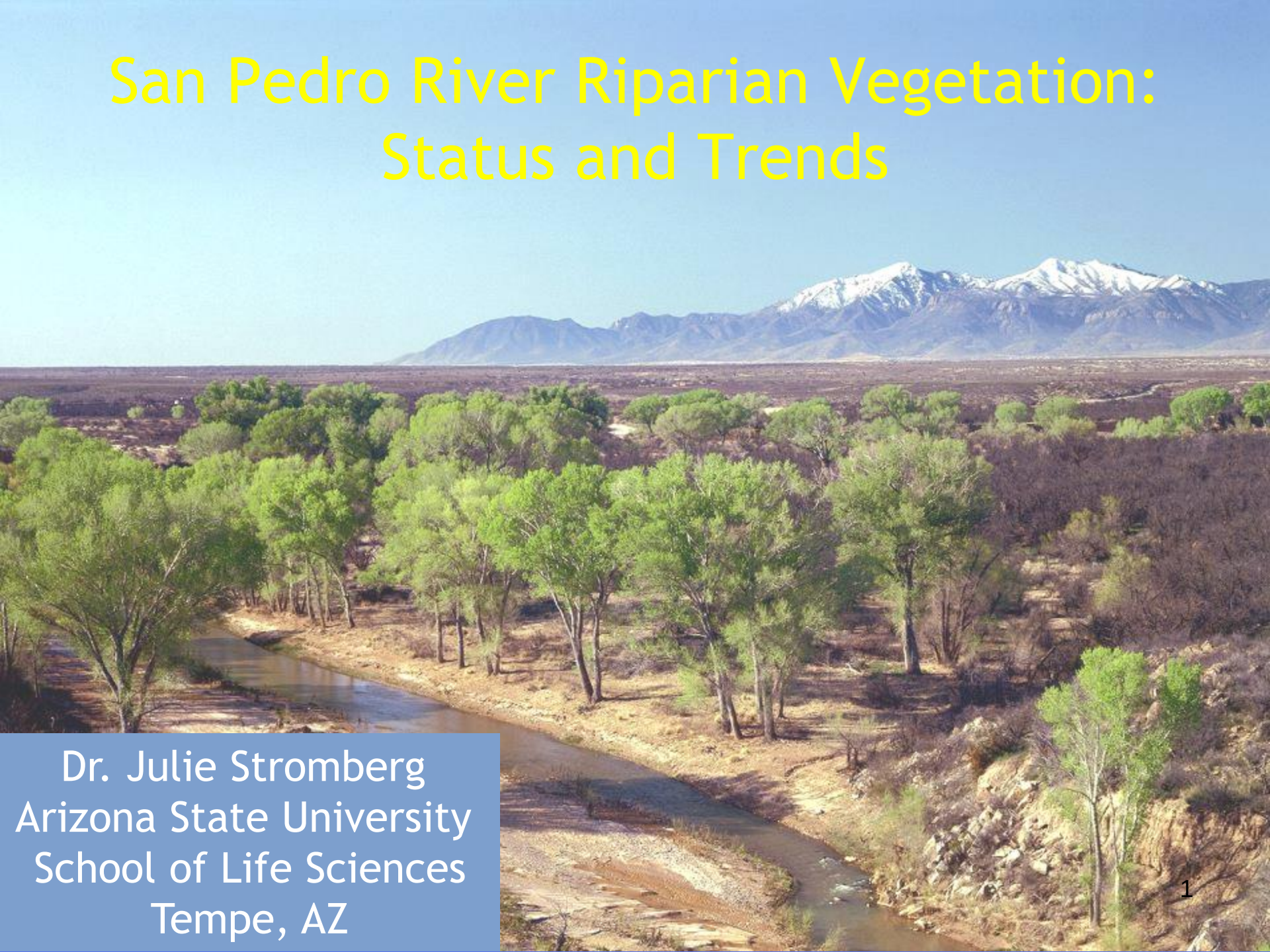
San Pedro River Riparian Vegetation: Status and Trends

