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Southwest Western Australia

2.1 During its visit to Western Australia (WA) on 7–8 November 2011, the Committee held a public hearing in Perth, before visiting various sites in the southwest corner of the state.

2.2 Southwest WA is one of Australia's 15 national biodiversity 'hotspots' and the only biodiversity hotspot located in Australia that is recognised by Conservation International.[1] The Margaret River region also forms the western extremity of Gondwana Link, a landscape connectivity project creating wildlife corridors connecting the forests of southwest WA with the Great Western Woodlands, around 1000 kilometres to the east.[2]

2.3 Southwest WA has been identified as one of three areas worldwide containing 'very old, climatically buffered, infertile landscapes', or OCBILs, which are known for their highly fragmented ecological communities with large numbers of endemic species. Species in OCBILs are particularly vulnerable to rapid climate change due to their evolution under climatically buffered conditions over the past tens of millions of years.[3]

2.4 The Committee was particularly interested to see some examples of the impacts that a recent long term drying trend in the climate of southwest

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1 Department of Sustainability, Environment, Water, Population, and Communities, 'Australia's 15 National Biodiversity Hotspots', <http://www.environment.gov.au/biodiversity/hotspots/national-hotspots.html> viewed 18 April 2012; Conservation International, 'The Biodiversity Hotspots: Asia–Pacific', <http://www.conservation.org/where/priority_areas/hotspots/asia-pacific/Pages/asia-pacific.aspx> viewed 18 April 2012.

2 Gondwana Link, 'The Gondwana Link Vision', <http://www.gondwanalink.org/aboutus/vision.aspx> viewed 16 April 2012.

3 Hopper, S. D. (2009), 'OCBIL theory: towards an integrated understanding of the evolution, ecology and conservation of biodiversity on old, climatically buffered, infertile landscapes', *Plant and Soil*, 322: 19–86.

WA has had on biodiversity in the area, and to learn about some of the management techniques that are being deployed in response.

Committee activities

2.5 The Committee met with organisations in Bunbury and Margaret River, presenting a range of views about some of the projects operating in southwest WA and the challenges facing the region. The Committee was also able to conduct site inspections in Lake Cave and Leeuwin Estate, which highlighted issues of tree decline, changing hydrological patterns (rainfall and groundwater), and connectivity between ecosystems. Several representatives from the organisations below accompanied the Committee for the duration of the 8 November site inspections and provided briefings on a range of issues relating to biodiversity conservation in southwest WA.

Meeting with South West Catchments Council and South Coast Natural Resource Management

2.6 On 7 November 2011, the Committee met with and received presentations from the following organisations in Bunbury:

- South West Catchments Council (SWCC), represented by:
  - ⇒ Mr David Gardner, Chair;
  - ⇒ Mr Bernie Masters, Deputy Chair; and
  - ⇒ Mr Damien Postma, CEO; and
- South Coast Natural Resource Management (SCNRM), represented by Mr Justin Bellanger, Operations Manager.

2.7 The SWCC and SCNRM are two of the nation's 56 natural resource management organisations, the boundaries for which have been established by agreement between the Commonwealth and state and territory governments. The organisations receive funding from the Commonwealth Government under the Caring for our Country initiative, in addition to other funding sources. Together, the two organisations cover an area of more than 10 million hectares of southwest WA.[4]

2.8 The Committee received an overview of the operations of both organisations and some of the particular issues they face in relation to biodiversity conservation. General issues discussed in relation to the

4 Australian Government, Caring for Our Country, 'NRM Regions', <http://www.nrm.gov.au/about/nrm/regions/index.html> viewed 18 April 2012.

governance of natural resource management organisations included the need for longer term funding models to improve staff retention, the importance of skills-based boards of management, the value of administrative funding for small, volunteer-run organisations, and the advantages and disadvantages of Western Australia's non-statutory model of natural resource management.

