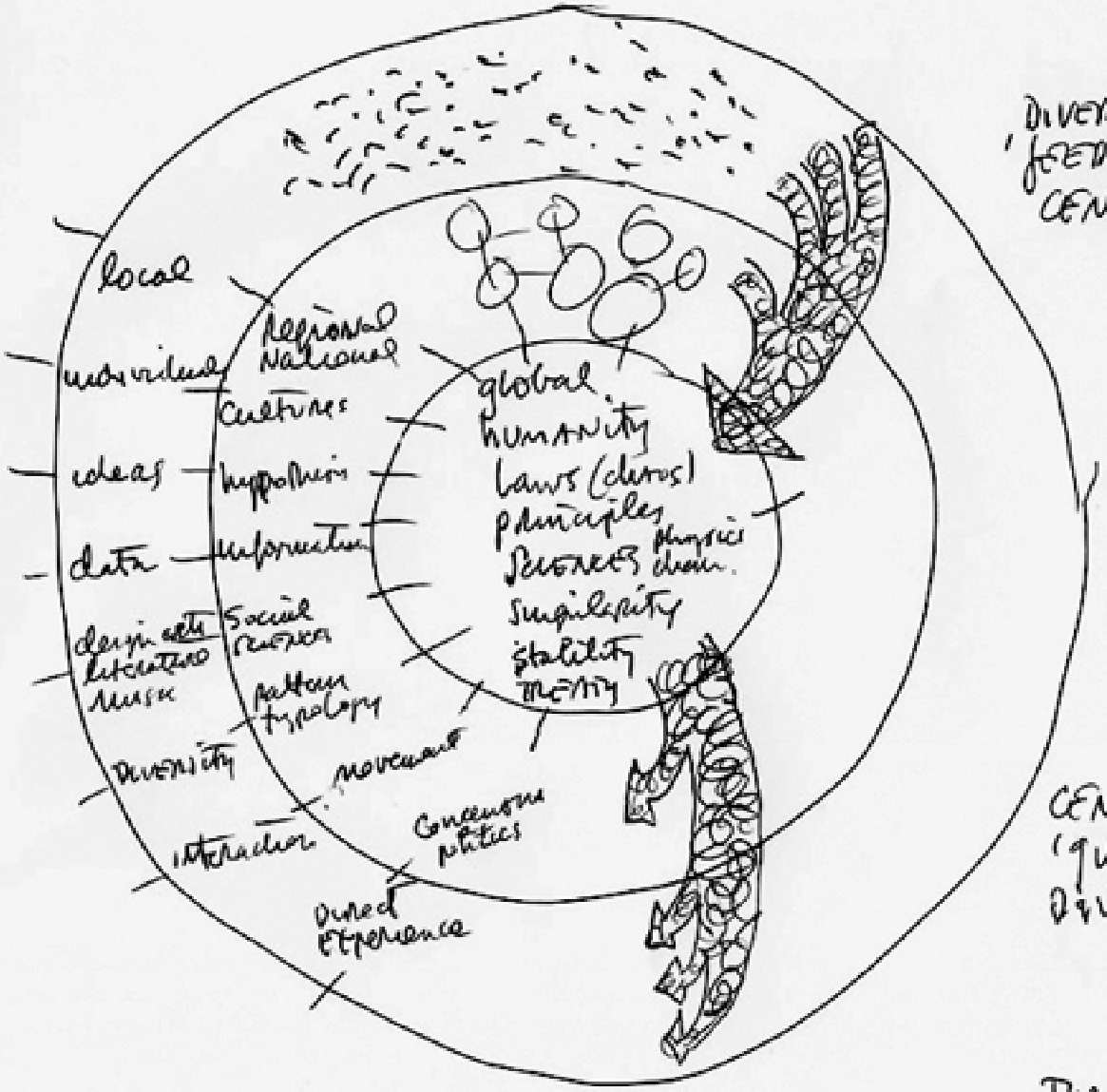
“Many devices which work on a small scale do not work on a large scale.”

Galileo

C. Shiver 2002 ©



DIVERSITY
'FEEDS'
CENTRALITY

CENTRALITY
'GUIDES'
DIVERSITY

The NARROWER
the circles and bands
the WORSE in
the long term,
and the more
authoritarian
it seems

The wider
the circles, and bands
the better, but
the more
chaotic it
seems

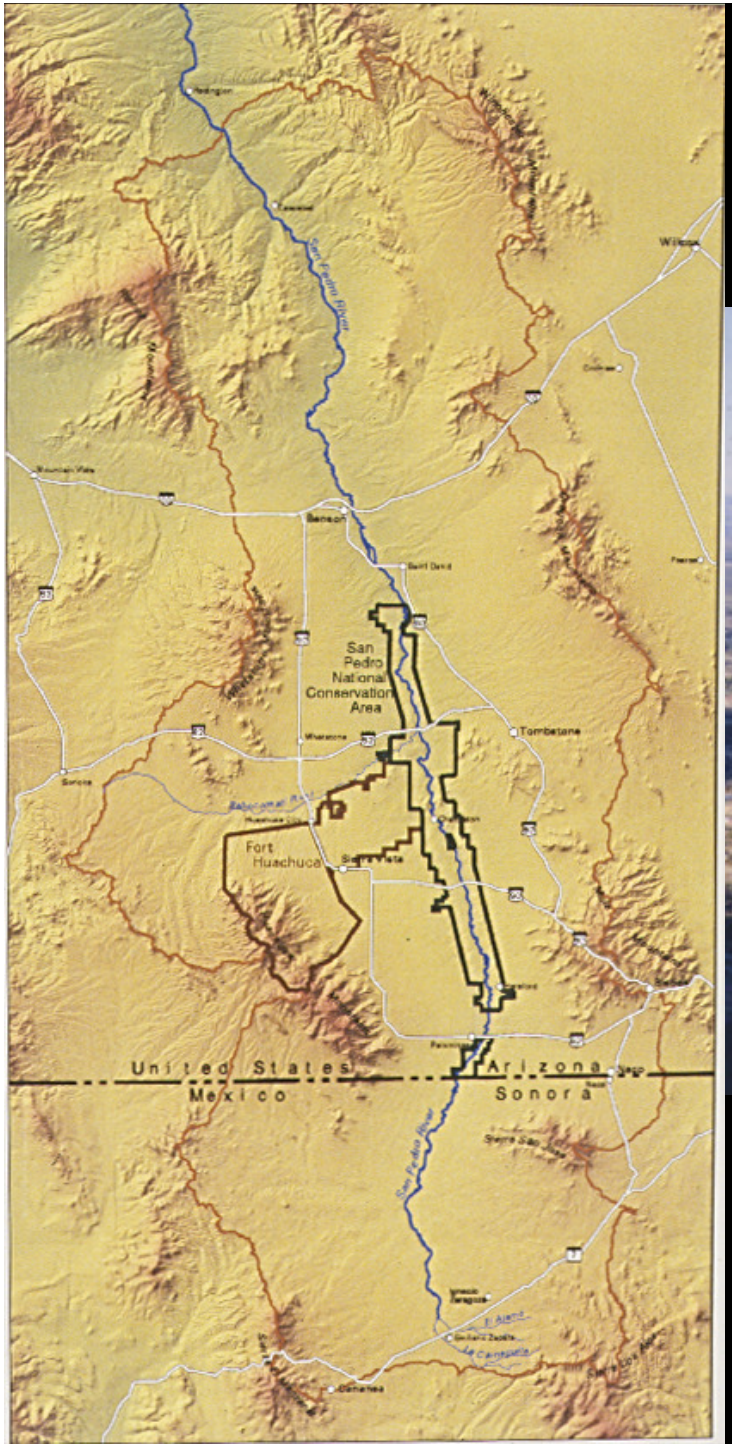
The balancing concept is "risk"
and this is the tension in
decision making and education.

