

Wildfire Management Plan for Killiney Hill and Mullins/Roche's Hill

Phase 2 Report: Baseline assessment of environmental sensitivity and environmental conditions which affect wildfire

Final



The results of wildfire modelling showing the likely fire spread during average summer weather conditions

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1 Introduction

This Phase 2 report has been prepared following the work programme agreed for this study. It is essentially a baseline report covering the following:

- Assessment of the biodiversity affected by wildfire
- Assessment of the environmental conditions important for wildfire development and control.
- Illustration of management operations recommended

As the garden survey (ostensibly carried out to examine biodiversity in gardens) resulted in direct contacts between the surveyor and residents this report also includes a preliminary assessment of community awareness of the risk of wildfire. Some results have been reported to Dun Laoghaire Rathdown and these reports will be referenced here.

2 Assessment of biodiversity

2.1 Sources of information

Information sources include:

- The detailed briefing note prepared by the Biodiversity Officer, Anne Murray at the commencement of the study.
- Examination of published information on geodiversity and biodiversity produced by the GSI and NPWS.
- Examination of Roche's Hill Vegetation Study 2023 (FitzGerald 2022)
- Examination of Killiney Hill Management Plan (Anon, 2012))
- Consultations with Willie Carr, DLR consultant, in relation to the status of badger and red squirrel on Killiney Hill.
- Results of fieldwork by Alexis Fitzgerald (commissioned by this study) to discover status of heathland on Killiney Hill communicated directly to Mary Tubridy.
- Results of fieldwork by Willie Carr (commissioned by this study) to clarify location of badger setts on Killiney Hill communicated directly to Mary Tubridy.
- Direct inspection of Killiney Hill and Roche's Hill vegetation by project ecologist Mary Tubridy in February / March 2023.
- Casual conversations with residents who allowed their gardens adjacent to Killiney Hill Park and Roche's Hill to be inspected by the project ecologist, Dr Mary Tubridy. A total of eighteen gardens were inspected to examine the relationship between their vegetation and that on the hill.

2.2 Results

Geodiversity

Killiney Hill and Roche's Hill are of high geological interest (Gallagher et al, 2014). They are at a high elevation in comparison to their surroundings. They are both underlain by granite with mica schist. While seaward sides are

partially covered in boulder clay which originated from the Irish Sea, outcropping rock is not uncommon, particularly on Roche's Hill. Quarrying occurred in both areas and the quarry on Killiney Hill is particularly well known, as rock from the area, called Dalkey Quarry was used to construct Dun Laoghaire Harbour. Quarry walls are now important for rock climbing and are a habitat for birds of prey.

Recent Landscape History

The land associated with Killiney Hill Park formed part of the demesne belonging to the family which lived in Killiney Castle. When in private hands the land was managed for farming, quarrying and substantial forestry. Tree planting did not occur on Roche's Hill, probably because soil was less suitable and farming and quarrying were the principal land uses. Farming ceased on both areas; in the 19th century at Killiney Hill and in the mid 1900's on Roche's Hill.

Killiney Hill and Roche's Hill are within the Dublin Bay Biosphere Reserve, are close to several Natura sites and within a Proposed Natural Heritage Area.

UNESCO Dublin Bay Biosphere

The Biosphere designation assigned by UNESCO covers the entire area of Dublin Bay and associated lands. The principal objective of Biosphere reserves is the promotion of sustainable development through a partnership approach. The management group for this partnership comprises Dublin Port Authority, Failte Ireland, National Parks and Wildlife Service, Dún Laoghaire-Rathdown County Council, Fingal County Council and Dublin City Council. There is one full time staff member who acts as co-ordinator. Funding is provided principally by local authorities. Activities within the biosphere include research on management strategies, the promotion of more sustainable business activities and education and awareness programmes within local schools and communities.

The map below shows the location of the Natura designated within a 15km radius of Killiney.

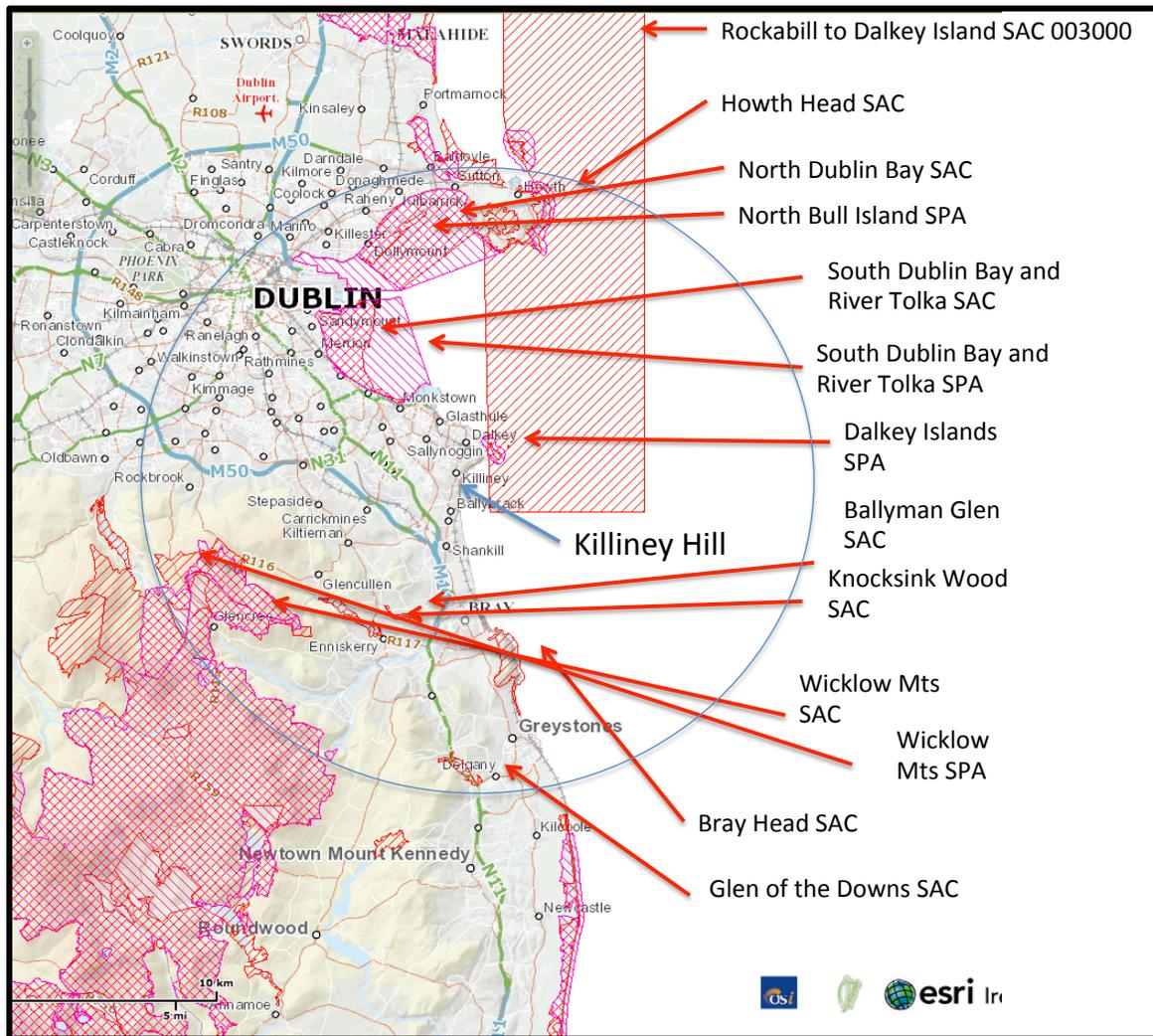


Fig. 1 EU Designated sites within 15km of Killiney and Roche's Hill.

