(1999) calls *critical and creative thinking*. Critical thinking is held to high standards of knowledge and prior validation, creative thinking is free to go in any direction without being constrained by what is already known. The rational and intuitive aspects of knowing are not, as many believe, in opposition but in reality are complementary. When used together each balances the weakness of the other and provides a more complete picture of reality and its likely impact in the future.

There are many approaches to the landscape planning process. Most of these are directed toward the implementation of a predetermined development outcome: planning a residential subdivision, for example. In these cases the answer is largely determined prior to framing the questions. A more open approach to landscape change might begin with the end product as more of a question than a predetermined answer. A comprehensive framework for organizing holistic landscape change is proposed by Carl Steinitz (1994). He suggests that such a procedure should include the positing of six types of questions, each representing an independent level of inquiry related to a theory-driven modeling type. Each level of inquiry requires the management of information, and geographic information systems may be used, but each type of model requires a different application.

The six-level modeling approach is employed to identify the context and scope of the project before carrying it forward to its conclusion. The six questions (and their appropriate modeling types) are:

1. **How should the state of the landscape be described?** In context, boundaries, space, and time? What is the structure of the landscape?
   (Representation model)
2. **How does the landscape operate?** What are the functional and structural relationships among its elements? What is the function of the landscape?
   (Process model)
3. **Is the current landscape functioning well?** Is it organized to facilitate human and environmental processes and prevent conflicts among them?
   (Evaluation model)
4. **How might the landscape be altered?** By what actions, where, and when?
   (Change model)
5. **What predictable differences might the changes cause?** Will the differences improve the function, character, or health of the landscape?
   (Impact model)
6. **Should the landscape be changed?** How is a comparative evaluation of the impacts of different alternatives to be made? Will proposed changes bring about improvement? Are the benefits worth the costs?
   (Decision model)

Steinitz recommends that the framework, which functions as a systematic inquiry into what is and what might be, should be applied in multiple iterations and in reverse numerical order. The application sequence proceeds as follows:

- **Propose** (or decide whether) to make a change in the environment.
  (Decision modeling)
- **Predict** the impacts of alternatives for comparison by simulating change.
  (Impact modeling)
- **Specify** (design) the changes to be simulated.
  (Change modeling)
- **Evaluate** current conditions in order to specify the change.
  (Evaluation modeling)
- **Understand** how the landscape works in order to evaluate it.
  (Process modeling)
- **Employ** representational schemata to understand how the landscape works.
  (Representation modeling)

This approach to landscape planning operates cyclically through the different levels of inquiry, with each level of investigation taking its definition of necessary contributing products from the previous one. It is offered as a comprehensive way to address the wide range of issues, processes, and impacts that are influenced by changes to the landscape. The process is both speculative and evaluative and suggests an approach that is sadly lacking in much of conventional decision making about landscape development and change. That is, it inquires about the best set of reciprocal relationships between what is proposed and what exists. This is quite different from a process to facilitate or rationalize decisions in support of a preconceived notion of what the developer wants before an in-depth analysis of the situation has been conducted. Conventional land-use development decisions are almost always guided by single dimensional criteria, most commonly short-term economic gain, not ecological, social, or even economic advantages over the long run.

Landscape Suitability Analysis

Analysis of the landscape, or **suitability analysis**, is a process of determining the fitness of a specific landscape condition to support a well-defined activity or land use (Steiner 1991). Suitability analysis of the landscape—as prominently advanced by McHarg (1969:103) and others—has over the last thirty years become accepted as one of the most comprehensible and defensible approaches to landscape planning. Its basic purpose is to determine the appropriateness of a given landscape for a particular use. The basic premise of suitability analysis is that each aspect of the landscape has intrinsic characteristics that are in some degree either suitable or unsuitable for the activities being planned, and that these relationships can be revealed through detailed evaluation and assessment (Marsh 1998:196). Suitability evaluation supports a preferential decision to provide for certain types of activities (such as recreation, housing, or industry) within a particular landscape condition (such as floodplains, wetlands, steep slopes, or upland ridges). Such suitability is determined through systematic, multi-factor analysis of the different conditions of the landscape. Ideally, the result is a site arrangement that takes advantage of the landscape's intrinsic attributes while avoiding unsuitable or unsupportable locations for activities where obvious site conflicts or incompatibilities may be expected. The intention of the process is to determine the optimum site location for activities while minimizing negative impacts on the environment (see figure 3.3).

The factors to be considered in suitability assessment include the human, biotic, and abiotic aspects of the landscape. Human factors include community needs, economics, community organization, demographics, land use, and history. Biotic factors include wildlife (mammals, birds, reptiles, and fish) and vegetation (habitats, communities, and plant types). Abiotic factors include soils, hydrology, topography, geology, and climate. The independent analysis of these factors is carried out to determine the extent to which each factor is favorable or unfavorable for the location of the activities being considered and leads to a suitability assessment for each activity. Each landscape factor (for example soils or hydrology) is individually assessed to determine the level of compatibility with the proposed land-use activity (such as highway location). Soils with poor bearing capacity might be incompatible with major road or bridge construction and judged unsuitable for their location. Well-drained upland ridges with soils having good bearing capacity supportive of road development might be judged suitable, and would be mapped to reflect their suitability.

