

Centre for Legumes in Mediterranean Agriculture  
(CLIMA)

Strategic Plan

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## **THE PURPOSE OF THIS DOCUMENT**

The purpose of this document is to explain the origin and purpose of CLIMA; and to provide a strategic framework and set of objectives for the CLIMA Research Alliance.

## **ACKNOWLEDGEMENTS**

We wish to thank all of the people who have contributed to the development of CLIMA's strategic plan by contributing material and making comments on drafts of the plan. In particular we wish to thank Professor Clive Francis, Dr Mark Sweetingham, Associate Professor John Howieson, Dr Howard Carr and Adjunct Professor Neil Turner for their insight and contribution to the document.

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## **THE CLIMA CONCEPT**

The Centre for Legumes in Mediterranean Agriculture (CLIMA) is a Research Alliance between the Department of Agriculture, Western Australia, The University of Western Australia, CSIRO and Murdoch University. It was formed in July 2000 to continue the research collaboration begun in 1992 under the Commonwealth Government’s Cooperative Research Centre Program.

In creating and supporting CLIMA the objective of the partner institutions is to create a research environment for the legume industries where the returns from the substantial investment in R&D made by the State Government, Universities, CSIRO and industry groups can be maximised for the benefit of primary producers, industry and the community.

## **CLIMA’S MANDATE**

*Mandate: A command, order, injunction ..... (Oxford English Dictionary)*

“To apply leading edge science to the problems and priorities identified by the Western Australian grain and pasture legume industries with the objective of creating value for the industries and the wider community”.

## **THE CLIMA VISION**

“Innovation in Legume Science and Technology”

Our CLIMA vision is for a Centre of Excellence in grain and annual pasture legume research and development that leverages the strengths of its partners to address the problems and priorities of the Western Australian grain and pasture legume industries.

This will be achieved through the conduct of strategic scientific research and development linked to an applied research base. The Centre intends to be a world leader in problem-focused legume research and will achieve this by drawing on the expertise within its four partner organisations and from other collaborating organizations as appropriate.

## **CLIMA’S CLIENTS**

CLIMA’s clients are those individuals, businesses and organisations associated in some way with the grain and pasture legume industries who may benefit from CLIMA’s activities. CLIMA’s most significant clients are:

- Growers of grain and pasture legumes (collectively, rather than as individuals);
- The Grains Program of the Department of Agriculture, Western Australia;
- The Grains Research and Development Corporation (GRDC) and other organisations that may invest their research funds through CLIMA;
- Agribusiness that may wish to participate in research and/or the commercialisation of CLIMA products; and
- Grower and government organisations that need access to CLIMA’s knowledge and expertise in legume science and production technology.

## **CLIMA'S OBJECTIVE**

CLIMA's objective is to add value to the activities of its clients, core partners and associated staff and students and in doing so, maximise the benefits of co-operation and co-ordination of research.

In working toward this objective, the benefits that flow to clients, core partners and staff are:

FOR CLIENTS – INVESTORS IN R&D, GROWERS AND AGRIBUSINESS – CLIMA WILL:

- Introduce innovative products that will add opportunity and value to their businesses.
- Act as a single door for action on problems and opportunities identified by industry.
- Provide an opportunity to build self-reliant research infrastructure responsive to grower needs.

FOR CORE PARTNERS CLIMA WILL:

- Add value to our joint venturers' investment in legume research to ensure the profitable and sustainable use of legumes in Western Australia.
- Be a sign of the commitment of the partner organisations to work together for the good of agriculture and the Western Australian community and to leverage greatest value from the limited resources available for research and development.
- Create an environment conducive to co-operative research that builds on the strengths of the partner organisations for the benefit of Western Australia.
- Increase Western Australia's competitiveness for national research funding in agriculture.

FOR CLIMA ASSOCIATED STAFF AND STUDENTS THE ALLIANCE WILL:

- Provide opportunities to interact with a larger research community and to make a difference.
- Enable access to equipment and knowledge held by the partners.
- Multiply opportunities for post-graduate training linked to partner institutions.

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## SECTION 1 – INDUSTRY CONTEXT

### 1.1 INTRODUCTION

Australia's mediterranean region (cool, wet, winter growing season and hot, dry summers) covers the south-west of Western Australia as well as southern South Australia and parts of western Victoria and southern New South Wales. From these areas comes 75% of Australia's wheat and barley, 90% of the grain legumes and oilseeds, 65% of her sheep and 15% of her cattle.

The harsh climate and the ancient, nutritionally deficient soils that dominate most of Australia's mediterranean region have resulted in farming systems where pasture legumes and more recently grain legume crops play an important role. For a century, sheep were grazed on subterranean clover or medic pastures used to raise soil fertility and break disease cycles as they shared a rotation with cereal crops. In the last 20 years grain legumes and oilseeds have entered rotations in response to economic pressures and technical innovation and now share a more diversified farming system with animal enterprises.

As a result of this diversification, Australia's mediterranean farming systems are potentially more ecologically and economically stable than at any time in their history. Yet challenges remain:

- Disease in grain legumes has deterred many growers from exploiting the benefits of grain legumes to their farming systems.
- Herbicide resistance in major weeds challenges the very basis of existing systems and will require new farming systems based on the innovative use of grain and pasture legumes.
- The basis of adaptation of crops and pasture is poorly understood, limiting the ability of breeders to select for improved types.
- The cash value of some grain legumes (e.g. narrow-leafed lupin) is low relative to other crops and there are opportunities to increase their value through processing.
- Pastures are seen solely in terms of animal feed and their value as chemical factories for high value natural products has been ignored.

These were some of the challenges taken up by the Cooperative Research Centre (CRC) for Legumes in Mediterranean Agriculture from 1992 to 2000. The achievements of the CRC were widely acknowledged and have been documented by Abadi et al (2001). The role of the CLIMA Research Alliance is to build on the achievements of the CRC phase and to continue to improve the value of grain and pasture legumes in Western Australia's farming systems.

### 1.2 THE GRAIN LEGUME INDUSTRIES

Over the past 25 years grain legumes have emerged from virtual obscurity to become an important part of the Australian grains industry with an annual production of about 2 million tonnes and a gross value of production of about \$600 million. Above this, grain legumes are estimated to contribute an additional \$600 million per annum in value to the cereal industries through their roles in nitrogen fixation and disease control.

#### WA Grain Legume production

|                 | 1995 | 1996 | 1997 | 1998 | 1999 |
|-----------------|------|------|------|------|------|
| Lupin           |      |      |      |      |      |
| Prod'n ('000 t) | 1290 | 1272 | 1347 | 1317 | 1274 |
| Value (\$ m)    | 260  | 269  | 258  | 201  | 200  |
| Other pulses    |      |      |      |      |      |
| Prod'n ('000 t) | 80   | 106  | 112  | 109  | 217  |
| Value (\$ m)    | 23   | 34   | 39   | 34   | 67   |

Currently the gross value of production of grain legumes in Western Australia is approximately \$250 million per annum of which about 80% is attributable to narrow-leafed lupin and the remainder to other legume crops.

Production of all agricultural crops peaked in 1999 and grain legume production and value has been lower in 2000 and 2001 due to adverse seasonal conditions and disease. The potential contribution of grain legume crops, however, is substantially greater provided that the problems of disease and poor adaptation can be overcome. Based on analysis of soil types and farming systems the maximum area for production of pulses has been estimated to be 2.3 million ha - about double the current area.

