REPRODUCTIVE DISEASE INVESTIGATION

GUIDELINES FOR PRODUCERS

Northern Australia Biosecurity Surveillance Working Group
Version 1 April 2019

The Northern Australia Biosecurity Surveillance Project is part of the Australian Government's Agricultural Competitiveness White Paper, the government's plan for stronger farmers and a stronger economy.

Table of Acronyms

BCS	Body Condition Score
BEF	Bovine Ephemeral Fever
BHV	Bovine Herpes Virus
BSL	Biosecurity Sciences Laboratory Queensland
BTV	Bluetongue Virus
BVDV	Bovine Viral Diarrhoea Virus
BVL	Berrimah Veterinary Laboratories Northern Territory
CFT	Complement Fixation Test
DDLS	Diagnostics and Laboratory Services Western Australia
EAD	Emergency Animal Disease
ELISA	Enzyme Linked Immunosorbent Assay
EMAI	Elizabeth MacArthur Agricultural Institute New South Wales
IBR	Infectious Bovine Rhinotracheitis
Lepto	Leptospirosis
L1	First Lactation
MAT	Microscopic Agglutination Test
NABS	Northern Australia Biosecurity Surveillance
NABSnet	Northern Australian Biosecurity Surveillance Network
NATA	National Association of Testing Authorities
PCR	Polymerase Chain Reaction
PI	Persistently Infected animal with BVDV
PTIC	Pregnancy Tested In Calf
P4M	Pregnant within 4 Months of Calving
RBT	Rose Bengal Test
SAT	Slide Agglutination Test
Trich	Trichomoniasis
Vibrio	Vibriosis
VNT	Virus Neutralisation Test
VTM	Virus Transport Media

The purpose of this guide is to provide information for producers which can assist with the decision of whether to engage a veterinarian to investigate if a reproductive disease is the cause of low reproductive performance in a beef herd in northern Australia.

A key objective of the guide is to outline the steps required, timeframe, and costs for a reproductive disease investigation in addition to improving producer knowledge of the herd health information which will be required to conduct an investigation. These factors will improve the ability to effectively diagnose disease which may be affecting the reproductive performance of the herd and enable the correct preventive and control measures to be applied.

In addition to identifying and working towards resolving the reproductive problem, engaging a veterinarian to undertake a reproductive disease investigation also allows the herd to be checked for notifiable exotic diseases such as Bovine Brucellosis, abortion causing strains of Bovine Herpes Virus and exotic strains of Bluetongue virus and Pestivirus, which are not known to occur in Australia. This information is a requirement to verify Australia's freedom from these diseases and also supports your property of origin declaration for live export.

Outline of Guide

Acknowledgements

This guide is based on information drawn from research projects relating to reproductive wastage in northern Australia. These projects include Bull Power, Cash Cow, Beef Consultative Research Corporation and Calf Alive. Scientists, veterinarians and producers contributing to these projects and authors` of scientific papers referenced include, but are not restricted to, Geoff Fordyce, Brian Burns, Peter O'Rourke, Richard Holroyd, Michael McGowan, Kieren McCosker, Nigel Perkins, Alistair Henderson, Andrew Brown, Lee Taylor, Ian Braithwaite, David Smith, Kevin deWitte and Sandra Jephcott.

Northern Australia

For the purposes of this guide, the northern Australian beef herd is located north of the Tropic of Capricorn and includes all of the Northern Territory.

It is divided into the following regions based on beef breeding production potential, climate and geography:

- **Tropical north Qld** including Cairns and Normanton
- **Top End/Kimberley** area around Darwin, Katherine and Victoria River District of western Northern Territory and eastern Western Australia
- **North-west Qld** areas from Townsville to Cloncurry
- **Channel Country** of Qld which is the extreme west of Qld from the Qld and South Australian border to Mt Isa
- **Central-west Qld** is north of a line from Rockhampton to Longreach including prominent beef areas around Emerald and Clermont. The Mackay area usually falls into this region.
- **Barkly Tablelands**
- **The arid zone of the Southern Northern Territory**
- **Pilbara** of Western Australia.

The most recent large scale herd reproductive research project 'Cash Cow' utilised country types to categorise properties for analysis of herd reproductive performance and generate benchmarks. Properties with forested land types and fertile soils in the central and south-east regions of Queensland were differentiated into those outside (Southern Forest) and within the Brigalow belt (Central Forest). In northern areas of Queensland, Northern Territory and Western Australia, land types predominated by tree-less black soil downs (Northern Downs) which included parts of central west Queensland and Barkly Tableland were separated from forested land types with low-fertility soils (Northern Forest) which included Northern Queensland and Top End/Kimberley. Figure 1. shows the location of properties participating in the Cash Cow project by country type. The northern Australian regions have been allocated to the most relevant country type representing the region to enable properties to benchmark herd performance.

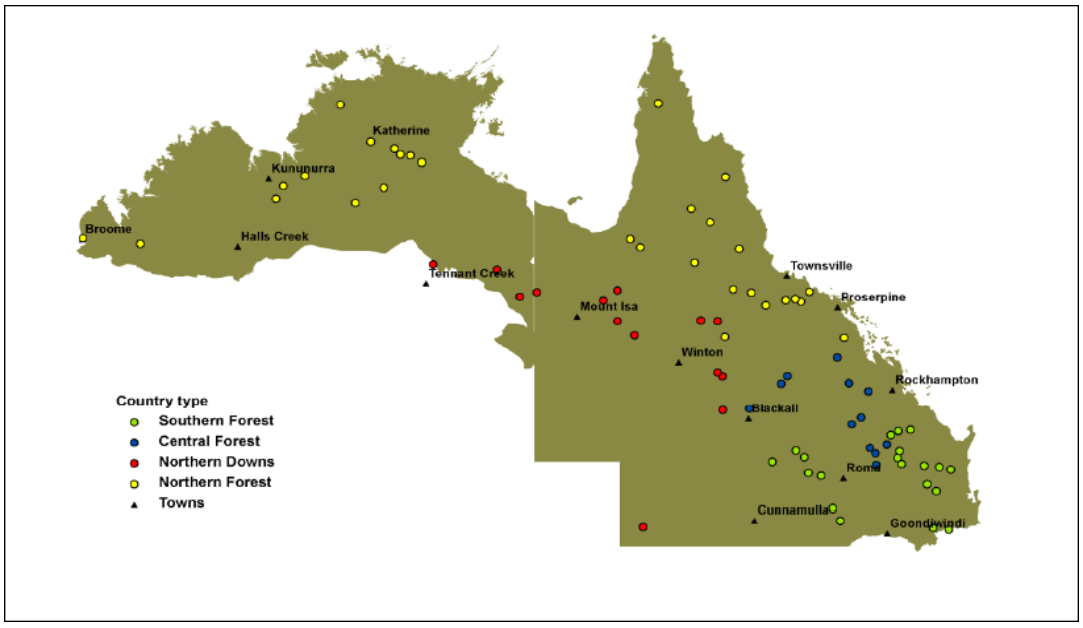

Figure 1. Map showing the approximate locations of country types for the northern Australian beef breeding production regions

Part 1. Reproductive Performance

1.1 Definition of low reproductive performance

Low reproductive performance in commercial beef breeding herds can be defined as:

- Delayed conception after females of an appropriate age and weight are exposed to bulls that have passed a veterinary fertility test, under adequate nutritional conditions
- Excess foetal/calf losses between pregnancy and weaning.
- Mortality of pregnant or lactating cows

Low reproductive performance may be suspected when:

- Pregnancy rates fall below 80% for Cows or 85% for Heifers
- Branding rates fall below 70%
- Weaning rates fall below 65%
- The number of foetuses found exceeds 1%
- The number of dead calves found exceeds 2%

Being able to assess reproductive performance requires good herd record keeping

IF YOU CAN'T MEASURE PERFORMANCE YOU CAN'T MANAGE IT EFFECTIVELY

1.2 Assessment of reproductive performance

When assessing a property for reproductive performance, the performance and production parameters need to be benchmarked against other properties with **similar country types** or **historical performance** within the property being investigated under similar seasonal and management conditions.

