Trinity River Watershed Council

June 11th, 2024 at 10:00am – 12:00pm

TCRCD Conference Room, #30 Horseshoe Lane, Weaverville

Our Mission:

To protect, enhance, restore and revitalize the watershed through collaborative efforts that leverage external resources, work toward common goals, educate and engage community stakeholders, address natural resource issues, and support healthy ecosystems for future generations.

Agenda

10:00-10:10 Welcome and Introductions

10:10-10:45 Guest Speakers Topic: Opportunities and limitations with applying the State Water Resources Control Board (SWRCB) - funded stream classification of California to benefit Trinity County streams with Professor Gregory Pasternak from University of California Davis

10:45-11:55 Partner Updates

a. USFS – Shasta Trinity National Forest

b. USFS- Six Rivers National Forest

c. Bureau of Land Management (BLM)

d. California Department of Fish and Wildlife (CDFW)

e. Natural Resources Conservation Service (NRCS)

f. Trinity River Restoration Program (TRRP)/ Bureau of Reclamation (BOR)

g. Trinity County

h. Hoopa Tribal Fisheries

i. Yurok Tribal Fisheries

j. Tsnungwe Tribe

k. Nor Rel Muk Wintu Nation

l. Trinity County Resource Conservation District

m. The Watershed Research and Training Center

n. 5 Counties Salmonid Conservation Program/ Northwest California Resource Conservation & Development Council

o. Trinity County Fish and Game Commission

p. Trinity County Agricultural Alliance

q. Flowra

r. New Attendees

11:55-12:00 Close

Next Meeting is September 10th, 2024 at 10am-12pm

Virtual Meeting Information

Zoom link: https://us02web.zoom.us/j/89707228772?pwd=WUo1VW5hS2x0UC85ODE4dFViNEFYUT09
Meeting ID: **897 0722 8772**
Passcode: **96093**
+16694449171,,89707228772#,,,,*96093# US +16699009128,,89707228772#,,,,*96093# US (San Jose)

Questions?

Contact Annyssa Interrante at 530 623 6004 X 209 or email at ainterrante@tcrcd.net

Trinity River Watershed Council – June 11th, 2024

Meeting Notes

Attendance

In-person (2):

- Annyssa Interrante— Watershed Program Coordinator Trinity County Resource Conservation District (TCRCD)
- Chris Losi— Senior Environmental Coordinator, Flowra

Online (19):

- Christine Burchinal— Watershed Stewards Program (WSP) Corpsmember TCRCD
- Adrien Keys— Policy Chair and Events Coordinator, Trinity County Agriculture Alliance (TCAA)
- Kelly Sheen— District Manager TCRCD
- Kellan Korcheck— Environmental Consultant, Flowra
- Liam Gogan— Trinity County District 3 Supervisor
- Lesli Mounivong— Watershed Stewardship Program, Watershed Research and Training Center
- David Colbeck— Trinity County Natural Resources Division and Environmental Compliance
- Danielle Putman— Environmental Consultant, Flowra
- Bridger Cohan— Watershed Stewardship Program, Watershed Research and Training Center
- Heidi Carpenter-Harris— Trinity County District 4 Board of Supervisors
- Matt Mitchell— Environmental Scientist, CDFW Region 1
- Josh Smith— Watershed Stewardship Program, Watershed Research and Training Center
- Gregory Pasternack— Guest Speaker, UC Davis Professor and Trinity County Resident
- A.J. Donnell— Six Rivers Watershed Program Manager
- Cyndie Childress—Nor-Rel-Muk Wintu
- Galen Anderson - USFS
- SMyracle
- Megan Killeen - WRTC
- Christine Mai - USFS

Total Attendance: 21 people

Meeting Start: 10:03am
Meeting End: 11:45am

Guest Speaker Topic: "Opportunities and limitations with applying the SWRCB CA Stream Classification to benefit Trinity County streams," presented by Professor Greg Pasternack (pasternack.ucdavis.edu)

- **Introduction**
  - Greg has been a professor at UC Davis for 25 years
  - Known for his work on salmon, spawning and rearing habitat issues at the interface of geomorphology and aquatic ecology
  - Has worked advising river management teams on Yuba, Mokelumne, Feather, and Trinity Rivers
    - Designed gravel placement below Lewiston Dam
  - Students from his lab have populated various consulting firms

  - Greg does a lot of volunteer outreach and paid consulting
  - He believes that humans are part of nature and that "the way to steward nature and promote healthy multicultural communities is to understand rivers, their biota, and human society as an intertwined system".
    - Mission to help people in California
    - Big believer in science as a collaborative social activity
- **Environmental Flows Needed in California**
  - State Water Resources Control Board faces issue of deciding how to give out permits to take water
    - State must have a defensible, cost-effective, and time-sensitive way of establishing what instream flows are needed to determine how much water may be taken— must be based on sound science
  - In 2015, cannabis legalization changed use of water in coastal region of Northern CA
  - How can one determine what amount of water may be taken?
  - 14 regulatory regions in CA
    - Trinity County in Region 1 (Klamath)
    - Allows for specific approach taking into account unique ecology and hydrology of each region
  - ~700,000 200 meter stream intervals for which to develop eFlow targets
- **Diverse Community Viewpoints Argued to Manage Flows and Channels**
  - Management of any given river usually involves lengthy, intensive, involved process to determine water usage values
    - Impossible to scale this complex process up to encompass entire state of CA
- **Challenges with Formulating Designs When Scaling Up from 1 to 1,000,000 Stream Intervals**
  - Limited ecological data unevenly distributed around the state
  - Detailed process-based methods are impossible at scale of entire state's river system
    - Attempts being made to perform analysis of individual maps at this level of detail
    - Thick forests and turbid rivers make remote sensing difficult
- **Option 1: Give Up and Reset to "Stage 0"**
  - "Holistic approach"— remove degraded features and step back and allow nature to run its course
    - Can be successful in remote locations
    - Fails in populated areas adjacent to homes and infrastructure
  - Many rivers are incised so deeply that this option is not possible
  - "Holistic approach"— remove degraded features and step back and allow nature to run its course
    - Can be successful in remote locations
    - Fails in populated areas adjacent to homes and infrastructure
  - Many rivers are incised so deeply that this option is not possible
  - **Holistic hydrology and downscaled flow regimes**
    - Mimicking natural hydrology
      - Spring snow melt, pulses
    - Ca has dry climate
      - If water is not added to river, vegetation will not be effected in a natural way
    - Must understand mechanisms of how things work "to make sure we get it right"
      - Give it time
  - **Holistic approach incorrectly assumes simple links between physical action and ecological outcome**
    - Uncertainty as to how to "correctly" mimic nature
      - Inject gravel into river or place it along the bank?

        - Ecological approach involves treating system as black box
        - Unknown variables can include unforeseen highly specific, complex issues
            - Ex. Fish don't like the smell of the gravel
    - Water management models are complex, and we should expect similar effort to understand ecology
        - Idea that solutions should be "simple" rejected by Pasternack
            - Nature is complex!
            - We should have the understanding and tools to function at a sophisticated level
- **River assessment and engineering should be mechanistic, not statistical or holistic**
    - Hypothesis-driven process (basic scientific method):
        - Conceptualize river system
        - Make specific hypothesis (I.e. how does vegetation establish?)
        - Collect data
        - Analyze data
        - Use performance indicators to assess hypothesis validity
    - Restoration perspective:
        - Turn design into list of design hypotheses (why would a specific site work?)
            - Can assess whether final result meets initial expectations and why or why not
        - Use any available biophysical models to make predictions
            - Evaluate all potential designs
            - Adapt design to get best outcome
- **Flow, form, and function (F3) design framework**
    - How to implement restoration design process on state-wide scale
    - 2 broad components:
        - Characterize how system works in terms of hydrology, geomorphology, and ecological functionality (and chemistry when possible)
            - Characterizes entire region (Recall 14 regions in California)
            - Usually pick one site to use as reference site
                - Does not apply when geomorphology is too altered to represent ideal state
        - River engineering goals captured in designs
            - Capture ideal target state (archetype)
                - Flow regime archetype
                - River corridor archetype
                - Ecological functionality archetype
            - Target state must be specific to regional ecosystem
    - Integrated analysis of design functionality takes all components into account
        - Used in both restoration and flow determination applications
- **Hydrological classification of rivers**
    - Several types in Trinity County
    - Based on full natural flow records existing throughout CA
    - Regression tree predicts classification
- **Geomorphic classification of rivers**
    - Require obtaining new data that is consistently collected across CA
        - Data must be consistent in how it is measured
    - Teams from various institutions collaborated on field work campaign in 9 regions in CA
        - Developed unique way of stratifying potential River types in each region to sample all

regions with equal effort
        - 1,110 field sites with 11 cross-sections each
        - Each region classified independently
- **Desktop GIS field campaign sampling design**
    - Region by region sampling comprising ~120 new sites and existing datasets
    - Segregate stream networks into 200 meter intervals
        - Stratify 30 groups per region in 3 ways:
            - Sediment supply USLE method (2 bins)
                - High vs low sediment supply
            - Valley confinement (3 bins)
                - Confined vs partly confined vs unconfined
            - Local slope & catchment area (5 bins)
        - Classes represent hypothesis, not specific to local area
        - Local field crews told to sample particular types of rivers
            - Faced issues of accessibility
- **Klamath region site map**
    - 105 sites representing 7 classes
    - Most data collected along accessible roads
        - Tributaries in wilderness and South Trinity areas not equally represented
        - Creates opportunity to add more data for expected stream types
- **Regional Geomorphic Classification of River Types**
    - Data from sites went through hierarchical cluster analysis creating 7 types:
        - Types give better classification of what is actually present than other classification methods
        - 3 types occurring in confined valleys:
            - K-6: confined, cobble-boulder, cascade/step-pool
            - K-1: confined, boulder, bedrock, bed-undulating step-pool
            - K-7: confined, cobble-boulder, uniform bed and width
        - Partially confined types (abundant, riffle-pool systems generally found here):
            - K-5: partly-confined, gravel-cobble, riffle-pool
        - Unconfined types:
            - May still be incised
                - Incision refers not to the valley itself but to the channel within the valley
            - K-2: unconfined, low width-to-depth, gravel, plane bed
            - K-4: unconfined, high width-to-depth, gravel, uniform
            - K-3: unconfined, high order, gravel-cobble, riffle-pool
- **Klamath River "CART" Classification Tree**
    - Used classification tree to determine classes
    - Large grain size (i.e. boulders) differentiates a type
    - Coefficient Variation of depth (bed undulation), valley confinement, etc. also used to differentiate types
    - Provides strong accuracy
- **Network-Scale River Type Prediction @ 200-m**
    - Statewide geospatial datasets used to create predictions
        - Scale may vary
    - Machine learning research used to figure out what is the best algorithm and what parameters to

use etc.
    - Applied machine learning to Klamath region to predict channel type for entire stream network
- **Klamath Region "Entropy" Uncertainty Metric**
    - Uncertainty caused by small size of confined channels, geospatial dataset has trouble differentiating different types of channels
    - People tend to live in flat areas, unconfined streams
        - Difficult to find unaltered unconfined streams in California
- **Carry out Aquatic and Riparian Ecological Studies**
    - Studies exist which help us understand how the aquatic ecosystem works
    - Lane (2022) examined relationships between organisms and environmental factors in eel river
- **Use Ecohydraulics to Predict Functional Patterns**
    - Use habitat information to create models
        - Can create habitat suitability curves for target organism
            - Used to make maps of areas likely to be used by organism
- **Alignment of Areas Needed for All Steps in Complete Reproduction Function**
    - Different processes work together to create suitable habitat
        - Many factors must be considered in models to determine whether what is identified as suitable habitat is actually high-quality habitat
            - High level of scientific rigor needed
- **Ecohydraulic Functional Assessment**
    - Many tools exist to predict habitat and population estimates
    - Decision support systems also exist which are used where regulatory infrastructure is lacking
- **Hydro-Geo-Eco Functional Archetypes**
    - Need functional archetypes to understand how a site should function
        - Must be tested to ensure that archetype provides desired functions
- **Proposed Management Application**
    - Framework put in place for when an entity wants to take water from a given site
        - Must first identify and register site
        - Selection of hydro archetype and ecological functions
    - Users should have ability to use machine learning framework to access site metrics
    - 3D model should indicate how much water should be left in the channel
    - Cross-sectional survey can be used to predict in higher resolution what 3D terrain would look like
    - Combination of machine learning resources provides baseline performance expectations
        - Adjustments may then be made to flow regime
- **Hypothesize Key Seasonally Based, Archetypal Functional Flows**
    - Flow calculator software extracts 24 flow metrics out of river hydrograph to determine magnitude, timing, and duration of a record
        - 5 seasonal components analyzed
- **River Topography Design with River Builder**
    - River Builder software utilized text input to generate exact river designs with wide diversity of features
        - Generates river valley and channel
        - May layer features including boulders, waterfalls, etc
        - Provides visualization of various features at various scales
- **Archetype Functional Analyses of Urban Streams**
    - "Urban Stream Syndrome"- Rivers in urban areas tend to become incised because sediment supply

is cut off and then become wide and deep
    - Urban streams have lower abundance of shallow water habitat
        - River Builder used to modify features to attempt to create more suitable habitat
- **Follow-up Research in Trinity County**
    - Observations of more locations needed to better represent Trinity County
    - Each stream class formed by unique processes
    - Competition in Trinity County between different approaches to restoration
- **Salt Creek Property Opportunities**
    - Pasternack purchased 60 acres in Salt Creek Valley south of Hayfork
        - Goals are scientific research, training, and stewardship
        - Historically used for cannabis grow operations
        - Water incised over long term due to disturbance
- **Salt Creek Assessment and Stewardship**
    - Pasternack interested in getting community members involved
    - Property is on ancestral lands of Nor-El-Muk Wintu tribe
    - Steelhead spawning and rearing occurs in creek
    - What biological resources are available on Salt Creek?
    - Must assess history and current status of conditions and processes in Salt Creek
    - Pasternack hopes to develop meaningful projects for the land
        - Possibility of getting students involved
        - Wants to provide compensation for labor

