Developing appropriate incentives for improving water quality in the Burdekin River catchment

Allyson Lankester[1] and Romy Greiner[2]

1 ACTFR, James Cook University, QLD, 4811. Email: allyson.lankester@jcu.edu.au
2 River Consulting, 68 Wellington Street, Townsville, QLD, 4812 and School of Business, James Cook University, Townsville QLD, 4811. Email: romy.greiner@riverconsulting.com.au

Abstract

Achieving a reduction in the discharge of diffuse agricultural water pollutants from the Burdekin River catchment to the Great Barrier Reef lagoon has become a high priority for government. Such an achievement requires an increase in the voluntary adoption of best management practices by landholders. Past policies and programs to encourage adoption do not appear to have achieved significant improvements in water quality. It is thought that a more tailored suite of incentive measures would be more effective in encouraging landholders to adopt management practices. This paper presents preliminary results from a catchment wide landholder survey on how landholders perceived the effectiveness of different incentive instruments. Results indicated that there was a suite of preferred incentives from different categories including financial incentives (specifically income tax incentives); education and extension programs (specifically on-farm demonstration sites) and increased security of property rights. Government regulation was the least preferred option. These results suggest a 'tool-box' of incentives will be required to encourage the range of landholders and their different situations to adopt management practices. Regional NRM bodies such as the Burdekin Dry Tropics NRM will have many roles to play in the design, support and delivery of such incentive mechanisms.

Keywords

Water quality improvement, land management, landholders, policies and incentives, survey

Background to research

The Burdekin River Catchment (Burdekin Dry Tropics region) has been identified as one of ten high risk catchments along the Queensland east coast due to the Burdekin River producing the largest sediment output – combined with the delivery of land-based contaminants – into the Great Barrier Reef World Heritage Area (GBRWHA)(Roth, Lawson & Cavanagh, 2002). Key pollutants from adjacent catchments leading to a decline in water quality and impacting on the GBRWHA have been identified as nutrients, sediments and agricultural chemicals (Moss, Brodie & Furnas, 2005). Agricultural practices that have been linked to this decline in water quality include grazing practices in the drier catchments and overgrazing in general, water use practices, extensive vegetation clearing, wetland drainage on coastal plains, and development on acid sulphate soils (The State of Queensland & Commonwealth of Australia, 2003) .

The Coastal Catchment Initiative (CCI) is an Australian Government program that seeks to deliver significant, targeted reductions in the discharge of pollutants to agreed hotspots. The Great Barrier Reef is considered one of these hotspots. The approach taken by the CCI is to protect the values, uses and health of Burdekin Dry Tropics water bodies through the development of sustainable land management practices that reduce agricultural pollutants (Burdekin Dry Tropics Natural Resource Management, 2006). The CCI is responsible for delivering a Water Quality Improvement Plan (WQIP) for the Burdekin Dry Tropics Region. The WQIP will be integrated within the Burdekin Dry Tropics (BDT) NRM Plan and Regional Implementation Strategy (RIS). The BDT-NRM Plan identifies incentive instruments as a key strategy for supporting the implementation of preferred land and water management actions.

This paper reports on research that was funded by the CCI and sought to discover what would be an appropriate mix of (non-regulatory) incentives to encourage the adoption of best water quality improvement management practices – which are tailored to the specific conditions and diversity of situations that landholders in the Burdekin catchment face. We define incentives to include all policies and programs that

effect change in decision making by landholders, including market-based and other financial incentives, suasion (education, extension, research), industry measures and changes to property rights.

Background to study region and population

The Burdekin River catchment, including the adjacent coastal plains, is the second largest catchment in Queensland covering an area of approximately 134 000 sq km. The Burdekin River catchment has four sub-catchments – Belyando/Suttor, Upper Burdekin, Bowen/Broken and the Lower Burdekin coastal plains – which include a wide range of diverse tropical habitats: semi-arid woodlands, wooded grasslands, mountainous tropical rainforests, coastal plains, mangroves and wetlands (Roth *et al.*., 2002).
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The catchment has a population of around 55 000. Grazing is the predominant land use in the catchment (98% of area), followed by irrigated sugarcane in the delta. Horticulture, dry land cropping, aquaculture, fishing and mining are other primary industries in the catchment. Broadly indicative figures for average annual gross value of production are: cropping (mainly sugar and horticulture) around $450 million; livestock (mainly beef cattle) around $170 million; commercial fishing around $20 million; and mining (mainly coal and gold) more than $750 million (Beare *et al.*, 2003). Grazing properties are typically large (30 000 hectares, herd of 33-36 00 cattle) while agricultural enterprises tend to be a lot smaller (119 hectares for sugar cane and 39 hectares for horticulture crops) (Beare *et al.*, 2003).