Reproductive performance (median achievable level) for specific country types across northern Australia are outlined in Table 1. The range displayed in brackets is the 25th and 75th percentile figures respectively. The 75th percentile figure indicates the achievable level of performance that producers should be working towards for pregnancy testing rates and the 25th percentile figure for foetal/calf loss. The figures are based on properties participating in the Cash Cow project, a major northern Australian cow fertility research project. Four country types were used in the study which have been approximated to correspond with the northern Australian regions. Representative figures are currently limited for Channel country, Arid Zone and Pilbara regions.

These figures can be used for comparison with an individual properties annual pregnancy rate and foetal/calf loss to determine whether there is low reproductive performance in the herd which may require further investigation. Pregnancy rate is the annual percentage of pregnant cows in a management group that are pregnancy tested in calf (PTIC) in a one year period. Foetal/calf loss is identified when a heifer or cow is diagnosed as pregnant in one year and dry (non-lactating) at least one month after the expected calving month the following year. Mortality is estimated as annual percentage of pregnant cows missing without being culled.

Pregnancy rates should to be divided into pregnancy rates for:

- Heifers
- First lactation (L1) cows and
- Mature cows (preferably being not older than 10-12 years depending on breeding history).

Foetal/calf loss between pregnancy and weaning should be divided into loss from:

- Heifers
- L1 cows and
- Mature cows

Heifers and L1 cows can have higher, more variable losses due to dystocia, no previous exposure to reproductive disease, maternal inexperience leading to higher rates of mis-mothering and failure of transfer of passive immunity.

A good indicator of what is a commercially achievable level of performance is the number of lactating cows that became pregnant within 4 months of calving (P4M). This should be **>80%** in more fertile areas and **>50%** in the less fertile areas.

- The median achievable herd pregnancy rates are **85%** on commercial properties in fertile areas, **80%** in black soil areas and approximately **65%** in the less fertile, harder country.
- The median achievable herd foetal/calf losses are **7%** on commercial properties in fertile areas, **10%** in black soil areas and approximately **13%** in the less fertile, harder country.
- The median breeder mortality rates are **6%** on commercial properties in fertile areas, **7%** in black soil areas and approximately **12%** in the less fertile, harder country.

Table 1. Median achievable level of performance for breeders in different country types

Measure	(Southern Forest)	**Central Qld** (Central Forest)	**Barkly Tablelands/ West Qld** (Northern Downs)	**North Qld/Top End/Kimberley** (Northern Forest)
Annual Pregnancy rate herd (%)	85 (76-92)	85 (79-92)	80 (75-90)	66 (55-73)
Heifers Annual Pregnancy rate (%)	89 (75-93)	80 (75-87)	87 (77-94)	67 (40-81)
First lactation cows (L1) Annual Pregnancy rate (%)	84 (68-91)	78 (67-85)	75 (47-86)	43 (21-72)
Mature and aged cows > 4 years old Annual Pregnancy rate (%)	87 (77-93)	88 (79-92)	82 (75-91)	66 (56-74)
P4M (%)* re-breed rate	78 (65-89)	81 (69-88)	76 (69-81)	26 (14-47)
Foetal/calf loss herd (%)	6 (2-10)	7 (5-10)	10 (5-15)	13 (10-19)
Heifers Foetal/calf loss herd (%)	9 (4-14)	10 (4-18)	15 (7-20)	16 (11-19)
First lactation cows (L1) Foetal/calf loss herd (%)	5 (1-7)	7 (4-11)	5 (4-9)	10 (5-14)
Mature and aged cows > 4 years old Foetal/calf loss herd (%)	5 (2-9)	6 (4-9)	7 (3-15)	14 (9-19)

**Definition of P4M is lactating cows that become pregnant within 4 months of calving*

A realistic target weaning rate for tropically adapted cattle in areas of northern Australia with good beef breeding production potential, in average or better rainfall years, is 70-80 calves weaned for each 100 cows mated (70-80% branding). Industry surveys suggest that the majority of beef breeding herds in northern Australia would fall below this mark, as the reported overall annual branding percentage is 63%.

1.3 Causes of low reproductive performance

Reproductive wastage can occur at any time of the reproductive process from joining to weaning. Figure 2 outlines a summary of stages in the reproductive process, the measures of reproductive performance that may indicate a herd problem and the potential infectious diseases that can lead to reduced reproductive performance. More information on individual reproductive diseases is provided in Section 3.3. It is important to note that reproductive wastage is caused by multiple factors and is primarily associated with risk factors other than infectious disease. These risk factors are discussed in more detail in Section 1.4.

Figure 2. Shows the stages in the reproductive process, measures of reproductive performance that may indicate a problem is present and the potential infectious diseases that may be associated with the reduced reproductive performance

<table>
<tr><td>Stage in reproductive process</td><td><u>CONCEPTION</u></td><td><u>PREGNANCY</u></td><td><u>BRANDING</u></td><td><u>WEANING</u></td></tr>
<tr><td rowspan="4">Measurement of reproductive impact which may indicate a problem</td><td>Re-breed rates lower the expected
60% in mature cows
40% in first calf cows</td><td>Annual pregnancy rate <80%
Heifer pregnancy rate <85%
First lactation pregnancy rate (re-breed rates) <40%
Lactating mature cow pregnancy rate (re-breed rate) <60%</td><td>Branding rate <70%</td><td>Weaning rate <65%</td></tr>
<tr><td>Foetal aging/calving patterns delayed or unusual</td><td colspan="3">Observation of >1% aborted foetus’s or >2% dead calves in a short time frame</td></tr>
<tr><td rowspan="2"></td><td colspan="2">Loss between positive pregnancy test and branding >15% in one year or averaging >7% over a 3 year period. (NB first lactation cows can be up to 20% without one particular abnormality)</td><td></td></tr>
<tr><td colspan="3">Loss between positive pregnancy test and weaning >15% in one year or averaging >12% over a 3 year period (NB first lactation cows can be up to 25% without one particular abnormality)</td></tr>
<tr><td>Infectious Disease</td><td>BEF
Vibriosis
Trichomoniasis
BHV-1/BHV-5/BHV-6</td><td>Akabane
Leptospirosis
Neosporosis
Brucellosis (exotic)</td><td></td><td></td></tr>
<tr><td colspan="2"></td><td colspan="2">BVDV-1 (incl BVDV-2 exotic strain)
BHV-1 (exotic strains causing abortion)
Clostridial diseases</td><td>BHV-1.2b (IBR)/BHV-5</td></tr>
<tr><td colspan="5">MULTIFACTORAL CAUSES to a REPRODUCTIVE PROBLEM so recommend PRODUCER QUESTIONAIRRE completed – queries about property, management, nutrition, environment and disease to confirm or deny that further disease investigation is needed.</td></tr>
</table>

The key events in the reproductive process when reproductive wastage occurs include:

- **Infertility/embryonic mortality**
- **Abortion**
- **Neonatal mortality**
- Pre-branding loss
- Post-branding loss
- Cow mortality

Table 2. Key events in reproductive process, measure and potential cause of reproductive wastage