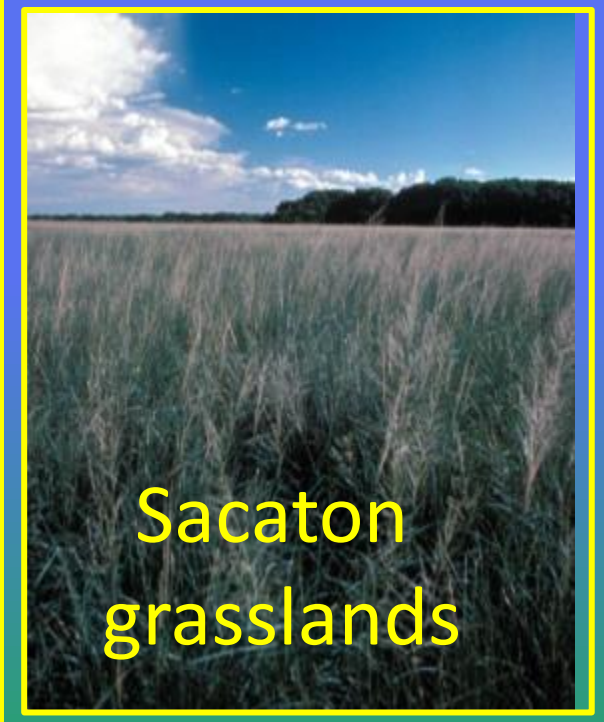


Dr. Julie Stromberg
Arizona State University
School of Life Sciences
Tempe, AZ

San Pedro River: Mike Collier

Cienegas and other marshlands

Tamarisk shrublands


Sacaton grasslands

Cottonwood-willow forests

Mesquite bosques

Floods

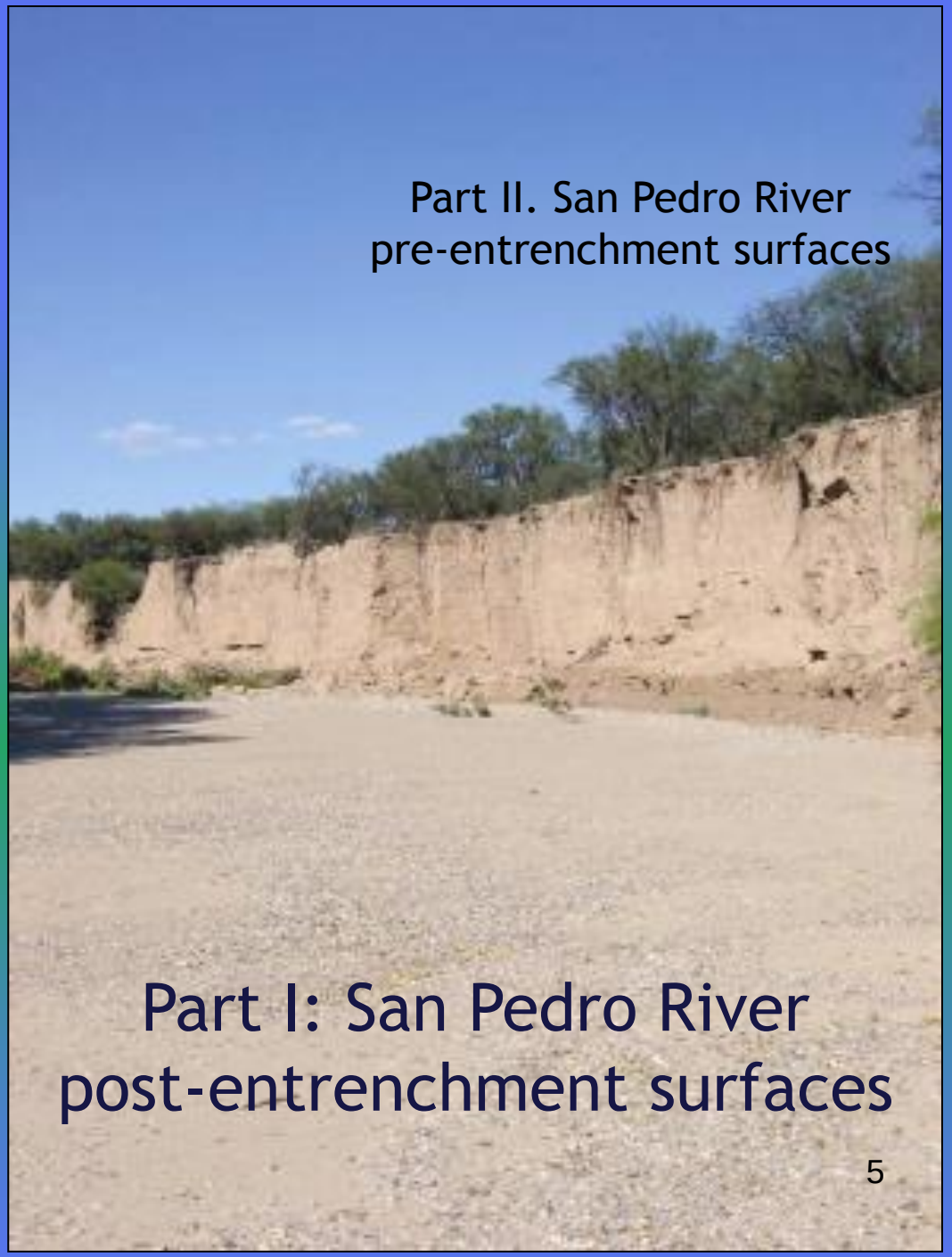
Fire

Drought

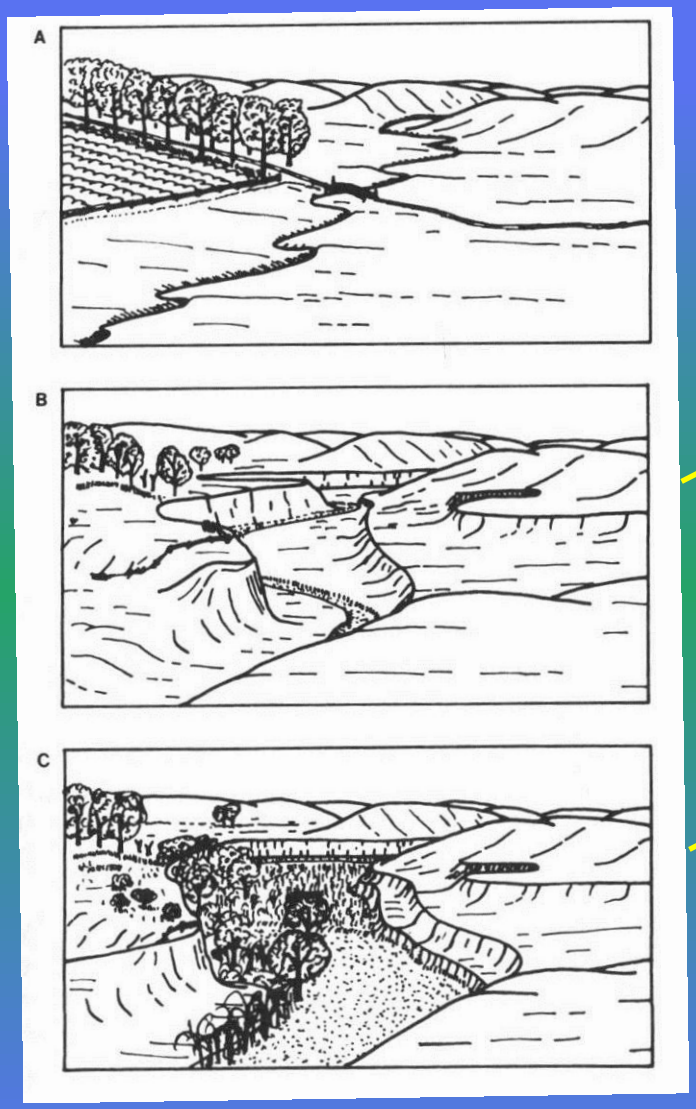
Beaver

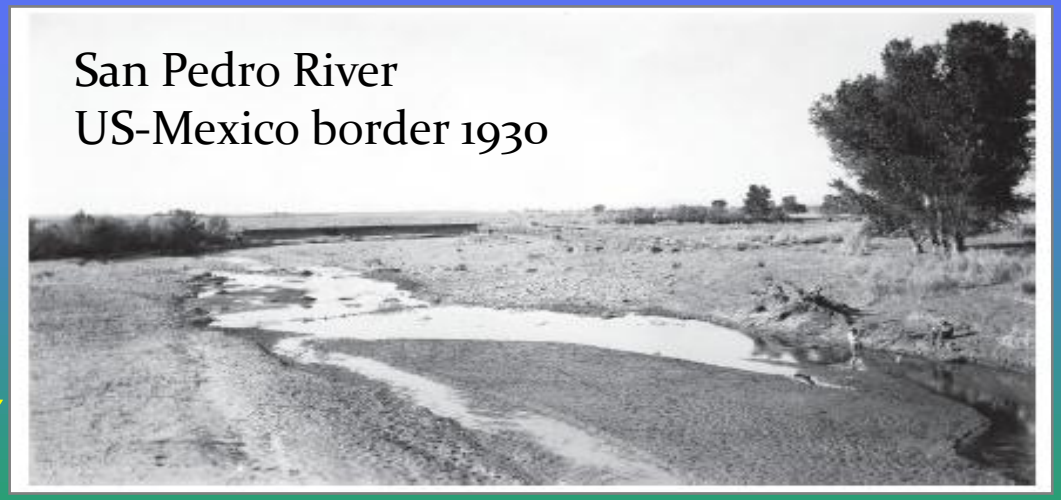
River entrenchment

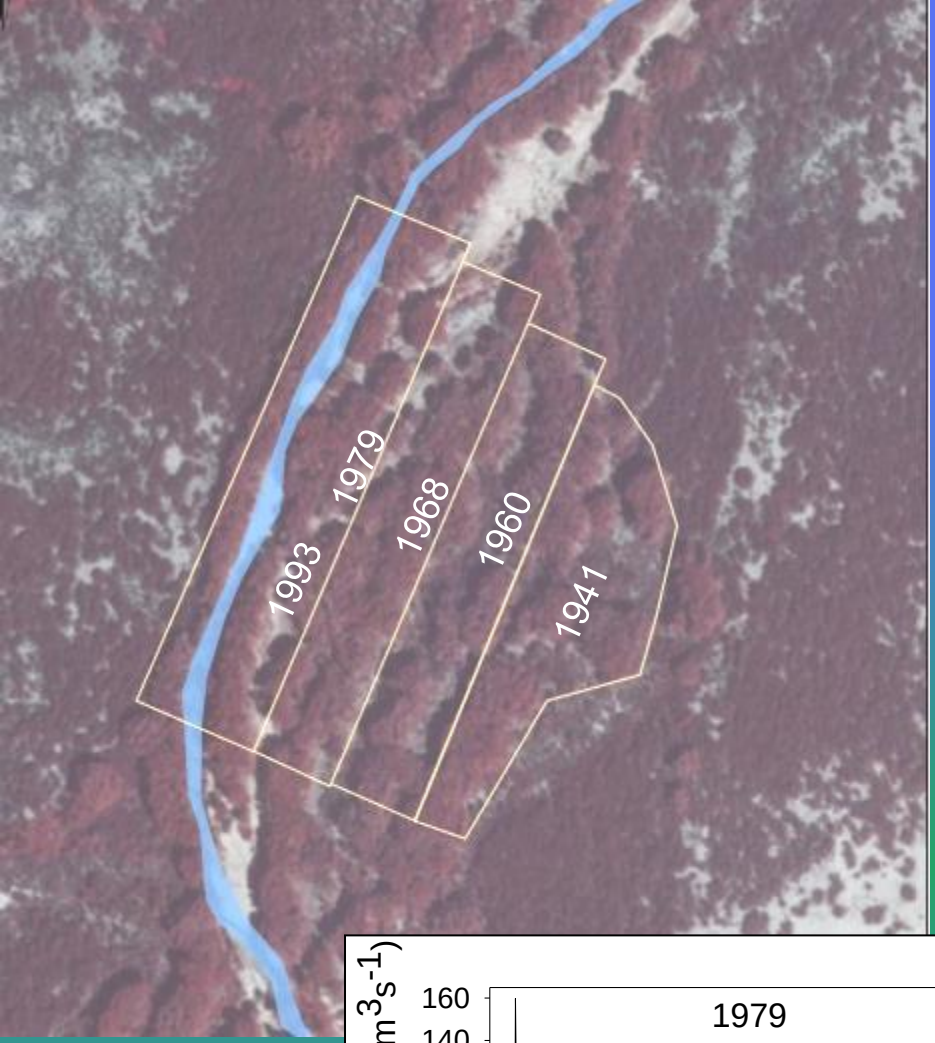
"It was probably during the 1896 flood that a channel almost 244 m wide and 6 m deep developed…" (Hereford and Betancourt 2009).

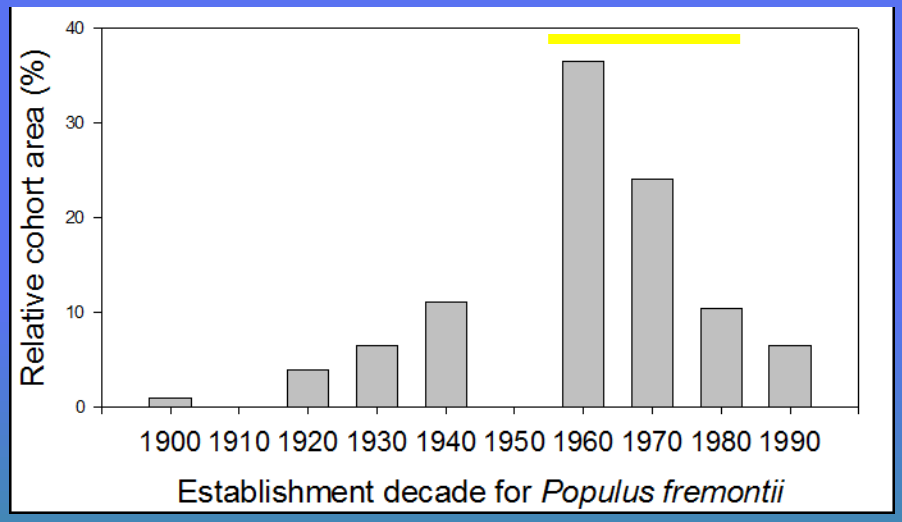


Extreme disturbance reset the San Pedro, triggering a century of forest expansion

