

Case Study 9.1-2 How 4R Nutrient Stewardship reduces greenhouse gas emissions. A 4R Nutrient Stewardship plan forms the basis of the Nitrous Oxide Emission Reduction Protocol (NERP) for farm-level carbon credits in a quantifiable, credible and verifiable way in Alberta, Canada. This protocol was developed by ClimateCHECK and by the Canadian Fertilizer Institute, and was officially approved by Alberta Environment (Government of Alberta) in October 2010.

During NERP's development, one of the first issues raised was the potential trade-off between nitrous oxide (N_2O) emission reductions and crop yield loss. However, the two pronged approach for the quantification of N_2O emissions tries to account for that. The "Tier 2" approach accepted by the Intergovernmental Panel on Climate Change for Canada's greenhouse gas inventory assigns a region-specific emission factor as a function of N rate applied. This emission factor varies across Canada from about 0.2% to 1.7% of applied N emitted as N_2O .

To account for the other three R's of right source, right time and right place a reduction modifier, derived from expert judgement, is applied to each performance level. Three beneficial management practice (BMP) performance levels ranging from Basic to Intermediate and Advanced allow the adoption of varying levels of BMPs and intensity of monitoring data with increasing degree of landscape-directed management. The higher the performance level, the more potential exists for reduced emissions as reflected by the smaller reduction modifier. Examples of BMPs for the prairie soils of Western Canada specified for the Basic performance level include the use of ammonium-based formulation, spring or split fertilizer application and banding. The Intermediate level also requires ammonium-based formulations but must also use slow/controlled release fertilizers or inhibitors. Under the Advanced category the rate of N application is based on quantified field information derived from grid sampling, satellite images or digitized soil maps.

By applying the principles of 4R Nutrient Stewardship, the NERP seeks to:

- "Optimize the crop response per unit of added nitrogen" and,
- "Minimize the opportunity for nitrate-N to accumulate or persist in the soil where it is potentially denitrified, and/or emitted directly or indirectly as N_2O or lost to the system through leaching".

The protocol specifies a role for accredited professional advisors (APAs) in assisting farmers to set up and implement their 4R plans, and in calculating the associated carbon credits. Professional Agrologists (PAGs) and/or Certified Crop Advisers (CCAs) can qualify as APAs by completing specialized training in 4R Nutrient Stewardship and NERP requirements, and by passing an accreditation exam. Only APAs are authorized to sign the plan. Additional requirements may also apply, varying with local laws and regulations.

The quantification approach of the NERP is based on the methods used in Canada's National Greenhouse Gas Inventory Report, which is prepared to meet Canada's reporting requirements under the United Nations Framework Convention on Climate Change. The NERP has been developed according to the ISO 14064-2 standard, which meets the requirements of the Alberta Offsets System, and is compatible with the stated intentions of Canada's Offsets System, of the Climate Action Reserve, and of other voluntary greenhouse gas programs in North America. The Alberta NERP is the first of its kind in the world. NERP is being evaluated for possible implementation in the United States by The Fertilizer Institute.

The NERP was developed through a process of comprehensive and transparent consultation with science experts for approval under the Alberta Offset System. These science experts represent the major agricultural universities in Canada, Agriculture and Agri-Food Canada, the International Plant Nutrition Institute, provincial soils specialists, and industry stakeholders. International experts were also included.

At the initial Consultation Workshop for the NERP held in Calgary in 2008, participating experts approved the general design of the NERP according to the 4Rs. Although consensus was achieved on the main elements of the NERP, the participating experts identified some gaps requiring further development. These gaps were subsequently addressed in a Decision Paper, which was submitted to the science experts in an on-line webinar format to further the consensus-building process. The webinar participants resolved the development of the NERP to allow standardization and submission to the formal review and approval process of the Alberta Offset System. This process is a prime example of how the 4R principles and stakeholder involvement may be applied to address specific societal concerns and nutrient management challenges.

Reference

Alberta Environment. 2010. Quantification Protocol for Agricultural Nitrous Oxide Emissions. [\[On-line\]](#).

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