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Climate change in Western Australia – Issues Paper September 2019 by DWER

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Introduction

The opening statement about the impact of climate change on South West region of WA being '*more than almost any other place on the planet*' '*during the past century*' has definitively set the context for the issues paper. This region is already suffering.

Urgent action by the WA State Government is needed now to greatly reduce emissions **AND** to increase carbon sequestration throughout WA.

General comment

While there is a lot of good information about issues and opportunities, there are some significant gaps and inadequate information:

1. **Total GHG emissions:** There is a lack of data on the current sources and amounts and percentages of greenhouse gas emissions for WA. It is not well publicly understood that LNG mining production and use is the single biggest contributor of emissions for WA, and this proportion of ~36% is currently proposed to be increased significantly. Cattle and sheep farming produces a significant proportion of methane emissions, but how much and what % is this of the total? What are the amounts and % for methane (CH₄) and carbon emissions from landfill? And so on for each source.
2. **Clearing:** There is **no data given** for the changes and net loss of vegetation cover for WA, and for the net loss of native vegetation in *each* IBRA region *each* year. The density of vegetation index (as in NDVI) for each IBRA region gives a measure of vegetation cover from satellite imagery. Changes in extent of SW forests from clearing and fire should be available each year. This data should be provided by DWER in order to monitor and report changes in vegetation extent and thus carbon sequestration in each IBRA region.
3. **Biodiversity:** Climate change is a major threat to our biodiversity. While the threats to biodiversity are listed, the opportunities for protecting biodiversity are grossly understated and there are significant gaps especially for the south west hotspot, including the Perth Peel region. The **whole of Government Bush Forever program** is not even mentioned. Its completion is now 9 years overdue. **Regional Park recommendations and plans** are not mentioned. These matters of unfinished business by the State Government are top priorities for conservation and restoration.
4. **Carbon sequestration:** There is a lack of information and data on the importance of removal of CO₂ from the atmosphere by vegetation. There needs to be a net increase in carbon sequestration in

WA by revegetation and carbon farming, AND also by **retaining existing native vegetation** rather than clearing. **There should be no further clearing in the south west and the wheatbelt.**

5. Assumption of population growth: There is an underlying assumption that population growth will continue for the Perth Peel regions and in regional WA. The assumption of 3.5 million for Perth by 2050 is challenged. We should be planning for much less and progressing towards zero population growth.

1. TRANSFORMING ENERGY GENERATION

What are the main challenges for decarbonising WA's electricity supply while ensuring adequate generation capacity, security and reliability?

The main challenges are securing renewable baseload power, and encouraging householders, industry AND Government to shift to 100% renewable supply for their premises.

Industry must recognise that it needs to shift to construction of solar thermal plants and/or wind farms and battery for baseload power. Big electricity users should be required to shift to renewables as a matter of urgency.

Management of the grid transition with significant changes by Western Power is another challenge.

A key challenge is the political domination by fossil fuel industries, especially the LNG industry. WA must shift away from LNG to 100% renewables. **The LNG sector from 5 facilities is currently the single biggest emitter of greenhouse gas emissions in WA** (Ref. CCWA's Key Findings, www.cleanstate.org.au).

All new greenhouse gas emissions are harmful. We are now at the peak of emissions and therefore there must be no new sources of emissions. The main challenge is that the WA Government (via the *Environmental Protection Act*) must refuse and stop all new LNG mining projects including those currently proposed (both for WA supply and for export).

What are the most effective ways to overcome these challenges by 2030?

- **Stop all new and extensions of fossil fuel mining in WA and offshore.** This includes LNG, coal, coal seam gas fracking, oil.
- Western Power must have increased funding and technical expertise from the WA Government to smartly adjust and adapt the power grid system with the best available technology so that renewables take over with battery and other storage such as solar thermal to provide stability.
- Householders should be given grants or subsidy incentives to install solar panels, battery storage, solar hot water systems and two way meters.
- State government grants should be given to homeless shelters and those living in poverty to install these renewable systems. This must also include remote Aboriginal communities, some of which do not now have electricity supplied.
- Also, the payment for solar power exported to the grid or to immediate neighbours needs to be increased as an incentive. In some areas, a localised grid with battery storage could best be installed.
- Local Governments should be encouraged to install solar panels/battery storage on all their facilities and buildings.
- Where technically possible, all State Government buildings should have solar panels/battery storage installed.
- The State Government should help fund the development of wave energy production near Albany. This would provide stable base load power for Albany and surrounds.