Event in Reproductive Process	Reproductive wastage	Cause
Infertility/embryonic mortality		
Embryonic loss (Day 0–45)	• 10% but could be higher depending on number of bulls infected and unvaccinated /naïve females. • Delayed conception patterns leading to smaller weaners	• Vibrio and less commonly Trich
Delayed conception and low annual pregnancy rates and re-breed rates. This is particularly seen in heifers and lactating cows. In lactating cows, the age group most commonly seen with low re-breed rates are first lactation (L1) cows.	• 20 – 30% reduction in conception and or delayed conception so heifers are calving at wrong time of year nutritionally • Up to 40% reduced conception. Out-of-season (Jul – Sept) calving can have 50% lower re-breed rates than cows calving in Oct – Dec. • 10% but could be higher depending on number of bulls with low fertility and level of disease. • High grade Brahmans have 10% lower re-breed rates than cows with <50% Brahman • First lactation cows can have up to 30% lower re-breed rates than mature breeders	• Vibrio, Trich, BEF, BVDV, BHV • Age at puberty and joining weight • Low bodyweight and body condition score (BCS) cows • Grazing management, P status, month of calving
Abortion		
Foetal abortion (Day 45 – Birth)	• 10% but could be higher in epidemics	• Vibrio, Trich, BEF, BVDV, Lepto, Neospora, Akabane, Brucellosis
Calf born dead	• 10% but could be higher in epidemics	• BVDV, Lepto, Neospora, Akabane
Post-natal calf death		
Calf loss (Day 0-30)	• Up to 10%	• BVDV, Lepto, Neospora, Akabane • heat stress, cow BCS and predation (wild dogs)
	• Up to 10%	• Mustering time, method, handling
	• Up to 20%	• Cow culling policy e.g. calf rearing ability including low udder structure and bottle teats

Event in Reproductive Process	Reproductive wastage	Cause
Pre-branding Loss		
Loss between Calving – Branding	• Up to 10%	• Dystocia
	• Up to 10%	• Mis-mothering/low mothering ability /calf vigour
From Day 0-30, calves are highly susceptible to infection, dehydration and death.	10% but could be higher in epidemics	• Infectious diseases – outlined above
	• Up to 5%	• Predation (wild dogs)
	• Up to 10%	• Mustering time, method, handling
	• Up to 7%	• High heat stress during time of calving
	• Up to 20%	• Cow culling policy, ie calf rearing ability including low udder structure and bottle teats
	• Up to 10%	• Grass availability (<2 tonnes/ha at beginning of dry season), P deficiency, grass quality. This all can result in low BCS
	• 4% higher foetal/calf loss in subsequent years.	• Cow lactation status in the previous year e.g. lost a calf or foetus in the previous year
		• Inherited defects, stress, toxins
Post-branding Loss		
Calf loss (Branding-Weaning)	• 2-5%	• Clostridial diseases and dehorning/castration infection
	• Up to 10%	• Mustering time, method, handling
	• Up to 10%	• BVDV, mis-mothering, heat stress
Cow Mortality		
Cow / heifer mortality while pregnant or lactating	• Up to 25% unvaccinated/non-immune	• Botulism and tick fever
	• Up to 10%	• Low BCS, particularly pregnant cows
	• Up to 10%	• Dystocia
	• 6%	• Cow age
	• Up to 100%	• Toxins such as urea poisoning or poisonous plants

1.4 Major risk factors relating to low reproductive performance in beef herds in northern Australia

In northern Australia, reproductive wastage is caused by multiple factors and is primarily associated with risk factors other than infectious disease. Understanding what these risk factors are and what impact that each risk factor may have on reproductive wastage in your herd is critical prior to initiating a reproductive disease investigation.

The impacts of over eighty property, management, nutritional, environmental and infectious disease risk factors on reproductive performance were investigated in the Cash Cow project. The major factors affecting performance are outlined in Table 3. Strategies to address these risk factors to maximise reproductive performance are outlined in Appendix 1.

Three diseases (Bovine Viral Diarrhoea Virus (BVDV) also known as Pestivirus, Vibriosis and Botulism) are considered to be a moderate risk leading to greater than 5% reproductive wastage. Three diseases (Neosporosis, Akabane and Leptospirosis) are considered to be a low risk contributing to less than 5% reproductive wastage. Five other diseases (Trichomoniasis, Tick fever, Tetanus, Bovine Herpes Virus (BHV) and Bovine Ephemeral Fever (BEF) also known as Three day sickness) are also considered to be low risk. Although the diseases are not thought to significantly contribute to reproductive wastage in a herd, they have been identified as priority endemic diseases with some having a medium to high economic impact.

Table 3. Major risk factors ranked by level of reproductive wastage

Highest risk factors (>20% increase in reproductive wastage)	**Moderate risk factors** (>5% increase in reproductive wastage)	**Lowest risk factors** (<5% increase in reproductive wastage)
INFECTIOUS DISEASE RISK FACTORS		
	• BVDV (incl exotic) • Vibriosis • Botulism	• Neosporosis • Akabane • Leptospirosis • Trichomoniasis • Bovine Herpes Virus (incl exotic) • Bovine Ephemeral Fever • Tick fever • Clostridial diseases
PROPERTY, MANAGEMENT, NUTRITIONAL AND ENVIRONMENTAL RISK FACTORS		
Teat/udder conformation Vit A deficiency	• Body Condition Score < 3 mid pregnancy • Mustering efficiency <90% • Mustering first lactation cows within 2 months of calving month • No dry season segregation based on foetal age • Breeder mob size > 800 head • Cows age >9 years of age • Dystocia • Cows calving between June and September • Low birth weight and low calf vigour • Country type • Low herd phosphorus	• Cows with large frame score (hip height >140 cm) • Mustering mature cows within 2 months of calving month • Failed to lactate in year after diagnosed pregnant • No follow up rain within a month after first storms at end of dry season • Pasture available <2 tonnes/ha in early dry season • Low protein dry season feed, ie crude protein CP:DMD dry matter digestibility ratio < 0.125 • Temperature humidity index (THI) >79 for >2 weeks in month of calving • Wild dog predation • Dehorning

Part 2. Reproductive Disease Investigation

2.1. Steps involved in Reproductive Disease Investigation - Producer

When a reproductive disease problem is suspected in your herd, there are benefits to having an established relationship with a local cattle vet, detailed herd records and historical monitoring of the reproductive performance of the herd.

Standard Operating Procedure

1. Assess the reproductive performance of your herd and benchmark against other properties within similar country (Section 1.2) if herd records are available.
2. Contact your vet to discuss the problem and identify whether a reproductive disease investigation is needed.

Cattle veterinarians working in the region will know which cattle reproductive diseases are most likely to cause a problem based on the information available. They will also have a good working relationship with regional laboratories and will know what samples to take and how to get them to the laboratory in a timely manner. A network of private northern Australian cattle vets has been established with the skills, experience and resources to undertake significant disease events impacting herd health. A list of these vets is available at http://nabsnet.com.au/

3. Obtain all the records required for the investigation and/or initiate additional herd recording requirements. Complete the Producer Questionnaire (Appendix 2) and review the level of Herd Records (Appendix 3) currently available.
4. Contact vet when all the required records have been obtained to arrange a visit.
5. Work with the veterinarian to provide the cattle for examination and sampling and herd records.
6. Review the non-disease risk factors (Appendix 1) and implement changes as appropriate.
7. Ask the veterinarian for exotic disease testing to be undertaken for relevant reproductive diseases.
8. Ask the veterinarian to provide a report with the laboratory results, the interpretation of the results, a diagnosis and recommendations for management.
9. Consider the options for prevention and control of reproductive diseases and implement the most appropriate strategies budget allows.
10. Monitor the reproductive performance of the herd and assess the impact of any changes implemented.

2.2. Information for Reproductive Disease Investigation

Reproductive wastage in northern Australian beef herds is primarily due to property, management, nutrition or environmental factors. Information is required to determine whether the cause of low reproductive performance is associated with an infectious disease in addition to the non-disease factors. A reproductive disease investigation and the collection of samples for laboratory testing may be unnecessary because implementing management changes for other risk factors may reduce reproductive wastage. The key information required by the veterinarian for investigation is outlined in Table 4 and can be sourced from:

- Herd data records
- Producer questionnaire which identifies other epidemiological herd information

Table 4 Summary of key information when investigating a disease problem includes:

Animal data	Property data	Management info
Pregnancy diagnosis	Land condition	Supplement
Joining Weight for heifers	Pasture assessment	Bull management
Body condition score	Weaning weight	Vaccinations
Lactation status	Rainfall	Wild dog control
Hip Height / Frame Score	Temperature	Mustering technique
Age	Dung samples (NIRS)	Genetic selection
% *Bos indicus* content	Water distribution	Culling policy
Udder structure, including teats		Joining policy (controlled) and dates
Disease prevalence		Weaning management
		Herd records

Herd data records

Herd records provide accurate data to assist producers and other advisors in making herd management decisions. Some cattle properties maintain records on a software program operated crush side by a technician during procedures such as pregnancy testing. Others record hard copy data crush side and transfer data to electronic form in the office. Some properties may not have detailed individual animal records.

