

# Report of the international review team



**Jim Buizer<sup>\*</sup>, Jim Hansen<sup>†</sup> and Rohan Nelson<sup>§</sup>**

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<sup>\*</sup> Arizona State University, Tempe, [James.Buizer@asu.edu](mailto:James.Buizer@asu.edu)

<sup>†</sup> International Research Institute for Climate and Society, Palisades, [jhansen@iri.columbia.edu](mailto:jhansen@iri.columbia.edu)

<sup>§</sup> CSIRO Sustainable Ecosystems, Canberra, [rohan.nelson@csiro.au](mailto:rohan.nelson@csiro.au)

## **Contents**

|   |          |
|---|----------|
| <b>Recommendations .....</b>                | <b>i</b> |
| <b>Introduction.....</b>                    | <b>1</b> |
| Background .....                            | 1        |
| Approach .....                              | 2        |
| <b>Findings.....</b>                        | <b>3</b> |
| 1. Resourcing.....                          | 3        |
| 2. Institutional capacity .....             | 3        |
| 3. Project succession .....                 | 4        |
| 4. Partnerships & linkages.....             | 4        |
| 5. Policy engagement .....                  | 5        |
| 6. Public awareness .....                   | 5        |
| 7. Program design & management .....        | 6        |
| 8. Program research.....                    | 6        |
| <b>Appendix A – Terms of reference.....</b> | <b>8</b> |

## Recommendations

### *Resourcing*

There is generally a significant time lag between innovation and adoption of climate risk technologies. Further, success of the MCV program depends heavily on positive relationships between communities, across disciplines and research institutions, and most importantly with industry partners, which take time and continuity of engagement.

1. We recommend that MCV be funded on a 5-year cycle with full program reviews every 3 years. We also recommend that the program manager have the discretion to fund projects, particularly those focused on stakeholder engagement, for 3 or more years.

### *Institutional capacity*

Successful systems for climate knowledge production and use require individuals equipped to perform at the researcher-stakeholder interface as well as systems thinkers and managers.

2. We recommend that MCV promote formal interdisciplinary education at Australian universities. We also recommend that MCV engage in training of future “boundary spanners”, integrators, and interdisciplinary researchers and systems thinkers.

### *Project succession*

By engaging industry partners, MCV will inevitably raise expectations to maintain the relationships past the end of the research projects, therefore taking the program beyond research into a service provision function.

3. We recommend that project succession plan be elaborated and implemented to avoid the risk of losing the trust of the farmers that have been engaged by the projects. This should also increase the likelihood of their participation in future programs and their recognition of the value of the program.

### *Partnerships & linkages*

Given the economies scale in dynamic seasonal climate prediction, MCV should encourage greater collaboration internationally and within Australia in its efforts to improve seasonal forecast lead-time and accuracy. Long-term advances in seasonal prediction skill and lead time are more likely to come through global collaborative dynamic modelling efforts than through independent project, state or even national efforts.

4. We recommend that MCV increase international collaboration to help Australian researchers gain access to the experience and advances in methodology for improving the skill and relevance of Global Circulation Model (GCM) forecasts that is being developed in international climate prediction centres. Useful linkages could include, but are not limited to, the climate forecasting and applications programs of :
  - a. the International Research Institute for Climate and Society (IRI);

- b. the Sector Applications Research Program (SARP) of the U.S. National Oceanic and Atmospheric Administration's Climate Program Office;
- c. the European Centre for Medium Range Weather Forecasting; and
- d. the Hadley Centre of the United Kingdom Meteorological Office.

There exists a tension between the scientific freedom needed to develop improved forecast information, and the hazards associated with stakeholder use of that information.

- 5. We recommend that MCV develop a policy for communicating experimental seasonal forecast products that combine freedom to develop and share experimental forecast information, with consistent standards for evaluation, and transparent communication of the accuracy and past performance of any forecast model or system.

### *Policy engagement*

There is a particularly good opportunity for MCV to garner political support from state and national political officials through direct engagement, and by using the strong relationships already established with stakeholder groups.