#### Peak and potential area of grain legume production in Western Australia.

| Species             | Peak area | Area ('000 ha) | Potential area ('000 ha) |
|---------------------|-----------|----------------|--------------------------|
| Narrow-leafed lupin | 1,200     | 1,000          | 1,400                    |
| Yellow lupin        | 4         | 1              | 200                      |
| Albus lupin         | 30        | 1              | 50                       |
| Chickpea            | 80        | 30             | 200                      |
| Field pea           | 70        | 60             | 250                      |
| Faba bean           | 40        | 12             | 150                      |
| Lentil              | 5         | 5              | 25                       |
| Vetch               | 15        | 11             | 60                       |
| Total               | 1,444     | 1,120          | 2,335                    |

#### Industry needs and research opportunities

The dramatic growth in narrow-leafed lupin production in the 1980s to over 1 million ha and the rapid growth of other grain legume crops in the 1990s has stalled as problems have emerged. The rapid growth of the industries began in a relatively disease free environment, but as the area has increased diseases have emerged that have constrained production. The most significant are:

- Anthracnose has already resulted in the closure of the albus lupin industry in Western Australia and threatens the industry Australia-wide.
- Aschochyta blight of chickpea, identified in South Australia in 1996, has rendered chickpea production less economic over much of southern Australia.
- Chocolate spot, aschochyta and rust have constrained an otherwise viable faba bean industry.
- Black spot of field pea has reduced yield and limits the use of field pea in rotation.

Although fungal diseases are the highest profile and most immediate threat to the grain legume industry, these are overlaid on less than optimal adaptation to the environment. Compared to the cereals all of the grain legumes have only a short history of breeding and cultivation in Western Australia. With the exception of narrow-leafed lupin, where local breeding and selection has been in progress for 40 years, virtually all pulse varieties currently available to growers are selections from imported germplasm. Experience from overseas and with other crops suggests that breeding and selection for adaptation will provide a long phase of improvement in yield, yield stability and product quality. Important abiotic stresses for which improved adaptation must be sought are:

- Drought and heat stress.
- Tolerance to hostile soil conditions including waterlogging, pH, and boron toxicity.
- Tolerance to widely used herbicides.

For human food, grain legumes are sold mainly on their size and appearance, whereas for stock feed nutritional composition determines the value of the grain to the end user and the price received by the producer. Improving ‘quality’ in both major markets is an avenue to increase the returns to producers and thus the incentive to include grain legumes in farming systems. Important targets for improvement are:

- Seed size, shape, appearance, splitting recovery and cooking quality for grain legumes targeted to premium human food markets.
- Nutritional value for stock feed applications of grain legumes.
- Seed composition for potential processing for functional proteins, starches and other food ingredients.

### 1.3 THE PASTURE LEGUME INDUSTRY

Western Australia’s farming systems are a legacy of the ‘sub and super’ revolution that allowed development of the millions of hectares of nutrient deficient, light land soils cleared for agriculture in the 1950s, 1960s and 1970s. Superphosphate and trace elements allowed the prolific growth of subterranean clover for animal production and provided the residual nitrogen needed to grow the following cereal crops.

Many challenges to this simple system – phyto-oestrogens (clover disease), poor seed set, inadequate hard seed, insect pests and fungal disease – have been met and overcome through scientific research in the decades since the system was introduced. More recently, low prices for wool and animal products have reduced producer interest in improving pastures for animal production, but wool prices are rebounding and new opportunities to use pastures as vital parts of sustainable crop-orientated farming systems are emerging. Development of new pasture species with improved adaptation to hostile soil conditions, aerial seeding for easy harvest and adapted to short pasture phases are poised to recapture a significant role in farming systems.

#### Peak and potential areas of pasture legumes in Western Australia.

| Species      | Peak area | Area (‘000 ha) | Potential area (‘000 ha) |
|--------------|-----------|----------------|--------------------------|
| Sub-clover   | 3,200     | 1,500          | 3,000                    |
| Annual medic | 1,800     | 600            | 1,500                    |
| New species  | 90        | 80             | 3,500                    |
| Total        | 5,900     | 2,900          | 8,000                    |

#### Industry needs and research opportunities

For the annual pasture legume industry the most important industry needs and research opportunities are:

- The profitable adoption by growers of the suite of new pasture legume species developed through the CRC and National Annual Pasture Legume Improvement programs (NAPLIP).

By maximising the adoption of the cohort of species developed in the CRC and through NAPLIP, CLIMA could be instrumental in enabling growers to adopt more profitable and sustainable farming systems. The opportunities are in exploiting these species as tools to avoid herbicide resistance in weeds, improvement in hydrological balance and providing high inputs of nitrogen at minimal cost, while providing excellent animal feed with unique characteristics.

- Investigation of improved animal performance through better pasture legume based nutrition.
- The development of novel products and secondary processing of pasture legume components. Pastures have traditionally been used solely as a source of feed for grazing animals. There is the opportunity to exploit our pasture legume genetic resources for novel outcomes – natural anthelmintics, valuable phytohormones, summer legume feed and aquaculture.

- Identification and development of new annual species productive on hostile soils (salt affected, waterlogged, acidic) or soils where current species are deficient.
- Enhancement of information flow between pasture scientists, extension workers and farmers with respect to pasture legume usage and adoption.

## SECTION 2 - RESEARCH AND DEVELOPMENT CONTEXT

### 2.1 THE RESEARCH ENVIRONMENT

Across Australia and overseas, there is a clear pattern of consolidation of small research groups into larger, better integrated, and well resourced research organisations and alliances. The driving forces behind this consolidation are:

- The enormous expansion in biological knowledge as a result of advances in molecular biology, genomics, computing and bio-informatics;
- Increased costs that result from the shortened life of research instruments and infrastructure;
- The realisation that scientific insights and advances are more likely from the cross-fertilization of ideas and the integration of research disciplines in the laboratory; and
- The need to link education and training more closely with the research & development industry to attract and retain high calibre people for the future.

These are some of the forces that have driven the Commonwealth’s Cooperative Research Centre program. The Plant Science CRC (1991-1999), the CRC for Tropical Plant Pathology (1992-2007), the CRC for Legumes in Mediterranean Agriculture (1992-2000), the CRC for Molecular Plant Breeding (1997-2004), and the Value Added Wheat CRC (2001-2008) are some examples.

Even where CRCs have not been established, groupings and alliances are being formed as research organisations attempt to maximise the return on their investments. Recent Australian examples of consolidation are:

|                                                                             |                                                                                                                                                                                                     |
|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Agricultural Productions Systems Research Unit (APSRU)                      | CSIRO Divisions of Sustainable Ecosystems and Land & Water, the Queensland Departments of Primary Industries and Natural Resources & Mines and the University of Queensland.                        |
| Centre for Environment and Life Sciences                                    | Eight Divisions of CSIRO: Land and Water, Sustainable Ecosystems, Entomology, Forestry and Forest Products, Livestock Industries, Plant Industry, Mathematical and Information Sciences and Marine. |
| The Joint Centre for Crop Research                                          | Agriculture Victoria, La Trobe University, The University of Melbourne.                                                                                                                             |
| NSW Agriculture Centre for Plant Genomics                                   | NSW Agriculture and CSIRO.                                                                                                                                                                          |
| The Australian Centre for Plant Functional Genomics                         | The Universities of Adelaide, Melbourne and Queensland, SARDI and DNRE.                                                                                                                             |
| Biotechnology Centre of Excellence: Centre for Stem Cells and Tissue Repair | A number of institutions from Victoria, Queensland, New South Wales, South Australia and ACT.                                                                                                       |

With the exception of the Centre for Environment and Life Sciences, all of the Centres are Research Alliances linking organisations with different strengths and common interests.

In Western Australia the small size of the research community and the isolation from major eastern Australian and international research centres makes it imperative that the benefit from limited R&D resources be maximised. The Cooperative Research Centre for Legumes in Mediterranean Agriculture (1992-2000) is an example of what can be achieved through cooperation and, for CLIMA, can act as a model for the future. CLIMA’s success will thus depend, to a large degree, on its ability to build cooperation between its institutional partners and to stimulate the synergies potentially available from combining their individual resources and areas of expertise.

