Central Coast Council

Central Coast Council
Species Management Plan
Scrub Turpentine (*Rhodamnia rubescens*)

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Executive Summary

The Scrub Turpentine (*Rhodamnia rubescens*) is a large shrub or small tree up to 25 m high and is found in swamp sclerophyll forest, wet sclerophyll forest, rainforest and rainforest margins on the Central Coast. Prior to the introduction of myrtle rust fungus (*Austropuccinia psidii*) into Australia in 2010, the Scrub Turpentine was a common midstorey species, particularly in forests dominated by Sydney Blue Gum (*Eucalyptus saligna*), Turpentine (*Syncarpia glomulifera*) and Blackbutt (*Eucalyptus pilularis*). The species has since experienced a rapid decline. Myrtle rust fungus affects the ability of Scrub Turpentine to flower and set seed, thus seedling recruitment is negatively affected. In recognition of the threats posed to the species and the declines in the abundance and populations, the Scrub Turpentine is listed as Critically Endangered under Schedule 1 of the *Biodiversity Conservation Act 2016* and Critically Endangered under section 178 of the *Environment Protection and Biodiversity Conservation Act 1999*.

Despite the lack of recruitment, the Scrub Turpentine has been recorded throughout the Central Coast Local Government Area (LGA). Increasing population and development pressures across the Central Coast LGA are placing the remaining Scrub Turpentine populations and their habitat at an increased risk from development impacts, habitat fragmentation and habitat degradation. Species distribution modelling indicates that 59% of modelled Scrub Turpentine habitat with a predicted habitat suitability of greater than 70% has the potential to be negatively impacted by development. In addition, 64% of modelled habitat with a predicted habitat suitability of greater than 90% has the potential to be negatively impacted by development.

This Species Management Plan (SMP) outlines the process that proponents of planning proposals and biodiversity certification, local development and Council works must follow to avoid, minimise and mitigate impacts to the Scrub Turpentine. The SMP also identifies that local population monitoring will occur to determine changes in the occurrence or abundance of Scrub Turpentine across the Central Coast.

1. Legislative context

A key requirement of the *Biodiversity Conservation Act 2016* is that proponents of development must demonstrate avoidance and minimisation of impacts to biodiversity, prior to the calculation and retirement of biodiversity credits. Indirect impacts, referred to as Prescribed Impacts, must also be adequately considered and avoidance and minimisation of Prescribed Impacts must occur prior to the retirement of credits. For the Scrub Turpentine, impacts that may transmit myrtle rust fungus to adjacent retained plants must be adequately considered.

The Biodiversity Conservation Regulation 2017 identifies the need for consideration of Serious and Irreversible Impacts (SAII) on threatened species and ecological communities. A SAII is an impact that a consent authority considers likely to significantly increase the extinction risk of a threatened species or ecological community. Under the *Biodiversity Conservation Act 2016*, a determination of whether an impact is serious and irreversible is made in accordance with the four principles prescribed in section 6.7 of the Biodiversity Conservation Regulation 2017. The concept of serious and irreversible impacts is fundamentally about protecting threatened entities that are most at risk of extinction from potential development impacts. The Scrub Turpentine is identified as a species at risk of a SAII as it is in a rapid rate of decline (Principle 1, refer to Section 5).

Where Council requires the preparation of an ecological assessment, Biodiversity Development Assessment Report (BDAR) (for development applications) or Biodiversity Certification Assessment Report (BCAR) (for planning proposals), adequate targeted surveys for the Scrub Turpentine must occur. Targeted surveys must consist of parallel transects completed in accordance with Council's Flora and Fauna Guidelines (2019) or the NSW Government's publication, Surveying Threatened Plants and their Habitats (2020). For development where Scrub Turpentine habitat is being impacted directly or indirectly and does not automatically trigger the need to prepare a BDAR, additional assessment criteria are required. This includes preparation of a Threatened Species Test of Significance in accordance with Section 7.3 of the BC Act. The 'test' must demonstrate that a significant impact on the Scrub Turpentine is unlikely to occur. If a significant impact is likely to occur, a BDAR or Species Impact Statement (SIS; if the action is being assessed under Part 5 of the EP&A Act) must be prepared. Where a BDAR or BCAR is required, an assessment must then be completed to determine if a SAII is likely to occur. Where a consent authority is of the opinion that a development is likely to result in a SAII, the consent authority (e.g. Council) cannot provide development consent if the development is being assessed under Part 4 of the EP&A Act.

Mitigation measures nominated within this SMP will be included as Conditions of Consent on a Development Consent or as part of nominated mitigation measures within a Review of Environmental Factors for Council's own works. The mitigation measures can be nominated as conditions of consent if they relate directly to the development, are for a planning purpose and can reasonably be achieved.

2. The Planning Area

This Species Management Plan covers all areas of potential and known Scrub Turpentine habitat on the Central Coast, including all private and public land.

3. Aim of this Species Management Plan

The aim of this SMP is to increase the long-term viability of Scrub Turpentine populations across the Central Coast. The sub-aims of this SMP are to ensure that appropriate avoidance, minimisation and offsetting of Scrub Turpentine populations occur on the Central Coast, and where possible, habitats are also enhanced. The aim and sub-aims will be met through the implementation of the recovery objectives outlined in Section 9.

4. Species ecology and overview

The Scrub Turpentine, in the family Myrtaceae, is a large shrub or small tree up to 25 m high with reddish/brown fissured bark. Young stems are densely covered in fine hairs. Leaves are strongly 3-veined from base with moderately dense, translucent oil dots. The upper surface of the leaf is green and sparsely hairy, while the lower leaf surface is paler and sparsely to densely hairy (Figure 1). White flowers are borne between September to November with peak flowering occurring in October. A small red berry (5-8 mm in diameter) develops following flowering, turning black and maturing in December. The fruit is bird/water-dispersed, and germination is typically one to two months.

The Scrub Turpentine occurs from coastal districts of NSW north from Batemans Bay to Bundaberg in Queensland. Populations of Scrub Turpentine occasionally extend inland onto escarpments up to 600 m above sea level in areas with rainfall of 1,000-1,600 mm (Figure 2). The Scrub turpentine occurs in rainforest and rainforest margins, swamp sclerophyll forest, wet sclerophyll forest and open Eucalypt-forest dominated by Sydney Blue Gum (*Eucalyptus saligna*), Blackbutt (*Eucalyptus pilularis*) and Turpentine (*Syncarpia glomulifera*) on sedimentary, volcanic clay and alluvium soils (Benson & McDougall 1998).

Figure 1. Foliage of the Scrub Turpentine. *Photo: Jed Field*

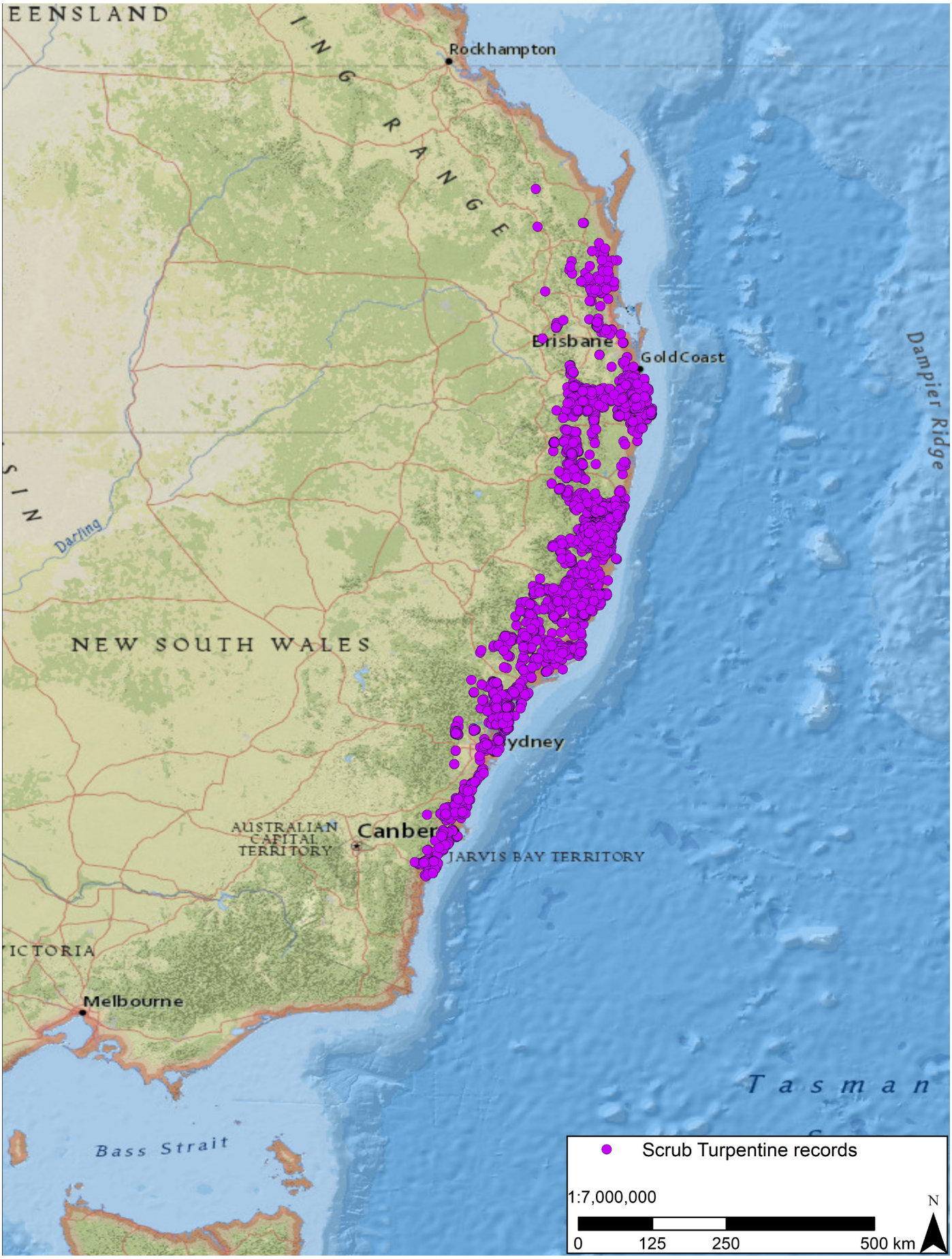

Figure 2. Known distribution of the Scrub Turpentine. Data source: *Atlas of Living Australia*

