Department of Parks and Wildlife

AURIZON

Buru Energy

sustainable consulting

Bilby BlueSheet

(Last updated 20 November 2013)

A Where are we now?

Around the Bilby

- Increasing human activity & disturbance of the natural environment in northern WA
- Limited funding for biological research
- Proponent activity contributing to growing number of biological surveys in northern WA
- Proponent offsets potentially available to fund relevant biological research & environmental management initiatives
- CSIRO/DPaW work underway to prioritise management strategies to address threats to biodiversity in the Pilbara

The Bilby

- Small marsupial omnivore; formerly present throughout much of Australian mainland; still widespread but now with reduced coverage & lower abundance; found in a range of habitats; can change diet according to circumstances; 3 main signs = tracks, scats & diggings; often associated with certain Acacia species & Mulgaras

Challenges

- Fragmented data sets
- Tend to be private (= 'not present' does not necessarily mean 'absent')
- ~~'Confusable' with other species~~
- Difficult to ascertain source populations
- No known strong attractant
- No recognised reliable monitoring technique
- Populations can move around
- Up to 50,000 ha required to maintain viable populations

Opportunities

- Good Indigenous knowledge of species

Focusing question

How can we best use research to ensure ongoing survival of viable Bilby populations in northern WA?

B Where do we want to be?

Objective

Ongoing survival of the Bilby in northern WA

Threats to be mitigated

1. Predation by introduced carnivores
2. Competition from introduced herbivores
3. Habitat degradation
4. Vehicle strikes
5. Climate change
6. Knowledge gaps & erroneous data
7. The above threats in combination

Guiding principles

1. Make best use of current Bilby data set
2. Encourage open & early sharing of all Bilby-related data
3. Draw upon Bilby learnings from other parts of Australia
4. Provide proponents with clear guidance about how to best manage for the Bilby
5. Progress research & management initiatives as part of one integrated program

C What do we do to get there?

Our strategy

Work together & take every opportunity to implement the integrated research program below

1. Refine **survey methods**

2a. Better understand **biology**

2b. Better understand **habitat requirements**

2c. Better understand **population dynamics**

3a. Better understand **predator impacts**

3b. Better understand **herbivore impacts**

3c. Better understand **fire & rainfall regimes**

D How do we make this happen?

What?	Who?	When?
1. Prepare workshop outputs	CS	Nov13
2. Distribute workshop outputs	SvL	Dec13
3. Scope-up & distribute research priorities	SvL & volunteers	Jan14
4. Develop updated state Recovery Plan	SvL	Q1 14
5. Consider updating National Recovery Plan	VR	Q1 14
6. Look for opportunities to progress agreed research priorities	All	Ongoing

CLIENT

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Bilby Workshop TalkBook

Held on 10 October 2013
At Department of Parks and Wildlife
Dick Perry Avenue, Kensington
Facilitated by Craig Salt

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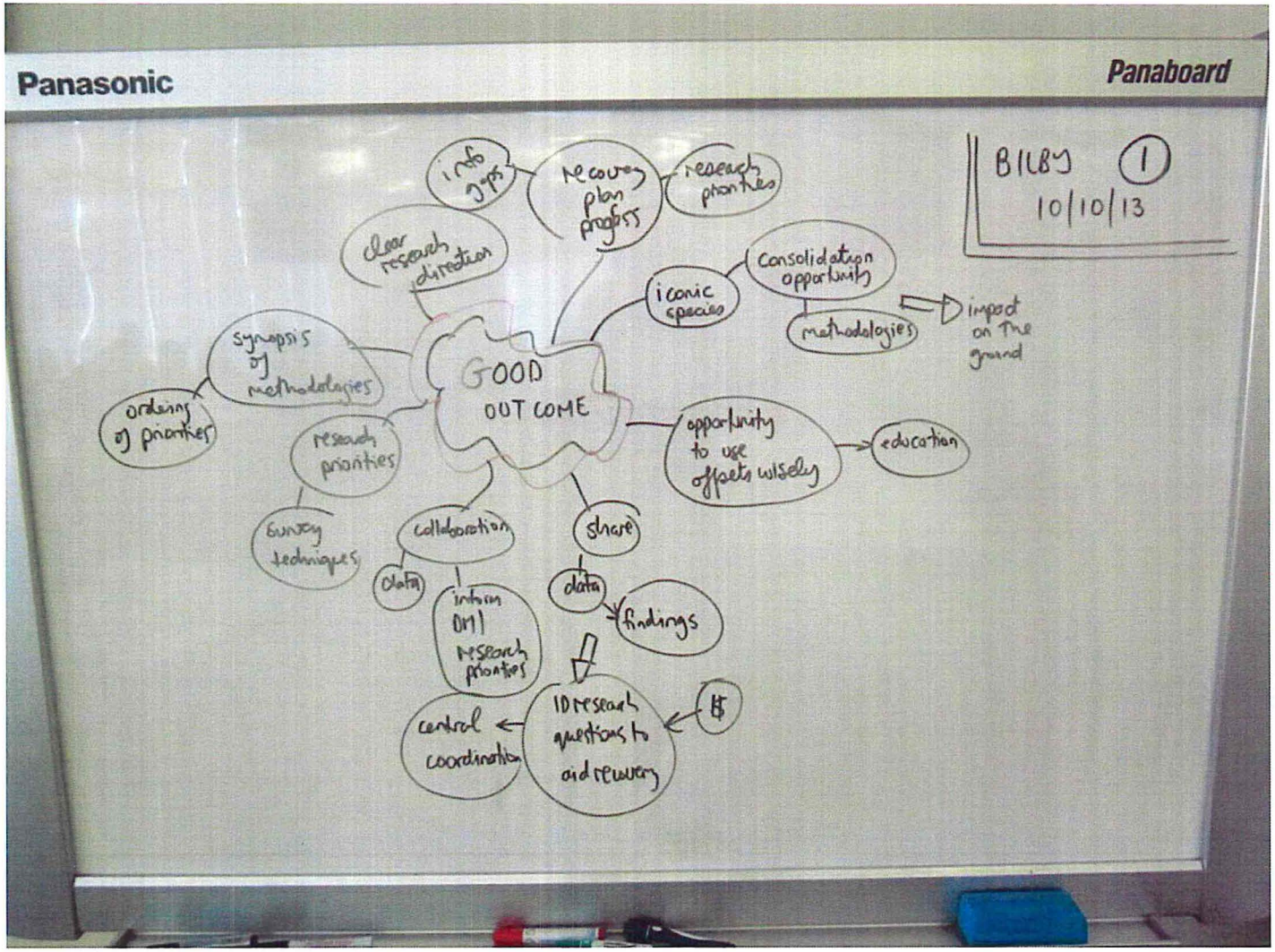
PROVIDER

Participants

Participants

Insert names here


Panasonic
Panaboard
BILBY (1)
10/10/13
info gaps
recovery plan progress
research priorities
clear research direction
consolidation opportunity
iconic species
methodologies
impact on the ground
synopsis of methodologies
GOOD OUTCOME
ordering of priorities
research priorities
survey techniques
collaboration
share
data
data
findings
interim DMI research priorities
central coordination
10 research questions to aid recovery
opportunity to use offsets wisely
education

Setting the scene

Electronic whiteboard 01

After Welcome-to-Country, participants introduced themselves on each table and identified what would constitute a good outcome from this workshop

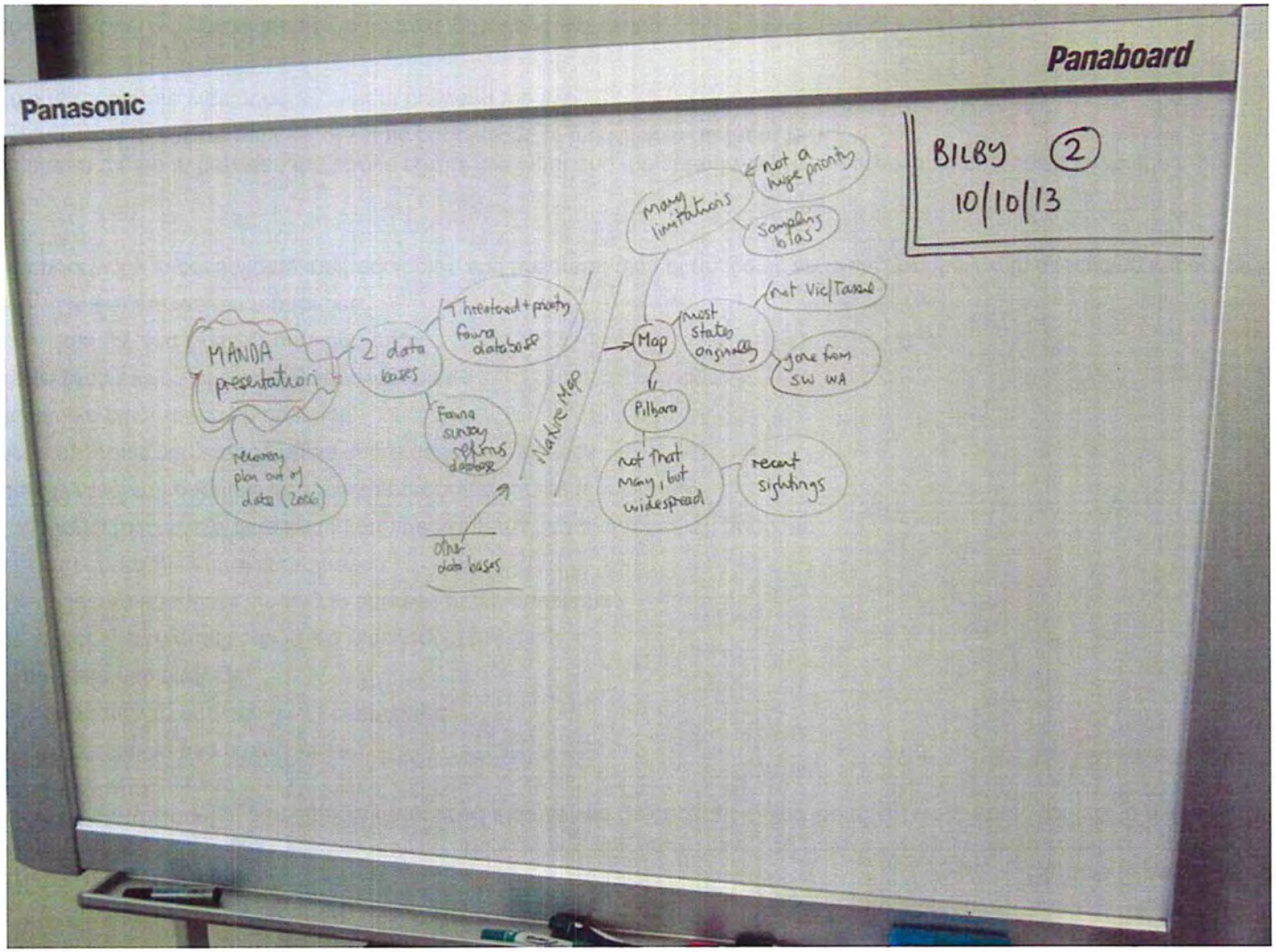
- An opportunity to use offsets wisely
- An opportunity to educate and be educated
- Share data and findings
- Identify research questions to aid recovery of the Bilby
  - Secure adequate funding to address these questions
  - Encourage central coordination
- Collaboration to share data and inform decision-making and research priorities
- Identify research priorities and most appropriate survey techniques
- Get a synopsis of methodologies and ordering of priorities
- Develop a clear research direction
- Assist progression of the Bilby recovery plan
  - Identify and close information gaps
  - Determine research priorities
- An opportunity to consolidate methodologies and understanding of an iconic species, hopefully with a resulting impact on the ground

We explored the tie-in between the above participant input and the stated workshop purpose 'to determine the highest-priority research needs to ensure survival of viable populations of the Bilby in northern WA'

- We agreed there was good alignment between the two

Stephen van Leeuwen provided some context for today's workshop

- It is one in a series of Pilbara-focused biodiversity-related workshops being coordinated by the Department of Parks and Wildlife (DPaW) and the Department of Environment (DoE) using offset funding from Pilbara-based proponents
  - Today's workshop is funded by Aurizon and Buru Energy

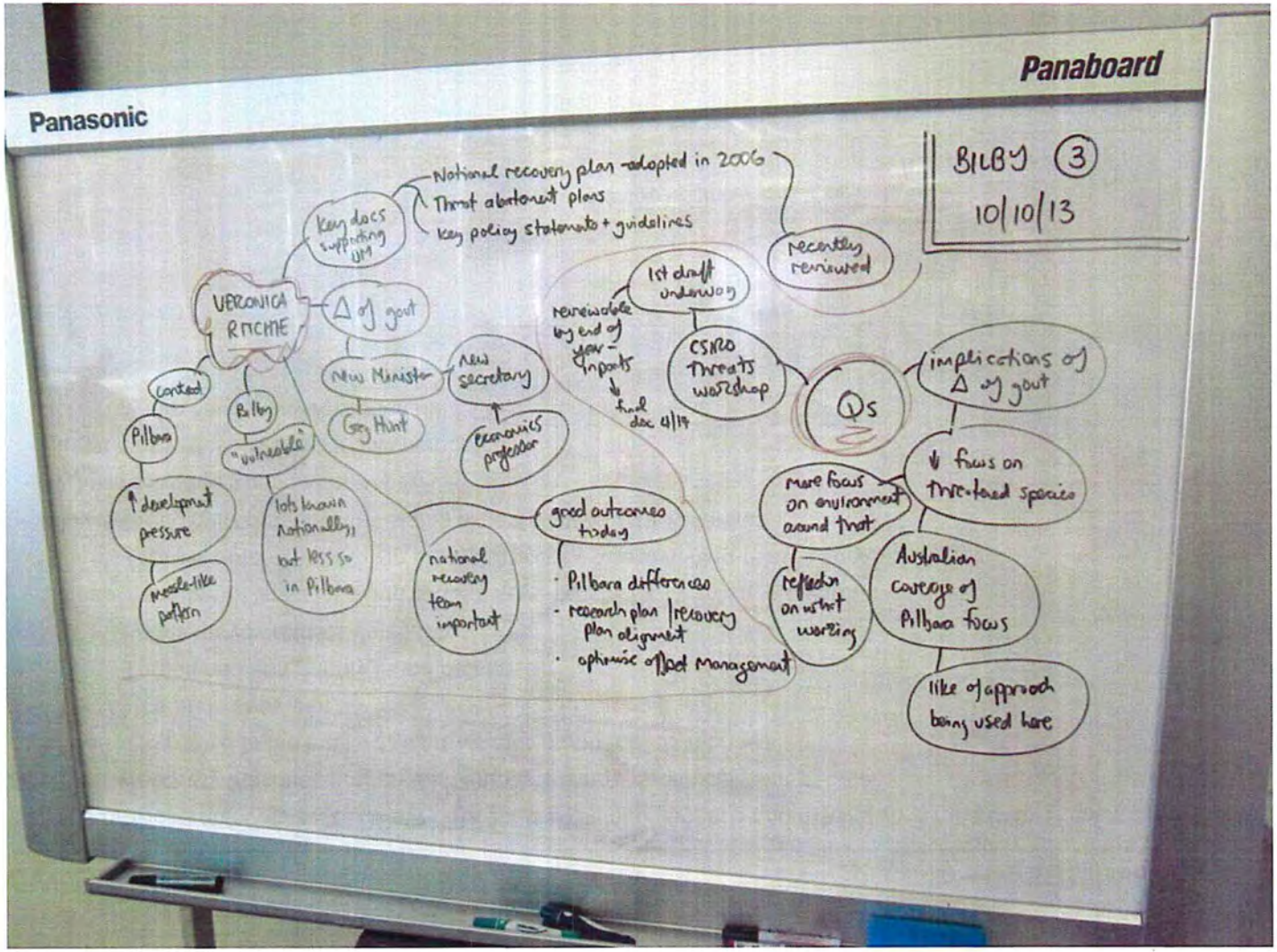

Panaboard
Panasonic
BILBY (2)
10/10/13
many limitations
not a huge priority
sampling bias
MANDA presentation
2 data bases
Threatened + priority fauna database
Fauna survey reports database
Native Map
Map
most states originally
not Vic/Tassie
gone from SW WA
Pilbara
not that many, but widespread
recent sightings
recovery plan out of date (2006)
other data bases

DPaW Bilby data

Electronic whiteboard 02

Manda Page provided an overview of DPaW data acquisition, maintenance and availability for the Bilby (Presentation 1 attached)

- The current Recovery Plan was prepared in 2006 and is now technically out-of-date
- NatureMap is available to the public and draws on a number of data bases
  - Two of the main ones are:
    - Threatened and priority fauna database
    - Fauna survey returns database
  - It has a number of limitations and is not a huge priority for DPaW at present
    - There is potential sampling bias for the Bilby due to mining-related surveys
- The Bilby was originally present in all states except Victoria and Tasmania
  - It has now gone from southwest WA
  - It remains widespread but in low numbers in the Pilbara
    - There have many recent sightings in the region


Panasonic
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BILBY (3)
10/10/13
key docs supporting WM
National recovery plan adopted in 2006
Threat abatement plans
key policy statements + guidelines
recently reviewed
1st draft underway
renewable by end of year - inputs
final doc 4/14
CSIRO threats workshop
Qs
implications of Δ of gait
VERONICA RITCHIE
Δ of gait
New Minister
New secretary
Grey Hunt
economics professor
context
Pilbara
Bilby
"vulnerable"
development pressure
mosaic-like pattern
lots known nationally, but less so in Pilbara
national recovery team important
good outcomes today
· Pilbara differences
· research plan / recovery plan alignment
· optimise offset management
more focus on environment around them
↓ focus on threatened species
reflects on what working
Australian coverage of Pilbara focus
like of approach being used here