End of Presentation

- Questions for Dr. Pasternack from Liam Gogan
    - Gogan: Will you take the same approach to Salt Creek as Stage Zero project done on Indian Creek by Yurok Tribe?
    - Pasternack: I visited the Indian Creek site in April 2023 during a very wet winter and found the site interesting but I have some concerns about Stage Zero. One concern is creating a braiding effect without providing the sediment supply from which braided rivers naturally emerge. At that site I saw that the river is carving a new channel on the opposite bank and will bypass the valley and re-entrench unless it is managed otherwise. It is making a beautiful riffle-pool stream but with Stage Zero you must be mindful of the processes that sustain the goals that you have for a river. In a place with no liability risk it is possible to let the river do what it will, but on this property I do not have that luxury because there is a farm property and cattle ranch downstream. If the river was brought up six meters there would be liability risks to those properties. Rather, I want to determine the suitable archetype that balances ecological function with cultural values for management of this stream. Many things such as sediment supply and contamination have changed in the past 500 years so we need to be realistic. I have no pre-conceived conception; my preference would be to develop that vision through studies that are carried out on a partnership basis.
    - Gogan: How much sediment does Dobbins Creek usually put in?
    - Pasternack: From my knowledge, I haven't been able to come across any watershed assessments. I haven't been able to get in touch with Rachel Shea out of Michael Love and Associates to see if they have any watershed studies associated with their downstream restoration effort. I think one of the things we need to establish is the historical baseline and establish some new monitoring. I own the bridge over Salt Creek at the downstream end of the parcel and can do what I want with it, but I

don't have one at the upstream edge. There is also a bridge at Dobbins; there has been a lot of direct channelization downstream of Dobbins. I've been observing strong evidence of sediment transport in winter 2023-2024, so I think we have to undertake a sediment budget study to try and figure it out.
    - Gogan: You'd also mentioned that you saw some fish in the creek there, were any of those invasive species?
    - Pasternack: I will admit that I am not an expert ichthyologist. In my photos, there were a lot of rearing fish, some of which were in a stranding pool at the confluence with Dobbins. I consulted with a few different fish biologists and there was some difference of opinion, but there was also a consensus that I needed higher resolution images to make an accurate determination. I am happy to send you the photos and videos if you want and you can see what you think.
    - Gogan: What was their difference of opinion?
    - Pasternack: One works for Pacific States Marine Fisheries Commission and the other is an avid fisherman who is finishing up his master's degree on cover so… One said speckled dace, my grad student thought there was steelhead. Possibly some pikeminnow.
- Josh Smith wrote in the chat: I've seen spawning winter steelhead just upstream of there. I don't know of any surveys done in that reach in recent decades.
- Liam Gogan wrote in the chat: Josh, thank you, I had thought there were S/H in this area. Has water been tested for contaminants.
    - Gogan: In the past has anyone seen any spawning redds in that area?
    - Pasternack: There were studies in the 80s as well as some studies of frogs. It does appear that this is a section of the river where there were past biological surveys but that was quite some time ago.
    - Gogan: Does the creek dry up in the summer due to cultivation or climate change, or just hot? Does it ever dry up completely?
    - Pasternack: Dobbins Creek is drying completely on an annual basis. But I was impressed with how much it was flowing this winter. It was quite substantial, and with significant sediment transport. There is also aquatic vegetation present in both Dobbins Creek and Salt Creek. Whether it's natural or influenced by nutrients coming down from agriculture hasn't been investigated. My understanding is that Salt Creek at this location is usually perennially flowing.
- Questions for Dr. Pasternack from Josh Smith
    - Smith: I'm guessing that the Geomorphic Classification mapping for this particular section would show you any upstream sediment inputs, or the potential for them, from Dobbins Creek or otherwise. You had mentioned that you had those map links in a PDF, can you sent that out to the group again?
    - Pasternack: We have the state-wide hydrologic classification and the region-by-region channel classification, so I can share with you the Klamath region classification as well as the state-wide hydrologic classifications. I can send those and they can be distributed. I'll send them as shape files and if anyone wants them as a KMZ file I can get that as well to you.
    - Smith: I have to admit some confusion as to how this applies to the county and state-wide water board. Can you describe again, how does your work in both geomorphic and hydrologic… what is the water board going to do with this?
    - Pasternack: When somebody wants to take water out of the stream, the water board has to be able to respond to that user with respect to a permit as far as how much water they can take out. If there is a request for a certain amount of water, will that request be approved? Typically, you can take out a certain percent of annual flow, that's a common approach. But there is now something called the California Environmental Flows Framework (CEFF). CEFF is at two scales: the simpler GIS-

based approach that gives you a quick and dirty number, and then there is the requirement to go into our methodology for a more thorough approach. What I've shown you is the underneath tools that we've created, and this is being built into the decision support system. There's a consultant called Paradigm that is building out that system prioritizing the South Fork Eel catchment as the first test of the whole thing. So the State Water Resources Control Board is using our channel and hydrologic classifications to create relationships between discharge and ecological functionality for priority species, which then govern how much water can be given out in a given region. That's how they're actually using it. If I was a landowner, I would have some concerns about it, but then the question is, how much resources does anybody have to try and figure out that answer. If you're Department of Water Resources and you own a dam on the Feather River, you're going to be doing millions of dollars of research over 30-40 years and you're still not going to get your permit. So somewhere from that end of the spectrum to just saying "Okay you can take out 10 cfs because that's 10% of mean annual flow", then this is trying to find that middle ground of a process-based way, which is what the state water board is actually doing. Now the concern is, if you're in Trinity County and this data does not represent your streams, then that would put you as a disadvantage if the archetypes and ecological functions are not good enough for the county. This isn't being implemented by Trinity County yet. Region 4, the North Coast region, is where it's being done first, but it will eventually be rolled out to the whole state.

- Smith: I was wondering if you had any sense of, is this coming in 5 years? Longer? Shorter?
- Pasternack: I'm just the scientist. You could change the governor and they could throw the whole thing in the trash. Some of you may be familiar with the Voluntary Settlement, have you heard of that? So, in the Central Valley, the Voluntary Settlement Agreement is this huge negotiation about how much flow has to be put back in the rivers and what can be substituted with habitat restoration projects. And so, typically the water districts would prefer to do a large amount of supplementation and restoration projects rather than giving up water. CDFW is responsible for deciding what are the ecological conditions that have to be met in terms of fish passage, or habitat abundance or availability. It's still largely using this ecohydraulic approach and calculating rearing habitat, doing 1D and 2D modelling. This takes everything to a higher level but still requires that someone at the state has to specify the ecological standards that have to be met.
- Smith: I'm curious about the geomorphic classifications, the maps that you'll send. That's essentially a baseline; you said a 200-meter scale, a relatively fine scale. Within that I'm wondering, based on those classifications are you able to find or locate what you'd consider outliers? An area that is of a different classification than what you would anticipate?
- Pasternack: There's 2 ways this whole thing goes wrong. One is that the classification itself has problems. Two is that the prediction has problems. For example, the way that I found this property on Salt Creek is that I was coming through Trinity County in spring 2023 to try to visit sites and stand at a location and go through in my mind, whether it was making sense or not. For example here is this threshold, coefficient of variation of depth, which is standard deviation divided by mean. So if that is 0.25, then it has this thing. But what if you're at 0.24 or 0.26? Then you're going off in this completely undesirable way because within the range of uncertainty you're close to that threshold and you could've gone off in a different direction. I've absolutely seen that at sites around the state. You can implement a fuzzy approach to it but that doesn't really fix things because, adding in all the uncertainties, people don't know how to use that information in river management. So, we're trying to think through ways of validating it other than just a dataset. I wish we could go to a site with a rapid reconnaissance method and visually go through a decision tree like this and classify a bunch of sites and see how well it performs and where it's going off the rails for a place like Trinity County. I

think that there's more that can be done and I think that as the state shifts towards this kind of process-based approach for environmental flows, the scrutiny will ramp up, and then there will be a need to address concerns with that kind of work.

- Dr. Pasternack gave his email in the chat: gpast@ucdavis.edu
- Josh Smith wrote in the chat: Hey Liam, I don't know of any contaminants (nor studies for contaminants).

Partner Updates

- Six Rivers
  - AJ Donnell: Our focus so far has been preparing for this upcoming season, to start implementing some of our projects that are under the wildfire crisis strategy. We got at least a 1000-acre footprint that we are looking to treat with fuels reduction along roadsides and key strategic ridgetops. We have some roadside hazard tree projects which we will be implementing where the Red Salmon footprint was and our Knob Fire that was a couple years ago. Leroy, our fish biologist for Orleans, has been working with partners to come up with a project there in Cedar Creek and one in Old Campbell Creek. I'm hoping in the next couple years we can implement those projects. We're going to be getting out there with our Mad River bio and our seasonal, McKenzie, to do some of our annual fish population surveys on a few of our long-term monitoring channels like Old Campbell Creek. Next week we'll be out deploying our stream temperature gauges that we've been putting out on an annual basis.
- Shasta-Trinity
  - Galen: Will start installing wildfire cameras. Trinity Knolls is next, then August phase 2 and Hyampom after that. Those are wildfire detection cameras.
- CDFW
  - Matt Mitchell: No updates, but I was curious, what is the latest on the little grass alley creek culvert blowout at the Oddfellows Camp, is there any movement there to get that replaced or fixed?
    - David Colbeck: I believe there have been a number of conversations with Cynthia Tarwater at TCRCD about grant opportunities. I just received an email from one of the property owners asking some questions about grading permits. I believe it's moving forward with an emergency action potential as well as a future restoration project but I can't speak to where those stand in particular. I know Kate Blanchard is up to date on what is being proposed so she may know more.
- Nor-Rel-Muk
  - Cindy Childress: We are at 90% completion design on East West Weaver Creek for our planning grant. We will be seeking implementation funds with the Yuroks. On Shea Island we are getting ready to replant trees and cultural plants after the Yuroks restoration down there.
- Trinity County Resource Conservation District
  - Annyssa: We submitted our Upper Trinity Assessment and Restoration Plan back in April. The final that will be submitted to the Department of Conservation will be due in March, so if anyone has commentary on it we are more than open to it. We have started our field work for the season and are installing temperature loggers on tributaries to the Trinity and are assisting with some of the South Fork Trinity loggers as well. We installed flow sites at West Weaver and potentially East Fork Trinity, Coffee Creek and Stuart Fork. We are conducting Stream Condition Inventory surveys and have started doing Beaver Dam

Analogue surveys in the Weaverville Community Forest and in the North Lake region. We also got funding for fish passage assessments in the North Lake region.
    - Kelly Sheen: We are working more directly with Watershed Research and Training Center to provide more watershed and fisheries support to the Forest Service and will continue working in collaboration with them.
- Watershed Research and Training Center
    - Bridger Cohan: We finished a draft version of the Upper Trinity Assessment Report and are continuing to refine it. We finalized an agreement with CDFW to implement the Corral Gulch restoration project and are hoping to do that later this summer. At Salt Creek we are doing some groundwork with the community and the water district in Hayfork to build support for that project. We are also seeking additional funding to implement that.
    - Lesli Mounivong: We will have 8 water storage systems fully operational this summer, which is about 322,500 gallons of water saved. We are planning on implementing another 2 this year which will equal an additional 55,000 gallons in Browns Creek. One of our grants through the North Coast Regional Partnership was amended. We increased the project budget so we could implement another tank system. That will be in 2025. We began our roads program and have Zack Blanchard with us now. He's starting road upgrades in wildfire areas and doing some implementation in this month or the next. Zack and Josh have been working with the Yurok Tribe at the McKinney Fire area and hoping to do those road upgrades as well. Another local road project is the Barker Valley Road in conjunction with the CDFW Cannabis Restoration Grant program. We are hoping to start implementation this year.
- Trinity County Agriculture Alliance
    - Adrien Keys: We will be having a local foodweb workshop on August 3rd at the Riverview Beautification Project in Hayfork, which was a hog farm that was degraded to be a trash dump. It's been completely cleaned up and is now a community garden and educational facility. Our first workshop will be the benefits of winter cover crop planting: increased carbon storage, reduce nitrogen inputs, and improve sediment discharge. We will also be doing fall and winter food crops and a mushroom bed installation. We want to turn this into a spring and fall, twice a year event to bring more information on sustainable agriculture, including cannabis, to the community.
- Flowra
    - Chris Losi: We expect the grant for Post Mountain roads to be signed on the first of the fiscal year in July. We are making plans for a public meeting and road surveys. This is an assessment of the roads on Post Mountain and their sediment contribution as a way to identify potential work, and to start working on permitting for that.
- Announcement from Annyssa
    - This council is being funded by Department of Conservation and that funding expires in March 2025. If you appreciate this council please consider including the administration of it in your future grant applications so we can continue to have these collaborative spaces.

Meeting End: 11:45

Opportunities & Limitations With Applying The SWRCB CA Stream Classification To Benefit Trinity County Streams

Prof. Greg Pasternack

http://pasternack.ucdavis.edu

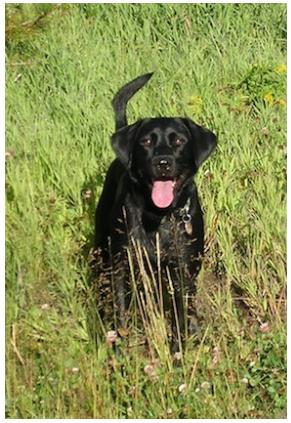
Department of
LAND, AIR AND WATER RESOURCES
University of California, Davis

Pasternack Career Mission Statement

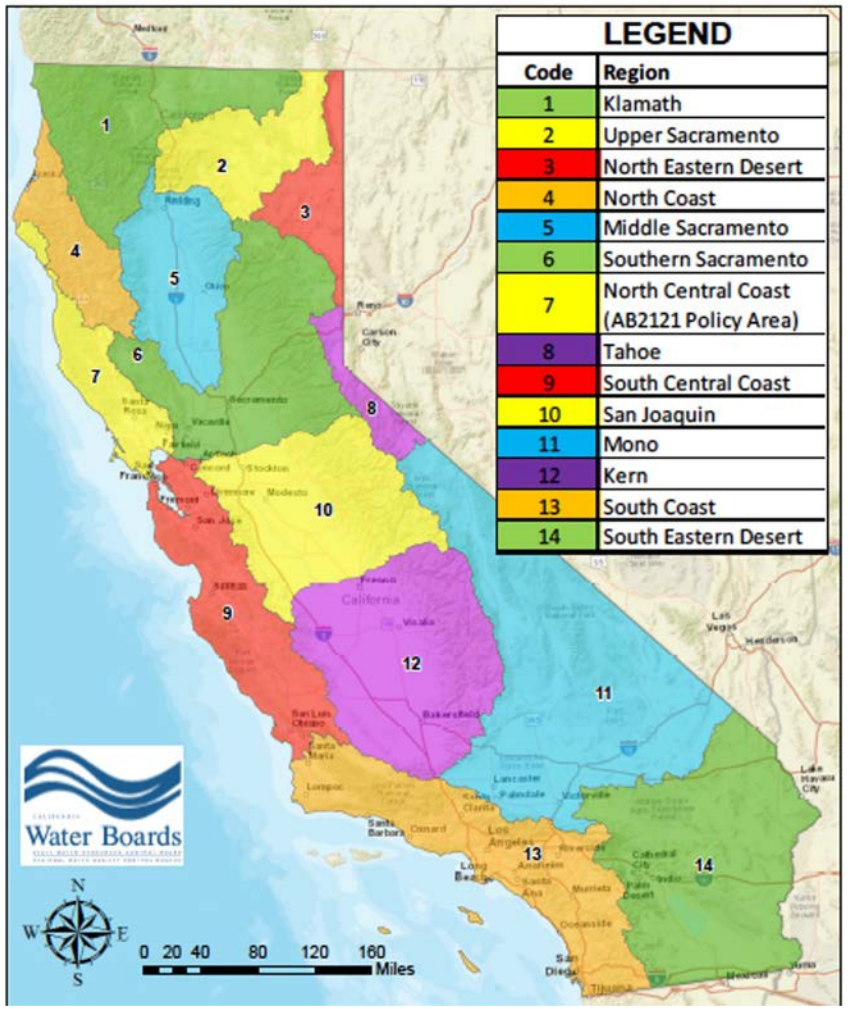
I believe that the way to steward nature and promote healthy multicultural communities is to understand rivers, their biota, and human society as an intertwined system.

- Professor @ UCD for 25 years
- Extensive fluvial geomorphic and ecohydraulics research on large Cal rivers like Trinity, Yuba, Mokelumne, Feather.
- Volunteer outreach and paid consulting working with river management groups.

It Takes a Diverse Community- Thank You!



Environmental Flows Needed in California, USA

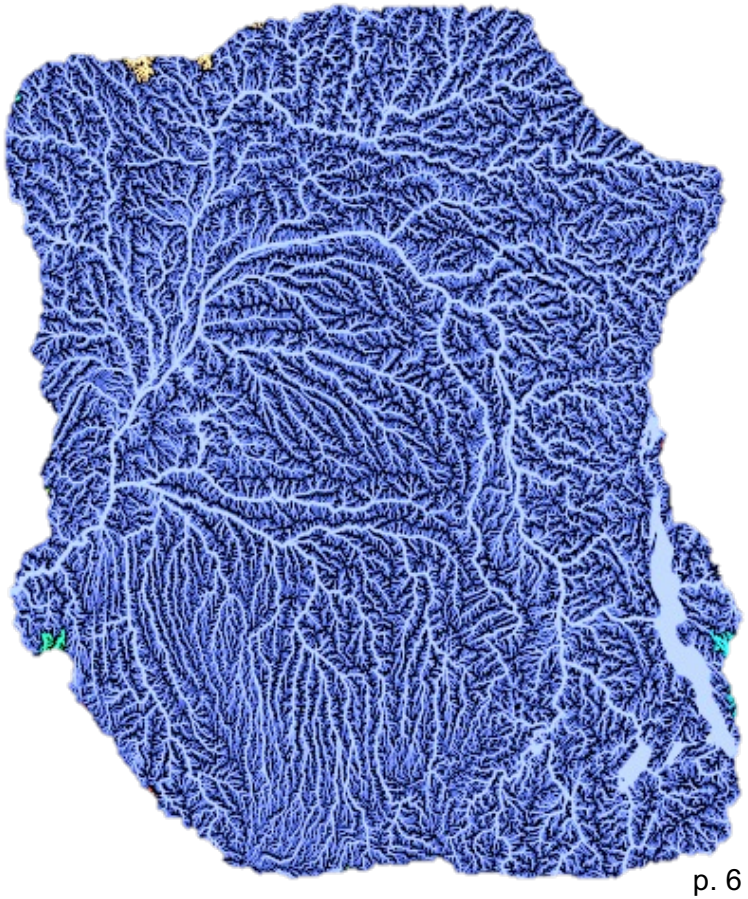


- State of California must develop **defensible, cost-effective, and time-sensitive approaches to establishing instream flows using sound science and a transparent public process.**
- Cannabis legalization is a new water use for which eFlows need to be specified.
- 14 regions. Coastal ones are top priority.
- 689,029 stream intervals (200-m) to develop eFlow targets for!

