UC Berkeley
Earlier Faculty Research

Title
Addressing Environmental Challenges in the California Transportation Plan

Permalink
https://escholarship.org/uc/item/7qk0s0t2

Authors
Thomas, John V.
Deakin, Elizabeth

Publication Date
2001-05-01

eScholarship.org Powered by the California Digital Library
University of California

Revised May 2001

Addressing Environmental Challenges in the California Transportation Plan

JOHN V. THOMAS
ELIZABETH DEAKIN
University of California Transportation Center
108 Naval Architecture Building
Berkeley, CA 94720-1720
jvt@uclink4.berkeley.edu
edeakin@uclink.berkeley.edu

Addressing Environmental Challenges
in the California Transportation Plan

Summary

The purpose of this paper is to highlight challenges the State will face as it attempts to address environmental impacts within the forthcoming transportation plan. The first section highlights major issues that shape the policy context for environmental planning. The second section summarizes key trends among major environmental categories. Finally, the implications of California's environmental trends for the State transportation plan will be discussed.

The first section focuses on four topics:

1. Distinct characteristics among environmental issues shape their relationship to transportation planning
2. The differing views of environmental priorities among various constituent groups are also an important consideration
3. A need exists for improved understanding of benefits associated with mitigation, preservation and restoration alternatives
4. Many of the most sensitive natural resources are also found in areas under substantial development pressure

With these policy issues as a backdrop, significant environmental trends are reviewed:

Air Quality

- ***Toxic/Hazardous Air Pollutants***
    - Substantial progress was made over the past decade in reducing or eliminating toxic emissions such as asbestos, cadmium, and ethylene dibromide
    - However, transportation is still a significant source of benzene, formaldehyde, butadiene, acetaldehyde, nickel and lead
    - In many cases, freight movement and off-road mobile sources such as aircraft are the largest source of these emissions
    - Diesel exhaust has become an increasing concern due to the fact that it contains several hazardous substances
    - Finally, the concentration of toxic pollutants is almost exclusively an urban problem, with urban counties experiencing emissions per square mile 3 to 10 times higher than the state average

- ***Criteria Air Pollution***
    - In the transportation sector, significant progress has been made in reducing emissions of Carbon Monoxide and Reactive Organic Gases
    - Fewer reductions in Nitrogen Dioxide emissions have been achieved and particulate emissions from transportation sources have increased
    - Substantial progress has been made among gasoline powered vehicles, which account for the largest share of emissions across all four categories
    - Diesel powered vehicles have shown slower progress Carbon Monoxide and Reactive Organic Gas emissions and increases in Nitrogen Dioxide and particulate emissions
    - Emissions from off-road mobile sources, many of which are transportation related, have increased substantially in each category
    - Predominantly rural areas such as the Salton Sea Air Basin and the San Joaquin Valley Air Basin have criteria air pollution problems worse than several urban areas in some categories

Water Quality

- ***Stream, Lake and Ocean Water Quality: Watershed Planning***
    - An increasing number of efforts to protect the quality of water resources are recognizing the benefits of regional planning at the watershed level.
    - Within California 142 separate watersheds have been identified and cataloged by the California Rivers Assessment project, providing an excellent base of information for long range planning
- ***Water Contamination***
    - MTBE contamination has been the most prominent concern in this area, with samples showing 1% to 2% of the states water supply potentially effected
    - However, replacing MTBE, a methanol based additive, with ethanol based fuel oxygenation, will require time and investment to reach the significant output levels required to serve the California market
- ***Wetlands***
    - Most of California's wetlands have been lost over the last 100 years,
    - However, net gains in wetlands have been made over the past decade through restoration and creation of wetlands
    - Of the states remaining wetlands the overwhelming majority are on private lands
    - Vernal pool wetlands have received increasing attention, but are less understood than other wetland types
    - California has nearly 1 million acres of Vernal pool complexes larger than 40 acres, of this total more than 90% are on private land

Land Resources

- ***Habitat***
    - The Gap Analysis Project systematically evaluated adequacy of plant and mammal habitat management across the state, comparing species distribution, levels of protection and development pressures
    - They concluded that the areas with the most significant "Gaps" between endangered resources and managed areas were in a ring on the periphery of

the Central Valley, Western Santa Barbara County and the Central Sierra foothills

- ***Farmland***
  - Although Riverside County has the highest level of rural land conversion, Central Valley counties such as San Joaquin and Kern are losing more acreage of irrigated agricultural land each year to urban development

Implications for Transportation Planning

Together the policy context and trends have the following implications for addressing the environment within the State's Long-range Plan:

- ***Strategies to move from compliance to stewardship***
  - A national survey of transportation professionals working on environmental issues emphasized the importance of effective stewardship in improving public and regulator attitudes.
  - Such improvement contributes to reduced project delays and compliance costs
  - Collaboration with existing local, regional and State initiatives is essential to achieving effective stewardship and context sensitive design
- ***Developing an environmental investment portfolio***
  - Several state transportation agencies have been developing programs to proactively invest in environmental enhancements
  - However, better information on environmental resources and specific evaluation criteria for investments are needed to make such programs effective
- ***Identification of connections between local or regional environmental planning processes and statewide transportation planning***
  - Given information gaps, unique local contexts and the need to avoid duplication of existing efforts, the state plan should catalog specific points at which corridor level transportation planning can connect with local initiatives

Policy Context

Issue 1 – Environmental issues have distinct characteristics that impact how they should be considered within planning processes

The basic environmental considerations relevant to transportation planning can be characterized along a continuum. At one end of the scale are highly visible issues that are of immediate concern to the general public. At the other end are less visible problems with more potential for lasting impacts. Additionally, variation also exists in the degree to which the impact of transportation is direct and significant versus indirect and secondary. (See Table 1)

Table 1

Environmental Issue	Nature of Environmental Impact		Nature of Transportation Role
	Visibility	**Reversibility**	
Water Quality			
Water Supply Contamination	Immediate	Depends on Pollutant	Indirect – Leaking underground tanks Runoff from roads in some cases
Stream/Lake Quality	Cumulative	Depends	Indirect – runoff from construction and use of roads, as well as related development
Costal Water Contamination	Immediate	Reversible	Indirect – runoff from construction and roads, as well as related development
Aquatic Habitat	Cumulative	Reversible at low levels of degradation	Indirect – runoff
Air Quality			
Toxic Air Pollution	Immediate	Reversible	Direct – 76% of Benzene 67% of Formaldehyde 59% of 1,3-Butadiene 84% of Acetaldehyde 63% of Lead 10% of Nickel [1]
Criteria Air Pollution	Immediate	Reversible	Direct- 59% of NO_x 51% of PM_{10} 47% of ROG 73% of CO 20% of SO_2 Regional conditions vary [2]
Land Resources			
Unique Farmlands	Immediate	Irreversible	Indirect influences on land development patterns
Prime Farmlands	Immediate	Irreversible	Indirect influences on land development patterns
Unique Natural Landscapes	Immediate	Somewhat Irreversible	Indirect influences on Land Development Patterns
Habitat	Delayed	Reversible at low levels of degradation	Indirect influences on Land Development Patterns

[1] Source: *1996 National Air Toxics Assessment, California Summary Tables,* US EPA
[2] Source: California Air Resources Board, *California Air Quality Trends,* Tables in Ch 3.

Other Issues			
Greenhouse Gas Emissions	Delayed	Reversible only over long-term (100+ yrs)	Transportation accounts for 57% of CO_2 emissions in Cal.[3]
Noise	Immediate	Reversible	With the exception of airports, effects are highly localized
Waste & Hazardous Materials	Immediate	May be costly or require considerable time to reverse effects	Spills and disposal of transportation related materials

Given this context transportation plans naturally tend to focus on environmental problems most directly and visibly impacted by investments. However, the concerns requiring the most foresight and long-term planning are often those at the other end of the spectrum. Many of the more subtle problems have cumulative and long-lasting impacts. Therefore, they tend to present the most difficulty for policy makers. A recent Transportation Research Board report on sustainability illustrates this important dilemma:

"A decision was made to focus [this report] on environmental disturbances posing lasting and adverse environmental consequences that may not become fully manifest for decades. Disturbances that have such delayed consequences are less likely to attract the public's attention or be the subject of public policies and programs to curb them. Left untreated, their adverse consequences may worsen, causing serious environmental problems for future generations."
Transportation Research Board Special Report 251, *Toward a Sustainable Future*

Issue 2 - Constituents' differ on how they view environmental priorities

Among the many constituent groups in Californian, views differ on development versus environmental protection as well as priorities among environmental concerns. Differences in the State can be found between: urban versus rural, inland versus costal, city versus suburb, individual community versus regional, low versus high income households, and racial/ethnic groups.

For example a recent statewide survey by the Public Policy Institute of California (PPIC) examined differences in the views and opinions among the state's racial/ethnic groups. The general conclusion was that, in spite of considerable agreement on the most important problems and some agreement on policy responses, priorities and preferred solutions varied along racial/ethnic lines. Another PPIC study chronicled the differences in regional views on air quality, growth, traffic congestion and policies to address these concerns. Again, although the survey found broad agreement, important regional differences existed.

Finally, constituents' also have different definitions of environmental concerns. Not only do differences exist among citizens and interest groups in terms of priorities, but views of what qualifies as an "environmental impact" can also differ substantially. Groups or individuals place different levels of emphasis on:

- ***Human Health Effects*** of pollution
- ***Aesthetic/Quality of Life Impacts*** of natural resources (e.g. scenic quality, recreation, visibility)
- ***Existence Value*** of species

[3] Source: California Energy Commission, *Frequently Asked Questions on Global Climate Change,* http://www.energy.ca.gov/global_climate_change/index.html This total compares to 32% of greenhouse gases nationally from transportation in 1994.

