

Informal Cooperation in the Commons? Evidence from a Survey of Australian Farmers Facing Irrigation Salinity

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1. Introduction

The causes of agriculture-related conflicts over environmental goods are typically diffuse, making their governance costly compared with point-source conflicts (Wills, 1997). Over the last couple of decades, moreover, there has been a noticeable acceleration in the onset of these 'agri-environmental' conflicts as more and more of the environmental goods relied upon by agriculture have become fully committed (Reeve, in press). As this transition from a 'frontier' into a 'mature' agricultural economy proceeds, the need for agri-environmental governance can be expected to continue to accelerate (Syme, 1993).

This transition has been accompanied in many countries by a realisation that the relevant government agencies are never likely to be granted sufficient resources to satisfy more than a small share of the need for agri-environmental governance (Batie, 1986). A major part of the response to this has been to shift the load of governance away from the planned order sought by formal institutions towards the unplanned order offered by informal institutions. This is implicit in the rhetoric of 'community ownership', 'community empowerment' and 'peer pressure' associated with the 'participative' agri-environmental programs initiated by Australian governments over the last 15 years (e.g. Total Catchment Management, and the National Landcare Program)(Marshall, 1999).

These participative initiatives have yielded notable successes, including the volunteer conservation work organised by landcare groups and the integrated catchment plans developed by community-based committees (Bellamy, McDonald, Syme, et al., 1999; Curtis, Britton and Sobels, 1999). Nevertheless it is questionable whether there has been any significant lessening of the formal share of agri-environmental governance. Regardless of whether community ownership and peer pressure have arisen through such initiatives, there has been little change in farmer expectations of being compensated by governments for adopting conservation practices that yield external benefits. On current trends demands on Australian governments to resource agri-environmental conservation will therefore continue to greatly exceed their capacity (Young, 1997). Moreover translating the concept of participative catchment planning into practice is proving difficult (Pigram, Musgrave, Hooper, et al., 1994; Syme, Butterworth and Nancarrow, 1994; AACM and Centre for Water Policy Research, 1995; Margerum, 1996; Bellamy, et al., 1999).

The failure of participative governance to live up to its rhetoric has caused considerable frustration for both civil and government participants. Reviewing international experiences with participative watershed (i.e. catchment) management, Rhoades (2000 p. 330) noted that critics were "starting to argue wistfully that the participatory rhetoric has outrun the ability to accomplish" and that a return to top-down governance "without the noise of participation" should be reconsidered.

Yet the limited success may have more to do with the steep learning curve faced by designers and practitioners of participative programs than with an inherent lack of potential. After all, there are many examples around the world of successful civil self-governance of natural resources (McCay and Acheson, 1987; Ostrom, 1990; Baland and Platteau, 1996). Nevertheless participative governance has been *terra nova* for most government professionals, as well as for civilians. In addition, the move up the

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learning curve has been slow due to the received hegemony of the physical sciences within resource management agencies. Despite politicians recognising the potential of civil participation for addressing social and political hurdles to resolving conflicts over natural resources, many in the implementing agencies have persisted in viewing resource management as a technical problem requiring technical solutions (Woodhill, 1997). One effect of the lingering technical bias within these agencies has been resistance against giving social research a share of research budgets commensurate with the increasing reliance on participative programs seeking to facilitate social change. Until recently at least, it has largely been assumed that the required social knowledge is self-evident and does not justify the level of research devoted to technical problems (Martin, Tarr and Lockie, 1992).

Rhoades (2000 p. 337) has remarked upon the “social underdesign” of participative programs, lamenting that “the very science we need most in watershed research ... a solid social science – is the one seen as the most dispensable”. Similarly Sturges (1997 p. 34) observed that most experiments in participative governance have failed “because of a lack of appreciation of the conditions necessary for success”, and advocated research as a way of redressing this knowledge gap. Landcare, he claimed, “has not lived up to its potential” due to a lack of regard for systematically learning about what conditions need to be met for its success. At this stage the knowledge underpinning the design of participative strategies “is almost entirely anecdotal” (Rhoades, 2000 p. 333).

The purpose of this paper is to contribute to empirical knowledge about the scope for informal governance, and the voluntary cooperation it yields, to reduce the costs of resolving agri-environmental conflicts. The new-institutional tradition of economic theory that informed the empirical modelling is reviewed in section 2. The case study setting is described in section 3, and the method discussed in section 4. The models estimated are specified in section 5, with the results discussed in section 6. Finally, some concluding comments are offered.

2. Theory

Collective action and governance

Governance is fundamentally concerned with overcoming collective action, or social, dilemmas arising in the provision of public goods. The neoclassical economic explanation of such dilemmas is that benefits from providing public goods are not fully excludable or rival, so that provision efforts by individuals generate external benefits for others. Neoclassical economists, led by Mancur Olson (1965), thus concluded that efforts by individuals in a group will, unless the group is small, usually provide less of public goods than is collectively rational. The neoclassical ‘market failure’ solution toward the coercive powers of the state. The state would use these powers as a ‘third-party enforcer’ of formal institutions designed to ensure collectively-rational provision of public goods. It could raise taxes to finance provision. It might regulate appropriation of public goods in cases where appropriation is rival (e.g. fishing). Otherwise it might directly regulate individuals’ provision of a public good (e.g. conscript people into the armed forces).

The origins of the modern justification for the state as a third-party enforcer is usually attributed to Thomas Hobbes (1991 (1651)). He recognised that it is the problem of credible commitment, not external benefits, that really lies at the heart of social dilemmas. External benefits from public good provision are symmetric. Consequently they distinguish individual and collective rationality only to the extent that individuals do not expect that their provision efforts will be reciprocated. However, the difficulty lies in individuals convincing each other that they are committed to agreed shares of public good provision. Hobbes did acknowledge that commitments can be made between individuals in the “state of nature” and that informal sanctions such as “fear of the consequence of breaking their word” and “pride in appearing not to need to break it” could lend these commitments some degree of credibility. Nevertheless he argued that informal governance of this kind would not be stable.

The state as third-party enforcer

As far as Hobbes was concerned the only stable solution to the problem of credible commitment is for civilians to concede to the state the power to enforce cooperation among them. However, the apparent simplicity of this solution is deceptive for at least two reasons. Firstly, third-party

enforcement, or formal governance, comes at a cost which must be counted before its efficiency relative to informal governance can be decided. Moreover the law of diminishing returns suggests that any comparative advantage of formal vis-a-vis informal governance will lessen as the load on it increases, all else held constant. Thus Gambetta (1988) commented: "Societies which rely heavily on the use of force are likely to be less efficient, more costly, and more unpleasant than those whose trust is maintained by other means". Ostrom (1998 p. 16) observed similarly that "no police force and court system on earth can monitor and enforce all the needed rules on its own. Nor would most of us want to live in a society in which police were really the thin blue line enforcing all rules".

Secondly, formal governance solves 'horizontal' social dilemmas between civilians at the additional cost of introducing 'vertical' social dilemmas between the state and the civil sphere. As Putnam (1993 p. 165) put it: "For third-party enforcement to work, the third party must itself be trustworthy, but what power could ensure that the sovereign would not 'defect'?" The difficulty of trusting the state is indicated by the following comment from North (1990 p. 59): "Put simply, if the state has coercive force, then those who run the state will use that force in their own interest at the expense of the rest of society".

Confidence in the state indeed appears to be diminishing. Randall (1999 p. 32) recently remarked that "faith in the legitimacy and efficacy of scientific government has declined precipitously ...". Support for (1999b) conclusion, on the basis of data from *World Value* surveys carried out in 1981-3, 1990-3 and 1995-7, that "public support for the core institutions of representative government – including parties, parliaments, and governments – has fallen in many, but not all, established and newer democracies". Closer to home, Papadakis (1999) found that between 1983 and 1995 the share of Australian respondents claiming to have confidence (either a 'great deal' or al government declined from 55 per cent to 26 per cent. Inglehart (1999) has attributed such trends to two causes: a declining emphasis on goals of economic and physical security that favour strong authority; and a long-term rise in educational levels and in political skills among the citizenry. From this he predicted that "in the long run, industrialized societies of both East and West must cope with long-term changes that are making their publics less amenable to doing as they are told ..." (p. 251). It follows that third-party enforcement by the state is becoming increasingly costly, as evidenced by the finding of Norris (1999a p. 264), based on data from all countries covered in the *World Values* survey 1995-97, that "trust in government institutions was positively associated with willingness to obey the law voluntarily".

Evidently formal governance is no panacea for social dilemmas in the modern world. Instead of having to choose one or the other, there is growing recognition that formal and informal governance have complementary roles and the challenge is to devise strategies which best harness this complementarity. For instance, Nee (1998 p. 88) has observed that the behaviour of people frequently bears little semblance to that stipulated by formal rules. He explained this as a result of the "decoupling" of formal and informal rules: "Compliance with formal rules may be largely ceremonial, with informal norms guiding the day-to-day business of the organization". Informal norms can thus become "opposition norms". Consistent with this analysis but of more specific relevance to agri-environmental governance, Baland and Platteau (1996 p. 347) identified a basic need to reshape state interventions to:

... end those unproductive situations where [administration and resource users] are pitted against each other as antagonistic actors in the process of resource regulation. Enough evidence has indeed been accumulated to show that, when rural inhabitants come to view state agents with hostility and distrust, all state efforts are doomed to yield disappointing results. This is partly because villagers are bent on violating rules and resisting programs the rationale of which they do not understand, all the more so if they have the impression that those rules or programs are clumsy or do not reflect a proper understanding of the specific problems and constraints confronting them.

Harnessing the contribution of informal governance

On the other hand if formal rules are perceived as congruent with informal rules then they will reinforce each other. Thus Day (1998 p. 97) reasoned that "both individuals and corporations will succeed best when they find themselves running with the grain of the social and cultural relationships which surround them; when they are sustained and propelled by the whole rather than rubbing against it".

