DOI: 10.5191/jiaee.2005.12302

Major Issues and Solutions to Applied Climate Education in Australia[1]

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Abstract

In the past decade, Australian agriculture has evolved considerably. During this period, climate variability has been of considerable concern, compounded recently by the threat of climate change. Applied climate education has attempted to keep up-to-date with these developments. Understanding the issues and solutions to applied climate education is a challenge confronting agriculture in Australia. This paper reports on the major issues and solutions to applied climate education in Australia as identified in the literature.

Keywords: Applied Climate Education, Sustainability, Issues and Solutions

[1] Acknowledgment: This research was developed from an applied climate education project (ClimEd), which was funded partly by FarmBis, a program of the Australian Government Department of Agriculture, Fisheries and Forestry.

Introduction

Agriculture in Australia has evolved considerably in recent decades (Douglas, 1997; Kilpatrick, 2000), and this needs to be reflected in applied climate education. Commodity prices and yields oscillate in response to world prices and local and regional climate fluctuations and consequent supply and demand scenarios (Hammer, Nicholls, & Mitchell, 2000; Munro & Lembit, 1997). Major issues affecting Australia have been the variability of climate, frequency and duration of drought, plus subsequent diminished water supplies, salinity, and de-regulation and instability in established industries such as dairying and sugar cane. Climate education although not specifically responding to all these issues has also evolved with emphasis moving from one day workshops (George, Buckley, & Carberry, 1998) to accredited training courses (George, 2004a, 2004b). More resources have developed in print form (Bayley & Brouwer, 2000; Brouwer & George, 1995; Partridge, 2001; Truscott & Egan, 2002), software (or discussion support software) and Web sites to suit the needs of a diverse client group (Sivakumar, Gommes, & Baier, 2000; Clewett, Cliffe, Drosdowsky, George, O'Sullivan, Paull, et al., 2000; Clewett, 2003; Nelson, Holzworth, Hammer, & Hayman, 2002). Adults have stated they want from any applied climate education 6 things to occur simultaneously to be of value to them (Clarkson, 2000). These include: awareness of climate variability; understanding climate and causes of variability; historical records for their location; analytical tools to describe the variability; forecasting tools to give advance warning of likely seasonal conditions; application of forecasts to key decisions. In designing applied climate education, it is no small task to bring together relevant resources and expertise for a range of enterprises relevant to a broad geographic area with relevant climatic data (Clewett, 2003).

Of perhaps more importance however is not just the resources available but *how* training is delivered. Adult learning principles (Kilpatrick, 1997) and experiential learning have recently been more emphasised (Carberry et al., 2002; McCown, 2002). Problem-solving scenario exercises have also been utilised to accommodate the predominant 'pragmatic' learning styles relevant to producers (Davey, 1987; Honey & Mumford, 1986). Further work is happening in utilising 'World Wide Web' resources for schools (George, 2001) and also for adults. This work is continuing to be developed in consultation with the major client group of producers, so applications may be maximised. Participatory action research has informed practice to develop the best resources and in delivering appropriate training (Langenbach & Aagaard, 1990; George et al., 2003; George, Keogh, Buckley, & Mavi, 2003). Applied climate education via an accredited Unit of Competency (George, 2004b; George, Clewett, Birch, Wright, & Allen, 2005b), is one more tool that may assist in improving knowledge and skills to better manage the variable climate. It has the capacity to appeal to a diverse range of industries because of its emphasis on 'process' (of survey, analyse and plan), balanced with 'content' derived from the industry it is intended.

Issues and Solutions for Stakeholders

Researchers, agriculturalists and educators have been involved in applied climate education programs of varying success (Seeley, 1994; Vanclay & Lawrence, 1994; Clewett, 2003). An overview of some of the issues and ways that have been suggested to overcome these concerns is described in this section, along with how this improved educational design may redress some of these issues. If applied climate education has a role to play in helping reduce the uncertainty of farming in a variable climate, it is important to consider the major issues and solutions other researchers have already discovered in this arena. This will be discussed with respect to the major client groups of producers (farmers), trainers, extension staff and some issues common to all groups.

Producers

Producers are confronted by a multitude of obstacles in relation to applying climate information in their management. These have been broadly grouped into climate information reliability, and, training preference and motivation.

Climate information reliability. The major issues confronting producers when applying seasonal climate forecast information in their management according to Vanclay and Lawrence (1994), are the obstacles of the information not being reliable enough, too regional or broad, no assistance with interpretation, no scope for changing management practices, not seen as a useful risk management tool, not promoted in media, late availability of seasonal information, stakeholders had little idea of how to incorporate into management planning, poor understanding of link between seasonal forecasts and yield [*and prices*], lack of management options available regardless of season. Possible solutions include:

- Establish local champions
- Distribute seasonal climate forecasts for management rather than as a general seasonal climate forecast
- Use extension networks
- Run training for advisors, facilitators, producers
- Develop case studies
- Evaluate usefulness of seasonal climate forecasts
- Forecast with longer lead times
- Improve forecast accuracy
- Consider producers points of view
- Enhance opportunities to learning by use of narratives (Cathro, 1995; van der Does & Arce, 1998).