- ***Option Value*** of maintaining a reserve of natural resources for future needs
- ***Fair Distribution of Impacts*** among groups and communities

Issue 3 – Alternatives for investing in preservation, mitigation, or restoration are not always well understood

Lack of baseline data can make it more difficult to prioritize scarce resources. For example, section 1108(a)(7), of TEA-21 made Surface Transportation Program funds eligible for environmental restoration. The amendment allows up to 20% STP funds to be used for storm water treatment or other runoff mitigation in connection with highway reconstruction or rehabilitation.[4] However, justifying the commitment of potentially large sums of Federal funds for such purposes requires estimates of the potential benefits that could be expected from specific projects.

Benefits assessments may be a specific area in which the State transportation plan could be used to identify future environmental enhancement investments. This will require development of baseline information and criteria for evaluating investments. Examples of best practices can be found among state DOTs who are also grappling with this difficult issue.

Issue 4 - Many sensitive resources are also within the areas facing strong development pressures

One of the most important roles for the State Transportation Plan could be to identify how priority investments identified in the plan correspond to sensitive environmental resources. Many of the most sensitive natural resource areas can be found on the periphery off the Central Valley and in the Central Sierra Foothills. Parts of these regions are also experiencing spillover effects as the commuting sheds and geographic scope of urban development expand. For example, Western Kern, Stanislaus, San Joaquin and Solano counties, the Great Sierra Valley region of Plumas, Lassen and Sierra counties and Western Santa Barbara County are all zones where significant development pressure and significant development pressure coincide.

Within these sensitive "hot spots" priority investments for preservation, mitigation, and restoration could be identified. The specific resource areas and natural characteristics identified by projects such as the Gap Analysis Project (habitiat), the California Rivers Assessment Project, California Wetlands Information System and the Farmland Mapping and Monitoring System are strong starting points. The resources identified by such efforts provide information that can be extremely helpful for proactive identification of the key ***pressure points*** between transportation infrastructure plans and natural resources.

Environmental Trends

Air Quality

By most measures air quality is the best understood and most developed interface between environmental and transportation planning. While not without problems, air quality modeling techniques are a fairly well established component of transportation planning processes.

[4] Transportation Equity Act for the 21st Century, Sec. 1108, Public Law 105–178, as amended by title IX of Public Law 105–206, pg. 39.

Additionally, the Conformity process, created by the 1990 Clean Air Act Amendments formalized the linkage with state air quality planning.

In spite of these characteristics, many air quality challenges still exist in this arena that will have an impact on the State's long range planning for transportation. The role of fine particulates as an air quality is one such issue. The U.S. Supreme Court recently upheld the implementation of new National Ambient Air Quality standards covering fine particulate matter ($PM_{2.5}$).[5] However, air quality monitoring and therefore our understanding of the sources of particulates is primarily geared toward larger particulate matter (PM_{10}). To address this problem the California Air Resources Board is currently developing monitoring and emissions inventories for $PM_{2.5}$.[6]

Additionally, the disproportionate impact of carcinogenic emissions on central city and low-income communities is continuing to increase pressure to control their sources. In California, diesel trucks and buses account for a large share of such emissions in many categories. Clearly this will have implications for transit agencies, ports and other facilities with large volumes of truck traffic.

Toxic and Carcinogenic Air Pollution

AB 1807, enacted in 1983 formalized the process for defining categories of toxic air pollution for regulation. Currently the California Air Resources Board tracks and has issued reports on twenty-two such categories of emissions that, "may cause or contribute to an increase in mortality or an increase in serious illness, or which may pose a present or potential hazard to human health."[7] At the Federal level, 33 such pollutants plus diesel particulates have been identified for national assessment.[8] AB 2728 (1993), made all Hazardous Air Pollutant (HAP) defined under Federal regulations automatically qualified as a Toxic Air Contaminants (TAC) subject to State regulation and control.

Over the past decade, transportation emissions of most toxic pollutants have been substantially reduced. Ethylene dibromide, cadmium, asbestos and other air toxics have been reduced to near zero through changes in fuels, catalytic converters and composition of vehicle parts. However, mobile sources are still a significant source of seven types of hazardous air pollutants. (See Table 2)

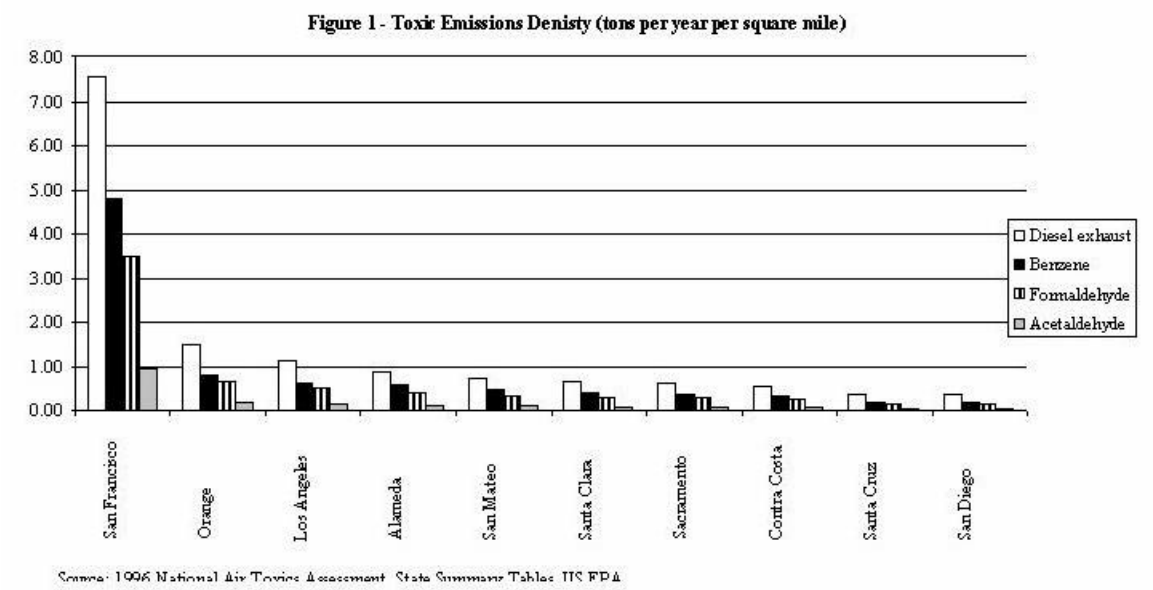
[5] *American Trucking Association vs. U.S. Environmental Protection Agency, 2001.*
[6] *PM 2.5 Inventory Resource Center*, California Air Resources Board, http://www.epa.gov/ttn/chief/eiip/pm25inventory/
[7] *Toxic Air Contaminant Staff Report, Executive Summary*, California Air Resources Board, 1999, http://www.arb.ca.gov/toxics/summary/summary.htm
[8] *1996 National Air Toxics Assessment*, U.S. EPA Office of Air Quality Planning and Standards, http://www.epa.gov/ttn/uatw/nata/

Table 2

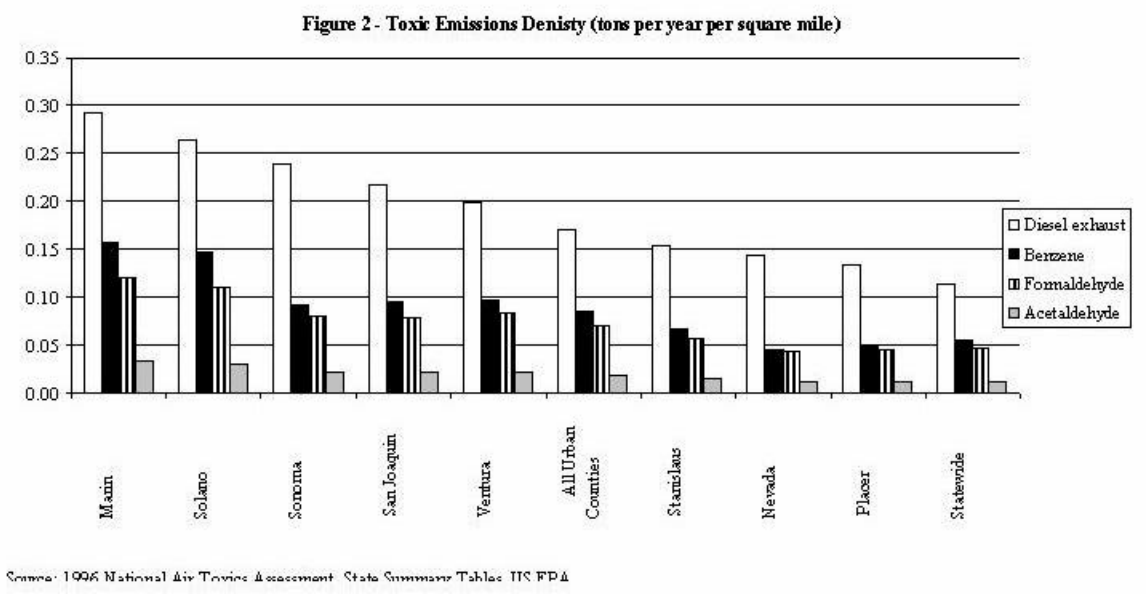
Pollutant	Statewide Emissions Tons/yr		Transportation Share (Non-road mobile sources) [9]	Risk / Unit Cadmium =100 [10]
	1996 [11]	1993 (estimate)[12]		
Benzene	20,235	16,110	76% (34%)	0.7
Formaldehyde	26,059	18,000	67% (39%) (Plus indirect ROG oxidation)	0.1
1,3-Butadiene	2,778	3,900	59% (7%)	4.1
Cadmium	3	16-18	1% (1%)	100
Acetaldehyde	7,851	110-24,000	84% (58%)	0.06
Inorganic Lead	101	175-180	63% (61% Primarily Aircraft)	No data
Nickel	78	20-360	10% (8%)	6.2
Asbestos	0	470	0%	4.5
Ethylene Dibromide	4	378	0%	1.7
Diesel Particulates **	43,358	No data	100% (59%)	See footnote