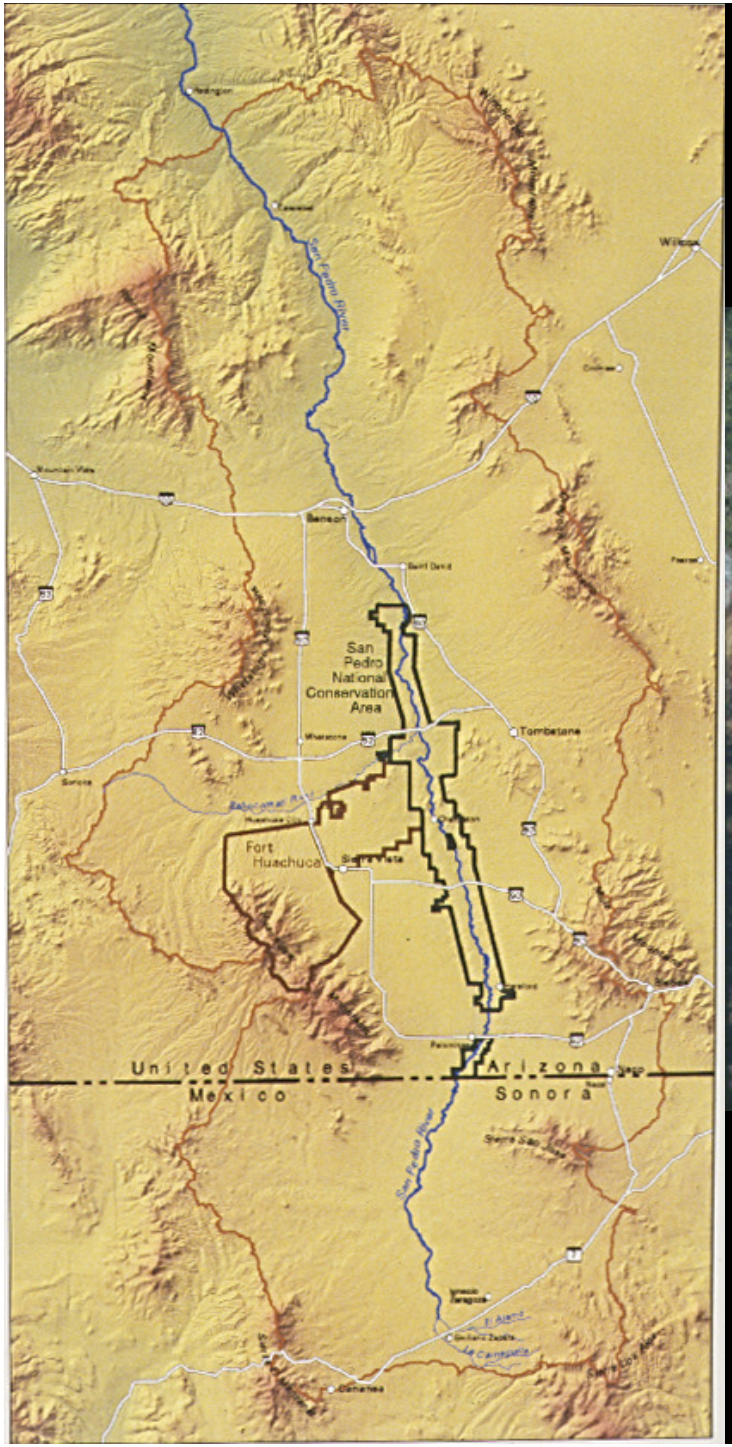

United States
Study Area
Upper San Pedro River
Mexico

Alternative Futures for Changing Landscapes

THE UPPER SAN PEDRO RIVER BASIN IN ARIZONA AND SONORA

Carl Steinitz
Hector Arias
Scott Bassett
Michael Flaxman
Tomas Goode
Thomas Maddock III
David Mouat
Richard Peiser
Allan Shearer


San Pedro National Conservation Area
Fort Huachuca
Tombstone
United States
Mexico
Arizona
Sonora


San Pedro National Conservation Area
Fort Huachuca
Tombstone
United States
Mexico
Arizona
Sonora

