## Final Report December 2008



# Guidelines for a Large Scale Impact Monitoring [Deliverable 8.1]

## LIFE05 ENV/D/000182





### Water Resources Management in Cooperation with Agriculture

#### **Guidelines for a Large Scale Impact Monitoring**

In the UK an intensive sampling programme was undertaken within the WAgriCo pilot areas. The data collected was used to evaluate the effectiveness of the measures and to provide data for both the field and catchment scale NIPPER modelling. The NIPPER model results were then fed into a model which simulates both historic nitrate concentrations in boreholes and also enables forecasting of changes in nitrate concentrations over the coming years/decades.

The recommendations for large-scale impact monitoring, based on the experiences within the WAgriCo project would be a mix of the following approaches:

- Detailed (intensive) monitoring at field/farm level select appropriate methods (soil water and soil sampling); use these data to:
  - Provide indicative data to stakeholders on progress against targets, seasonal variation;
  - $\circ~$  As an education too of likely cause and effect of values, i.e. increase understanding of nutrient cycling; and
  - Publish promotional articles to raise awareness of farm management issues.
- Use for model validation/calibration; models can then be used to extend findings across catchments, when inked with farm practice data (from surveys). This approach was adopted by the WAgriCo project, i.e. by using the NIPPER model above. It is also an approach adopted for reporting under the Nitrates Directive (see Fig. 1).
- Use on farm nutrient budgeting tools as a proxy for likely risk to water quality; this can be adopted across many more farms than a detailed field measurement campaign and can also be part of environmental reporting.
- Use large scale monitoring of water bodies, as currently undertaken by the regulatory authorities. This will provide information on longer-term trends, but is insufficient generally to identify short-term movements in water quality and cause/effect.

Thus, in summary, it is recommended that a large-scale impact monitoring has to involve a mix of approaches at different scales to provide a complete picture.



Figure 1: Schematic representation of linking field measurements from indicator farms to validate models; and then using the modes with farm management data to estimate catchment scale effects of mitigations.

#### **Guidelines for Intensive Sampling**

As a result of this work guidelines have been provided for undertaking monitoring on a larger scale across many catchments. Sampling needs to be targeted to small areas within each of the catchments due to the cost and labour intensive nature of the sampling. This has already been adopted by Catchment Sensitive Farming Officers across England within a number of the 40 priority catchments (increased by an additional 10 catchments in October 2008).

Parameter	How	Frequency	Comments	
Nitrate Leaching	Measured by porous ceramic cups on the free draining soils, and on individual drains or groups of fields within surface water micro- catchments using flow monitoring and automated water samplers.	On most soils sample the pots every two weeks or after 25 mm rainfall, whichever is sooner	Record crop cover at the time of sampling. Start to collect samples before Irriguide indicates a return to field capacity. Early sample results will act as an insurance against missing the peak nitrate loss due to heavy rainfall.	
Autumn soil mineral N (SMN)	On groundwater sites, nitrate concentration is measured on half the sites using porous ceramic cups. On surface water sites (clay soils), nitrate and flow are measured at selected drain and stream locations.	Sampling period is October – March, depending on soil type. 10 cores per field, either 0-60 cm or 0-90 cm in 30 cm increments.	Detailed land use, cropping & land management data should also be collected.	

Soil nutrient status	Analysis of topsoil for P, K, Mg and pH	Sample arable fields to 15 cm and grass fields to 7.5 cm. Take 20-25 cores from a field, bulked for analysis.	Avoid small untypical areas. Do not sample within six weeks of a previous inorganic fertiliser application or three months of a previous lime, or manure application.
Water quality	Sampling of boreholes, wells and streams and rivers and analysis for nitrates	At least monthly	

#### **Guidelines for Calculating Nutrient Budget and Nutrient Efficiency**

WAgriCo modelling and monitoring results suggest that many of the high nitrate concentrations that are now being measured in water bodies may be due to historic farm practices. Modelling results estimate that any reduction in nitrate concentrations from mitigation measures which are implemented now will take, in some cases decades to show any improvement in the monitored water body. Consequently, by only monitoring at the water body or receptor it is very difficult to evaluate the successfulness of any programme of measures within the reporting time frames of the WFD. One of the findings of the WAgriCo work is that more recent indicators of change are required. Both nutrient budgets and nutrient efficiency calculations have been shown to be a useful tool in evaluating the impact of mitigation measures on the farm scale; they are also a useful benchmarking tool both on a local and national scale. The use of nutrient budgets and efficiency calculations have until recently been restricted to research. The new version of the PLANET software, due to be released later this year does however have nutrient budget functions within it.

Much of the data required to calculate nutrient budgets and efficiencies are already kept by the farmers for cross compliance, NVZ regulations and fertiliser recommendations. At this time WAgriCo only recommends the use of nutrient budgets for large scale impact monitoring. However, the data collected for nutrient budgets may be used to further refine N-efficiency methodology.

Parameter	How	Data Requirements	Comments
Farmgate	Use of	Farm area	It's useful to have at
Nutrient	PLANET	Livestock numbers	least 2-5 years
Budget	Software	Imported animal	worth of historic
		feed/bedding/manure/livestock	data to calculate a
		/fertiliser	baseline from which
		Exported livestock/animal	future change can
		products/crops/manure	be measured
N Efficiency	Use of	Farm area	It's useful to have at
	PLANET	Livestock numbers	least 2-5 years
	Software	Imported animal	worth of historic
		feed/bedding/manure/livestock	data to calculate a
		/fertiliser	baseline from which
		Exported livestock/animal	future change can
		products/crops/manure	be measured