

MAKING FARM FORESTRY PAY

Selling the environmental services of farm forestry

The environment supplies important 'services' that benefit human societies. A healthy environment provides rainfall, productive oceans, fertile soil, clean air, clean water, waste processing, buffering against extreme weather, and regeneration of the atmosphere.

The environmental services that trees supply include carbon sequestration, groundwater recharge reduction, surface water filtration, protection from wind and water erosion, weed exclusion and habitat for nature conservation.

Can environmental services make farm forestry pay? Markets for environmental services are not a panacea. They will only supplement established commercial markets for wood products.

Further, they will not provide a total solution to Australia's pressing environmental problems. However, markets for environmental services have the potential to add value to farm forestry projects and to complement the suite of policy tools available to address environmental degradation.

A priority of the Joint Venture Agroforestry Program is the development of commercially driven tree production systems for addressing land degradation issues.

Low to medium rainfall zones are a priority because these are where environmental degradation is greatest and because uptake of farm forestry has been slow in these areas. One of the reasons for the slow uptake is that farmers perceive that trees do not pay.

The income derived from trees, by supplying wood products and by providing shelter for stock and wind protection for crops, may not balance the costs of the farm forestry. There are no substantial markets for the additional *environmental* services provided by farm forestry.

Figure 1 shows the environmental, forestry and agricultural services that a farm forestry ecosystem provides.

The markets for the commodities provided by traditional agricultural and forestry services are well-established, whereas most of those shown for the environmental services can only be considered as *potential* commodities and markets.

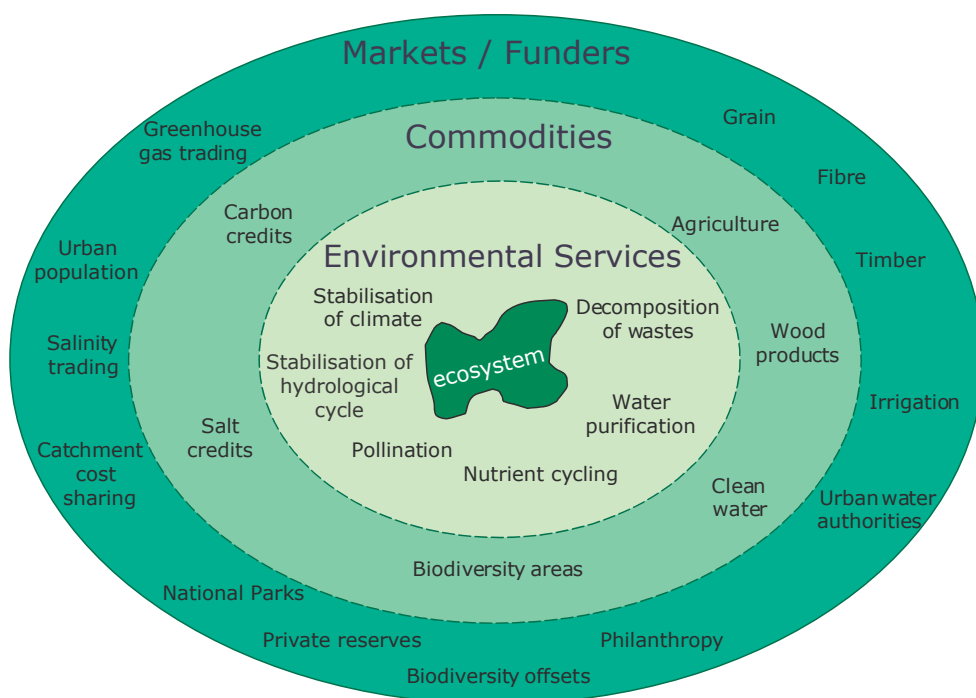


Figure 1. The services provided by a farm forestry ecosystem, and the *established* forestry and agricultural commodities and markets and *potential* environmental commodities and markets which are supported by those services

Are there ways in which land managers can be rewarded for the environmental benefits that farm forestry provides? This document summarises two studies that investigated this question.

The first study, by Carl Binning, Brendon Baker, Seona Meharg, Steve Cork and Allen Kearns, assessed why the existing incentives for farm forestry are not adequate, and whether markets for environmental services could be developed to make farm forestry economically attractive.

The second study, by Martin van Bueren, reviewed several 'real life' environmental markets that are emerging in the United States of America and the United Kingdom, concentrating on the elements that

were critical for the success of the trading programs.

The studies concluded that there were opportunities in Australia to develop markets for environmental services that would raise land-holder participation in farm forestry and that well-designed markets could have the added benefits of directing plantings to those areas that would provide the greatest environmental benefit. However, the development of such markets would involve taking risks and would take time.

One of the major challenges is to devise broadly accepted and legally defensible ways of measuring the environmental services provided by a particular farm forestry project.



JVAP reports on markets for environmental services

Binning, C., Baker, B., Meharg, S., Cork, S., and Kearns, A. 2002 *Making Farm Forestry Pay – Markets for Ecosystem Services – A Scoping Study to Set Future Research Directions*, RIRDC Publication No. 02/005.

van Bueren, M. 2001 *Emerging Markets for Environmental Services – Implications and Opportunities for Resource Management in Australia*, RIRDC Publication No. 01/162.

Why incentives are needed

Previous RIRDC reports have shown that farm forestry offers a range of benefits to farm enterprises, including income from wood products, control of dryland salinity and waterlogging, prevention of soil erosion, provision of shade, shelter and stock fodder, nature conservation and improved aesthetic value. However, direct economic benefits to the land-holder may not be sufficient to pay for tree establishment.

One study (see Box on page 4) showed that farm forestry makes good economic sense for some properties when all the benefits are taken into account in a 'whole farm' approach.

However, a study of economic prospects for farm forestry enterprises in low rainfall zones (400 to 600 mm average rainfall a year) found that lack of appropriate infrastructure and the long time before harvest were major impediments (for more details, see RIRDC Publication No. 99/152, *Commercial Prospects for Low Rainfall Agroforestry*, by A. Zorzetto and P. Chudleigh, published in 1999). Other impediments that have been identified in RIRDC

projects include the absence of a culture of farm forestry in Australia, farmers' lack of farm forestry experience, and confusion and inconsistencies in taxation, regulation and policies between different tiers of government and different government agencies.

Several JVAP research projects are addressing how to overcome the most influential impediments. One of the recognised approaches is the use of financial incentives. Financial incentives already exist for encouraging land owners to plant trees on farms. What can be expected from these existing incentives?



Calculating the economics of farm forestry using a 'whole farm' approach

The economics of nine farms whose land-holders had incorporated farm forestry into their operations were analysed (see RIRDC Publication No. 99/99, *Practical Farm Forestry: Whole Farm Case Studies*, by Campbell White and Associates Pty Ltd and A. Black, published in 1999). The results showed that for five of the nine farms, land-holders could expect a clear increase in the income from the property with the incorporation of farm forestry, while three farms had neutral outcomes and one land-holder could expect a substantial decrease in income.