- 6. We recommend that MCV develop and implement a strategy to communicate with political leaders who could serve as advocates of the program.

### *Public awareness*

A dedicated strategy of engaging the popular media early in the projects helps let civil society know about the efforts and scientific advances being made on their behalf.

- 7. We recommend that MCV develop and implement a strategy to engage select members of the popular media as a component of the projects at an early enough stage to educate them in the complexities of what is being attempted.

### *Program design & management*

Program design and management is absolutely critical to the success of “boundary spanning” organizations such as MCV. While some structure is necessary to provide institutional focus toward the overarching mission, organizational flexibility to be able to move quickly toward new opportunities is critical.

- 8. We recommend that the existing leanness and flexibility in management of the program be increased by giving the Program Manager discretion to retain 10% of the allocated funds to seed new ideas throughout the year.

### *Program research*

Given its emphasis on risk management decisions with strong economic implications, MCV would benefit from greater input of economic expertise.

- 9. We recommend that MCV increase input of economic thinking and methodology as a means to:
  - a. allow program management and individual project leaders to target effort toward the most promising avenues for increasing value;

- b. inform realistic expectations among stakeholders in participatory projects;
- c. inform program investors about returns to their investment;
- d. provide credible evidence to enhance political support for climate risk management; and
- e. critically examine whether the current set of decision support and analysis activities miss important opportunities to manage climate risk, such as shifting allocation among a diversified set of enterprises.

Several GCMs are run operationally in various centres around the world for seasonal prediction, and are available as hindcasts. International climate research and forecast centres, such as the IRI and European Centre for Medium Range Weather Forecasting, have relevant expertise and useful methods for improving the skill and utility of GCM output for a target variable and location.

10. We recommend that MCV systematically evaluate the skill, at varying lead times, of globally operational GCMs, using the available tools for processing model output, at targeted locations. Evaluation should include rigorous comparison with the standard SOI phase system, and consider forecast characteristics important to MCV.

## Introduction

This paper presents the summary findings of an international review of the Managing Climate (MCV) research and development program MCV's conducted at the *Climate Connect 2006* forum held in Adelaide on 29-30 March 2006. The first day of this national forum showcased the goals, activities and achievements of MCV for current and potential future partners and other stakeholders in government and industry. On the second day, presentations from MCV project leaders supported an independent review of the program by two international reviewers. The review team was Jim Buizer of Arizona State University and Jim Hansen of the International Research Institute for Climate and Society, supported by Rohan Nelson, who coordinated the program in 2005 and is now with CSIRO. This paper summarises the results of the review, and was drafted by the team in the two days immediately following the conference.

## Background

### *MCV*

The goal of MCV is to increase Australia's capacity to manage the risks and opportunities related to a highly variable climate. The program has its origins in the national drought policy of 1992. It is a partnership of between the Australian Government and several agricultural industries including:

- Department of Agriculture, Fisheries and Forestry (NHT)
- Grains R&D Corporation
- Land & Water Australia
- Meat and Livestock Australia
- Dairy R&D Corporation
- Rural Industries R&D Corporation
- Sugar R&D Corporation
- Australian Wool Innovation
- National Farmers Federation

The MCV partnership emerged from a recognition that the management of climate risk involves technologies and principles common to all rural industries and natural resource management. It also increasingly seeks to meet the emerging need of rural land managers to manage the impacts of changing climate variability.

MCV's goal has been distilled into three specific objectives (Appendix A):

1. increased adoption (regions and industries);
2. increased adoption (natural resources management); and
3. improved seasonal climate forecasts.

### *The need for international review*

There are a number of reasons why MCV would greatly benefit from increased contact with international climate risk management experts able to independently comment on the progress of Australian research. The small size of the climate risk management R&D community in Australia is potentially both a strength and a weakness. It facilitates dynamic interaction between researchers in the community, leading to the generation of new ideas, sharing of resources and integration of diverse approaches. However, an over-reliance on idea generation within the community risks

missing or reinventing innovation elsewhere, loss of momentum and foregone opportunities to adapt to changing external conditions and user needs. In practical terms, it is difficult to find independent reviewers within Australia with sufficient expertise that are not in some way connected to the program or its research community.