National government perspective

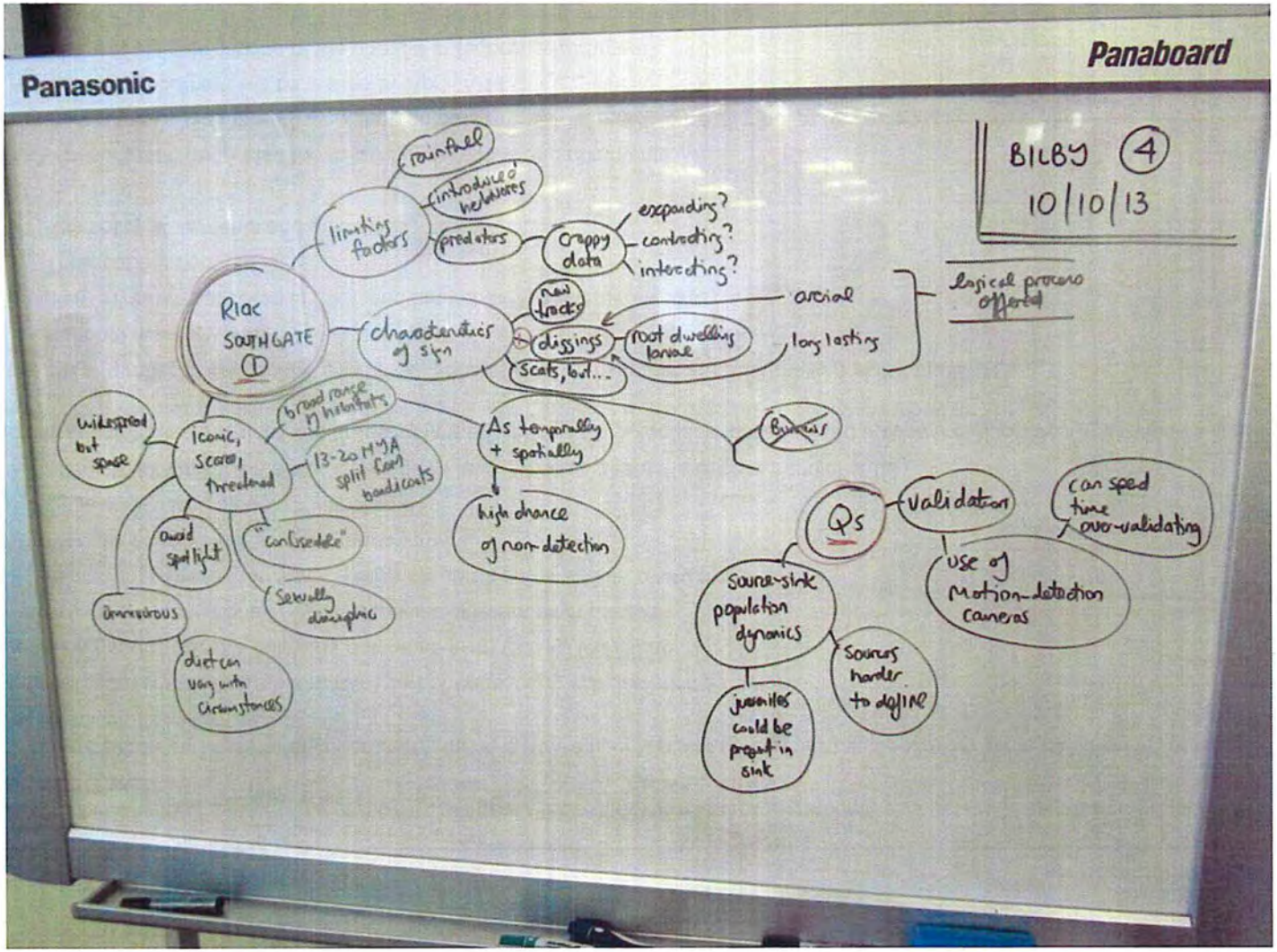
Electronic whiteboard 03

Veronica Ritchie provided an overview of recent changes in federal government arrangements plus details of its position on the Bilby (Presentation 2 attached)

- With the recent change in federal government, there is now a new Minister (Greg Hunt) and secretary (who has a background of being an economics professor)
- A national recovery team is an important part of conserving species such as the Bilby
- It would be good to see the following outcomes from today's workshop:
  - An understanding of any Pilbara-specific differences in the Bilby
  - Alignment between the various Bilby research plans and recovery plans
  - An optimal approach to offset management
- The Bilby is considered as being 'vulnerable'
  - Although lots is known about it nationally, less is known about the Pilbara population(s)
- There is considerable development pressure in the Pilbara, with potential impacts spread across the landscape in a measles-like pattern
- There are a number of key federal government documents that support decision-making about the Bilby
  - National recovery plan
    - This was adopted in 2006 and has recently been reviewed
  - Threat abatement plans
  - Key policy statements and guidelines

Veronica's presentation generated the following questions and comments:

- A first draft of the CSIRO threats workshop outputs are almost ready to be distributed for review
  - The final document will be issued by April 2014
- What are the likely implications of the change in federal government?
  - There is likely to be greater focus on the environment around each threat
  - There is growing recognition of the importance of the Pilbara's biodiversity
    - The Australian recently published an article on this
  - There is also growing recognition of the value of the emerging collaborative model for managing biodiversity in the Pilbara (of which today's workshop is one such example)


Panasonic
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BILBY (4)
10/10/13
Risk
SOUTHGATE
(1)
limiting factors
rainfall
introduced predators
predators
crappy data
expanding?
contracting?
interacting?
characteristics of sign
new tracks
diggings
scats, bed...
arcial
long lasting
root dwelling larvae
logical process affected
widespread but sparse
Iconic, scarce, threatened
broad range of habitats
13-20 MYA split from bandicoots
avoid spotlight
"conservative"
sexually dimorphic
dangerous
diet can vary with circumstances
As temporally + spatially
high chance of non-detection
Qs
validation
can speed time over-validating
use of Motion-detection cameras
source-sink population dynamics
sources harder to define
juveniles could be present in sink

Bilby sign

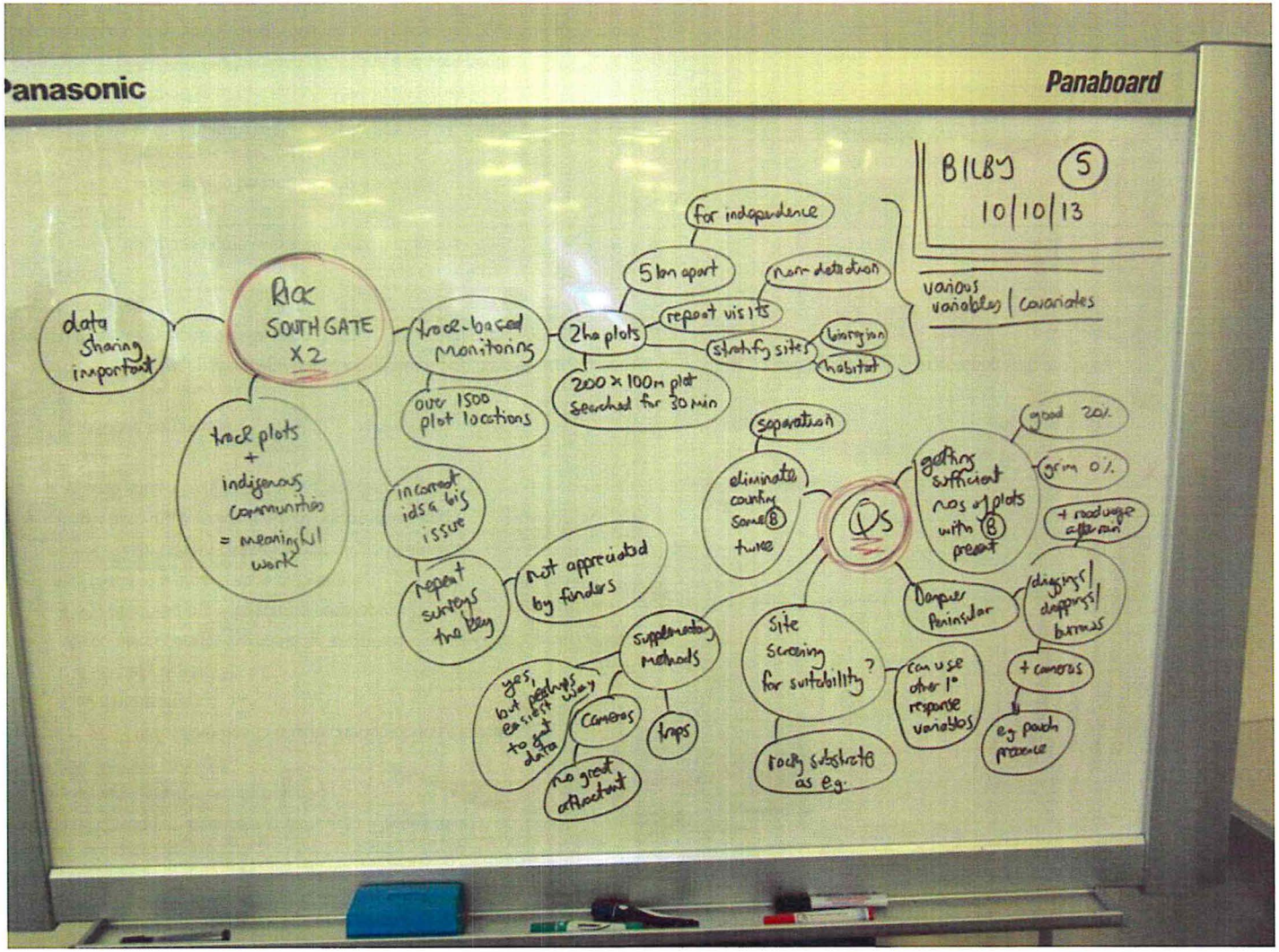
Electronic whiteboard 04

Rick Southgate provided an overview of Bilby sign (Presentation 3 attached)

- The Bilby is iconic, scarce and threatened
  - It avoids the spotlight
    - This contributes to a high chance of non-detection
  - It is 'confusable'
  - It is sexually dimorphic
  - It is omnivorous with the capacity to change diet according to circumstances
  - It is widespread but with sparse coverage
  - It is found in a broad range of habitats
    - Habitat can change temporally and spatially
  - It split from the bandicoot 13-20 million years ago
- There are some known limiting factors for the Bilby
  - Rainfall
  - Introduced herbivores
  - Predators
    - However it is unclear whether predator populations are expanding or contracting and how they are interacting with the Bilby
- There are three main types of Bilby sign
  - New tracks
  - Scats
    - But these come with associated limitations
  - Diggings
    - These tend to be long-lasting
    - They can be detected from the air
    - They are often associated with root-dwelling larvae

Rick's presentation generated the following questions and comments:

- There are some complexities when working on source-sink population dynamics
  - Juveniles can be present in a sink
  - Sources are harder to define
- Motion detection cameras can be useful in some situations where validation is required
  - However once we know the Bilby is present through other signs, a lot of time can be used going through camera footage


Panasonic
Panaboard
BILBY (5)
10/10/13
various variables / covariates
data sharing important
Rx SOUTH GATE X2
track plots + indigenous communities = meaningful work
track-based monitoring
over 1500 plot locations
2ha plots
200 x 100m plot searched for 30 min
5km apart
for independence
repeat visits
non-detection
stratify sites
bioregion
habitat
incorrect IDs a big issue
repeat surveys the key
not appreciated by funders
Qs
separation
eliminate counting some (8) twice
getting sufficient nos of plots with (8) present
good 20%
grim 0%
+ roadkill after rain
Dampier Peninsular
diggings/ droppings/ burrows
+ cameras
eg perch presence
Site Screening for suitability?
can use other 1° response variables
rocky substrate as eg.
supplementary methods
yes, but perhaps easier way to get data
cameras
traps
no great attractant

Sign-based surveys

Electronic whiteboard 05

Rick Southgate provided an overview of sign-based surveys in his second presentation (Presentation 4 attached)

- Data sharing is very important
- Powerful results can be gained from combining track plots with Indigenous knowledge and expertise
- Rick has done a lot of work using track-based monitoring
  - Over 1,500 plot locations have been covered to date
  - Plots are typically:
    - 2 ha in size
    - 5 km apart to ensure independence
    - Visited more than once to reduce the likelihood of non-detection
    - Have dimensions of 200m x 100m and searched for 30 minutes
  - Sites are stratified to take account of habitat and bioregion factors
- Incorrect identification is a big issue
  - Repeat surveys are critical
    - However this tends to be not appreciated by funding bodies

Rick's presentation generated the following questions and comments:

- The 5km separation theoretically prevents the same animal from being counted twice
- There are a range of supplementary methods which can be used
  - Traps
  - Cameras
    - The Bilby has no known great attractant
  - Depending on the survey objective, these methods are perhaps not the easiest way to obtain relevant data
- Primary response variables can ne used to screen survey sites for potential suitability
- Experience on the Dampier Peninsular showed that cameras can be used to gather important information such as pouch presence
  - Road verge sampling after rain can also generate valuable data
- Ideally a survey program should generate at least 20% of plots with the Bilby present


Panaboard
anasonic
BILBY 6
10/10/13
MARTIN DZIMINSKI
① distributional data
② monitoring technique
③ LT pop monitoring
④ Broadscale survey technique
⑤ survey of Pilbara
aerial survey planning
LiDAR detection by burrows
drones?
UAV
us collaboration to trial
sample based on habitat modelling
distance sampling transects for scats
DNA fingerprinting
Pilot study
5 individuals from 7 scats
128 bilbies released
8 sites in Pilbara
Long Gen
UIs effects on populations
determine genetic structure
land area for viable population
UIs big impacts
disturbance
corridors
grazing
50
8K ha X
18K ha
33K "
Soc
Moving populations an issue
2-3 km in 1 year
10-15 km in 3 years
fibre enhancements
rphare
social media
Voluntary data submissions
Q's
error score high for small samples
need 70 samples
transect implications
Use of quadrats
pt surveys
encourage more strongly
can put into spreadsheet
just coordinates
genotyping work refine method expand to Pilbara

Conservation & management in the Pilbara

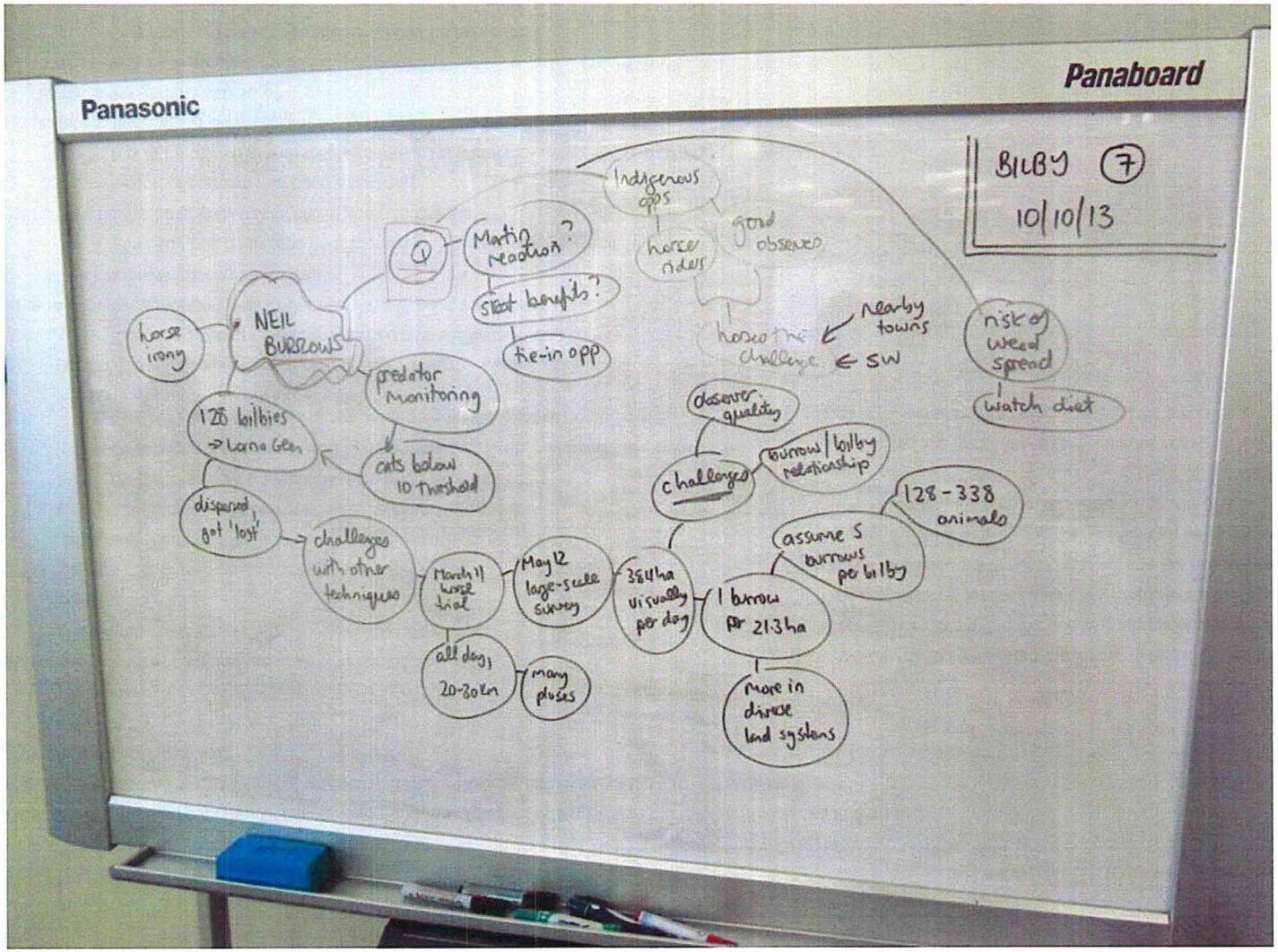
Electronic whiteboard 06

Martin Dziminski provided an overview of conservation and management of the Bilby in the Pilbara (Presentation 5 attached)

- Distribution data comes from a range of sources and makes its way onto NatureMap via:
  - Government agencies
  - Consultants
  - Proponents
- Future enhancements of NatureMap are being considered
  - Smartphone compatible
  - Social media angles
- There is not yet a recognised reliable way of monitoring Bilby numbers
  - A pilot study was conducted at Lorna Glen
    - 128 Bilbies had been previously released into the area
    - Distance sampling transects were used to collect scats
    - DNA fingerprinting was used to determine the number of individuals present
      - In that study, 7 scats were determined to have come from 5 different individuals
  - This method will now be refined based on the lessons learned from Lorna Glen
    - It is hoped this can be further tested in the Pilbara in due course
- Long-term population monitory was undertaken at 8 sites in the Pilbara
  - Moving populations can be an issue
    - The Bilby has been recorded as moving 2.3 km in one year and 10.5 km in 3 years
- Aerial surveys offer a potentially useful broad-scale technique
  - Lidar detection of burrows has been examined
    - A collaborative trial with folk from the US is underway to test the use of drones
- It is important to understand Bilby population dynamics
  - What is the genetic structure?
  - What land area is required for a viable population?
    - One piece of research suggests 50,000 ha is required
  - What are the big impacts?
    - Disturbance?
    - Corridors?
    - Grazing?

