PROFILE FOR ECOLOGICAL FIRE MANAGEMENT OF MABUIAG ISLAND

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1. INTRODUCTION

Mabuiag is one of several inhabited islands in the Torres Strait on which fire plays an integral role in maintaining its natural habitats. As such, this document details the requirements for ecological fire management on the island, as much as they can be ascertained from current knowledge of the island habitats. It is intended that the practices and programs outlined in this report will be the responsibility of the rangers and therefore, to guide them as much as possible, these reports go, in some detail, into the history, theory, and practice of what will be referred to as prescribed burning. Particular emphasis is placed on its traditional aspects.

Prescribed burning refers to the planned use of fire; it is not synonymous with the term “back-burning” which is sometimes used, and fuel-reduction burning is but one form of prescribed burning which is done with the much narrower aim of reducing the intensity and spread of unplanned fires (bushfires or wildfires).

The report should be read in conjunction with similar reports for Moa and Badu, Mabuiag’s nearest inhabited island neighbours. The management of fire on these larger islands is considerably more complex, due largely to the greater diversity of habitats and landscape and as such these reports present a much more detailed synopsis of the rationale for burning and fire management in general.

The three islands of Mabuiag, Badu and Moa, as for the majority of island in the Torres Strait, have mostly intact natural environments and sit in what has been identified as one of the most pristine parts of the world’s oceans. For this the thousands of years of stewardship of the area by the people of the Torres Strait must take much of the credit.

1.1 The Need for Fire Management

The vegetation of Mabuiag Island, as we see it today is shared with that of Cape York Peninsula and is the end product of at least 60 million years of evolution that has seen gradual but continual change in its structure and species composition. That change was imposed by changing climate and changing landscape as mountains formed and were eroded, and the sea rose and fell. Ever present however, was fire, first ignited by lightning, and then by the firestick of man. Its influence would always have been dramatic as it sifted from the landscape those species which could not tolerate its varying regimes of frequency and intensity, and favoured others more tolerant. The arrival of man would have brought the most dramatic and rapid changes of all as infrequent but hot and widespread fires were replaced by frequent numerous and smaller ones. Man effectively took charge of fire to use it in many different ways to manage and shape the landscape to serve his own requirements of safety, ease of access, and food supply. The anthropologist Rhys Jones (Jones, R. 1969)

coined the term “firestick farming” to describe this process. Undoubtedly man shaped fire to serve his ends, and in the process fire shaped man as it changed the landscape and thus the way man adapted to live within it.

It seems certain that, in the last century or so, much that was traditional in the way fire was used on the island has largely been abandoned, and undoubtedly the island’s vegetation has changed as a result. That these changes have clearly not been dramatic would be due to the fact that most of the landscape is still subject to fire at fairly regular intervals. From on ground evidence, it is apparent that the emphasis in burning has now shifted to late in the year and is less discriminatory. Where some habitats are burnt annually, other areas are left to the chance occurrence of wildfire.

In spite of the changed emphasis, under the current fire regime the island’s habitats are being maintained, and appear to be in what, by any comparison with similar habitats elsewhere, could be described as excellent condition. If it were possible (and while the island remains inhabited it would certainly not be) to remove the influence of fire from the island altogether, change, far more dramatic than that brought by the arrival of man, would be initiated. From what the writer has seen of the effect of withdrawal of fire for 70 years and more, over thousands of square km of eastern Cape York Peninsula, it is clear that the loss of regular fire from the islands’ vegetation would, in a few decades, initiate change in most of its habitats that would be unpredictable but make it very different in structure and species composition from that at any stage when man was present. Because the speed of change would not allow the gradual adaptation of species to their changing environment, many species of plants and animals and their habitats would be lost.

1.2 The Situation Elsewhere

Comparable habitats to those on Mabuiag are found covering large areas of Cape York Peninsula. The writer’s (Peter Stanton’s) comments in this section are made on the basis of experience in working on Cape York Peninsula with both the Queensland Department of Forestry and the Queensland National Parks and Wildlife Service, at various periods spanning almost 40 years, but mostly concentrated between 1972 and 1997. His responsibilities involved initially exploratory surveys and later land management of areas acquired as National Parks. During that period it was possible to observe the effects of the extremes of fire regimes over vast areas of countryside. Except for the situation on some National Parks fire was mostly unmanaged.

Over large areas of north-eastern Cape York Peninsula, fire had disappeared with the removal of aboriginal influence during the 1930’s and 1940’s. Over most of the remainder of the Peninsula, however, a wildfire regime prevailed, with individual fires burning for weeks or months during the drier and hotter part of the year. In the former situation, the wildfires

burning on the western side of the Peninsula never penetrated because they came against barriers of numerous rainforest lined creeks. As a consequence fire sensitive species, such as those found in rainforest and cypress pine, have invaded former open forests and changed them to closed forests that will no longer carry fire. Where late season hot fires prevail they are destroying hollow trees, so essential for many species of wildlife. In addition these fires destroy most of the litter layer which protects soils from the erosive power of the first storms. Many parts of the Peninsula are also subject to pressure from grazing animals, both domestic and feral, which has altered or destroyed the ground cover vegetation in wide areas around streams and wetlands, facilitating erosion and invasion by weeds.

It is a remarkable observation that, because of a better fire regime over a long period of time, the absence of significant grazing pressure, and freedom from invasion by exotic weeds, that the habitats contained within the insignificantly small islands of Moa, Badu and Mabuiag when compared to the vastness of Cape York Peninsula, are now some of the best examples to be found in relation to pre-European condition. The reason for this is clearly that these islands have remained populated since European contact, and have not developed a grazing economy. Much of Cape York Peninsula is now what it has not been for possibly 40,000 years or more, a wilderness – a land which has lost its people, and its natural landscapes have suffered accordingly.

1.3 The Value of Effective Fire Management

It is clearly established that most Australian vegetation has evolved with fire and that the particular expression of any habitat (vegetation type) at any time, is, in the absence of disturbance such as clearing or heavy grazing, or the short term effects of cyclonic wind, determined by its fire regime. A fire regime is defined by the number of fires that occur over a given period and their intensity, and these things must be measured over a time period long enough to be meaningful. If a long established fire regime changes, then the habitat will begin to change in ways that disadvantage some species of plants and animals, and advantage others.

It needs to be recognized that there is much antipathy to the use of fire within the Australian population. It is found at all levels of society from the man in the street to the academic community. It is largely an urban or near urban phenomenon, but is also common in large areas of rural Australia where the use of fire is not seen to have any role in land management. This attitude ignores the now indisputable fact that fire in the hands of pre-European Aboriginal and Islander Australians played a pre-eminent role in determining the nature of the vegetation and landscape that European Australians inherited. There would appear to be no rational basis now for abandoning that ancient order for the hazardous and uncertain future of land management without fire.

Central to the distaste felt by many for the suggestion that fire should play a major role in the management of natural lands for the maintenance of biodiversity is the deeply ingrained belief that fire can only be a destructive force. It is a belief that is continually reinforced by the recurring catastrophic fires of southern Australia, with loss of homes and lives. That these fires are fuelled by huge accumulations of litter as the result of long exclusion of fire, generally escapes attention. Considering its role in shaping the Australian bush, however, fire is as natural a factor as wind and water.

In the hands of a skilful land manager, fire can be many different things, each used in different ways to achieve different results. In the hands of indigenous land managers it was, for tens of thousands of years, mostly a gentle force that shaped the land to their desire, and in turn, with time, gradually shaped their society. Indigenous land management gave to modern Australia the habitats, vegetation, and wildlife of which we are so proud, and see as the iconic features of our national identity, but have been, for more than two centuries, progressively destroying. There is, however, for most of Australia, no option of returning to that traditional management. Most of what are recognized as natural environments have changed from those that the indigenous people once tended. They have been subjected to altered fire regimes; to logging and mining; to widespread invasion by introduced animals and plants; and destructive pressures from recreational users. In these environments the purposeful use of fire is still critical to their management, but now must often be used in ways that are remote from traditional indigenous practice. This does not, however, apply to Mabuiag Island. Here, because regular fire has been retained and the island's environment has not been significantly degraded by the factors referred to above, there is an opportunity to re-establish traditional practices. It is an opportunity shared only with the more remote parts of northern Australia, but currently being seized only in few areas in central Australia and in Arnhem Land. On Mabuiag, Badu and Moa Islands, and a number of other islands of the Torres Strait, there is a unique opportunity to demonstrate what high quality land management in the high rainfall (+ 1,500mm/annum) section of north-eastern Australia should be, using the power, precision, and skills of traditional burning.

1.4 The Nature of Effective Fire Management

It is known from the historical record, early studies of traditional land management, and contemporary studies of surviving practices in Arnhem Land (Russell-Smith et al, 2009) that they could be characterized by certain features. The extensive historical research of Gammage (2011) also demonstrated that these features were common to indigenous practice in all parts of Australia (including the island of Tasmania).

These features were:

- Fire was used purposefully to shape the landscape in ways that provided maximum advantage for ease of access, to facilitate the capture of game, and to protect and promote plant food resources.

- Large fires were few; numerous small fires were lit progressively during the year.

- Aboriginal people used fire to manage the fuel around them.

The logic of the last feature is clear if one looks at it from the perspective of people who lived with fire. They camped with fire, and they carried the fire stick with them wherever they went. They could not safely tolerate conditions in which a stray spark could ignite a large and uncontrollable fire. Clearly, they could not have survived under the current conditions in the bush in most of southern Australia.

The fine scale of traditional fire management is rarely appreciated today. In essence it involved the use of thousands of small fires in areas which today are burnt by rare single fire events – often decades apart. The anthropologist Rhys Jones, for example, estimated that in the better populated areas of Australia, in an area of thirty square km that would have supported a band of roughly 40 people "Assuming that on average, three foraging parties of various types left camp per day, that each lit 10 bushfires and that this happened on only half of the days of the year, then within that area, no less than 5,000 bush fires would be lit each year". He went on to state that he considered that to be a highly conservative estimate.

2. A PROPOSED APPROACH TO FIRE MANAGEMENT ON MABUIAG ISLAND

The precise direction of fire management on Mabuiag will have to depend on some measure of community consensus, and the resources available to carry out any particular program. It must be stressed that without majority community support the pursuit of any program could be difficult. The alternatives for fire management on Mabuiag Island are threefold:

a) To let things continue as they are;
b) To attempt, in part of the island or all of it, to permanently remove fire from the landscape;
c) To establish purposeful fire management over part or all of the island.

Dealing with each or all of these in turn:

a) It is acknowledged that the island's habitats are generally in good condition, and the question would naturally arise, if that is so, as to what purpose would trying to change things serve? From on ground observation, it is apparent that some habitats are regularly burnt in

hot and dry conditions, in particular those habitats adjacent to and behind the township. From discussions with rangers, there is concern that these fires threaten residential areas and associated infrastructure. Other less accessible areas are not burning at all, or in a sporadic fashion. Some areas of grassland at Talai and Wagedugam on the islands north facing coast are suffering from encroachment of melaleuca shrubs in some locations.