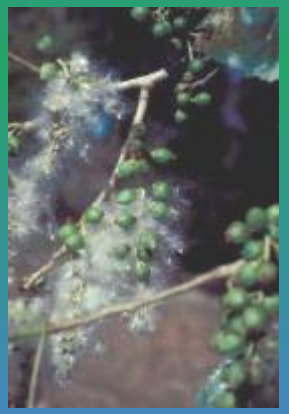


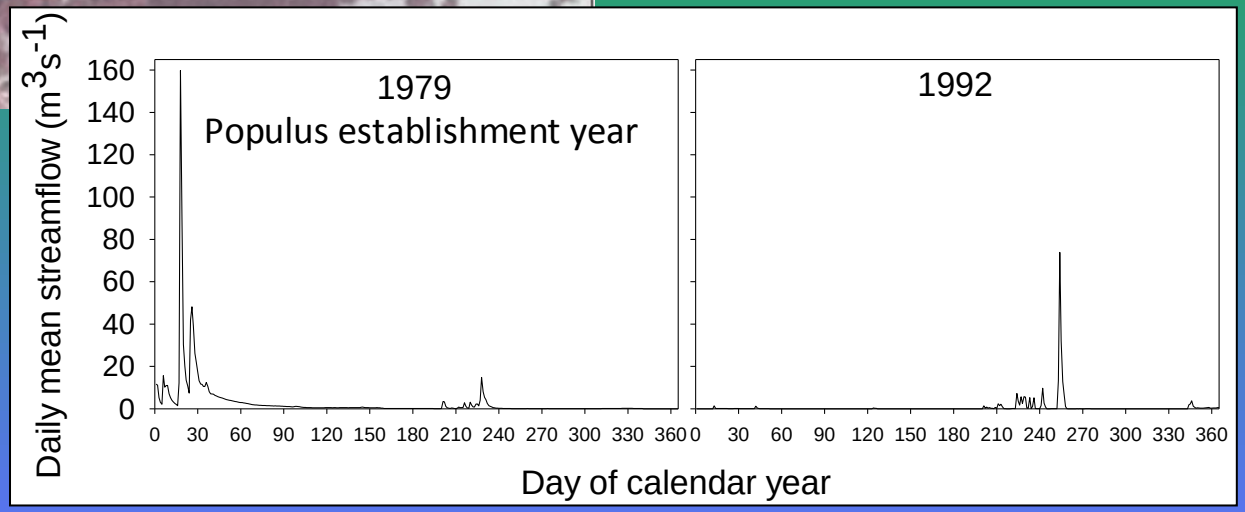


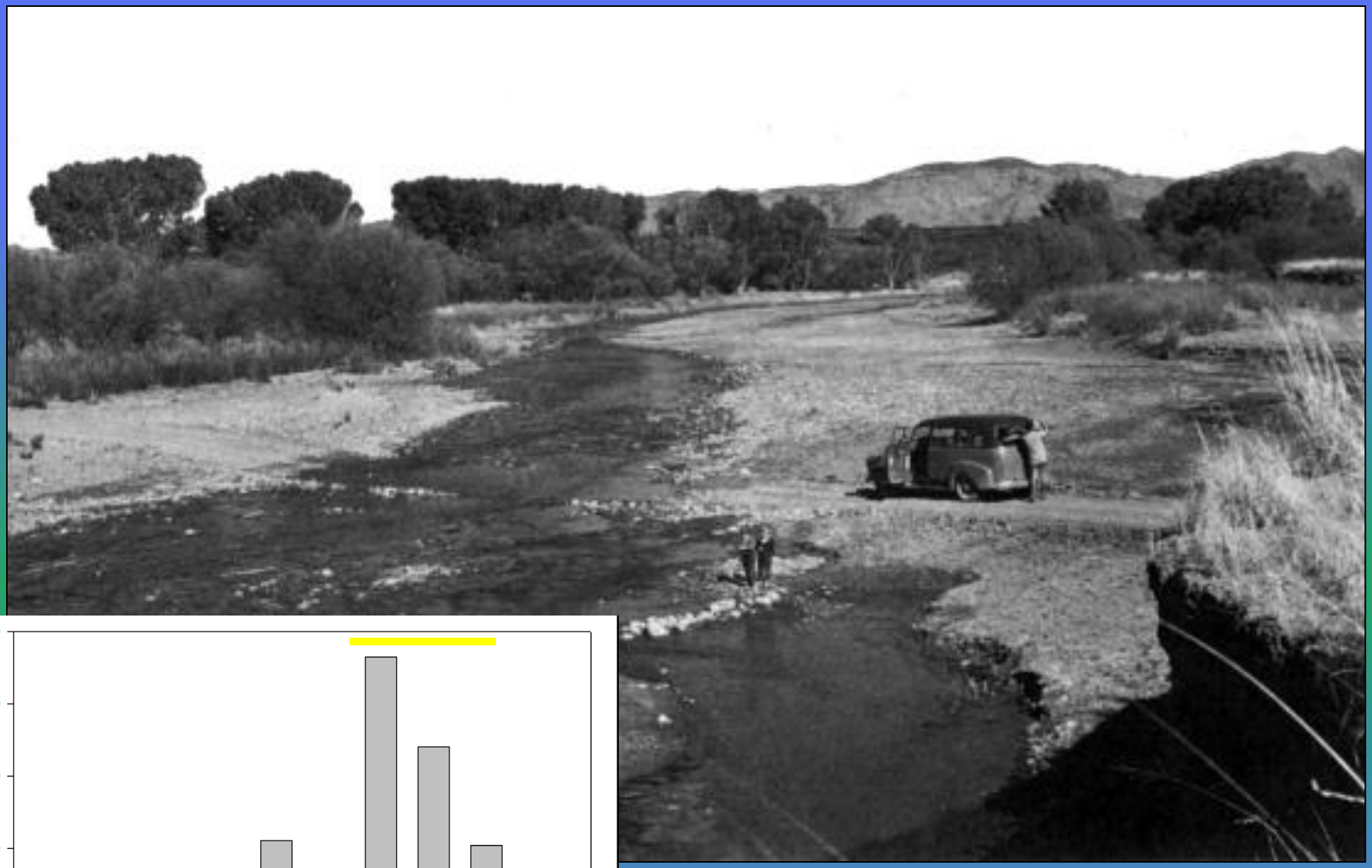


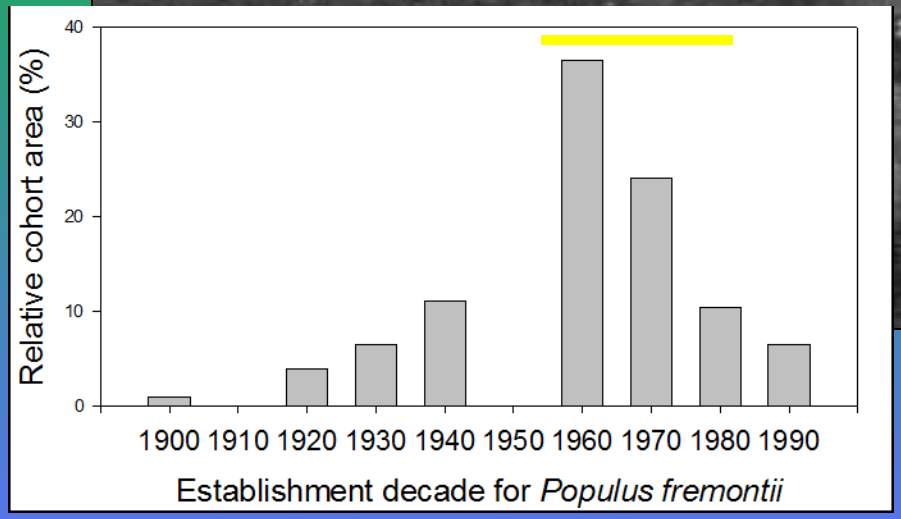


Episodic forest infill during years with winter floods



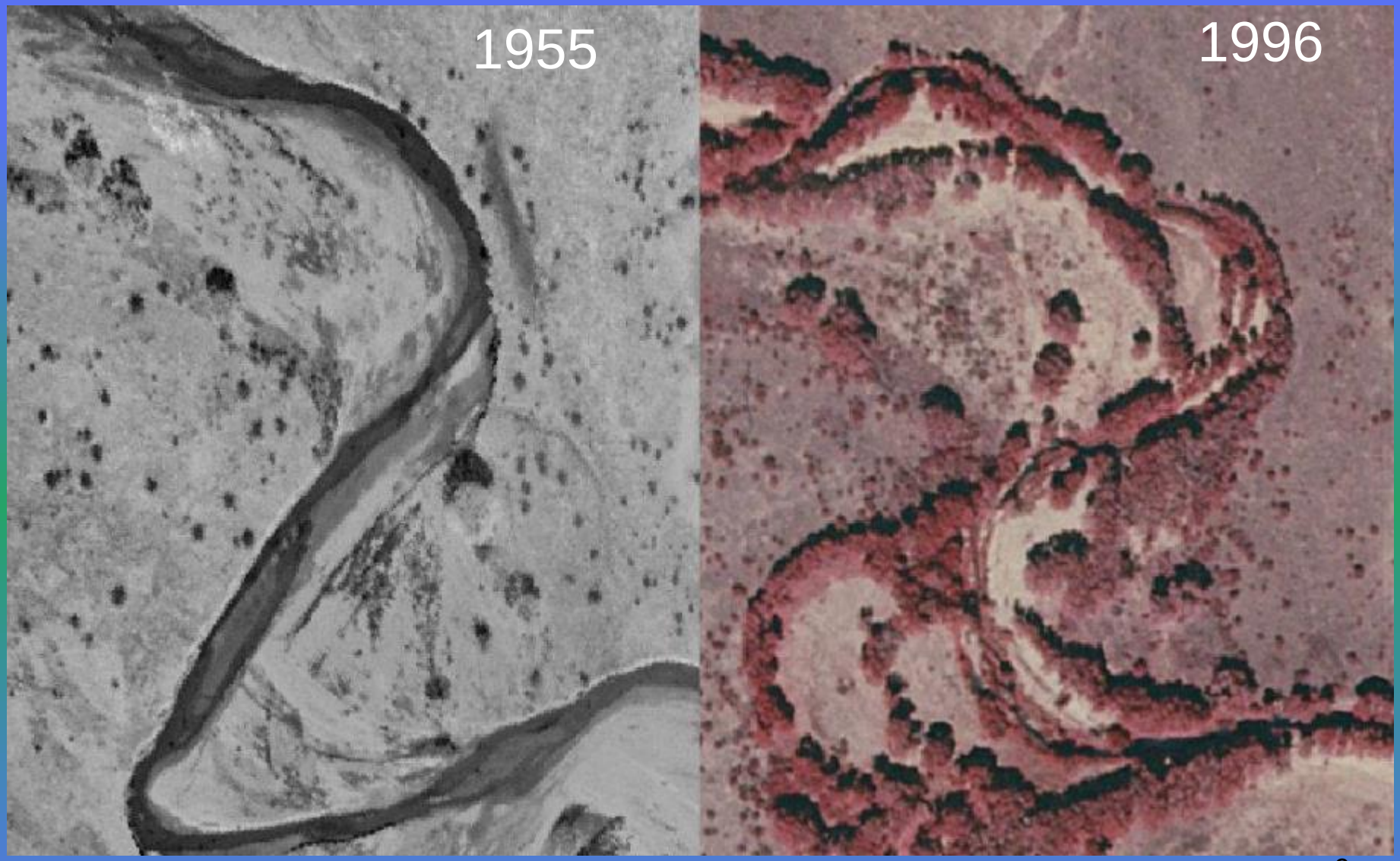






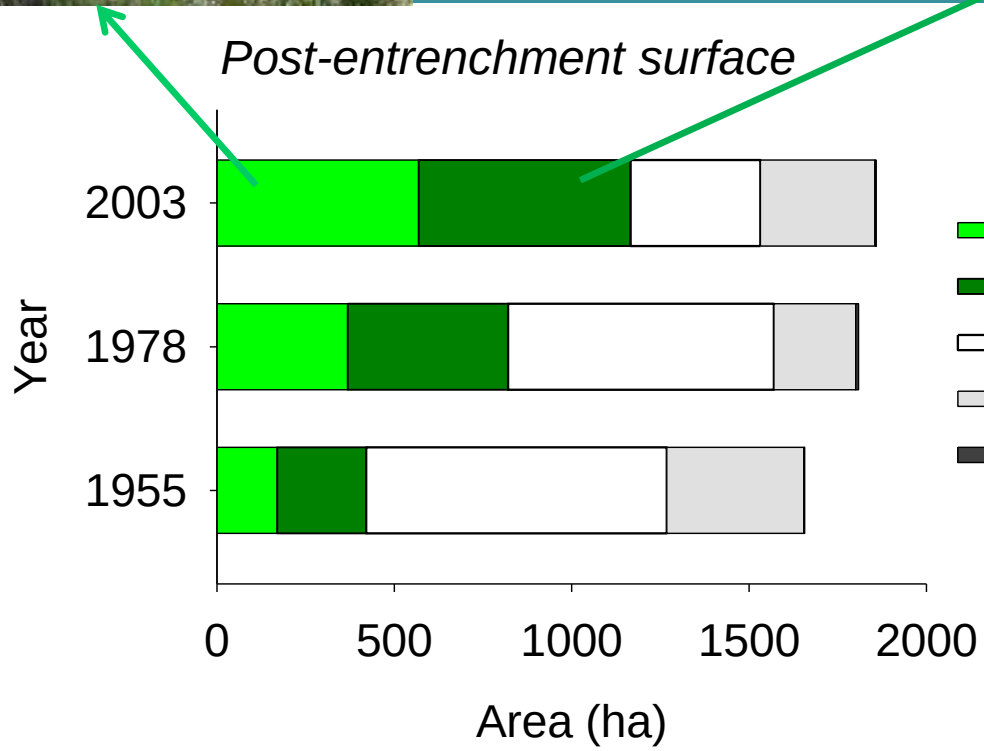
The San Pedro River near Charleston, April 1950.

3x Increase in Riparian Forest since 1950s

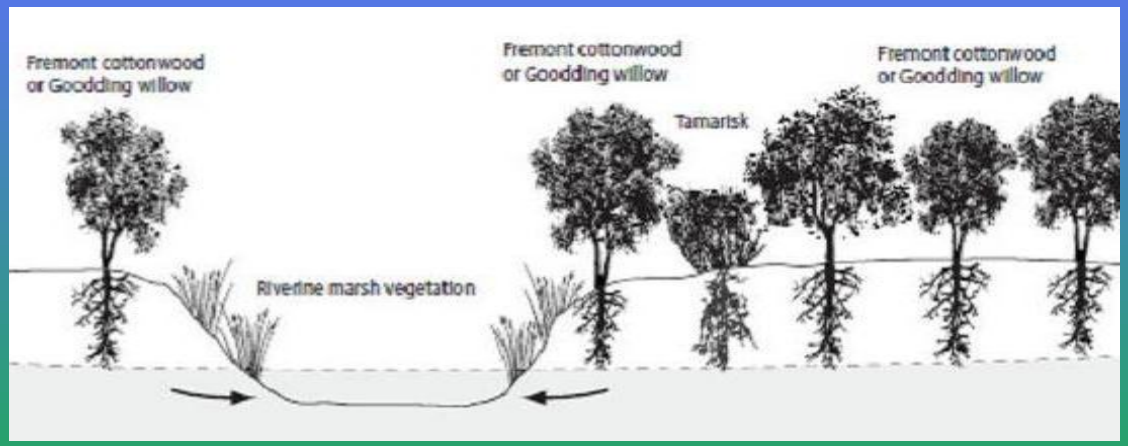


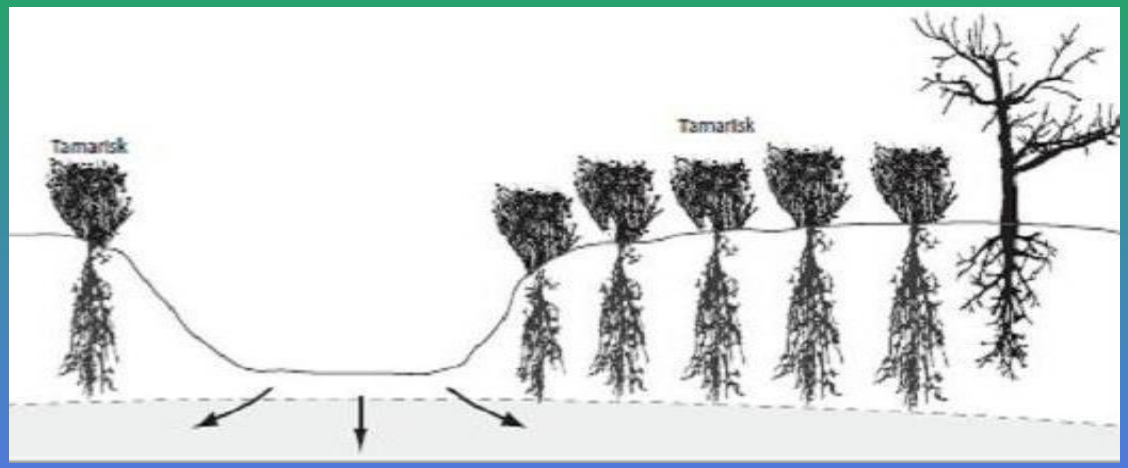
Cottonwood-willow

Tamarix



Threshold: Cottonwood-willow forests decline where water tables are >10 feet





Thresholds of change simplification of community structure as stream water is depleted

Riverine marshland	Obligate phreatophytes (Populus/Salix)	Facultative phreatophytes (Tamarix)	Xeroriparian shrubs
T1	Obligate phreatophytes (Populus/Salix)	Facultative phreatophytes (Tamarix)	Non-phreatophytes
		Facultative phreatophytes (Tamarix)	Non-phreatophytes
			Non-phreatophytes

