Key Topic #7: Understanding the social, economic, political impacts of natural resources management and decision making.

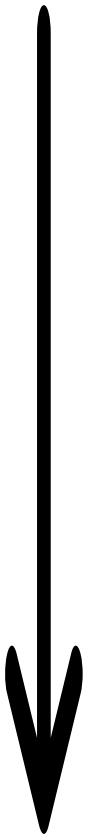
Objective 1. Describe the social, economic and political impacts of regulating water quality and quantity.

Objective 2. Understand the delicate balance behind decision making – funding projects, social responsibility, regulatory authority.

Resources:

1. Groundwater Fundamentals *(3 pages)*
2. Understanding social and economic influences on natural resource management *(5 pages)*

(SCROLL DOWN for RESOURCES)



Groundwater Fundamentals

In This Section

What is groundwater?

Groundwater is the water that soaks into the soil from rain or other precipitation and moves downward to fill cracks and other openings in beds of rocks and sand. It is, therefore, a renewable resource, although renewal rates vary greatly according to environmental conditions.

It also is an abundant natural resource.

Of all the freshwater in the world (excluding polar ice caps), 95 percent is groundwater. Surface water (lakes and rivers) only make up three percent of our freshwater.

Groundwater's importance to the environment

Hydrologists estimate, according to the National Geographic Society, U.S. groundwater reserves to be at least 33,000 trillion gallons — equal to the amount discharged into the Gulf of Mexico by the Mississippi River in the past 200 years.

At any given moment, groundwater is 20 to 30 times greater than the amount in all the lakes, streams, and rivers of the United States.

About a quarter of all U.S. rainfall becomes groundwater. Groundwater provides much of the flow of many streams; many lakes and streams are “windows” to the water table. In large part, the flow in a stream represents water that has flowed from the ground into the stream channel. It’s estimated by the U.S. Geological Survey that about 30 percent of U.S. streamflow is from groundwater, although it is higher in some locations and less in others.

All the water of the Earth including the atmosphere, oceans, surface water, and groundwater participates in the natural system we call the hydrologic cycle. As water moves through all these elements repeatedly, the system is truly cyclical.

Groundwater's importance to people

While about 90 percent of our freshwater supplies lie underground, less than 27 percent of the water Americans use comes from underground sources, which illustrates the underutilization of groundwater. [1]

The United States uses 79.6 billion gallons per day of fresh groundwater for public supply, private supply, irrigation, livestock, manufacturing, mining, thermoelectric power, and other purposes. [2]

California pumps 10.7 billion gallons per day of groundwater for all purposes, a third more as much than the second-ranked state — Texas (8.02 bgd). [3]

More than 15.9 million water wells for all purposes serve the United States. [4]

Approximately 500,000 new residential wells are constructed annually, according to NGWA estimates. The construction of these vitally needed water supply systems involves the use of more than 18,460 drilling machines by an estimated 8,085 groundwater contracting firms. [5]

NGWA has determined that 44 percent of the U.S. population depends on groundwater for its drinking water supply — be it from either a public source or private well. [6]

Private household wells constitute the largest share of all water wells in the United States — more than 13.249 million year-round occupied households have their own well. [7]

Other kinds of wells are used for municipal systems, industry, agriculture, and quality monitoring. Groundwater accounts for 33 percent of all the water used by U.S. municipalities. [8]

Michigan, with an estimated 1,121,075 households served by private water wells, is the largest state market, followed by Pennsylvania, North Carolina, New York, and Florida. [9]

Irrigation accounts for the largest use of groundwater in the United States. Some 57.2 billion gallons of groundwater are used daily for agricultural irrigation from 475,796 wells. [10] In 1900, the United States used only 2.2 billion gallons of groundwater daily for irrigation from 17,000 wells.