Insufficient records can directly impact the outcome of a reproductive disease investigation. Major challenges to assessing the reproductive performance of extensively managed breeding herds include the reality that breeding females are often only mustered once or twice a year and herds are either continuously mated or employ long joining periods. Determining whether a pregnant female has reared a calf is an assessment of her lactation status at the time of each round of weaning but this also depends on individual identification and recording the information either electronically via NLIS tags or manually.

Herd records are essential to enable the assessment of the impacts of management, nutritional, environmental and infectious disease factors on:

- how efficiently cows become pregnant,
- the likelihood of pregnant cows rearing a calf and
- the likelihood of cow mortality

Appendix 3 Herd Records outlines different levels of herd recording and the potential diagnostic benefits for increasing levels of data.
The basic records needed to effectively determine the cause of reproductive wastage include:

- pregnancy testing - foetal ageing, lactation status (wet/dry) to calculate calf loss and body condition score (BCS)
- cattle numbers by class (branders, weaners, heifers, first lactation cows, older cows) and average weight annually
- number of stock sold and purchased by class and average weight

It is vital that dates are recorded with the data and/or activities are recorded in a diary. Data recorded needs to be translated into meaningful information that dictates management decisions. Use simple recording templates to count breeders, record pregnancy, count calves branded and weaned. A graphic illustration of these records can show producers where losses are occurring and where investigation, including diseases, should be focused.

Other Information - Producer Questionnaire

A questionnaire completed by the owner/manager provides information which may not be readily available in herd data records and is directly relevant to the current situation being

investigated. Completing the Producer Questionnaire (Appendix 2) will assist the veterinarian with identifying whether a reproductive disease investigation should be initiated. The questionnaire should be completed before samples are collected and definitely before samples are sent to the laboratory for reproductive disease testing.

2.3. Timing for Reproductive Disease Investigation

To minimise the management and mustering costs associated with a reproductive disease investigation, it is recommended that any investigation should be undertaken when mustering and management procedures are scheduled. Unfortunately a low level of reproductive performance is often not apparent until after pregnancy testing and branding/weaning when the herd data records are reviewed. Regular monitoring of the herd performance is an important management practice to enable investigations to be initiated when a problem is first noticeable. It can also take time to gather the information, so the investigation may be initiated in the following round of mustering. The problem may also not be obvious for a number of seasons, so maintaining and reviewing historical records is also important when investigating low reproductive performance. Samples for diagnostic testing can be collected when cattle are in the yards, or cattle can be drafted off and held if necessary or when foetuses or dead calves are found in the paddock or in yards.

Aborted foetuses/calf loss

Under normal extensive conditions it is very rare to find aborted foetuses in the paddock due to predation. Foetal remnants are most commonly seen in yards or on trucks following transport. It is critical that the aborted foetus or dead calf are collected for examination immediately and the associated heifer/cow identified and held in the yard or following transport are also available for sampling.

Samples from bulls

Opportunity for sampling bulls usually occurs when bulls are being examined prior to joining or during pregnancy testing or mustering for other management purposes.

Samples from heifers and cows

It may become apparent during pregnancy testing that there may be a problem e.g. lower than expected pregnancy rate, delayed pregnancy, evidence of infection or reabsorbing foetal remnants. If the pregnancy testing is being undertaken by a veterinarian, then samples for disease testing can be taken at the same time or cattle drafted off and held in yards until sampling equipment can be sourced.

If the pregnancy testing is being undertaken by a producer, then contact will need to be made with a veterinarian to discuss the investigation and potential sampling options. Most producers will not have access to the sampling equipment required for a reproductive disease investigation.

In some cases, veterinarians will collect samples from suspect animals during pregnancy. These samples may not be submitted to the laboratory immediately. They may be submitted following analysis of the pregnancy testing results showing poor performance or they may be submitted the following year if the mob's pregnancy or calving results are significantly different. Alternatively, samples can be taken from the same mob in consecutive years to give comparative results.

2.4. Costs for Reproductive Disease Investigation

Reproductive disease investigations can be expensive to undertake. In addition to the costs for the veterinarian to investigate the problem, there are laboratory testing costs and possible additional mustering or holding costs associated with sampling or resampling.

The Guide for Reproductive Disease Lab Tests and Costs (Appendix 4) outlines the costs for individual sample tests for reproductive diseases available at each of the State Veterinary Laboratories for northern Australia. The testing costs for an infertility investigation for 3 diseases for 10 animals is approximately $1500.

Currently, samples tested for **exotic notifiable diseases** BVDV-2, BHV1.1 and 1.2a, Brucellosis (*Brucella abortus*) and exotic Bluetongue virus serotypes are free of charge.

Most laboratories charge for other reproductive diseases tests including Vibriosis, Trichomoniasis, BVDV-1, Leptospirosis, Neosporosis, Infectious Bovine Rhinotracheitis (IBR), BHV1.2b, Akabane, BEF and other diseases.

Part 3. Best Management Practice

3.1 General recommendations

The Northern Beef Program provides key recommendations to achieve optimum reproductive performance in northern Australian beef herds with a Heifer Program focused specifically on maximising heifer performance.

3.2 Reproductive Disease Recommendations

- Monitor the reproductive performance of your herd against the median achievable level for properties in similar country (Table 1). Contact a veterinarian to discuss investigating the problem if your herd has lower than expected performance and you are concerned; bulls, heifers or cows have symptoms consistent with reproductive infectious diseases during bull testing or pregnancy testing; or aborted foetuses or deformed calves are found
- Maintain sufficient herd records to enable your herd performance to be assessed
- Undertake bull testing and pregnancy testing in your herd
- Understand the reproductive disease risk factors and apply preventative measures where budget allows:
    - Vibriosis vaccination for bulls and heifers if Vibriosis is known to be a problem
    - Pestivirus strategy Guidelines for investigation and control of BVDV
    - Annual 7-in-1 vaccination for breeders (Leptospirosis and Clostridial diseases) or 5-in-1 if your veterinarian advises
    - Botulism vaccination strategy to reduce breeder mortality
    - Tick fever vaccination in marginal cattle tick areas and for new introductions to cattle tick areas.
    - BEF vaccination for new introductions of bulls from BEF virus free regions
- Ask your veterinarian to test for exotic notifiable diseases to support your cattle property disease free status when undertaking other reproductive disease testing.

3.3 Reproductive Disease Factsheets

A number of simple information sheets for key reproductive infectious diseases are available to assist producers with understanding the important diseases, the potential impact on

reproductive performance in the herd and what can be done to prevent disease entering the herd or to control disease when it is present within the herd. The **Factsheets** outline the:

- Cause
- Northern Australian distribution
- Symptoms
- Reproductive impact
- Sampling and diagnosis
- Prevention and control measures

Akabane Factsheet

BEF Factsheet

Brucellosis Factsheet

BVDV Factsheet

Bovine Herpes Virus Factsheet

Leptosporosis factsheet

Neosporosis Factsheet

Trichomoniasis Factsheet

Vibriosis Factsheet

APPENDIX 1 - PROPERTY, MANAGEMENT, NUTRITIONAL AND ENVIRONMENTAL RISK FACTORS CAUSING REPRODUCTIVE WASTAGE

In northern Australia, reproductive wastage is caused by multiple risk factors.

A **risk factor** is any measurable attribute, characteristic or exposure of an individual that increases the likelihood of developing a disease. In this case, it is any factor that the animal has or is exposed to which contributes to reducing the reproductive performance of the animal and herd.

In many cases, low reproductive performance is associated with risk factors other than infectious disease, and a costly reproductive disease investigation may not provide a simple disease diagnosis. Making changes to these "other" factors can have a significant impact on improving herd reproductive performance. A number of strategies which are utilised by high performing herds for these key risk factors are outlined below.

