susceptible to ground fires. This emphasizes the point that wetlands within catchments dominated by timber plantions are "hydrologically compromised" to a greater or lesser degree, which needs to be recognized by management.

Section 2 can be used for a "screening" of the wetlands in a forestry estate to identify those areas most sensitive to the two negatively-impacting regimes given above, as well as to assist in designing an open area monitoring system that effectively accounts for the impacts of burning.

Section 3 provides practical guidelines for carrying out a selected burning regime. It is used once Section 2 has been applied to identify the most sensitive areas which should be given due consideration. It nevertheless recognizes that forestry managers must work within the constraint of minimizing the fire hazard within the forestry estate. The guidelines in Section 3 attempt to work within this constraint, while at the same time mitigating, as far as possible, the negative outcomes resulting from this constraint.

2 Assessing the impacts of burning

In order to identify potential impacts associated with the current burning regime of wetlands within a tree plantation area, identify which of the following situations apply to the estate which you are assessing.



2.1 Annual early winter burning

Specific investigations are lacking regarding the effects of burning timing and frequency on wetlands, including annual early winter burning. Therefore, there is a need to rely on related studies (notably those carried out on mesic grasslands[1]) as well as to draw on "first principles" relating to wetland functioning. From these, the following negative effects of annual early winter burning are identified.

- **Loss of faunal diversity** as a result of the removal of cover required for protection against predation by small mammals and secretive birds such as flufftails. Where burning takes place at the beginning of the dormant season then the wetland is left exposed for several months before regrowth of the vegetation re-establishes cover, and rodents and secretive birds such as flufftails will be left exposed without the required protection from predators (Taylor, 1995). Late summer/winter breeding species, notably the threatened grass owl (*Tyto capensis*) the African marsh harrier (*Circus ranivorus*) and the marsh owl (*Asio capensis*) may also be severely affected by early winter fires.

- **Loss of plant diversity**. Prolonged exposure of the soil to drying out is likely to lead to the loss of species (mainly short, shallow-rooted forb species) which are not adapted to such drying out of the soil. Although this has not been specifically investigated in wetlands, it has been shown to occur in mesic grasslands (Fynn et al., 2004). It is important to add that the desiccating effect of plantation trees in a wetland's upstream catchment may compound the desiccating effect of annual early winter burning. In addition, very frequent (e.g. annual) burning may also change the competitive balance of the dominant species in a way similar to that demonstrated by Mitsch and Gosselink (2000), particularly where the vegetation includes a mix of species with complete dieback of aboveground portions (advantaged by annual fires) and those with more persistent aboveground portions (disadvantaged by annual fires).

- **Reduced organic matter levels in the topsoil** as a result of the increased drying out of the soil and reduced surface litter inputs. Although this is likely to apply to only the uppermost centimeter or so of soil, referred to by Mills and Fey (2004) as the pedoderm, it is nevertheless the most critical layer in terms of soil processes affecting plant growth and biogeochemical cycling, and affects ecosystem function in a disproportionate manner as it controls water and air entry into the soil (Mills and Fey, 2004).

- **Increased exposure to atmospheric loss of water in wetlands subject to frosting back of the vegetation.** Where severe frosts cause natural winter-dieback of leaves then in wetlands that remain flooded or saturated to the soil surface, evaporative loss of water during the winter season is greatly reduced. This is particularly important where the winter season coincides with the dry season, which pertains to the summer rainfall areas of South Africa, and all of the mesic grasslands in the country. The dense layer of reflective non-transpiring material limits heating up of the soil as well as limiting the movement of air across the water or soil surface (Donkin, 1994).

- **Increased exposure to erosion**, which is likely to lead to increased rates of soil loss from wetlands with a high sensitivity to erosion. However, those wetlands with a low sensitivity are likely to be minimally affected. It is important to also add that under certain circumstances if a burn is earlier

[1] These studies are likely to have a high level of relevance to hygrophilous grassland and sedge meadow wetlands, which are similar in their structure to mesic grasslands.

it may allow the vegetation greater opportunity to recover before the wet season when the most erosive flows take place.

From the effects described above, it can be appreciated that the more severe the frosting and pronounced the dormant period, the greater will be all of the above impacts. Conversely, if the climate is warm, e.g. on the KwaZulu-Natal North Coast, then the recovery of vegetation from burning in early winter will be only marginally slower than following a late winter/early spring burn, and the impacts described above will be potentially minimal.