Should the electricity sector make a pro-rata (or greater) contribution to Australia's national greenhouse gas emission targets?

Absolutely. The sector should aim for zero emissions by 2030 or sooner, i.e. a shift to 100% renewable supply ASAP.

How fast do you think the transition of the electricity sector should occur?

The south west of WA is already suffering 1.5 degree C increased temperature and greatly decreased rainfall of ~30% both of which are significant threats to our unique biodiversity. **The tipping point in ecological function is now in our biodiversity hotspot.** Therefore, to minimise further warming, **the transition of the electricity sector should be immediate and rapid and must be achieved by 2030 at the latest, but could easily be much sooner.** WA has no excuse to be slow as there is abundant sun and wind, and in coastal areas an abundance of tidal power. This transition work will provide jobs.

2. INDUSTRY INNOVATION

What measures have been implemented by your business to lower energy use or emissions?

What are the barriers to decoupling energy use and emissions in the resources sector?

Failure by industry to take seriously its responsibility for increased emissions and their contribution to global and local climate change. Big business can easily switch to renewable sources of energy. Much of this will also have a marketing advantage.

Have you assessed the implications of the low carbon transition for your business or sector? How are these risks disclosed to stakeholders?

What exemptions should apply to trade-exposed sectors in reducing our emissions?

There should not be any exemptions.

How can the Government of WA foster clean industries and technologies?

- Support with Government funding the development of the **renewable hydrogen industry** as stated.
- Support the battery industry as stated. In addition, **subsidise installation** of 'batteries before the meter' especially for low income earners, homeless shelters, remote communities.
- **Require** renewable energy supply for mining and energy projects as stated in the opportunities for industry innovation.
- **Require** phasing out of **all LNG and coal mining** and production as soon as possible. Apply a new, very high State resource tax from 2020 to encourage this fast transition out of LNG and coal mining.
- **Refuse approval of all new and extended LNG mining projects, including those currently being assessed by the EPA.**

3. FUTURE MOBILITY

What are the barriers to purchasing a low emissions vehicle for your household or business?

- High cost of purchase.

What can be done to facilitate the uptake of electric and other low emission vehicles in Western Australia?

- Invite and support production of electric vehicles (EV) in Australia suited to Australian conditions. This could be in SA where expertise and capacity remains after closing vehicle production there recently – eg by Toyota.

- Support development of small EVs as driverless cars.
- Support conversion of existing petrol vehicles to EVs.
- Introduce hydrogen fuelled buses, trucks in cities and towns in WA.

How can we further encourage use of public transport and active transport, such as walking and cycling?

- Immediately introduce in 2020 an Urban Growth Boundary for Perth so that there is **no further clearing** and urban sprawl. (Refer to State Government 2004 Dialogue with the City: https://www.researchgate.net/publication/228634300_A_Case_Study_in_Deliberative_Democracy_Dialogue_with_the_City). Notably, **clearing patch by patch reduces carbon sequestration**.
- Do not permit any further urban development on the urban fringe regardless of current zoning. The commuter distance is already too great.
- Limit urban development to infill (without further clearing) along current public transport corridors.
- Accelerate implementation of the State Government's 'Transit Oriented Development' (TOD) policy, with associated public awareness.

How can we ensure that Western Australia isn't left behind in the transition to cleaner transportation?

- Ban the use of all diesel fuelled buses by end of 2020.
- Ban the use of diesel trucks by end of 2022. (Note this is being done in the UK.)
- Support the introduction of clean hydrogen fuelled buses and trucks.
- Introduce trackless trams (as described by Prof Peter Newman) on major existing roads.
- **Do not locate new heavy rail lines or other forms of public transport in Bush Forever sites and areas of native vegetation.** This land **clearing reduces the carbon sink** as well as **destroying biodiversity values of lands that are supposed to be conserved**.
- Get goods transport off trucks and back on rail, including sea containers, rural and regional deliveries.

4. REGIONAL PROSPERITY

How will climate change affect your regional community?