Scenarios The Upper San Pedro River Basin

PLANS

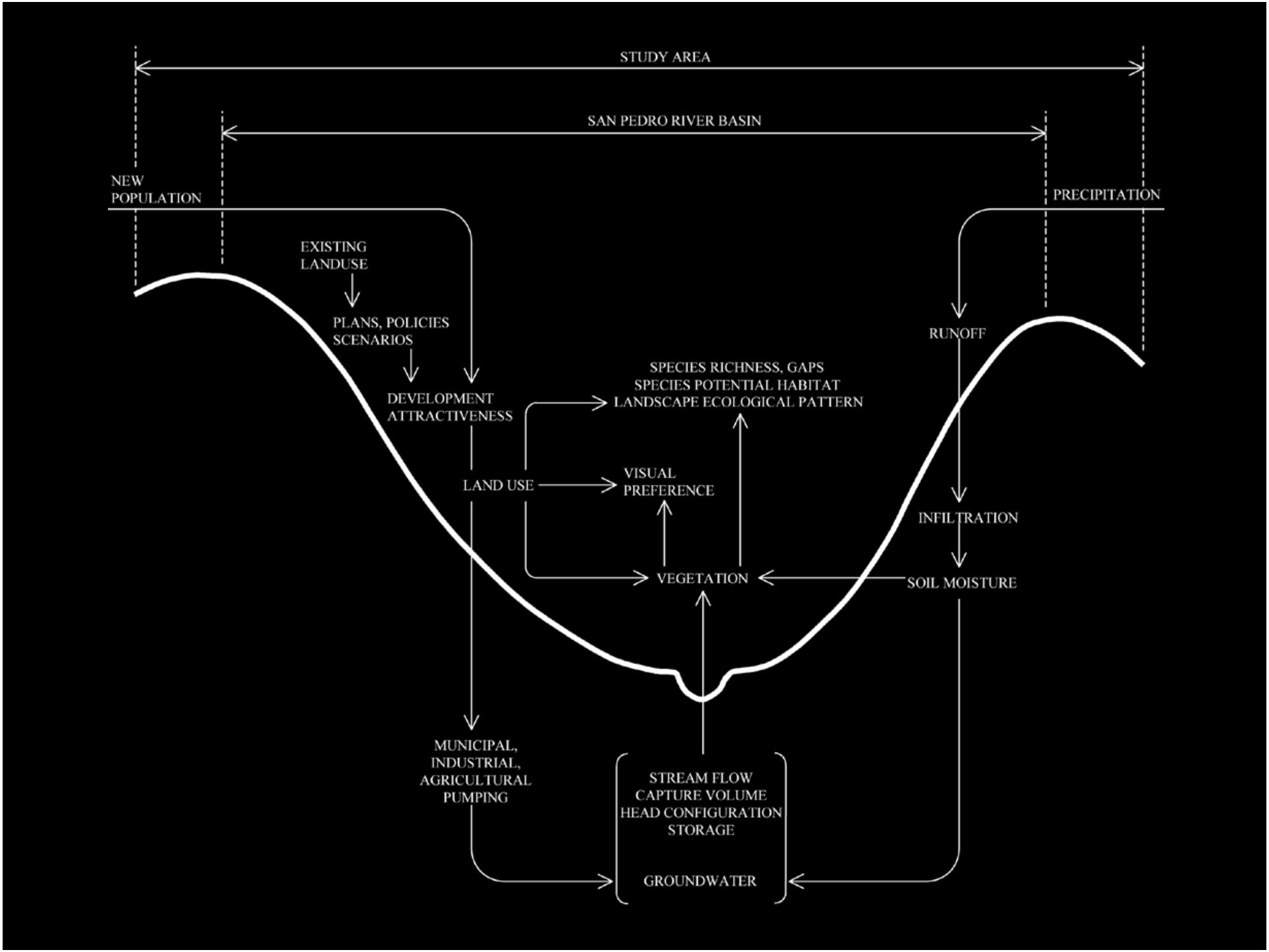
Plans	A scenario in which population growth is as forecast and an interpretation of the current plans of the area are followed
Plans $_1$	Variation in which the current (1990) population doubles
Plans $_2$	Variation in which Mexico experiences high urban and rural growth
Plans $_3$	Variation in which a more conservative interpretation of the area plans is used

CONSTRAINED

Constrained	A scenario in which population growth is low and development is directed to urban areas
Constrained $_1$	Variation in which Fort Huachuca's population doubles
Constrained $_2$	Variation in which Fort Huachuca closes

