Department of Conservation
*Te Papa Atawhai*

***Internal Correspondence***

*Our ref:* ***DOCDM-1026844***

To: Steve Edwards

From: Rachael Thorp

Date: 16 July 2012

---

Subject: **Baring Head Fire Risk Assessment**

---

## Background

A proposal has been put forward to cease grazing on the Baring Head reserve which is part of East Harbour Regional Park. Predominant fuel types on the reserve are coastal scrub and grass which is kept low due to current grazing. Current access is on foot only with some permitted vehicles e.g. Regional Council, private landowner and vehicles with a permit only. Horse riding is allowed by permit only. Vehicles can and do illegally cross the Wainuiomata river mouth. This means they can drive round to the rock climbing area and at low tide could navigate round the boulders to get access to the western coastline and the interior of the reserve from the coast.

## Issues

Removal of grazing will mean a change in the vegetation cover over the entire reserve and a change in the fire risk. To accurately determine what this risk would be over time I suggest having some fuel plots cordoned off from current grazing to determine what height the grass would grow to in the conditions on the south coast and the other species that are likely to establish over time. The fuel at Turakirae is a similar environment to Baring Head with no grazing. The grass in this reserve is approx knee height on an average adult.

The image below, also of Turakirae shows a mixture of tussocks, grass and coastal scrub in the non grazed area.

Department of Conservation
*Te Papa Atawhai*

## *Internal Correspondence*

Gavin Wallace has provided some information on fire behaviour in his report giving actual values. This information best represents a prediction on fire behaviour on an average mid summer day for the south coast. As the fuel type changes by adding a mixture of gorse and other coastal scrubs with tussock the fuel load increases from 1.7 tonnes per hectare for grazed grass to approx 20 tonnes per hectare with the mixture of fuel types and ungrazed land. This has a huge impact on fire intensity and the ability for the fire to be extinguished. Rates of spread will increase with slope and also a change from grazed to ungrazed land which in turn also increases fire intensity.

Fire breaks in this area would be costly to maintain. Using the fire behaviour prediction tables and the figures supplied in Gavin Wallace's report a fire intensity of 12,000 kW/m would require an 11m fire break to have a 0% probability of the fire breaching the break in grass fuels. This increases with the addition of scrub (e.g. gorse) to an 85% chance of a fire breaching an 11m fire break.

Land status has changed with more recreational users and increasing visitor numbers over time. This will mean an increase in fires and an increase to the risk of the visitors in the park should a fire occur. A number of fire callouts occur currently to the east of the Wainuiomata River with people visiting, illegally lighting campfires or poaching and lighting fires then leaving without extinguishing them. Due to the remoteness of this coast fires often go unnoticed for some time allowing them to take hold before fire vehicles arrive. The photo below shows a recent fire at Turakirae Head Scientific Reserve as an example of these fires.

Fire vehicles are unable to cross the current bridge and would need to ford the river to get access for firefighting. Water supplies for the interior of the reserve are also minimal meaning a large fire would need helicopter response and depending on sea conditions either dipping out of the sea or hand filling from portable pumps set up from the river. The NZ Fire Service (Wainuiomata Volunteer Fire Brigade) provides first response for fires in the valley and their vehicles are unable to go off road or use the current bridge. Wainuiomata Volunteer Rural Fire Force should be put on first response to this area as well.

A wildfire threat analysis was undertaken in 2004 which shows a threat of high to very high with the current values, risk and hazard layers. A change in these layers by a change in land use, fuel type and biodiversity will likely increase this threat from very high to extreme. For more information on the wildfire threat analysis project refer to the national rural fire authority website.

Private land owner risk will be increased with an increase in fuel around their property for the same reasons discussed above.

**Recommendations**

1. Continue current grazing over the reserve while undertaking research which may be over the next ten years.

2. Have some areas cordoned off as fuel research areas to determine what the risk would be if grazing was removed. This would allow a scientific approach of the risk to removal of the grazing and a history of land use and illegal fires in the reserve area to build up. Part of this research would also be the possibility of grazing zones e.g. grazing the coastal escarpment and having no grazing in some areas above the coastal escarpment and the private property.

3. Have a multi agency fire plan in place for the reserve area which would include discussion on current call out details with the NZ Fire Service, Wainuiomata Volunteer Rural Fire Force and Department of Conservation to enable appropriate vehicle access via the bridge to respond and assess the situation on receipt of a fire call.

4. Ensure the private landowner knows the current risk and problems for fire vehicles to access their property. They should be given information on fire sprinklers and other mitigation measures to reduce the risk with an increase in visitor numbers.

