

INDICATORS

The next step after obtaining a sufficiently accurate map or model of barriers to goals is to develop and implement plans to achieve goals (Figure 2). It is useful at this stage to develop indicators to guide progress toward the goal and to detect if improvements in goals, models or action plans are required.

What are indicators? Indicators are representations that communicate correct and relevant information quickly and easily to people who are not necessarily experts in the field (Jesinghaus 1999). In contrast, data are values that need further processing before they provide meaningful information, such as a statistic. Statistics describe real phenomena according to exact definitions, but they often require interpretation. Indicators communicate a correct message without further interpretation (note: the term ‘indicator’ is also used generically for any variable related to the information of interest).

Indicators may 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”. Finally, indicators might be based on many measurements related to the needed information, 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 should communicate how well goals related to soil functions are being achieved (Figure 3). At the same time, they are also effective for the communication of goals and knowledge related to soil functions.

Good indicators are relevant, sound and cost-effective. A relevant indicator is directly related to the most important aspects of the goal, is self-explanatory, is sufficiently sensitive for its purpose, and can be used to develop and monitor actions. A sound indicator is acceptable to experts in the field, regardless of their backgrounds. Thus, it is science-based and sufficiently accurate, precise and robust for its intended purpose. For an indicator to be cost-effective, the value of its information must be greater than its cost. In general, this means required data is readily available, computation is relatively easy, and the data is required or synergistic with other needs.

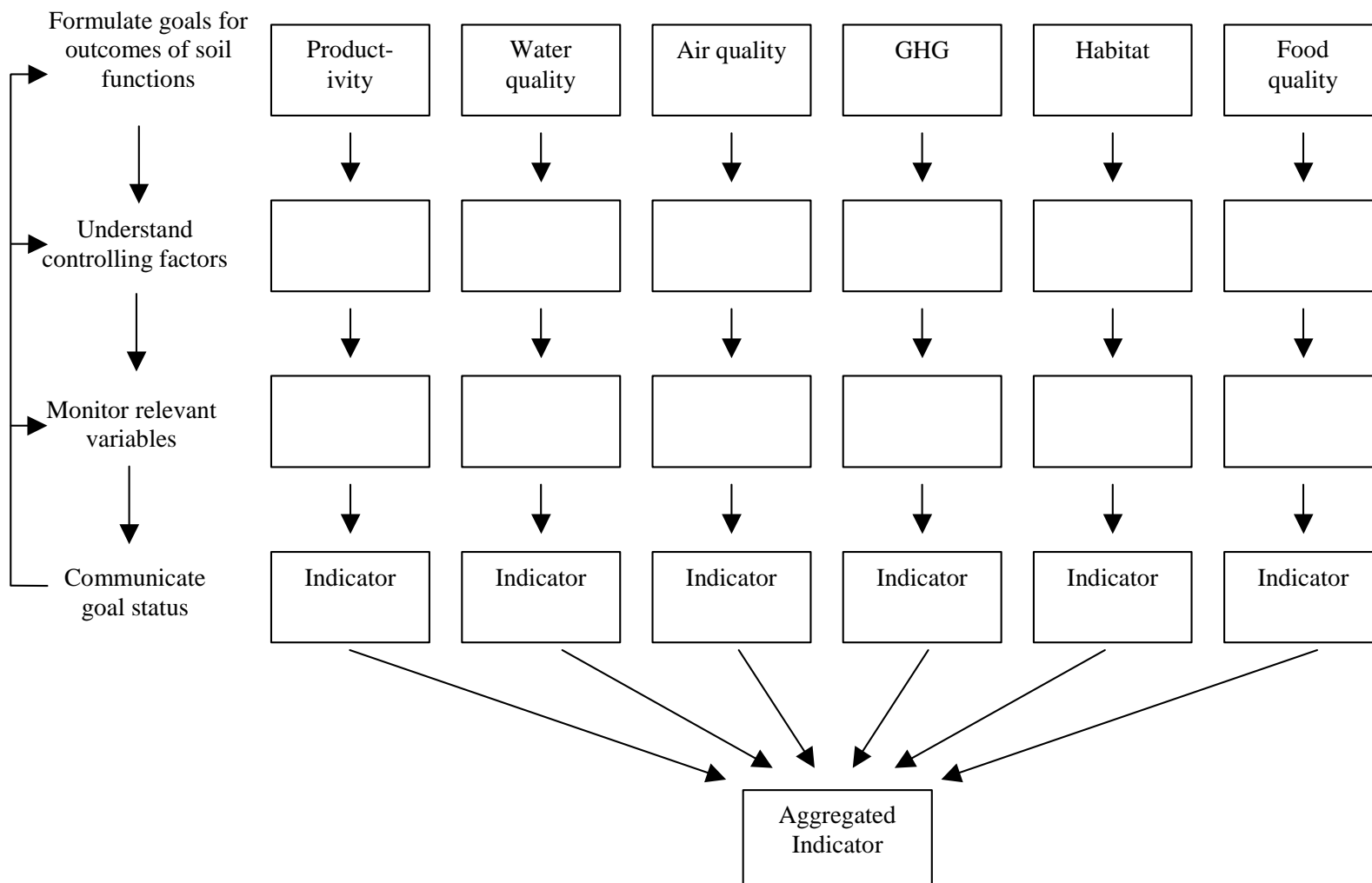


Figure 3. Proposed flowchart for the evaluation of soil quality

Indicators can be used to communicate information on driving forces, outcomes, or responses. Driving force indicators communicate information on the causes of a problem, which may provide incentives for appropriate responses or be used to monitor the efficacy of responses. Outcome indicators communicate information on the effects of a problem on a goal. Outcome indicators are often slow to respond, but are directly related to the issue and are useful for assessment and planning. Response indicators communicate information on the extent to which remedial actions are implemented. Response indicators respond quickly, but their effects are not evident until much later.

Indicators may communicate information on level, change or structure (Garcia 1997). An indicator of *level* provides an absolute measure of driving force (e.g., market price of annual crops), outcome (e.g., area of unsuitable land under annual cropping) or response (e.g., area of unsuitable land with regulations prohibiting annual cropping). An indicator of *change* provides information on the direction and rate of change in driving force (e.g., change in market prices), outcome or response. An indicator of *structure* provides information on industry or policy structures related to driving force (e.g., average farm size) or response (e.g., proportion of farms with an environmental farm plan).