Second Australian Stream Management Conference
8-11 February 1999, Adelaide, South Australia

# Management Of Stock Access To The Riparian Zone

*Ian Bell [1] and Tom Priestley [2]*

**SUMMARY - THE MAIN POINTS OF THIS PAPER**

- The damage stock cause to streams is a major environmental concern.
- Significant benefits to the whole community will accrue from managing stock access to streams.
- A range of practical measures are available to deal with the problem.

**Figure 1: Buffalo Brook before stock exclusion**

**Figure 2: Buffalo Brook - same location 8 years after stock exclusion.**

## 1. ABSTRACT

The paper discusses some of the cause-effect relationships of stock access to the riparian zone which were established following an extensive review of the national and international literature. This information has been applied to experience of the Australian situation gained during the project "Management of Stock Access to the Riparian Zone" and a number of practical solutions to the problem are presented, along with farmers perspectives on the issue.

## 2. BACKGROUND

It is surprising that the issue of stock impact on the riparian zone and on water quality and the stream ecosystem generally has not received a great deal more attention, given the scale and importance of the effects in the Australian landscape.

Professor Nix summed up the situation well in a radio interview on the ABC on World Environment Day 1996. *"Well the rivers are in trouble from all sorts of causes. A major source, possibly the single largest source of trouble is uncontrolled grazing on river banks. A great deal of the sedimentation in Australian rivers is actually coming from undercutting and erosion of bank material, and this is because of banks becoming unstable through livestock access, trampling, removal of cover so the banks aren't bound. So I mean this is happening every day, it's highly visible - anybody can see it. Most landowners don't really appreciate this."*

Recently, there has been quite a lot of interest in the issue of how to manage the impact of stock on streams and riparian zones, with work underway in all States highlighting the need to pool knowledge at a national level.

This paper outlines some of the findings of a project "Management of Stock Access to the Riparian Zone" which is funded by the Land & Water Resources Research and Development Corporation (LWRRDC) under the Rehabilitation and Management of Riparian Lands R&D Program, Component 'C', demonstrations. This component of the national program aims to develop a range of options for managing stock access to the riparian zone as well as providing evidence of their effectiveness in physical and economic terms so that land managers are more likely to adopt improved management practices.

## 3. THE IMPACT OF STOCK ON THE RIPARIAN ZONE

When stock are reliant on a stream as their only source of water it is inevitable that there will be significant damage caused by the concentration of their activity along fragile stream bank environments causing loss of riparian vegetation and wildlife habitat and increased erosion.

Unlimited stock access removes protective vegetation, and reduces bank stability. The soil becomes compacted and tracks and gullies form so that the banks become rutted. Erosion and slumping are increased (David 1994).

[1]Senior Water Management Officer, Department of Primary Industries, Water and Environment, PO Box 46, KINGS MEADOWS TAS 7249
[2]Technical Officer, Department of Primary Industries, Water and Environment, PO Box 46, KINGS MEADOWS TAS 7249

Soil loss is a significant factor caused by stock access to river banks in Ohio (Owens 1996) with average annual soil loss along streams 40% lower after cattle were fenced away from streams. It was also found that decreased soil loss accompanied a 60% reduction in average sediment concentration in the storm flow after fencing. The problem of erosion is confirmed by Trimble (1994) who found that grazed stream banks eroded three to six times faster than ungrazed stream banks. The process of erosion starts from the ramps cattle form when obtaining access to the stream and produces a rate of erosion of about 40 cubic meters per kilometre per year. Coyne (1995) showed that a 9 metre wide grass filter strip can trap 99% of soil and 74% of faecal coliform material, and this has important implication for the grazing of riparian vegetation.

Platts (1981) found that stock access causes significant increase in stream width and decreased stream depth. The area of water covered by in-stream vegetation is greater when stock have access, in part due to the wider shallower channel, however the area of water shaded is greatly reduced and habitat is similarly reduced. Stream banks become eroded and steeper, with a reduction in channels cut into the stream bed.