This is not to say that it is easy to know which way the grain of the informal runs in particular settings; this knowledge often comes only with considerable perceptiveness and experience. The diverse elements of informal governance generally are not documented and not consciously designed – they emerge through an ‘invisible-hand’ process that relies on individuals pursuing their private concerns (Coleman, 1990). Hence they can be elusive to identify and easily taken for granted.

As a consequence, formal governance has often been imposed in ignorance of what informal governance already provides, thereby “destroy[ing] social arrangements which represent substantial past investments with enormous potential” (Day, 1998 p. 103). Mutually reinforcing relationships between formal and informal elements of governance can only be built if greater efforts are made “to understand what it is that binds populations together, and gives them energy, so that development can build on the positive strengths they have rather than appearing as a challenge and a threat” (p. 97). According to Pretty (1998 p. 217), the way to harness this understanding is to shift to “endogenous” from “exogenous” strategies for designing rural governance. The endogenous strategy actively encourages the emergence of institutional capacity from within the population suffering conflict. A variety of participative methods are available for applying this strategy. However, the exogenous strategy has dominated in the modern era. This presumes that governance is best imposed from outside the conflicted population. This model tends to foster a “dependency deadlock. Local people become entirely dependent on external agencies and actors to provide solutions to their local problems” (Pretty, 1998 p. 226). Participative methods must recognise and build escapes from this deadlock if endogenous approaches are to establish momentum.

Aside from this ‘negative’ case for the importance of designing formal governance so that it complements endogenous informal governance, there is a ‘positive’ case. The positive case emphasises that this strategy has the potential to yield substantial benefits by reducing the costs of overall governance. Recall that this is what, according to its rhetoric, participative agri-environmental governance seems to be striving for.

Kaufman (1995 p. 21) coined the phrase “order for free” to describe the self-organising propensity of certain complex systems. Sturgess (1997) borrowed this phrase to refer to the unplanned, or spontaneous, social order provided by informal institutions. This is not to argue that the actions of individuals from which informal institutions evolve and by which they are monitored and enforced are costless. The point is that these actions often occur for reasons unrelated to the need to create or maintain institutions. Thus Nee (1998 p. 87) observed that:

... informal norms ... are reinforced by means of ongoing social relationships ... Unlike formal rules, the monitoring of informal norms is intrinsic to the social relationship, and enforcement occurs informally as a by-product of social interaction ... The cost of social rewards to achieve conformity to norms is low because it is produced spontaneously in the course of social interaction in networks of personal interactions.

Jacobs (1961 p. 36) drew similar insight from studying how an inner city New York neighbourhood contributed to its own security: “The safety of the street works best, most casually, and with least frequent taint of hostility or suspicion precisely where people are using and most enjoying the city streets voluntarily and are least conscious, normally, that they are policing”. Furthermore she found that this informal policing largely occurs without significant personal cost due to “small, sensitively managed details, practised and accepted so casually that they are normally taken for granted” (p. 59). Likewise, Ellickson (1991 p. 53) found that the initial response from graziers in Shasta County, California, to discovery of a stray animal was usually a phone call “usually couched not as a complaint but rather as a service to the animal owner, who, after all, has a valuable animal on the loose”. Where breaches continued, the culprits were disciplined through an escalating scale of sanctions almost exclusively self-administered rather than by officials. An example of this disciplinary strategy closer to home has been documented by Sturgess (1997 p. 17):

There is a widespread convention amongst fishers not to inform on other fishers [to government inspectors] ... However, fishers do enforce their own local rules and conventions, a process which was described to the author as ‘educating’ offenders. Typically this involves escalating penalties. At the lowest level, a fisher breaching local rules would be ‘spoken to’, whether informally on the water or more formally following a meeting between the fishers from the affected area. In some cases, especially where the offender is a relatively new entrant who lacks a

sophisticated understanding of the local conventions, or where they can only afford one or two different kinds of nets, this really will be a process of education.

At the second level of enforcement, where the offending behaviour persists, the fisher will be ostracised, perhaps finding access to a lake blocked by the cars of other commercial fishers, or being denied access to a private coolroom ... While there is a general reluctance on the part of commercial fishers to complain to fisheries inspectors, this remedy will also be pursued from time to time, particularly where the offenders come from outside the local region and normal methods of 'education' or shaming are likely to be ineffective.

In the most serious cases, the offending fisher might find their boat or gear damaged, or the tyres on their car let down ...

The current generation of Australian farmers nevertheless seems not to have inherited a robust tradition of informally enforcing their own rules. Compared with the USA case, at least, state involvement in settling rural areas has historically been high in Australia. While rural populations in the USA became relatively self-reliant in resolving their conflicts, continued willingness by the state in Australia to provide third-party conflict resolution meant that rural populations have had less reason to develop and enforce their own conflict-resolution mechanisms (Reeve, 1999).

To the extent that relevant informal norms do exist, are enforced and affect behaviour, however, then efficiency urges that full advantage be taken of the order they already provide. Accordingly Nee (1998 p. 88) has argued that formal rules should be made consonant with relevant informal rules so that "informal processes of social control largely subsume the cost of monitoring and enforcement". Indeed when this is achieved then "it is often difficult to demarcate the boundaries between informal

Social norms

So far this discussion has abstracted from what informal institutions are and what gives them force. Informal institutions are often also known as social norms. Posner (1997 p. 365) defined a social norm as "a rule that is neither promulgated by an official source, such as a court or legislature, nor enforced by the threat of legal sanctions, yet is regularly complied with ...". Thus social norms are diverse and include etiquette, customs, rules of grammar, moral codes of conduct, and so on. Strong norms lessen the challenge of credible commitment by enabling individuals to predict more confidently how even strangers will behave (Sturges, 1997).

Posner (1997) suggested that social norms are given force by four types of incentives for individuals to obey them. Firstly, some norms are self-enforcing because they are prerequisites to advantageous transactions (e.g. rules of grammar). Secondly, they can be enforced by social disapproval, the efficacy of which lies in its implicit threat of exclusion from ongoing advantageous transactions. Thirdly, compliance with norms might sometimes be due to emotional reasons like fear that non-compliance might provoke revenge. Finally, norms might be internalised and therefore obeyed to avoid feelings of guilt or shame. He recognised that in any given case compliance is likely to be affected by a mix of these incentives. In addition, Boyd and Richerson (1990) identified conformism ('When in Rome, do as the Romans do') as giving further force to compliance with norms. They argued that when there are high costs of individuals self-learning the optimal behaviour in a given situation, they reason that the norm followed most frequently must be the most advantageous.

Fairness

Social norms concerning fairness have particularly strong implications for the cost of obtaining compliance with formal governance of agri-environmental conflicts. It has been noted earlier that, for most environmental goods used by agriculture, appropriation rates have reached full capacity only over the last few decades. As a result, the realisation that one landholder's freedom comes at the expense of other landholders or the public generally has started to dawn only quite recently. Due to the slow evolution of norms generally, fairness norms concerning agricultural use of environmental goods therefore lag some way behind the reality of agriculture's biophysical relationship with the natural environment having matured. This explains in part why the absolutist view of property rights in agricultural land, whereby ownership of land also confers de facto rights to exploit whatever open-

access environmental goods happen to be appropriable from that land, still remains so pervasive in countries like Australia and the USA (Reeve, in press).

External intervention is indeed often justified because fairness norms are no longer congruent with contemporary social needs. Hardaker (1993 p. 206) has remarked how institutions “often survive long after they have ceased to be effective”. Designing formal rules without sensitivity to long-held fairness norms nevertheless runs a high risk of entrenching the latter as opposition norms, thereby appreciably increasing the enforcement effort required for successful intervention. Moreover, there is evidence that government agency staff also prefer policy alternatives that farmers perceive as fair (McCann, 1999; McCann and Easter, 1999). As McCann and Easter (1999 p. 206) found, “policy makers do not want to implement unpopular policies”. Agency staff reluctance to recommend or enforce policies that farmers consider to be unfair can be particularly problematical in Australia where agri-environmental legislation and regulations have often been framed in ways that leave agencies considerable discretion over how they are to be enforced (Bradsen and Fowler, 1987). As Bradsen (1994 p. 442) remarked, “programs with a heavy reliance on discretion and appropriate administrative attitudes have minimal chances of ensuring efficacy”.

It is possible to distinguish norms of procedural fairness from norms of distributive fairness. Distributive fairness is closely aligned with the mainstream economic concept of equity. According to Syme et al. (1999 p. 53), the major hypothesis of procedural justice research is that “if procedural justice is demonstrated in a decision-making process the outcome is more likely to be accepted”. On the basis of a review of evidence in water-policy contexts, their judgement on the hypothesis was: “Fair decision-making processes are of paramount importance to community acceptance of water allocation decisions” (p. 67). Similarly, Syme et al. (1991 p. 1793) concluded “it may be just as important from the point of view of the public to feel that the decision was arrived at ‘fairly’ as for them to approve all aspects of the final plan”. Likewise, McClaran and King (1999) found that improvements in both procedural and distributive fairness would increase participants’ support for a forestry agency more than would increased agency emphasis on presenting an image of expertise.

It follows that potential exists to reduce opposition to redistributing de facto environmental rights away from farmers by tailoring the associated decision-making processes as closely as possible to farmers’ norms of procedural fairness. Participative decision-making processes which give farmers a chance to speak their mind and an opportunity to influence the process can be important in this regard (Syme, et al., 1999). Importantly they also provide opportunities to identify the norms of procedural fairness that apply in a given situation. Moreover, a procedurally-fair participation program can give farmers confidence to engage with each other, agency staff and others in a discourse that enables a more rounded understanding of the conflict at hand. Reeve (in press) has reasoned accordingly that:

As far as long term changes in land management practices are concerned, the unimplementable catchment plan is an irrelevance. What is important and likely ultimately to have gradual impacts on land degradation and externalities is the learning and reflection that occurred in the preparation of the plans and the normalising power of integrated catchment management discourse to bring about self-imposed restrictions by landholders on the property rights associated with land ownership.