Finally, it is important to emphasize that the ultimate impact of annual early winter burning, or any burning regime for that matter, will also be determined by other human impacts on the wetland. One of these, desiccation by plantation trees in a wetland's upstream catchment, has already been discussed. A further very important additional impact that interacts with burning is livestock grazing. Where annual early winter burning is combined with moderately heavy to heavy stocking rates then the impacts described above could potentially be amplified. By eating the new growth, the livestock potentially slow down the recovery of vegetation cover in that season (The longer term impacts of grazing on the vigour of the plants are discussed in the following paragraph). Trampling by livestock also potentially increases erosion of the exposed soils.

In addition, frequent burning and heavy grazing may act together to lead to increased degradation of the vegetation, given that burning and grazing are closely interlinked. Fire removes unpalatable old growth and stimulates new growth, therefore encouraging increased levels of grazing. Where grazing camps are lacking, leaving un-burnt areas can be used to facilitate rotational resting as a result of livestock preferentially using the recently burnt areas and leaving the un-burnt areas. However, if the whole area is burnt every year then no such opportunities are provided. Furthermore, early winter burning stimulates the plants to draw on their reserves, and they will then do this again in the following spring. This, in turn, will lead to individual plants more readily depleting their stored reserves, ultimately leading to the decline of Decreaser species (i.e. species indicative of good condition veld).

Given the discussion so far, it can be appreciated that level of impact associated with annual early winter burning may vary greatly from one wetland to the next, depending on the specific circumstances at the site (Table 2.1). From Table 2.1 it can be seen that in certain wetlands, e.g. where no secretive or late summer/winter breeding species are likely to naturally occur, the dormancy period is short, vegetation is inherently poor in species and the erosion hazard is inherently low, the impacts are likely to be much lower, probably negligible, than in a wetland supporting autumn/breeding species and with an extended dormancy period.

Table 2.1: A summary of how the specific features of the wetland affect its sensitivity to impacts from annual early winter burning

Factors affecting sensitivity	Level of sensitivity		Ecosystem services likely to be most affected
	Low (resilient)	**High**	
Sensitivity of the wetland's fauna	Flufftails and other secretive species and late summer/winter breeding species are unlikely to naturally occur in the wetland[1]. Dormancy period short.	Flufftails and other secretive species and late summer/winter breeding species are likely to naturally occur in the wetland. Dormancy period long	Maintenance of biodiversity: intermediate to high impact
Sensitivity of the wetland's flora	Vegetation is inherently poor in species, e.g. a mono-specific stand of *Phragmites australis* or the area was historically cultivated and is currently dominated by a few pioneer species. Dormancy period short.	Vegetation is rich in species, as is characteristic of many intact temporarily saturated areas supporting a mix of several different grass, sedge and forb species. Dormancy period long	Maintenance of biodiversity: moderately low to intermediate impact
Sensitivity to depletion of organic matter levels in the wetland's topsoil[2]	Dormancy period short.	Dormancy period long	Carbon assimilation: moderately low[2]
Sensitivity to exposure to atmospheric loss of water	Dormancy period short.	Dormancy period long	Streamflow regulation: moderately low to intermediate
Sensitivity of the wetland erosion	Erosion hazard of the wetland is inherently low and dormancy period short.	Erosion hazard of the wetland is inherently high and dormancy period long	Erosion control: moderately low to intermediate
Level of livestock grazing[3]	Low intensity. Dormancy period short.	High intensity. Dormancy period long	Erosion control: moderately low to intermediate

[1] "to naturally occur in the wetland" refers to the situation where the hydrology, vegetation structure, etc. are suitable for the species, and burning conditions are favourable. Where flufftails and other species are "unlikely to occur", it is because of the hydrology, vegetation structure, etc. are unsuitable rather than the burning regime itself being unfavourable.

[2] It is assumed here that burning is confined to surface fires. If major or frequent ground fires occur then impacts would be very high irrespective of the length of the dormancy period. The impacts of ground fires are dealt with specifically in Section 2.3.

[3] Level of livestock grazing is included here based on the fact that the effect of fire on a wetland may be strongly affected by the level of grazing occurring in the wetland, i.e. fire and grazing interact in their effects.