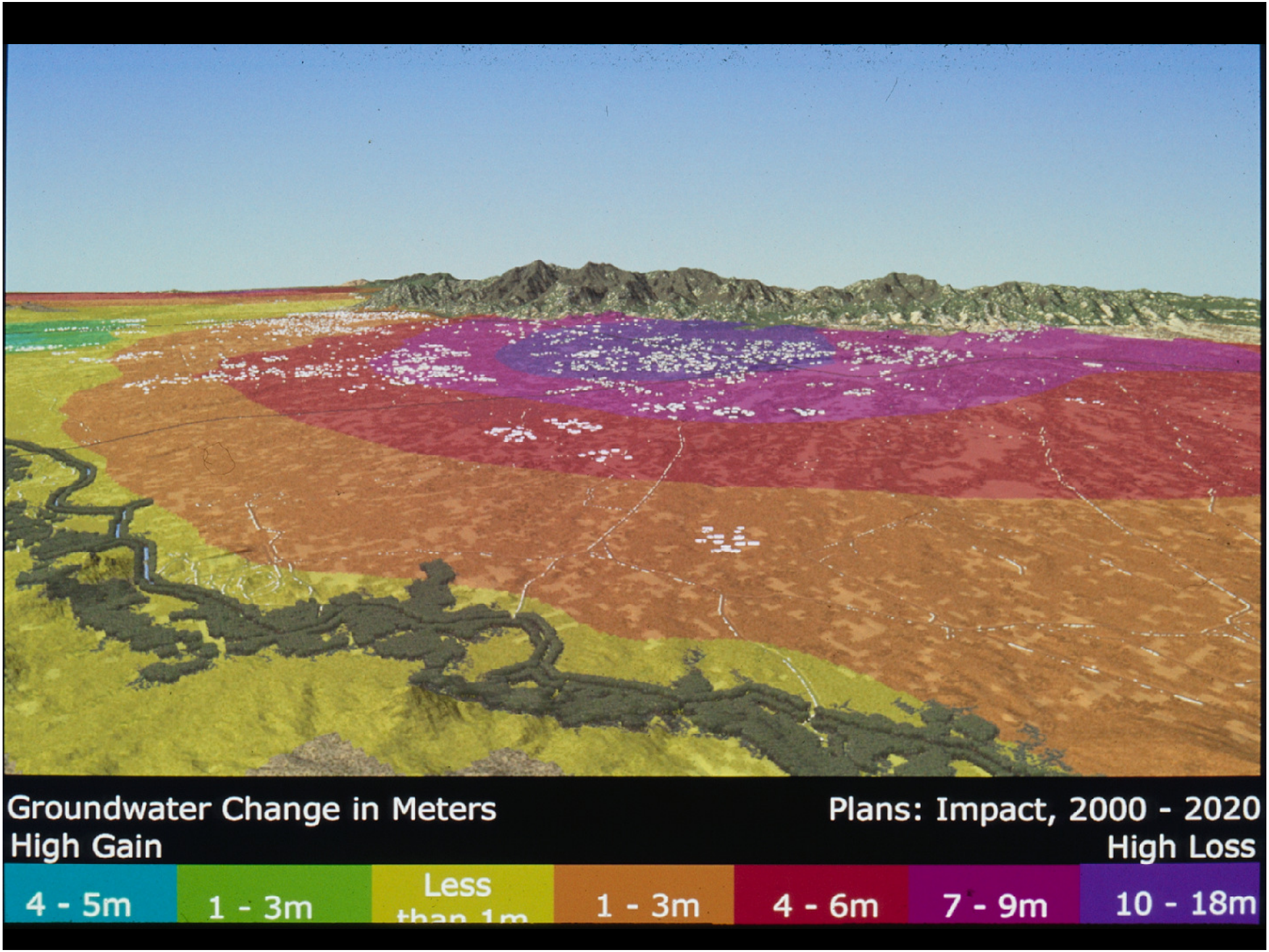
OPEN

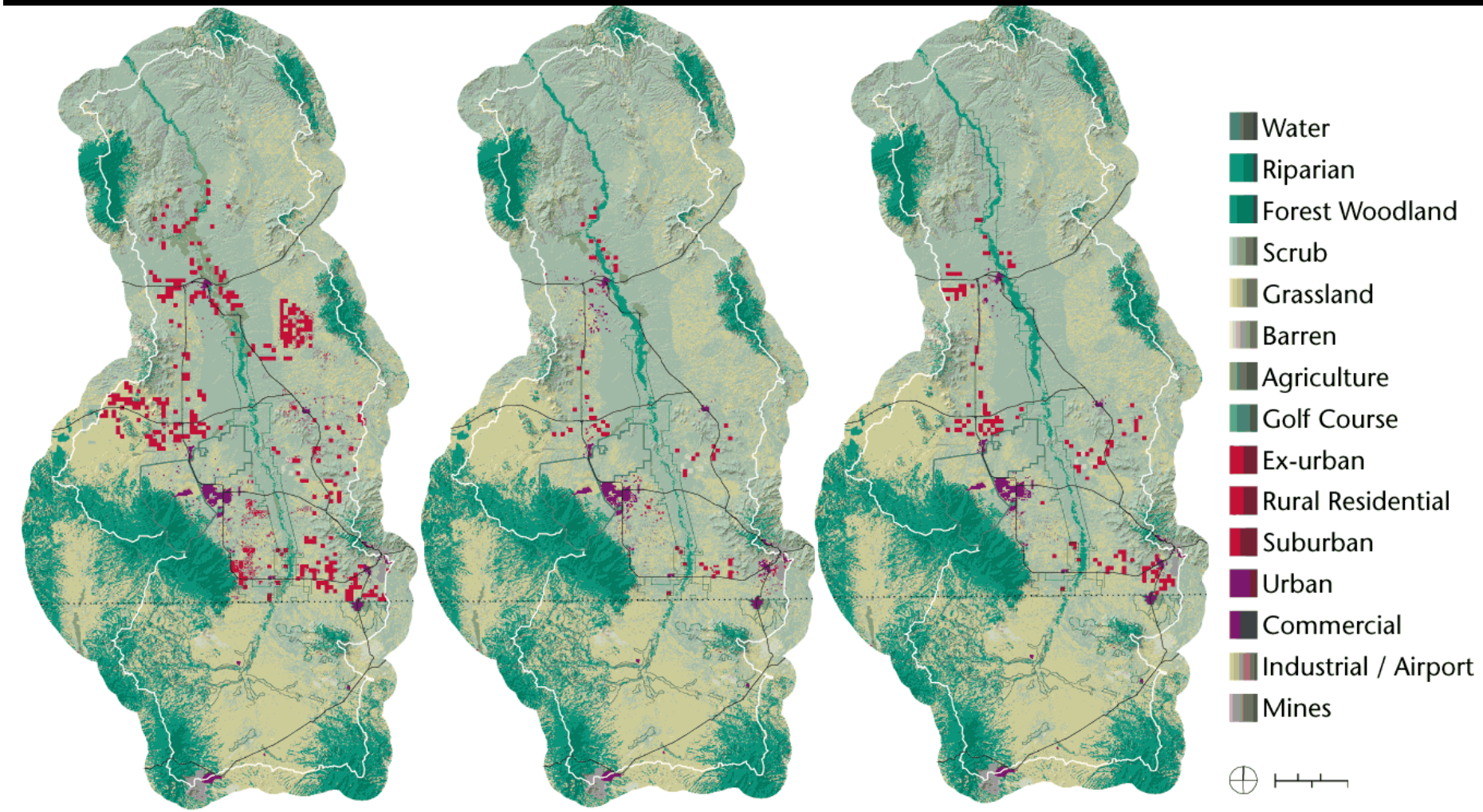
Open	A scenario in which population growth is high and few controls on type or location of development
Open $_1$	Variation in which Fort Huachuca closes, and there are controls on rural residential land splits
Open $_2$	Variation in which Fort Huachuca's population doubles and Mexico experiences high urban and rural growth


