Local Scale Monitoring Methods and Equipment

Water monitoring efforts are adding to a bank of information about how, when and where nutrients, sediments and pesticides are moving. Together with farmers, it helps us understand, track and respond.

Wet Tropics Major Integrated Project

Putting local knowledge into reef action

Solar, flume and platform

Paddock Monitoring

A close look at how paddock management practices affect water quality

Paddock run-off monitoring

Why?

Many factors, like rainfall, soil type and management practices, influence how nutrients, soil particles and pesticides behave in the paddock. Paddock monitoring tells us how much of these pollutants are running off the surface of a farm paddock when it rains.

How?

- A weather station records rainfall information, so we can see how much local rainfall it takes to create runoff.
- We channel the water moving across the paddock through a narrow structure (a “flume”) and measure the depth. We can then calculate how much water is running off the paddock.
- Automatic sampling equipment sits on a platform above the flume to keep it out of the wet zone. It takes regular water samples from the flume when it rains. The equipment is refrigerated to to preserve the samples until we collect and analyse them.
- The system is solar-powered with batteries. It’s connected to our computer so we can see what’s happening at the site – what the weather is like and when the samples are being taken.
- Time lapse cameras at the sites also keep track of what’s happening out there!

Water sample carousel in refrigerated autosampler

Time lapse camera

Shallow groundwater monitoring

Why?

Soluble fertilisers move easily. They are sometimes lost from the paddock before the crop has a chance to use them. We can track changes in nutrient concentrations below the root zone, where they are no longer accessible to the crop. This helps us to start thinking about the relationship between paddock management practices, rainfall and changes in water quality.

How?

- We use a groundwater bore (a piezometer or “piezo”) with a porous casing going down a few metres to collect water that has trickled down beyond the root zone.
- Every fortnight, we take samples for analysis by pumping all the water out of the piezo three times, allowing it to re-fill between purges, and then pumping up a final sample to send to the lab.

Bioreactor piezo

Purging the piezo

Groundwater monitoring

Sub Catchment Monitoring

Tracks how water quality changes as it moves down the creek system through different land uses and land types

Routine monitoring

Why?

Different land uses have different impacts on water quality. We take regular manual samples at strategically located sites. The information on the water's physical and chemical parameters helps us answer the question about the impact of different land uses, such as rainforest, agriculture and urban, on water quality.

How?

- Manual water samples ("grab" samples) are taken from the same sites on a regular basis – monthly in drier months and fortnightly during the wet season.
- We analyse these samples in a lab, looking for dissolved and total nutrients, total suspended sediments and pesticides.
- A handheld instrument measures, dissolved oxygen, pH (acidity), turbidity (cloudiness), electrical conductivity (salt levels) and depth. These help show whether the water quality is good enough to sustain healthy ecosystems.
- We also record what we see at the site, like flow conditions, algal blooms, and dead animals, which gives us context and helps support interpretation of the results.

Sample bottles

Handheld instrument

Event-based monitoring

Why?

When we get heavy, sustained rain (an "event"), nutrients, soil particles and pesticides can be washed into waterways. Monitoring during high rainfall helps us understand how these big runoff and stream flow events influence water quality as they pick up nutrients, soil particles and pesticides.

How does it work?

- We take manual grab samples at designated sites along the stream, when it starts to rise substantially, peaks, and subsides. We send them to a lab to look for the total and dissolved nutrients, total suspended sediments, and pesticides.
- "Rising stage" sampler units help out when we can't get to the sites to take manual samples (for example, if the stream rises overnight or conditions are too dangerous). The samplers are fixed at different levels up a stream bank. As the water level rises, water flows into the sample bottle and is stored safely through an air lock system. When the water level falls, someone can retrieve the sample.

Rising stage samplers and depth logger

In-stream continuous monitoring

Why?

Water quality in the creek can change very quickly – within hours or even minutes. In-stream continuous monitoring automatically measures a range of parameters every half hour, giving us a better picture of changes in water quality over time compared to manual sampling.

How?

- Water is pumped from a creek into a flow-through cell housed on a platform. The platform keeps the electrical equipment out of the flood zone. Probes sit in flow-through cells and measure nitrate, pH (acidity), electrical conductivity (salt levels), turbidity (cloudiness) and dissolved oxygen levels.
- To estimate pollutant loads we need to calculate the volume of water moving down the stream. To do this we measure the creek cross section, slope and velocity at different stream heights. Every time the probe takes a measurement, stream height is logged. Using the characteristics listed above, stream height can be converted to stream flow rate (the volume discharged over a certain time frame).
- To keep track of small, localised weather events, a rain gauge and weather station at each site record rainfall, barometric pressure, humidity, wind speed and direction, and air temperature.

In-situ monitoring infrastructure

In-situ monitoring inside the box

On-the-spot nitrate monitoring

Why?

Equipment like photometers and handheld nitrate sensors are portable and can give rapid, on-the-spot measurements of nitrate concentrations. They're not as accurate as lab analysis but are a useful demonstration tool.

How?

- When we use a photometer, we add a reagent to the water sample and wait a few minutes while the added chemical reacts with the nitrate in the water and changes colour. The sample gets slotted into the machine and the water's nitrate concentration displays on the screen.
- A handheld nitrate sensor takes an instant nitrate reading of a water sample.

Handheld nitrate sensor

Photometer

End of catchment monitoring site at Euramo

End of Catchment Monitoring

The big picture

Why?

End-of-catchment monitoring sites are managed by the Queensland Government. The water has travelled down the river system picking up contributions from all the different land types and uses along the way. This monitoring helps to track the long term trends in water quality entering the Great Barrier Reef lagoon, and the overall catchment progress towards Reef 2050 water quality targets.

How?

- Monitoring points are located at the lowest practical point of the river. On the Johnstone River that's Coquette Point, and on the Tully River it's at Euramo.
- Dry weather grab sampling occurs either weekly or monthly depending on the time of year and what is being analysed.
- More intensive monitoring takes place during high flow events, using automatic samplers.
- Samples are sent to the lab for an analysis of nutrients, total suspended sediments and pesticides.
- On site, instruments measure nitrate levels, total suspended sediment, turbidity and electrical conductivity.
- At Coquette Point there are also instruments in place to measure river flow and height, and at Euramo, river height.

Refrigerated sampler

End of catchment monitoring housing at Euramo

www.terrain.org.au/mip

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