2.9 During its meeting with SWCC and SCNRM, the Committee was presented with the following documents:

- *Annual Report 2010–11*, SWCC.
- *South West Regional Ecological Linkages: Technical Report*, Western Australian Local Government Association and Department of Environment and Conservation, 2009.
- *State of the Environment Report: Western Australia 2007*, 'Theme 5: Biodiversity', Environment Protection Agency (WA).
- *Phytophthora Dieback: Under the Radar and on the Move*, SCNRM, 2011.
- *Southern Prospects 2011–2016: The South Coast Regional Strategy for Natural Resource Management*, SCNRM, 2011.
- *Identification and Conservation of Fire Sensitive Ecosystems and Species of the South Coast Natural Resource Management Region*, Department of Conservation and Land Management (WA), 2009.
- *Climate Change: Whole of Landscape Analysis of the Impacts and Options for the South Coast Region*, prepared for SCNRM, 2009.
- A variety of other materials including trend data for WA's rainfall, temperature and dam inflows; maps; DVDs; brochures; newsletters; a coastal planting guide; and promotional materials related to phytophthora dieback mitigation.

Meeting with Gondwana Link, Cape to Cape Catchments Group, and Greening Australia

2.10 On 8 November 2011, the Committee met with:

- Gondwana Link, represented by Mr Keith Bradby, Program Director;
- Cape to Cape Catchments Group, represented by:
  - ⇒ Mr Drew McKenzie, Biodiversity Project Officer; and
  - ⇒ Ms Hayley Rolfe, Co-ordinator; and
- Greening Australia, represented by:
  - ⇒ Mr Craig Anderson, CEO Western Australia; and
  - ⇒ Mr Hamish Jolly, Advisor and former National CEO.

2.11 During the meeting, the Committee received presentations on Gondwana Link and the Cape to Cape Catchments Group, and was presented with the following document:

- *Gondwana Link: A Landscape Scale Restoration Project in South-West WA*.

2.12 Further information about Gondwana Link and the Cape to Cape Catchments Group is discussed below.

Lake Cave and nearby marri tree decline

2.13 The Committee travelled to Lake Cave, one of many caves in the Leeuwin–Naturaliste Ridge and a popular local tourist attraction. The Committee was given a tour of the cave by representatives of the Augusta Margaret River Tourism Association, which is responsible for managing the area's caves.

2.14 During the tour, the Committee was shown evidence of declining water levels in the cave, and was informed about the impact this has had on the cave's aquatic subterranean invertebrates, known as stygofauna. The Committee also heard about the recent installation of a rainwater harvesting system to supplement the water naturally occurring in the cave in order to minimise the impact of the drying climate.

2.15 Following the visit to Lake Cave, the Committee was presented with the following document describing the impact of the region's drying climate on the cave's aquatic root mat communities and stygofauna:

- *Lake Cave Eco-Hydrology Recovery Project: Threatened Ecological Community and Hydrology Baseline Monitoring Report No. 1*, Subterranean Ecology Pty Ltd and Augusta Margaret River Tourism Association, 2010.

2.16 Close to Lake Cave, the Committee was also shown a typical example of a large marri tree that has declined in health in recent years. This was facilitated by the representatives of the Cape to Cape Catchments Group.

Figure 2.1 Lake Cave's dramatic opening

Photograph courtesy of committee secretariat

Riparian rehabilitation at Leeuwin Estate

2.17 Also on 8 November 2011, the Committee was shown an example of some riparian rehabilitation work undertaken along a fenced section of the Boodjidup Brook running through the land of the Leeuwin Estate winery, near Margaret River.

2.18 The work has involved plantings of native species appropriate for the area, and was intended to stabilise the banks of the stream and improve the natural amenity of the land. The work was coordinated by the Cape to Cape Catchments Group, with assistance from Leeuwin Estate and from a variety of other groups, including school groups.