More than 90 percent of the groundwater pumped from the Ogallala, the nation's largest aquifer underlying some 250,000 square miles stretching from Texas to South Dakota, is used for agricultural irrigation. Representing about one-third of all U.S. irrigated agriculture, it creates about $20 billion annually in food and fiber.

If spread across the surface of the entire United States, the Ogallala's groundwater would cover all 50 states with 1.5 feet of water. Scientists estimate it could take 6,000 years to refill naturally if it were ever to be fully withdrawn. [11]

Texas leads the nation in the number of irrigation wells with 81,511. [12]

[1] Estimated Use of Water in the United States in 2005, U.S. Geological Survey Circular 1344, October 2009
[2] Estimated Use of Water in the United States in 2005, U.S. Geological Survey Circular 1344, October 2009
[3] Ibid.
[4] Estimate prepared by the National Ground Water Association from various federal data sources at U.S. Environmental Protection Agency, U.S. Department of Agriculture, and the U.S. Census
[5] Estimate prepared by the National Ground Water Association from various Association-sponsored industry surveys
[6] Resident population of the United States in 2005 was 296,410,404, U.S. Census
[7] American Housing Survey, U.S. Bureau of the Census, 2008

[8] Estimated Use of Water in the United States in 2005, U.S. Geological Survey Circular 1344, October 2009; U.S. Environmental Protection Agency, Drinking Water and Ground Water Statistics 2007, March 2008
[9] U.S. Census, 1990 (best available data by state)
[10] U.S. Department of Agriculture, Farm and Ranch Irrigation Survey 2013, November 2014, and U.S. Geological Survey, June 2018 report on 2015 water use
[11] Scientific American Water 3.0, March 2008; Understanding Water Risks, World Wildlife Fund, March 2009; State of the Water Industry, TechKnowledgey Strategic Group, March 2009
[12] U.S. Department of Agriculture, Farm and Ranch Irrigation Survey 2013, November 2014

Understanding social and economic influences on natural resource management decisions

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Abstract

This paper introduces the social, economic and historical constraints and drivers to achieving natural resource management goals. While land degradation is manifested in a biophysical way, this paper suggests that the causes of land degradation are broader than the biophysical, and derive from a combination of biophysical, economic, historical, social and cultural factors that inform land manager behaviour and actions. The influence of each of these factors is highly inter-dependent. Therefore, the significance of individual factors lies in their relationship to other factors and their importance to the individual land manager.

Media Summary

If we are serious about investing in sustainable land use practices then we need to understand the needs and expectations of people working on the land.

Key words

Financial constraints, attitudes, landholder behaviour

Introduction

This paper explores historical, economic and social drivers of poor natural resource management, and constraints to achieving natural resource management goals, focusing particularly on the agricultural sector. An analysis of landholder surveys conducted in various natural resource management regions in Queensland provides a new perspective on some of the traditionally held beliefs concerning what drives and constrains landholders' decision-making.

This paper is drawn from a more comprehensive review of the literature as outlined in Stanley, Clouston and Binney (2005) *"Understanding social and economic influences on natural resource management decisions"* http://www.regionalnrm.qld.gov.au/planning/state_wide/nap/se05_se_drivers.html

Historical drivers and constraints

While social and economic trends and conditions influence land manager decisions in respect of natural resource management, historical policies and social trends have also influenced decision-making, and to some extent continue to impact on land management practices and land manager capacity to adopt natural resource management practices. Some examples are, early government land development and management policies, government advice, and early expectations of the Australian landscape.

Many **early government policies**, such as closer settlement schemes, tax concessions for clearing, drought relief programs, subsidies, and bounties to eliminate 'pest' native species have inadvertently contributed to land degradation as it manifests today by encouraging grazing and cropping in areas unable to sustain such practices (Campbell, 1992).

In the past **government advice** to farmers was also often based on poor or undeveloped science and other government objectives, with the result being a failure to fully understand and appreciate the limitations that the Australian landscape presented for European derived agriculture (Goldney and Bauer, 1998).

