The potential for carbon trading in the SA Murray Darling Basin: Integrated methods to account for heterogeneous attitudes and behaviour in the design of market based policies

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Abstract: This paper describes the empirical calibration of a conceptual modelling and simulation methodology that incorporates variable dryland farmer attitudes and land management into landscape scale natural resource management (NRM) planning. Planning efforts in the SA Murray Darling Basin have focused on the endemic revegetation of degraded, privately held agricultural land, simultaneously conferring biodiversity benefits and salinity and wind erosion reductions. Current payment schemes have yielded relatively minor contributions to resource condition targets. As an alternative, market based approaches are increasingly endorsed as a class of policy instrument to motivate individual behavior such that land management actions are both economically rewarding and better align with social aspirations expressed as policy objectives. Our previous research indicates the hypothetical removal of extant institutional constraints, prohibiting access to an international CO_{2e} market, as the most cost effective and feasible instrument to promote large scale revegetation efforts. *A priori* evaluations of market based policy initiatives are often founded on normative behavioural parameterizations of profit maximization and optimal responses to available information. Failure to account for heterogeneous attitudes and motivations and variable willingness and capacity to participate, manifest as levels of revegetation, may result in reduced instrument performance or failure and attendant social cost. Spatially referenced attitude and behavioural profiles at the farm scale were characterized using a combination of spatial correlation, principle components and cluster analysis of survey responses of 583 dryland farmers (N=1094). Controlled economic field experiments, simulating the biophysical, economic and policy decision environment elicited the magnitude and timing of revegetation of actual landholders subject to information treatments, including visual cues of near neighbour and catchment wide farm actions. The combined results improved the enumeration of the relationship between statistical attitude and behavioural classes, expressed as farm scale land management actions. We describe a spatially explicit model, imputing multi-attribute farmer utility functions within a dynamic agent-based simulation environment. Fifty year landscape futures were simulated by modelling farmer responses to changes in both exogenous factors (climate, societal change and commodity prices) and NRM policies. These perturbations influence the potential for revegetation actions, which determine farm economic viability and the magnitude of aggregate contributions to specific regional policy targets. The results provide an evidence based *ex ante* assessment of the biophysical, economic and social impacts of market based policy initiatives to encourage carbon trading at farm and catchment scale.

Keywords: Multi-attribute Utility Theory, Field experiments, Decision Making, Agent-based Modelling, Natural Resource Management