In Colorado, overgrazing has resulted in damage, or loss of fish and wildlife habitat, resulting in 51% of the area along 5,300 miles of perennial streams being in poor condition with 39% in fair condition. Similar effects have been observed in other States (Armour 1994). Changes in channel morphology, loss of riparian vegetation, increasing water temperature and reduced dissolved oxygen all lead to damage to fish and wildlife habitats.

Most of the bare banks subjected to grazing on the Murray River in an area studied by Frankenberg (1994) are eroding at the high water mark by undercutting and collapse, and once the loose material is washed away the process is repeated. Soil loss in one year is quoted as 900 cubic meters from a 150 metre length of bank. By contrast ungrazed banks with *Phragmites* do not show the undercut profile with very slight erosion occurring. The riparian stream ecosystem is highly vulnerable to the impact of grazing by stock. This is the single most productive type of wildlife habitat that benefits the greatest number of species. Population densities of birds with habitat both in and adjacent to the riparian zone are adversely affected by the removal of vegetation by grazing (Kauffman 1984).

## 4. THE IMPACT OF STOCK ON STREAM WATER QUALITY

This is an important issue because of the serious environmental and human health issues involved and legal precedents are now arising where landowners have been required to protect water quality for downstream inhabitants by restricting stock access to streams which run through their property.

The most obvious effects on water quality by stock access to streams are increased sediment and turbidity caused by disturbance of soil on the stream banks and bed, and the deposition of faecal material either directly or indirectly into the stream. The increase in nutrients associated with this soil and faecal matter are of major concern. In addition, Meehan (1978) points out that large quantities of sediment change the structure of aquatic communities, reduce stream bed habitat, and reduce the permeability of the stream bed. Increased bacteria levels, reduced oxygen levels and high ammonia levels which result from faecal material can have a devastating effect on fish. Platts (1985) showed that fish numbers were 7.6 fold and biomass 10.9 fold greater per unit area in streams where stock had been excluded along a heavily grazed stream.

Maintenance of good water quality for human consumption is particularly important in rural areas. Streams contaminated with faecal material can also present a risk to human health from diseases such as giardiasis, salmonellosis (gastroenteritus and including typhoid fever) hepatitus A, amebiasis, viral gastroenteritus (Spilchen 1992). Removal of stock can reduce faecal inputs by up to 90% (Larsen 1994).

An indirect effect of stock on water quality is increased water temperature due to the loss of riparian vegetation through grazing and increased light levels (Meehan1978). Increased temperature has the effect of reducing oxygen carrying capacity of the water, and an increase in light levels can lead to a proliferation of algae.

## 5. METHODS OF MANAGING STOCK ACCESS

With the objective of avoiding the several impacts identified above, the obvious way to manage stock access to the riparian zone is by exclusion with fencing and the provision of a troughed water supply. This forms the basis of recommendations of much of the relevant literature. Management recommendations must be soundly based, practical and achievable. Fencing is an effective means of controlling stock but can be expensive (Platts 1984). Consequently it may be advisable to fence the most valuable reaches and highly impacted areas as a priority.

However, an interesting model for fencing riparian areas has been developed in Western Australia (Schur 1992) in which a co-operative approach to funding uses funds from Councils for catchment based watercourse fencing programs. Under the model, these funds are distributed by local landcare organizations, with matching funds from other agencies. Similar systems are being developed around Australia with some Councils using funding from an environmental levy to each property to support the work.

Another way of managing damage to the riparian zone is by limiting the time stock are able to spend in this zone. Davis (1990) showed how time controlled

grazing so that stock were relocated from the stream side pasture after 40% of the riparian zone forage was consumed reduced the impact on that zone. Even though stock preferred grazing in the riparian zone, time controlled grazing appeared to spread cattle use out over more of the total pasture available on the property. She also refers to salt licks and other herd management factors as being effective in reducing the congregation of stock in the riparian zone.