Socio-economics of adoption

Landholders' adoption of recommended natural resource management practices is dependent on many socio-cultural and socio-economic influences. Adoption behaviour will further vary depending on factors including geographical location, soils, and characteristics of current and proposed practices and extent of institutional support.

Extensive research has been undertaken to try and understand landholders' decision making in regard to the adoption of sustainable agricultural, conservation or natural resource management practices. Reviewing relevant literature, Pannell *et al.,* (2006) conclude that adoption of a conservation practice depends principally on whether landholders expect that the practice will help them to achieve their goals – which may include economic, social and environmental goals. They further conclude that adoption is influenced by the characteristics and circumstances of the landholder and the characteristics of the practice, especially its relative advantage over existing practices and the results of trialing the practice.

Economic motivations appear to be the dominant driver of landholders' motivation to implement conservation practices (e.g. Camboni & Napier, 1993; Cary & Wilkinson, 1997; Lockie & Rockloff, 2004; Saltiel, Bauder & Palakovich, 1994). Principally, farm properties are businesses and operators thus seek to make a return on the capital, financial and human resources they invest into a new enterprise within budgetary and cash flow limitations. In exploring impediments to implementing conservation practices and riparian management practices in the Burdekin Dry Tropics rangelands, Greiner *et al.,* (2003) and Lankester (2005), both found financial factors (lack of labour and time, costs associated with implementing and maintaining practices) to be the key constraints to adoption. Greiner *et al.,* (2003) further point to risk (reliability of expected returns) as a key barrier to adoption.

Even in the absence of economic barriers, landholders may still not adopt conservation practices if they are unconvinced of their proposed benefits and/or the practice is not, for example, compatible with their beliefs, values and lifestyle. Fielding *et al.,* (2005) identify beliefs about the benefits of riparian zone management, and perceptions of the extent to which barriers impede riparian zone management, as most significant for determining landholders' intentions to manage riparian zones in the Fitzroy catchment, Queensland.

Designing incentives

Effective incentives are considered to be those that have a relatively high take up, minimum unintended outcomes and meet their stated objectives. Incentive mechanisms have been categorised as either inducing (i.e. market based instruments), compelling (i.e. regulation) or facilitating (i.e. community engagement and information) change (Mackenzie *et al.,* 2004). Education and information leading to attitude change will

always be an important component of incentive policy portfolio (Stoneham, Chaudhri & Strappazzon, 2003). Education programs help generate landholders' intrinsic motivation to implement best practices.

While governments have taken regulatory approaches to issues such as clearing of native vegetation, the principal approach to water quality management is one of voluntary participation. While regulations clarify what is expected of landholders, a key limitation is that they set standards which do not encourage resource users to improve their performance beyond that minimum standard (Mackenzie *et al.*., 2004). Mackenzie *et al.*, (2004) suggest that facilitative mechanisms are most effective where public interest and private benefits are closely aligned. Market based incentives are helpful where the landholder sees a lack of private benefit**.** Market-based instruments change the cost of income elements of conservation practices. They include taxes and subsidies, grants, competitive tender mechanisms, cap and trade mechanisms, offset mechanisms, transferable development rights. Unlike regulation, market-based incentives can be tailored.

There have been a number of Market Based Incentive (MBI) projects that have occurred through the National MBI Pilot Program (established in 2003 under the National Action Plan for Salinity and Water Quality) to have looked at designing incentives to specifically encourage adoption of water quality improvement practices. In the Fitzroy basin, Queensland, Rolfe and Windle (2005) found that cap and trade mechanisms are unlikely to be effective because there are relatively few point sources, making the determination and elimination of a cap problematic. On the other hand, Rolf, Wake and Donaghy (2005) discovered that competitive tender mechanisms with voluntary adoption may be more efficient than broad regulatory approaches due to the wide range of opportunity costs in the region.

Methods

The principal method of the research was a landholder survey. The survey was administered as a mail-out, mail-back survey. It was sent to grazing, sugarcane and horticultural properties in the Burdekin catchment in October and November 2006. Privacy legislation made it difficult to obtain property addresses so the White Pages and Landcare group contact lists were the principal sources.

A total of 110 landholders responded by the end of December 2006. Respondents were operating a total of 217 properties. Thus, the survey response rate was 32%. The returned surveys were digitized using Statistica Version 7. This paper focuses on the initial data analysis of the survey question relating to how landholders rated the effectiveness of different incentive options.