The current fire regime is imposing a fairly uniform burning pattern over the majority of the island which is the antithesis of what would have happened under a traditional burning regime which would have consisted of numerous relatively small fires, spread evenly across the islands flammable habitats over a period of several months. The current fire regime is not providing the variety in the landscape essential for long term maintenance of the island habitats and survival of associated species of plant and animal. A particular threat to the reproductive cycle of many species would certainly arise from the confinement of most fires to the same location and same narrow calendar time each year.

Clearly, the situation could be improved, and the maintenance of the various habitats of the island, for whatever purpose is determined, can only be guaranteed by having clear goals and acting to attain them. In brief, to let things continue as they are would be to rely on continuing good luck and thus to gamble with the future.

b) It is a fact that cannot be avoided that in the island situation, dominated by fire derived and fire prone vegetation, and with a resident population, it would be impossible to permanently exclude fire from the island or any large portion of it. All it would do would be to shift the fire regime to one of less frequent and mostly hotter fires that could potentially be destructive of some values, both cultural and natural, that are precious to the community. Such attempts would also destabilize the island's habitats, which, under a new fire regime would begin to change in numerous ways, largely predictable, but varying in degree and type according to the habitat considered.

c) To take charge of the island's future by actively managing fire throughout its habitats would seem to be the most appropriate of the three options to pursue, and it would best be done by trying to re-establish traditional practices as far as they can be determined or assumed to have been. It would have the clear benefit on top of those to the island's habitats, of necessitating the development of a detailed knowledge of the island, which in turn would foster much interest in it and a greater sense of ownership among those participating.

2.1 Principles for Effective Fire Management

There are two important principles that are central to actions recommended in the plan that follows. They are the principled of patch or mosaic burning, and the principle of a step by step approach to full implementation of the plan.

1) Patch or Mosaic Burning

Central to all recommended actions is the concept of patch or mosaic burning. This has been touched upon in previous sections of this report but is described more fully in the following paragraphs.

In pre-aboriginal Australia lightning was the main source of ignition and individual fires would have burnt over large areas. The aborigine tamed the lightning; he had to. By managing the fuel around him he deprived lightning of its potency, and guaranteed security for himself and his food resources. He turned the landscape into a mosaic of numerous cool fires where previously few fires but large and hot ones would have raged, fed by accumulations of fuel over large areas, and ignited by the lightning of dry summer storms. The later arrival of people in the Torres Strait would have initiated the same process there and given Mabuiag, and some other islands, the inheritance of habitats, plant species, and wildlife they have today, and which, unlike in most parts of Australia where massive change to the natural landscape has occurred, are still recognizable as that pre-European legacy. The long-term protection of that legacy demands a return to traditional burning as the only way to guarantee its long term survival, and on Mabuiag, as it is on Moa and Badu Islands, as on so few places on mainland Australia, such a return, if that is what is wished, is still possible.

The question of fire management is often approached from the point of view of the requirements of individual species, usually high profile species rare, or representative in their life history of a large number of species within a particular habitat. This then usually leads to prescriptions concerning appropriate fire return intervals and assumes a high level of control of the way in which fire behaves in the landscape in contrast to the element of chance that is inherent in traditional burning practices. There are several problems that arise from the application of this approach. The first is that there might be dozens of species in any particular habitat, and nowhere in Australia is it likely that there have been detailed studies of the life histories of more than a few of them. In the case of Mabuiag Island it is unlikely that any species has been appropriately studied in any depth. Secondly, to apply the knowledge of individual species requires a large measure of control over the return interval of fire and its seasonal timing in individual habitats. A third consideration is that for every species that is advantaged by a particular fire regime, another could be disadvantaged, and this observation is as equally valid for animals as it is for plants.

A more useful approach to protection of individual species is to manage to maintain in healthy condition the habitat that supports them. It is far simpler to establish plots to monitor trends in habitat condition and population numbers of target species than it is to elucidate the life histories of a number of species.

A mosaic burning system, progressively and appropriately applied during the year, requires few constructed firebreaks, is relatively inexpensive to apply, and has maximum benefits in relation to diversity of habitats and species of plants and animals. It also takes into account as no other system can, the requirements of hundreds, or even thousands of species such as insects, fungi, and invertebrates in general that are involved in breaking down the litter layer and assisting nutrient recycling, and that are the main supporters of health in an ecosystem. It does this by creating across the landscape an intense mosaic of areas representing different fire return intervals, different seasons of burning, and different intensity of burn that provides maximum opportunity for the maintenance of habitats and the survival of all species of plant and animal.

2) The need for a gradual progression towards effective fire management across the whole island.

Starting without long involvement in on-the-ground fire management one cannot become an effective fire manager overnight. No matter what ideals, enthusiasm, and impatience to begin with one brings to the task no fire management plan, no matter how prescriptive and detailed, can achieve its aim without those involved having an understanding of fire behaviour across the full range of habitats and conditions of the area they are responsible for, and a detailed knowledge of its geography.

Thus achieving the goal of effective fire management for the whole island must of necessity involve several steps. First, the development of a broad plan for the whole island, secondly the development of short term goals on the way towards achieving implementation of effective management of the whole island, and, before beginning on field implementation, the development of an understanding of fire behaviour and knowledge of the island among those taking part if these things are not already there.

Beyond the steps referred to above, there are two pre-eminent requirements. There must be continual acknowledgement of the need to work within the limits of resources. There is nothing that will lead to the collapse of any project faster, or breed greater discouragement in those involved, than having ambitions exceed capacity to deliver. On the other hand success in achieving progressive small steps develops interest and enthusiasm and a better chance of achieving the long term goals. It is also essential that those selected for involvement in the work must be clear in their mind that that is what they want to do, and have an interest in the work or feel that they can develop such an interest. It is also very important that those involved in the work have a good chance of long-term tenure in it. There is no point in developing expertise in ranger staff only to lose it and have to start again with someone else. In such a scenario the overall project would never be capable of getting beyond the first steps. It needs hardly to be said, of course, that without stable long-term funding effective fire management of the island cannot succeed.

Before beginning, majority community support should be sought and obtained but the process for achieving that, if it is possible, is a subject that the writer of this report is not qualified to address. Clearly, ranger staff cannot work in an environment where any mistake brings with it the chance that the project might be shut down, or there is such lack of concern for their efforts that firebugs through lack of condemnation by the community feel free to abort the most sincere efforts of the rangers.

The essence of the advice above is that fire management on the island should begin in a small way with progressive increase in responsibility as knowledge and confidence is built up in ranger staff. In this way the limits to function imposed by shortage of resources at any point should become clear long before they are tested, and the morale and interest of staff should not be seriously challenged. In line with these suggestions, it would be best to start with clearly defined but limited objectives. These matters will be further addressed below.

2.2 Fire Behaviour of Mabuiag Island Habitats

Map 1 illustrates six divisions of the island into categories according to habitat sensitivities and the way in which fire behaves in various habitats. These are basic divisions and the real situation in regard to fire behaviour is much more complex than this. It must be emphasized that any fire management plan not informed by detailed knowledge and on the ground practice in the parcel of land to which it refers can be only broadly prescriptive. If that experience and knowledge is not present then opportunity must be provided for its development by providing a starting point that reflects a broad understanding of fire behaviour in particular habitats and the general principles that guide its management.
The categories into which the island is divided and which are illustrated on **Map 1** are now described, and the way in which fire should be used in each of them outlined.

2.1.1 Category 1 and Category 1a

This illustrates the areas which with some exception, are unlikely to burn in the majority of circumstances although may be damaged by fire. It includes rainforest and vine thicket, both deciduous and semi-deciduous and other closed forests such as those dominated by *Welchiodendron longivalve.* Vegetation associated with beach ridges is also included within this category.

In the case of the coastal dune vegetation (mapped as **Category 1a**), these are highly restricted spatially and generally severely degraded by fire with flammable vegetation fringing the habitat margins. Due to the habitat value these features provide to a number of threatened bird species (beach-stone curlew in particular), action is required to protect these habitats with cool burning of fringing and interspersed grasslands.

In regard to other rainforest and vine thicket communities included in this category, these all have potential to be damaged by fire, particularly in extremely intense fire events. The margins of these habitats are however often associated with physical barriers, such as rock or boulder talus that limits the entry of fire into the forest margins. Hence boundaries in the majority of situations could be considered stable and not subject to further attrition. Cool burning on the margins of these habitats may in some cases promote expansion of these forest types although the requirement for this can be judged on a case by case basis.

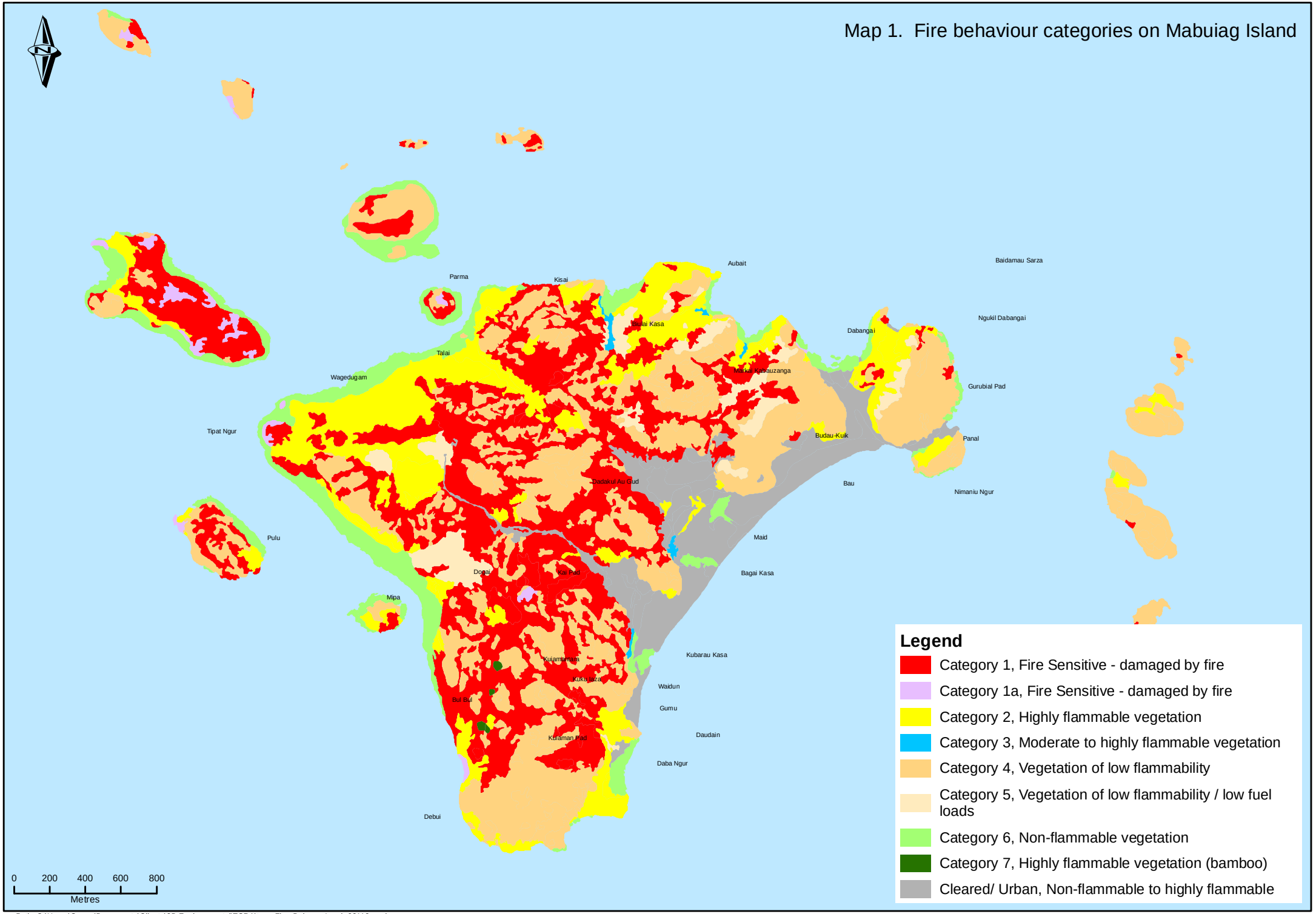
2.1.2 Category 2

This accommodates areas which support a heavy medium to tall ground cover of grass which rapidly re-develops after each fire event and reaches maximum fuel accumulation within 3 to 4 years. It covers grassland and the associated woodland types with melaleuca or pandanus.

