Efficient Farming Program

By Trevor Parker

Background

The efficient farming program is a combination of the intensive mapping and the farm management support projects. It has been built through the on-going development of the intensive mapping and the farm management support programs which has been delivering regionally for over 5 years. The efficient farming program recognises that growers need to be more efficient as production costs are continually rising and profit margins are diminishing. An efficient farm has both production and natural resource management (NRM) outcomes.

Fortunately a monitoring component is funded in the efficient farming program which has allowed the continuation of earlier work of environmental accounts for the Mareeba-Dimbulah Water Supply Area (MDWSA). This was initiated in 2011 by NGRMG and implemented by Niilo Gobius, Kristjan Sorensen and Trevor Parker.

Aims:

1. To promote and encourage the implementation of sustainable land management practices
2. Monitor the soil and water health of the Mareeba-Dimbulah Water Supply Area (MDWSA).

Philosophy of the program

An efficient farm is a more sustainable and profitable farm. A profitable farm provides a means for a healthier community and environment. A more efficient farm delivers both NRM and production outcomes. Being more efficient means better use of our resources whether it is soil, energy, water or nutrients.

How is it delivered?

The delivery of sustainable land management practices in this program is through a carrot not a stick approach. NGRMG employ a one-on-one extension, mentoring and training approach to skill up local people to move growers to more sustainable land management practices. NGRMG provide production reasons to be more efficient and hence more sustainable.
What is delivered?

The following is delivered to 10 farming enterprises per year in the MDWSA:

1. Detailed property mapping and spatial information and technology support

   The property mapping services provides essential information for farm planning and management. The property mapping has become the backbone for NRM, regenerative and sustainability work in the MDWSA. Growers, state government and agro-consultants are finding NGRMGs mapping products such as the infrastructure, topographic and ground conductivity mapping essential for NRM. Growers, state government and agro-consultants are using the mapping products for various farm activities such as irrigation management, fertiliser management, research and erosion and sediment control.

   The following mapping products are delivered as part of the efficient farming program:

   i. Farm infrastructure maps. Using on-ground GPS survey and aerial photography, farm layout maps are created using GIS.

   ii. Topographic maps. Using a RTK GPS system detailed topographic surveys are conducted to produce detailed topographic maps and topological mapping products.

   iii. Land variability maps. Using a dual dipole EM38 and a RTK GPS system, an EC conductivity map is created. A detailed soil survey is conducted and various maps are then created such as soil texture, pH, sodicity and variable rate maps.

   iv. Land management practices. Detailed land management practices are captured during mapping surveys and stored in a geodatabase.

   v. Soil maps are supplied to growers using the current best available 25K and/or 8K soil mapping.
Map above: Ground conductivity survey detailing soil variation. These maps are being used as best practice for evaluating soil variability for experimental research sites, detailed soil maps and variable rate maps.

2. Nutrient management & Soil health

For both production and NRM outcomes nutrient management must be compatible with soil type, soil fertility and the irrigation system. Through one-on-one extension the nutrient management planning delivers the following:

- accurate existing fertilizer and crop protection practices
- soil nutrient status, both total and soluble
- assessment of plant nutrient uptake via leaf samples
- Consultation with grower regarding nutrient delivery techniques, soil type and nutrient cycles
• Provide and explain results and nutrient budget report to grower.

The importance and role of soil health and soil fertility is also covered through workshops and one-on-one extension.

Above: David Hardwick (soil ecologist) explains the importance of soil health and the role microbes play for nutrient cycling during the Soil health forum held in Walkamin April 2014.

3. On-farm leachate, water quality and soil moisture monitoring

Knowledge of soil moisture levels, irrigation water quality and nutrient movements are essential for NRM and to maximise crop potential. The leachate and soil moisture monitoring in the program provides this information to program participants. The results help the growers to improve nutrient management, soil health, water management and irrigation scheduling. As an incentive to growers irrigation costs can be significantly diluted through improved irrigation scheduling. Improved irrigation management has both production and NRM outcomes.
Above: Leachate and soil moisture monitoring site for improved soil health, water quality and irrigation and fertigation management. Shown is G-dot water moisture monitoring probe (front left), soil spec leachate monitoring tube (front right) and (centre background) fullstop irrigation indicator. G-dot is showing 6 green dots which is one dot less of a fully wet soil at 30 cm.

Above: Graph showing pH for irrigation and soil water quality as part of leachate and water quality monitoring results. Soil spec (red line) shows pH of soil water at 50cm depth and fullstop (green line) is pH of soil water a 30cm depth.
4. **Integrated pest management**

Management of pest and weeds through Integrated Pest management (IPM) is ideal to maintain the balance of good and bad insects. NGRMG are providing advice and workshops to farmers on the best way to deal with pests and weeds, ensuring chemicals are used wisely.