## 2.2 THE BUSINESS ENVIRONMENT

Traditionally, agricultural research has been the domain of government. This has been justified on the grounds of ‘market failure’ - the lack of investment in R&D services by the private sector due to their inability to capture an adequate share of the benefits.

Government investment in agricultural R&D has been found to have consistently generated high rates of return on investment and to have provided large community benefits. Although there is no sign that return on investment may be lower in the future, investment by government is unlikely to continue at levels that will be required to maintain competitive advantage.

World-wide the trends are:

- Agribusiness is consolidating into a small number of very large, often vertically integrated companies that have the capacity to undertake research and effectively market the products of that research;
- The focus of these companies is narrowing to the handful of mega-crops with the area and value to produce significant returns;
- There is reorientation of government priorities from issues of agricultural production to those of environmental quality and community;
- Some agricultural research (in particular plant breeding) has elements of private good.

For the grain and pasture legume industries the implications of these changes are profound – the important needs are still, in the main, productivity orientated yet the industries are too small to interest international agribusiness, and government resources in the future are unlikely to be able to meet the demand for R&D investment.

CLIMA, as an alliance of four publically funded institutions, is a way of consolidating otherwise fragmented government support for the grain and pasture legume industries. This is important now and will be of even more importance in the future.

## 2.3 CLIMA’S CORE BUSINESS

CLIMA’s core business is the facilitation of scientific research, commercialisation, communication and training for the benefit of its clients. Its mandate, is research, both basic and applied, for the grain and pasture legume industries in Western Australia. For these industries CLIMA can offer its clients:

- A focus for industry problem solving and prioritisation of research.
- Facilitation and support for development of research proposals using the expertise of its partners.
- Access to new, non-traditional sources of investment for research in the industries.
- Promotion to investors of the benefits of using the CLIMA ‘umbrella’ as an investment vehicle.
- An intellectual and physical environment within which research contracted through CLIMA can flourish.
- A framework using a holistic approach to technology transfer and training.
- A framework and support for post-graduate and industry training.
- An avenue to commercialisation that balances the needs of industry for rapid adoption of new technology with the legitimate needs of business to profit from its endeavours.

Because CLIMA is a Research Alliance it relies on funds for investment provided by its clients for project specific R&D. Some of its clients – such as the Grains Program and other relevant commodity Programs of the Department of Agriculture, Western Australia – are a partner of the alliance, but most – for example GRDC – are external.

CLIMA will work with clients to identify opportunities for R&D and then develop strong proposals to undertake that research as a core business activity. Final decisions on research priorities and research objectives will ultimately be set by the organisations making the investment and not by CLIMA.

## **SECTION 3 – CLIMA’S PLAN TO MAKE A DIFFERENCE CONSULTATION, RESEARCH, COMMUNICATION AND TRAINING, INTERNATIONAL LINKAGES**

### **3.1 CONSULTATION**

CLIMA’s ability to identify, relate to and respond to its clients needs will be critical to its success. CLIMA recognises this and essential consultation is built into the CLIMA structure through the Board, the Industry Advisory Group and the Program Management Team (see Section 4). In addition to these mechanisms, CLIMA plans an ongoing program of less structured industry consultation through:

- Periodical industry workshops to canvas industry priorities and to report back on CLIMA’s progress in addressing industry problems and priorities
- An ongoing program of one-on-one meetings with potential research investors and industry partners.

CLIMA will use these mechanisms to ensure that emerging problems and priorities are addressed and to drive ongoing review of its research and communication programs to ensure continued relevance to industry.

### **3.2 THE RESEARCH PLAN**

CLIMA’s research programs will reflect its investors’ objectives for the grain and pasture legume industries and will endeavour to meet these objectives through two Programs – Grain Legumes and Pasture Legumes themselves divided into relevant subprograms and components. Program and subprogram leaders make up CLIMA’s Management Team.

#### **Grain Legume Program**

Leader: Dr Mark Sweetingham

The Grain Legume Program has been developed to respond to the industry needs and opportunities identified in Section 2, with the goal of increasing the efficiency and reliability of grain legume production and increasing profitability through the value chain by orientating research to high value products. Research will focus on:

Responding to the pest and disease threats that currently constrain the grain legume industry (Subprograms 1 and 2):

Effective disease and pest management is the key to restoring grower confidence in the grain legume industries. This is essential if the industries are to be rebuilt following the major disease epidemics encountered in the 1990s. In the short term integrated management based on improved knowledge of the epidemiology and ecology of the diseases and pests in different environments will assist growers to reduce the impact of pests and diseases. In the longer term, durable genetic resistance will strengthen good management and rotational practice and should eliminate the threat posed by all of the major diseases and insect pests. The subprogram will contribute to these goals by improving the efficiency and effectiveness of screening procedures and seeking novel resistance strategies based on an understanding of the molecular basis of plant-pathogen interactions.

Developing varieties with improved adaptation to abiotic (climatic and edaphic) stress and thus greater and more reliable yield (Subprograms 1 and 3):

Abiotic stresses are diverse and insidious and include drought and heat stress, waterlogging, herbicide induced stress and nutrient deficiency or toxicity. The objective of the subprogram is to

assist breeders through improving methods to screen for abiotic stress and to enable agronomists to better match genotypes to environments to maximise grain production and quality.

Increasing the value of grain legume products (Subprogram 4):

The ‘low value’ received for lupins in the livestock feed market has long frustrated growers and threatens the place of lupins in farming systems. The challenge is to increase the value of lupin grain in the marketplace and this is one focus of subprogram 4. The subprogram will attempt to define the grain quality parameters required by specific end users and develop the tools for breeders to accurately screen for them. It will work with industry to research new grain legume products to increase returns to growers and to create processing opportunities for Australian investors in traditional food and feed markets and special nutritional, functional food and health products.

Germplasm Development - Subprogram 1 - is a key linking subprogram. Disease resistance, improved adaptation and grain quality all have a strong genetic base and this subprogram will support the needs of breeding programs in Western Australia and nationally. The subprogram will focus on genetic resources – with the objective to find new genes conferring high value traits from natural germplasm currently untapped by Australian grain legume breeding programs. It is also desired to make more efficient use of existing germplasm collections and to develop more cost-effective acquisition strategies. Key research within the subprogram will include:

- pre-emptive breeding for resistance to exotic pathogens and pests;
- wide-cross introgression of novel genes for resistance to key pathogens and pests;
- identification of genes for resistance to abiotic stress;
- evaluation of existing collections using multivariate/pattern analysis of agronomic, morphological and molecular data.

| <b>Subprogram</b>                                                                      | <b>Component</b>                                                                                                                                |
|----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| Subprogram 1: Germplasm Development<br>Dr Bevan Buirchell                              | Genetic resources<br>Breeding technologies                                                                                                      |
| Subprogram 2: Disease & Pest Management<br>Prof. Richard Oliver                        | Resistance<br>Integrated Pest Management                                                                                                        |
| Subprogram 3: Agro-ecological Adaptation<br>Adjunct Prof. Neil Turner                  | Physiological, biochemical and molecular basis of environment interaction<br>Improved screening methods for resistance/tolerance                |
| Subprogram 4: Grain Quality, Utilization, & Product Development<br>Dr Mark Sweetingham | Improving grain appearance, composition and processing properties<br>Legume feed research<br>Processing research, food uses and health benefits |

## **Annual Pasture Legume Program**

Leader: Professor Clive Francis

Not since the post-war farming revolution of subterranean clover with superphosphate has there been the potential to improve productivity and profitability from pastures as there is at present, nor has the need ever been greater. In many regions of Western Australia pasture decline has become endemic as on-farm resources have been focused upon cropping. Yet, paradoxically, productive pastures are the tool that will enable crop-based farming systems to remain productive and to overcome the looming problems of herbicide resistance, nitrogen supply and sustainability of the soil.

