

## **Evaluating mitigation aimed at reducing impacts of roads on butterflies and other animals**

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### **Abstract**

The road network serves society's needs of maintaining social, work, and trade connections but, as historically built, conflicts with our needs to be stewards of a functioning environment. These two societal needs can be minimized as mitigation methods are informed and evaluated by the new subdiscipline of Ecology that focuses on measuring the ecological effects of roads on populations of organisms, habitats, and ecosystem processes. Two related short-term road ecology projects are proposed. The first project, which capitalizes on a new window of opportunity with the US Forest Service, will evaluate mitigation options and create an informed adaptive management plan for a federally listed threatened species, the Oregon Silverspot Butterfly. For the second, a student will conduct a focused but thorough literature search to produce an annotated bibliography and fill in a spreadsheet of information. These will allow us to analyze data abstracted from these papers and highlight what work needs to be done on three topics central to road ecology on the effectiveness of mitigation, benefits and problems from roads and their verges, and the genetic consequences of roads on animal populations.

### **Rationale and scope of projects**

The road network crisscrosses our landscape, providing enormous benefits to our society and our expanding transportation needs. Of course, this large web has negative consequences as well, including a myriad of impacts to ecosystems and wildlife. One of the most obvious impacts roads have on the natural world is direct mortality to individual animals that attempt to cross roads. Animal-vehicle collisions are a serious issue resulting in costs from property damage, injury and possible death, as well as typically fatal results for wildlife. Cars collide with large animals over one million times each year in the US and with small ones more often (Conover et al. 1995). These collisions with large animals cause human injury more than 4% of the time and sometimes death, kill 92% of the animals, and create damage-related expenses totaling over eight billion dollars yearly (Allen & McCullough 1976, Conover et al. 1995, Huijser et al. 2007). In addition, road mortality has been implicated as a major threat to 21 federally listed threatened or endangered species (Huijser et al. 2007). There clearly is a need to engineer and maintain roads with organisms and ecosystems in mind in order to minimize the impact of the road network on nature as well as to minimize collisions dangerous to people. One of the most effective mitigation techniques to reduce animal-vehicle collisions is lining the road with fencing (Huijser et al. 2007). However, installing fencing can increase other major types of impacts roads have on natural systems: habitat fragmentation and decreased landscape permeability.

Habitat fragmentation is considered one of the most important factors affecting the local extinction of populations (Wilcox & Murphy 1985). As human development increases and as we face the unknown future of climate change, the need for functional ecosystems and viable connections between habitats becomes even more vital. Even without fences or high rates of animal-vehicle collisions, roads often fragment habitats and decrease animal movements towards and across roads due to pollution from roads (e.g., noise pollution), changed water flow, *etc.* Fragmentation can be at least partially mitigated by adding wildlife passages and restoring or saving wildlife corridors to increase landscape permeability. A fully permeable landscape is one