Martin's presentation generated the following questions and comments:

- There is room to explore the use of quadrats alongside point surveys
- There is provision for voluntary data submissions to NatureMap
  - However this is not obligatory, and not likely to become so
- Some of the data available in NatureMap can be exported into spreadsheets
  - Coordinates are not available for export
- A minimum of 70 samples is required to avoid unacceptable error scores
  - This has implications for transect sizes
- Data is reviewed before being approved for inclusion in NatureMap


Panasonic
Panaboard
BILBY (7)
10/10/13
Indigenous ops
Mating reaction?
horse riders
good observers
Nearby towns
SW
NEIL BURROWS
horse irony
predator monitoring
test benefits?
tie-in opp
risk of weed spread
watch diet
observer quality
challenges
burrow/bilby relationship
128-338 animals
assume 5 burrows per bilby
120 bilbies → Lorna Glen
cats below 10 threshold
dispersed, got 'lost'
challenges with other techniques
March 11 trial
May 12 large-scale survey
384ha visually per day
1 burrow per 21.3ha
all day, 20-30km
many pluses
more in diverse land systems

Horseback monitoring

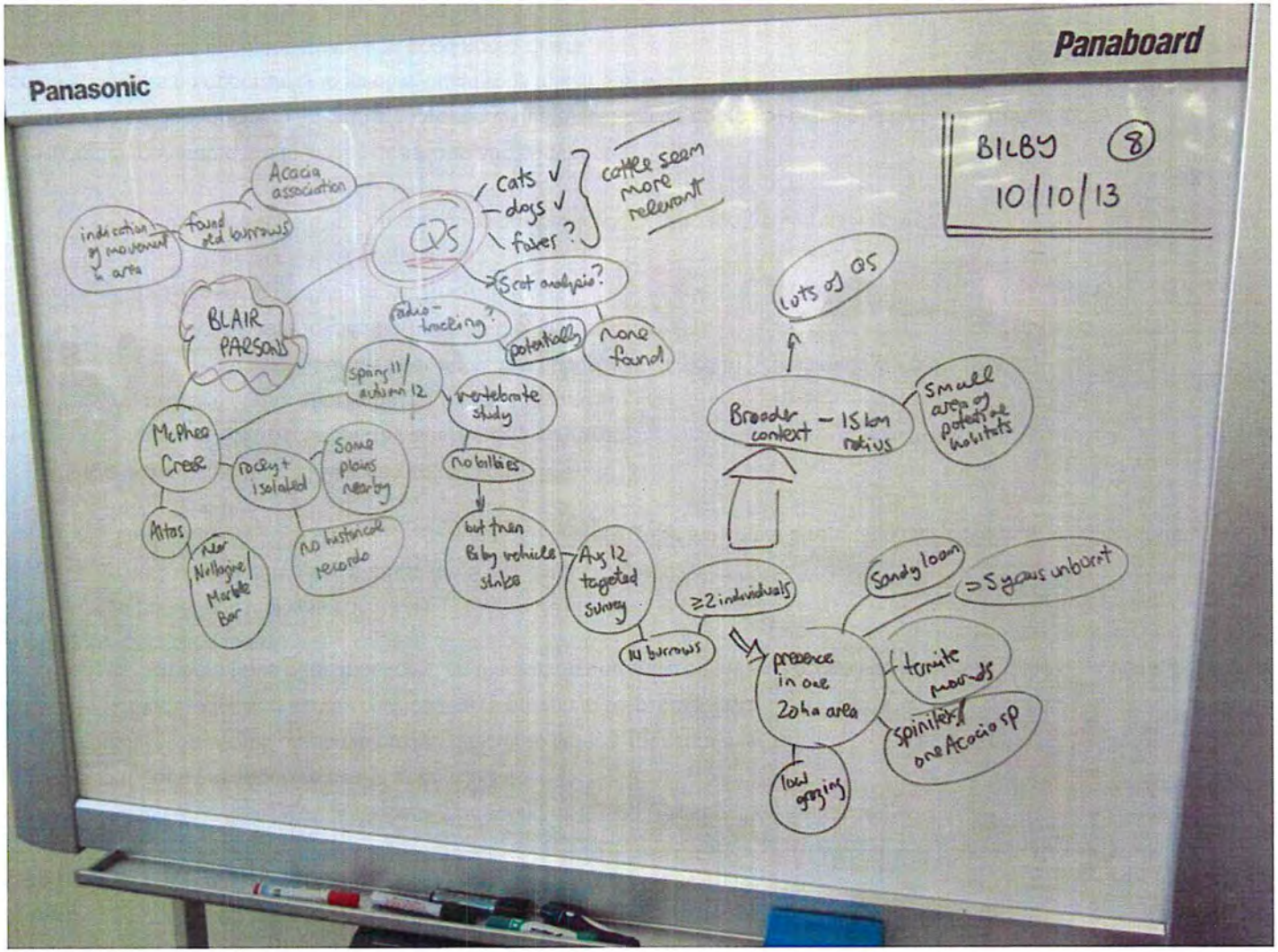
Electronic whiteboard 07

Neil Burrows provided an overview of horseback monitoring of Bilbies (Presentation 6 attached)

- 126 Bilbies had been previously released at Lorna Glen
  - They quickly dispersed and have proven difficult to reliably measure ever since
    - Other recognised survey methods have proven to be problematic
  - Predator numbers have been monitored on the station and were below the recognised threshold at the time of the horseback survey discussed today
  - An initial horseback trial was conducted in March 2011
    - This involved surveying a 20-30 km linear length in one day
    - There is some irony in using horses to track Bilbies, given they have a reputation for adversely impact our natural environment
  - A large-scale horseback survey was conducted in May 2012
    - An average of 384 ha per day was visually surveyed
    - An average of one barrow per 21.3 ha was found
      - Assuming 5 burrows per Bilby, this suggests that 128 to 338 animals were present
      - More were found in diverse land systems
    - There are some challenges with this approach
      - Observer quality is critical
      - There is no clearly established burrow-to-Bilby ratio for the Lorna Glen area

Neil's presentation generated the following questions and comments:

- There may be an opportunity to tie-in this approach with the scat-based approach explained by Martin earlier today
- There seems to be an opportunity to involve indigenous folk in this work
  - They tend to be good observers and good horse-riders
- Using horses increases the risk of weeds being spread
  - Appropriate diet choice can reduce this risk
- The biggest challenge with this approach is securing the right number and quality of horses


Panaboard
Panasonic
BILBY (8)
10/10/13
Acacia association
indication of movement in area
found old burrows
CVS
cats ✓
dogs ✓
foxes ?
cattle seem more relevant
scat analysis?
radio-tracing?
potentially
none found
BLAIR PARSONS
spring 11/ autumn 12
vertebrate study
no bilbies
but then Bilby vehicle strike
Aug 12 targeted survey
N burrows
McPhee Creek
Atlas
Nor Nellagine Marble Bar
rocky + isolated
Some plains nearby
no historical records
Lots of QS
Broader context - 15 km radius
Small area of potential habitats
≥2 individuals
presence in one 20ha area
Sandy loam
=5 years unburnt
termite mounds
spinifex & one Acacia sp
low grazing

Bilbies at McPhee Creek

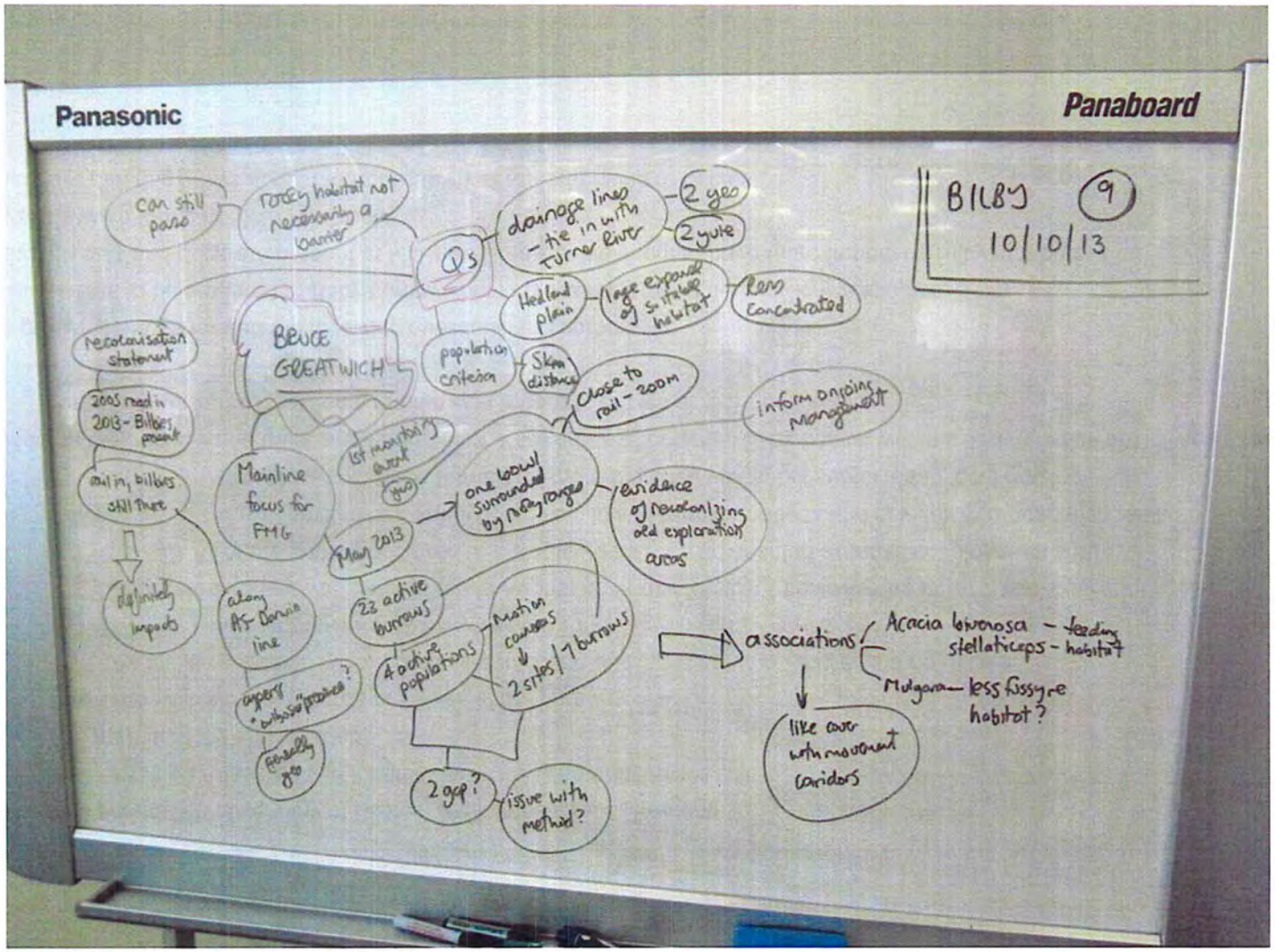
Electronic whiteboard 08

Blair Parsons provided an overview of Bilbies at McPhee Creek (Presentation 7 attached)

- McPhee Creek is an Atlas Iron site located near Nullagine and Marble Bar
  - The area is rocky and isolated
  - There are no historical records of Bilbies in the area
    - An initial vertebrate study conducted in spring 2011 and autumn 2012 found no Bilbies
      - However there was a Bilby vehicle strike later in 2012
    - A targeted survey was undertaken in August 2012 and found 14 burrows and at least two individual Bilbies
      - All of the activity occurred in a single 20 ha area adjacent to an Atlas development site
        - That site had sandy loam soil, lots of termite mounds and spinifex and Acacia vegetation
        - It had not been burned for more than five years, but subjected to local grazing
- Based on the above work, there are a number of small areas of potential Bilby habitat within a 15 km radius of McPhee Creek
  - Lots of unanswered questions remain with regard to Bilbies at McPhee Creek

Blair's presentation generated the following questions and comments:

- There seems to be a pattern of Bilby burrows being prevalent around certain Acacia species
- Although cats and dogs are present at McPhee Creek, cattle seem to have more impact on Bilby numbers
- No scats were found at McPhee Creek
- There are differing views about the applicability of radio-tracking to Bilbies


Panasonic
Panaboard
BILBY (9)
10/10/13
can still pass
rocky habitat not necessarily a barrier
Qs
drainage lines - tie in with Turner River
2 geo
2 gully
Hardland plain
large expanse of suitable habitat
Rocks concentrated
BRUCE GREATWICH
recolonisation statement
2005 road in 2013 - Bilbies present
pop. criteria
5km distance
close to rail - 200m
inform ongoing management
1st monitoring event
two
Mainline focus for FY16
one local surrounded by many ranges
evidence of recolonizing old exploration areas
May 2013
definitely impacts
along AF Davis line
22 active burrows
4 active populations
motion cameras
2 sites / 7 burrows
associations
Acacia bivenosa - feeding
stellaticeps - habitat?
Mulga - less fissure habitat?
like over with movement caridors
open + subscriptions?
fenced off
2 gap?
issue with method?

Monitoring along the Fortescue mainline rail

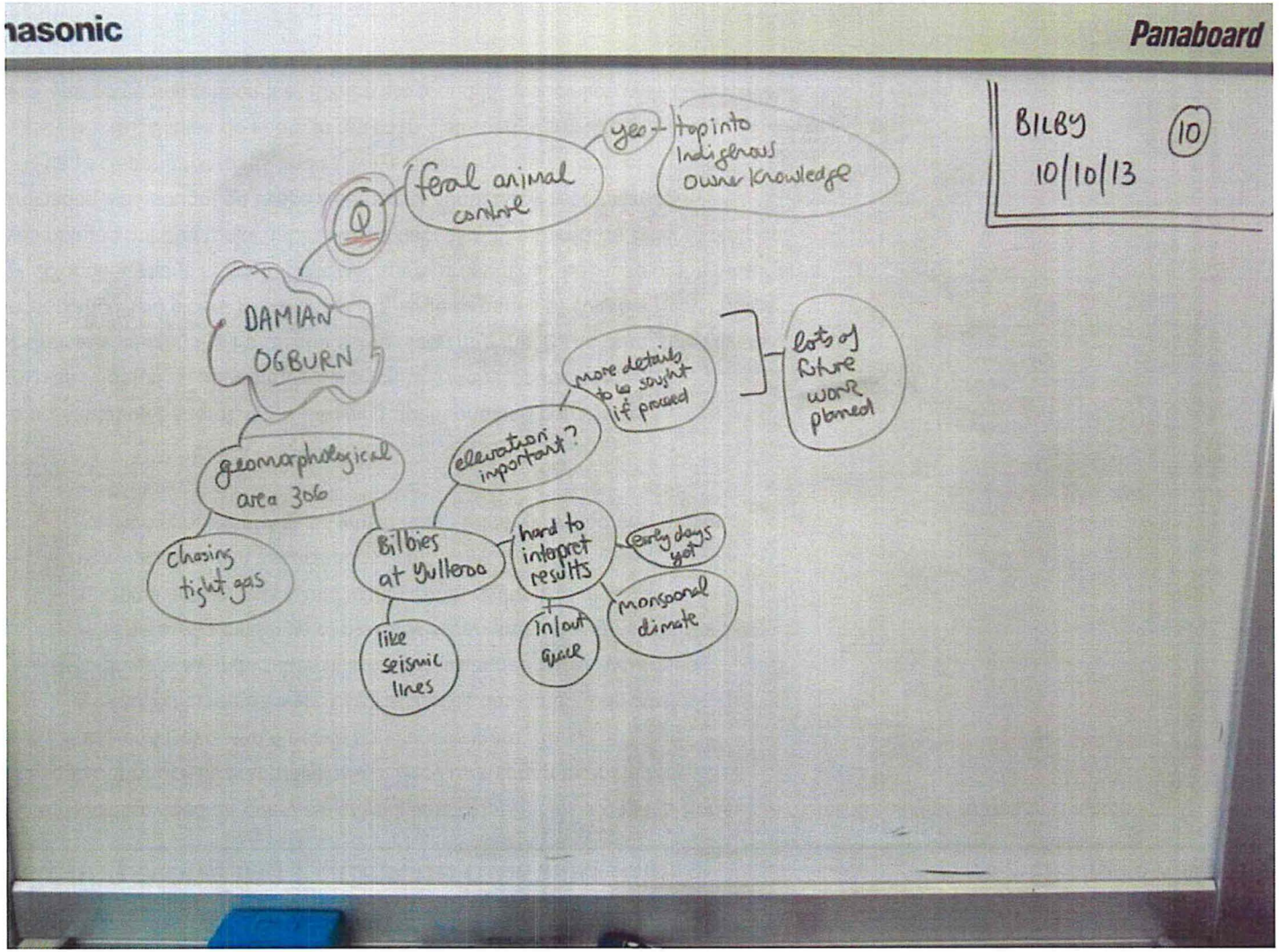
Electronic whiteboard 09

Bruce Greatwich provided an overview of monitoring for Bilbies along the Fortescue mainline rail (Presentation 8 attached)

- Fortescue undertook its first mainline rail Bilby monitoring event in May 2013
  - 23 active burrows and 4 active populations were found
    - Motion cameras were used at 2 sites covering 7 burrows
  - The survey was undertaken in a bowl surrounded by rocky ranges
    - There was evidence of old exploration areas being recolonized
    - Bilby activity was found within 200m of the rail line
  - Bilbies were found in associations with:
    - Two species of Acacia which seem to provide food and habitat
    - Mulgaras

Bruce's presentation generated the following questions and comments:

- 5 km was adopted as an arbitrary distance between populations
- The drainage lines in the Fortescue survey feed into the Turner and Yule Rivers
- The Hedland Plain closer to the coast is a large expanse of suitable Bilby habitat
  - Concentrations seem to be lower there, presumably because of the larger area
- It was pointed out that rocky habitat is not necessarily a barrier to Bilby movement
- Clarification was sought on Bruce's comment about Bilby recolonization
  - Land clearing for roads and railways definitely has an impact
    - But Bilbies do seem to return to disturbed areas in due course
- There was some suggestion that Bilbies are found in association with *Cyperus bulbosus*


Panaboard
BILBY
10/10/13
10
feral animal control
yes
tap into Indigenous owner knowledge
DAMIAN OGBURN
more details to be sought if pursued
lots of future work planned
geomorphological area 306
elevation important?
chasing tight gas
Bilbies at Yulleroo
hard to interpret results
early days yet
like seismic lines
in/out fence
monsoonal climate