These are the habitats which need the most attention as, without being broken up by numerous small fires, starting with whatever will burn as early as possible after the wet season, they have the potential to support fires which will burn over large areas. In the majority of cases, grassland habitats are derived from the attrition of closed forest types although due to their long term stability, represent an important component of the islands cultural and ecological landscape. Where **Category 2** vegetation fringes rainforest margins, there is potential for damage to be inflicted and rainforest margins further degraded. This is particularly true of littoral scrubs, where severe damage has been previously noted. There are also large areas where grassland habitats are being heavily encroached upon by shrubby thickening and require specific management to arrest widespread conversion of grassland to shrubland. This scenario is discussed in more detail in following sections.

In brief, an appropriate strategy for this category is to break the country up with small fires, ignited progressively during the year, to such an extent that any unplanned fires will quickly run into previously burnt areas, and be incapable of gathering the momentum necessary to sweep over large areas. Areas of shrubby thickening require prescriptive measures which include targeted fires burnt to produce maximum fire intensity. Storm burning as described in **Section 3** should be considered a fundamental tool for the management of invasive shrubs.

Map 1. Fire behaviour categories on Mabuiag Island



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Photograph 1. The internal structure of welchiodendron dominant forest (Category 1) with rocky substrate which prevents the entry of fire.

Photograph 2. The boundary of a littoral dune scrub (Category 1a) with severe fire damage evident on margins (far left) (November 2007).

Photograph 3. Grassland habitats supporting *Cycas badensis* populations on the north side of Mabuiag.

2.1.3 Category 3

Although having an extremely restricted distribution on Mabuiag, this habitat comprises swamp forests that are seasonally wet and characterised by *Melaleuca saligna.* They typically occur on the margins of, or in association with ephemeral drainage lines with the best development on the island occurring in close vicinity to the island township. These habitats will support regular fire and quickly accumulate fuel from the profuse litter provided by such understory plants as pandanus, and in places from heavy growth of grass and ferns. Even those paperbark communities that have little ground cover are profuse shedders of leaf litter that will burn when dry. These swamp forests are generally capable of burning again two years after a fire. As they dry out there is a progressive increase in the amount of fuel available to burn, and late dry season fires can be very hot and destructive. It is best to burn these habitats during periods when the substrate is moist to prevent severe damage to the ground and herb layers.

2.1.4 Category 4

This covers areas dominated by shrubs, with some areas of low open woodland. They generally comprise a mix of shrubs and small trees that include *Melaleuca viridiflora, Welchiodendron longivalve, Asteromyrtus brassii*, *Lithomyrtus retusa, Psydrax reticulata, Alyxia spicata* and *Acacia brassii.* Ground cover, depending on the depth of soil and height

development of the canopy, varies from a light to moderate cover of sparse grasses, sedges and herbs to almost non-existent. Mixed throughout are small patches of deciduous shrubland characterised by *Cochlospermum gillivraei* typically occurring on stonier locations and shrublands of *Acacia brassii* which are confined to rockier locations where fuel loads are broken up by rocky pavements.

It is relatively difficult to define an appropriate fire regime for these habitats due to the variable flammability of component shrubs and ground covers. Where ground cover is sparse to non-existent and the habitats are dominated by welchiodendron or deciduous elements, they would burn rarely, and would show little obvious change for possibly many decades after a fire. There are, however, likely to be a number of short-lived species within them that would only regenerate from seed, and are likely, therefore, to need a fire for that to happen. Where there is a light ground cover in these communities they will support fire at intervals of a few years, but will need dry and even windy conditions for that to happen.

For those areas where *Asteromyrtus brassii* is prominent, their fire ecology is well known from observations in the large areas they cover in the northernmost parts of Cape York Peninsula. These communities tend to change only slowly with time since last burn, and usually require 4 to 5 years or more before they have acquired enough fuel to burn again. The main changes to be observed are that many species within them are relatively short lived and will only regenerate from seed, gradually disappearing only to reappear after the next fire. There is no imperative to burn these areas as soon as they are ready to burn as most shrub species within them will reappear after burning even when fire has been absent for many decades. The need to continue burning these communities, however infrequently, is due to the fact that after 10 years or so, species begin to disappear from them. In the very long term it is inevitable that without fire they will be dominated by a few long-lived species capable of forming a canopy, and therefore excluding those light-demanding species that cannot. More importantly, the fate of the many light-demanding species in the ground layer is of potential concern. As the shrub canopy thickens with time excluding light from the ground layer, there will be a total disappearance of the grasses, sedges, and herbs which comprise it. It is unlikely that most of these would have sufficiently long lasting seeds or tubers to regenerate decades after they had disappeared.

It is important to be aware that these communities often burn in a way that consumes them completely, leaving only blackened bare stems and bare ground. This, despite its appearance, is not destructive of them as they have great regenerative power after such events, and are more likely to be harmed by the species impoverishment that follows fires that are too mild to remove enough of the canopy, or to consume enough litter, to provide the light and bare ground that is critical for the regeneration of many species.

Photograph 4. Asteromyrtus brassii dominant shrubland to the west of Mabuiag township.

Photograph 5. Shublands of *Cochlospermum gillivraei* on rocky footslopes, partially protected from a recent hot fire by bare pavement, November 2007.

2.1.5 Category 5

This category represents welchiodendron dominant woodland and open forest habitats of relatively low stature developed on rocky footslopes around the island. The habitat is characterised by a sparse to moderate ground cover of grasses, interspersed with rocky areas, which does not support fire readily. Large areas within this category are difficult to ignite unless they have been unburnt for several years, and even then only when the dry season is well advanced. Like areas in **Category 2** they are best managed under a patch burning regime. This type of regime offers the best chance of promoting maximum biodiversity while minimizing the danger of large unplanned fires. In general conditions, fire will tend to creep through the groundcover of these habitats and extinguish against rock piles and outcrops and any other areas where the ground fuel is broken. Only extreme events will scorch the canopy and kill canopy trees.

Areas in **Category 5** should only be burnt when the burning program in **Category 2** areas is well advanced. This is because they will be unlikely to burn before well into the dry season, and fires within them have the potential to run into high fuel accumulations in **Category 2** areas, igniting large fires which the program in those areas is designed to avoid.

Photograph 5. Woodland of welchiodendron that has been subject to a recent gentle fire creeping through the groundcovers, November 2007.

2.1.6 Category 6

Category 6 describes those habitats that will not burn under any circumstance. On Mabuiag Category 6 vegetation is limited to the mangrove fringes with occupy embayments around the islands coastline. Rocky areas, although not flammable discretely, have been included in Category 4 as they regularly mix with flammable shrubland habitats.

2.1.7 Category 7

Bamboo groves, where they exist in mappable size, are represented as a separate category in fire behavior mapping. Bamboo may have considerable value as a cultural resource although is destroyed by hot fire, burning intensely whilst the shallow root system is destroyed. Depending on priorities, asset protection burning may be warranted around these copses to protect them from severe fire events.

Photograph 6. Bamboo grove amongst grassland at Wagedugam, Mabuiag's north facing coastline.

2.1.8 Other Vegetation – Cleared / Urban Areas

A final category is reserved for Cleared / Urban areas which occur most extensively around the township. This category includes residential areas, associated groves on exotic vegetation and interspersed groves of grassland and shrubland, both native and exotic as well as mango groves. Whilst the majority of these areas can be considered to be of low flammability, rank

grassland habitats which intrude and fringe the township area can be extremely flammable and of considerable risk to assets and infrastructure if ignition occurs under extreme conditions. A program of fuel reduction burning should be considered in early season to reduce the risk of ignition during periods of high combustibility.

Photograph 7. Cleared areas around the fringes of Mabuiag township demonstrating a mix of rank grassland, woodland and cleared areas. A recent fire scar is visible in the foreground.

3. GUIDING PRINCIPLES FOR PROGRESSION TO THE ESTABLISHMENT OF EFFECTIVE FIRE MANAGEMENT OF THE ISLAND AS ONE UNIT.

The fire management principles applied on Moa and Badu have guided the production of this plan for Mabuiag. Mabuiag is however a much smaller, more accessible and ecologically less complex island than its neighbours and as such, the task at hand is much more manageable and straightforward.

3.1 The Ultimate Goal

Drawing together the information provided in previous sections of the report, it is now possible to provide an outline of what a fire management program would look like that was designed to promote long-term stability in its natural habitats, and would promote maximum biodiversity. It would closely approach but not achieve traditional management because of the essential

difference that it would never have enough people on the ground to carry it out, and would no longer be guided by the precise timing and customs handed down from generation to generation. It should, however, in the present situation be the best that can be achieved. It would have the following features:

i. It would adopt mosaic burning practices in all habitats that will carry fire with the timing of ignitions and their intensity varying according to fuel types.

ii. As soon after the wet season as fire will carry (April-May in most years) burning will begin in those habitats where fuel accumulates most rapidly (**Category 2**) and there is the greatest potential for fire scorch in sensitive habitats (**Category 1** and **1a**). These areas are the grasslands and woodlands with a tall grass understory.

The ability to start early burning in these areas depends on having a large percentage of it with at least two years fuel accumulation. Without that there is a risk that the initiation of a program to break up fuel across these areas might have to be delayed so late in the year that fires in them will spread far into parts of those areas with a sparse ground cover. This would risk the desirable orderly progression of burning across the landscape and run the risk that fires in the first target area might cover a wider area than is desirable.

The nature of the ground cover in the tall grass areas is that they reach maximum fuel accumulation in 3 to 4 years after fire. They are difficult to burn in the cool season two years running, but are quite capable of supporting undesirably hot fires late in the season in the second year after burning. After 3 years without fire any late season fires are bound to be hot. The ideal situation for starting early burning and establishing a significant mosaic burning pattern, would, therefore, be to have burnt an average of one third to one half of the target habitat per year. Experience with burning in these communities has demonstrated that once a mosaic is well established with progressive patch burning then this sort of average is what is attained by a combination of chance, and some judgement on the part of the field operator. That judgement is enhanced with experience.