Dalkey Islands SPA No. 004172 and Rockabill to Dalkey Islands SAC No. 003000 are the closest Natura sites of relevance to Killiney. Qualifying interests for Dalkey Islands are Roseate Tern (*Sterna dougallii*), Common Tern (*Sterna hirundo*) and Arctic Tern (*Sterna paradisaea*) and for the SAC they are Reefs and *Phocoena phocoena* (Harbour Porpoise).

The designation means that any development which could affect these sites or/and annexed species and is not necessary for their management must be subject to a four-stage assessment process called Appropriate Assessment (AA) as defined by the NPWS. The first stage in Appropriate Assessment is the production of a Screening Report which is submitted to the authorities. The aim of screening is to discover whether the project is 1) directly connected to or necessary for the management of the site, and 2) whether a plan or project, alone or in combination with other plans and projects, is likely to have significant effects on a Natura 2000 site in view of its conservation objectives. Screening is essentially a desk-based exercise informed by existing information about the sensitivity of the site, the status of European sites and species and pathways between them. If the work is essential to protect the Natura site then an AA is not necessary. If effects are deemed to be

significant, potentially significant, or uncertain, or if the screening process becomes overly complicated, then the process proceeds to Stage 2. At Stage 2 specific consideration is given as to whether the plan or project, alone or in combination with other projects or plans, will have adverse effects on the integrity of a Natura 2000 site. It will include any mitigation measures necessary to avoid, reduce or offset negative effects. The output of the Stage 2 is a **Natura Impact Statement** which will be submitted to the authorities. This will incorporate Stage 3 of the AA which examines any alternative solutions or options that could enable the plan or project to proceed without adverse effects on the integrity of a Natura 2000 site. The process must return to Stage 2 as alternatives will require appropriate assessment in order to proceed. Demonstrating that all reasonable alternatives have been considered and assessed, and that the least damaging option has been selected, it is necessary to progress to Stage 4. Stage 4 is the main derogation process of Article 6(4) which examines whether there are imperative reasons of overriding public interest (IROPI) for allowing a plan or project that will have adverse effects on the integrity of a Natura 2000 site to proceed, in cases where it has been established that no less damaging alternative solution exists. If IROPI is cited as a reason to proceed compensatory measures must be proposed and assessed in a Stage 4 report. The EU Commission must be informed of the compensatory measures. Compensatory measures must be practical, implementable, likely to succeed, proportionate and enforceable, and they must be approved by the relevant Irish Minister.

The area under study is also within a pNHA , the Coastal Zone and Killiney Hill (pNHA: 1206), an area designated for biodiversity under Irish legislation. This p NHA covers bordering coastal lands south of Killiney, Dalkey promontory coast as far as Dun Laoghaire (Fig. 2).



Fig.2 Designated area pNHA No. 1206 Dalkey Island and Killiney Hill

The following account of this pNHA was compiled by the NPWS in the 1990's.

“This site includes the coastal stretch from Scotman's Bay to south of White Rock, the Dalkey Island group and Dalkey Sound, and Killiney Hill. Killiney Hill is at the edge of the Wicklow mountain intrusion and so it is formed of a mixture of granite and mica schist. It provides one of the best exposed junctions of these rock types, on the beach at White Rock, at which mineralization has taken place due to contact metamorphism. The minerals include biotite, andalusite and garnet, with aplite and pegmatite veins also exposed. The seaward parts of Killiney Hill have in addition a covering of calcareous glacial drift. The rocky shore is mainly of granite. Dalkey Sound and its environs have been highly regarded as a valuable marine collecting area for many years. The Sound is especially noteworthy for the occurrence of west and south coast invertebrates. Species taken include Squat Lobsters (*Galathea spp.*), Swimming Crabs (*Portunus spp.*) and the Crawfish (*Palinurus vulgaris*). The area is also noted for the occurrence of gymnoblastic hydroids, with the rate *Antedon bifida* being taken regularly. Some rare European species which occur are members of the Order Nudibrachia and the Spiny Starfish (*Marthasterias glacialis*). Dalkey Island lies c. 400m off Sorrento Point. The island is low-lying, the highest point at c.15m is dominated by a Martello Tower. Soil cover consists mainly of a thin peaty layer, though in a few places there are boulder clay deposits. Vegetation cover is low, consisting mainly of grasses. No woody plants have become established, probably due to constant grazing by goats. Dense patches of bracken (*Pteridium aquilinum*) and Hogweed (*Heracleum sphondylium*) occur in places. Lamb Island lies to the north of Dalkey Island, attached at low-tide by a line of rocks. It has a thin soil cover and some vegetation, mainly grasses, Nettles (*Urtica dioica*) and Hogweed (*Heracleum sphondylium*). Further north lies Maiden's Rock, a bare angular granite rock up to 5m high. There is no vegetation cover. Muglins, a small granite rock, lies about 1km north-east of Dalkey Island. A small lighthouse is on the rock. Herring Gulls nest on Dalkey Island (17 pairs in 1986), Lamb Island (29 pairs in 1986) and Muglins (207 nests in 1982). Great Black-backed Gull nests on Dalkey Island (maximum 62 nests in 1982-88), and two pairs of Lesser Black-backed Gull nested there in 1981.

Common Terns breed annually on Maiden's Rock, with a maximum of 54 nests between 1980 and 1986. One pair of Arctic Tern bred on Maiden's Rock in several years and in 1986 two pairs of Roseate Terns nested but were unsuccessful. Manx Shearwater is suspected of breeding on Dalkey Island. Sheluck, Mallard and Oystercatcher nest on Dalkey and Lamb Island. Meadow and Rock Pipits breed on Dalkey Island. Maiden's Rock is an important autumn roosting site for up to 2,000 terns, including Roseates from the Rockabill colony. In autumn and winter Dalkey Island is an evening roosting site for Cormorants, Shags, Curlew and large gulls. Up to 50 Turnstones and 15 Purple Sandpipers occur in winter.