Social norms in modern society

In societies with developed economies, Posner (1997) suggested that it may be quixotic to expect that the need for formal governance can be reduced by relying more on normative regulation. As society becomes more complex in the course of economic development, social dilemmas are less and less shared by people who are familiar with one another; increasingly these dilemmas are shared by strangers. Normal social interaction becomes less able to provide incentives spontaneously to comply with social norms. So the cost of informal governance increases, all else held constant.

In addition, Posner argued that incentives to follow norms are likely to be reduced as incomes rise with economic development. To the extent that education levels increase with income (because

education is a superior good¹), norm internalisation may be weakened by increasing individuals' abilities to think for themselves and circumvent norms by such devices as rationalisation and pluralism. By exposing people to more of the diversity of norms held across a society, education may also encourage "norm shopping", whereby an individual can opt into the system of norms that constrains his own (Posner, 1997 p. 367). He suggested that the reduced scope for norm shopping in rural areas compared with cities partly explains the well-documented moral differences between the two (although he acknowledged that the greater degree to which social dilemmas in cities are shared between strangers, and thus the lower efficacy of social disapproval, also plays a part here). Relatedly, heterogeneity of norms, and awareness of this heterogeneity, reduces the contribution that norms can make to predicting how others will behave. As Sturgess (1997 p. 29) has pointed out:

If one is not sure whether the other party has the same deep background in a particular social convention, or if they are using unfamiliar cues to signal compliance or temporary departures from the rules, then it will be much more difficult to read or to anticipate the extent of the other's compliance.

Additionally Posner observed that privacy, because it is also a superior good, becomes increasingly protected by law as incomes rise. Protected privacy makes it harder for civilians, potential norm-enforcers, to observe others' behaviour and thereby reduces the costs expected by those violating norms. Finally, as incomes rise the cost of being subjected to social disapproval can be expected to fall, all else held constant:

... because in a wealthy society the individual is less dependent on the good will of his particular community (either because he is wealthy himself or he has a social safety net under him) ... [Thus] normative regulation is an inferior good.

On the other hand, North (1990 p. 35) has observed that depersonalisation of social dilemmas means that "the returns of opportunism, cheating, and shirking rise in complex societies". From this Putnam (1993) concluded that economic development makes informal governance increasingly essential. Does this not contradict the earlier conclusion that the cost of informal governance is tending to increase? Although Putnam does not address this question, an answer may be adduced. Posner (1997) failed to acknowledge that formal governance introduces new, vertical, social dilemmas between the state and civil society. These vertical social dilemmas are also susceptible to the incentives for opportunism, cheating and shirking that strengthen with economic development. The cost of effective formal governance (i.e. including the cost of resolving associated vertical dilemmas) therefore can also be expected to increase as economic development proceeds. To the extent that formal institutions are expected to continue coping alone with the increasing load of governance associated with economic development, their share of overall governance vis-a-vis informal institutions will increase. Following from the law of diminishing returns, the comparative advantage of formal institutions will tend to decline compared with informal institutions, all else held constant. Informal institutions thereby become increasingly essential for efficient governance.

The increasingly impersonal nature of the social dilemmas faced in modern societies nevertheless presents a formidable challenge to informal governance. Yet there is considerable evidence of strategies based on informal governance successfully providing durable solutions to impersonal social dilemmas (e.g. Ostrom (1990)). Evidence of this kind motivated a wide-ranging research effort seeking to explain these successes in order to draw lessons for maximising the spontaneity, hence minimising the cost, of informal governance. This effort started by recognising that "all else" aside from economic development, and indeed the nature of this development, is not constant nor preordained.

Generalised reciprocity

Perhaps the most significant discovery in this research has been that high rates of spontaneous compliance with norms of generalised reciprocity are possible even in quite impersonal situations. According to Putnam (1993 p. 172), "generalized reciprocity"² refers to a continuing relationship of

¹ The amount demanded of a superior (or normal) good has a positive relationship with the level of income (Kamerschen and Valentine, 1977).

² This is distinct from balanced reciprocity which refers to a simultaneous exchange of items of equivalent value (Putnam, 1993). Hereafter reciprocity will refer exclusively to generalised reciprocity.

exchange that is at any time unrequited or unbalanced, but that involves mutual expectations that a benefit granted now should be repaid in the future". Essentially it involves cooperating with others unless others defect first, and in that case defecting in proportion to the level of defection by others (Axelrod, 1984).

Compliance with reciprocity, like with other norms, requires cooperation in providing a collective good. Compared with other norms, however, in addition it has a retaliatory aspect requiring individuals to cooperate in enforcing the compliance of others. As Elster (1989 pp. 40-41) realised, informal enforcement of norms is itself subject to a social dilemma: "Punishment almost invariably is costly to the punisher, while the benefits of punishment are diffusely distributed over the members". The cost of punishment, and thus the difficulty of this dilemma, increases as the share of punishment that occurs during normal social interaction declines. As social dilemmas become more depersonalised, consequently, adequate enforcement of most types of norms becomes less likely.

By punishing failure to punish, reciprocity norms suggest a solution to this problem. Yet it is a solution only to the extent that people comply with such norms. The key aspect of compliance with reciprocity is that it requires trust that one's cooperation or non-cooperation now (either in providing the collective good sought or in punishing non-providers) will later be reciprocated. Hardin (1993 p. 516) described the trust of one person for another as "just the expected probability of the dependency working out well" and argued that this trust is revised through an instinctive form of Bayesian learning as new information is gained through time.

Trust and reciprocity are positively reinforcing (Ostrom, 1998). As observed by Betts (1997 p. 2), "a group can become engaged in a virtuous circle of reciprocal exchanges where trust and collaboration beget more trust and collaboration, or a vicious circle where defection and betrayal lead to more of the same". More technically, Bayesian learning increases trust in others following reciprocity once greater compliance with this norm is observed. Increased trust raises the expected returns from cooperating (and the opportunity cost of risking ostracism by not cooperating) which, in turn, strengthens the incentive to follow reciprocity. Conversely, reduced reciprocity weakens trust and thereby further lessens reciprocity.

Whether this helix of positive feedback causes escalating or diminishing compliance with reciprocity norms can be influenced by modifying the structure of a social dilemma to affect the "shadow of the future" (Axelrod, 1984 p. 126). This shadow refers to the opportunity cost of missing out on future rewards from cooperation as a consequence of non-compliance in the present. This cost for an individual depends on a range of factors including the expected stream of rewards from continued cooperation, perceived risk of non-compliance being detected, expected punishment associated with detection, rate of risk aversion, and rate of time preference.

As an example, any depersonalisation of social dilemmas associated with economic development tends to reduce the risk of non-compliance being detected, thereby weakening the shadow of the future and reducing incentives to follow reciprocity. Nevertheless people have managed to sustain feedback regarding compliance and trustworthiness in many impersonal settings. Evolutionary psychologists have explained this by speculating from experimental evidence that humans inherit a "faculty of social cognition" that helps them to adapt reciprocity norms to the various social dilemmas they face (Cosmides and Tooby, 1992 p. 163). Hence feedback in impersonal settings often occurs through "the endless 'chatter' that goes on in a successful community, the continuous shuttling back and forth of small bits of information about expectations and performance" (Sturges, 1997 p. 29). According to Jacobs (1961 p. 119), the secret of this impersonal feedback is to "grow networks of small-scale, everyday public life and thus of trust and social control ...". Networks of this kind enable trust to become transitive. Putnam (1993 p. 169) illustrated this process as follows: "I trust you, because I trust her and she assures me that she trusts you". Indeed, Newton (1999 p. 185) concluded from

Eurobarometer and *World Values* survey data that ‘social’ trust in Western Europe has generally been rising³, and that this is partly due to a shift to “a greater variety of looser social relations”.

A classic portrayal of how loose social networks provide the feedback required for trust in an inner city neighbourhood has been provided by Jacobs (1961 p. 56), and is worth quoting at length:

The trust of a city street is formed over time from many, many little sidewalk contacts. It grows out of people stopping by at the bar for a beer, getting advice from the grocer and giving advice to the newsstand man, comparing opinions with other customers at the bakery and nodding hello to the two boys drinking pop on the stoop, eyeing the girls while being called for dinner, admonishing the children, hearing about a job from the hardware man and borrowing a dollar from the druggist, admiring the new babies and sympathizing over the way a coat faded. Customs vary: in some neighbourhoods people compare notes on their dogs; in others they compare notes on their landlords.

Most of it is ostensibly utterly trivial but the sum is not trivial at all. The sum of such casual, public contact at a local level – most of it fortuitous, most of it associated with errands, all of it metered by the person concerned and not thrust upon him by anyone – is a feeling for the public identity of people, a web of public respect and trust, and a resource in time of personal or neighbourhood need. The absence of trust is disaster in a city street. Its cultivation cannot be institutionalized.

Feedback for distinct social dilemmas often happens to be provided by networks which overlap each other. In such cases the incentive to follow reciprocity is greater than it would otherwise be since non-compliance in one social dilemma risks punishment in others as well. For instance, Ellickson (1991) noted that farmers typically deal with one another on a large number of fronts, including staffing the volunteer bushfire brigade, controlled burns, fence repairs, and social events. These farmers are said to have multiplex relationships with each other. Moreover, overlap of social dilemmas affords greater flexibility in complying with reciprocity norms. As Ellickson (1991 pp. 55-56) observed:

A person in a multiplex relationship can keep a rough mental account of the outstanding credits and debits in each aspect of that relationship. Should the aggregate account fall out of balance, tension may mount ... But as long as the aggregate account is in balance, neither party need be concerned that particular subaccounts are not.