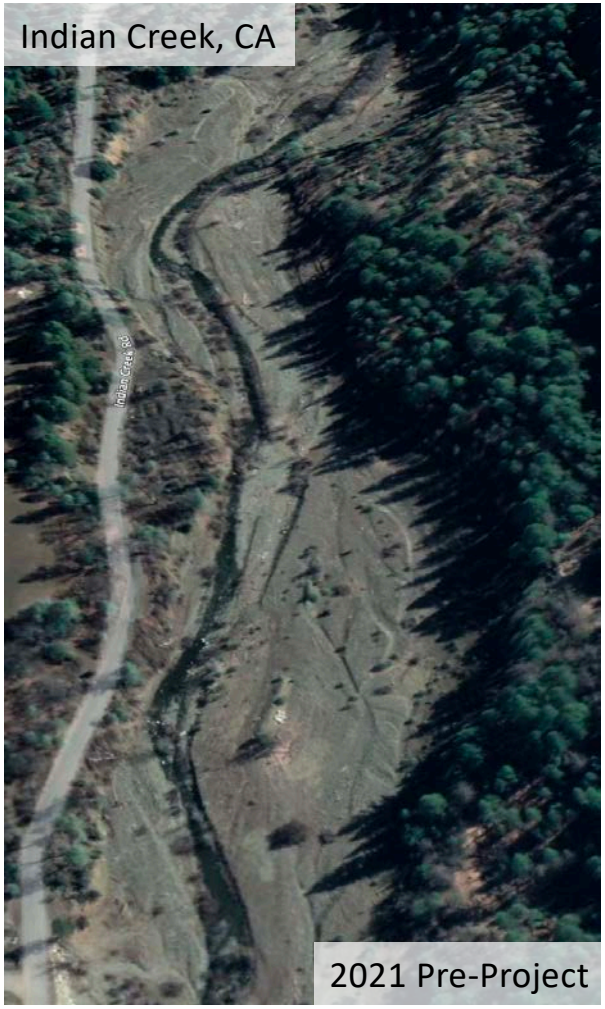
Typically, For A Single River, Diverse Community Viewpoints Are Argued To Manage Flows & Channels

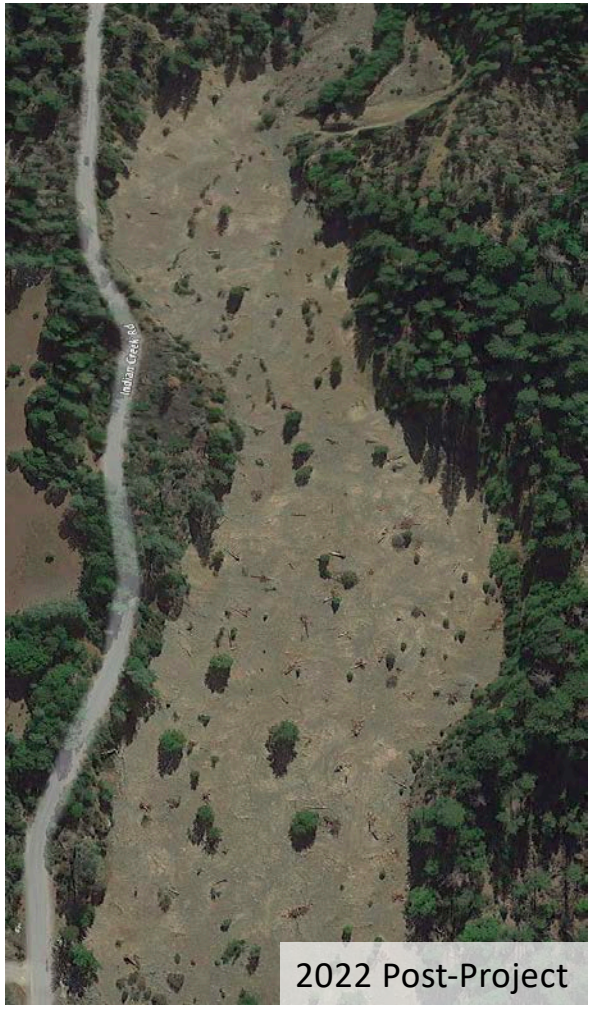
Challenges With Formulating Designs When Scaling Up From 1 To 1,000,000 Stream Intervals

- **Limited ecological data unevenly distributed around state.**
- **Process-based ecohydraulics analysis infeasible at network scale (>10^2 km of channels).**
  - Turbid rivers, dense forests, aerated water poorly suited to remote sensing of topo-bathymetry
  - Computing power insufficient



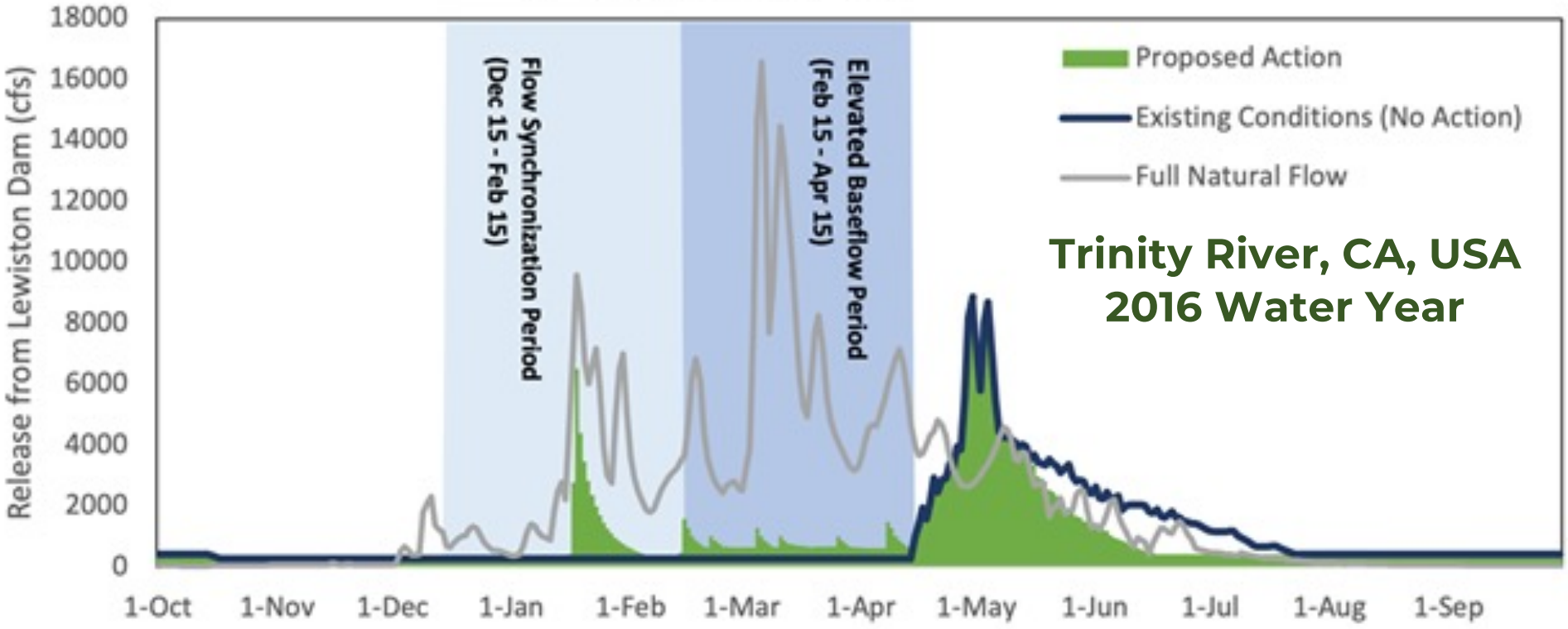
Option 1: Give Up & Reset to “Stage 0”





- Erase degraded stream from valley, let flow, sediment, & wood regimes instill new pattern.
- May be suitable in remote valleys, unsuitable adjacent to homes, businesses, & infrastructure.

Option 1: Holistic Hydrology & Downscaled Flow Regime

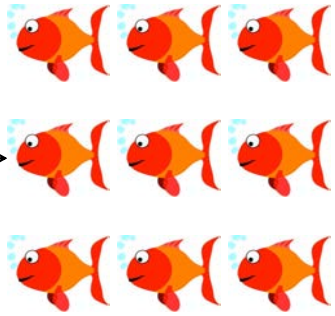


PROBLEM: Many natural functions have fixed scales and do not “shrink”.

"Holistic" Approach Incorrectly Assumes Simple Link Between Physical Action And Ecological outcome

Inject Gravel Into a River Or Place It Along Bank???

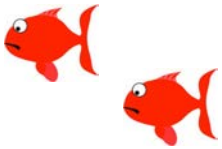
River System Black Box



$p < 0.001$

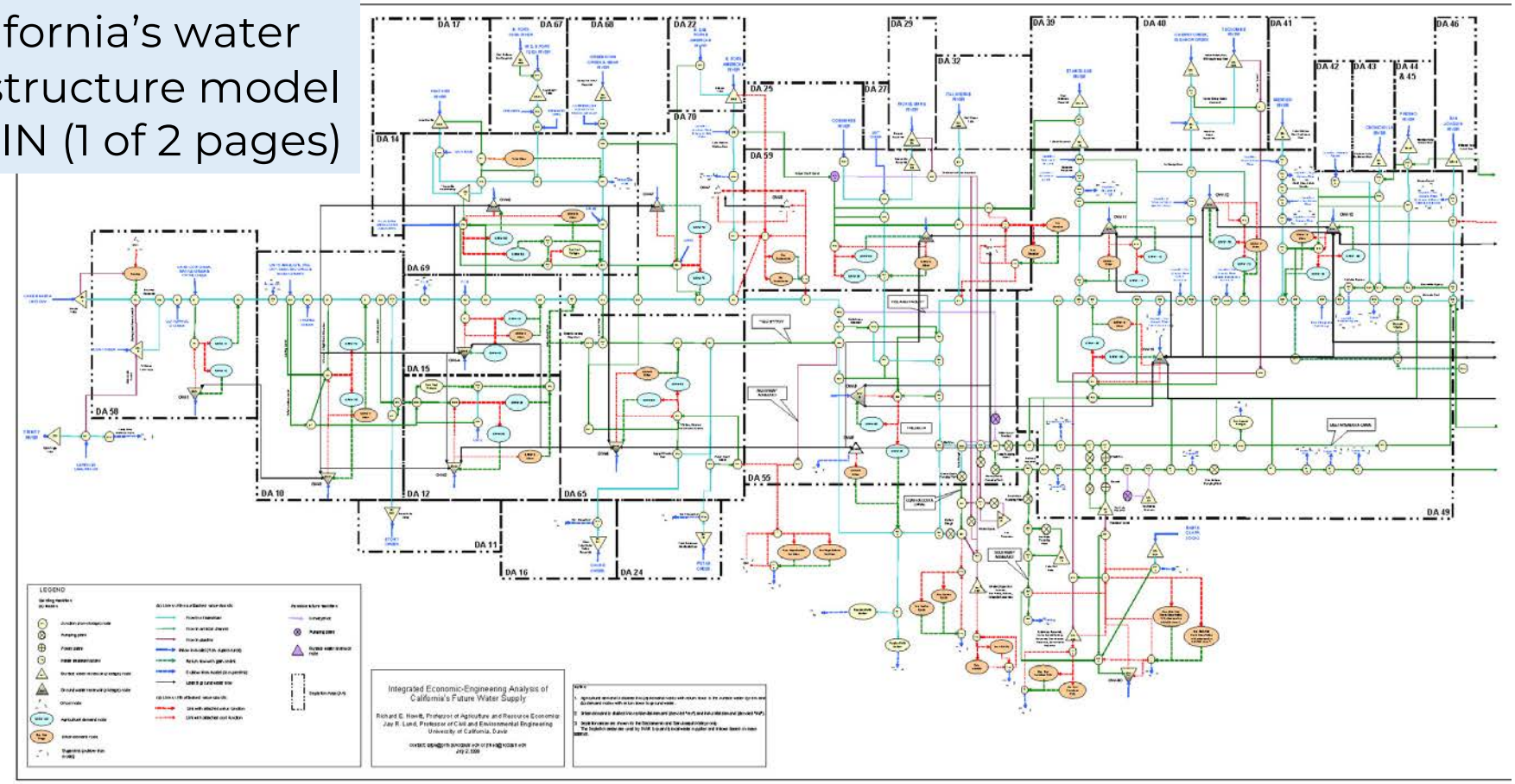
(fake example!)

River System Black Box

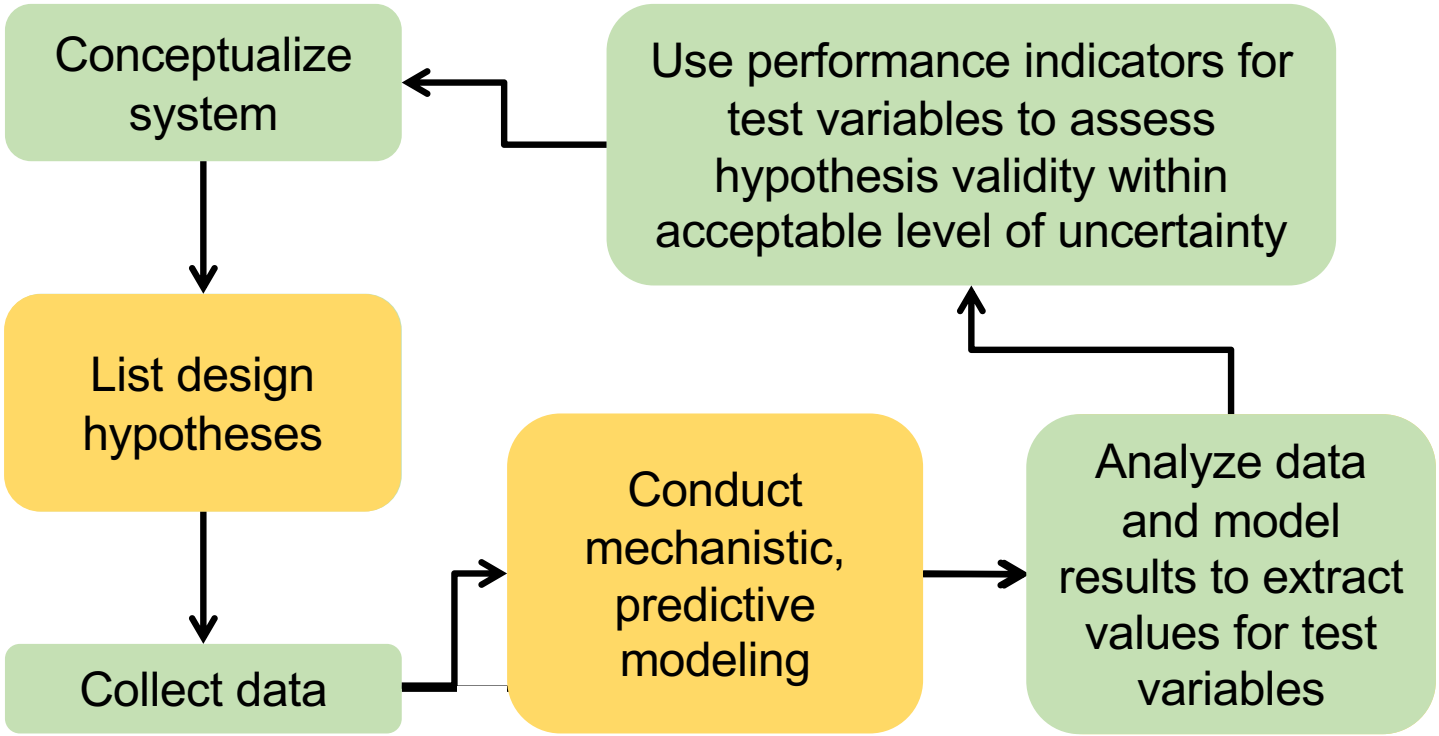


Water management models are “complex”, and we should expect similar effort to understand ecology

California’s water infrastructure model CALVIN (1 of 2 pages)



River Assessment And Engineering Should Be Mechanistic, Not Statistical Or Holistic



"A design hypothesis is a mechanistic inference, formulated on the basis of scientific literature review, and thus is assumed true as a general scientific principle." –Wheaton et al., 2004, JRBM.

