11 Goals and Objectives

If you do not know where you are going, any road will take you there.
The White Rabbit to Alice (Lewis Carol)

The planning of an ecological risk assessment depends primarily on the goal of the management action to be supported. Most environmental laws in the United States provide rather vague goals such as "protect public health and the environment" or "protect and restore the physical, chemical and biological integrity of the Nation's waters." Agencies that implement laws should interpret those vague goals in more concrete terms that can be evaluated. For example, the International Joint Commission (1989) interpreted the biological impairment goal for Lake Superior thus: "The Lake should be maintained as a balanced and stable oligotrophic ecosystem with lake trout as the top aquatic predator of a cold-water community and with *Pontoporeia hoyi* as a key organism in the food chain." Such specific goals, called objectives, may apply to an entire regulatory or management program, or may be assessment-specific. A programmatic example is the European Commission's goals for their water quality objectives (WQOs). Accordingly, a WQO

- should be such as to permit all stages in the life of aquatic organisms to be successfully completed
- should not produce conditions that cause these organisms to avoid parts of the habitat where they would normally be present
- should not give rise to the accumulation of substances that can be harmful to the biota (including man) whether via the food chain or otherwise and
- should not produce conditions that alter the functioning of the ecosystem (CSTE/EEC 1994)

Examples of appropriate management goals in the EPA's guidelines include "reduce or eliminate macroalgal growth" and "maintain diversity of native biotic communities" (EPA 1998a). Goals for site-specific or "place-based" assessments may be generated through workshops or other consensus-building processes. Goals for public lands or other natural resources are often contained in their management plans. In addition to these goals for a specific law or assessment, it may be possible to define national environmental goals. However, goal setting is probably the most inconsistent and ill-defined component of the ecological risk assessment process (McCarty and Power 2001). In any case, careful thought should be devoted to defining goals (Box 11.1). However derived, ecological goals provide the basis for identification of the assessment endpoints.

Some goals are defined in terms of desired attributes and require no comparison. Examples for fish species include: (1) the endangered species should persist for at least 50 years after the action, (2) the fishery should support a median yield of 100 MT, or (3) no kills should occur. However, it is often necessary to define goals relative to a reference condition. As discussed in

BOX 11.1
Goals for Urban Streams

A goal of the US Clean Water Act is to "protect and restore the physical, chemical and biological integrity of the Nation's waters." The biological integrity goal obviously requires some clarification. The most common approach is to define relatively undisturbed streams in the least disturbed watersheds within a region as having integrity and then to develop an index or other indicator to define a scale of loss of integrity relative to the undisturbed stream (Yoder and Rankin 1995b). However, since even developments that result in only 10% to 20% impervious surfaces in a watershed cause significant changes in stream communities, it is not possible to achieve that sort of integrity in urban streams. Rather, somewhat degraded standards such as "modified warm-water habitat" are created for such streams. An alternative would be to develop definitions of biological integrity for urban streams, based on what is desirable and possible in those conditions. This need not be an unambitious goal. It may require expensive projects and controversial regulations to eliminate combined sewer overflows, store, treat and slowly release storm water, eliminate toxicity and high nutrient levels in effluents, reduce residential pesticide and fertilizer use, and create habitat structure. However, the goal of a high quality urban stream rather than a somewhat less impaired stream could provide significant incentives and psychosocial benefits. This would require more than a change in the semantics of the goal. The metrics that define the degree of departure from an ideal undisturbed stream would not be the best metrics to define the departure from a high quality urban stream. For example, it may be impossible to reduce temperatures sufficiently to support trout and darters, but it may be possible to sustain an urban fishery of catfish and sunfish that differs from undisturbed streams in the region but has an integrity of its own. Hence, the goals would be to achieve design criteria for designated uses including recreation, flood control, aesthetics, and recreational fisheries, rather than minimal departure from a regional reference state. This would require the development of a practice of urban aquatic ecology that would be equivalent to urban forestry.

succeeding sections, the definition of reference is usually treated as a technical problem during the definition of assessment endpoints and the development of the analysis plan. However, as the urban stream example illustrates (Box 11.1), the choice of reference has policy implications. The results of management will be different if the goal is to achieve an attribute of undisturbed and uncontaminated ecosystems (e.g., wilderness steams) of some percentile of all ecosystems (e.g., the tenth percentile of all streams arrayed from highest to lowest quality), of a historical reference (e.g., the community composition reported in the first records), or of high quality urban streams. Hence, the bases for comparisons should be defined by decision makers during the goal setting process.

Ideally, the management goals would also specify the decision criteria. Thresholds for effects, three-part logics, cost-effectiveness, cost–benefit, net environmental benefit, or other decision criteria should lead to different risk assessments. For example, thresholds for acceptability may be based on any variety of metrics, but cost–benefit or net benefit analyses require that the expected changes in the environment be clearly specified and quantified.