Coleman (1988) argued that multiplex relationships are a particularly important ingredient of social capital⁴. The extended trust yielded by multiplex relationships allows behaviour of the kind described below to be understood as a product of reciprocity:

Where social capital is high people contribute to the school library, even though it will not be finished before their child leaves. Where it is low a parent would be a soft-headed fool to do such a thing. Where it is high people join a working-bee to care for a local park. Where it is low they dump their household rubbish in it (Betts, 1997 p. 1).

Rehabilitating social capital

Despite human ingenuity in using whatever social capital exists to apply reciprocity, the social capital of farming communities seems to have suffered from the depersonalising effects of economic development. Pretty (1998) has described how modernisation of agriculture has reduced the number of people involved in farming. It has also meant that horizontal links within rural communities have been replaced by vertical links to organisations located elsewhere. For instance, local information networks have been replaced by external sources; banks have substituted for local credit arrangements; the place of cooperatives and marketing boards has been taken by input and product markets; and supermarkets have replaced local shops. Consequently, farmers have fewer direct contacts with local people.

This suggests the capacity of local social networks to provide the feedback necessary for trust formation in rural communities has declined. As a result rural people, like people elsewhere, have had to rely more on the mass media for feedback of this kind. However, the efficacy of this remedy is diminishing as trust in mass media weakens. Papadakis (1999) has reported that between 1983 and 1995 the share of Australian respondents expressing confidence in the press fell from 29 per cent to 16 per cent. It seems reasonable to suppose that increasing globalisation of mass media, so that services offered are less tailored to local needs, norms and values, has contributed to this trend. As overall

³ The question asked in the *Eurobarometer* survey was: “Now I would like to ask you how much trust you have in people from [your own country]. Please tell me whether you have a lot of trust in them (4), some trust (3), not very much trust (2), or no trust at all (1)”. The question asked in the *World Values* survey was: “Generally speaking would you say most people can be trusted or that you can’t be too

⁴ Social networks were first recognised as building blocks of social capital by Jacobs (1961).

capacity to obtain the required feedback has dissipated, therefore, capacity for local self-organisation has also eroded.

If informal governance of agri-environmental conflicts is indeed to be strengthened, then identification and implementation of ways out of this 'vicious circle' of diminishing social capital, trust and reciprocity is required. The importance of this task appears to be acknowledged in the rhetoric of participative agri-environmental programs that typically stresses the importance of strengthening the sense of community between parties to a conflict. Participative programs may indeed contribute in this direction by bringing more of the parties together face to face, with the result that the quality and extent of informal social networks linking them is improved (Marshall, 1999). Nevertheless empirical evidence of what these strategies can realistically deliver remains sorely lacking (Bellamy, et al., 1999).

3. The Case Study

Rationale

As Dovers (1999 p. 100) has remarked, "... the very rapid growth in community-based [natural resource management] programs follows no apparent coherent design or intent ...". Likewise, Mobbs and Dovers (1999 p. 4) commented that many of these participative programs "are in place before any sound proposition of how they might work has been formulated". Accordingly these authors identified an important role for the social sciences in drawing lessons from past and present experiences. The aim would be to "isolate elements, strategies or mechanisms within particular experiences with potential for more generic application" (Mobbs and Dovers, 1999 p. 131).

The research reported in this paper was motivated by thinking of this kind. It sought to use a participative process of developing and implementing four 'land and water management plans' (LWMPs) as a case study to add to the stock of knowledge available to those pursuing participative agri-environmental programs elsewhere.

Case study setting

The four land and water management planning processes largely correspond with the four sets of government-built irrigation schemes located around Deniliquin. This town currently has a population of about 8,500 (with around 4,000 more in the surrounding shires), and it is a drive of 300 kilometres (three and a half hours) north from Melbourne and 750 kilometres (nine hours) south-west from Sydney. Its industries are mainly associated with the surrounding agricultural and pastoral industries, and it also serves as a regional administrative and work headquarters for various government and semi-government organisations (McCotter, 1994). A Deniliquin community worker was quoted by Bullen and Onyx (1998 p. 29) as follows:

Deniliquin is a strong community ... The isolation gives it a bonding sense ... Local Government doesn't have much to do with community services in Deniliquin. It is not that they don't see it as a need. It is just that we as a community have been doing it for 20 years.

The four irrigation schemes are Berriquin, Wakool/Tullakool, Deniboota and Denimein. The farm area in the four districts is 749,202 hectares. The number of farm businesses within the schemes has recently been estimated at 1,610, of which 209 operate farms with less than 20 megalitres of water entitlement. After excluding these small businesses, the average business area is 518 hectares (Murray Irrigation Limited (MIL), 1998b).

The corresponding 'land and water management planning districts' are known as Berriquin, Wakool, Cadell and Denimein. The Cadell district includes the Deniboota scheme as well as an adjoining area to the east (East Cadell) which includes considerable private irrigation development. East Cadell includes a farm area of 156,137 hectares. Across the four LWMP districts, around 46 per cent of the farm area has been developed for irrigation (MIL, 1998b). While the intensity of irrigation is low, the large area means that MIL, which now runs the schemes, has the largest single diversion license in the Murray-Darling Basin (MDB), covering one-seventh of the area of Australia, within which it lies (Marsden, 1996).

Origins of the LWMP processes

The hydrological consequences of clearing deep-rooted vegetation for irrigation development, and of irrigation itself, became apparent 'on the ground' when shallow watertable problems were first recorded in the Wakool scheme area in the early 1950s (Wakool CWG, 1995). Once a watertable rises to within a critical depth from the soil surface, which in the MDB is generally considered to be two metres, upward movement of salt to the root zone can occur due to capillary rise of saline moisture from the watertable (Pope and Marston, 1988).

Early responses to the problem of rising watertables typically concentrated on large-scale engineering schemes, as exemplified by the Wakool Tullakool Sub Surface Drainage Scheme which was built between 1979 and 1988 (Wakool CWG, 1995). Intensification of irrigation also contributed to increasing problems of surface drainage. The schemes were intended originally for stock and domestic water and low-intensity irrigation of pasture and fodder crops, and consequently were constructed without surface drains (Marsden Jacob Associates, 1994). These problems were worst in Berriquin which mostly has very little topographical relief and lacks effective natural drainage. Again the focus was on a single-fix engineering solution, so government construction of a surface drainage scheme commenced in 1979. By the end of the 1980s, however, NSW Government policy for funding further drainage works had changed, requiring communities and governments to co-operate and coordinate their efforts with regard to surface and sub-surface drainage.

This change in public policy coincided with growing concern that rising watertables would threaten local agricultural viability by exacerbating the existing waterlogging problems as well as by causing soil salinisation. As a result members of the Berriquin farming community organised a public meeting in August 1991 to instigate development of the Berriquin Land and Water Management Plan. Over 250 farmers and community representatives attended the meeting and voted to support the proposal. A Community Working Group (CWG) was elected at the meeting to oversee the development of the Plan. Representatives from local government and relevant government agencies were subsequently invited to become members of the Working Group (Stewart, 1992). The objective ultimately adopted by the Working Group was "to halt or reduce accessions to the watertable, thus stopping or retarding the spread of high watertable areas and the attendant salinisation and to decrease the extent and duration of waterlogging across the District" (Berriquin CWG, 1995).

Government and community leaders now recognised that solutions involving engineering schemes are subject to social dilemmas of their own. These dilemmas arise because the aquifers behind the shallow watertables responsible for soil salinisation normally overlap boundaries between farms and also between farm areas and other areas. Due to transmissivity of groundwater within an aquifer, one party's effort to lower its own watertable helps to lower others' watertables. 'Freeboard' between the soil surface and an underlying watertable consequently has characteristics of a common-pool resource (CPR). As with any public good, provision of this freeboard will be less than collectively rational unless credible commitment to share this provision is established.

Lack of mutual trust historically between farmers and the succession of government agencies responsible for running the irrigation schemes had been a particularly serious obstacle to coordinating efficient solutions to issues arising in running them. This is consistent with Reeve's (1999 p. 5) observation that there has been a long Australian tradition of rural resistance to state authority "dating ny and continuing with the resistance by gold miners and squatters⁵ to the establishment of bureaucratic controls by the State, and with the support rural communities afforded to some bushrangers⁶".

Developing the LWMPs

By June 1992, CWGs had formed to develop draft LWMPs to address problems of rising watertables in all four districts. The conditions under which the Groups could gain financial and logistical support from Government for plan development and implementation were outlined in the *Guidelines for Land and Water Management Plans* prepared by the (community-based) Murray and Murrumbidgee Catchment

⁵ An Australian term for people who historically settled on Crown land to graze livestock without state approval.

⁶ An Australian term for robbers or outlaws who historically operated in 'the bush' (i.e. the countryside as opposed to the towns).

Management Committees (1992 p. 4). The importance of CWGs actively consulting with their constituents was stressed strongly in the *Guidelines*. At the same time the CWGs were encouraged to “gain the support of government if you want funding” (p. 7) and to “be realistic about possible

The Department of Water Resources appointed an independent consultant in late 1991 as a Project Coordinator for the Berriquin LWMP process, but soon after this role was extended to the other three processes. Each CWG met at least monthly until the draft plans were submitted to the NSW Government towards the end of 1995. The average Denimein CWG member was estimated to have attended a meeting every ten days during 1993-94 (Denimein CWG, 1995).