Summary of economic results

Case study location	Project NPV (\$)	Annual NPV (\$)	Income increase or decrease (%)	Economic impact	Environmental impact
WA	154,068	13,180	29	++	+
SA	160,912	8,525	32	+	=
Vic	(28,889)	(1,746)	-4	=	++
Tas	147,912	8,553	7	+	+
Vic	(313,967)	(17,894)	-24	--	++
NSW	78,668	4,664	28	++	+
NSW	1,062	72	0	=	+
WA	15,029	831	0	+	++
WA	54,143	3,307	5	+	+

Project NPV = net present value over the duration (which varied from case to case) of the farm forestry project (numbers in brackets indicate negative NPV)

Annual NPV = project net present value divided by the planned duration (in years) of the project

Income increase/decrease = calculated increase or decrease in income for the property after incorporating farm forestry as a percentage of the income expected without farm forestry

Economic and environmental impacts: subjective assessments based on the results of the analyses and authors' observations; + represents a positive impact; ++ represents a strongly positive impact; = represents a neutral impact; -- represents a strongly negative impact

The existing incentives are not enough

In many catchments, radical landscape transformations are required to address land degradation.

For example, dryland salinity problems may require more than 30 per cent of the landscape to be planted to trees. The existing mechanisms and incentives for encouraging farm forestry are not resulting in such transformations.

Are there opportunities to develop additional incentives that would be more effective? Farm forestry provides environmental services. Could these be commercialised?

In high rainfall regions close to appropriate markets there are good opportunities for growing trees for profit and investors are willing to provide capital finance for plantations.

Low and medium rainfall areas do not currently attract such investments, and the only available financial incentives focus on addressing land degradation with little or no allowance made for commercial returns.

Financial incentives are not the only way to encourage the adoption of farm forestry – education and regulation are also used (see Box on pages 5/6). Markets for environmental services are likely to be more effective if they are backed by sound regulations and secure, strong community support.

Together, financial incentives, education and regulation are effective in achieving their goals to some extent.

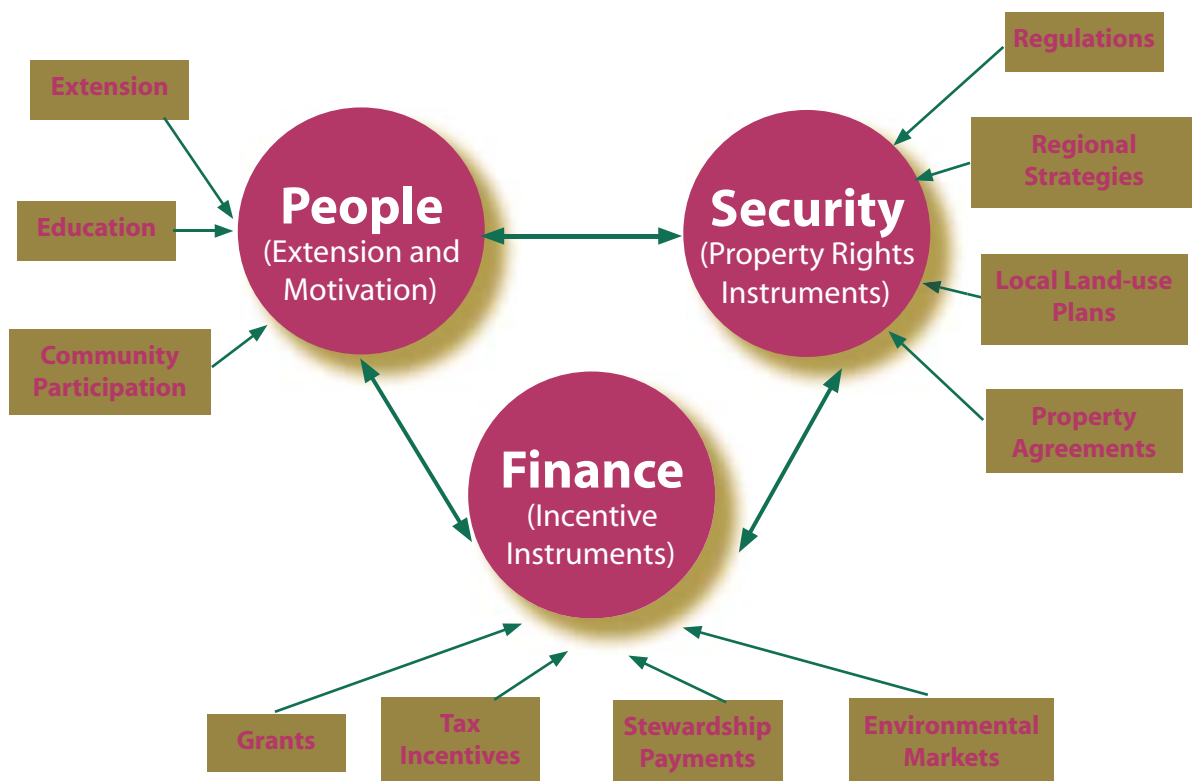
They encourage tree plantings, deliver environmental benefits (habitat restoration, landscape rehabilitation) and increase the uptake of more sustainable land uses.

However, the rate of uptake is low and ecological change is slow.

In one leading region, the Goulburn-Broken Catchment in northern Victoria, existing initiatives appeared to just halt the decline of native vegetation between 1993 and 1998. Australia-wide, tree clearing continues to outstrip plantings.

Getting the policy mix right

The diagram below provides an overview of the range of policy tools that can be used to promote farm forestry.



The tools are divided into the following broad categories:

- those that can be used to motivate and retain land-holders' support for farm forestry programs (**People** tools);
- those that can be provided to share the costs of managing farm forestry and act as financial incentives (**Finance** tools);
- the regulatory, legal and voluntary property right instruments that can be used to provide secure management of farm forestry (**Security** tools).

These categories provide a useful framework for evaluating policy instruments. Research has shown that policy mixes which harness the synergies between educational (people), regulatory (security) and economic (finance) incentives are likely to be more effective (both in terms of cost and environmental outcomes) than those which use only single instruments.

(Box continued from previous page)

This insight is critical because policy-makers are generally biased towards one type of instrument based on their disciplinary training and professional experience. For example, lawyers and planners tend to prefer regulation and land-use planning, economists tend to prefer market-based instruments, and social scientists tend to prefer education and participatory processes. To develop successful policy approaches it is necessary to bring these differing perspectives together and to seek complementarity.

This is supported by evidence from studies that have shown:

- awareness-raising through education is a critical first step, but has little influence on short-term behavioural change;
- market-based tools alone are likely to be ineffective until awareness is raised and land-holder attitudes are shifted towards positive management of the environmental resource;
- regulations have failed in the absence of strong community support.

These examples suggest that an ideal policy approach involves: awareness raising to shift attitudes, financial incentives to assist in meeting the transition to more sustainable management, and regulations to secure the community's investment in improved management.

Markets can assist in binding these different policy elements together. Of course, other policy approaches may be effective under different circumstances - for example, financial incentives may secure large structural changes (such as adoption of new regulations) in a short time.