When conducting a health assessment of a wetland, e.g. using WET-Health, many of the impacts of burning are subtle and are not apparent during a rapid field assessment. It is therefore necessary to infer impacts based upon a joint consideration of the burning regime and the inherent sensitivity of the site. Table 2.2 is used to infer impacts (low to high) based on the sensitivity of the wetland (assessed in Table 2.1) and choosing which description in column 2 best describes the burning regime. Table 2 should ideally be applied at a landscape level to a cluster of wetlands in the landscape but could also be applied to an individual wetland.

Table 2.2: Guidelines for scoring the level to which early winter burning in forestry areas is impacting negatively upon the wetland's health and ecosystem services delivery[1,2]

<table>
<tr><th colspan="2" rowspan="2">A description of the burning regime (the five classes given below are represented pictorially in Figure 2.1)</th><th colspan="2">Level of impact likely to result</th></tr>
<tr><th>Sensitive wetland[3]</th><th>Resilient wetland[3]</th></tr>
<tr><td rowspan="5">Increasing level of exposure ↓</td><td>Some areas of the wetland may burn annually in early winter, but these are limited to less than 5% of the overall area of the wetland. The remainder of the wetland is burnt rotationally[4], mainly in late winter/early spring, but some areas (<20%) may be burnt in early winter.</td><td>Negligible/ low</td><td>Negligible/ low</td></tr>
<tr><td>Some areas of the wetland burn annually in early winter, but these are generally limited to less than 20% of the overall area of wetland. Although most of the wetland is rotationally burnt[4], approximately 20-50% is burnt in early winter.</td><td>Moderately low</td><td>Low</td></tr>
<tr><td>Although at least half of the wetland is rotationally burnt, burning takes place predominantly in early winter (>50% of the area).</td><td>Moderately high</td><td>Moderately low</td></tr>
<tr><td>Most of the wetland burns annually in early winter, but some rotationally burnt areas remain (up to 20% of the wetland). Impacts may be amplified slightly by grazing, but grazing pressure is generally not high.</td><td>High</td><td>Intermediate</td></tr>
<tr><td>Close to the entire wetland (>90%) burns annually at the beginning of winter, and the impacts are often amplified by heavy livestock grazing.</td><td>Very high</td><td>Moderately high</td></tr>
</table>

[1] The rationale for the scoring system is given in the text preceding the table.

[2] The scoring system given above applies particularly to wetlands with a cold winter, leading to a pronounced dormant period. Where the dormant season is very limited then burning at the beginning of winter is not considered to have a significantly greater impact than burning at the end of winter/early spring.

[3] Sensitivity of the wetland is assessed based on the factors described in Table 2.1.

[4] Rotational burning is where an estate is divided into different burning areas (blocks), and from year to year the areas which are burnt are rotated. Thus, if a given area is burnt this year then in the following year/s it is rested from a burn while other areas are burnt. The rest period varies, but for the high rainfall grasslands of South Africa, a two to three year rest is generally recommended.