Developing a model for the Western Sandlands

Electronic whiteboard 10

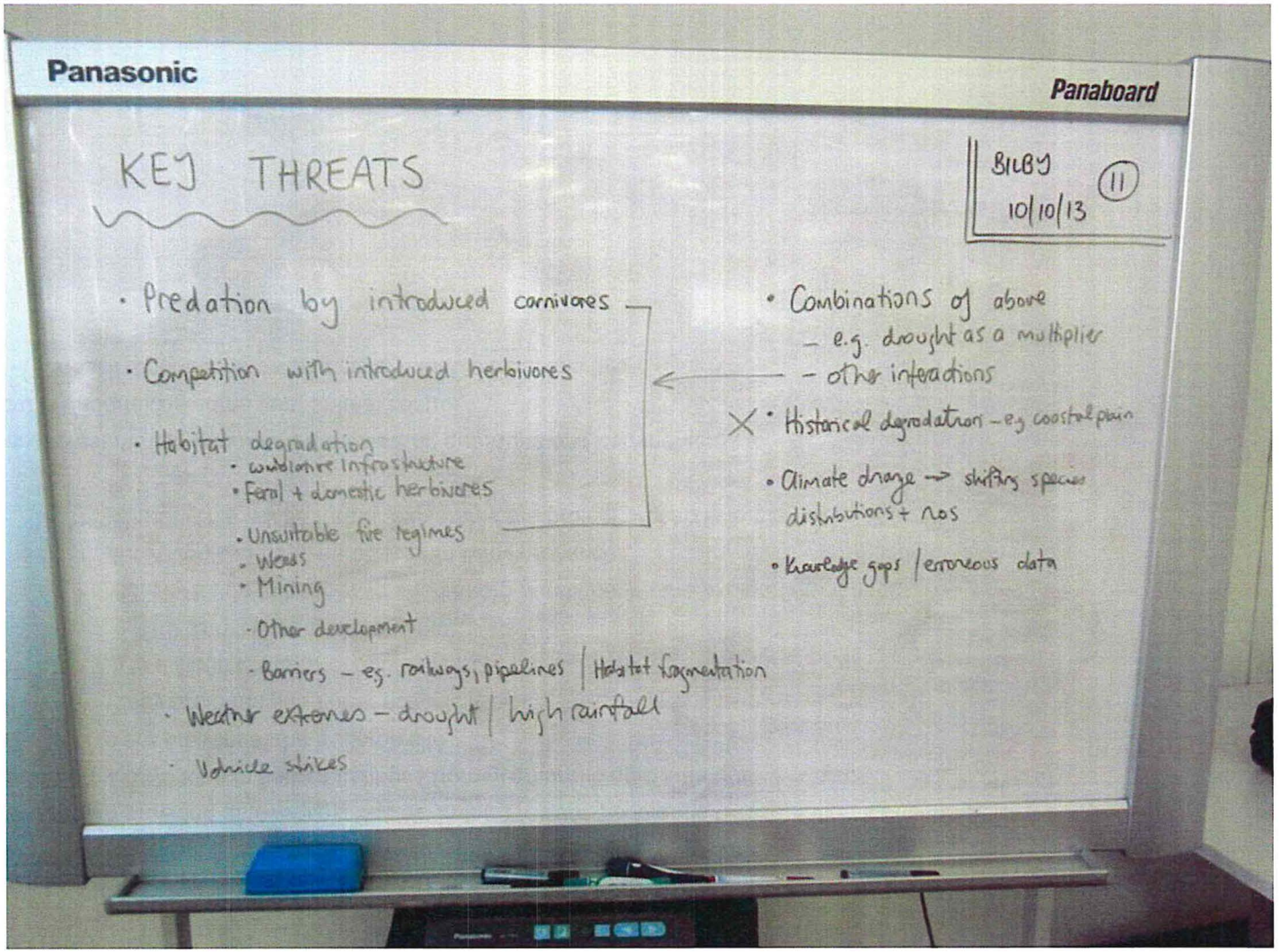
Damian Ogburn provided an overview Bilbies in the Western Sandlands (Presentation 9 attached)

- Buru Energy is working to source tight gas from geomorphologic area 306
  - Bilbies are present at the Yulleroo site
    - They are often seen near seismic lines
    - It is difficult to interpret survey results
      - But it is early days yet
    - Activity tends to happen in short sharp bursts during the exploration phases
    - Elevation seems to be a factor in Bilby presence
      - This will be further explored if the project proceeds to the next stage

Damian's presentation generated the following questions and comments:

- Buru is undertaking some feral animal control
  - Local indigenous knowledge is a valuable input into this

Key threats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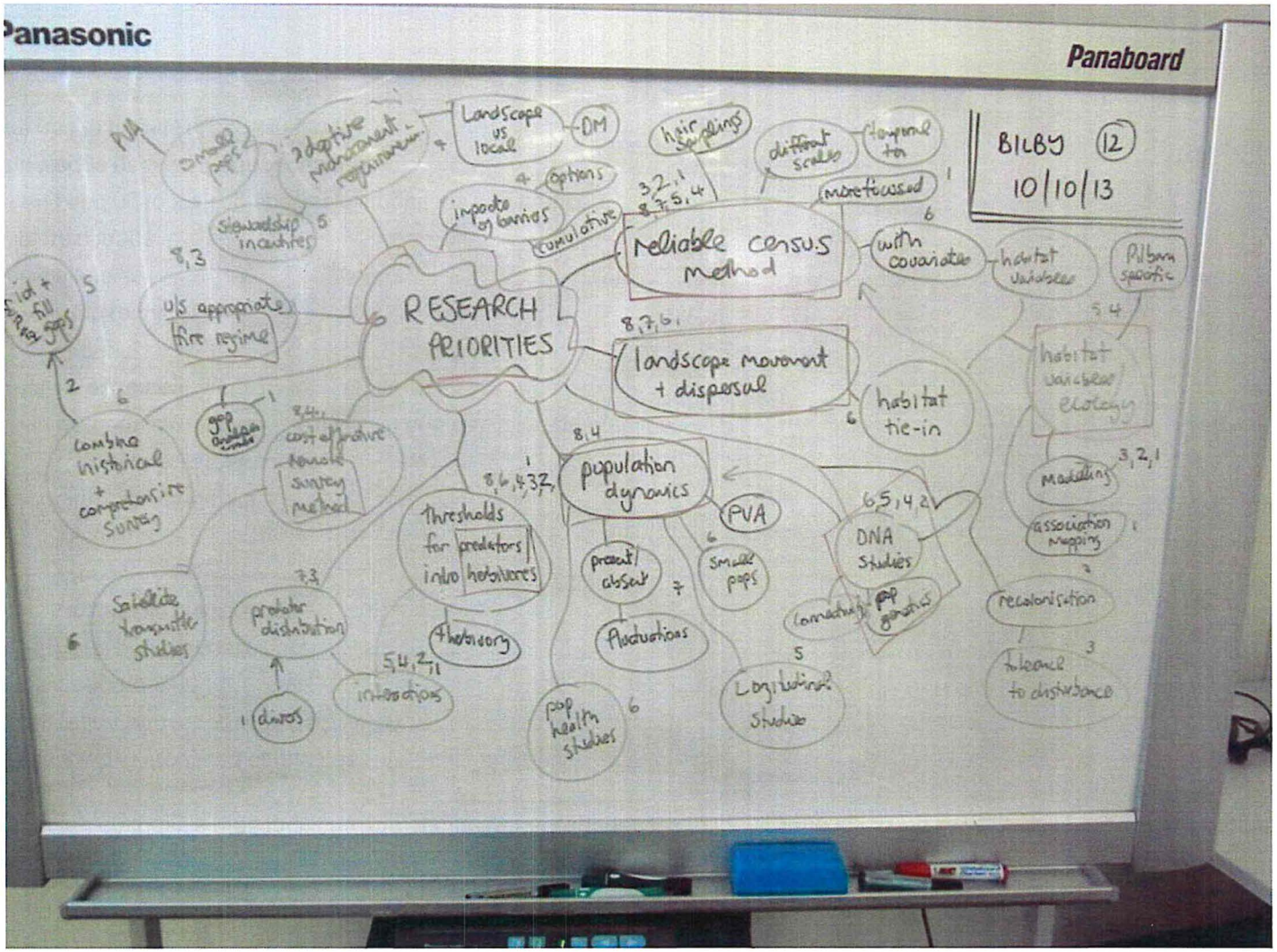
KEY THREATS
BILBY
10/10/13
11
• Predation by introduced carnivores
• Competition with introduced herbivores
• Habitat degradation
• wildlonire infrastructure
• Feral + domestic herbivores
• Unsuitable fire regimes
• Weeds
• Mining
• Other development
• Barriers – eg. railways, pipelines | Habitat fragmentation
• Weather extremes – drought | high rainfall
• Vehicle strikes
• Combinations of above
– e.g. drought as a multiplier
– other interactions
• Historical degradation – eg coastal plain
• Climate change → shifting species distributions + ros
• Knowledge gaps / erroneous data

Key threats

Electronic whiteboard 11

We reflected on today's presentations and our individual experiences to identify the following key threats to the Bilby in northern WA :

- Predation by introduced carnivores
- Competition with introduced herbivores
- Habitat degradation
  - Feral and domestic herbivores
  - Unsuitable fire regimes
  - Weeds
  - Mining
  - Other development
  - Cumulative infrastructure
  - Barriers (e.g. railways, pipelines) and habitat fragmentation
- Weather extremes
  - Drought
  - High rainfall
- Vehicle strikes
- Climate change
  - Leading to shifting species distributions and numbers
- Knowledge gaps and erroneous data
- The above threats in combination


Panasonic
Panaboard
BILBY 12
10/10/13
RESEARCH PRIORITIES
reliable census method
landscape movement + dispersal
population dynamics
habitat tie-in
habitat variables ecology
with covariates
more focussed
different scales
hair sampling
landscape vs local
DM
adaptive management - experiment
small pops
options
impacts of barriers
cumulative
stewardship incentives
w/s appropriate fire regime
combine historical + comparative survey
cost effective remote survey method
Thresholds for predators into herbivores
PVA
DNA Studies
small pops
present/absent
fluctuations
Longitudinal Studies
pop health studies
predator distribution
herbivory
interactions
dingos
satellite transmitter studies
modelling
association mapping
recolonisation
fidelity to disturbance
connectivity
pop genetics

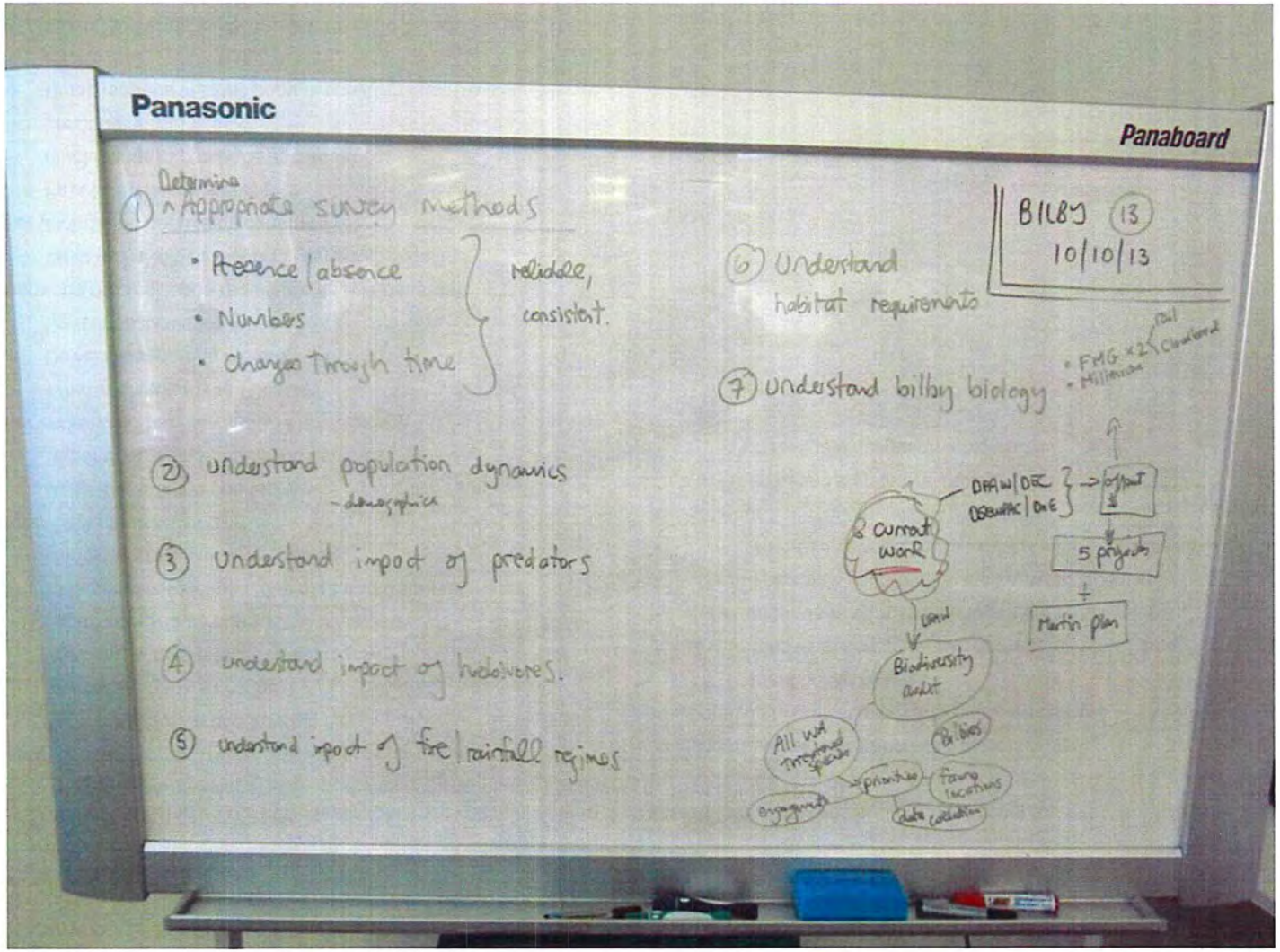
Research priorities

Electronic whiteboard 12

On each table, we reflected on our individual experiences plus the information shared during this workshop to identify our top five Bilby-related research priorities in northern WA (individual table feedback notes appear on pages 43 to 49 of this TalkBook)

- Reliable census method
  - At different scales and through time
  - Investigate hair samplings
  - We need to take a focused approach
  - Include covariates and habitat variables
- Better understand landscape movement and dispersal
  - Understand the tie-in with habitat
- Further DNA studies
  - Better understand connectivity
  - Better understand population genetics
- Better understand habitat variables and ecology
  - What is unique to the Pilbara?
  - Develop supporting models
  - Develop association maps
- Understand recolonization requirements and patterns
  - What is the Bilby's tolerance to disturbance?
- Better understand population dynamics
  - Population health studies
  - Fluctuations in presence and absence
  - Longitudinal studies
  - What happens in small populations?
  - PVA
- Better understand thresholds for predators and introduced herbivores
  - Interactions
  - Predator distributions
  - Various drivers
- Develop cost-effective remote survey methods
- Undertake satellite transmitter studies
- Combine historical and comprehensive surveys
  - Identify and fill gaps
- Understand what constitutes an appropriate fire regime
- Better understand adaptive management requirements
  - This could contribute to stewardship incentives
  - To assist with landscape versus local decision-making
- Better understand the impact of barriers
  - Including cumulative impacts
  - Investigate mitigation options

Priority research themes & current work



Priority research themes & current work

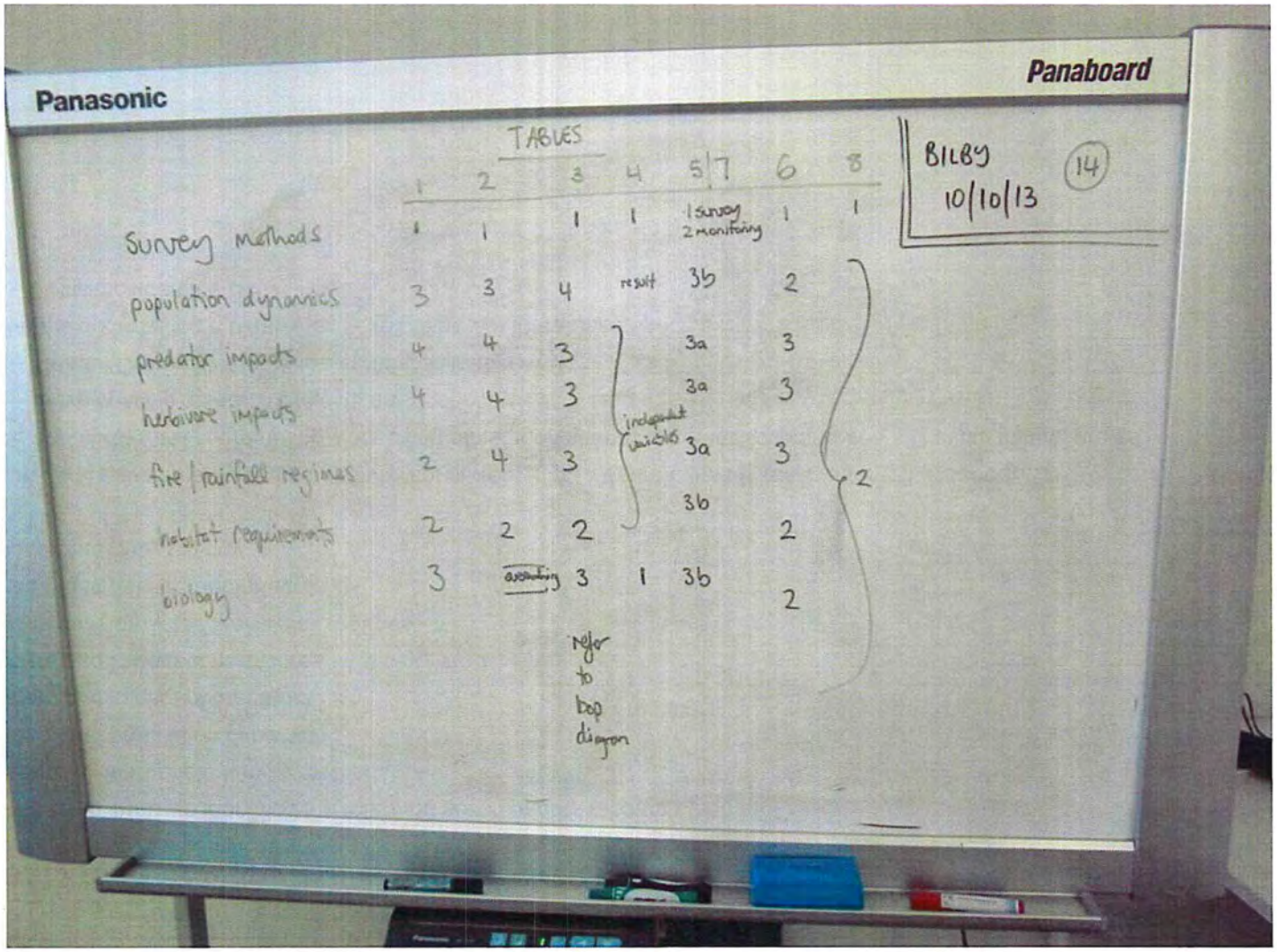
Electronic whiteboard 13

From the table input we identified the following seven priority research themes:

- Determine appropriate survey methods
- Understand population dynamics
- Understand impact of predators
- Understand impact of herbivores
- Understand impact of fire/rainfall regimes
- Understand habitat requirements
- Understand Bilby biology

Stephen van Leeuwen provided an overview of current Bilby research work (Presentation 10 attached)

- DoE and DPaW are coordinating work using offset money from two Fortescue and one Millenium mining project
  - Five specific research projects are underway
  - Martin Dziminski's work is also funded in this way
- DPaW is undertaking a biodiversity audit of all WA threatened species
  - This includes the Bilby

