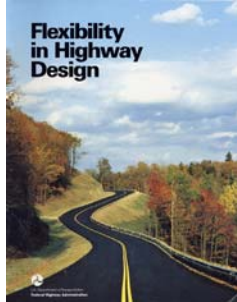


ROAD ECOLOGY



Forman, R.T., D. Sperling, et al. (2003). *Road Ecology: Science and Solutions*. Island Press, Washington D.C..

ABSTRACT

Road Ecology focuses on the relationship of the road network—the largest human artifact on the planet—and the land on which the roads are built. The authors describe the road network as a net that humans have laid over the land. The roads tie the land together for humans but separate nature into pieces. At the same time, nature degrades roads, necessitating constant maintenance to keep the network usable. The authors suggest that both effects—nature degrading roads and roads degrading nature—are both costly to society.

The main purpose of this book is to integrate the principles of landscape ecology with road and automotive engineering to provide new ideas for roadway designers and for society as a whole. It was written by transportation specialists, ecologists, and a hydrologist. The main audience for this book includes transportation engineers, planners, environmental specialists, economists, social scientists, students, and the general public who use the road network and participate in its development.

The book is divided into four parts: 1) roads, vehicles, and transportation planning, 2) roadsides, vegetation, wildlife, and mitigation, 3) water sediment, chemicals, aquatic ecosystems, and the atmosphere, and 4) road systems, major landscape types, and further perspectives.

Part One: Roads, Vehicles, and Ecology provides an introduction to the basic elements of road ecology, a new field of study proposed by the authors. Road ecology, or the interaction of organisms and the environment linked to roads and vehicles, is explained along with a description of basic ecological concepts and landscape concepts. This is followed by a history and description of the US and Canadian road systems including discussions of the size, growth, and pattern of the US road network. An explanation of roadway elements (including roadsides, bridges, traffic and noise barriers, culverts, and other engineering structures) provides the necessary background for the reader on basic roadway structures.



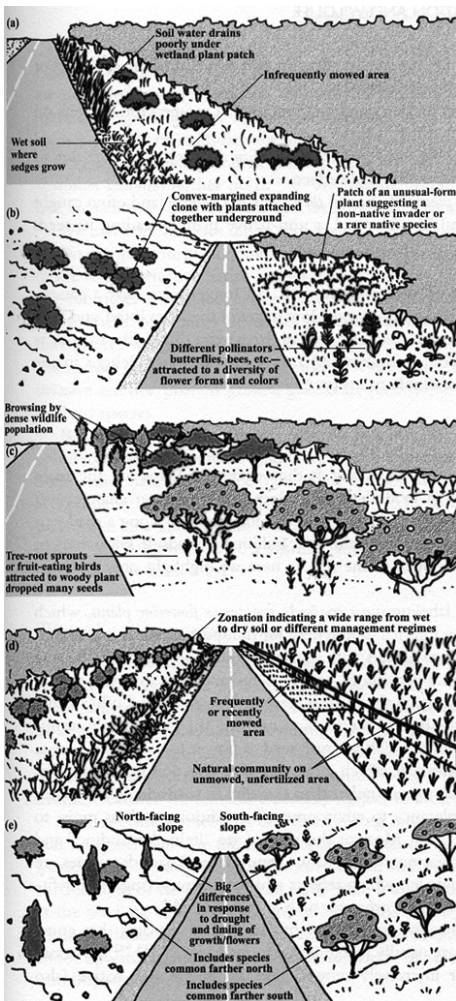
Part one concludes with a discussion about vehicles and transportation planning.

History and trends in automobile use, size, and technologies are discussed.