### *Terms of reference*

The terms of reference for the review are attached as Appendix A, and include bionotes for the two international reviewers. The purpose of this review is to evaluate the program against its objectives, and write a synthesis report making recommendations to MCV about its future direction and management. These recommendations address the different components of the program including MCV's:

1. applied climate science;
2. participatory engagement with stakeholder industries in R&D; and
3. delivery of climate risk management services.

The reviewers were also given the opportunity to comment on MCV's program management and interaction with researchers, recognising that this is difficult without an intimate knowledge of the program.

### **Approach**

The reviewers attended the *Climate Connect 2006* conference in Adelaide on 29-30 March 2006 and developed impressions of the program and its performance across the following themes:

1. resourcing;
2. institutional capacity
3. project succession;
4. partnerships & linkages;
5. policy engagement;
6. public awareness;
7. program design & management; and
8. program research.

The reviewers identified strengths and opportunities arising from MCV's performance under these themes, and used these to suggest the recommendations presented above for MCV's future direction and management.

## **Findings**

### **1. Resourcing**

Funding for institutions and programs that bridge the gap between production of science-based knowledge and the practical applications of this knowledge is a serious issue world-wide. The inadequacy of financing for these activities is, in part, due to the challenge of getting existing funding institutions to go beyond their traditional missions and recognize the value of new program areas. In addition, the debate that improved climate information is a public good and should be tax-payer supported versus the perspective that those industries that stand to benefit the most by production of tailored climate products should pay for them, confound the issue.

#### *Strengths*

The hybrid government-industry funding model is impressive and strengthens the program in many ways, including but not limited to increasing total funds available, increasing “ownership” of the program from both government and industry, and diversifying funding sources.

MCV does a great job in leveraging previous investments made elsewhere in climate and resource management research, modelling and data collection. It also serves as a catalysing agent for future investments in related research.

#### *Opportunities*

The relatively short term nature of the funding assurance can discourage fullest engagement and commitment of the best researchers, and will make the challenging task of garnering trust of the stakeholders, achievable only through long-term engagement, very difficult.

### **2. Institutional capacity**

Use-inspired research and applications programs such as MCV require active engagement of individuals capable of working across disciplines in a fully integrative manner, and those who are able to address the problems from a systems perspective. Further, individuals who can garner the respect and trust of both research and stakeholder communities are critical to the success of the enterprises.

#### *Strengths*

There is an admirable level of cross-discipline collaboration and engagement of industry stakeholders in the projects.

Many of the project leaders are embedded in State Governmental agencies having operational resource management missions, allowing for real-time provision of services.

#### *Opportunities*

There is an increased need for human capacity development, especially in the training of individuals equipped to perform at the researcher-stakeholder interface as well as in the training of systems thinkers and managers.



### **3. Project succession**

Successful communication across communities of interest requires that relationships be fostered and maintained over a relatively long period of time. This leads to expectations on the part of stakeholders that relationships will be maintained beyond the end of research projects. Programs should consider the need for succession past the end of the projects.

#### *Strengths*

There is recognition of the need to plan for project succession to address the issue of maintenance of the relationships developed and nurtured between and amongst the various communities of interest.

#### *Opportunities*

MCV should be cognisant that engaging industry partners will inevitably raise their expectations to maintain the relationships beyond the end of the research projects, therefore taking the program beyond research into a service provision function.

### **4. Partnerships & linkages**

A program that seeks to use interdisciplinary knowledge and technology to effect change needs to manage interactions effectively among a range of stakeholders, including the target beneficiaries, operational institutions and their funding sources, research groups working on similar problems, and the component research disciplines. We considered three crucial areas of partnership and networking within MCV:

- (a) Australia's climate risk management research community;
- (b) the international research community in climate risk management and its component disciplines; and
- (c) agricultural and resource management stakeholders.