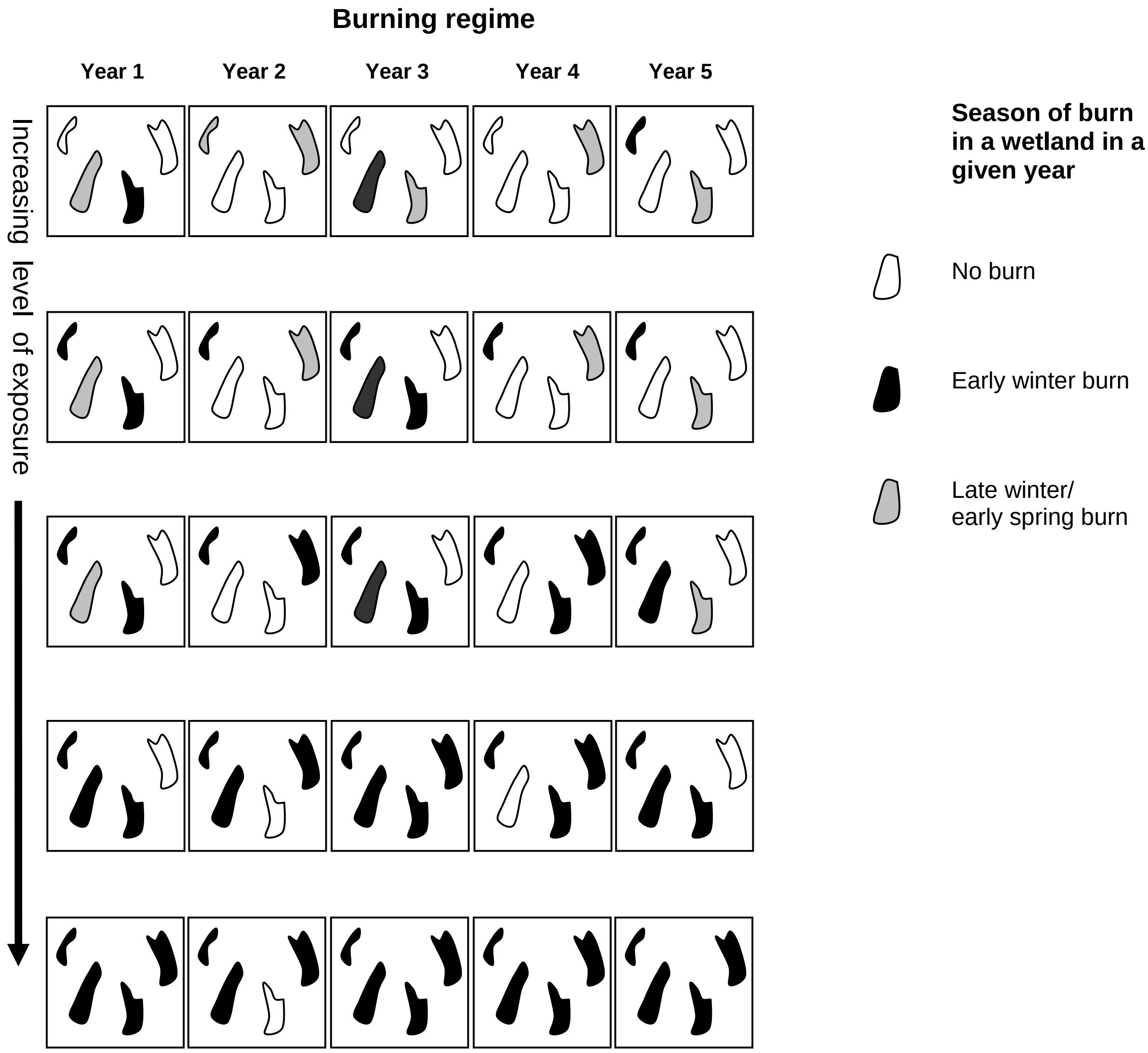


Figure 2.1: Five different burning regimes for cluster of wetlands arranged in order of increasing level of exposure of the wetland as a result of the burning

2.2 Inadequate burning

Naturally forested wetlands have a low capacity for burning owing to the high moisture content of their leaves throughout the year, and are therefore inherently protected against fire. However, naturally herbaceous wetlands are typically characterized by the seasonal accumulation of standing dead material of low moisture content that provides good fuel loads, and are naturally subject to fires. Thus, most herbaceous wetlands have evolved with fire, and if fire is excluded from these wetlands then an important determinant of their natural structure and composition would be altered (Kotze 2010). However, not all herbaceous wetland areas are likely to respond in the same way to the exclusion or suppression of fire - their response would depend on several factors, including other determinants of wetland structure and composition (Table 2.3). Some herbaceous wetlands will probably be little affected by the exclusion of fire (e.g. particularly permanently saturated areas in cold climates, where climate and wetness act to exclude woody plants, and have an overriding controlling influence on vegetation structure and composition). However, other wetlands are likely to radically change (particularly temporarily saturated areas, especially those in warm climates, where woody plants usually rapidly colonize if not excluded by fire). For more discussion of this, see the review of burning (Kotze, 2010).