Rachael Thorp
TSO Fire
(04) 470 8410

## Fire Risk - Baring Head Reserve

Should the proposal to stop grazing on the Baring Head reserve be implemented, then the intensity of a fire occurring in that area will certainly be heightened, and the severity of consequences increased. Fire intensity is measured along a vegetation fire front by integrating the heat energy released across the depth of the active fire at each metre of front. Think of a rectangle 1 metre wide, and with a side corresponding to the depth of the fire line. The intensity is quoted in kilowatts/metre of fire line, kW/m. Obviously, the head of a fire will have the highest intensity. And, as the intensity increases, the depth of the fire line will also increase.

Our system of denoting fire danger, as shown on the familiar half-grapefruit roadside signs, is based on the expected fire intensity. The threshold for the transition from Very High to Extreme fire danger corresponds with a frontal fire intensity of 4,000 kW/m. Between 4,000 and 6,000 kW/h, fire control is marginal, and it becomes impossible beyond 6,000 kW/h, no matter how many helicopters and resources are used. With such fire intensities, it is necessary to withdraw and wait for conditions to ease before engaging in suppression operations. Note that this fire danger assessment is independent of the type of vegetation involved.

One example of an extreme grass fire occurred at Tikokino, Hawkes Bay, on 31 January 1991. The grass was only 100mm high, but fully cured, and weather conditions were 24.5 °C and relative humidity of 31%. Driven by a wind of 56 kph, the rate of spread of the fire was 12 kph, and the frontal fire intensity peaked at 13,970 kW/m. The 2000 Boxing Day fire on the grassy Wither Hills of Marlborough burnt under weather conditions of 27.7 °C, RH 29% and wind of 37 kph. It was estimated that on the flat, the rate of spread was 10 kph with an intensity of 18,500 kW/m; on a 10° slope, these parameters escalated to 16 kph and 41,000 kW/m. That fire burnt out about 6,600 ha. Closer to home, an experimental burn in 10 year old gorse at Coast Rd, Wainuiomata, on 6 April 1994 spread at 0.9 kph with an intensity of 18,000 kW/m and flame lengths reaching 10-15 m. The weather conditions were such that had this experimental burn been done in a pine forest, the fire would have fizzled out and died. It demonstrated that gorse is one of the most flammable vegetations in the world. Under less benign weather, a later experimental burn on Coast Rd demonstrated fire intensities up to 80,000 kW/m.

The proposal to cease grazing at Baring Head will cause a transformation in the type of vegetation cover. This area has a microclimate somewhat distinct from Wainuiomata further to the north. In a good summer, the golden colour of the Head is more akin to the Marlborough hills, indicating a high degree of grass curing. Ungrazed, grass will become longer, possibly tussock may evolve, and shrub species such as gorse or manuka/kanuka could invade. These are all termed flashy fuels, meaning ignition is easy and rate of spread is rapid. Over many years, rural fire researchers of Scion have researched wild and experimental fires to produce reliable models that predict fire intensities and rates of spread under different weather conditions and fuel loadings. In the case of grasses, the primary environmental factors governing fire behaviour are fuel loading, degree of curing and wind speed. The degree of curing determines how much of the fuel loading is available to burn. The following table provides an indication of the escalation in potential fire behaviour that will result from cessation of grazing at Baring Head:

| curing = 25% | wind = | | 30 kph | | | 60 kph | | |
|---|---|---|---|---|---|---|---|---|
| **fuel** | **H m** | **t/ha** | **kph** | **kW/m** | **FL m** | **kph** | **kW/m** | **FL m** |
| Pasture - grazed | 0.1 | 1.7 | 0.067 | 57 | 0.5 | 0.142 | 120 | 0.7 |
| Pasture - ungrazed | 0.2 | 4.3 | 0.081 | 174 | 0.8 | 0.188 | 408 | 1.2 |
| Tussock - ungrazed | 0.3 | 20 | 0.051 | 515 | 1.4 | 0.152 | 1,527 | 2.3 |
| | | | | | | | | |
| **curing = 50%** | **wind =** | | 30 kph | | | 60 kph | | |
| **fuel** | **H m** | **t/ha** | **kph** | **kW/m** | **FL m** | **kph** | **kW/m** | **FL m** |
| Pasture - grazed | 0.1 | 1.7 | 0.375 | 317 | 1.1 | 0.795 | 672 | 1.5 |
| Pasture - ungrazed | 0.2 | 4.3 | 0.450 | 976 | 1.8 | 1.053 | 2,281 | 2.7 |
| Tussock - ungrazed | 0.3 | 20 | 0.472 | 4,730 | 3.8 | 1.400 | 14,024 | 6.3 |
| | | | | | | | | |
| **curing = 75%** | **wind =** | | 30 kph | | | 60 kph | | |
| **fuel** | **H m** | **t/ha** | **kph** | **kW/m** | **FL m** | **kph** | **kW/m** | **FL m** |
| Pasture - grazed | 0.1 | 1.7 | 1.865 | 1,577 | 2.3 | 3.951 | 3,340 | 3.2 |
| Pasture - ungrazed | 0.2 | 4.3 | 2.239 | 4,850 | 3.8 | 5.235 | 11,339 | 5.7 |
| Tussock - ungrazed | 0.3 | 20 | 1.728 | 17,308 | 6.9 | 5.124 | 51,318 | 11.4 |