Applied climate education needs to include an examination of climate historical records along with examinations of forecast skill and timing issues (Clewett, 2003; George, Clewett, Birch, Wright & Allen, 2005b). Historical climate and yield relationships need to be scrutinised because it will be a pointer for sustainability and highlight the affect of improved management of climate on the soil - plant - animal - water systems being utilised in the future. Involvement of producers with experience in an industry although not directly documented in the design but in-building time for reflection and discussion of others experiences is essential. Balancing climate forecasts with better understanding of historical climate variability is also a useful tool (Sherrick, Sonka, Lamb, & Mazzocco, 2000; Clewett, 2003).

Training preference and motivation. Many producers have constraints to adoption of technology because of a number of factors including: new technology is complex, unclear observable outcomes, financial cost, beliefs and opinions about technology, farmer motivation, relevance of new technology, attitude to risk and change (Guerin & Guerin, 1994; Visser, Cawley, & Röling, 1998; Jarvis, 1995). There may also be reluctance to participate in training/education, especially older producers with low levels of formal education (Murray-Prior, Hart, & Dymond, 2000; Austen, Sale, Clark, & Graetz, 2002). It is also possible there is a lack of suitable local training activities and lack of confidence in relevance of training and a preference of informal over formal learning (Murray-Prior et al., 2000).

Guerin and Guerin (1994) maintain extension and education has to play an increasingly important role. Education and training assists in altering values and attitudes to new practices (Kilpatrick, 2000). There is a possibility many of these obstacles may be overcome by using participatory approaches, soft systems methodology, incorporating ways to address different decision making styles and social context of potential users (Lynch, Gregor, & Midmore, 2000) or a range of techniques (Millar & Curtis, 1997; Black, 2000) and sound methodology (Carr, 1997). Producers prefer information from known sources over training (Kilpatrick & Rosenblatt, 1998) because of independence, need of familiarity with highly contextual learning mode, lack of confidence in training settings, and there may be a genuine fear of exposure to new knowledge and skills (Seeley, 1994).

Weather and climate information and forecasts need to be specific to agriculture (Seeley, 1994) and locations. It is useful to demonstrate the value and benefits of increased understanding of climate variability and seasonal climate forecasts (Cobon, Unganai, & Clewett, 2003a, 2003b). Visser et al. (1998) adheres to an avoidance of the 'transfer of technology' method, preferring an approach as co-learning and instead aim for empowering the community (Macadam, 2000).

The design aspect of applied climate education should not be a factor contributing to reluctance of participants to attend training activities. However if local champions are convinced of the merits of a course, then by word of mouth, others motivations may be increased (Kilpatrick, 1997). The emphasis must then be on training key people in a community to help endorse the merits of applied climate education and training. Design which assesses the current knowledge and skills levels of participants, and then builds on these concrete experiences, is desirable (Kolb & Fry, 1975).

Trainer/Facilitators

An obvious issue with trainers and facilitators is ineffective training (Kilpatrick, 1997). Suggested ways to overcome this problem include:

- Interactive training with opportunity for discussion and interaction with participants and experts (Nelson et al., 2002)
- Relevant topics applicable to target group situations
- Credible facilitators, instructors and materials
- Groups of people who regard each other as similar and are comfortable
- Reduction or removal of barriers such as child care and travel
- Session times and venues to suit target groups work and personal lives
- Short sessions
- Value for money
- Programs taken in manageable chunks, and,
- Marketing through associations and organisations (Kilpatrick, 1997).

Applied climate education design should enable easy use of resources by trainers and facilitators (Kilpatrick, 1997). Participants Manuals with complementary training manuals are essential (George 2004a, 2004b). Training of credible trainers skilled in climate and agriculture needs to be addressed so sound design can be delivered to participants, which in turn requires sound marketing of an applied climate education program.

Extension Staff

Cai and Smit (1994), allude to the capacity/ ability/ capability of extension staff enabling integrating climate and weather information into agricultural production and natural resource management. This could be addressed by:

- Identifying personality and group types to provide targeted education and training (Roberts, 2000; Shrapnel & Davie, 2001),

- Agriculture extension officers need a change of role from ‘teachers’ to ‘facilitators’ and be effective with appropriate tools for this (Engel & van den Bor, 1995; Hagmann, Chuma, & Murwira, 1996)
- Increasing the number of diploma graduates (and consequent resources), to meet the expected increased demand of clients, would require agricultural education to be more broad-based to meet the occupational demand, and target increased participation from the private sector (Rama Rao, Muralidhar, & Kalla, 1997).
- Deliver training at farmer field schools (van de Fliert, Pontius, & Röling, 1995), and,
- Promote sustainable agricultural practices (including climate / weather) in extension strategies (Düvel & Botha, 1999).

The above points are acknowledged and are beyond the scope of this paper but are included for the sake of completeness of covering the topic adequately.

