SAVING OUR SPECIES

Nabiac Casuarina

2022-2023 annual report card

Overall status*

- Populations at all sites are known to be on track.
- Threat management is known to be on track at all sites, and population status is unknown at one or more sites.
- Threat management is known to be off track at one or more sites, and population status is unknown at one or more sites.
- **Populations at one or more sites are known to be off track.**

* For SoS priority management sites (may not include all locations where the species occurs in NSW)

Summary

Management sites	Booti Booti National Park; Nabiac; Wallis Island
Action implementation	4 (of 4) management actions were fully or partially implemented as planned for the financial year.
Total expenditure	$900 ($0 cash; $900 in-kind)
Partners	Environment and Heritage Group

Photo: Barry Collier

Scientific name:
Allocasuarina simulans

NSW status:
Vulnerable

Commonwealth status:
Vulnerable

Management stream:
Site-managed species

Priority management site: Booti Booti National Park

Local government area:
Mid-Coast

Partners:
Environment and Heritage Group

Population outcome

Monitoring

Species population monitoring by one or more methods indicates response to management over time and provides an outcome measure.

Monitoring metric	Species abundance
Annual target	Abundance of plants per square metre equal to or greater than 2018 estimate of 0.302 plants/m^2.
Long term target	Maintain or improve population at 2018 estimates, i.e. an increase from 0.302 plants/m^2.
Monitoring result	The number of Nabiac casuarina plants in each 400 m^2 quadrat ranged from 1 to 597, and large variations in density were encountered between quadrats separated by short distances in seemingly homogenous habitat. Plots showed a decrease in plant numbers over time. The mean density for the 20 quadrats was 0.23 plants/m^2, which is substantially less than a density of 0.30 plants/m^2 obtained for quadrats recorded previously. The results of the new population estimate method calculated a total population size of 118,260 plants within 214 ha of available habitat, providing a value of 0.055 plants/m^2.
Scientific rigour of monitoring method	High
Conducted by	Environment and Heritage Group

Management actions

The following actions are those identified as being required in financial year 2022-2023 to secure the species in the wild.

Threat	Management action	Implemented as planned?
Potential for frequent fire to disrupt reproduction and remove individuals.	Review BioNet Nabiac casuarina records accordingly and ensure any new records have been entered. Update Threatened Species Profile Database (TSPD) accordingly once accurate fire regime data is collected.	Yes

Threat outcome

Assessment on the status of critical threats at this site.

Threat	Annual target	Threat status
Potential for frequent fire to disrupt reproduction and remove individuals.	No decline in plant abundance per square metre from 2018 baseline data of 0.302 plants/m^2 following fire events.	Baseline data collection
At risk from incursion of various weed species.	Absence of weeds on site.	On track

Site summary

A decrease in plant counts was observed across the majority of plots at Nabiac and Booti Booti, suggesting the populations may be in decline. Nabiac has been subjected to a higher fire frequency in the last decade than Booti Booti, yet the results indicate a decline in plant numbers at both sites (which have similar weather patterns), regardless of fire regime (i.e., in both burnt and unburnt habitat). Perhaps these 2 sites represent extremes in fire regime. Without long-term data it is unknown if this decrease is cause for concern, or simply natural senescence. The cause of decline is also unknown and requires experimental design, implementing various fire regimes.

Many heathland plants have evolved with fire, and the frequency, season and intensity is known to strongly affect population dynamics (Morrison and Renwick 2000). Some authors purport that the absence of fire may be of more concern than too frequent fire (Myerscough and Clarke 2007). In contrast, if fire is too frequent, there may be insufficient time for mature soil seed bank to accumulate and replace plants killed by the fire. Studies show that frequent fire in wallum ecosystems deplete soil nutrients and excludes obligate seeders from the system (Adams et al. 1994; Bradstock et al. 1997; Myerscough and Clarke 2007). Vegetative reproduction is highly developed in some heathland plants. However, the ability to resprout may decline with age (Gill and Groves 1981). It is uncertain at what age plants gain the capacity to regenerate vegetatively or at what age it is lost. At Nabiac, an approximately 25-year-old Nabiac casuarina (recorded 6 m in height and 6 cm basal diameter) was burnt in 2020 during severe drought. Non-destructive root excavation revealed that the ‘old-growth’ plants retained the capacity to vegetatively reproduce after bushfire. Despite its age the individual was also observed producing fruiting cones at the time of the fire (Griffith 2022). This is another knowledge gap requiring further investigation.

