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Assessing the ecology and conservation of *Pomaderris mediora* (Rhamnaceae), a highly restricted coastal Sydney sandstone shrub

Kurtis J. Lindsay

Land Eco Consulting 4F/6 Jubilee Avenue, Warriewood NSW 2102, AUSTRALIA

email: kurtis.lindsay@landeco.com.au

Abstract

Pomaderris mediora N.G. Walsh and Coates (family Rhamnaceae) is a narrowly distributed endemic shrub confined to coastal sandstone landscapes of the Sydney region, but despite being formally described almost three decades ago, has received little scientific attention. It has a severely fragmented distribution extending approximately 210 km between Port Stephens and Bulli and is currently known from four geographically isolated population groups; North Arm Cove (Port Stephens), the Northern Beaches of Sydney, Appin and the Illawarra Escarpment (Maddens Plains and specifically, Sublime Point). Herbarium records, published literature, biodiversity databases and recent field observations indicate that only 180–250 mature individuals remain, distributed across eleven locations, most with fewer than ten mature plants; several historical occurrences have not been relocated despite recent survey effort.

Occupied habitat is strongly associated with sandstone-derived substrates including Hawkesbury Sandstone, Newport Formation, Bulgo Sandstone with proximal shale influence such as a shale lens or underlying shale formation. Ecological characteristics appear broadly consistent with other rare *Pomaderris* species, including probable fire-cued recruitment from persistent soil seedbanks and localised ant-mediated seed dispersal.

Pomaderris mediora is not listed under the New South Wales *Biodiversity Conservation Act 2016* or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* but appears to satisfy criteria consistent with listing as Endangered under the *Biodiversity Conservation Act 2016*. Threats to its survival include small population size, severe fragmentation, altered fire regimes, weed invasion, recreational disturbance, infrastructure maintenance and herbivory by introduced mammals. To secure its long-term persistence in the wild, formal listing of the species as Endangered is strongly recommended. Targeted surveys across suitable habitat areas across its distribution, coupled with targeted monitoring, ecological research and habitat management, are also needed.

Keywords: conservation assessment, endemic flora, Sydney Basin, Rhamnaceae, threatened species, fire ecology, sandstone vegetation, coastal headlands

Introduction

The Sydney Basin Bioregion supports one of the most distinctive floras in Australia, characterised by high levels of local endemism associated with nutrient-poor sandstone landscapes, complex topography and long-term environmental stability (Benson and Howell 1990, Tozer et al. 2010). Many plant taxa occurring within the region are naturally restricted in distribution and occupy specialised habitats such as coastal headlands, sandstone escarpments, upland swamps and shale–sandstone transition zones. Although numerous Sydney Basin endemic flora species are recognised as threatened under State and Commonwealth legislation, others remain poorly known despite exhibiting ecological and biogeographic characteristics commonly associated with elevated extinction risk.

The genus *Pomaderris* Labill. comprises approximately 65 species distributed across Australia and New Zealand, with south-eastern Australia representing the principal centre of diversity (Walsh and Coates 1997). Many *Pomaderris* species have geographically restricted ranges and several have experienced substantial declines due to habitat loss, altered disturbance regimes and small population size. Consequently, a disproportionately high number of species within the genus are recognised as threatened, including, *Pomaderris adnata*, *Pomaderris walshii*, *Pomaderris reperta*, *Pomaderris brunnea*, *Pomaderris cotoneaster*, *Pomaderris delicata* and *Pomaderris sericea* (Walsh and Coates 1997, Le Breton et al. 2020, Le Breton et al. 2023, Bell et al. 2026).

Pomaderris mediora N.G.Walsh and Coates (Figure 1) was formally described from material collected at Turimetta Headland on Sydney's Northern Beaches (Walsh and Coates 1997) with the specific epithet derived from the Latin *medius* and *ora*, meaning "middle coast", reflecting the species' distribution along the Central Coast of New South Wales (NSW). Since its description, the species has received comparatively little scientific attention and remains one of the least studied members of the genus.

Pomaderris mediora is confined to a narrow coastal corridor extending from Port Stephens (North Arm Cove) in the north to Bulli in the south, occurring on sea cliffs overlooking the Tasman Sea and inland to a distance no greater than 7 km. Existing information is largely restricted to herbarium collections, local government vegetation surveys, unpublished field observations and scattered records within biodiversity databases (PlantNET 2026, AVH 2026). It persists as a series of small, highly fragmented populations associated with sandstone-derived substrates (ALA 2026, ABH 2026, DPIRD 2026, Colquhoun et al. 2026).

The conservation significance of a species such as *Pomaderris mediora* extends beyond its intrinsic biodiversity value. Narrow-range endemics frequently contribute disproportionately to regional floristic uniqueness and may represent important evolutionary lineages adapted to highly specialised environmental conditions (Hopper 2009). Their persistence is often dependent upon ecological processes operating at relatively small spatial scales, making them particularly vulnerable to habitat fragmentation, altered fire regimes and stochastic events.

The present study provides the first comprehensive synthesis of available information on *Pomaderris mediora*, specifically to (1) document the known distribution, abundance and habitat of

the species, (2) review current knowledge of its ecology and life history, (3) evaluate threats affecting populations throughout its range, and (4) assess its conservation status against contemporary threatened species criteria.

