# A GIS-BASED DECISION SUPPORT TOOL FOR ESTIMATING RIPARIAN ZONES AT THE WATERSHED AND/OR PROJECT SCALE SCOTT DUSTERHOFF, JOSHUA COLLINS, TONY HALE, SARAH LOWE, MARSHALL KUNZE, and KRISTEN CAYCE San Francisco Estuary Institute, Richmond, CA, USA

# ABSTRACT

The loss of riparian areas throughout the Bay-Delta region has affected water quality and habitat conditions and presented a number of challenges for resource managers related to water targeted for development.

floodplains.

watershed management community and can be downloaded at http://www.sfei.org/projects/ripzet.

## BACKGROUND

RipZET is a modular toolset that:

- Provides an estimate of the riparian zone width based on selected function and watershed
- Supports the California Wetlands and Riparian Area Protection Policy (WRAPP), a statewide effort to define and protect riparian areas
- Uses the National Academy of Sciences definition of "riparian," which states that riparian areas have a surface/subsurface hydrologic connection and biophysical gradients between uplands and channels, and they serve variable ecosystem functions depending on distance from channel and channel location within the watershed location
- Consists of three modules: Hillslope, Vegetation, and Hydrologic Connectivity
- Allows

# **OVERVIEW**

- Functional riparian width is driven by adjacent hillslope gradient (A)
- Applied at the watershed scaled
- Appropriate for steep headwater channels

TARGETED FUNCTION

## Coarse sediment input

HILLSLOPE

MODULE

## METHODOLGY

- Requires high resolution topography, and a stream network (line features) and/or wetland areas (polygon features)
- Default threshold hillslope gradient is 20°
- Functional riparian width = 1 m for each 1° increase in gradient above 20°
- User can easily update the default hillslope gradient value

## MODULE OUTPUT

 A width of 0 is estimated where average bank slope < 20°

Functional riparian width

Riparian zones widen with increasing average bank slope

## OVERVIEW

- Functional riparian width is driven by adjacent hillslope gradient (A) and riparian vegetation height (h)
- Applied at the watershed scale
- channels to lower gradient alluvial

## TARGETED FUNCTIONS

- Bank stabilization

### METHODOLGY

VEGETATION

MODULE

- Requires high resolution topography, and a stream network (line features) and/or wetland areas (polygon features), and vegetation data (type and mature height)
- Functional riparian width =  $2h \times cos(A)$
- User can easily update the default tree height

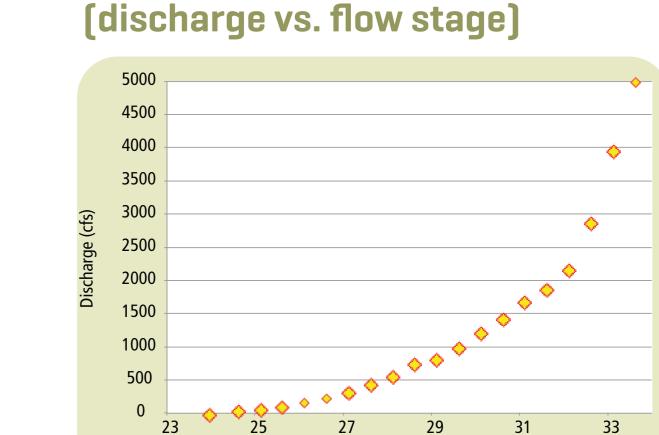
- A minimum 1m width is estimated
- Riparian zones widen with increasing tree height and decreasing hillslope gradient

## METHODOLOGY

### STEP 1

COMPILE APPROPRIATE CHANNEL PHYSICAL DATA Channel/floodplain x-sect, local channel slope, roughness values

USE PHYSICAL DATA W/ MANNING'S EQ. TO DEVELOP A LOCAL RATING CURVE



 $Q = (1.49/n)*A*(R^{2/3})*(S^{1/2})$ 

POTENTIAL NEXT STEPS

Additional module validation around

Update the HyCon module to

Develop additional modules

be used at the watershed scale

(e.g., degree of channel incision,

thermal loading, riparian habitat)