Bryant (1982) concludes that it is important to treat riparian zones as separate grazing units to maximize pasture utilization on up slope areas and reduce the impact on the riparian zone - presumably providing alternative water supplies to up slope areas. Time of grazing also has an influence on the areas preferred by stock, with a preference for the riparian zone during summer months (Marlow 1985).

The location of watering points has a dominating effect on the movement and dispersion of stock around paddocks, with stock production often limited by availability of water. In large paddocks stock can spend a considerable amount of time walking to and from watering points, tending to drink less frequently or camp for longer periods around watering points. Shade is also an important factor in determining grazing distribution, and the location of watering points and shade need to be planned to force stock to use paddocks more evenly (Simpson 1992).

Another means of restricting stock access to the riparian zone is using an audio electrical stimulation collar stimulated by a transmitter which Quigley (1990) reports is effective within two days in training cattle to avoid an area without a fence defined boundary. Initially the collar was set to provide both audio and electrical stimulation, however cattle soon learned to respond to the audio signal alone. It is stated that audio electrical stimulation may provide a cost effective alternative to fencing. The unit used was a Tri-tronics A1-90 remote trainer developed for training dogs.

One of the most promising opportunities for the future is identified by Miner (1992) in trials which measured the effect of providing a separate water supply only as a means of reducing stock access to the stream by attracting them away. He concludes that under winter feeding conditions, the amount of time cattle spent drinking or loafing in the area of the stream was dramatically reduced by more than 90% by the presence of a watering trough. Miner makes the connection that in terms of water quality, the relationship between time spent and faecal pollution is evident, and concludes that this may be an economically viable alternative to total exclusion from the riparian zone.

## 6. PRACTICAL RIPARIAN ZONE FENCING

The LWRRDC project has established a range of practical approaches for addressing fencing of the riparian zone which allay many of the concerns expressed by the farming community.

The key to sustainable management of the riparian zone is to treat and manage it as a sensitive zone which requires a different management approach from virtually all other areas of the property. Figure 3 shows two alternative fencing locations for the same stream. Option 1 is what is commonly visualised when riparian fencing is discussed and is what is often seen in the field. This approach has merit in that it is capable of providing total exclusion and minimises the area of land "lost" from production. It may be quite a suitable compromise where overbank floods are rare and the location of the stream does not change.

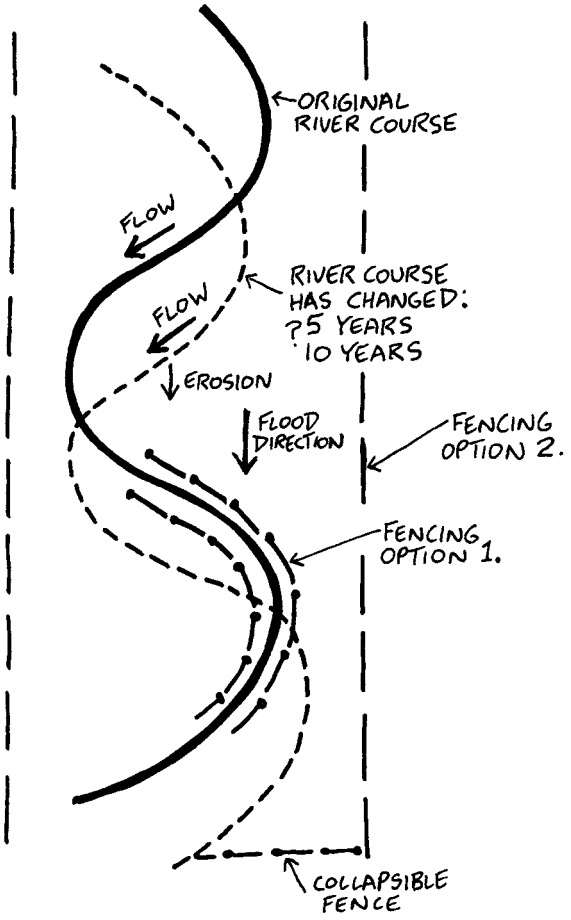


**Figure 3: Principles of riparian fence location**

However problems arise from this approach if the stream is subject to over-bank flooding, meandering and avulsion. Firstly the fence may be outflanked and undermined as the process of meandering redefines the stream course. The strip of preserved riparian vegetation is similarly continually vulnerable.