**Combination of benzene, formaldehyde, 1,3-butadiene, arsenic, nickel and 37 other pollutants listed as TACs. [13]

Unlike criteria pollutants, high concentrations of toxic emissions are primarily an urban problem in California. Across almost all categories, urban counties had the highest levels of emission per square mile.[14] For mobile source emissions the intensity ranged from 10 to times the State average among urban counties. (Figures 1 and 2)

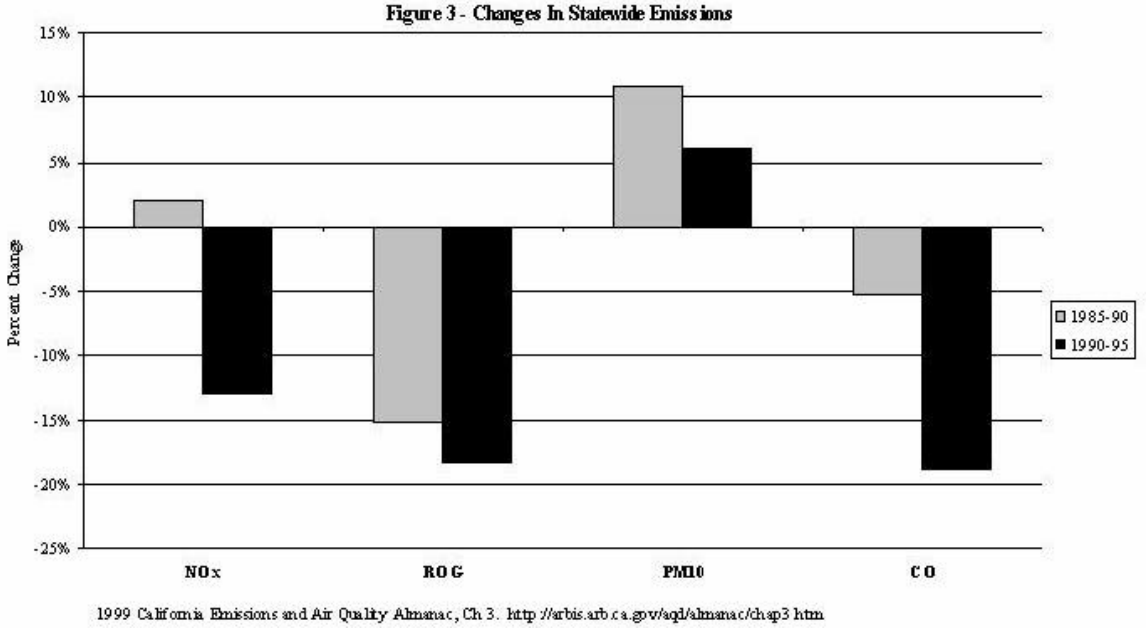


[9] *1996 National Air Toxics Assessment*, U.S. EPA
[10] *Toxic Air Contaminant Staff Report, Executive Summary*, 1999.
[11] *1996 National Air Toxics Assessment*, U.S. EPA.
[12] *Toxic Air Contaminant Staff Report, Executive Summary*, 1999.
[13] Diesel engines release particles at a relative rate of about 20 times greater than from gasoline-fueled vehicles, on an equivalent fuel energy basis. Source: CARB, *Executive Summary For the Proposed Identification of Diesel Exhaust as a Toxic Air Contaminant*, April 1998 http://www.arb.ca.gov/toxics/summary/dieselex/dieselex.htm
[14] Tons per square mile is the indicator used by EPA to reflect the intensity of toxic emissions.



Traditional Criteria Air Pollution

Among the major classifications of criteria air pollutants the general trend in California has been toward declining emissions. The steepest declines have been seen in reactive organic gases (ROG)[15] a precursor to ozone. From 1985 to 1995, statewide ROG emissions declined by more than 30%.[16] Over the same period, carbon monoxide emissions declined by 23%. Nitrogen Dioxide (NO_x) emissions declined more modestly, 11%. The notable exception to the trend was particulate emissions, which increased by 18%. (Figure 3)

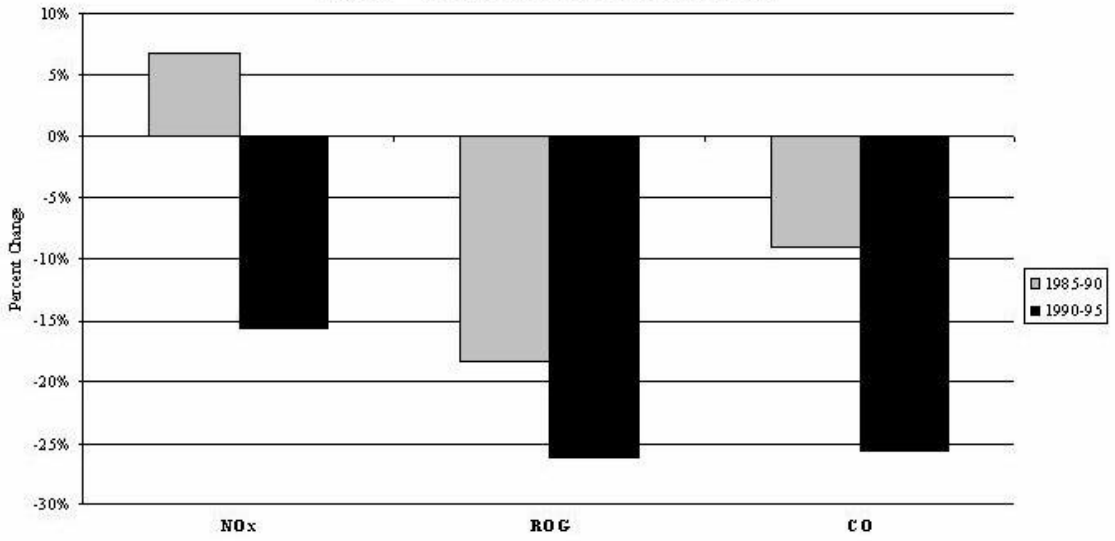


[15] There pollutants are also referred to as Volatile Organic Compounds, (VOCs). Such emissions result from engine evaporation, emissions during refueling and tailpipe emissions.

[16] *The 1999 California Air Quality and Emissions Almanac,* California Air Resource Board, Table 2-1.

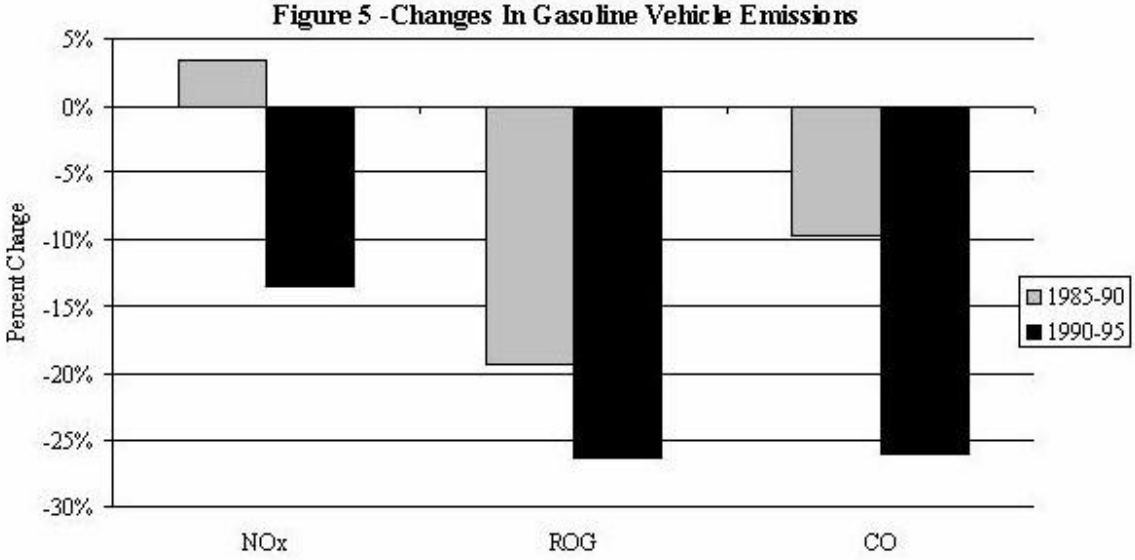
Reductions in the transportation sector followed a similar pattern, with ROG, CO and NO_x emission declining by 40%, 32% and 10% respectively.[17] (Figure 4) However, emissions from diesel vehicles showed much less improvement than gasoline vehicle emissions. NO_x emissions declined by only 8%, ROG emission were nearly unchanged and CO emissions increased by nearly 40%. (Figure 5) However, diesel vehicles account for a relatively small share of total emissions, 14% of NO_x, 2% of ROG and 1%, of CO, while gasoline vehicles account for 44%, 45% and 71% respectively. (Figure 6)