5. Myrtle rust and treatment

In April 2010, myrtle rust, a disease caused by the invasive fungus Austropuccinia psidii (formerly *Puccinia psidii*; Beenken 2017) was detected for the first time in Australia on the central coast of NSW. Myrtle rust spread rapidly along the east coast and is now infecting vegetation in a range of native forest ecosystems (Pegg et al. 2017). Myrtle rust affects many native species in the Myrtaceae family such as eucalypts (*Eucalyptus, Corymbia*), paperbarks (*Melaleuca*), bottlebrushes (Callistemon), tea trees (*Leptospermum*) and lilly pilly (*Acmena, Syzygium*; Carnegie and Lidbetter 2012). Australia is floristically dominated by Myrtaceae, which is widespread and abundant across Australia and is thus important in many ecological processes (Myerscough 1998). In recognition of the threats posed to native biodiversity, myrtle rust is recognised as a serious biosecurity threat in Australia (Commonwealth Department of Primary Industry 1985; Glen et al. 2007) and is listed as a Key Threatening Process under the NSW *Biodiversity Conservation Act 2016*.

The Scrub Turpentine is a known host of myrtle rust and is classified as extremely susceptible to infection, with the disease affecting leaves, stems, flowers and fruits from seedlings to mature individuals (Carnegie et al. 2016) (Figure 3). Individual plants exposed to repeat infections from myrtle rust, have been shown to suffer from crown loss and mortality (Carnegie et al. 2016). Flowering and fruiting have been severely affected and viable seed production and seedling recruitment in affected individuals is rare (Pegg et al. 2017). Consequently, the Scrub Turpentine is projected to decline by 96-99% over three generations across its range (Gallagher 2018) and therefore is in a rapid rate of decline. The main threats to the Scrub Turpentine are decline in health and mortality of individual plants, and lack of seed-based recruitment due to infection by myrtle rust. These effects are also magnified by clearing of habitat and habitat fragmentation, habitat degradation and competition from transformer weeds.

Myrtle rust spreads naturally by wind, water, insects, and animals. Spread can occur quickly and spores from myrtle rust can travel very long distances and can infect plants many kilometres from the initial site of infection (DPI 2015). Myrtle rust can also be spread over long distances via infected plant material, contaminated equipment, vehicles, and clothing. As such, preventative measures remain an important first line of defence to reduce the chance of myrtle rust being introduced into unaffected plant communities. Chemical treatment for infected plants involves fungicide application. However, highly susceptible species such as the Scrub Turpentine are prone to reinfection unless regularly treated. Preliminary work has found that fungicide applications targeting new growth were required to maintain effective infection control (see Horwood et al. 2013; Pathan et al. 2020; Adusei-Fosu et al. 2021).

Figure 3. Scrub Turpentine showing signs of myrtle rust infection. Photo: *Jed Field*

6. Scrub Turpentine on the Central Coast

There is a total of 37,664.1 ha of vegetation associations representing potential suitable habitat for the Scrub Turpentine across the Central Coast local government area (Figure 4). This potential suitable habitat for the Scrub Turpentine comprises 6,959.8 ha of rainforest vegetation, 2,347.6 ha of swamp sclerophyll forest and 28,356.7 ha of wet sclerophyll forest. This consists of 25,114.5 ha that are publicly owned, with the remaining 12,549.6 ha privately owned.

The NSW BioNet database is maintained by the NSW Government and includes records for a range of common and threatened plants and animals in NSW. In February 2020, a Species Distribution Model[1] (SDM) was prepared (Figure 6) using Scrub Turpentine records contained in the database. As of November 2021, the database contained 332 records of Scrub Turpentine in the Central Coast LGA (Figure 7).

The initial SDM developed in February 2020, was used to identify suitable habitat, and guide targeted surveys to validate and develop a final SDM. From February 2021 to February 2022, Council completed a targeted survey of Scrub Turpentine in suitable habitat across 233 sites (Figure 8). The surveys detected the Scrub Turpentine at 72 sites (Figure 8), with their characteristics described in Table 1 and myrtle rust infection classes in Table 2.

The final SDM was prepared for the Scrub Turpentine (Figure 9). The NSW BioNet records and the 2021 targeted surveys were used to develop the final model, along with 42 environmental variables (listed in Appendix 1). To estimate habitat suitability parameters, a binomial model was fitted to the data, first fitting the maximal model with all predictors, and then simplified to remove non-significant predictors. The most influential environmental variables that contributed to the SDM are displayed in Figure 10. The SDM identified 7,329 ha of potential habitat with a predicted habitat suitability greater than 70% (Figure 11). 4,232 ha (58%) is publicly owned (Council bushland, State Forest and National Parks), 4,310 ha (59%) are located outside of the Conservation Zones (C1 National Parks and Nature Reserves, C2 Environmental Conservation, C3 Environmental Management and C4 Environmental Living) and 1,653 (23%) are located in State Forest. The SDM also identified 1,943 ha of potential habitat having a predicted habitat suitability greater than 90% (Figure 12). 1,144 ha (59%) are publicly owned, and 1,249 ha (64%) are located outside of the Conservation Zones (C1 National Parks and Nature Reserves, C2 Environmental Conservation, C3 Environmental Management and C4 Environmental Living).

[1]SDMs use environmental variables such as temperature, rainfall, soil type, and elevation to determine which areas of the landscape are most suitable to be occupied by a species (Figure 5).

Table 1.

Summary statistics for targeted Scrub Turpentine surveys including number and % of sites where Scrub Turpentine was detected and vegetation associations for sites where the Scrub Turpentine was detected.

Number of sites where Scrub Turpentine were detected (% sites)	Number of Rainforest sites where detections occurred (% sites)	Wet Sclerophyll Forest	Swamp Sclerophyll Forest	Open Eucalypt Forest
72 (31)	5 (83)	44	1	12

Table 2.

Summary statistics including rust fungus infection severity for all Scrub Turpentine individuals observed during targeted surveys.

Disease extent				
Very small e.g. a few leaves	Single branch	Several branches	Majority of crown	Whole crown
7	4	66	68	41

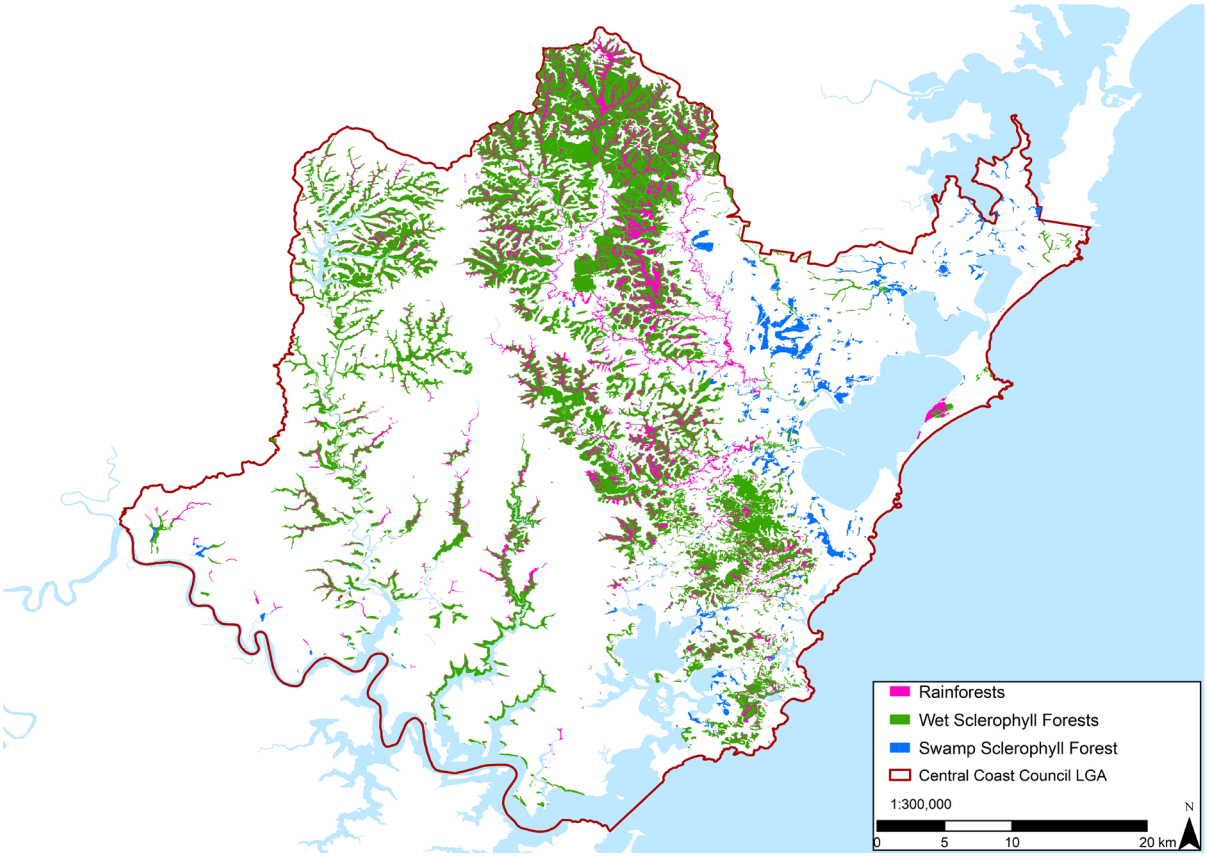

Figure 4. Distribution of vegetation associations representing potential suitable habitat for the Scrub Turpentine.