Figure 2.2 The Committee inspecting a riparian rehabilitation project near Leeuwin Estate winery

Photograph courtesy of committee secretariat

Issues explored in southwest Western Australia

2.19 Through its program of meetings and site inspections in southwest WA, the Committee heard about issues that were particularly relevant to the region, including changed rainfall patterns, tree decline, phytophthora dieback, reduced groundwater, and connectivity between ecosystems.

Changed rainfall patterns in southwest WA

2.20 The Committee was presented with evidence of a drying trend in rainfall and stream flow patterns across southwest Western Australia, which appears to be associated with various other threats to biodiversity in the region as discussed below.

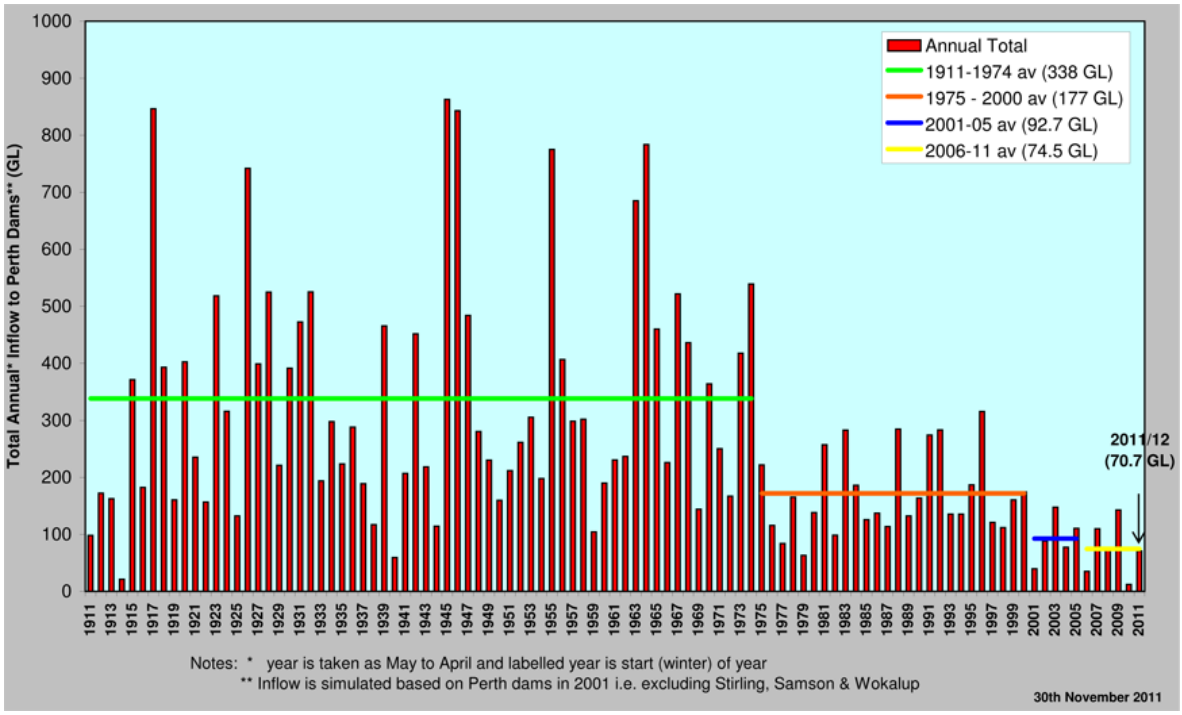
2.21 The Committee was advised that although overall reductions in rainfall in the area have been only moderate, changes in rainfall seasonality and intensity have led to dramatically reduced amounts of run-off. As shown in Figure 2.3, the total annual inflow into Perth dams has reduced from an

average of 338 gigalitres prior to 1975 down to an average of only 74.5 gigalitres over the past six years.[5]

2.22 This was illustrated in Margaret River, where the Committee heard that although rainfall has reduced by only nine per cent in the past ten years, this has resulted in a 46 per cent reduction in stream flow compared to previous decades.