After the large public meetings held initially in each district to gain community support for the LWMP processes and select CWGs, each group moved independently to more focussed consultation strategies. Farmers were consulted in rounds of locality meetings held in places convenient and comfortable for farmers like wool sheds, paddocks, community halls, clubs, and pubs. In general, four or five rounds of these meetings were held during plan development. In Berriquin, the initial round comprised 23 locality meetings, followed by 17 for the other four rounds. The typical attendance at each of these rounds was around 300, or about 40 per cent of Berriquin farm businesses.

A final round of four larger locality meetings was held in March 1994 at which the LWMP proposals, their costs and cost-sharing arrangements were discussed. Negotiations with the NSW Government over cost-sharing arrangements eventually took place during September 1995 and the resulting Berriquin LWMP was formally endorsed at a community meeting held a month later and attended by over 300 farmers (Berriquin CWG, 1995). Similar consultation processes were followed, and levels of community approval obtained, in the other three districts. The high levels of approval at the final meetings were taken as evidence that community consultation had created a sense of local ownership of, and commitment to, the plans.

The NSW Government agreed to contribute \$A116 million over the first 15 years of plan implementation, subject to the Federal Government meeting half this cost and the community delivering annually on its agreed contributions. Farmers agreed to contribute \$A382 million over 30 years (Percival, 1996). Most of this contribution is ‘in kind’, in the form of costs incurred in adopting the on-farm measures included in the various LWMPs. Local government in the region agreed to contribute a further \$A2 million toward implementing the plans (Marsden, 1996).

Implementing the LWMPs

As part of a wider process of water policy reform, the four irrigation schemes were privatised in March 1995. The schemes became the property of Murray Irrigation Limited. Shares in this company are fully apportioned among its water supply customers. Eight of the ten elected company director positions are reserved for irrigators. One vote is allowed for each landholding owned within MIL’s area of operation (MIL, 1997a). The company is autonomous within the constraints set by Government-imposed conditions attached to the licenses it needs to operate under the Irrigation Corporations Act, 1994 (Schroo, 1998). The four district communities eventually agreed that MIL become the ‘implementation entity’ for the plans.

The details of how devolution of LWMP implementation authority to MIL was to occur were specified in a Heads of Agreement signed in April 1996 by community leaders and relevant NSW Government Ministers (Percival, 1996). Such a document signifies agreement in principle, is given informal force by political convention, and can be a precursor to a legally-binding contract. The Agreement included compliance with the LWMPs as a condition in MIL’s licenses. It was anticipated MIL would enforce farmer compliance with LWMPs through attaching conditions to water supply agreements with its customers.

The MIL Board established an Environment Committee to, among other roles, advise it on matters relating to LWMP implementation (MIL, 1998a). The four CWGs (renamed Community Implementation Groups) now provide feedback and advice to MIL regarding LWMP implementation in their respective districts (MIL, 1998b). They have continued to keep their communities involved in

implementation decisions through locality meetings, newsletters and the like. The Implementation Groups have a particularly important role in suggesting how their LWMPs can be improved as better knowledge becomes available.

Musgrave (1996a p. 56) has expressed concern that “despite the substance and discipline imparted to them by their legal underpinning” the successful implementation of LWMPs ultimately depends on “moral agreement” between governments and communities and the trust on which it rests. He concluded “that such an important process of reform should have to rely on such a fragile instrument is cause for concern. Despite this, understanding of the problems leads to the conclusion that such reliance is probably unavoidable”. The trust problem of course cuts both ways, but a particular challenge for governments is to establish confidence that the community leadership with whom they reach agreement has the capacity to deliver on its side of the bargain. Given the past lack of progress by governments in gaining widespread farmer adoption of conservation measures (Barr and Cary, 1992; Martin, et al., 1992; McDonald and Hundloe, 1993), the NSW Government’s signing of the Heads of Agreement for the Murray LWMPs represents a remarkable vote of confidence in the Murray community’s leadership.

So far MIL has relied on farmers complying voluntarily with the LWMPs. In doing so it has, given the underlying ‘freeboard commons’ dilemma, placed considerable faith in the community commitment to the plans that was fostered by developing them participatively. It is difficult at this stage to judge whether MIL needs to become more coercive to ensure that on-farm targets of the LWMPs are met. However, it has already introduced a policy – also for watertable management purposes – under which paddocks exceeding a rice irrigation (megalitres per hectare) limit must be withdrawn from further rice growing (MIL, 1997b). Although the policy was supported by most irrigators, it attracted vociferous opposition from a minority. It is arguable that this balance would have been much less favourable if the Government water supply agency had tried to carry such a policy.

Although MIL is a private company, it is also a common property regime insofar as it has been granted property rights to assets with CPR characteristics such as irrigation supply channels and drains, and (implicitly) to the watertable freeboard within its area of operation. Although MIL’s area of operation was primarily determined by its infrastructure management role, this jurisdiction fortuitously coincides in large degree with that needed for regional watertable governance. Significant economies of scope were therefore available by spreading MIL’s fixed costs over both functions.

4. Method

Rationale

There is considerable optimism that the contractual approach pioneered with the Murray LWMPs will enable greater success by imposing increased discipline on the parties responsible for implementation. However, implementation of these LWMPs still depends to a large extent on voluntary farmer compliance. The optimism is based on two beliefs: farmers are more likely to comply with a plan that they helped to create; and, they are more likely to cooperate with an implementation authority they co-own than they are with government. As yet, however, these beliefs remain untested. Closing this knowledge gap appears to be a vital step in gauging whether the Murray LWMP model has merit for other settings. The aim of the empirical research to be reported here was to help close this gap.

Research over the last few decades into how rural communities have dealt with CPR dilemmas has made considerable progress (see Baland and Platteau, 1996 for a survey). The early phase of this effort mainly involved qualitative comparison of successful and unsuccessful cases, the aim being to identify ‘design principles’ generally explaining success. This research is exemplified by the works of McCay and Acheson (1987), Ostrom (1990) and Bromley (1992). Progress with this line of research slowed during the 1990s because many of the variables thought to be critical functioned interactively and it was difficult finding field studies which allowed the interactions to be isolated for qualitative investigation (Ostrom, 1998). As Wirt, Morey and Brakeman (1971 p. 4) have observed, “The slippery nature of causation makes the move from description to explanation extremely difficult”.

The research program consequently moved into a second phase which emphasised experiments with people subjected to social dilemmas simulated in 'laboratory' settings. This method is amenable for isolating and testing inter-variable relationships using statistical methods and has added considerably to knowledge of how voluntary cooperation emerges even in challenging social dilemmas. This research is surveyed in Ostrom (1994) and Ostrom (1998).

Difficulties nevertheless remain in extrapolating laboratory findings to complex real social dilemmas (Ostrom, 1998). In particular, relationships demonstrated in laboratory research may not be substantively significant in real settings given the effects of myriad other variables. As this study was concerned with a real setting, a method for isolating and testing relationships of interest under such circumstances was required. The method chosen was multiple regression using data from a survey of the farmers facing the real social dilemma of implementing the on-farm aspects of their respective LWMPs. This approach allows quantitative testing of theories by passively observing phenomena as they occur naturally.

Sample and interviews

In order to demonstrate on-farm compliance with the LWMPs, each year MIL undertakes a survey of land holdings within the four planning districts. The interviews are performed face-to-face and are concerned with enumerating adoption of the on-farm measures included in the plans. The interviews for the study reported here were conducted immediately after the standard MIL interview. MIL's sample was used. This was selected according to a stratified-random procedure. There were 235 farm businesses in the sample, which represents 14.6 per cent of the 1998 population of 1,610 farm businesses.

The interview schedule was comprised mainly of bi-polar (e.g. strongly agree/strongly disagree) rating scales. Unless otherwise specified, a nine-point rating scale (with the negative and positive poles scored for analysis as one and nine respectively), was used for such items. A 'don't know' response was also allowed.

Method of statistical analysis

Standard methods of multiple regression like the Ordinary Least Squares (OLS) technique assume that all variables are measured on an interval scale. Rating scales differ from an interval scale since in the former there is no guarantee of equality of interval. In this study, multiple regression using the ordered probit method was used to avoid this measurement problem, at least in respect of the dependent variable. The general specification of each single-equation model is

$$y^* = \beta'x + \varepsilon$$

where y^* is a latent (unobserved) variable, x is a $(K \times 1)$ vector of observed explanatory variables, \mathbf{b} is a $(K \times 1)$ vector of unknown parameters, and ε is a random error term. Although y^* is not observed, what can be observed is

$$\begin{aligned} y &= 1 && \text{if } y^* \leq 0, \\ &= 2 && \text{if } 1 < y^* < \mathbf{m}_1, \\ &= 3 && \text{if } \mathbf{m}_1 < y^* < \mathbf{m}_2, \\ &&& \vdots \\ &= J && \text{if } \mathbf{m}_{J-1} \leq y^*. \end{aligned}$$

The \mathbf{m} s are unknown parameters to be estimated with \mathbf{b} . The parameters of the ordered probit model are obtained by maximum-likelihood estimation. A pseudo- R^2 was calculated as a measure of the goodness-of-fit of the estimated models. The measure chosen was one recommended by Veall and Zimmerman (1992) because, when it takes a value less than about 0.6, it seems to mimic the OLS- R^2 that would be calculated if y^* could be observed.

5. Model specification

Dependent variables

The aim of the case study was to explore how informal governance influences farmer compliance with the Murray LWMPs. In doing so it was recognised that farmer compliance targets were generally set globally (e.g. a total number of drainage recirculation systems to be installed) rather than for individual farm businesses. Moreover, many of the targets are long term (e.g. irrigated woodlots established within 15 or 30 years), while implementation of the plans formally commenced less than five years ago. Given these factors, as well as the multiplicity of applicable targets, it was decided to model precursors to compliance instead of compliance per se. Moreover, compliance was to be considered on an ‘average’ basis rather than separately for each on-farm measure included in the LWMPs.