Killiney Hill is a complex of coastal heath and mixed woodland. The woods are mostly planted and include Sycamore (*Acer pseudoplatanus*), Horse Chestnut (*Aesculus hippocastanum*), some Oak (*Quercus spp.*), Ash (*Fraxinus excelsior*) and Holly (*Ilex aquilinum*). The ground flora is mainly Ivy (*Hedera helix*) and Brambles (*Rubus spp.*) but there are some areas with more typical woodland species such as Wood Sorrel (*Oxalis acetosella*) and Herb Robert (*Geranium robertianum*). Many of the rock surfaces on the open and bushy

areas on the east side of the summit of the hill are roches moutonnes while near the summit spodumene is found in a small scarp exposure. This results in an interesting flora, with Wood Vetch (*Vicia sylvatica*), Yellow Fumitory (*Corydalis claviculata*) and Madder (*Rubis peregrina*) growing amongst the Gorse (*Ulex europaeus*). The shallow soils overlying the rock support a community of winter annuals and early flowering perennials such as Spring Squill (*Scilla verna*) and Crow Garlic (*Allium vineale*). The drift banks above and below the railway have warm shallow soils. Here grow scarce plants such as Bloody Cranesbill (*Geranium sanguineum*), Bee Orchid (*Ophrys apifera*), Sea Storksbill (*Erodium maritimum*) and Clovers (*Trifolium ornithopodioides*, *T. striatum* and *T. scabrum*). The naturalized Silver ragwort (*Senecio cineraria*) is widespread. Up to five pairs of Fulmar breed on the cliffs below the railway line. Kestrel breeds in the area, as well as Stonechat. (NPWS, 1995)''

More recent studies commissioned by DLR have provided accounts of biodiversity in Killiney Hill Park (Anon, 2012) and Roche's Hill (Fitzgerald, 2022).

Habitat survey of Killiney Hill Park in 2012 (Anon, 2012) mapped the following habitats shown on Fig. 3.

- Mixed broadleaved/ coniferous woodland (WD2, WD3 and WD5)
- Scrub (WS1) and dry siliceous heath (HH1)
- Exposed siliceous rock (ER1)
- Semi-natural grasslands (calcareous, neutral and acid) (GS1 and GS3)
- Wet grassland (GS4)
- Ponds (FL8)
- Rocky sea cliffs (CS1)
- Amenity grassland (GA2)
- Stonewalls and other Stonework (BL1)
- Buildings and artificial surfaces (BL3)
-

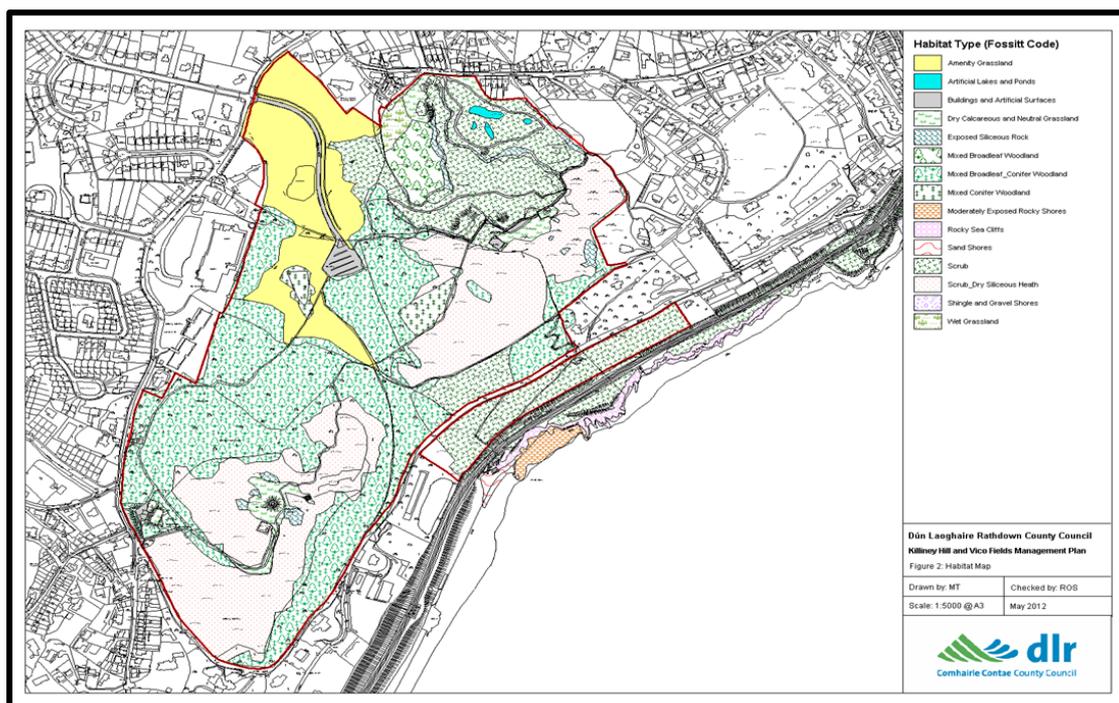


Fig. 3 Habitats mapped in Killiney Hill Park 2012

On Roche's Hill the following habitats were mapped in 2022 (Fitzgerald, 2022):

- Acid oligotrophic lakes (F12)
- Exposed siliceous rock (ER1)
- Dry meadows and grassy verges (GS2)
- Dry-humid acid grassland(GS3)
- Dense bracken(HD1)
- Dry siliceous heath (HH1)
- Oak-ash-hazel woodland (WN2)
- Scrub (WS1)
- Immature woodland (WS2)



Fig. 4 Habitats mapped on Roche's Hill in 2022

The most significant habitat in both areas is dry heathland (HH1), an annex habitat protected under the EU's habitat directive and therefore of international value. The location of dry siliceous heathland has been mapped in the land managed by DLR on Roche's Hill (Fig.3).

Dry heathland (mapped by Alexis Fitzgerald at the request of Mary Tubridy in 2022) is also present on Killiney Hill park, but at a very low cover in two locations. See Figs 5 and 6 for details of their location.



Fig. 5 Site of dry heathland at north of Killiney Hill Park



Fig. 6 Site of dry heathland at south of Killiney Hill Park

At these two locations there is good coverage of *Erica cinerea* (Bell Heather), which is a classic heathland species (but no *Calluna vulgaris*). The main species recorded across these two nascent heathland patches were *Erica cinerea*, *Ulex europaeus*, *Festuca rubra*, *Festuca ovina*, *Hedera helix*, *Hypnum* species, *Sedum anglicum*, *Agrostis capillaris* and *Geranium robertianum*.

The vegetation grades into rocky scrub. These are likely nascent heathland habitat and match a similar patch of nascent heathland habitat that was found on Roche's Hill. As the patches are too small for the usual minimum mapping size the map simply indicates their location. Following the interpretation from the Roche's Hill survey, these two small patches are identified as nascent dry heath, and so can be classified as the Habitats Directive Annex I habitat European dry heaths [4030].

Survey work commissioned by DLR shows that the sea adjacent to Killiney Hill Park and Roche's Hill has reef habitat, another annex habitat under the EU habitat directive.

Fieldwork by Mary Tubridy in 2022 and 2023 confirmed contrasting vegetation types between Killiney Hill and Roche's Hill. As extensive tree planting occurred on Killiney Hill vegetation here is dominated by woodland of various types described in a habitat survey in 2012 (Anon, 2012). Since the land was redeveloped as a park, farming ceased, little management has occurred in these woodlands, and trees, shrubs and bracken have colonised abandoned fields. Where deep soil is present and land was previously used for farming, grassland of GS2 type is now found, bracken (habitat HD1) has invaded or/and various non-native trees or scrub (WS1 and WS3) have appeared, often dominated by the native common gorse (*Ulex europaeus*). It was noteworthy that semi-natural vegetation dominates both parks such as old planted woodlands, (WD types). Scrub (native and garden type) and semi-natural grasslands such as GS2, GS3 (Dry-humid acid grassland) on short turf on rock outcrops and wet grassland (GS4) on the quarry floor

Amenity grassland (GA2) is only found in Killiney Hill Park. There it is close to the principal access point to the Park.