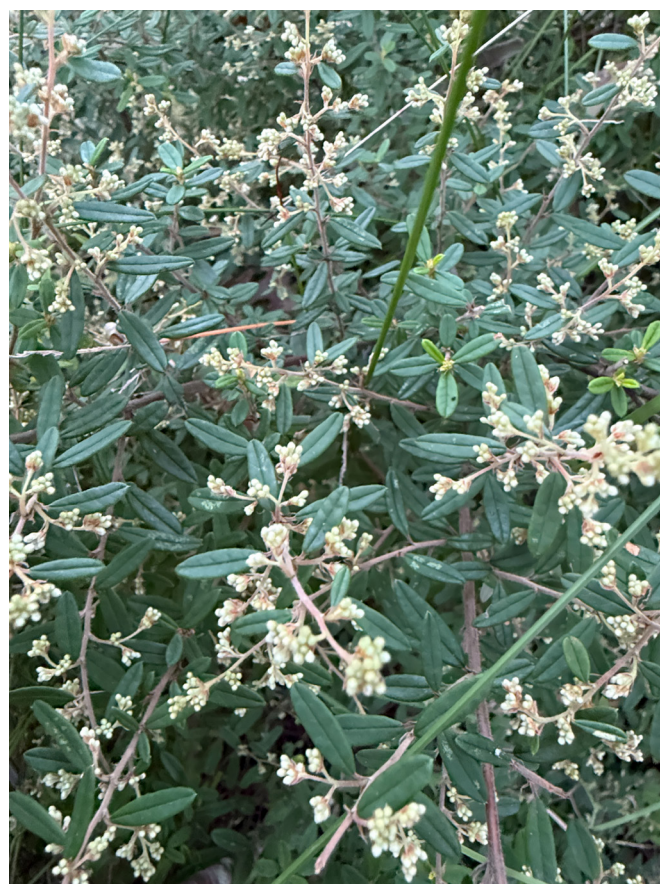


Figure 1. Foliage and buds of *Pomaderris mediora* (K.Lindsay)

Methods

Records of *Pomaderris mediora* were compiled from multiple sources including the Australasian Virtual Herbarium (AVH 2026), Atlas of Living Australia (ALA 2026), PlantNET (2026), iNaturalist (2026) observations, published literature, unpublished field observations and recent conservation assessment work undertaken throughout the species' range (Walsh and Coates 1997, AVH 2026, PlantNET 2026, Lindsay 2026).

All available records were reviewed to determine geographic location, habitat characteristics, collection history and actual or estimated population count. Historical records lacking precise geographic coordinates were retained where locality descriptions permitted broad geographic interpretation. Records were classified as extant where observations had been confirmed during the previous twenty years or where contemporary observations were available through biodiversity databases. Records lacking confirmation despite recent botanical activity within the surrounding area were treated as historical populations. Individual occurrence records situated in proximity (less than 1km apart) and occupying contiguous habitat were grouped as 'population units' for the purposes of the conservation assessment.

Habitat characteristics were compiled from herbarium specimen labels, field observations and geological mapping. Using the QGIS geographical information system (GIS) we overlaid all

validated *Pomaderris mediora* records upon the NSW Seamless Surface Geology map (Colquhoun et al. 2026) and 5m digital elevation model (NSW Spatial Services 2026). This enabled us to identify patterns in landscape position, geology and elevation because these factors appear strongly associated with the occurrence of the species. Geological nomenclature follows the NSW Department of Primary Industries and Regional Development (DPIRD 2026). We overlaid Plant Community Type (PCT) data into the GIS to identify those within which *Pomaderris mediora* occurs.

Population estimates were derived from documented historical field counts where available and supplemented by habitat-based inference for populations lacking recent abundance data. Given the absence of coordinated range-wide survey effort, all abundance estimates should be considered preliminary.

We used the GeoCAT tool (IUCN 2026) to calculate Extent of Occurrence (EOO) and Area of Occupancy (AOO) to inform the conservation assessment against IUCN criteria. Assessment of conservation status was undertaken using criteria contained within the *BC Act 2016* and by reference to the IUCN Red List Categories and Criteria (IUCN 2022).

Results

Distribution

Pomaderris mediora is endemic to NSW and occupies a narrow coastal corridor extending approximately 210 km between Port Stephens (Carrington Road, North Arm Cove) and Bulli on the Illawarra Escarpment (Walsh and Coates 1997, AVH 2026). Despite this relatively broad linear range, all known populations

occur within approximately 7 km of the coast (Tasman Sea) and are strongly associated with Sydney Basin sandstone-derived substrates (Table 1, Figure 2). The species possesses a highly restricted distribution centred on the Sydney Basin Bioregion, with a narrow extension into the lower North Coast Bioregion, essentially an outlier from the adjacent Sydney Basin Bioregion in the bioregional transition zone. Four geographically isolated population groups can be recognised from current records: North Arm Cove, the Northern Beaches of Sydney, Appin and the Illawarra Escarpment (Maddens Plains) area. These groups are separated by substantial discontinuities and there is no evidence that intervening habitat currently supports populations (Figure 2).

The northernmost occurrence is the population group situated adjacent Carrington Road at North Arm Cove where the species was recorded beneath a powerline easement on sandy soils derived from tuffaceous sandstone (AVH 2026; DPIRD 2026). Although the population has not been comprehensively surveyed since it was first sampled in May 2011, the site remains significant as the only known occurrence north of the Hawkesbury River.

The largest population group occurs on Sydney's Northern Beaches, with records from Frenchs Forest, Belrose, Ingleside, Mona Vale Headland, Warriewood (Turimetta Headland), Avalon Beach (Bangalley Headland) and Palm Beach (AVH 2026; iNaturalist 2026). Historical records from Newport, Whale Beach and Careel Bay have not been relocated despite extensive botanical activity throughout the district in recent decades (AVH 2026). The Northern Beaches population group represents the core distribution of the species and supports most known individuals.