The key that will unlock the potential of pastures in farming systems is the discovery and release of new, alternative pasture legumes through the CLIMA and NAPLIP programs. This process was begun, with notable success, by the Cooperative Research Centre for Legumes in Mediterranean Agriculture between 1992 and 2000 and will be continued through the research programs of CLIMA. We envisage improvements in stock carrying capacity and nutrition, hydrological balance, nitrogen nutrition of crops and associated herbs, weed control without herbicides, feed stability, improved structural stability in poor textured soils and perhaps in the management of animal intestinal parasites. For all these parameters we have significant evidence of effect, however, we require focussed and multidisciplinary research to gain a full understanding of the problems and their optimal management.

The Pasture Legume research program reflects the needs and opportunities defined in Section 2, namely:

- Germplasm development (Subprogram 1) will focus on germplasm development based on genetic resources linked with international projects.
- Biotic interactions (Subprogram 2).
- Developing new species (and improving existing species) for soils and environments currently lacking pasture legume options (Subprogram 3).
- Adding value to the pasture legume industry through novel pharmaceutical and nutrition products (Subprogram 4).

The implications and opportunities for the innovative use of new pasture legumes in farming systems remains enormous and few farmers, extension workers or scientists are fully aware of the new tools that are becoming available. An important task across the Pasture Legume Program is thus to raise awareness of the new pasture ‘tools’ and how to best use them.

| <b>Subprogram</b>                                                          | <b>Component</b>                                                                                                                                                                                                |
|----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Subprogram 1: Germplasm development<br>Mr Richard Snowball                 | Genetic resources acquisition to support pasture legume development<br>AQIS liaison<br>Development of offshore projects in legume breeding and selection for specific tasks, rhizobial selection, seed increase |
| Subprogram 2: Biotic Interactions<br>Dr Soressa Kitessa                    | Legume / animal interface<br>Legume / symbiont interface<br>Legume / pest and disease interface                                                                                                                 |
| Subprogram 3: Annual pasture legume improvement<br>Assoc. Prof. Mike Ewing | Evaluation, selection and breeding<br>Seed production<br>Regional testing for adaptation                                                                                                                        |
| Subprogram 4: Novel uses of forage legumes<br>Assoc. Prof. John Howieson   | Pharmaceutical, aquacultural, horticultural and agriceutical uses                                                                                                                                               |

### 3.3 CLIMA’S INTERNATIONAL LINKAGES PROGRAM

From 1992 to 2000 the CLIMA Co-operative Research Centre built a network of international linkages with standing agreements for research cooperation and exchange of legume germplasm with 15 countries and specific project-based linkages with many others (Table 1). The outcome of this program has been the introduction of invaluable grain and pasture legume germplasm and the direct release of eight new grain legume varieties and six new pasture/forage cultivars. Two of these,

*Biserrula pelecinus* from Morocco and *Trifolium glanduliforum* from Israel, were species new to world agriculture.

Despite these successes, Australia has barely scratched the surface of available variability in most leguminous species and an important role for CLIMA is to maintain and build on the international linkages established by the CRC. Opportunities for the international linkages program are to:

- Continue the program of international scientific and germplasm exchange, especially with the key CGIAR centres of ICARDA and ICRISAT.
- Utilise existing agreements with the Vavilov Institute and ICARDA and extend these to include the USDA and IPK Gatersleben collections. This will provide access to the world's greatest collections with, collectively, over 200,000 legume accessions.
- Continue to use offshore facilities and skills for germplasm evaluation and especially for screening for disease resistance. Offshore testing programs have resulted in new sources of ascochyta resistance in chickpea (program based in Turkey), chocolate spot and ascochyta resistance in faba beans (based in Syria) and anthracnose resistance in lupins from Ethiopia. These successes were achieved in a fraction of the time and at lower cost of evaluation than in Australia. In addition, millions of dollars in quarantine and handling costs have been saved.

#### CLIMA Major International Grain Legume and Pasture Germplasm Linkages

| Country    | Institution                                                                        | Country     | Institution                                                     |
|------------|------------------------------------------------------------------------------------|-------------|-----------------------------------------------------------------|
| Bangladesh | BARI                                                                               | New Zealand | Institute for Crop and Food Research                            |
| Canada     | University of Saskatchewan                                                         | Pakistan    | PARC, Islamabad                                                 |
| Ecuador    | INIA                                                                               | Portugal    | INIA, Oeiras                                                    |
| Ethiopia   | Biodiversity Institute, Addis Ababa - Ethiopian Agricultural Research Organisation | Poland      | Institute of Plant Genetics, Poznan - Tissue culture technology |
| France     | University of Auburn                                                               | Russia      | Vavilov Institute, St Petersburg                                |
| Germany    | IPK, Gatersleben                                                                   | Spain       | CIHEAM, Instituto Agronomico Mediterraneo de Zaragoza           |
| Greece     | Greek Gene Bank, Thessalonica.                                                     | Syria       | ICARDA, Aleppo                                                  |
| India      | ICRISAT, Hyderabad<br>ICAR, New Delhi                                              | Turkey      | AARI                                                            |
| Italy      | ISCF CNR, Lodi, Sassari.                                                           | UK          | University of Birmingham<br>University of Reading               |
| Morocco    | INRA, Rabat                                                                        | USA         | Washington State University, Pullman<br>USDA                    |
| Nepal      | NARC, Katmandu                                                                     |             |                                                                 |

New initiatives developed by CLIMA and currently in progress are:

- A new international initiative, funded by ACIAR in collaboration with ICARDA and the Vavilov Institute, is the development of linkages with countries of the Central Asian republics notably Uzbekistan, Turkmenistan, Kazakhstan and the trans-Caucasian countries Azerbaijan, Armenia and Georgia. These are rich centres of diversity and will ensure a continued flow of unique legume germplasm into the CLIMA programs.

- A project with the Plant Genetics Institute, Posnan, Poland to integrate offshore testing of international lupin germplasm from the Vavilov Institute, Portugal and Australia for reactions to the anthracnose and fusarium pathogens.
- A new ACIAR project on integrated management of botrytis grey mould in chickpea between Bangladesh and Australia.

### **3.4 COMMUNICATION AND TRAINING**

As a part of the Commonwealth's Cooperative Research Centre Program (1992-2000), CLIMA developed an Education Program that aimed to:

- identify and fill gaps that existed in professional development for legume producers and researchers;
- add value to postgraduate training; and
- increase public awareness of the value of legumes and of the scientific research that underpins legume production.

As a University-based Research Alliance, CLIMA will continue to support education and training with a renewed focus on communication, professional development and adding value to postgraduate training. Public education, which was a requirement of the CRC program, will have less emphasis in the CLIMA Research Alliance.

#### **Communication**

Effective communication of CLIMA's purpose and value to its partners, clients and staff will be an important part of delivering the benefits desired by the CLIMA partners. Although Commonwealth funding ceased in June 2000, the highly successful research programs are continuing through the new CLIMA Research Alliance.

CLIMA's communication objectives are:

- To increase the rate of uptake and extent of use of CLIMA's research outputs by industry.
- To increase awareness of the opportunities for industry collaboration.
- To assist in diversifying and increasing CLIMA's funding base.

In all of these, acknowledgement of the roles of the partner organizations will be paramount.

An Annual Report and the CLIMA web-site ([www.clima.uwa.edu.au](http://www.clima.uwa.edu.au)) will form the external "corporate face" of CLIMA. They are essential to provide information to industry in a timely and professional manner. These flagship activities will be supported by regular press releases (~ one/month), a regular electronic newsletter, workshops, organised visits to CLIMA by industry groups, and a CLIMA presence at selected field days, expos and partner open days.

#### **Professional development**

When CLIMA was a CRC it took a leading role in professional development for both its staff and the legume industry. Over 3,500 people participated in 80 workshops, short courses, symposia and conferences. The need for these activities has not diminished, but increased.