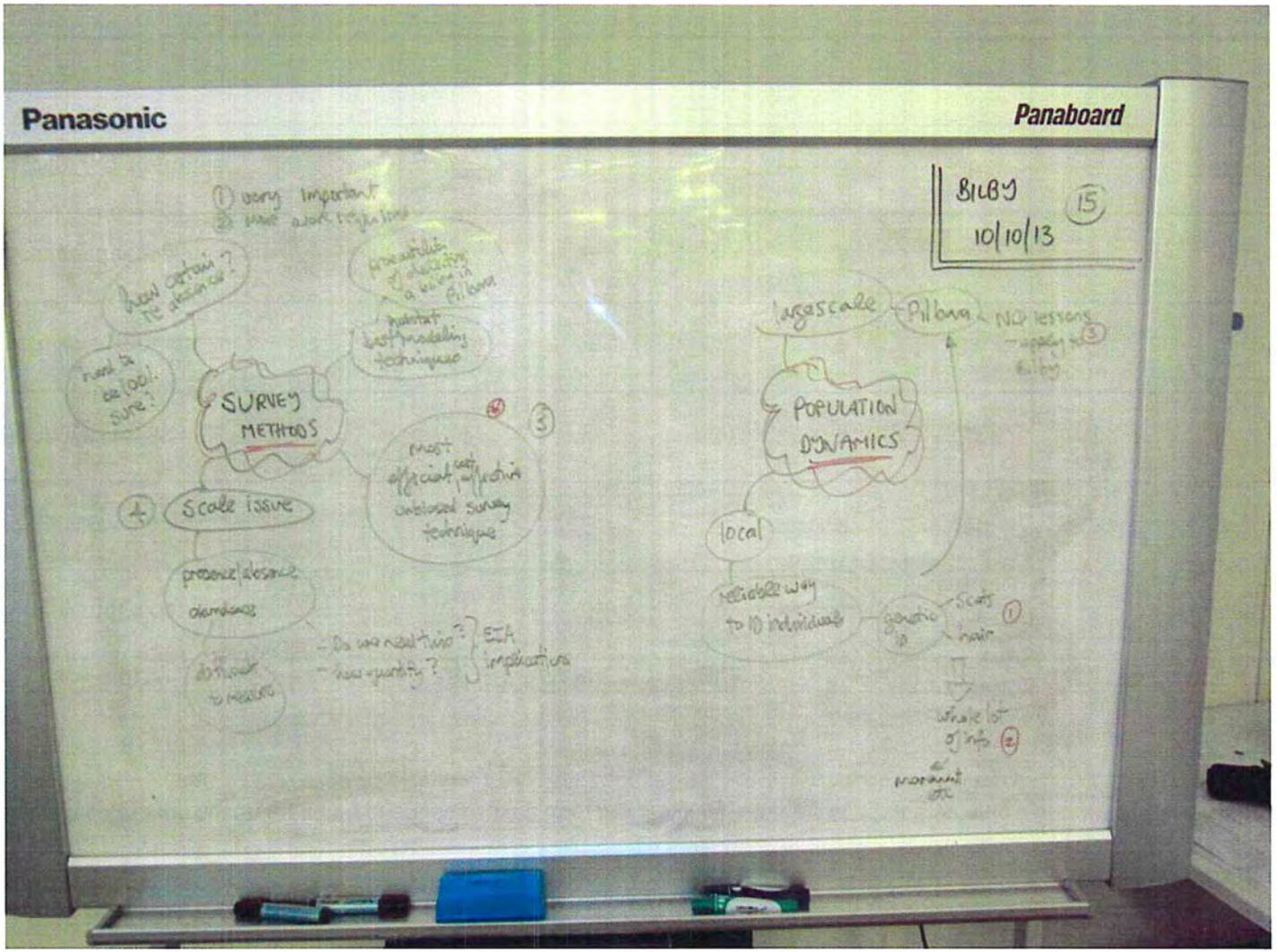

Panasonic
Panaboard
TABLES
1 2 3 4 5 7 6 8
BILBY
10/10/13
14
Survey methods
population dynamics
predator impacts
herbivore impacts
fire / rainfall regimes
habitat requirements
biology
1 survey 2 monitoring
result
independent variable
refer to top diagram

Research program

Electronic whiteboard 14

Each table took the top seven research priorities derived from the previous exercise and put them into a sequence-based program

FOCUS AREA	TABLE 1	TABLE 2	TABLE 3	TABLE 4	TABLE 5/7	TABLE 6	TABLE 8
Survey methods	1	1	1	1	1 = survey, 2 = monitoring	1	1
Population dynamics	3	3	4	2	3b	2	2
Predator impacts	4	4	3	4	3a	3	5
Herbivore impacts	4	4	3	4	3a	3	6
Fire / rainfall regimes	2	4	3	4	3a	3	4
Habitat requirements	2	2	2	3	3b	2	3
Biology	3	Over-riding	3	1	3b	2	2


Panasonic
Panaboard
BILBY
10/10/13
15
SURVEY METHODS
POPULATION DYNAMICS
Scale issue
local
Pilbara
NO lessons
Bilby

Breakdowns: survey methods & population dynamics

Electronic whiteboard 15

We formed new tables according to expertise and interest to determine the most pressing areas of focus for each research priority

- Survey methods
  - Determine the most efficient, cost-effective and unbiased survey technique
    - Presence/absence informs abundance, which in turn relates to monitoring efforts
  - How can we be more certain about recorded absences?
    - Failure to detect a Bilby doesn't necessarily mean they aren't present at a site
  - How do we reliably scale presence/absence data at a site level into meaningful abundance information for a larger area?
    - This has environmental impact assessment implications
  - Work on habitat modelling techniques would help to identify areas of the Pilbara where the Bilby is most likely to be present
    - This would inform future survey efforts
- Population dynamics
  - At a local scale, we need to find better ways to identify individual Bilbies
    - Genetic identification through scat and hair analyses can assist with gathering a whole lot more information (e.g. movements and ranges)
  - At a regional scale, better understanding is also required
    - Lessons from the recent Northern Quoll workshop could be applied to the Bilby
  - (A more comprehensive account of this table's thinking is captured on page 51 of this TalkBook)

Breakdowns: predator & herbivore impacts

Electronic whiteboard 16

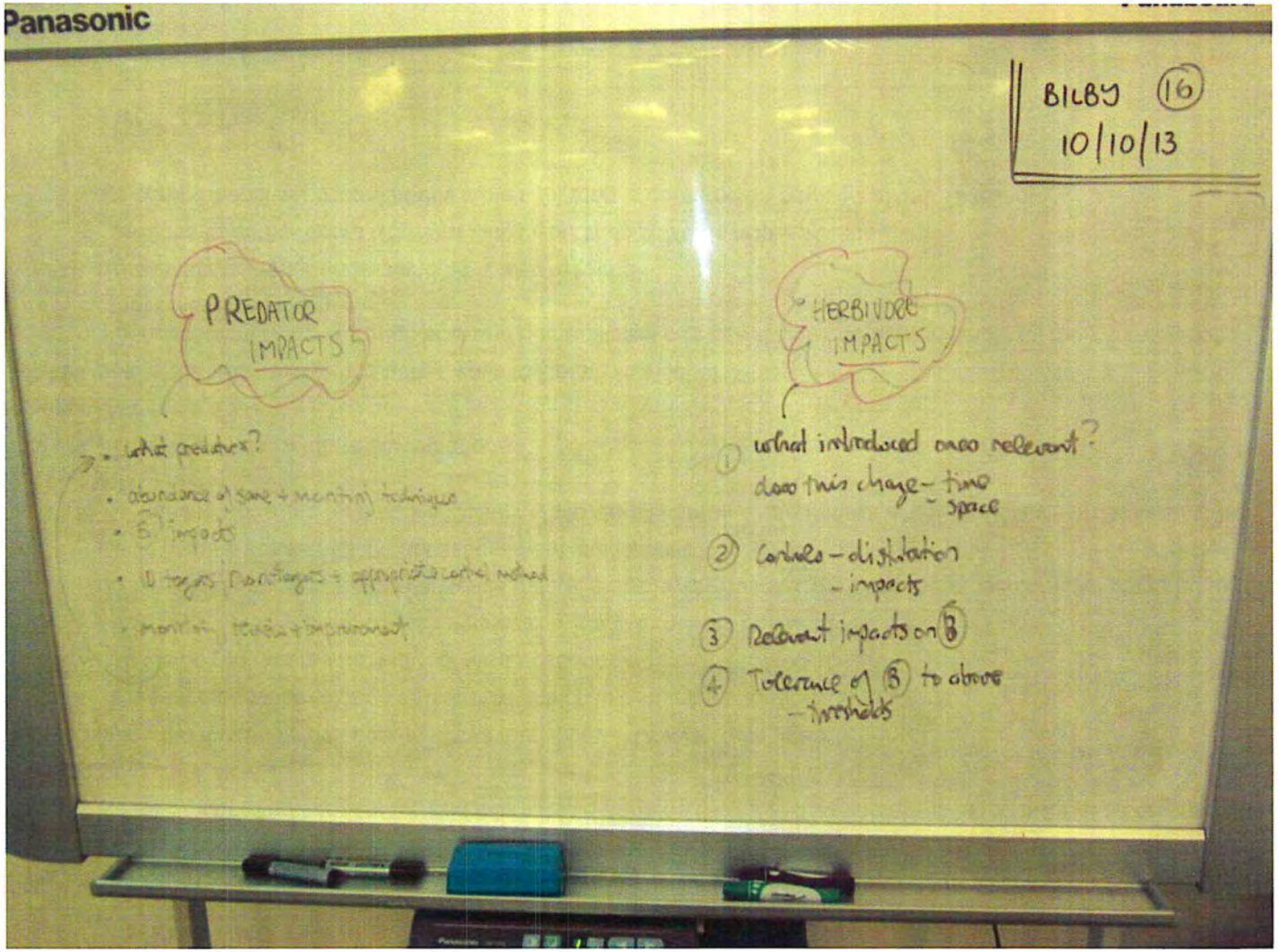


Table determinations of the most pressing areas of focus for each research priority *(continued)*

- Predator impacts
  - Determine the most important Bilby predators in the Pilbara
  - Determine the abundance of each predator
    - Develop appropriate monitoring techniques
  - Assess level of impact on the Bilby for each predators
  - Identify primary predator targets and appropriate control methods for each target
  - Monitor Bilby numbers and review and improve associated research and management programs as relevant
- Herbivore impacts
  - Determine which introduced herbivores are most relevant to the Bilby
    - Does this change through time and space?
  - What controls herbivore distribution and level of impact?
    - In terms of distribution
    - In terms of impact on the Bilby
  - Which impacts are relevant to the Bilby?
    - Habitat simplification
    - Trampling
    - Soil compaction
    - Direct competition
  - What is the tolerance of the Bilby to each of the above impacts?

Breakdowns: fire & rainfall regimes & habitat requirements

Electronic whiteboard 17

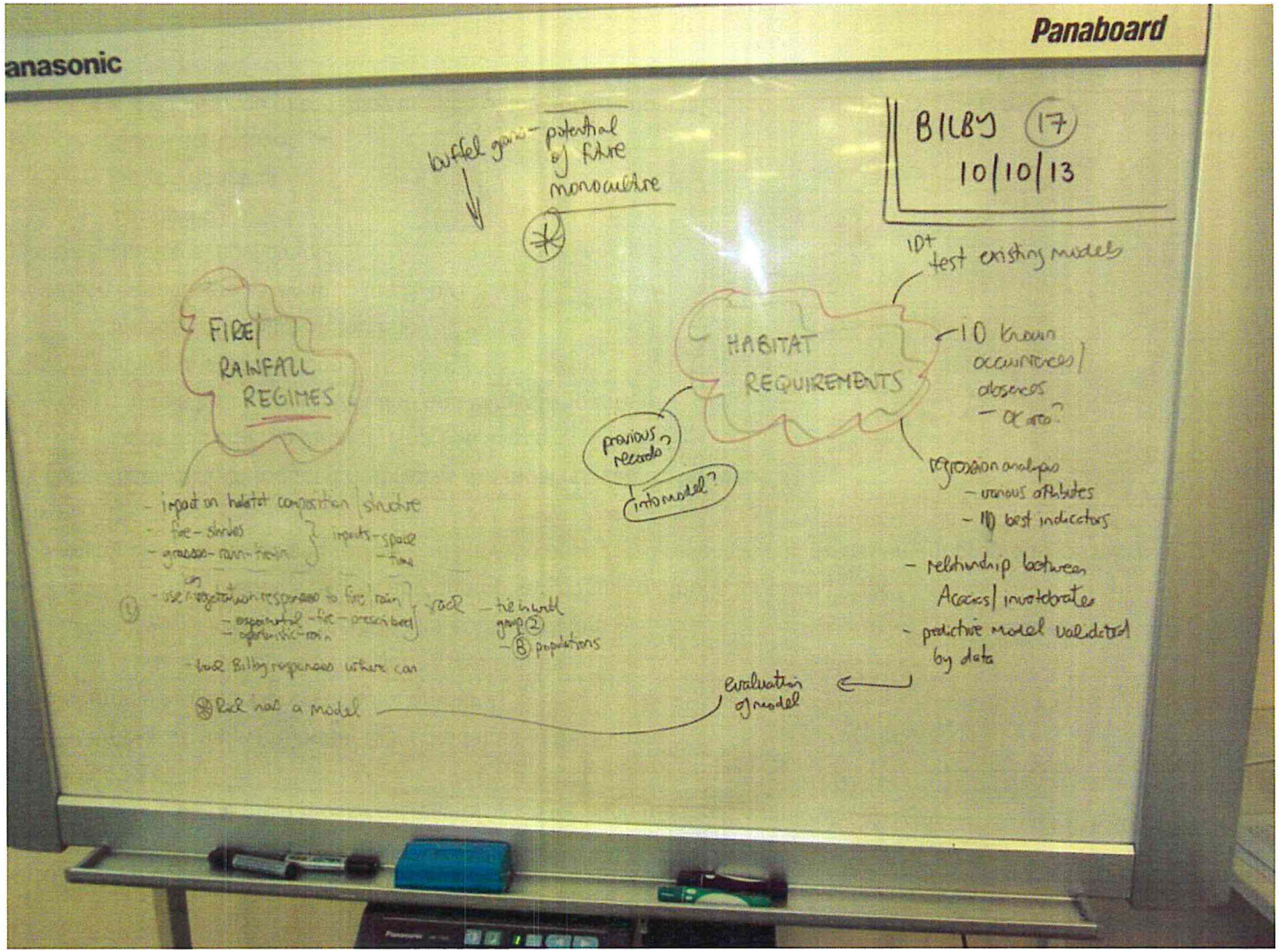
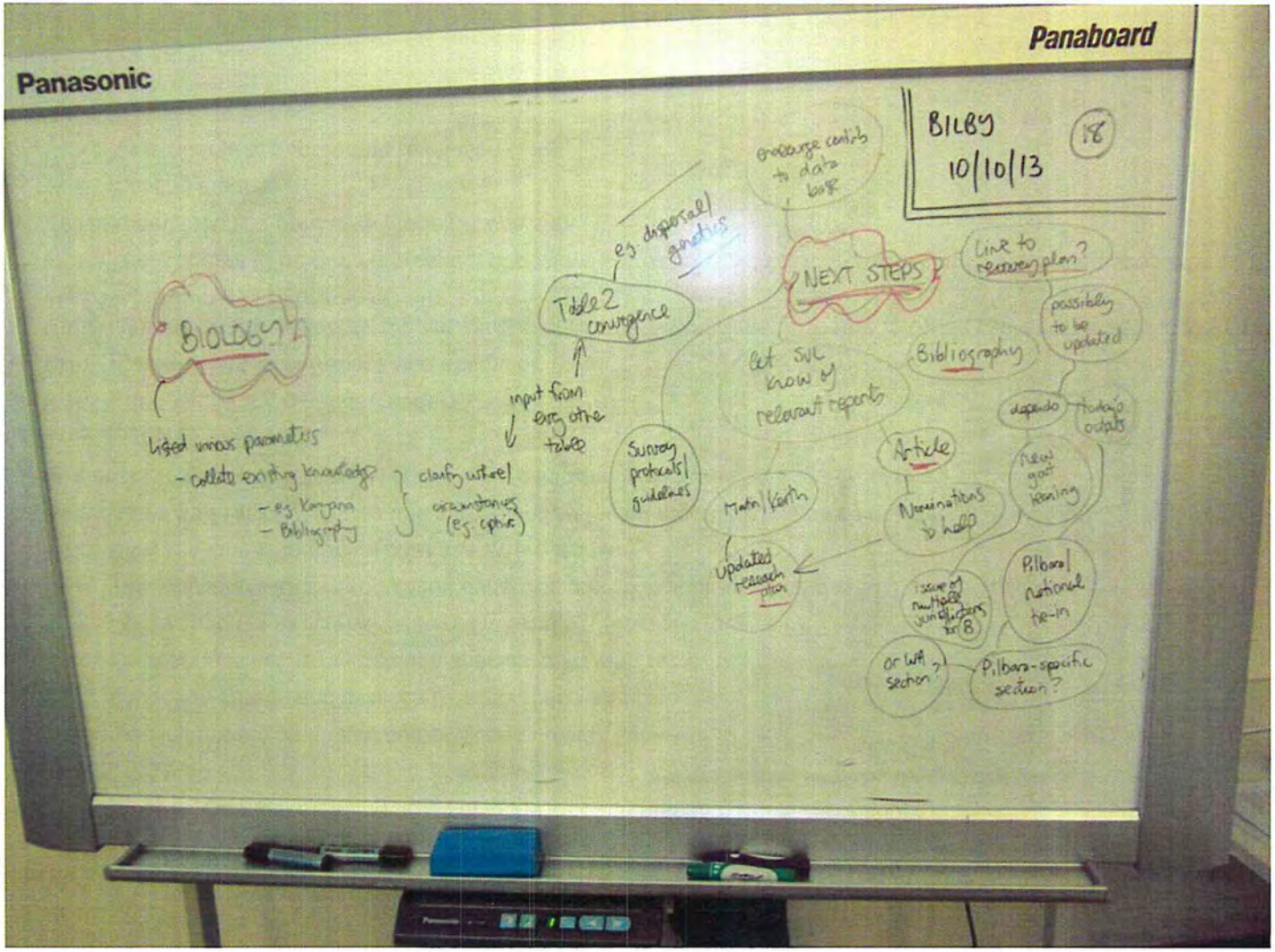


Table determinations of the most pressing areas of focus for each research priority *(continued)*

- Fire & rainfall regimes
  - Determine the impact on habitat composition and structure
    - Impact on shrubs and grasses through space and time
  - Track the responses of key vegetation species to fire and rain
    - Combination of experimental (e.g. fire) and opportunistic (e.g. rain)
    - This will tie-in with the population dynamics research addressed on page 33 of this TalkBook
  - Track Bilby responses to habitat changes where feasible
  - It was noted that Rick Southgate has a potentially relevant model for this piece of work
  - (A more comprehensive account of this table's thinking is captured on page 54 of this TalkBook)
- Habitat requirements
  - Identify and test existing habitat models
  - Identify known Bilby occurrences and absences
  - Undertake regression analyses against various attributes / requirements for the Bilby life cycle with a view to identifying the best indicators of Bilby habitat
    - There seems to be good a prospect of positive correlations with certain Acacia and invertebrate species
  - Validate any resulting predictive model(s) with data
    - Existing models
    - New models at appropriate resolution


Panaboard
Panasonic
BILBY
10/10/13
18
BIOLOGY
Table 2 convergence
eg dispersal genetics
input from eg other tables
NEXT STEPS
Link to recovery plan?
possibly to be updated
Bibliography
let SVL know of relevant reports
Survey protocols/ guidelines
Article
New post keeling
Updated research action
Pilbara national fire-in
Pilbara-specific section?