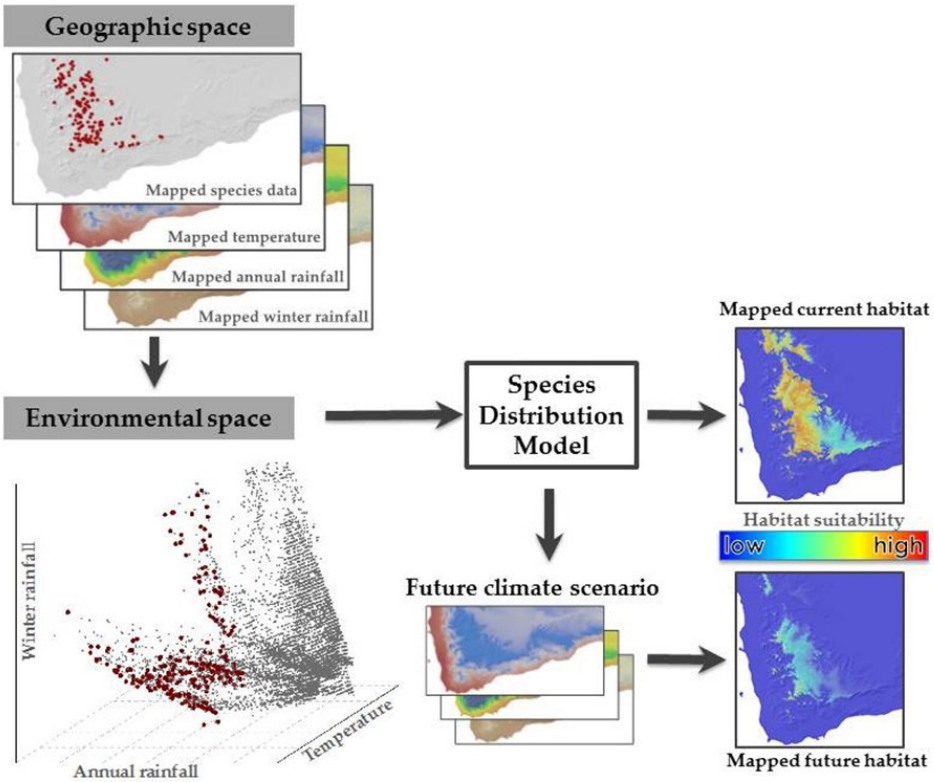

Figure 5. The relationship between mapped species and environmental data (geographic space, top left), environmental space (bottom left), species distribution model (top centre), future climate change scenario data (bottom centre), mapped current habitat (top right) and mapped future habitat (bottom right).

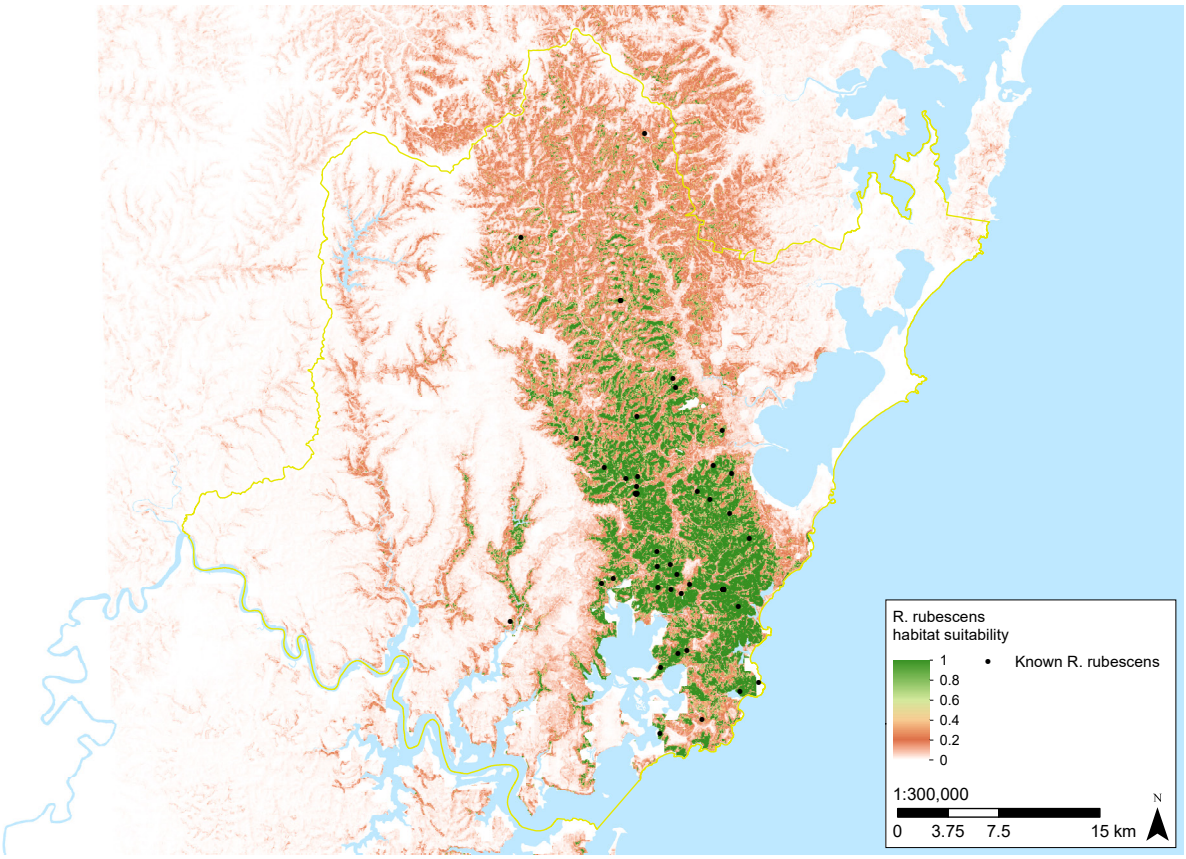

Figure 6. Initial species distribution model for the Scrub Turpentine used to identify habitat suitability. The darker green areas represent highly optimal habitat.

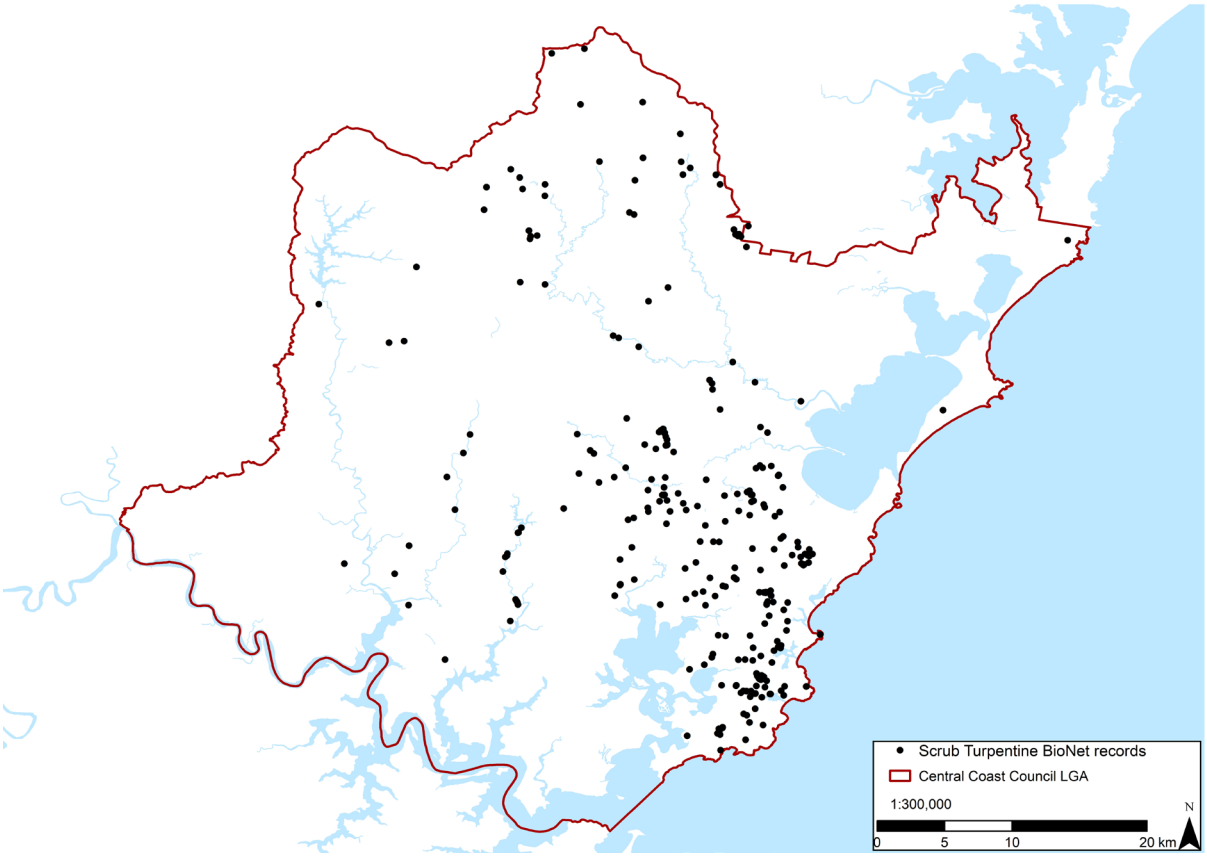

Figure 7. BioNet records of Scrub Turpentine observations within the Central Coast LGA.