- Our regional community is the south west of WA IBRA region. It is high in endemism with 70-80% endemic flora species out of the ~12,000 species of flora present. **Climate change has already affected the south west biodiversity hotspot. Small changes can lead to big impacts especially in bushland plant regeneration. Some species cannot shift.**
- Further rainfall decline and erratic weather events will affect ecological processes such that presence of some specific insect pollinators may not coincide with flowering times, especially for short range endemics. Thus many flora species may become extinct. For example, Dr Adam Cross, Ecologist at Curtin University stated at the Climate Change Seminar (11 November 2019) that **25% of all Banksias could be gone by 2030. We are already at the tipping point in ecological function in our SW biodiversity hotspot. Thus urgent action is needed.**
- Tied to ecosystem health is our human health. Increased extreme hot and cold weather events affect the health of elderly, young, homeless and disadvantaged people, leading to increased illnesses and deaths.
- **Increased wild fire and inappropriate prescribed burning especially in spring and early summer has burnt excessive areas of the south west with massive fauna deaths and GHG emissions.** After burning, the process of carbon sequestration is greatly reduced

for some years. Sensitive areas such as peat lands have been destroyed by inappropriate and uncontrolled prescribed burns by DBCA on their lands.

What steps can we take to further enhance the resilience of our regions and our primary industries?

- **Stop land clearing in the south west IBRA region.**
- **Stop all native forest logging.**
- **Stop all land clearing in the Wheatbelt.**
- **Increase local native tree planting and carbon farming as below.**
- **Plant native trees as crops in the south west and Wheatbelt.**

How can we support the agricultural sector to participate in the low carbon transition?

- Provide State Government **landcare grants and expertise to propagate and plant local native tree and shrub flora species in tree lots on farms. Establish inter-connecting linkages across the farm landscape.** The Gondwana Link (www.gondwanalink.org) is an excellent role model.
- Provide advice for reduced beef cattle farming and their replacement with carbon farming as stated in the opportunities.
- Carry out all the opportunities as listed.
- For the leased Rangelands properties in the north, **remove the requirement** for cattle, sheep animal farming and allow carbon farming to replace this, and/or with the possibility of kangaroo or emu or other suitable native species production. Also allow tourism to be the main income earner. Encourage and support traditional Aboriginal landowners on their country to manage these lands.
- Support the State Government's Outback Ranger Program, working with traditional landholders.
- In low rainfall areas and the south west, on lands already cleared, **support carbon farming of local native species as crops.** Examples are for sandalwood production, other tree species such as Jarrah, Marri, Karri with wood suitable for building industry, furniture etc.

What opportunities do carbon offset markets present for Western Australian land managers, including Aboriginal groups?

- **The opportunities for Aboriginal people in carbon farming** in regional and remote areas as described are supported and should be well funded by the State Government and major mining companies.
- For the Collie region, to support regional prosperity, offsets and increased royalties on big mining companies could fund construction of wind farms and/or solar thermal plants to replace power supply to the grid after closing the coal fired power stations at Collie. This would provide jobs for former coal workers and for Aboriginal groups.

What matters should the State Government take into account in developing a strategy for carbon farming in Western Australia?

- **Data availability: It is essential for the State Government to monitor and regularly report the density of vegetation cover (NDVI) in each IBRA region of WA from satellite imagery (such as Land Monitor) to ensure it increases each year, thus increasing carbon sequestration.**

Notably, fires will have an impact on vegetation density which will change from year to year with regrowth after fire. **It is essential to achieve increasing vegetation cover in each region.**

The Government should invest in employing specialists in this data collection, management and reporting in an appropriate State agency. This information should be shared locally, nationally and internationally.

- **It is also essential for land clearing to be stopped in the over-cleared wheatbelt and in the south west IBRA region.** This is an obvious first step in increasing carbon sequestration as well as biodiversity conservation.
- Avoid large scale prescribed burning as now practised in the south west. It counteracts carbon sequestration achievements from carbon farming and destroys biodiversity in native vegetation. Use other methods for reducing fire risk and to extinguish fires by fast attack. There should not be any prescribed burning permitted on the Swan Coastal Plain especially as grassy weed growth increases and thus worsens fire risk.

5. WASTE REDUCTION

What areas can we target to further reduce greenhouse gas emissions from waste?

- As described, methane production must be greatly reduced.
- Soft plastics should be banned from sale and use in WA.
- Products which are not re-useable, repairable or recyclable should not be permitted for sale or use in WA as they end up in landfill waste or in the environment including waterways and the oceans and produce emissions and/or plastic waste.

What can households, businesses and government do to reduce their waste and compost more?

