

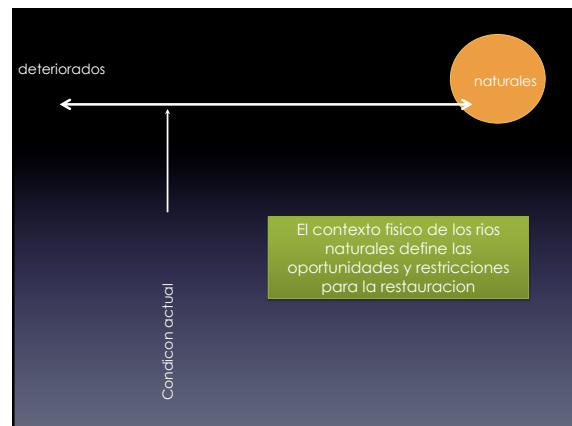
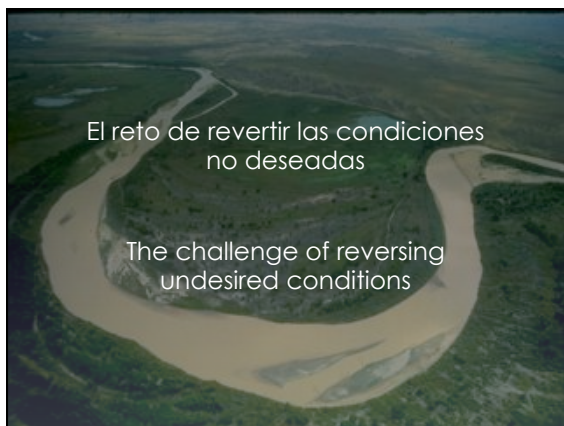
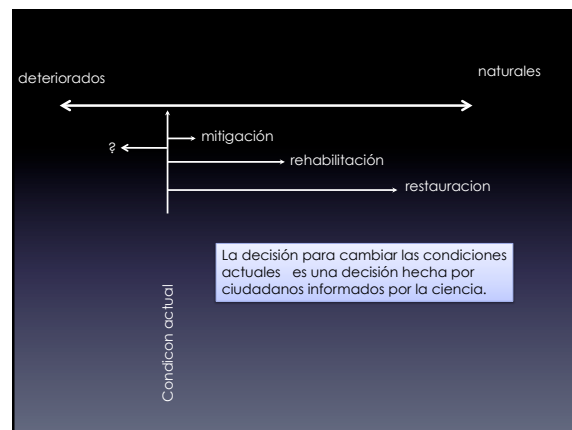
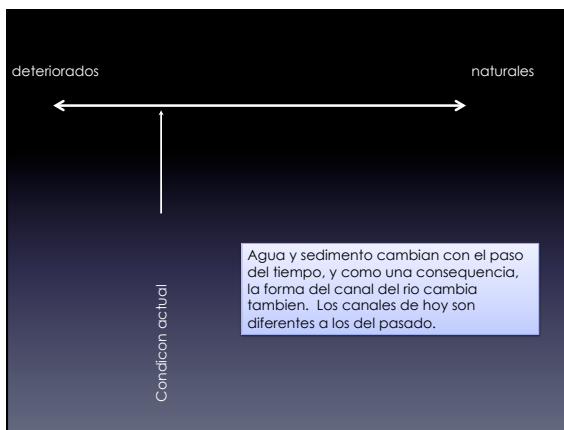
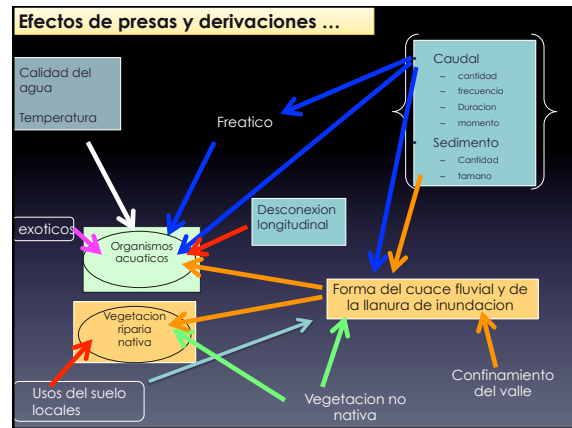