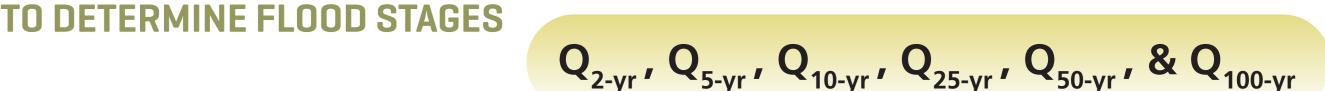
California

n = roughness (or Manning's n)

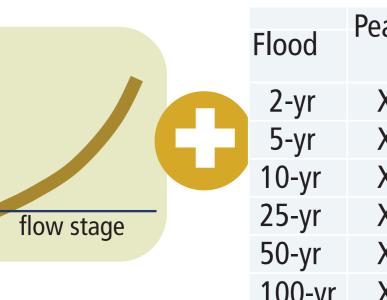
A = cross-sectional area (ft<sup>2</sup>)R = hydraulic radius (or average depth, ft)

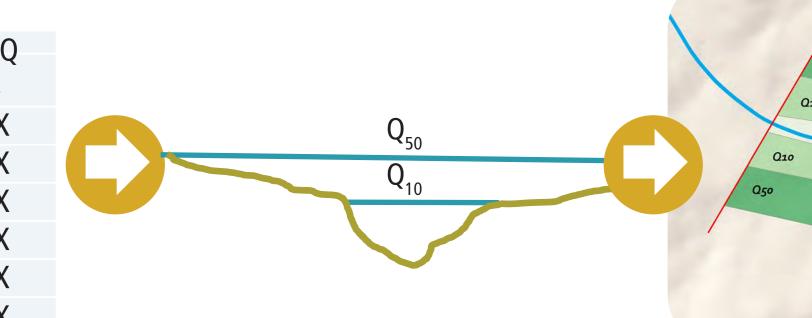
## S = local channel slope

STEP 3 USE LOCAL FLOOD FREQUENCY DATA (peak Q for flood events)



**DETERMINE FLOOD EVENT INUNDATION EXTENTS** 





management and land use planning. Current approaches for restoring and protecting riparian areas are starting to focus on appropriate riparian functions or ecological services, including stream shading, bank stabilization, organic and inorganic material input, runoff filtration, floodwater storage, and groundwater recharge. Land-use planners therefore need tools to help delineate and map the extent of "functional riparian width" as a means of ensuring appropriate riparian width in developed stream reaches targeted for restoration and relatively undisturbed stream reaches

The Riparian Zone Estimation Tool (RipZET) is a recently released GIS-based decision support tool that estimates functional riparian width based on channel type and associated riparian functions. The tool provides reach-scale functional riparian width testimates based on average height of mature riparian vegetation, the steepness of hillslopes adjacent to the channel, and the floodplain inundation extent for large storm events. The appropriate width estimate for a reach is then determined based on the riparian functions associated with different channel types, which range from steep headwater channels to low-gradient, meandering channels with broad

RipZET has been tested to date in the San Francisco Bay Area, as well as in the Tahoe Basin and Central Coast, and has been reviewed by regional science and management experts. This presentation will provide an example of applying the tool in the Bay Area to estimate functional riparian widths using readily available topographic, vegetation, and hydraulic data. The tool is now ready for use by the



Appropriate for steep headwater

- Shading
- Large woody debris (LWD) loading

## **MODULE OUTPUT**

for areas with little or no vegetation

## TARGETED FUNCTIONS Floodwater storage

HYDROLOGIC

CONNECTIVITY

Functional riparian width

is driven by the flooding

extents for the 10- and

Appropriate for lower

Developed using data

Applied at the reach scale

gradient alluvial channels

from North Bay watersheds

(Marin, Napa, and Sonoma

50-year floods

OVERVIEW

- Groundwater recharge