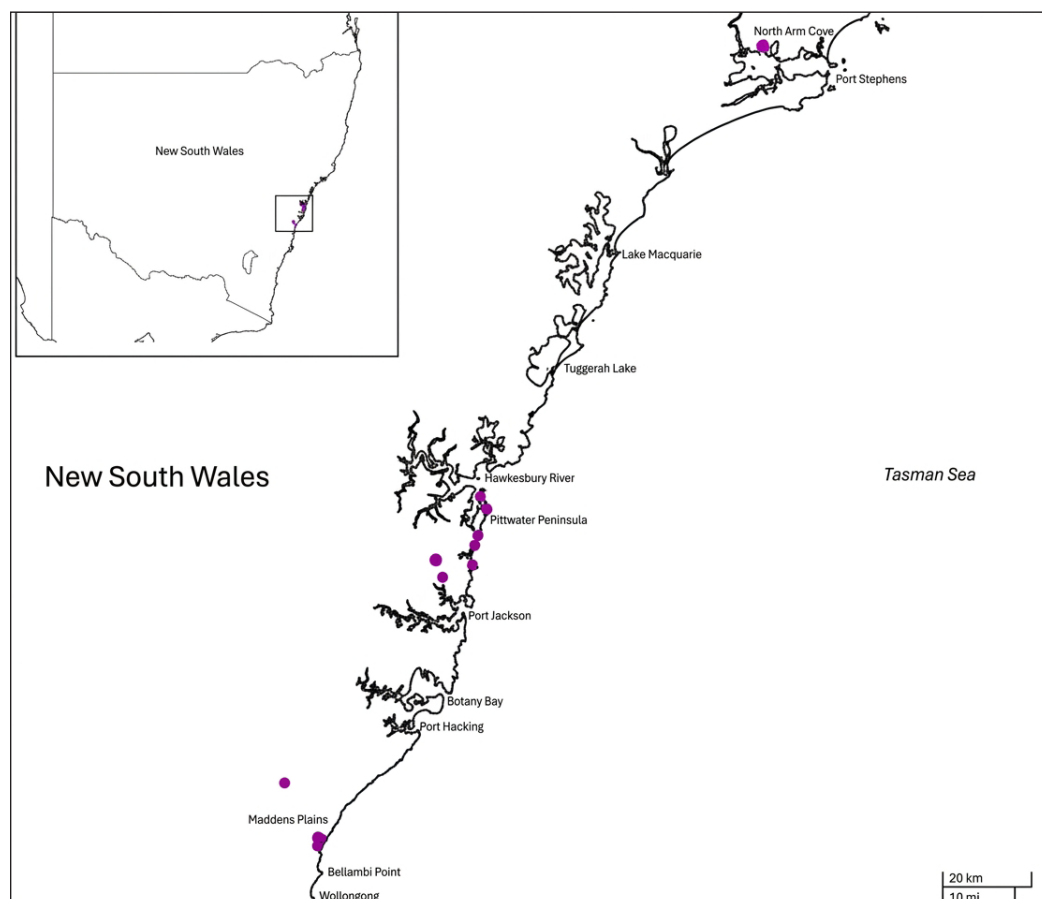


Figure 2. Current distribution of *Pomaderris mediora* showing all known existing populations (purple dots)

Landscape Position and Geology

Pomaderris mediora occurs consistently on ridgetops, upper slopes and benches (Table 1). In most locations the species occurs in sandstone in or near a transitional zone to a fine-grained sedimentary rock such as shale or claystone formations or lenses embedded within the sandstone (DPIRD 2026). The rock types known as 'shale', 'claystone' and 'mudstone' are similar from a structural and geochemical composition and used by geologists who have studied these formations in the locality (Whitehouse 2016, Martyn 2024).

The prevailing geology underlying all *Pomaderris mediora* occurrences from the Northern Beaches south to Maddens Plains is sandstone, close to or at the transitional boundary with claystone (DPIRD 2026). It occurs in different sandstone formations including Newport (Turimetta and Mona Vale), Bulgo (Sublime Point, Maddens Plains) and Hawkesbury (all other sites) (DPIRD 2026). The Turimetta and Mona Vale sites are located close to the mapped boundary with Garie Formation (claystone), and the Sublime Point occurrences are located along a transitional zone between Bulgo formation, Newport Formation Gosford Subgroup, and Bald Hill claystone (DPIRD 2026).

At most of the Northern Beaches sites, and at North Arm Cove there is evidence of iron oxide (laterization) in the surface rock (pers. obs.), perhaps suggesting a subtle edaphic factor that may influence habitat suitability. Whitehouse (2016) describes a distinct iron-oxide layer at the base of the Hawkesbury formation shales separating the transition to sandstone. The Pittwater Peninsula specimens all occur on sandstone that is transitional to a shale lens (i.e. Palm Beach) or transitional to a claystone formation such as the Garie Formation, in the case of Bangalley Headland, Mona Vale Headland and Turimetta Headland.

The Frenchs Forest population (Figure 3) occupies a south-west facing bench below Ararat Reserve on Hawkesbury Sandstone influenced by colluvium from a deep, Hawkesbury Formation shale lens that extends up slope (DPIRD 2026). Similar geological landscapes, involving Hawkesbury Sandstone enriched by upslope or embedded shale lenses, occur elsewhere on the Northern Beaches; many of these shale lenses have not been displayed in any published geological maps as they are too small or localised (DPIRD 2026, Martyn 2024). This transitional, geological environment may provide locally favourable nutrient conditions not typically associated with sandstone landscapes. The distribution of rare species on localised or isolated shale-influenced sites within a broader sandstone landscape is a common pattern along the Sydney coast and suggests they are relics of formerly wider distributions that became more isolated as climate has become more variable (i.e. droughts fires and floods) over at least the last 6000 years (Benson 2024). Previous collectors have speculated that the Frenchs Forest *Pomaderris mediora* population is not naturally occurring, but perhaps introduced from historical land disturbance such as imported fill (AVH 2026); however, this is highly unlikely. *Pomaderris mediora* is a sensitive and rare species, not likely to readily establish in dumped soil, and the chance of material being artificially transported from one of the few sites where this species occurs, to a location that enabled establishment of a self-sustaining

Pomaderris mediora population, is low. The landscape position occupied by the Frenchs Forest population shows a similar pattern (sandstone ridge-tops and upper slopes with a distinct shale influence) to other *Pomaderris mediora* populations and confirms it as a naturally occurring remnant population. This population has extremely high conservation significance.