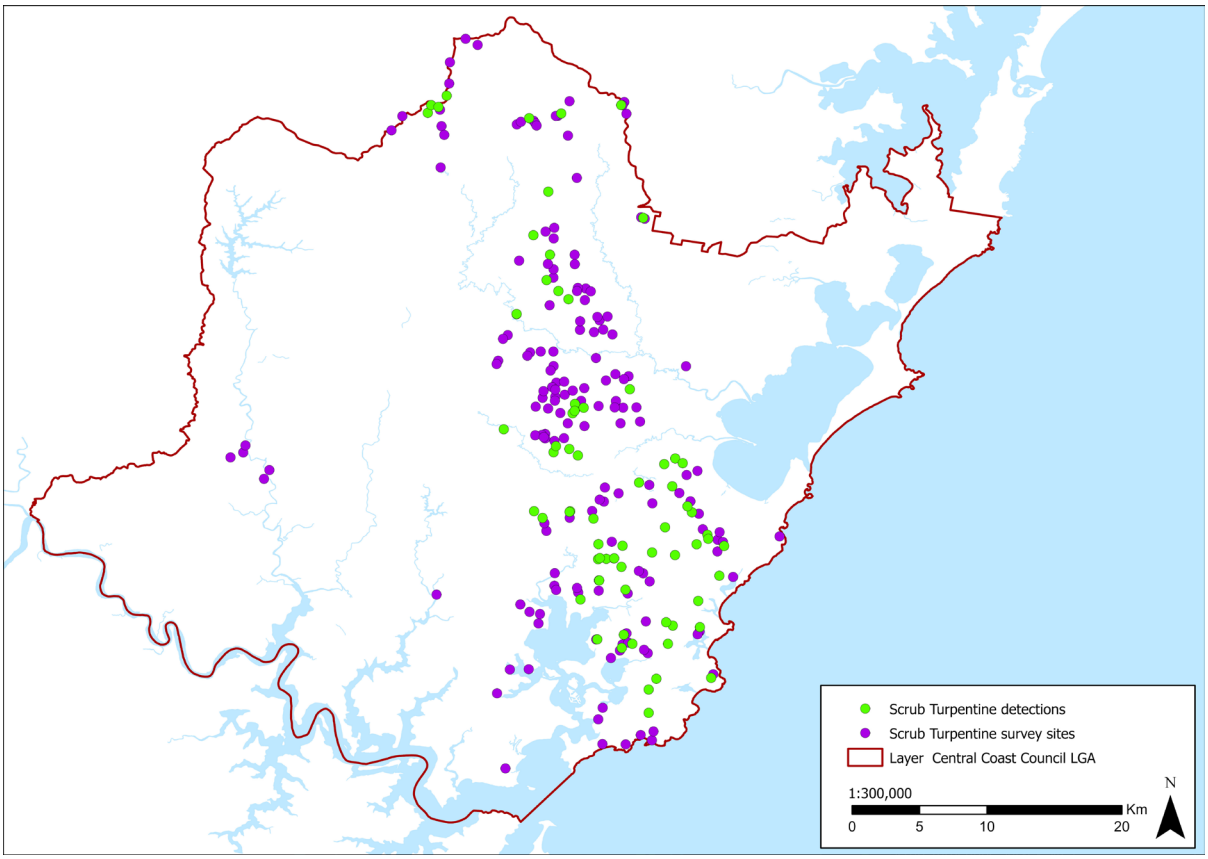

Figure 8. Scrub Turpentine survey sites (purple dots) and sites where the Scrub Turpentine was detected (green dots) during targeted surveys.

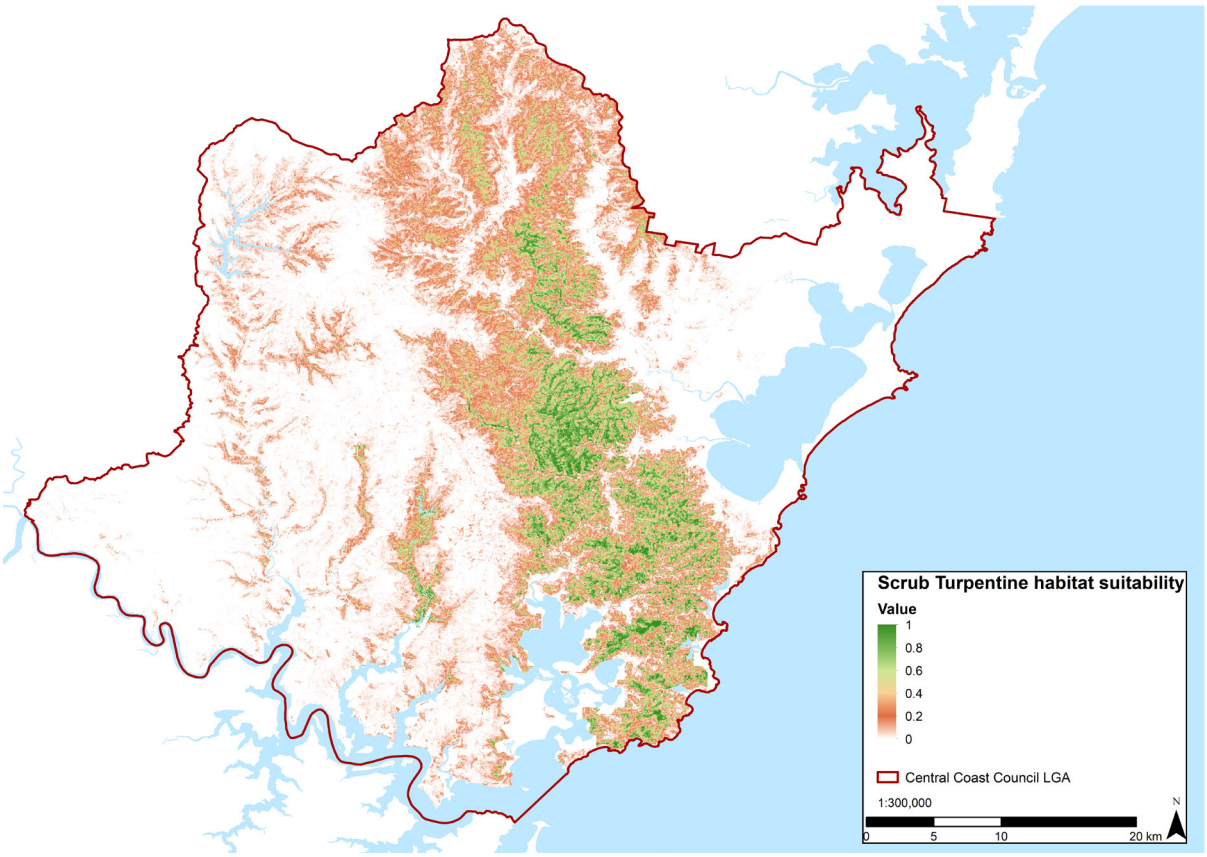

Figure 9. Species distribution model for the Scrub Turpentine indicating habitat suitability. The darker green areas represent highly optimal habitat.

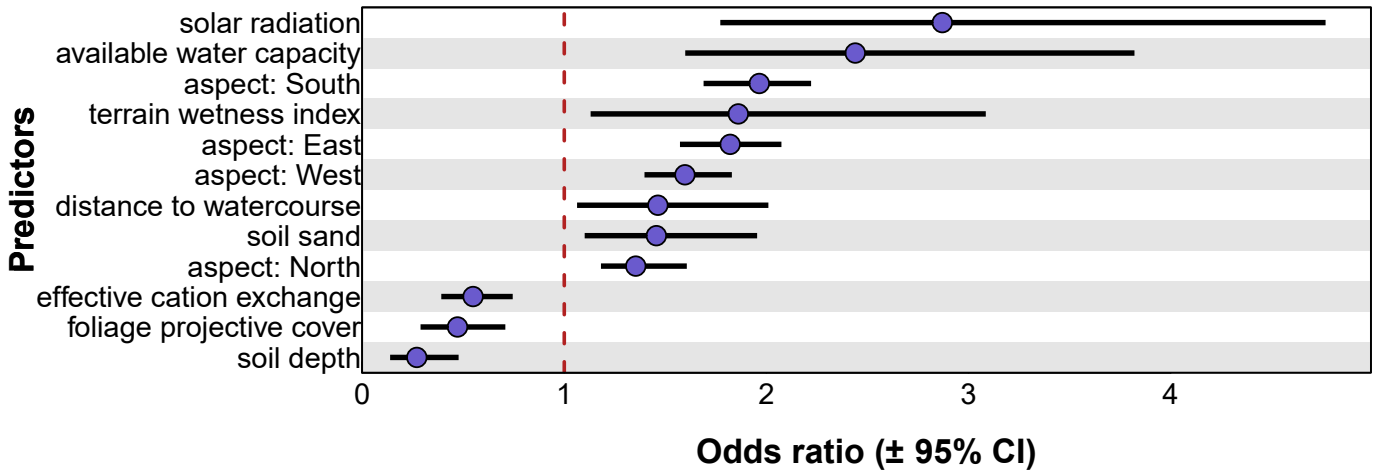

Figure 10. Odds ratio[2] and 95% confidence intervals for the association between habitat suitability for the Scrub Turpentine and environmental variables (predictors) identified as most influential in the SDM.