Figure 4 - Changes In On-road Vehicle Emission



1999 California Emissions and Air Quality Almanac, Ch 3. http://arbis.arb.ca.gov/aqd/almanac/chap3.htm

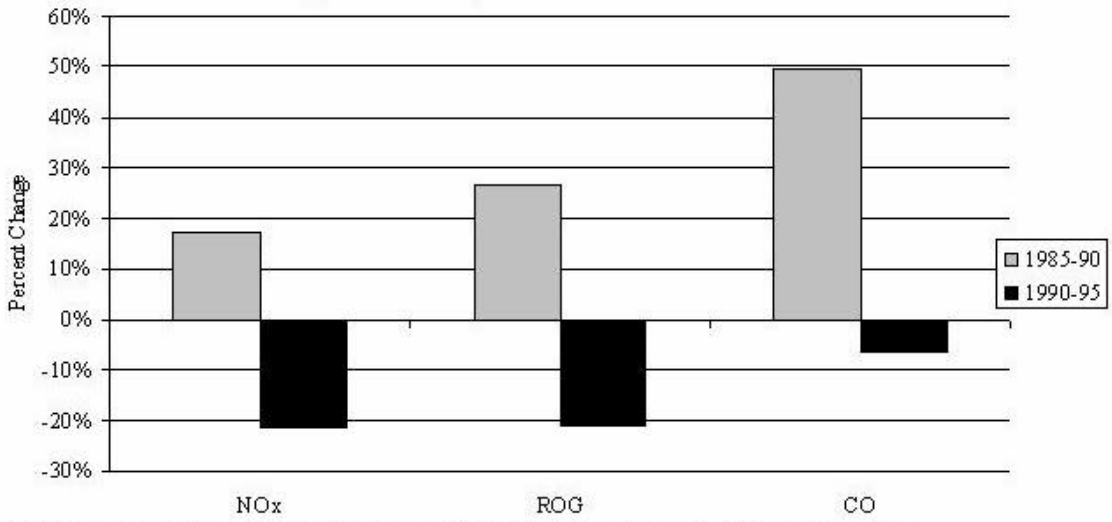
Figure 5 -Changes In Gasoline Vehicle Emissions



1999 California Emissions and Air Quality Almanac, Ch 3. http://arbis.arb.ca.gov/aqd/almanac/chap3.htm

[17] Note PM10 emissions discussed separately.

Figure 6 - Changes In Diesel Vehicle Emissions

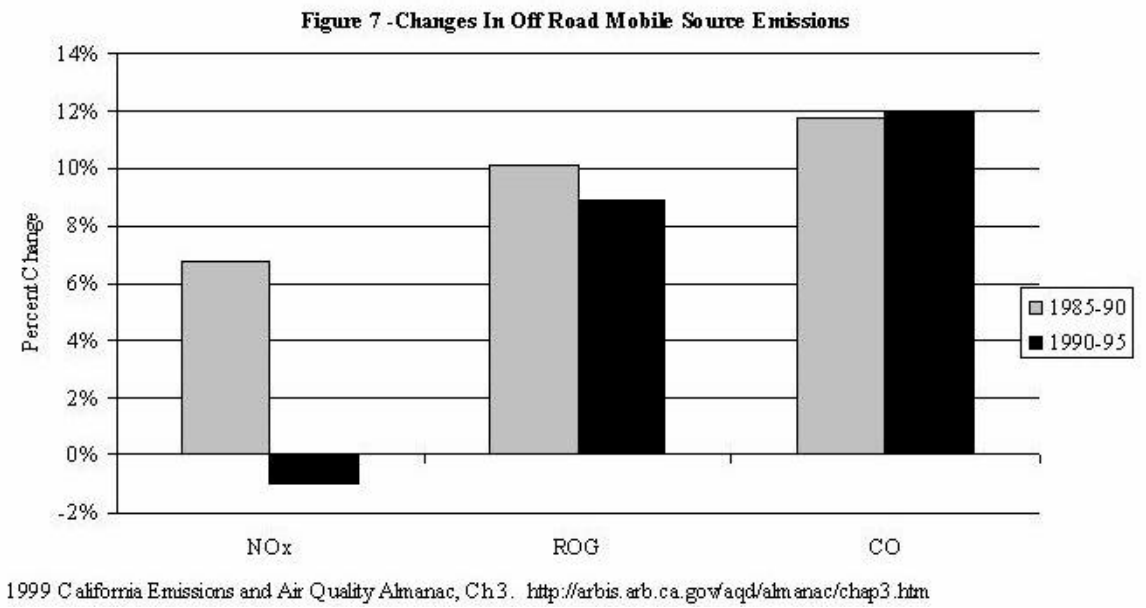


1999 California Emissions and Air Quality Almanac, Ch 3. http://arbis.arb.ca.gov/aqd/almanac/chap3.htm

The trends with respect to PM_{10} emissions deserve a separate discussion. Unlike other forms of criteria air pollution, stationary and mobile sources account for a very small share of total emissions. Fugitive dust from area-wide sources accounted for 85% of PM_{10} emissions statewide.[18] Approximately 57% of these area-wide sources are transportation related, such as fugitive dust from vehicle travel on roads (both paved and unpaved), and transportation related construction.[19] However, farming, commercial/residential construction and industrial processes are also significant area-wide sources. Area-wide transportation sources and direct emissions from on-road vehicles together account for just over 50% of statewide PM_{10} emissions.

Another trend that stands out is the substantial increase in emission from off-road mobile sources. Across all categories, emissions from off-road mobile sources are steadily increasing. Although they currently account for a small share of total emissions, sharp increases along with decreases from other sources are changing their significance as a source. (Figure 7)

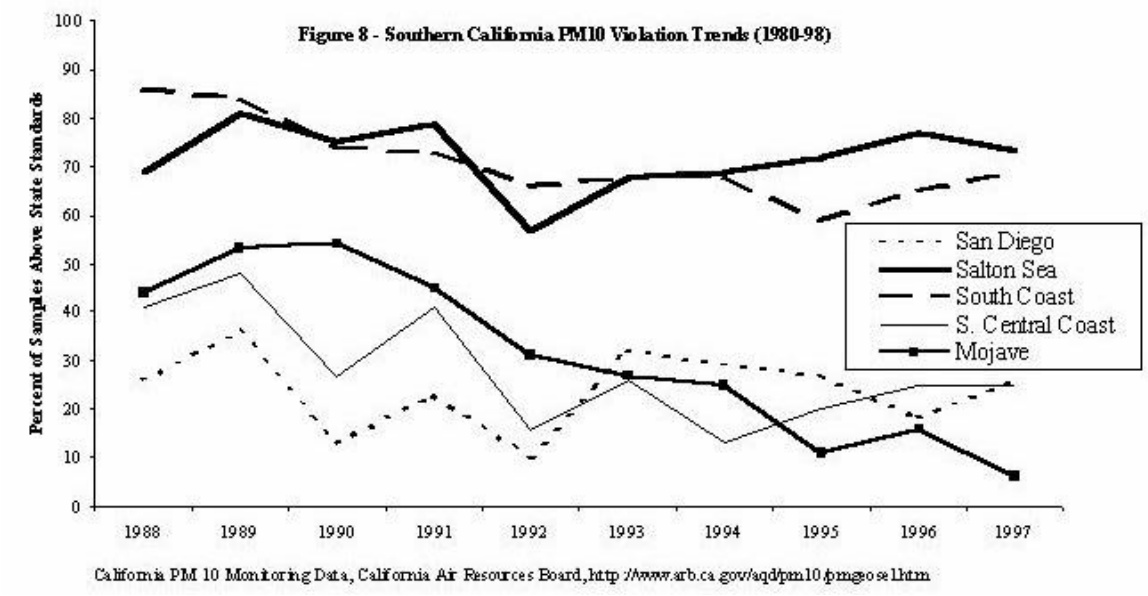
[18] ibid. Table 2-1.
[19] Ibid. Table 2-2.

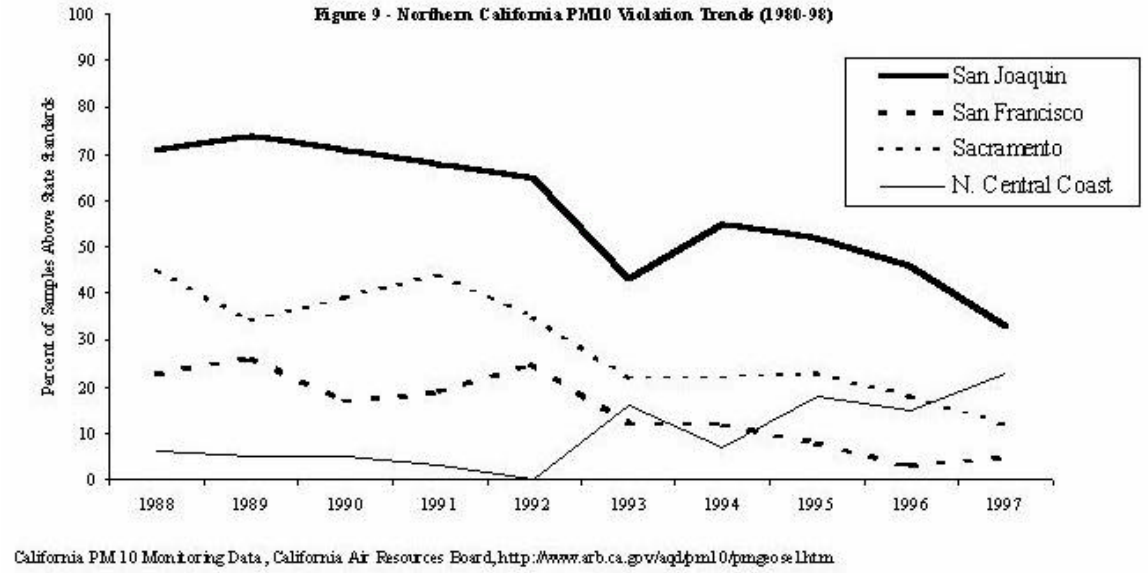


Airplanes, marine vessels, rail locomotives and heavy equipment used in road construction, all fall within this category. However, many off-road mobile sources are outside the scope of transportation planning in spite of their classification as mobile sources. The most significant contributors are mobile industrial and commercial equipment, accounting for 9% of statewide NO_x emissions, 7% of CO emission and 2% of ROG emissions. Recreational vehicles, both boats and off-road vehicles also contributed non-trivial shares of CO and ROG emissions, 3.5%, and 4.5%.[20]

