Notes: Damn farm dams – the investment decision!

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- How much to invest in farm water supply? What to invest in?
- Not everything you can count counts, not everything that counts can be counted.
- **Farm benefit cost evaluation involves the same thinking** for every case, but there will be different answers for every case as every farm situation is unique: topography, system, farmer, goals.

Cost and Benefit Evaluation (not about $ (though use $ where we can), but about all benefits and all costs that are caused through the farm system of whatever nature)

Criteria is most likely (high probability) return on extra capital invested (has to be higher than alternative) plus considering what the non-monetary benefits and costs may be

Costs

Costs are straight-forward usually, usually $ terms captures most (but not all) of them

Getting size of the investment (dam) right can be tricky. Right size refers to the size that gets enough use of/output from the capital to earn a profit and delivers the required water in an apt range of rainfall years.

Extra Capital cost

- Annual depreciation of the capital investment
- Annual profit foregone from using the capital in this way instead of another

Extra Operating Costs

- Annual maintenance/operating cost of the capital investment, management

Benefits of Dam Investment

Some measurable and can be valued in $ terms

Some unmeasurable and cannot be valued in $ terms

In this case possible benefits include:

- Increased production and income from livestock using better quality water (the extra production comes from extra output such as liveweight which can come from increased consumption of feed as a result of cleaner water plus improved health or less animal ill-health as a result of healthier water/less unhealthy water.
- Saving of some dam renovations/cleanings that would otherwise be needed over its life
- Convenience? Biodiversity? Carbon? Management?
- Aesthetics contributing to value of the property

Thresh-hold Approach: Benefits are hard to be sure about, so how big would the benefits of all types need to be to justify the investment and how likely is it that the benefits will be big enough?

The Without/With Comparison

Define scope of system affected by the investment-e.g. dam will service 40ha of pasture, or dam with troughs will service 400 ha, 10 paddocks, 10 troughs etc.

Take simplest e.g. dam investment to serve 40ha pasture.

Count all extra costs attributable to the change –

e.g. $20k investment, 40 year life, extra depreciation is $20k capital, 40 years life 20% value at end, annual depreciation is ($20k-$4k)/40=$400 annual depreciation (would do for separate items with different lives)

Extra capital cost-this is the profit foregone from the capital in this use instead of another, e.g 10% (real) elsewhere on farm into pasture improvement. Based on average capital invested ($20k+$4k)/2=$12k*0.1=$1200

Depreciation and opportunity cost = $400+$1200=$1600

Plus annual maintenance and operating (if no troughs, pumps etc in this e.g., so this would be low), say $500

Equals extra costs $2100

Extra Benefits – all extra benefits from part of farm system affected by the change

- Hard to be sure of benefits. So how big would all of them need to be?
- Need to be equal to all costs including covering the opportunity cost of 10%, i.e. in this case, need benefits of $2100/year (costs are $2100 including required profit)
- Where might this required $2100 (to get the 10% RoC and cover other costs), off the 40 ha area affected, come from?

Some evidence animals on cleaner water put on some more liveweight.

Definitely reduced dam cleaning/renovation needed

Maybe some animal health gains?

Take simplest e.g.-dam to serve 40ha pasture.

Can estimate reduced dam cleaning, say avoid a couple of these over life of investment, if $6000 down the track say half in years 15 and 30. This is same value as $2k in todays dollar values, divided by 40 years, comes to $150/yr benefit.

Lets set that aside and see how the livestock production side of things can help.

Livestock production gains

- Common observations that livestock do better on clean water – not much reliable measurement, but idea passes tests of common sense. But, how much better? Enough to justify the investment to deliver clean water, which can get big once troughing and pumping comes into it?
- It does often, as it is done, but it depends on each case.

First, depends on the system – is a system of small grazing areas the key to high reproduction performance/high pasture dry matter production and utilization/high animal output? – Or, is a system extensive, low stocking rate, low pasture dry matter consumption/ha etc.

So start with the system the investment in water is to fit into.

Then see where you might plausibly find the required benefits needed to justify the investment –in this case an extra $2050 p.a. net benefit from 40 ha of pasture feeding livestock.

Simple Example-simple livestock system, only benefits is in extra liveweight from extra feed (from healthier animals consuming more)

Growing out beef weaners from 250kg at 7 months to 400kg at about 12 months.

Some research claims ’10% increase in production of liveweight by steers as a result of clean water’.

But- there are **no free lunches** (unless animals converting same quantity of feed into more liveweight). The extra LW comes from extra feed which comes from somewhere – do other animals get less? Pasture responds to keener more intensive grazing- maybe from animals with keener appetites following clean water?

Pasture-animal complex is a dynamic. The pasture =f(SR), SR= f(pasture).

If increased liveweight is not free…..

Need extra $2100 from 40ha carrying 12 DSE/ha. DSE is 300kg pasture DM, 3000MJ ME. 12 DSE/ha is 3600kg pasture DM consumed/ha, 10 MJ ME per kg DM.

Liveweight produced is worth say $2.50/kg lw (back to reality).

Therefore need an extra nearly 800kg extra Lw to cover the extra cost and required extra benefit of around $2000 from the 40 ha.

Current system feeding 40ha *12DSE and a growing out steer averages 9 DSE over their time, so could produce for sale LW from 1.3steers/ha*40=52 400kg steers equalling 2080 kg lw from the 40 ha.

We now need to find another $2000 as the benefits of the dam investment. This would be 800 extra kg lw income at $2.50/kg/lw.

If the pasture is delivering 12 DSE/ha, even then some paddocks could be lifted above this with the right soils and rainfall zone and paddock sizes and management.

Lets assume there is no free lunch, the current system is producing, and having consumed, as much pasture dry matter as it is able to, given the state of the pasture, soils, topography, and the grazing management, and so the extra liveweight animals we want the animals to put on as a result of having clean water has to come from extra feed supplied.

An indicator of the cost of acquiring extra feed is what farmers will pay for agistment, or standing hay or conserved forage or concentrates – or= how much they invest to lift the carrying capacity (e.g. $4-500/ha, lift it from 7-8 DSE to 14-16 DSE, lasts 8-10 years).

- We need to find an extra $2000 net income, which is an extra 800 kg lw from the animals, and the extra lw will require about an average of near 10kg DM to make a kg lw (av. Over whole is 7 kg DM/kgLW, but these last kgs need more DM than the average DM hitherto.)
- So we need 800*10=8000 extra kgs DM consumed to add the extra 800 kg LW required. If purchased extra DM by pasture investment (valued at agistment rate or standing hay etc) at $100/t (after waste) or 10c/kg DM consumed this costs $800.
- We now have to cover the extra capital costs of the dam **and** the extra costs of enabling the animals to benefit from having the cleaner water.
- If we add were to add an extra **1333 kg lw** by increasing the feed supply off the 40 ha, this would cover the cost of supplying the extra feed and the cost of the dam by adding a net benefit of $2000.
- The investment would pass the test of earning 10% RoC.
- Note: only thinking about the direct pecuniary benefits here – often many benefits (for some if not all dams on farm) are real but not directly financial, e.g. aesthetics, biodiversity
- Note-risk and uncertainty about all these numbers and expectations is another part of the story which has to also be assessed!
- The way of thinking is what matters most here.

Morals of the story

1/ Investing in improving the quality of the water supply has a number of benefits, only some of which are monetary.

2/When incurring extra costs and investing in a part of a farm system and by doing so increasing the production potential of that part of the system, we have to also lift the productive potential of the directly related parts of the system, so that the added productive potential created by the investment is realized and become actual benefits that cover the actual costs and are thus profitable investments.