It should be noted, however, that with all average figures there can be some extreme variation away from the mean. In some years burning will be difficult because of constant showers in most months, and consequently a high percentage of it will burn in the following year if there is not a repetition of the same weather pattern. Very early season action will be required if the following wet season ends abruptly. In such a sequence of years the variation in the percentage burnt in any one year could be as extreme as from 15% to 70%.

iii. Once burning in areas with a heavy grass cover is well advanced in its coverage of the ground (once again only the judgement of experienced rangers can determine this point) then attention should turn to those woodlands and forest areas of moderate to sparse ground cover and commensurately lower levels of fuel accumulation (Category 4 and Category 5). In these areas burning should start with widely spaced on the ground ignition in areas that can be readily accessed on foot. The appropriate timing for that operation in most years would be from June to mid-August. Because these areas accumulate fuel relatively slowly and are not subject to rapid change in the absence of fire, the intensity of ignition patterns should not be as high as in those areas with a tall grass cover. These areas of moderate to sparse ground cover contain a variety of communities with significant variation in the way in which fire behaves within them and generalisations as to the percentage of the area that should be covered by fire in any one year are not useful. More useful would be an analysis of the area covered by individual fires. If one, or only a few fires, burnt more than half the total area in any one year, that would be a clear indication of a need to review, and if necessary, revise practices in the following years.

iv. The swamp forests are and extremely minor component of the Mabuiag vegetation mosaic. Even though they may hold water for part or all of the year they continue to build up fuel above the waterline from fallen leaves (particularly pandanus leaves) and from dying leaves of sedges, ferns and grasses. Unlike the grasslands and grassy forests which quickly attain a maximum level of fuel accumulation where the rate of accumulation is balanced by rates of decay, these swamp forests appear to be capable of continuing to accumulate fuel for many years and can of support very hot fires even while they hold water. An appropriate course of action for these forests would be to effectively manage fuel in surrounding areas, and then burn the swamps periodically to avoid heavy accumulations of fuel.

Because of variations in the nature of the swamp forests in relation to the ground cover (or lack of it) within them, and the type of litter fall, decisions on whether or not, and when to burn them in any year can only be made after ground inspection. Even those prone to develop the most heavy accumulations of fuel can be safely allowed to go 4 years or more without fire, provided they are burnt at a time when soil conditions are moist.

v. Shrubland communities and communities of rock pavements pose some peculiar problems for management which varies with geographical location and often defy precise prescription. Within this category are communities which will only burn after many years of accumulation of fuel, and then with ferocity, and other areas which because of a rocky ground surface will not burn under most circumstances. There are

also areas which carry enough ground cover to support regular light fires. When they are mixed together, the problem is compounded.

Because shrubland communities change only slowly with time since burning there is little point in persisting with attempts to burn them under conditions in which fires will only trickle through them. More often than not they will only burn fiercely or not at all, and in the welchiodendron dominated shrublands it is likely that large areas of them will not burn.

The shrubland communities dominated by *Asteromyrtus brassii*, on rocky foothills, will continue to accumulate fuel loads for a decade or more, and as that happens the time at which they will easily ignite and burn hotly will gradually shift from late season to cooler times of the year. There is a risk to surrounding communities if they are burnt late in the year. If a late burn is decided upon it will have to be planned a year in advance so that burning of those surrounding communities can begin early in the year.

vi. Affecting most of the matters referred to above are some issues, practices, and principles which are important enough to draw together at this point so that their significance is not lost by being diffused throughout the report.

Storm burning: This is a useful technique to apply in any areas where a thick understory has developed as a result of long absence of fire, or because heavy grazing has destroyed the ground cover allowing shrubs and trees to escape competition from grasses, and has also removed the fuel that would allow fires to destroy the understory. Storm burning changes the competitive balance between trees and shrubs, and grass, in favour of the grass. This is because it is carried out after the first storms of the wet season when there is adequate soil moisture to promote rapid growth of grass which then suppresses regrowing shrubs and small trees.

The presence of significant numbers of grazing animals (horses and cattle): These could be very destructive of soil and habitat values if they concentrate on small patches burnt early in the season. In large enough numbers they would diminish the ability to carry out the fire management programs recommended in this report.

Burning on a declining hazard: The lighting of fires before midday should only be practiced early in the season or in any other circumstances where fires will only carry with difficulty. At other times burning should be carried out at times of day when wind speed is not likely to increase, temperatures are dropping, and humidity is rising, i.e. a decreasing hazard. This usually means after 2.00pm.

4. A PROPOSED FIRE MANAGEMENT PROGRAM FOR MABUIAG ISLAND

It is acknowledged that the natural habitats of Mabuiag Island are mostly in very good condition, particularly when compared with similar habitats on Cape York Peninsula. The main reason for this is that regular fire has been maintained in much of the landscape. Whether or not the importance of that action for survival of those habitats is realized the people involved in it must be given credit for the appropriateness of their actions in the situation in which they have found themselves. Fire management on the island could however clearly be improved. In the habitat management profile (3d Environmental 2012) for the island emanating from comprehensive field work, reference the invasion of grassland habitats by melaleuca shrubs most likely as due to inappropriate or ad-hoc fire regimes. The evidence that most, if not all burning is confined to late in the year, focusing on the month of October and November, leads to the inevitable conclusion that it is not ideal for biodiversity management. The ideal situation for that is spelt out in **Section 3** of this report. There is a need to extend burning more widely throughout the year, focusing particularly on the early dry season.

Whilst fire may be missing some important parts of the landscape there is also a likelihood that it is being damaging to others. Coastal dune scrubs, although limited in extent, have been observed to be heavily degraded by fire. There has also been evidence of extremely hot fires in foothills near the community which have been damaging to habitats and destructive of general biodiversity values.

4.1 Proposed Program for Year 1 – 2013, 2014

Establishing an island wide fire management regime as recommended in this report will not be an easy process of putting something in place where nothing existed before. It will involve the difficult task of taking an existing system and improving it with some radical shifts in extent and timing. The rangers do not have the power to impose change and will therefore have to try to obtain community support, and however that is achieved it will be easier if the community has confidence in their professional abilities. For that reason therefore, although it would add an extra burden of responsibility that their job descriptions may not have included, it would be valuable for them, before they devote too much effort to the island wide tasks, to address the urban area problems in regard to fire hazard control and reduction referred to above. It is suggested, therefore, that they get fully involved with any brigade set up under the Rural Fires Act, including becoming office bearers, and desirably, having one of them take up the position of Rural Fires Warden.

In any area where fire management is proposed, the initial task will be to remove the risk posed by heavy fuels in the rank grasslands that surround the township and infrastructure. The main infrastructure concerns for asset protection burning are:

1. The airstrip and its perimeter fence line.
2. The water catchment area.
3. Power generation plant.
4. Residential dwellings and numerous small huts in picnic areas.

Asset protection would involve either the slashing or spraying (using herbicide) of a 2m wide strip around the perimeter of these areas very early in the season (March to April) followed by burning of the dead grass as soon as ignition is possible to create a fire break.

The water catchment area is extremely sensitive; the use of herbicide may not be acceptable and burning on the perimeter at any time is likely to result in undesirable ash-fall into the catchment pond. Hence, consultation with the council will be required before any firm management action is undertaken. It may be that the most appropriate action would be to undertake early season fire management of adjacent vegetation at a time when wind direction is favourable.

Photograph 8. Dense strip of exotic grasses on the margins of the airstrip perimeter fence which requires management prior to implementation of the fire program.

To build a solid basis for establishment of a patch burning regime in the following year, it would be best to exclude fire from as much of the islands habitats as possible during the initial year of the program. This is relatively important as without at least a seasons accumulation of fuel, it will likely not be possible to commence effective patch burning early in the following years operations. Reality is however is that is unlikely that the habit of regular late season burning will die easily, and without some significant shift in this pattern it will be difficult to accumulate enough fuel to make an early start to post wet-season burning possible in the following year

The year should therefore be devoted to completion of small test burns, extinguished before leaving them, commencing in the early part of the year in as wide a variety of habitats as possible, to help develop an understanding of fire behaviour within the islands habitats. A small test burn was completed during the April 2013 consultation which successfully burnt several hectares prior to extinguishing against a line of inflammable vegetation. Despite being undertaken in thick grassland with more than 2 years fuel accumulation, the fire was easily controlled, being readily extinguished with brush cuttings. The fire successfully demonstrated the application of an early season burn without risk to sensitive forest types or infrastructure.

Photograph 9. Test burn in dense grassland with at least 2 years fuel accumulation in April 2013.

Attention should also focus on increasing knowledge of the island's geography by driving or walking all roads and tracks, walking away from roads, as well as recording and mapping any

areas that do burn. Knowledge of the fire patterns and the varying intensities of burning would be invaluable knowledge in planning burning operations in the following year. Areas subject to shrubby thickening within grassland habitats should also be identified and included in plans for prescribed burning in later efforts.

4.2 Proposed Program for Year 2 – 2014, 2015

As for the initial year, the focus on the first round of work would be fire mitigation works within and surrounding the township during the early part of the year. Requirements have been described within **Section 4.1**. For the following period, while it may not be possible to make other than a small beginning because of a scarcity of fuel, every effort should be made on the ground, as soon as fires are likely to carry (mid-April to mid-June depending on the season) to burn anything that can be found to burn, no matter how small the resulting patch. Early season burning should focus on **Category 2** vegetation, particularly where it shares a common boundary with littoral scrubs or vine forests. There is no emphasis, as these should be in a fully evolved patch burning program, on adopting procedures, such as burning at a time of day (mid-afternoon) when temperatures are falling and humidity rising, avoiding burning in strong winds, or ceasing when fires begin to burn during the night. This is because the main task is to spread fire across a wide area of the landscape being targeted before late season (post July) fires begin.

Once on ground operations in **Category 2** vegetation are largely complete, generally by the end of May, focus can be shifted to the burning of **Category 3**, **Category 4** and **Category 5** vegetation. This should be undertaken initially along roadsides and access tracks to assess fuel loads and whether effective ignition is actually feasible. Dependent on results, patch burning efforts can be spread more widely throughout these habitats, possibly with the assistance of aerial incendiary devices if on ground resources are insufficient to the task. The appropriate timing for this operation cannot be defined as it depends on seasonal conditions, but on average it should commence in June and be completed by mid-September. In the range country, the motivation to break up the fuel is the same as for the lower elevation country, but the situation is quite different. It is likely that much of it has not burnt for some years. In a rough broken landscape such as the Mabuiag, with boulders and a generally rocky surface, and numerous patches of closed forest, most spot ignited fires will not carry far. The only way to spread fire across the landscape will be to hope that some fires will continue to burn over a number of days, trickling around the landscape. This will inevitably lead to great variations in the intensity of the fire according to the time of day during which it was burning, the weather, and whether or not it was burning up or downslope. That, however, is the historic nature of fire in such country.

It should also be noted that with the *Melaleuca saligna* dominant swamplands (**Category 3**), these habitats are fringed by dense swards of both native and exotic grasses which have

direct linkage with urban areas. Hence fire breaks will need to be established through early season burns on the habitat margins if these areas are to be burnt successfully with safety. In such hazardous situations, operational safety measures such as burning on decreasing fire hazard (late afternoon) should be considered and incorporated into the burn plan as necessary.

