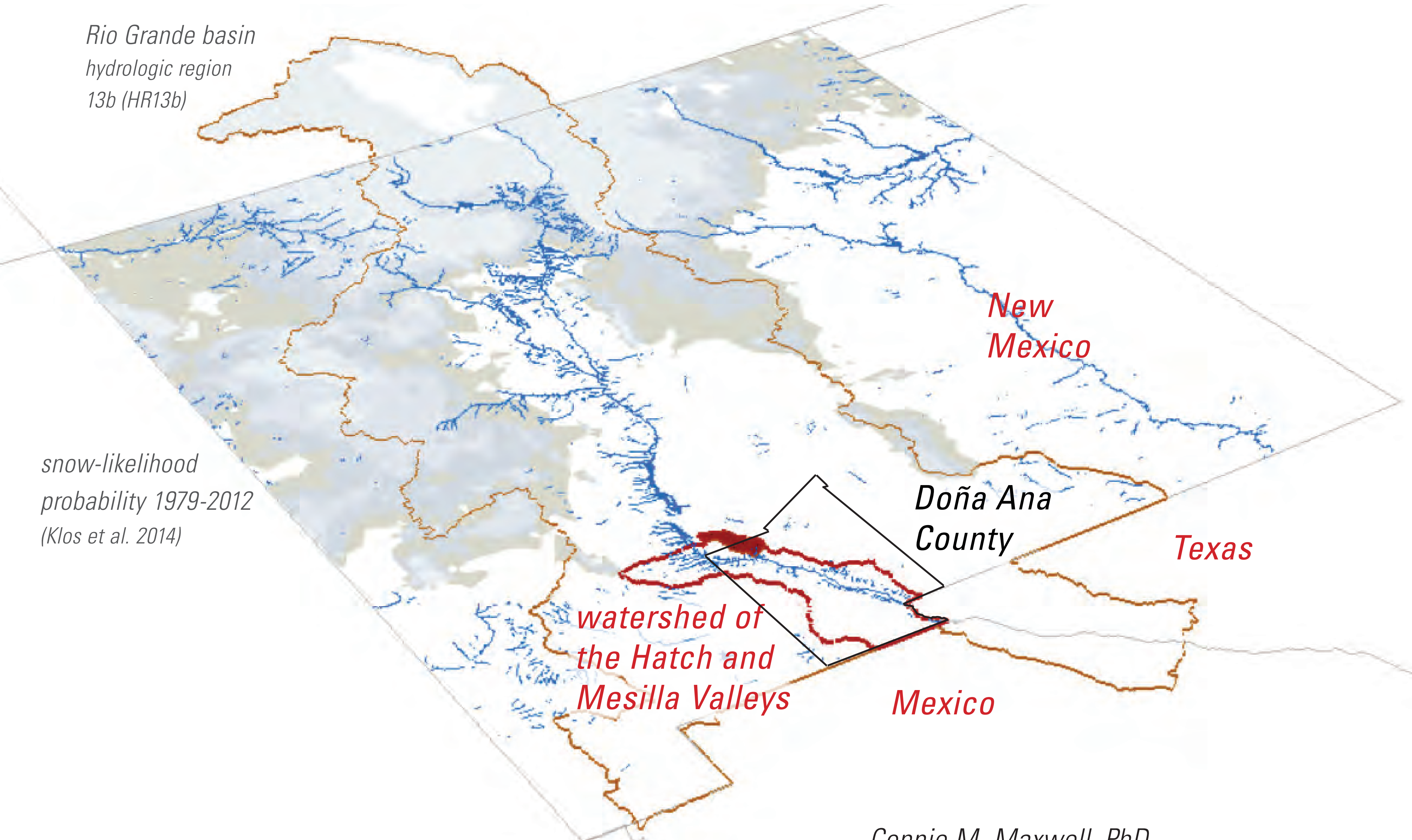
Managing Water Budgets for Resiliency Scenarios in Southern New Mexico's Rio Grande Basin



Connie M. Maxwell, PhD

New Mexico Water Resources Research Institute (NM WRRI) post-doctoral researcher,
leader of the NM WRRI Water and Community Collaboration Lab,
co-chair Stormwater Coalition watershed restoration working group

at the New Mexico Water Resources Research Institute

NMWRRI WATER & COMMUNITY COLLABORATION LAB

- The WCC-Lab fosters ***links between the best science, communities, stakeholders and students*** to inform decision-making, research, and education on water and the environment. Our work is led by the challenges that communities face, an action research approach, where we ***collaboratively develop and test innovative and feasible strategies with communities*** to address the complex issues of water supply and usage.