The extent of land covered by semi-natural vegetation (grasslands, scrub and woodlands) is responsible for a significant diversity of fauna at both sites. The 2012 habitat survey of Killiney Hill Park reported the following species:

- Badgers
- Bats
- Red Squirrel
- Birds such as Peregrine Falcon, Sparrowhawk and Kestrel
(there are also Raven and owls known to the location in recent times)
- Common Lizard
- Rare Plants

Consultation with DLR's Biodiversity Officer (Anne Murray, Pers.Comm) provided the following information about red squirrel, an iconic species of Killiney Hill Park and a protected species under Irish Law. There are two species of squirrel in Ireland, the red squirrel and the grey squirrel. The red squirrel is native but is undergoing a decline throughout the country and in Killiney Hill Park. The decline is due to competition from the introduced grey squirrel, which came to Ireland from North America in 1911.

Management work by DLR, carried out under the guidance of a consultant ecologist has sought to address this issue. However, according to the most recent Killiney Hill red squirrel monitoring report in 2022, the decline is also attributable to the increasing number of dogs off lead on Killiney Hill Park.

As visitors to parks such as Killiney increased during the pandemic this was also associated with an increase in visitors with dogs off lead. Dogs off lead are difficult to keep to existing paths. For example, dogs off lead explore all the habitats within the park, scenting and pooing in these habitats. They usually disappear into vegetation and are difficult to see, creating tracks through the ground flora, and dog owners also end up trampling on ground flora if they have to venture off path to find their dogs. It is widely accepted that mammal behaviour displays stress in the presence of dogs off lead and also in response to dog scenting and pooing within their territories. Mammals affected in Killiney Hill Park include not only the red squirrel but rabbit, badger, hedgehog and birds.

Therefore while dog owners and their dogs are not deliberately damaging habitats or disturbing native species their presence is impacting on important native species and stopping them from seeking cover or refuge. They are gradually being displaced from their natural habitats for feeding, breeding and resting including the iconic red squirrel. As a result the overall biodiversity value of Killiney Hill and the proposed Natural Heritage Area is under severe pressure including pressures from climate change.

DLR are currently looking at how to improve and restore areas of Killiney Hill for red squirrel and to examine ways to encourage visitors to keep dogs on the lead, and to keep to paths.

Consultations with William Carr, mammal consultant, confirmed the presence of three badger setts in Killiney Hill Park.

Survey work commissioned by DLR (MERC Consultants 2022) revealed the presence of an otter holt along the shoreline adjacent to Killiney Hill Park.

Not surprisingly, given the activity of botanists in the locality, rare plants have been recorded at both sites. Dalkey quarry floor supports a large population of a rare native tree *Sorbus hibernica*. DLR commissioned rare plant surveys carried out in 2009/2010 (Reynolds and Nash, 2009, 2010) revealed the presence of rare clovers in grassland on the short turf on Killiney Hill.

The garden survey carried out in properties adjacent to the hills revealed that it is not uncommon to find outcropping granite in these gardens (Tubridy, 2022). In most cases the vegetation on the granite outcrop is managed for amenity or to reduce fire risk. In contrast to the usual type of management, an excellent example of heathland habitat, managed for biodiversity was found in one of the gardens adjacent to Roche's Hill.

2.3 Goat grazing case study

As a contribution to the discussion about the use of conservation grazing in both areas a report was prepared on the goat grazing project in Howth. This is contained in Appendix 1 and will provide background to recommendations in the final report.

3 Environmental conditions which affect wildfire and its potential for control

3.1 Sources of information

The baseline analysis was based on reconnaissance fieldwork and desk research principally using global data sets, satellite imagery and modelling systems developed to describe wildfire behaviour.

A reconnaissance visit was carried out to the two sites to provide a practical understanding of the locations and enabled important data to be gathered on the various factors that would influence fire behaviour. This included an initial analysis of the fuel arrangement, the fuel structure, fuel continuity and the landform over which the vegetation was arranged. Photographic evidence was taken and a record kept of the exact location from where the images were captured. Details of the methodology are in the Inception Report (Gibson and Tubridy, 2022)

Desk research was carried out to identify the historic weather patterns that support high-intensity fire events in Ireland.

Desk research considered the shape of the landform which in the wildfire environment plays an integral part in determining how a fire will develop and spread across a landscape.

Consideration of the relative use of the landscape for recreation, and nature and location of infrastructure provided to facilitate recreational use.

Utilisation of global fire monitoring systems, satellite, remote sensing systems and historic data bases to analyse and forecast potential fire behaviour within the fuels found across the sites and surrounding area.

Examination of the Global Forecasting System, to identify weather trends suggesting future fire behaviour likely to occur. Climate data was acquired from Terra Climate (Abatzoglou et al. 2018). The maximum monthly temperature, minimum monthly temperature, total annual precipitation, and mean annual deficit were derived from this dataset at a ~4-km. A study was also made of a number of sources providing information on weather trends.

Sentinal 2 and Sentinal 3 infrared imagery was obtained through the Copernicus programme and reclassified vegetation data sets were used to obtain up to a 30 m resolution map of the study area.

Extensive fire modelling and computerised fire simulations were carried out using FARSITE and Wind-ninja to determine likely fire spread and intensity, making a comparison between the variables of the weather scenarios used in the study.

The software used to simulate fire spread dynamically and statically utilises the following advanced fire behaviour applications:

<https://www.firelab.org/project/flammap>

<https://www.firelab.org/project/farsite>

Database of meteorology:

<https://cds.climate.copernicus.eu/#!/home>

Wildfire database usage.

<https://effis.jrc.ec.europa.eu/>

The purpose of the simulations is to establish an understanding of how the fuel, topography and supportive weather conditions interact, influencing fire behaviour and its spread across the landscape allowing fire spread prediction from any point across the study area. NEXUS and FLAMMAP modelling was used to perform the first simulations. NEXUS which is a simulation tool based on the Rothaermel fire model which uses energy balance equations to predict the rate of spread. NEXUS (Scott, 1999) has been widely used as a simulation tool (e.g., Fuel et al., 2002; Scott, 2006). It is based on the same basic principles as FLAMMAP, and adapts its graphical interface to perform simultaneous simulation of fire scenarios. Input data in NEXUS interprets fuel structure and weather conditions. Fuel structure can be defined in NEXUS either by pre-defined fuel models (Scott & Burgan 2005) or via the direct entry of stand descriptors. These fuel models gather numerical information about fuel load, fuel size, moisture content or heat of combustion. The acquired understanding allowed the team to identify a number of areas on the sites landscape that provide significant support to fire development, in particular its intensity and spread amongst the fuels. These locations are termed to be Strategic Management Areas (SMA's). The reduction of biomass at the

identified SMA's can reduce fire spread and have a significantly limiting effect on fire behaviour reducing potential scale and intensity.