The over- or under-use of fire may significantly alter soil nutrient pools and availability, and these changes may alter community composition and productivity (Adams et al. 2009). The Nabiac sand barriers have been subject to a high fire frequency over the last decade, with plants being burnt in 2014, 2018 and 2020. This is more frequent than what is prescribed for *Allocasuarina emuina*. Clearly, the complexities surrounding fire management and the importance in understanding appropriate fire regimes for individual plants whilst maintaining suitable habitat conditions and ecosystem health (e.g., soil chemistry) over the long-term, is crucial.

References:

Adams M, Iser J, Keleher A and Cheal D (1994) ‘Nitrogen and phosphorus availability and the role of fire in heathlands at Wilsons Promontory’, *Australian Journal of Botany,* 42:3269-81.

Adams MD, Law BS and French KO (2009) ‘Vegetation structure influences the vertical stratification of open- and edge-space aerial-foraging bats in harvested forests’, *Forest Ecology and Management,* 258:92090-100.

Bradstock RA, Tozer MG and Keith DA (1997) ‘Effects of high frequency fire on floristic composition and abundance in a fire-prone heathland near Sydney’, *Australian Journal of Botany*, 45:4641-55.

Gill A and Groves H (1981) ‘Fire regimes in heathlands and their plant ecological effects’, in Specht (ed) *Ecosystems of the world 9B: Heathlands and related shrublands, Analytical Studies*, Elsevier Scientific Publishing Company, Amsterdam.

Morrison DA and Renwick JA (2000) ‘Effects of variation in fire intensity on co-occurring species of small trees in the Sydney region’, *Australian Journal of Botany*, 48:71-9.

Myerscough PJ and Clarke PB (2007) ‘Burnt to blazes: Landscape fires, resilience and habitat interaction in frequently burnt coastal heath’, *Australian Journal of Botany*, 55:2.

Priority management site: Nabiac

Local government area:
Mid-Coast

Partners:
Environment and Heritage Group

Population outcome

On track

On track (inferred)

Not on track (inferred)

Not on track

Monitoring

Species population monitoring by one or more methods indicates response to management over time and provides an outcome measure.

Monitoring metric	Species abundance
Annual target	Abundance of plants per square metre equal to or greater than 2018 estimate of 0.185 plants/m^2.
Long term target	Maintain or improve population at 2018 estimates, i.e. an increase from 0.185 plants/m^2.
Monitoring result	Nabiac plant numbers showed consistent decreases across the majority of plots. The number of Nabiac casuarina plants in each 400 m^2 quadrat ranged from 0 to 243, and this large variation in density was also encountered between quadrats separated by short distances in seemingly homogenous habitat. Differences in plant numbers between 2014 and 2021 ranged from 1 to -10 plants with percentage decline ranging from a 4% increase to 31% decrease per plot. The mean density of 6 quadrats established in 2014 was 0.15 plants/m^2 compared to 0.17 plants/m^2 recorded in 2014 (Griffith 2014).
Scientific rigour of monitoring method	High
Conducted by	Environment and Heritage Group

Investment

Participant	Cash	In-kind
Environment and Heritage Group	$0	$900

Management actions

The following actions are those identified as being required in financial year 2022-2023 to secure the species in the wild.

Threat	Management action	Implemented as planned?
Potential for different land uses to impact on the species' viability.	Continue discussions with stakeholders.	Yes
Potential for frequent fire to disrupt reproduction and remove individuals.	Collect seed from all populations. Minimum 1,000 seeds per population.	Yes

Threat outcome

Assessment on the status of critical threats at this site.

Threat	Annual target	Threat status
Potential for different land uses to impact on the species' viability.	Hold at least 2 stakeholder meetings.	On track
Potential for frequent fire to disrupt reproduction and remove individuals.	Gather baseline data on post-fire recovery.	Not on track

Site summary

A decrease in plant counts was observed across the majority of plots at Nabiac and Booti Booti, suggesting the populations may be in decline. Nabiac has been subjected to a higher fire frequency in the last decade than Booti Booti, yet the results indicate a decline in plant numbers at both sites (which have similar weather patterns), regardless of fire regime (i.e. in both burnt and unburnt habitat). Perhaps these 2 sites represent extremes in fire regime. Without long-term data it is unknown if this decrease is cause for concern, or simply natural senescence. The cause of decline is also unknown and requires experimental design, implementing various fire regimes.