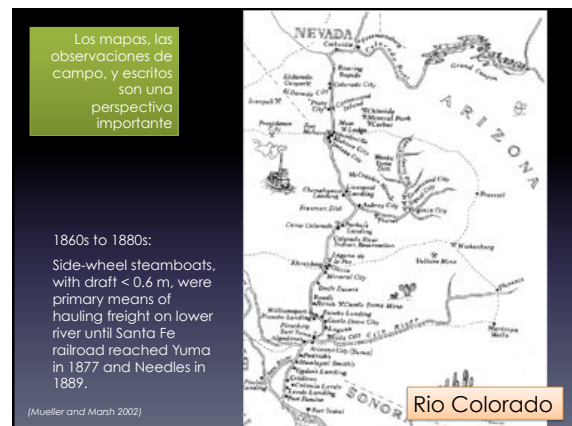
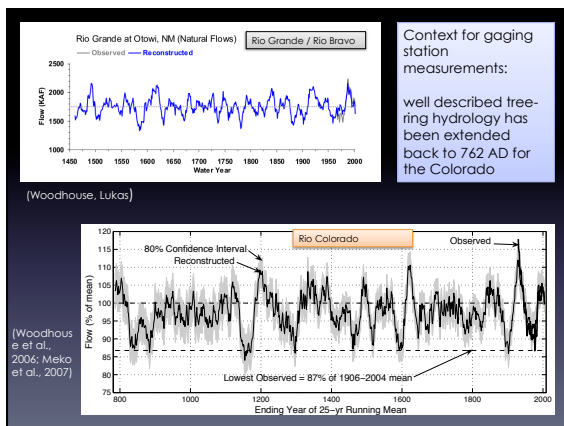
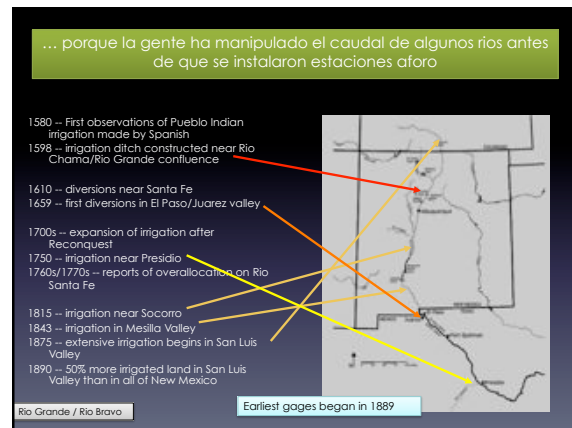
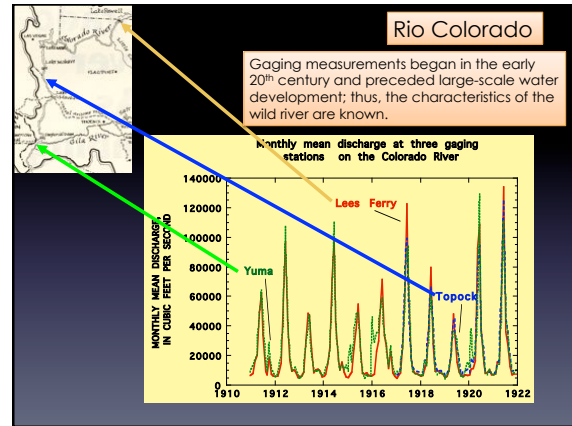
Ponencia del experto internacional en ríos Jack Schmidt sobre " Regulación de caudales, sedimentos y restauración fluvial" ofrecida en la Jornada sobre restauración de ríos organizada por la Consejería de Medio Ambiente de la Junta de Andalucía. Sevilla (26 de mayo 2011)

The challenge of restoring rivers

John C. Schmidt
Utah State University

ICRRR
Intermountain Center for River Rehabilitation and Restoration





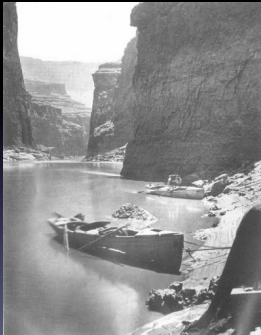
Rio Colorado

La literatura, los escritos científicos y las fotografías constituyen una buena evidencia del río en el pasado.

