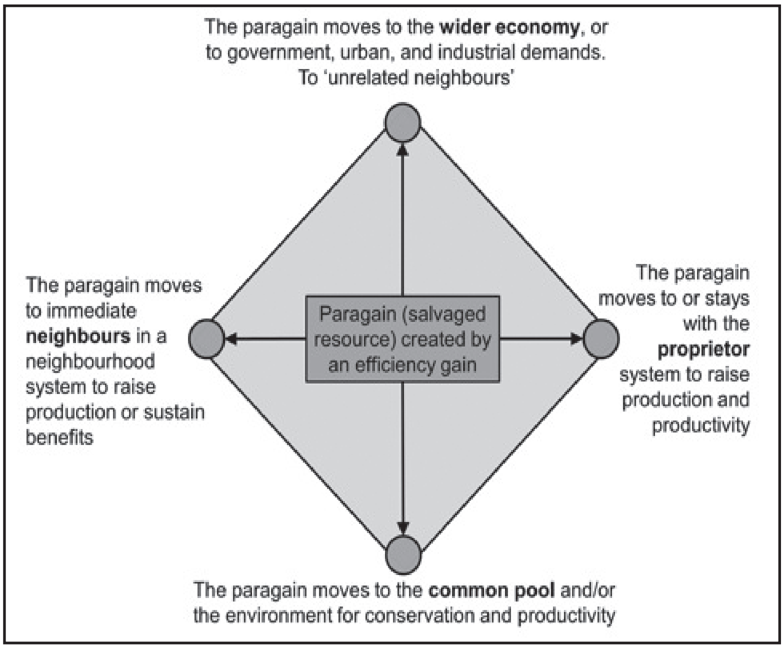
The Paracommons of Salvaged Water

Bruce Lankford explores the surprisingly complex question of what happens to the water 'saved' by changes in irrigation practices.

In a resource-scarce world, society is increasingly interested in how to get more from less. Efficient use of natural resources, especially water, underpins the idea of a green economy, and the combination of burgeoning demand and increasing variability of water supply (due to climate change) has brought a major new emphasis on efficiency.[1] Yet the promise of efficiency hides significant challenges, and also opportunities for current resource users to further entrench a disproportionate consumption of resources.

More efficient resource use implies tangible savings. For example, farmers who consume less water per hectare this year than last, while producing the same yield, are improving their 'water efficiency'. In principle, this allows more of the resource (water) to be saved for other purposes. But what does this mean in practice - who actually benefits from the 'saved' resource?



This question of competition over future resources newly 'freed up' by efficiency gains can be examined using the concept of paracommons, to describe the salvaged resources arising from such future changes. While competition over existing natural resources (such as fish now in seas or trees now in forests) can be discussed within the well-explored conceptual framework of the commons, the paracommons covers competition over yet-to-be-conserved resources arising from future increases in consumption efficiency.[2]

The prefix 'para' (as in 'parallel') indicates firstly that the paracommons stems from and sits alongside the commons. 'Para' also implies an abstraction (as in paraphysical), where the paracommons describes a competition over resources not yet freed up, so not fully available. However, 'para' can also mean 'against', as in 'paradox' (para = against, doxa = belief). Paradox is in fact central to the theme of efficiency, because without careful planning and forethought, the material gains arising from increased efficiency may not end up where we expect or intend. Under many circumstances, such material savings will not 'return to nature' and therefore, paradoxically, will not reduce natural resource consumption.

A version of this paradox was described in the 19th century by William Jevons, but while the Jevons paradox is shaped primarily by price and economics, the paracommons of natural resources are more affected by material resource cascades and consumption pathways.[3]

Montana vs Wyoming: paragains

The question over who gets the benefit from an efficiency gain was considered in 2011 by the US Supreme Court, following a dispute between the states of Montana and Wyoming. The Court backed Wyoming's defence that their prior appropriation water law (see also pp28-29) enabled them to use the water freed up by introducing more efficient sprinkler irrigation systems. The previously 'inefficient' flood technology had spilled drainage water which downstream neighbouring Montana had become accustomed to. Contrary to what might have been expected, more efficient irrigation systems upstream in Wyoming did not provide more water to downstream Montana. Paradoxically, it resulted in less water flowing to Montana, because Wyoming used the freed-up gain to expand the area under cultivation, resulting in more crops grown in Wyoming but also more water lost to the atmosphere through evaporation.