- On-site aerobic composting and worm farms should be encouraged and supported so that organic kitchen waste and garden waste do not go to landfill.
- In mowing lawns, **all householders and lawn mowing contractors** should be advised to take the catcher off their mower so that lawn clippings are recycled on site and are not sent to landfill where they would break down anaerobically to produce methane – a greenhouse gas. An **awareness program** to achieve this locally over WA should be conducted by all Local Government Authorities with support from DWER.
- Stop using single use plastics such as takeaway cups, straws, soft plastics. This needs to be put into legislation by the State Government so that it is rigorously enforced.

6. SAFE AND HEALTHY COMMUNITIES

What are the main climate risks for your household or your community? What can be done to manage these risks?

- The stated issues and opportunities for healthy communities are well described and should be supported and funded by Government.
- **Smoke** from wild fires and prescribed burns are a significant **human health hazard and cost**.
- Extreme weather events, unseasonal and increasing hot weather and decreased rainfall are all significant in our south west hotspot for native flora, fauna and for us humans. The homeless, elderly, young, unemployed, low income earners and those suffering allergies and related medical conditions suffer most.
- The heat island effect in newer suburbs is real. These suburbs need excessive areas of concrete and hard surface removed and planted with local native trees and shrubs. This can be achieved on streets and on household blocks. House and building design needs changing to much smaller, solar passive (including orientation on block, materials, veranda, trees) with much less use of concrete.
- **Install underground power** in all suburbs so that more tree planting and cooling can take place, and risk of fallen power lines in wild weather is removed.
- **Dry grassy weeds** along street verges and especially adjacent to bushland reserves is an increased fire risk. Road verges should all be mown before seed set and drying by the LGA or Main Roads, or by residents in suburban streets.

- **The two main issues on the Swan Coastal Plain to be addressed to reduce fire risk and its health impacts are grassy weed control and arson prevention. Prescribed burning on the Swan Coastal Plain** is not supported as it actually increases the spread of grassy weeds and may stimulate arson activity. It is also a smoke health hazard and cost.

What are your biggest concerns about Western Australia's future climate?

- Exponential increase in average temperatures, damage from increased extreme weather events, reduced rainfall especially in the south west region which has already had more than the global average increase in temperature and some 30% decrease in rainfall in the last 10 years – as clearly stated in your Introduction.
- **Significant destruction and loss of biodiversity and ecosystem stability. Loss of native fauna and flora species.**
- The invisible harm to native fauna from fire, climate changes and extreme events.

What could be done to ensure your community is better prepared for possible climate impacts?

- Provide government grants and incentives for solar panels, solar hot water systems and air conditioners especially for remote communities, low income earners, householders.
- Retrofit existing housing with insulation, daylighting, energy efficiency, reduce outdoor hard areas of concrete and replace it with planting of trees, shrubs and lawn.
- **Urban forest greening using suitable local native species.**
- Provide underground power to all suburbs
- **Fire control:** Invest in more aircraft water bombers; increase preparedness for **very fast attack** in the event of fire; invest in arson prevention programs such as the successful **JAFFA program** by FESA now DFES; **educate** all primary school aged children about fire, its behaviour and dangers so that they understand and are not tempted to play with it; increase **arson watch programs** especially for residents adjacent and near bushland areas.

7. WATER SECURITY

What can we do to encourage Western Australians to use water more efficiently and adapt to a drying climate?

- As **groundwater levels are declining on the Gngangara and Jandakot Mounds**, review the use of groundwater for home gardens and its impact on groundwater levels. As there is no charge and no metering of this domestic use, the current drawdown as a result of domestic and local government use is not well known - or is it known from past groundwater monitoring bore data?
The domestic use should probably be stopped as falling groundwater levels are causing native vegetation decline and deaths.
- Increase domestic garden watering restrictions from potable supply for at least 2 months each of spring and autumn to once per week for sprinkler use.
- Immediately make restrictions for domestic home bore water use the same as for potable scheme water – ie twice per week only in summer and once per week as above.
- The volume of groundwater used by LGAs for irrigating sports facilities, public places etc should be reviewed and reduced. Sprinkler systems which deliver large droplet sizes (compared with fine spray and misting) are more efficient and should be mandatory.
- Groundwater use **should not be permitted** in areas adjacent to bushland reserves within the local zone of depression. There are examples where localised drawdown by bores has caused a sudden death of mature Banksias such as at Cottonwood Crescent Bush Forever site.