Loss of perennial flow

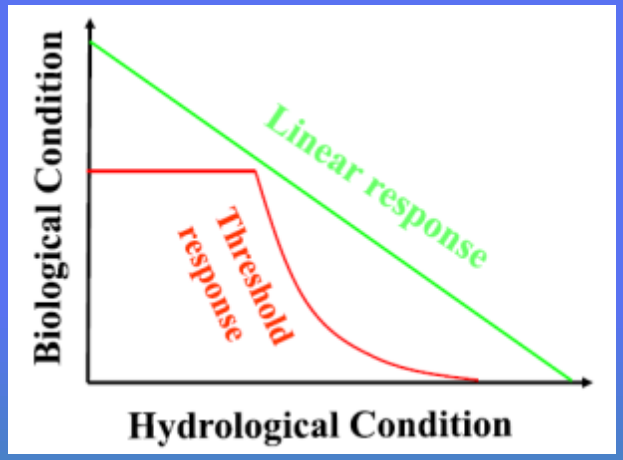
T2

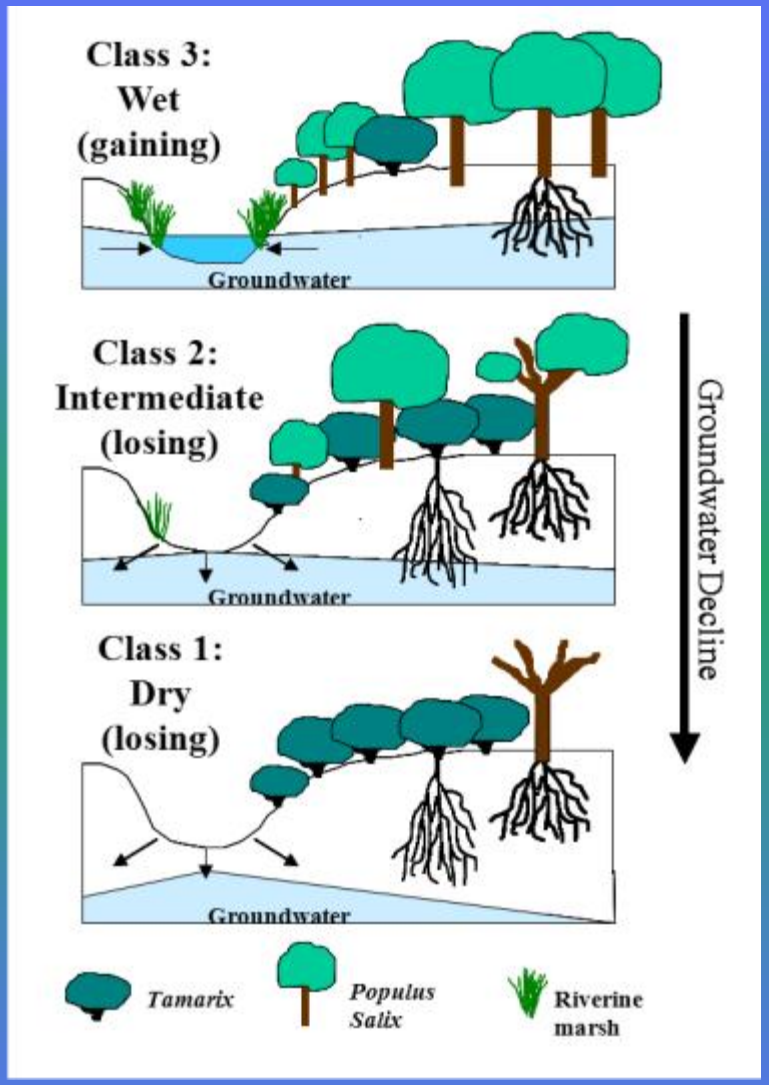
Water table <3 m + fluctuation >1m

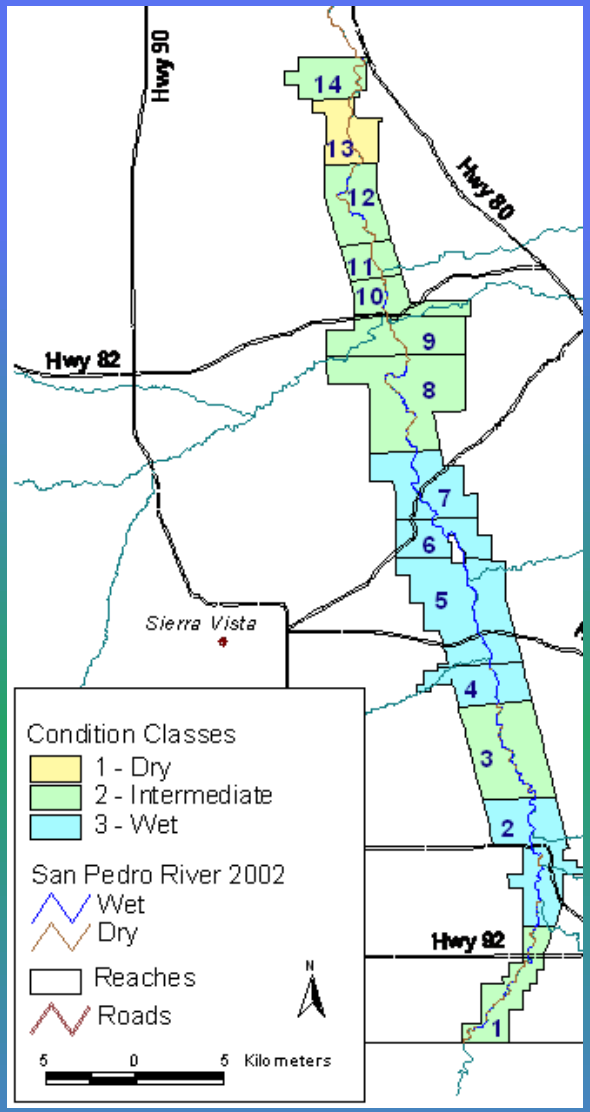
T3

Water table >7 m

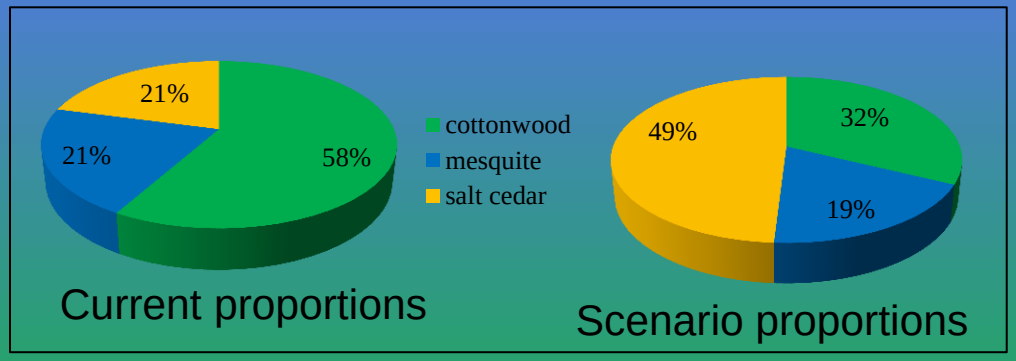
Threshold #1: Wetland herbaceous perennials decline sharply as stream flow becomes non-perennial

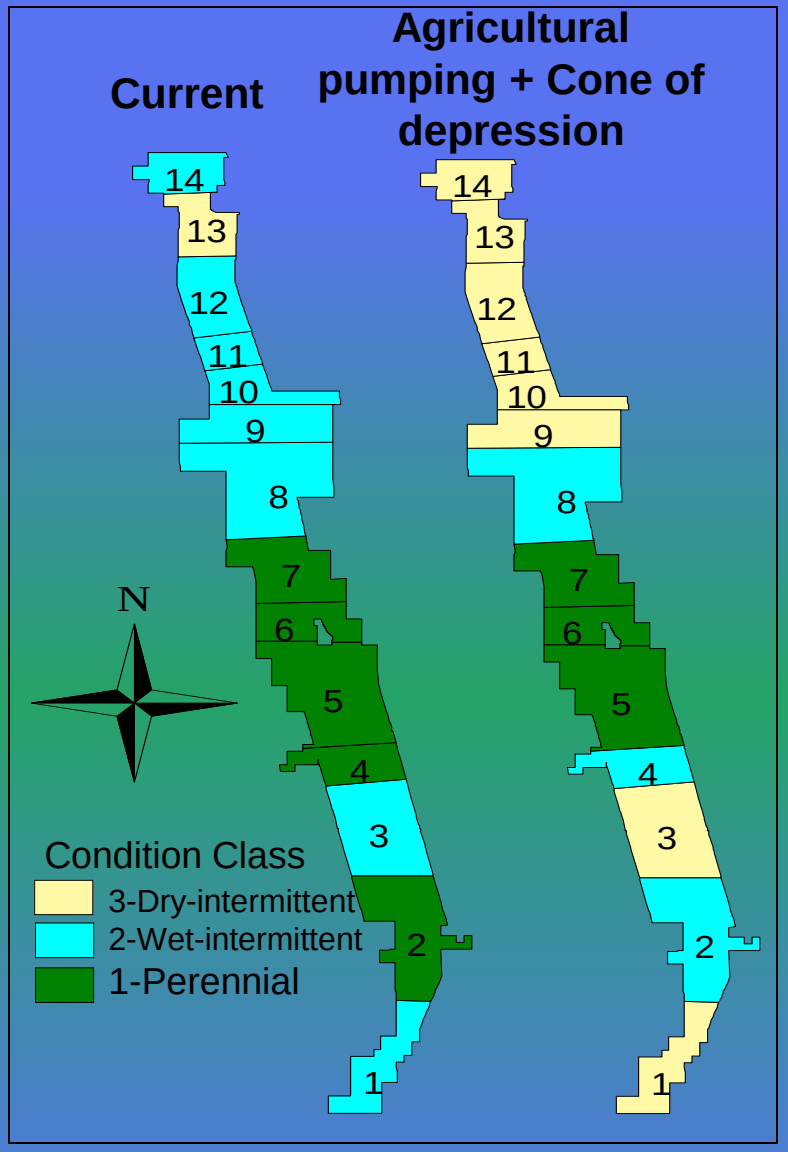



Class 3:
Wet
(gaining)
Groundwater
Class 2:
Intermediate
(losing)
Groundwater
Class 1:
Dry
(losing)
Groundwater
Groundwater Decline
Tamarix
Populus
Salix
Riverine
marsh