As part of its Communication and Training Program, CLIMA will continue to identify opportunities for professional development and will deliver these through workshops, short courses, and other means.

#### **Postgraduate training**

Postgraduate training was another important CRC responsibility and over the life of the CRC some 73 postgraduates working on CLIMA programs were enrolled at The University of WA or Murdoch and by 2000, 36 students had completed higher degrees (34 PhD, 2 MSc). One of the most beneficial

aspects of the CRC's education program was the association of postgraduate students with non-University staff in the supervision of research degrees. The establishment of CLIMA in a University setting is intended to ensure that a strong, industry orientated postgraduate training program will continue.

Objectives for CLIMA's postgraduate training are to:

- Continue the highly supportive environment for postgraduate students developed in the CRC.
- Actively identify problem-orientated research opportunities of relevance to the grain and pasture legume industries and secure funding for that research.
- Encourage cross-institutional supervision of postgraduate students, especially from the non-University partners.

## **SECTION 4 – HOW CLIMA WILL MANAGE ITSELF**

### **4.1 CLIMA’S CORE VALUES**

CLIMA acknowledges the following core values and is committed to upholding these in its dealing with partners, clients and staff:

- A commitment to high ethical standards in all CLIMA endeavours.
- A valuing of people for their intrinsic qualities regardless of origin, religion, gender or race.
- Maintenance of the highest intellectual standards in research, extension and education.
- A commitment to consultation and partnership with the industry.

### **4.2 MANAGEMENT**

CLIMA’s management plan provides for input from its clients, staff and the alliance partners.

#### **Program Management Team**

CLIMA’s program management team is composed of the Director, Deputy Director, the leaders of the research programs, the Communications Coordinator, the Commercialisation Coordinator and the Finance Officer. The Program Management Team meets monthly and is responsible for:

Management and integration of CLIMA’s research programs.

- Systematic review of research programs.
- Operational aspects of the Centre

#### **Industry Advisory Group (IAG)**

The Industry Advisory Group is the most important source of CLIMA’s industry interaction, advice and feedback. The IAG has an independent Chairperson and meets twice each year. CLIMA has made a deliberate decision to establish a large IAG (19 members) with the objective of drawing on the widest possible advice and ensuring that a wide cross-section of the grain and pasture legume industries can be directly represented in the CLIMA structure. An additional advantage of the large group is the profile it provides for CLIMA with its key client groups. The IAG is responsible for:

- Providing independent advice to the Director on CLIMA policy and direction.
- Industry feedback on pulse and pasture legume industry needs and emerging issues.

#### **Governing Board**

CLIMA’s Governing Board is composed of the Chief Executive Officer or another senior representative from each of the four CLIMA partners, plus the Director. The Board meets twice per annum.

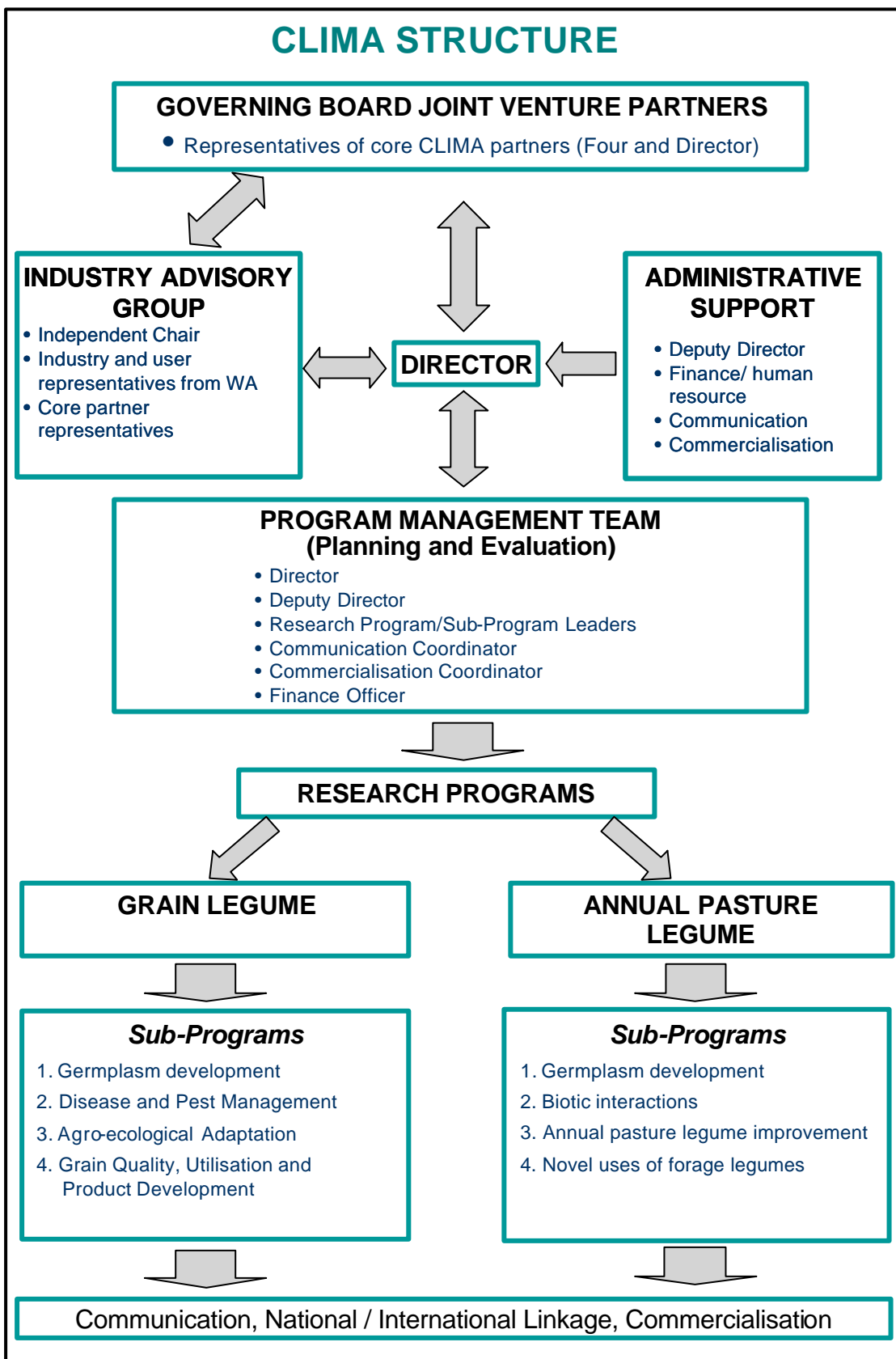
The Board is responsible for:

- High level decisions in respect to CLIMA operation.
- CLIMA policy in relation to matters such as commercialisation, private sector alliances etc.
- Advice and support for the Director.

#### **The Director**

The Director is responsible for:

- Day-to-day management of CLIMA including the IAG and Program Management Team.
- Implementation of policies approved by the Governing Board.
- Development and updating of a CLIMA Strategic Business Plan and investment opportunities.



## 4.3 RESOURCES

CLIMA, as a Research Alliance, is dependent upon the resources assigned to it by the CLIMA partners, its success in attracting competitive research grants, and other sources of income that it can attract or earn.

CLIMA's potential sources of investment are:

- The research programs of its partners, in particular the Grains Program and other commodity Programs of the Department of Agriculture, Western Australia. The partners provide substantial in-kind contributions of staff and infrastructure plus limited operating funding;
- Research investments made by the Grains Research and Development Corporation. These include grants made to the partner institutions for research within the mandate of CLIMA;
- Research investments made by other sources including ACIAR, RIRDC, The Grain Research Committee, ARC etc;
- Agribusiness;
- Direct investment by growers and grower groups; and
- Income from CLIMA activities including royalties, the sale of products, and fee-for service activities.

