Humans Plan

"A man, a plan, a canal, Panama."

Palindrome describing the creation of the Panama Canal

"I returned, and saw under the sun, that the race is not to the
swift, nor the battle to the strong, neither yet bread to the wise,
nor yet riches to men of understanding, nor yet favor to men of
skill; but time and chance happeneth to them all."

Ecclesiastes 9:11, King James Bible

Over the past few millennia, humans have spread to cover the globe. In the
process, we have changed more of the earth, more profoundly, than any species
before us. We have altered the face of the planet by building a canal between the
Atlantic and Pacific oceans, reestablishing a connection that had not existed for
more than 2 million years; by cutting vast forests at all latitudes; and by chang-
ing the global climate. As human communities grow, we shape nature. With our
advanced technologies, however, we often forget that nature shapes us as well.

As we extend ourselves across the landscape, we plan. Sometimes our plans
are explicit and carefully thought out documents, while other times they are im-
plicit thoughts, such as, "If I create a farm here, it will be productive for several
years," or "If we build a town here, it will be a safe place to live." Plans give us a
secure feeling about the future and reinforce our sense that we can control the
landscapes where we live. Drawings and carefully crafted words describe what a
given site or region will look like if the plan goes into effect—but these plans can
be misleading in two ways.

First, most plans focus primarily on the site or area for which they are plan-
ing. While they may consider roads and other aspects of human society outside
the study area, they rarely consider ecological issues beyond the boundaries. A
certain piece of terrain is either in the study area (and included in the plan) or
out of the study area (and typically ignored). In fact, most plans show virtually
nothing that is outside the planning area or site, as if it were an island floating in
space (see Figure 1-1).
New York City's Water

Beginning in the mid-nineteenth century, New York City developed one of the first municipal water supplies in the world. Today, the city's water is an estimated 9 million people with 1.3 billion gallons of potable water. The water comes from a system of reservoirs and lakes fed by a 1,900-square-mile (5,000 square kilometer) watershed that extends more than 100 miles (160 km) north of the city.

In 1885, New York City began to undertake large-scale water supply projects, including the construction of upstate reservoirs and the main treatment that it received from the Catskill and Delaware mountain areas. In the early 1900s, the city expanded its water supply system to include water from the upper Hudson River and the Catskill Mountains.

In the 1970s, the city began to implement a comprehensive program to improve its water supply system. This included the construction of new reservoirs and the improvement of existing ones, as well as the installation of new treatment facilities.

As of 2023, New York City's water supply system is one of the largest in the country, providing water to more than 9 million people. The city's water is nationally recognized for its quality and reliability, and it is used by a variety of industries and residents throughout the city.

Figure 1.1. This sample site map shows a fifty-acre (20 ha) farm, including fields, farm buildings, a stream, and wooded areas, surrounded by crops and pasture. It represents some of the concerns surrounding the farm.
borders to create a remarkable water supply system. At the end of the twentieth century, the city again looked beyond its borders—and beyond the confines of human technology—to envision a future in which humans protect natural areas in ways that help both humans and countless nonhuman organisms living across the landscape. This example offers the following lessons:

- Sometimes we are better served by letting nature provide necessary services than by using technology to fulfill our needs. When we protect and maintain healthy ecosystems, humans can reap significant health and economic benefits.
- By setting aside parcels of nature for one purpose—in this case, to provide safe drinking water—both human and ecological communities may benefit in other ways. The watershed lands protect the rural character of dozens of communities as well as high-quality habitat for the region’s native species.

While looking beyond the boundaries of a site can help identify the benefits and services that nature provides, taking a broad view can also help one avoid some of the problems that nature can bring, as the next case study illustrates.

Fire in Colorado

Several years ago, some friends of ours purchased a house in Pine, Colorado. This small community, nestled beside and within the Pike National Forest, has become a bedroom community for Denver as the capacity of the highways into the city has expanded. The mountain ridges surrounding Pine are covered with maturing pine forests that are not only lovely to look at but also contain a surprisingly intact ecological community that includes black bear, elk, mule deer, coyotes, and even mountain lions—all less than an hour’s drive from Denver. This ecosystem offers aesthetic and recreational amenities that have undoubtedly contributed to Pine’s recent popularity among home buyers.