Biology breakdown & next steps

Electronic whiteboard 18

Table determinations of the most pressing areas of focus for each research priority *(continued)*

- Biology
  - A range of relevant parameters were listed during the table feedback process
    - *(Unfortunately the handwritten notes from that table were not secured at end of the day)*
    - Key points included captured on the whiteboard included:
      - ❑ Collate existing data from all known sources
        - Bibliography arising from this workshop
        - Kanyana
      - ❑ There is lots of overlap between this research and the research described by other tables today

Stephen van Leeuwen summarised the planned next steps after today's workshop:

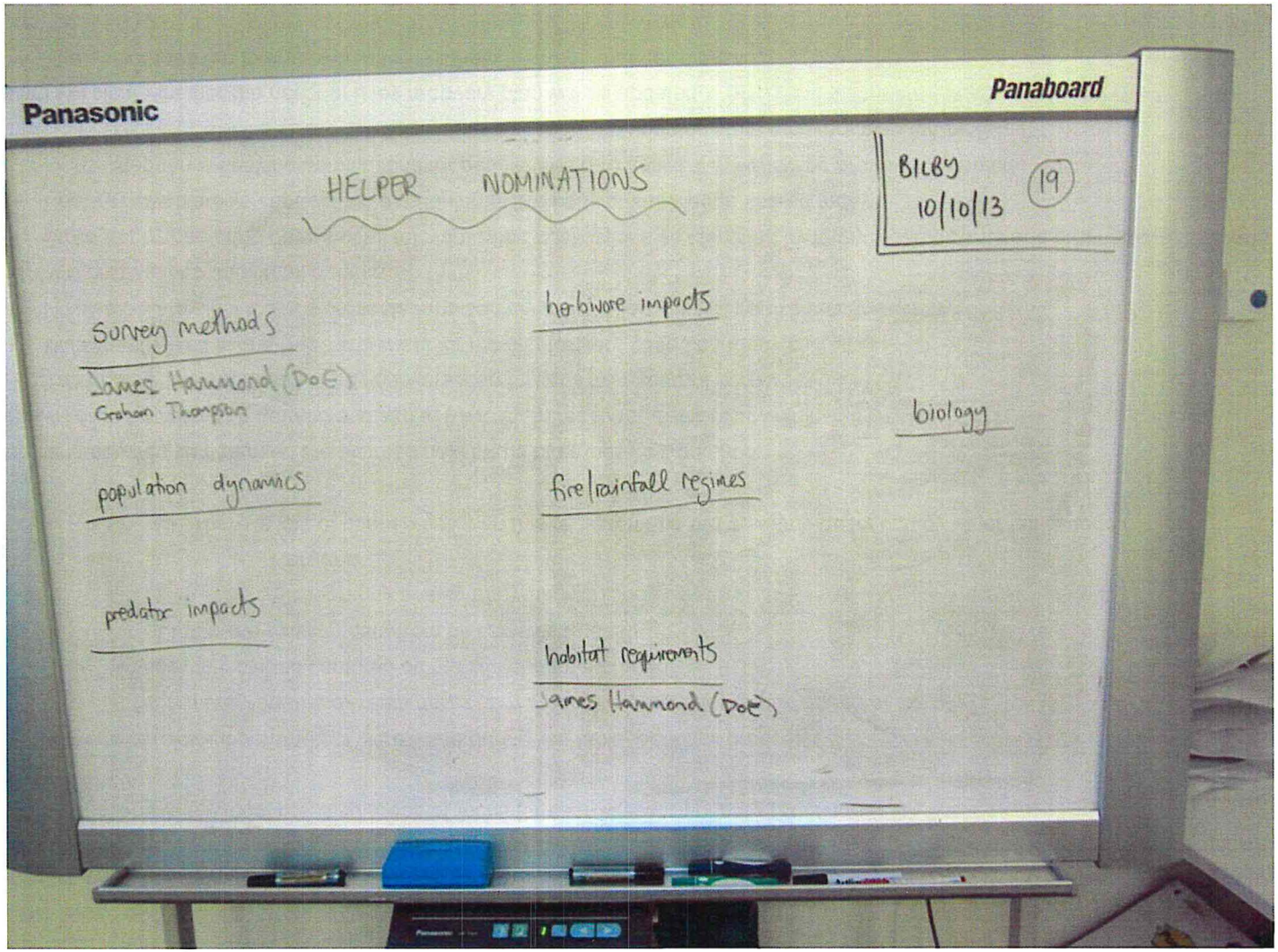
- Craig will draft the following outputs and aim to have them ready for distribution within 2-3 weeks
  - TalkBook which captures the key conversation threads from today's conversation
  - BlueSheet which is one-page argument for moving forward based on today's input
- Craig will also collate all of today's presentations so they are available for all participants to review
- DPaW will prepare two additional outputs
  - Bibliography capturing details of all relevant Bilby publications as identified by today's participants and other relevant experts
  - Peer-reviewed article capturing in a meaningful the body of knowledge shared today
    - Stephen is seeking nominations for people willing to assist with reviewing drafts of the article
    - This article will be used to inform development of an updated state recovery plan for the Bilby
- It is not yet clear whether the national Bilby recovery plan will be updated
  - The outcomes from today's workshop will help to shape that decision

Those present made two other requests:

- That everyone be encouraged to contribute to the central data base
- That establishing clear survey protocols and guidelines be treated as a priority

Volunteer nominations

Electronic whiteboard 19



Volunteer nominations

Electronic whiteboard 19

The following participants volunteered to help progress the Bilby research priorities identified during this workshop:

- Survey methods
  - James Hammond
  - Graham Thompson
- Habitat requirements
  - James Hammond
- Biology
  - Trish Fleming

WORKSHOP FEEDBACK

Client:	DPaW											
Topic:	Bilby workshop											
Date(s):	10-Oct-13											
Question	Strongly agree		Agree		Disagree		Strongly disagree		Not relevant		No answer	
	#	%	#	%	#	%	#	%	#	%	#	%
Outcomes												
Generated powerful ideas for moving forward	6	18%	26	76%	2	6%		0%		0%		0%
Identified clear next steps	4	12%	27	79%	3	9%		0%		0%		0%
Advanced our thinking	9	26%	22	65%	2	6%		0%	1	3%		0%
United our group	3	9%	29	85%		0%		0%	2	6%		0%
Likely to have a positive impact	10	29%	20	59%		0%		0%	1	3%	3	9%
Process												
Comfortable & suitable venue	15	44%	19	56%		0%		0%		0%		0%
High quality equipment	13	38%	19	56%	1	3%		0%		0%	1	3%
Relevant supporting material	15	44%	17	50%	1	3%		0%		0%	1	3%
Conversation accurately tracked	20	59%	12	35%	1	3%		0%	1	3%		0%
Range of views adequately captured	10	29%	23	68%	1	3%		0%		0%		0%
Adequate time for each section	8	24%	24	71%	2	6%		0%		0%		0%
Facilitator												
Spoke clearly & audibly	17	50%	17	50%		0%		0%		0%		0%
Used appropriate language	17	50%	17	50%		0%		0%		0%		0%
Motivated our group	18	53%	15	44%	1	3%		0%		0%		0%
Provided assistance & support when needed	19	56%	13	38%		0%		0%	1	3%	1	3%
Overall experience												
Understood what was happening	11	32%	23	68%		0%		0%		0%		0%
Felt heard	9	26%	24	71%	1	3%		0%		0%		0%
Enjoyed it	11	32%	22	65%	1	3%		0%		0%		0%
Would speak favourably about it	13	38%	20	59%		0%		0%		0%	1	3%
Comments / suggestions												
Complex issues so next steps not totally clear from today but will be down the line.												
Need clearer outcomes. Need to clarify who will action outcomes. Outcomes appear a bit idealistic.												
Great work Craig thanks.												
I felt it was difficult to clearly define steps - lots of different ideas but was good for discussion & to flesh out ideas.												
Ok, not as good as the early ones.												
First, second & last papers were largely a waste of time.												

