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RESEARCH, DEVELOPMENT AND EXTENSION

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Report on MLA-DPI Audit Relating to Red Meat Research, Development and Extension

Abstract

The Primary Industry Ministerial Council has recognized that there needs to be a closer relationship between each of the State Departments of Primary Industry and research funding organizations so that there is optimization of scarce primary industry research, development and extension resources.

With this background and with MLA undertaking an extensive 5 year planning process for Livestock Production Research and Development (for the period 2006 to 2011), MLA convened a series of meetings between September 2005 and July 2006 with the 7 State and Territory Departments of Primary Industry (DPIs) to address two major questions:

- What outcomes do we expect for our mutual customers?
- How do we cooperate to ensure the outcomes are delivered in the optimum way?

The focus was on achievement of objectives to use the limited resources to make a real difference for industry development, the economy and sustainability.

An important decision from the initial meeting was agreement to form an MLA-DPI Coinvestment Committee, to meet regularly and work on areas of mutual interest. It is recognized that there are a number of other key players in red meat research and development including the CSIRO and universities. However, it was agreed that because of the very clear areas of mutual interest of the DPIs and MLA, the initial work undertaken would be limited but could be extended in the future from this base.

One of the agreed outcomes of the MLA-DPI Coinvestment Committee was to conduct a national audit of red meat on-farm research, development and extension activities, capacities and resources. This audit was undertaken by Dr Ian McCausland to examine:

1. The current capacity versus future industry needs in relation to:
   a. future industry, Government and community expectations,
   b. relevant future technologies,
   c. maintenance or development of critical mass
   d. the nature and value of R,D&E resources available
2. The options for processes that enable a more comprehensive and collaborative approach to any potential rationalisation of R&D resources.
3. The key resources in each of the States and Territories and recommendations to avoid duplication.

The R&D audit report has been completed and for the first time provides a snapshot of the research, development and extension capacity within each of the State and Territory DPIs, relevant to the red meat industry. This snapshot shows the capability currently available and its relationship to the priorities for industry development as described in the MLA Livestock Production R&D Strategic Plan 2006-2011.

A template has been developed to allow future similar audits to be undertaken and to assist in planning and coordination of research, development and extension across Australia. The MLA-DPI Coinvestment Committee will continue to meet, at least annually, to coordinate planning activities and examine areas for possible rationalization and co-investment.

Executive Summary

This audit was initiated by the MLA/DPI Co-Investment Committee and is, in effect, a photograph in time of the number and cost of people and resources used by State and Northern Territory Departments of Primary Industry (or equivalent, but all abbreviated to 'DPIs' in this report) for on farm, red meat related R,D&E during the financial year 2005/2006. The results are conservative; they include neither diagnostic work nor some biosecurity and natural resource management R,D&E.

The audit is designed to be simple, transparent and repeatable. It uses the Australian Standard Research Classification (ASRC) of R,D&E activities. At its centre is a costing model based on full time equivalent (FTE) salaries plus on costs, with a multiplication factor to account for the total cost of running an R,D&E organization, in line with National Competition Policy. The audit also includes:

- The amount of external funds received by the DPIs.
- Numbers, in FTEs, of R,D&E personnel working in each ASRC subject area, in each of the nine MLA Strategic Plan 2006 -2011 priorities, and for each DPI.
- Numbers of FTEs working for beef, sheep, goats, feedlot and live export sectors of the red meat industry.
- The age profile of R,D&E personnel.
- The identity of R,D&E teams which are of particular relevance to the on farm red meat industry.
- A brief description of the DPI facilities used for on farm red meat R,D&E.
- Maps showing the location of R,D&E personnel nationally and in each State and Territory.
- The results of discussions with DPI and MLA Managers about current and future R,D&E.

A summary of the results is shown in the following table:

	Full Time Equivalents (FTEs)				**Cost ($000)**	
	Beef	**Sheep**	**Other**	**Total**	**Total**	**State Contribution**
NSW	86.50	60.25	3.00	149.75	29,674	25,455
NT	29.00		0.70	29.70	5,687	4,882
Queensland	94.54	5.30	3.70	103.54	20,410	16,019
SA	10.07	26.13	3.16	39.36	7,017	4,920
Tasmania	7.35	6.50	0.10	13.95	2,627	2,518
Victoria	31.05	92.06	0.40	123.51	21,568	16,764
WA	25.82	41.61	2.05	69.48	13,002	12,596
Totals	**284**	**232**	**13**	**529**	**99,985**	**83,154**

The results show that:

- There were 529 FTEs of DPI employed personnel working in on farm red meat related R,D&E across Australia, at a total annual cost of just under $100 million. Of this total amount, the DPI contribution was $83 million; the DPIs assessed that MLA contributed $7 million of the remainder directly, and some further funds indirectly through Co-Operative Research Centres (CRCs).
- The DPIs contributed slightly more FTEs to beef (284) than sheep (232), and far fewer to feedlot (6), live export (5) and goat (2) R,D&E.
- NSW contributed the most FTEs (150), followed by Victoria (124), Queensland (104), WA (69), SA (39), NT (30) and Tasmania (14).
- The five top ASRC subject areas for FTEs were Education and Extension (142), Plant Improvement (53), Animal Nutrition (39), Animal Growth and Development (34) and Agronomy (30).
- The great majority of R,D&E personnel (502 FTEs) were working within the 9 MLA Strategic Plan priorities.
- Nationally, more of the FTEs were contributed by people who are over 40 years of age (308) than are under this age (221), however there was considerable variation between DPIs.
- Thirty four DPI based R,D&E teams were identified as particularly relevant to the on farm red meat industry; almost all collaborated with organisations other than their own.

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1 Introduction

During 2005 MLA invited each of the 7 State and Territory Departments of Primary Industry (or equivalent), hereinafter referred to as DPIs, to discuss matters relating to co-investment, and from those discussions the MLA/DPI Co-Investment Committee was formed. The Committee decided to conduct an audit, a photograph in time, of the DPI resources engaged in on farm red meat related research, development and extension (R,D&E) during the financial year 2005/2006.

The Committee is made up of the following people:

- Reuben Rose (Chairman), General Manager, Livestock Production Innovation, Meat and Livestock Australia
- Mark Dolling, Director, Animal Industries Development, Department of Agriculture and Food, Western Australia
- Geoff Kroker, Strategic Investment Manager, Department of Primary Industries, Victoria
- Neil MacDonald, Manager Pastoral Research, Department of Primary Industries, Fisheries and Mines, Northern Territory
- Simon Maddocks, Chief Scientist-Livestock Systems, PIRSA/SARDI, South Australia
- Greg Robbins, General Manager Animal Sciences, Department of Primary Industries and Fisheries, Queensland
- Helen Scott-Orr, Director, Health Sciences, Strategic Alliances and Evaluation Science and Research Division, NSW Department of Primary Industries
- Robin Thompson, Manager, Extensive Agriculture Branch, Department of Primary Industries, Water and Environment, Tasmania

A framework for the audit, detailing the principles under which it was to be conducted, was approved by the Committee in February 2006. The Committee members agreed to provide the required data and each member was interviewed personally to ensure the consistency of the data across all DPIs, and to discuss

- possible approaches to future coordination and/or rationalization of resources,
- future R,D&E capacity needs, and
- key R,D&E teams and facilities within their organizations

The main principles applied to the audit are as follows:

- It covers on farm beef, meat sheep, feedlot, live export and goat R,D&E currently being carried out by DPIs in all States and Northern Territory.
- It is based on R,D&E personnel and the R,D and/or E they conduct, classified according to the Australian Bureau of Statistic's Australian Standard Research Classification (ASRC)).
- The number of personnel is calculated by determining the proportion of each person's full time spent on meat related on farm R,D&E. Added together this gives the total full time equivalents (FTEs) of people engaged in R,D&E.
- The calculation of the dollar value of the R,D&E is based on a conservative averaging of a Victorian DPI system of costing developed in line with National Competition Policy. The total cost of the R,D&E performed is calculated by determining the proportion of each person's full time (their FTE proportion) spent on meat relevant on farm R,D&E and multiplying that proportion of their salary, plus 30% on costs, by a factor of 2.5. The 2.5 multiplier covers all management, building depreciation, maintenance, research herd or flock costs, and other

back up services etc needed to operate the R,D&E part of the organization: the total $ value is then equivalent to the annual cost that new owners would incur if they were to take over the organization on a 'walk in-walk out' basis.
- The data is transparent and the audit can be repeated in the future with the capacity to make direct comparisons of costs, personnel numbers and R,D&E activities.

The following people are acknowledged for their valuable assistance in preparing the audit:
- Staff of the State and Territory DPIs who put together the required data under tight deadlines.
- Committee member Mark Dolling and his staff, who developed the spreadsheet for data collection and has offered to hold and further manipulate all the data collected from each DPI.
- Staff of the Bureau of Rural Sciences, Department of Agriculture, Fisheries and Food, Canberra, who produced the maps included in the report.

1.1 Personnel, Costs, Industry Sectors and R,D&E Classifications

The following table (Table 1) shows the number of personnel nationally, classified according to their R,D&E activities, and the FTEs committed to each sector of the red meat industry. It also shows the total cost for each R,D&E classification and the total cost nationally for all red meat related on farm R,D&E. Similar tables for each DPI are shown in the Appendices. In both Table 1 and the DPI tables from which Table 1 is derived, there is some subjectivity in deciding, for individual personnel, the appropriate ASRC Classification(s) for their work and the proportion of their time spent on the various industry sectors.

Table 1: Full Time Equivalents and Costs for DPI R,D&E Activities Nationally

ASRC Classification		Full Time Equivalents (FTEs)						Total Cost $000
		Beef	Sheep Meat	Goats	F'lots	Live Export	Total	
300101	Soil Physics		0.25				0.25	52
300102	Soil Biology	1.50	1.90				3.40	588
300103	Soil Chemistry	1.70	5.20				6.90	1342
300104	Land Capability & Soil Degradation (incl salinity)	11.50	8.15				19.65	3717
300105	Applied Hydrology	4.05	2.99				7.04	1373
300202	Plant Nutrition	0.50	0.5				1.00	171
300203	Plant Improvement (selection, breeding &genetic engin.)	24.52	26.26			2.33	53.11	9677
300204	Plant Protection (pests, diseases & weeds)	3.42	5.33			0.30	9.05	1785
300205	Agronomy	6.85	22.80			0.22	29.87	5472
300299	Crop & Pasture Production not elsewhere classified	0.40	0.30				0.70	140
300401	Animal Breeding (& genetics)	17.10	9.30	0.20			26.60	5313

300402	Animal Reproduction	11.90	1.60				13.50	2966
300403	Animal Nutrition	22.79	12.81		2.40	0.70	38.70	7363
300404	Animal Husbandry (incl an. welfare & behaviour)	6.16	4.75		0.20		11.11	2033
300405	Animal Protection (field trials for pests & pathogens)	3.30	13.40				16.70	2893
300406	Animal Growth & Develment	12.82	20.91				33.73	5358
300499	Animal Production not elsewhere classified	1.60	0.80				2.40	516
300505	Anatomy & Physiology		0.10				0.10	25
300506	Pathology	2.42	4.34	0.10			6.86	1322
300507	Microbiology	3.13	4,96	0.10			8.19	1645
300508	Parasitology	0.50	7.50				8.00	1605
300510	Virology	6.60	4.90	0.10			11.60	2267
300599	Veterinary Sciences not elsewhere classified	0.60	0.30				0.90	264
300801	Environmental Management and Rehabilitation	6.20	6.17		1.10		13.47	2136
300803	Natural Resource Man'ment	0.40	0.20				0.60	140
300804	Environ Impact Assessment		3.82				3.82	815
300901	Farm Management etc	1.90	0.05			0.05	2.00	391
300903	Sustain D'ment (incl grazing lnd m'ment, prodn modelling)	44.50	1.00				45.50	8814
309902	Education and Extension	83.47	53.20	1.90	2.40	1.00	141.97	27279
340201	Agricultural Economics	2.70	1.95				4.65	1036
340402	Econometric & Statistical Methods	1.30	0.10				1.40	338
260602	Climatology	0.10	0.10				0.20	24
300999	Ag, vet & enviro sciences not elsewhere classified	0.40	5.90				6.30	1125
	Totals	**284.3**	**231.8**	**2.4**	**6.1**	**4.6**	**529**	**99,985**

1.2 External vs State and Territory Funding

Table 2 shows the external funding as assessed by the DPIs for the 2005/2006 financial year. The total external funding is then subtracted from the overall total cost shown in Table 1 to reveal the actual contribution from the State and Territory DPIs. Similar tables for the States and Territory are included in the Appendices (Table 2).