2.23 At the public hearing in Perth on 7 November, representatives of the WA Centre of Excellence for Climate Change, Woodland and Forest Health advised the Committee to consider the impact of these reductions in rainfall and stream flow on WA's biodiversity, noting that water is one of the key drivers of ecosystem function. It was emphasised that 'environmental water'—that is, the water used by forests to maintain biodiversity—is crucial for the health of ecosystems. The Committee heard that over the past two decades there have been significant declines in ground water levels in the region, including falls of up to 10 to 20 metres.[6]

Figure 2.3 Annual stream flow into Perth dams 1911 to 2011



Source *Western Australian Water Corporation*

5 Western Australian Water Corporation, 'Yearly streamflow for major surface water sources', <http://www.watercorporation.com.au/D/dams_streamflow.cfm> viewed 11 April 2012.

6 Prof. Bernard Dell, Chief Investigator, Western Australian Centre of Excellence for Climate Change, Woodland and Forest Health, *Committee Hansard*, Perth, 7 November 2011, p. 37.

Committee comment

2.24 The Committee understands that while the precise impacts on rainfall under different climate change scenarios is difficult to predict, and varies greatly from place to place, southwest WA is one location where there is particularly strong evidence of a drying trend. As noted in the above discussion, the impact of a drying climate on water supplies is already being observed in WA, and this appears to be having a correspondingly severe impact on the region's biodiversity.

Tree decline

2.25 At the public hearing in Perth, representatives of the WA Centre of Excellence for Climate Change, Woodland and Forest Health informed the Committee that over the last decade southwest WA has been experiencing widespread declines in a range of woodland tree species, including tuart, wandoo, WA peppermint, jarrah and marri. While the exact mechanisms leading to these declines are uncertain, the Centre expects that they are at least partially due to the hotter and drier conditions attributed to climate change in the area.[7] In the summer of 2010–11, the area experienced a mass collapse of around 18 000 hectares of northern jarrah forest, a key over-storey species, coinciding with a period of high temperatures, the driest year on record, and the unprecedented ceasing of flow in both 'permanent' and ephemeral streams.[8]

2.26 As noted above, in the Margaret River area the Committee was shown an example of a marri tree that was suffering from decline in health. The marri (*Corymbia calophylla*) is considered a keystone species which a number of threatened species, including the Carnaby's black cockatoo, depend on for food.[9] While the precise causes for marri tree decline are unknown, marri are subject to deterioration in health due to a fungal canker disease that damages stems and branches. They are also subject to a second fungal disease that affects buds, flowers and new shoots.[10] While these diseases were affecting marri trees prior to the advent of modern

7 Prof. Giles Hardy, Director, Western Australian Centre of Excellence for Climate Change, Woodland and Forest Health, *Committee Hansard*, Perth, 7 November 2011, p. 36.

8 Prof. Hardy, Western Australian Centre of Excellence for Climate Change, Woodland and Forest Health, *Committee Hansard*, Perth, 7 November 2011, p. 36; Prof. Dell, Western Australian Centre of Excellence for Climate Change, Woodland and Forest Health, *Committee Hansard*, Perth, 7 November 2011, p. 37.

9 Cape to Cape Catchments Group, 'Threats to Biodiversity', <http://www.capetocape.org.au/ccg-programs/biodiversity/threats-to-biodiversity> viewed 12 April 2012.

10 Cape to Cape Catchments Group, 'Threats to Biodiversity', <http://www.capetocape.org.au/ccg-programs/biodiversity/threats-to-biodiversity> viewed 12 April 2012.

climate change, researchers have suggested that the drying climate has increased the susceptibility of trees to such existing stresses, to the extent that these pathogens are now more capable of killing the trees.[11]

2.27 At the public hearing in Perth, the Committee heard that many forests have unnaturally high densities of young trees due to past timber harvesting, which has resulted in high water usage and higher susceptibility to tree decline under drought conditions. It was suggested that consideration needs to be given to trialling the use of thinning techniques and changes to fire regimes in some forests to attempt to reduce the density of trees to a sustainable level.[12]

2.28 At its meeting in Bunbury, the Committee was cautioned about the inherent conflicts involved in this type of intervention. For example, the Committee heard that to regenerate tuart trees, Western Australian peppermint trees need to be burned in order to create a suitable ash bed. However, as peppermint trees provide important habitat for the threatened western ringtail possum, such burning does not occur.