Source: A Manual of Tools for Participatory R&D in Dryland Cropping Areas, compiled by J. Petheram. RIRDC Pub. No. 00/132



The dawn of environmental markets

Governments and non-government organisations are beginning to use market forces to reduce pollution, to control the use of natural resources that are becoming scarce, or to increase the supply of environmental services.

Evidence of this commercialisation is the diverse range of market-based schemes that have been implemented or proposed in Australia during the last few years (Table 1).

They include tradeable resource access rights, environmental taxes and subsidies, permit trading, environmental accreditation, eco-labelling and performance bonds.

The recent surge of interest in these schemes was caused partly by trends overseas, particularly

in the USA where market-based programs have been operating efficiently and have delivered environmental improvements.

In that country, the Acid Rain Trading Program reduced industrial emissions of sulphur dioxide by more than the target amount at less than one-half the expected cost.

In Australia, water and fishing entitlements have been traded since the early and mid 1980s.

In these cases, a cap is placed on the total extraction of water or fish from a defined area and individual users are permitted to buy and sell rights within that cap.

Table 1. Australian market-based schemes for managing environmental outcomes

Scheme	Example schemes	Implementation stage
Tradeable resource access rights	Transferable water entitlements in irrigation regions of the Murray Darling Basin	Commenced early 1980s
	Individual transferable quotas in the Southern Bluefin Tuna Fishery	Commenced 1984
Environmental taxes and offset payments	Local-based licensing program for water effluent (NSW EPA)	Commenced 1999
	Offset payments for aquatic habitat damage (NSW Fisheries)	Commenced 2000
	Offset payments for vegetation clearing (NSW DLWC)	Proposed 2001
Environmental subsidies and tax concessions	Auctions for environmental services (Victorian DNRE, WWF)	Pilot phase 2001
	Landcare tax rebates	Commenced 1997
Credit or permit trading programs	Hunter River salinity trading program (NSW EPA)	Commenced 1995
	Renewable energy tradeable certificates (AGO)	Commenced 2001
	Intra-firm carbon emissions trading (Shell, BP)	Commenced 1999
	Native vegetation and salinity offsets (NSW DLWC)	Proposed 2001
Eco-labelling	Banrock Station winery wetland restoration program	Commenced 1997
Certification and environmental management systems	ISO 14000 certification	Commenced 1996
	Green slips for salinity management practices (NSW Salinity Strategy)	Proposed 2000
Deposit-refund systems and performance bonds	Great Barrier Reef Marine Park Authority performance bonds	Commenced 1987



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In Australia, water and fishing entitlements have been traded since the early and mid 1980s.

In addition, the relationships and time lags between land management changes and environmental outcomes are poorly understood and variables such as rainfall and temperature make prediction difficult.

These issues generate risks for environmental services from agriculture and forestry.

Overseas, substantial progress has been made towards establishing markets for some of the environmental services associated with the rural sector.



In these cases, a cap is placed on the total extraction of water or fish from a defined area and individual users are permitted to buy and sell rights within that cap.

Water trading is now seen as a mainstream management tool and provides an example of a mature market for an environmental resource.

Markets for environmental services from land under agriculture and forestry are less advanced than those for industrial emissions and they need to overcome additional obstacles.

For example, environmental impacts of agriculture vary from one place to another, and this causes measurement and accounting difficulties.



Lessons for Australia from overseas trading programs

Six messages emerge from an examination of overseas trading programs.

1. Enforceable caps are the key

Setting enforceable limits, or 'caps', on environmental qualities is the most effective and efficient way of creating scarcity and hence stimulating demand for environmental services. Another option is for governments to purchase environmental services. However, the use of subsidies to encourage land managers to improve environmental quality is generally less efficient than a market in tradeable credits because land managers do not have an incentive to provide quality improvements beyond the amount stipulated by the subsidy agreement. Furthermore, subsidies do not necessarily encourage land managers to develop innovative, least-cost ways of supplying the environmental improvement.

2. Start from scratch

Rather than making piecemeal alterations to existing programs, it is better to design trading schemes from scratch. A scheme should be simple to understand and should have the most appropriate incentives for the environmental issues being addressed.

3. Assess the potential of the market

Whether trading in environmental services has the potential to provide economic benefits hinges largely on whether there are enough companies interested in participating in a market, and whether the costs of abatement vary between them. Determining this is the first stage in designing a trading scheme. If there is sufficient evidence that a trading program will yield efficiency gains over an alternative instrument, then the process should continue to a second stage of framework development and, finally, implementation.

4. Involve all interested parties

The success of a trading program relies on the participation of interested parties in the planning and design phases. In addition, the responsibility of day-to-day management of a trading scheme can be given to a community-based association, rather than being handled by government.

5. Keep trading rules simple

Complicated trading rules are a factor in failed trading programs. There must be transparency in the trading process and minimal bureaucratic intervention and restrictions on trade.

6. Get the science right

It is critical that a physical basis for emission permits or credits is clearly defined, measurable, easy to monitor and legally defensible. In Australia, this may involve refining the methods and criteria used to measure biodiversity and habitat function. For non-point sources of pollutants such as salinity and nutrients, robust models for defining the impacts of land use changes (within known margins of error) for different locations will be required. Before trading instruments are applied to dryland salinity, the relationship between groundwater recharge and discharge for different parts of the landscape, and the margins of errors associated with predictions, need to be defined better.



Overseas water quality markets

The USA is at the forefront in developing water effluent trading programs. In that country, the main water quality issue is nutrient discharge, but sediments, salt and pesticides are also problems.

Effluent is discharged from both 'point' and 'non-point' sources. Point sources are those which discharge effluent at distinct places, such as at pipe outfalls, and include sewage treatment plants and industrial facilities. Run-off from agricultural land constitutes a non-point source because the discharge of the effluent occurs along a broad front.

Those responsible for point sources require permits to operate and limits are set on the quantity of each type of effluent that can be discharged. These measures have brought about significant improvements in water quality, but the effluent from non-point sources is still preventing water quality objectives being met.

Recently, USA governments have pushed for the formal development of catchment management plans in catchments where pollution levels are unacceptable. The plans specify total maximum daily loads (TMDL) of effluent for each catchment and allocate loads for each point and non-point source.

The TMDL plans have encouraged water trading to develop because those responsible for point sources are facing high costs to meet the new quality standards.

Industrial facilities with high abatement costs can purchase credits from farmers and this can result in large cost savings since it is usually cheaper to reduce nutrient discharge from farmland than from industry.

A credit is generated when a point source reduces its discharge by one unit or, alternatively, when a farmer reduces discharge by adopting an approved management practice.

At least 35 trading programs are in various stages of planning and implementation.

Trading issues for non-point source pollution

Unlike point source pollution, non-point source pollution is rarely measured directly or observed.

Therefore, it is not simple to attribute any improvements in water quality to particular farmers in order to allocate emission credits.

Instead, emission credits can be allocated according to changes made in land management or according to the expected changes in effluent discharge (calculated using process-based models).

Changes in land management that earn credits are defined for each catchment, and may include practices such as establishing farm forestry, growing lucerne or planting buffer strips.