South-west of Sydney, a single collection from Dharawal State Conservation Area near O'Hares Creek represents the Appin population. This specimen was collected on a mid-slope bench in Hawkesbury formation geology on the escarpment from Cobbong Creek (AVH 2026). The species has not been relocated since 2008 despite extensive survey effort. While the population may remain undetected within inaccessible habitat, its status remains uncertain; further targeted survey is required.

The southernmost occurrences of *Pomaderris mediora* are situated on the Illawarra Escarpment between Sublime Point and Upper Loddon Creek, upstream of the Cataract Dam in the locality of Maddens Plains. These occurrences are of conservation significance because they represent the southernmost population of the species, separated from the Northern Beaches by approximately 70 km, and they occur within a unique geological setting of Bulgo Sandstone transitioning to Bald Hill Clay Stone and Narrabeen Formation Gosford Subgroup. Surveys undertaken in 2006 documented several discrete clusters of plants occupying cliff-edge ledges, sandstone benches and light gaps within escarpment woodland (AVH 2026).

The population of *Pomaderris mediora* at Port Stephens (currently only known from North Arm Cove) is a geographic and geological outlier, in that it occurs only on the Nerong Volcanics, specifically on colluvium derived from tuffaceous sandstone (DPIRD 2026).



Figure 3. Habitat of *Pomaderris mediora* at Frenchs Forest (K.Lindsay 31 May 2026)

Table 1. Abiotic habitat characteristics (geology, elevation, landscape position) of representative *Pomaderris mediora* populations.

Locality	Geology	Elevation (m ASL)	Landscape Position
North Arm Cove	Tuffaceous sandstone of the Nerong Volcanics	20–40	Lower slope
Palm Beach	Hawkesbury Formation sandstone with shale enrichment (embedded shale lens) and evidence of laterisation	55–70	Sheltered bench
Bangalley Headland	Newport Formation transitioning to Garie Formation	55–115	Coastal headland
Mona Vale	Newport Formation transitioning to Garie Formation	15–40	Coastal headland
Turimetta Headland	Newport Formation transitioning to Garie Formation	25–50	Coastal headland
Ingleside	Hawkesbury Formation sandstone with shale enrichment (embedded shale lens) and evidence of laterisation	170–180	Ridgetop
Belrose	Hawkesbury Formation sandstone with shale enrichment (embedded shale lens) and evidence of laterisation	90–120	Upper slope
Frenchs Forest	Hawkesbury Formation sandstone with shale enrichment (lateral enrichment from upslope deep shale lens and evidence of laterisation)	114–125	Gully head bench
Appin	Hawkesbury Formation sandstone with shale enrichment (embedded shale lens) and evidence of laterisation	225–300	Sheltered bench
Sublime Point	Bulgo Sandstone transitioning to Bald Hill Clay Stone and Narrabeen Formation Gosford Subgroup	180–250	Cliff edge

Population size

Current evidence suggests that the total population of *Pomaderris mediora* is approximately 180–250 mature individuals. Most known occurrences support fewer than ten mature plants. The most substantial coastal populations occur in the Northern Beaches population group, on the Pittwater Peninsula where the Frenchs Forest, Bangalley Headland and Turimetta Headland populations account for a substantial proportion (>90%) of all known individuals (Table 2). Bangalley Headland supports approximately 50 plants and represents the largest extant population currently known. The Turimetta Headland population, where more than 30 individuals occur, has been repeatedly documented through both field surveys and citizen-science observations and appears to remain relatively stable (AVH 2026,

ALA 2026). Smaller populations occur at Avalon Beach (north of Bangalley Headland), Mona Vale Headland and Palm Beach.

At the Illawarra Escarpment/Maddens Plains populations, past specimen collection events included both mature plants and seedlings, indicating recent recruitment at the time of collection. However, no subsequent collections have confirmed the continued persistence of these populations and concern has been expressed that the entire population group may already have declined substantially toward extirpation (R. Miller pers. comm.). Such a small population size, across a fragmented distribution places the species amongst the least abundant unlisted NSW vascular plant taxa.

Table 2. Estimated extant population sizes for *Pomaderris mediora* across its natural range.

Population Group	Locality	Status	Estimated number of plants (n)
Port Stephens	Carrington Road, North Arm Cove	Extant	Unknown
Northern Beaches	Frenchs Forest	Extant	50–80
Northern Beaches	Belrose	Extant	~5
Northern Beaches	Ingleside	Extant	≥1
Northern Beaches	Turimetta Headland	Extant	>30
Northern Beaches	Mona Vale Headland	Extant	>4
Northern Beaches	Bangalley Headland	Extant	~50
Northern Beaches	Palm Beach	Extant	≥1
Northern Beaches	Newport	Historical	Unknown
Northern Beaches	Whale Beach	Historical	Unknown
Northern Beaches	Careel Bay	Historical	Unknown
Appin	O'Hares Creek	Uncertain	Unknown
Illawarra	Sublime Point	Extant/Declining	~15
Illawarra	Upper Loddon Creek	Historical	Unknown

Associated species and Plant Community Types

Across much of its range *Pomaderris mediora* occurs within open woodland or scrub dominated by combinations of *Corymbia gummifera*, *Eucalyptus sieberi*, *Eucalyptus botryoides*, *Eucalyptus umbra* and *Allocasuarina* spp. Associated shrubs commonly include *Banksia spinulosa*, *Banksia integrifolia*, *Melaleuca hypericifolia*, *Leucopogon lanceolatus* and *Hakea* spp. Notably, *Melaleuca hypericifolia* occurs at many known sites and may represent a useful indicator species for identifying potentially suitable habitat for future targeted survey or translocation efforts.

