Natural Sequence Farming (NSF)

by Peter Andrews, David Goldney et al.,*

Natural Sequence Farming is a holistic land management process initially developed by Peter Andrews in the 1970s at Tarwyn Park, Bylong, in the Upper Hunter catchment of New South Wales. NSF specifically addresses land degradation and biodiversity losses in riparian systems and their disconnected floodplains and valley slopes. It does this primarily by restoring the hydrological functions once associated with the 'chain of ponds – swampy meadow complexes', landscape features almost completely destroyed by European land use changes.

NSF can be viewed as a circuit breaker that enables the inherent energy and biological potential still present in the landscape to be harnessed. The implementation of NSF facilitates the relatively rapid crossing of seemingly irreversible ecological thresholds thereby enabling the jump-starting of the pre-existing and natural self-repair mechanisms needed to address degraded systems.

Water-flow, the watertable, alluvial deposition (i.e. active erosion), plant succession and production are harnessed and manipulated in a sequence of relatively simple actions (Natural Sequence Farming) to:

- Recreate a functional floodplain that drives high levels of productivity (i.e. useable and accessible farm biomass);
- Address and cost-effectively repair land degradation within valley floors (e.g. soil erosion, bank collapse, gully formation, floodplain stripping, saline leakage, saline scalds etc.);
- Functionally reconnect the hydrology of drainage lines, creeks and rivers with their adjacent floodplains;
- Enable the underground storage of significant volumes of water along the floodplain thereby allowing plant production to continue during drought conditions (i.e. drought-proofing);
- Ameliorate deleterious energy fluxes;
- Improve nutrient fluxes between the riparian zone and the floodplain; facilitate nutrient retention and cycling thereby minimising nutrient losses from the system; and
- Create landforms that functionally mimic pre-European 'chain of ponds-swampy meadows' complexes once prevalent in valley systems.

The implementation of NSF whole of landscape principles are deceptively simple and, to some extent, counter-intuitive and takes place in five steps. These are:

- Re-conceptualising how pre-European Australian valley systems operated based primarily on an understanding of whole of valley pool-riffle effects and the chain of ponds – swampy meadow complex;
- Physically intervening in the floodplain to create:

  (1) Appropriate small scale, leaky structures in the stream bed to slow down water flow and to facilitate water recharge in the floodplain, thereby mimicking the 'dam structures' created by perennial swamp plants such as sedges, rushes, cumbungi and phragmites in the pre-European 'chain of ponds-swampy meadows complexes';

  (2) One or more additional stream paths over the floodplain running approximately parallel with and within the valley floor to simulate pre-European multi-channelled floodplains, thereby enabling water to be redistributed across the floodplain to the 'break of slope' of the valley floor, and thereby raising the water table across the whole of the valley floor (Yes raising the water table!);

- Harnessing natural freshes or flooding (minor or major) to initiate the processes of sedimentation and plant succession across the floodplain, above and below the leaky structure(s);
- Adaptively managing the process to achieve the stated goals, and to fine-tune structures, assess sediment build up and biomass production, check piezometer levels where appropriate to assess the volume and dynamics of stored water in the floodplain, check salinity levels where appropriate, manipulate vegetation, promote plant succession through animal influences and impact as well as targeted replanting and/or removal); and
- Harvesting productivity through cropping, haymaking, grazing and encouraging appropriate wildlife, the latter two activities facilitating nutrient reallocation across the valley from riparian zone to valley tops.

Once understood, the underlying principles and the implementation of NSF, whilst very simple to understand and cost effective to introduce, could, if implemented without the appropriate knowledge and training, lead to unwanted outcomes and the exacerbation of land degradation. Furthermore because the NSF process harnesses and manipulates water in the riparian zone there are legal and statutory obligations that may need to be met.

In the presentation, we will also outline the claims that are made about the benefits of adopting NSF, the science and credibility underlying NSF principles and practice, the transferability of the process across the Australian landscape, and briefly describe four case histories where NSF has been implemented.

References

Eyles, R.J. (1977) Changes in drainage networks since 1820. *Australian Geographer,* **13**, 377-387.

Brierley, G.J., Coehn, T., Fryirs, K. and Brooks, A. (1999) Post-European changes to the fluvial geomorphology of Bega catchment, Australia: implications for river ecology. *Freshwater Biology* **41**, 839-848.

CSIRO Land and Water (2002) *Expert Panel Report: The 'Natural Farming Sequence', Tarwyn Park, Upper Bylong Valley, New South Wales.* Report prepared for the Hon. John Anderson MP, Deputy Prime Minister of Australia and Minister for Transport and Regional Services.

Mactaggart, B.G., Bauer, J.J., Goldney, D. & Rawson, A. (2006) 'Problems in naming and defining the swampy meadow - An Australia perspective', (*under revision Journal of Environmental Management*)

Windsor, D., Goldney, D., Rawson, A. and Bloomfield, A. (2004). Understanding geomorphic processes in the Upper Macquarie Catchment as a basis for riparian restoration. Pp 37- 67 *In* Ecological status and restoration of degraded riparian zones in the Upper Macquarie River Catchment. Ed. by Donna Windsor, Chris Bloomfield and David Goldney. University of Sydney, Orange Campus. (Out of print).

Note:

The substantive NSF paper, subject to review, is likely to be published in the *Journal of Ecological Management and Restoration* in the first quarter 2007.

*Peter Andrews[1] David Goldney[2, 3], David Mitchell[3], Paul Newell[4], John Williams[5] and Barb Mactaggart[2, 3] are the co-authors of this paper.

[1] Baramul Stud, [2] University of Sydney, [3]Charles Sturt University, [4]Meadlowland Stud, [5] NSW Natural Resources Commissioner