Hwy 90
Hwy 80
Hwy 82
Hwy 92
Sierra Vista
14
13
12
11
10
9
8
7
6
5
4
3
2
1
Condition Classes
1 - Dry
2 - Intermediate
3 - Wet
San Pedro River 2002
Wet
Dry
Reaches
Roads
N
5 0 5 Kilometers

Scenario modeling: Groundwater decline

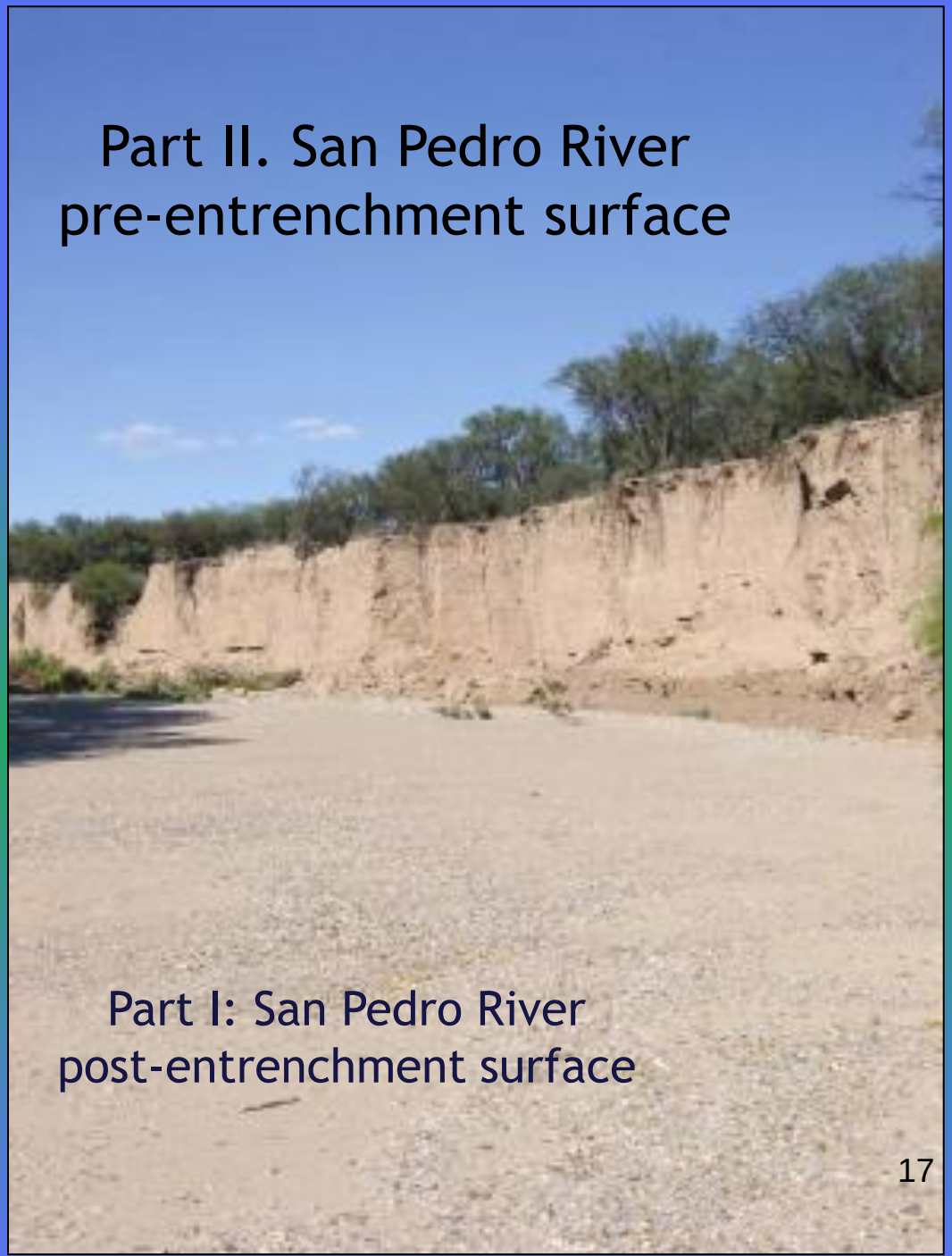




In cottonwood/willow forest, fire caused

- canopy decline
- increased grass cover
- shift towards older cottonwoods
- shift towards younger willows

Questions?


Part II. San Pedro River
pre-entrenchment surface
Part I: San Pedro River
post-entrenchment surface

Velvet mesquite woodlands

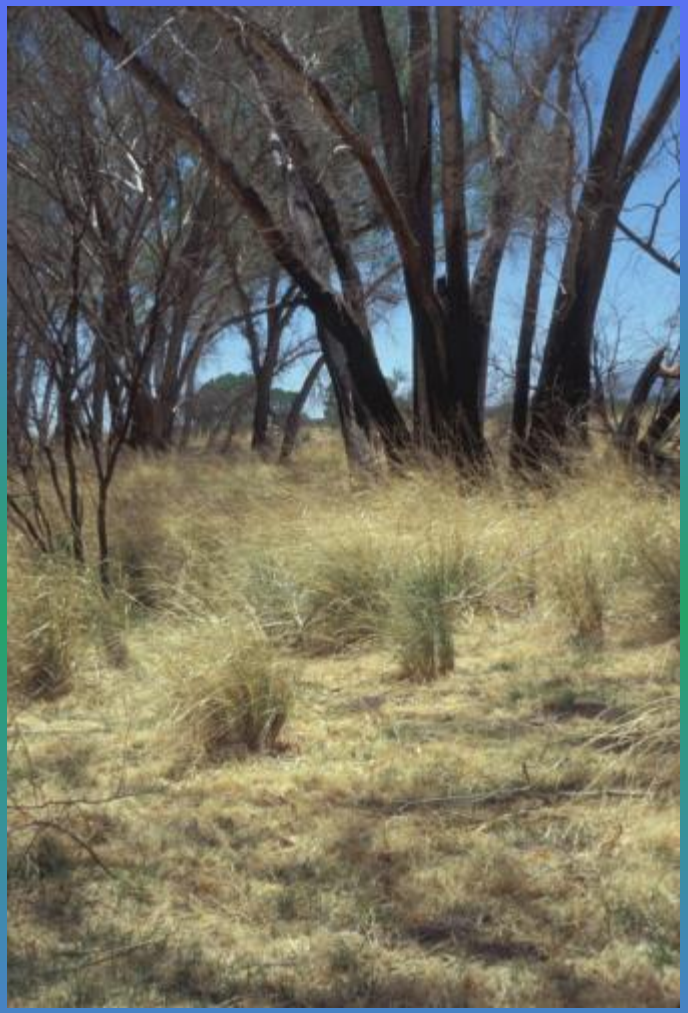
(*Prosopis velutina*)

