

## **5.0 SUMMARY**

The AESA Soil Quality Benchmark Program was designed to provide data for modeling exercises, provide baseline soil information, evaluate landform effects on soil quality and to monitor changes in soil quality over time. The fifth year of monitoring agricultural soil quality in Alberta has been completed and this literature review of international soil monitoring programs is part of the program evaluation process. The review, conducted between September 2001 and June 2003, provides a basis of comparison for the AESA program to determine if the monitoring protocol could be altered to increase the value of the data currently being collected.

The monitoring programs described in this review include the monitoring of soil properties, which have been resampled or were intended to be resampled. The programs are currently operational or were operational during the last 15 to 20 years and are situated in areas comparable to Alberta in climate or land use. Although long term agronomic plot studies and one time surveys were not included in the review, they may provide supplemental information to monitoring programs.

The 52 monitoring programs illustrate the variability of the soil resource across the globe and the wide range of issues that stem from the utilization of soil. Each program is unique, having different objectives, which are created to address specific concerns relating to sustainable land use, human health and policy development.

A majority of the monitoring programs originate in Europe, which may indicate that the sustainability of the soil resource is more of a priority there than in other parts of the world, or perhaps information about monitoring programs in Europe is more accessible to the public than for example, in North America. Most of the programs are managed and/or funded at the Federal government level, which may explain why most began in the 1990s and are still operational. The 1990's marked the beginning of widespread environmental consciousness where the public demanded environmental accountability from all levels of government.

The number of ecosystem types and components monitored by each program varies mainly because of the environmental concerns in the particular country or region. Some programs measure only one ecosystem or one component within that ecosystem, but many are part of a larger environmental monitoring program which integrates all four ecosystem types (agricultural, forested, natural and others) and the four components within those ecosystems (soil, biota, water and air). Even those with a narrow focus, concentrating on one ecosystem or component, contribute by increasing the knowledge about the sustainable use of environmental systems and should be considered as an asset.

There are various sampling methods applied by the monitoring programs. Spatial variability of sampling points ranges from grid based to benchmark sampling. The monitoring interval is also quite variable between programs. A five-year sampling interval is the most commonly used method.

The soil parameters measured by each program relate back to the objectives of the program. The parameters are chosen for their ability to provide the necessary information to meet the objectives. The networks described in this literature review are designed to integrate many monitoring projects or programs and decrease data compatibility problems by encouraging the use of similar monitoring protocols and measurement of the same soil parameters.

Parameters such as land management, climatic and site description information are approached in different manners. Some programs focus only on the changes in soil parameters, while others acknowledge the valuable role climate, topography, soil classification and land use have in determining soil quality.

The AESA Soil Quality Benchmark Program is unique in North America. The data collected from these benchmark sites is valuable as it encompasses a wide range of variables such as climate, soil type, and land management. The benchmarks are stratified by ecodistrict (characterized by relatively homogeneous biophysical and climatic conditions) and landform. Temporal and spatial variability is addressed by annual sampling of several parameters and through the use of a landform sampling strategy.

To date, the AESA program has examined data from individual soil parameters such as organic matter and micronutrients/heavy metals from the standpoint of landscape, management and soil/climatic influences. One time sampling of micronutrient/heavy metal and pesticide contents has resulted in collaboration with other research institutions to answer other environmental questions related to agricultural soil sustainability such as nitrogen mineralization, pesticide accumulation and phosphorus adsorption.

Upon comparing the AESA Soil Quality Benchmark Program to other soil monitoring programs around the world, it is clear that the AESA program has identified the importance of soil quality. The AESA Soil Quality Benchmark Program regularly measures eight of ten parameters. Areas concentrated on include fertility, chemical properties, physical properties, management and climate information, many of which are included in the minimum dataset of indicators proposed by Doran and Parkin in 1994. The indicators proposed by Doran and Parkin that are not being addressed include rooting depth, infiltration and respiration. Measurement of these indicators could provide a more comprehensive evaluation of agricultural soil quality across Alberta. Soil quality is currently being monitored on an annual basis and the AESA program needs to assess when significant differences in results can be determined which may influence future refinements in the sampling interval.

Monitoring is an essential component of environmental management. It provides us with information in order to make educated decisions about how we manage our resources. Regardless of the magnitude and focus of each monitoring program, they all strive to increase the understanding of how human involvement and environmental interaction impacts soil quality, ultimately leading to more sustainable use of the soil resource. The AESA Soil Quality Benchmark Program helps document the complexity of soil and management practices across the agricultural areas in Alberta, provides a cost effective

cross validation dataset for model verification and ultimately improves the public's understanding of soil quality issues in Alberta (16).

You are invited to visit the AESA Soil Quality Monitoring Program website at:  
<http://www.agric.gov.ab.ca/sustain/aesasoilqm.html>