Committee comment

2.29 The decline and rapid collapse of tree communities in southwest WA in response to recent climatic conditions is of concern to the Committee. The Committee recognises the need for long term monitoring of the tree decline problem in southwest WA, and supports limited trials of management techniques which could help minimise future damage and help conserve the region's biodiversity.

Phytophthora dieback

2.30 Phytophthora dieback refers to the *Phytophthora cinnamomi* pathogen, a water-borne mould which thrives in moist and warm soil environments with a Mediterranean climate around the world.[13] Its presence was first confirmed in Australia in the 1930s, and now infects native forests in all states and the Australian Capital Territory, including around 1 million hectares in southwest WA.[14] According to the WA Department of Environment and Conservation, as many as 2000 out of the estimated 9000 plant species in southwest WA are susceptible to phytophthora dieback.[15]

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11 Science Network Western Australia, 'Is Climate Change Behind Marri Cankers?', <http://www.sciencewa.net.au/topics/environment-a-conservation/item/145-is-climate-change-behind-marri-cankers??tmpl=component&print=1> viewed 12 April 2012.

12 Prof. Hardy, *Committee Hansard*, Perth, 7 November 2011, pp. 37, 38.

13 Markus, N. (2011) *Phytophthora Dieback: Under the Radar and on the Move*, SCNRM, p. 2.

14 WA Department of Environment and Conservation, *Supplementary Submission 74.1*, p. 1.

15 WA Department of Environment and Conservation, *Supplementary Submission 74.1*, p. 1.

Once a susceptible plant is infected, its roots become unable to take up water, causing the plant to become severely affected or die.[16]

2.31 At the public hearing in Perth, phytophthora dieback was described as a 'biological bulldozer' because of the severity and extent of its effect on native ecosystems.[17] Of particular concern is that the sites with low nutrient, fragile soils favoured by phytophthora are also the sites of some of Australia's richest biodiversity, such as the heavily infected Stirling Range National Park.[18]

2.32 SCNRM informed the Committee at its meeting that phytophthora dieback is the single biggest threat to biodiversity in southwest WA, and protection of uninfected areas is a critical concern. It was noted that phytophthora thrives under moist, warm conditions, and that an increase in the proportion of rainfall falling during summer months in southwest WA due to climate change may exacerbate the threat.

2.33 SCNRM advised that priority actions that need to take place to reduce the impact of phytophthora include investments in mapping uninfected areas, testing the susceptibility of species to dieback, management of infected areas, and community education and engagement. The Committee was also informed that more research is needed to better understand how the disease works.

Committee comment

2.34 Although it has received little attention at a national level to date, it is clear that phytophthora dieback has the potential to have a severe impact on Australia's biodiversity. Of particular concern to the Committee is that the pathogen is widespread in parts of southwest WA with very high levels of biodiversity, such as the Stirling Range National Park. These areas are home to many unique and iconic plant species, which could be threatened with extinction if the threat from dieback is not contained.

2.35 The Committee accepts that more needs to be done to help prevent the further spread of phytophthora dieback. This will require increased resourcing for efforts to monitor, contain, and treat affected areas, and to better educate the community about its threat. Additional research may also be required to better understand the phytophthora dieback pathogen and how it might respond to the changing climate in southwest WA.

16 Markus, N. (2011) *Phytophthora Dieback: Under the Radar and on the Move*, SCNRM, p. 3.

17 Mr Keiran McNamara, Director-General, WA Department of Environment and Conservation, *Committee Hansard*, Perth, 7 November 2011, p. 6.