Two such dependent variables were used as proxies for actual compliance. The first, known as Farmer Commitment, was measured by scores recorded against the following rating item:

On our farm we are committed to following the plan⁷.

The rating item used to measure the other dependent variable, called Farmer Intention, was:

How likely is it that your farm business will carry out all the applicable on-farm aspects of the plan within the next ten years?⁸

The Farmer Intention variable is clearly a more direct precursor to actual compliance than is the Farmer Commitment variable. The measurement of Farmer Intention is more likely to have accounted for farmers’ capacity to comply within a defined, yet reasonable, period.

Explanatory variables concerned with informal aspects of LWMP governance

Both these dependent variables were modelled using the same set of explanatory variables.

Compliance with a LWMP was hypothesised to be positively affected by the degree to which farmers perceive that the regional problem it primarily addresses – rising watertables (and a consequent worsening of soil salinity and waterlogging) – is also important in the context of their own farms. Farmers vary in their risk of exposure to rising watertables due to inter-farm differences in topography, soil type, enterprise mix, and so on. The hypothesis was tested by including an explanatory variable, known as Watertable Threat, in the models. The variable was measured (on a seven-point scale) using the rating item that follows:

How do you regard the following as threats to the long-term viability of your farm business? ... Salinisation and waterlogging if the plan is not successfully carried out⁹.

The possibility that compliance by farmers is also motivated in part by off-farm benefits that they expect to result for their wider community was tested by including a variable measured by the rating item following:

The long-term viability of our district’s community would really be improved if everyone successfully carried out their parts of the plan.

This hypothesis need not contravene rational choice theory’s assumption that all motives derive from maximisation of self interest. Contributing to community viability often confers private benefits as well. The chairperson of the Wakool CWG revealed how he emphasised community-minded self interest to local farmers by saying things like “Do you want to end up drinking in the pub on your own?” and “When you go to sell your farm, do you want prospective buyers driving through wasteland to get to your place?”. Moreover, experimental evidence supports the notion that group identity can emerge from interactions among its members, and that this phenomenon can cause group members to behave with some degree of self-interested other-regardingness towards each other (Dawes, van de Kragt and Orbell, 1990).

There are considerable differences between farmers in terms of the degree of commons dilemma associated with their compliance decisions. Depending on local transmissivity of shallow groundwaters,

⁷ The poles were “very far from my view” and “very close to my view”. Unless otherwise specified, this also applies to other rating items.

⁸ The poles were “extremely unlikely” and “extremely likely”.

⁹ This was one of seven threats listed in relation to the same question. The poles were “no threat at all” and “a very serious threat”.

for instance, farms differ in the extent to which LWMP compliance confers private benefits as against benefits to neighbouring farms. It was anticipated that compliance by farmers would tend to be negatively related with the degree to which they perceived themselves as facing a commons dilemma. This proposition was explored by testing two hypotheses dealing with different ways in which the commons dilemma might be viewed by farmers. The first of these hypotheses was tested by including a variable that measured the extent to which farmers perceive that their on-farm benefits of compliance depend on how others (farmers and non-farmers) comply. The variable, called Dependence, was developed as a summated scale, derived as the mean of the scores of the three rating items that follow:

- The benefits on our farm of following the plan depend at least partly on what other farmers do;
- The benefits on our farm of following the plan depend at least partly on what is done with the plan off-farm; and
- The long-term viability of our farm would really be improved if everyone successfully carried out their parts of the plan.

The composition of this scale was suggested by exploratory factor analysis. Cronbach's Alpha for the scale is 0.64, indicating that it has a satisfactory level of internal consistency reliability¹⁰. This variable was hypothesised to be related positively with compliance.

The second of the two hypotheses was tested by including a variable that measured the degree to which farmers perceived that their own compliance would be worthwhile regardless of how others comply. This variable, called Independence, was based on the rating item following:

- There would be worthwhile benefits to us from following the plan even if no one else followed it.

As this variable measured freedom from exposure to a commons dilemma, it was hypothesised to have a positive relationship with both the compliance proxies.

Farmers can also be expected to differ in terms of how trusting they are that compliance by other parties will be sufficient to make their own compliance worthwhile. Following from the theory reviewed earlier, each farmers' compliance was expected to be positively influenced by this degree of trust, all else held constant. This proposition was examined by testing three hypotheses relating to different dimensions of this trust.

The first of three hypotheses was tested by including a variable representing the social trust that the literature suggests is important for enabling generalised reciprocity in modern society. Factor analysis indicated that this variable, called Social Trust, be measured by a summated scale comprised of these rating items:

- When you work with others to solve a common problem, you generally get less out of it than you put in;
- Over the long haul you will be more successful if you avoid accepting help from other people; and
- Over the long haul you will be more successful if you avoid giving help to other people.

These items were reverse-scored so the scale corresponded positively with social trust. The scale's Cronbach's Alpha of 0.72 evidences reasonable reliability. This variable can be viewed as representing farmers' assessments of the degree to which people generally can be trusted to reciprocate cooperation. In everyday parlance it provides a measure of how farmers regard the common decency of their extended society.

The second of these hypotheses was tested by including a variable, known as Plan Compliance Trust, representing farmers' more specific trust that others (farmers and non-farmers) will comply with the LWMPs. This variable, expected to relate positively with the compliance proxies, was measured by the following rating item:

- The overall plan will be successfully carried out inside the scheduled time.

¹⁰ A researcher-designed scale is considered to have an acceptable level of reliability if Cronbach's Alpha is 0.6 or greater (Cooksey, 1997).

The last of the trust-related hypotheses explored the effect of trust of an even more specific kind: trust by farmers that other farmers will comply. The variable representing this type of trust was measured using the rating item that follows:

We are waiting to see how other farmers follow the plan before we go further on our farm¹¹.

The strategy referred to in this rating item was anticipated to be a common response by farmers lacking trust that overall compliance by other farmers would be sufficient to make their own compliance worthwhile. It can be viewed as a way of farmers attempting to strengthen trust in other farmers (although it may also have the opposite result). It potentially allows farmers lacking this kind of trust to gain more of it by allowing themselves additional time in which to assess other farmers' reputations (in the abstract meaning of the term used earlier). A farmer with a high score for this variable was accordingly presumed to currently lack trust that LWMP compliance by other farmers will be sufficient to make his or her own compliance worthwhile (and vice versa). Hence this variable, known as Wait and See, was hypothesised to be negatively related with the compliance proxies.

A further set of three variables was included to assess various hypotheses regarding the effect of peer pressure on compliance. Firstly, the possibility that farmers' adherence to a norm of civic duty positively influences their LWMP compliance was tested by including a variable based on the rating item:

The rights of individuals should come before the interests of their local community.

Scoring for this item was reversed so this Civic Duty variable appropriately measured adherence with such a norm.

Secondly, a variable representing farmers' sensitivity to peer pressure from their local farming community was included. The rating item used to measure this variable was:

I really don't care if other farmers respect me or not.

Item scores were reversed in order to enumerate the variable appropriately. The variable, called Peer Sensitivity, was hypothesised to relate positively with the compliance proxies.

Thirdly, it was hypothesised that the strength of peer pressure on farmers is positively influenced by the level of peer pressure anticipated. This degree of anticipation was accounted for by including a variable based on the rating item following:

Other farmers respect for us would be lowered if we did not follow the plan.

It was hypothesised that this variable, known as Peer Threat, is positively related with compliance.

Other variables were included in order to explore whether farmer perceptions regarding procedural and substantive fairness influence their intentions to comply. The two procedural fairness variables are known as Procedural Fairness (P) and Procedural Fairness (I), where *P* and *I* denote the plan development and plan implementation phases of the LWMP program, respectively. The rating items used to measure these two variables were, respectively:

How satisfied were you with chances to influence what went in the plan?; and

How satisfied are you with chances to influence how the plan is carried out?¹²

The Distributive Fairness variable was measured by the rating item:

How fair is your farm's share of the costs of carrying out the plan?¹³

The three fairness variables were all hypothesised to positively influence the compliance proxies.

Explanatory variables representing other possible socio-economic influences

Additional variables were included to control for socio-economic factors conventionally accounted for in studies of farmer adoption of technologies. Abadi Ghadim and Pannell (1999) noted that the

¹¹ The poles were "very far from my strategy" and "very close to my strategy".

¹² The poles were "not satisfied at all" and "completely satisfied".

¹³ The poles were "very unfair" and "very fair".

literature has identified a wide range of such socio-economic variables. Two of these factors were modelled in this study: farm business security and farmer age.

Farm business security is normally accounted for in terms of wealth. Abadi Ghadim and Pannell (1999 p. 152) observed that greater wealth is likely to influence adoption of an innovation positively since it “allows the farmer to invest a relatively smaller proportion of their (sic) wealth to venture into an uncertain enterprise”. They attributed the influence of this factor to its relaxation of financial constraints and its likely reduction of risk aversion. The first of these effects was emphasised as follows in the Berriquin LWMP: “Farmers in a strong financial position are ... better placed to undertake capital investments and changes to management that will lead to greater environmental sustainability” (Berriquin CWG, 1995 p. 128). A well-worn agri-environmental aphorism puts it more colourfully: “You can’t be green if you’re in the red”.

Since the limited time available for each interview precluded obtaining the data required to calculate farm wealth, and perceptions of business security are in any case inherently subjective, perceived business security was measured in this study by the following rating item:

How secure is the long-term viability of your farm business?¹⁴

This variable, known as Security, was hypothesised to positively influence the dependent variables.