Table 2.3: A summary of how the specific features of the site that may modify its inherent sensitivity to impacts from inadequate burning

Factors affecting sensitivity	**Level of sensitivity**		**Ecosystem services likely to be most affected**
	Minimal	**High**	
Sensitivity to invasion by woody plants based on wetness and climate[1]	Low sensitivity	High sensitivity	Maintenance of biodiversity: intermediate to very high
Sensitivity to invasion by woody plants based on being recently disturbed[2]	Undisturbed	Very recently disturbed	Maintenance of biodiversity; moderately low to intermediate impact
Importance of water supply to downstream ecosystems[3]	Low	High	Maintenance of biodiversity; streamflow regulation: moderately low to intermediate impact
Sensitivity to loss of plant diversity	Vegetation is inherently poor in species, e.g. a mono-specific stand of *Phragmites australis* or the area was historically cultivated and is currently dominated by a few pioneer species.	Vegetation is rich in species, as is characteristic of many intact temporarily saturated areas supporting a mix of several different grass, sedge and forb species.	Maintenance of biodiversity: intermediate to high impact
Conservation importance of the existing vegetation	Low	High (contains Red Data species and/or is a threatened vegetation type)	Maintenance of biodiversity: intermediate to very high

[1] This refers to how easily a wetland which is naturally dominated by herbaceous plants (sedges and grasses) is likely to be invaded and "taken over" by woody plants given the particular wetness conditions of the wetland and its particular climate. See preceding text and the burning review by Kotze (2010) Fig. 2.2. The exclusion of fire from a herbaceous area that is very vulnerable to invasion by woody plants is likely to result in the herbaceous area being completely taken over by woody plants, generally causing the complete loss of the original vegetation

[2] An area that has been recently disturbed through removal of the vegetation (e.g. for cultivation or timber production) is generally more vulnerable to change in composition and structure than one which has not been subject to such disturbance.

[3] Woody plants commonly growing in wetlands (e.g. *Syzigium cordatum*) generally have higher atmospheric water losses than herbaceous vegetation. Therefore if a wetland which is naturally herbaceous is colonized by woody plants then the amount of water potentially available to supply downstream ecosystems would be reduced. The more important the supply of water from the wetland is to downstream ecosystems, the more sensitive the situation will be to impacts resulting from invasion of herbaceous wetlands by woody plants.

Under warm climates, wetland areas which were previously herbaceous then planted to timber plantations and subsequently withdrawn from timber, are generally vulnerable to developing into woody wetlands. Two factors, at least, contribute to this sensitivity. Firstly, the disturbance and withdrawal increases opportunities for a change to a new state. Secondly, during the many years that the area was under timber plantations, some forest under-story species (and in some cases young trees) may have become established. This, in a sense, gives the woody component a “head start” relative to the herbaceous component once the plantation trees are removed. For example, in the Kwambonambi area in the KwaZulu-Natal North Coast, the fern *Staenoclina tenuifolia*, may establish a dense understory in timber plantations, and when plantations are removed it may persist (being difficult to burn) to the exclusion of fire-adapted herbaceous plants.

Given the situation described above, for a period of a few years following the withdrawal of timber from previously herbaceous wetland areas, an “aggressive burning regime” will be required to assist the herbaceous vegetation to become well established. This aggressive regime would include frequent fires and preferably some relatively hot fires, but if the soil was organic then caution would be required to prevent ground fires (see Section 2.3). In addition, mechanical control of the woody plants may also be required for those saplings that have grown to the point that they are no longer vulnerable to the impacts of fire. Once the herbaceous vegetation is well established then the burning regime could be “relaxed” in terms of frequency and the inclusion of hotter fires, but a relatively frequent burning regime, at least every third year would probably need to be maintained.

Herbaceous wetlands located in very narrow tongues of natural vegetation within forestry timber compartments are generally impractical to burn, and are therefore often protected entirely from fire. In addition, these areas are subject to prolonged shading from the adjacent trees, which would be totally absent under natural conditions. Except for a few shade-specialist species, herbaceous wetland plants are generally not well adapted to shady conditions, and with time they will be greatly reduced in vigour, and may be lost entirely. In contrast, forest precursor species (many being woody plants) as well as several woody alien invasive species will be greatly favoured by the reduced vigour (and therefore reduced competition) from the herbaceous plants. Thus, the increased shading is likely to amplify the effect of the fire exclusion in altering the composition and structure of the vegetation. It is therefore inevitable that in many of the very narrow tongues of natural vegetation within forestry timber compartments the natural herbaceous vegetation structure and composition will change greatly. Thus, if any of these areas have particularly high conservation value, special measures (generally involving further withdrawal of the timber to allow for an expanded buffer) will be required to maintain their natural composition and structure.

Herbaceous wetlands which have become dominated by trees (albeit indigenous) with relatively high transpiration rates compared with the herbaceous vegetation may have very limited biodiversity and hydrological value. This lends support to the concept of “give and take planting”, whereby the extra buffer around those areas of high conservation importance is compensated for (in terms of timber production) by planting through narrow tongues of low conservation value, provided that those areas planted through do not pose an erosion hazard and result in significant downstream hydrological impacts.

