



Effects of the Urban Edge on Soil Conditions, Stand Structure, and Understory Composition in a Coast Redwood Forest Summary Report

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Introduction

A wildland-urban interface (WUI) is an area where urban development and wildlands meet. Many forests in the WUI experience edge effects caused by human activities, such as timber harvest and urban development, which can alter vegetation composition and structure within the forest community. These changes can be problematic, as forests contain associated plants and animal species dependent on natural ecosystem functioning. Both the WUI and resulting edge effects are well studied in general. However, the influence of the urban edge on coast redwood forests specifically is not well understood. This study aimed to analyze soil properties, stand structure, and understory composition across a WUI in the coast redwood preserve.

Research Questions

RQ1a: Do soil properties (temperature, pH, moisture, duff depth, and compaction) correlate with distance from permanent induced edges in the Forest of Nisene Marks State Park?

RQ1b: Does the forest edge differ from the control site in terms of soil properties in the Forest of Nisene Marks State Park?

RQ2a: Does stand structure (canopy cover, stand density, basal area, dominance, and tree species diversity) correlate with distance from permanent induced edges in the Forest of Nisene Marks State Park?

RQ2b: Does the forest edge differ from the control site in terms of soil properties in the Forest of Nisene Marks State Park?

RQ3a: Do understory species composition correlate with distance from permanent induced edges in the Forest of Nisene Marks State Park?

RQ3b: Does the forest edge differ from the control site in terms of understory species composition in the Forest of Nisene Marks State Park?

Methods

Data was collected in the Forest of Nisene Marks State Park in the Santa Cruz Mountains, California, adjacent to an urban area (Figure 1). The Forest of Nisene Marks State Park is located in Aptos, an unincorporated town in Santa Cruz County, with an elevation ranging from sea level to 790 m.

Twenty 300 m transects were established in the WUI with five circular ten-meter diameter sample plots set at a distance of 0, 40, 80, 160, 300 m from the forest edge. An additional twenty transects were established as a control in a forest interior.

The data collected included soil temperature, pH, moisture, duff depth, compaction, canopy cover, stand density, basal area, dominance, species cover, and species diversity. SPSS was used to conduct Spearman's rank correlation, Mann-Whitney U test, and chi-square test of independence.



Figure 1. Study Site

Results

Results indicated that soil conditions, forest structure, and understory composition were significantly affected by distance from the urban edge (Table 1). Spearman's rank correlations indicated that several variables exhibited positive correlations with distance from the edge, including soil pH and moisture, duff depth, canopy cover, an abundance of *Sequoia sempervirens* and *Notholithocarpus densiflorus*, tree diversity, and the abundance of coast redwood understory species. In contrast, soil temperature and the abundance of *Quercus wislizenii* exhibited negative correlations.

Table 1. Summary Results In the distance from the edge column, + means the values increased towards the forest interior and – means the values decreased towards the forest interior. In the control vs edge column, + means the control treatment had higher values than the edge treatment – means the control treatment had lower values than the edge treatment.

Variable	a. distance from edge	b. control vs edge
temperature	-	n.d.
pH (0-15cm)	+	n.d.
moisture (0-15cm)	n.d.	+
moisture (15-30cm)	+	+
duff depth	+	-
compaction	-	n.d.

Variable	a. distance from edge	b. control vs edge
overall cover	n.d.	-
native species cover	n.d.	-
native species richness	n.d.	-
redwood sorrel cover	+	n.d.
redwood-associated species cover	+	-
redwood-associated species richness	+	-
non-native species cover	-	+
non-native species richness	-	n.d.

Variable	a. distance from edge	b. control vs edge
canopy cover	+	+
overall stand density	n.d.	-
overall basal area	n.d.	-
coast redwood stand density	+	n.d.
coast redwood basal area	+	n.d.
coast redwood dominance	+	n.d.
tanoak stand density	+	n.d.
tanoak dominance	+	n.d.
oak stand density	-	-
oak basal area	-	n.d.
oak dominance	-	n.d.
pacific madrone stand density	n.d.	+
pacific madrone dominance	n.d.	+
douglas-fir dominance	n.d.	-
tree species richness	+	-
tree species evenness	+	-
tree species diversity	n.d.	-

n.d.: no difference

Conclusion

The urban edge effect influences soil properties, stand structure, and understory composition within the forest edge in a coast redwood preserve. Data collected during Spring and Summer seasons can develop the understory species data since more plant species are found during this period. Further studies in the different coast redwood preserves are recommended since this research was limited to one state park within Santa Cruz Mountains. Findings from this research may contribute to raising awareness of WUI issues to resource managers who are committed to preserving the coast redwood forest and their surrounding ecological communities.