Table 2: External Funding $000

External Funds	Beef	Sheep Meat	Goats	Feedlots	Live Export	Totals
MLA	2,353	4,781	22	127	32	**7,315**
Other	5,867	3,422		92	135	**9516**
Total Ext	8,220	8,203	22	219	167	**16,831**
				Total R,D&E Cost*		**99,985**
				Total DPI Contrib		**83,154**

* Total R,D&E cost from Table 1

1.3 R,D&E Personnel Working on MLA Priorities

The MLA/DPI Co-Investment Committee agreed that the nine MLA Priorities for on farm R,D&E, as stated in the MLA Livestock Production R&D Strategic Plan 2006-2011, effectively bring together the priorities for on farm meat related R,D&E nationally and Table 3 shows the numbers of personnel (expressed in FTEs) from each State and Territory working on each. It also includes a category 'Other on farm R,D&E' for activities outside the 9 MLA priority areas. While consistency has been actively sought in filling out this table, there is an element of subjectivity in deciding on the priority or priorities which best fit an individual's work.

Table 3: Personnel Working on MLA Priorities for On Farm R,D&E

Key Priorities*	NSW	NT	Q'land	SA	Tas	Vic	WA	Totals
1. Reproductive rates	1.00	4.0	10.80	2.50			4.98	**23.28**
2. Mortality rates	2.00	0.5	0.20	0.50			1.70	**4.90**
3. Age at sale	1.70	1.5	9.40	0.30			1.98	**14.88**
4. Eating quality	9.40		2.60	1.70		7.00	2.75	**23.45**
5. Cost of production	57.35	4.0		25.46	3.80	68.70	18.99	**178.30**
6. Environmental risks	33.90	7.2	31.00	1.00	1.50	20.18	5.40	**100.18**
7. Skills & knowledge	38.60	3.0	32.78	7.90	8.65	26.55	23.53	**141.01**
8. Animal welfare	0.10	0.3	1.00			1.08	0.10	**2.58**
9. Biosecurity	5.70	3.5	4.00					**13.20**
10.Other R,D&E		5.7	11.76				10.05	**27.51**
Totals	**149.75**	**29.70**	**103.54**	**39.36**	**13.95**	**123.51**	**69.48**	**529**

1.4 Personnel Categories and Ages

Age profiles of personnel involved in research, extension and technical work are shown in Table 4. The numbers shown are totals of FTEs in each category and are derived from State and Territory tables shown in the Appendices (Table 3).

Table 4: Age Profile of R,D&E Personnel (FTEs)

Category	Under 40 yrs	40-50 yrs	Over 50 yrs	Total
Research	95	82	42	**219**
Extension	64	62	31	**157**
Technical	62	67	24	**153**
Total	**221**	**211**	**97**	**529**

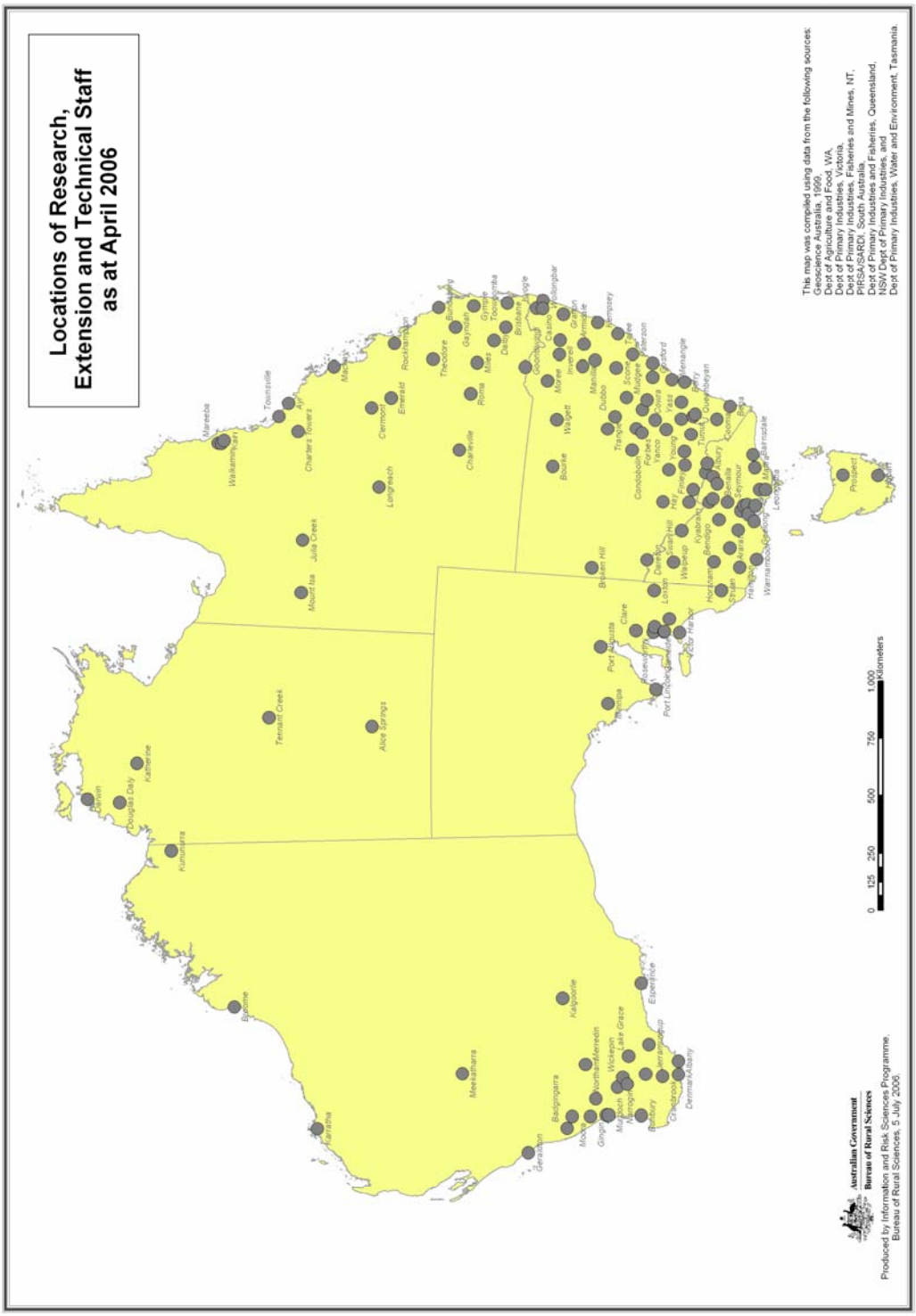
1.4.1 Teams, Linkages and Facilities

Details of teams involved in on farm meat related R,D&E and which are robust and widely acknowledged for their expertise, have sufficient resources and have published their results, and, most importantly, have had industry impact, are described in the State and Territory Appendices. Also shown are the organizations with which each team collaborates and their sources of external funding.

Short descriptions of main State and Territory facilities for meat related on farm R,D&E are also shown in the Appendices.

1.4.2 Location of Research, Extension and Technical Personnel

The map on the following page shows the base location of DPI research, extension and technical personnel across the Australian continent. State maps, shown in the Appendices, include bar charts indicating the number of each of the three categories at every base location. Actual numbers are shown in tables accompanying these maps.


Locations of Research, Extension and Technical Staff as at April 2006
This map was compiled using data from the following sources:
Geoscience Australia, 1999.
Dept of Agriculture and Food, WA.
Dept of Primary Industries, Victoria.
Dept of Primary Industries, Fisheries and Mines, NT.
Dept of PIRSA, South Australia
Dept of Primary Industries and Fisheries, Queensland.
NSW Dept of Primary Industries, and
Dept of Primary Industries, Water and Environment, Tasmania.
0 125 250 500 750 1,000 Kilometers
Australian Government
Bureau of Rural Sciences
Produced by Information and Risk Sciences Programme.
Bureau of Rural Sciences, 5 July 2006.

2 Discussions with DPI and MLA Managers

Discussions were held with individual MLA/DPI Co Investment Committee members, on some occasions with other senior staff taking part, and with MLA Program Managers as a group. The Committee met to discuss the draft report and made some minor changes to this section. At the interview stage comments were sought on the subjects covered by the following headings; there was no further prompting of participants, and no prior information was given on the comments of those interviewed earlier. Qualitative information reported below represents some of the priority issues raised by at least three of the individuals interviewed.

2.1 R,D&E Capacity Expectations

Industry: Producers will want better access to information tailored to their needs, delivered in a way that makes it accessible to a much larger percentage of producers than can be serviced by a diminished and/or refocused extension service.

Government: Some State and Territory governments treat their DPI as an economic development agency which delivers community benefit through a stronger agricultural sector, while others consider their DPI to be an agency for direct community benefit through animal welfare and environmental sustainability. All are of the view that private benefit should be on a user pays basis, but interpretations differ and the distribution of public and private benefits is complex and difficult to apportion.
There was general agreement that the State governments concerned are unlikely to increase funds for agricultural R,D&E and most consider funding will decrease further as other pressing priorities such as hospitals and transport receive priority. To retain core capacity, clear benefits will need to be demonstrated from government funded R,D&E.

Community: The community at large is expected to demand objective guarantees that the meat they buy comes from cattle and sheep which are treated humanely and are raised in environmentally sustainable ways.

2.2 Future Technologies

Data Collection, Analysis and Modelling: Collection of data through automated monitoring systems (eg, feedlot feeding monitors, weighing devices at gates), and the National Livestock Identification Scheme will provide for 'precision farming and marketing systems' based on information about individual animals.
Modelling of farming and nutrition systems is considered important for the future and agricultural and veterinary graduates should have training in this area.

Land Management Technology: Land management technology (eg, virtual fencing, gate and water monitors, satellite indicators of soil and vegetation) will become increasingly important as producers find it harder and harder to attract staff and consumers demand objective information about sustainable production.

Full Utilisation of Gene Markers: Nutrition and management requirements need to be determined to optimize gene expression where markers have been identified ("just knowing where genes are is not enough").

Information Delivery: Information delivery systems are needed which meet the specific requirements of individual producers and can be targeted to reach all sectors of the producer community ("Amazon books records your on-line purchase and sends you titles that others who bought your first book are ordering").

MLA's Role: In identifying and setting industry priorities MLA has a key role in determining what new technologies will be needed; the DPIs need to be collaborators in the priority setting process so that they can understand what technologies need to be developed now for the future, and which will be redundant and can be dropped.

2.3 Critical Mass Maintenance and Development

Current Status: Critical mass is close to lower limits in some DPIs and in some there is only one remaining person in key disciplines and those people are mostly near retirement. Budgets have generally been static or declining for the past five years and most DPIs expect this trend to continue as other issues such as health and transport demand more funds. Great difficulty is experienced in replacing key individuals and teams once they are lost.

Future Research Leaders: Senior people of great worth are retiring or are close to retirement age. These people were often the beneficiaries of government sponsored graduate and post graduate training which ceased some 20-30 years ago; there are now relatively fewer middle aged researchers of similar qualifications and experience to replace them. While young graduates are easier to recruit, they are usually on 'soft' money or short term contracts and perceive little career opportunity and they often leave after five years or less. This may be a societal phenomenon relating to the Y generation rather than a specific problem relating to employment in DPIs.
One view of a solution is to ensure a good supply of agriculture and veterinary graduates who can turn their hand to whatever is needed in the future. They should be trained to think in a multidisciplinary way and have good grounding in the sciences that lie behind modelling production scenarios.

Suggested Support for R,D&E: Individual ideas for funding support to underpin future R,D&E human resources included:

- The federal government to stabilise MLA income within a 10% rise or fall in any one year. (Large falls in MLA levy income could be caused by an industry catastrophe such as an outbreak of exotic disease).
- MLA to identify the top R,D&E leaders in key disciplines (including extension) and ensure them continuity of funds and people to keep their teams at the cutting edge.
- MLA to provide financial support for young researchers to work for up to three years alongside experienced people, particularly if they are about to retire.