5. **Targeted grants**

As part of the program a $5000 grant is provided to growers for farm improvements that have NRM outcomes. This year the grant has largely been paid out on improving irrigation system efficiency. Some examples are:

- Irrigation system upgrades
- Digital weather station
- Solar pump
- More efficient pumps
- Soil moisture probes

Above: Purchased courtesy of the $5000 grant, this weather station provides essential local data for evapotranspiration, temperature and rainfall to hone irrigation scheduling practices for a Mango and Avocado farm

6. **Irrigation scheduling**

Irrigation costs can be significantly diluted through improved irrigation scheduling. Also ensuring the crop gets the right amount of water at the right time according to soil type ensures water and nutrient losses to the environment are minimised. Pat Daley is contracted to train growers through one-on-one extension to use irrigation scheduling tools and to calculate daily crop water requirements.
Above: Graph output from University of Southern Queensland’s Scheduling Irrigation Diary detailing irrigation and rainfall for crop growing period. This aides the grower with their irrigation scheduling, helping get the right amount of water on the crop minimising waste and losses.

7. Irrigation system assessments

Essential to any sustainability or NRM assessment of irrigated farmland is irrigation system assessments. NGRMG contracts Pat Daley from DWS Irrigation Pty. Ltd to conduct the following: pump and mainline irrigation system assessments, integrated nutrient injection system assessments, hydraulic analysis from pump to irrigation systems, soil infiltration tests (where necessary), pump and irrigation system performance and efficiency tests, and farmers provided consultation and one-on-one mentoring to implement changes from the assessments.
Above: Pat Daley talking irrigation efficiency with local grower during one-on-one extension for irrigation system assessments.

The following was delivered regionally:

1. Monitoring water quality and soil health

The Mareeba-Dimbula irrigation area (MDIA) within the Northern Gulf region is subject to a wide variety of present and historical land-use pressures, including intensive agriculture with significant irrigation, cattle grazing, abandoned mining, and urban and industrial waste assimilation. As a result of this, there is an increasing concern within the community about the health of the waterways that drain these lands. The Walsh River catchment, a major sub-catchment of the Mitchell River has been extensively altered, particularly as a result of intensive agricultural practices within the region. This once ephemeral stream now flows continuously due to its use to supply water from Tinaroo Dam to feed the regions irrigation. Local tributaries such as Cattle Creek have a high public profile due to concerns about salinity and agricultural pollutants, and the long term impact this may have on the sustainability of the region. The Northern Gulf Resource Management Group is currently undertaking a soil and water monitoring program within the region to determine the current health status of the streams and surrounding environment within the catchment.

Water quality monitoring is being performed using multi-parameter continuous data loggers which are strategically placed to coincide with identified input pressures in the catchment. Certain locations inside the headwaters of the Mitchell River are also being targeted. This data is also supported by on-the-spot recordings of water quality using hand held devices which is collected on a weekly basis.
This monitoring program continues on from previous work conducted over the past few years and is attempting to fill gaps identified in the previous research. In the past, water quality samples were analysed at specific locations using hand-held portable devices that provided a snapshot of conditions at that particular point in time. Although a valuable indication, this did not account for monthly, weekly or even daily fluctuations that can and do occur within such an intensively modified river system. This year has seen the introduction of in-situ continuous water quality loggers to record conditions every fifteen minutes over a weekly period. There are three loggers being used concurrently to record indicators of water quality which are relocated on a weekly rotation over nine sites. The combined effort will provide information on key environmental parameters such as, electrical conductivity (a measure of salinity), turbidity, nitrate concentration, pH, dissolved oxygen, temperature and oxidative potential. On-the-spot sampling is also being conducted to test for heavy metal contamination from lead, mercury, and copper.

Reference conditions for the above parameters which include upper and lower limits have been selected from the Australian and New Zealand Environmental Control Council (ANZECC) guidelines. These will be used to make an analysis of the health status of the waters within the MDIA region of the Mitchell River Catchment. For example, although natural variations of things like salinity occur, localised and sudden increases that coincide with elevated water tables and low stream flows can be extremely detrimental to aquatic organisms. The same situation may occur when levels of dissolved oxygen in the water fall consistently below the lower thresholds that are required to sustain a healthy system. An oxygen deficiency (known as hypoxia) can be caused by excessive nutrient runoff into the streams which promotes the proliferation of certain algal growth. These algae then consume the available oxygen and leave little for other organisms to survive on. The result is a very unhealthy waterway. Even if conditions don’t fall below a level considered to be toxic, the ecology of a river can be significantly altered. Pest species which are better adapted to poor conditions gain the opportunity to rapidly become dominant by displacing or outcompeting native species.

This demonstrates the requirement for stream water quality monitoring, to ensure that no unexpected adverse conditions appear, to aid in the process of mitigation if they do happen to occur, and to collect reliable and representative baseline data so the emerging problems can be detected as rapidly as possible.
Above picture: Manta Eureka 2 water quality logger ready to go

Above picture: Manta Eureka 2 water quality logger installed in stream
2. Regional skills development training and workshops

An important part of the program is regional skills development which aims to ‘skill-up’ locals to provide local expertise in sustainability. This knowledge can then expand regionally via extension and mentoring. The irrigation system training is also supported via Irrigation Australia and Rural Water Use Efficiency program. The training and workshops conducted this year were:

- Irrigation system assessment fundamentals training
- Integrated pest management and irrigation scheduling workshops to promote BMP
- Soil health forum (conducted in partnership with Terrain NRM)
Above: Pat Daley training growers, dealers and extension officers in irrigation system fundamentals.

Above: Chart showing results of attendees’ knowledge after the Soil health forum (courtesy of Fiona George from Terrain NRM)