Flow, Form, and Function (F^3) Design Framework

Baseline characterization from samples of populations

- Hydrologic Classification
- Geomorphic Classification
- Eco Function Classification

River Engineering Goals Captured in Designs

- Flow Regime Archetypes
- River Corridor Archetypes
- Eco Function Archetypes

Integrated Analysis of Design Functionality

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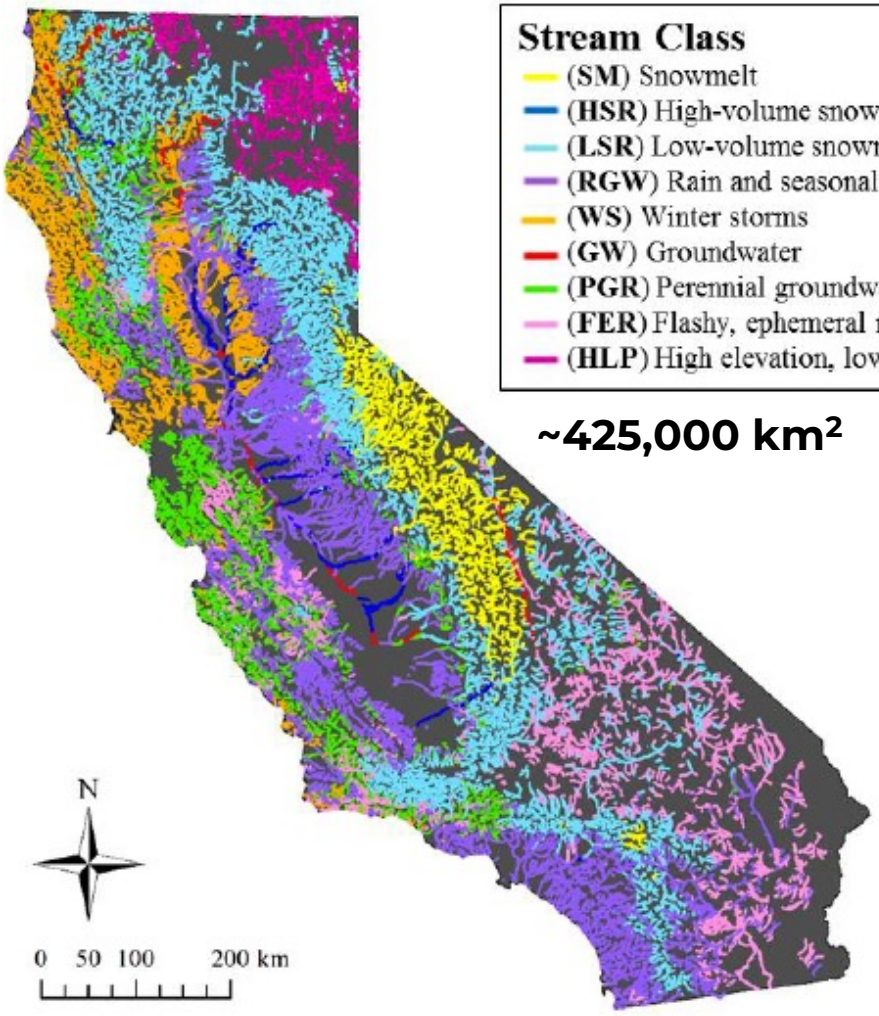
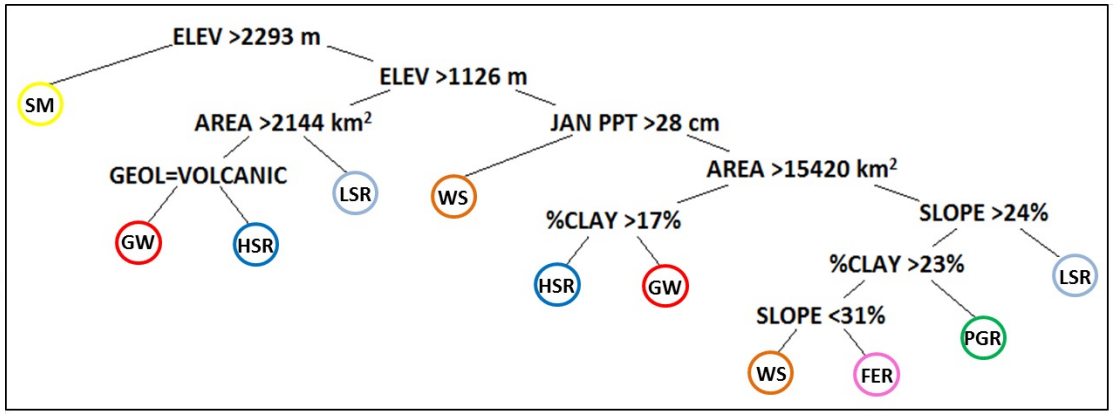
Hydrological Classification of Rivers



~425,000 km²

(Lane et al. 2017, 2018)

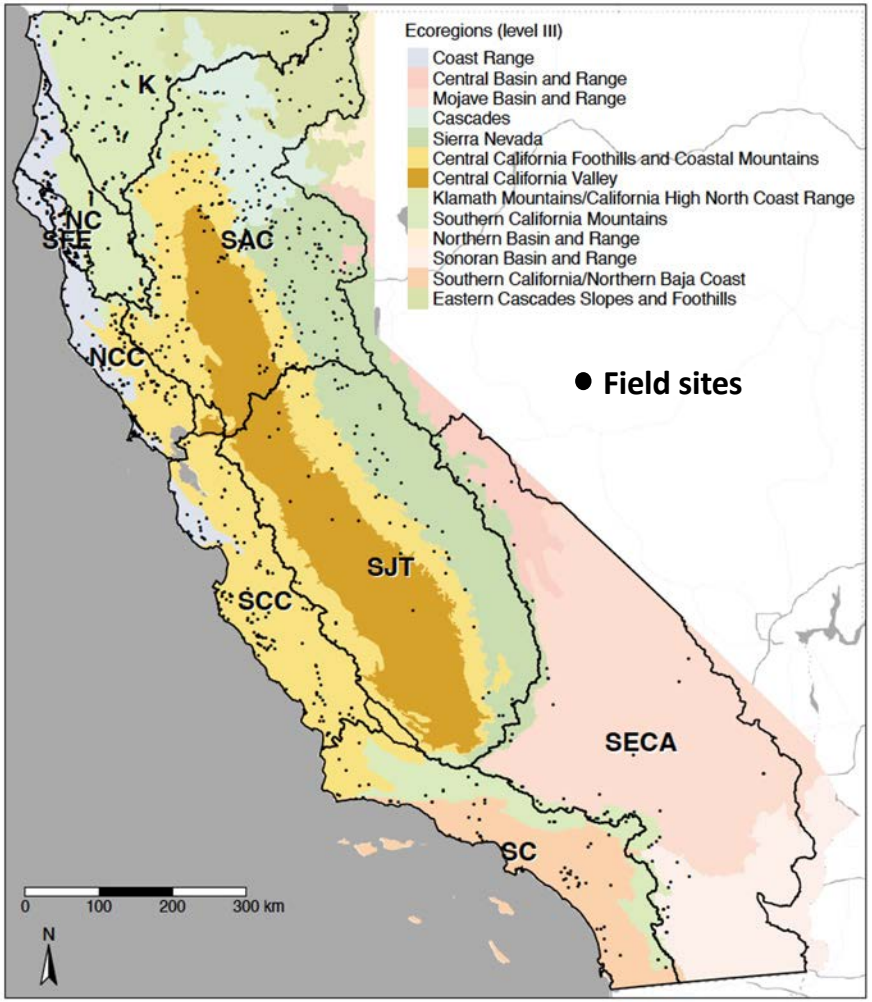
Classification & Regression Tree



Geomorphic Classification of Rivers

Fieldwork Campaign

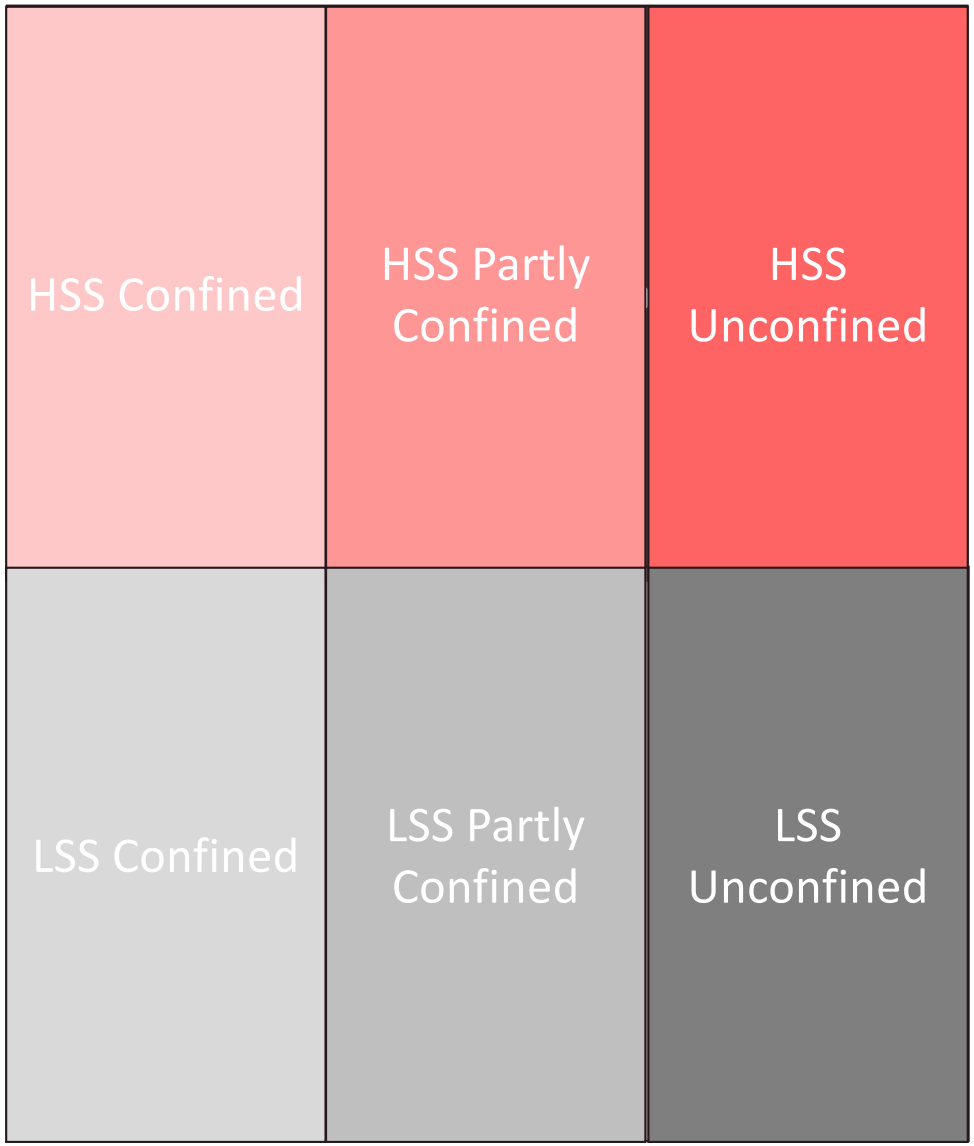
- 9 regions (not sampled equally)
- Objective stratified random sampling scheme striving for equal effort sampling of different controlling processes
- 1,110 field sites have 11 XS each.
- Carefully design geomorphic observation protocol.
- Multiple field teams trained together.
- Each region classified independently
- Statewide unified classification also done but not as detailed or accurate as regional ones.



Desktop GIS Field Campaign Sampling Design

- Region by region sampling with ~120 new sites each + existing datasets.
- Segregate state stream network into 200-m intervals
- Stratify 5·3·2= **30 groups per region** by:
  - Sediment Supply USLE method (2 bins)

(Byrne et al., 2020, *ESPL)*



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- Region by region sampling with ~120 new sites each + existing datasets.
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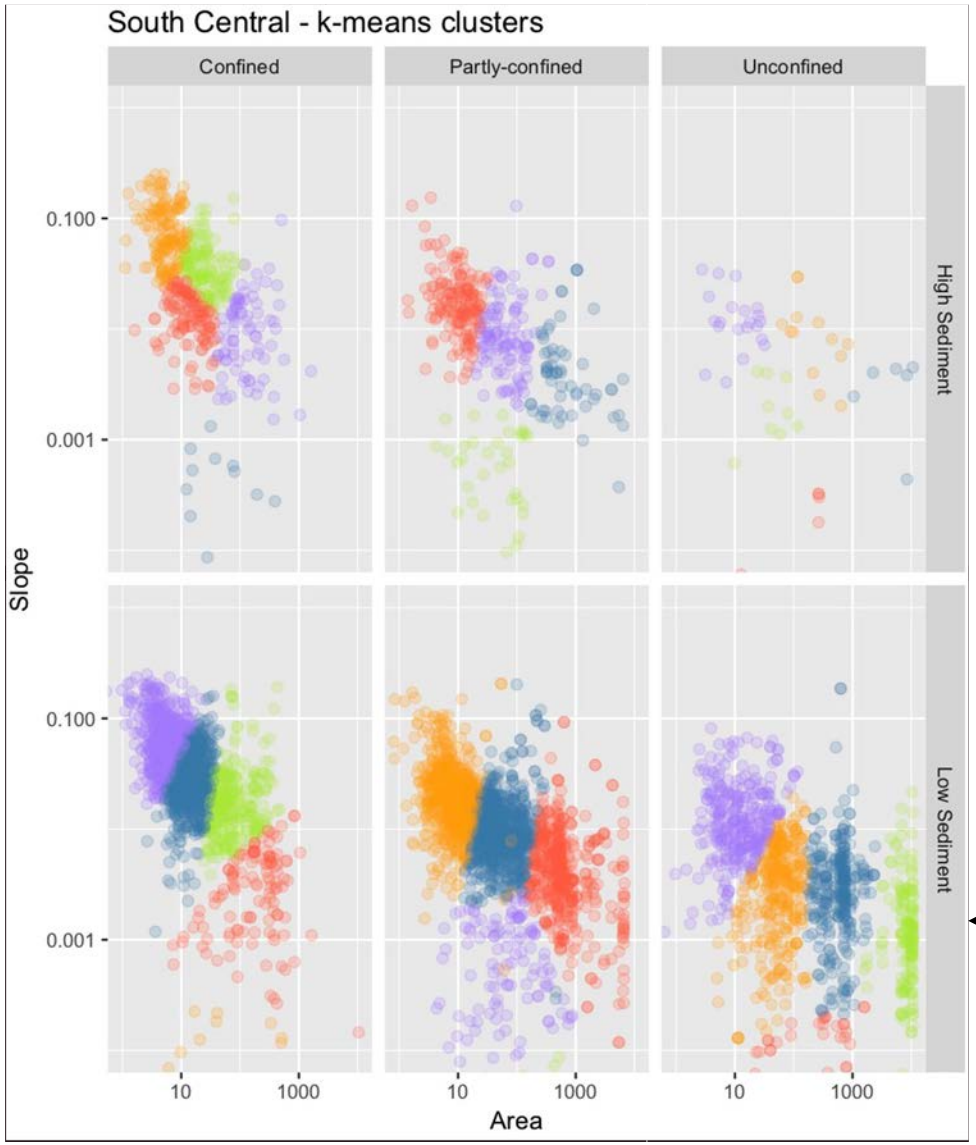
  - Valley confinement (3 bins)