2.4 Coordination and Rationalisation

Specific Cases: Various DPIs indicated the R,D&E activities they wish to concentrate on, and, in some cases, the activities for which they are happy to leave leadership to other DPIs. Examples given were:

- New South Wales expects to maintain investment in the red meat industries through strategic alliances and a focus on sustainable productivity improvements;
- Queensland will retain its particular competence in tropical and subtropical systems;
- Western Australia would like to be recognised as the main sheep R&D resource in Mediterranean climate mixed farming systems; it will do complementary work on beef with other States; WA will maintain its successful capability for developing annual legume pasture systems;
- Victoria wants to continue to build lamb R&D, molecular plant breeding and animal welfare; it is prepared to rely on others for beef R&D;
- Tasmania's focus is on field trialling new research findings, not competing in research that could be done anywhere;
- South Australia will continue to focus on southern Australian production systems for beef and sheep, in collaboration where appropriate;
- Northern Territory enjoys strong cooperation with Western Australia and Queensland in R,D&E specific to north Australia.

Rationalisation and Renewal of Infrastructure: Closing and disposing of facilities as well as generating funds for new investment is very difficult. State Governments need input and support from national and State industry bodies to manage the political complexities associated with such decisions. It would be helpful if there were more high level liaison between meat industry leaders and state government Ministers in relation to these issues.

Interstate Coordination and Rationalisation: The following points relate to interstate cooperation:

- 'Rules of engagement' need to be determined before one State's people can work in another's jurisdiction; this is a necessary precondition for one State to service a closed down R,D&E activity of another.
- A small State seeking assistance needs to articulate a convincing case for another to provide it, including the ways in which it can reciprocate.
- Cooperation across States and organizations will work best if reciprocal acknowledgement of all the inputs can be made.
- National coordination is needed for agricultural resource management but has become increasingly difficult because it is now conducted through numerous localized Catchment Management Authorities.

MLA's Role: MLA is already a key player because it forms and co-funds critical mass R,D&E across organizations and States to achieve industry's priorities. Comments on possible future roles for MLA included the following:

- MLA can take a stronger rationalising role, but needs to do it in collaboration with the DPIs,
- The R&D Audit is a good start for future rationalisation,
- MLA could join with other funders to become a major player in coordination (eg 'Grain and Graze' has four major funders, MLA and Australian Wool Innovation are investing significant funds in Sheep Genetics Australia and sheep genomics R&D, and pasture and feedbase

R&D offers opportunities for collaboration with a number of Rural R&D Corporations such as Dairy Australia, Grains Research and Development Corporation, Australian Wool Innovation and MLA),
- MLA could work in a 'CRC way' across DPIs. It is already doing so for sheep genomics.

Extension: Because of the pressure on extension personnel and the lack of suitable training for replacements, there is a need to:
- Examine new models for effecting change and uptake of technology,
- Formalise relationships with existing networks of land care facilitators, veterinarians, producers, etc,
- Develop partnerships with private sector organizers for more effective delivery by coordination with departmental extension personnel.
- Develop a better relationship and integration of extension with R&D.

Caution about Rationalisation: Before rationalisation of specific areas of R,D&E is initiated there needs to be consensus that it is appropriate. If it is to occur, then the following points are worthy of consideration:
- Resources not required for current industry priorities need to be identified so that they are retained for future use (eg for exotic disease control),
- Too much rationalisation may take out healthy competition; groups need to compete against each other to stay at the leading edge.

3 Appendices

3.1 Appendix A

3.1.1 R&D Audit for New South Wales DPI

Table 1: Full Time Equivalents and Costs for R,D&E Activities

ASRC Classification		Full Time Equivalents (FTEs)						Total Cost $000
		Beef	Sheep Meat	Goats	F'lots	Live Export	Total	
300102	Soil Biology	1.5	1.1				2.6	458
300103	Soil Chemistry	1.7	1.2				2.9	666
300104	Land Capability & Soil Degradation (incl salinity)	11.5	7.95				19.45	3680
300105	Applied Hydrology	4.05	2.95				7.0	1367
300203	Plant Improvement (selection, breeding &genetic engin.)	12.0	6.5				18.5	3599
300204	Plant Protection (pests, diseases & weeds)	1.4	1.0				2.4	529
300299	Crop & Pasture Production not elsewhere classified	0.4	0.3				0.7	140
300401	Animal Breeding (& genetics)	8.1	5.2	0.2			13.5	2956
300402	Animal Reproduction	1.0					1.0	242
300403	Animal Nutrition	4.95	2.6				7.55	1511
300404	Animal Husbandry (incl an. welfare & behaviour)	0.1	2.5				2.6	456
300405	Animal Protection (field trials for pests & pathogens)	0.1	1.2				1.3	267
300406	Animal Growth & Develment	6.2	5.5				11.7	1319
300506	Pathology	0.3	0.3	0.1			0.7	164
300507	Microbiology	1.2	1.7	0.1			3.0	758
300510	Virology	0.7	0.3	0.1			1.1	479
300599	Veterinary Sciences not elsewhere classified	0.4	0.3				0.7	211
300801	Environmental Management and Rehabilitation	1.2					1.2	232
309902	Education and Extension	25.7	17.6	0.7	1.5	0.3	45.80	9266
340201	Agricultural Economics	2.7	1.95				4.65	1036
340402	Econometric & Statistical Methods	1.3	0.1				1.4	338
	Totals	**86.5**	**60.25**	**1.2**	**1.5**	**0.3**	**49.75**	**29,674**

Table 2: External Funding $000

External Funds	Beef	Sheep Meat	Goats	Feedlots	Live Export	Totals
MLA	325	189	12			**526**
Other	1,986	1,707				
Total Ext	2,311	1,896	12			**4,219**
				Total R,D&E Cost*		**29,674**
				Total DPI Contrib		**25,455**

* Total R,D&E cost from Table 1

Table 3: Age Profile of R,D&E Personnel (FTEs)

Category	Under 40 yrs	40-50 yrs	Over 50 yrs	Total
Research	14	18	11	**43**
Extension	14	29	14	**57**
Technical	15	27	8	**50**
Total	**43 (29%)**	**74 (49%)**	**33 (22%)**	**150**

Teams

Teams described below fulfil the following five criteria; the leaders named for each team are from NSW DPI unless indicated otherwise; only funders additional to NSW DPI are listed:

- The team is robust (not dependant on one key person).
- The team's expertise is known and acknowledged by others in the subject area.
- The team has appropriate and sufficient physical resources.
- The team's results have been published in refereed journals (or equivalent).
- The team's work has had or is highly likely to have significant industry impact.

Veterinary Virology

Focus: Establishment of the geographic and seasonal distribution of key arboviruses of trade significance; research to understand the role of pestivirus in mucosal disease and feedlot respiratory disease.
Leaders: Peter Kirkland, Deborah Finlaison
Collaborators: AAHL, other DPIs
Funders: MLA, Biosecurity Australia
Impact: Increased areas for which exports can be sourced for China; recent release of pestivirus vaccine for general use.

Animal Genetics and Breeding Unit (AGBU)
Focus: Development and maintenance of the national genetics evaluation system (Breedplan and Ovis)
Leaders: Hans Graser, Stephen Barwick
Collaborators: UNE, ABRI
Funders: MLA
Impact: Objective evaluation has demonstrated increased genetic improvement through use of Breedplan, which is now used internationally as well as throughout Australia.

Nett Feed Intake (NFI) Team
Focus: Identification, measurement and selection of more efficient feed conversion
Leaders: Robert Herd, Peter Parnell
Collaborators: Beef CRC, Victorian, WA and SA DPIs
Funders: MLA, Beef CRC
Impact: Included in a Breedplan EBV and used by Angus breeders.

Prograze
Focus: Empowering groups of producers with tools and skills to manage their pastures
Leaders: Phil Graham, Col Langford
Collaborators: Southern DPIs
Funders: Client fees
Impact: Extensive participation by producers; independent evaluation has shown behavioural changes and adoption.

Sheepmeat Genetics
Focus: Improvement of meat sheep through quantitative genetics
Leaders: Neil Fogarty, David Hopkins
Collaborators: Lambplan, Victorian DPI
Funders: MLA, Sheep CRC
Impact: Continuous improvement in meat sheep productivity.

Grasslands and Rangelands Pasture and Weed Management
Focus: Research leading to identification and implementation of improved grazing systems for native and introduced pastures and weed control.
Leaders: David Michalk, Ron Hacker, Greg Lodge
Collaborators: Southern DPIs
Funders: MLA, AWI, ACIAR, Charles Sturt University, Weeds CRC
Impact: Underpinning of the SGS and Grain and Graze programs.

Pest Animals
Focus: Control of vertebrate pests and preparation for exotic disease by research into the economics and effectiveness of various control options.
Leaders: Glen Saunders, Steve McLeod
Collaborators: Rural Land Protection Boards
Funders: CRC for Invasive Animals, MLA, AWI
Impact: Development and implementation of 'Outfox the Fox' program; partners in Ausvetplan exercises for exotic disease; determined that assurances could be given that calicivirus would not affect other species.

Facilities

The following facilities are currently in use for on farm meat related R,D&E:

Armidale Beef Centre of Excellence and AGBU, Armidale: Staff are located at the UNE campus. Extensive laboratory, computer, feedlotting and grazing facilities (beef CRC, genetics etc)

Elizabeth Macarthur Agricultural Institute, Camden: 1100 hectares of farmland; extensive laboratories, animal houses (Centre of Excellence for animal and plant health, biosecurity, biotechnology); co-location with U Sydney Faculty of Vet Science and Plant Breeding Institute; a key part of the NSW Centre for Animal and Plant Biosecurity.

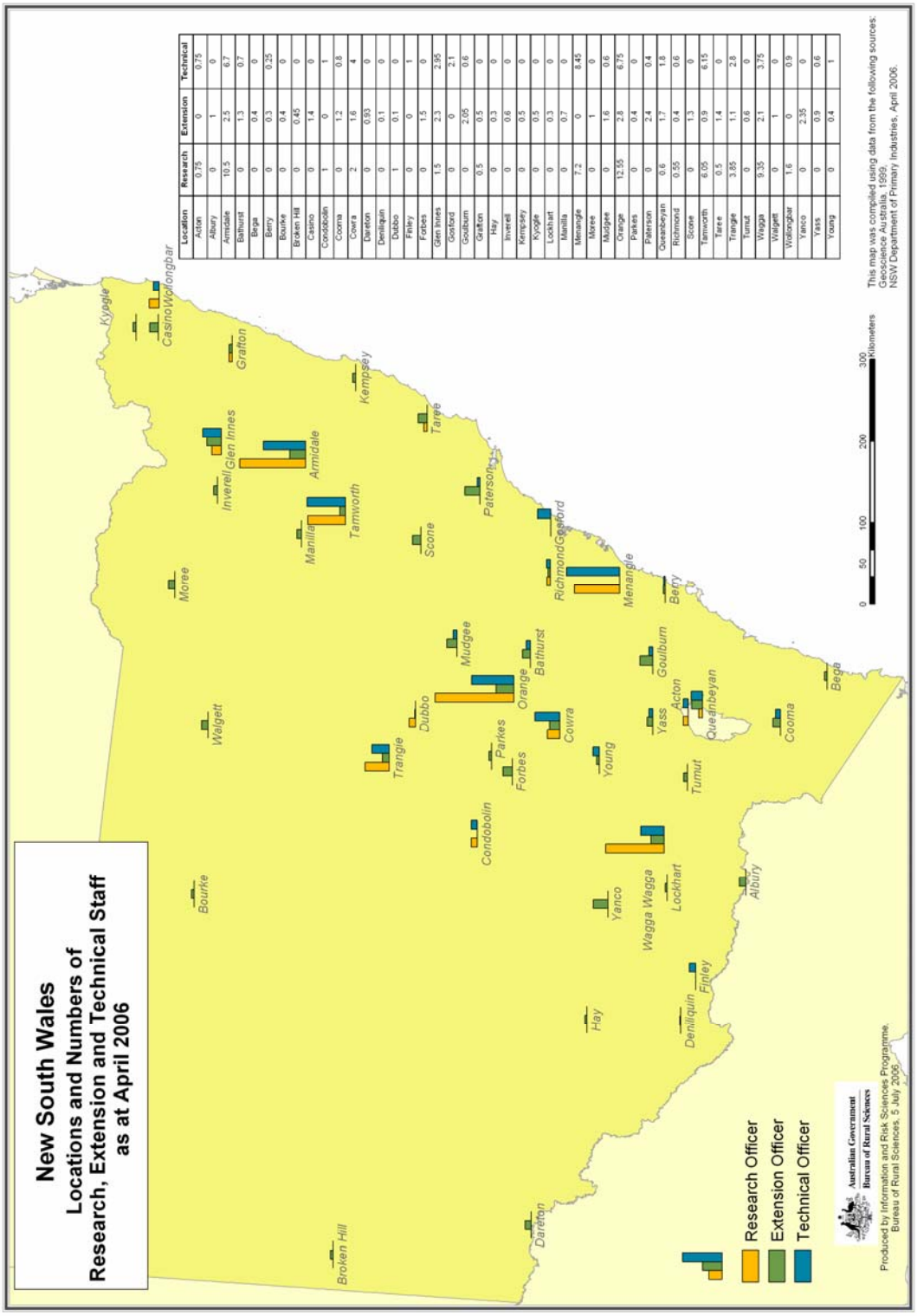
Centre of Excellence for Southern Farming Systems, Wagga Wagga: Laboratories and animal houses (feed analysis, plant breeding); co-location with Charles Sturt University and a key part of the EH Graham Centre for Agricultural Innovation.