STUDY AREA
SAN PEDRO RIVER BASIN
NEW POPULATION
PRECIPITATION
EXISTING LANDUSE
PLANS, POLICIES SCENARIOS
DEVELOPMENT ATTRACTIVENESS
RUNOFF
SPECIES RICHNESS, GAPS
SPECIES POTENTIAL HABITAT
LANDSCAPE ECOLOGICAL PATTERN
LAND USE
VISUAL PREFERENCE
INFILTRATION
VEGETATION
SOIL MOISTURE
MUNICIPAL, INDUSTRIAL, AGRICULTURAL PUMPING
STREAM FLOW
CAPTURE VOLUME
HEAD CONFIGURATION
STORAGE
GROUNDWATER


Land Use
1997


Land Use
Open Scenario 2017


Groundwater Change in Meters
High Gain
Plans: Impact, 2000 - 2020
High Loss
4 - 5m
1 - 3m
Less
1 - 3m
4 - 6m
7 - 9m
10 - 18m



New Development 2000-2020

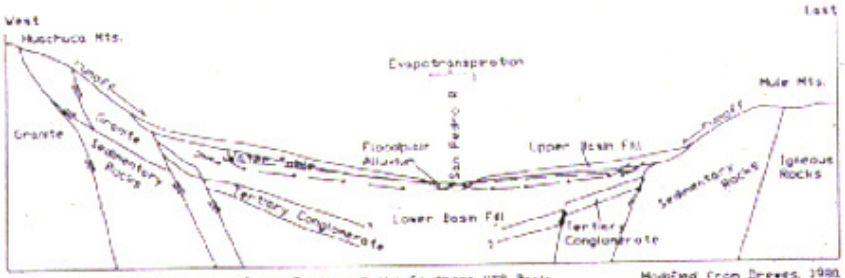
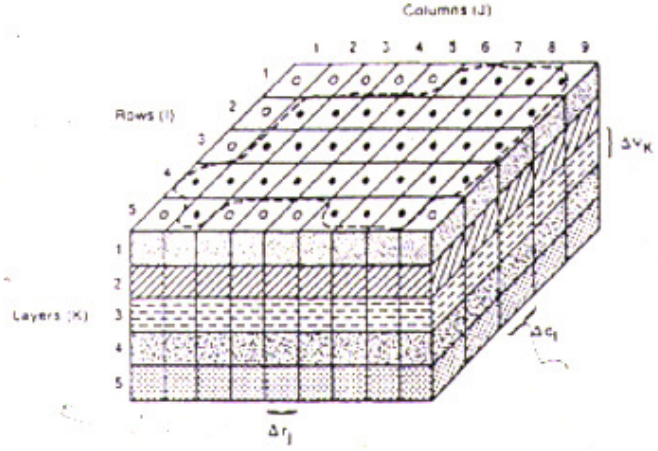
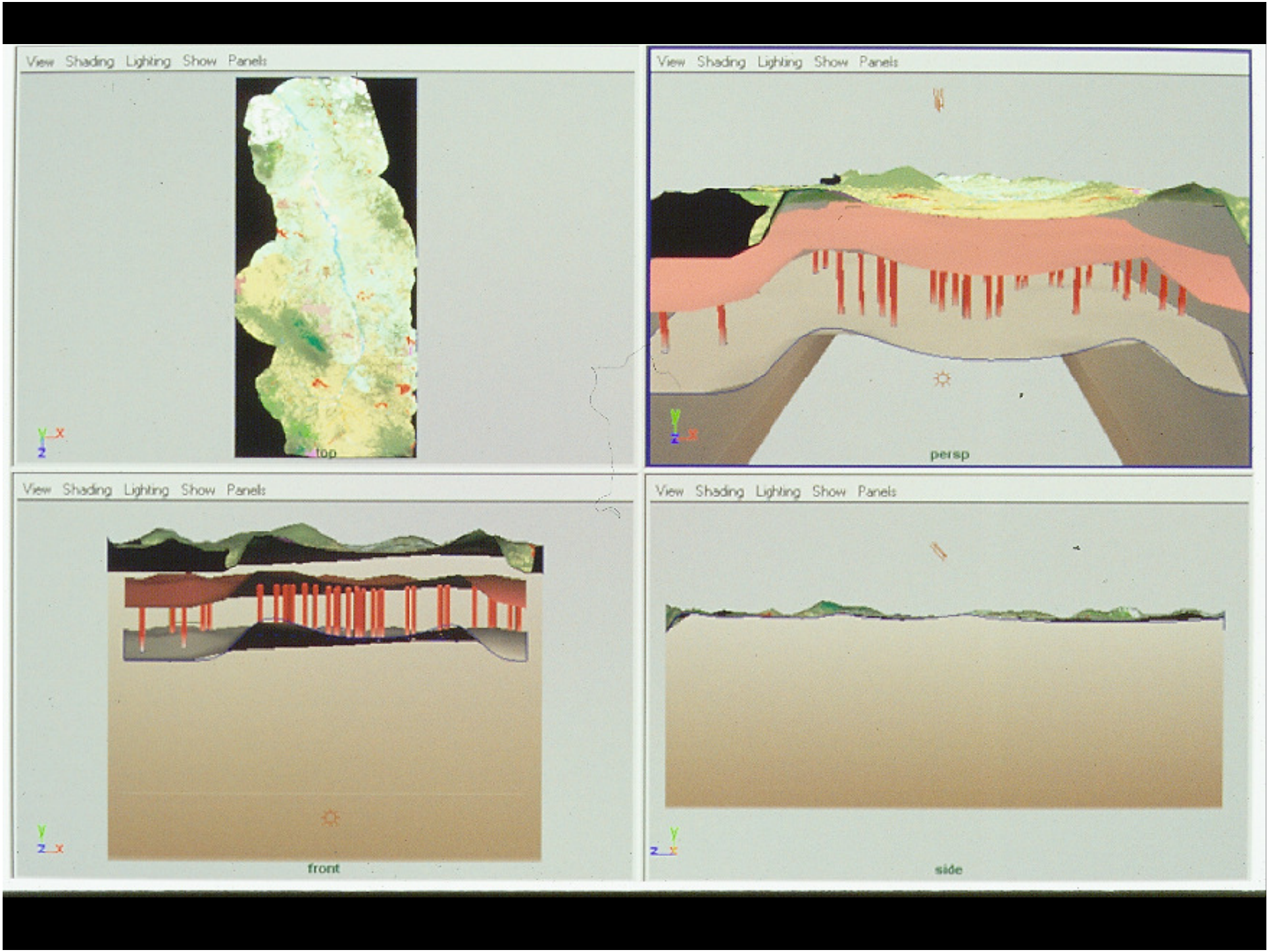
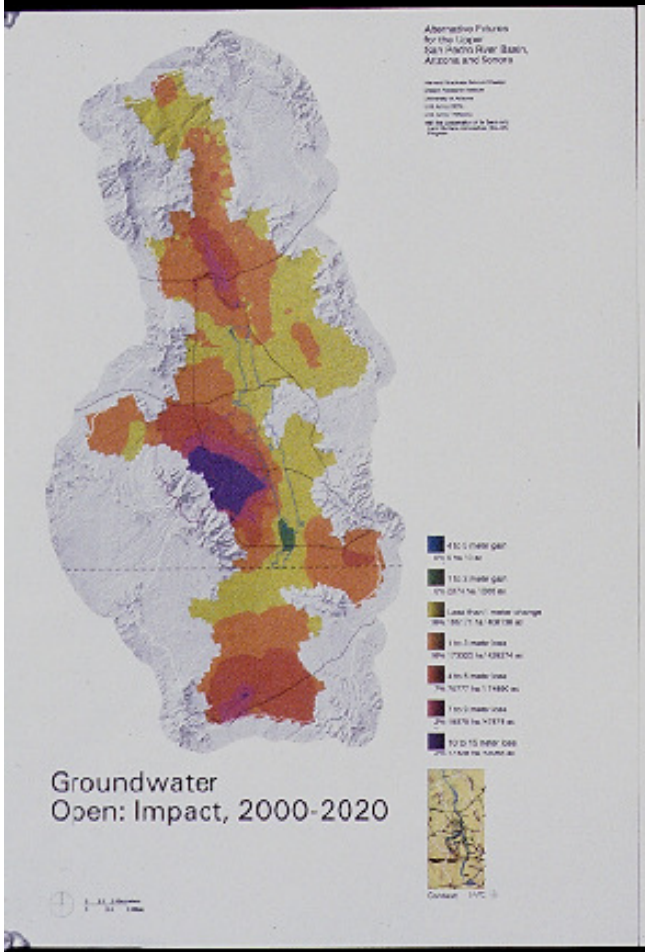


