Influence of Managed Forest Structure on Hillslope-scale Post-thinning Recovery and Water Yield

Louis Graup[1], Naomi Tague[1], Adrian Harpold[2]

University of California, Santa Barbara[1]; University of Nevada, Reno[2]

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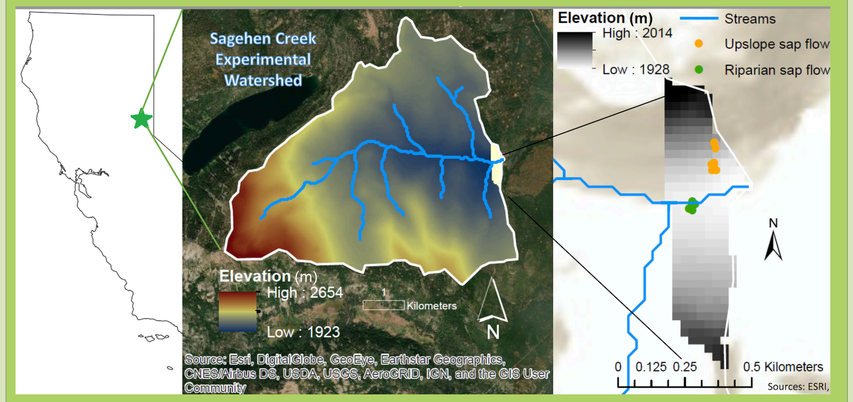
Study Site

Sagehen Creek Experimental Watershed
Sierra Nevada, CA

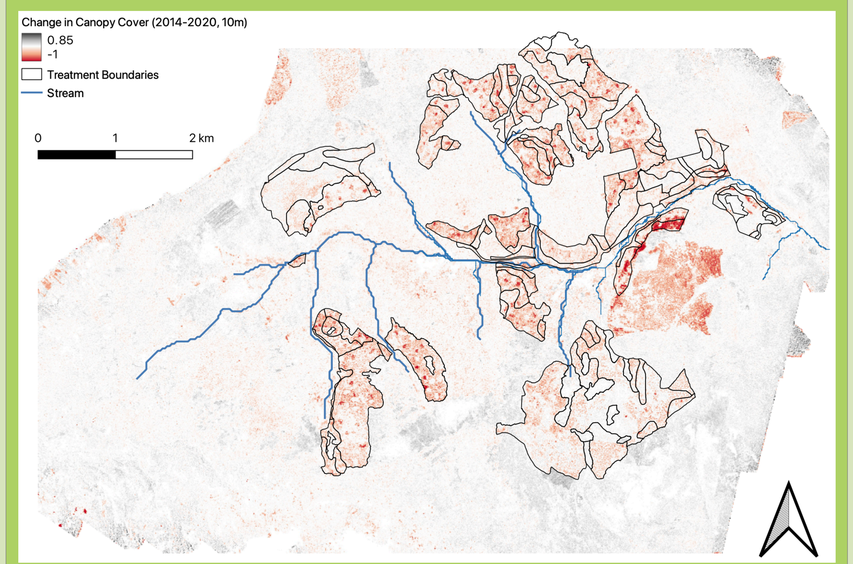
- Catchment area: 27 km²
- Mean Annual Precipitation: 850 mm
- Thinned in 2015-18 by USFS



Research Questions

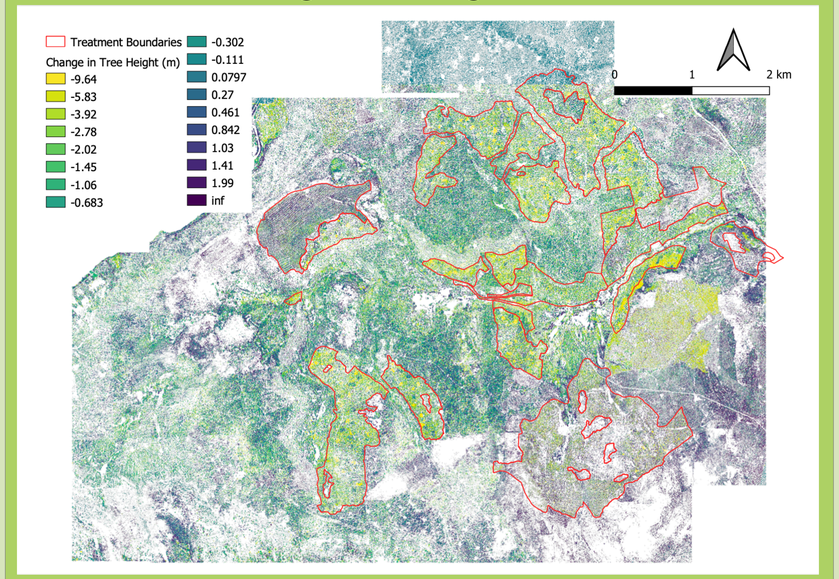
1) How do forest treatments change forest structural heterogeneity across space and over time? (Lidar analysis)
2) How do forest thinning treatments affect upslope and riparian sites differently? (Ecohydrologic model analysis)