Centre of Excellence for Rangeland, Trangie: 6,000 hectares of dryland and irrigated land (cattle breeding, cattle and sheep genetics).

Centre of Excellence for Perennial Grazing Systems, Glen Innes: 500 hectares of temperate dryland pastures (beef cattle genetics, growth and carcase studies in liaison with Beef Centre at Armidale).

Orange Agricultural Institute, Orange: Weed and pasture management and veterinary diagnostic and research laboratories (insect, fungal and bacterial collections, GIS and remote sensing).

Pasture Genetics and Improvement Unit, Wagga, Tamworth, Glen Innes: Each site maintains a 'germplasm resource centre' with laboratory glasshouse complexes and field facilities (quantitative genetics, germplasm conservation, eco-physiology, animal nutrition, agronomy).



Location	Research	Extension	Technical
Acton	0.75	0	0.75
Albury	0	1	0
Armidale	10.5	2.5	6.7
Bathurst	0	1.3	0.7
Bega	0	0.4	0
Berry	0	0.3	0.25
Bourke	0	0.4	0
Broken Hill	0	0.45	0
Casino	0	1.4	0
Condobolin	1	0	1
Cooma	0	1.2	0.8
Cowra	2	1.6	4
Dareton	0	0.93	0
Deniliquin	0	0.1	0
Dubbo	1	0.1	0
Finley	0	0	1
Forbes	0	1.5	0
Glen Innes	1.5	2.3	2.95
Gosford	0	0	2.1
Goulburn	0	2.05	0.6
Grafton	0.5	0.5	0
Hay	0	0.3	0
Inverell	0	0.6	0
Kempsey	0	0.5	0
Kyogle	0	0.5	0
Lockhart	0	0.3	0
Manilla	0	0.7	0
Menangle	7.2	0	8.45
Moree	0	1	0
Mudgee	0	1.6	0.6
Orange	12.55	2.8	6.75
Parkes	0	0.4	0
Paterson	0	2.4	0.4
Queanbeyan	0.6	1.7	1.8
Richmond	0.55	0.4	0.6
Scone	0	1.3	0
Tamworth	6.05	0.9	6.15
Taree	0.5	1.4	0
Trangie	3.85	1.1	2.8
Tumut	0	0.6	0
Wagga	9.35	2.1	3.75
Walgett	0	1	0
Wollongbar	1.6	0	0.9
Yanco	0	2.35	0
Yass	0	0.9	0.6
Young	0	0.4	1

3.2 Appendix B

3.2.1 R&D Audit for DPIF&M, Northern Territory

Table 1: Full Time Equivalents and Costs for R,D&E Activities

ASRC Classification		Full Time Equivalents (FTEs)						Total Cost $000
		Beef	Sheep Meat	Goats	F'lots	Live Export	Total	
300205	Agronomy	3.2					3.2	674
300401	Animal Breeding (& genetics)	1.3					1.3	274
300402	Animal Reproduction	1.5					1.5	264
300403	Animal Nutrition	2.0				0.7	2.7	480
300404	Animal Husbandry (incl an. welfare & behaviour)	3.0					3.0	627
300406	Animal Growth & Develment	0.5					0.5	100
300510	Virology	3.5					3.5	644
300901	Farm Management etc	0.2					0.2	41
300903	Sustain D'ment (incl grazing lnd m'ment, prodn modelling)	11.2					11.2	2053
309902	Education and Extension	2.6					2.6	530
	Totals	**29.0**				**0.7**	**29.7**	**5,687**

Table 2: External Funding $000

External Funds	Beef	Sheep Meat	Goats	Feedlots	Live Export	Totals
MLA	265					**265**
Other	510				30	**540**
Total Ext	775				30	**805**
				Total R,D&E Cost*		**5,687**
				Total DPI Contrib		**4,882**

* Total R,D&E cost from Table 1

Table 3: Age Profile of R,D&E Personnel (FTEs)

Category	Under 40 yrs	40-50 yrs	Over 50 yrs	Total
Research	9	3.6	3	**15.6**
Extension	3	2	0.5	**5.5**
Technical	5.2	2.4	1	**8.6**
Total	**17.2 (58%)**	**8 (27%)**	**4.5 (15%)**	**29.7**

Teams

Teams described below fulfil the following five criteria unless headed with a qualifying statement; the leaders named for each team are from NT DPIF&M unless indicated otherwise; only funders additional to NT DPIF&M are listed:

- The team is robust (not dependant on one key person).
- The team's expertise is known and acknowledged by others in the subject area.
- The team has appropriate and sufficient physical resources.
- The team's results have been published in refereed journals (or equivalent).
- The team's work has had or is highly likely to have significant industry impact.

Grazing Management
Focus: To objectively estimate the sustainable carrying capacity of native pastures.
Leaders: Neil MacDonald, Robyn Cowley, Alison Kennedy
Collaborators: Heytesbury Beef, CSIRO, Department of Natural Resources, Environment & Arts, Q DPI, WA DPI.
Funders: MLA, Natural Heritage Trust, Tropical Savanna CRC
Impact: Graziers have been provided with, and are now using, tools to tailor their stock numbers to the sustainable carrying capacity of their land.

Arboviruses
Focus: Assessment of the actual and potential effect of arboviruses (recognised and unrecognised) in Northern Australia.
Leaders: Lorna Melville, Anton Janmaat
Collaborators: AAHL, NSW DPI, Biosecurity Australia, CRC for Emerging Infectious Diseases, Northern Australia Quarantine Strategy
Funders: Biosecurity Australia
Impact: Improved market access by defining areas free of arbovirus and by developing control measures for exporting from infected areas.

Livestock Export to South East Asia
Focus: Training and extension on animal husbandry and nutrition for SE Asian customers of Australin live cattle exports
Leaders: David Ffoulkes, Barry Lemcke
Collaborators: Private consultants; Darwin University; Livecorp, Indonesian, Phillipines and Sabah governments; ACIAR; NT live export companies (eg, Austasia)
Funders: ACIAR, MLA
Impact: Continuation of strong livestock export despite political and currency factors.

The following team has not yet had an industry impact and is included because of its future importance to the region:

Arid Zone
Focus: Appropriate cattle management for a highly variable climate
Leaders: Mark Ashley, Chris Materne
Collaborators: Centralian Land Management Association
Funders: Natural Heritage Fund, Desert Knowledge CRC

Expected Impact: Reduction of the impact from drought and improved profitability for all climatic conditions.

Facilities

The following facilities are currently in use for on farm meat related R,D&E.

Victoria River Research Station, Katherine Region: 340 sq km native pasture (herd and rangeland management).

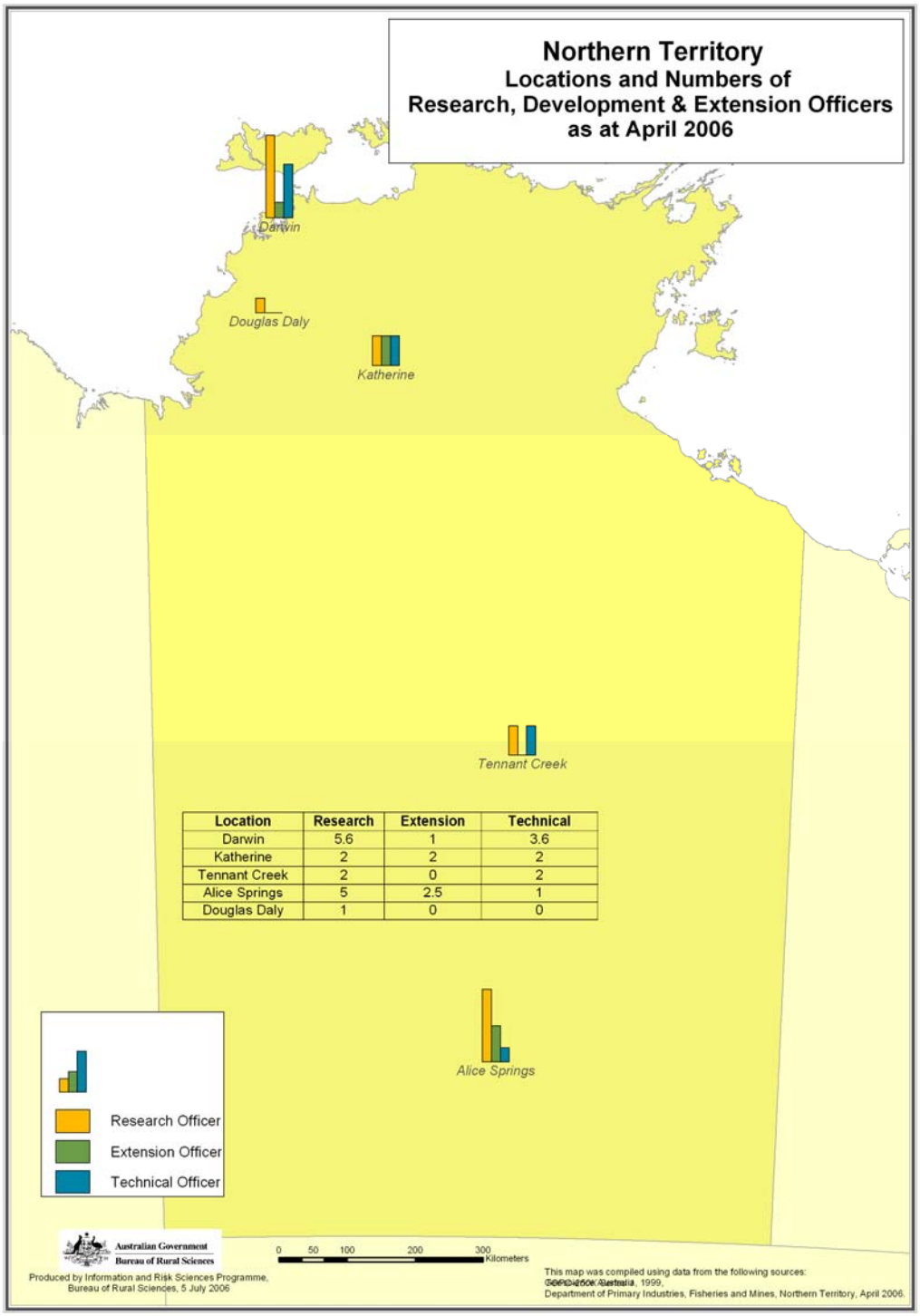
Katherine Research Station, Katherine Region: 1200 hectares of native and improved pasture with a 350 head herd (cattle breeding and finishing).

Douglas Daly Research Farm, Douglas Daly: 3100 hectares with 1400 head herd (cattle breeding and finishing).

Beatrice Hill, Adelaide River: 2600 hectares with a 400 head buffalo herd (buffalo and tropical pasture research).

Old Man Plains, Alice Springs: 500 sq kms native pasture with 400 cattle (arid zone best practice demonstrations).

Berrimah Agricultural Research Centre and Veterinary Laboratory, Darwin: 250 hectares (virology).