Risk factors causing high levels of reproductive wastage

1. **Teat and udder conformation**

Cull cows with bottle teats irrespective of pregnancy status; cull cows >9 years old; and identify and cull cows that failed to lactate in year after being diagnosed pregnant irrespective of current pregnancy status. Undertake careful selection of heifers and purchase of bulls as bottle teats are highly genetic.

2. **Prolonged dry period with cows having no access to green forage containing vitamin A**

During prolonged dry periods, particularly after consecutive low rainfall years on treeless plains ensure vitamin A is included in any supplementary feed. If necessary, give pregnant cows a **vitamin A injection**

Risk factors causing moderate levels of reproductive wastage

3. **Low body condition score (BCS) -** < 3.5 in cows > 3 months pregnant (BCS 1 – 5 scale) can result in low calf birth weight; low calf vigour and dystocia. It will also significantly reduce re-breed rates; prolong inter-calving intervals; and reduce annual pregnancy, weaning and branding rates. Falling condition in late pregnancy predisposes to ketosis and death. Consider drafting off cows in last trimester of pregnancy and providing supplementary feed

Match stocking rate to carrying capacity. At the end of the wet season, assess available forage regarding quantity (kg/ha) and quality (protein and digestibility) and adjust stocking rate, by selling cattle if necessary, according to calculation on what stock will consume over the six-month dry season when there is no grass-growing rain. Pasture quality can be assessed by taking faecal samples and sending them away for NIRS analysis. Department of primary Industry can provide training and information on how pasture quantity can be assessed in kg/ha.

Implement dry season cow segregation based on foetal age and preferentially supplementing cows calving between June and September when nutrition is of low quality and quantity. Supplementing cattle with non-protein nitrogen, e.g. urea, during the dry season or year round in arid zones will improve utilisation of low digestibility and low protein grasses.

4. **Mob size and mustering -** Mob size can affect activities like grazing patterns, access to water and shade and stress of mustering and yard work. Breeder mob size > 800 cows, mustering technique, mustering timing and infrastructure.

Reduce the size of the breeder mobs, develop infrastructure and implement breeder segregation.

Breeder mobs should not be >800 head.

Yards should be no further than 20km apart so cows and calves do not have to walk further than 10km.

Waters should be no further than 6-8km apart so cows and calves only have to walk a maximum of 3-4km to graze and get a drink.

Mustering should be done in a planned, steady manner and cows and calves should not be rushed.

Where appropriate, implement dry season cow segregation based on foetal age so cows are not mustered when calves are <2 months old. If these mitigation strategies are implemented, calf loss may be reduced by more than 10%, particularly with first lactation cows.

5. Breeder age - Aged breeders are more susceptible to low BCS; higher mortality rates; poor udder structure; higher abortion and calf loss; and higher levels of dystocia due to their low BCS.

Cull cows aged 10 years and older separately and cull them after they raise their current calf.

6. Dystocia (difficulty calving and inability to calve) - largely caused by foeto-pelvic disproportion. Over the last thirty years, the increased focus on selecting bulls with high growth EBVs, and the focus on fertility and meat quality has led to introduction of British and European breeds into northern Australia. Consequently, dystocia has become a more common problem in northern Australia than it was in previous years. Dystocia is a well-recognised cause of neonatal loss and although calves maybe born alive, they may be slow to suckle or fail to suckle due to cerebral anoxia (lack of oxygen to the brain), which occurs during prolonged parturition. Although the prevalence of dystocia in *Bos indicus* cattle is generally lower than in *Bos taurus* cattle, there are reports of significant losses in tropically adapted crossbred or composite cattle due to dystocia e.g. In a mob of maiden Brahman heifers mated to Charbray bulls the prevalence of dystocia was 4%. Another study reported a mortality rate of 5-10% due to dystocia in Brahman-cross females calving at two years of age. Other causes of dystocia are cows in low body condition, buffel grass (lazy heifer syndrome) and uterine inertia (limited or no contractions).

Bull selection and heifer management

Bull breeds joined to the cow herd, particularly heifers, should not instigate foeto-pelvic disproportion. Bulls joined to heifers should be selected with **EBVs of high calving ease and low birth weights.**

Ensure selected joiner heifers are on good quantity and quality nutrition from weaning until joining. During this same period ensure the heifers are in a paddock secure from bull access. Heifers should be joined at a weight and age appropriate for their breed and should be joined to bulls at a time so they calve in a period of optimum nutrition. In northern Australia, this generally means joining heifers between late December and February. In Central Australia there is no specific period of optimum nutrition because rainfall is unpredictable and variable. Although temperature is important. Planning for calving between September and November/December enables calves to develop their thermoregulatory mechanism before peak temperatures of up to 45°C are frequent.

7. Country type– feed quality, water availability and quality, topography

The quality of stock water and consequential stock water intake minimising dehydration and maximising feed intake. Approximately 13% of bore waters in the Northern Territory and 4% of bore waters in Queensland can have toxic levels of fluoride that can cause chronic or acute levels of fluorosis in cattle.

Water testing - All bore water should be tested to ensure it is suitable for stock.

8. **Low herd phosphorus** - reduces fertility and growth rate; increases cow mortality; and reduces calf vigour.

Supplement with P in dry and wet season and monitor intakes to ensure they are consuming adequate amounts. P is vital during the wet season but needs to continue to be fed through the dry season when supplement intakes are higher and paddocks are accessible. Use of supplements will effectively increase stocking rate due to increased utilisation of feed. Vaccinate all cattle against botulism at the intervals recommended by the vaccine manufacturer – triennial, biennial or annual as P deficiency causes cows to eat carcasses/chew bones and they contain botulism spores. Carcasses may also contaminate waterways and wherever possible should be removed and burnt to remove the source of infection.

Risk factors causing low levels of reproductive wastage

9. **Producer culling policy**

Cull cows that fail to lactate in the year after being diagnosed pregnant. This will not only reduce reproductive wastage, it will also reduce stocking rate which may improve body condition of retained cows and consequently further reduce reproductive wastage. Mature cows that fail to lactate in the year after being diagnosed pregnant should not exceed 10% in northern Australia depending on when they are identified and should not exceed 15% in first lactation cows. If they exceed these percentages, reproductive wastage in the herd should be discussed with the relevant veterinarian.

10. **Large frame scored cows with a hip height >140cm** - These big cows struggle to maintain body condition with risk to foetal and calf survival.

Cull large frame cows that fail to lactate in the year after being diagnosed pregnant

11. **Temperature humidity index (THI) >79 for >2 weeks in month of calving**

Prolonged periods of a combination of high temperatures (>35^{0}C) and high humidity (>60%) make it difficult for cows and calves to dissipate heat and cool down. This reduces cow feed intake and calf survival. High THI will decrease calf vigour and increase calf, and sometimes cow, mortality. Similarly, activities such as mustering and branding during periods of high THI will increase calf mortality.

Avoid mustering cows and calves when hot and humid and provide shade where possible- Nutritionally, the ideal time for calving is from September to December which can also coincide with periods of high humidity and temperature. It is important to maintain breeds that are environmentally adapted to the heat and humidity of the dry tropics of northern Australia. It also important that cows calving during the summer have access to ample shade.

12. **Wild dog predation**

Dog control - Dog baiting or shooting may or may not be effective in reducing calf death and mutilation. Some cow breeds e.g. Brahmans are very protective of their calves and will prevent dog predation. Other breeds are not as protective and dog predation will be higher.

13. **Dehorning -** may cause excessive bleeding, infection, external parasite infestation and mismothering due to stress and pain which can increase calf losses between the branding process and weaning or at weaning if the branding process is done then rather than at calving. The impact of horns can be reduced by selecting polled bulls and heifer replacements.