### **CLIMA's role in research funding**

An important objective of CLIMA is to increase the level of investment in grain and pasture legume research by creating a critical mass in Western Australia and thus making it more attractive for investment in R&D. A second important objective is to diversify the sources of funding and to stimulate new sources of investment in legume research.

## 4.4 IP POLICY

CLIMA has been, and will continue to be, a significant generator of intellectual property (IP), dominantly new plant varieties, but also information and other products. Whenever desirable and feasible the results of CLIMA's R&D, will be introduced to the target audience through the marketplace. For CLIMA to succeed in the field of IP commercialisation it is appropriate to define some guiding principles that will maximise the return on investment and minimise the commercial risk to CLIMA as a business entity and custodian of the interests of Australian mediterranean agriculture.

### **Guiding Principles for the Commercialisation of CLIMA IP**

Guiding Principles for the Commercialisation of CLIMA IP are:

- CLIMA will respect and protect third party IP in accordance with industry best practice.
- CLIMA will protect new IP with mechanisms commensurate with the commercial value of the IP.
- An unambiguous method for determining Project IP Equity will be agreed to prior to the commencement of research.
- The terms and conditions of CLIMA IP commercialisation must deliver the net benefit to the targeted agriculture sector.
- Unless the net benefit to the target sector is diminished, the selection of private sector partners for the commercialisation of CLIMA IP will be by public tender.
- Private investment in CLIMA will not be allowed to compromise the net benefit to the target sector.
- CLIMA will conduct fee-for-service research for private and public sector clients.

## **The Public Good/Profit Paradox**

The CLIMA partners have given a commitment to re-invest a significant proportion of income generated from the commercialisation of CLIMA IP into CLIMA-based research activities. Such income is a potentially valuable source of research funds. Paradoxically this income is often derived from the agricultural sector CLIMA has been established to serve. Thus, each IP commercialisation project must be tailored to maximise revenue whilst minimising the negative economic side effects on the target group. Wherever possible the point at which commercialisation revenue is collected should be moved up the supply chain towards ultimate end-users.

With a strong program of industry focussed R&D, excellent industry stakeholder links and an open consultation process, CLIMA is well positioned to ensure that such commercialisation activities do not place an undue financial burden on susceptible sections of the agricultural industry.

## **CLIMA’s IP Commercialisation plan**

The Commercialisation of CLIMA IP will involve IP protection and management, new business development, and commercial project management, all of which will be aligned with, and contribute towards, the achievement of a net benefit to Australian mediterranean agriculture.

### **IP Protection and Management**

The protection and effective management of IP forms the basis of IP policy. Components of IP protection and management include:

- Protection of third party IP used by CLIMA.
- Internal IP security and protection of new IP (termed ‘foreground IP’) created by CLIMA.
- Registration of IP ownership.
- Negotiation on equity in foreground IP created with resources from more than one source.

### **New Business Development – Commercialisation of IP**

Once new IP has been generated and properly protected, and assuming commercialisation of IP will deliver a net benefit, as many local, interstate and overseas business opportunities as possible must be identified, analysed and if pertinent exploited. Most of these opportunities will involve the licensing of CLIMA-developed IP within Australia, through a conventional tender and due diligence process.

Other business opportunities include the attraction of new private sector investment in CLIMA. Private sector investors need to see a strategic benefit to their business from the research activity or a commercial rate of return on their investment. In either case private sector investors will expect to share in IP commercialisation activities, by earning an IP equity or ownership share and/or gaining preferential access to the IP in the marketplace.

### **Commercial Project Management**

Once an IP commercialisation plan has been implemented it must be pro-actively managed to ensure that the terms and conditions of the licensing agreement are fulfilled. Revenues must be collected on time and the licensee and/or revenue collection agent audited randomly, or as deemed necessary, for financial and performance compliance. Other requirements include the provision of QA seed to the market, free and open public access to plant IP (seed) and the dissemination of accurate promotional material.

## SECTION 5 – APPENDICES

### 5.1 KEY CONTACTS

| <b>Name</b>                 | <b>Position</b>               | <b>Phone</b> | <b>Email</b>                    |
|-----------------------------|-------------------------------|--------------|---------------------------------|
| Professor Kadambot Siddique | Director                      | 9380 7012    | ksiddiqu@agric.uwa.edu.au       |
| Professor Clive Francis     | Deputy-Director               | 9380 1878    | cfrancis@cyllene.uwa.edu.au     |
| Dr Debbie Thackray          | Communication Coordinator     | 9380 7074    | dthackra@agric.uwa.edu.au       |
| Dr Howard Carr              | Commercialisation Coordinator | 9368 3279    | hcarr@agric.wa.gov.au           |
| Mr Greg Madson              | CLIMA Reception               | 9380 2505    | gmadson@agric.uwa.edu.au        |
| Ms Sue Dodimead             | Finance Officer               | 9380 1973    | dodimead@cyllene.uwa.edu.au     |
| <i>Program Leaders</i>      |                               |              |                                 |
| Dr Mark Sweetingham         | Grain Legumes (GL)            | 9368 3298    | msweeting@agric.wa.gov.au       |
| Professor Clive Francis     | Pasture Legumes (PL)          | 9380 1878    | cfrancis@cyllene.uwa.edu.au     |
| <i>Subprogram Leaders</i>   |                               |              |                                 |
| Dr Bevan Buirchell          | GL1                           | 9368 3653    | bbuirchell@agric.wa.gov.au      |
| Prof. Richard Oliver        | GL2                           | 9360 7404    | roliver@central.murdoch.edu.au  |
| Adj. Prof. Neil Turner      | GL3                           | 9333 6612    | neil.turner@csiro.au            |
| Dr Mark Sweetingham         | GL4                           | 9368 3298    | msweeting@agric.wa.gov.au       |
| Mr Richard Snowball         | PL1                           | 9368 3517    | rsnowball@agric.wa.gov.au       |
| Dr Soressa Kitessa          | PL2                           | 9333 6639    | soressa.kitessa@csiro.au        |
| Assoc. Prof. Mike Ewing     | PL3                           | 9380 1876    | mewing@cyllene.uwa.edu.au       |
| Assoc. Prof. John Howieson  | PL4                           | 9360 2231    | jhowieso@central.murdoch.edu.au |

## 5.2 INDUSTRY ADVISORY GROUP

| <b>Title</b>   | <b>First Name</b> | <b>Surname</b> | <b>Organisation</b>                                |
|----------------|-------------------|----------------|----------------------------------------------------|
| <i>Chair</i>   |                   |                |                                                    |
| Mr             | Trevor            | Flugge         | Farmer                                             |
| <i>Members</i> |                   |                |                                                    |
| Mr             | Dale              | Baker          | GRDC Western Panel                                 |
| Mr             | Rob               | Sewell         | The Grain Pool of Western Australia                |
| Mr             | John              | Orr            | Premium Grain Handlers                             |
| Mr             | Bruce             | Piper          | Council of Grain Grower Organisations              |
| Mr             | Rory              | Coffey         | Milne Agritech                                     |
| Mr             | Neil              | Ballard        | Ballard Seeds                                      |
| Mr             | Chris             | Gillam         | Farmer                                             |
| Mr             | Mervin            | McDougall      | Pulse Australia                                    |
| Mr             | Neil              | Young          | Western Australian No Tillage Farmers Association  |
| Mr             | Greg              | Kirk           | Australian Association of Agricultural Consultants |
| Mr             | Greg              | Warren         | Western Australian Farmers Federation              |
| Mr             | David             | Thomas         | Rabobank Group                                     |
| Ms             | Mary              | Nencke         | Australian Women in Agriculture                    |
| Dr             | Graeme            | Robertson      | WA Dept of Agriculture                             |
| Professor      | Mike              | Jones*         | Murdoch University                                 |
| Professor      | Richard           | Oliver*        |                                                    |
| Professor      | Hans              | Lambers        | The University of WA                               |
| Mr             | Mick              | Poole          | CSIRO                                              |
| Professor      | Kadambot          | Siddique       | CLIMA, The University of WA                        |