Location	Research	Extension	Technical
Darwin	5.6	1	3.6
Katherine	2	2	2
Tennant Creek	2	0	2
Alice Springs	5	2.5	1
Douglas Daly	1	0	0

3.3 Appendices C

3.3.1 R&D Audit for DPI&F, Queensland

Table 1: Full Time Equivalents and Costs for R,D&E Activities

ASRC Classification		Full Time Equivalents (FTEs)						Total Cost $000
		Beef	Sheep Meat	Goats	F'lots	Live Export	Total	
300203	Plant Improvement (selection, breeding &genetic engin.)	4.00					4.00	864
300401	Animal Breeding (& genetics)	5.30					5.30	903
300402	Animal Reproduction	5.60					5.60	1265
300403	Animal Nutrition	11.96	3.00		2.40		17.36	3210
300404	Animal Husbandry (incl an. welfare & behaviour)	1.00					1.00	251
300405	Animal Protection (field trials for pests & pathogens)	3.20	0.80				4.00	709
300506	Pathology	0.10					0.10	25
300507	Microbiology	0.30					0.30	82
300508	Parasitology	0.50					0.50	124
300510	Virology	0.10					0.10	25
300599	Veterinary Sciences not elsewhere classified	0.20					0.20	53
300801	Environmental Management and Rehabilitation				1.00		1.00	224
300903	Sust Develmnt (incl grazing lnd m'ment, prodn modelling)	33.30					33.30	6593
309902	Education and Extension	28.98	1.50			0.30	30.78	6082
	Totals	**94.54**	**5.30**		**3.40**	**0.30**	**103.54**	**20,410**

Table 2: External Funding $000

External Funds	Beef	Sheep Meat	Goats	Feedlots	Live Export	Totals
MLA	1,110			127		**1,237**
Other	2,868	194		92		**3,154**
Total Ext	3,978	194		219		**4,391**
				Total R,D&E Cost*		**20,410**
				Total DPI Contrib		**16,019**

* Total R,D&E cost from Table 1

Table 3: Age Profile of R,D&E Personnel (FTEs)

Category	Under 40 yrs	40-50 yrs	Over 50 yrs	Total
Research	13	14.66	12.9	**40.56**
Extension	14.93	9.25	8.6	**32.78**
Technical	16.2	7	7	**30.20**
Total	**44.13 (43%)**	**30.91 (30%)**	**28.5 (27%)**	**103.54**

Teams

Teams described below fulfil the following five criteria unless headed with a qualifying statement; the leaders named for each team are from QDPIF unless indicated otherwise; only funders additional to QDPIF are listed:

- The team is robust (not dependant on one key person).
- The team's expertise is known and acknowledged by others in the subject area.
- The team has appropriate and sufficient physical resources.
- The team's results have been published in refereed journals (or equivalent).
- The team's work has had or is highly likely to have significant industry impact.

Cattle Nutrition
Focus: Increasing growth rate; rewriting the feeding tables for tropical pasture systems
Leaders: Stuart McLennan, Dennis Poppi (UQ)
Collaborators: UQ
Funders: MLA, ACIAR, Cornell University
Impact: Significant influence on EDGE nutrition workshops which are the main vehicle for extension of cattle nutrition.

Rumen Ecology
Focus: Manipulating rumen function to increase productivity and decrease greenhouse gas emissions.
Leaders: Athol Klieve, Diane Overkerk
Collaborators: UQ, CSIRO, NSW DPI, Ohio State University, Meat and Wool NZ
Funders: MLA, Beef CRC, Pastoral Greenhouse Gas Research Consortium
Impact: Current commercialisation of a probiotic to control acidosis in cattle; isolation of kangaroo organism which reduces methane emission.

Beef Cattle Reproduction
Focus: Male and female reproductive physiology to increase reproduction rates
Leaders: Dick Holroyd, Geoff Fordyce
Collaborators: UQ, CSIRO, NSW DPI.
Funders: MLA, Beef CRC
Impact: Identification of effective bulls and impact of meat quality selection on reproductive rates, as delivered through 'Bullpower', 'Breeding Edge' and 'Breeding for Profit' workshops.

Integrated Pest Management
Focus: Reduced or low chemical methods of controlling animal insect pests (eg, buffalo fly, feedlot flies)
Leaders: Peter James, Rudolph Urech
Collaborators: Commercial properties and feedlots
Funding: MLA
Impact: Zero chemical treatment of buffalo fly (due to tunnels) and feedlot flies (due to native parasitic wasp).

Grazing Land Management and Nutrition (EDGE Team)
Focus: Accelerating the rate of adoption of new technologies and practices through development and delivery of structured learning packages by accredited facilitators.
Leaders: Russ Tyler, Col Paton
Collaborators: NT DPI, WA DPI, Tropical Savanna CRC, UQ, CSIRO
Funders: MLA, Regional NRM Groups, Fee for service
Impact: Very high rates of satisfaction by participants, with evidence of implementation.

Feedlot Environmental Management
Focus: Innovative solutions to air quality and effluent management for feedlots
Leaders: Neale Hudson, Alan Skerman
Collaborators: ALFA, USQ
Funders: MLA
Impact: Systems in place to monitor the soil nutrients load from effluents and to objectively measure odour.

Sustainable Rangeland Management
Focus: Optimising production from rangelands on a sustainable basis.
Leaders: Peter O'Reagain, David Phelps, Chris Chilcott
Collaborators: CSIRO
Funders: MLA
Impact: Industry pasture and animal management practices have changed as a result of this team's work (eg use of rotational spelling, reintroduction of regular fire regime).

Facilities

The following facilities are currently in use for on farm meat related R,D&E.

Toorak Research Station, Julia Creek District: 75,000 hectares of Mitchell grass plains, carrying capacity 1200 adult equivalent (AE) beef cattle or 8,000 DSE (beef cattle and sheep R&D).

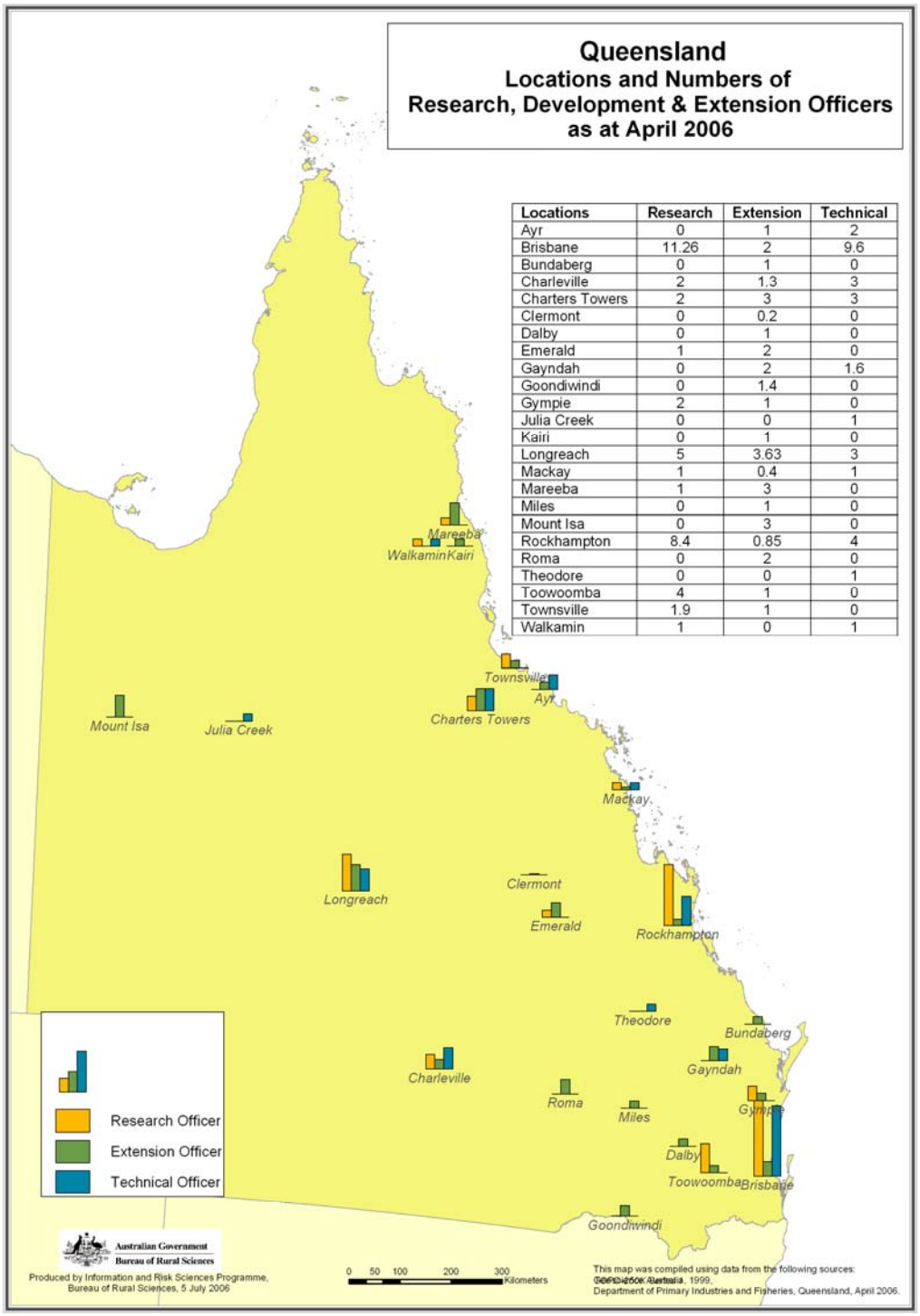
Rosebank Research Station, Longreach: 6,900 hectares of semi-arid zone Mitchell grass downs, carrying capacity 600 AE or 4150 DSE.

Swan's Lagoon Research Station, Ayr District: 36,000 hectares of northern black spear grass country, carrying capacity 3500 AE beef cattle (breeding cattle for trials elsewhere).
Brigalow Research Station, Theodore District: 3595 hectares, carrying capacity 1000 AE beef cattle. Four hundred head feedlot with feed mixing and storage facilities (long term catchment study site).

Brian Pasture Research Station, Gayndah: 2,000 hectares of southern speargrass country, some irrigated (grazing performance of native and improved pastures).

Animal Research Institute, Yeerongpilly: Large laboratory complex (microbiology, virology, biochemistry, parasitology, pathology, biometry, animal production, genetics, grazing land management).

Parkhurst, Rockhampton: Laboratories (animal production, genetics, animal welfare and behaviour, grazing land management).



Locations	Research	Extension	Technical
Ayr	0	1	2
Brisbane	11.26	2	9.6
Bundaberg	0	1	0
Charleville	2	1.3	3
Charters Towers	2	3	3
Clermont	0	0.2	0
Dalby	0	1	0
Emerald	1	2	0
Gayndah	0	2	1.6
Goondiwindi	0	1.4	0
Gympie	2	1	0
Julia Creek	0	0	1
Kairi	0	1	0
Longreach	5	3.63	3
Mackay	1	0.4	1
Mareeba	1	3	0
Miles	0	1	0
Mount Isa	0	3	0
Rockhampton	8.4	0.85	4
Roma	0	2	0
Theodore	0	0	1
Toowoomba	4	1	0
Townsville	1.9	1	0
Walkamin	1	0	1

3.4 Appendix D

3.4.1 R&D Audit for SARDI, South Australia

Table 1: Full Time Equivalents and Costs for R,D&E Activities

ASRC Classification		Full Time Equivalents (FTEs)						Total Cost $000
		Beef	Sheep Meat	Goats	F'lots	Live Export	Total	
300203	Plant Improvement (selection, breeding &genetic engin.)	4.67	7.005			2.335	14.01	2273
300204	Plant Protection (pests, diseases & weeds)	0.60	0.90			0.30	1.80	322
300205	Agronomy	0.70	0.925			0,225	1.85	358
300401	Animal Breeding (& genetics)	2.00	3.90				5.90	1115
300402	Animal Reproduction	0.20	1.50				1.70	367
300403	Animal Nutrition		0.30				0.30	62
300406	Animal Growth & Develment		1.40				1.40	222
300508	Parasitology		3.00				3.00	517
300803	Natural Resource Man'ment	0.40	0.10				0.50	110
300903	Sustain D'ment (incl grazing lnd m'ment, prodn modelling)		1.00				1.00	168
309902	Education and Extension	1.50	6.10		0.30		7.9	1503
	Totals	**10.07**	**26.13**		**0.30**	**2.86**	**39.36**	**7,017**

Table 2: External Funding $000

External Funds	Beef	Sheep Meat	Goats	Feedlots	Live Export	Totals
MLA	38	230				**268**
Other	353	1,371				**1,724**
Total Ext	391	1,601			105	**2,097**
				Total R,D&E Cost*		**7,017**
				Total DPI Contrib		**4,920**

*Total R,D&E cost from Table 1

Table 3: Age Profile of R,D&E Personnel (FTEs)

Category	Under 40 yrs	40-50 yrs	Over 50 yrs	Total
Research	8.0	8.56	3.5	**20.06**
Extension	4.1	2.5	1.3	**7.9**
Technical	2.3	7.5	1.6	**11.4**
Total	**14.4 (37%)**	**18.56 (47%)**	**6.4 (16%)**	**39.36**

Teams

Teams described below fulfil the following five criteria unless headed with a qualifying statement; the leaders named for each team are from PIRSA/SARDI unless indicated otherwise; only funders additional to PIRSA/SARDI are listed:

- The team is robust (not dependant on one key person).
- The team's expertise is known and acknowledged by others in the subject area.
- The team has appropriate and sufficient physical resources.
- The team's results have been published in refereed journals (or equivalent).
- The team's work has had or is highly likely to have significant industry impact.