An overall plan is developed to optimize the design condition in relation to a host of site features. There also are a series of cultural features that are typically considered in a suitability analysis. These include such considerations as land use, zoning, circulation, utilities, and community service facilities. The site being analyzed is mapped with a different suitability assessment layer for each factor considered. For example, there might be suitability assessments for land-

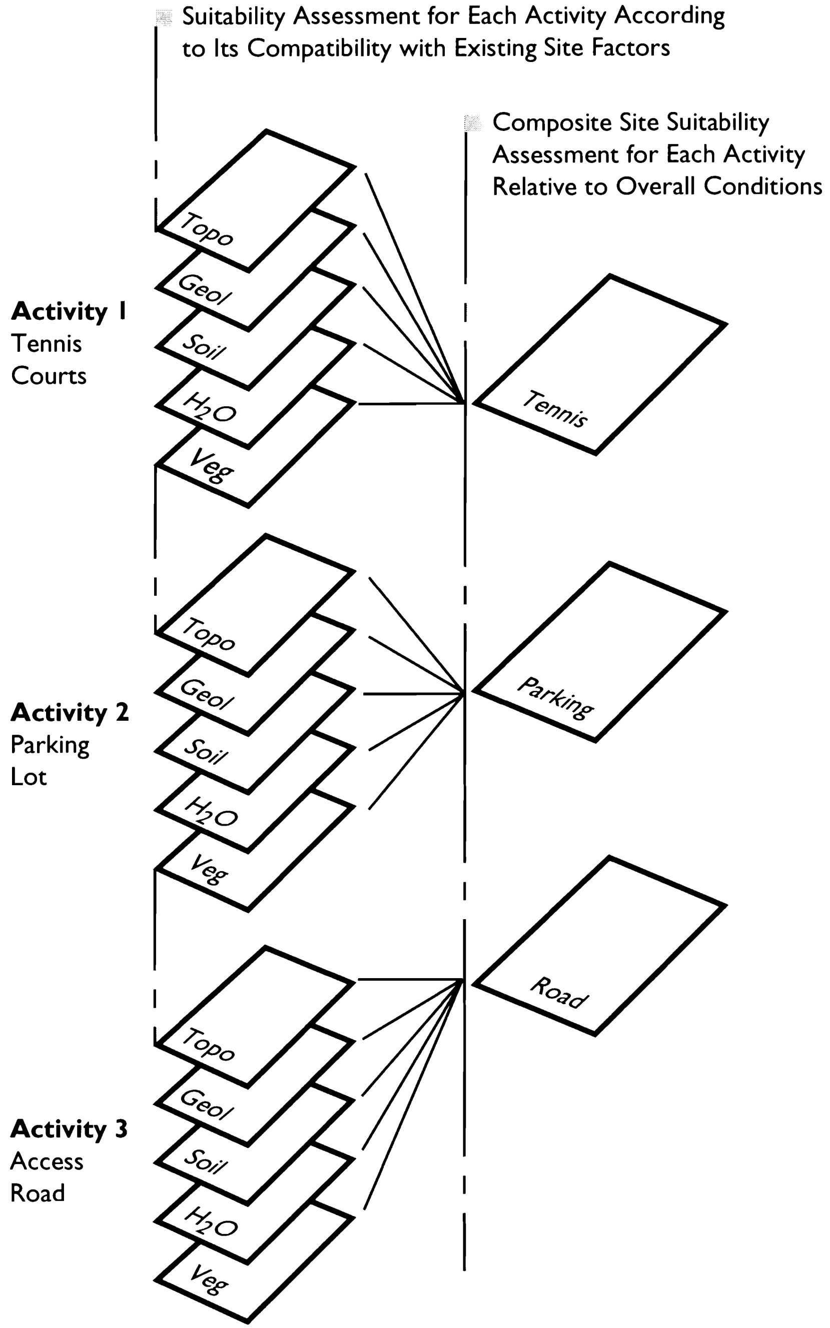

Figure 3.3
Landscape suitability analysis

scape layers such as topography, soils, geology, vegetation, and so on. Each layer is mapped to indicate those portions of the site that are suitable, unsuitable, or neutral for each particular activity being contemplated. The maps do not reveal the site conditions themselves, such as topography, but the extent of suitability for development as revealed by an assessment of that particular site factor. The suitability assessments may be expressed, for example, as high, moderate, or low suitability. Ultimately, all of the site-factor suitability maps may be synthesized into a composite map to provide an overall picture of the site as a whole for the different land uses being considered.

The suitability analysis process provides a systematic method of assessing a wide range of site conditions and land uses. In its composite form the suitability map provides a cumulative, overall assessment of site locations that possess the most supportive, as well as the most problematic, array of site conditions in regard to each particular type of land use. From this comprehensive assessment, overall site organization decisions may be made on the basis of spatially specific evidence.

Although it is cumulative rather than holistic, the suitability analysis approach to making land-use planning and design organization decisions has demonstrated its value. The process helps designers examine, set parameters, and solve the problems associated with locating human activities in the landscape in ways that use the resources of the landscape to optimum advantage (Ndubisi 1997:24).

Landscape suitability analysis has one significant weakness. It does not establish the most appropriate relationships among the activities to be developed, which is just as important as determining the most appropriate location for each activity. The knowledge gained by this process reveals only the relationships between the land-use activities being planned and their landscape setting, not the relationships of land uses among one another.

4

The Biophysical Environment

> Most of the problems we face as a nation, and most of the goals to which we aspire are closely linked in one way or another with our use of the environment.
>
> —National Academy of Sciences

> The thin mosaic, the tissue of the planet, is in upheaval. An urgent need exists for new tools and new language to understand how to live without losing nature. The solutions will be at the landscape scale—working with the larger pattern, understanding how it works, and designing in harmony with the structure of the natural system that sustains us all.
>
> —Grant Jones, in *Landscape Ecology Principles in Landscape Architecture and Land-use Planning*

Environment factors are among the most significant influences in shaping the character of the built environment and, therefore, future directions in professional practice. A basic understanding of the environment is prerequisite to effective professional education as well as to meaningful professional practice. And yet, this fundamental understanding does not exist at a significant level. Although landscape