(Byrne et al., 2020, *ESPL)*



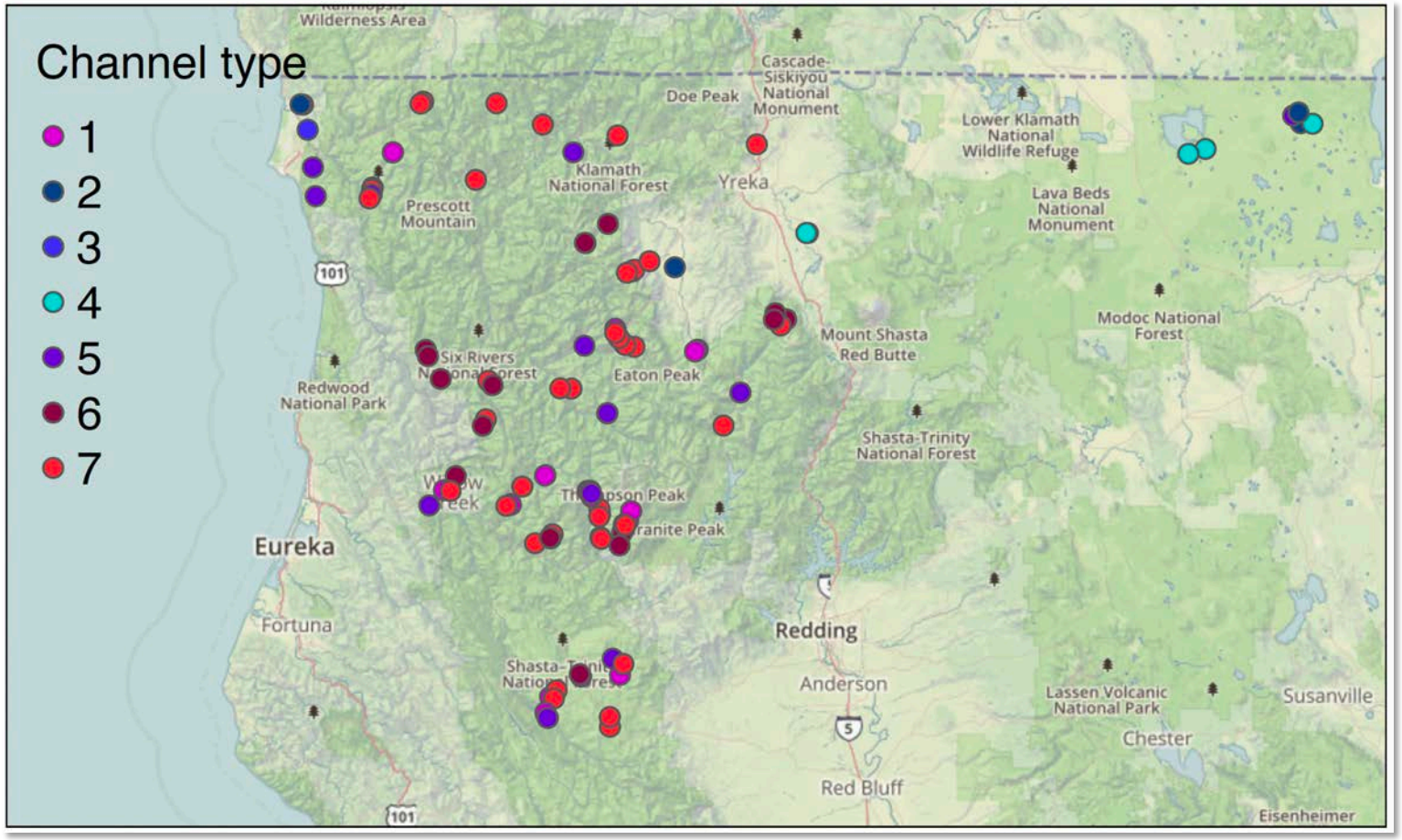
Desktop GIS Field Campaign Sampling Design

- Region by region sampling with ~120 new sites each + existing datasets.
- Segregate state stream network into 200-m intervals
- Stratify 5·3·2= **30 groups per region** by:
  - Sediment Supply USLE method (2 bins)
  - Valley confinement (3 bins)
  - Local Slope & Catchment area (5 bins)

← South Central Coast Region Example

(Byrne et al., 2020, *ESPL)*

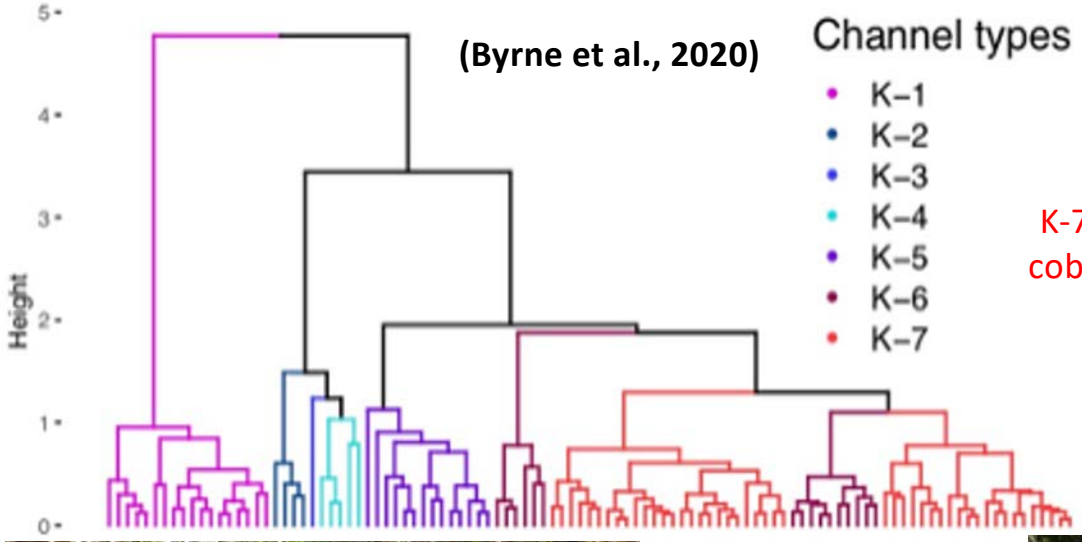
Klamath Region Site Map



- Accessibility was the #1 constraint
- Focus on sampling expected stream types, not on achieving geographic spread
- Large geographic gaps away from roads

Field work and exact site selection performed by HSU (aka Cal Poly Humboldt)

Regional Geomorphic Classification of River Types

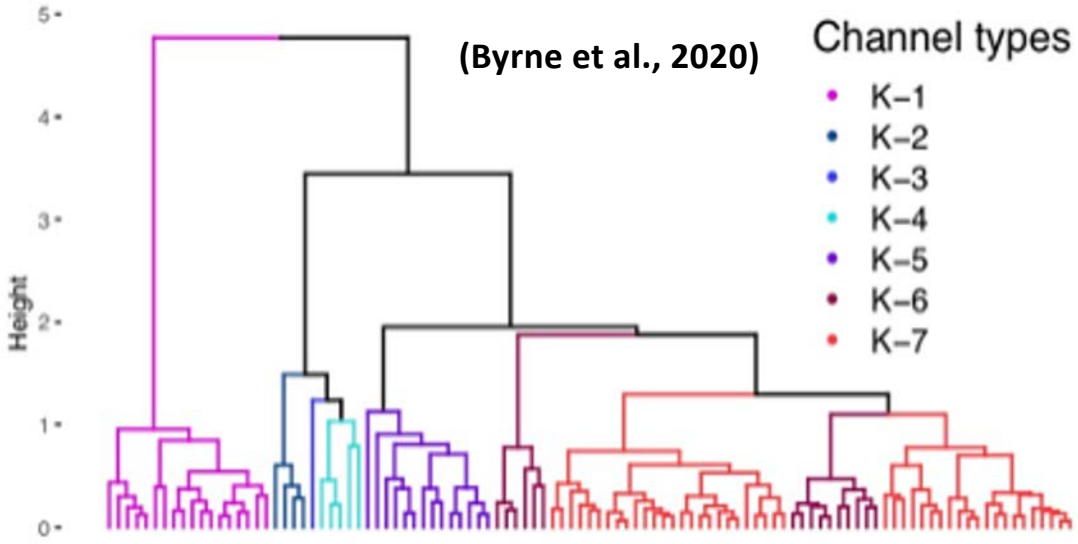


K-7 - Confined, cobble boulder, uniform

K-6 - Confined, cobble-boulder, cascade/step-pool

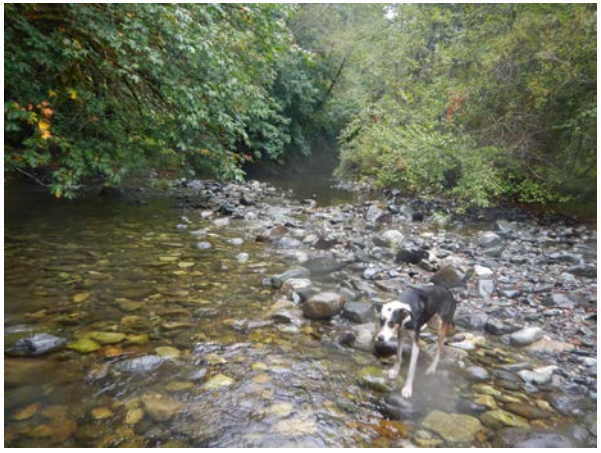
K-1 - Confined, boulder bedrock, bed-undulating step-pool

Regional Geomorphic Classification of River Types



K-3 - Unconfined, high order, gravel-cobble, riffle-pool

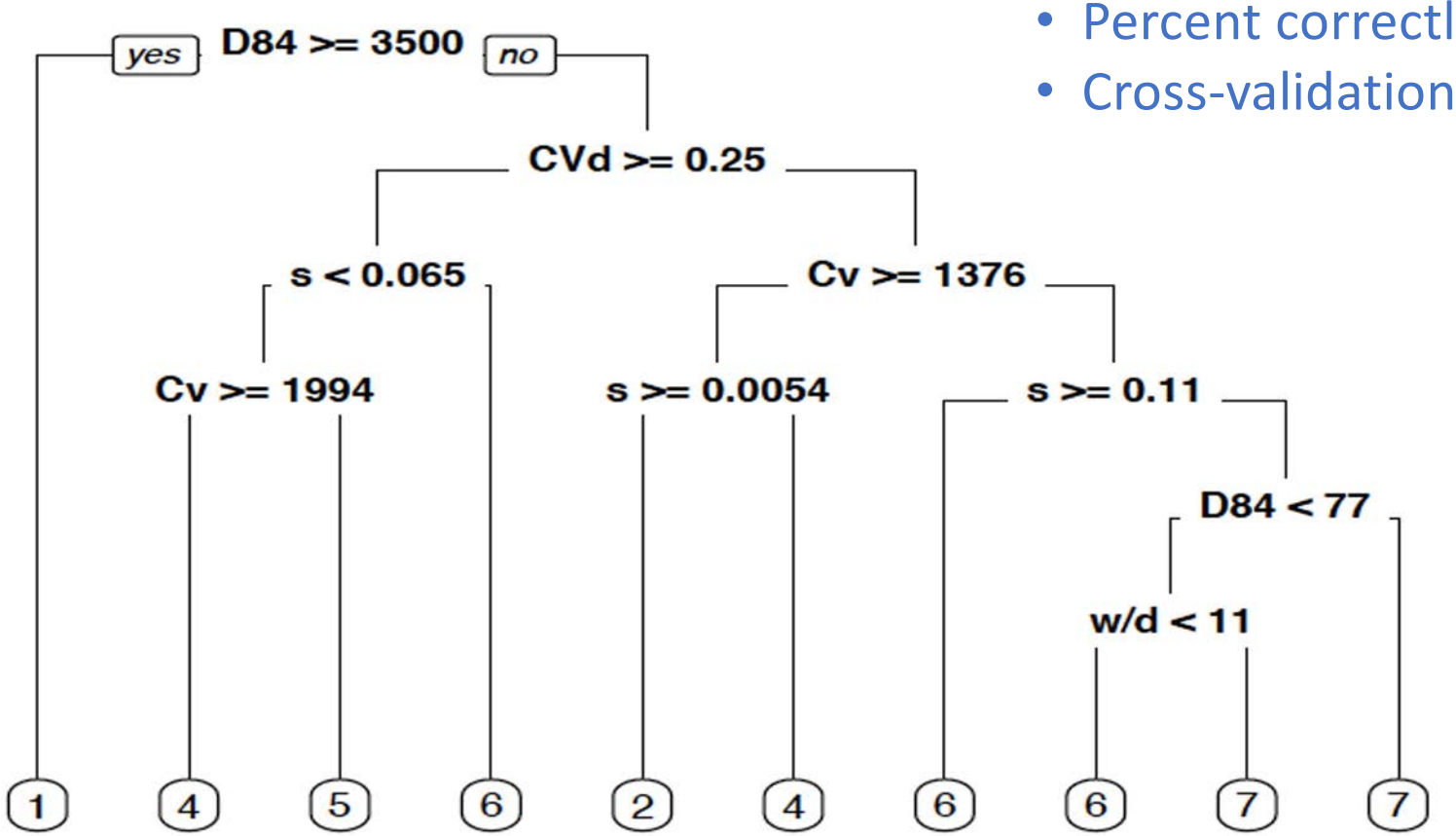
K-4 - Unconfined, high width-to-depth, gravel, uniform