As noted by Abadi Ghadim and Pannell (1999), the traditional view is that older farmers are more risk averse, suggesting that they tend to be less likely to adopt new measures. Age can also serve as a proxy measure of experience in farming. However, a farmer’s experience has both positive and negative implications for his or her propensity to adopt new measures (Abadi Ghadim and Pannell, 1999). Given these opposing tendencies, the parameter for Age was hypothesised only to differ from zero.

Dummy variables to control for interviewer-induced bias

Finally, a set of three dummy variables was included in the models to control for possible interviewer-induced response bias. This possibility arose because the 17 interviewers used by MIL for the survey included farmers from within the LWMP districts, as well as other people involved in the development and/or implementation of the LWMPs. Interviewee’s awareness of the background of this group of interviewers might have biased some of their responses, for instance due to not wanting to appear critical or unenthusiastic.

Preliminary analysis indicated significant differences between data collected by four groups of interviewers in respect of a few of the key survey items. The four mutually-exclusive groups were: (i) non-farmers from outside all four LWMP districts; (ii) farmers from inside the LWMP districts with no further involvement in the LWMP process; (iii) people who have served on an LWMP Working or Implementation Group or worked for MIL, excluding the person comprising the fourth group; and (iv) an ex-chairperson of one of the CWGs. Due to the indication of a possible bias, dummy variables were included in the models to test for biases associated with interviewer groups (ii), (iii) and (iv). These variables are known as Int_Dum1, Int_Dum2 and Int_Dum3, respectively.

Discussion of sample statistics

Sample statistics, and expected coefficient signs, for each of the (non-dummy) variables discussed above are presented in Table 1.

Table 1: Descriptive statistics, and hypothesised coefficient signs

Variable	Mean	Standard deviation	Hypothesised sign
Farmer Commitment	7.0	1.67	n.a.
Farmer Intention	6.9	2.23	n.a.
Watertable Threat	5.2	1.96	+
Community Benefit	7.7	1.53	+
Dependence	6.3	1.77	-

¹⁴ The poles were “very insecure” and “very secure”.

Independence	7.0	1.99	+
Social Trust	7.0	1.75	+
Plan Compliance Trust	5.0	2.29	+
Wait and See	1.9	1.46	-
Civic Duty	6.2	2.30	+
Peer Sensitivity	6.1	2.77	+
Peer Threat	5.7	2.31	+
Procedural Fairness (P)	6.1	2.28	+
Procedural Fairness (I)	5.4	2.32	+
Distributive Fairness	5.9	2.24	+
Security	5.9	2.04	+
Age	48.8	11.99	?

The sample means for most of the variables measured by rating items lie above the midpoint values of their respective scales (this value is five for all variables based on rating items other than Watertable Threat – in which case the midpoint value is four). Wait and See is a notable exception, signifying that farmers on average are only weakly predisposed to delay their LWMP compliance until they obtain greater feedback regarding compliance by other farmers.

Although the sample mean for Farmer Commitment marginally exceeds that for Farmer Intention, the Wilcoxon signed-rank test indicates that the scores for each variable do not differ significantly ($p = 0.732$, 2-tailed). Nevertheless the sample means for both of these variables are only about three-quarters of the maximum possible mean score of nine. Thus it appears that governance – formal, informal or both – needs to be strengthened if widespread farmer compliance with the LWMPs is to be achieved.

The shortfalls in Farmer Commitment and Farmer Intention might be explained in part by the sample mean for Plan Compliance Trust being only about 70 per cent of the sample mean for Social Trust. The Wilcoxon signed-rank test confirmed that farmers' scores are significantly higher for Social Trust than they are for Plan Compliance Trust ($p = 0.000$, 2-tailed). It follows that one way of increasing farmers' compliance with the LWMPs is to implement a strategy for raising the level of Plan Compliance Trust towards that of Social Trust.

Of the two procedural fairness variables, the sample mean for Procedural Fairness (P) exceeds that for Procedural Fairness (I). The Wilcoxon signed-rank test indicates that scores for the first variable indeed are significantly higher than for the second ($p = 0.000$, 2-tailed). The perception that the more recent phase of the LWMP process has been less fair procedurally than the earlier phase is perhaps surprising at first glance given that a company owned by the farmers has had a major influence over how the regional-level management of the implementation phase has proceeded. Although it is possible only to speculate here, one reason why procedural fairness during this phase is perceived to be lower could be a feeling that district farming communities, as represented by their CWGs, have lost some influence over the process during a time that non-farmer or non-local groups (e.g. the Nature Conservation Council) seem to have gained influence.

6. Results and discussion

Coefficient estimates

The estimated models for Farmer Commitment and Farmer Intention are presented in Table 2.

Table 2: Ordered probit models for Farmer Commitment and Farmer Intention

Explanatory variables	Dependent variables					
	Farmer Commitment			Farmer Intention		
	Coef.	$P > z $	Sig.	Coef.	$P > z $	Sig.
Watertable Threat	0.01	0.891		-0.02	0.624	

Community Benefit	0.26	0.000	**	0.13	0.047	*
Dependence	-0.02	0.758		-0.03	0.558	
Independence	0.08	0.047	*	0.02	0.688	
Social Trust	-0.04	0.440		0.02	0.674	
Plan Compliance Trust	0.10	0.007	**	0.15	0.000	**
Wait and See	-0.11	0.047	*	-0.13	0.040	*
Civic Duty	-0.01	0.863		-0.04	0.315	
Peer Sensitivity	0.07	0.017	**	0.04	0.184	
Peer Threat	0.01	0.828		0.01	0.795	
Procedural Fairness (P)	0.01	0.861		-0.04	0.413	
Procedural Fairness (I)	0.02	0.584		0.03	0.550	
Distributive Fairness	0.09	0.018	**	0.11	0.005	**
Security	0.02	0.615		0.09	0.018	**
Age	-0.00	0.584		-0.00	0.787	
Int_Dum1	-0.01	0.959		0.04	0.862	
Int_Dum2	0.32	0.200		0.34	0.190	
Int_Dum3	0.32	0.378		-0.07	0.846	
μ_1	0.56			0.48		
μ_2	0.79			0.98		
μ_3	1.49			1.22		
μ_4	1.83			1.46		
μ_5	2.63			1.74		
μ_6	3.00			1.99		
μ_7	4.01			2.74		
μ_8	4.85			3.40		
Pseudo R ²	0.39			0.31		

Note: * and ** indicate that a coefficient differs significantly from zero in the direction hypothesised at the 0.05 and 0.01 levels of confidence, respectively.

Goodness-of-fit for both models is reasonable given the use of cross-sectional data, although the fit is better for the Farmer Commitment model. Unexpected coefficient signs are evident for the following cases: Social Trust (Farmer Commitment model only), Civic Duty (both models), and Procedural Fairness (P) (Farmer Intention model only). However, in none of these cases would the coefficient be significant with a two-tailed test. There is no evidence of interviewer-induced bias.

The hypothesised influence of Watertable Threat on the compliance proxies is not supported by either of the estimated models. This suggests that farmers' LWMP compliance does not depend on the degree to which the watertable focus of the LWMPs is relevant to the viability of their agricultural businesses.

The hypothesis that Community Benefit positively affects the compliance proxies is supported at the 0.01 level for the Farmer Commitment model and at the 0.05 level for the Farmer Intention model. This suggests scope for increasing compliance by farmers by fostering group identity among farmers and their community and by raising their appreciation of the benefits that flow to their local community and in turn back to themselves.

The hypothesis that Dependence negatively affects farmer compliance with the LWMPs is not supported in either model. The hypothesis that Independence positively affects compliance is also not supported in the case of the Farmer Intention model. Nevertheless the latter hypothesis is supported at the 0.05 level in the case of the Farmer Commitment model. Given that the Farmer Intention variable is likely to more validly measure actual compliance, however, these results suggest that asymmetry in farmers' perceptions of LWMP compliance as a commons dilemma is not directly

responsible for variation in their compliance. This suggests that the participative process and collective farmer endorsement of its outcomes may have broadened farmers' self-interested rationality, perhaps by way of establishing a sense of group identity or 'community ownership'.

The hypothesis that Social Trust affects compliance positively is not supported in either case. For both models, however, support at the 0.01 level for the hypothesis that Plan Compliance Trust positively affects compliance is evident. Based on the earlier identification of trust as a crucial precursor to generalised reciprocity, it seems reasonable to presume that the positive affect of Plan Compliance Trust on compliance is through enabling generalised reciprocity. These findings indicate that the trust farmers need to follow this norm appears to emerge from assessing reputations of other parties involved in LWMP implementation rather than the common decency of people more generally.

The hypothesised negative influence of Wait and See on the compliance proxies is supported by both models, at the 0.05 level in each case. One interpretation of this result – that is consistent with the logic justifying inclusion of Wait and See in the model – is that differences in farmers' LWMP compliance are partly due to some farmers being less trusting than others that there will be sufficient compliance by farmers generally to justify their own compliance. Nevertheless an alternative, or at least complementary, explanation of this result is possible. Differences between farmers in their adoption of a wait-and-see strategy may be due to some farmers being less trusting than others that the measures that they are supposed to adopt will be as effective as they have been advised. In the agricultural extension literature farmers who are less trusting in this respect are typically referred to as conservative. According to Abadi Ghadim and Pannell [1999 #1499] conservative farmers are those that require a greater number of observations of adoption being successful for other farmers before they finally decide to adopt. Hence further analysis is underway to ascertain the extent to which the negative coefficients for the Wait and See variable should be interpreted as evidence that farmers who lack trust in compliance by other farmers are less likely to comply themselves.

The lack of support from both models for Civic Duty positively influencing compliance suggests that farmer education programs are misguided to the extent that they seek to inculcate civic responsibility instead of a better understanding of the importance of community viability and cohesion for individual welfare. This conclusion is consistent with Sinden and King's (1990) finding (for Manilla Shire, NSW) that civic responsibility in the form of a 'land stewardship ethic' helps to explain farmers' recognition of a land degradation problem but does not help to explain their adoption of conservation measures.