Roots to 15 m or more

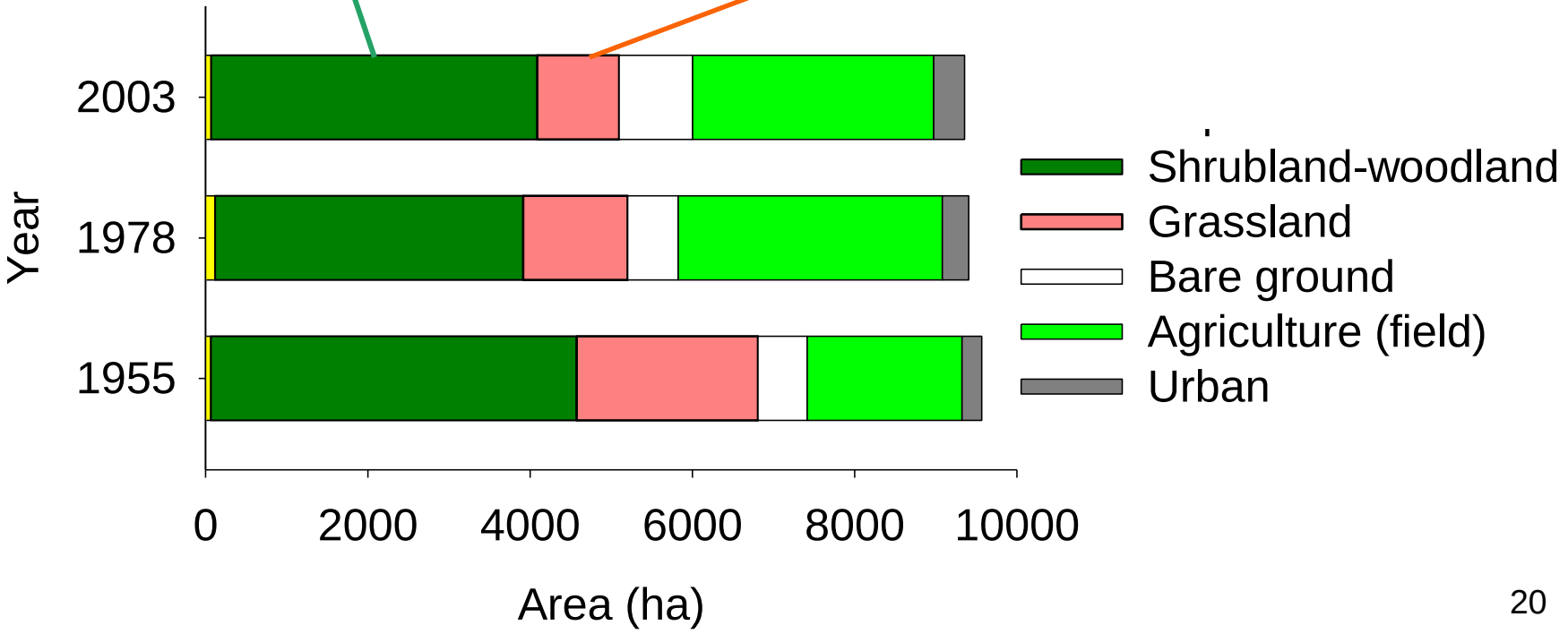
Sacaton grasslands

(Sporobolus wrightii)

Roots to about 4 meters



Vegetation change on terraces

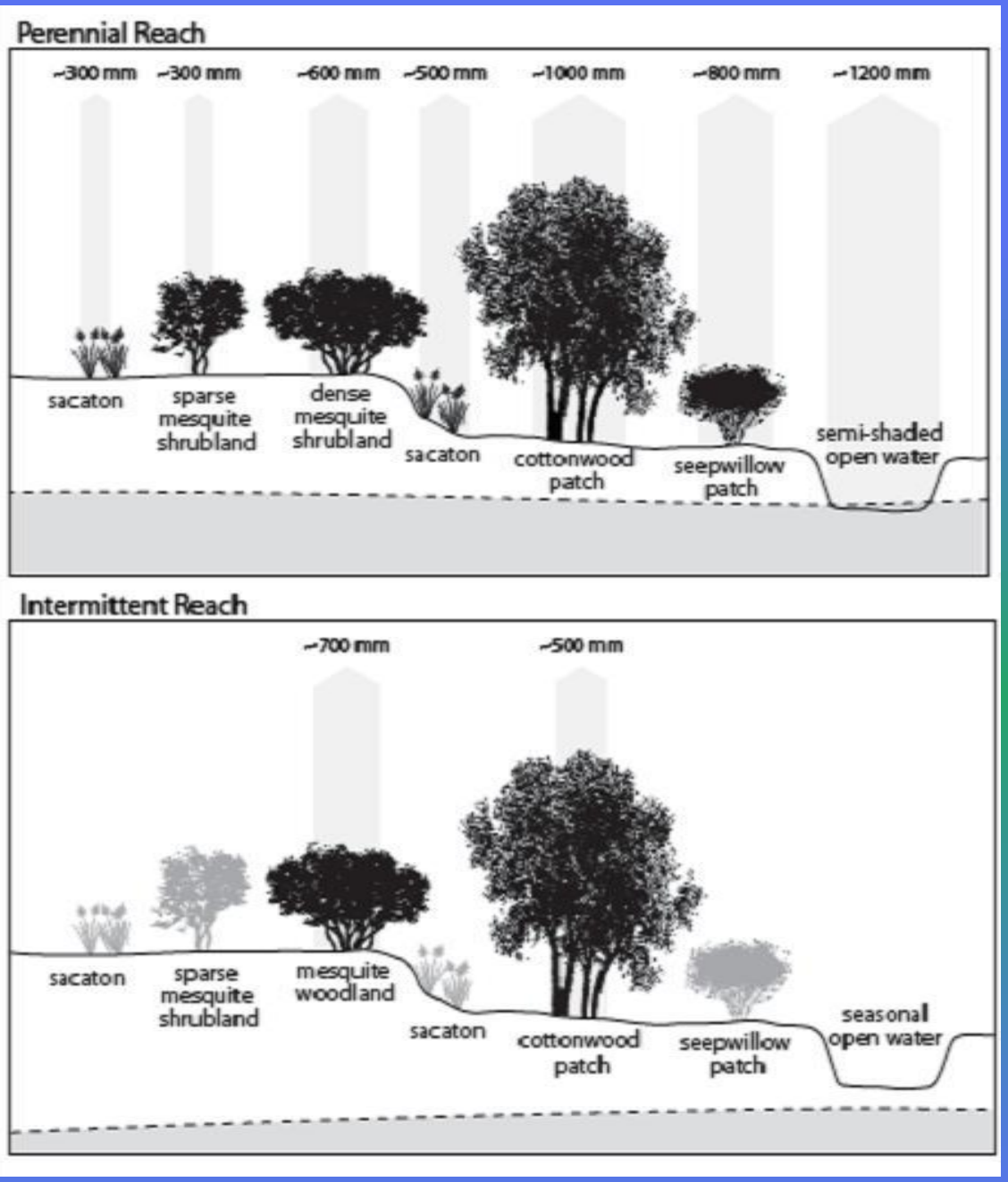


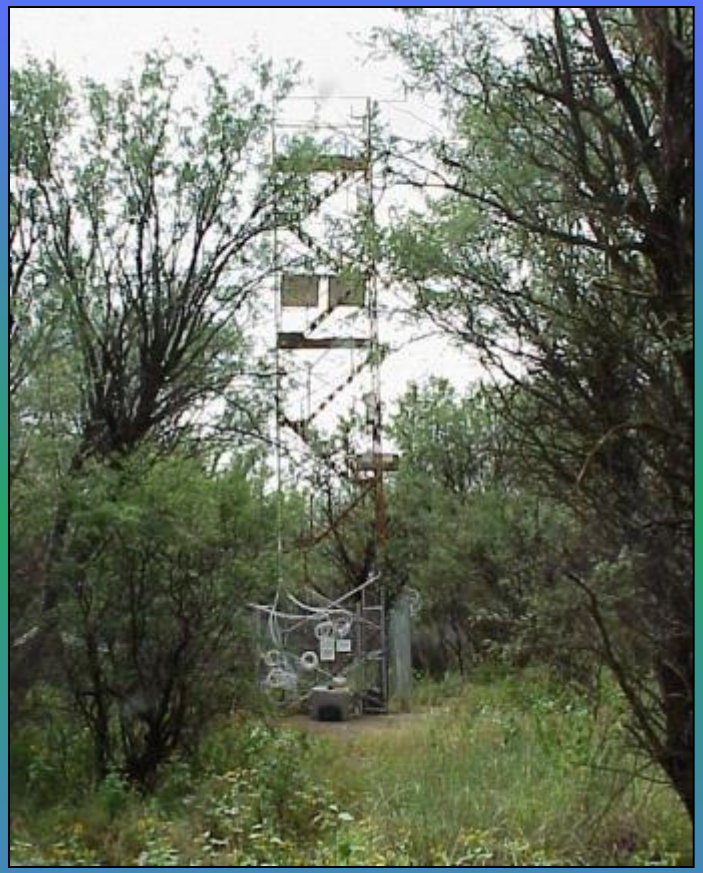
Some grasslands converted to mesquite woodlands after river entrenchment

During the early and mid-1900s, many grasslands and forests were converted to agricultural fields.