The alternative approach (option 2) is to accept that the riparian zone and accompanying floodplain require special management to preserve their unique features. By locating the fence well back from the stream so that it can be located generally parallel to the direction of floods a number of advantages accrue:

- The fence is not subject to undermining as stream shape is redefined.
- The fence is less subject to damage because flood flows are parallel to it, velocities are lower and debris is not such a problem.
- Conventional fencing designs are generally suitable.

Because of the considerable area excluded, option 2 may imply that stock be permitted into the riparian zone at times. Access time needs to be managed to limit damage and it is desirable to install a water trough which can be accessed from this area. (to save cost preferably accessible from both sides of the fence). The inescapable problem remains that places where a fence is across the direction of the flood flows are inevitable and these will require specially designed and installed flood resistant fences.

**6.1 Flood resistant fences**

Extensive observations have confirmed that it is not practicable to install conventional fences across the path of a significant flood. Fencing options are available to suit every situation including actual stream crossings. Two of the simplest approaches which have been successfully trialed are shown in Figures 4 and 5.

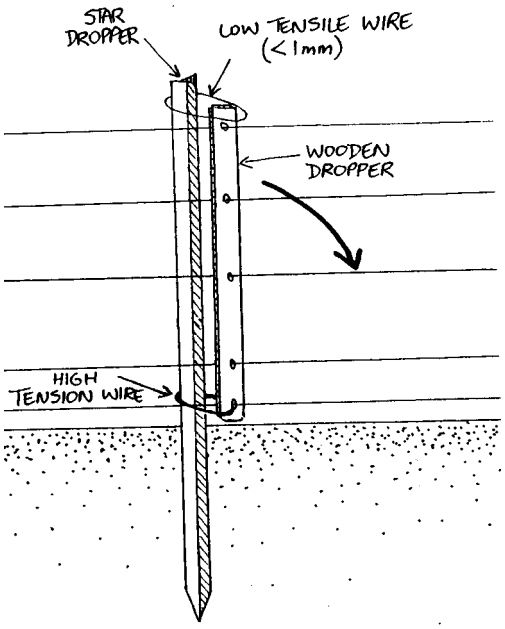


**Figure 4: Example of flood resistant fence**

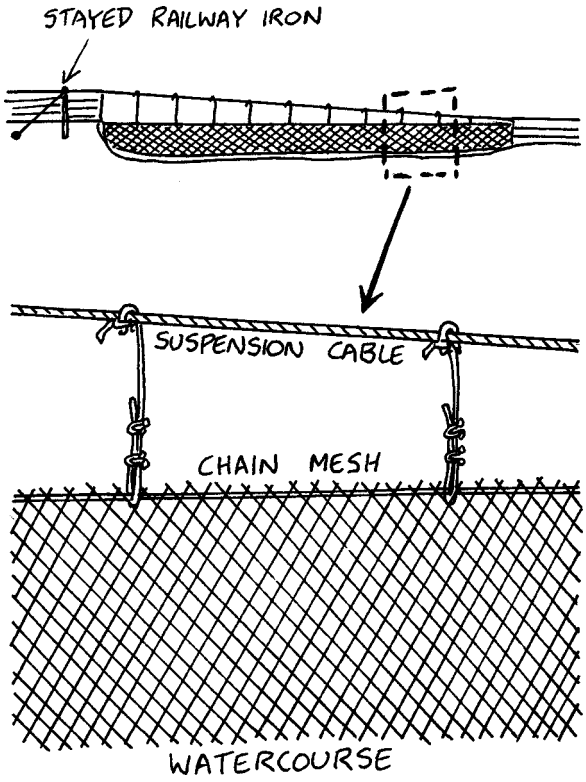


**Figure 5: Example of fence for stream crossing**

**7. BENEFITS OF RIPARIAN FENCING AS IDENTIFIED BY FARMERS**

Farmers identify the following benefits from excluding stock from the riparian zone.