Part Two: Vegetation and Wildlife discusses roadside vegetation and wildlife issues pertaining to roadways such as wildlife mortality, habitat, and mitigation techniques. The section begins with a chapter on vegetation that explains one way to read the roadside landscape. It deals with vegetation types, plant succession, roadside habitat, and vegetation management. Wildlife habitat and connectivity are also discussed as they relate to roadways and the effects of road density. Wildlife mitigation—for mortality, habitat loss, and reduced habitat quantity—are the topic of the third chapter of this section. The effectiveness of wildlife underpasses and overpasses is discussed along with the factors affecting the use of these types of passages.

Part Three: Water, Chemicals and Atmosphere deals with water and sediment flows, road chemicals, aquatic ecosystems, and wind and atmospheric effects. Roads are a major contributor to the erosion process because of the amount of exposed soils along or on roadways. This, in turn, increases sedimentation in nearby water bodies. The flow of water can be harmful to roadways by causing deterioration, especially on unpaved roads or roads that are on hillsides. Conversely, roads disrupt natural surface and ground water flows, and can introduce chemicals and sediments into water bodies. There are four main functions of roads relative to water. A road can be a source of water when it runs off the road, a sink for water when it accumulates on the surface, a barrier for water when it holds back the flow on a slope, or a conduit for the flow of water when it runs down ruts in the roadway. Water and roadways interact in complex and multiple ways that impact both the natural environment and the road itself.



Chemicals that are washed off or seep through a road impact aquatic ecosystems and chemicals that make it into the air from roadways impact the atmosphere. Chemical sources come from both vehicles and road maintenance and management practices. Sodium chloride application on roadways has been a major source of chemical pollution in cold weather climates. Chemical spills from trucks and autos are another source of chemicals pollution from roadways. The ecological impacts of chemicals on the environment are covered in-depth, for both terrestrial and aquatic ecosystems.

There are four ways road systems impact the surrounding atmosphere. Roads produce significant amounts of dust and chemical pollution. Fossil fuels burned by cars and trucks driving on roads is a major source of atmospheric pollutants and greenhouse gasses. Road construction uses large amounts of concrete and asphalt, both of which impact the atmosphere. Road construction is destructive to natural environments and is a major cause for deforestation and the resulting loss of carbon storage.

Part Four: Road Systems and Further Perspectives discusses how road systems are linked with the landscape and how road systems and vehicles affect certain land types. These issues are investigated at the landscape scale through a discussion of issues such as network theory, the spatial attributes of road networks, and changes to road networks over time.



This section then investigates the characteristics linking the terrain, land use, and road system of four large landscape types in North America and then considers the ecological effects of roads interacting with the landscape. The four landscape types are: 1) built land, 2) forest land, 3) agricultural land, and 4) grazing-arid land. Four other landscape types that are not currently impacted as intensely by human population or the road network are discussed as well. These four landscape type include 1) remote land, 2) park land, 3) the Arctic, and 4) the tropics. These areas are currently dominated by natural ecosystems and therefore, the effects of roads and vehicles can be significant.

Chapter 14: Further Perspectives identifies policy and planning solutions by highlighting actions of the major agencies responsible for road systems in the United States. The authors also introduce an array of ideas for integrating the concepts of ecology into the road design process.

SUMMARY The topic of this book, road ecology, is approached in a way that makes it readable and a useful tool for non-ecologists. Transportation designers, regulators, and community members will benefit from reading this book.

KEY WORDS *Applicable Project Delivery Stages:* Administration, Planning, Scoping, Design, Construction

Applicable Transportation Professionals: Administrators, Transportation Engineers, Planners, Economists, Environmental Specialists, Landscape Architects

Applicable Transportation Modes: Vehicular, Bicycle, Transit

Transportation Topics: Aquatic Ecosystems, Chemical Pollutants, Ecology, Erosion, History of Canadian Road System, History of US Road System, Road Ecology, Road Network, Roadside Habitat, Roadside Vegetation, Sediment, Transportation Planning, Wildlife Mitigation

WEB LINKS http://johnmuir.ucdavis.edu/road_ecology/
(Road Ecology Center at the University of California, Davis, homepage)