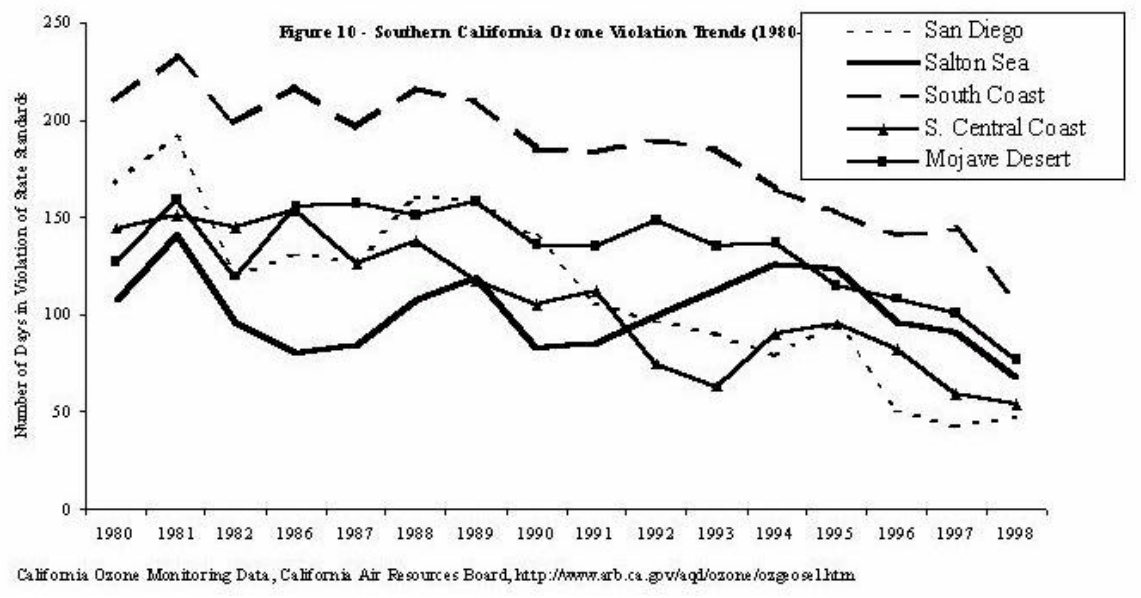
Regional air quality trends also vary across the State. For example, the State's top fifteen sites exceeding particulate standards are heavily concentrated, with seven are in the South Coast Air Basin, and five along the border with Mexico in the Salton Sea Air Basin.[21] Although the South Coast Air Basin has traditionally had the highest levels of particulate pollution, the area is showing some small improvement. On the other hand, particulate pollution in the Salton Sea, San Diego, and North Central Coast air basins has increased significantly.[22] (Figures 8 and 9)

[20] Ibid. Table 2-2.
[21] California Air Resources Board, *Air Quality Data, http://www.arb.ca.gov/aqd/pm10/ws15.htm*
[22] ibid.

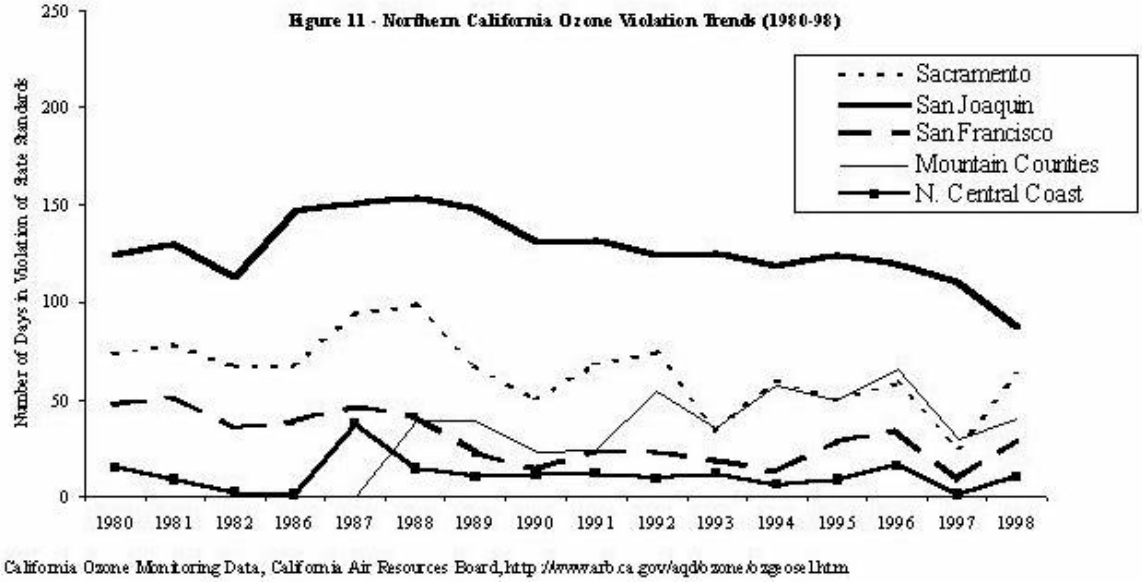




Trends in ozone violations have also varied across the state. The South Coast, San Diego, Mojave Desert, San Joaquin Valley and Salton Sea Air Basins have traditionally had the the largest number of days exceeding Federal and State ozone standards. Since 1980, San Diego has made the most progress in reducing the number of ozone violations, falling from second to seventh worst. Although, it still has the most days in excess of state standards, the South Coast Air Basin has reduced the number from 210 days in 1980 to 107 days in 1998. Progress in other regions such as the San Joaquin, Sacramento, Salton Sea and Mojave air basins has been more uneven. Strikingly, the Mountain Counties Air Basin has seen ozone concentrations increase in recent years. (Figures 10 and 11)



California Ozone Monitoring Data, California Air Resources Board, http://www.arb.ca.gov/aqd/ozone/ozgosel.htm



California Ozone Monitoring Data, California Air Resources Board, http://www.arb.ca.gov/aqd/ozone/ozgosel.htm

Water Resources

Stream, Lake and Ocean Water Quality: Watershed Planning

Water quality planning at the watershed level implies a regional and comprehensive focus. The benefits of managing water resources at a broad level have been demonstrated in a variety of planning contexts. The State of Washington has been developing a comprehensive program to integrate watershed management and transportation planning. (Figure 12) From the regulatory standpoint, experiments to streamline the environmental review process are also encouraging more comprehensive approaches by drawing a broad range of agencies into a single process. (Figure 13)

Figure 12
Watershed Based Approach to Planning
Washington State DOT
Environmental Affairs Office

Washington DOT brings together an interdisciplinary team of resource managers to create a watershed-based approach to the delivery of transportation projects. The program provides resources and technical assistance during the planning process to promote "environmental and economic benefits, process streamlining, and sound environmental policy and procedures."

The program is also intended to ensure that transportation planning and project delivery are integrated into statewide watershed recovery efforts. The primary objective of the "watershed approach" is to direct transportation mitigation dollars toward high priority watershed recovery projects by working cooperatively with other agencies to reduce transaction costs, increase environmental benefits and obtain a more streamlined consensus on projects.

The key features of the program are:

- Mitigation and enhancement investments from the Advance Environmental Mitigation Revolving Account
- Coordination of Programming through the Capital Budget Coordination Committee (CBCC)
- Environmental liaisons to the Flood Management Initiative and Stormwater Initiative

Figure 13
Environmental Streamlining Process Guide
Mid-Atlantic Transportation and Environment Task Force

The Task Force was comprised of representatives from State and Federal transportation and environmental agencies from across the Mid-Atlantic region. Their goal was to develop a streamlined review process that "is specific enough to ensure its effective implementation in all States, yet allow States to fit their individual project development processes into its framework." The process built upon the success achieved by the previous integration of NEPA reviews and Clean Air Act Section 404 permitting process. The goal of the initiative was to create concurrent review of Endangered Species Act, Clean Air Act, Fishery Conservation and Management Act, and Section 404, during the NEPA process with early involvement from all agencies.

The process guide charts an 11-step process for effectively streamlining environmental reviews:

Step 1 – Transportation Planning Process
Step 2 – Scoping
Step 3 – Purpose and Need
Step 4 – Alternatives Development
Step 5 – Detailed Alternatives Analysis & Draft NEPA Document
Step 6 – Identification of Preferred Alternative & Conceptual Mitigation Plan
Step 7 – Final NEPA Document
Step 8 – Record of Decision
Step 9 – Project Design & Final Minimization and Mitigation Coordination
Step 10 – Final Permit Decision
Step 11 – Project Implementation and Monitoring

At each stage a specific list of activities and responsibilities of each agency are outlined. Additionally, a set of tools that can be used throughout the process as well as tools specific to each stage are cataloged.

The process guide makes a key point with respect to the role of long range planning:

> "Given the fact that Long Range Transportation Planning is the cornerstone of developing a fiscally constrained, efficient, and integrated transportation system, the linkage of transportation planning and project development which occurs in Step 1 has the potential to be one of the most influential steps in the new streamlined process."