Early expectations of the Australian landscape saw the introduction of familiar European style farming practices many of which were unsuited to the Australian landscape, with its climatic extremes and frequently poor soils. Large-scale efforts were made to adapt the landscape to one that was consistent with European farming landscapes, with devastating effects on the environment. Acclimatisation societies were formed with the express

purpose of developing ways to assist settlers in adapting to their new continent, not by changing their expectations but by attempting to change the landscape itself (Lines, 1991).

Economic drivers and constraints

There are a number of economic influences that act to drive resource degradation and hinder the adoption of sustainable management practices. Broadly, these can be divided into problems arising from market failure and financial constraints. While these issues are interrelated they will be discussed sequentially.

Market failure will occur if the private market will not supply a sufficient quantity of goods desired by society as a whole. This is particularly the case for goods that are public in nature, with a lack of markets to buy and sell the good. Other causes of market failure are related to uncertainty of rights and expectations, externalities and information asymmetry. Problems related to public goods and externalities are particularly pertinent to natural resource management as their presence constrains landholders investing in actions that primarily provide a public rather than a private benefit.

One of the most important characteristics of natural resources such as land and water is their public nature as they provide benefits (mostly as products or services) that are generally available for society at large. A good or service may be considered a **public good** if individuals cannot be excluded from consuming the good due to poorly specified or unenforceable property rights. This means that one person's use of the good may diminish another person's use. Also, as nobody can be excluded from consuming a public good, individuals will not freely pay for them. In this case the market will fail to supply public goods at levels which society as a whole might demand. This then means that land managers will have little incentive to use their land to supply more public goods when the additional private benefit is less than their additional private cost. Similarly, there is little incentive to mitigate actions that cause damage to public goods if there is no private benefit. This leads to market failure in the form of externalities.

Externalities occur when the actions of one individual impact on others and the costs of these impacts are not borne solely by the perpetrator. Externalities can be both positive and negative and may be unintentional. For example, an action such as the application of fertiliser on-farm may result in nutrient runoff and pollute waterways throughout a catchment. Although it is an on-site activity it results in off-site problems. Several of Australia's most pressing natural resource management problems are a result of externalities. These include: rising watertables from land clearing, nutrient run-off, salt leaching, chemical overspray, siltation from erosion and the spread of weeds and pests (Industry Commission, 1998).

As these external costs of activities are rarely accounted for in production decisions there is no incentive to mitigate these effects or invest in ways to do so, as the cost to land managers of mitigating externalities may exceed the on-farm benefit both in the short and long term (Cary *et al*., 2002). One way to reduce externalities is to internalise the external costs of the activity so that negative effects are accounted for; the polluter should pay to pollute. For example, the costs can be internalized by levying charges and taxes on the activity in question equal to the value the community places on avoiding the externality. Another effective solution may be to tax the input – the fertiliser – to reduce usage and run-off. Where it is not possible to internalise the costs of externalities (and regulatory responses are not appropriate) then financial support may be provided to landholders to encourage management practices that reduce externalities.

Past research indicates that **financial constraints** are 'self-reported' by land managers as an important barrier to the adoption of otherwise attractive management practices (Cary *et al*., 2002; Greiner *et al*., 2003; Lockie and Rockloff, 2004; Byron *et al*., 2004). If land managers do not have sufficient resources to meet their own needs they will be unlikely to invest in improved natural resource management. Poor or low financial viability may therefore constrain the adoption of more sustainable management practices (Cary *et al*., 2002*).* Rendell *et al.* (1996) using the FM 500 benchmark suggest that a disposable family income exceeding $50,000 per year was required to sustain a household and investment in a farm's natural and capital resources*.* A number of indicators suggest that land managers have been facing financial pressure in recent years and that incomes may have fallen below the FM 500 benchmark. These indicators include, declining commodity prices and terms of trade, trends in farm cash income, profit at full equity, non-farm income, and changes in farm debt. However, this traditional view that it is simply a lack of financial resources that constrains improved practices is now being questioned.