2.3 Wetlands requiring special protection from fire

As indicated in Section 1, some peat wetlands which evolved under burning have been desiccated by plantation trees in the upstream catchment so that fires may now easily burn down into the dried-out organic soils. Therefore they need to be burnt with caution. Firstly, annual burning of these areas is unacceptable, given that in an annual frequency there is no flexibility to leave the area unburnt in a particularly dry year. However, if burnt less frequently, then there is flexibility to only burn in wetter years when the soils are less susceptible to ground fires.

Concerning the timing of the burn, the later in the dry season that burning takes place, the drier the soils are likely to be, and therefore the more likely is the occurrence of ground fires. Therefore from the perspective of avoiding ground fires, in a summer rainfall area, an early winter fire may be preferable to a late winter fire. It is important to emphasize, however, that in severely dessicated organic soil, although an early dry season burn presents a lower risk than a late dry season burn, it may nonetheless have a high probability of resulting in a ground fire, particularly in a drier year, or where the level of desiccation is moderately high or high (Table 2.4).

Table 2.4: A system for scoring the level of desiccation of organic soil wetlands that are naturally permanently saturated

Description of the moisture conditions of the wetland soil:	Dries out in exceptionally dry years, but in the remaining years remains naturally re-wetted	Dries out in most below-average rainfall years but is re-wetted in most above average rainfall years	Even in above-average rainfall years the wetland soil remains desiccated, and is only re-wetted fully in exceptionally wet years	Even in exceptionally wet years the soil does not fully re-wet
Score for level of desiccation:	Moderately low	Intermediate	Moderately high	High

Another situation in wetlands that may require special protection from fire is where swamp forests have been disturbed and rendered vulnerable to fire. These may need protection for a few years while they fully recover.

3 How to enhance the ecological benefits and minimize the ecological impacts of burning

3.1 Planning the location, frequency and timing of burns

1. Identify on the estate map all non-commercial compartment areas that support natural or semi-natural vegetation.

2. Demarcate the firebreak areas where annual burning is considered necessary for fire protection purposes.

3. Identify, using the guidelines in Section 2, areas requiring special treatment, including:
    a. Transitional areas identified as needing to be maintained as herbaceous and which if inadequately burnt would follow a successional path to forest (This applies mainly to wetlands in coastal areas, where the climate is warm). These historically herbaceous areas should be identified based on historical knowledge or on past aerial photographs.

b. Peat wetlands requiring particular caution to prevent ground fires, especially in years with low rainfall
c. Swamp forests which require total protection from fire.

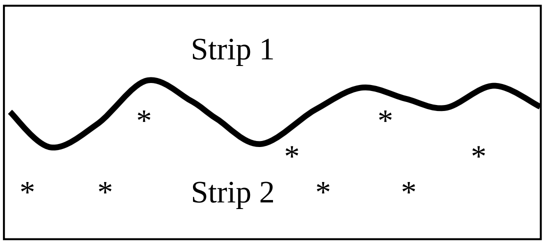
4. Note the location of any breeding areas of late summer/autumn and winter breeding birds, which have special requirements (see Boxes 1 and 2)

5. Designate the remaining demarcated areas to be burnt on a biennial basis

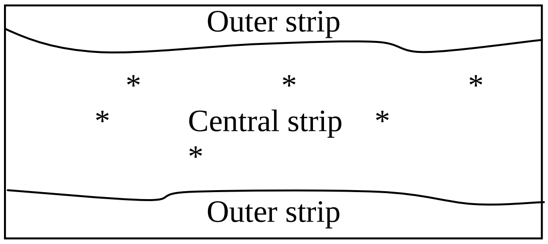
6. Re-examine the designation of the annually burnt firebreak areas using the guidelines in Section 2 to identify where annual burning is likely to have high impacts and to see if some of these could be re-classified as biennially burnt portions without unduly compromising the fire protection of the plantations. Annual burning is only acceptable where absolutely necessary. Wide wetland areas and wetland areas adjacent to grassland can potentially be burnt biennially using strip burning[2].