K-5 - Partly-confined, gravel-cobble, riffle-pool

K-2 - Unconfined, low width-to-depth, gravel, plane bed

Klamath River "CART" Classification Tree



Klamath Region Performance

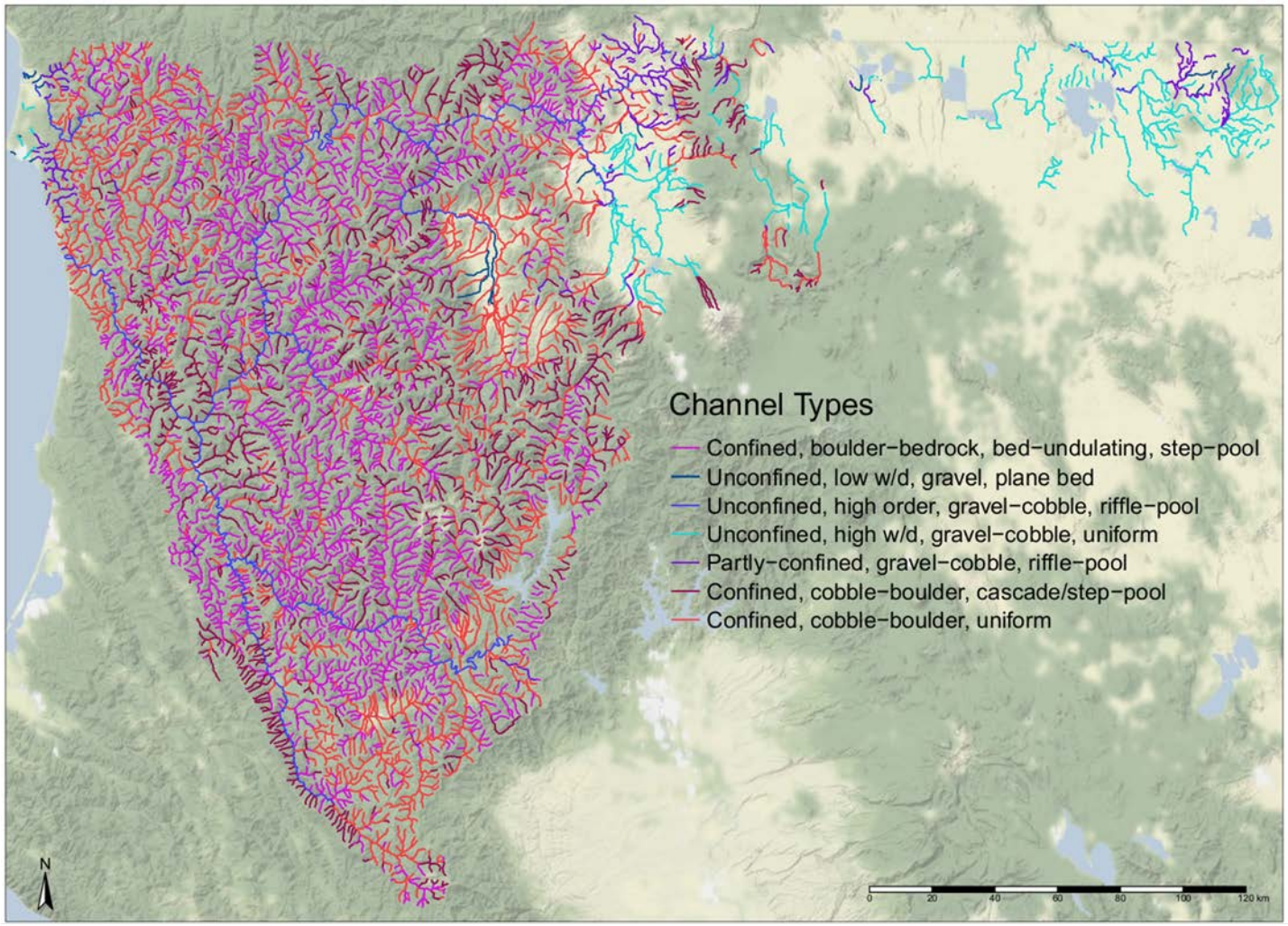
- Percent correctly classified = 96.2%
- Cross-validation = 82.9%

Network-Scale River Type Prediction @ 200-m

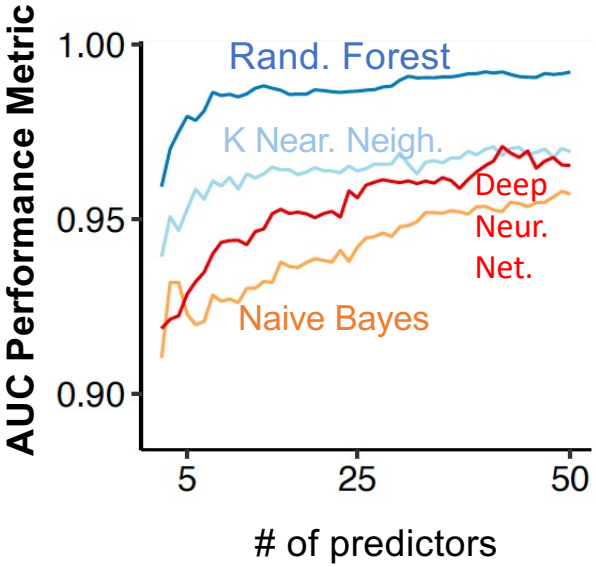
- GIVEN: River **Labels** for X sites from field-scale classification per region (105 for Klamath region).
- GIVEN: 287 **Predictors** from statewide geospatial datasets
- FIND: Best machine learning algorithm and pre-processing tools to yield highest cross-validation performance at matching known labels.
  - Study what makes algorithms and preprocessing poor or effective
- Apply the best tools to California regions

(Guillon et al., 2020, *WRR)*

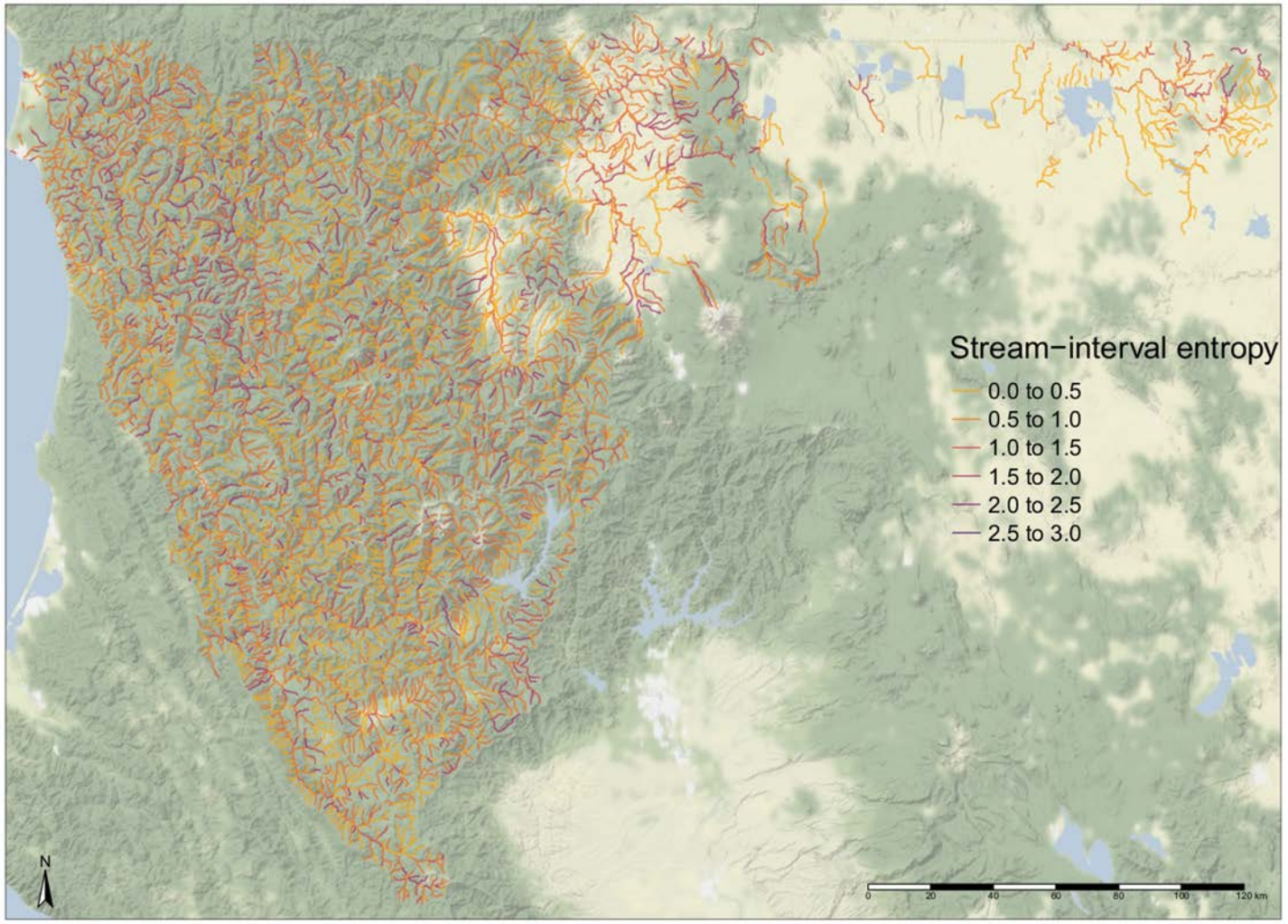
Klamath Region RF Prediction of River Types



High Accuracy With Random Forest Model



Klamath Region "Entropy" Uncertainty Metric



- Dark → higher uncertainty
- There is high "entropy" (uncertainty in model predictions) in some settings.
- Uncertainty varies spatially by region and within a region

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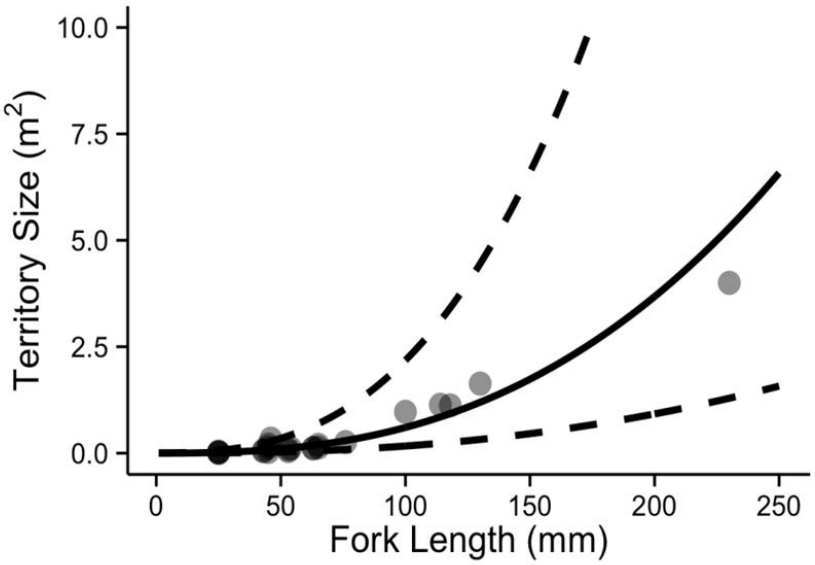
Integrated Analysis of Design Functionality

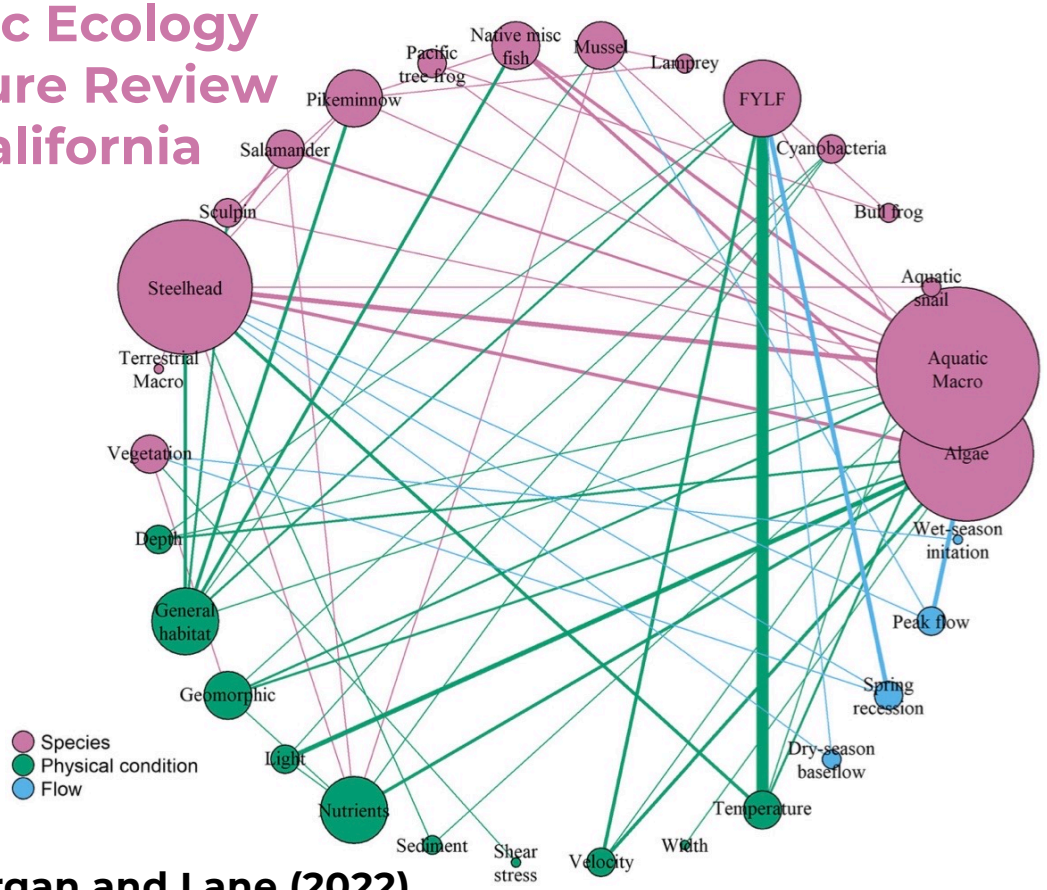
Carry out Aquatic & Riparian Ecological Studies

How much territory does a single fish need?



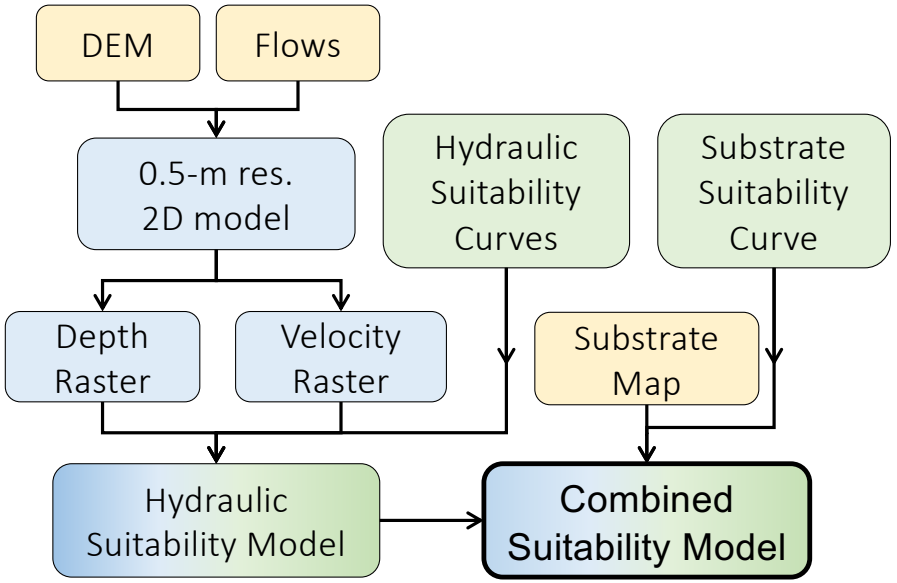
Grant and Kramer (1990)

Region-by-Region Aquatic Ecology Literature Review of California

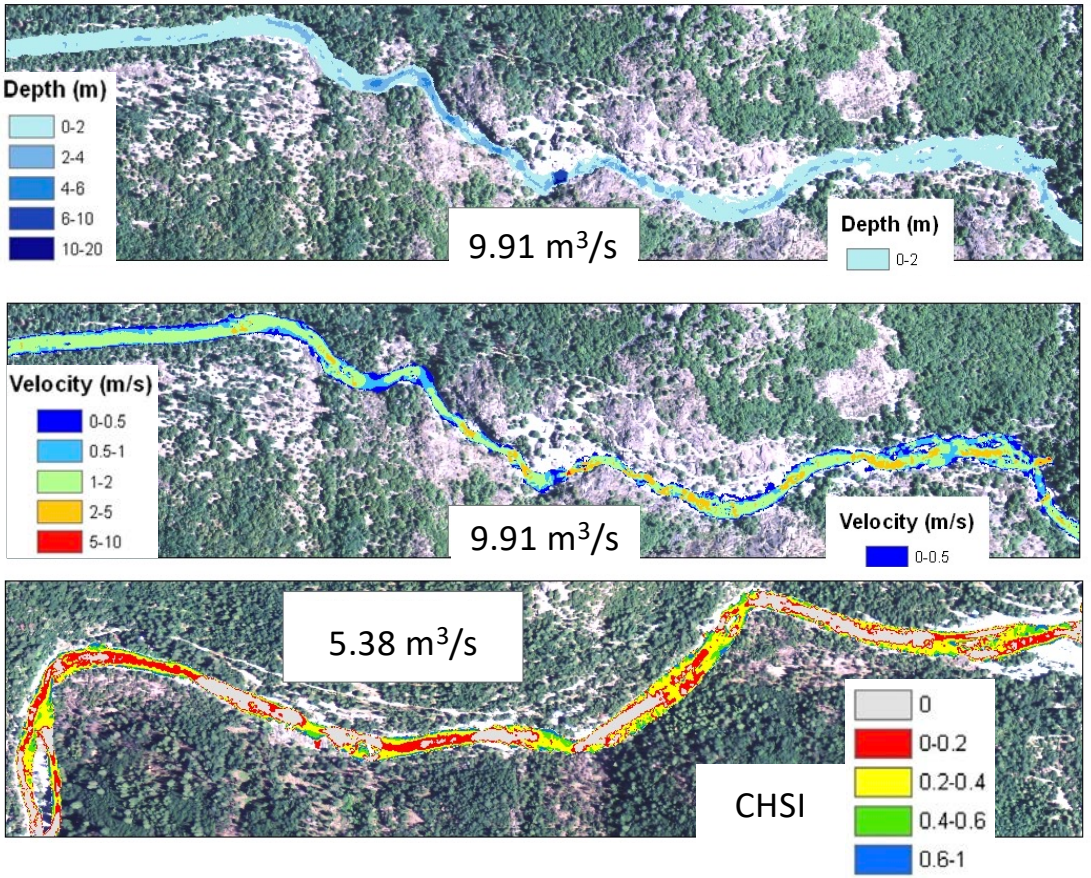


Morgan and Lane (2022)