Although available evidence demonstrates the constraints land managers face from declining terms of trade and the increased reliance on off-farm income, there have been few definitive studies that link objectively measured financial indicators to adoption of sustainable practices (Cary *et al*., 2002). However, as Cary *et al*. (2002) note it is often a land manager's *perception* of their future financial situation that has more influence over their decision-making than an objective measure of their future financial situation. So, land managers who feel confident about their future financial position are more likely to adopt new resource management practices. Thus an individual's subjective assessment of their financial situation may be a better predictor of adoption than objectives measures.

A review of the Australian Bureau of Agricultural and Resource Economics (ABARE) Resource Management Supplementary survey for the 2001-2002 financial year for Queensland suggests that financial resources may not be the limiting factor when land managers consider addressing resource degradation issues. For example, while 56% of respondents agreed that land and water degradation was a key concern in farm planning, only 31% of respondents agreed that they did not have the financial resources to address the issue. Perhaps the greatest constraint identified in the survey was the element of risk associated with a practice, with 38% of respondents claiming that changing the way they do things on the farm could present a major risk. This suggests that while land managers may feel that they have the money and skills to address resource degradation they are not willing to accept the associated risks. If it is perceived that the benefits from changed management are largely public then there may be even less incentive to engage in improved natural resource management.

Further evidence that landholders are unwilling to invest private funds in activities that provide public benefits comes from landholder surveys undertaken in the Burnett Mary and Queensland Murray Darling regions. In the Burnett Mary region, 64% of respondents believed that they should be paid to provide ecosystem services that benefit the wider community (Byron *et al*., 2005). Similarly, in the Queensland Murray Darling 76% of respondents felt that they should be paid for environmental services that benefit the community (Byron *et al*., 2004). Only 30% agreed that a loss in productive capacity could be justified by long-term improvements in the environment.

It is this perception of land managers, that they do not have sufficient financial capacity to undertake improved natural resource management that requires both economic and social solutions. The provision of financial support (through grants, auctions and stewardship payments) to meet natural resource management outcomes may overcome this constraint. However, if land managers are not convinced about the efficacy of the changed practices then education and suasion will be more effective in producing the desired change.

Social drivers and constraints

While economic factors most certainly have a significant role to play, they are amongst a myriad of factors that influence a land manager's decision-making. This section will explore potential constraints of a social nature that may reduce the likelihood of landholders undertaking natural resource management or changing land use practices. Alternatively, landholder surveys and other research have revealed that some social factors that have traditionally been considered as constraints may have considerably less influence on landholder decision-making than previously thought.

Much emphasis has been placed on several social factors as being important constraints to landholders changing land practices – namely **formal education**, an **ageing population**, and **poor NRM attitudes**. There is little evidence however, to suggest a direct relationship between formal education and uptake of natural resource management practices, although participation in training courses and field days does appear to increase adoption (Cary *et al.,* 2002; Curtis *et al.,* 2000). Moreover, while the age of landholders is often considered to be an indicator of willingness to adopt changed practices, with the assumption that younger farmers are more likely to adapt to change, numerous studies have found no significant relationship between age and adoption rates of natural resource management practices (Guerin and Guerin, 1994; Byron *et al.,* 2005; Lockie *et al.,* 2002; Cary *et al.,* 2001; 2002). In fact, while Byron *et al.* (2005) identified stage of life as an important constraint, they stressed that the age group where this was most likely to emerge as a constraint was those less than 30 years due to family commitments and debt. Realistically, the relationship is unclear, and will likely be confounded by other factors.