Fire simulations (thousands) were carried out to identify the fire behaviour likely to occur within the site's vegetation/fuel, under the influence of the dominant fire weather scenarios. Other factors, such as the effect of slope, orientation of the landform to the sun, the effect of topographic features such as ridge lines, drainage features and natural and man-made fuel breaks, were also considered.

3.2 Results

Results of baseline analyses for Killiney and Roche's Hill are presented in Figs. 7- to 10.

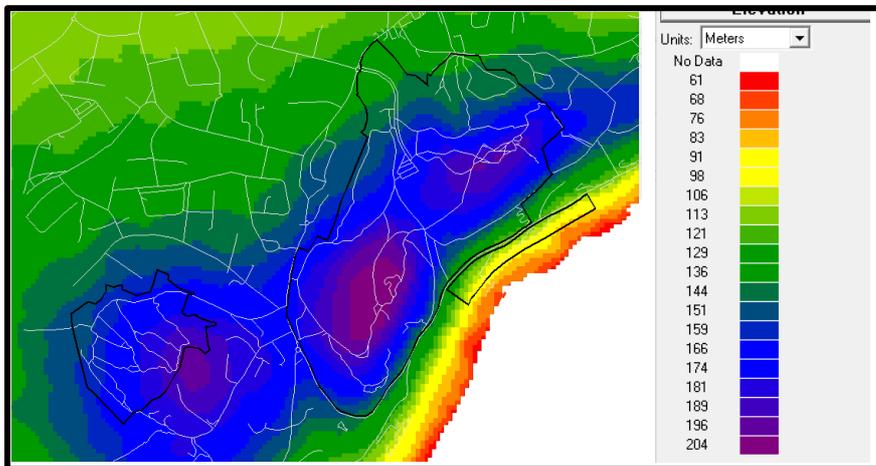


Fig. 7 Elevation

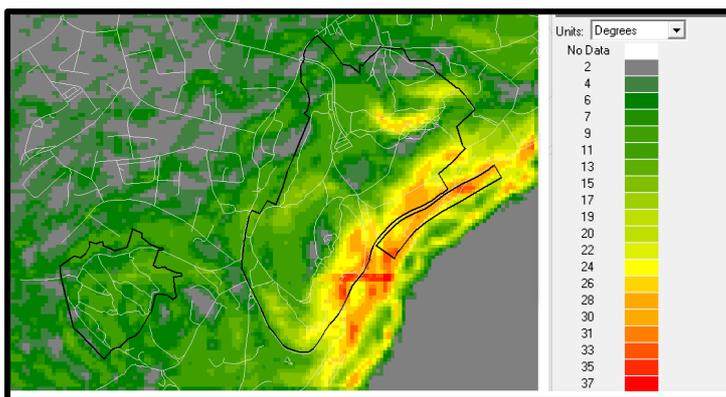


Fig. 8 Slope

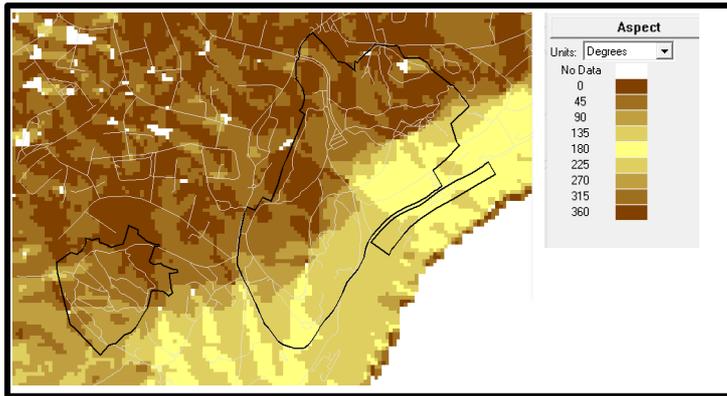


Fig. 9 Aspect

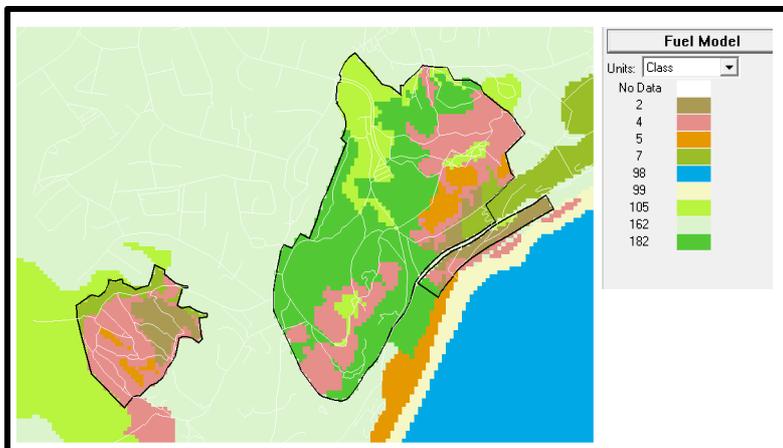


Fig. 10 Fuel model

Satellite imagery was the principal source of information for elevation, slope and aspect. Fuel load i.e. vegetation type was mapped according to the model whether grassland, scrub or woodland, using photos and satellite imagery and partly customised following Scott and Bergen (2005)

The following maps which describe fire behaviour in relation to polygons were produced by modelling exercises. Polygons of different sizes were produced by refining the levels of change in fire behaviour within the sites.

Fire behaviour has been mapped depending on weather conditions. Coloured arrows indicate likely fire intensity.

Green = low-intensity, Yellow Moderate-high Intensity, Red very High intensity.



Fig 11 Fire spread between the fire polygons during average summer weather conditions

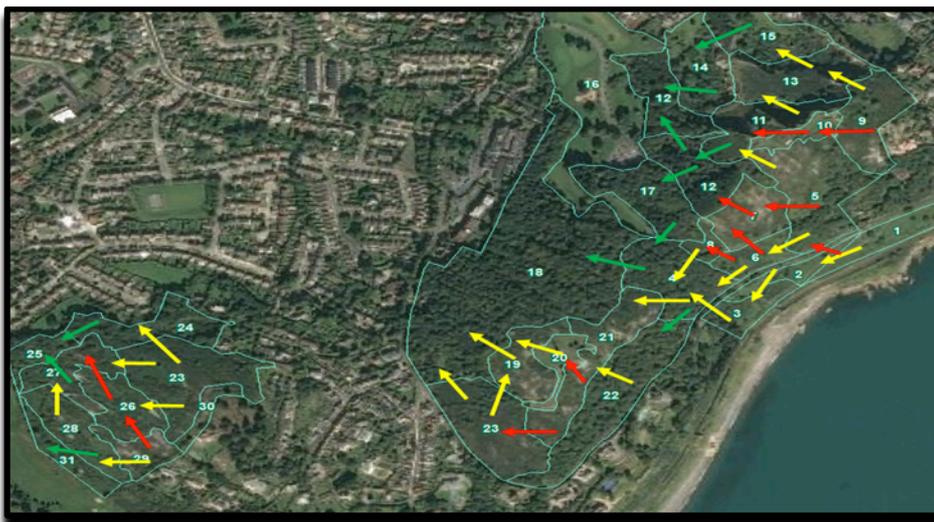


Fig 12 Fire spread between the fire polygons during the more supportive easterly weather conditions.