- Stock are safe from floods - losses greatly reduced
- Streambank and floodplain erosion is reduced reducing the loss of productive land
- Benefits to the stream environment (return of birds fish and plants)
- Shelter for stock
- Improved lifestyle - not so tied to the property
- Safer working environment.
- Time saving rounding stock
- Reduction in the need to carry out erosion prevention works to save land and or structures such as bridges
- Improved property appearance and resale value
- Improved drinking water
- Improved recreation zone

Farmers also identify a number of problems including weeds, habitat for game, fires, but most see that these problems are part of a wider problem with which they have to deal, and can be incorporated into their overall property management.

## 8. CONCLUSIONS

Stock access to streams is a major cause of stream degradation, however the issue has been somewhat overlooked because we are so used to seeing this effect as part of the landscape. Problems due to stock access are readily addressed by excluding stock by fencing and/or by providing alternative troughed water supplies.

Although there is large amount of general information on the effect of stock on the riparian zone, there is a lack of specific information, especially under Australian conditions. Because of the cost of fencing and its disfavour in some sectors of the farming community who may see this as a threat, alternatives are needed. Furthermore, fencing is not suitable for all situations. Wetlands, small tributaries and gullies comprise very large areas of important aquatic environment which need protection from the damage from constant lingering of stock in these areas. It appears likely that provision of water supply points alone may significantly reduce the impact of stock in these areas.

## 9. REFERENCES (CITED AND RELEVANT)


Adams, B. and Fitch, L. (1995). "Caring for the green zone : Riparian Areas & Grazing Management".

Armour, C., Duff, D. and Elmore, W. (1994). "The Effect of Livestock Grazing on Western Riparian and Stream Ecosystem". Fisheries, Vol 19, No. 9. September. 9-12.

Bourchier, J. (1996). "Watering Stock from Natural Water Sources". Farming Ahead with the Kondinin Group. No 54. June. 38-52.

Bryant, L.D. (1982). "Response of Livestock to Riparian Zone Exclusion". Journal of Range Management 35(6). November. 780-785.

Buchanan, B. (1992). "Surface Water Quality for Cattle". Prairie Water News. Vol.2. No.1.

Buchanan, B. (1992). "Surface Water Quality for Cattle". Prairie Water News. Vol.2. No.2.

Coyne, M.S., Gilfillen, R.A., Rhodes R.W. and Blevins R.L. (1995). "Soil and faecal coliform trapping by grass filter strips during simulated rain". Journal of Soil and Water Conservation. July-August. 405-408.

Crane, S.R., Moore, J.A., Grismer, M.E. and Miner, J.R. (1983). "Bacterial Pollution of Agricultural Sources: A Review". American Society of Agricultural Engineers. Transactions of the ASAE. 858-872.

David, L. and Paget, A. (1994). "Assessment of the Tarwin River System". Public Report for the Tarwin River Management Board. July.

Davis, J.W. (1986). "Options for Managing Livestock in Riparian Habitats". North American Wildlife. National Resources Conference 51st.

Davis, K.C. and Marlow, C.B. (1990). "Altering Cattle Behaviour Through Grazing Management". Montana Ag Research. Winter. 11-14.

Davis. J. W. "Options for Managing Livestock in Riparian Habits". Trans 51st N.A. Wildl. & Nat. Res. Conf. 290-297.