Table 3. Distribution of Plant Community Types across study sites

Presence of a PCT at a *Pomaderris mediora* site is indicated by •. Site abbreviations: NAC, North Arm Cove; PB, Palm Beach; AB, Avalon Beach (Bangalley Headland); MV, Mona Vale; TU, Warriewood (Turimetta Headland); ING, Ingleside; BEL, Belrose; FF, Frenchs Forest; APP, Appin; MP, ILL, Illawarra (including Sublime Point and Upper Loddon Creek, Maddens Plains).

PCT	NAC	PB	AB	MV	TU	ING	BEL	FF	APP	ILL
3028 Illawarra Escarpment Warm Temperate Rainforest										•
3154 Illawarra Blackbutt Moist Forest										•
3250 Northern Foothills Blackbutt Grassy Forest	•									
3259 Sydney Coastal Shale-Sandstone Forest								•		
3261 Sandstone Plateau Shale Forest										•
3407 Central Headland Grassland				•	•					
3544 Coastal Sands Apple-Blackbutt Forest	•									
3546 Coastal Sands Littoral Scrub-Forest					•					
3582 Hunter Coast Lowland Apple-Bloodwood Forest	•									
3584 Illawarra Escarpment Cliffline Scrub										•
3586 Northern Sydney Scribbly Gum Woodland						•				
3590 Southern Sydney Scribbly Gum Woodland										•
3592 Sydney Coastal Enriched Sandstone Forest		•	•				•			
3593 Sydney Coastal Sandstone Bloodwood Shrub Forest						•	•	•		
3594 Sydney Coastal Sandstone Foreshores Forest		•								
3595 Sydney Coastal Sandstone Gully Forest						•			•	•
3598 Woronora Plateau Scribbly Gum Woodland									•	•
3789 Coastal Headland Clay Heath			•	•						
3807 Northern Sydney Heath-Mallee						•				
3810 Southern Sydney Rockplate Heath						•				•
3814 Woronora Plateau Heath-Mallee						•	•	•	•	•
3924 Sydney Coastal Upland Swamp Heath						•		•		•

Ecology propagation and dispersal

Little is known regarding the reproduction of *Pomaderris mediora*. No published studies have examined germination, recruitment, pollination biology or longevity. The only available information is Clarke and Howes (2024) who stated: “*Propagation can be carried out from seed which germinates well following treatment with boiling water. Seed is shed from the plant when ripe and is difficult to collect.*”

Ecological inference can be drawn from studies of closely related species, particularly *Pomaderris adnata* and *Pomaderris walshii*, both of which occur within the Sydney Basin and possess similar habitat requirements (Natale 2016, Le Breton et al. 2020,

For Plant Community Types (PCT) that support *Pomaderris mediora* across its distribution (Table 3) most contain *Corymbia gummifera* either in forest, or mallee form, as a dominant or associated tree species. The exceptions are in PCT 3028, PCT 3407 and PCT 3546. While there are *Pomaderris mediora* records in these PCT, they occur on the edges of the main aggregation in a transitional zone with an adjacent PCT.

Le Breton et al. 2023). Experimental work undertaken by Natale (2016) demonstrated that seeds of *Pomaderris adnata* and *Pomaderris walshii* exhibit strong dormancy-breaking responses following exposure to high temperatures, with maximum germination occurring after heat treatments approaching 100°C. These findings suggest adaptation to fire-prone environments and support the hypothesis that recruitment in *Pomaderris* species is closely linked to the passage of fire. Similar responses have been documented in *Pomaderris vacciniifolia* and other members of the genus (Patykowski et al. 2014, Patykowski et al.2016). The occurrence of seedling *Pomaderris adnata* within recently burnt habitat at Sublime Point further supports the hypothesis that *Pomaderris mediora* is a fire-responsive obligate

seeder (Le Breton et al. 2020). If this interpretation is correct, both excessively frequent fire and prolonged fire exclusion may represent threats to population persistence. Frequent fire may eliminate immature plants before replenishment of the soil seedbank, whereas long periods without fire may result in senescence of adult plants and failure of recruitment. Such dynamics have been documented in other threatened *Pomaderris* species (Natale 2016, Le Breton et al. 2020, Le Breton et al. 2023).

Pomaderris mediora seeds have an enlarged elaiosome (Figure 4), the presence of elaiosome-bearing seeds throughout the genus suggests that ants play an important role in seed movement and burial (Berg 1975). While this mechanism may enhance seed survival and promote local recruitment, dispersal distances are generally limited to a few metres (Berg 1975, Patykowski et al. 2016). In a world-wide study of myrmecochorous plant species, Gómez and Espadaler (2013) found the mean seed dispersal distance was 2.24 ± 7.19 m from parent plants. The ability for plants to colonise suitable habitat between populations that are separated by uninhabitable barriers exceeding 8 metres in width, is expected to be extremely limited or entirely absent. Consequently, natural recolonisation of extirpated populations is likely to be extremely slow or effectively absent.

Increasing evidence suggests that many rare *Pomaderris* species exhibit substantial levels of clonality and polyploidy, particularly where populations are isolated and geographically restricted (Chen et al. 2019, Nge et al. 2025, Simmons et al. 2025). Gene flow is limited to short distances among most of the smaller *Pomaderris* species, and distance is limited by the reproductive strategy of the species. Small insects of the orders coleoptera, and hymenoptera are the primary pollinators of most species in the genus *Pomaderris* (Armstrong 1979) however, for some species, apomixis is the primary strategy for reproduction (Harvey and Braggins 1985). The little-known pollination and seed production strategies of *Pomaderris mediora* warrant investigation given the small population sizes and pronounced fragmentation observed throughout the species' range.