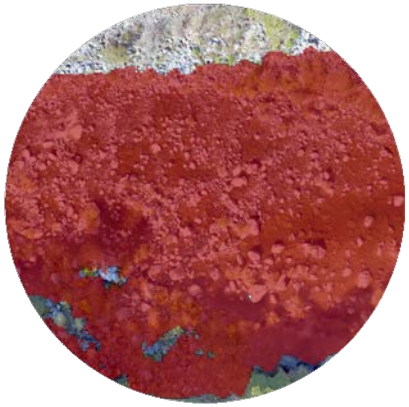
Use Ecohydraulics To Predict Functional Patterns



In-Channel Study Flows (m^3/s)		
0.14	1.56	9.91
0.42	2.83	---
0.85	5.83	---



Alignment of Areas Needed For All Steps In Complete Reproduction Function



1

Bed Preparation Geomorphic Function

2

Salmon Spawning Behavior Habitat

3

Embryo Incubation Conditions Satisfied

<u>87%</u> less Area Than High-Quality Spawning Habitat

Ecohydraulic Functional Assessment

Population Estimation Tools

- Life cycle model
- Intrinsic Potential
- RIPPLE
- ESHE
- Population dynamics model
- Eco Evidence

WHAT CAN WE DO?

Decision Support Systems

- **IFIM**
- **FITHydro**
- **DRIFT**
- **IDRAIM**

Ecohydraulic Functions Tools

- River Architect
- CASIMIR
- EFDC+
- Functional Flows Model
- BORIS
- ELAM
- FB4
- FishXing
- HEC-EFM
- SEFA
- HABBY
- PHABSIM
- MesoHAB SIM

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Hydro-Geo-Eco Functional Archetypes

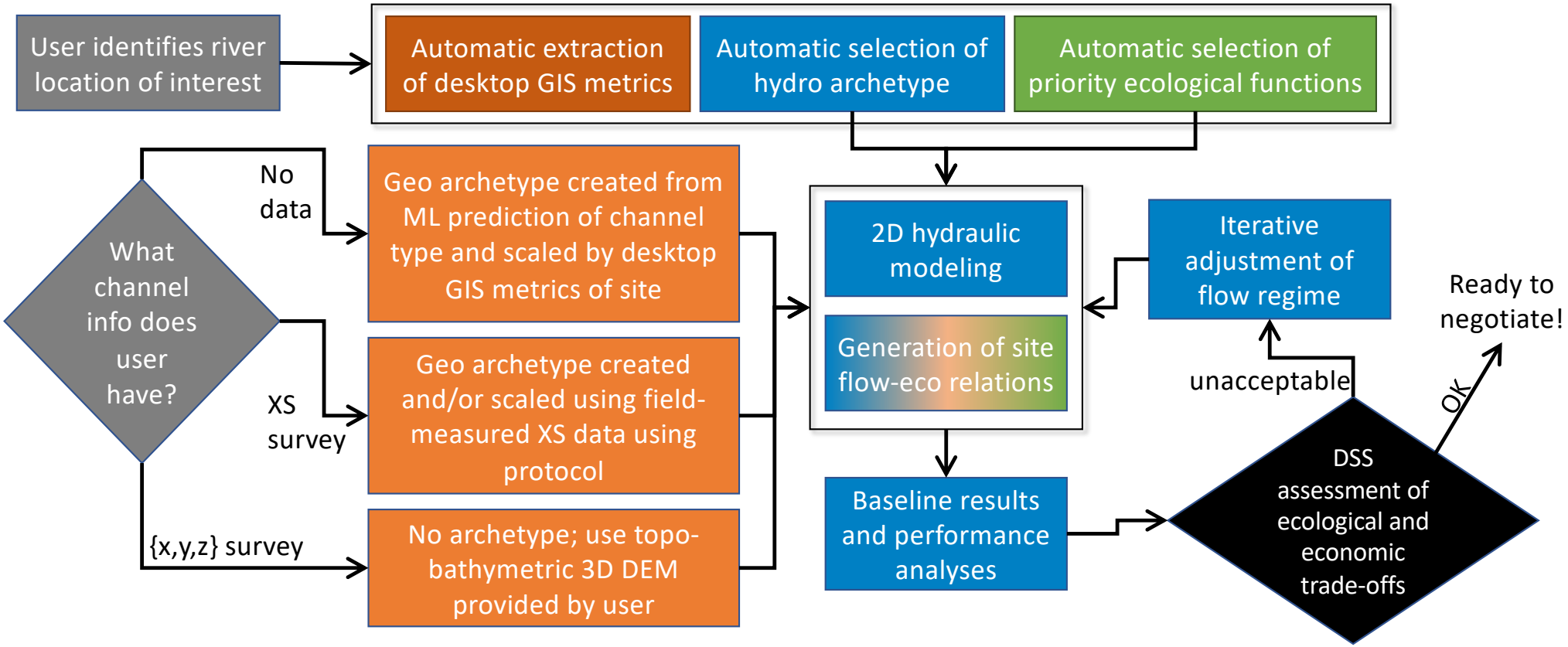
PROBLEM: Most places where people want to take water out of streams have not been studied. How can we automatically generate an eFlow or river restoration design for any arbitrary location in a network?

SOLUTION: ***Functional archetype…***

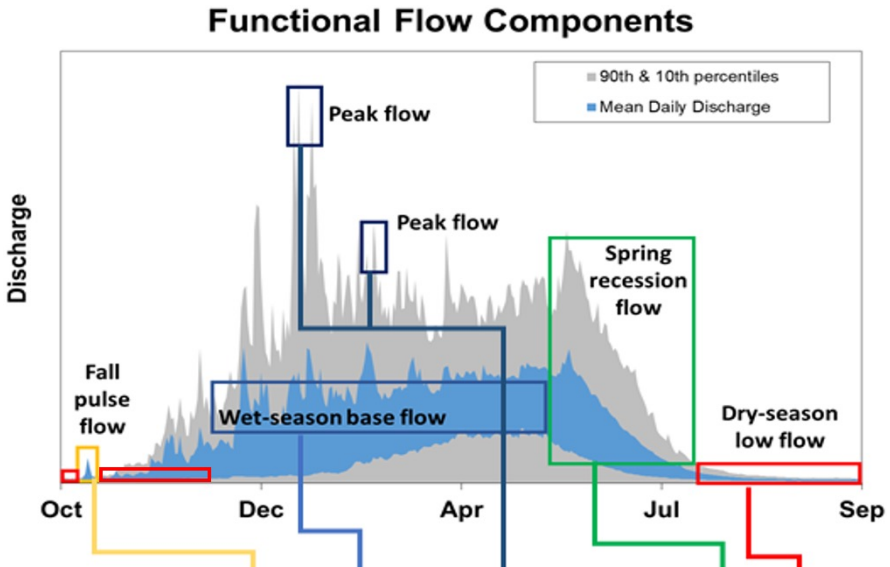
Idealized 3D site representation of the geo-hydro-eco setting, including detailed information of expected site attributes

While “idealized”, not simplistic… use patterns of spatial variability

Proposed Management Application



Hypothesize Key Seasonally Based, Archetypal, Functional Flows



Flow Characteristics	Fall Pulse	Wet Baseflow	Peak Flow	Spring Recession	Dry Low Flow
	Functional Flow Components				
Magnitude	X	X	X	X	X
Timing	X	X	X	X	X
Duration		X	X	X	X
Frequency			X		
Rate of Change				X	X

- 5 seasonal functional flows
- 24 functional flow metrics

Flow Calculator YouTube Instructional Video: https://www.youtube.com/watch?v=nN08f3nFGe8

(Escobar-Arias & Pasternack, 2010; Patterson et al., 2020)

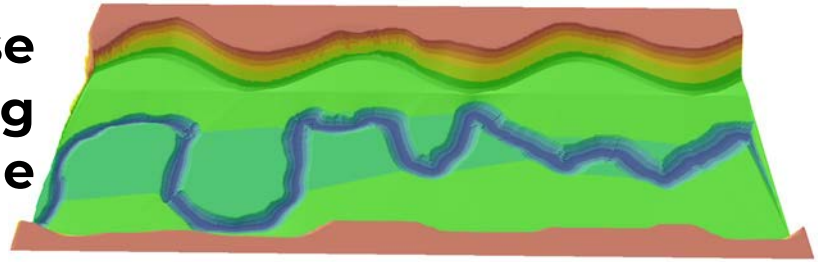
River Topography Design With River Builder

https://github.com/RiverBuilder/RiverBuilder

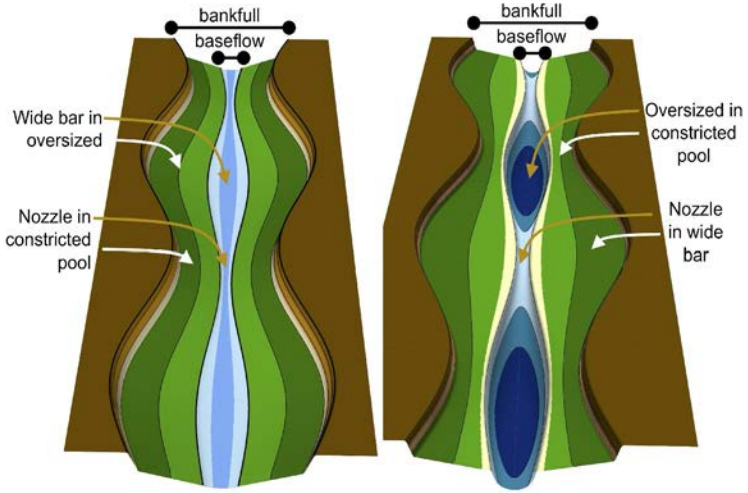
“Procedural generation” of exact designs

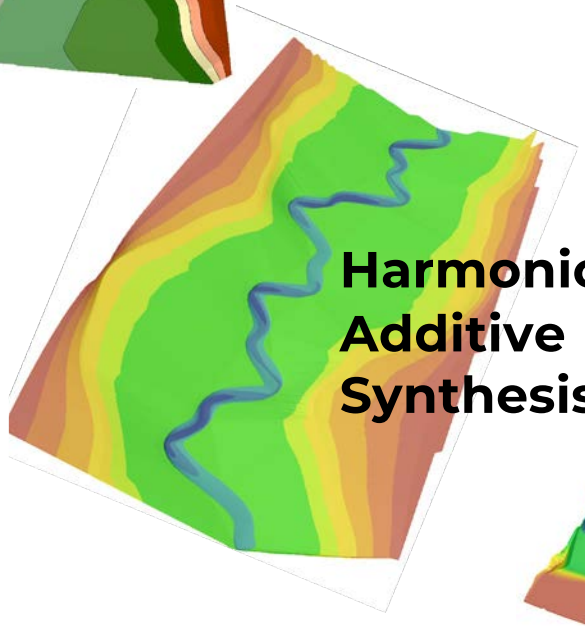
(Pasternack & Zhang, 2020; Lee et al., 2023)

Piecewise varying centerline

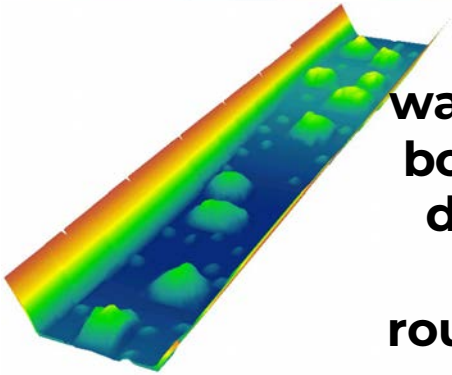


Hierarchical Nesting Of Multiple Inundation Zones



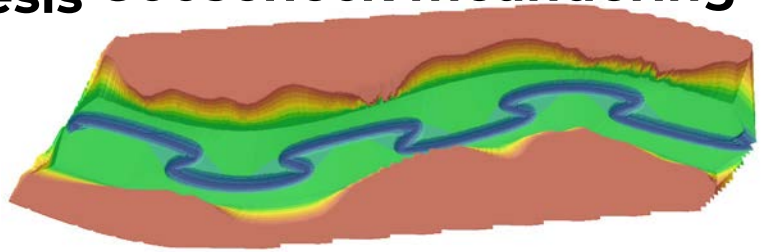


Harmonic Additive Synthesis



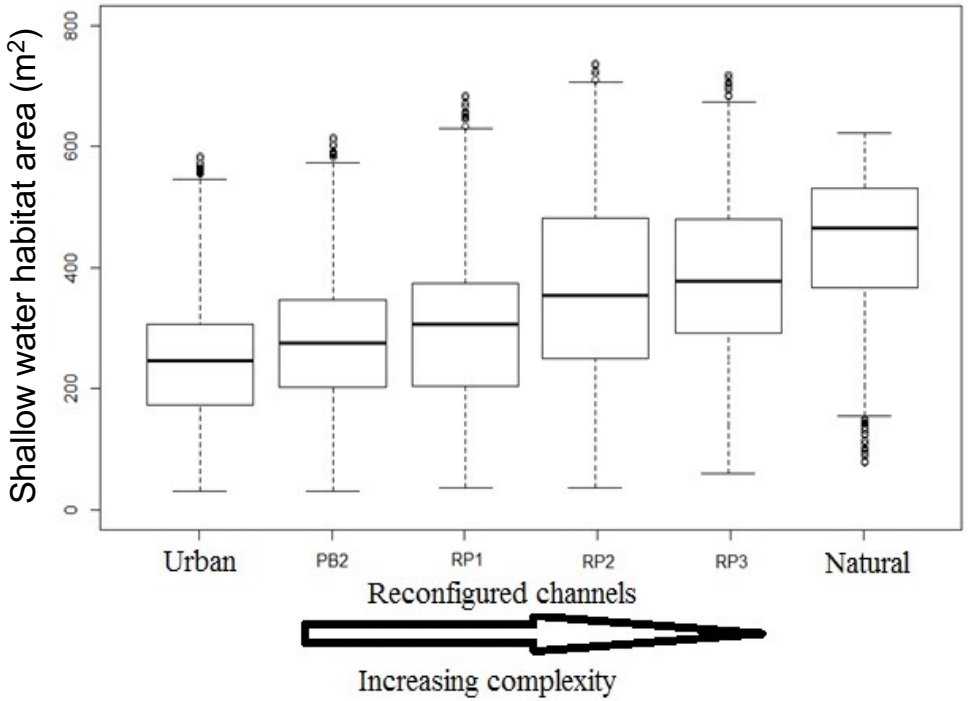
waterfalls, boulders, dams & bed roughness