If the operations described above achieve their expected result, they will provide the basis for building a mosaic of burn patterns across the landscape, and leave enough unburnt country to provide a better basis for progressive patch-burning operations in the following year. If not, there is little option but to repeat these procedures in the following year.

4.3 Proposed Program for Year 3 – 2015 and Following Years

A program for year 3 can, at this stage, only be tentative. It will depend very much on the experience of the preceding years, and how closely its goals can be reached. There are unpredictable circumstances relating to how successful a start can be made on changing burning patterns and establishing a mosaic pattern of burning on which to build. Also to be tested at all stages is the question of whether or not resources available are adequate for the task. For these reasons, therefore, fine detail has been avoided, and this report confines itself to outlining the direction of an ideal program to occupy the year 2015, and repetitively from there on, while emphasizing its essential features. Whatever precise direction is pursued for 2015 and beyond, it should be shaped by the experiences of the operations in preceding years, and all annual programs from there on should evolve from past experience.
The sequence of events in an ideal operation for 2015 and following years, at a basic level should be:

a) To continue a program of ensuring the safety of the town area by keeping fire breaks open, and burning whenever there is two years accumulation of fuel – if the weather allows it. Additionally, rangers should ensure that their operations cannot cause damage to huts or other infrastructure away from the town area;
b) To begin burning as soon as possible after the wet season, with on the ground operations to spread spot fires through readily accessible sections of grasslands and grassy woodlands (see map) and other areas with a cover of tall grass.
   In most years these operations should occupy the period mid-April to the middle of June.
c) As soon as on the ground operations are judged to have a satisfactory level of coverage in grassy woodlands, focus should shift to the burning of habitats with lower fuel levels. This includes shrublands on rocky footslopes, melaleuca dominant open forest and other woodland habitats comprising *Welchiodendron longivalve.* Such operations should commence in June and extend through August, possibly into September with aerial ignition of rangeland country if a lack of resources dictates.

A general guide to regimes for longer term fire management actions based on vegetation type is provided in **Map 2**. There are however some areas which will need special management attention that transcends the demands of the routine operations described above, but can be accommodated within them. All of them will require the precise attention that can only be given by on the ground operations and it might be beyond the physical and time resources of the rangers to deal with them on top of the demands of the routine operations. If that proves to be the case then, additional assistance may be sought from other island rangers groups (Badu or Moa) to assist the operation.

Areas requiring special attention relate specifically to areas affected by shrubby thickening, noticed particularly in Talai where shrubby encroachment of melaleuca threatens both grassland habitats and a significant population of *Cycas badensis.* The only management option available to reverse this process is the use of fire, and the longer the thickening has been occurring, the hotter the fire will have to be. This will require some consideration to cycad groves where seedling recruitment and expansion of the existing population will be compromised by hot fires. Hence early season burns may be required on the population margins prior to application of more intense burning episodes.

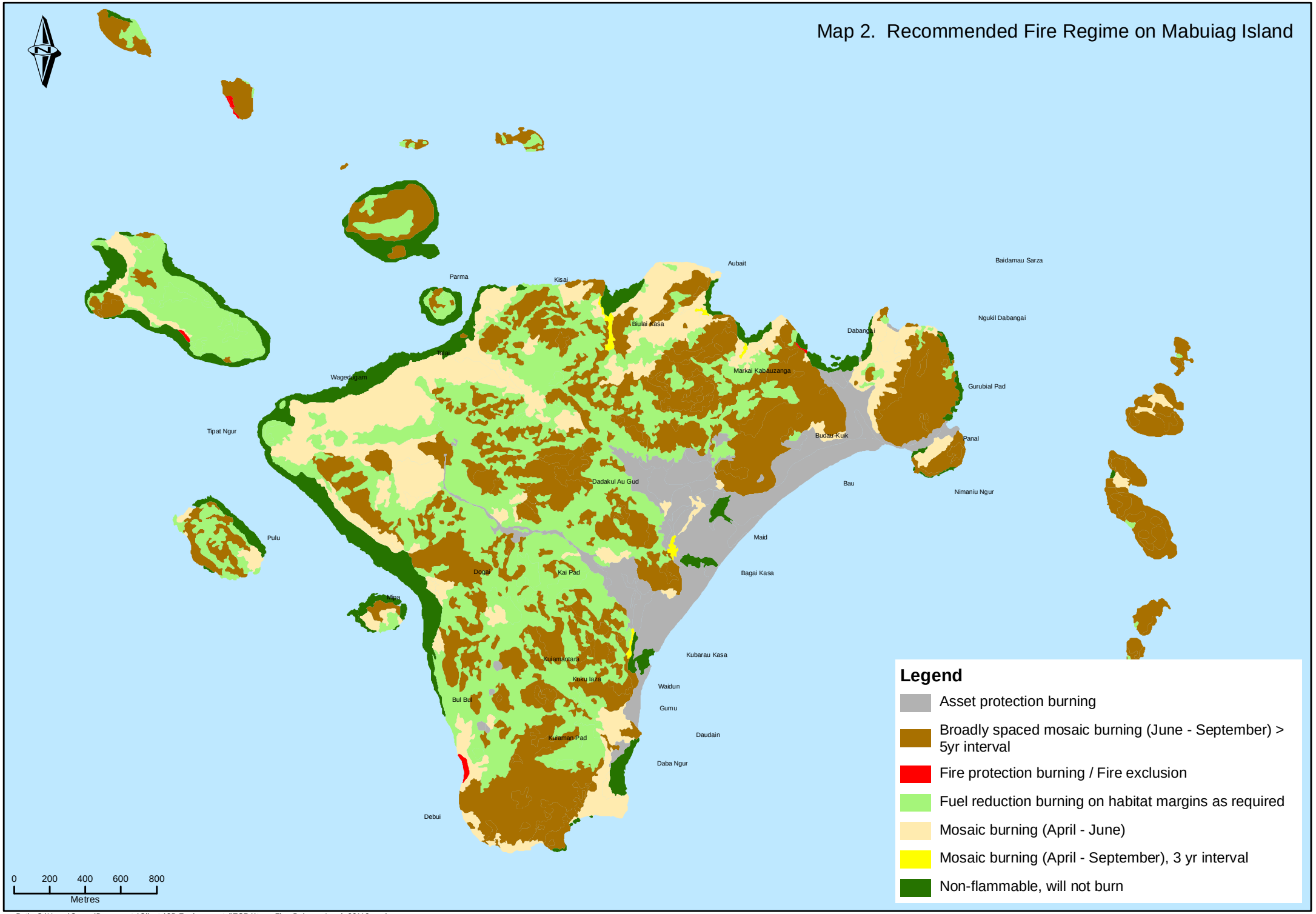
The problems of managing the broad landscape with patchy cool fires while applying late season hot fires to part of it are obvious. It will mean the abandonment of aiming for a mosaic of burnt and unburnt country in surrounding areas in favour of a meticulous program of maximum possible fuel reduction over a wide area. The problems are magnified where hot fires have to be applied adjacent to sensitive areas such as vine forest margins or populations of sensitive species. In both cases intensive fuel reduction will have to be undertaken adjacent to sensitive areas starting early in the season, and then to await suitable conditions for putting a hot fire through them. In all burning operations to remove a thickening understory the time of day fires are lit is not important as the aim is to generate maximum heat in the fire. Storm burning, as described in **Section 3** may be considered a feasible management option in these locations.

There are also some areas where repetitive hot fires are causing noticeable retreat of vine thicket boundaries, particularly Bidhay Kup which is located to the west of the township along the coastline. The application of cool burns along the margins of the retreating vine thicket habitats should arrest this process and result in gradual re-establishment of vine thicket species along fire exposed footslopes. Where fire sensitive vegetation such as vine forest is concerned, lighting of fires should be done in a line as close to the margin as possible.

Photograph 10. The early stages of dense shrubby thickening of *Melaleuca viridiflora* in grassland near Talai, a potential target for late season or storm burning efforts.

Photograph 11. Vine thicket margins at Bidhay Kup west along the coastline from the township which have retreated upslope in response to repetitive hot fire. Early season burning along the margins of vine thicket habitats may effectively reverse this retreat.

Map 2. Recommended Fire Regime on Mabuiag Island



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6. APPENDIX

A1. FIRE MANAGEMENT FRAMEWORK

The essential feature of the fire management framework is that it is based on the premise that the diversity and patterns of distribution of the island's habitats are the result of the purposeful use of fire by man over perhaps thousands of years, and therefore the maintenance of these features depends, at the most basic level on the continuing presence of fire. Whilst the precise nature of traditional management cannot be determined in the absence of its practitioners, its main features are known, and the island's fire management should be guided by them. It should endeavour to create a patchwork of numerous small burnt areas by using progressive ignition throughout the year whenever conditions are suitable. It should ensure that most fires are of mild to moderate intensity, and provide the conditions under which wildfires will tend to self-extinguish before they can cover large areas.

Fire management will take place in three overlapping stages. During, or soon after the wet season, priority will be given to securing the town area by grading, slashing, mowing and burning of fire breaks to protect infrastructure. As soon after the wet season as fires will carry, patch burning will be carried out on the ground in grasslands woodlands with a tall grass understory, paying particular attention to littoral scrubs and rainforest margins. When it is judged that satisfactory progress has been made in these operations, attention will then shift to the remaining shrublands, open forests and woodlands where fuel levels accumulate more gradually and are generally lower. When all areas that can be easily accessed on the ground are covered, or resources are clearly inadequate to cope with the task while weather conditions are likely to remain favourable (before the end of June in most years) assistance should be considered through aerial ignition using a helicopter. Special attention will be paid at all stages to vine forest margins, littoral scrubs and areas subject to shrubby thickening.

A2. FIRE MANAGEMENT STRATEGY

A2-1. General introduction to the approach to fire management

The fire management program should aim to:

- ensure as the highest priority the protection of life and property;

- establish an approximation of traditional burning practices by burning throughout the year, when conditions are suitable, to establish a mosaic pattern representing burns at different times of the year, and at different intensities and return intervals;

- replace any existing fire patterns dominated by relatively few large fires with smaller more numerous ones;

- provide the conditions under which fires can self-extinguish;

- protect the edges of rainforests and vine thickets from scorch;

- manage specific habitats to provide appropriate conditions for the survival of sensitive species.

A2-2. Ecological description of the island

Location and Landscape: Mabuiag Island is part of the Near Western Island Group which also includes the larger continental island of Moa and Badu. The island, with an area of 744 is located 69 km NNE of Thursday Island, and is characterised by a rocky landscape with numerous rocky knolls which attain a maximum height of 146 m. The Mabuiag landscape is formed by the acid welded tuff and rhyolite of the Torres Strait Volcanic group and soil development over much of the island is skeletal with surface exposures of hard rock pavements, rock piles, boulders, and associated boulder slopes. The formation of deeper soil profiles is largely restricted to the northern part of the island, where weathering of diorite has allowed development of uncharacteristically red and relatively fertile soils. Coarse-grained alluvial soils are restricted to confined pockets associated with seasonal streams and gully lines. Sand dunes, which occur sporadically on the coastal fringe, often form a single parallel ridge of coral rubble and grit, pushed into place by tidal action. These are young features of late Holocene age (< 5 000 yrs BP) that are formed in response to present day sea levels. A well-developed system of beach sand ridges occurs in the vicinity of the settlement, although this dune feature has been largely cleared for development.