The mail survey has been the main data collection method. The questionnaire consisted of 39 questions, many of which were Likert scale design, and covered: social-economic and demographic aspects of the property operation, land uses, motivations, attitudes towards different incentive mechanisms, risk taking, strategies used to manage risk, factors causing risk, implementation of best management principles (with emphasis on water quality improvement practices), constraints to adoption and information sources and influences. To maximize response rate a reminder postcard was sent out, notices were posted in local newspapers and five prizes were raffled among respondents.

Preliminary results

Respondents managed, on average, two properties (min 1, max 14, median 1). In terms of enterprises, of respondents 92 managed grazing enterprises, 5 dry land cropping, 17 irrigated crops (11 sugarcane), 5 horticulture annual, 5 horticulture perennial, 2 forestry tenure, 9 conservation, 2 tourism, 1 horse operation and 2 rural residential. The total area covered by all properties included in the survey was 3,1948,00 hectares. The average property size was 29,310 hectares. This equates to roughly one quarter of the estimated total property coverage for the Burdekin River catchment area (approx. 134,000 square km).

Question 17 of the survey asked respondents to indicate on a 5-point Likert type scale (1= completely ineffective to 5 = completely effective) how effective they believed a list of programs and incentives would be in helping landholders overcome constraints to conservation practices. Figure 1 illustrates the mean and standard error of responses.

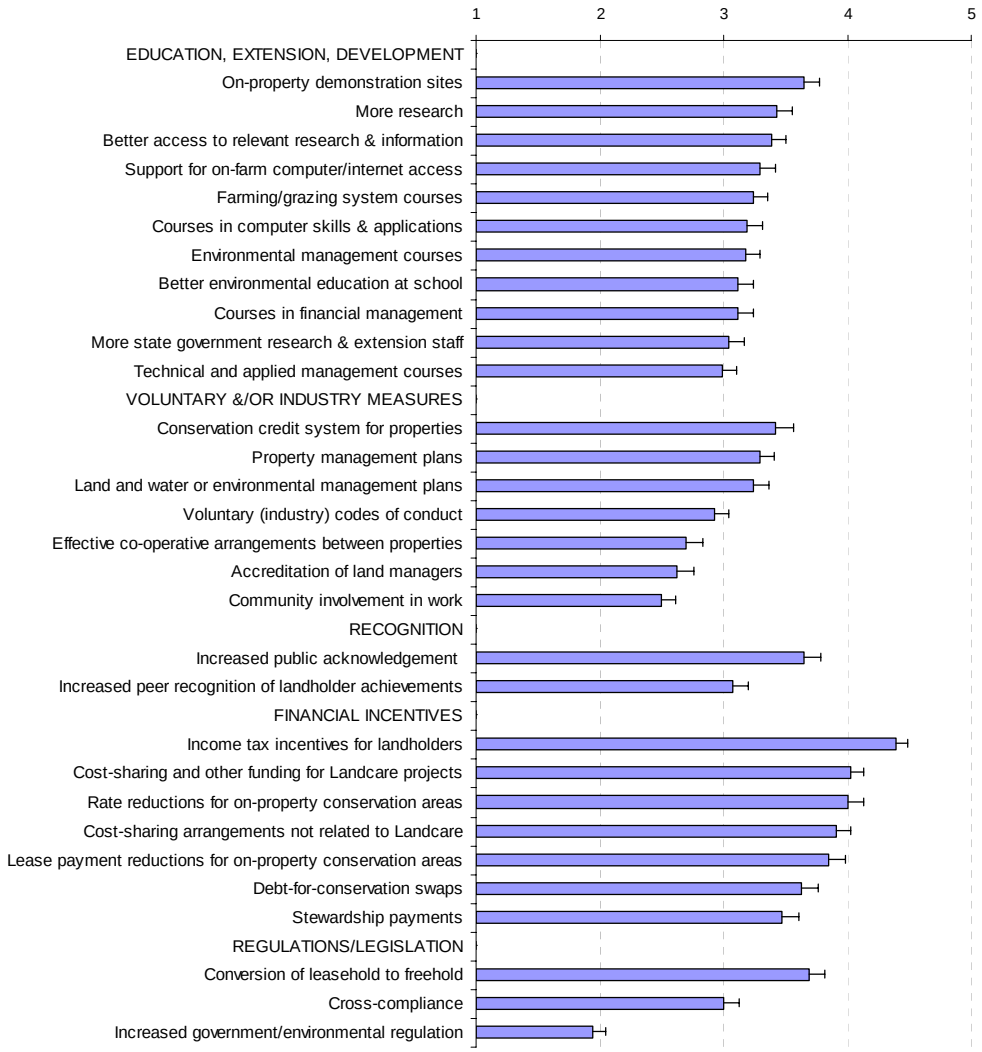

Figure 1. Perceived effectiveness of incentives: mean values and standard errors (items sorted by mean value).