All Groups

A major issue relevant to ‘all groups’ was global climate change – where is it specifically getting wetter or drier and, changes to frequency and duration of extreme events (Rasool & Fellous, 1997), plus consequent carbon management (Uri & Bloodworth, 2000). A possible solution is the need to incorporate latest climate change research results and ways to apply this research into agriculture and resource management and incorporating food security. Education with demonstration about value of increased soil carbon levels would also be desirable. Any educational design should allow for discussion about latest results of climate change, and discussion of impacts and options to include into a strategic planning process in time-frames that participants establish.

In terms of policy, Warren (1998) discussed the point that rural extension is an ad hoc reaction to a succession of crises rather than as a planned strategy. This leads to ideas about complementary education (Koulaouzides, 1997) for secondary, post-secondary and adult education. A possible solution is for climate, weather and agriculture needs to be incorporated into a strategic plan for agricultural education (van den Bor, Bryden, & Fuller, 1995; Warren, 1998). The above point is also acknowledged but is also beyond the scope of this paper but is included for the sake of completeness of covering this topic adequately.

Instructional Materials and Processes to Improve Knowledge and Skills

In designing an applied climate educational Unit of Competency for Australian agriculture, there is a need to balance content and process so as to appeal to a diverse range of industries and climatic zones. Feedback should be continually requested and analyzed so that exercises can be developed and applied in the farming business. Explanation of forecasts and research being developed to increase accuracy of forecasts is discussed (George et al., 2005a, 2005b). Preparations to be better organized for the ‘next’ dry time is always of paramount importance (George et al., 2005a, 2005b). Training of trainers in other agricultural educational industries (such as explicit livestock or cropping ‘streams’) is a strategy to assist in raising the profile of climate applications.

Learning is promoted where there are links between the subject matter and the problem often confronted by the stakeholder group (Davey, 1987; Kilpatrick, 2000). For example, looking at historical climate variability for *producers own* locations help to provide reflection and construct learning from their own experiences.

Being given immediate opportunity to implement what has been learned was also seen as valuable. For example, with beef producers, exercises could be utilised which had the current climate scenario and an opportunity to examine impacts and options and decisions for that region were seen as helpful (George et al., 1998). Providing opportunities to present and discuss ideas as a group help to discuss successes and mistakes from all participants is helpful and empowering (Macadam, 2000).

Exercises, which simulated a 'real' problem, are also seen as beneficial. Avoidance of learning which focused on theoretical examples or where producers could not see the benefits of the learning activity is encouraged. Discussion of a probabilistic forecast and what it means to different individuals was seen as clarifying the ambiguity often surrounding such forecasts (George et al., 1998).

Formal accreditation enables the creation of a standard and lifelong-learning pathway to be established, and embraced if desired by participants.

The Long-Term Outlook Needed for Strategic Planning in Applied Climate Education

Hammer et al. (2000) approaches effective applications of climate and agriculture using '…given this type of season, what are the likely outcomes (i.e. risks) associated with decision options being contemplated…?' The strength of the strategic planning approach evidenced in this new Unit of Competency (described in companion papers George et al., 2005a, 2005b) strongly links forecast information and implications on decision options, as well as extending the planning emphasis beyond the current season. It is suggested that any applied climate education should address the current season and also look at the longer term.

Adult Education Theory for Applied Climate Education and Training

An important part of adult learning theory is experiential learning (Kolb & Fry, 1975; Jarvis, 1995), which includes learners in planning their training (Merriam & Caffarella, 1991; Kilpatrick, 1997). Experiential learning emphasises a process of exploring, analysing, deciding and acting, then repeating the process with new issues. Action research combines theory and research to establish and implement a change of behaviour. Researchers study the efforts applied in early changes, assess what is not working and then refine or change the initial strategies (Langenbach & Aagaard, 1990). These theoretical models have had some success with education and training in applying climate information (Carberry et al., 2002; Keogh, Bell, Park, & Cobon, 2004).

Recommendations for Extension

In the past, information, education and training about climatic risk has mainly occurred through several avenues such as the media, several short courses and one-day workshops, books, software, Web sites (Cobon & Clewett, 1999; Paull & Peacock, 1999; Partridge, 2001; Clewett et al., 2000). This work needs to be maintained and further developed, and to be more widely embraced by extension staff with a focus in developing climatic risk management strategies with their clients. Specific applied climate education training for extension staff to apply in their work would be valuable in applied climate units that are strategically focused, in-depth and directed at management (George et al., 2004a, 2004b, 2005b). Initiation of a formal in-depth climate risk management training course (e.g. 40 hours theory, 40 hours practical) for farm managers, resource managers and agribusiness would be desirable.

Conclusion

There is no easy solution to the problems of climate variability and agricultural sustainability. However, educators can provide a process of designing and incorporating climate information into on-farm strategic planning and this helps the farm manager to be better equipped to assess, plan, monitor and respond to the current and expected future of farming in a variable climate. Applied climate educational design which incorporates strategic planning, is a valuable skill that can be applied across cultures, and is highly beneficial because of immediate relevance and lifelong learning implications. Climate education and training have a role to play in delivering the message from climate historical records and from a climate forecast, and its applications enhanced in agriculture and resource management. In addition, a guiding principle is that better preparation for managing climate variability should at least also help to improve the management of climate change.

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