

A photograph of a dirt road winding through a forest. The road is unpaved and appears to be made of dirt and gravel. On the left side of the road, there is a steep, eroded embankment with visible soil layers. The forest is dense with trees, and the lighting is somewhat dim, suggesting a shaded area. The text is overlaid on the image in a bright yellow color.

# Fundamentals of Rural Roads

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# Types of Roads

- Permanent, all season use roads
- Permanent, seasonal use roads
- Temporary roads and trails
- “Legacy” roads, in use or not in use

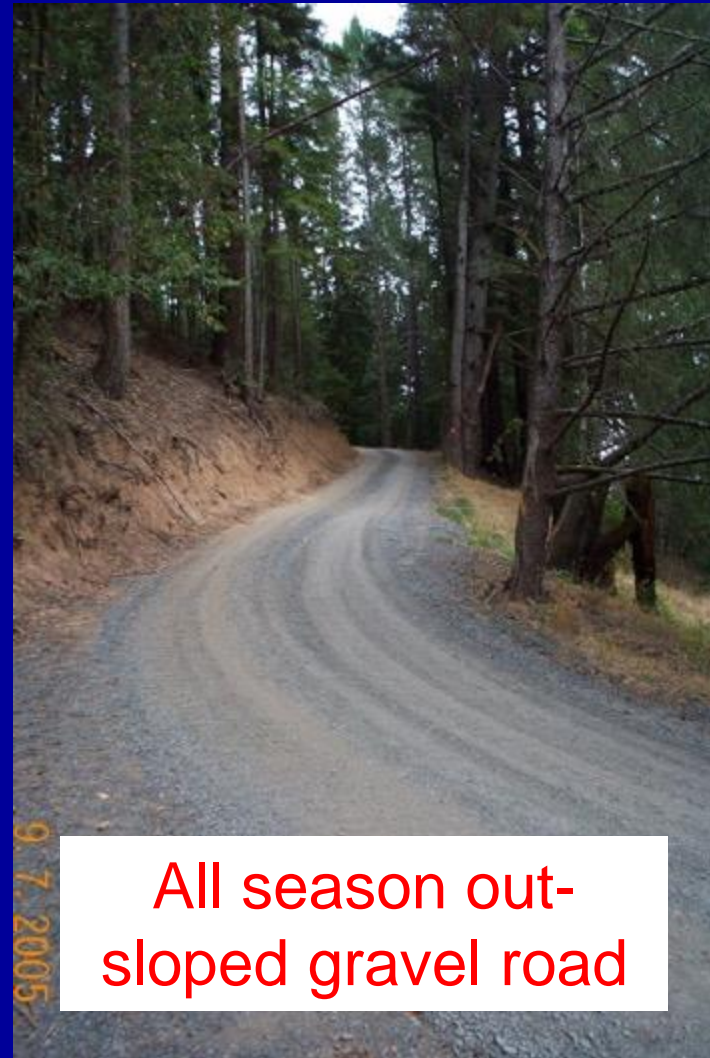
# Road Standards and Design Should Suit the Uses