The expected effluent discharge is calculated by modelling the surface water, soil water and groundwater processes that operate in the different parts of a catchment under different land management practices.

The ways in which credits are calculated have to be defensible, otherwise the integrity of the trading program is weakened and subject to legal challenge.

Even if reliable models can be developed and calibrated for different locations, there is still the difficulty of monitoring individual farm practices or inputs.



Overseas carbon markets

The Kyoto Protocol is an agreement between parties of the United Nations Framework Convention on Climate Change that coordinates moves to reduce the production of greenhouse gases by industrialised nations and to increase the sequestration of carbon dioxide using 'vegetative sinks' such as tree plantations. Three mechanisms are being considered to help countries meet their targets:

- **international emissions permit trading**, which allows nations to trade permits they have been allocated which authorise them to emit specified amounts of greenhouse gases;
- **joint implementation**, which allows industrial nations to earn 'emission reduction units' by financing other industrial nations to reduce emissions or sequester carbon;
- **clean development mechanism**, which allows industrial nations to earn 'certified emission reductions' by investing in projects to reduce emissions or sequester carbon in developing countries.

The Protocol has not been finalised, and some countries are reluctant to ratify it.

However, other countries have already established permit trading schemes and a substantial number of large companies have committed to voluntary reductions in greenhouse gases.

For instance, the Royal Dutch Shell Group has launched an internal cap and trade system that aims to make a 10 per cent reduction in emissions by 2002 relative to its 1990 levels.

Similarly, BP Amoco has pledged to cut its emissions by 10 per cent from a 1990 baseline over the period to 2010.

These companies have already invested in forestry projects to obtain carbon sequestration rights.

The reasons why companies voluntarily reduce greenhouse gases include:

- internal company trading has the potential to improve efficiencies across a company's production centres;
- companies are willing to invest time and resources in learning about trading mechanisms so that they will be prepared if and when greenhouse gas limits are imposed;

- early movers may gain more favourable treatment by regulators and may influence the design of a trading program;
- a public-relations benefit results from gaining a 'clean, green' image;
- the finance industry will gain confidence that industrial companies can manage the financial risks posed by future regulations.

In April 2001, the UK introduced a tax, the Climate Change Levy, for all industrial companies and began a national trading scheme for emissions permits and reduction credits.

The scheme has established a framework within which UK companies can trade in an international market for carbon credits – including credits from tree plantation sinks – if and when an international market is established.

Case Study: The Chicago Climate Exchange

The Chicago Board of Trade and a consulting company, Environmental Financial Products, are establishing a Climate Exchange for trading greenhouse gas emissions in seven states in the mid-west of the USA. They aim to:

- encourage companies to voluntarily commit to a goal of reducing emissions by five per cent below their 1999 levels over five years;
- establish mechanisms for monitoring, verifying, tracking and reporting; and
- allow credits to be created for targeted domestic and foreign emission reduction projects, including methane abatement, solar and wind energy generation, and carbon sinks.

The program was due to be launched in late 2002, and by mid 2001, 25 companies and non-profit organisations had agreed to participate (this included utility companies that generated about 20 per cent of greenhouse gas emissions in the Midwest region).

If this pilot program succeeds, it will establish a price for carbon – which has only been estimated previously.

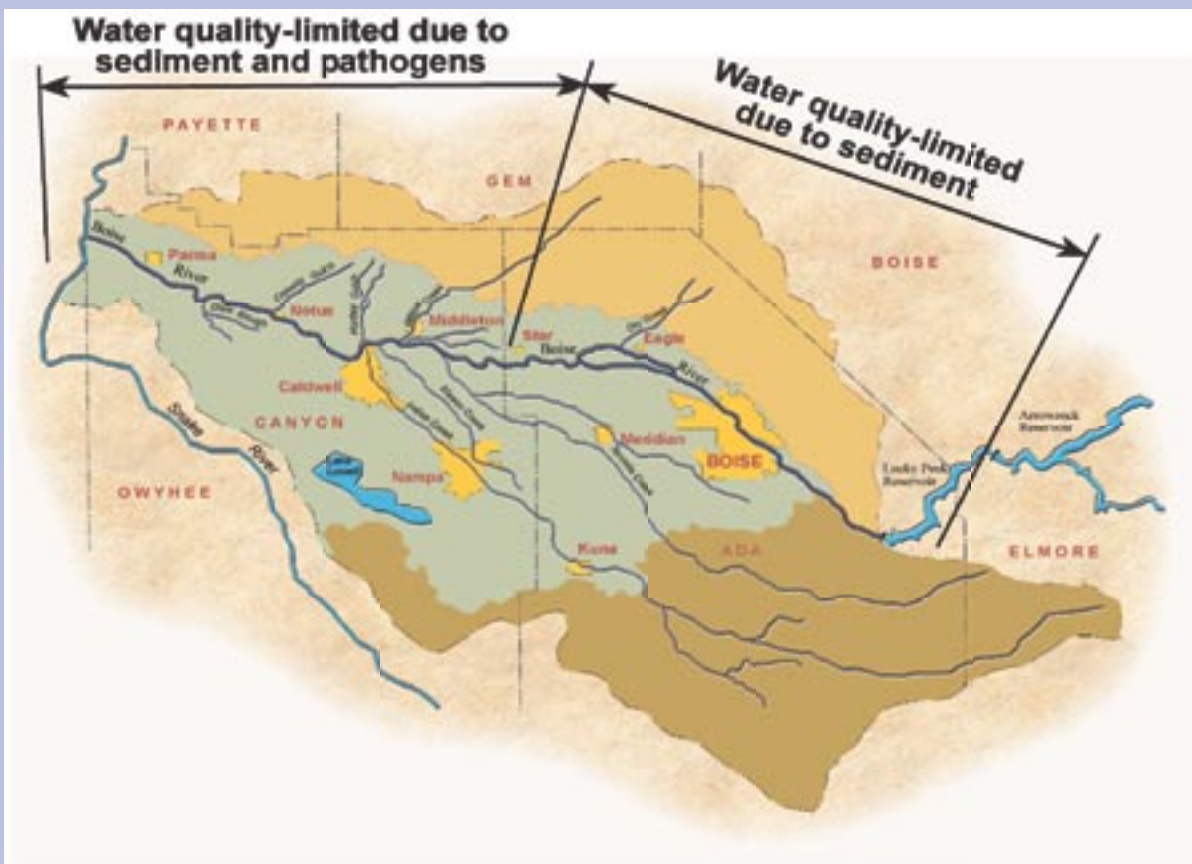


A Case Study: The Lower Boise River Trading Program

The Lower Boise catchment covers about 1300 square miles in the state of Idaho in the north-west of the USA. The Environmental Protection Agency (EPA) planned to introduce new water quality standards in 2001. Sewage treatment plants, factories and agriculture all discharge phosphorous into the Boise River. Initial investigations showed that trading could reduce the total costs of meeting the new standards because there were opportunities for point source

agricultural sector is not subject to an enforceable baseline level of discharge, but the trading program will allow non-point source polluters to generate credits by adopting 'best management practices' (BMPs – see below). If a farmer enters into a contract to supply and sell credits to a company that is a point source polluter, the company will be required to retire a proportion of the credits from the system. This is known as a 'water quality contribution' and its objective is to reduce the total amount of phosphorous discharge from the agricultural sector.