Are there policies adopted in other jurisdictions we should consider for Western Australia?

- Require the Water Corporation to **recycle all wastewater for re-use** rather than pumping secondary treated water out to sea. This is currently an issue with the Water Corporation proposing to duplicate the SDOOL2 pipeline rather than upgrade treatment for re-use – especially for potential industrial etc use at Kwinana. The SDOOL2 pipeline risks destruction of the CE TEC Lake Richmond thrombolites and DWER/EPA needs to stop this.
- Treated wastewater could be used to grow crops such as tree crops in agricultural and near country town areas.

What are the best management options to deal with the water security implications of climate change for our agricultural sector?

- For the drying Wheatbelt region, invest in revegetation with local species on farms and along roadsides. Revegetation will result in increased local and potentially mesoscale rainfall.
- The most efficient irrigation techniques should be **mandatory** for all licensed horticultural users. A **volumetric charge** should be introduced for all agricultural and horticultural licensed users with meters installed and monitored by the Government – as is the case for domestic potable supply in Perth. This would drive much more efficient use.
- **New limits in the next Gnangara groundwater allocation plan** as described are strongly supported. Substantial new limits on groundwater availability are urgently needed.
- The failure of adequate government control of water use in the Murray-Darling Basin is an on-going catastrophe and is a situation which must be avoided in WA.

8. LIVEABLE TOWNS AND CITIES

What are the key barriers to improved energy efficiency for our built environment?

- Lack of passive solar design. Lack of regulation to require energy efficiency through passive solar design for both residential buildings and commercial developments.
- Lack of solar panels and solar hot water on buildings. They should be mandatory for all new buildings and renovations.
- Excessive use of concrete and paving resulting in far too much hard surface area and lack of vegetation and shade. This includes ‘plastic lawn’ that is laid on a hard base (often crushed granite), stopping water infiltration and also creating a heat sink.
- Notably, concrete production produces very high emissions. Lack of public recognition and regulation of the extent of use of this factor is a significant barrier.
- Excessively large houses on small-medium blocks where no tree and vegetation cover has been retained.

What information or tools do you require to improve energy efficiency in your household or workplace?

- Support for solar panels and battery energy storage before the meter.

What energy efficiency standards or disclosure measures do you support for our homes and offices and the appliances we use in them?

- Replace all gas appliances with those electric and cut off gas supply to our homes and offices in association with solar panels and solar hot water systems – see below).
- As described in opportunities, require much higher construction standards with features as below.
- Require rooftop solar panels and solar hot water systems.
- Retrofit older houses with passive solar design features, including north facing windows, windows for natural air flows, daylighting, space lighting not multiple downlights, insulated ceilings and walls.

- **Build small:** Retrofit or build with small smart interior design. Build **small houses** with 50% green area retained on the site. Current houses are much too big and use excess concrete and materials. **Limit concrete use and hard cover area.** Use the advice of Dr Garry Baverstock, experienced expert architect specialising in sustainable design.
- Install roof gardens on multi-story buildings where feasible.
- No black or dark coloured roofs.
- Avoid tall fences and dark coloured fencing. Minimise all fencing and paving.
- **Plant local native trees and shrubs** to provide shading especially on west side of buildings.

How do you think climate change will affect the liveability of your neighbourhood or region?

How can we improve the retention of vegetation, particularly tree canopy, in our cities and suburbs?

- **Introduce a total ban on clearing of native vegetation and remnant trees (regardless of the zone of the land). Obviously the first step in increasing the urban forest is to keep what remains.**
- **Provide greatly increased funding for DBCA Swan Region so that all Threatened Ecological Communities (TECs) and habitat of endangered species and all Bush Forever Areas are properly protected and restored.** This includes the Banksia Woodlands TEC and Tuart Woodlands CE TEC. and many other TECs. These are fabulous public assets which improve public health and wellbeing.
- Stop all outer urban sprawl with introduction of an 'Urban Growth Boundary'.
- Install underground power in all suburbs and cities.
- Introduce a program to decrease the area of concrete and hard cover on verges, driveways and around houses and other buildings. Require an increase in green area cover in established suburbs.
- Require 50% green area in redevelopments and new areas.
- Retain trees and native vegetation remnants in redevelopments.
- LGAs to introduce **tree protection**. Removal of any tree greater than 3metre high should require explicit approval of the LGA. Such legal tree protection has been in place by the Ku-ring-gai Council in Sydney NSW for many years and the suburb has an excellent and community supported tall tree canopy.
- Plant local native trees and shrubs in suburban street verges and in gardens.
- Supply landholders with information on local native tree and shrub species. Promote these.