All season gravel road with slope protection and armored drainage ditch

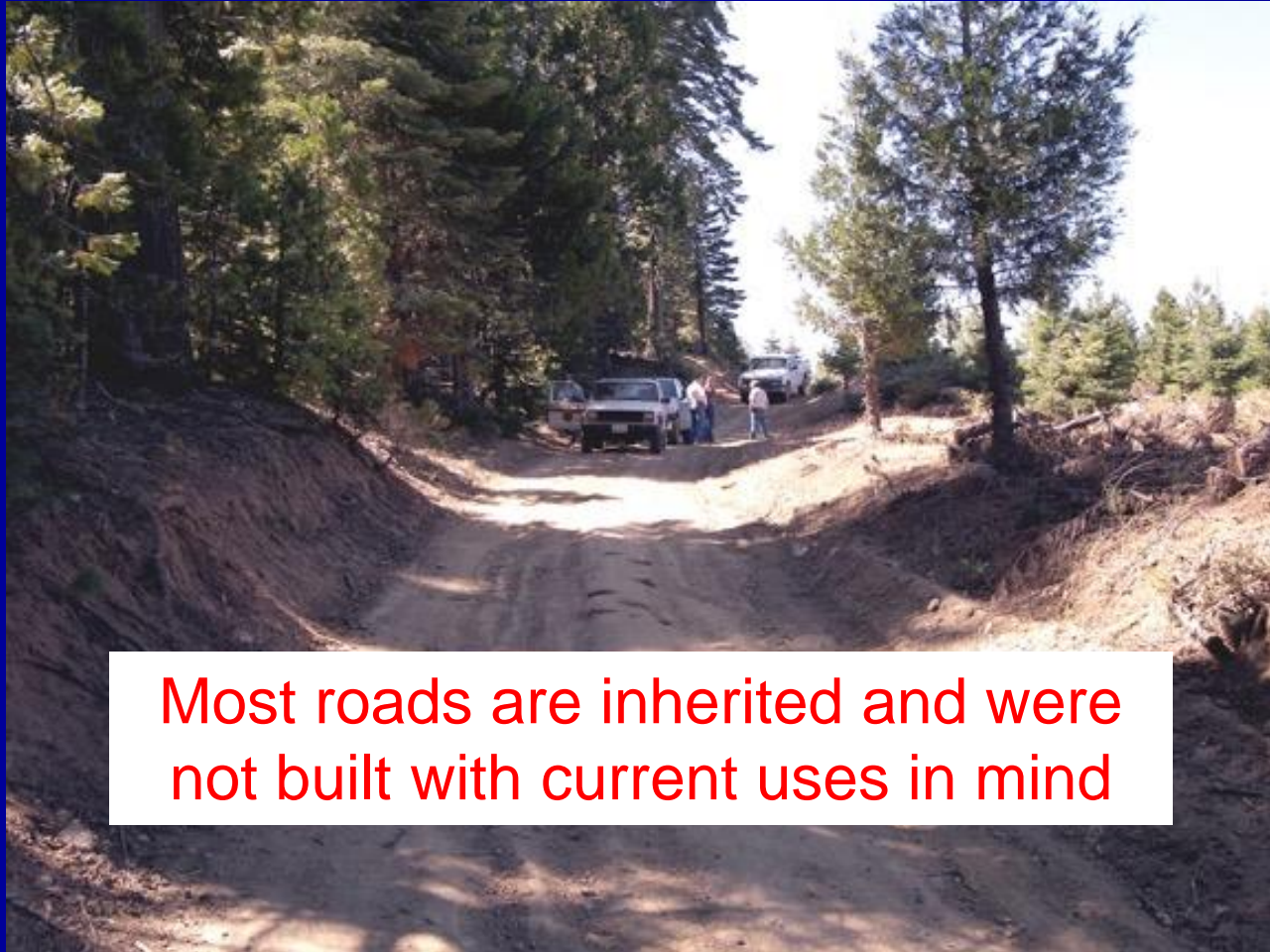
# Design Criteria

- Width, gradient, curvature
  - Drainage
  - Surfacing
- Determined by
- Vehicles (“critical vehicle”) and traffic levels
  - Seasonality of use
  - Environmental constraints



All season out-sloped gravel road

# Unfortunately



Most roads are inherited and were not built with current uses in mind

Landowners are often faced with chronic problems caused by poor choices made in the past or inappropriate use



Many problems are related to drainage (or lack of it)



# “Wish List for a Good Road”

- Designed, built and maintained to withstand stressing weather events
- Just enough road for the uses (both length and width)
- Located on stable terrain away from streams, preferably at mid-slope on the contour to facilitate drainage
- Hydrologic “invisibility”