Figure 3 General Hydrogeologic Cross Section of the Southern USP Basin Modified from Brewes, 1980

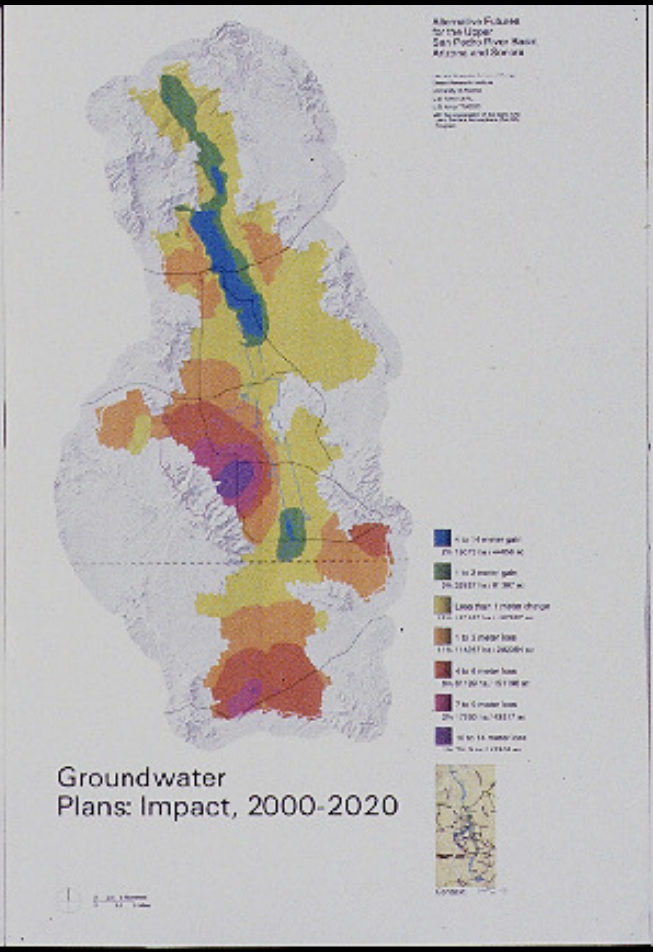
A Discretized Hypothetical Aquifer System
(McDonald and Harbaugh,1984)
Figure 4-1



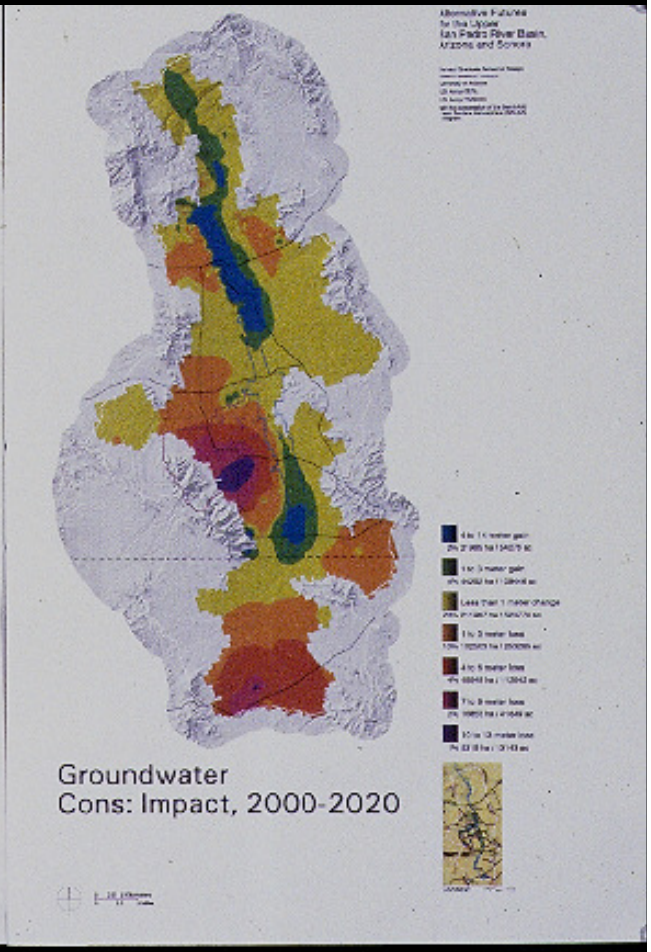

View Shading Lighting Show Panels
top
View Shading Lighting Show Panels
persp
View Shading Lighting Show Panels
front
View Shading Lighting Show Panels
side