[2] Odds ratio is the measure of the association between a predictor (environmental) variable and response variable (i.e., habitat suitability). An odds ratio of >1 is associated with an increased occurrence of suitable habitat in relation to the environmental predictor and an odds ratio of <1 is associated with a decreased occurrence of suitable habitat in relation to the environmental predictor

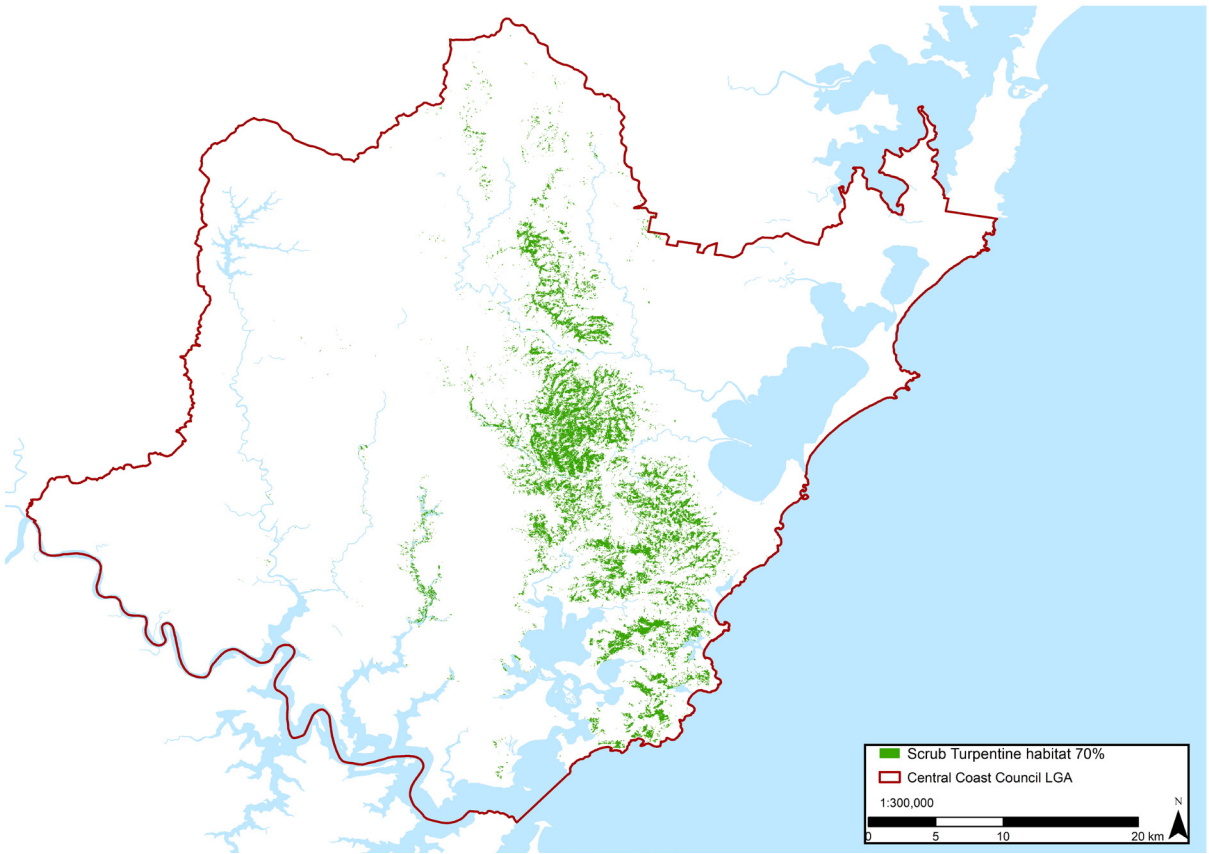

Figure 11. Species Distribution Model of habitat suitability for the Scrub Turpentine with a likelihood of occurrence of greater than 70%.

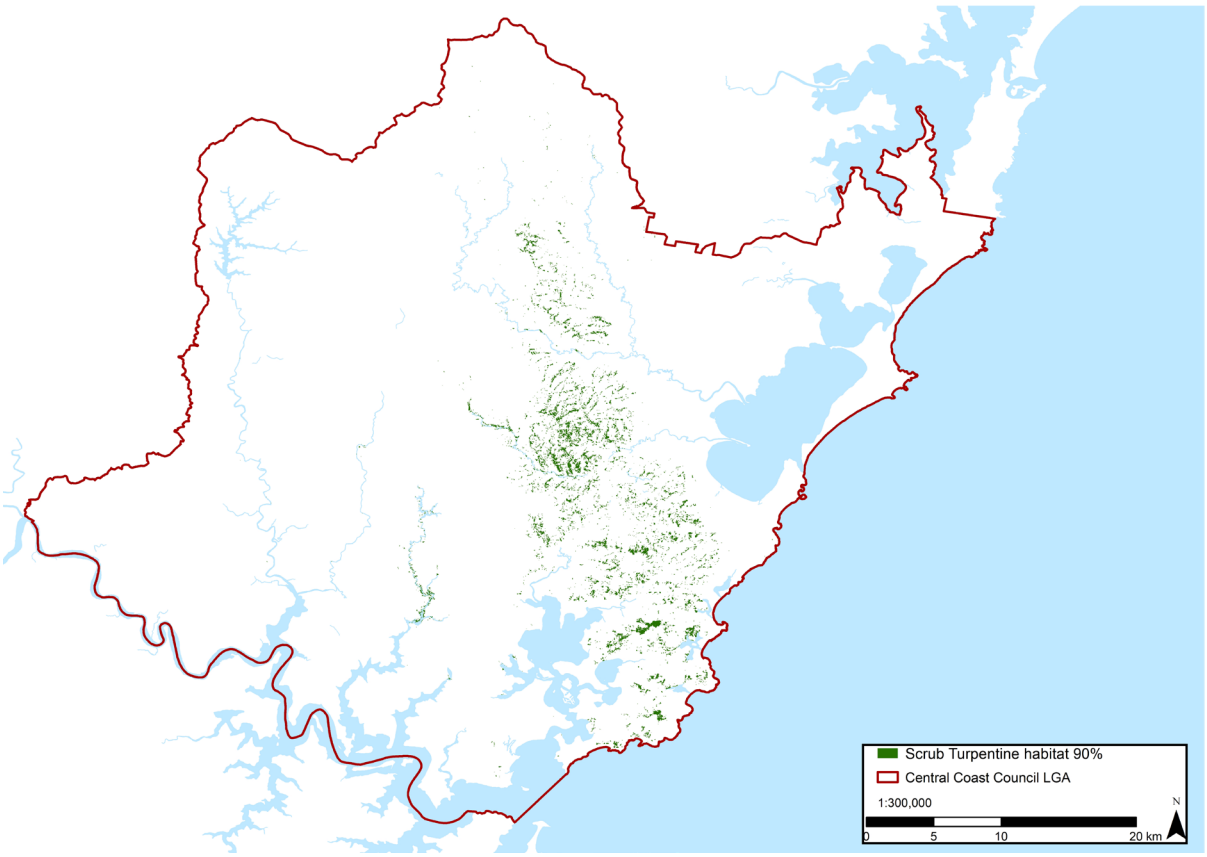

Figure 12. Species Distribution Model of habitat suitability for the Scrub Turpentine with a likelihood of occurrence of greater than 90%.

7. Consideration of Scrub Turpentine during landuse planning and development assessment

7.1. Required surveys

During the ecological assessment phase of a project proposal, an assessment must be made to determine if potential Scrub Turpentine habitat occurs on the site. Potential Scrub Turpentine habitat includes modelled habitat with a likely occupancy greater than 70% (Figure 11) and also includes swamp sclerophyll forest[3], wet sclerophyll forest[4], rainforest[5] and rainforest margins (Figure 4).

Where a proposal area either occurs: 1) within 50 m of potential Scrub Turpentine habitat, 2) where Scrub Turpentine has previously been recorded on the site or is highlighted on the site during BioNet searches, or 3) when Scrub Turpentine has been generated as a candidate species in a BDAR or BCAR, then targeted surveys must occur. Targeted surveys must consist of parallel transects completed in accordance with Council's Flora and Fauna Guidelines (2019) or Surveying Threatened Plants and their Habitats (2020).

7.2. Assessment of impacts on the Scrub Turpentine

7.2.1. Consideration of Scrub Turpentine during planning proposals

It is Council's position that a BCAR is prepared for all planning proposals that impact on native vegetation and any mapped habitat for the Scrub Turpentine with a likelihood of occurrence of greater than 70% (Figure 8). The BCAR must also demonstrate how the proposal has been designed to avoid impacts on the Scrub Turpentine.