- $'s supporting NM WRRI translates into assistance for communities. We have spearheaded the pursuit of funding efforts and secured five projects for the Lower Rio Grande (Doña Ana County) water planning region, to:
  - Develop a watershed plan for the Hatch and Mesilla Valley
  - Implement and model scenarios of watershed-scale floodwater harvesting
  - Restore a major watershed in the region
  - Remaining two are watershed restoration pilots in key locations

photo credit: hatch valley produce, inc., porter family farm

Connie Maxwell, alamosa@nmsu.edu

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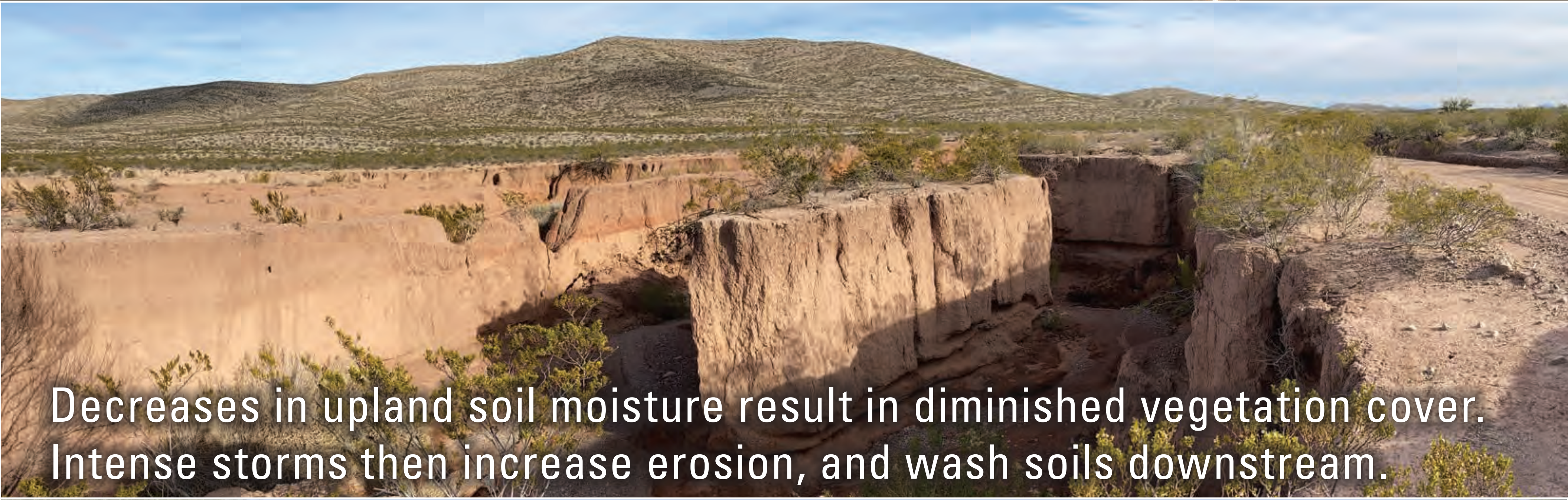
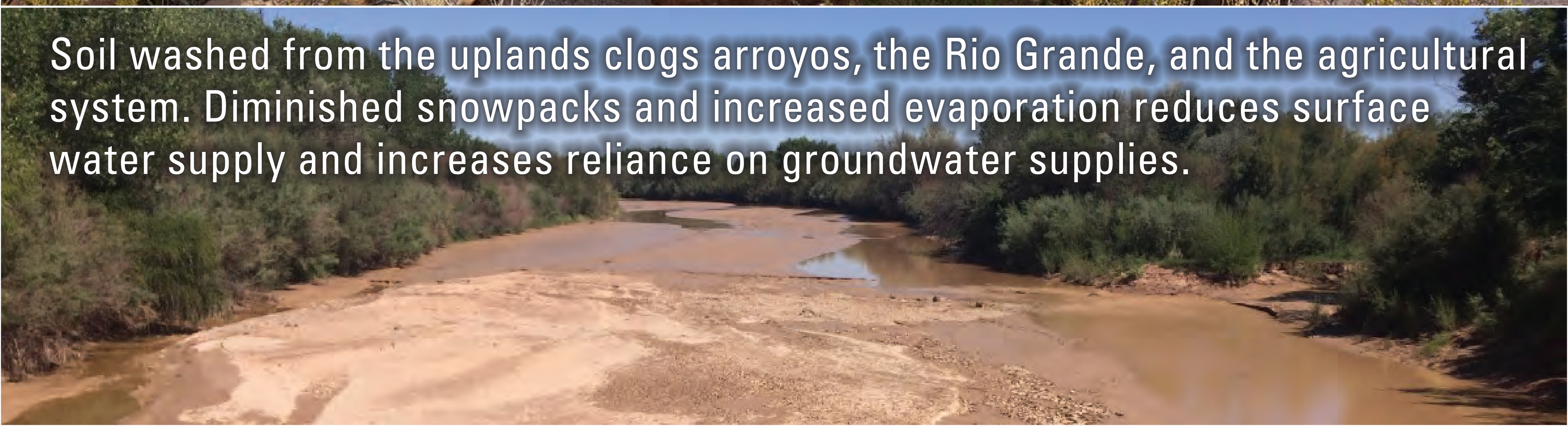
growing aridity is resulting in
water scarcity across the landscape