Climate: Mabuiag Island, as for other Torres Strait Islands is influenced by the summer monsoon (wet season) between December and March during which moisture laden north and north-westerly winds prevail. South-easterly trade winds dominate for much of the remaining months with transitional periods between April to May, and October to November. March is typically the wettest month producing on average precipitation of 352 mm out of an annual average of 1753 mm compared with Badu which is the wettest recording station in the Torres Strait at 1983 mm and Dauan which is the driest at 1082 mm (BOM 2008). There is however considerable rainfall variability on both annual and decadal cycles. Due to its location, and the regulating effect of the ocean, moderate temperatures are experienced throughout much of the year and the broader Torres Strait experiences a mean annual temperature of 27° with minimal range from 25° to 28°.

Vegetation: The island is blanketed with a mosaic of natural vegetation with cleared and otherwise disturbed areas forming 8.7 % of the islands total area. A total of 11 natural broad vegetation groups are represented on the island of which welchiodendron dominant forests are the most extensive occupying 238 ha or 32 % of the islands vegetated area. Restricted areas of rainforest are scattered throughout the central portion of the island with rainforests and thickets comprising 2 % of the islands total vegetative cover. Shrubland and rock pavement communities cover an extensive portion of the islands rocky slopes and headlands forming 34 % of the islands vegetation cover with grasslands occupying 13 %. Vegetation communities mapping is provided within **Map A.**

A2-3. The history of fire in the island's landscape

It is not known when traditional burning was abandoned and there is no documentation of fire history since then. From field evidence, it is apparent that the island is regularly burnt by a number of people and that burning has been co-ordinated to the extent that it is completed largely in the months of October and November. The condition of the island's habitats indicates that they are largely stable under the prevailing fire regime.

A2-4. Specific requirements for asset protection

Specific factors that require consideration during prescribed burning are detailed in Table **A2-4** overleaf. The table is intended as a guide to information that is required and it is expected that additional detail will be added as the fire program develops.

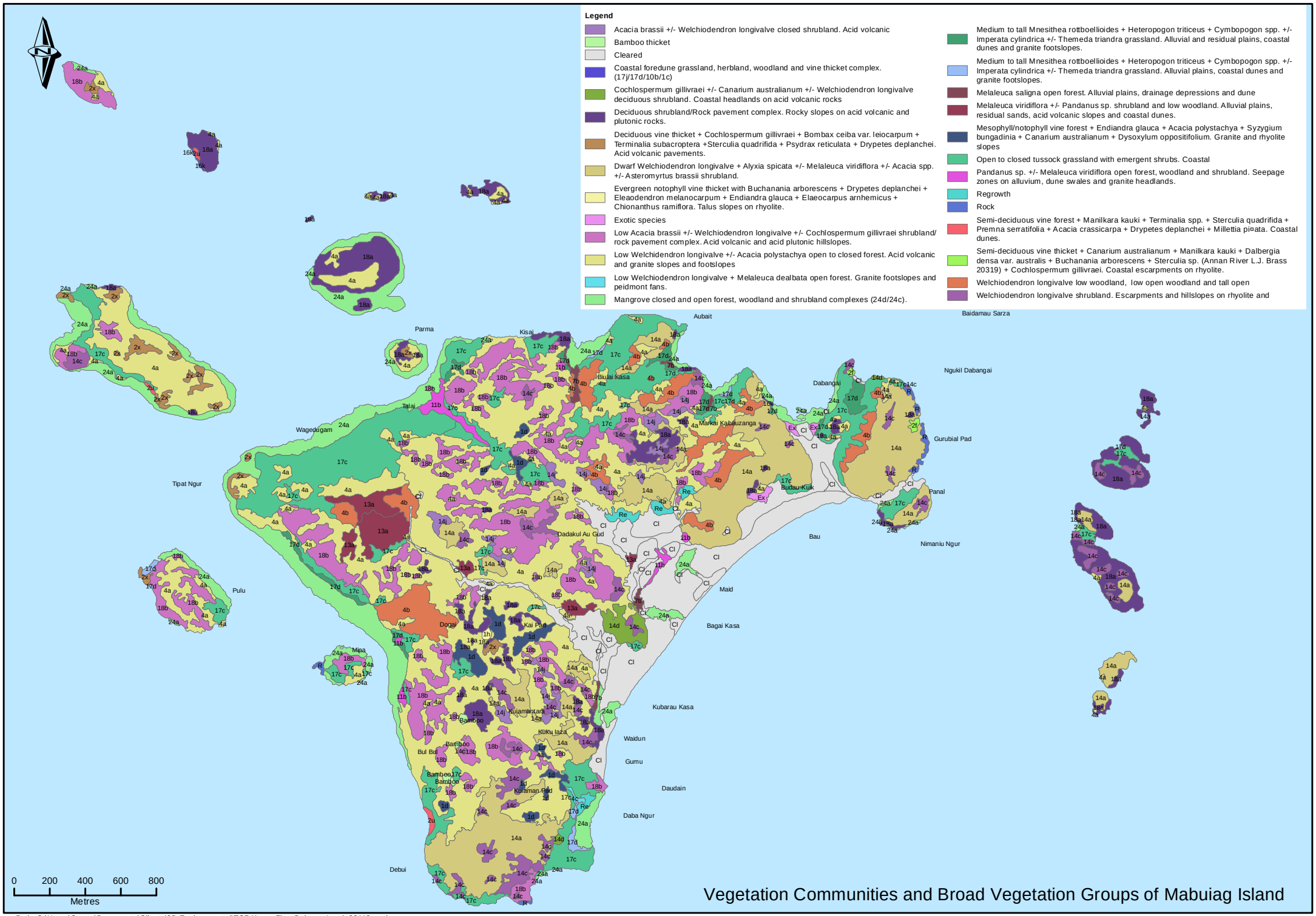

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Table A2-4. Preliminary list of assets, specific issues and requirements and contact information.

Asset	Issues	Specific Requirements	Stakeholders (to be listed)	Contact
Mabuiag township area	Flammable fringing rank grassland habitat occurs as fingers intruding into the community and as a broader swathe on the settlement margins. Flammable vegetation occurs up to boundary fences of dwellings in some locations.	A program of hazard reduction burning is required to manage the risk that hot wildfire poses to dwellings.	Mabuiag Council	
			Mabuiag Community	
			Island Rangers	Terence Whap
			Rural Fires – Fire warden	
Airport – including potential smoke problems	Surrounded by vegetation of moderate flammability although smoke from fires has potential implications for aircraft transit. The perimeter of the airstrip is fringed by a plastic coated wire fence which has on its outer margins a dense border of exotic grass.	Prior to any prescribed fire, a fire break needs to be established to protect the wire fence. This will need to be completed by either spraying or slashing a break, followed by burning of the trash when first capable of ignition.	Mabuiag Council	
			Mabuiag Community	
			Island Rangers	Terence Whap
			Rural Fires – Fire warden	
			Commercial airline operations	
Powerline and generators	The location of generators and powerlines requires consideration. Other facilities should be identified.	• A narrow fire break is already established around the current facility which should be widened using techniques described above. • Hazard requires management around facilities including slashing of grass around generators	Ergon Energy??	
			Mabuiag Council	
			Island Rangers	Terence Whap

Asset	Issues	Specific Requirements	Stakeholders (to be listed)	Contact
		and power poles. • Ergon to be given minimum of 2 weeks notice prior to a planned burn. • Ergon on ground maintenance teams to cut grass 2 m from around poles and look after generators.		
Water supply and other infrastructure	The risk that fires pose to water supply infrastructure including the borefield and associated facilities needs to be considered in burning plans.	The water catchment area requires specific attention as herbicide cannot be used on its margins and any fire on the peripheries is likely to result in ash being deposited within the catchment. Consideration should be given to hazard reduction burning within habitats on the margins when winds are favourable (i.e. blow ash away from the catchment facility).	Mabuiag Council	
			Island Rangers	Terence Whap
Cultural assets (requiring further documentation)	Cultural assets and the risk fire poses to them requires further consideration and documentation.	Mapping of cultural assets and assessment of the risk posed to them by fire. This includes flammable assets such as bamboo groves.	Island Rangers	Terence Whap
			PBC	
Other infrastructure – bridges, signage etc.	The susceptibility of other infrastructure to fire damage needs to be established	Mapping the location of fire sensitive infrastructure is	Mabuiag Council	

Asset	Issues	Specific Requirements	Stakeholders (to be listed)	Contact
	and considered in the fire program.	required and considered in the burning program.	Mabuiag Community	
			Island Rangers	Terence Whap

A2-5. Fire management requirements for weeds

There are a number of herbaceous environmental weeds that may benefit from targeted burning if this is followed up by chemical spraying as green shoots re-emerge. Such infestations are restricted to disturbed lands around settlements and include a number of herbs and scrambling vine species such as stylo (*Stylosanthes* spp.), siratro (*Macroptilium atropurpureum),* phasey bean (*Macroptilium lathryioides*), butterfly pea (*Clitoria terneata),* coral vine (*Antigonon leptosus)* and beggar weed (*Desmodium tortuosum*). Such areas should be identified and an approach to burning and subsequent herbicide treatment considered on a case by case basis. Verano stylo (*Stylosanthes hamata)* has created dense cover in some locations and control of this species may be assisted with hot fire. Fuel reduction burning should be undertaken in areas surrounding the infestation prior to application of late season fires. Follow up application of a selective herbicide may be required in conjunction with fire to maximise the effectiveness of control measures.

A2-6. Management requirements for cultural sites.

A list of cultural sites is to be compiled with any specific requirement for fire management issues to be detailed.

Table A2 – 6. Management requirements for cultural sites (example - to be compiled).

Cultural Site	**Location (GPS)**	**Specific Fire Issues/ Treatment**

A2-7. Management requirements for vegetation communities.

Recommended fire regimes and treatments for vegetation communities on Badu Island are provided in **Table A2 – 7**.

Table A2 – 7. Fire behavior and recommended treatment for vegetation communities on Badu Island.