(pg. 8)

Within California, many comprehensive watershed-planning efforts already exist at the regional level. At the State level, the California Resources Agency is sponsoring the California Rivers Assessment Project (CARA), managed by UC Davis. The project has compiled a database containing information on the 149 separate watershed basins across the State. For each watershed, critical data is reported that could be potentially useful to transportation project planning. (Table 3)

Table 3 - Data Contained in CARA Database

Basic Physical Data	Environmental Data	Administrative Data
Total watershed area in acres	Average Precipitation per Year	Number of Planning watersheds within each basin[23]
Miles of natural waterway	Percentage of Land Area above 15% Slope	Number of Selected Watershed Projects
Miles of Near-Stream Roads	Number of Special Status Species[24]	Percentage of Land Area Protected
Number of Dams	Number of Holland Communities[25]	Percentage of River Miles in Protected Lands
Number of Stream Crossings	Number of Wildlife Habitat Relations (WHR) Types	
Percentage of Free Flowing River Miles	Number of Natural Diversity Database (NDDB) Types	
	Impaired streams, lakes or other bodies of water[26]	

Water Contamination

The issue of water contamination by toxic and carcinogenic materials is a high priority issue since are the potential health impacts are significant and contamination tends to be difficult to reverse. Transportation infrastructure can contribute to contamination of lakes, streams and water supplies in a number of ways. The most visible form of contamination is through hazardous material spills. However, the cumulative effects of transportation facility runoff containing heavy metals and other toxic materials can also contaminate surface water. Finally, leakage form underground storage tanks is another source of water contamination. This issue has been the most visible in recent years due to the controversy surrounding the fuel additive Methyl Tertiary Butyl Ether (MTBE).

MTBE

A 1997 sample of 20% of the State's water sources found that 1.2% had contaminated by MTBE, this total included both underground and surface water supplies. The Los Angeles Regional Water Quality Control Board found MTBE present in 2.3% of its sources.[27] Although the health risks of low-level exposure are still relatively unknown, fairly low levels of contamination (5

[23] CalWater Units as defined by the State Water Control Resources Board
[24] Threatened or Endangered
[25] Vegetation classifications defined by dominant species, measure of biodiversity
[26] Water Body System database rivers exceeding Total Maximum Daily Load (TMDL) levels
[27] Ghirelli, Robert P., Hassan Amini, Brent D. Kerger, Alexis Hillman, and Richard O. Richter, *MTBE Water Contamination: Key Considerations for Remediation, Risk Assessment, and Risk Management,*

parts per billion) give water an unpleasant taste and odor.[28] Therefore, even at low levels MTBE can render a water supply unusable.

However, phase-out of MTBE will take time. The most viable alternative for oxygenating fuel is ethanol. However, the significant quantities necessary to replace MTBE are beyond current ethanol refining capacity in the State. In the short-term, replacing MTBE will likely require ethanol imports from the Midwest or major international producers such as Brazil.

Wetlands

Wetlands are a critical element of watershed planning. However, regulations and permit process are complex and criticized for focusing on such resources in isolation. One source of this complexity relates to the difficulty of precisely defining wetlands. Additionally, a wide variety of wetlands exist, and each type possesses unique characteristics. The incomplete tracking of changes in wetlands is yet another factor that makes it more difficult to address wetlands issues through comprehensive planning. Finally, the wide variety of public and private entities involved in wetlands management presents challenges for organizing effective stakeholder involvement.

Defining Wetlands

Although, the State is attempting to develop and implement a consistent definition of wetlands, differences exist between Federal and State approaches. Even among the Federal agencies, differences exist with respect to the definition of wetlands for regulatory purposes. The U.S. Army Corps of Engineers uses a "three-parameter test" for permitting and planning purposes. Permits for altering land are required only if hydrophytic vegetation, hydric soils, and wetland hydrology are all present.[29] U.S. Fish and Wildlife Service uses a much broader definition that encompasses: swamps; freshwater, brackish water, and saltwater marshes; bogs; vernal pools, periodically inundated saltflats; intertidal mudflats; wet meadows; wet pastures; springs and seeps; portions of lakes, ponds, rivers and streams.[30]

In 1989 the EPA also issued new rules broadening definitions of federally protected wetlands. This change, in effect doubled the amount of wetlands that were under federal control, from 100 million to 200 million acres. An estimated 75% of these wetlands are on privately owned land.[31]

Wetlands can be grouped by type: marine, estuary, lake, river and *palustrine* wetlands. Marine and estuary wetlands are both associated with coastal wetlands, such as tidal marshes. *Palustrine* wetlands may be isolated resources such as vernal pools or marshes, swamps, and bogs.[32] California also categorizes wetlands as seasonal or permanent based on the portion of the year they are inundated with water.

---

[28]

[29] *Defining Wetlands*, California Wetlands Information System, http://ceres.ca.gov/wetlands/introduction/defining_wetlands.html

[30] ibid.

[31] Marzulla, Nancy G. "Property Rights Movement: How It Began and Where It Is Headed," ch. 4 in *A Wolf in the Garden*, eds. Philip Brick and R. McGreggor Cawley, Rowman & Littlefield, 1996, pg. 49.

[32] *Defining Wetlands*, California Wetlands Information System,

Vernal pools are a category of wetlands that have received an increasing attention recently. However, they are perhaps the least well-understood category of wetlands. Vernal pools are defined as:

> "seasonally flooded depressions found on ancient soils with an impermeable layer such as a hardpan, claypan, or volcanic basalt, allowing the pools to retain water much longer then the surrounding uplands…. Only plants and animals that are adapted to this cycle of wetting and drying can survive in vernal pools over time. These specialized plants and animals are what make vernal pools unique."[33]

California has 17 distinct *Vernal Pool Regions*. Nearly 1 million acres of vernal pool complexes over 40 acres in size still remain in the Central Valley according to a Department of Fish and Game and Fish and Wildlife Service study. Of these pools, 64,075 acres are on publicly owned lands and 932,546 are on privately owned land. However, many of the latter fall within regional and habitat conservation planning efforts.

(For links to detailed regional information see: California Wetlands Information System at http://ceres.ca.gov/wetlands/geo_info/vernal_pools_map.html)

Tracking Changes in Wetlands

Losses and gains of California's wetlands are tracked two mechanisms. The State's 3 regional U.S. Army Corps of Engineers offices track significant wetlands changes through permits required under Section 404 of the Clean Water Act. The Streambed Alteration Agreements, managed by the Department of Fish and Game, track very small wetlands and riparian habitat. Generally, impacts from illegal fills and isolated wetlands less than one acre go unreported.

Wetlands tracking began in 1993, following the creation of a statewide program by Executive Order W-59-93. Between 1993 and 1998, the State Resources Agency reported that approximately 62,000 acres were acquired, 26,500 acres were restored, 137,500 acres were enhanced and 1,500 acres were created. Detailed statewide data on losses were unavailable prior to 1996, but statistics suggest that a 7 to 1 ratio of gains to losses during 1996 and 1997.[34] A statewide database of wetlands projects is maintained at:
http://ceres.ca.gov/wetlands/tracking.html

Existing Planning Efforts

Within the State there are five regional wetland planning efforts and four watershed planning efforts that include major wetland resources.[35] (Table 4)

[33] California Wetlands Information System - http://ceres.ca.gov/wetlands/whats_new/vernal_sjq.html
[34] *The State of the State's Wetlands*, California Resources Agency and California Environmental Protection Agency, Sacramento, December 1998, pg. 3.
[35] *The State of the State's Wetlands*, pg. 9

Table 4

Regional Wetland Planning Efforts	Other Wetland/Watershed Efforts
Pacific Coast Joint Venture	Monterey Bay National
Central Valley Habitat Joint Venture	Marine Sanctuary
San Francisco Bay Joint Venture	Morro Bay National
Southern California Wetlands Clearinghouse	Estuary Project
Intermountain West Joint Venture	

Land Resources

A lively debate still exists in the transportation planning field over the strength of the impact transportation investments have on the shape of commercial and residential location patterns. [36] Regardless, it is widely recognized that transportation facilities and land use patterns exist in a feedback loop and cannot be considered in isolation from one another. The State's major metropolitan areas have exerted considerable effort developing tools to capture these relationships and account for such dynamics in their forecasts. However, smaller urban areas and non-urban regions lack such a capacity to specifically estimate the impacts of the transportation / land use relationship.

Habitat

In this policy arena extensive analysis has been conducted as part of the *Gap Analysis Project*. The project is part of a national effort to identify landscapes that contain large numbers of potentially unprotected vegetation types and vertebrate species. Such areas can then be studied in more detail as candidates for additional management and conservation efforts to fill "gaps" in the reserve network.[37]

In California, the project was a joint partnership led by the University of California Santa Barbara and the U.S. Geological Survey. The State was divided into 10 distinct regions and detailed GIS-based analysis was conducted. The analysis revealed the following[38]:

- In terms of the ownership patterns affecting land resources
    - Just over half of land in the State exists in a low priority (status 4) management category, most of which is privately owned.
    - Roughly 18% falls within high priority biodiversity management zones (status 1 and 2)
    - The remaining 30% are on public lands, but *not otherwise designated for biodiversity management*

[36] For literature on the debate see: Giuliano, Genevieve, "The Weakening Transportation-Land Use Connection," *Access*, n. 6, Spring 1995, pp. 3-11; Cervero, Robert and John Landis, "The Transportation-Land Use Connection Still Matters," *Access*, n. 7, Fall 1995, pp. 2-10; Kelly, Eric D., "The Transportation Land-Use Link," *Journal of Planning Literature*, v. 9, n. 2. pp. 128-145 and Boarnet, Marlon G. "The Direct and Indirect Economic Effects of Transportation Infrastructure," *UCTC Working Ppaer 291*, 1997.