In this table, H is the fuel height (with an understorey of 200mm assumed for tussock), and the fire behaviour values are calculated for a Fine Fuel Moisture Code (FFMC) of 90, equivalent to a warm day around the peak of summer in this area. Even in a very dry summer, curing is unlikely to get close to the maximum 100% in this part of the country. FL is the ensuing flame length. Clearly, cessation of grazing will potentially result in much greater fire intensities.

Historically, what has been the incidence of fires in the vicinity of Baring Head? The largest one occurred on the 23 February 1973 when a fire escaped from the vicinity of Turvey's homestead south of Eastbourne in Gollan's Valley. The buildings were saved that night, largely with backfires, but over the next few days the fire burnt its way unchecked to Baring Head, consuming several thousands of acres in the process. While there has subsequently been many wildfires in the valley south of Wainuiomata, Baring Head has been spared. A pole fire was dealt with on 31 January 2002, but this did not ignite the grass. More recently, there have been numerous drift wood and a few scrub fires on the Wainui Beach but these are usually east of the Wainuiomata River estuary. One beach fire was at the foot of Baring Head, and spread into the hillside scrub, but was suppressed before it rose very far.

While history may suggest a low fire risk at Baring Head, it could be argued that past experience is not relevant given the change in use of the land. Now that the area has become a recreational park, it has become popular with walkers, with fire risk has increasing as a consequence. Furthermore, the enhanced fire behaviour that would result from cessation of grazing will increase the danger to these walkers of entrapment should a wildfire occur. The area is difficult to access quickly as our fire trucks can no longer use the Baring Head bridge and must pass through private land to ford the Wainuiomata River. And once on the peneplain, open water supplies are non-existent for ground fire suppression operations. Any sizable fire will require helicopters picking up water from the sea.

In conclusion, I urge that the proposal to stop grazing on Baring Head be rejected. If it were granted, there is a real possibility that the special environment that makes the reserve uniquely appealing and attractive could be destroyed.

Dr Gavin Wallace QSM
Controller, Wainuiomata Bushfire Force
Deputy Principal Rural Fire Officer, Hutt City Council

# FIRE RISK ASSESSMENT BARING HEAD RESERVE

I have looked at the assessment Dr Wallace has completed and as expected he has provided you with a comprehensive and factual break down of the science behind a potential fire that could affect the reserve.

Dr Wallace has highlighted the factors that all fire managers need to take into consideration, topography, slope, fuel loading, and potential fuel loading, wind, weather, temperatures and potential fire head intensity.

I intend to respond to you from a practical prospective, more of 'hands on' fire response.

After my visit to the reserve, I believe that your greatest threat of wildfire will come from the beaches and lower slopes that are easily accessible by the public.

In the Wellington coastline across the harbour, beach fires and subsequent sea face spread fires were a regular occurrence. The majority of fires were caused by humans. 4 x 4 adventurists, or fishermen / poachers lighting fires on the beach or in the scrubland above the beach. If these fires were not properly extinguished by the fire lighter and left, the fires would continue to burn in the subsurface / available drift wood and if the wind came up overnight, the fires would eventually be pushed towards the lower escarpments and heavier fuel loading and this resulted in a wildfire spreading up the seas faces, being driven by the slope and wind.

WCC has managed to almost completely eliminate the beach fire problem by identifying locations where fires can be lit and safely used by the public. These locations are easily accessible and can be reached by the fire services to extinguish any potential problem fires before they case to many problems. When members of the public know an area they can go to have a fire, they no longer go around the coast to have their fires. Over the last 5 years there have been no sea face fires.

## The fires

In the Baring Head Reserve, if a fire was started on the beach and spread to the reserve escarpments, it would be quickly spotted by the public, ferries, aircraft etc. There is a good access road that the NZFS could respond their closest vehicles in a short time. Depending on the sea conditions, the NZFS initial truck may have a Wajax fire pump and can draught from the sea to start initial fighting the fire. As per SOP's for vegetation fires, the WBFF would be responded to take over the / any extended fire response.

Keeping in mind the location of the reserve and with the experience of Dr Wallace and his crews, a helicopter/s would be called very quickly to support the fire crews. The flight time for a helicopter from Wellington is less than 5 minutes and the helicopter could arrive already fitted out with monsoon bucket. The helicopter would dip fill from the sea and under supervision will attack the fire and work towards containing the fire edge, and provide close support to the ground crews.