Perhaps one of the most poorly interpreted social factors affecting change is landholder attitude, with attitudinal constraints frequently cited as the most significant barrier to widespread adoption of changed practices. It is argued that farmers may choose short-term economic gain over long-term sustainable practices due to a "poor attitude". It is often assumed that by developing a stewardship ethic amongst farmers, improvements in land management will occur (Lawrence *et al*., 2003). However, most evidence suggests that stewardship is already strong in the rural

sector (evidenced by Landcare) but that having a stewardship attitude will not necessarily lead to the adoption of changed practices due to other constraining factors (Vanclay, 1992; Lockie and Rockloff, 2004; Davidson and Stratford, 2000). For example, while a survey of land managers in the Queensland Murray-Darling region identified a strong stewardship ethic, two-thirds of respondents did not believe that a short-term loss in productive capacity could be justified by long-term natural resource management benefits, demonstrating that the presence of a stewardship ethic does not overcome the need to maintain short-term productivity. As discussed previously, differing time preferences between individuals' means that some land managers will place a higher priority on the present value of exploiting land than they do on the potential future value of protecting their land. So, while attitudes towards conservation may play a role in shaping behaviour, the significance of attitude is perhaps overestimated, as changes in behaviour are usually also reliant on other issues. As a result, the role of education in changing behaviour is perhaps also overestimated, suggesting the need to develop a mix of tools, such as the provision of training, social recognition, and demonstrations and field days.

The **suasive power of rural communities** – the power that a community has over individuals to behave in a particular way – may also influence the willingness of landholders to adopt changed practices and innovative ideas that lie outside of the community's scope: "those who do break away from the dominant productivist paradigm risk facing social sanctions" (Richards et al., 2003). In small communities particularly, this can be a strong disincentive to adopting changed practices.

Suasive pressure can also provide opportunities to regional NRM bodies who can harness the power of the community – its **social capital** – to change an individual's perceptions and priorities about the environment. Social capital refers to community processes such as networks, norms, reciprocity and social trust, which can play a significant role in solving collective-action problems such as natural resource management challenges, with an absence of social capital acting as a constraint to changing landuse practices (Kilpatrick and Falk, 2001). Strong social capital can increase the range of knowledge, skills, expertise, and support available to individuals, increasing their capacity to implement changed practices (Hofferth and Iceland, 1998). Warriner and Moul (1992, cited in Gray *et al.,* 2000) suggest that new ideas are more likely to be adopted when land managers are part of a strong communication network, giving credence to the suggestion that rural social health does impact on natural resource management decision-making. Regional NRM bodies therefore have some role to play by ensuring that decisions and investments do not contribute to the decline of social capital, and wherever possible contributes to the expansion of networks, by providing resources and support for networks to flourish. Moreover, by keeping communities informed, by delivering promised outcomes, and by demonstrating a commitment to sustainability, regional NRM bodies can facilitate the growth of trust.

The role that **succession** plays in affecting natural resource management decision-making is unclear. Gray *et al.* (2000), Byron *et al.* (2005) and Cary *et al.* (2002) suggest that the probability of a farm being transferred to the next generation may encourage longer-term planning, with integrated natural resource management. This is also consistent with an economic rationale for land managers to maintain the condition of their property to be bequeathed to a future generation, as it will have greater economic value. Taylor *et al.* (2000) found that producers with well-established farm/family links (i.e. generational farmers) displayed a greater capacity to implement sustainable farming practices. However, Gray *et al.* (2000:37) hypothesise, that successors are potentially more likely to maintain traditional farming values, where *"good farming is defined in traditional rather than modern conservation terms"*, suggesting a negative relationship between succession and the uptake of new practices. In contrast to both of these views, Sinden (1988, cited in Gray *et al.,* 2000) found no relationship between succession and uptake of conservation farming practices, and Guerin and Guerin (1994), while acknowledging that a relationship might exist between these factors, concluded that it was not supported by evidence. There is however some scope for regional NRM bodies to work with current and future generations to reduce the influence of current managers' traditions on future generations if these are not conducive to improved natural resource management. Regional NRM bodies could also offer assistance and advice regarding succession planning.