[37] *Gap Analysis Project: Final Report*, "Executive Summary," University of California Santa Barbara, http://www.biogeog.ucsb.edu/projects/gap/gap_proj.html

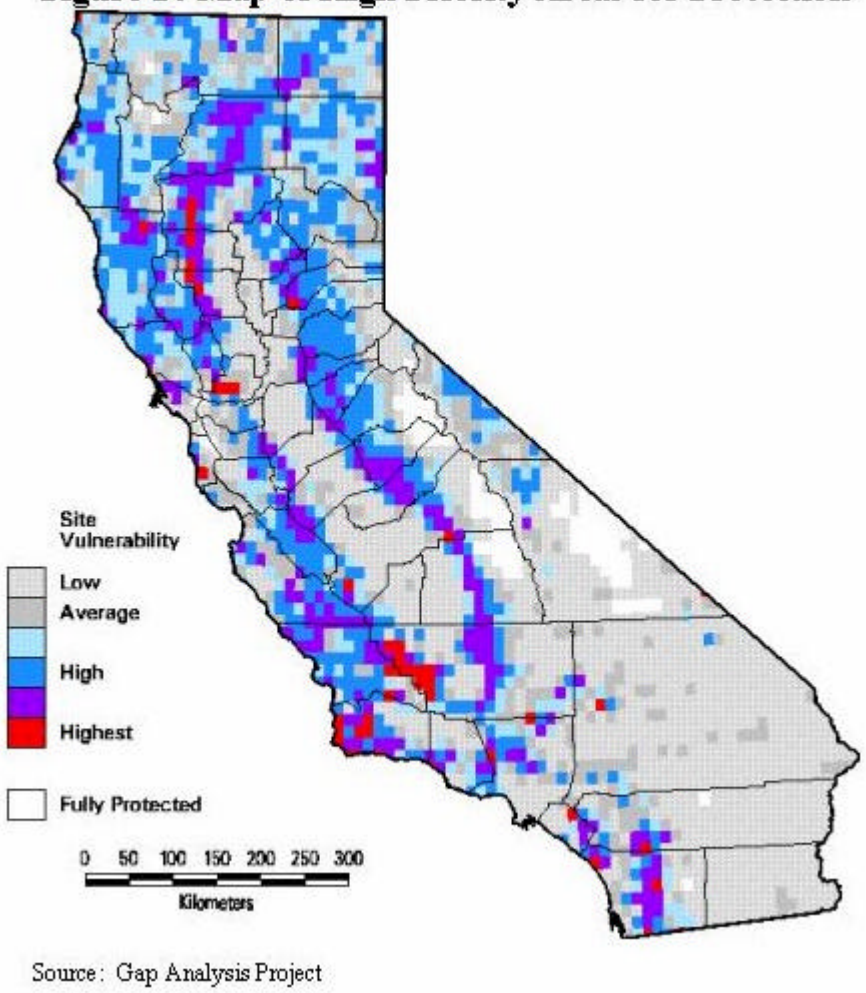
[38] ibid.

    - The majority of status 1 and 2 lands are in the southern Sierra Nevada, Mojave Desert and Sonoran Desert regions
        - Low elevations, particularly along the coast and in Great Central Valley are strikingly under-represented
- Among the States 197 vegetation classifications…
    - ***The least-protected***: Coastal scrub, Great Basin scrub, prairie grasslands, hardwood woodlands, and a few conifer forests
    - ***The best-protected***: Mojave Desert scrub, sub-alpine conifer and alpine communities
- Among species with very low levels of representation in protected areas they identified four types
    1. *Adapted to human-dominated habitats*
        - Little or no action needed
    2. *Very limited ranges*
        - Best evaluated in a "fine-filter" approach to complement the "coarse-filter" gap analysis
    3. *Marginal to the state*
        - Should be reassessed in eco-regional gap analyses over their entire multi-state range
    4. *Diminishing or degraded habitats*
        - The most vulnerable group of species

Based on these site characteristics and the proximity to development pressures, the final report prioritized the State's potential "gaps" at a detailed level. The report highlighted regions by the priority that should be given to additional protection measures (Figure 14):

- **Highest scoring**
    - A ring around the Great Central Valley - particularly western Kern County, Glenn, Colusa, and Tehama counties
    - Western Santa Barbara and Solano counties contain other particularly high scoring clusters of valuable at-risk habitat
- **Relatively high scoring**
    - Sierra Nevada foothills
    - Much of the Central Western region (Counties?)
    - Parts of Shasta County
    - Undeveloped areas throughout the Southwestern California region
    - A small area along the border with Nevada in Lassen County
- **Low scoring**
    - Great Central Valley, Los Angeles Basin, and the Imperial Valley near the Mexican border where agriculture or urbanization have eliminated most of the native vegetation
- **Other low scoring areas**
    - Higher elevations of the southern Sierra Nevada and the majority of the Mojave and Sonoran Desert regions where the habitat communities are ***well represented in managed areas and thus tend to have low priority***

Figure 14 Map of High Priority Areas for Protection



Source: Gap Analysis Project

Farmland

One of the most visible land resource issues is the loss of farmland to urban development. While this issue has received attention in many U.S. states, it is a particularly significant issue in California given its importance as a national supplier of agricultural products. Statistic Additionally, it is important to distinguish between prime and unique farmlands.

The California Farmland Conversion Report published by the Department of Conservation's Farmland Mapping and Monitoring Program provides a comprehensive source of data on farmland trends. The report contains statistics on prime and unique farmland down to the county level. The most recent report tracked changes in farmland patterns over a two-year period (1996-1998). The inventory covers roughly half of the State's land area and approximately 90% of farmlands. The key findings in the report are:

- In 1998 the state had roughly 9 million acres of irrigated farmland, 2.8 million acres of non-irrigated farmland and 15 million acres of grazing lands.
- This compared to 3.1 million acres of urban land
- Between 1996 and 1998, 69,885 new acres of land was converted to urban uses compared to 55,896 over the previous two-year period

- Of this acreage, 31% (21,664 acres) was previously irrigated farmland, the same share as the previous period
- 17 counties had a net increase in farmland. The largest increases were in Santa Barbara, Sonoma and San Luis Obispo counties and the Sierra Valley area of Lassen, Plumas and Sierra counties.
    - New vineyards on lesser quality soils was a large part of the increase in the three costal counties
    - While irrigated pastures and alfalfa fields were the primary use added in the Sierra Valley region
- The San Joaquin Valley Region ranked second in the growth of new Urban Land, with 14,414 acres, but 66% was formerly irrigated farmland (9,505 acres)
- Southern California added 30,306 new acres of urban land, but only 19% was formerly irrigated farmland, (5,758 acres)
- Riverside was the most rapidly urbanizing county with 8,902 acres of new Urban Land, but only a quarter of this total was converted from irrigated farmland (2,335 acres)

Environmental Priorities and Trends in Public Opinion

A series of Public Policy Institute of California studies have identified important differences in how Californians view environmental issues. As part of an on-going series of statewide survey's PPIC has explored how different regions and racial/ethnic groups in the State view rapid population growth, air quality, sensitive natural resources, traffic congestion and other concerns. The surveys explore whether people are concerned about particular issues, how they view potential policy solutions, and how the concerns rank alongside other state priorities.

In a survey exploring differences along racial and ethnic lines PPIC found:

- All groups rated education and crime highly as the most important issue. However, views on the environment as a policy priority varied:
    - Whites were more than twice as likely other groups to consider environmental issues to be the State's most important policy issue and half as likely to view jobs as the most pressing problem
- When asked rate pollution is a *big problem, somewhat of a problem* or *not a problem* in their region, at least 69% felt there was a problem.
    - Blacks and Latinos were more likely than Asians and Whites to identify pollution as a big problem
- On the question of growth and development as an environmental issue 65% of adults did see a problem in their region
    - Whites were more likely to see this issue as a big problem, while Latinos and Blacks were most likely to see the issue as not a problem
- Finally, stricter environmental laws were viewed by 63% of the population as *Worth the cost*
    - Latinos and Blacks were more likely than Whites to view them as *hurting the economy*, while Asians were the least likely to view stricter environmental laws as negative for job growth

Table 5

	All Adults	White	Latino	Asian	Black
Environmental Issues					
How much of a problem is air pollution, water pollution, and other forms of environmental pollution in your region?					
Big problem	27%	26%	30%	28%	32%
Somewhat of a problem	42%	43%	40%	45%	40%
Not a problem	31%	31%	30%	27%	28%
How much of a problem is population growth and development in your region?					
Big problem	26%	29%	19%	21%	23%
Somewhat of a problem	39%	39%	39%	44%	35%
Not a problem	35%	32%	42%	35%	42%
Do stricter environmental laws and regulations cost too many jobs and hurt the economy, or are stricter environmental laws and regulations worth the cost?					
Cost jobs, hurt the economy	37%	35%	41%	30%	40%
Worth the cost	63%	65%	59%	70%	60%

Baldassare, Mark, *PPIC Statewide Survey*, Table 3.6

Another PPIC study chronicled the differences in regional views on environmental issues. Not surprisingly, Bay Area residents were the most concerned about the pace of growth and more willing to vote for growth restrictions even if they meant less economic growth, while Californians in the Central Valley were least concerned.[39] However, views on air quality as a big problem followed a different pattern. Residents of the Los Angeles region were the most likely to view the issue as a big problem while residents of the Central Valley were just as likely as Bay Area residents to attach this level of concern to air quality.[40]

Smaller differences were found among regions on whether or not restricting development to preserve wetlands, rivers and environmentally sensitive areas would improve quality of life over the next 10 years. Only, 33% of Central Valley residents felt this would be *very effective* compared to 47% and 44% in the Bay Area and LA. However, in all major regions surveyed, less than 25% of respondents felt that such policies would be ineffective at improving quality of life.