Lidar-derived Change in Canopy Cover with Fuel Treatment

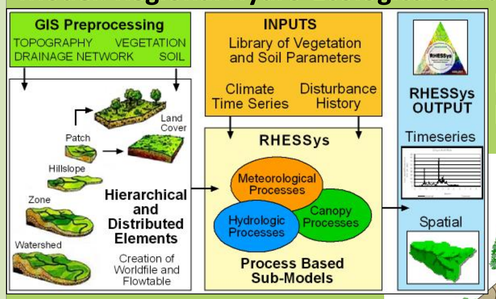


Graup, L. (2021). Preserving Mountains with Forest Management, CA 2020. National Center for Airborne Laser Mapping (NCALM). Distributed by OpenTopography. https://doi.org/10.5069/G96H4FMX.

Tree Crown-scale Change in Tree Height with Fuel Treatment

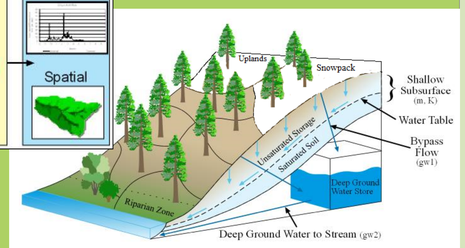


Model: Regional Hydro-Ecological Simulation System (RHESSys)



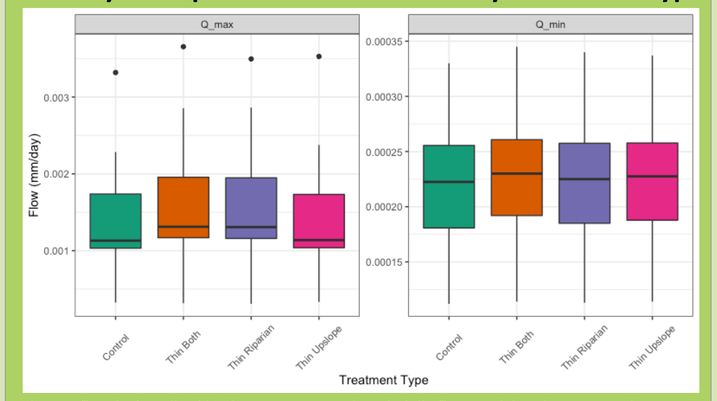
Graup, L.; Tague, C.; Harpold, A.A.; Krogh, S.K. (in review) "Subsurface Lateral Flows Buffer Riparian Water Stress Against Snow Drought." *JGR-Biogeosciences*

Hillslope Ecohydrology RHESSys Conceptual Model



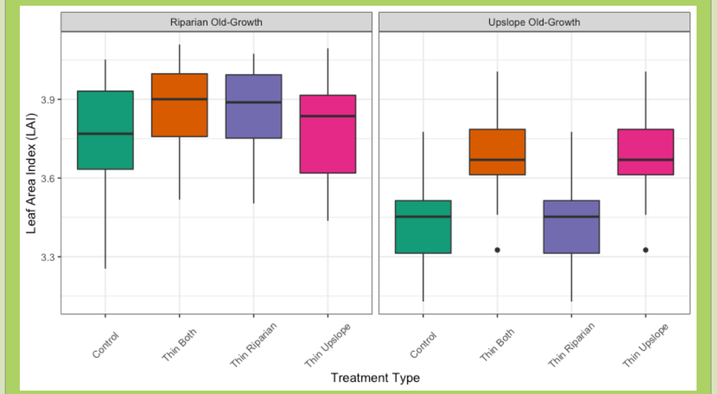
RHESSys Comparison of Tree Growth by Treatment Type

RHESSys Comparison of Streamflow by Treatment Type



Streamflow is described by Q_max, or annual peak daily flow, and Q_min, or annual minimum daily flow, across 15 years of post-thinning RHESSys simulations for different treatment types

RHESSys Comparison of LAI by Treatment Type



Maximum annual Leaf Area Index (LAI) is shown for upslope and riparian old-growth trees (remaining trees after thinning), across 15 years of post-thinning RHESSys simulations for different treatment types

Conclusions

- Impacts of treatment on minimum annual streamflow are minimal for all treatment types; minor increase in peak flow only if riparian trees are treated
- Substantial benefit of upslope thinning to productivity of remaining trees, including trees in downslope riparian area
- Riparian thinning shows more modest gains in productivity of remaining trees

Credits/Acknowledgments

github.com/RHESSys/RHESSys
fiesta.bren.ucsb.edu/~rhessys

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