Applied Genetics
Focus: Estimation of genetic parameters and on farm selection approaches for traits of importance, and the effect of Merino maternal genetics on prime lamb performance.
Leaders: Forbes Brien, Janelle Hocking-Edwards
Collaborators: U Adelaide, Sheep CRC, NSW DPI, Commercial producers
Funders: MLA, AWI
Impact: Has influenced sheep producers nationally in their approach to genetic selection and management of ewe nutrition (eg 'Lifetime Wool' program).

Reproductive Technology
Focus: Key factors influencing the viability of early embryos in achieving maximum reproduction rates from embryo transfer, and related procedures.
Leaders: Simon Walker, Jen Kelly
Collaborators: U Adelaide, People's Republic of China, beef and sheep stud breeders
Funders: Australian Research Council, commercial companies
Impact: Introduction, development and commercialisation of JIVET and MIVET.

Internal Parasites
Focus: Reducing dependence on chemical treatments for internal parasite control by developing practical tools and management strategies for on farm use.
Leaders: Ian Carmichael, Mick O'Callaghan
Collaborators: Victorian, Tasmanian and WA DPIs
Funders: AWI, MLA, Sheep CRC
Impact: Leading producers have changed management practices for internal parasite control

Pasture Legumes
Focus: Pasture legume improvement for temperate areas
Leaders: Geoff Auricht, Andrew Craig
Collaborators: NSW, Victorian, Queensland, Tasmanian DPIs, seed companies,
Funders: GRDC, AWI, MLA, Salinity CRC
Impact: An average of two new annual pasture legumes provided to industry annually, and one lucerne cultivar every 2-3 years.

The following team has not yet had an industry impact but is included because of its industry importance for the future:

Molecular Biology
Focus: Identifying genes controlling traits relative to meat quality and muscle development.
Leaders: Simon Bawden, Greg Nattrass
Collaborators: AWI/MLA Sheep Genomics Program, U Adelaide
Funders: AWI, MLA, Sheep and Beef CRCs
Impact: An international reputation in development of transgenic sheep and contributing to research which will lead to important genetic markers for meat quality, but has not yet delivered an industry impact.

Facilities

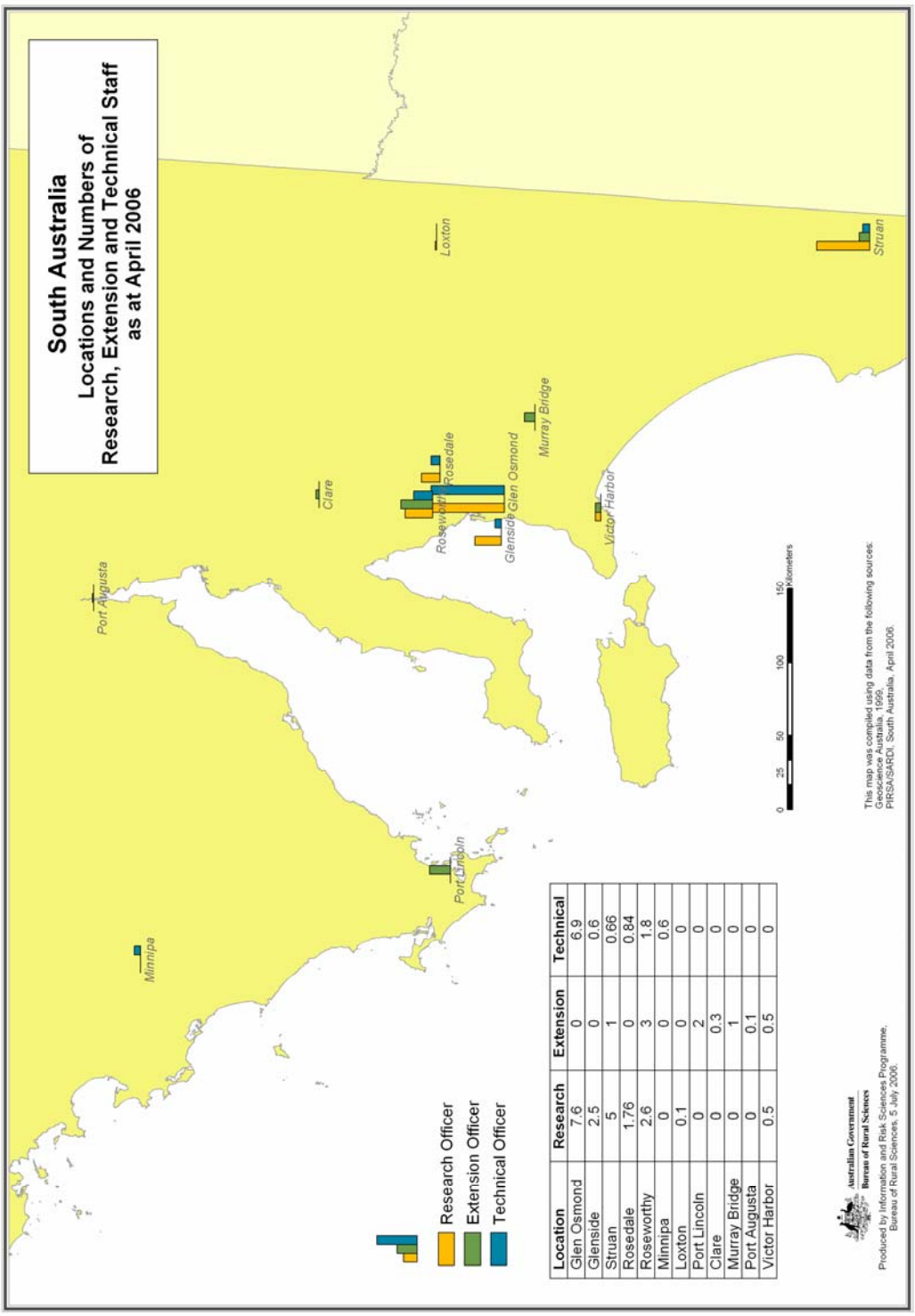
The following facilities are currently in use for on farm meat related R,D&E:

Roseworthy Campus, Roseworthy: Sixteen hundred hectares of farmland; the J S Davies laboratories (molecular and applied genetics); co-location with the U Adelaide (animal science and agronomy) and TAFE (primary industry vocational training).

Turretfield Research Centre, Rosedale: Eleven hundred hectares of farmland; laboratory facilities, including controlled environment (embryology, external parasitology, pasture and crop research).

Struan Agricultural Centre, Naracoorte: Includes Kybybolite Research Centre, 1400 hectares in total and supported by additional leased holdings; laboratory facilities (pastures, crop agronomy, cattle and sheep genetics, grazing management, meat production and quality); two hundred head feedlot and technograzing system.

Glenside Veterinary Laboratories, Glenside: Laboratories (parasitology and animal health).



Location	Research	Extension	Technical
Glen Osmond	7.6	0	6.9
Glenside	2.5	0	0.6
Struan	5	1	0.66
Rosedale	1.76	0	0.84
Roseworthy	2.6	3	1.8
Minnipa	0	0	0.6
Loxton	0.1	0	0
Port Lincoln	0	2	0
Clare	0	0.3	0
Murray Bridge	0	1	0
Port Augusta	0	0.1	0
Victor Harbor	0.5	0.5	0

3.5 Appendix E

3.5.1 R&D Audit for DPIW&E, Tasmania

Table 1: Full Time Equivalents and Costs for R,D&E Activities

ASRC Classification		Full Time Equivalents (FTEs)						Total Cost $000
		Beef	Sheep Meat	Goats	F'lots	Live Export	Total	
300202	Plant Nutrition	0.5	0.5				1.0	171
300203	Plant Improvement (selection, breeding &genetic engin.)	0.95	0.95				1.9	267
300205	Agronomy	1.0	1.0				2.0	423
300404	Animal Husbandry (incl an. welfare & behaviour)	0.3	0.55				0.85	129
300405	Animal Protection (field trials for pests & pathogens)		0.3				0.3	69
309902	Education and Extension	4.6	3.2		0.1		7.9	1568
	Totals	7.35	6.5		0.1		13.95	2,627

Table 2: External Funding $000

External Funds	Beef	Sheep Meat	Goats	Feedlots	Live Export	Totals
MLA	100	9				**109**
Other						
Total Ext	100	9				**109**
				Total R,D&E Cost*		**2,627**
				Total DPI Contrib		**2,518**

* Total R,D&E cost from Table 1

Table 3: Age Profile of R,D&E Personnel (FTEs)

Category	Under 40 yrs	40-50 yrs	Over 50 yrs	Total
Research		0.5	1.3	**1.8**
Extension	2.4	4.4	1.1	**7.9**
Technical	1.75	2.0	0.5	**4.25**
Total	**4.15 (29%)**	**6.9 (50%)**	**2.9 (21%)**	**13.95**

Teams

The team described below fulfils the following five criteria; the leaders named for this team are from both DPIWE and from the Tasmanian Institute of Agricultural Research (TIAR); only funders additional to DPIWE are listed:

- The team is robust (not dependant on one key person).
- The team's expertise is known and acknowledged by others in the subject area.
- The team has appropriate and sufficient physical resources.
- The team's results have been published in refereed journals (or equivalent).
- The team's work has had or is highly likely to have significant industry impact.

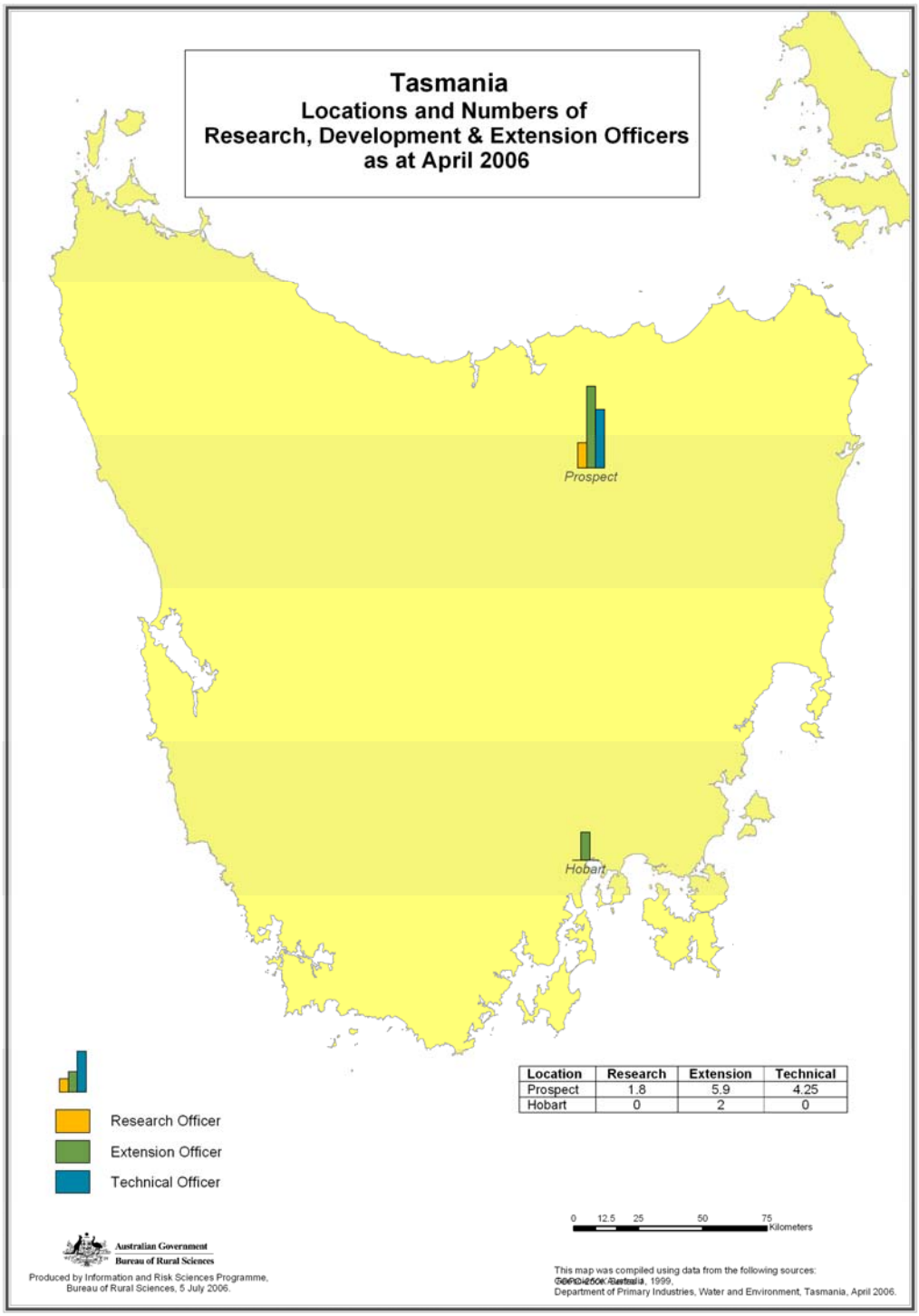
Herbage Development Group
Focus: Using a unique collection of genetic material to develop pasture and forage species and cultivars of superior merit for a cool temperate environment.
Leaders: Eric Hall (TIAR), Stuart Smith
Collaborators: Victorian DPI, Tasmania Global Seeds Pty Ltd, commercial farms
Funders: U Tasmania
Impact: Continual adoption of new pasture species and cultivars by producers in temperate Australia; most recently Arotas arrow leaf clover; Astrid red clover; Bass and Targa oats.