#### *Strengths*

- We were impressed by the degree of awareness and genuine collaboration within Australia's climate risk management research community. The community spans academic disciplinary boundaries quite effectively. MCV plays an effective role in fostering and sustaining awareness and collaboration across disciplines and across groups based in all Australian states.
- The research community in Queensland is recognized internationally for their pioneering work in climate risk management. MCV has played a valuable catalytic role in extending interdisciplinary collaboration and climate risk management approaches to other Australian states.
- MCV is also effective in fostering the linkage between researchers interested in climate risk management and stakeholders within the agricultural industry. This is accomplished both through significant stakeholder engagement in funded projects and strong industry representation on the management committee. We believe that the public-industry funding mechanism also fosters industry ownership.

### *Opportunities*

The research community supported by MCV would benefit from greater effort to exchange knowledge and, in some cases, collaborate actively, with the international research community. Increased international collaboration and publication of project innovations in the peer-reviewed international literature would allow Australia's pioneering work in the effective use of decision support to benefit climate risk management efforts elsewhere in the world.

Greater incorporation of knowledge and methodology developed internationally could address recognized needs within the MCV program, particularly for elements of climate prediction science and methodology. The development of model based seasonal forecasting systems benefits from approaches that incorporate multiple global forecasting systems from around the world. Reliance on existing methods such as the SOI phase forecasting system needs to be constantly re-evaluated in light of the development of alternative approaches internationally.

There are economies of scale in developing dynamic seasonal climate prediction that favours international collaboration due in part to the high cost of ocean and atmospheric monitoring, the computational requirements of global climate models (GCMs), and demonstrable improvements in predictive skill from combining multiple GCMs. Increased collaboration would help MCV researchers gain access to the experience and tools for improving the skill and relevance of GCM forecasts at international climate prediction centres. The same argument applies to increasing coordination between MCV and the climate modelling efforts within, for example, BoM and CSIRO.

## **5. Policy engagement**

Elected officials are accountable to their constituencies for decisions made about public investments in research. Increasingly, the scientific community is being asked to conduct policy-relevant science. This is particularly true in the field of climate forecasting and applications. A dedicated strategy to engage key political leaders in a way that helps them do their jobs can help garner political support for the research programs and budgets.

### *Strengths*

MCV supported the bid for a CRC for Climate Risk Technologies which put significant effort into political engagement. Through this experience, MCV gained valuable insight into what works and what does not.

### *Opportunities*

MCV does not seem to have a strategy to communicate with State and National political leaders who could serve as advocates of the program. This disconnect can lead to a lack of understanding by politicians about the good work being conducted by the program. There is a particularly good opportunity for MCV to garner political support through direct engagement, and by using the strong relationships already established with stakeholder groups.

## **6. Public awareness**

All publicly supported research programs, particularly those attempting new and innovative approaches to complex problems, can benefit from a communication

strategy that helps take the message outside the scientific and primary user communities. A dedicated strategy of engaging the popular media early in the projects helps let civil society know about the efforts and scientific advances being made on their behalf.

### *Strengths*

MCV has stressed communication of information as an important function of the program

### *Opportunities*

Select members of the popular media should be seen as potential communicators of the MCV message to civil society and should therefore be engaged in the projects at an early enough stage to educate them in the complexities of what is being attempted.

## **7. Program design & management**

Program design and management is absolutely critical to the success of “boundary spanning” organizations and their programs. Boundary organizations are those that integrate traditional academic disciplines and conduct activities that bridge across professional and cultural boundaries in order to make science-based research useful to policy-makers and resource managers. While some structure is necessary to provide institutional focus toward the overarching mission, organizational flexibility to be able to move quickly toward new opportunities is critical. These institutions require particularly strong leaders able to garner the confidence, respect and trust of all communities involved, from their managing boards to researchers and stakeholders. While having expertise and recognition in a relevant field, the program leader should not bring a disciplinary bias into decisions, but rather should recognize the value of all components and disciplines. Program integrity should be maintained through a rigorous process for selection of the highest quality research proposals.

### *Strengths*

MCV has been and continues to be very well managed, with strong, yet balanced leadership. Its management structure is lean and flexible, allowing it to adapt to changes in direction and advances in the field. By international standards, MCV maintains very low management overhead costs. The projects are of high quality and in many cases are breaking new ground in the field.