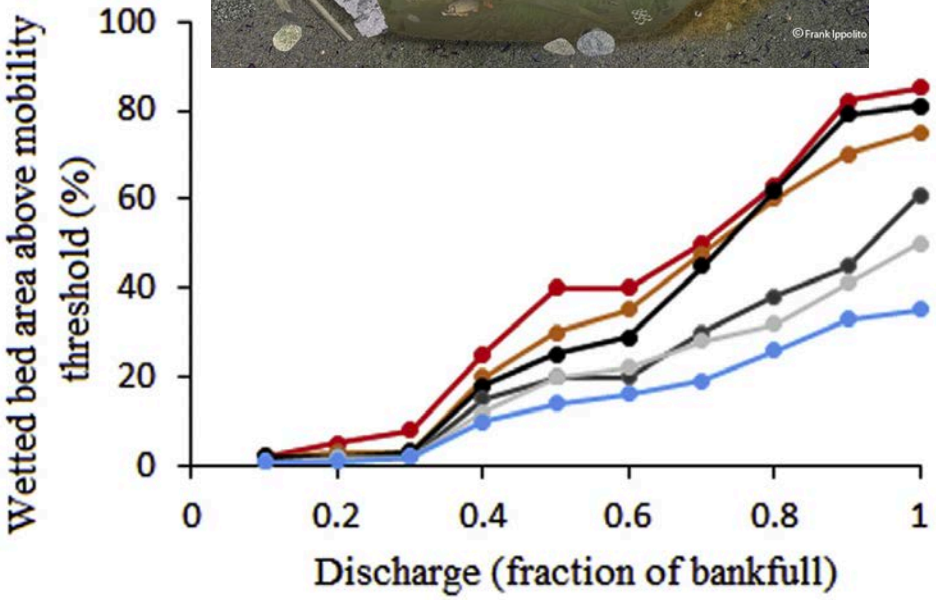
Gooseneck meandering



Archetype Functional Analyses of Urban Streams

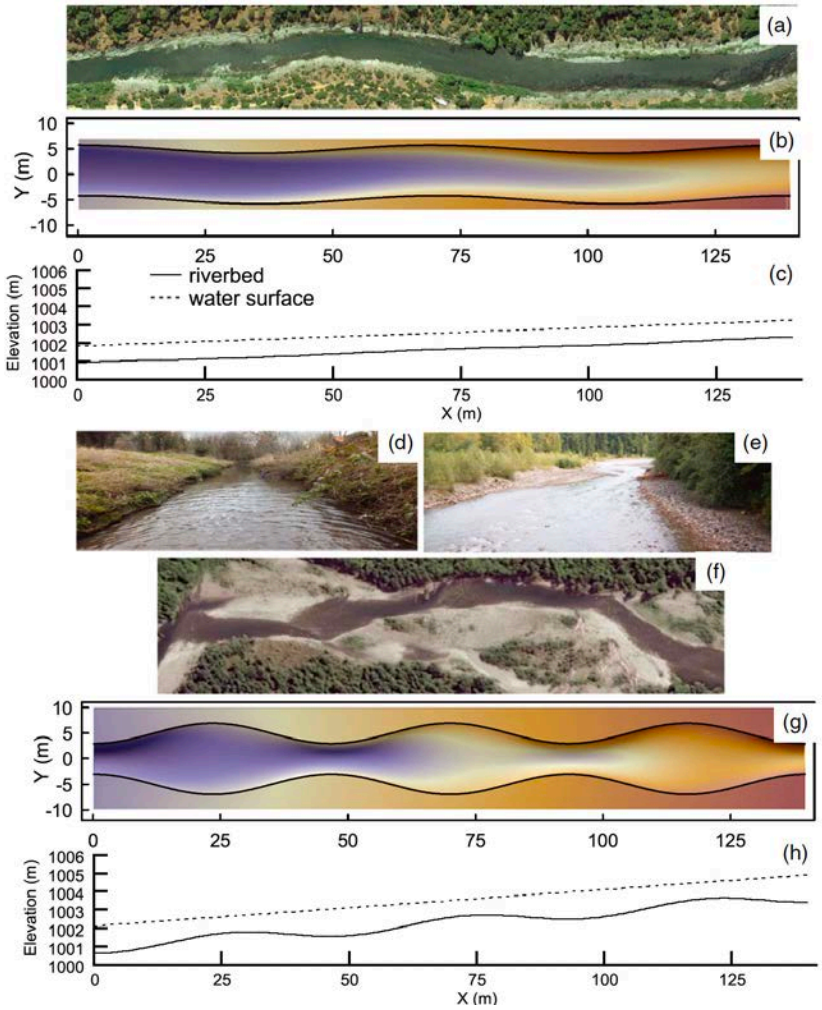
- "Urban River Syndrome" shallow water habitat assessment, Melbourne, Australia.



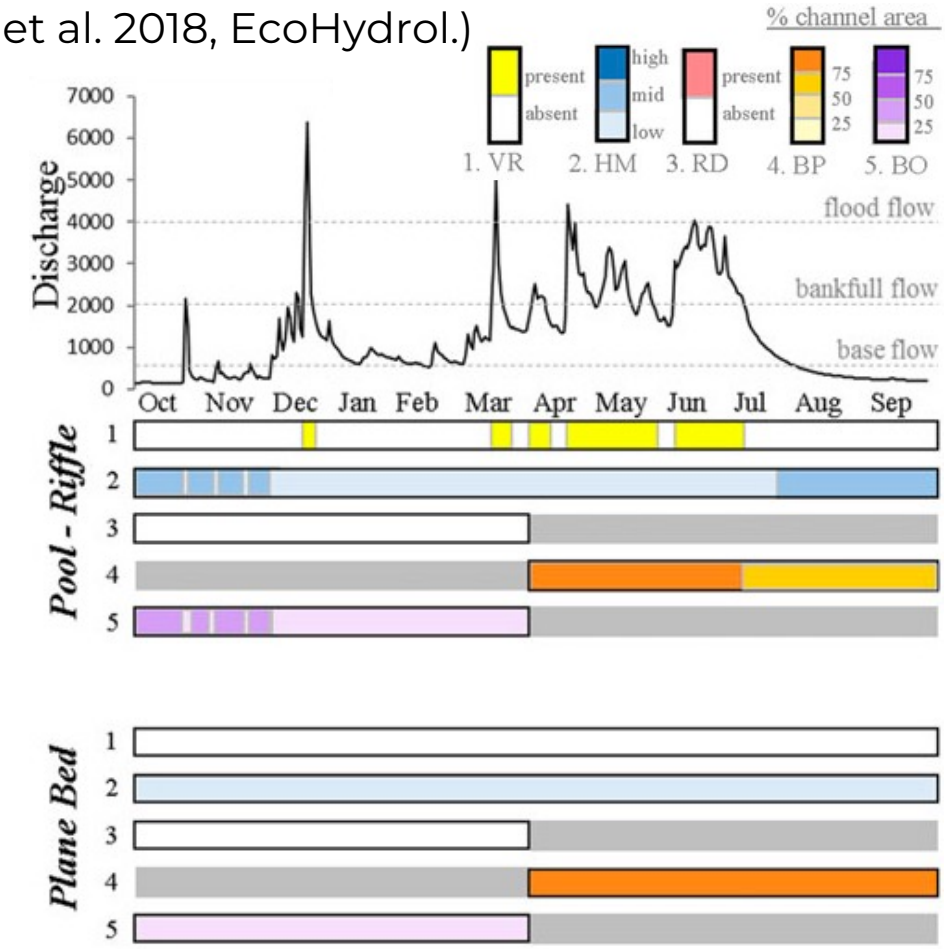


et al., 2019, J. Env. Man.)

Eco-Geo-Hydro Functionality of Two River Types



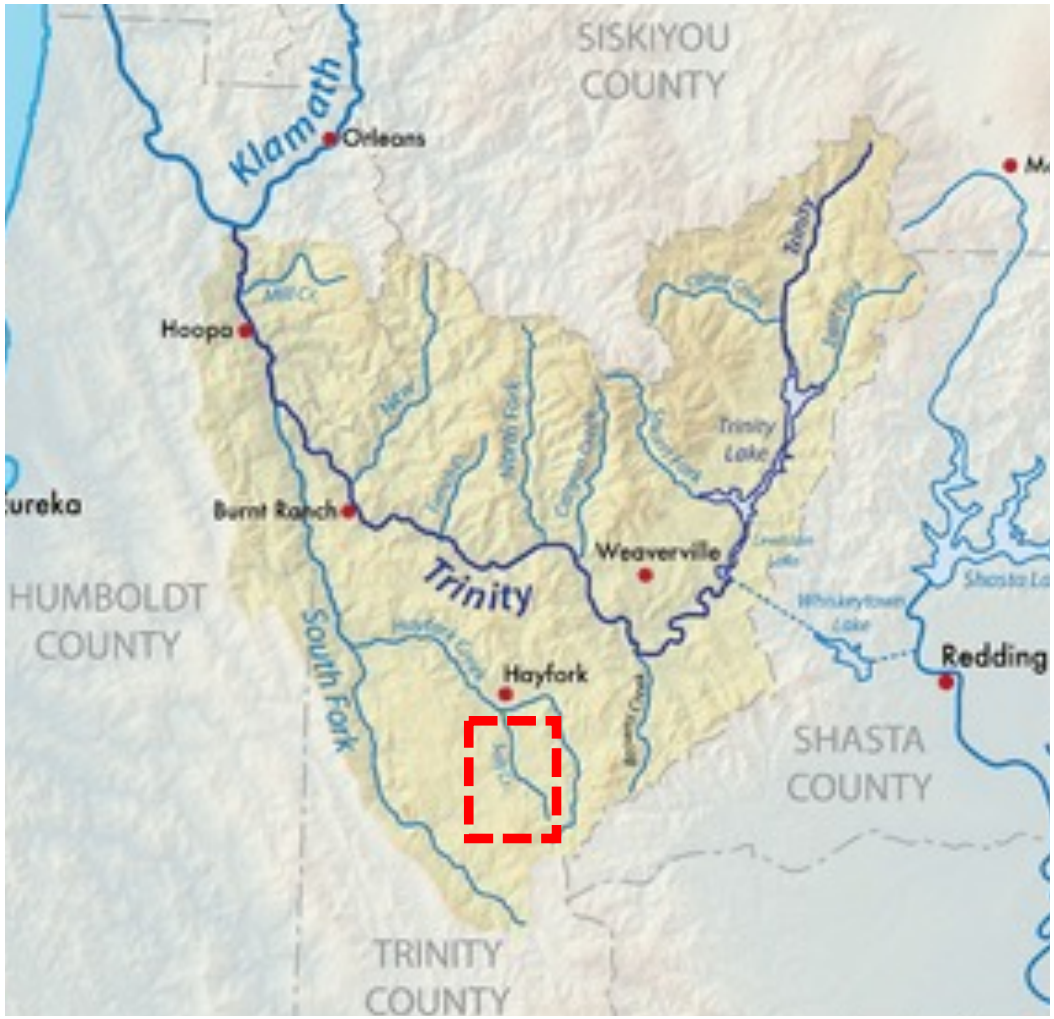
(Lane et al. 2018, EcoHydrol.)



Follow-up Research in Trinity County

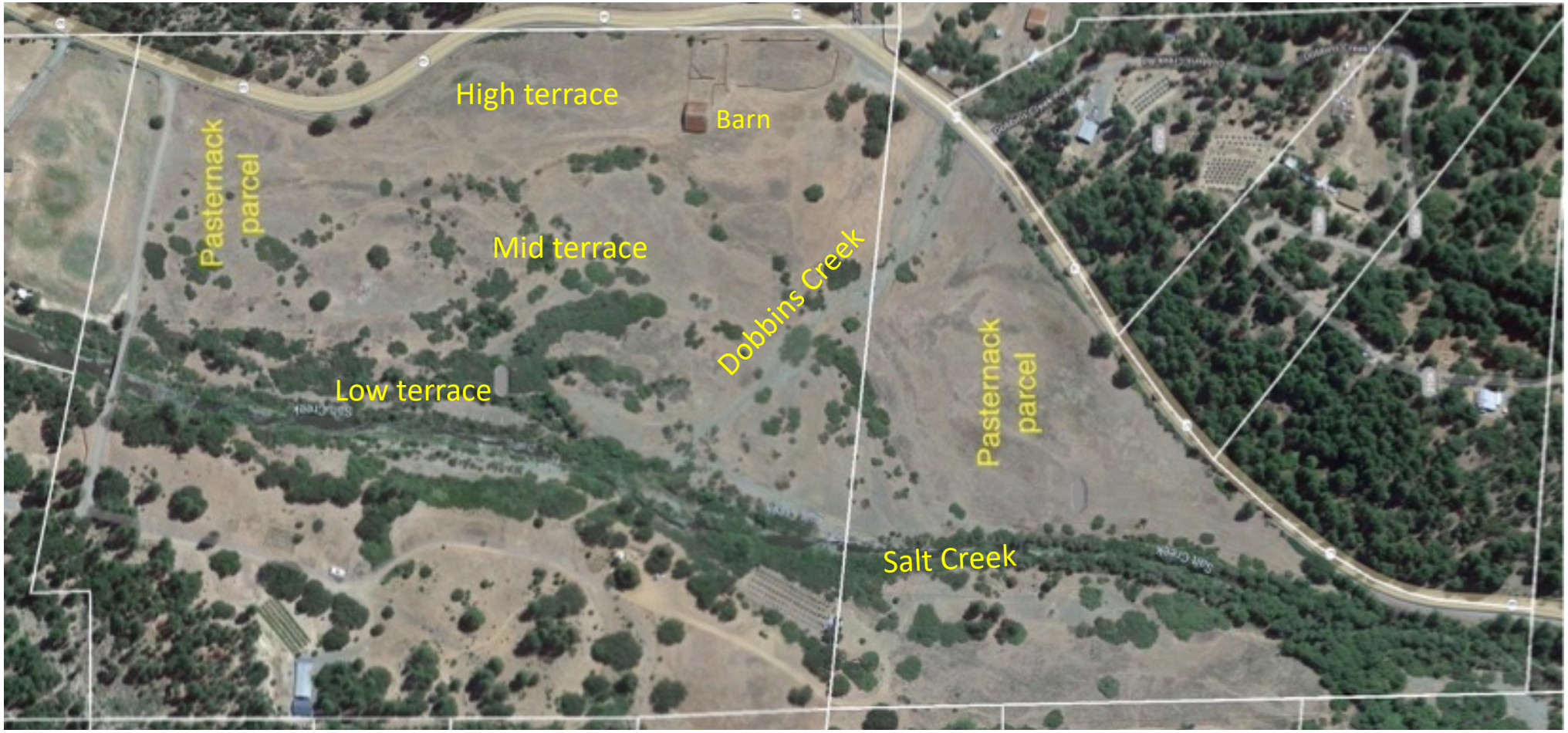
- **Survey additional, different streams**: Trinity County has a greater diversity of streams than observed in the original classification.
- **Process-Based Studies**: Do not assume stream types have idealized functionality by stream type; perform research to evaluate how Trinity County stream types function.
- **Restoration Studies**: There is already heated competition among restoration approaches, so no need to add more. Nevertheless, Pasternack Lab geomorphic and ecohydraulics tools & methods could be brought to bear to aid improved restoration success.

Salt Creek Property Opportunities



- Salt Creek is a tributary of Hayfork Creek, south of Hayfork.
- In October 2023, I purchased 60 acres of Salt Creek valley.
- Goals:
  - Scientific Research
  - Training Location/Facility
  - Valley Stewardship

Salt Creek Property Aerial Imagery



Salt Creek Drone Oblique View

Salt Creek Assessment & Stewardship

Seeking engagement from tribal, technical, community, and government entities interested in collaborating to…

- Assess the history and status of conditions and dynamics in Salt Creek catchment and Salt Creek itself.
- Create a vision for the short- & long-term future of Salt Creek emphasizing sustainability, natural functioning, and cultural values.
- Develop proposals and projects to implement the vision
- Carry out the work on a collaborative basis with paid roles for cooperating entities.