Decreases in upland soil moisture result in diminished vegetation cover. Intense storms then increase erosion, and wash soils downstream.



Soil washed from the uplands clogs arroyos, the Rio Grande, and the agricultural system. Diminished snowpacks and increased evaporation reduces surface water supply and increases reliance on groundwater supplies.

we use the Dynamic Statewide Water Budget Model (DSWB) to analyze future potential scenarios

resiliency scenarios

what would it take to achieve these resilience visions? we are collaboratively developing these scenarios to test with our stakeholders

1. *turn around the groundwater trends to the extent that groundwater is connected the Rio Grande surface flow*
2. *slow and spread flood flows to mitigate scouring floods and reduce soils washing into the Rio Grande and agricultural ditches and causing flooding*

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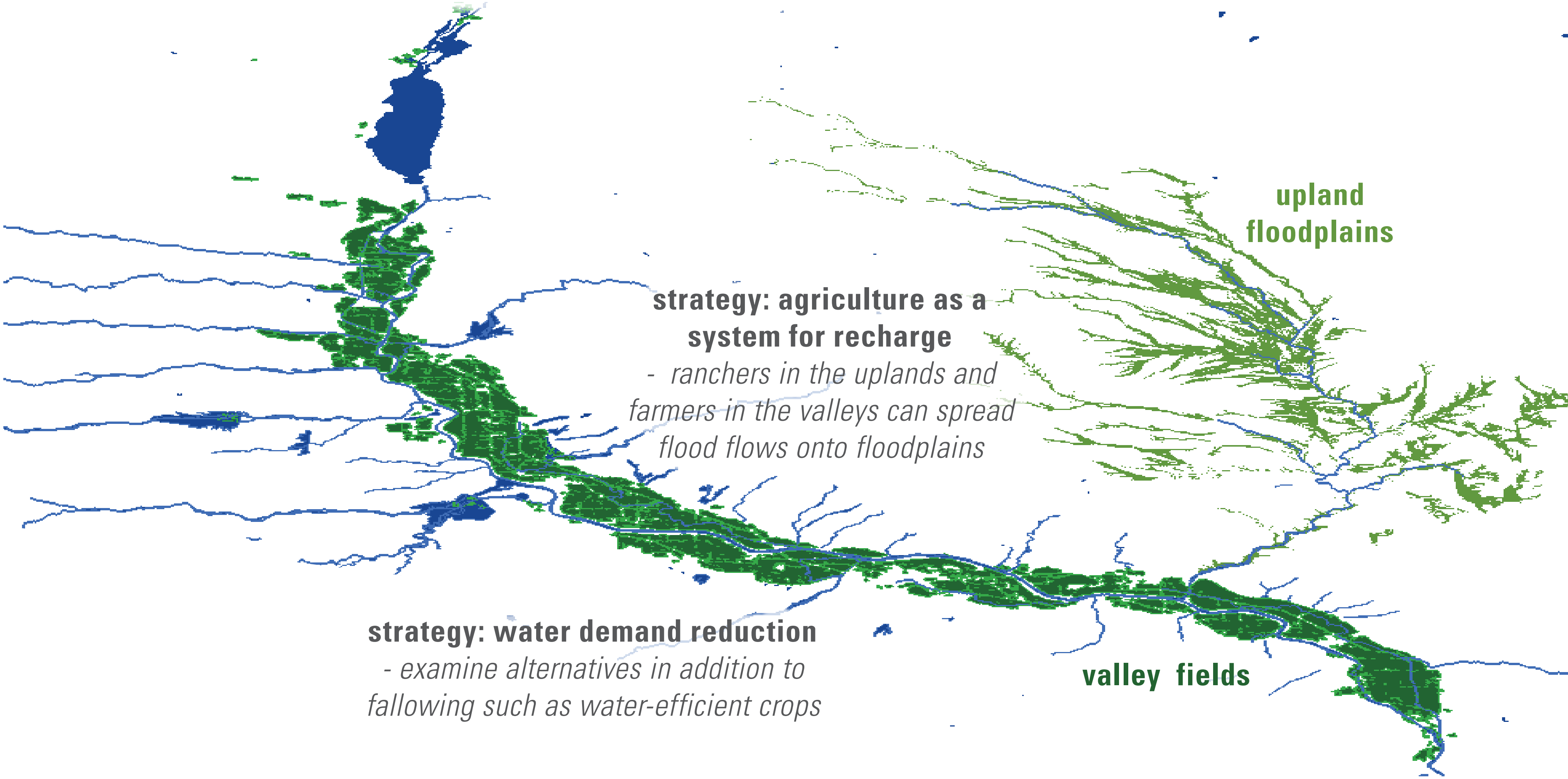
we create customized models that
integrate socio-economic factors and other submodels