This case illustrates that as shown above, there are four parties or destinations competing for 'paragains' (meaning material but uncertain efficiency gains):

(i) the proprietor making the efficiency gain (e.g. an irrigation scheme);
(ii) immediately connected neighbours (e.g. farmers or villagers using drainage water from the irrigation scheme);
(iii) the common pool (the river system); and,
(iv) the wider economy (other users such as industry).

In the Montana/Wyoming case, these respectively correlate to;

i) Wyoming irrigators;
(ii) Montana irrigators;
(iii) the Yellowstone river system; and
(iv) other economic sectors in both Montana and Wyoming, or further downstream in the Missouri River system.

Competition over resources takes place between these four parties, and many factors affect the destination of the resources as they cascade through the overall system, including not only changing practices and technologies, but also shifting perceptions about efficiency, waste and ownership. Moreover unlike more traditional commons, it is not always easy for the four parties or their representatives to communicate or negotiate easily and effectively, since the relevant communities are harder to identify.

Gravity irrigation of rice in Pakistan may appear inefficient, but the surface runoff is recaptured and used by neighbouring farmers.

Furthermore society's ability to track resource quantities and gains is limited by the complexity of understanding and monitoring resource consumption at different locations, scales and times. Clearly though, the key reason that material gains tend not to flow back to nature is because proprietors and/or neighbours appropriate the 'new' resources, often backed by legal frameworks ill-suited to dealing with fast-moving and pressing concerns.

California: spare water?

Proper consideration of paracommons and paragains is needed if resource efficiency science is to move away from the competing binary claims "resources are always freed up by efficiency gains" versus "no resources are freed up by efficiency gains".

These two camps have their respective protagonists, as seen in a recent heated debate in which one party, led by the Pacific Institute claimed that "a million acre feet" of "spare water" for California could be found in currently inefficient irrigation systems. An alternative view was that no such 'spare' water existed, as it was already being recycled via nature through aquifers and drainage lines. The difficulty of agreeing on a middle ground in this debate is explained by the great complexity of the science, study and management of irrigation efficiency.[4] Again, this example shows that how simplistic is the expectation that spare water for future allocation exists within inefficient use, provided it can be 'freed-up'.

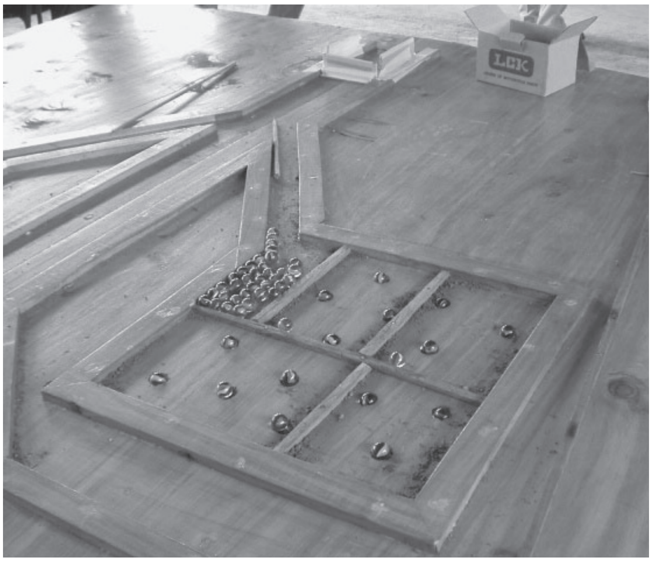
Spain: Irrigation, efficiency and complexity

During the 2000's, Spain spent approximately seven billion euros on an irrigation efficiency improvement programme which aimed to help farmers replace open surface/canal systems of water distribution with 'more efficient' drip irrigation systems using pipes and emitters. Looking back on this programme reveals the complexity of raising irrigation efficiency over large areas: a review showed that *no water savings* could be satisfactorily claimed to any level of detail or validity. Sadly this highlights the all-too-common gaps in knowledge of both the starting point (or baseline), and the actual outcomes of an efficiency programme.[5]

One can ask why engineers in Spain did not put in place systems to record efficiency 'before and after'. The exact answer may never be known, but it seems clear that a key role was played by the narrative widely assumed by many engineers and social commentators, that gravity irrigation systems are very inefficient, and that drip systems are very efficient. Therefore the programme was 'bound' to raise efficiency and free up water to sustain environmental river flows or to be put to other uses.