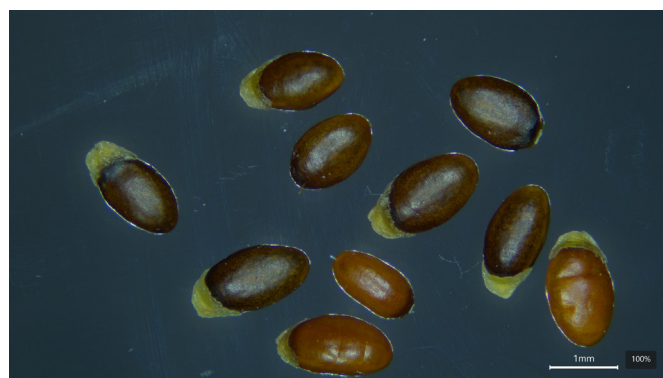


Figure 4. Seeds of *Pomaderris mediora* (S. Padgett and R. Paroissien)

Discussion

Threats

The available evidence indicates that *Pomaderris mediora* possesses many of the characteristics typically associated with threatened plant taxa, including a highly restricted distribution, small population size, severe fragmentation, inferred decline at several locations and exposure to numerous ongoing threatening

processes. While the species is not currently listed under either State or Commonwealth threatened species legislation, the available data suggests that its conservation status warrants urgent consideration.

The total known population, approximately 180–250 mature individuals, is distributed amongst eleven locations, with most containing fewer than ten mature plants (Table 2). Several populations are known only from historical collections and have not been located since their first collection, despite substantial botanical activity in surrounding areas. The apparent disappearance of some populations, combined with uncertainty surrounding the status of the Appin and Illawarra occurrences, suggests a continuing decline in the number of mature individuals and occupied locations may already be occurring (AVH 2026, R. Miller pers. comm.).

A notable feature of *Pomaderris mediora* is the pronounced fragmentation of its distribution. Four regional population groups are separated by distances ranging from tens to more than one hundred kilometres. Small and isolated populations are also more susceptible to genetic drift, inbreeding depression and stochastic demographic processes, particularly where recruitment is episodic or infrequent (Young et al. 1996, Frankham et al. 2010). Given its likely myrmecochorous seed dispersal, opportunities for future long-distance dispersal are extremely unlikely. Consequently, recolonisation of extirpated populations is unlikely without direct human intervention.

Altered fire regimes pose a significant ecological threat. *Pomaderris mediora* is likely to be a fire-responsive obligate seeder, dependent upon periodic disturbance to stimulate germination from a persistent soil seedbank (Natale 2016, Le Breton et al. 2020, Le Breton et al. 2023). Consequently, both excessively frequent fire and prolonged fire exclusion have the potential to negatively affect population viability. Repeated short-interval fires may eliminate juvenile plants before they reach reproductive maturity and replenish the seedbank, while long periods without fire may result in senescence of mature plants, accumulation of litter and suppression of recruitment. Similar processes have been implicated in the decline of other rare *Pomaderris* species in south-eastern Australia (Patykowski et al. 2014, Le Breton et al. 2023). The consequences of fire exclusion may be particularly relevant to several Northern Beaches populations where long-unburnt vegetation has developed dense shrub layers and substantial litter accumulation. At Frenchs Forest, some of the mature *Pomaderris mediora* plants exhibit signs of senescence and there is little evidence of recent recruitment (pers. obs). Comparable concerns regarding a lack of recruitment have been raised regarding the Illawarra population group, where some sites have not been observed for almost two decades and may now persist primarily as dormant soil seedbanks (R. Miller pers. comm.).

Herbivory and physical disturbance by introduced mammals may destroy *Pomaderris mediora* plants and further reduce recruitment success. European rabbits (*Oryctolagus cuniculus*) and European hares (*Lepus europaeus*) occur throughout much of the species' range and can consume seedlings and disturb soil seedbanks through increased risk of erosion from overgrazing and burrowing. In the Illawarra and Appin regions, rusa deer (*Rusa timorensis*) and other feral deer species are now widespread and may damage plants through browsing, trampling and bark

stripping. Deer impacts have become increasingly important conservation issues within sandstone vegetation communities throughout eastern NSW (Moriarty 2004).

Some *Pomaderris mediora* populations occur adjacent to urban areas where on-going mechanical management of vegetation through slashing and mowing of the shrub and ground layer is undertaken to protect nearby dwellings from wildfire. This activity 'Asset Protection Zone' (APZ) is considered a significant on-going threat to *Pomaderris mediora* populations at Belrose, Frenchs Forest, and potentially Ingleside. Mechanical vegetation removal, slashing and associated soil disturbance is likely to directly destroy plants and deplete seedbanks to the point they become locally extinct. It is possible the Belrose population has already succumbed to this fate. At Belrose, a specimen of *Pomaderris mediora* was collected in April 2011 from a small cluster of plants located in sandstone ridgetop woodland dominated by *Eucalyptus haemastoma* and *Corymbia gummifera* with associated *Eucalyptus sieberi* and *Eucalyptus capitellata*, adjacent to a dirt track near Garigal National Park (AVH 2026). This population was particularly vulnerable owing to its small size, proximity to urban development and exposure to weed invasion, recreational disturbance and management of vegetation as an APZ. A targeted survey in June 2026 by the author however found no evidence of the species. The Ingleside population in a similar habitat, is known from a single historical collection on private land and remains poorly documented.

Weed invasion represents another pervasive threat. Introduced species are present at many known sites and appear particularly problematic within the Northern Beaches population group. Environmental weeds compete for light, moisture and nutrients, alter fire behaviour and may fundamentally change habitat structure over time (Groves and Willis 1999). Weed impacts are especially evident at Frenchs Forest, Belrose and several coastal headland populations where urban edge effects facilitate ongoing invasion. Similar threats have been recognised as significant

drivers of decline in other threatened shrub species occupying fragmented habitats (NSW Scientific Committee 2024).