introduce alternative management strategies



strategy: agriculture as a system for recharge
- ranchers in the uplands and farmers in the valleys can spread flood flows onto floodplains

strategy: water demand reduction
- examine alternatives in addition to fallowing such as water-efficient crops

to what extent can alternate strategies achieve these future scenarios?
what are the policy implications of these strategies?

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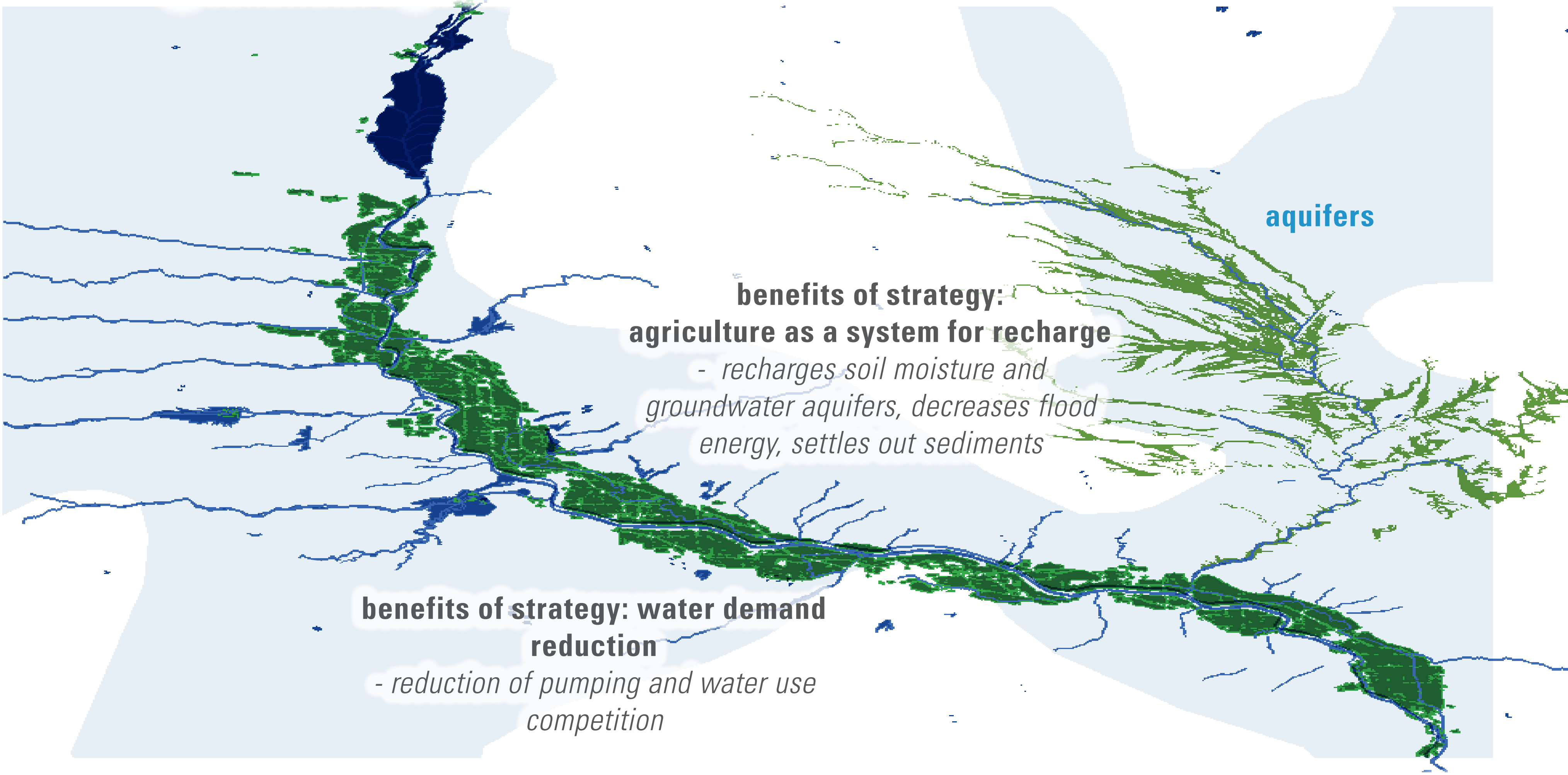
we estimate the effects, *e.g. on soil moisture, vegetation, groundwater aquifers, and agricultural viability*