Preventative medication and breeder segregation

Injectable and liquid formulations are now available that have haemostatic, anti-bacterial, pain relief and insecticidal properties. These formulations should routinely be used at the time of dehorning. There is less bleeding, mismothering and trauma when dehorning is carried out on calves between 2-6 months so a concerted effort should be made to process calves during this time period. This is another advantage of implementing breeder segregation and paddocking cows according to their time of calving. Calves also have faster recovery if they are returned to cows. The timing of the branding process should be planned so cows and calves are given ample time to ‘mother up’ before being walked

APPENDIX 2 - PRODUCER QUESTIONNAIRE

Contact Details

Property Name: _____ PIC:_____

Manager: _____

Telephone: _____ Fax: _____

Email:_____

UHF _____ Date_____

Estimated travel time to property and sick animals _____(hrs)

Period of illness _____❑ Days ❑ Weeks ❑ Months

Presenting signs (eg: abortions, low pregnancy rate, cows returning to service, low weaning rate)

_____

_____

_____

Livestock details:

Breed ❑ Brahman ❑ Brahman X ❑ Charolais ❑ Char X ❑ Santa Gertrudis

❑ Shorthorn ❑ Short X ❑ Hereford ❑ Here X ❑ Other

Class ❑ Weaners ❑ Heifers ❑ Steers ❑ Cows ❑ Bulls ❑ Mixed

❑ Homebred ❑ Introduced (when) (where from)

Age ❑ Months ❑ Years

Sex ❑ Male ❑ Female ❑ Mixed

Body Condition ❑ 1(emaciated) ❑ 2 ❑ 3 ❑ 4 ❑ 5 (obese)

3Ltr Brand _____ Symbol Brand: _____ Earmark _____

Total number on property _____ Total number in paddock _____

Neighbouring properties showing symptoms ❑ Yes ❑ No ❑ Unsure

Previous property history ❑ Previous report ❑ SAN/Laboratory No. _____

History

1. Breeder management systems and strategies - please indicate which of the following apply:

(a) **Mating strategy**:

Controlled mating period ❑

Continuous mating without segregation ❑

Segregation with pregnancy testing including foetal aging ❑

Other (discuss): _____

(b) **Branding muster timing**:

At what time/s of the year is this undertaken? _____
Are temperature and humidity factored into decisions around the timing of mustering?

_____

(c) **Mustering technique**:

Please indicate which methods are used: Helicopters ❑

Motorbikes ❑

Horses ❑

(d) **Weaning**: Is a decision made on timing of weaning based on:

Cow body condition score ❑

Set mustering date ❑

Set weaner weight ❑

None of the above (discuss) ❑

_____

(e) **Preventative treatments and invasive procedures**: please indicate which of the following are undertaken at branding muster:

Dehorning ❑

Castration ❑

Vaccination (calves & weaners) ❑

Vaccine/s used for calves/weaners:

Botulism ❑ Tick Fever ❑ Vibrio ❑ 5in1 ❑ 7in1 ❑ BEF ❑

Parasite control ❑ Active ingredient: _____

Oral ❑ Pour-on ❑ Injectable ❑ Plunge dip ❑ HGP ❑

(f) **Management of heifers and first lactation cows**:

Are heifers kept in age and gender-segregated paddocks prior to joining? Yes ❑ No ❑

Are heifers assessed for minimum weight and age prior to joining? Yes ❑ No ❑

Are nutritional supplements provided to heifers prior to and at joining? Yes ❑ No ❑

If yes, type of supplement provided? Composition:

Urea ❑ 10% ❑ 15% ❑ 20% ❑ 30% ❑ 37% ❑ Other
❑ Salt ❑ Sulphur ❑ Phosphorus ❑ Molasses ❑ CSM

Type: ❑ Block ❑ Loose mix ❑ Water medication

Feeding level (How much) _____ (How often) _____ (How long) _____

Are stock consuming all supplement? Yes ❑ No ❑

Are vitamin supplements provided to breeders prior to and after joining? Yes ❑ No ❑

(g) Age structure of herd:

Are records kept of number of cows in each age bracket? Yes ❑ No ❑

Are cows culled for age? Yes ❑ No ❑

Are cows culled for body morphology eg: bottle teats, poor body condition? Yes ❑ No ❑

Are bulls culled for age? Yes ❑ No ❑

Are bulls culled for body morphology eg: hock confirmation, prepuce shape or injury? Yes ❑ No ❑

(h) Records:

Are cows individually identified? Yes ❑ No ❑

Method for crush-side data recording: paper-based data ❑ electronic data ❑ both ❑ none ❑

Are herd and breeding records kept? Please indicate which of the following are recorded:

Mortality ❑ Pregnancy rate ❑ Branding ❑ Weaning rate ❑

If pregnancy testing is performed, is it done by: Veterinarian ❑ Non-veterinarian ❑

AND: Is the testing manual ❑ ultrasound ❑

What is the estimated pregnancy rate this season? _____

2. Property details that will assist with indicating carrying capacity and nutritional value:

(a) In what area is the property located? _____

(b) Average annual rainfall and distribution? _____

❑ Recent rainfall (when) _____ (how much) _____ (where) _____

Pasture response to rainfall _____

Soil quality and type? _____

❑ Recent Fire _____ (when)_____ (where) _____

Pasture response to fire _____

3. Pastures, Water, Supplementary Feed:

Pasture – current pasture assessment:

❑ Soil type _____

❑ Pasture grasses _____

❑ Shrubs _____

❑ Woody weeds _____

❑ Trees _____

❑ Poisonous plants _____

(a) Pasture quality – digestibility and protein:

Do you assess pasture quality & quantity and adjust stocking rate accordingly? Yes ❑ No ❑

If yes, how recently was this done? _____

(b) Pasture quality – available dry matter kg/ha:

Are you trained to assess feed quantity as kg/ha? Yes ❑ No ❑

Do you regularly assess average mob body condition: Yes ❑ No ❑

Is this recorded? Yes ❑ No ❑

(c) Distance between watering points:

What is the distance between watering points in breeder paddocks? ❑ < 6km ❑ >6km

(d) Water quality and origin?

What is the water source in breeder paddocks?

Supply: ❑ Bore ❑ Creek ❑ River ❑ Dam ❑ Trough

Quality: ❑ Clear ❑ Dirty ❑ Algae ❑ Analysis from NRETA

Quantity: ❑ Sufficient ❑ Insufficient (how long) _____ (days)

Has bore water been tested for stock safety? Yes ❑ No ❑

Please list any relevant result of water testing (eg: bacterial load, algae, mineral content):

_____

4. Herd health:

(a) **Vaccinations** for bulls and cows for **Trichomonas and Campylobacter**:

Are bulls vaccinated? Yes ❑ No ❑

If yes, please advise your vaccination regime (eg: prior to joining, annual booster):

_____

Are heifers vaccinated prior to joining? Yes ❑ No ❑

If yes, please advise your vaccination regime (eg: prior to first joining, annual booster):

_____

Please outline your vaccination protocols, including storage and handling of vaccines during transport and at the yards:

_____

(b) **External parasite control**:

What are the main external parasites on your property?

Mosquito ❑ Midges ❑ Buffalo fly ❑ Ticks ❑

Have you experienced an unusually heavy insect infestation recently? Yes ❑ No ❑

If yes, please describe?

_____

(c) Internal parasites:

Are faeces from a number of weaners checked for worm eggs by a laboratory? Yes ❑ No ❑

If yes, have preventative worming treatments been used? Yes ❑ No ❑

Has there been an increase in weight gain noted after worming treatments? Yes ❑ No ❑

(d) **Mortalities and morbidity**:

Are records kept of illness or stock deaths? Yes ❑ No ❑

Has there been any herd illness in the last 6 months? Yes ❑ No ❑

If yes, please indicate the type of problem (tick all that apply):

Respiratory ❑ Enteric ❑ Genital ❑ Fever ❑ Mastitis ❑

Comments (describe, give approx. numbers) _____

Are deaths or illness investigated by a veterinarian or stock inspector? Yes ❑ No ❑

Have any of the following been noted:

Stillborn calves ❑ Deformed calves ❑ Weak calves ❑ Ataxic (wobbly) calves ❑

Comments:

_____

(e) Predation:

Is there evidence of calf loss to wild dogs? Yes ❑ No ❑

(f) Introduced stock:

Have any cattle been introduced to the property in the last 3 years? Yes ❑ No ❑

If yes, please answer the following:

Recent stock movement: ❑ Waybill #_____

Date _____/_____/_____Property of origin _____ Number stock _____

Travelling time _____ Spelling ❑ No ❑ Yes (time) _____ (hrs)

Condition at destination ❑ Good ❑ Poor ❑ Recumbent _____ ❑ Dead

Management at destination: Yard ❑ Paddock ❑ Feed _____ Water _____

5. Bulls and breeds:

(a) What is the selection process when purchasing bulls?