Recreational disturbance impacts are increasingly important in coastal and peri-urban *Pomaderris mediora* populations. Informal walking tracks, mountain-bike trails and associated trampling may directly damage plants, compact soils, erode soils and disturb seedbanks. These impacts are particularly relevant at Turimetta Headland, Mona Vale Headland, Frenchs Forest, Belrose and Sublime Point where recreational use of native vegetation has increased substantially over recent decades. Although individual impacts may appear minor, repeated disturbance can be significant where populations comprise only a small number of individuals.

Infrastructure maintenance presents an additional threat to throughout much of the *Pomaderris mediora* range. Roadside slashing, fire trail maintenance, track upgrades and powerline easement management all have the potential to damage or destroy plants. Such impacts are of particular concern at North Arm Cove, Frenchs Forest and Belrose where populations occur adjacent to access corridors or utility infrastructure. Off-target herbicide application during weed control activities may also affect populations because young *Pomaderris* plants can be easily mistaken for introduced woody weeds such as small-leaved privet (*Ligustrum sinense*), Italian buckthorn (*Rhamnus alaternus*) and cotoneaster (*Cotoneaster* spp.).

Collectively, these threats are likely to act synergistically rather than independently. Small population size increases vulnerability to local extinction, and fragmentation limits opportunities for recolonisation. Fire regime disruption may suppress recruitment and weed invasion or herbivory may further reduce establishment success. Consequently, even relatively minor disturbance events may have disproportionately large impacts upon population viability. Threats and locations most effected are summarised in Table 4.

Table 4. Current and potential threats affecting *Pomaderris mediora* populations.

Threat	Mechanism of impact	Populations most affected	Relative severity
Small population size	Demographic and genetic stochasticity	All populations	Very High
Fragmentation	Isolation and reduced gene flow	All populations	Very High
Fire exclusion	Recruitment failure and senescence	Frenchs Forest, Illawarra	High
Too frequent fire/intense wildfire	Loss of immature plants and seedbank depletion	Urban-fringe populations	High
APZ management	Mechanical clearing and soil disturbance	Frenchs Forest, Belrose, Ingleside, Avalon Beach (Bangalley)	High
Weed invasion	Competition and habitat modification	All Northern Beaches populations	High
Recreation	Trampling and erosion	All Northern Beaches populations and Maddens Plains (Sublime Point)	Moderate
Track maintenance	Direct plant mortality	North Arm Cove, Belrose, Frenchs Forest, Turimetta Headland, Mona Vale, Appin, and Maddens Plains (Sublime Point)	Moderate
Powerline maintenance	Slashing and clearing	North Arm Cove, Belrose	Moderate
Herbicide drift	Off-target mortality	Frenchs Forest, Belrose, North Arm Cove	Moderate
Rabbits	Grazing and soil disturbance	All populations	Moderate
Deer	Browsing and trampling	Appin, Illawarra	High

Assessment against threatened species criteria

The most immediate conservation priority is formal assessment and listing of *Pomaderris mediora* under the *Biodiversity Conservation Act 2016*. Assessment against both the *Biodiversity Conservation Act 2016* and the IUCN Red List Categories and Criteria indicates that *Pomaderris mediora* is likely to satisfy thresholds consistent with listing as 'Endangered' (Table 5). The extent of occurrence (EOO) is estimated at approximately 1346 km², while the area of occupancy (AOO) is estimated to be 52 km². Although the extent of occurrence appears relatively large when measured as a minimum convex polygon, the actual area occupied by the species is extremely small and highly fragmented. Most populations occupy less than 0.05 km² of habitat and several are represented by only a handful of individuals. This disparity between EOO and AOO is characteristic of many sandstone endemics and highlights the importance of considering fine-scale habitat occupancy when assessing conservation status.

The total number of mature individuals is estimated at fewer than 250, and a continuing decline can reasonably be inferred from the apparent loss of historical populations, uncertainty surrounding several extant occurrences and the operation of multiple ongoing threatening processes. The species satisfies the IUCN (2022) criteria associated with restricted geographic distribution, severe fragmentation, small population size and continuing decline. Failure to implement conservation measures may result in future eligibility for a higher threat category.

The conservation significance of *Pomaderris mediora* extends beyond its rarity. It is one of only a small number of vascular plants endemic to coastal sandstone environments between the Hunter and Illawarra regions and contributes to the floristic distinctiveness of these landscapes. Protection of the species will therefore assist in conserving broader patterns of biodiversity and evolutionary history within the Sydney Basin.

Table 5. Assessment of *Pomaderris mediora* against the IUCN Red List Categories and Criteria (IUCN 2022).

Criterion	Evidence	Assessment
A. Population reduction	Historical population losses are apparent and continuing decline is inferred; however, no quantitative estimate of population reduction is available.	Not applicable
B1. Extent of occurrence (EOO)	EOO = 1,346 km ² .	Meets Endangered threshold (<5,000 km ²)
B2. Area of occupancy (AOO)	AOO = 52 km ² .	Meets Endangered threshold (<500 km ²)
B(a). Severe fragmentation	Distribution fragmented into four geographically isolated population groups with negligible natural connectivity.	Criterion met
B(b). Continuing decline	Inferred continuing decline in habitat quality, occupied locations and mature individuals due to historical losses, uncertain population status and ongoing threats.	Criterion met
B(c). Extreme fluctuations	No evidence of extreme fluctuations.	Criterion not met
C. Small population size and decline	Total population estimated at 180–250 mature individuals with continuing decline inferred.	Meets Endangered threshold (<2,500 mature individuals)
C2a(i). Subpopulation size structure	No known subpopulation contains more than 250 mature individuals; most contain fewer than 10 individuals.	Criterion met
D. Very small population	Total population estimated at 180–250 mature individuals.	Meets Endangered threshold (<250 mature individuals)
E. Quantitative analysis	Population viability analysis unavailable.	Not assessed
Overall assessment	Restricted geographic distribution, severe fragmentation, inferred continuing decline and very small population size.	Endangered EN B1ab(i,ii,iii,v)+2ab(i,ii,iii,v); C2a(i); D

Conservation management

Recognition as a threatened species would provide an essential framework for coordinated management, facilitate access to conservation funding and ensure that populations are appropriately considered during planning and development assessment processes. While several populations occur within conservation reserves or public open space, formal reservation alone is unlikely to be sufficient given the range of threats currently operating across the species' distribution. The highly fragmented distribution, small population size and apparent dependence upon disturbance-mediated recruitment indicate that active conservation management will be required to ensure the long-term persistence.