A standard list of approved BMPs is being developed by a working group of government and non-government representatives. The list



Source: Lower Boise River Watershed Advisory Group

polluters to trade with non-point source polluters and reduce their compliance costs. A trading program for phosphorous reduction credits was developed and it was expected to be operational by 2002.

The trading program will allow point source polluters to generate credits by reducing discharge below the required limit and to sell these credits to other point source polluters that wish to operate above the set limit. The

will include buffer strips alongside watercourses, wetland construction, specific irrigation control systems and specific tillage systems. It will specify minimum design, construction, maintenance and monitoring requirements. Credits will only be issued where a non-point source polluter has adopted a new BMP; they will not be issued retrospectively.

For situations where discharge reductions can easily be measured, 'measured credits' will be

issued. However, in most cases, measurement will not be technically feasible or will be too costly, so discharge reductions will be assessed using a computer model, and 'calculated credits' will be issued. Calculated credits will be adjusted by an 'uncertainty discount' to account for calculation inaccuracies and variability in effectiveness. Both types of credit will specify the quantity of phosphorous reduced in a given month.

The point source polluter that purchases the non-point source credits will be responsible for ensuring that the BMP has been installed and is performing according to specifications. Once the credits have been verified, the buyer signs and submits a Reduction Credit Certificate to a Trading Association. Since the buyer will be liable for failure of a BMP to deliver nutrient reductions, the buyer must also pay for ongoing monitoring of the BMP. An accredited third party could be paid to do this. The EPA will retain the authority to perform audits and to apply penalties for non-compliance.

Not all credits are equal. A credit will specify the quantity of phosphorus reduction in a particular month. But the effect of reducing phosphorous by a particular amount will vary, depending on the location of the source within the catchment.

The objective of the Lower Boise River trading scheme is to meet a water quality target at Parma, at the mouth of the Boise River. Credits will be converted to 'Parma Pounds' according to the

location of the sources of pollution within the catchment. One of three separate conversion ratios will be applied:

- **River location ratios** have been developed for different regions along the river and will depend on the calculated decrease in the phosphorous loading at the river mouth caused by the change in discharge at the pollution source.
- **Drainage delivery ratios** allow for the fact that some sources do not discharge directly into the river, but into a drainage canal or tributary first. Credits generated by reductions in such discharges will have lower value than those for sources which discharge directly into the river.
- **Site location ratios** address the potential for diversion and re-use of water below the point of discharge into the drain or tributary. For example, if non-point discharge flows into a canal and is re-used by downstream irrigators, then the impact of discharge reductions will be lessened.

A private Trading Association will connect buyers with sellers, develop and maintain the trade-tracking database, prepare monthly catchment-wide summaries of trades, and provide support to the trading system as requested and agreed to by its members.



Wetlands of the Barmah Forest, Victoria
Source: Murray Darling Basin Commission (A. Mostead)



Farm forestry in Australia – potential rewards for environmental services

How can land managers be rewarded financially for the environmental services provided by farm forestry? Can markets for the services be created?

Overseas experience shows that if a trading scheme for environmental services is to be successful as a sole driver, it has to provide greater benefits than any alternative enterprise.

This means that the potential markets should be identified and the funds they could generate should be calculated and compared with other options before a marketing scheme is designed.

In low rainfall regions of Australia, it is unlikely that the returns from any single service will be sufficient to secure large-scale investment in farm forestry.

For example, it has been estimated that carbon credits may be worth up to \$40 per tonne in the future. This alone would not be sufficient to sustain a viable farm business.

Markets for environmental services are not expected to be the sole driver for farm forestry. Their potential lies in their ability to supplement existing returns and make farm forestry pay.

A framework for selling environmental services to markets

Several frameworks linking sellers and buyers of environmental services have been suggested. A simple one is shown in Figure 2. It contains three main agents - Buyers, Sellers and an Investment Vehicle - and links to strategic planning to ensure appropriate landscape design, accreditation, enforcement and monitoring.

The framework relies on buyers creating a demand for the commodities provided by environmental services, and providing capital finance for establishing farm forestry. Buyers may represent a company interested in purchasing carbon or salt credits, or an organisation that funds the protection of biodiversity. Buyers will have different motives for providing funds. Examples are philanthropy, landscape restoration, 'right-to-pollute' and corporate image. Currently, governments are the most significant buyers of environmental services through programs such as the Natural Heritage Trust.

Sellers deliver environmental services for the buyers to purchase. The sellers are the land-holders who establish farm forestry operations (called 'projects') that deliver environmental services. For example, a land-holder may sell carbon credits to a company, salt credits to a land-holder upstream, and biodiversity credits to a philanthropic investor.

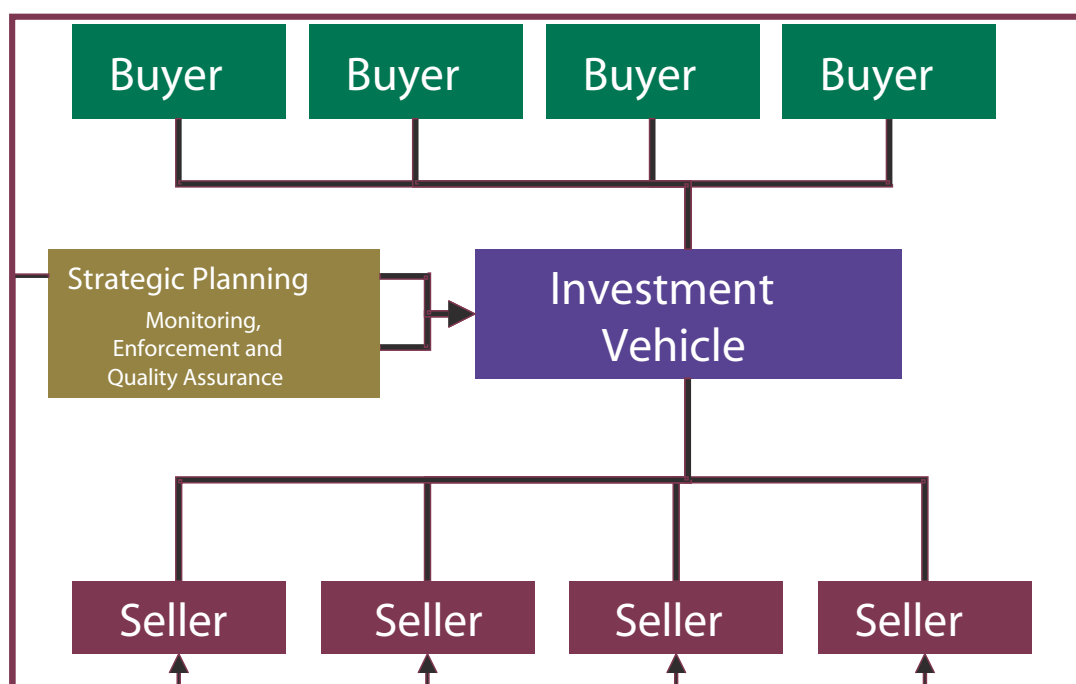


Figure 2. A simple framework for linking sellers and buyers of environmental services

The investment vehicle links the sellers with the buyers. It collects funds from buyers and distributes the money as financial capital to sellers. It is required to provide efficient and strategic trading to ensure that individual projects are located in areas that contribute to a region's strategic environmental objectives. The investment vehicle would organise contracts with land-holders to acquire the rights to the environmental services of particular parcels of land. Dealers or brokers could then pool small amounts of an environmental service into volumes of interest to buyers.