It is also important to note that public perceptions and priorities can also change over time. In 1989, a national poll asked, "What do you consider the single most important environmental problem today?" Respondents were asked to name two issues. Toxic wastes in water supplies and air pollution were named by almost half of those polled. Damage to rivers, lakes and oceans were primary concerns for about one-third. Less than one-in-ten felt that uncontrolled economic growth, traffic congestion, destruction of natural vegetation and global warming were

[39] Baldassare, Mark, "Special Survey on Californians and the Environment," *PPIC Statewide Survey*, June 2000, pg. 2.
[40] Ibid, pg. 3

not primary issues of concern.[41]

However, more recent polls show a substantial shift. A Pew Research Center poll conducted in 1997 asked people specifically about their concern over the commercial development of open space. More than two-thirds of respondents said they worry a great deal or fair amount about this issue.[42] Other pollsters confirm this shift in American's environmental concerns:

> "No issue speaks more directly to Americans' quality of life than their ability to enjoy open spaces, parks and wilderness areas, said Washington pollster Frank Luntz, who surveyed 900 Americans nationwide. Luntz said lawmakers who want to 'connect' with voters in the 2000 election should pay attention to the issue."[43]

The 1998 election season confirmed the growth in prominence of this issue. A total of 240 initiatives to protect or improve parks, open space, farmland, historic resources, watersheds, greenways and natural habitat were on the ballot in 31 states.[44] 173 of these measures were passed, approving $7.5 billion in new state and local spending on conservation.[45]

Implications for Transportation Planning

From Compliance to Stewardship

A variety of research and implementation efforts have been underway to encourage a proactive approach to environmental issues. Such approaches are often referred to as *Environmental Stewardship.* However, defining what environmental stewardship means in the context of transportation programs is not a simple task. The TRB Environmental Analysis in Transportation Committee recently released the results of a national survey attempting to develop a more specific understanding of the concept in practice. The summary report grouped the insights gleaned from the survey into 10 areas. (Figure 15)

[41] Los Angeles Times National Poll on Environmental Issues, Telephone Survey of 1,623 Adults, November 21, 1989.
[42] Pew Research Center Poll, Telephone Survey of 1200 Adults, Princeton Survey Research Associates, November 24, 1997.
[43] Rumbler, Bill, "Living with Nature: More buyers opt for developments that preserve open space and wildlife habitats," *Chicago Sun-Times*, Friday, August 27, 1999, Sec**:** HOF; Pg. 1; N, Chicago Sun-Times, Inc.
[44] Myers, Phillis, "Livability at the Ballot Box: State and Local Referenda on Parks, Conservation, and Smarter Growth, Election Day 1998," A Discussion Paper for the Center on Urban and Metropolitan Policy, The Brookings Institution, January, 1999, p. 2.
[45] ibid. p 2.

Figure 15

Environmental Stewardship in Transportation Program Execution

Transportation Research Board

Environmental Analysis in Transportation Committee

- Environmental stewardship has six defining characteristics;
    1. Improving quality of life where possible, not just complying with regulations
    2. Careful management of resources through public/private partnerships
    3. Individual attitudes, ethics and behavior
    4. Wise choices based on comprehensive understanding of consequences
    5. Acting as a trustee for future generations, moving toward cost-effective and sustainable future
    6. Integrating environmental values as a core business value
- Agency-wide commitment to environmental excellence is important
- Effective stewardship improves public and regulatory attitudes
- Effective stewardship improves programs and services
- Many opportunities exist for environmental stewardship in transportation
- Costs of environmental stewardship need to be included in the price of transportation business
- Environmental stewardship can help achieve TEA-21 Streamlining Goals
- The transportation sector can develop a stewardship ethic through, achieving and publicizing enhancements, becoming environmental leaders, providing managers with the authority and accountability needed to integrate environmental planning, top management commitment, monitoring performance…
- Barriers must be overcome
    - "Us vs. Them" attitudes between transportation and environmental professionals
    - Integrating principles into programmatic agreements
    - Fear of precedent and future implications
    - Lack of available information and examples
    - Perception among transportation professionals that protection of the environment is the responsibility of environmental agencies
    - Perception that enhancement choices cost too much and take too long
    - Myth that environmental and transportation decisions are separate
    - Lack of awareness of environmental consequences and available alternatives
    - Compartmentalization of environmental functions within transportation organizations
    - Narrow interpretation of transportation mission and public safety
- A range of more subtle concerns and benefits must also be considered

Other initiatives incorporate elements of *environmental stewardship*, but do not necessarily use this term to describe their efforts. For example, a project co-sponsored by AASHTO and FHWA takes a different approach than the TRB effort. The focus of the program is to identify principles of excellence for *Context Sensitive Design*. Principles have been developed to describe both design elements and the process surrounding design, (Figure 16)[46]

Figure 16
Context Sensitive Design: Thinking Beyond the Pavement
AASHTO / FHWA

Project Design Principles

1. Satisfies purpose and needs as agreed to by a full range of stakeholders. Agreement is forged in the earliest phase of the project and amended as the project develops.
2. Safe both for the user and the community.
3. The project is in harmony with the community and preserves environmental, scenic, aesthetic, historic and natural resource values of the area.
4. Exceeds the expectations of both designers and stakeholders
5. Efficient and effective use of resources (time, budget, community) of all involved parties.
6. Designed and built with minimal disruption to the community.
7. The project is seen as having added lasting value to the community.

Process Principles

1. Communication with all stakeholders is open and honest, early and continuous.
2. A multi-disciplinary team is established early, based on the needs of the specific project and with the inclusion of the public.
3. A full range of stakeholders is involved with transportation officials in the scoping phase. The purposes of the project are clearly defined and consensus on the scope is forged before proceeding.
4. Development process is tailored to the circumstances. Multiple alternatives are explored and emphasis is on a process that will result in consensus on approaches.
5. A commitment to the process from top agency officials and local leaders is secured.
6. The public involvement process, which will include informal meetings, is tailored to the project.
7. The landscape, the community, and valued resources are understood before engineering design is begun.

A full range of tools for communication about project alternatives is used (e.g., visualization).

[46] *Context Sensitive Design: Thinking Beyond the Pavement*, Federal Highway Administration, American Association of State Highway and Transportation Officials, http://www.fhwa.dot.gov/csd/mdbroch.pdf

This implies that solutions must be generated in part from local processes. For example the broad differences among Caltrans Districts suggest that the State transportation plan's treatment of environmental issues must begin with a systematic evaluation of the constraints, pressures and opportunities present in each region. For example:

- Even among areas within the Central Valley the urban development pressures are different. San Joaquin County is expected to grow by more than 200,000 over the next 20 years while Modoc County is expected to grow by less than 50,000.
- The land resources under development pressure in Riverside and Imperial County are different from the land resources in Stanislaus or Kern County.
- The impact of transportation infrastructure on air quality, water quality, habitat and land resources depend on the level of use, the location of activity in relation to resources and the population effected by damage to resources.

Ultimately, attention to building broad partnerships while developing the State plan could help build a base of support for future planning efforts. Reaching early consensus around investments with the least damage or enhancements with the most benefit, can reduce conflict over future elements of Project Development Reports and Transportation Improvement Programs.

Creating an Environmental Investment Portfolio

The ability to accurately assess the value of potential investments is also critical to moving beyond simply responding to pressure from the public or regulators and toward proactive environmental stewardship. A strategic *environmental investment portfolio* approach can yield larger benefits from scarce public resources. However, prioritizing expenditures is difficult without better information. Not all natural resources have equal value to ecosystems. Therefore, better quantifying the contribution of particular wetland resources, or habitat zones is necessary. Additionally, current inventories and classification systems can often be incomplete or include a measure of subjectivity.

Some efforts have been made to develop criteria to evaluate alternatives. For example, North Carolina DOT has developed a set of criteria for evaluating wetlands enhancement and mitigation alternatives based on soil and hydrological characteristics. Investment criteria designed with California's resource base in mind would be an important contribution to effective stewardship policies.

The State transportation plan can also make a strong contribution by gathering the baseline information that needed to apply environmental investment criteria. A more solid base of information would make it possible to build a comprehensive environmental enhancement portfolio. In this area, a potential model is Washington State DOT's *Advanced Environmental Mitigation Revolving Account*. The state program provides a reimbursable fund permitting mitigation investment in advance of project impacts. Originally established to enable wetland mitigation banking, the program has been expanded to include mitigation for fish habitat, fish passage and flood management.[47]

[47] *Background on the Advanced Environmental Mitigation Revolving Account*, Environmental Affairs Office, Washington State DOT, http://www.wsdot.wa.gov/eesc/environmental/programs/watershed.htm

Conclusions

Effectively addressing the environment within the upcoming State transportation plan is clearly a complex task. Lack of information on current conditions, uncertainty about future trends and the complex context surrounding environmental issues combine to make forging effective polices difficult. In an ideal world, the many interests involved with major investments could be brought together in a comprehensive processes. However, in the real world, a number of barriers make this form of environmental stewardship difficult to achieve in practice.

The State transportation plan is an opportunity to begin laying a foundation to overcome such barriers. Improving the base of information needed to make decisions is a first step. In this endeavor initiatives already under way among other State and local agencies can be of substantial assistance. However, improved information alone is insufficient. Better processes in which information is applied are also necessary. Evaluating alternatives and trade-offs among various interest groups is essential to reducing future conflict. Proactive environmental investments can help build the trust and goodwill needed to move key investments forward later in the process. The recent TRB survey on the topic suggests that at least some transportation professionals believe that such efforts benefit transportation programs.