Facilities

The following facilities are currently in use for on farm meat related R,D&E:

Mount Pleasant Laboratories, Launceston: Laboratories and glasshouses (agronomy).

Elliott and Cressy Research and Demonstration Stations, Elliott and Cressy: 150 and 460 hectares of farmland respectively (agronomy, grazing systems)



Location	Research	Extension	Technical
Prospect	1.8	5.9	4.25
Hobart	0	2	0

3.6 Appendix F

3.6.1 R&D Audit for DPI, Victoria

Table 1: Full Time Equivalents and Costs for R,D&E Activities

ASRC Classification		Full Time Equivalents (FTEs)						Total Cost $000
		Beef	Sheep Meat	Goats	F'lots	Live Export	Total	
300101	Soil Physics		0.25				0.25	52
300102	Soil Biology		0.80				0.80	130
300103	Soil Chemistry		4.00				4.00	676
300105	Applied Hydrology		0.04				0.04	6
300203	Plant Improvement (selection, breeding &genetic engin.)		7.91				7.91	1253
300204	Plant Protection (pests, diseases & weeds)	1.22	2.23				3.45	645
300205	Agronomy		10.09				10.09	1773
300403	Animal Nutrition	1.00	6.71				7.71	1524
300404	Animal Husbandry (incl an. welfare & behaviour)	0.46	0.62				1.08	204
300405	Animal Protection (field trials for pests & pathogens)		11.10				11.10	1848
300406	Animal Growth & Develment	4,02	13.57				17.59	3160
300506	Pathology	2.02	4,04				6.06	1133
300507	Microbiology	1.63	3.26				4.89	805
300510	Virology	2.30	4.60				6.90	1119
300801	Environmental Management and Rehabilitation	5.00	6.17				11.17	1663
300803	Natural Resource Man'ment		0.10				0.10	30
300804	Environ Impact Assessment		3.82				3.82	815
309902	Education and Extension	13.40	12.75		0.40		26.55	4732
	Totals	**31.05**	**92.06**		**0.40**		**123.50**	**21,568**

Table 2: External Funding $000

External Funds	Beef	Sheep Meat	Goats	Feedlots	Live Export	Totals
MLA	375	4,118	11			**4,504**
Other	150	150				**300**
Total Ext	525	4,268	11			**4804**
				Total R,D&E Cost*		**21,568**
				Total DPI Contrib		**16,764**

* Total R,D&E cost from Table 1

Table 3: Age Profile of R,D&E Personnel (FTEs)

Category	Under 40 yrs	40-50 yrs	Over 50 yrs	Total
Research	40.24	22.61	4.70	**67.56**
Extension	16.55	9.20	0.80	**26.55**
Technical	12.21	14.52	2.67	**29.40**
Total	**69.00 (56%)**	**46.33 (37%)**	**8.17 (7%)**	**123.50**

Teams

Teams described below fulfil the following five criteria; the leaders named for each team are from DPI Victoria unless indicated otherwise; only funders additional to DPI Victoria are listed:

- The team is robust (not dependant on one key person).
- The team's expertise is known and acknowledged by others in the subject area.
- The team has appropriate and sufficient physical resources.
- The team's results have been published in refereed journals (or equivalent).
- The team's work has had or is highly likely to have significant industry impact.

Beef and Lamb Best Practice
Focus: Establishment and use of producer networks and continuous improvement and evaluation in extension methodology to achieve on farm practice change.
Leaders: Tim Hollier, Phil Franklin, Martin Dunstan
Collaborators: Regional Institute of Skills Training, private consultants, SW TAFE, Beef Improvement Association, supermarkets, processors, stock agents, studs.
Funders: MLA, AWI, Beef CRC.
Impact: Independent evaluations demonstrate increased uptake of pasture production and grazing management technology leading to increased profitability.

Animal Production Systems
Focus: A holistic, multidisciplinary, systematic flock approach to introducing new technology, increasing production and meeting market specifications
Leaders: Harsharn Gill, Geoff Saul
Collaborators: All State DPIs, U Melbourne, producers, consultants, Lambplan, Sheep Genetics Australia.
Funders: MLA, AWI, Beef and Sheep CRCs, CRC for Dryland Salinity, Land and Water Australia (LWA)
Impact: Enabled the industry to meet US market specifications through development and extension of systems for grazing management, genetic improvement and parasite control.

Pasture Systems and Genetics
Focus: Development of new pasture varieties by germ plasm identification and enhancement; increase in dry matter production by integrating new and/or existing pasture species, tailoring of fertiliser, and environmental adaptation.
Leaders: German Spangenberg, Chris Korte
Collaborators: southern DPIs; CSIRO; pasture seed companies
Funders: Molecular Plant Breeding CRC, Dryland Salinity CRC, MLA, AWI, Dairy Australia, LWA., commercial companies
Impact: Historical introduction of new pasture varieties; currently precommercial testing of disease resistant, highly digestible new ryegrass and clover varieties for use across SE Australia.

Salinity/Environmental Management Systems
Focus: Understanding the negative impact of agriculture on catchments; providing solutions for salinity by use of deep rooted perennial pastures and strategic tree planting.
Leaders: Anna Ridley, Michael Crawford
Collaborators: Victorian CMAs and Water Authorities; Murray Darling Basin; southern DPIs, CSIRO, Enviromeat.
Funders: Salinity CRC, MLA, AWI, LWA, NHT
Impact: Developed sustainable pasture systems which have been widely adopted and are the basis of a developing market accreditation system for environmentally friendly beef.

Facilities

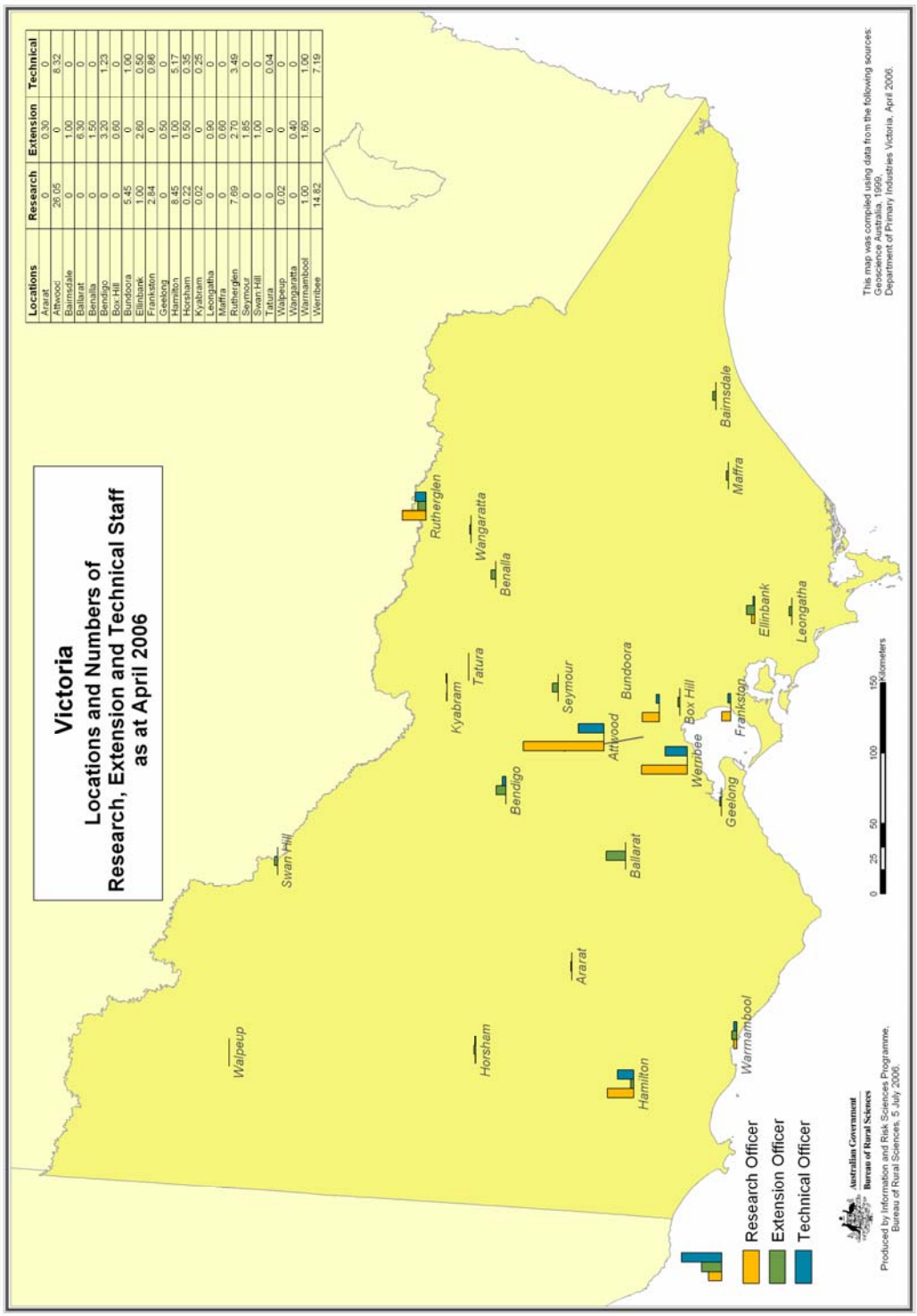
The following facilities are currently in use for on farm meat related R,D&E:

Werribee Research Farm, Werribee: 550 hectares of farm land and laboratories (intensive livestock research, prime lamb).

Hamilton Research Farm, Hamilton: 988 hectares of farm land (crossbreeding for veal, prime lamb)

Rutherglen Research Farm, Rutherglen: 800 hectares of farmland, including a feedlot facility (cropping, prime lamb)

Victorian Institute of Animal Science, Attwood: Extensive laboratories (multidisciplinary, including vaccine development, proteomics, genomics)


Victoria
Locations and Numbers of
Research, Extension and Technical Staff
as at April 2006
Locations | Research | Extension | Technical
Ararat | 0 | 0.30 | 0
Attwood | 26.05 | 0 | 8.32
Bairnsdale | 0 | 1.00 | 0
Ballarat | 0 | 6.30 | 0
Benalla | 0 | 1.50 | 0
Bendigo | 0 | 3.20 | 1.23
Box Hill | 0 | 0.60 | 0
Bundoora | 5.45 | 0 | 1.00
Ellinbank | 1.00 | 2.60 | 0.50
Frankston | 2.84 | 0 | 0.86
Geelong | 0 | 0.50 | 0
Hamilton | 8.45 | 1.00 | 5.17
Horsham | 0.22 | 0.50 | 0.35
Kyabram | 0.02 | 0 | 0.25
Leongatha | 0 | 0.90 | 0
Maffra | 0 | 0.60 | 0
Rutherglen | 7.69 | 2.70 | 3.49
Seymour | 0 | 1.85 | 0
Swan Hill | 0 | 1.00 | 0
Tatura | 0 | 0 | 0.04
Walpeup | 0.02 | 0 | 0
Wangaratta | 0 | 0.40 | 0
Warrnambool | 1.00 | 1.60 | 1.00
Werribee | 14.82 | 0 | 7.19
Rutherglen
Wangaratta
Benalla
Bairnsdale
Maffra
Kyabram
Tatura
Seymour
Bundoora
Ellinbank
Leongatha
Box Hill
Attwood
Frankston
Werribee
Bendigo
Geelong
Swan Hill
Ballarat
Ararat
Walpeup
Horsham
Hamilton
Warrnambool
Research Officer
Extension Officer
Technical Officer
0 25 50 100 150 Kilometers
This map was compiled using data from the following sources:
Geoscience Australia, 1999.
Department of Primary Industries Victoria, April 2006.
Australian Government
Bureau of Rural Sciences
Produced by Information and Risk Sciences Programme,
Bureau of Rural Sciences, 5 July 2006.