Strip burning can be carried out in two ways. (1) The wetland corridor is divided into two parallel strips, which are burnt alternatively. If a stream channel is present, this can be used as a convenient natural tracer line between the two strips. (2) The wetland corridor is divided into a central strip and two outer strips, which are burnt together, alternating with the central strip. Roads may often provide a useful tracer line for demarcating the outer strips from the central strip.

Strip burning using two parallel strips and a central stream as a trace



Strip burning using two outer strips and a central strip



When planning the burning system and setting management objectives it is important to have a broad landscape view. Think in terms of optimizing the total area of wetland rotationally rested from fire within the estate. It is difficult to prescribe acceptable levels, as these will be strongly affected by the extent to which a particular estate has been planted to trees and the risks of arson and runaway fires, which serve to restrict the extent to which open areas can be left un-burnt in a particular year. The severity of both of these factors may vary considerably form estate to estate. As an absolute minimum, every estate should aim to have at least 50% of the wetland area burnt biennially.

Remember that the situation both within the estate and in neighbouring lands is dynamic. For example, the hazard from arson fires may change over time. Therefore the fire plan is likely to require a periodic review.

[2] The narrower the wetland and the buffer around the wetland, the more limited will be the scope for strip burning, and the greater will be the tendency for management to annually burn the wetland to eliminate the fire hazard it poses to the trees. Therefore when withdrawing trees to create and expand the buffer around wetlands, an important factor to consider is the extent to which this will allow the increased extent of areas rotationally rested from burning

3.2 Implementing burns

The following generally applicable recommendations are made, aimed at reducing the extent, intensity and damage caused by fire.

- Generally aim to promote a cool and patchy burn by burning when the relative humidity is high and the air temperature is low, preferably after rain. Such fires, result in more vegetation cover remaining for wildlife. However, if fire is to be used to assist in controlling the invasion of woody plants into herbaceous areas then occasional hot fires are desirable (see Section 3.1).

- Head fires (burning with the wind) are generally preferable to back fires (burning against the wind). Temperatures at ground level tend to be higher in back fires and consequently the impact on the growing points of plants is greater. Although the fire front advances less rapidly in a back fire, direction is more difficult to predict. Also, because the fire front advances more rapidly with head than with back fires, particularly if the wind speed is high, the fire has less time to spread laterally. Thus, head fires can be used more effectively for burning only portions of the wetland without the use of fire breaks. However, this method of burning portions of a wetland is dependent on many factors outside the manager's control, such as wind direction changes, and cannot be relied upon for consistent block burning.

- If conditions are unfavourable for burning (e.g. if the soil is very dry and susceptible to sub-surface fires, which is particularly important for peatland areas) delay burning until the following year.

- Give preference to burning areas with abundant dead (moribund) stem and leaf material that is obviously limiting new growth.

- Protect areas known to be important bird breeding areas (e.g. reed marsh areas used by herons or sedge marsh areas used by ducks) but even these may need to be burnt every fourth or fifth year to stimulate new plant growth.

Box 1: Burning recommendations to account for the grass owl (*Tyto capensis*), marsh owl (*Asio capensis*) and African marsh harrier (*Circus ranivorus*)

In areas in which these species breed, burn rotationally through block burning and check before burning by having 'beaters' 10 m apart walking through the area and then closely examining all localities where these birds are flushed (D Johnson, 1993. *Pers comm*., KwaZulu-Natal Nature Conservation Services). Leave areas unburnt where chicks have still not fledged, or, if possible, delay burning for that year.

Box 2: Burning recommendations to account for the wattled crane (*Bugeranus carunculatus*)

The wattled crane is a winter to early spring breeder. Thus, if this species is breeding in the wetland then:

- If a nest with eggs is present temporarily remove the eggs and place in a small incubator (an insulated box warmed with hot water bottles can be used but do not place the eggs directly on the hot water bottles).
- Consider delaying burning until the chick can fly and therefore escape the fire
- If burning cannot be delayed long enough then attempt to catch the chick, perform a patchy burn and then release the chick after the burn. Alternatively, if the chick cannot be caught (which will probably be the case) observe where the chick is at the time of the burn and burn strategically, sometimes having to burn a break around where the chick is hiding.
- In all cases it is vitally important that a patchy burn is performed so as to leave sufficiently tall vegetation areas for the chick to hide from predators.

It is recommended that where specific advice for cranes and burning is required, assistance be sought from the Endangered Wildlife Trust's Crane Conservation Programme.

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