# Environmental Impacts of Roads

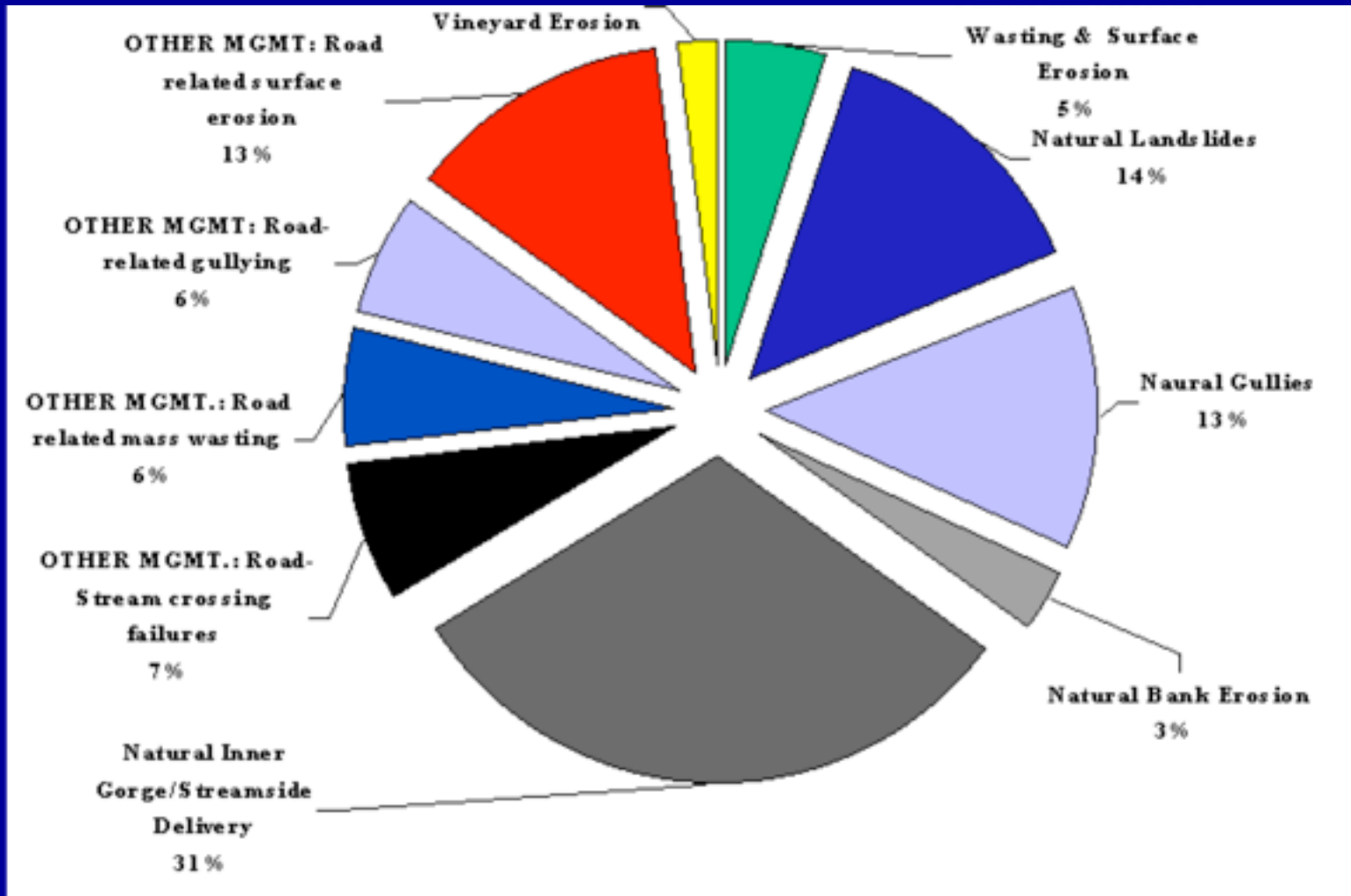


# Hydrologic Impacts

- Roads intercept streams, intercept groundwater and increase drainage density. Roads and drainage ditches are essentially tributary streams.
- Where roads intercept streams, a crossing is needed. Crossings are susceptible to failure.
- Intercepted groundwater must be drained off the road and will increase flow in receiving streams via drainage ditches.
- Runoff from impervious road surfaces may increase peak flows and cause channel erosion.

# Water Quality Impacts

Roads are the main source of “unnatural” sediment in forested and range watersheds



# Water Quality Impacts

- Roads connected to streams via ditches and culverts deliver sediment directly to streams.
- Failing fill and cut-slopes also contribute sediment to watercourses.
- Atmospheric deposition of dust from un-surfaced roads can be a significant seasonal issue.
- Other pollutants such as hydrocarbons may also affect water quality.



# Impacts on Aquatic Habitat and Organisms

- Suspended sediment can adversely affect fish e.g., scouring gills, and their ability to feed (impaired visibility).
- Sediment deposition can reduce pool volumes, “embed” gravels and reduce dissolved oxygen in redds.
- Culverts can prevent migration of fish and other aquatic organisms.



# Impacts on Wildlife

- Road kills, including both small and large animals.
- Roads create migration barriers, displace habitat and fragment habitat patches.
- Roads increase human disturbances and lead to associated land use changes such as land development.
- Traffic noise can disrupt breeding and feeding behavior.
- Roads are a primary means by which invasive species are introduced into wildlands, changing habitat.



# Prioritizing Mitigation

- Reducing the impacts of roads on watercourses and associated biota is the principal objective of regulatory agencies and land managers.
- The remainder of this workshop will focus on diagnosing road related hydrologic and water quality problems and methods for solving them.

# Sources of More Information

- See the three part webinar series on rural roads at <http://ucanr.edu/sites/forestry/webinars/> particularly the sessions on rural roads and the environment.
- The series covered rural roads and the environment, rural road design and operations and road assessment, remediation and restoration.
- Presentations are available as videos posted on youtube and as pdfs.
- The webinar webpage also has an extensive library of resources that can be downloaded or viewed on line in the case of videos.

A photograph of a dirt road winding through a forest. On the left side of the road, there is a significant landslide of earth and rocks. The road continues into the distance, disappearing into the trees. The overall scene is somewhat dimly lit, suggesting a shaded forest environment.

**Thank You!**

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**Forest Stewardship Helpline**

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