model results provide prediction of benefits



we hypothesize that these two strategies can make substantial strides to achieving the desired scenarios: turn around groundwater current depletion trends and restore the upper watersheds to mitigate scouring floods

what would the effects be if this was a statewide strategy, how much surface water could be increased?

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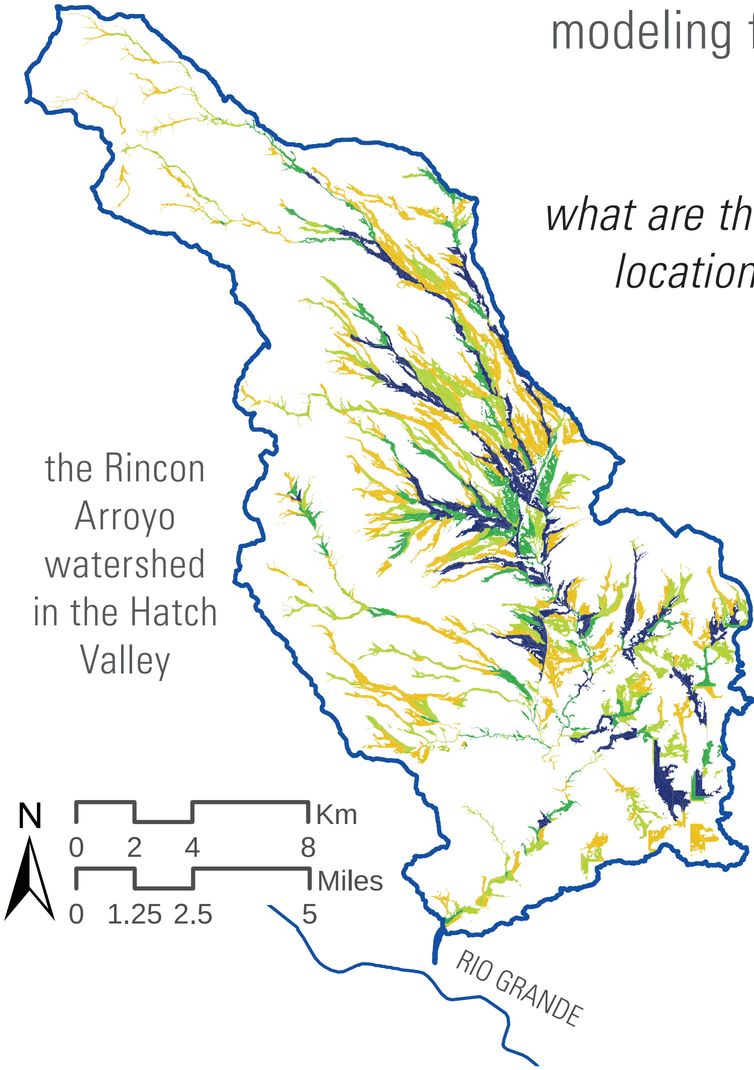
recharge / floodwater harvesting practices
log jam spreads flow onto adjacent floodplain
rock weirs along headwater arroyos
stone lines along contours
passive small ponds to settle out sediment
flood irrigation from surface water in the valleys

we developed
the flood flow connectivity to landscapes
modeling framework (FlowCon)

sub-model:
watershed analysis

what are the best locations?