\*Professor Mike Jones and Professor Richard Oliver will share IAG membership

### 5.3 RESEARCH CONTRACTS (as at July 2002)

| CLIENT | GRANT NO. | TITLE                                                                                                                                                     | SUPERVISOR                         |
|--------|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| GRDC   | UWA 290   | Forecasting and decision support for aphid and virus control in crops and medic pastures                                                                  | Dr R Jones                         |
| GRDC   | UWA 295   | Improving lupin quality and yield by modifying the hull and the pod wall                                                                                  | Dr M Dracup<br>Dr J Clements       |
| GRDC   | UWA 308   | International linkages for crop plant genetic resources                                                                                                   | Prof C Francis                     |
| GRDC   | UWA 309   | Transgenic Pulse Development Project                                                                                                                      | Dr P Smith<br>Dr S Barker          |
| GRDC   | UWA 313   | Determining the yield limiting potential of new virus diseases of lupin or canola and surveying for virus infection reservoirs outside the growing season | Dr R Jones                         |
| GRDC   | UWA 314   | Incorporation of pea weevil resistance into a cultivar field pea                                                                                          | Dr D Hardie<br>Ms Oonagh Byrne     |
| GRDC   | UWA 315   | Lupin resistance to aphids: Enhance selection procedures and identify mechanisms of resistance.                                                           | Dr J Ridsdill-Smith                |
| GRDC   | UWA 337   | Perennial pastures for cropping systems                                                                                                                   | Assoc Prof M Ewing<br>Mr G Moore   |
| GRDC   | UWA 339   | Low recharge farming systems for the southern wheat belt of WA based on lucerne                                                                           | Prof P Cocks                       |
| GRDC   | UWA 345   | Lucerne intercropping for sub-soil water management                                                                                                       | Dr T Lefroy                        |
| GRDC   | UWA 346   | An international program for selection of lupins with improved resistance to anthracnose and Fusarium wilt                                                | Dr M Sweetingham<br>Prof C Francis |
| GRDC   | UWA 354   | Screening for resistance to chilling and Helicoverpa sp. in chickpea                                                                                      | Dr H Clarke                        |
| GRDC   | UWA 357   | Determination and promotion of health benefits of pulses with special emphasis on chickpea                                                                | Dr N Longnecker                    |
| GRDC   | UWA 360   | National annual pasture legume improvement program - Western Australian Component                                                                         | Assoc Prof M Ewing                 |
| GRDC   | CLM 30    | Lupin anthracnose: genetics, pathology and marker-assisted breeding                                                                                       | Dr B Buirchell                     |

|       |                     |                                                                                                                                                                    |                                                |
|-------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|
| GRDC  | UWA 366             | International collaboration for the collection of germplasm of herbaceous perennial legumes and rhizobia with which to develop plant solutions to dryland salinity | Assoc Prof J Howieson                          |
| GRDC  | PDF38               | Post Doctoral Fellowship - Fucheng Shan - Characterisation evaluation of wild Cicer genetic resources to accelerate chickpea improvement in Australia              | Dr H Clarke<br>Prof K Siddique                 |
| RIRDC | 0049 UWA 64         | Integrate, Segregate or rotate trees with crops                                                                                                                    | Dr T Lefroy                                    |
| RIRDC | RAS 0040<br>UWA 60A | Perennial grain crops for high water use                                                                                                                           | Dr T Lefroy                                    |
| RIRDC | NPP98-26            | New high quality oil seed crops for temperate and tropical Australia                                                                                               | Prof C Francis                                 |
| RIRDC |                     | Seed production limits sulla and purple clover as fodders                                                                                                          | Assoc Prof M Ewing                             |
| ACIAR | CS1/1999/064        | Lentil and Lathyrus in the cropping systems of Nepal: improving crop establishment and yield of relay and post-rice sown pulses in the terai and mid-hills         | Prof C Francis<br>Prof K Siddique              |
| ACIAR | CS1/2001/039        | Integrated management of Botrytis grey mould of chickpea in Bangladesh and Australia                                                                               | Prof K Siddique<br>Dr M A Bakr<br>(Bangladesh) |
| ACIAR | CS1/2000/066        | Host resistance, epidemiology and integrated management of faba bean chickpea and lentil disease - WA component                                                    | Prof K Siddique<br>Mr Bill MacLeod             |
| ACIAR | CS1/1996/07         | Traits for yield improvement of chickpea in drought-prone environments of India and Australia                                                                      | Adj Prof N Turner<br>Prof K Siddique           |
| GRDC  | UWA00005            | Improving the utilisation of pasture germplasm by the development of a core collection using ecogeographical and molecular techniques                              | Dr S Bennett<br>Mr R Snowball                  |
| GRDC  | UWA00009            | Improved lupin grain quality and yield through genetic manipulation of key physiological traits                                                                    | Dr J Clements<br>Dr B Buirchell                |
| GRDC  | UWA00015            | Differentiating between sweet and bitter lupins in the field                                                                                                       | Dr D Harris<br>Dr Buirchell                    |
| GRDC  | UWA00022            | Quality screening support for pulse breeding programs -Western Region                                                                                              | Dr T Khan<br>Ms S Sipsas                       |
| GRDC  | UWA00035            | An International collaboration to develop robust protocols for doubled haploid production in field pea and chickpea                                                | Prof K Siddique<br>Dr J Crosier                |
| GRDC  | UWA00036            | An International collaboration to develop interspecific hybrids between chickpea and its wild annual relatives                                                     | Prof K Siddique<br>Dr H Clarke                 |

|       |          |                                                                                                                                                                                                   |                                       |
|-------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| GRDC  | UWA00038 | Genetic Dissection of Fungal Disease Resistance in Legumes using <i>Medicago trunculata</i>                                                                                                       | Dr K Singh<br>Prof R Oliver           |
| GRDC  | UWA00040 | Germplasm collection of <i>Trifolium</i> and other pasture legume species from short season, low latitude regions in the Mediterranean                                                            | Mr R Snowball<br>Assoc Prof M Ewing   |
| GRDC  | UWA00042 | Improving lupin tolerance to metribuzin and developing germplasm with tolerance to the new herbicides, Balance and Affinity                                                                       | Dr M Sweetingham<br>Dr Ping Si        |
| GRDC  | UWA00043 | The potential of the pearl lupin ( <i>lupinus mutabilis</i> ) for southern Australia                                                                                                              | Dr M Sweetingham<br>Prof C Francis    |
| GRDC  | UWA349   | National Faba Bean Improvement Project - Western Component                                                                                                                                        | Dr P White<br>Prof K Siddique         |
| RIRDC |          | Investigation into legumes with pharmaceutical and aquaculture potential                                                                                                                          | Dr S Wang<br>Assoc Prof J Howieson    |
| RIRDC |          | New oilseed options for Australian Farmers and Industry                                                                                                                                           | Prof C Francis<br>Ms M Campbell       |
| GRC   |          | Developing <i>L. angustifolius</i> with seed quality changes using single seed NIR screening                                                                                                      | Dr J Clements<br>Prof C Atkins        |
| GRC   |          | Fast tracking South Australian field pea germplasm to Western Australia                                                                                                                           | Dr T Khan<br>Prof K Siddique          |
| GRC   |          | Lupin rust an exotic disease threat to Australia                                                                                                                                                  | Dr M Sweetingham<br>Dr J Clements     |
| GRDC  | UWA391   | Travel Grant - Professor Kadambot Siddique to attend 2 <sup>nd</sup> International Congress of Plant Physiology on Sustainable Plant Productivity under Changing Environment, India, January 2003 | Prof K Siddique                       |
| COGGO |          | Fast tracking ascochyta resistant, high quality kabuli chickpea varieties for Australia                                                                                                           | Prof K Siddique<br>Ms K Regan         |
| GRDC  | NEGVC4   | Development of value-added plant protein products for the aquaculture feeds sector                                                                                                                | Dr Brett Glencross<br>Ms Sofie Sipsas |