Achieving on-ground action in areas that will gain high levels of environmental benefit will require input from catchment management authorities. All of the potential environmental services would have to be considered concurrently to address any adverse environmental outcomes.

For example, the location of tree planting for carbon sequestration would – particularly in higher rainfall areas – need to take account of the likely decrease in run-off from the site, as this could result in increases in salt concentrations in downstream watercourses.



Linking good biophysical planning with well-designed investment mechanisms has the potential to add discipline to regional planning processes and encourage efficient and effective allocation of scarce funds for environmental works.

The framework is not focused on privatising the environment or giving unfettered reign to markets. Governments can and do play major roles as:

- legislators/regulators;
- buyers, through natural resource management programs;
- sellers, on government-owned and managed lands; and
- brokers, through strategic natural resource management planning.

How will the buyer / investment-seller model work?

There are three important questions to answer:

1. How are buyers secured?
2. How are land-holders engaged in farm forestry projects to become sellers?
3. How are buyers and sellers linked through an investment vehicle?

Securing buyers

There are opportunities for both government and private investors to become buyers.

Government investment is already made in the form of grants and direct investments, but there are limitations on the number of projects that could be funded this way. Governments would be required to prioritise environmental spending by:

- identifying and targeting priority areas within catchments based on their status, threats and options for rehabilitation; and
- targeting priority projects based on their outcomes from multiple environmental objectives.





Changing times have seen fishing rights becoming a tradeable commodity

Some of these issues are being addressed by both state and federal governments through the development of the National Action Plan for Salinity and Water Quality, which commits governments to establishing targets for salinity and water quality.

Because governments have limited funds for environmental management projects, using some of the money for incentives to encourage private sector investment may produce greater total environmental benefits.

Voluntary investment is the dominant existing form of private investment in environmental services. The motives of voluntary investors fall into six groups:

- **philanthropy** – individuals and companies donate time or money for altruistic reasons;
- **socially responsible investment** – there is a growing market for projects with social and environmental objectives in addition to financial ones;
- **promotion of a good company image** - corporate investors choose investments strategically and demand a return of some kind, often in terms of good publicity;
- **first mover status** – corporations could participate in markets in order to influence their development;
- **self-regulation** – corporations could invest to address environmental problems before governments impose regulations as a form of risk management;
- **cost minimisation** – it could be more cost-effective to invest to maintain natural assets rather than investing in substitutes (for example, water authorities increasingly invest in the management of the natural

resources within water catchments to lower water treatment costs).

A key requirement in securing voluntary investors as buyers would be the ability to account for the environmental benefits of individual investments so that the buyer can identify the value they get for their money.

Other non-government investment could come from introducing regulations or caps to limit the use of natural resources.

This would create scarcity and increase demand, and environmental services would gain commercial value. Overseas, caps have been found to be crucial to the success of markets for environmental services.

Regulations could be designed to apply the same standards or requirements to all resource users.

Alternatively, regulation could be used to set an overall cap on resource use, and then rights to that resource would be traded between competing resource users.



Tradeable water rights and fishing rights are examples of market-based mechanisms used to regulate resource use in Australia.

Similarly, if a cap was set on native vegetation clearing, people seeking to clear native vegetation on their land would purchase 'biodiversity credits'.

Once a currency for trading is established, the buyers and sellers will define the financial value. The more restrictive the cap, the greater the scarcity will be and the higher the value of environmental credits.

Regulations should be designed to allow caps to be refined through time as scientific knowledge and community values change.

In summary, government and voluntary investors are likely to drive investment in environmental services in the short to medium term.

To secure more buyers for environmental services, regulations to limit the access to resources could be introduced to create scarcity and demand for such services.

Identifying sellers

In any market, trading is used to identify those people who are able to supply goods of a given quality at the lowest price. Markets for environmental services need to identify both the land-holders with the greatest willingness to undertake farm forestry at least cost, and those actions and projects that will yield the best environmental outcome.

There are four broad approaches to engaging land-holders and providing payments for environmental services.

1. **Catalytic incentives** aim to obtain the maximum benefit for scarce funding



Will we see biodiversity credits as mainstream tradeable commodities like water and fishing rights?

by working with willing land-holders to demonstrate the benefits of farm forestry. The Landcare and Natural Heritage Trust programs work in this way.

2. **Cost-sharing** (beneficiary pays) incentives are paid according to an estimate of the public benefits resulting from tree planting. The South Australian Coorong and Districts Local Action Plan used this approach when it provided payments of from \$250 per hectare for plantings with only a salinity benefit to \$400 per hectare for plantings using local species that had both biodiversity and salinity benefits.
3. **Equal pay** for equal work is similar to a cost-sharing approach except that payments do not vary with environmental benefit. For example, the Bushcare program provides \$1200 per kilometre for fencing, irrespective of environmental benefit.
4. **Auction systems** request land managers to place bids on the payments they require to invest in tree planting. In theory, each land-holder will bid the lowest acceptable price, resulting in the payments being minimised.



Under the auction approach, projects of the same environmental value may receive different payments depending on the bids of the different land-holders. The scheme can be very cost-effective but may not be equitable between land-holders. In contrast, the cost-sharing approach allows all plantings of the same environmental benefit to receive the same payment, but it may not be as cost-effective as an auction scheme.

The four approaches have different strengths and weaknesses, but well-designed markets for environmental services have the potential to raise land-holder participation and the environmental effectiveness of farm forestry projects without raising expectations of large increases in payments.

Linking buyers and sellers – the investment vehicle

An investment vehicle would be successful if it was able to market the benefits of a set of farm forestry operations to investors who do not currently purchase services from the land managers concerned.

Brokers or dealers are required to make formal links between the buyers and sellers. An accredited broker receives a brokerage fee for acting as an intermediary, tailoring products to suit investors, but at no stage owns the rights to the services. A dealer

acquires proprietary rights from land-holders, pools these into a product likely to be of interest to third parties, and then on-sells them.

Several approaches are being tried or debated. The alternatives have different information requirements and levels of risk and security associated with their operation.