Comprehensive survey of *Pomaderris mediora* throughout its known range should be undertaken as a matter of priority (see

for example Bell et al. 2026 for *Pomaderris sericea*) Several populations, particularly those at Appin and the Illawarra Escarpment, have not been confirmed for almost two decades. Similarly, historical records from Newport, Whale Beach, Careel Bay and Upper Loddon Creek warrant targeted survey. Given the specialised habitat occupied by the species, predictive habitat modelling may assist searches. Long-term monitoring should be established at representative populations throughout each of the four recognised population groups. Monitoring should quantify abundance, recruitment, mortality and habitat condition, with particular emphasis on understanding the demographic consequences of different fire regimes. Permanent monitoring plots would provide valuable baseline information and enable assessment of population trajectories through time.

A major knowledge gap concerns reproductive ecology. Studies investigating germination requirements, seed longevity,

pollination biology and dispersal mechanisms are required to inform future management. Experimental work undertaken on *Pomaderris adnata*, *Pomaderris walshii* and *Pomaderris vacciniifolia* suggests that fire plays a critical role in recruitment dynamics (Patykowski et al. 2014, Natale 2016, Le Breton et al. 2020, Le Breton et al. 2023); similar studies have not been conducted on *Pomaderris mediora*.

The role of fire requires careful consideration. Determining whether the species is an obligate seeder, facultative resprouter or possesses mixed post-fire regeneration strategies should be a high research priority. Available evidence suggests that both excessively frequent fire and prolonged fire exclusion may be detrimental. Fire management should aim to maintain intervals that allow maturation and replenishment of soil seedbanks while preventing long-term senescence and recruitment failure. Traditional custodians should be engaged and cultural burns that focus on ground-level biomass reduction should be trialled. Until species-specific ecological information becomes available, precautionary fire management informed by related *Pomaderris* species studies is recommended.

The small number of extant individuals and highly fragmented nature of populations make the species particularly vulnerable to stochastic events. Seed collection and ex situ conservation should be undertaken from all populations to maintain as much genetic diversity as possible. Seed banking through the Australian PlantBank has commenced. Associated conservation programs would provide an important safeguard against catastrophic population loss and facilitate future translocation or population augmentation if required.

Management of habitat threats should focus on weed control, minimisation of recreational impacts and protection from infrastructure-related disturbance. Weed management programs should prioritise populations where invasive species are actively expanding and threatening habitat integrity and take care that weed control operations do not inadvertently damage *Pomaderris mediora* plants through herbicide drift, trampling or misidentification. Development of species identification guides for bush regeneration practitioners may assist in reducing these risks.

Finally, genetic studies are required to determine levels of diversity within and between populations. Given the geographic isolation of the North Arm Cove, Northern Beaches, Appin and Illawarra populations, substantial genetic differentiation may exist. Such information would assist in defining management units and guiding any future translocation or restoration programs. The extreme isolation of the North Arm Cove population may indicate this northern population is a distinct taxonomic entity.

Future research priorities

This review highlights numerous knowledge gaps that limit understanding of the conservation requirements of *Pomaderris mediora*. Future research should focus on the following issues:

1. Predictive habitat modelling
2. Comprehensive range-wide survey and population census.
3. Genetic assessment of population structure and connectivity.

4. Investigation of reproductive biology and pollination ecology.
5. Experimental determination of germination requirements and seedbank dynamics.
6. Assessment of post-fire recruitment and fire response strategies.
7. Quantification of generation length and longevity.
8. Investigation of clonal reproduction and polyploidy.
9. Habitat suitability modelling and climate change vulnerability assessment.
10. Evaluation of herbivory impacts from rabbits and deer.
11. Development of evidence-based fire management guidelines.

Addressing these priorities would substantially improve understanding of the species and provide a stronger scientific basis for future conservation management.

Conclusion

Pomaderris mediora is a highly localised endemic shrub confined to a narrow coastal corridor extending from Port Stephens to the Illawarra within the Sydney Basin Bioregion. The species persists as a series of small, highly fragmented populations associated with coastal headlands, sandstone benches, escarpment ledges and upper slopes on localised sandstone-derived soils with associated shale, claystone or tuffaceous influences.

Currently approximately 180–250 mature individuals are distributed amongst eleven locations, the largest populations being on Sydney's Northern Beaches; populations at Appin and the Illawarra Escarpment may be in decline and require urgent reassessment. The species exhibits ecological characteristics consistent with other rare *Pomaderris* taxa, including probable fire-dependent recruitment from persistent soil seedbanks and limited dispersal mediated by ants.

Multiple threats operate throughout the species' range, including fragmentation, small population size, altered fire regimes, weed invasion, recreational disturbance, infrastructure maintenance and herbivory by introduced mammals. These threats are likely to act synergistically and may already be contributing to local population declines.

Available evidence suggests that *Pomaderris mediora* satisfies criteria consistent with listing as Endangered under the *Biodiversity Conservation Act 2016*. Formal recognition of the species as threatened, together with implementation of targeted monitoring, ecological research and habitat management, is recommended to secure the long-term persistence of this NSW endemic species.

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