Objective measurement ❑

Disease freedom ❑

Fertility testing ❑

All of the above ❑

None of the above ❑

Other:

_____

(b) What is the bull joining percentage? _____

Examination of live animals: Visual examination of herd

Morbidity _____% Mortality _____ **%**

Clinical signs _____

Location of deaths ❑ Around water ❑ Around supplement ❑ Yard
❑ Throughout paddock

❑ Other _____

Description of findings:

_____

_____

_____

Reproductive examination of individual animals

Urogenital

Urination: ❑ Normal ❑ Difficult ❑ Painful

Urine Colour ❑ Clear ❑ Yellow ❑ Orange ❑ Red ❑ Black

Transparency ❑ Clear ❑ Opaque

Odour ❑ Ammonia

Vulva/Vagina ❑ Swelling ❑ Lesion ❑ Haemorrhage ❑ Discharge

Uterus ❑ Prolapse ❑ RFM ❑ Mummified foetus ❑ Macerated foetus

Rectal ❑ Empty ☐ Pregnant ____ (mths) ❑ Prolapse

Udder ❑ Wet ❑ Dry ❑ Swelling

Testicles ❑ Swelling ❑ Abscess ❑ Hernia ❑ Cryptorchid

Penis/Sheath ❑ Swelling ❑ Adhesion

APPENDIX 3 – HERD RECORDS

When it comes to herd reproductive performance, data is essential to better understand what is going on in the herd and identify whether there is a problem. In some cases, you may either not see the need to record data, do not know what level of data to record or can't justify the time taken to keep detailed records. Unfortunately, reproductive disease testing alone without herd data records does not provide an accurate picture of reproductive performance. There are advancing diagnostic benefits with more detailed herd records.

Levels of herd recording and diagnostic benefits

The following outlines recording systems in advancing levels.

Level 1 – Minimum level of herd recording

- total number of breeding cows joined to bulls at the beginning of the year
- total number of active bulls
- annual bull and cow sales and purchases
- total number of calves and/or weaners recorded throughout a 12-month period
- dates that all numbers were recorded
- historical records over at least a 3-year period for comparative purposes

Diagnostic details from these records

- Bull joining %
- Cow and bull culling percentages may give an indication of herd age
- Calving % and/or weaning %
- Compare results between years

Level 2 – Medium level of herd recording

- total number of breeding cows joined to bulls at the beginning of the year
- total number of active bulls
- age details of herd – cows and bulls
- pregnancy test results[1] from different cow age groups and paddocks
- total number of calves and weaners recorded throughout a 12-month period.
- number of calves and/or weaners recorded throughout a 12-month period per paddock and/or cow age groups
- Weights of different classes of on-property cattle and sale and purchase cattle
- annual sales and purchases
- dates that all numbers were recorded
- historical records over at least a 3-year period for comparative purposes

Diagnostic details from these records

- Bull joining %, pregnancy %, calving % and weaning %
- Gross losses between pregnancy and branding; losses between branding and weaning can be determined to isolate where the problem is
- Reproductive rates in different age groups can be determined to isolate whether the problem is in heifers, mature breeders or aged cows or across the board
- Reproductive rates in different paddock groups can be determined to isolate whether there is a nutritional or other environmental effect
- Compare results to previous years

Note: If foetal ageing is determined at pregnancy testing and cows are identified as feather bang, bang tail or long tail according to trimester of pregnancy, it can be determined by their lactation status in subsequent musters whether they have lost a calf and need to be tested for disease. Empty cows can be tagged.

Level 3 – Advanced level of herd recording

- Total number of breeding cows joined to bulls at the beginning of the year
- Total number of active bulls
- Age details of herd – cows and bulls
- All purchased bulls fertility tested to veterinary standards and throughout working period culled for any physical disorders and cull for age
- Pregnancy test results, including foetal ageing, from different cow age groups and paddocks. A template (Attachment 1.) for recording pregnancy testing foetal age, body condition score, lactation status and date, paddock, vet pregnancy testing and cow age group is provided
- Segregation of pregnant cows into paddocks according to a 2 or 3-month calving period
- Number of calves and / or weaners recorded throughout a 12-month period per segregated group
- Weights of different classes of on-property cattle and sale and purchase cattle
- Annual sales and purchases
- Historical records over at least a 3-year period for comparative purposes

Diagnostic details from these records

- Bull joining %, pregnancy %, calving % and weaning %
- Losses between pregnancy and calving; losses between branding and weaning can be more accurately determined to isolate where the problem is, as cows are paddocked in calving groups
- Reproductive rates in different age groups can be determined to isolate whether the problem is in heifers, mature breeders or aged cows or across the board
- Reproductive rates in different paddock groups can be determined to isolate whether there is a nutritional or other environmental effect.
- Any bull fertility problems can be determined
- Problems specific to calving groups at different times of the year will be recognised

Level 4 – Best Practice Management level of herd recording

- Total number of breeding cows joined to bulls at the beginning of the year
- Total number of active bulls
- Age details of herd – cows and bulls
- All purchased bulls fertility tested to veterinary standards and throughout working period culled for any physical disorders and cull for age
- Pregnancy test results, including foetal ageing, from different cow age groups and paddocks
- Segregation of pregnant cows into paddocks according to 2 or 3-month calving period
- Number of calves and / or weaners recorded throughout a 12-month period per segregated group
- All cattle in herd have NLIS tag which can be scanned and all details of the animal are initially recorded by a technician on a mobile device at the branding cradle. The technician then operates crush side during pregnancy testing so reproductive history of cow can be accessed on mobile device. Programs used include StockIt from Livestock Exchange, Gallagher TSI, Kool Collect which was developed by Stanbroke in-house and Trutest
- Historical records over at least a 3-year period for comparative purposes
- Dates that all numbers were recorded
- Vaccination records

Diagnostic details from these records

- Bull joining %, Pregnancy %, Calving % and Weaning %
- Losses between pregnancy and calving; losses within a pregnancy period; losses between branding and weaning can be more accurately determined to isolate where the problem is, as cows are paddocked in calving groups
- Biannual pregnancy testing with records and record of lactation status allows for identification of abortion; calf death; and failure to conceive (re-breed rates)
- Reproductive rates in different age groups can be determined to isolate whether the problem is in heifers, first calf cows, mature breeders or aged cows or across the board
- Reproductive rates in different paddock groups can be determined to isolate whether there is a nutritional or other environmental effect
- Any bull fertility problems can be determined
- Problems specific to calving groups will be recognised
- Individual reproductive history per cow can determine whether losses are related to an age group, a year, a paddock, a calving period, a breed etc

Attachment 1: Herd record for pregnancy testing

Date:
Station:
Paddock:
Av age of cows:
Preg tester:
Scribe:

Status	BCS 2.0 or <	BCS 2.5	BCS 3	BCS 3.5	BCS 4	BCS 4 or >	Total	Calving Month
Empty								
1								
2								
3								
4								
5								
6								
7								
8								
9								
Total								

APPENDIX 4 - GUIDE FOR REPRODUCTIVE DISEASE TESTS AND COSTS IN NORTHERN AUSTRALIA STATE LABORATORIES

PLEASE NOTE: Test availability and prices are subject to change. Please contact the relevant laboratory for current advice

