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Key Principles and Steps in Catchment Repair in Arid Rangelands

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These notes were prepared for attendants of an EMU catchment ecology and restoration workshop held in Alice Springs in April 2007 and hosted by Centralian Land Management Association, funded by the National Landcare Programme. The notes were prepared after the workshop in response to HP's perception that there seems to be a culture of restoration based on "what should we do here?" , rather than stepping back and assessing where the bang for the buck will be to fix the big picture problems.

We present here a checklist of key activities and associated principles to help guide those planning and implementing repair of water flows and longer lasting positive soil moisture balances arid rangelands. We emphasise the word "repair", rather than "restore" in recognition that complete restoration to pre-disturbance functioning may not be possible, but something much better than current degraded states is usually possible.

We also emphasise the necessity to undertake thorough investigation, assessment and planning before deciding on any course of action. In other words, we stress the importance of starting with thorough investigation and being led by a plan, rather than by particular tools (e.g. ponding banks or scrub filters).

Where, what, and why does a particular area(s) require repair?
It is very important that any repair project has clear objectives and activities planned as a guiding strategy in terms of e.g. location, type of intervention or whether a site could likely self-repair if protected by exclosure.

1. Gather whatever air photos and satellite images are accessible and use them to plan a flight over the area of interest and its surrounds. Use the air photos and satellite images with subsequent observations and digital photos taken during low-level flying (100 to 200m above ground level) to choose where to visit on the ground as a groundtruthing exercise.
2. Consider all the information gathered in point 1 above and synthesise it, preferably in a small group. Record your assessments of key features on a clear overlay over a satellite image or contour map showing infrastructure of the area (preferably have a land system map with infrastructure and satellite image at the same scale so they can be used interchangeably.
3. In what part of the catchment is the area to be recovered; headwaters, middle, lower, coastal (or salt lakes). Is this area the main catchment or a tributary to a bigger system?
4. Locate and map drainage bottlenecks (including at the keyline), channel junctions and rock bars.

5. Map gully heads and major rill heads. These active features are critical points to be stabilised first in any repair project as they are migrating upslope with every rainfall event making the situation worse and more difficult to repair.
6. If a floodplain, floodout, pan or lake is involved, has it become perched above effective flooding/recharge except in exceptional rainfall events?
7. Have these run-on/into surfaces changed from a grassland/sedgeland into (or towards) scrubland? Identify the indicators of a drying change (e.g. *Acacia tetragonophylla* and other acacias).
8. Determine base-levels at drainage key points ("critical control points") to be stabilised and repaired (restored if feasible) that will allow a return to "normal" or "usual" flood levels and frequency to inundate run-on/into areas effectively. For example, these key points may be a sill around a pan, a gully head stripping a floodout or a breached rock bar in a major channel.
9. Identify the floodout and exit points of floodwaters onto and out of the flooded area.
10. Map or sketch the landscape pattern (aerial view) and site cross-sections. Identify for example, depth of channel incision as demonstrated by exposed roots, position of river pools (e.g. behind rock bars or on outer curve of a bend in the river channel), condition and impacts of threats (e.g. gully head breaching or excessive damage from stock breaking down banks and consequent silting up.
11. When a whole drainage unit is to be addressed, at any dimension or scale, *always* start at the head or source of that unit and work downstream from there to the next tributary junction or drainage bottleneck, where transverse (across-flow) water-ponding and slowing structures can most effectively be positioned (e.g. "sausage roll" of wire mesh or crushed rock and geotextile structure).
12. Of critical importance is that valley-side tributaries can flood run-on/into areas frequently from relatively light rainfall events, whereas main river or creek floods, when deeply incised, will only floodout with the infrequent, major rainfall events. Thus, for more frequent flooding, valley-side tributaries are of paramount importance.
13. Assess and map infrastructure impacts: positions of tracks, roads, fencelines and artificial watering points in relation to area being repaired.
14. All road/track/pad/fenceline "rivers" to be redirected to their original drainage pattern. Establish bunds across the eroding "rivers" and help restore natural flows in-between (e.g. floodways).
15. Take before and after fixed point photographs as a minimum of monitoring.

There is quite a bit of background investigation, assessment and overlay mapping to be done!

But now (and NOT before), you are ready to open the toolbox of repair options and start planning what to do where.