Doran, J.W. and Linn, D.M. (1979). "Bacteriological Quality of Runoff Water from Pastureland". Applied and Environmental Microbiology. US Dept of Agriculture, May. 985-991.

Dudley, D.R. and Karr, J.R. "Concentration and sources of faecal and organic pollution in an agricultural watershed". Water Resources Bulletin. American Resources Association. Vol 15. No.4. 911-923.

Faust, M.A. (1982). "Relationship between land-use practices and faecal bacteria in soils". J.Environ. Qual., Vol 11, No1. 141-146.

Frankenberg, J. (1994). "Guidelines for growing Phragmites for erosion control". Riverwise - NSW Guidelines for Stream Management.

Frankenberg. J. (1994). "The use of vegetation for river bank stability". Murray-Darling Freshwater Research Centre, New South Wales. 139-144.

Goode, D. (1986). "The Murray-Darling Basin". Parkwatch No. 145. 22-27.

Hafner, C.L. and Brittingham, M.C. (1993). "Evaluation of a stream-bank fencing program in Pennsylvania". Wildlife Society Bulletin. Vol.21(3). 307-315.

Jawson, M.D., Elliott, L.F. Saxton, K.E. and Fortier, D.H. (1982). "The effect of cattle grazing on indicator bacteria in runoff from a Pacific northwest watershed". J. Environ. Qual. Vol 11, No.4. 621-627.

Kauffman, J. B. & Krueger, W. C. (1984). "Livestock Impacts on Riparian Ecosystems and Streamside Management Implications...A Review". Journal of Range Management 37(5). September. 430-439.

Kondinin Group (1994). Wires and Pliers. Ed Casey M

Larsen, R.E., Miner, J.R., Buckhouse, J.C. and Moore, J.A. (1994). "Water-quality benefits of having cattle manure deposited away from streams". Biosource Technology. 113-118.

Marlow, C.B., and Pogachik, T.M. (1985). "Time of Grazing and Cattle-Induced Damage to Streambanks". North American Riparian Conference. Riparian Ecosystems & their Management. 279-283.

Marwick, G. (1988). "Water requirements for sheep and cattle". Agfact A0.5.4. NSW Agriculture & Fisheries. Agdex 400/58.

Meehan, W.R. and Platts, W.S. 1978. "Livestock grazing and the aquatic environment". Journal of Soil and Water Conservation. November-December. 274-279.

Miner, J.R., Buckhouse, J.C. and Moore, J.A. (1992). "Will a water trough reduce the amount of time hay-fed livestock spend in the stream (and therefore improve water quality)?" Rangelands 14(1). February. 35-38.

Munks, S. (1995). "Report on a visit to Musselbrook, Sydney, Albury and Melbourne to discuss various aspects of riparian vegetation and its management". Department of Primary Industry and Fisheries, Tas.

Munks, S. (1996). "A Guide to Riparian Vegetation and its Management". Department of Primary Industry and Fisheries, Tas.

Myers, R. (1995). "Watercourse Revegetation Part 2 (a) Fencing. (Data sheet). Upper River Torrens Landcare Group.

Myers, R. (1995). "Watercourse Revegetation Part 2 (b) Floodgates". (Data sheet). Upper River Torrens Landcare Group.

Myers, R. (1995). "Watercourse Revegetation Part 2 (c) Electric Fencing". (Data sheet). Upper River Torrens Landcare Group.

Myers, R. (1995). "Watercourse Revegetation Part 1b : Structures for stabilising watercourses". (Data Sheet). Upper River Torrens Landcare Group.

Nicholas, S. and Mack, P. "(1996). "Farmer Attitudes to Riparian Area Protection: Fencing, watering systems & Management". Goulburn Valley Environment Group.

Nicholas, S. (1996). "Manage Your Banks : A practical guide to streamside management, fencing and water supplies". The Goulburn Valley Environment Group.