Participant feedback

Table #1 notes re research priorities

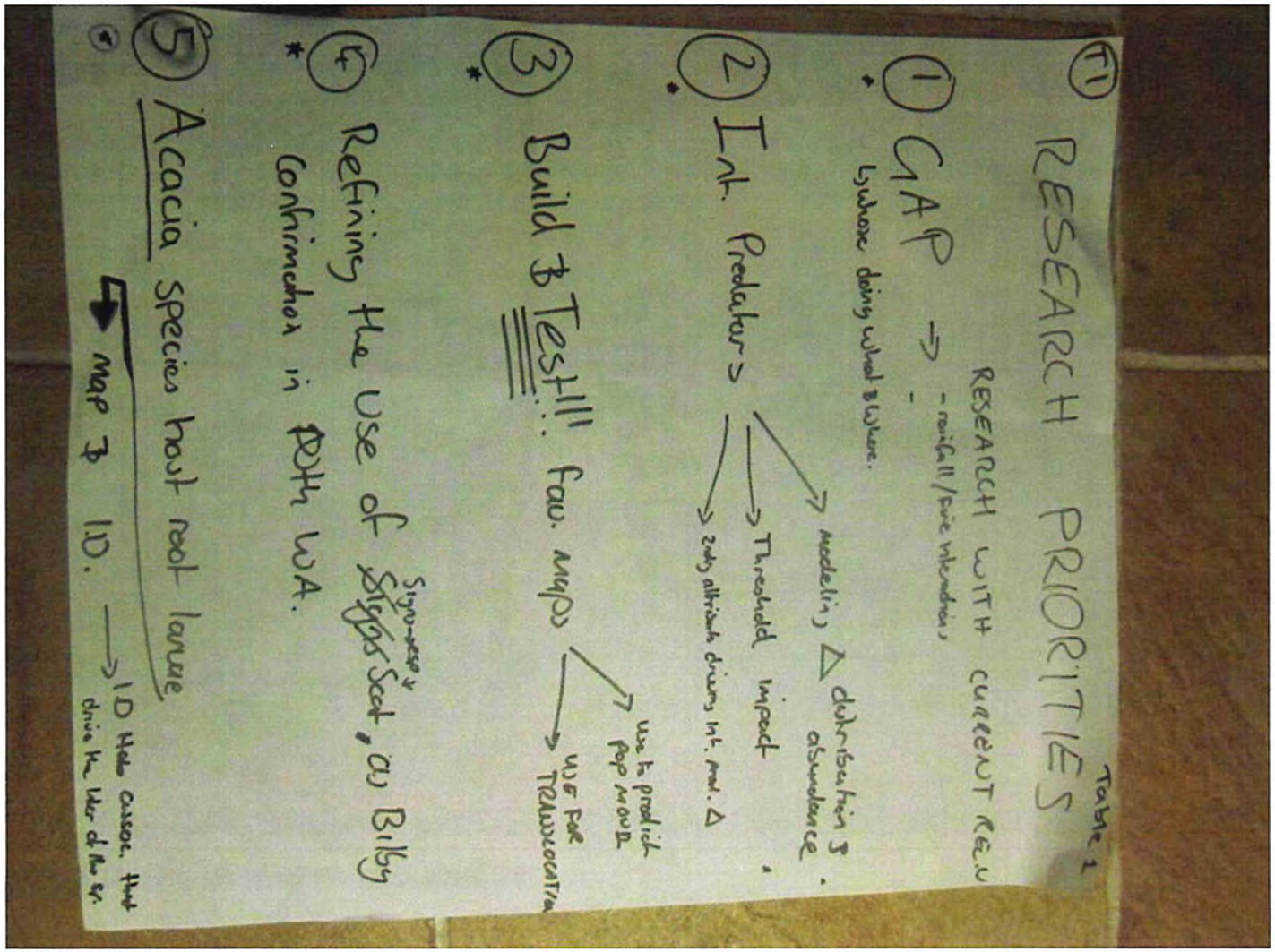


Table #2 notes re research priorities

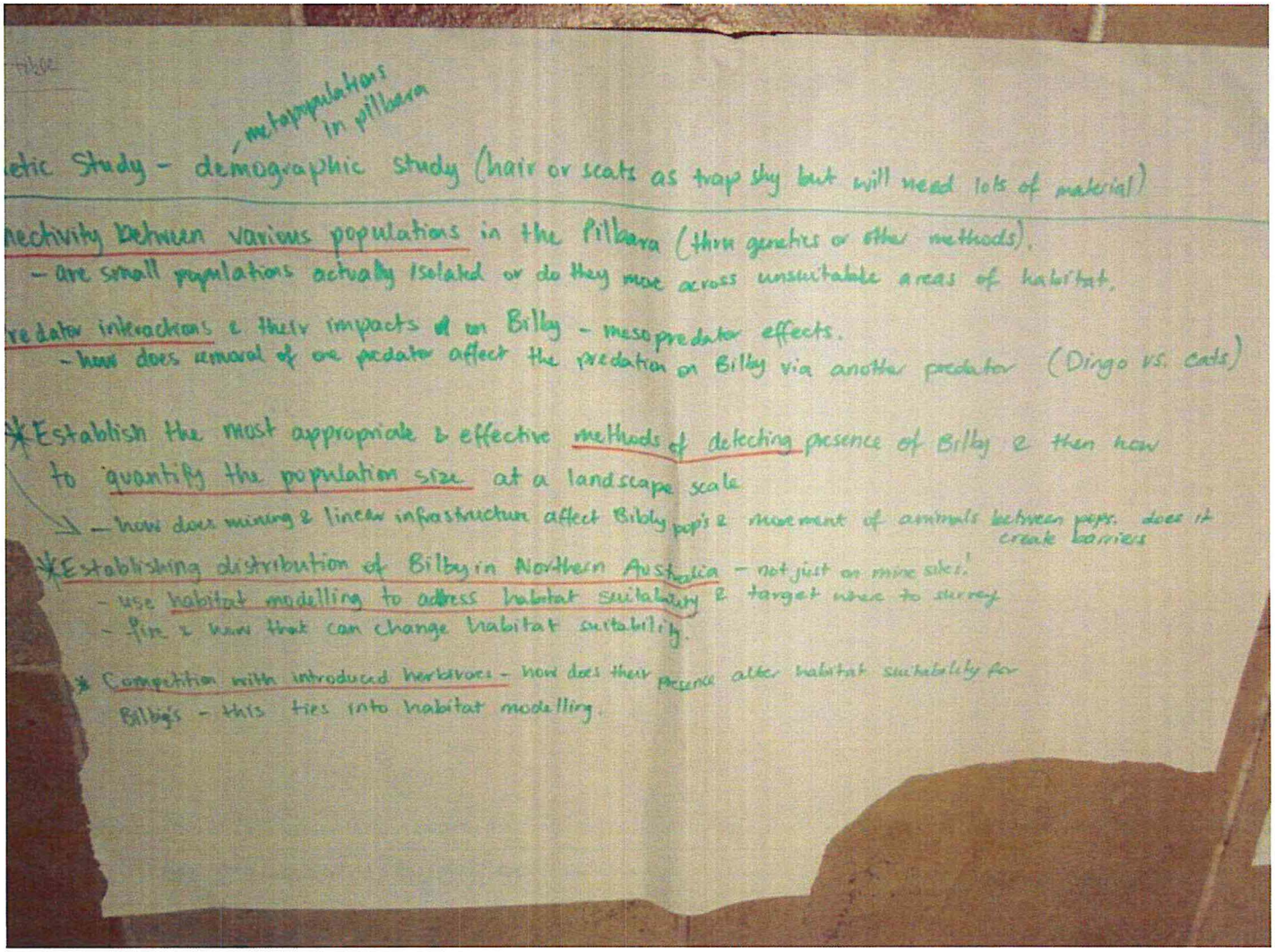


Table #3 notes re research priorities

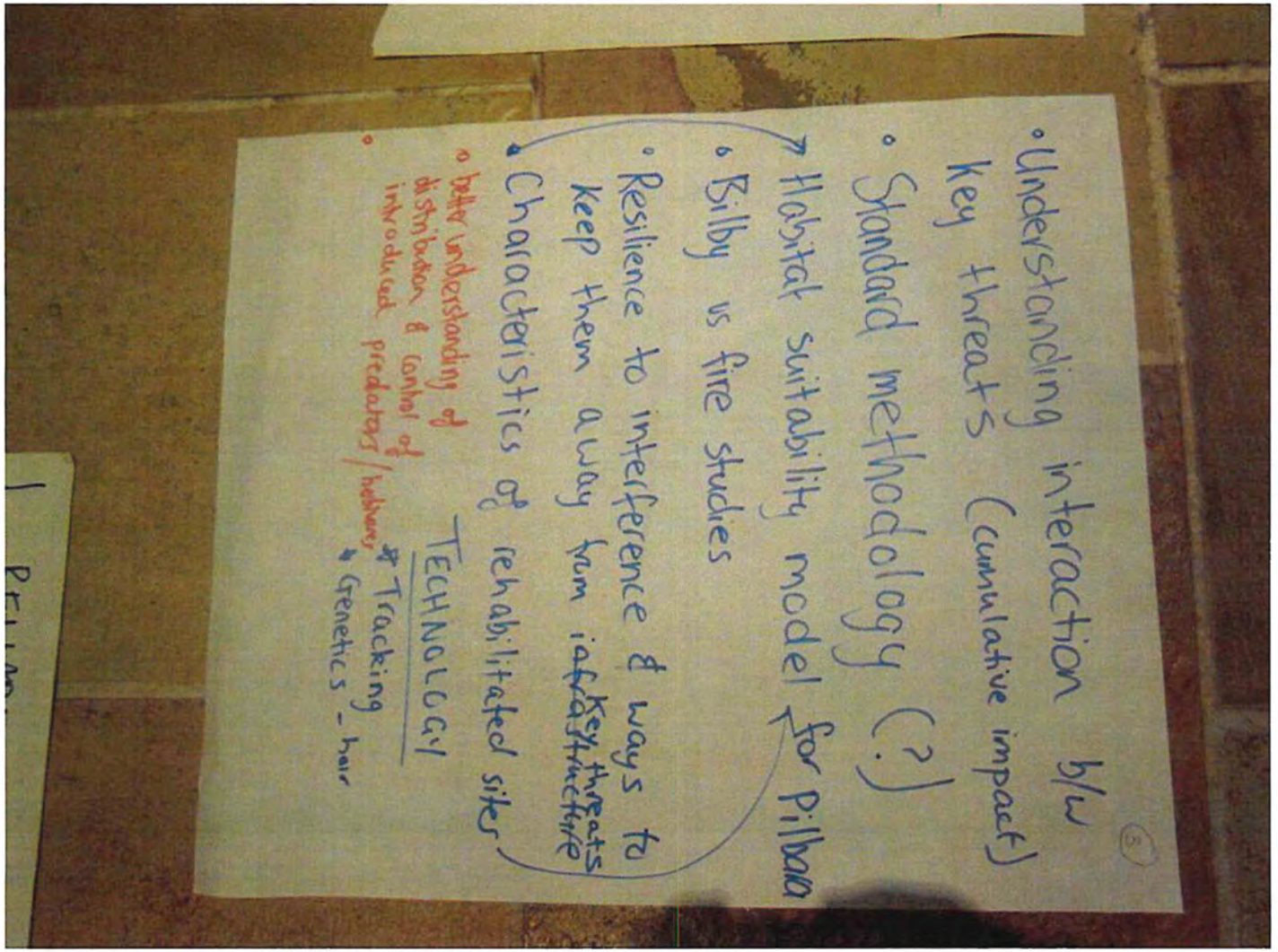


Table #4 notes re research priorities

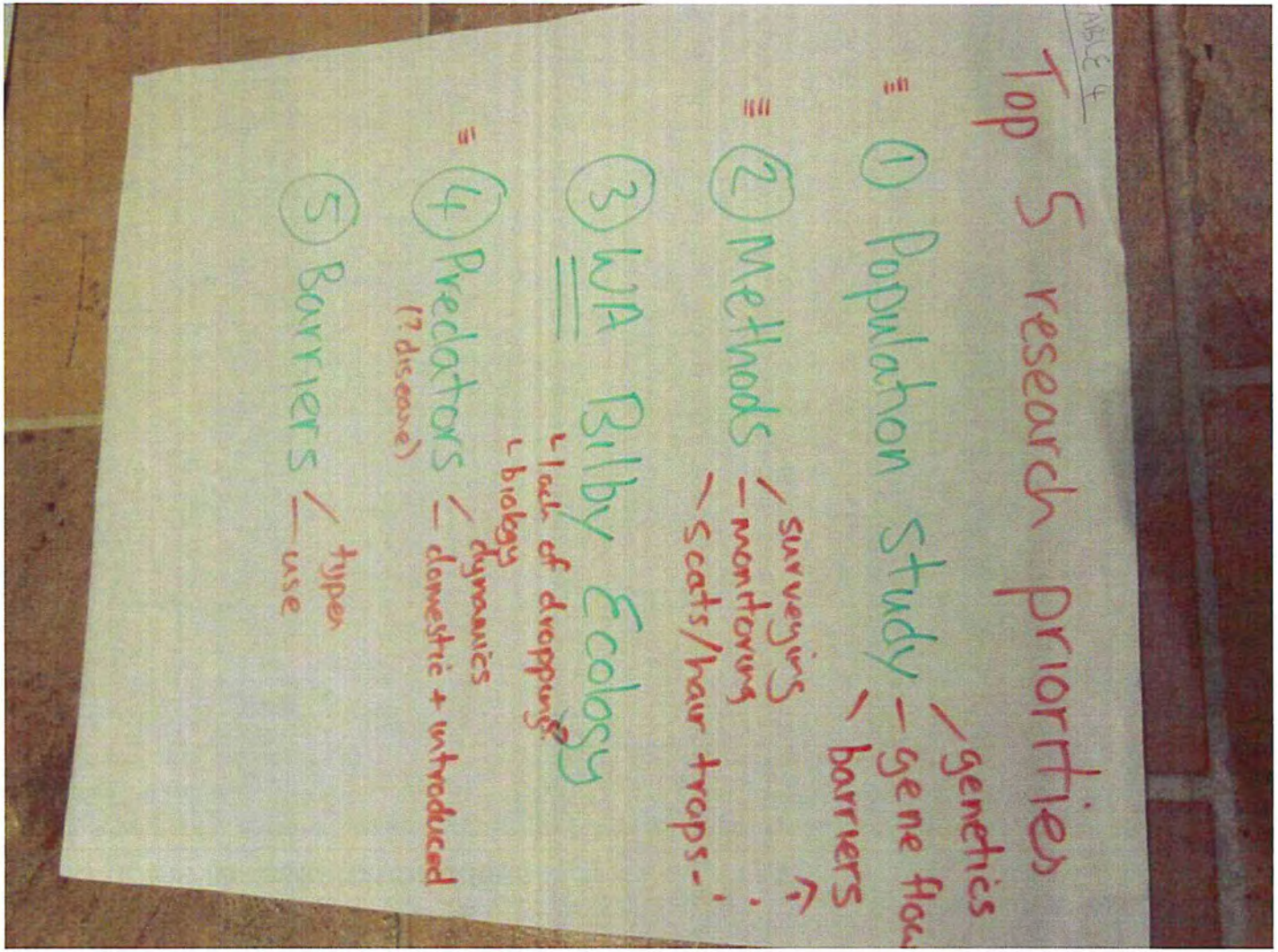


Table #5 or #6 notes re research priorities

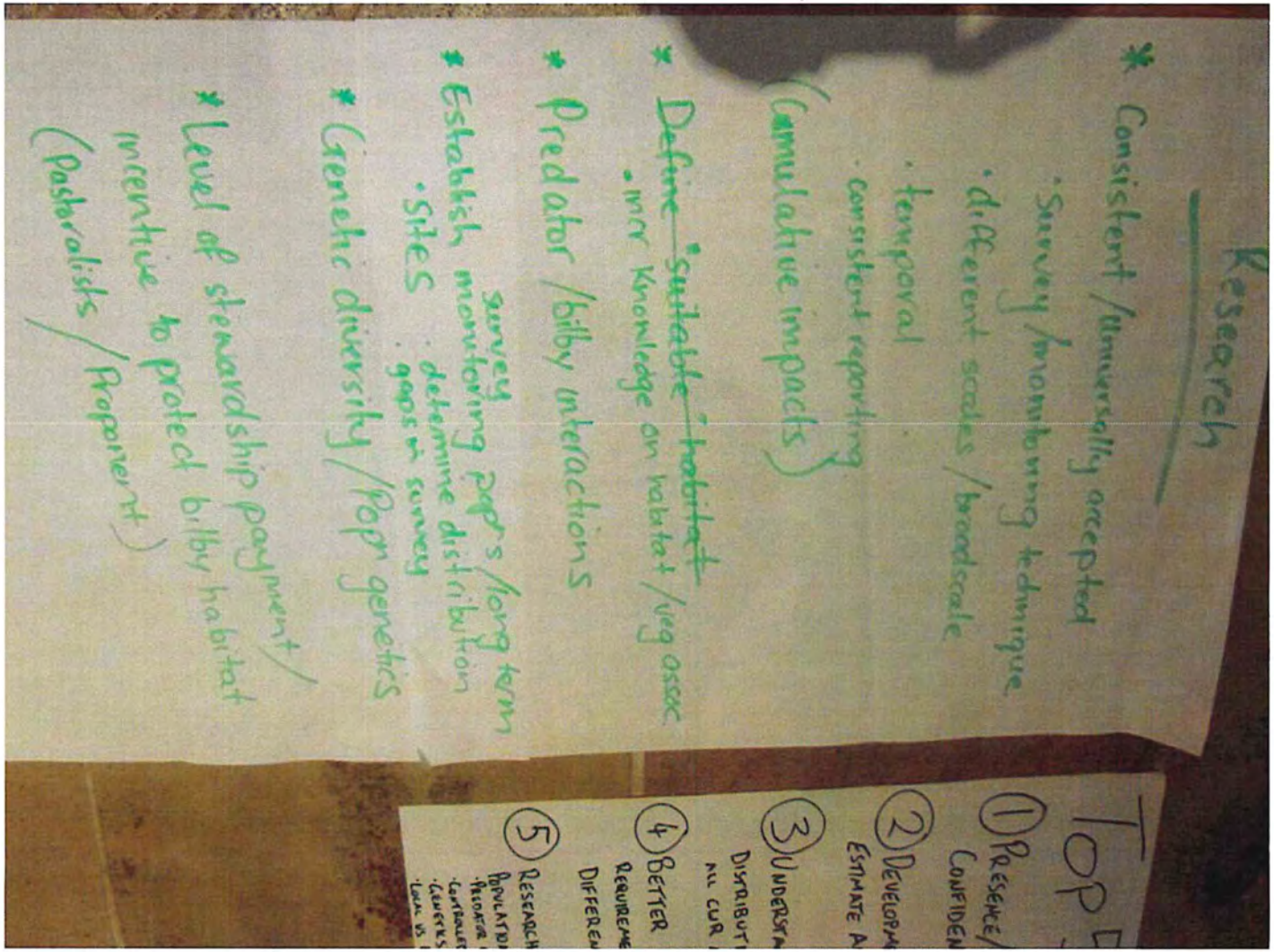


Table #7 notes re research priorities

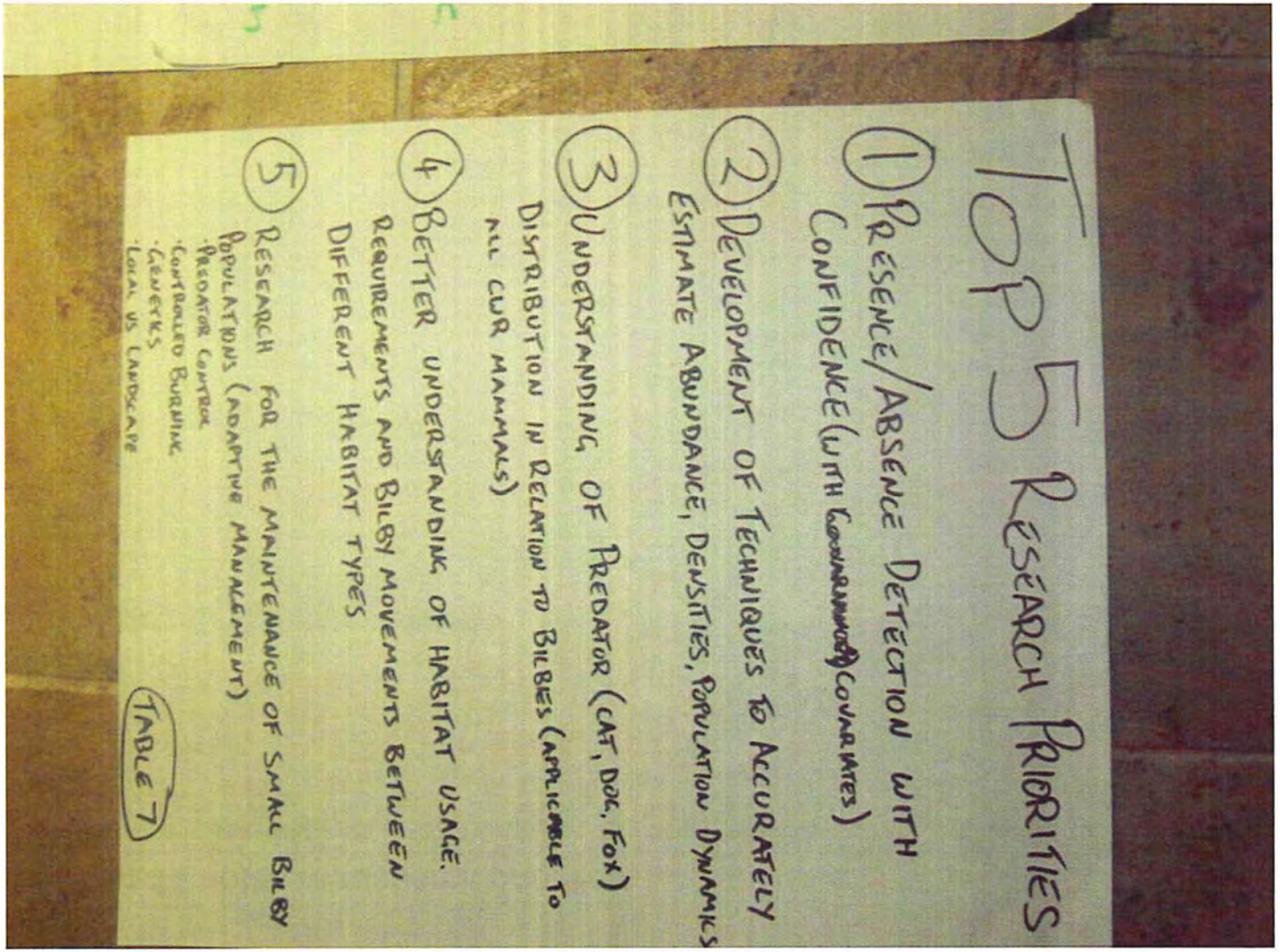


Table #8 notes re research priorities

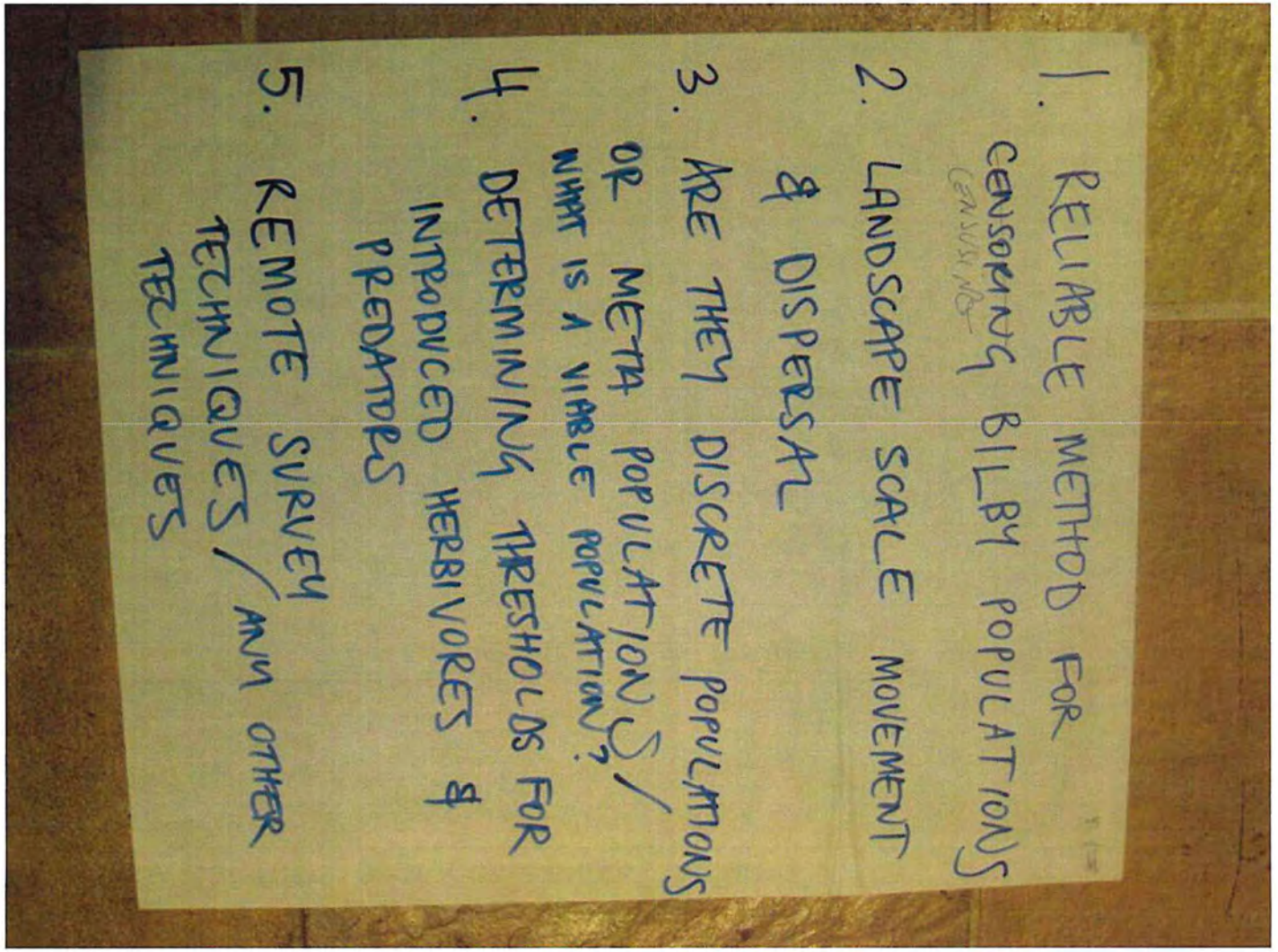


Table notes – 'determine appropriate survey methods'

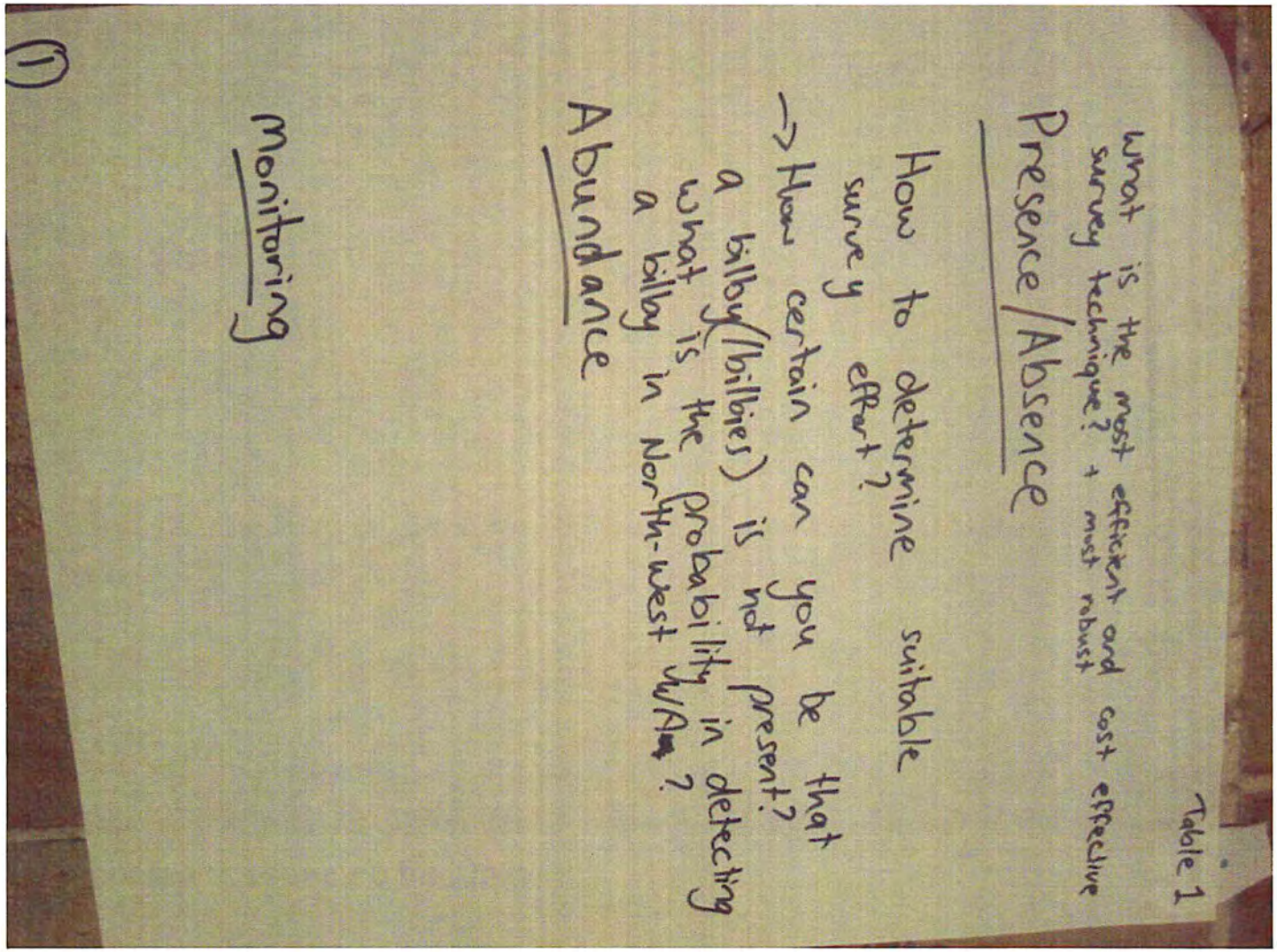


Table notes – 'understand population dynamics'

