

# Climate Change Adaptation Research Grants Program

## - Primary Industries Projects

### Project title:

Adaptive capacity and adaptive strategies of broadacre farms experiencing climate change.

Principal investigators: Professor Ross Kingwell

Lead organisation: Department of Agriculture & Food, Western Australia

### Objectives:

- (i) Drawing on longitudinal farm data, assess the adaptive capacity of broadacre farm businesses.
- (ii) Drawing on this dataset, complemented by a social/management survey data, identify successful adaptation strategies and associated farm and farmer characteristics.

### Project design and methods:

**Study Region:** Climate change projections indicate that the agricultural region of south-western Australia will be particularly adversely affected by climate change, & evidence has already emerged that the region has experienced a warming & drying trend since the mid-1970s. It has been said that the region potentially acts as a climate canary for broadacre agriculture in southern Australia. Agriculturally the region is economically important, generating up to almost 40 percent of Australia's cereal production.

**Farm Data:** Assessing the adaptive capacity of broadacre farms in south-western Australia will involve drawing on unique, detailed longitudinal farm datasets. Agricultural consulting firms with farm business clients in the region are keen to provide relevant farm business data. Two firms will supply data from 2004 to 2010 for about 120 farms in the north & eastern grainbelt of WA. Another firm will supply data for around 50 farms from 1998 to 2010 in the southern grainbelt. These are unique longitudinal datasets, allowing the adaptive capacity of each farm business to be tracked through time & for their adaptation strategies to be noted & compared. Productivity & profitability measures for each farm will be determined also.

**Socio-Economic Data:** Complementing these physical & financial datasets of farm businesses will be socio-economic & managerial assessments that, after analysis, will identify if socio-economic & managerial traits are linked to farm performance & adaptive capacity. Using specially designed questionnaires, data will be collected on farmer demographics, their information sources & business attitudes, their goals & motivations, & their control over & management of their farm business.

**Research Methodology:** Drawing on each farm's financial & physical records, a suite of farm performance measures will be derived, including business equity, operating profit/ha, return on capital, & the debt to income ratio. Trends & correlations of these measures will be determined. Farms will be placed into performance categories & farm characteristics that link to each category will be identified. Generalised linear mixed effects models will be used to fit a range of explanatory variables & interactions to the four business indicators. The performance of farm businesses will be compared & contrasted through time. Characteristics of farms & management strategies that proved successful (or unsuccessful) through the range of seasons, underpinned by a warming & drying trend, will be identified.

Using factor analysis & then ANOVA, the socio-economic dataset will be analysed to identify key groupings, traits & their interrelationships. Using regression techniques the socio-economic data will be linked to the business performance measures to identify key explanators of business performance. Information sources & information use of farmers identified as successfully adapting to climate change will be identified. Further complementing the business & socioeconomic analyses will be the decomposition of the profitability & productivity measures of the farms. This will also help identify successful adaptation strategies. For example, to combat the adverse impacts of climate change & other sources of business risk, productivity growth is vital. Decomposing the measures of farm profitability into farm total factor productivity (TFP) & farm terms of trade & then decomposing TFP into technical change & technical efficiency components will reveal which business strategies & management actions underpin high productivity & therefore assist in adaptation to climate change. The productivity levels & components can also be related to the socio-economic & management traits of the farmer to see if farmers with certain traits & information sources achieve high levels of productivity & profitability.