All Scrub Turpentine individuals must have adequate buffers applied during the Planning Proposal stage. All buffers are to be a minimum of 30m surrounding Scrub Turpentine individuals. Where removal is unavoidable, improvement measures that will result in positive gains for Scrub Turpentine in the local landscape must be proposed (see Table 3), including through a Planning Agreement if relevant.

[3]Swamp sclerophyll forest is vegetation community listed as an Endangered Ecological Community under the BC Act. Swamp Sclerophyll Forest is a community that generally has several layers of vegetation, including trees, shrubs, groundcovers and wetland plants such as reeds and sedges. It is a community of plants that are generally found close to standing water on soils that are either waterlogged or subject to periodic flooding or inundation. It is usually an open to closed forest with a shrubby or reedy/ferny understorey, although in some areas the tree layer is low and dense and the community takes on the structure of scrub.

[4]Wet sclerophyll forests are dominated by trees of the genera Eucalyptus, Angophora, Corymbia and Syncarpia. Wet sclerophyll forests are restricted to areas of higher rainfall and moderate fertility and often include a dense understorey of soft-leaved rainforest shrubs and small trees in moister situations (shrubby subformation). In drier situations these forests may have an open, grassy understorey (grassy subformation) with a sparse, sclerophyllous shrub layer.

[5]Rainforests are defined by a closed canopy generally dominated by non-eucalypt species with soft, horizontal leaves, although various eucalypt species may be present as emergents. Rainforests tend to be restricted to relatively fire-free areas of consistently higher moisture and nutrient levels than the surrounding sclerophyllous forests.

Table 3. Examples of on or offsite improvement measures in relation to the level of impact that must be proposed where removal of Scrub Turpentine plants are unavoidable.

Level of impact	Improvement measures
Less than 2% of the local population	Five-year Scrub Turpentine Management Plan, including annual fungicide treatment regime for retained plants located within or adjoining the development including bushfire asset protection zones. Retirement of species credits in accordance with the Biodiversity Offset Scheme. Vegetation Management Plan. Implementation of Section 88 covenants under the Conveyancing Act 1919 (NSW) on the title of the subject Lot.
Greater than or equal to 2% of the local population	Detailed five-year Scrub Turpentine Management Plan, including annual fungicide treatment regime, which is to generally be applied to retained plants located within a 50 m buffer of the development. Retirement of species credits in accordance with the Biodiversity Offset Scheme. Vegetation Management Plan. Implementation of Section 88 covenants under the Conveyancing Act 1919 (NSW) on the title of the subject Lot. Land dedication/land transfer into Council Ownership[6] or NSW National Parks and Wildlife where large populations of Scrub Turpentine occur. Conservation agreement with the Biodiversity Conservation Trust[7], Wildlife Land Trust[8] or Land for Wildlife.

7.2.2. Consideration of Scrub Turpentine during Council's own operations

The avoid and minimise criteria must be applied to all Scrub Turpentine individuals and any habitat within 30 m of any Scrub Turpentine individuals. After all avoidance measures have been applied and where individual Scrub Turpentine plants require removal, a Vegetation Management Plan and either a five-year Scrub Turpentine Management Plan for remaining plants on the site or a detailed five-year Scrub Turpentine Management Plan in accordance with the requirements associated with the level of impact outlined in Table 3 must be provided.

Central Coast Council undertakes a variety of infrastructure works and land management activities that have the potential to impact Scrub Turpentines on Council Land. This includes construction and maintenance of roads, water and sewer assets, community infrastructure, walking tracks and fire trails. These activities are assessed and approved by Council as development permitted without consent under Part 5 of the EP&A Act in accordance with Council's Environmental Assessment Procedure.

[6]Where supported by Council's Biodiversity Strategy (2020) that also includes funding for management.

[7]How to apply for a voluntary agreement with the Biodiversity Conservation Trust.

[8]Wildlife Land Trust

Threatened species impacts for Part 5 activities are assessed via a test of significance and any significant impacts are assessed via a species impact statement or a BDAR report if Council elects to opt into the Biodiversity Offset Scheme.

Council will apply the following controls to its activities that have the potential to impact Scrub Turpentines:

- Threatened species assessments will be undertaken for works impacting native vegetation.
- Scrub Turpentine will be prioritised for retention and only removed as a last resort.
- Projects and Infrastructure will be sited and designed to avoid impacting Scrub Turpentine to the fullest extent possible.
- A buffer of 30m of vegetation will be provided surrounding identified specimens of Scrub Turpentine.
- Scrub Turpentine will be prioritised as a species for replanting when Council undertakes tree planting and offsetting.
- Where Scrub Turpentine impacts cannot be avoided, they will be minimised and then offset as a last resort. Offsetting will include the preparation and implementation of a vegetation management plan on the impact site or suitable adjoining habitat.

7.2.3. Consideration of Scrub Turpentine on non-conservation zoned land during development assessment

A genuine attempt at avoiding and minimising impacts to Scrub Turpentine must be shown within the Flora and Fauna Assessment or BDAR. Where avoidance cannot occur and removal is unavoidable, improvement measures for the Scrub Turpentine must be demonstrated in accordance with Table 3.

7.2.4. Consideration of Scrub Turpentine on Conservation zoned land during development assessment

The assessment of impacts on Scrub Turpentine and Scrub Turpentine habitat proposed for industrial, commercial and residential zoned land must be followed. However, the level of acceptable impacts on Scrub Turpentine in Conservation zoned land is lower. Targeted surveys for Scrub Turpentine are required (see Section 6.1) to identify the occurrence of Scrub Turpentine and the size of the population. Where sufficient avoidance of Scrub Turpentine impacts has been demonstrated, minimal Scrub Turpentine individuals may be proposed for removal. In this case, Council will require detailed improvement measures that will result in positive gains for Scrub Turpentine in the local landscape (see Table 3).

All development applications with Scrub Turpentine on the site will be referred to Council's Ecologists for assessment, regardless of if a BDAR is required.

8. Hypothetical case studies – examples of appropriate and inappropriate avoidance measures

Note that the following examples are hypothetical and any resemblance to past, current or future Development Applications is purely coincidental. These examples have been provided as a guide only and should not substitute advice from a qualified consulting ecologist. All Development Applications are assessed on a case-by-case basis, and the examples of avoidance measures listed here may not comply with proposals in similar contexts.

Case study 1: Adequate avoidance of Scrub Turpentine for a single dwelling on land zoned C4- Environmental Living due to constructing to a higher BAL

Adam and Sonia own a 1 ha property in the Holgate area. They were seeking to extend their current dwelling. The current dwelling had no bushfire consideration, however the addition required application of Planning for Bushfire Protection 2019. From the edge of the extent of the addition, rainforest occurred around 20 metres away, with several Scrub Turpentine occurring 25-30 metres from the edge of the addition. The addition was built to BAL 29, which required a 16 metre APZ, which did not require any clearing of rainforest and allowed a 25 m buffer to be created. If a lower BAL had been selected, this may have required rainforest and Scrub Turpentine to be affected (Figure 11).

Case study 2: Inadequate avoidance of Scrub Turpentine on an industrial development results in DA withdrawal

A local company owns an industrial site in the Gosford area which contains several Scrub Turpentine plants. The company seeks to build a hardstand over all Scrub Turpentine on their land. This provides no avoidance, thus the proposal is not supported by Council (Figure 12).

Case study 3: Challenges of a constrained site leads to a consent

Robbie owns land zoned C3 Environmental Management in the far west of the Central Coast which is fully vegetated with wet sclerophyll forest. He wishes to build a single dwelling; however, the property has several hundred Scrub Turpentine present. Robbie's Ecologist maps the extent of the Scrub Turpentine and in considering Planning for Bushfire Protection 2019, identifies a location that affects the least amount of Scrub Turpentine and elects to construct to BAL 40, requiring 24 metre APZs. This results in six Scrub Turpentine being removed (2% of the local population) for construction, a further 20 Scrub Turpentine being retained in the APZ, and a Vegetation Management Plan (VMP) being developed and implemented by the consultant ecologist for the maintenance of the other several hundred Scrub Turpentine that occur elsewhere on the site (Figure 13).