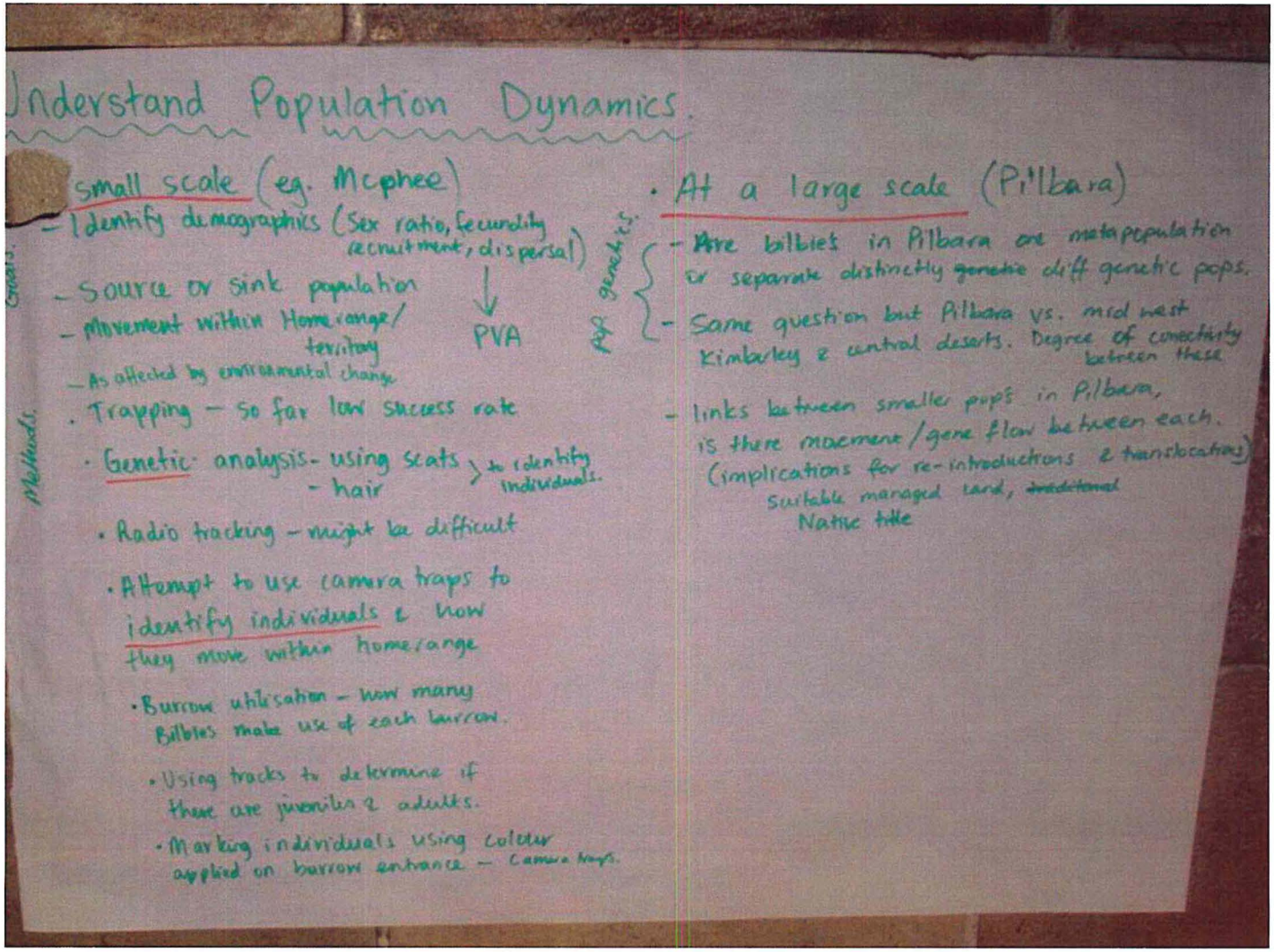


Table notes – 'understand predator impacts'

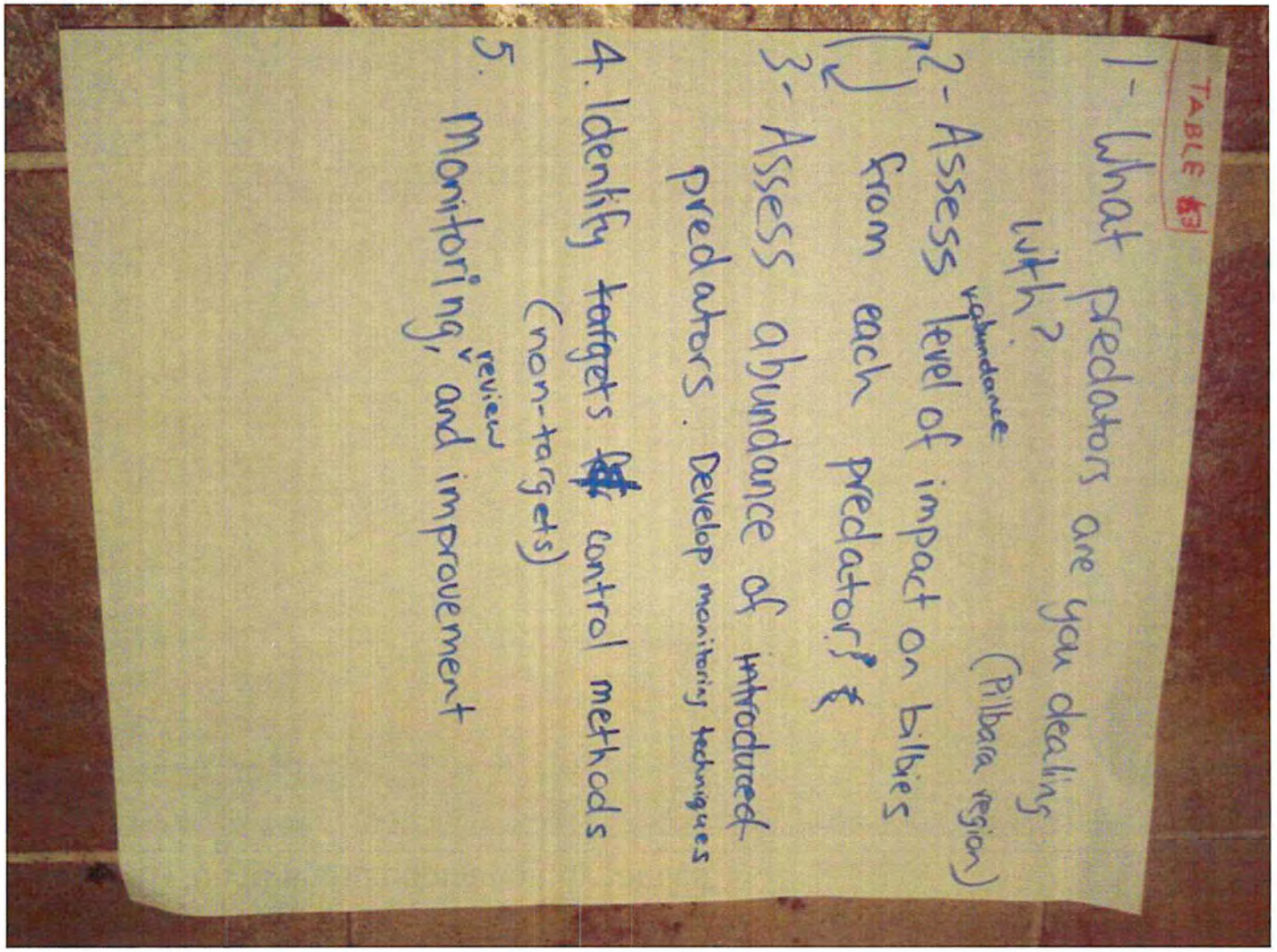
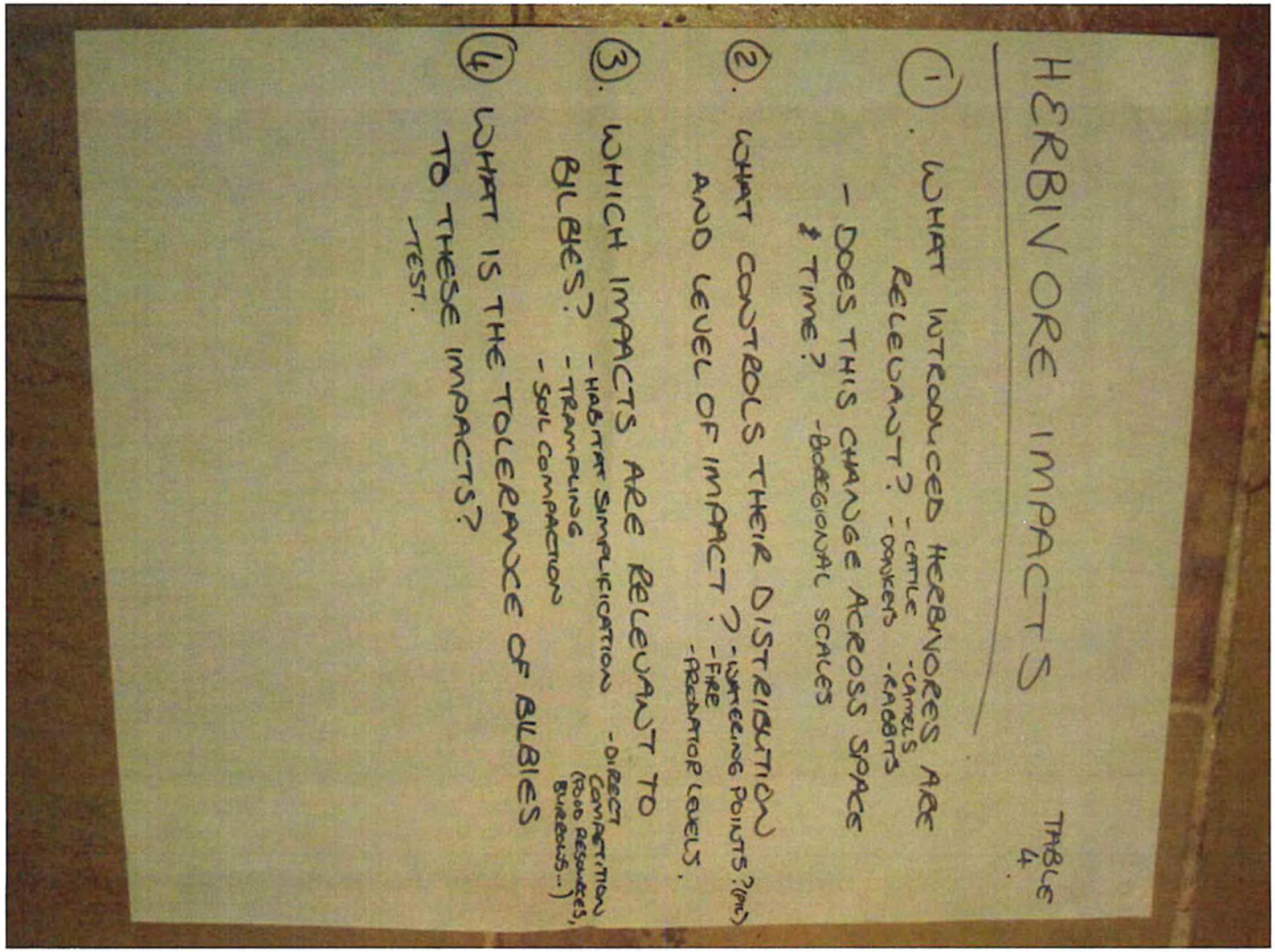


Table notes – 'understand herbivore impacts'



HERBIVORE IMPACTS

TABLE 4.

(1). WHAT INTRODUCED HERBIVORES ARE RELEVANT? - CATTLE -CAMELS -DONKEYS -RABBITS
- DOES THIS CHANGE ACROSS SPACE & TIME? -BIOREGIONAL SCALES

(2). WHAT CONTROLS THEIR DISTRIBUTION AND LEVEL OF IMPACT? - WATERING POINTS? (PM) -FIRE -PREDATOR LEVELS.

(3). WHICH IMPACTS ARE RELEVANT TO BILBIES? - HABITAT SIMPLIFICATION -DIRECT COMPETITION (FOOD RESOURCES, BURROWS...)
- TRAMPLING
- SOIL COMPACTION

(4) WHAT IS THE TOLERANCE OF BILBIES TO THESE IMPACTS?
-TEST.

Table notes – 'understand impact of fire / rainfall regimes'

* consistent protocols
* use existing veg plots

FIRE & RAIN

- Altered fire regimes
  - absence of fire → changes to habitat structure & vegetation.

Pindan → short-lived & weedy respond to fire

Bandicoots – beetle & moths.

Grasses → rain response.

Interaction of rain & fire in maintaining food supply – abundance distribution across landscape.

- Fire refuges — prescribed burns of areas
- Fire-monitoring sites
  - understand plant responses & key indicator spp.

Table 2 – population dynamics
track resource peaks (track bilby pops in tandem with resource peaks)
↓ ↑
pops after

- exptal or opportunistic approach

- Prescribed burns in areas known to have bullies → track veg responses → track bulby response.

Table notes – 'understand habitat requirements'

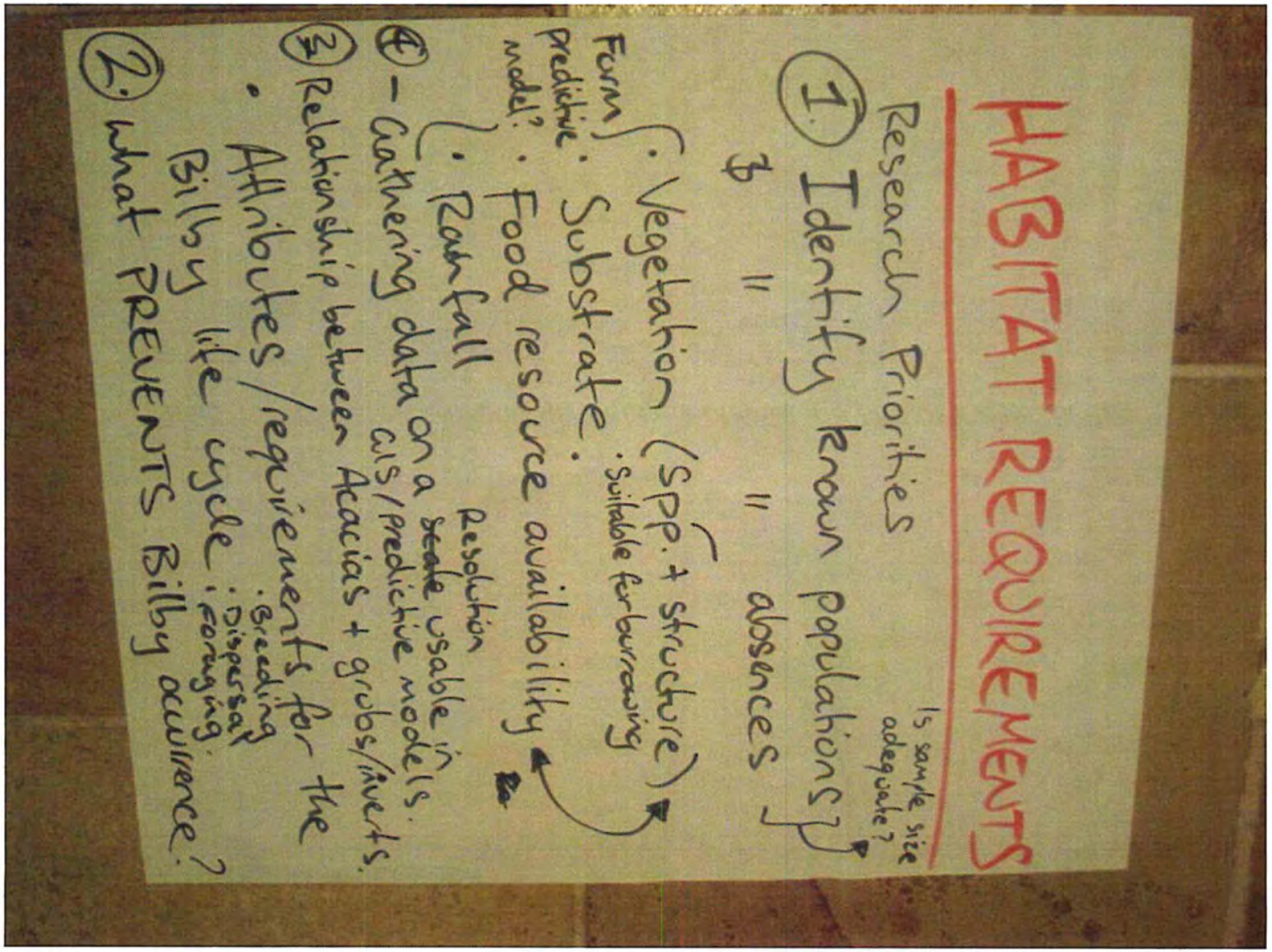


Table notes – 'understand biology'

These notes were inadvertently not collected at the end of the workshop