This ecosystem, however, is not entirely benign. Although the setting of our friends’ house appears quite suburban, with several houses visible nearby, mountain lions are enough of a danger that many children do not play outside at dusk or dawn. But the single most notable species in this ecosystem is not one of the large mammal species but rather the Ponderosa pines (Pinus ponderosa) that dominate the landscape. And the single most notable process in the ecosystem is fire.

Left alone, Ponderosa pine forests typically burn lightly and frequently, with ground fires removing underbrush while leaving mature trees intact. However, in areas where fires have long been suppressed and underbrush has been allowed to accumulate, as is the case throughout much of the American West, fires burn

heavily. As they engorge themselves on the dense growth left unpruned by the now-disrupted fire regime, they become massive, destructive crown fires capable of killing even the largest trees.

In June 2000, the Hi-Meadow Fire roared through the subdivisions and forests of Pine with impunity. The 10,800-acre (4,400 ha) fire destroyed fifty-eight structures, including several houses that could be seen from our friends’ deck, but firefighters stopped the blaze thirty feet from their house (see Color Plate 1). The fires around Pine offer several critical lessons:

- Understand the ecological processes of the place you are planning or designing. Developers creating new subdivisions in Ponderosa pine forests, and local planning commissions that approve these subdivisions, need to understand how the local ecosystems function. The same lesson applies to ecosystems across the continent.
- Context is critically important. What is outside the boundary of a site can add tremendous value—economic, ecological, recreational, or aesthetic—to the site, but it can also threaten health, safety, and property.
- Always consider the array of possible futures for the land around a site. This includes changes that may be brought about by humans, those that might occur naturally, and those that may occur through a combination of human and natural causes.
- Plan with a measure of humility. There are forces in nature that we may not be able to control.

The examples of New York City and Pine demonstrate that when we plan for the future, we need to look beyond the edges of our properties—which the planners of New York’s water system certainly did, but which the designers of the subdivision in Pine did not do adequately.

Different Ways of Thinking about the Future

Planners, designers, ecologists, and conservationists all concern themselves with how specific landscapes will look and function in the future, and many of these professionals attempt to shape the future in different ways. But each profession approaches its work from a different background and with a different set of issues in mind, and each tends to view the world in a very different way (see Table 1-1). Developers who build houses in a wetland know that they may be penalized under the laws of humans and that some houses may end up with wet basements because of the laws of hydrology. Planners, in contrast, might be most concerned with how development in the wetland will affect the lives of humans, some of whom live far downstream from the wetland. Ecologists and conservationists
Although it is impossible to quantify all the nuances and complexities of these professions in such a brief space, the large differences in assumptions and expectations within these ecological contexts can only be captured if we change our frame of reference. The broader context of ecological processes is needed, with their underlying patterns of interaction and disturbance. Thus, the importance of understanding the context in which these professions operate becomes critical. If we do not consider the broader context, we may overlook important aspects of ecological processes and fail to appreciate the full significance of these professions.

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Table 1.1

Humans, Nature, and Interactions
Planning with Context in Mind

To appreciate the importance of considering a site's ecological context in space and time, let us return to Figure 1-1, in which we saw a hypothetical site as it exists today. The site contains fifty acres (20 ha), of which about thirty acres are currently farmland and fields, ten are forest, seven consist of a pond, stream, and wetland, and three are roads and buildings. Typically, developers and designers working on a site such as this will have considered the site's human context, such as the location of roads, schools, and nearby land uses, as well as such factors as zoning, property values, and the marketability of different development options. But what about the site's ecological context? Consider a series of three maps, each of which shows the site in a different ecological context (see Figure 1-2). These different contexts have profound implications for the site itself.

Figure 1-2. These three maps show three different hypothetical contexts for the site depicted in Figure 1-1. Each context might lead planners and developers to value the fifty-acre (20 ha) site in the middle very differently.

For example:

- Are the forest patches on the eastern and northern sides of the site contiguous with additional forest, or are they isolated patches? The forests are contiguous with larger forests in all three situations (Figures 1-2a, b, and c). In Figure 1-2a, the site's eastern forest plays a critical role in a habitat corridor connecting two large forested areas. In Figure 1-2b, the site's eastern forest is part of a buffer between agricultural lands and a lake/wetland system. The site's northern forest is part of a small forest patch that might be an
Respecting Natural Processes That Cross Boundaries

Learning how to respect your home and your community.