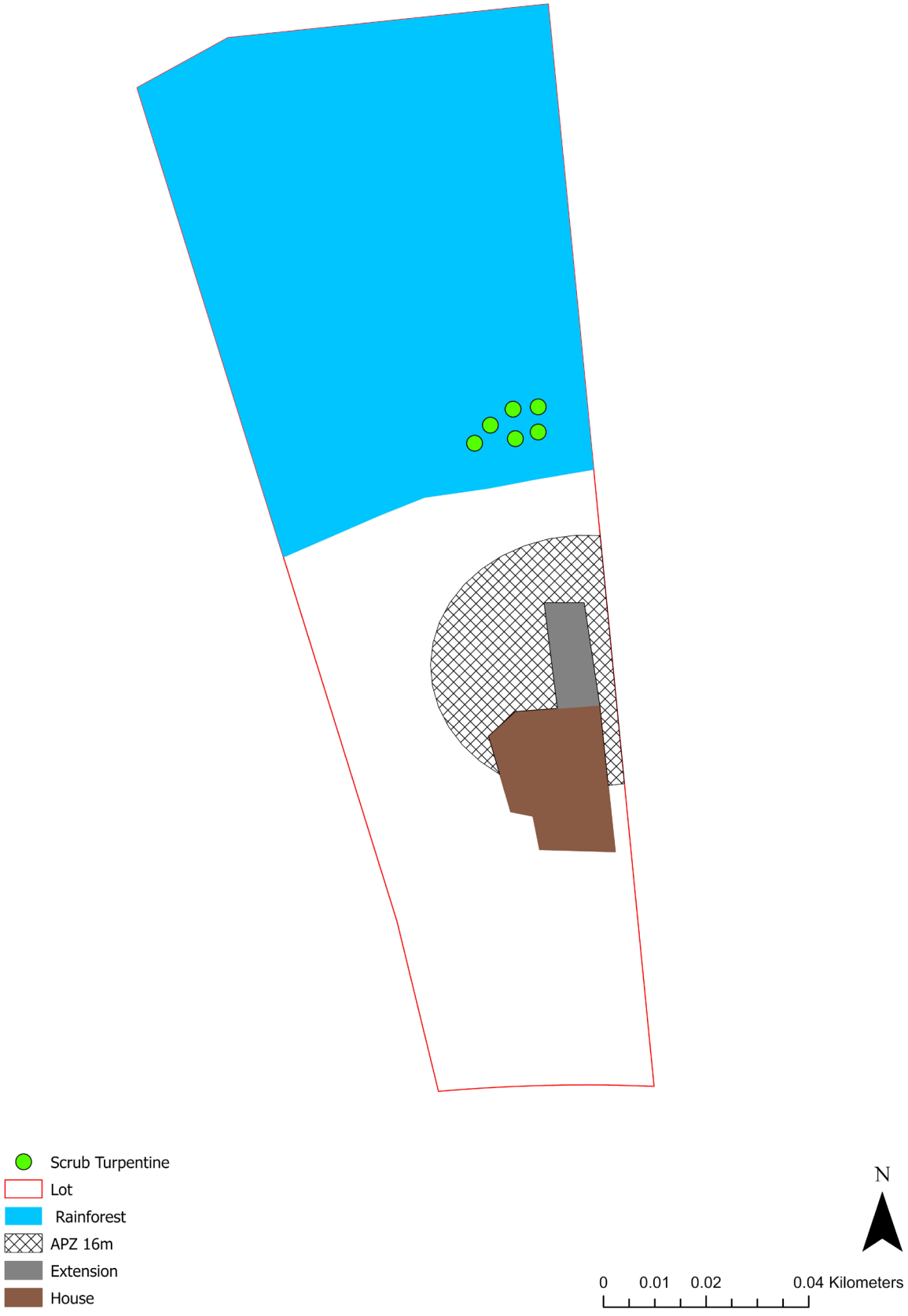

Figure 12. Case study 1 – Example of adequate avoidance of Scrub Turpentine for a single dwelling on land zoned C4- Environmental Living due to constructing to a higher BAL.

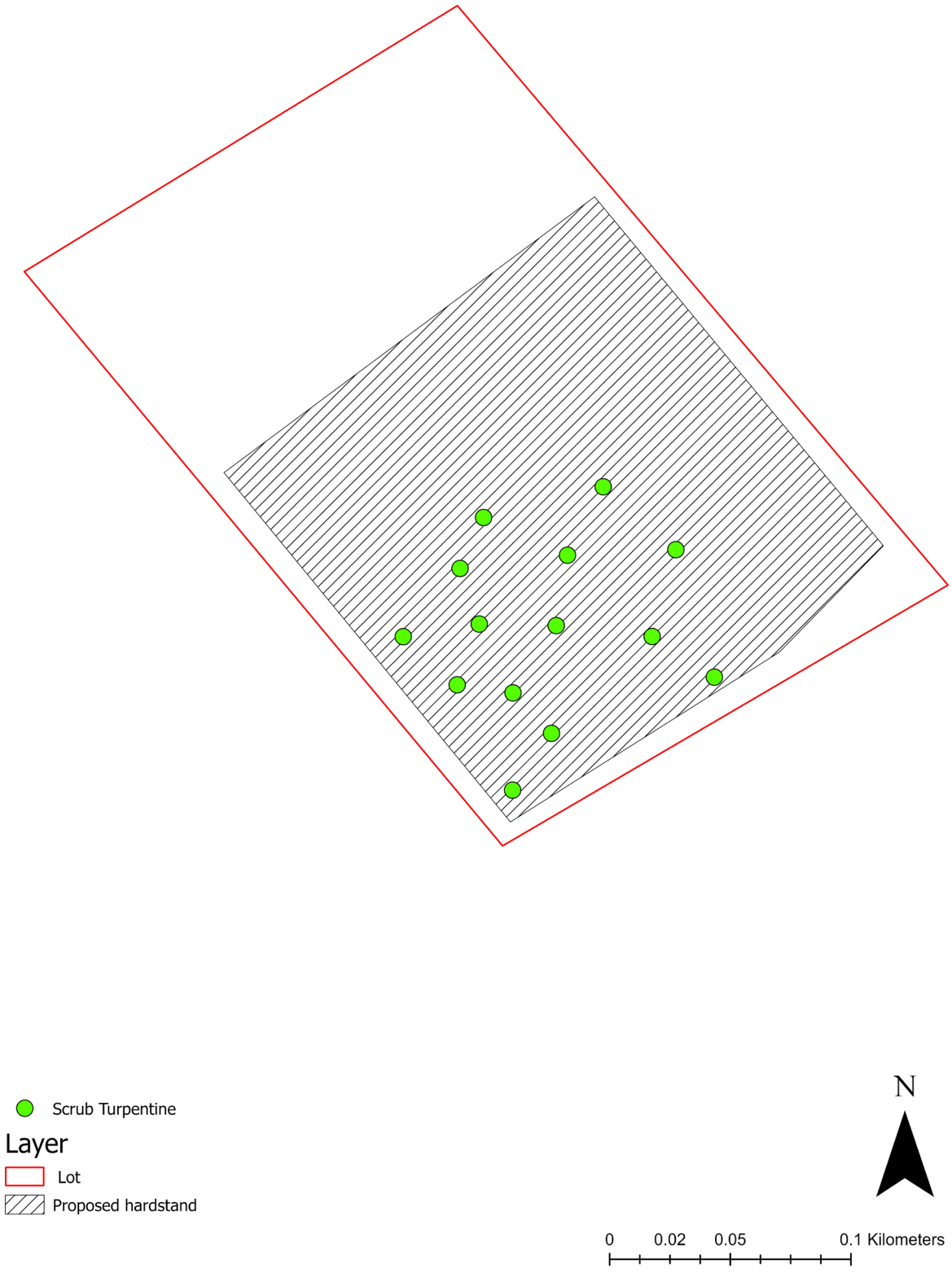

Figure 13. Case study 2 – Example of inadequate avoidance of Scrub Turpentine on an industrial development that results in DA withdrawal.

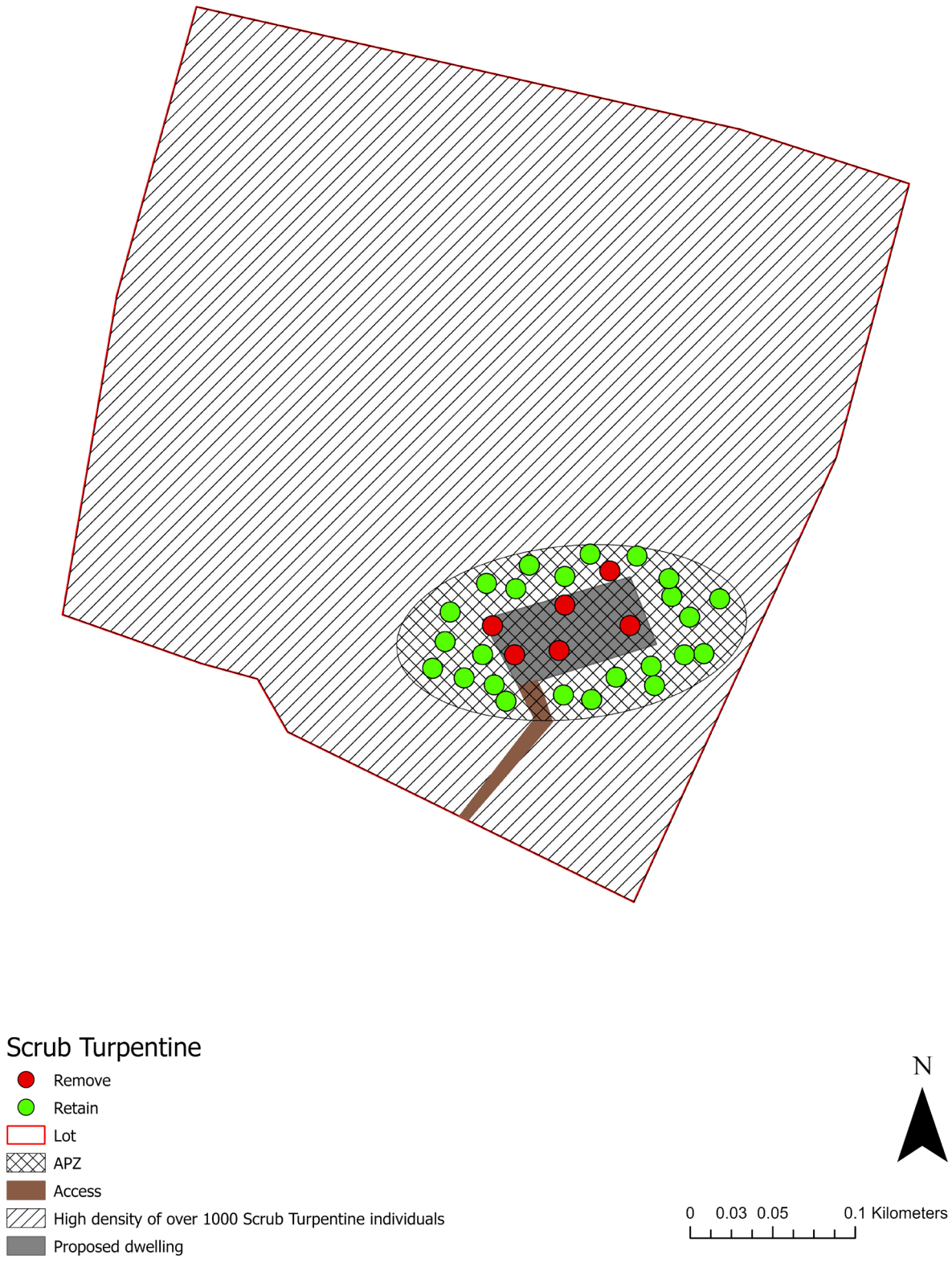

Figure 14. Case study 3 – Example of challenges of a constrained site that leads to a consent.