Nix, Prof. H., Hamblin, Dr A., Craik, W. and Long T. (1996). World Environment Day - State of the Nation. ABC-Radio Transcript. 5th June.

Odonnell, S. (1995). Preliminary Investigation into the Management of Riparian Rainforests in South-east Queensland.

Outhet, D. (1995). "Livestock Control Near Rivers : Ways of Keeping Livestock Out of River Beds and Off the Banks". Riverwise. Land & Water Conservation NSW Government. Agdex 572.

Owens, L.B., Edwards, W.M. and Van Keuren, R.W. (1996). "Sediment losses from a pastured watershed before and after stream fencing". Journal of soil and water conservation 51(1) 90-94.

Parlevliet, G.J. (1983). Water Quality for Stock. Quantity Pollution Algae Salt. Western Australian Department of Agriculture.

Platt, S. and Temby, I. (1994). "Fencing for Wildlife". Trees & Natural Resources. June. 6-11.

Platts, W. S. (1981). "Effect of Sheep Grazing on a Riparian-Stream Environment". USA Dept of Agriculture Research Note INT-307. March. 1-6

Platts, W.S. and Rinne, J.N. (1985). "Riparian and Stream Enhancement Management and Research in the Rocky Mountains". North American Journal of Fisheries Management. Vol.5. No. 2A. 115-125.

Platts, W.S. and Wagstaff, F.J. (1984). "Fencing to control Livestock Grazing on Riparian Habits Along Streams: Is it a Viable Alternative?". North American Journal of Fisheries Management 4. 266-272.

Popolizio,C.A., Goetz, H. and Chapman, P.L. (1994). "Short-term response of riparian vegetation to 4 grazing treatments". Journal of Range Management 47(1). January. 48-53.

Quigley, T.M., Sanderson, H.R., Tiedemann, A.R. and McInnis, M.L. (1990). "Livestock Control with Electrical and Audio Stimulation". Rangelands 12(3) June. 152-155.

Rauzi, F. and Hanson, C.L. (1966). "Water Intake and Runoff as Affected by Intensity of Grazing". Journal of Ranges Management Vol 19 351-356.

Rowe, P.B. (1963). "Streamflow Increases after removing woodland-riparian vegetation from a southern California watershed". Journal of Forestry V61. 365-370.

Schur, B. (1992). "Management Reports: Ribbons of green and blue - A model for how local Governments can support catchment-based riverbank fencing and regeneration programs in Western Australia". Land and Water Research News, No.13. 28-31.

Sherer, B.M., Miner, J.R., Moore, J.A. and Buckhouse, J.C. 1988. "Re-suspending Organisms from a Rangeland Stream Bottom". Transactions of the ASAE. Vol 31(4) July-August.

Sherer, B.M., Miner, J.R., Moore, J.A. and Buckhouse J.C. (1992). "Indicator Bacterial Survival in Stream Sediments". J. Environ. Qual. 21:591-595.

Simpson, I. (1992) "Property and Grazing Management". Rangeland Management in Western New South Wales. NSW Agriculture. Chap.6. 40-53.

Spilchen, E. (1992). "Bacteria in Farm Dugout Water". Prairie Water News. Vol.2. No.1. pg6.

Trimble. S.W. (1994). "Erosional Effects of Cattle on Streambanks in Tennessee, USA". Earth Surface Processes and Landforms, Vol 19. 451-464.

Willms, D., Kenzie, O., Mir, Z. and Quinton, D. (1995). "Effects of water supplied from old dugouts on the performance of cattle". Fifth International Rangeland Congress (Salt Lake City, Utah, July 23-28).

Willms, Dr. W. D. (1994-1995). "Water quality factors affecting livestock performance with emphasis on the role of Giardia & Cryptosporidium". Alberta Cattle Commission Pre-Proposal.

Willms, W.D. 1989. "Distribution of cattle on slope without water restrictions". Can. J. Anim. Sci. 70: 1-8. March.