### *Opportunities*

The program manager should be granted the discretion to retain a small fraction of the annual investment from the project pool so as to give him/her the ability to seize opportunities throughout the year to “seed” new ideas. This increases the desired flexibility of the program.

## **8. Program research**

Improved management of climate risk within agriculture and natural resource management can only be achieved through the application of appropriate technology. As a relatively new and integrative endeavour, climate risk management spans traditional academic or sectoral boundaries in ways that are often context-specific. MCV supports research that is generally need-driven, diverse and integrative both across the program’s research portfolio and within individual projects. The dominant

areas of research are climate science, economics, agroecological research and modelling, decision support tools and participatory research related to adoption and communication.

### *Strengths:*

The vast majority of research activities are applied rather than theoretical, driven by identified stakeholder needs, and consistent with project and program objectives.

Most projects show meaningful integration of different knowledge areas. In particular, model-based computer decision support tools are used effectively as a mechanism for integrating agroecology, climate and participatory decision research.

The program's strongest research is in the development and uptake of decision support tools for agriculture and natural resource management, where research groups involved in MCV are recognized as world leaders. This work exploits a strong history of agroecological modelling, led largely by the Queensland-based Agricultural Production Systems Research Unit (APSRU).

The agroecological research supported by MCV, including monitoring based on remote sensing and modelling of tree growth, appears to be sound and justified by gaps in need-driven methodology.

MCV has had the flexibility to fund some creative, exploratory climate forecast research that is outside of the mainstream, with perhaps high risk but high potential payoff.

### *Opportunities*

Given its emphasis on risk management decisions with strong economic implications, MCV would benefit from greater input of economic expertise. Only a few projects explicitly incorporate economic expertise or analysis. Opportunities exist to develop methodologies for valuing the economic benefits of climate forecasts. MCV's existing economic research and development could be better integrated with the participatory, decision support and agroecological modelling components of the program.

In addition to adding credibility and relevance to the program's decision support work, economic input could:

- (a) inform allocation of resources toward the most promising avenues;
- (b) inform realistic expectations among stakeholders in participatory projects;
- (c) inform program investors about returns to their investment; and
- (d) provide credible evidence to enhance political support for climate risk management research and development.

MCV's farm decision support work focuses primarily on agronomic management decisions within individual crop and grazing enterprises, often at a field scale. Economic expertise could be used to consider broader opportunities to derive economic benefits from managing climate risk, particularly by shifting resource allocation among enterprises (livelihood portfolio management). MCV-supported research confirms that livelihood diversity increases Australian farmers' resilience to climate risk. In other contexts, farmers have identified shifts in the allocation of land

and labour among crops, between crops and livestock enterprises, or between on-farm and off-farm income sources as promising responses to seasonal forecast information.

The quality of the program's knowledge and adoption strategy, and participatory decision research with stakeholders is generally high. The social sciences that deal with, for example, understanding the decision makers' context, communication preferences, perceptions and aspirations, and the adoption of innovations, have the potential to add considerable value to this research.

There are opportunities for additional research to explore the potential of dynamic climate prediction models to enhance prediction skill and lead-time, and to account for non-stationarity from both climate change and slow natural variability in the global climate system. Evaluation of available GCM hindcasts (predictions from past years) at selected locations, using available methods to improve the skill, scale and relevance of GCM output, is quite feasible in a short time frame and with modest resources.

Improvements in the skill of available GCM forecasts would create new opportunities to apply them via agroecological simulation models.

The program's applied participatory focus, and its objective of improving the accuracy, lead-time and ease of use of seasonal forecasts creates a tension between scientific freedom and safeguards on industry use. Statistical forecasts derived from cross-validated hindcast analyses can risk artificial skill and create overconfidence in their use. Expressed industry stakeholder demand for improved forecasts may create pressure to operationalise experimental forecasts. Inappropriate use of experimental forecasts can have serious repercussions for the livelihoods of decision makers, and the reputation of the program and its associated institutions. The program needs to develop a policy to manage this risk.