The following maps summarise the likely wildfire development in relation to these polygons.

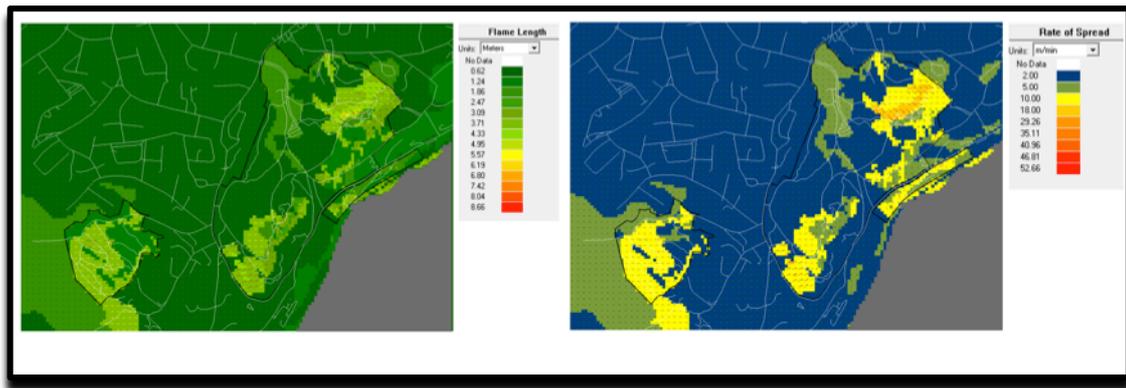


Fig. 13 Wildfire development under normal conditions: west winds 6km/h
Normal summer moisture vegetation conditions

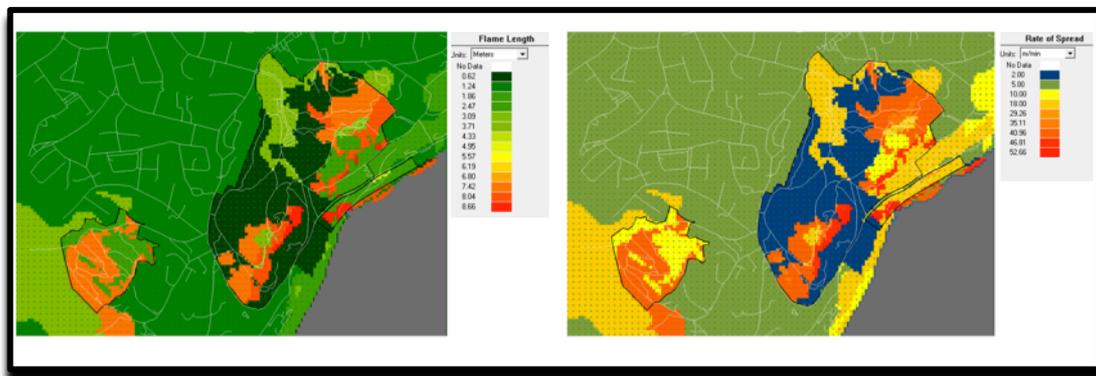


Fig. 14 Wildfire development under extreme conditions: east winds 20km/h,
dry vegetation

These maps show flame length and rate of spread, all produced by the wildfire modelling exercises.

Based on a preliminary analysis of wildfire behaviour a proposal was developed to modify expected fire behaviour by creating buffer zones, management areas and dividing axis, as illustrated in Fig. 15.



Fig 15 Suggested buffer zones, management areas and dividing axis

Buffer Zones are areas of where the fuel load is kept at a low level, to create an area of low fire intensity to significantly reduce the potential of fire spreading to sensitive features such as properties or areas covered in sensitive vegetation or supporting vulnerable species. The key function of buffer areas is to significantly reduce the risk of fire spread. In the case of woodland this involves removing the shrub layer. Buffer areas do not have the same width because their width depends on the expected flame length, and also the expected fire type, the nature of the fire, and the fuel model conditions. If the fire has extreme behaviour, the area should be wider. The buffer areas mapped here have the ideal minimum sizes.

Management Areas are areas of strategic importance where greater fire resilience is built across the landscape so that fire responders can more easily limit fire spread and reduce the potential scale of fire events. This is an orientative layer, to indicate the places that should be managed. The size of the area should be a minimum of six times the flame length (FL) expected, and for those particular places, FL goes between five and seven meters.

The Dividing Axis is of particular relevance to fire fighting. They define where the fuel loading should be reduced to a point where in the event of fire; responders would be provided with an opportunity to prevent fire from spreading from one area to another. The axis show how the landscape should

be "broken" in a future to limit the fire to those big areas and force it to have behaviour within the fire suppression capacity of the fire service. In Roche's Hill, the axis already exists at the limit of the last fire.

The principal function of Buffer Areas, Management Areas and Dividing Axis is to reduce and control fuel load to allow for more effective and safe fire fighting. They do not require complete clearance of vegetation. Details of the preferred nature of vegetation in these areas should be defined by DLR Parks and Biodiversity Officer depending on other management objectives and in consultation with NPWS given the presence of important habitats and species. Vegetation could be allowed to recolonize naturally or new species could be added to cleared areas. A management system will be needed to prevent any of this resulting vegetation becoming a fire risk. If the objective is to restore and maintain biodiversity values vegetation should only feature native species of trees, shrubs and herbs.

Following consultation with DLR precise location of these areas was redrawn and illustrated below.



Fig. 16 Proposed areas where management could occur to reduce fire risk and improve fire-fighting capacity. Version 2

Further information about the buffers is provided in Fig. 17 and options for further modifications are shown in Fig. 18.