3.7 Appendix G

3.7.1 R&D Audit for DA&F, Western Australia

Table 1: Full Time Equivalents and Costs for R,D&E Activities

ASRC Classification		Full Time Equivalents (FTEs)						Total Cost $000
		Beef	Sheep Meat	Goats	F'lots	Live Export	Total	
300104	Land Capability & Soil Degradation (incl salinity)		0.2				0.2	37
300203	Plant Improvement (selection, breeding &genetic engin.)	2.9	3.9				6.8	1421
300204	Plant Protection (pests, diseases & weeds)	0.2	1.2				1.4	289
300205	Agronomy	1.95	10.79				12.74	2244
300401	Animal Breeding (& genetics)	0.4	0.2				0.6	65
300402	Animal Reproduction	3.6	0.1				3.7	828
300403	Animal Nutrition	2.88	0.2				3.08	576
300404	Animal Husbandry (incl an. welfare & behaviour)	1.3	1.08		0.2		2.58	366
300406	Animal Growth & Develment	2.1	0.44				2.54	557
300499	Animal Production not elsewhere classified	1.6	0.8				2.4	516
300505	Anatomy & Physiology		0.1				0.1	25
300508	Parasitology		4.5				4.5	964
300801	Environmental Management and Rehabilitation				0.1		0.1	17
300901	Farm Management etc	1.7	0.05			0.05	1.8	350
309902	Education and Extension	6.69	12.05	1.2	0.1	0.4	20.44	3598
260602	Climatology	0.1	0.1				0.2	24
300999	Ag, vet & enviro sciences not elsewhere classified	0.4	5.9				6.3	1125
	Totals	**25.82**	**41.61**	**1.2**	**0.4**	**0.45**	**69.48**	**13,002**

Table 2: External Funding $000

External Funds	Beef	Sheep Meat	Goats	Feedlots	Live Export	Totals
MLA	140	234			32	**406**
Other						
Total Ext	140	234			32	**406**
				Total R,D&E Cost*		**13,002**
				Total DPI Contrib		**12,596**

* Total R,D&E cost from Table 1

Table 3: Age Profile of R,D&E Personnel (FTEs)

Category	Under 40 yrs	40-50 yrs	Over 50 yrs	Total
Research	10.54	13.37	6.23	**30.14**
Extension	9.29	6.05	3.70	**19.04**
Technical	10.41	6.84	3.05	**20.30**
Total	**30.24 (43%)**	**26.26 (38%)**	**12.98 (19%)**	**69.48**

Teams

Teams described below fulfil the following five criteria unless headed with a qualifying statement; the leaders named for each team are from DAFWA unless indicated otherwise; only funders additional to DAFWA are listed:

- The team is robust (not dependant on one key person).
- The team's expertise is known and acknowledged by others in the subject area.
- The team has appropriate and sufficient physical resources.
- The team's results have been published in refereed journals (or equivalent).
- The team's work has had or is highly likely to have significant industry impact.

Sheep Genetics

Focus: The genetic trade offs in selecting for meat or wool attributes, and the science of breeding for resistance to internal parasites.
Leaders: Johan Greeff, Bronwyn Clarke
Collaborators: CSIRO, South African DPI
Funders: MLA, AWI, Sheep CRC
Impact: Leading producers and stud breeders have accepted the team's findings on selection for resistance against parasites and the inverse relationship between fleece weight and reproductive performance.

Pasture Assessment by Satellite
Focus: Estimating pasture growth and mass on commercial properties by use of meteorological data and satellite mapping.
Leaders: Steve Gherardi, Graham Donald (CSIRO)
Collaborators: CSIRO, Commercial producers, Department of Land Information
Funders: CRC for Spatial Information; ?
Impact: Cooperating producers have sustainably increased stocking rates by up to 40% in response to the information provided.

Grazing Management for Animal Performance
Focus: Managing ewe condition to cost effectively optimize weaning rate and post weaning performance.
Leaders: Chris Oldham, Mike Hyder, Andrew Thompson (DPI Vic)
Collaborators: DPI Victoria, Commercial producers
Funders: AWI
Impact: Commercial producers adopted the findings and have achieved an increase in weaning and stocking rate with an overall reduction in costs.

Integrated Parasite Management
Focus: Characterisation of the dynamics of the development of a resistant nematode population and development of management systems to prolong the effectiveness of existing drenches.
Leaders: Brown Besier, Rob Woodgate
Collaborators: CSIRO, Murdoch U Vet School, commercial vets.
Funders: AWI, MLA, Sheep CRC
Impact: Widespread adoption by industry of recommendations arising from this research.

Pasture Development
Focus: Breeding new annual and perennial legume varieties for WA pastures.
Leaders: Clinton Revell, Phil Nichols
Collaborators: UWA; SARDI; NSW and Queensland DPIs.
Funders: GRDC, AWI
Impact: Responsible for 70% of new pasture legumes sown in 2005

New Pasture Management
Focus: Determining all the key factors in establishment and management of new pasture in a range of farming systems across WA
Leaders: Paul Sanford, Perry Dolling
Collaborators: Commercial producers/grower groups; Lucerne Growers Association, Evergreen Group
Funders: MLA, AWI, GRDC, Salinity CRC
Impact: Widespread implementation of research findings in a variety of climatic niches, soil types and farming systems.

The following team has DPIFWA members but not a leader (the leader is from UWA). It is included because of its industry importance and impact:

Sheep Reproductive Physiology

Focus: Investigation of the interaction between reproductive physiology, nutrition and maternal behaviour to develop cost effective and chemical free ways to maximise weaning rates.
Leader: Graham Martin (UWA)
Collaborators: UWA
Funders: MLA
Impact: Implementation of the principal findings by leading producers.

Facilities

The following facilities are currently in use for on farm meat related R,D&E:

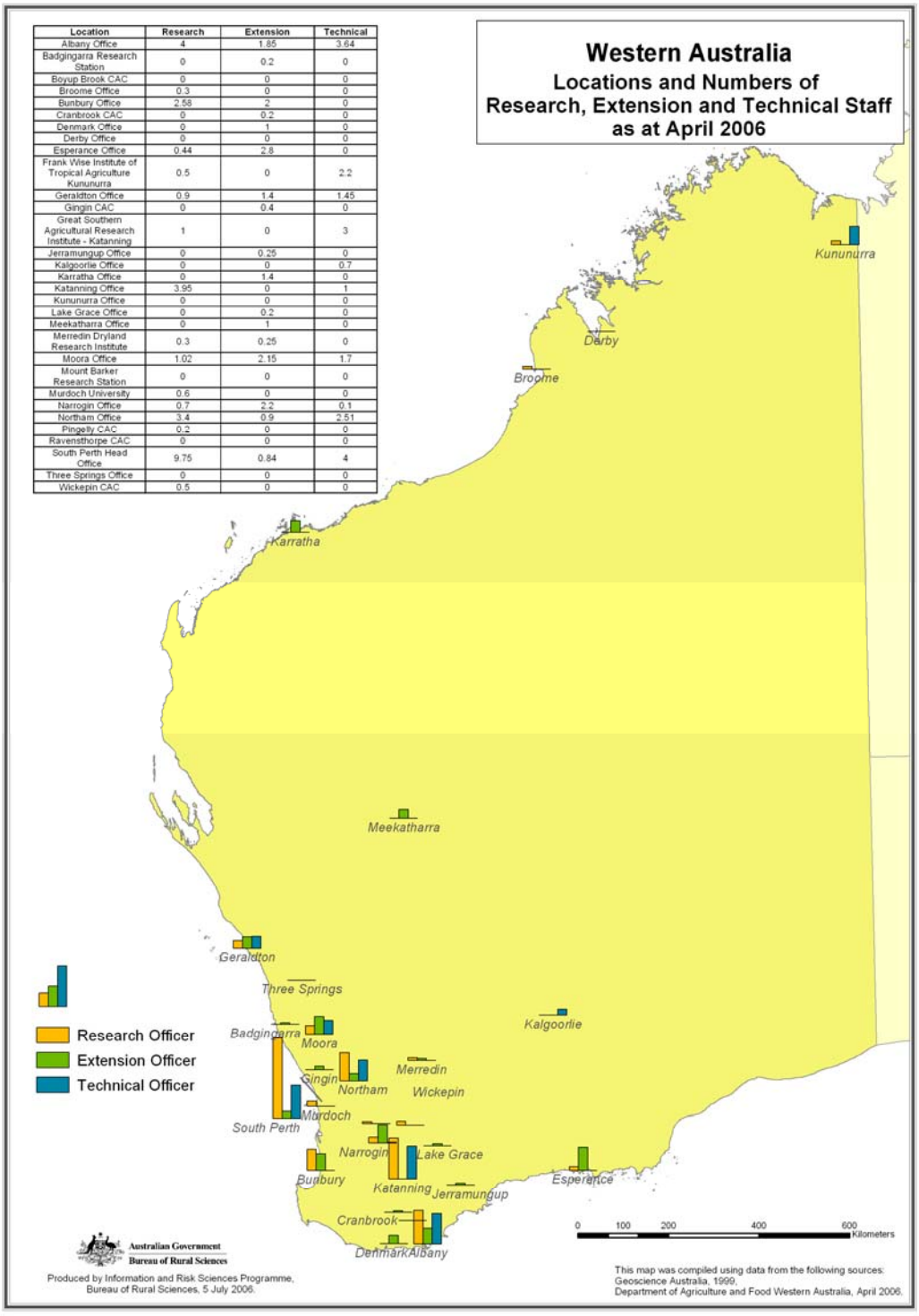
Vasse Research Station, Vasse: 850 hectares of farmland (beef maternal productivity).

Great Southern Agricultural Research Institute, Katanning: 1800 hectares of mixed cropping and grazing land (sheep genetics, pasture and mixed farming).

Mount Barker Research Station, Mount Barker: 1380 hectares of mixed cropping and grazing land (genetics, parasite resistance).

Esperence Downs, Merridin and Badgingara Research Stations: Extensive cropping and grazing land (various trials).

Location	Research	Extension	Technical
Albany Office	4	1.85	3.64
Badgingarra Research Station	0	0.2	0
Boyup Brook CAC	0	0	0
Broome Office	0.3	0	0
Bunbury Office	2.58	2	0
Cranbrook CAC	0	0.2	0
Denmark Office	0	1	0
Derby Office	0	0	0
Esperance Office	0.44	2.8	0
Frank Wise Institute of Tropical Agriculture Kununurra	0.5	0	2.2
Geraldton Office	0.9	1.4	1.45
Gingin CAC	0	0.4	0
Great Southern Agricultural Research Institute - Katanning	1	0	3
Jerramungup Office	0	0.25	0
Kalgoorlie Office	0	0	0.7
Karratha Office	0	1.4	0
Katanning Office	3.95	0	1
Kununurra Office	0	0	0
Lake Grace Office	0	0.2	0
Meekatharra Office	0	1	0
Merredin Dryland Research Institute	0.3	0.25	0
Moora Office	1.02	2.15	1.7
Mount Barker Research Station	0	0	0
Murdoch University	0.6	0	0
Narrogin Office	0.7	2.2	0.1
Northam Office	3.4	0.9	2.51
Pingelly CAC	0.2	0	0
Ravensthorpe CAC	0	0	0
South Perth Head Office	9.75	0.84	4
Three Springs Office	0	0	0
Wickepin CAC	0.5	0	0



3.8 Appendix H

3.8.1 Terms of Reference

To examine:

1. The current capacity versus future industry needs in relation to:
   a) Future industry, Government and community expectations
   b) Relevant future technologies
   c) Maintenance or development of critical mass
   d) The nature and value of R,D&E resources available
2. The options for processes that enable a more comprehensive and collaborative approach to any potential rationalisation of R&D resources available
3. The key resources in each of the States and Territories and recommendations to avoid duplication.