There is support at the 0.01 level for the hypothesis that Peer Sensitivity positively affects Farmer Commitment. Variation in farmers' desire for approval from other farmers thus appears to help explain variation in their commitment to their LWMP but not in their intention to comply with it.

The hypothesis that Peer Threat positively affects compliance is not supported in either case. Hence it seems that peer pressure does affect farmers' commitment to follow the LWMPs, but that this is driven by farmers abstractly desiring approval from other farmers, and not by adherence to a generalised norm of civic duty or a concrete fear of disapproval from other farmers. On the other hand, it appears that farmers' intention to comply is not affected by any of the three aspects of peer pressure modelled.

Neither the Farmer Commitment nor the Farmer Intention model supports the hypothesis that procedural fairness, either in plan development or implementation, positively affects compliance. In contrast, both models support the hypothesis that Distributive Fairness affects compliance positively at the 0.01 level. This finding does not exclude the possibility that farmers' perceptions of procedural fairness indirectly influence compliance by affecting their perceptions of distributive fairness. This possibility is to be explored in an extension of the current study.

The hypothesis that Security positively affects compliance is not supported by the Farmer Commitment model, but it is supported at the 0.01 level by the Farmer Intention model. This makes sense given that consideration of intention to comply within ten years is likely to be substantially more constrained by current financial capacity than is consideration of commitment to comply over an undefined period.

Finally, the hypothesis that Age (and, by proxy, farming experience) influences compliance is not supported by either model.

To summarise, the estimated models are consistent with the proposition that informal aspects of governance affect farmer compliance with the LWMPs. In particular, trust in the compliance of others (including non-farmers), recognition that compliance confers benefits to the local community, and a perception of LWMPs as fair in a distributive sense, all seem to have a positive effect on the intention to comply. However, peer pressure does not appear to positively influence farmers' intention to comply with the LWMPs.

Substantive significance of estimated model coefficients

The substantive significance of coefficients in ordered probit models is appropriately interpreted by calculating elasticities. These elasticities measure the effects of a one-percentage change in an explanatory variable on the probabilities of each of the possible ordinal values being observed in relation to the dependent variable. The method of calculating these elasticities is described in Greene (1993 pp. 673-675). The elasticities reported in Table 3 for the Farmer Commitment model were calculated with all explanatory variables set to their mean levels, except for the dummy variables which were set to zero.

Table 3: Elasticities for the Farmer Commitment model

from a 1% increase in:	% change in probability of a Farmer Commitment score of:								
	1	2	3	4	5	6	7	8	9
Watertable Threat	-0.1	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0	0.1
Community Benefit	-6.5	-5.7	-4.6	-3.7	-2.5	-1.5	-0.1	1.6	3.5
Dependence	0.3	0.3	0.2	0.2	0.1	0.1	0.0	-0.1	-0.2
Independence	-1.9	-1.7	-1.4	-1.1	-0.7	-0.4	0.0	0.5	1.0
Social Trust	0.9	0.8	0.7	0.5	0.4	0.2	0.0	-0.2	-0.5
Plan Compliance Trust	-1.6	-1.4	-1.2	-0.9	-0.6	-0.4	0.0	0.4	0.9
Wait and See	0.7	0.6	0.5	0.4	0.3	0.2	0.0	-0.2	-0.4
Civic Duty	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	-0.1
Peer Sensitivity	-1.4	-1.2	-1.0	-0.8	-0.5	-0.3	0.0	0.3	0.7
Peer Threat	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.1
Procedural Fairness (P)	-0.2	-0.1	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.1
Procedural Fairness (I)	-0.4	-0.4	-0.3	-0.2	-0.2	-0.1	0.0	0.1	0.2
Distributive Fairness	-1.8	-1.6	-1.3	-1.0	-0.7	-0.4	0.0	0.4	1.0
Security	-0.4	-0.3	-0.3	-0.2	-0.1	-0.1	0.0	0.1	0.2
Age	0.6	0.6	0.5	0.4	0.2	0.1	0.0	-0.2	-0.3

It is evident that Farmer Commitment is most elastic by far with respect to the Community Benefit variable. For instance, a one per cent increase in Community Benefit is estimated to effect a 6.5 per cent reduction in the number of cases scoring one for Farmer Commitment and a 3.5 per cent increase in the number of cases scoring nine. If the remaining variables identified as statistically significant in this model are ranked in declining order of elasticity, then Independence takes second place, followed by Distributive Fairness, Plan Compliance Trust, Peer Sensitivity and, finally, Wait and See.

The elasticities calculated similarly for the Farmer Intention model are reported in Table 4.

Table 4: Elasticities for the Farmer Intention model

from a 1% increase in:	% change in probability of a Farmer Intention score of:								
	1	2	3	4	5	6	7	8	9
Watertable Threat	0.3	0.2	0.2	0.1	0.1	0.1	0.0	-0.1	-0.2
Community Benefit	-2.4	-1.8	-1.4	-1.2	-0.9	-0.7	-0.2	0.5	1.4
Dependence	0.5	0.4	0.3	0.2	0.2	0.1	0.0	-0.1	-0.3
Independence	-0.3	-0.2	-0.2	-0.2	-0.1	-0.1	0.0	0.1	0.2
Social Trust	-0.4	-0.3	-0.2	-0.2	-0.2	-0.1	0.0	0.1	0.2
Plan Compliance Trust	-1.8	-1.3	-1.1	-0.9	-0.7	-0.5	-0.1	0.4	1.1
Wait and See	0.6	0.4	0.3	0.3	0.2	0.2	0.0	-0.1	-0.3
Civic Duty	0.6	0.4	0.3	0.3	0.2	0.2	0.0	-0.1	-0.3
Peer Sensitivity	-0.6	-0.4	-0.3	-0.3	-0.2	-0.2	0.0	0.1	0.3
Peer Threat	-0.1	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0	0.1
Procedural Fairness (P)	0.6	0.4	0.3	0.3	0.2	0.2	0.0	-0.1	-0.3
Procedural Fairness (I)	-0.3	-0.2	-0.2	-0.2	-0.1	-0.1	0.0	0.1	0.2
Distributive Fairness	-1.6	-1.2	-0.9	-0.8	-0.6	-0.4	-0.1	0.3	0.9
Security	-1.3	-1.0	-0.8	-0.7	-0.5	-0.4	-0.1	0.3	0.8
Age	0.2	0.2	0.1	0.1	0.1	0.1	0.0	-0.1	-0.1

As in the case of the Farmer Commitment model, Farmer Intention is most elastic with respect to the Community Benefit variable. Elasticities for Community Benefit are nevertheless lower than observed in the case of the Farmer Commitment model. For instance, a one per cent increase in Community Benefit effects a 2.3 per cent reduction in the number of cases scoring one for Farmer Intention and a 1.4 per cent increase in the number of cases scoring nine. Moreover, the gap between the elasticities

for Community Benefit and the elasticities for the other variables is not as great. The next most elastic effect relates to the Plan Compliance Trust variable; a one per cent increase in its value effects a 1.8 per cent reduction in the number of cases scoring one for Farmer Intention and a 1.1 per cent increase in the number of cases scoring nine. If the remaining variables identified as statistically significant in the Farmer Intention model are ranked in declining order of elasticity, then Distributive Fairness takes second place, followed by Security and, finally, Wait and See.

7. Concluding comments

Earlier it was observed that farm business viability is recognised by governments and communities to be an important constraint on farmer compliance with the LWMPs. Thus this variable can serve as a yardstick of the substantive significance of the informal aspects of governance found above to have a statistically significant influence on farmer intentions to comply. In this study the influence of farm business viability was accounted for by the Security variable. Farmer intentions to comply are less elastic with respect to this variable than they are with respect to the Community Benefit, Plan Trust and Distributive Fairness variables. Since it is not at all obvious that the cost of enhancing farm viability is less than that of enhancing the informal aspects represented by the latter three variables, it seems reasonable to conclude that these informal aspects should be paid at least as much attention in agri-environmental policy analysis and formulation as is paid to farm viability.

The challenge remains, however, to learn from experiences with participative agri-environmental programs so that they may be designed to deliver informal assets like farmers' trust and group identity ever more efficiently. Despite the intensive participation strategy followed in the Murray LWMP process, for instance, farmers' trust that others will comply with the plans remains only moderate on average. Social scientists, including economists, have an important role to play in explaining successes, or their lack, so that design and implementation of participative programs can move forward with increased confidence.

The results of the case study reported in this paper indicate that substantial capacity for informal governance already exists within the farming communities of the Murray LWMP districts. Without the voluntary cooperation, or 'order for free', afforded by this capacity, the need for formal governance of the region's commons dilemmas would be so much greater. Yet it seems there is considerable potential for voluntary cooperation that is yet to be tapped.

Obtaining the knowledge to realise this potential, in the case study setting and elsewhere, requires social scientists to shift from the materialistic conception of rationality that has conventionally dominated agri-environmental policy discourses. Business viability, for example, accords with this worldview and is regarded seriously in such discourses as a result. Economists, for instance, have expended considerable effort evaluating the case for government-sponsored structural adjustment programs to reduce the population of non-viable farm businesses (e.g. Gow and Stayner, 1995). In contrast, informal social assets of the kind mentioned above have no place in this worldview and, in consequence, are regarded as part of a natural order that is beyond the concern of rational policy (Stretton and Orchard, 1994).

Persisting with a narrow view of rationality in policy deliberations makes it likely that increasingly valuable opportunities to lighten the mounting burden of formal agri-environmental governance will be inadvertently missed. Acceptance of a broader notion of rational policy seems crucial.

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