- The Australian Bush Heritage Fund and other similar organisations have established markets for direct investment in biodiversity conservation. Philanthropic individuals donate funds to purchase land of high conservation value that is then managed for conservation.
- A Vegetation Bank has been suggested by the Murray Darling Basin Commission to invest scarce government funds in strategic forestry to contribute to salinity and water quality objectives. The Bank would only supplement operations to the point where they became commercially viable, possibly using an auction-based system.
- Expressions of interest from land-holders for contracting to deliver environmental services have been called for by the New South Wales Department of Land and Water Conservation. Since techniques have not yet been developed to quantify



environmental benefits, the scheme will need to be adaptable and to address risk management.

- A report prepared for business leaders by Allens Consulting Group (based in Sydney) suggested that governments establish low interest rate funds to be used for changing land use to improve environmental outcomes. An accreditation scheme would be required for land-holders to access the funds.
- The Sydney Futures Exchange has proposed setting up a carbon credits trading desk and such a system could stipulate that the trading was based on verifiable and quality-assured projects.

The most successful overseas schemes are those that were designed from scratch with the involvement of future participants, and those that have simple, clear trading rules.

Could this be achieved by establishing investment centres for environmental services (see Box) in Australian catchments?

There is still much to learn about the design of successful investment vehicles for environmental services, and initial schemes are expected to be experimental and innovative. In the longer-term, regulation should lead to more formalised buyer-investment-seller frameworks.



The 'Catchment Environmental Services Investment Centre'

Markets for environmental services and commodities could be created by the community, working in conjunction with, but at arm's length from, government.

One possible model for developing a regional market involves establishing an agency for a catchment to take on the tasks involved.

It could be called a 'Catchment Environmental Services Investment Centre'.

The agency (in conjunction with governments) would be responsible for:

- setting caps on resource use within the catchment and establishing credit trading for some environmental services;
- assigning credits for projects and for attracting clients or private brokers for those credits;
- encouraging appropriate projects in areas of strategic importance;
- certification of projects and verification of environmental products;
- bundling projects and pooling investments for services.

The agency could simply develop an investment portfolio based on a strategic environmental management plan or it could introduce e-commerce as a link between urban populations and regional Australia.

Such approaches must be viewed as experimental. The trading system itself will require continual monitoring, analysis and assessment.

All involved should expect, and plan for, the trading systems to change over time as knowledge increases and circumstances alter.



The next steps

Once a broad framework for the operation of environmental markets for farm forestry has been accepted, there are seven important steps to be taken:

- define the product;
- link markets to strategic regional outcomes;
- bundle services and pool credits;
- clarify and separate property rights;
- ensure quality and monitoring;
- manage risk; and
- remove government impediments to private investment.

The lessons learnt from overseas trading programs (see earlier section) should be considered during these stages.

1. Define the product

What is the product that is being offered for sale? In a market designed to reduce pollution, it may be an emission permit; in a market designed to manage a limited amount of irrigation water, it may be an abstraction right; in a market designed to increase carbon sequestration, it may be a carbon credit.

The environmental services provided by farm forestry include carbon sequestration, habitat improvement for nature conservation, groundwater recharge reduction and water purification.

Quantifying environmental services in terms of a single index is a substantial scientific challenge as the measure chosen must account for scientific uncertainty and heterogeneity in the environment, and still have credibility in the market place.

Conversely, the measure should not be so pragmatic that it loses scientific credibility. The task may become easier as advances in using satellite technology for mapping changes in land use and environmental qualities are made.

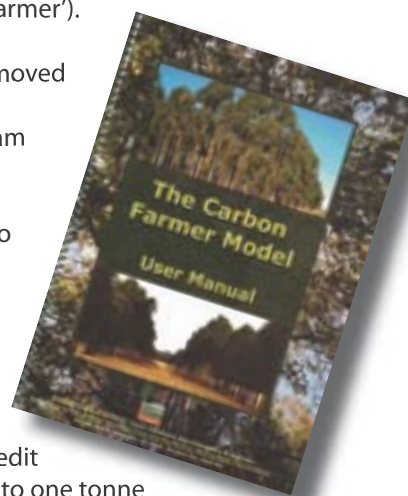
Different accounting systems are required for each commodity. Developments in measuring carbon, biodiversity, salt and water quality are described below.

Carbon

Researchers are developing computer models to calculate the volume of carbon sequestered in different situations (JVAP has developed one called 'The Carbon Farmer').

Australia has moved to establish a trading program incorporating carbon sinks, with permits to be issued in proportion to the volume of carbon sequestered.

Generally, one carbon credit would equate to one tonne of 'carbon equivalent' sequestered in a plantation or forest. However, there are still some uncertainties about how credits will be earned. To allow for changes in the system in the future, State Forests in NSW plans to manage a pool of carbon sinks (plantations) and then adopt a conservative approach by only trading in a proportion (say 60 per cent) of the expected carbon sequestered.



Biodiversity

Several organisations are researching appropriate accounting systems for biodiversity credits. Issues that are being discussed include the relative values of natural habitat and revegetated land, and how to combine attributes such as size, connectivity and condition into a single measure.

The role of farm forestry in conserving biodiversity is also being debated, particularly its impact when used to re-establish tree cover between separated areas of natural vegetation.



Salt

Salinity affects both land and water resources. Accounting systems for salinity are difficult to design because it is hard to link remedial works with outcomes quantitatively, spatially and through time. Should credits be allocated according to:

- the type of remedial work and the area treated (an input basis);
- the resulting reduction in recharge (a process basis);
- the reduction in the rate of land salinisation or the decrease in stream salinity (a performance basis); or
- the measured improvement in land or river health based on its biodiversity and habitat (an endpoint basis)?

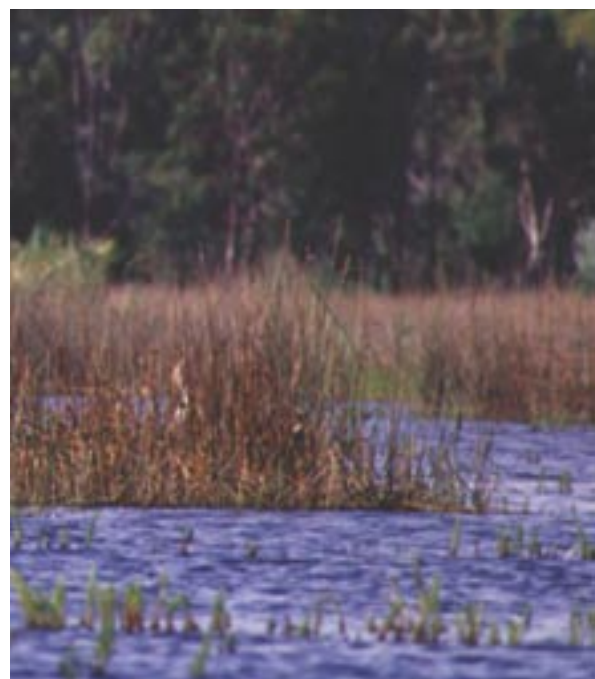
Attempts to assess the benefits due to various tree planting strategies under different conditions are described in the JVAP publication, *Trees, Water and Salt: an Australian Guide to using Trees for Healthy Catchments and Productive Farms*, edited by R. Stirzaker, R. Vertessy and A. Sarre, RIRDC Publication No. 01/186). There is potential to use the findings of the study as a basis for defining salinity credits.