## **MCV National Forum**

### **Terms of reference for an international review panel**

Coordinated by Rohan Nelson

*Version 4: Tuesday, 21 February 2006*

## **Introduction**

MCV is holding a two day national forum on 29-30 March 2006. The first day of the forum will showcase the goals, activities and achievements of MCV for current and potential future partners and other stakeholders in government and industry. It will focus on the evolution of seasonal climate forecasting and its application to agriculture and natural resource management, and the role MCV has played in catalysing this research and development.

On the second day, presentations from each of MCV's current and/or recently completed projects will support an independent review of the program by international reviewers. Two international reviewers will review the program against its objectives, and write a synthesis report making recommendations to MCV about its future direction and management. This paper provides a terms of reference for this review.

## **International reviewers**

Two international reviewers have agreed to attend the MCV National Forum: Jim Buizer of Arizona State University, and James Hansen from the International Research Institute for Climate and Society.

### *Jim Buizer*

James L. Buizer is Special Advisor to Arizona State University (ASU) President Michael M. Crow, and the founding Director of the Office of Sustainability Initiatives in the Office of the President (equivalent to the Vice-Chancellor). Prior to his current role in ASU, Jim served as Director of the Climate and Societal Interactions Program at the National Oceanic and Atmospheric Administration (NOAA) in Washington, D.C.. He was responsible for providing programmatic vision, design and leadership of NOAA's integrated, multidisciplinary research and applications program positioned at the climate and societal interface.

While at NOAA, Jim played leadership roles in the creation of a number of institutions that bridge science and society, including the International Research Institute for Climate Prediction, the Inter-American Institute for Global Change Research, and programs such as the Regional Integrated Sciences and Assessment (RISA) Program. Jim has interacted with the MCV R&D community, particularly in 2004 when he co-organised an international workshop on "Knowledge-action systems for seasonal to interannual climate forecasting" in Irvine, California. The MCV R&D community was represented at this workshop by Barry White, Peter Hayman, Holger Meinke and Wayne Newton.

### *James Hansen*

James Hansen is an agricultural scientist with the International Research Institute for Climate and Society (IRI) of the Earth Institute of Columbia University, in Palisades, New York. For the past ten years, his work has focused on managing climate risk in agriculture. His work at the IRI focuses on strengthening the connection between advances in climate science, particularly seasonal prediction, and agricultural development and management in the tropics. While operating in an international development context, his interests and expertise are very similar to those of many scientists in MCV R&D community.

Before joining the IRI in 1999, Dr. Hansen worked at the University of Florida with an interdisciplinary team to develop an applied program for applying ENSO-based climate prediction to agricultural decision making in the Southeast USA. His work has targeted the Philippines, Colombia, Argentina, India, Mali, Kenya and Zambia. He has authored or co-authored more than 60 scientific and technical publications, serves on the advisory committee of the international CLIMAG program, and serves as co-Editor-In-Chief of Agricultural Systems.

### **Program goals**

The goal of the Managing Climate Variability (MCV) research and development program is to increase Australia's capacity to manage the risks and opportunities related to a highly variable climate. MCV has its origins in the national drought policy of 1992. The goal of MCV is to *increase the capacity of Australia to capture opportunities and manage risks related to climate variability*.

This overarching goal of MCV has been distilled into three specific objectives:

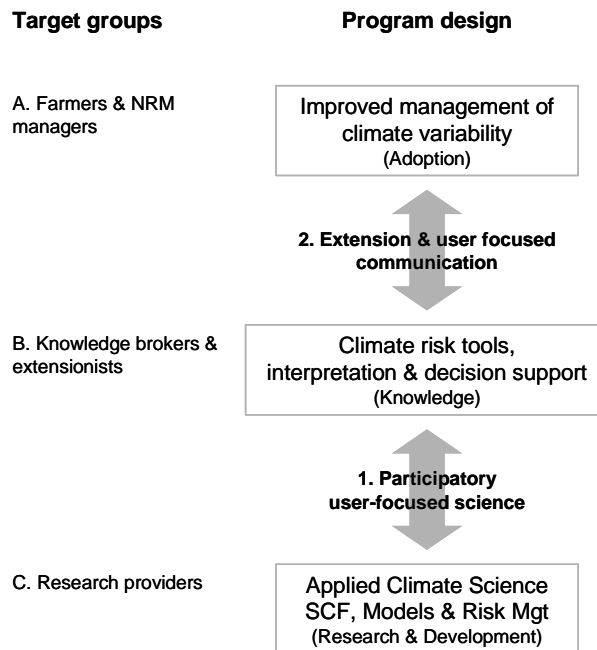
4. *Increased adoption (regions and industries)* Development of generic products and approaches to improve communication to users, including some projects which integrate climate change perspectives in regions/industries where there is potential for significant exposure to climate change.
5. *Increased adoption (natural resources management)*: Development of generic products and approaches to improve communication to users in natural and water resources management, including some projects which integrate climate change perspectives in catchments and regions where there is potential for significant exposure to climate change.
6. *Improved seasonal climate forecasts*: Projects will be funded which have the potential to rapidly improve the skill or applicability of statistical forecasts, for example the ease with which they can be used to show value of forecasts. Further projects will be funded which have the potential to significantly improve the skill and value of seasonal climate forecasts at longer lead times of 6 to 12 months by the end of the project.

### **Program design**

The program logic of MCV is summarised in figure 1. The adoption of climate risk management by farmers and NRM managers has always been the primary objective of the MCV program (A in figure 1). However, initial investment necessarily focused on developing the tools and techniques required to apply seasonal climate forecasts to improve the management of climate risk in agricultural production (C in figure 1). The link between the two is locally relevant delivery of seasonal climate forecasts through networks of knowledge brokers and extensionists (B in figure 1).



**Figure 1:** The design of the MCV program.



## International review

The international review of MCV will focus on the design and delivery aspects of the program. Two key questions for the review derive directly from the program logic in figure 1:

1. Participatory user-focused science
  - a. Is MCV's applied climate science state of the art from an international perspective? If not, why not and how could it be improved?
  - b. Is MCV's participatory engagement of farmers and other stakeholders state of the art from an international perspective? If not, why not and how could it be improved?
2. Extension and user-focused communication
  - a. Is MCV's delivery of climate risk management information and knowledge state of the art from an international perspective? If not, why not and how could it be improved?

In addressing these questions the review panel should consider the methods used, extent of multi-disciplinary and cross-institutional cooperation and degree of innovation.

The review also provides an opportunity for independent reviewers to make observations on the management of the program and its interaction with the R&D community.

3. Program management
  - a. Is MCV's program management state of the art from an international perspective? If not, why not and how could it be improved?
4. Interaction with R&D community

- a. Is MCV's interaction with the R&D community state of the art from an international perspective? If not, why not and how could it be improved?

### **Review process**

The review team will be supported by Rohan Nelson, previously coordinator of MCV and now with CSIRO. The review team will attend MCV forum on 29-30 March, and remain in Adelaide on 28 March and 2 April to complete a draft report.

The draft report will be brief and insightful (6-10 pages), and aimed at a policy audience. It will provide a brief rationale accompanying recommendations on the future direction and management of MCV.

### **Budget & travel arrangements**

It is suggested that the reviewers arrive in Adelaide on Wednesday 28 March, and depart Sunday 2 April. Travel expenses to and from Adelaide will be reimbursed at economy rates for each of the two reviewers. To retain maximum flexibility, the reviewers are asked to make their own travel arrangements, seeking reimbursement from MCV for those expenses directly related to travelling to and from Adelaide.

The review will be conducted collaboratively and not on a fee-for-service basis. MCV gratefully acknowledges the commitment to collaboration by Arizona State University and the International Research Institute for Climate and Society in contributing the reviewers' time for the review.

The PMC has allocated \$10,000 for the cost of the reviewers. It is anticipated that the actual cost will be less than this, to be reimbursed on the basis of receipts provided.