Fire Category	BVG	Vegetation Community	Description	Fire Behaviour/ Recommendations
Category 1	Evergreen forest and thicket	1d	Mesophyll/notophyll vine forest + *Endiandra glauca* + *Acacia polystachya* + *Syzygium bungadinnia* + *Canarium australianum* + *Dysoxylum oppositifolium.*	Generally will not burn under most conditions although habitat margins may be subject to damage and further attrition. Burns conducted early in the season (April to May) where these habitats share a boundary with highly flammable vegetation. Burns should be completed as close to the margins of the sensitive habitat as is possible.
		1h	Evergreen notophyll vine thicket with *Buchanania arborescens* + *Drypetes deplanchei* + *Elaeodendron melanocarpum* + *Endiandra glauca* + *Elaeocarpus arnhemicus* + *Chionanthus ramiflora.*	
	Semi-deciduous vine thicket	2f	Semi-deciduous vine thicket + *Canarium australianum* + *Manilkara kauki* + *Dalbergia densa* var. *australis* + *Buchanania arborescens* + *Sterculia* sp. (Annan River L.J. Brass 20319) + *Cochlospermum gillivraei.*	
		2x	Deciduous vine thicket + *Cochlospermum gillivraei* + *Bombax ceiba* var. *leiocarpum* + *Terminalia subacroptera* +*Sterculia quadrifida* + *Psydrax reticulata* + *Drypetes deplanchei.*	
	Welchiodendron dominant closed to open forests and woodlands	4a	*Welchiodendron longivalve* + *Acacia polystachya* +/- *Terminalia subacroptera* +/- *Canarium australianum* +/- *Bombax ceiba* var. *leiocarpum* open to closed forest.	
Category 1a	Communities of young coastal dunes (including some littoral thicket)	16k	Coastal foredune grassland, herbland, woodland and vine thicket complex (17j/17d/10b/2aa –	Hot fires will degrade habitats, particularly where they penetrate into

Fire Category	BVG	Vegetation Community	Description	Fire Behaviour/ Recommendations
			50/20/20/10).	grassland pockets. Preventative cool burns on the margins of habitat, particularly vine thicket components. Interspersed cool burns in grassland patches to prevent hot wildfire incursion and promote vine thicket expansion.
		2u	Semi-deciduous vine forest + *Manilkara kauki* + *Terminalia* spp. + *Sterculia quadrifida* + *Premna serratifolia* + *Acacia crassicarpa* + *Drypetes deplanchei* + *Millettia pinnata.*	
Category 2	Grassland	17c	Open to closed tussock grassland with emergent shrubs.	Susceptible to hot, late season fires and will burn with considerable intensity First communities to be burnt after wet season. Well-spaced fires lit progressively from as soon after the wet season as they will carry until, in most years, early June Targeted, hot, late season fires required to arrest/ reverse shrubby invasion.
		17d	Medium to tall *Mnesithea rottboellioides* + *Heteropogon triticeus* + *Cymbopogon* spp. +/- *Imperata cylindrica* +/- *Themeda triandra* grassland.	
	Pandanus dominant woodland	11b	*Pandanus* sp. +/- *Melaleuca viridiflora* open forest, woodland and shrubland.	
	Melaleuca dominant shrubland	13a	*Melaleuca viridiflora* +/- *Pandanus* sp. shrubland and low woodland.	
Category 3	Melaleuca dominant open forest	7b	*Melaleuca saligna* open forest.	Burns with considerable intensity under hot, dry conditions. Can be burnt at 2 year intervals due to fuel accumulation. Burning should overlap with that of Category 2 vegetation and be completed when soil conditions are moist. Patch burning should be undertaken in June to August to reduce fuel loads, once burning in Category 2 vegetation has been completed.

Fire Category	BVG	Vegetation Community	Description	Fire Behaviour/ Recommendations
Category 4	Shrublands and shrubland complexes	14a	Dwarf *Welchiodendron longivalve* + *Alyxia spicata* +/- *Melaleuca viridiflora* +/- *Acacia* spp. +/- *Asteromyrtus brassii* shrubland.	Generally will not burn unless conditions are severe and several years of fuel have accumulated. Widely spaced spot fires including incendiary burns, later in the season (from August onwards).
		14c	*Welchiodendron longivalve* shrubland.	
		14d	*Cochlospermum gillivraei* +/- *Canarium australianum* +/- *Welchiodendron longivalve* deciduous shrubland.	
		14j	*Acacia brassii* +/- *Welchiodendron longivalve* closed shrubland	
		18a	Deciduous shrubland / Rock pavement complex.	
		18b	Low *Acacia brassii* +/- *Welchiodendron longivalve* +/- *Cochlospermum gillivraei* shrubland/ rock pavement complex (18a/14j - 50/50).	
Category 5	Welchiodendron dominant closed to open forests and woodlands	4b	*Welchiodendron longivalve* low woodland, low open woodland and tall open shrubland.	Will not burn unless conditions are hot and several years of fuel have accumulated. Widely spaced spot fires including incendiary burns, later in the season (from August onwards) after mosaic burning of Category 2 vegetation has been completed
Category 6	Mangrove forest, woodland and shrubland complexes	24a	Mangrove closed and open forest, woodland and shrubland complexes (24d/24c – 80/20).	Will not burn
Category 7	Exotic Vegetation	Bamboo	Bamboo groves and thickets	Burns with high intensity. Hot fires will destroy plant due to shallow root system. Protection burning in early season as judged necessary

Fire Category	BVG	Vegetation Community	Description	Fire Behaviour/ Recommendations
Cleared / Urban Areas	Cleared Areas	Cleared areas and exotic vegetation	Includes exotic vegetation, rank grassland and infrastructure areas	Asset protection burning commencing early in the season. Fire breaks should be constructed pior to initiation.

Vegetation communities 1 and 1a: Vine thickets and dune complexes on coastal dune complexes.

Strategy: Protect these communities from fire damage to the margins. When burning in adjacent communities light the first fires close to the margins. The highly restricted dune scrubs and complexes are showing damage from fires necessitating preventative cool burns in the adjacent grasslands. The need for such action could only be determined on a case by case basis and its identification would rely on ground inspections by the rangers.

Vegetation communities 2: Vegetation communities of moderate to high flammability. Communities with a medium to tall grassy ground cover, including grasslands and woodland communities and some previously cleared areas.

Strategy: These communities accumulate fuel more quickly than others and should be the first burnt after the wet season. Well-spaced fires should be lit progressively from as soon after the wet season as they will carry until, in most years, early June, with the aim of reducing the capacity of unplanned late season fires to spread. As a high proportion of the rainforest areas have margins with these communities it is desirable that a cautious approach to them be adopted by lighting the first fires of the season near their margins (see Vegetation Communities 1, above.) The ability to start early burning in these areas depends on having on average between one third and two thirds of them with at least two years' fuel accumulation, and patch burning operations should cease if they seem likely, in any one year, to cover more than half of the available area.

Vegetation communities 3: Seasonally wet forests and woodlands that will support fire.

Strategy: Fires entering these swamp communities when they are dry have the potential to do severe damage. Patch burning undertaken from June when soil conditions are moist. Maintenance in good condition therefore, depends on appropriate patch burning strategies in surrounding country (typically rank grasslands on margins) that minimize the risk of wildfires entering the swamps when they are dry, and regular (+2 year intervals) fuel reduction in them, by burning when they carry surface water. It will also be necessary to undertake fuel reduction burning in adjacent rank grasslands prior to any prescribed management effort. This will that the risk posed by wildfire to infrastructure is minimised.

Vegetation communities 4: Communities with a sparse to moderate ground cover which includes a range of shrubland and low woodland communities of relatively low stature that are developed on low fertility rocky footslopes.

Strategy: Ignite widely spaced fires through these communities during a period that should extend, in most years, from June to mid-August, with the aim of promoting maximum diversity in the landscape while minimizing the danger of large unplanned fires. Burning in Category 4 vegetation should overlap with late season burns in residual areas of Category 2 vegetation and should be targeted by in the later part of the burning window (June to August) by aerial ignition runs if necessary. Aerial ignition should be followed up by ground ignition until seasonal conditions (indicated by fires continuing to burn for several days) are judged to be too severe to continue.

Where shrublands are dominated by *Welchiodendron longivale* or *Asteromyrtus brassii,* these communities are often difficult to burn except by hot (predominantly late season fires). They are generally not harmed by infrequent hot fires, which, however, would be undesirable in surrounding communities. A cautious approach should be adopted, by burning them in June to August, relying on both chance spread of fire from within those communities, and by extending aerial burning operations in them.

Vegetation Communities 5: Welchiodendron dominant woodlands with a sparse grassy ground cover, frequently broken by rocks.

Strategy: Fires will generally trickle through these habitats and self-extinguish where they run into physical breaks such as rocky areas. Ignite widely spaced fires through these communities during a period that should extend, in most years, from June to mid-August, with the aim of promoting maximum diversity in the landscape while minimizing the danger of large unplanned fires. Burning in these areas should overlap with a program in Category 2, and be simultaneously targeted by any aerial ignition runs in the latter part of the burning window. Aerial ignition should be followed up by ground ignition until seasonal conditions (indicated by fires continuing to burn for several days) are judged to be too severe to continue.

Vegetation Communities 6: Inflammable mangrove vegetation

Strategy: No strategy required as these habitats will not burn under most circumstances.

Vegetation communities 7: Bamboo thickets of cultural significance.

Strategy: Fuel reduction burning should be undertaken in adjacent highly flammable vegetation early in the season (generally April to May) where it is judged that these habitats require protection.

A2-8. Management requirements for sensitive species.

Table A2-8 details specific requirements for sensitive flora species known to occur on Mabuiag Island that may be influenced by fire regime. Additional baseline survey on sensitive fauna species populations is required before specific management issues are identified in regard to fauna. In the case of fauna species, as it is for the majority of flora species, mosaic burning of the landscape commencing early in the year is considered the most appropriate management action.

Table A2-8. Management recommendations for sensitive flora species

Species	Habitat requirements	Fire Management Requirements
Cycas badensis (vulnerable NC Act) (Cycadaceae)	A broad range of woodland and shrubland communities. Will grow under forest canopies although the ability to reproduce is hampered.	Mature cycads are generally tolerant of hot fires although hot fires will often destroy seedlings and seed. The seed bank is generally short lived, up to three years and any hot fire during this period will destroy the seed bank and limit ongoing recruitment. Seedlings are however tolerant of cooler fires which may promote population expansion. Healthy populations of the cycad will generally comprise a number of size classes of plants ranging from seedlings to mature adults. The recommended fire management framework that promotes patchiness in seasonal burning is considered the best practice for maintenance of the islands cycad population. Care should be taken where habitat for this species is subject to shrubby thickening as hot fires may damage plant. Mitigating strategies should be considered where this situation arises. This would include targeted burning on the margins of known populations to reduce the risk of late season fire damage.
Psydrax reticulata (vulnerable NC Act) (Rubiaceae)	Shrublands on rocky slopes, often associated with rock pavements.	Widely spaced mosaic spread evenly across the landscape to promote patchiness. Burning should be completed in June to August with the aid of incendiary devices when additional resources

Species	Habitat requirements	Fire Management Requirements
		are required.
Diospyros sp. (Bamaga BP Hyland) (Vulnerable) (Ebenaceae)	Eucalypt dominant woodland habitats.	Widely spaced mosaic spread evenly across the landscape to promote patchiness. Burning should be completed in June to August with the aid of incendiary devices when resources are insufficient to complete the task.
Dendrobium x superbiens *(Orchidaceae)* Vulnerable NC Act, EPBC Act	A range of low woodland and shrubland habitats although most typically associated with low open melaleuca dominant woodland. On Mabuiag, the species was recorded on rocky pavements.	Orchid diversity is promoted by a moderate fire regime that retains grassy ground cover yet avoids severe canopy or branchlet scorch. Mosaic burning in woodland habitats, particularly focusing on control of shrubland encroachment, will promote retention of the species in the landscape.

A2-9. Operational Tasks

This section provides a checklist of items that are considered essential to delivery of fire management on purpose of this section is to list those matters that are essential to the delivery of fire management on the island. Responsibilities for each task should be allotted each year and recorded in the annual burn plan.