18 Markus, N. (2011) *Phytophthora Dieback: Under the Radar and on the Move*, SCNRM, pp. 3, 5.

Reduced groundwater in Leeuwin–Naturaliste caves

2.36 Groundwater levels in the caves of southwest WA's Leeuwin–Naturaliste Ridge are known to have been declining since the 1970s, and more rapidly in recent years, primarily due to reductions in rainfall in the area.[19] Lake Cave, which has been a major tourist attraction in the Margaret River region for more than 100 years, is one example of an affected cave. The water level in Lake Cave's underground lake has declined from a relatively stable level of around 400 millimetres over the century up until 2005, rapidly declining to less than 200 millimetres in 2010.[20]

2.37 Lower water levels have had a significant effect on the biodiversity of the caves of the Leeuwin–Naturaliste Ridge, which support a number of distinct, groundwater-dependent ecological communities. The caves are home to various species of stygofauna (aquatic invertebrates) that are dependent on aquatic root mat communities (submerged tree roots). These root mat communities have been listed as critically endangered because of the declining groundwater levels, which have led to most known aquatic root mat communities in the Leeuwin–Naturaliste caves disappearing over recent years.[21]

2.38 In Lake Cave, a recent survey identified a 74 per cent reduction in stygofauna diversity, with the number of species reducing from 23 recorded in 2000 down to just six recorded in 2010. This was attributed to the decline in water levels and the subsequent drying out of many of the root mat communities in which these species were previously found.[22] During its visit, the Committee was informed that water acidification associated with lower water levels was also contributing to a decline in the cave's water quality.

2.39 The Committee is aware that rainwater tanks have been installed at Lake Cave. These tanks are being used to pump water into the cave to mitigate the effects of declining water levels. Water is monitored and treated to

19 Subterranean Ecology Pty Ltd and Augusta Margaret River Tourism Association (2010) *Lake Cave Eco-Hydrology Recovery Project: Threatened Ecological Community and Hydrology Baseline Monitoring Report No. 1*, p. 4.

20 Subterranean Ecology Pty Ltd and Augusta Margaret River Tourism Association (2010) *Lake Cave Eco-Hydrology Recovery Project: Threatened Ecological Community and Hydrology Baseline Monitoring Report No. 1*, p. 5.

21 Subterranean Ecology Pty Ltd and Augusta Margaret River Tourism Association (2010) *Lake Cave Eco-Hydrology Recovery Project: Threatened Ecological Community and Hydrology Baseline Monitoring Report No. 1*, pp. 5–6.

22 Subterranean Ecology Pty Ltd and Au% USgusta Margaret River Tourism Association (2010) *Lake Cave Eco-Hydrology Recovery Project: Threatened Ecological Community and Hydrology Baseline Monitoring Report No. 1*, p. 5.

achieve a sufficient level of quality before being fed into the back of the cave through a natural sand bank, using a drip irrigation system.[23]

Committee comment

2.40 The Committee's visit to Lake Cave highlighted the significance of the threat to biodiversity posed by the drying climate in southwest WA. Little attention is usually given to invertebrates in discussions about biodiversity. However, with a 74 per cent drop in the number of species at Lake Cave, this case study demonstrates that invertebrates may be one of the groups of animals most affected by climate change. It is clear that if it were not for the important tourism value of the caves, this particular impact would most likely have gone unnoticed.

2.41 The Committee sees a need for further assessment both of the impact of decreasing groundwater on biodiversity in other caves in the region, and of ways to mitigate species loss on a larger scale. Acknowledging that human interventions in environmental processes can be risky, interventions underpinned by solid research and regular monitoring may be necessary to prevent unacceptable levels of species loss.

Gondwana Link landscape connectivity project

2.42 The Gondwana Link project, established in 2002, aims to reconnect country across south-western Australia: more than 1000 kilometres from the Margaret River region in the west, to the woodlands and Mallee bordering the Nullarbor Plain in the east.[24] Of this area, the Committee understands that over 900 kilometres is intact native habitat, but many of the remaining parts have been heavily cleared for agriculture.