Financial incentives were rated by respondents as most effective; specifically income tax incentives followed by various cost sharing arrangements, including land rate reductions. Among the education/information incentives, respondents rated on-farm demonstration sites most highly, but also further research and better access to existing information. Increased public recognition of conservation achievements was seen as effective and – for landholders on leasehold land – increased security of property rights. Voluntary industry measures including conservation credits, property management plans and land/water/environmental management plans were also rated highly. The least preferred incentive was increased government environmental regulation. Community involvement in work and accreditation of land managers were also rated as being of low effectiveness.

Discussion and conclusion

Landholders perceived most incentives as effective to some extent. Due to the complexity of natural resource management issues such as water quality improvement it is unlikely that a single instrument will be effective. Rather, a suitable mix of incentives is required to address the diversity of decision-making situations encountered by landholders, the different barriers that landholders face to adoption, and the different innovations that contribute to water quality improvements (OECD, 2004; Young *et al.*, 1996).

The results indicate that landholders are focused on the profitability of their operation. They regard any incentive that generates financial benefit and/or offsets the cost associated with adopting conservation practices as effective. This confirms results of an earlier study by Greiner *et al.*, (2003), who specifically noted that tax incentives are only effective in years where landholders generate sufficient farm profit.

Recent literature points out that those market based incentives which can exploit differences in the cost between landholders of generating environmental services (e.g. biodiversity conservation, water quality improvement) are most efficient. One program – stewardship payments that are determined by an auction-based process – is currently being trialed in the southern part of the Burdekin catchment (Rolfe & McCosker, 2003). The purpose of this program is to establish a collaborative and regional solution to loss of native vegetation by building a vegetation corridor. The Bush Tender Program in Victoria pursues a similar rationale (Stoneham *et al.*, 2003). Stoneham *et al.*. (2003) point out that to be effective, a financial incentive needs to be able to discover supply prices in situations where there are non-standard benefits and poorly defined property rights.

The incentive ranking also supports the conclusion that incentives which are low risk, compatible with current operations and production goals and which require little external negotiation may be favoured over others. This was the case in studies of landholders' participation in on-farm conservation programs in the United Kingdom, which indicated that many landholders are largely motivated to participate due to the program being compatible with the existing farming system (Morris & Potter, 1995; Webster & Felton, 1993). As highlighted by Greiner *et al.*, (2003), many respondents are likely to have rated incentives on the basis of preference (i.e. what they most and least wanted to happen) instead of how effective they thought these incentives were at the regional scale. This could help explain why government regulation is rated so low. Furthermore, the increasing cost of public liability insurance might be an explanation for the low rating of community involvement in projects.

An important consideration in incentive design is the extent to which the instrument builds on or generates intrinsic motivation. Reeson and Tisdell (2006) found that formal institutions such as regulation and competitive tender mechanisms 'crowded out' voluntary contributions of public environmental goods. Consequently, the supply of public goods increased less than anticipated when such incentives were introduced. They suggested that incentives are best where intrinsic motivation is low and there are few voluntary contributions being made to increase the public good. Further, it is important to anticipate any 'perverse' consequences of a new incentive such as encouraging and/or rewarding poor land management and creating inequalities, as Greiner and Lankester (2006) illustrate in an assessment of debt-for-conservation swaps.

Regional NRM groups such as the BDT-NRM have an array of opportunity to provide and facilitate incentive mechanisms that encourage adoption of conservation practices. They can design and deliver suasion and recognition incentives and facilitate two-way communication between landholders, government/industry organisations and the wider community. In terms of providing/facilitating access to financial incentives, the role of NRM groups can include: fund or co-fund some cost-sharing arrangements; trial market-base incentives; facilitate information on and access to other programs; lobby for the initiation of incentives at the state and federal government level; lobby for trials of new incentives and the continuation of existing programs; work with industry groups and rural lenders to provide incentives; work with local government to strategically implement land rate reductions (in certain areas for certain activities). From here, the research will specifically explore the linkages between incentives and stated impediments to adoption for a range of conservation (including water quality improvement) practices and a variety of social, psychological and economic dimensions of respondents. This research will thus be able to make significant contributions to the theory of incentive design as well as inform the specific needs of the CCI for improving water quality in the Burdekin catchment.

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