Table A2-9. Operational requirements of the Badu Island burning program.

Requirement	Comments
Equipment inventory	A detailed list of equipment necessary for implementation of the burn program and checklist of items held by the Badu Island Rangers
Training	Essential training required for implementation of the fire program (further advice required; Mick Blackman). GIS mapping training to record burn locations.
Stakeholders	A list of all stakeholders including agencies, names and contact numbers (see **Table A2-4**).
Safety and emergency procedures	A full statement of emergency procedure is to be compiled. Advice is required from agencies such as the State Emergency Service / Mick Blackman).

Regulatory requirements	Advice from SES/ Mick Blackman is required in this regard.

A2-10. Monitoring and reporting

Specific requirements for monitoring and reporting on an annual basis are provided in **Table A2-10.**

Table A2-10. Recommended monitoring and reporting requirements

Requirement	**Comments/ Responsibility**
Establishment of photographic monitoring points	Specific photographic monitoring points need to be established at appropriate locations to detail the success of specific management actions. Guided by senior ranger/ ranger supervisor with external expertise sought where required.
Fire mapping	The locations and extent of areas burnt during each fire season should be mapped for ongoing reference. Guided by senior ranger/ ranger supervisor with external expertise sought where required.
Satellite mapping of fire scars	Satellite mapping of annual burns requires investigation. Currently under investigation.
Annual reporting	An annual report on the Badu Island fire program should be prepared at the completion of each burn season. This should provide a summary of areas burnt, timing, conditions as well as mapping of burn scars. Senior ranger guided by ranger supervisor
Preparation of annual burn plan	To be completed prior to commencement of the annual burn program with consideration given to previous years activities. Incendiary burning should be considered in inaccessible locations which are suffering from the long term absence of fire.

A2- 11. Mabuiag Burn plan

Burn Plan: Year 2013 - 2014: This year will be devoted to building community support for future fire management programs by becoming involved in dealing with fire problems in the urban area, in particular with managing fire risk around the township and surrounding area. This will require full involvement with any brigade set-up under the Rural Fires Act and training in relevant legislation. In any area where fire management is proposed, the initial task will be to remove the risk posed by heavy fuels in the rank grasslands that surround the township and infrastructure. The main infrastructure concerns for asset protection burning are:

1. The airstrip and its perimeter fence line.
2. The water catchment area.
3. Power generation plant.
4. Residential dwellings and numerous small huts in picnic areas.

Techniques chosen to implement fire protection measures should be trialled for effectiveness. Suitable techniques for asset protection might require either the slashing or spraying (using herbicide) of a 2m wide strip around the perimeter of these areas very early in the season (March to April) followed by burning of the dead grass as soon as ignition is possible to create a fire break. The water catchment area is extremely sensitive; the use of herbicide may not be acceptable and burning on the perimeter at any time is likely to result in undesirable ash-fall into the catchment pond. Hence, consultation with the council will be required before any firm management action is undertaken. It may be that the most appropriate action would be to undertake early season fire management of adjacent vegetation at a time when wind direction is favourable.

Attention should also be focused on increasing knowledge of the island's geography by driving or walking all roads and tracks as well as walking away from roads. Ecological knowledge of the island will be gained by examining habitats and the lighting of small test burns, extinguished before leaving them, in a wide range of habitats and under a range of seasonal conditions. Focus should also be paid to identifying areas of shrubby thickening and ascertaining what parts of the island burnt during the year through fires lit opportunistically. This will facilitate planning for burning in the following year. Knowledge of fire behaviour will be gained by lighting small test burns.

Burn Plan: Year 2014- 2015: Once obligations regarding safety surrounding the township have been met, the main focus of the task will be to spread patch burning operations widely across the island's landscape to lay the basis for a permanent shift, in following years, of the pattern of burning from a late season to an early season one.

- Patch burning operations will occur progressively from as soon after the wet season as fires will carry to no later than mid-September, both on the ground and in helicopter operations right across the island with the aim of leaving a minimum of fuel for late season fires. It is intended that these operations will, by reducing the occurrence of widespread late season fires, leave enough unburnt country to provide a better basis for progressive patch burning operations in the following year and subsequent ones. For this period, while it may not be possible to make other than a small beginning because of a scarcity of fuel, every effort should be made on the ground, as soon as fires are likely to carry (mid-April to mid-June depending on the season) to burn anything that can be found to burn, no matter how small the resulting patch. Early season burning should focus on **Category 2** vegetation, particularly where it shares a common boundary with littoral scrubs or vine forests.

- Once on ground operations in **Category 2** vegetation are largely complete, generally by the end of May, focus can be shifted to the burning of **Category 3**, **Category 4** and **Category 5** vegetation. This should be undertaken initially along roadsides and access tracks to assess fuel loads and whether effective ignition is actually feasible. Dependent on results, patch burning efforts can be spread more widely throughout these habitats, possibly with the assistance of aerial incendiary devices if on ground resources are insufficient to the task. The appropriate timing for this operation cannot be defined as it depends on seasonal conditions, but on average it should commence in June and be completed by mid-September.

- In the range country, the motivation to break up the fuel is the same as for the lower elevation country, but the situation is quite different. It is likely that much of it has not burnt for some years. In a rough broken landscape such as the Mabuiag, with boulders and a generally rocky surface, and numerous patches of closed forest, most spot ignited fires will not carry far. The only way to spread fire across the landscape will be to hope that some fires will continue to burn over a number of days, trickling around the landscape. This will inevitably lead to great variations in the intensity of the fire according to the time of day during which it was burning, the weather, and whether or not it was burning up or downslope.

- It should also be noted that with the *Melaleuca saligna* dominant swamplands (**Category 3**), these habitats are fringed by dense swards of both native and exotic grasses which have direct linkage with urban areas. Hence fire breaks will need to be established through early season burns on the habitat margins if these areas are to be burnt successfully with safety. In such hazardous situations, operational safety measures such as burning on decreasing fire hazard (late afternoon) should be considered and incorporated into the burn plan as necessary.

If the operations described above achieve their expected result, they will provide the basis for building a mosaic of burn patterns across the landscape, and leave enough unburnt country to provide a better basis for progressive patch-burning operations in the following year. If not, there is little option but to repeat these procedures in the following year.

Burn Plan: Year 2015 and Beyond: A program for year 3 can, at this stage, only be tentative. It will depend very much on the experience of the preceding years, and how closely its goals can be reached. There are unpredictable circumstances relating to how successful a start can be made on changing burning patterns and establishing a mosaic pattern of burning on which to build. Also to be tested at all stages is the question of whether or not resources available are adequate for the task. For these reasons, therefore, fine detail has been avoided, and this report confines itself to outlining the direction of an ideal program to occupy the year 2015, and repetitively from there on, while emphasizing its essential features. Whatever precise direction is pursued for 2015 and beyond, it should be shaped by the experiences of the operations in preceding years, and all annual programs from there on should evolve from past experience.
The sequence of events in an ideal operation for 2015 and following years, at a basic level should be:

a) To continue a program of ensuring the safety of the town area by keeping fire breaks open, and burning whenever there is two years accumulation of fuel – if the weather allows it. Additionally, rangers should ensure that their operations cannot cause damage to huts or other infrastructure away from the town area;
b) To begin burning as soon as possible after the wet season, with on the ground operations to spread spot fires through readily accessible sections of grasslands and grassy woodlands (see map) and other areas with a cover of tall grass.
   In most years these operations should occupy the period mid-April to the middle of June.
c) As soon as on the ground operations are judged to have a satisfactory level of coverage in grassy woodlands, focus should shift to the burning of habitats with lower fuel levels. This includes shrublands on rocky footslopes, melaleuca dominant open forest and other woodland habitats comprising *Welchiodendron longivalve.* Such operations should commence in June and extend through August, possibly into September with aerial ignition of rangeland country if a lack of resources dictates.

Other areas that require ongoing specific attention include:

a) Areas requiring special attention relate specifically to areas affected by shrubby thickening, noticed particularly in Talai where shrubby encroachment of melaleuca threatens both grassland habitats and a significant population of *Cycas badensis.* The only management option available to reverse this process is the use of fire, and the longer the thickening has been occurring, the hotter the fire will have to be. This will

require some consideration to cycad groves where seedling recruitment and expansion of the existing population will be compromised by hot fires. Hence early season burns may be required on the population margins prior to application of more intense burning episodes.

b) Areas where repetitive hot fires are causing noticeable retreat of vine thicket boundaries, particularly Bidhay Kup, should be targeted for specific management. The application of cool burns along the margins of the retreating vine thicket habitats should arrest this process and result in gradual re-establishment of vine thicket species along fire exposed footslopes. Where fire sensitive vegetation such as vine forest is concerned, lighting of fires should be done in a line as close to the margin as possible.

Table A2-11. Considerations for protection of life and property.

Area	Strategy
Mabuiag Township.	• During late wet season complete a system of fire breaks around the town as required by slashing or spraying and then burning the dead residue. • Flammable grasses are cleared from around houses by slashing or mowing, and raking. • Identify potential fire hazards around other island settlements and essential infrastructure, and liaise with owners to ensure appropriate action is taken to protect them, including early burning around them if necessary.

Table A2-12. Considerations for biodiversity conservation

Habitat	Strategy
Coastal dune complexes containing vine thickets and related vegetation, and woodlands or isolated trees of vine thicket species	Early burn grass areas to protect sensitive species and communities from late season fires. If resources for this work are limited, concentrate on these areas where there has been recession of vine thickets from the influence of past fires.
Swamp forests and other wetland areas that will support fire	Burn while there is still surface water at intervals of two years or more. In years when they will not be burnt, carry out intensive fuel management in adjacent areas to minimize the chance of fire entering them when they are dry, or the risk that intense fires targeted at swamps will spread extensively into areas of residential dwelling or infrastructure.
Areas of vegetation thickening within grassy woodland and grassland habitats.	Vegetation thickening reduces biodiversity within the ground layer species of the site, and could, in the long term, spread, leading to an inability of the habitat to regenerate itself. When such areas are identified, attempts will be made to reverse the thickening process by one or more late season fires. Before such burns there will be intensive fuel reduction in surrounding areas to limit the spread of late season fires. Storm burning should be considered as a viable option.

Table A2-13. Considerations for weed management.

Identify areas that will not be covered by the island-wide burning program, mostly in the vicinity of settled areas, where it could be useful to burn patches of heavy weed infestation, with follow-up spraying when new plants begin to germinate.

Table A2-14. Fire management program checklist (example)

Action	Responsibility	Date Achieved
• Has equipment been checked and serviced, and will it be adequate for the planned program?		
• Have all necessary approvals and permits been obtained, and relevant people advised?	Is there a fire warden? Is Council approval needed?	
• Has communication gear been tested and a communications protocol put in place?	Does communication gear have to be purchased? Might need to identify a consultant to advise on this.	
• Are adequate maps available?	Consult with 3D Environmental / TSRA GIS section on this.	
• Are safety and emergency plans in place?		
• Have those involved been briefed on the requirements of the burn plan, on safety and emergency plans, and trained in the use of equipment?		
• Has responsibility for post burning season reporting been allocated?		