Many heathland plants have evolved with fire, and the frequency, season and intensity is known to strongly affect population dynamics (Morrison and Renwick 2000). Some authors purport that the absence of fire may be of more concern than too frequent fire (Myerscough and Clarke 2007). In contrast, if fire is too frequent, there may be insufficient time for mature soil seed bank to accumulate and replace plants killed by the fire. Studies show that frequent fire in wallum ecosystems deplete soil nutrients and excludes obligate seeders from the system (Adams et al. 1994; Bradstock et al. 1997; Myerscough and Clarke 2007). Vegetative reproduction is highly developed in some heathland plants. However, the ability to resprout may decline with age (Gill and Groves 1981). It is uncertain at what age plants gain the capacity to regenerate vegetatively or at what age it is lost. At Nabiac, an approximately 25-year-old Nabiac casuarina (recorded 6 m in height and 6 cm basal diameter) was burnt in 2020 during severe drought. Non-destructive root excavation revealed that the ‘old-growth’ plants retained the capacity to vegetatively reproduce after bushfire. Despite its age, the individual was also observed producing fruiting cones at the time of the fire (Griffth 2022). This is another knowledge gap requiring further investigation.

The over- or under-use of fire may significantly alter soil nutrient pools and availability, and these changes may alter community composition and productivity (Adams et al. 2009). The Nabiac sand barriers have been subject to a high fire frequency over the last decade, with plants being burnt in 2014, 2018 and 2020. This is more frequent than what is prescribed for *Allocasuarina emuina*. Clearly, the complexities surrounding fire management and the importance in understanding appropriate fire regimes for individual plants whilst maintaining suitable habitat conditions and ecosystem health (e.g. soil chemistry) over the long-term, is crucial.

The next steps for the Nabiac site include to continue the collection of seed, liaison with stakeholders and research into fire regimes.

References:
Adams M, Iser J, Keleher A and Cheal D (1994) ‘Nitrogen and phosphorus availability and the role of fire in heathlands at Wilsons Promontory’, *Australian Journal of Botany,* 42:3269-81.

Adams MD, Law BS and French KO (2009) ‘Vegetation structure influences the vertical stratification of open- and edge-space aerial-foraging bats in harvested forests’, *Forest Ecology and Management,* 258:92090-100.

Bradstock RA, Tozer MG and Keith DA (1997) ‘Effects of high frequency fire on floristic composition and abundance in a fire-prone heathland near Sydney’, *Australian Journal of Botany*, 45:4641-55.

Gill A and Groves H (1981) ‘Fire regimes in heathlands and their plant ecological effects’, in Specht (ed) *Ecosystems of the world 9B: Heathlands and related shrublands, Analytical Studies*, Elsevier Scientific Publishing Company, Amsterdam.

Morrison DA and Renwick JA (2000) ‘Effects of variation in fire intensity on co-occurring species of small trees in the Sydney region’, *Australian Journal of Botany*, 48:71-9.

Myerscough PJ and Clarke PB (2007) ‘Burnt to blazes: Landscape fires, resilience and habitat interaction in frequently burnt coastal heath’, *Australian Journal of Botany*, 55:2.

Priority management site: Wallis Island

Local government area:
Mid-Coast

Partners:
None

Population outcome

On track

On track (inferred)

Not on track (inferred)

Not on track

The species population is inferred to be on track based on threat management being on track. The population trend is unknown at this time.

Monitoring

Species population monitoring by one or more methods indicates response to management over time and provides an outcome measure.

Baseline monitoring conducted.

Monitoring metric	Species abundance
Monitoring result	The Wallis Island population boundary covers approximately 104 ha. Within the population boundary, approximately 19.2 ha of Dry Sclerophyll Shrubland (DSS) was sampled. Bootstrapping calculated a mean density of 1.59 plants/100m^2 plot (95% CI 0.83 and 2.66), thus providing an estimate of 0.016 plants/m^2. A total population size of 3,053 plants (95% CI 1,593 and 5,107) occurs within DSS in the population boundary.
Scientific rigour of monitoring method	High
Conducted by	Environment and Heritage Group

Management actions

The following actions are those identified as being required in financial year 2022-2023 to secure the species in the wild.

Threat	Management action	Implemented as planned?
Knowledge of distribution limited.	Finalise surveys.	Yes

Threat outcome

Assessment on the status of critical threats at this site.

Threat	Annual target	Threat status
Knowledge of distribution limited.	Define Area of Occupancy for Wallis Island.	On track

Site summary

Baseline surveys of Wallis Island Nature Reserve identified 3,053 plants occurring across 19 ha of Dry Sclerophyll Shrubland habitat, giving a density of 0.016 plants/m^2. Ongoing monitoring will determine if the population is experiencing a decline as observed at the 2 other management sites.

Key threats identified on Wallis Island were limited to small, isolated populations, which can place the species at risk from stochastic events.