2.43 Gondwana Link incorporates areas of immense biodiversity value, including the Stirling Range and Fitzgerald River National Parks. The Committee was informed that the region supports more than 20 per cent of Australia's plant species. Much of the initial work of the project has concentrated on the area between these two national parks (known as the 'Fitz–Stirling').

2.44 Gondwana Link works with a range of partner organisations and community groups, including Greening Australia and the Cape to Cape Catchments Group, to achieve its goals. In the Fitz–Stirling region, Gondwana Link has secured protection for over 9400 hectares of land,

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23 See Subterranean Ecology Pty Ltd and Augusta Margaret River Tourism Association (2010) *Lake Cave Eco-Hydrology Recovery Project: Threatened Ecological Community and Hydrology Baseline Monitoring Report No. 1*, pp. 6–7.

24 Gondwana Link, 'The Gondwana Link Vision', <http://www.gondwanalink.org/aboutus/vision.aspx> viewed 16 April 2012.

both through acquisitions by organisations like Greening Australia and by encouraging land owners to enter into conservation covenants.[25] Most of the land is former farming land now considered marginal for agricultural purposes. In the Margaret River region, Gondwana Link has partnered with the Cape to Cape Catchments Group, which uses volunteer networks to initiate native habitat rehabilitation projects, such as the riparian rehabilitation project the Committee observed at Leeuwin Estate.

2.45 The Committee heard that community engagement is a major focus of the Gondwana Link project, including through partnerships with landowners, private industry, Indigenous groups, schools groups and the arts community. The Committee was informed that around 80 per cent of funding for Gondwana Link has come from the private sector, supplemented by some 'top-up' funding from the Commonwealth Government. The organisation has been exploring novel ways to fund its activities, including through biodiverse sandalwood plantations. With assistance from Greening Australia, Gondwana Link is now also exploring options for biodiverse carbon farming.

Committee comment

2.46 The Committee recognises the need for greater connectivity between protected areas in order to improve the resilience of ecosystems to climate change and provide opportunities for certain species to migrate. While acknowledging that connectivity corridors are only part of the solution to the biodiversity challenge, the Committee commends the contributions made by programs such as Gondwana Link.

Concluding remarks

2.47 The Committee is aware that one of the challenges in addressing threats to biodiversity is that, while impacts are observable in many ecosystems, threats to some species attract greater public awareness and concern than others. For less high profile species, severe impacts often go unnoticed. Most people are not aware of the devastating decline in biodiversity in ecosystems existing in rootmat communities, for example, but have great concerns about the impact of climate change on iconic animal species.

2.48 Similarly, phytophthora dieback is a threat to biodiversity that has a relatively low profile outside affected areas, and there is legitimate concern that its spread may become even more vigorous under changed climate conditions. During the course of its inspections to date, the

25 *Gondwana Link: A Landscape Scale Restoration Project in South-West WA*, p. 3.

Committee has observed that significant improvements in the public's awareness of threats to biodiversity can be achieved by cooperative projects involving a range of community stakeholders.

2.49 The Gondwana Link project provides a commendable example of how private sector organisations, volunteer groups, landowners and governments can combine resources and work together to achieve positive environmental outcomes and engage the community. The Committee appreciated the opportunity to see a small part of the project's implementation and to hear from some of the people involved. The Committee views this project as a model that could be replicated in other areas of high biodiversity value across Australia, not only for connectivity initiatives but also in response to other challenges such as salinity and invasive species.

2.50 The Committee expresses its thanks to all those who took the time to meet with the Committee during its visit to southwest WA. The opportunity to see and hear about some of the local effects that the changing climate is already having on biodiversity in the area was a valuable contribution to the current inquiry. Particular thanks go to Hamish Jolly for his role in arranging meetings and site visits in the Margaret River region.