A **lack of consultation and ownership of problems** may decrease the level of land manager engagement with natural resource management. Government agencies have not always successfully engaged the rural sector in decision-making surrounding natural resource management, giving little credence to the value of local knowledge and the responsibility that is placed on the rural sector to implement Australia's natural resource management agenda. The result is an element of doubt and cynicism among some sectors of the farming community, concerning the extent, nature and causes of environmental problems as identified by scientists and proclaimed by government (Lawrence *et al.,* 2003). If natural resource management decisions are made without consultation and consideration of the people who have to implement them, they may not be implemented and the natural resource management outcomes will not be achieved (Robertson and Pratley, 1998). If people are engaged and have some form of

ownership of a process they are more likely to understand recommendations and to adopt recommended practices. It is hoped that regional NRM bodies, located within regions, with community representatives on Boards, may succeed in building trust and engaging communities in natural resource management decision-making, with the expectation that this will lead to locally accepted decisions and an increased adoption of changed practices.

Access to ongoing professional advice is a constraint identified by land managers in a Byron et al. (2004) study. Lockie and Rockloff (2004) also identified access to reliable information on the benefits of changed practices, as a commonly identified factor constraining change. In a report examining the attitudes of rural interest groups towards on-farm conservation, it was found that landholders are suspicious of scientific knowledge as provided by government agencies (Juliet London Research and Consultancy, 2000). Despite this level of suspicion, Taylor *et al.* (2000) suggest that land managers who participate in property management planning activities show a greater capacity to adopt more sustainable practices, indicating a link between knowledge and skills, and capacity to change. Moreover, Byron *et al.'s* (2005) land manager survey in the Burnett Mary region revealed that while only 30% of respondents said they sourced information from governments departments, of these 63% ranked it as the most useful available source.

While general understanding of land degradation problems has increased in recent years several studies have identified a lack of land manager knowledge both of the seriousness of the problem on their own properties, as well as a lack of appreciation of the off-site ramifications of farm-level decisions (Richards *et al.,* 2003; Lockie and Rockloff, 2004). Richards *et al.* (2003) suggest also that a strong commitment to local knowledge acts as a driver for some land managers to make decisions contrary to scientifically endorsed land management practices. So, even when landholders do perceive problems on their land, if they lack appropriate information, advice and solutions, then they are unlikely to change their behaviour. This suggests an important role for regional NRM bodies to provide reliable, rigorous information, training days, demonstrations, and field days.

Specific attributes of land management practices will also introduce constraints for land managers. As discussed earlier if the **relative advantage** of a behavioural change is low (i.e. the action is public good in nature and personal benefit will not match the personal cost) many landholders will chose not to adopt the changes, as it is not in their own best interests (Cary et al., 2002). Like the adoption of most agricultural practices, innovations that are believed to be profitable have an increased likelihood of adoption. New practices that are perceived as relatively **risky** will also be less likely to be adopted by landholders. This will vary according to differences in income needs, risk perception, and profit motivation (Cary et al., 2002).

The **complexity** of an innovation also decreases the likelihood of it being adopted as complexity increases the risk of failure as well as the necessary knowledge investment. Similarly, if an innovation is not **compatible** with existing agricultural practices, knowledge systems and social practices it is less likely to be adopted (Cary et al., 2002). The **trialability** and **observability** of a natural resource management innovation are also likely to influence adoption (Byron *et al.,* 2005). If innovations can be trialled on a small scale and observed by others to be successful, perceived risk of failure decreases and adoption rates increase (Cary *et al.,* 2002).

Conclusion

As this paper demonstrates, a variety of social and economic factors may interact to drive or constrain land managers from engaging in natural resource management – either through the adoption of changed practices or involvement in natural resource management activities. These drivers and constraints are complex, difficult to isolate, and difficult to manage for. However, by conducting regional land manager surveys regional NRM bodies can begin to understand local constraints and tailor their programs to fit.