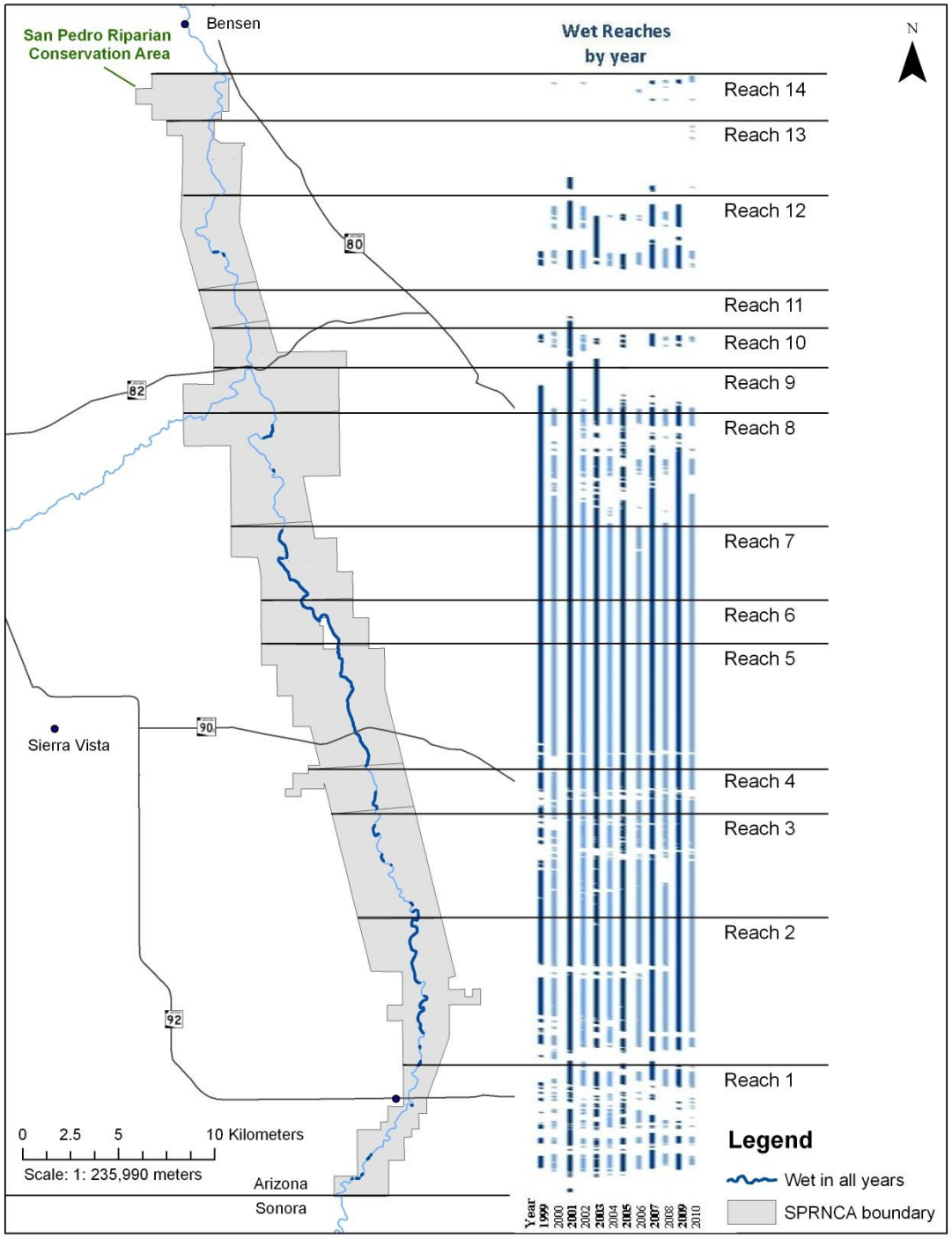
After fire:

- Sacaton resprouts (unless plants are too dry)
- Mesquite resprouts, becomes “shrubbier”


Perennial Reach
~300 mm
~300 mm
~600 mm
~500 mm
~1000 mm
~800 mm
~1200 mm
sacaton
sparse mesquite shrubland
dense mesquite shrubland
sacaton
cottonwood patch
seepwillow patch
semi-shaded open water
Intermittent Reach
~700 mm
~500 mm
sacaton
sparse mesquite shrubland
mesquite woodland
sacaton
cottonwood patch
seepwillow patch
seasonal open water



Monitoring


San Pedro Riparian Conservation Area
Bensen
Wet Reaches by year
N
Reach 14
Reach 13
Reach 12
Reach 11
Reach 10
Reach 9
Reach 8
Reach 7
Reach 6
Reach 5
Reach 4
Reach 3
Reach 2
Reach 1
80
82
90
92
Sierra Vista
0 2.5 5 10 Kilometers
Scale: 1: 235,990 meters
Arizona
Sonora
Year
1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Legend
Wet in all years
SPRNCA boundary

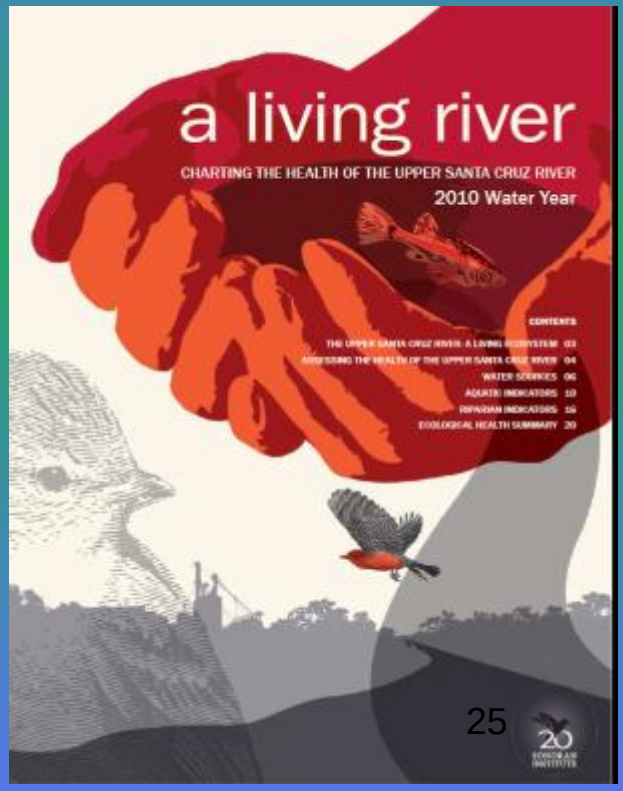
Monitoring indicators: Santa Cruz River, Pima Co.

Draft, Reviving River Technical Committee

Riparian vegetation indicators

1. Wetland indicator score (ranges from 1=obligate wetland to 5=obligate upland), based on sampling of plant cover at fixed stations along the low-flow channel during June

2. Canopy cover of hydroriparian trees (cottonwood, willow)



Contact: Claire Zugmeyer, Sonoran Institute
http://www.sonoraninstitute.org/where-we-work/southwest/santa-cruz-river.html

Vegetation Monitoring in SPRNCA

Multiple riparian transects: Suggested path forward

1. Channel-side abundance of herbaceous wetland plants. Annually, measure of cover of wetland herbaceous plants along low-flow channel during June, and calculate wetland indicator score.

2. Riparian forest cover. Bi-annually, measure total canopy cover on floodplain and terrace. Determine the percentage that is tall, hydroriparian trees (cottonwood, willow). The ratio of cottonwood/willow to saltcedar is a strong indicator. Field sampling or remote sensing (e.g., LiDAR).

Relevant Literature

Brand et al. 2001. Projecting avian response to linked changes in groundwater and riparian floodplain vegetation along a dryland river: a scenario analysis. Ecohydrology 4:130-142.

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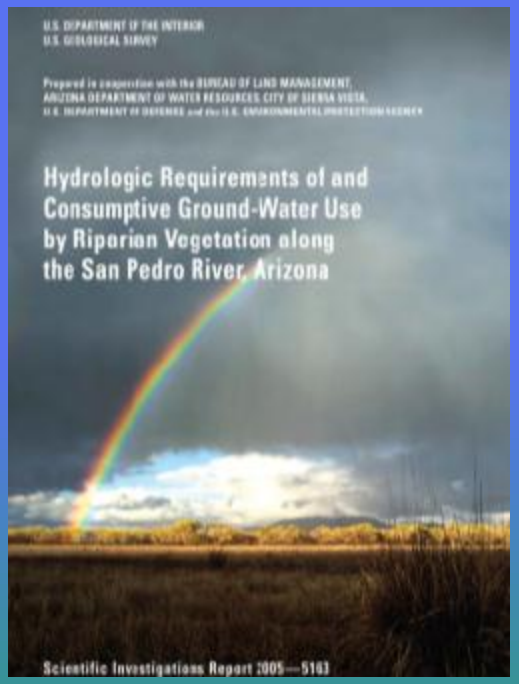

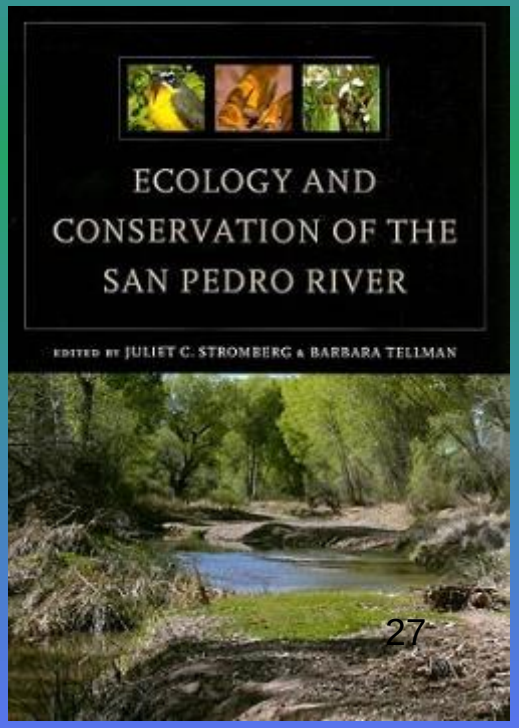

Acknowledgments

Photo sources: *Mike Collier, Gabrielle Katz, Liz Makings, Tyler Rychener, Russ Scott, Ron Tiller, USGS*

Any
Questions?