9. Recovery Actions

This SMP is intended to ensure that the viability of the Scrub Turpentine improves on the Central Coast over the next decade. The following 11 actions will allow for implementation of this plan by key stakeholders.

	Action	Intended recovery response	Who is responsible
1.	Ensure that maximum Scrub Turpentine populations are conserved during Planning Proposals, including retention of the highest quality habitat on site.	Improved Scrub Turpentine populations and habitat protection throughout the Central Coast.	Strategic Planning Staff, Private developers, Development Assessment staff.
2.	Improve habitat quality of Scrub Turpentine populations through completing bushland regeneration activities, as informed by Vegetation Management Plans.	Improve habitat quality via reduction of exotic weed species and reduce competition from transformer weed species and native scramblers.	Strategic Planning Staff, Development Assessment staff, Environmental Management Unit staff, Private developers.
3.	Identify and apply for Australian Research Council (ARC) linkage funding or other research funding opportunities for Scrub Turpentine.	Identify genetic/physiological pathways to achieve increase resistance and lower susceptibility of Scrub Turpentine to myrtle rust infection.	Council ecological staff and Environmental Management Unit staff.
4.	Develop trial fungicide treatment program for Scrub Turpentine populations on Council land.	Prevent loss and help to increase resistance of Scrub Turpentine to myrtle rust infection.	Council ecological staff and Environmental Management Unit staff.
5.	Develop Scrub Turpentine growing program for Council nurseries.	Supplement Scrub Turpentine populations to resistance of Scrub Turpentine to myrtle rust infection on Council owed land and bushland reserves.	Council ecological staff and Environmental Management Unit staff.
6.	Ensure conservation agreements and/ or land dedication to Council occur for land containing Scrub Turpentine populations at the development application stage.	Protection of Scrub Turpentine populations locally throughout the Central Coast.	Strategic Planning Staff, Development Assessment staff, Environmental Management Unit staff, Private developers.
7.	Ensure improvement of Scrub Turpentine populations during development of adjacent lands.	Reduced severity of myrtle rust infestation of Scrub Turpentine populations throughout the Central Coast.	Relevant Council staff (internal projects), Private developers, Development Assessment staff.
8.	Ensure the retirement of Scrub Turpentine Species Credits when Scrub Turpentine is impacted during development approved under Part 4 of the EP&A Act.	Protection of Scrub Turpentine elsewhere in NSW.	Council ecological staff and development planners.

	Action	Intended recovery response	Who is responsible
9.	Increased awareness of Scrub Turpentine among Landcare and Bushcare groups.	Increased community awareness of Scrub Turpentine.	Landcare staff and volunteers.
10.	Ensure annual monitoring reports for Scrub Turpentine required under development consents are submitted to Council.	Protection and improvement of Scrub Turpentine habitat.	Council ecological staff.
11.	Ensure GIS layer of potential Scrub Turpentine habitat is available on Council's online mapping tool.	Identify Scrub Turpentine populations and habitat that require impact avoidance throughout the Central Coast.	Council ecological and geospatial staff.
12.	Restore ecological fire regimes in suitable habitat for the Scrub Turpentine in Council reserves, research and apply appropriate fire intervals and intensity, and identify Scrub Turpentine populations in burn zones during burn planning.	Improve habitat quality and regeneration via restoration of appropriate fire regimes.	Council ecological staff and Environmental Management Unit staff.
13.	Ensure sightings of Scrub Turpentine are uploaded to BioNet by Council staff.	Identify additional Scrub Turpentine populations throughout the Central Coast.	Council ecological staff.
14.	Trial soil disturbance as an assisted regeneration technique to stimulate soil stored in the seedbank and/or provide opportunity for seed rain from mature Scrub Turpentine specimens.	Improved recruitment of Scrub Turpentine populations throughout the Central Coast.	Council ecological staff and Environmental Management Unit staff.

10. Monitoring, Evaluation and Reporting

Every 12 months, Council will undertake Scrub Turpentine surveys across the 72 sites where Scrub Turpentine was detected to determine the species persistence in the LGA. The 72 sites will also be updated to include other locations where the Scrub Turpentine is detected. The results of the survey will be included in a review and update of this plan every five years, commencing in 2027.

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Appendix 1.

Description of 42 environmental variables used to develop the Species Distribution Model.

Layer Name	Layer Type	Units	Layer Description
oeh_pct	Plant Community Type mapping	Ha	Office of Environment and Heritage Plant Community Type mapping
precipann	Climate/Water	mm	Annual Precipitation (bio12)
precipcq	Climate/Water	mm	Precipitation of Coldest Quarter (bio19)
precipdp	Climate/Water	mm	Precipitation of Driest Period (bio14)
precipdq	Climate/Water	mm	Precipitation of Driest Quarter (bio17)
precipseas	Climate/Water	CV	Precipitation of Seasonality: Coefficient of Variation (bio15)
precipwetq	Climate/Water	mm	Precipitation of Wettest Quarter (bio16)
precipwp	Climate/Water	mm	Precipitation of Wettest Period (bio13)
precipwq	Climate/Water	mm	Precipitation of Warmest Quarter (bio18)
rain_sumwinr	Climate/Water	mm	Average Rainfall - Summer Winter Ratio
rain1mm	Climate/Water	mm	Average Number of days with rainfall greater than 1mm Annual
rainspr	Climate/Water	mm	Average Rainfall - Spring
rainsum	Climate/Water	mm	Average Rainfall - Summer
rainwin	Climate/Water	mm	Average Rainfall - Winter
rough0100	Landform	index	Neighbourhood topographical roughness based on the standard deviation of elevation in a circular 100 m neighbourhood. Derived from DEM-S
rough0500	Landform	index	Neighbourhood topographical roughness based on the standard deviation of elevation in a circular 500 m neighbourhood. Derived from DEM-S
rough1000	Landform	index	Neighbourhood topographical roughness based on the standard deviation of elevation in a circular 1000 m neighbourhood. Derived from DEM-S
eucdist_ waterobs	Remote sensing	m	Euclidean distance to water observations
	Remote sensing	%	Foliage projective cover or the percentage of ground cover occupied by the vertical projection of foliage. Predicted using a time series of SPOT images between 2008-2011
rs_fpc	Remote sensing	%	Foliage projective cover or the percentage of ground cover occupied by the vertical projection of foliage. Predicted using a time series of SPOT images between 2008-2011

Layer Name	Layer Type	Units	Layer Description
soil_fert	Soil	Index	Soil fertility
strmdstall	Drainage	m	Euclidean distance to all streams (i.e., all orders: 1 to 9)
strmdstge2	Drainage	m	Euclidean distance to 2nd order streams and above
strmdstge4	Drainage	m	Euclidean distance to 4th order streams and above
strmdstge6	Drainage	m	Euclidean distance to 6th order streams and above
temp_ maxann	Climate/Temperature	oC	Average daily max temperature - Annual
temp_ maxsum	Climate/Temperature	oC	Average daily max temperature - Summer
temp_maxwin	Climate/Temperature	oC	Average daily max temperature - Winter
temp_minann	Climate/Temperature	oC	Average daily min temperature - Annual
temp_ minsum	Climate/Temperature	oC	Average daily min temperature - Summer
temp_minwin	Climate/Temperature	oC	Average daily max temperature - Winter
tempann	Climate/Temperature	oC	Annual Mean Temperature (bio1)
tempannrnge	Climate/Temperature	oC	Temperature Annual Range: difference between bio5 and bio6 (bio7)
tempcq	Climate/Temperature	oC	Mean Temperature of Coldest Quarter (bio11)
tempdiurn	Climate/Temperature	oC	Mean Diurnal Range (Mean period max-min)) (bio2)
tempdq	Climate/Temperature	oC	Mean Temperature of Driest Quarter (bio9)
tempmtcp	Climate/Temperature	oC	Min Temperature of Coldest Period (bio6)
tempmtwp	Climate/Temperature	oC	Max Temperature of Warmest Period (bio5)
tempseas	Climate/Temperature	CV	Temperature Seasonality: Coefficient of Variation (bio4)
tempwarmq	Climate/Temperature	oC	Mean Temperature of Warmest Quarter (bio10)
tempwetq	Climate/Temperature	oC	Mean Temperature of Wettest Quarter (bio8)
treeheight	Remote sensing	m	Tree height
waterobs	Remote sensing	m	Euclidean distance to water observations

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Council Office 2 Hely St Wyong | 8.30am - 5pm, Monday to Friday

P 02 4306 7900 | **W** centralcoast.nsw.gov.au