The problem with this efficiency narrative is that it misses out three critical factors. First, accurate measures of efficiency of whole irrigation systems in every-day use are rarely conducted. Second, the seepage under the old gravity system presumably found its way back into the river systems via groundwater, allowing us to classify the original losses as non-consumptive. The third factor is that drip irrigation can allow the area under irrigation to expand, in effect exchanging non-consumptive losses for consumption in the form of evapotranspiration. Thus in this instance, Spain cannot know who precisely 'gained' the efficiency gains. Most likely it was a mix of farmers expanding their irrigated areas, plus some additional flows to the environment and to the wider economy.

A Serious Game of Marbles



Bruce Lankford's innovative River Basin Game, with marbles to represent water, is used to encourage upstream and downstream users to collaborate on water management at a catchment level. Details are on his website at http://brucelankford.org.uk/research/natural-resource-gaming/. Watch the game being played at www.youtube.com/watch?v=fjFa_NEXVlc.

The picture on the left shows lax water management in a rice nursery on a mechanised farm at the top end of the Kapunga river system in Tanzania, showing non-beneficial evaporation from weeds and open water. On the right, careful water management in a smallholder's rice nursery at the tail end of the same river system, with straw mulch covering the rice seedlings, and no excess open water.

Ways Forward: Partnership

In summary, policies and technologies creating more efficient systems may result in unexpected outcomes. 'Savings' arising from ending inefficient resource use are complex and provisional, and become a matter of common-pool competition between stakeholders found in four different types of destinations.

The paracommons concept provides a clear way of signalling to society that many hidden and complex factors allow new patterns of resource consumption introduced under in the name of efficiency to paradoxically increase our footprint on the world's resources. Resources *can* be found from savings and efficiency gains: but their size, timing, character and destination depend on many context-specific factors, such as technology, terminology, water rights, and measurement.

Reducing the impact of an irrigation system on its hydrological environs, or at a larger scale, improving the efficiency of a country's irrigation sector, is extremely difficult. This can be explained in part by an inability to partner with farmers and other resource users to solve either national-level concerns regarding food production, or local-level concerns regarding 'top-tail' water sharing.[6]

An acknowledgement that irrigation efficiency and productivity are by-products emerging from multiple factors managed by farmers, rather than being inanimate design features, would dramatically change the relationship between irrigators, ministry engineers and other actors – in effect making them servants of irrigators, rather than vice versa.

It is only through a partnering approach, informed by much better studies, that efficiency gains will firstly be made achievable and measurable, and secondly directed to previously identified destinations such as environmental flows.

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REFERENCES

1. See eg Horizon 2020 (2014). *Societal Challenge 5: Climate action, environment, resource efficiency and raw materials*. Orientation Paper.

2. Lankford, BA (2013). *Resource Efficiency Complexity and the Commons: The Paracommons and Paradoxes of Natural Resource Losses, Wastes and Wastages* Routledge

3. See *The Land* issue 8: www.thelandmagazine.org.uk./articles/myth-resource-efficiency

4. Frederiksen, H. D., Allen, R. G., Burt, C. M. and Perry, C. (2012) Responses to Gleick et al. (2011) 'Water-Use Efficiency and Productivity: Rethinking the Basin Approach,' Water International, vol 36, no 7, pp784–798, which was itself a response to Frederiksen and Allen (2011). Water International, vol 37, no 2, pp183-197

5. Lopez-Gunn, E. Zorrilla, P. Prieto, F. and Llamas, R. (2012) 'Lost in translation? Water efficiency in Spanish agriculture', Agricultural Water Management, vol 108, pp83-95

6. Boelens, R. and Vos, J. (2012) 'The danger of naturalizing water policy concepts: Water productivity and efficiency discourses from field irrigation to virtual water trade', Agricultural Water Management, vol 108, pp16-26 ; Lopez-Gunn et al 2012, as note 5 above.