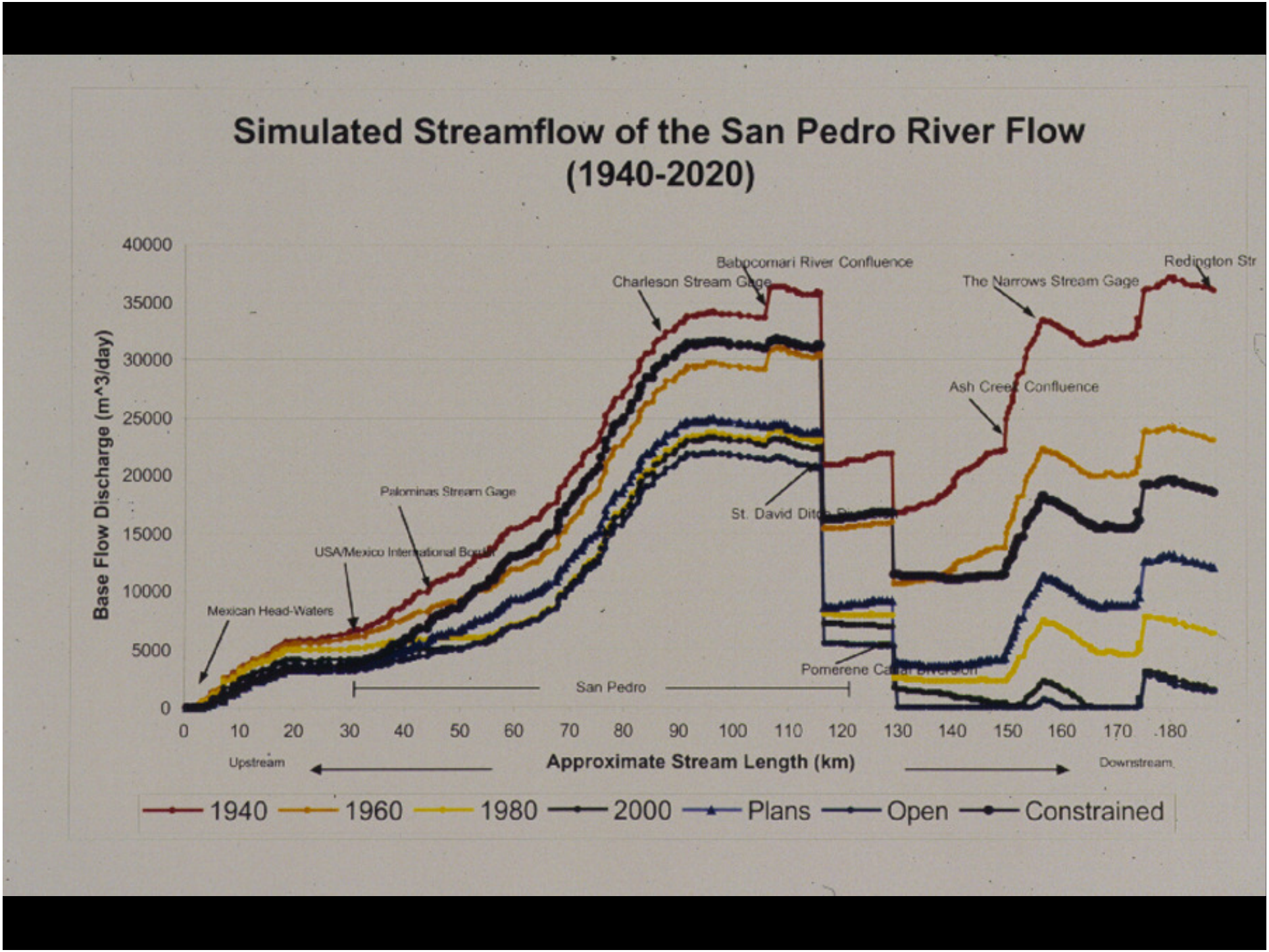
Groundwater
Open: Impact, 2000-2020



Groundwater
Plans: Impact, 2000-2020

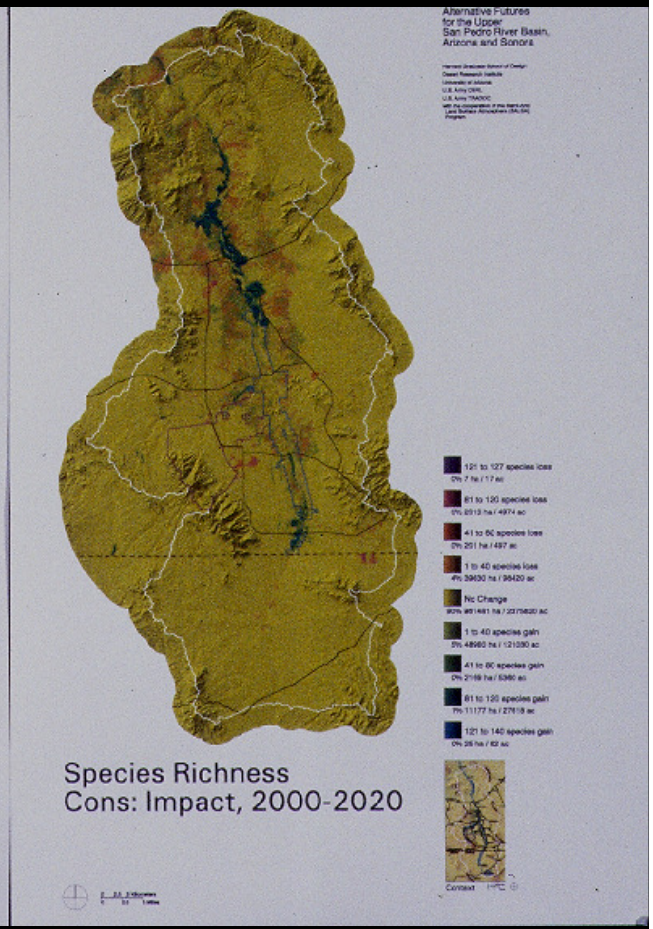


Groundwater
Cons: Impact, 2000-2020


Simulated Streamflow of the San Pedro River Flow
(1940-2020)
Base Flow Discharge (m^3/day)
40000
35000
30000
25000
20000
15000
10000
5000
0
Babocomari River Confluence
Charleson Stream Gage
The Narrows Stream Gage
Redington Str
Ash Creek Confluence
Palominas Stream Gage
USA/Mexico International Boundary
St. David Ditch Diversion
Mexican Head-Waters
Pomerene Canal Diversion
San Pedro
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180
Upstream
Approximate Stream Length (km)
Downstream
1940
1960
1980
2000
Plans
Open