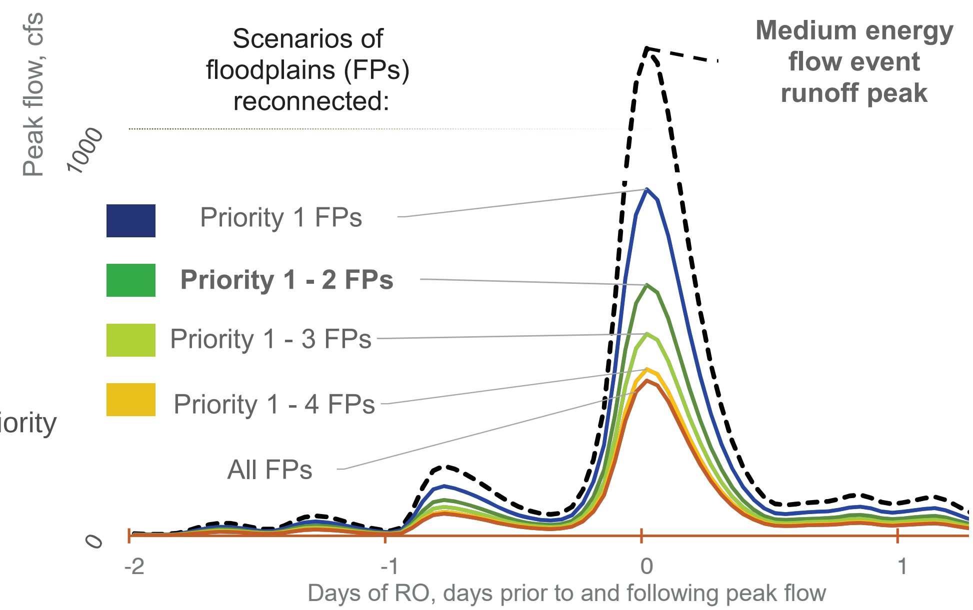
the Rincon Arroyo watershed in the Hatch Valley



Priority Ranking
- 78% - 94%
- 70% - 77%
- 61% - 69%
- 52% - 60%

Not shown, no priority
11% - 51%

how much restoration do we need?
shown here is the estimated benefit of reduction to peak flows



major publications of this work

Maxwell, C. M., A. G. Fernald, D. Cadol, A. M. Faist, and J. P. King. 2021. *Managing flood flow connectivity to landscapes to build buffering capacity to disturbances: An ecohydrologic modeling framework for drylands.* Journal of Environmental Management 278:111486.

Maxwell, C. M., S. P. Langarudi, and A. G. Fernald. 2019. *Simulating a watershed-scale strategy to mitigate drought, flooding, and sediment transport in drylands*. Systems, Special Issue on "System Dynamics: Insights and Policy Innovation" 7:53.

Langarudi, S. P., C. M. Maxwell, Y. Bai, A. Hanson, and A. Fernald. 2019. *Does Socioeconomic Feedback Matter for Water Models?* Ecological Economics 159:35-45.

Langarudi, S. P., C. M. Maxwell, and A. G. Fernald. 2021. *Integrated Policy Solutions for Water Scarcity in Agricultural Communities of the American Southwest*. Systems, Special Issue on "System Dynamics: Insights and Policy Innovation" 9:26.

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policies in other locations

From higher dykes to river widening

Working together towards a safe and attractive river region

floodplain reconnection

area of floodplains allowed to perform the natural function of storing and conveying floodwaters

Dutch Room for the River Programme

Begun in 2007, consisting of over 30 projects that strategically restore the river's natural floodplains

California Sacramento Valley 60,000 acre bypass

1986 - conveyed approx. 10 million acre feet of flood water (+3x total this basin's floodcontrol reservoir storage volume)

managed aquifer recharge (mar)

recharge of an aquifer for future recovery usually by pumping

Albuquerque - Bear Canyon

infiltration basins for recharge

Central Arizona Project

surface spreading recharge facility

California Kern County Water Bank

recharges excess water supplies for future recovery

recognizing watersheds as key infrastructure

watersheds as the source of runoff are recognized and defined as integral components of water infrastructure

2016 California Source Watershed Bill AB 2480

eligible maintenance including upland vegetation management to restore the watershed's productivity and resiliency, meadows, roads, and stream channel resotration

water banking

temporary transfer of use from agriculture

Colorado Grand Valley Water Users Association

Pilot program to reduce irrigation through a water banking program to avoid regional shortages