9. RESILIENT INFRASTRUCTURE AND BUSINESS

What are the key climate risks for the primary industry or resources sectors?

- Reduced rainfall with reduced pasture production for grazing cattle, sheep. Thus reduced animal carrying capacity of farms.
- Reduced crop yields.

Do you currently assess the impact of physical climate risks on your business, assets or infrastructure?

Is there information which would assist you to do this better?

What are the best ways to enhance the resilience of public and private infrastructure?

- As stated, the integration of large scale renewable energy projects such as solar farms, solar thermal plants and wind farms near country towns and/or near the grid would be beneficial. With battery storage, they could be independent of the main grid and 100% renewable. Thus after initial capital cost, they could provide inexpensive power.

- Such projects could also be smaller scale on individual properties or on small groups of properties. This would be very beneficial in remote Aboriginal communities. Indeed, some remote communities do not currently have power supplied and this should be rectified as a high priority.

10. PROTECTING BIODIVERSITY

Can existing land use and biodiversity management practices be modified to reduce vulnerability and improve resilience?

- **YES! Land clearing has a significant impact with reduced carbon sequestration. The net loss of native vegetation in WA by clearing must be stopped and reversed.** In the discussion paper, there is **inadequate consideration of land clearing** and its contribution to increased carbon dioxide concentrations by loss of the carbon sink.
- **Data of vegetation extent:** It is essential for the State Government to monitor and regularly report the density of vegetation cover (NDVI) in each IBRA region of WA from satellite imagery (such as Land Monitor) to ensure it increases each year, thus increasing carbon sequestration. This information is needed so that the Government can check and ensure that there is improved resilience to climate change with **net increases in vegetation cover** in WA each future year. In areas that are burnt, there will be a decrease in vegetation cover expressed as NDVI until regrowth occurs.
- **Fire:** Prescribed burning produces emissions and air pollution, and it also kills lots of native fauna and reduces biodiversity especially in fragmented areas such as Perth – Peel regions. On the Swan Coastal Plain prescribed burns destroy biodiversity and should not be conducted.
It is the long unburnt bushland areas which have the lowest fire risk and lowest ground fire fuel load, and they have the highest populations of fauna and healthy flora.
Wild fire risk is not necessarily related to fuel load. Wild weather events with high and turbulent wind and low humidity, as well as arson risk are most important. Management practices should be modified with increased capacity for fast attack in the event of fire by water bombers; by installation of large edge sprinklers especially in urban areas; by arson watch; by renewal and extension of the former JAFFA program; and by removal of dry grassy weeds on road verges adjacent to bushland before the summer ‘fire’ season.
- **Complete Bush Forever implementation as planned with all sites fully protected and managed as ‘A’ class reserves.** This includes the urgent need for greatly increased funding of DBCA Swan Region to manage Bush Forever Areas as planned. Also sites best located to be managed by LGAs must be transferred and actively managed to retain values.
- **Invest in protecting and restoring linkages** between existing patches of bushland in the Perth and Peel regions and especially along regionally significant ecological linkages and potential linkages as defined in Bush Forever.
- **Complete implementation of all Regional Parks recommendations** and greatly increase State Government and Local Government funding for their conservation management.
- **Increase collaborative support and funding for community groups** to assist in managing bushland reserves especially in the Perth and Peel regions. Note this should not replace the need for increased Government funding.

- Increase re-introduction of quenda and kangaroos or wallabies to Bush Forever Areas and other reserves as they greatly help reduce grassy weeds and associated fire risk.
- Actively control foxes and stray cats in the Perth and Peel regions especially, and also in the south west region.
- **Stop all further clearing of the south west IBRA region and the wheatbelt.** This should include retaining small patches and individual mature remnant trees, and all roadside vegetation especially in the wheatbelt and in the Perth and Peel regions.
- **Improve awareness amongst LGAs** about the need to retain and manage remnant trees and vegetation on all their lands, especially roadsides.
- Improve management **capacity and expertise by LGAs** to properly manage and restore their native vegetation remnants and linkages.
- In the Perth and Peel regions especially, increase **funding by DBCA and LGAs for grassy weed removal** from bushland areas which will help reduce vulnerability to fire and its biodiversity destruction. This should involve hand weeding by trained hand weeding teams – for example as those provided by the South East Centre Regional Centre for Urban Landcare (SERCUL www.sercul.org.au).