Constrained

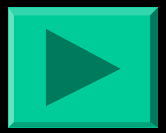
Species Richness
Open: Impact, 2000-2020

Species Richness
Plans: Impact, 2000-2020

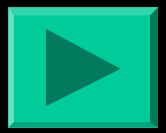


Species Richness
Cons: Impact, 2000-2020

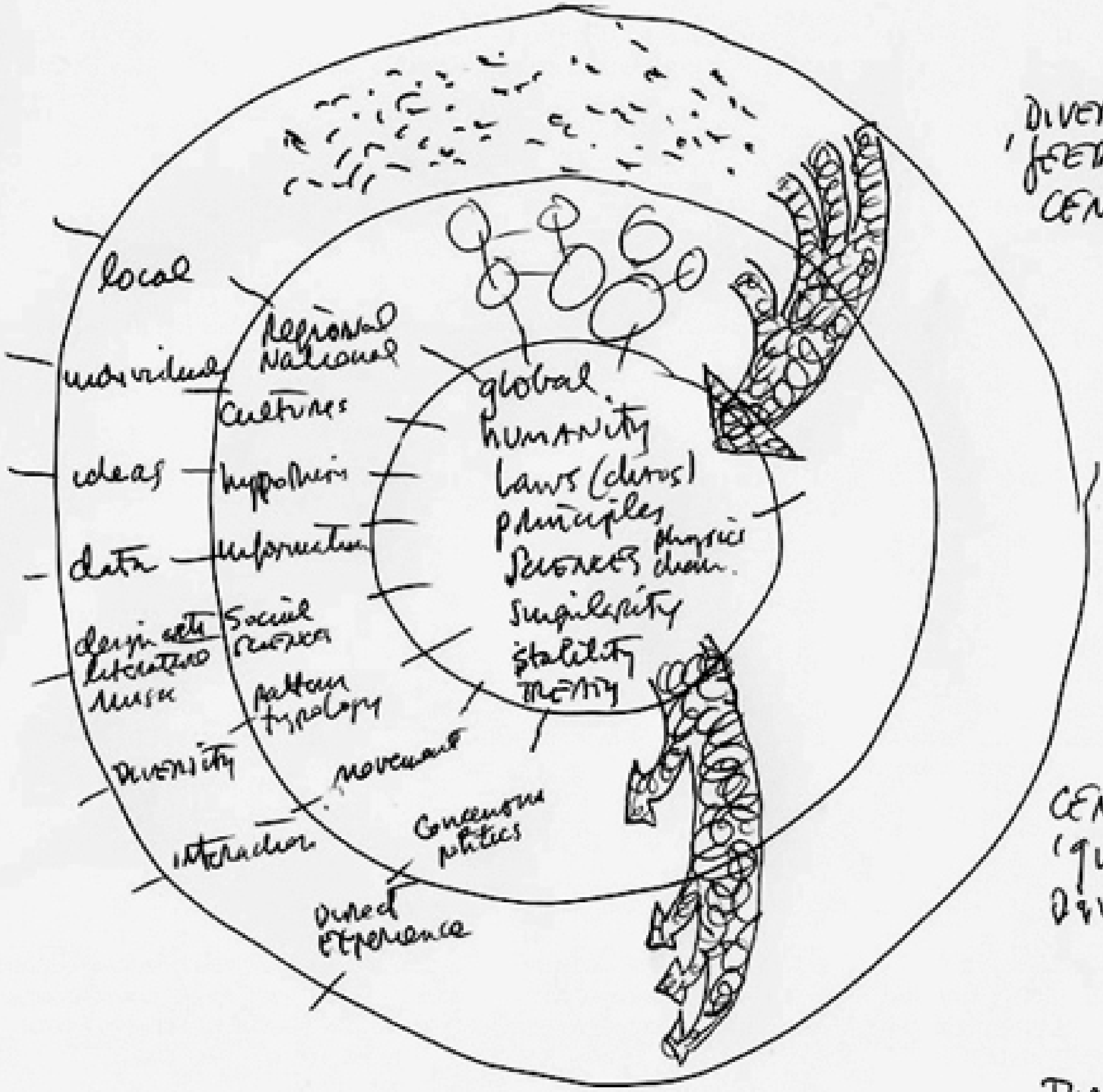
San Pedro Sierra Vista Open



San Pedro Benson Open



C.SHRIVER 2002



'DIVERSITY
'FEEDS'
CENTRALITY

The NARROWER
THE CIRCLES and bands
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and THE more
authoritarian
it seems

CENTRALISM
'GUIDES'
DIVERSITY

The wider
The circle, and bands
The better, but
the more
chaotic it
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The balancing concept is "risk"
and this is the tension, in
Decision making and education.