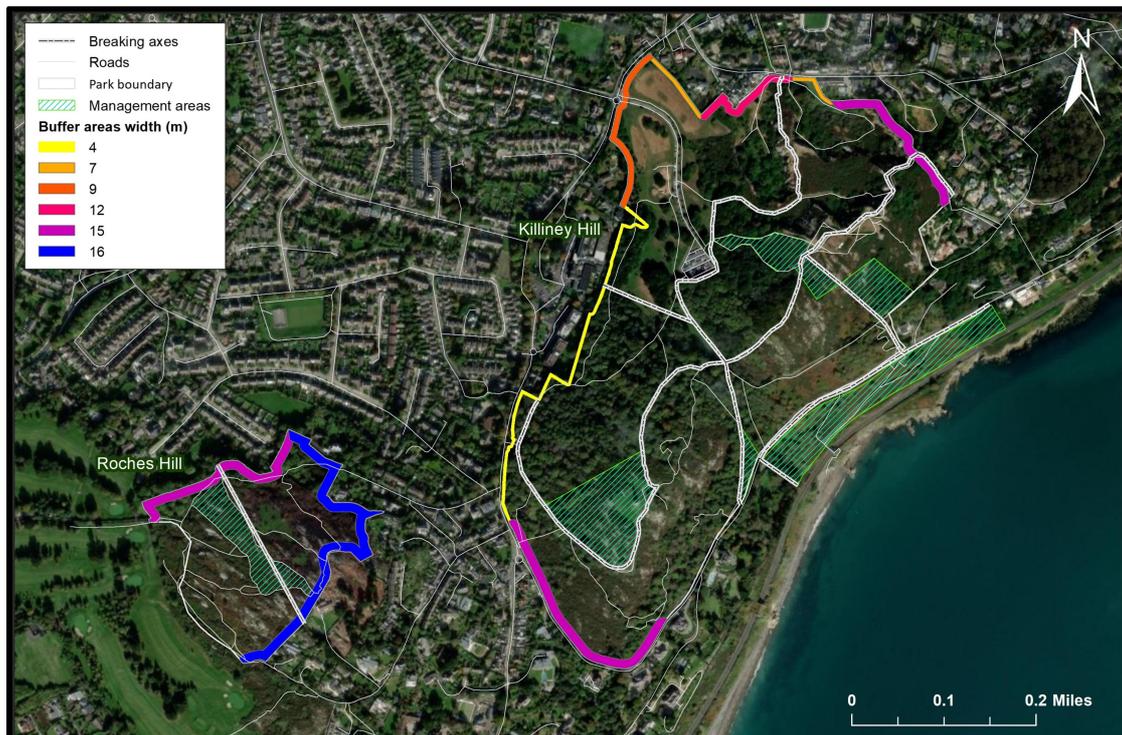


Fig. 17 Width of buffer areas



Fig. 18 Alternative management areas

4 Community awareness of wildfire risk and management

4.1 Introduction

All details from the garden survey were already submitted to DLR (Tubridy, 2022). The principal results are summarised here.

4.2 Results

Because of the occurrence of a large fire on Roche's Hill in 2022, householders in that area are particularly concerned with fire risk. One household beside Roche's Hill had useful information of fire history stating that in 1959 the family was evacuated from their house, that fires were usually every seven years until recently when small fires have become more frequent. After 1959 there was a fire in 1970, then 1976, then 1979, then 81/82 and now 2022. Dublin Fire Brigade records (see below) revealed the following pattern of fire incidents in both areas between 2012 and 2022.

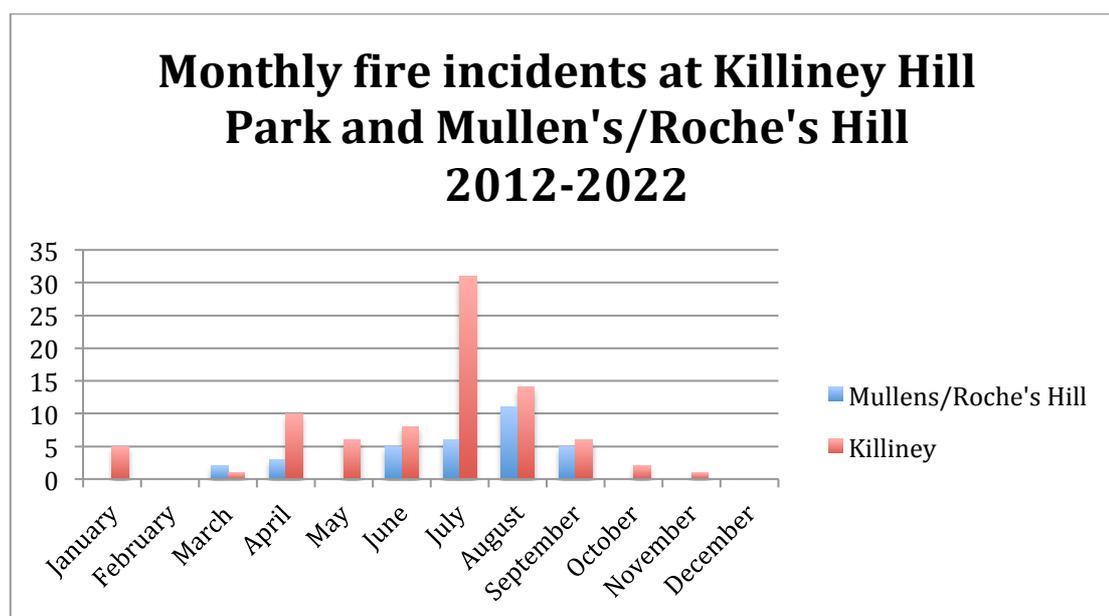


Fig. 19 Monthly pattern of fire incidents

All householders surveyed were sympathetic to biodiversity. A small number had specialist knowledge.

Measures have been taken by a minority of residents affected by the 2022 fire to manage fire risk by removing semi-natural vegetation, particularly gorse.

Residents should be given advice about management to reduce risk of fire to their garden and residences. This could consider nature of boundaries

and vegetation, advice on planting (for biodiversity and fire management), building in gardens, position of oil tanks and stockpiling of flammables. Reference should be made to Fire wise programmes for these types of guidelines

As residents in Ballinclea participated in a Whats app group sharing news and pictures of the recent fire such systems of information exchange could be elaborated to include other residents and interest groups and possibly facilitate liaison with the authorities.

5 Conclusions

5.1 Biodiversity baseline

Both parks are biodiversity hot spots, near others, i.e. the coast, big gardens and Killiney Golf Club. These include sites of international biodiversity importance i.e. SPA and SAC. Killiney Hill Park is a Proposed Natural Heritage Area, an area of national importance under the Irish Wildlife Act.

A report commissioned by Dun Laoghaire Rathdown Council in 2012 (currently being updated) described the general biodiversity interest of Killiney Hill Park. Roche's Hill has been subject to a more recent examination. 2022. Studies have highlighted their importance for semi-natural habitats, rare plants, birds of prey, bats, the common lizard and a wide range of birds.

There are small pockets of the rare habitat dry heathland in both areas. While not of particularly good quality, the existence of this habitat implies that there are particular obligations on the local authority to manage development in its vicinity.

The management of red squirrel is also a particular priority for park managers as this species was traditionally associated with the two parks and a recent survey work indicates a decline in the red squirrel population. It is considered that this is due to increase in grey squirrel and visitor pressures, in particular the impacts from dogs off leash. The retention of red squirrel population will rely on measures to encourage visitors to keep dogs on lead, and to paths.

5.2 Ecological assessment of management works

Any development including works to mitigate for wildfire risk in both areas should take care to minimise all impacts to semi-natural habitats and other habitats that support native species of flora and fauna. These works should ideally be designed to incorporate measures to improve biodiversity in particular the habitat for red squirrel in the parks.

Works to mitigate for wildfire will require ecological assessment by suitably qualified ecologists and should avoid any direct and indirect significant impacts to areas with dry heathland habitat, other important semi natural

habitats supporting bats and their roosts, badgers and their setts, red squirrel, rabbit, hedgehog, etc., reptiles and amphibians, important bird species, important flora and any other species noted during the surveys commissioned in 2023.

The timing of works should have regard for the bird-nesting season. Under Irish law, the local authority, Dun Laoghaire Rathdown, is responsible for the management of projects at Killiney and Roche's Hill that have the potential to significantly impact on protected and annex habitats and species including those protected by EU Directives.

A Screening for Appropriate Assessment will be required for the Strategy given that a number of European sites occur within the Zone of Influence of the Killiney and Roche's Hill. Any activities/projects related to the Strategy will also require a Screening for Appropriate Assessment, as a minimum at project level to determine any potential significant impacts on European sites.