Are there opportunities for new collaborations with landholders or communities to address climate risks and improve biodiversity outcomes?

- Yes. As above there is an opportunity for training of teams of hand weeders to be employed by landholders to carefully remove grassy weeds from reserves on the Swan Coastal Plain especially in Banksia woodlands which are vulnerable to disturbance. Removal of dry smothering veldt grass then allows **new regrowth** of the underlying native shrubs and ground cover species thus improving biodiversity outcomes. There are examples such as Wireless Hill and Inglewood Triangle urban bushland reserves where this has been successfully achieved.
- There are many opportunities for landholders to work with local communities to help manage and remove invasive species, and also for planting local species in revegetation and thus improve biodiversity outcomes.
- There are major **knowledge gaps in our biodiversity of the south west biodiversity hotspot** (including the Perth region). To improve biodiversity outcomes and address climate risks this must be addressed. There are opportunities for government funding to conduct a range of new citizen science projects in conjunction with government specialist scientists for **surveys of flora, vegetation communities, fauna, invertebrates, birds, mammals.** **Substantial government funding is needed for this work.**

11. STRENGTHENING ADAPTIVE CAPACITY.

Are there gaps in the availability of adaptation knowledge, climate information or skills for your community, organisation or sector?

- Yes. As described above: There are major **knowledge gaps in our biodiversity of the south west biodiversity hotspot** (including the Perth region). To improve biodiversity outcomes and address climate risks this must be addressed.
- **Land clearing: It is not known how much and where land clearing is taking place each year, nor how much is cleared each year** (ie the net loss of vegetation cover) **on all lands.**
- **Areas burnt should also be shown for each 6 month period** on data maps.

- **Information** showing local native flora species suitable for revegetation projects for each region and soil type should be available. Landholders and community groups need the help and advice from a contact person such as a botanist with the relevant knowledge of flora species for their area.
- **Local Government Authorities** especially in rural and remote regions lack knowledge of their local native vegetation, rare flora sites and their protection, especially on roadsides and lands they manage. This needs to be addressed. On roadsides, there are examples of rare flora markers being moved, and the patch cleared thus destroying the rare species and its habitat.
- Farmers and land managers in remote areas need contacts with the relevant local knowledge of flora and fauna species. Aboriginal elder knowledge of country should be shared with community groups and landholders.

How can these be addressed?

- There are opportunities for government funding to conduct a range of new citizen science projects in conjunction with government specialist scientists for **surveys of native flora, vegetation communities, fauna: invertebrates, birds, mammals. Substantial Government funding is needed for this work, and especially to employ scientists.**
- **Data showing the areas and extent of land clearing and of vegetation cover in each IBRA region** needs to be monitored and made publicly available by the State Government. At least 6 monthly and annual data updates need to be available on line, with changes shown. This enables the net changes in vegetation cover and density (NDVI) to be reported.
- **LGAs need to be upskilled about their local native vegetation, flora and fauna species.** They need to be advised to stop all clearing of their roadsides and to manage them and restore significant sites with replanting of the local species, especially if rare. Increased roadside tree and shrub cover increases tourism values in rural areas, increases wildlife habitat and resilience and has a cooling effect.

What are the main barriers to the adoption of effective climate change adaptation?

- Widespread ignorance of actions that can be taken at the local level and individual landholder level.
- Lack of State Government leadership and action.
- Lack of State Government **funding** and incentives for:
 - renewable energy production at the householder and small business level for solar panels and the power generated;
 - installation of solar hot water;
 - **biodiversity management especially by DBCA;**
 - **scientific expertise and capacity in government.**
- Lack of government (via DPIRD) support and funding for:
 - carbon farming and growing of WA native tree species – eg for building materials and for furniture manufacture in WA;
 - ecological linkages across rural properties as in the Gondwana Link example.
- **Lack of Government action via the Environmental Protection Act to prevent all increases in Greenhouse Gas Emissions from new or extended fossil fuel production (especially LNG and fracking) whether for WA use or for export.**
- **Lack of integrated Government action across all sectors** to reduce emissions and to promote renewable energy alternatives and carbon sequestration.