Green River, Canyon of Lodore (1871)



Marble Canyon, 1872



(Grams and Schmidt, 2005)



Green River in Browns Park

El Rio Colorado del pasado ...



Green River near mouth of the San Rafael

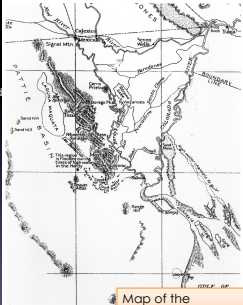
(Allred and Schmidt, 1999)

El Delta del Rio Colorado en Mexico

What was ...

- ... a wet gallery forest of cottonwood and willow in the north, interspersed with wetlands containing cattail and common reed in low areas and mesquite bosques on higher terraces.
- Large expanses of salt tolerant vegetation such as salt bush, salt grass, and arrowweed were found throughout the delta.
- endemic salt grass, *D. palmeri*, dominated the estuarine zone.
- Beaver, jaguars and deer were still found in the delta when Leopold visited [in the 1920s]

(Glenn et al. 2001)

Map of the Colorado River delta (Sykes, 1937)

Santa Elena Canyon (1901)



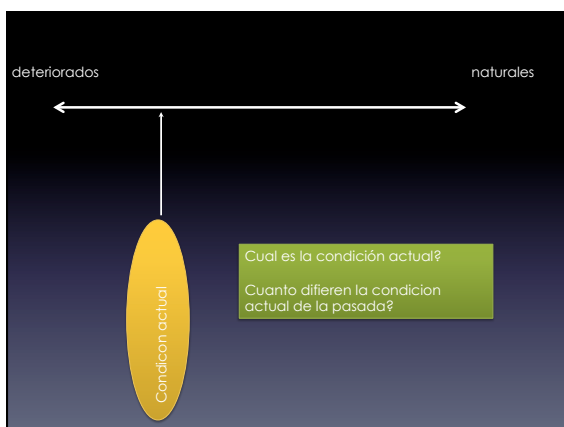
Vista aguas arriba de Boquillas, Mexico



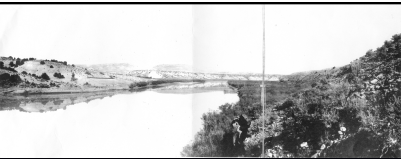
Rio Bravo / Rio Grande en el 1900s

Hot Springs Canyon (1901)



