

## EXECUTIVE SUMMARY

Soil quality is a judgement of a soil's ability to provide desired outcomes. For agricultural soils, Acton and Gregorich (1995) provide a practical definition of soil quality as "the soil's fitness to support crop growth without resulting in soil degradation or otherwise harming the environment". Evaluation of agricultural soil quality is difficult. Agricultural soils are not only important for supporting crop production, now and in the future, but also for maintaining clean water and air, reducing greenhouse gas emissions, preserving natural biodiversity and ensuring food quality. Adding to the difficulty, outcomes of soil functions are not only affected by soil properties, but also by climate, landscape and management; relations among these variables are complex.

Considerable efforts have gone into the development of indicators for soil quality. Indicators communicate correct and relevant information quickly and easily to people who are not necessarily experts in the field. Indicators might be based on a simple relationship between observation and information needs, e.g., a fuel gauge. Indicators might also be based on a proxy relationship between observation and information needs, e.g., the "canary in a coalmine." Indicators might be based on many measurements related to the information needed, e.g., gross domestic product. When expressed relative to an agreed standard, indicators are often referred to as indices, e.g., greenhouse gas index, consumer price index.

Indicators of soil quality were initially developed to provide information on the suitability and relative value of land for different types of agricultural production. More recently, indicators have been developed to provide information on the impacts of agricultural practices on land and environmental degradation. Indicators have also been developed to provide an integrated assessment of soil conditions in programs that monitor a wide range of soil properties. No indicator of soil quality is suitable for all purposes and contexts.

One purpose for a soil quality indicator is communicating information on potential impacts of a change in land management on the outcomes of soil functions. Current indicators for land suitability or relative productivity could be used, but they require modification to increase their sensitivity to objectives other than crop productivity, and possibly to account for soil properties that are unavailable from soil survey databases. Useful approaches for objectives other than crop productivity could be obtained from indicators developed for monitoring land and environmental degradation. Detailed monitoring of soil properties is useful for the validation of soil quality indices. A soil quality indicator based on detailed monitoring of soil properties could also be developed, but would need to be based on clear objectives for soil functions and a sufficient understanding of the linkages between measured soil properties and soil functions.

The following steps are recommended for the development of soil quality indicators useful for monitoring impacts of a change in land management: 1) identify and involve end users, 2) formulate appropriate goals for desired outcomes of soil functions, 3) understand and describe the most important variables and relationships controlling outcomes, 4) assemble a relevant database of observed outcomes and controlling variables, 5) test candidate indicators for scientific soundness, reliable prediction and usefulness, and 6) aggregate indicators for different goals.