Separately, all activities/projects will also require an ecological assessment to examine the potential impacts on all habitats, flora and fauna within the Zone of Influence including protected habitats such as EU Annex habitats which occur outside of a European site but are present on both Killiney and Roche's hills.

5.3 Modelling of wildfire and development of management options

The work to date has illustrated the types of interventions which are used to reduce fire risk and improve capacity of fire fighters to deal with wildlife. The locations of interventions will always represent a balance between managing for fire risk and protecting and enhancing other values of the site. Examples were provided of recommended locations for buffers, breaking axes and management areas. The final decision on their location will represent a balance between managing for fire risk and other values whether biodiversity or public safety.

Although beneficial, all of the above actions in themselves will not normally contain fire spread; their purpose is to lower fire intensity and rate of spread so that it is within the containment capacity of responders. These should be well trained and equipped, and apply tactics that are appropriate to the circumstances and fire behaviour being generated within the fuel complex.

Further consideration will be given to a wider range of initiatives in the final report.

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Appendix 1

Case study of goat grazing in Howth and implications for Killiney

Why goat grazing?

The principal objective of the goat grazing project in Howth is to maintain the quality of the rare heathland habitat and in so doing reduce the risk of wildfire on the hill. The land on the hill of Howth is mainly owned privately or leased to Howth Golf Club. Only a small area is owned by Fingal County Council, the principal agency involved in conservation management and the Competent Authority. Associated with the designation of the undeveloped parts of Howth as an SAAO, (Area subject to Special Amenity Area Order) the council works in partnership with landowners and community through the SAAO Management Group. This multi stakeholder group (landowners, concerned residents, recreational users, reps of environmental groups, NPWS and parks and planning staff in the local authority) meets regularly to agree and supervise research, works programmes, principally concerned with management for recreation and conservation and public awareness events. The re-introduction of goats was directly related to a project commissioned by the SAAO to examine the management of heathland, the most valuable habitat on the hill within the SAC and the SAAO.

Background research

Research for the heathland plan confirmed that in Europe, goats were common grazers of rough scrubby vegetation and grazing was a commonly used management tool in heathland conservation. Visits were made to goat conservation projects in Waterford and Westport which confirmed that certain breeds of goats could live outdoors all year round in Ireland and that they grazed on gorse and heather.

Planning for the project included the input of an international heathland management expert who was asked to comment on management options during a study visit. Local consultations were held with the SAAO Management Group and landowners and lease holders (Golf Club) to obtain their attitudes towards the introduction of goat grazing. A public meeting was held prior to the arrival of the goats to inform the public about the purpose of the initiative. As a result of this public meeting information emerged that goat grazing had been a feature of land management on heathland in the past (see Fig.1).



Fig. 1 Goats being milked in Howth c. 1930's

Feasibility Study of goat grazing

Soon after the public meeting in 2012 goats were introduced to an enclosure (50mx 50m) on the Hill of Howth within which had typical vegetation, but was distant from paths used by hill walkers. A high chain link fence was erected around the enclosure and a shelter was provided within it. Water collected from the roof of this shelter was the principal source of drinking water for animals. While it was appreciated that a more native breed of goat would survive year round in Howth, goats from Fingal's open farm were used in the feasibility study to address administrative arrangements concerned with animal welfare.

The goat grazing trial took place over two years during the summer months in 2012 and 2013. It was managed by a part-time goat herder, assisted by local volunteers. An ecologist surveyed vegetation in a defined set of sample squares (quadrats) before the goats arrived and also drew up a recording programme to be carried out by the volunteers. This involved recording the location of the goats with reference to different vegetation types within the enclosure during their inspection visits.

As project promoters were keen to engage the community, various activities were organised to raise awareness of the role of goats and thus indirectly publicise the importance of heathland management. As well as having a public meeting to explain why goats were needed (see Fig.2 for notice) a Facebook page was set up (Goats for Howth) to provide some background and a volunteer corps was established as goats needed to be inspected daily for animal welfare purposes.



Fig. 2 Notice of second public meeting 2013

When the goats arrived to their enclosure a ceremony was arranged to welcome them to Howth (covered by RTE television) when they were greeted by a representative of the St Lawrence family (owners of much of the land on the hill) and a large group of primary school children. When a major fire looked like threatening the goats in 2013, a local volunteer mobilised Fingal Co Co to safely remove them from the enclosure.

The grazing trial confirmed that goats removed trees from the enclosure and grazed sustainably on gorse and heather. The ecologist monitored the impact of goat grazing by recording presence and height of species in quadrats in the enclosure before and after grazing experiment. A botany student from TCD did an undergraduate thesis comparing vegetation inside and outside the enclosure.

The group of volunteers who inspected the animals daily contributed to the assessment of the impact of goat grazing as each time they visited the enclosure they recorded the location and nature of behaviour in a record sheet provided by project ecologist.

The publicity given to the project at the early stage proved detrimental to the grazing experiment as visitors to the enclosure usually brought food to the animals. Despite notices deterring this practise goats were usually treated to a wide variety of vegetables near the principal access point to the enclosure. Despite this practise they still managed to forage on the vegetation within the enclosure and demonstrate the potential of goat grazing on the Hill of Howth.

Large scale goat grazing

Following the success of the trial a tender was issued by Fingal County Council to provide a goat grazing service on the Hill of Howth. Based on a direct inspection of the site the Old Irish Goat Society submitted a proposal and it was awarded the contract to provide this service, which is on-going.

The goat grazing trial involved initially familiarising the herd of goats with its goat herd, environmental conditions and forage. This occurred in enclosed fields and shelter near the open hill, provided by a local farmer, where facilities were also provided for the full time goat herd. Over several weeks the herd and goat herd bonded, volunteers were recruited and gradually the goats started to range over heathland outside the farm. Visits from the public and people interested in conservation grazing were encouraged, often facilitated by assistant goat herds who took responsibility for the goats at weekends. The project is now in its second year and grazing is occurring at more distant locations from their base.

An issue in Howth now is disturbance of goats by dogs off leads. Despite signage and polite requests by the goat herd, dog owners regularly allow their dogs of leads. As this issue has become a major constraint to goat grazing Fingal Co Co is considering a range of measures to change behaviour (Hans Visser communication to Howth SAAO management committee, February 2023).

Lessons for Killiney Hill Park and Roches Hill

If goats are introduced to these area all dog walkers will need to keep their dogs on leads especially in areas where goats are grazing. In Howth dog owners offered the excuse that they could not see the goats and thus dogs were allowed roam.

Effective signage is needed and co-operation / consultation with dog warden.

Specific objectives for goat grazing should be clarified, baseline conditions described and monitoring systems agreed and implemented. It is recommended that there is consultation with Fingal County Goat Manager/ and the Irish Old Goats Society to explore the potential for a pilot grazing project.

An enclosed site should be provided initially in the locality where goats could become accustomed to the goatherd. This area should have shelter and

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grazing should include some vegetation that similar to that to be managed by conservation grazing.

An office is needed for the goatherd and meeting room for volunteers (volunteers are necessary to provide seven days a week monitoring)

If grazed areas are not fenced goats should be provided with electronic boundary collars.