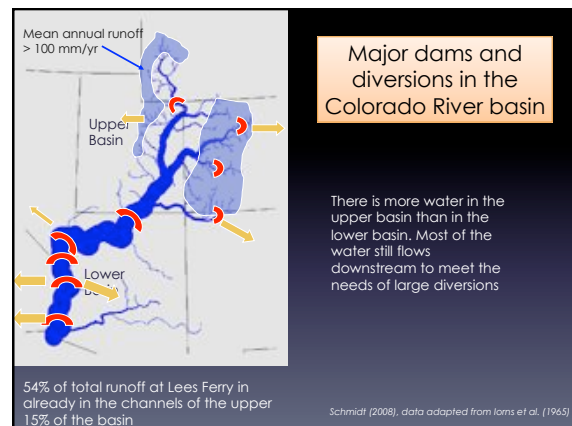
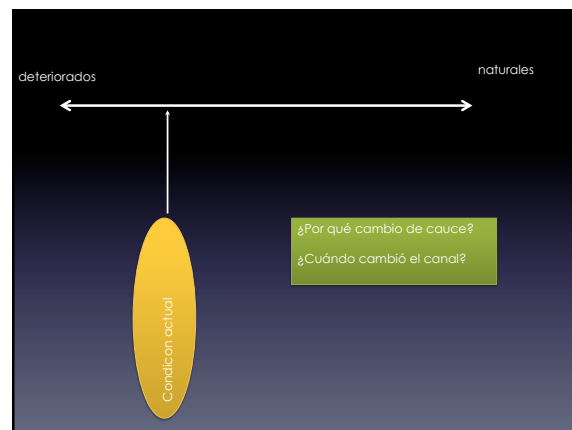
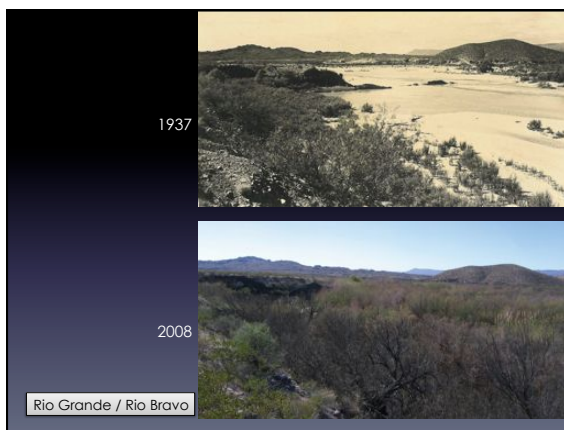
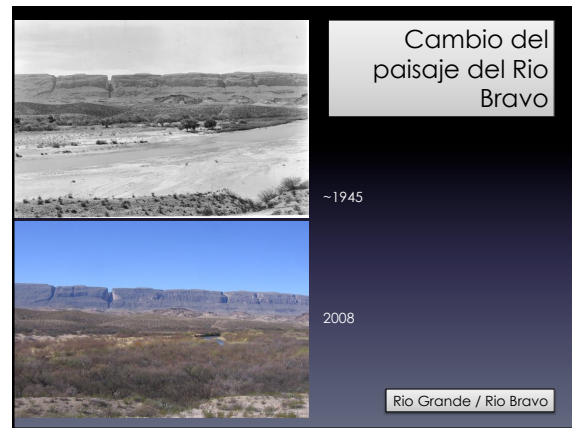
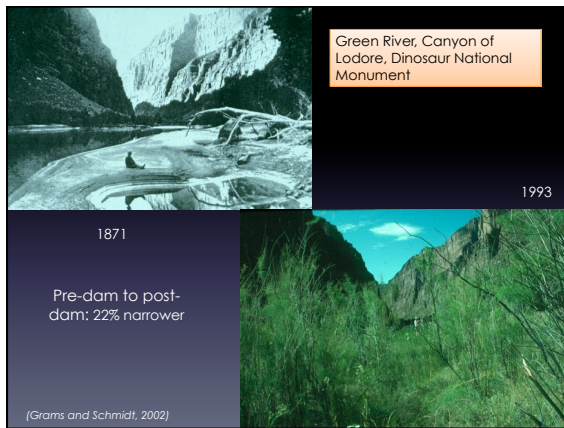