**CLIMA corporate objectives**

| Industry need                                                                                                                                                                                                                                                                                                                                                                                        | CLIMA Objective(s)                                                                                                                                                                          | CLIMA’s strategies                                                                                                                                                                                                                                                                 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>World competitive research focussed on the needs and opportunities of the Western Australian grain and pasture legume industries</p> <p><i>CLIMA’s mandate is to create a research environment that will maximise the return on investment in legume R&amp;D made by the State Government, Universities, CSIRO and industry groups for the benefit of primary producers and the community</i></p> | <p>Consolidate the support of CLIMA’s parent organisations for the concept of the Centre.</p>                                                                                               | <ol style="list-style-type: none"> <li>1. Clear delineation and promotion of CLIMA’s purpose and mandate vis-à-vis its parent organisations</li> <li>2. Regular and open communication between the CLIMA Director and the partner CEOs in all cross- institution issues</li> </ol> |
|                                                                                                                                                                                                                                                                                                                                                                                                      | <p>Build support for the CLIMA concept amongst research and administrative staff seconded to the Centre</p>                                                                                 | <ol style="list-style-type: none"> <li>1. Communication and interaction through newsletters, program management team meetings, seminars, workshops and social events etc.</li> </ol>                                                                                               |
|                                                                                                                                                                                                                                                                                                                                                                                                      | <p>Obtain support for the CLIMA concept amongst industry organisations, investors in research and private sector organisations servicing the grain legume and pasture legume industries</p> | <ol style="list-style-type: none"> <li>1. Articulate CLIMA’s vision and mission</li> <li>2. Identify and engage key individuals in industry organisations and the private sector</li> </ol>                                                                                        |

**Research**

| Industry need                                                                                                                                                                          | CLIMA Objective(s)                                                                                                                                           |                                                                                  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| <p>Discovery and application of new products and know ledge that will protect the production base and increase the productivity and sustainability of the legume based industries.</p> | <p>To be pro-active in identifying emerging problems and research opportunities for the Western Australia grain legume and pasture le gume industries.</p>   |                                                                                  |
|                                                                                                                                                                                        | <p>Create an environment that fosters science of the highest quality in the context of the needs and opportunities presented by the legume industries.</p>   |                                                                                  |
|                                                                                                                                                                                        | <p>Increase the number of investors in legume research and the total pool of investment available for research. Stimulate investment in legume research.</p> | <p>2. Undertake one-to-one briefings for potential private sector investors.</p> |

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## Communication and training

| Industry need                                                                                                                                                              | CLIMA Objective(s)                                                                                                                                                                                                                                                                                                                                                                           | CLIMA’s strategies                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>An industry with the skills, knowledge and capacity to understand and apply the new knowledge and products produced through investment in research and development.</p> | <p>Train the trainers and advisors in legume science.</p> <p><i>Training provides the capability to use and benefit from new knowledge and technology. CLIMA is in a unique position to create training opportunities drawing on its leading scientists and world-wide contacts.</i></p>                                                                                                     | <ol style="list-style-type: none"> <li>1. Organise training opportunities attractive to public and private sector intermediaries through the quality of the presenters and the relevance of the presentations and supporting material.</li> <li>2. Integrate with CLIMA’s University partners to provide post-graduate training that combines excellent science with practical experience.</li> </ol> |
| <p>Rapid industry uptake of new technology that can increase the profitability and/or sustainability of the grain legume and pasture legume industries.</p>                | <p>To speed the adoption of new technology and products by widening awareness amongst end users and support for intermediaries in the adoption process.</p> <p><i>Adoption will be maximised by creating awareness amongst end users (demand pull) and by providing information and support to intermediaries who have closer and more frequent contact with users(technology push).</i></p> | <ol style="list-style-type: none"> <li>1. Create wide awareness of CLIMA’s new legume products and legume technology amongst potential end users.</li> <li>2. Support information and/or training to private and public sector intermediaries assisting end users of CLIMA technology.</li> </ol>                                                                                                     |

## Intellectual property and commercialisation

| Industry need                                                                                                                                            | CLIMA Objective(s)                                                                                                                                                                             | CLIMA’s strategies                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Access to intellectual property (research knowledge, enabling technologies, diagnostics, varieties) that will add value to the legume industries.</p> | <p>To form partnerships that allow the IP of others to be used for the benefit of the Western Australian grain and legume pasture industries.</p>                                              | <ol style="list-style-type: none"> <li>1. To develop a reputation for effective and efficient management of IP using the highest standards of propriety.</li> <li>2. Develop a policy and operating principles for protection of intellectual property and disseminate this to staff.</li> <li>3. Conduct an annual audit of IP.</li> <li>4. Negotiate with the CLIMA partners to establish a company structure within which to hold and manage CLIMA intellectual property.</li> </ol> |
| <p>Access to new products and technologies (developed by CLIMA and others) in a form and at a cost that maximises the rate of adoption.</p>              | <p>Maximise the benefit of CLIMA discoveries for the Western Australian grain - and pasture legume industries; and in doing so provide economic benefit to the wider Australian community.</p> | <ol style="list-style-type: none"> <li>1. Establish the principles, acceptable to the partners, on which commercialisation of CLIMA intellectual property will be based.</li> <li>2. Disseminate the commercialisation policy to CLIMA staff, clients and potential commercialisation partners.</li> </ol>                                                                                                                                                                              |

## ABBREVIATIONS

|         |                                                                        |
|---------|------------------------------------------------------------------------|
| AARI    | Aegean Agricultural Research Institute                                 |
| ACIAR   | Australian Centre for International Agricultural Research              |
| APSRU   | Agricultural Production Systems Research Unit                          |
| AQIS    | Australian Quarantine Inspection Service                               |
| ARC     | Australian Research Council                                            |
| BARI    | Bangladesh Agricultural Research Institute                             |
| CGIAR   | Consultative Group for International Agricultural Research             |
| CIHEAM  | Centre International de Hautes Etudes Agronomiques Méditerranéennes    |
| CLIMA   | Centre for Legumes in Mediterranean Agriculture                        |
| CRC     | Cooperative Research Centre                                            |
| CSIRO   | Commonwealth Scientific and Industrial Research Organisation           |
| DNRE    | Department of Natural Resources and Environment, Victoria              |
| GL      | Grain Legume                                                           |
| GRC-WA  | Grains Research Committee of Western Australia                         |
| GRDC    | Grains Research and Development Corporation                            |
| IAG     | Industry Advisory Group                                                |
| ICAR    | Indian Council of Agricultural Research                                |
| ICARDA  | International Centre for Agricultural Research in Dry Areas            |
| ICRISAT | International Crops Research Institute for the Semi-Arid Tropics       |
| INIA    | Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria |
| INRA    | Institute National de la Recherche Agronomique                         |
| IP      | Intellectual Property                                                  |
| IPK     | Institut für Pflanzengenetik und Kulturpflanzenforschung               |
| NAPLIP  | National Annual Legume Improvement Program                             |
| NARC    | Nepal Agricultural Research Council                                    |
| NSW Ag  | New South Wales Agriculture                                            |
| PARC    | Pakistan Agricultural Research Council                                 |
| PL      | Pasture Legume                                                         |
| R&D     | Research and Development                                               |
| RIRDC   | Rural Industries Research and Development Corporation                  |
| SARDI   | South Australian Research and Development Institute                    |
| USDA    | United States Department of Agriculture                                |
| UWA     | The University of Western Australia                                    |
| WA      | Western Australia                                                      |