In addition, a recent audit of the salinity of Australian rivers can provide the basis for setting caps for individual catchments.

Water quality

The accounting issues for water quality markets are similar to those for salinity, and water quality may be traded in the same way as salt loads in rivers, by setting a pollution cap, with the emitters being allocated a proportion of the cap. One emitter may be allowed to increase loads in exchange for reduced loads from another.



2. Link markets to strategic regional outcomes

Strategic planning at regional scales is required to generate clear goals and targets for economic, environmental and social outcomes.

Fortunately, there is a growing body of quantitative information about the state of Australia's land and water resources, and this can be used as the basis for setting targets.

Any investment vehicle or broker of environmental credits will need to operate in accord with regional plans and national goals.

Strategic planning should result in clear sets of catchment targets measured as, for example, tonnes of carbon dioxide sequestered, percentage of land under natural vegetation, and electrical conductivity and nutrient concentrations of river water at the mouth of the catchment.

The relative impacts of different projects, and their credit ratings, will be difficult to evaluate.

One role of strategic plans will be to avoid adverse outcomes.

For example, farm forestry may be established to sequester carbon, but may also have the adverse effect of reducing stream flows, and thus increase concentrations of pollutants in the watercourses.

Table 2 shows how a set of relative ratings could look. It indicates that for some targets, such as salinity, the ratings may be as imprecise as high, medium or low.



Rankings will vary depending on the nature and location of projects in the landscape.

Because projects may have some negative impacts as well as positive ones, it is essential that they be assessed against all of a catchment's objectives.

Table 2. Hypothetical relative credit ratings for different projects based on catchment targets

	Carbon sequestration	Biodiversity maintenance	River salinity mitigation	River nutrient mitigation
	(based on tonnes of CO ₂ sequestered)	(based on % of planting providing high quality habitat for nature conservation)	(based on reduction in river salinity at mouth of catchment)	(based on reduction in river nutrient levels at mouth of catchment)
Commercial farm forestry	10	1	medium	3
Mixed benefit plantings	5	5	high	10
Biodiversity plantings	3	10	negative	6

3. Bundle services and pool credits

Farm forestry has multiple benefits and Table 3 shows an example of the commodities that a farming enterprise incorporating farm forestry could provide in the future.

One market which can deal with all of the commodities, can bundle products from many individual land-holders, and can sell them to different buyers would be more effective than several markets, each dealing with single benefits.

Buyers would only have to negotiate with one broker or dealer, and land-holders would have access to a pool of funding from investors in different environmental services.



No existing Australian trading program deals with multiple benefits. Instead, purchases have generally been limited to individual deals tied to single environmental benefits, and this limits the total level of funding and the size of incentive available to projects. For example, the first carbon and salinity trades in Australia were negotiated by State Forests of NSW in partnership with the Sydney Futures Exchange (which dealt only with carbon) and Macquarie Food and Fibre (which dealt only with salinity).

4. Clarify and separate property rights

The current definitions of property rights to land do not provide security for long-term investors in multiple environmental benefits. For example, if a land-holder sells carbon and water entitlements to different buyers, how are the buyers to secure their investments over the relevant period?

One option is to create common law contracts to provide environmental services for a fixed period.

This is a simple process as long as the land-holder's actions and the expected outcomes can be clearly described. However, if environmental outcomes are to be secured in perpetuity, then the land title has to be changed so that ownership of environmental services and land are separated. Each environmental service could have a separate title.

New South Wales was the first Australian state to pass legislation to allow the separation of carbon rights from land.

Table 3. Farm of the future - potential clients and relative returns to a farm that includes farm forestry

Commodity	Share of farm business (%)	Potential client
Wheat	35	world market
Wool	15	world market
Timber	10	speciality and world market
Electricity	15	power company
Carbon credits	10	steel company
Salinity credits	5	catchment management authority
Water filtration credits	7.5	urban water authority
Biodiversity credits	2.5	philanthropic trust



5. Ensure quality and monitoring

Environmental services will only be secure if there are effective, ongoing quality assurance, monitoring, enforcement and risk management schemes in place.

Projects need to be certified, but the type of certification can range from a fully independent accreditation process (such as that used by the Tasmanian Forest Practices Board to accredit timber harvesting plans) to self-regulation with spot-checking by an authority.

Certification could serve the double role of ensuring high-quality management and verifying the environmental benefits of a project.

An ideal approach would be to require accreditation of a farm's environmental management before a land-holder is allowed to participate in environmental services markets.

This would avoid the problem of a land-holder being rewarded for actions on one part of a property whilst continuing to degrade other parts.

6. Manage risk

Creating markets is a risky business. For instance, there are risks associated with measuring environmental benefits, ensuring governments recognise credits, ensuring proposed on-ground actions actually happen.

Risks must be carefully identified and managed. Consider, as an example, who should bear the risk for losses due to fire or other natural hazards.

One option is to share the risk between a group of land-holders or projects by establishing financial 'buffers' – that is, having banks of spare credits.

Another option is to assign responsibility to the broker or reinsurance agency.

A third option is to assign the responsibility to individual land-holders.

Mitigating risk is costly. What if a high risk of failure in the system adopted to measure the environmental commodity is identified?

Reducing the risk would require costly research and quality assurance processes.

It may be more cost effective to opt for lower measurement costs and accept a higher level of risk as the lower operating costs may secure more investment.

In the early stages of market development, governments and other voluntary buyers may need to accept high levels of risk.



Source: A Manual of Tools for Participatory R&D in Dryland Cropping Areas, compiled by J. Petheram. RIRDC Pub. No. 00/132

7. Remove impediments for private investors

There are important impediments to private and non-government investment in environmental services and they include:

- unfavourable taxation arrangements;
- regulations against trading in and commercialisation of wild species;
- requirements for government involvement in negotiating private conservation agreements;
- legal barriers to separating ownership of property from ownership of environmental resources such as carbon;
- poor access to finance; and
- government ownership of environmental data.

These impediments slow down the development of market-based approaches to environmental management and will need to be addressed as markets emerge.

Market creation is hard work. Markets for environmental services will take time to develop and will involve risk-taking and experimentation.

Governments face a number of legal and political

constraints in establishing markets. As new markets emerge, there will be both successes and failures. This is an impediment as governments are traditionally averse to risk.

Important technical issues are still to be resolved, such as developing robust and credible accounting for environmental services.

Because of this, the systems adopted will have to be adaptable. This is a disadvantage as resource users generally require certainty from governments.

A period of active and participatory development is needed. The processes of setting targets and accounting for on-ground actions are necessary, irrespective of the policy instrument chosen to deliver incentives for farm forestry.

By working with several regions at once, important issues could be addressed, including: how to use existing regional plans and data to effectively target programs; how to pool resources from different programs; and how to test the willingness of the non-government sector to invest.

If these steps are taken, governments may have better technical capacity and greater community support to develop and impose the caps on resource use that are ultimately required to drive the development of large-scale markets for environmental services.





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