Unfortunately, in the worse conditions (hot, dry and windy), a wildfire would travel very quickly through the fine fuels. The heavier fuels on the escarpment would send countless embers into the air. These embers would be carried by the wind and land on receptive dry ground on the tops and the fire would quickly spread.

Historically, fires around NZ that have occurred in similar locations / conditions have moved very quickly. Dr Wallace has sited a couple of these fires, Wither Hills is a classic example where the fire was being driven at the same speed as the wind and the ground based fire crews were quickly overwhelmed and could not keep up with the fire as it consumed everything in it's path. That fire grew to 6000ha.

Geographically, the Baring Head Reserve is a narrow stretch of land. A fire could cross the reserve in a little as 20-30 minutes depending on the wind. Once on the leeward side of the reserve, in strong winds, the wind would create a lee side rotor / vortex and hopefully turn the winds back on the fire and slow the progress. The fire crews will know this and may choose to use an indirect strategy and work on this area instead of chasing the fire across the open tops. Fortunately the Wainuiomata River side of the fire would work in the fire fighters favour. The fire would slow down as it burned downhill and it would have to jump the Wainuiomata River, but if the wind was strong enough and the fuel loading heavy enough, embers could be picked up and blown across the river. If the fire crossed the river, there are very little unbroken fuels between there and the Rimutaka Forest Park.

The prospect of fighting a fire with an elevated fine fuel loading on the tops of this reserve, due to cessation of grazing is not something that I would like to be planning for. If the grazing is stopped, the grass and tussock grasses will grow untouched. This will create a much greater fire danger.

To support the decision making process, I suggest that an experiment be conducted over the next 6 months. In three separate areas of the reserve, on the open tops, 2 x 2 meter areas are fenced off to keep the stock out. Keeping the stock away from these areas will give a good indication of how the grass and tussock grass will grow if the open grazing is ceased. Over the period of the experiment, records of the grass growth should be kept. At the conclusion, a destructive test should be carried out and this will give an accurate indication of the available fuels in the non grazing areas. This data can then be used to calculate the potential fuel loading of the tops of the reserve and that will consequently give the fire planning managers a set of figures that they can use to work out the plan of what resources and numbers of staff they will require to affectively respond to and contain a wildfire.

I have not taken into consideration the buildings and infrastructure by the lighthouse. The response to this area will depend on the fire conditions on the day and the fuel loading. If the fire has spread across the tops, the fire crews may not be able to reach the buildings to fight any fires. The NZFS do not have fire trucks that can access the area due to the bridge loading across the Wainuiomata River and steepness of the access road. Because there is only limited water on the buildings site, what the fire crews can do will be limited by the amount of water they can take with them, or how much water can be dropped from the helicopters.

Aerial fire fighting on structures is rarely successful and it may be more productive to stop the fire reaching the buildings in the first place. I fire break may be required surrounding these buildings / lighthouses.

**Members of the Public**

Any members of the public on the reserve will be limited to where they can escape an approaching fire. Unless there are well defined and signposted escape routes, members of the public will be left to their own devices to escape the fires. This is often not successful as the smoke and fast moving fire will cause confusion and the public to panic and potentially run in the wrong direction or get trapped. This creates its own issues where saving life / evacuating members of the public takes priority over any fire fighting. Plans will have to be drawn up for this contingency. I do not believe this report should address this matter.

The use of the reserve at Baring Head may have to be limited at different times of the year. During the summer months, when the potential 'un-grazed' grass is long and rank, any motor vehicle with a low slung exhaust may cause a fire. Any motorbike with a two stroke engine may emit hot pieces of carbon, than can start fires on receptive fuels. Even a motorbike falling on its side will cause a hot exhaust to come into contact with the fuels and start a fire.

Any maintenance activities like mowing tracks could be a potential source of fire. The Ward fire in the Wither hills was started by a farmer mowing his paddock. The mower blades struck a rock and the resulting spark started the fire. That fire burned 2,000ha and took three days to extinguish.

I have given you a few potential scenarios and maybe worse case scenarios of a fire on the hottest, windiest day in Wellington. As a fire manager, I always plan for the worst and hope for the best.

On the day in question, if the worse case scenario happens, the Wellington area has a Regional Incident Management Group that will come together and manage the fire. Experts in fire fighting, fire science / fire behaviour, and air operations will be responded. The fire will be very high profile because of the location but with the excellent working relationships in the region and the availability of good quality rural fire fighting resources, the fire will be dealt with very quickly.

*Jock Darragh*

Jock Darragh (FOG)
PRFO
Wellington