STATE LAB	QUEENSLAND	WESTERN AUSTRALIA	TERRITORY	NEW SOUTH WALES
Contact details	**BSL Qld** **Phone:** 07 3708 8762 **Email:** bslclo@daf.qld.gov.au **Address:** Block 12, 39 Kessels Road Coopers Plains QLD 4108	**DDSL WA** **Phone:** 08 9368 3351 **Email:** DDLS@dpird.wa.gov.au **Address:** C Block, 3 Baron-Hay Court South Perth WA 6151	**BVL NT** **Phone:** 08 8999 2249 **Email:** bvl@nt.gov.au **Address:** Makagon Rd, Berrimah NT 0828	**EMAI NSW** **Phone:** 1800 675 623 **Email:** laboratory.services@dpi.nsw.gov.au **Address:** Woodbridge Road, Menangle NSW 2568
Tests available and fees	https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/land-management/health-pests-weeds-diseases/sample-testing/submitting	https://www.agric.wa.gov.au/sites/gateway/files/Department%20of%20Primary%20Industries%20and%20Regional%20Development%20services%20products%20and%20fees%202017-18.pdf	https://dpir.nt.gov.au/primary-industry/laboratory-services/berrimah-veterinary-laboratory Prices for specific tests are not on the website	https://www.dpi.nsw.gov.au/about-us/services/laboratory-services/veterinary
Campylobacter culture (PCR AgriBio Vic)	Test kits $8.00/animal $51.23/animal	$76.50	Referred to AgriBio Vic for PCR or DDSL WA for culture	Test kits Campylobacter Enrichment Transport Media (CETM) **$5.50** $50.50/animal (Uses older transport media)
Campylobacter ELISA	Test kit $6.00/15 animals $15.43/animal https://www.daf.qld.gov.au/_data/assets/pdf_file/0017/1337300/BSL-GEN-010-Bovine-infertility-sample-collection-ELISA.pdf	$24.00	Referred to EMAI NSW	Test kits PBST and sterile swabs – Freight only $20.75/animal
Trich PCR (Not NATA accredited)	Test kits $6.00/animal $68.45/animal	$75.00	N/A	Tricamper Sampling tool (pack of 10) **$79.50** **PBS – Freight only. Test $120.25**

STATE LAB	QUEENSLAND	WESTERN AUSTRALIA	TERRITORY	NEW SOUTH WALES
Trich culture	Test kits $8.00/animal $51.23/animal	$70.00	Referred to AgroBio Vic	Trichomonas Foetus Enrichment Media (TFEM) **$10.75** **$41.00/animal**
BVDV AGID (Can transport for up to week)	$17.62	N/A	$11.55	$19.95
BVDV ELISA		$17.50	N/A	$15.25 $11.20 (> 10 samples)
BVDV Antigen Capture ELISA	$17.49	$17.50	35.30	
BVDV PCR	$68.45	$85.00	Referred to EMAI NSW	$84.55
BVDV VNT	$35.70	$34.25	N/A	$43.45
Lepto MAT *L.hardjo*, *L.pomona*, *L.tarassovi*	$14.02/animal per serovar	Referred to Forensic and Scientific Services Leptospirosis Reference Laboratory C/- Public Health Property Point, Loading Dock 1 39 Kessels Road Coopers Plains, Qld 4108	Referred to Forensic and Scientific Services Leptospirosis Reference Laboratory C/- Public Health Property Point, Loading Dock 1 39 Kessels Road Coopers Plains, Qld 4108	$13.00/animal per serovar
Leptospira sp. PCR	$68.45	$85.00	N/A	$87.50
Neospora ELISA	$14.02	$17.50	Referred to DDSL WA	$12.25
Akabane VNT	$35.70	$34.25	$28.00	$43.45
Akabane RT-PCR		N/A	N/A	$84.55
Akabane ELISA		$17.50	N/A	$12.25
Aino VNT	$35.70	$34.25	$28.00	$43.45
Aino RT- PCR		N/A	N/A	**$84.55**
BEF PCR	$68.45	N/A	$77.00	$84.55
BEF VNT	$35.70	$34.25	$28.00	$43.45
BEF ELISA		N/A	N/A	$12.25
BHV-1 VNT	$35.70	$34.25	$28.00	

STATE LAB	QUEENSLAND	WESTERN AUSTRALIA	TERRITORY	NEW SOUTH WALES
BHV 1.1 & BHV-1.2a	Referral	Referral	Referral	
BTV PCR	$68.45	$85.00	$77.00	$84.55
BTV VNT	Serotype 1 or 21 $35.70	N/A	$28.00 per serotype 1,2,3,5,7,9,12,15,16,20, 21,23	
BTV AGID	$17.62	N/A	$11.55	$19.95
BTV ELISA	$15.42	$17.50	$13.40	$12.25
Brucella sp. culture *B.abortus, B.suis*	N/A	Not routine	N/A	$64.75
B.abortus ELISA	N/A	N/A	N/A	$17.00
B.abortus CFT *B.suis* CFT	$13.22	$8.85	N/A	$13.00
Rose Bengal *B.abortus, B.suis*	$5.45	$8.85	$5.50	$6.25
B.abortus SAT	N/A	Not routine	N/A	$12.00
Fungal culture General	$52.54	$70.00	$44.30 Free for disease investigation	$50.50
Fungal culture Selective		$70.00	Free for disease investigation	$64.75
Chlamydia psittaci FAT	*Chlamydophila* spp. detection FAT $48.12	N/A	N/A	$67.71
Chlamydiaceae PCR	$68.45	$85.00	N/A	$87.50

Tests highlighted green are for national notifiable diseases and should be free of charge for suspect cases of notifiable disease reports

Request form for Repro Test Kits and Media

BSL Qld	https://www.daf.qld.gov.au/__data/assets/pdf_file/0006/313278/Equipment-Request-Form-GEN001.pdf
EMAI NSW	**Test Kits** https://www.dpi.nsw.gov.au/about-us/services/laboratory-services/kits-and-media
	Media https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0006/680586/Media-request-form.pdf

Laboratory Submission Forms

Queensland BSL	https://www.daf.qld.gov.au/__data/assets/pdf_file/0006/65733/GEN008SpecimenAdviceSheet.pdf
WA DDSL	https://www.agric.wa.gov.au/sites/gateway/files/DDLS%20animal%20pathology%20submission%20form_0.pdf
NT BVL	
NSW EMAI	https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0007/680425/Vet-specimen-advice-form-Feb2018.pdf

Other Forms

Repro History Form	https://www.daf.qld.gov.au/__data/assets/pdf_file/0007/1258945/BSL-GEN-006-Cattle-Herd-Reproductive-History-form-1.pdf
Sample Numbering Sheet	https://www.daf.qld.gov.au/__data/assets/pdf_file/0003/53742/Laboratory-SampleNumberingInformation-GEN113.pdf
Necropsy Form	https://www.daf.qld.gov.au/__data/assets/pdf_file/0010/98884/interactive-necropsy-form.pdf

Instructions for Reproductive diseases sampling

Serological sampling (BSL Qld) https://www.daf.qld.gov.au/__data/assets/pdf_file/0009/1258947/BSL-GEN-005-Submitting-samples-to-the-Biosecurity-Sciences-Laboratory-for-investigation-of-infertility-and-abortion-in-cattle.pdf

Vibrio ELISA (EMAI NSW) https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0004/800689/SCG-001-Diagnosis-of-Bovine-Venereal-Campylobacteriosis-Vibriosis-by-ELISA.pdf

Tricamper sampling (BSL Qld) https://www.daf.qld.gov.au/__data/assets/pdf_file/0004/277753/Tricamper-sampling-handout.pdf

Vibrio & Trich culture (EMAI NSW) https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0010/800695/SCG-003-Campylobacter-and-Tritrichomonas.pdf

Handling Media for Vibrio & Trich culture (EMAI NSW) https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0007/800692/SCG-002-MI-Camp-and-Trich-Culture.pdf

Video Vibrio & Trich sampling (CSU) https://www.youtube.com/watch?v=LUhUkg4jB-8

BVL Submitters Handbook (NT) https://dpir.nt.gov.au/__data/assets/pdf_file/0008/256769/submitters-handbook.pdf