2003’s efforts support the concept! However, if you are involved in these processes, you know that the changing conditions of human communities in ecologically diverse areas are not so benign. Such hazards as forest fires, floods, insect outbreaks, and more problems are not only more frequent, but also more severe. Other ecosystem services such as water and flood control are also endangered. The changing climate influences the human strategy and process needs of the ecosystem. Some ecosystems are more endangered than others. Understanding the ecological or human communities.

One definition of an ecological community is a set of interdependent organisms living together in a particular environment. This definition includes the interdependence of the organisms in the community. When people move to a new neighborhood, they usually consider not only the

Ecological Human Communities:

To understand the ecological context of your study area, we recommend:

1. Identifying the boundaries of the community;
2. Determining the ecological processes that affect the community;
3. Assessing the impacts of human activities on the community;
4. Developing strategies to mitigate these impacts.

While human communities are often considered separate entities, they are interdependent. The health of one community affects the health of others. By understanding and respecting these interdependencies, we can make informed decisions that benefit all. 

practice is crucial. It is simply not enough to consider local conditions. It is also important to consider how the interactions between ecosystems and human communities affect each other. By understanding these interactions, we can develop strategies that promote the health of all communities.
organisms perceive ecological systems as having leaky, fuzzy boundaries. For instance, the red-legged frog (*Rana aurora*) of the U.S. West Coast will, over its lifetime, use a variety of habitats, including small pools for growth as a tadpole and breeding as an adult, moist woods as its primary adult habitat, and the paths it travels between these sites. The frogs have no knowledge of the human-created property lines or jurisdictional boundaries that run through these habitats, although they may have to deal with human features on the landscape, such as roads and buildings (see Figure 1-3).

Even a natural boundary that seems clearly defined, such as the shoreline of a pond that divides land from water, is a porous barrier for many organisms. Frogs, toads, salamanders, dragonflies, damselflies, caddis flies, mosquitoes, and many other organisms spend the early part of their lives in the water and the later part on dry land, returning to the water to breed (for one example, see Figure 1-4). The entire sport of fly-fishing is built around two aspects of permeable ecological boundaries. Those who fly-fish create their lures so as to mimic adult caddis flies, mayflies, stoneflies, and other insects that spend their juvenile stages living under water and that return to water to lay their eggs. The artificial flies are intended to mimic these creatures because trout capture much of their food out of the water, eating flying adult insects.

*Figure 1-3.* The red-legged frog (*Rana aurora*) requires several different types of habitat, including small pools and moist woods, to complete its life cycle. These habitats may span several properties or even towns, but the frog has no knowledge of such human boundaries.

Just as land use plans often show sharp boundaries even though natural boundaries are usually imprecise, they also tend to portray only one desired future scenario for a site or community, though in actuality the ecology of any area—even a city—is an unfinished book that can have any of a number of endings. Because of unpredictable events—whether global climate change, massive storms such as hurricanes or tornados, biological invasions such as kudzu or the Asian longhorn beetle, or just the ongoing ecological changes that take place in any system—the ecological future of an area is never certain. For example, no plan could have predicted with certainty which parts of our friends’ subdivision in Colorado would be destroyed by fire, although an ecologist may have predicted that fire in this area was likely.

To account for natural processes and uncertainties when we plan, we must first seek to understand them. A recent study of Arizona’s Desert View Tri-Villages Area conducted by landscape planner Frederick Steiner illustrates how *ecological due diligence* can inform land use planning. The study emphasizes the importance of context, including not only maps of the Tri-Villages Area but also satellite images, maps, and elevation models of the surrounding landscape. It
An Introduction to Ecology and Biodiversity

Southeastern Arizona is one of the most beautiful parts of North America, with its surrounding desert landscapes and unique flora and fauna. The area is known for its exceptional biodiversity, particularly in the San Pedro River Basin, which is a critical habitat for many species. The basin supports a diverse array of wildlife, including birds, mammals, reptiles, and amphibians. By comparison, the entire United States contains just 786 bird species, 416 mammal species, and 534 reptile and amphibian species. The San Pedro watershed is biologically rich, with 43 species of reptiles and amphibians—all in an area smaller than Connecticut!

Biodiversity is the term used by conservation biologists to describe the entire diversity of life in a given area, as in the biodiversity of Deserts, rural areas, or within a single species or ecosystem. The Stuff of Life

In practice, biodiversity is sometimes measured simply by counting the number of species in an area.