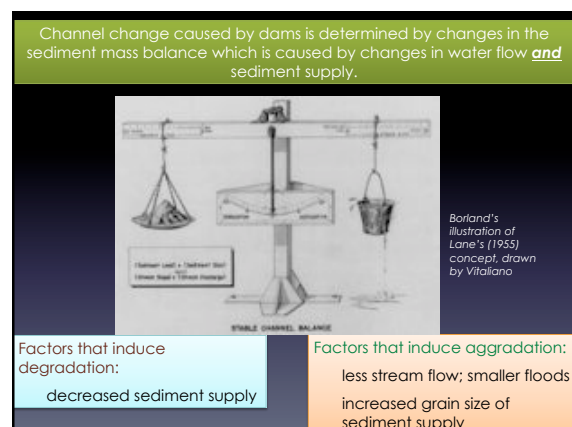
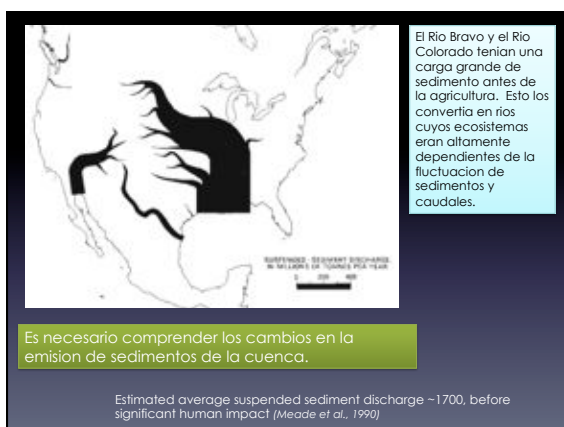
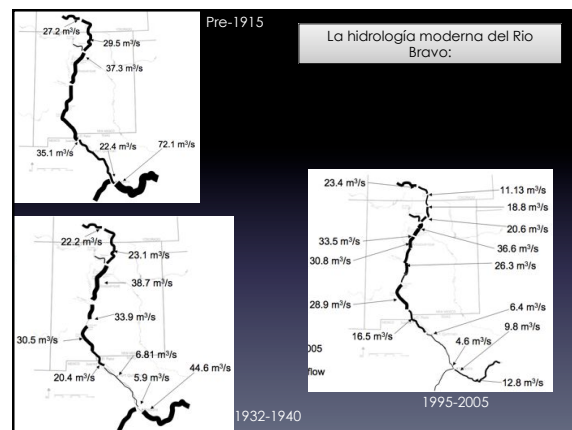
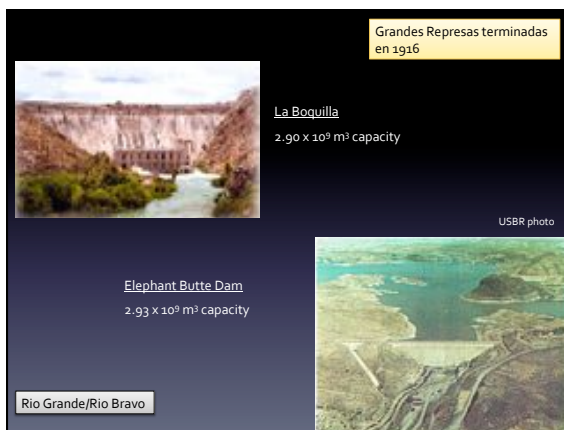
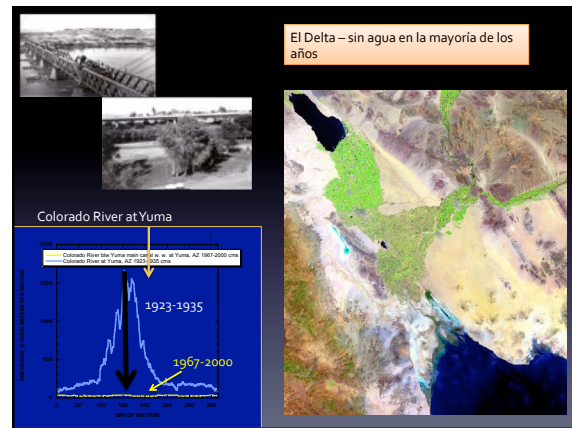
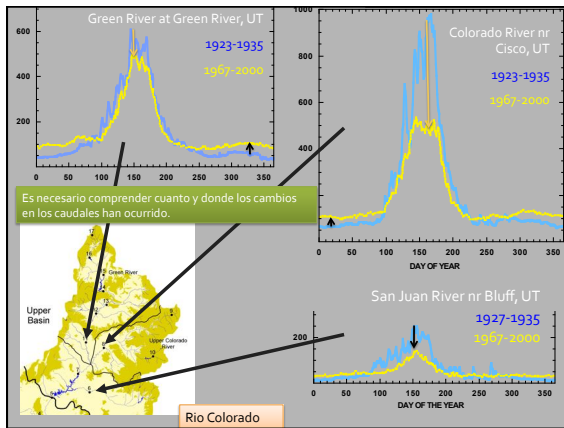
Green River in Browns Park: no bed incision; large flood reduction; 20-30% narrowing

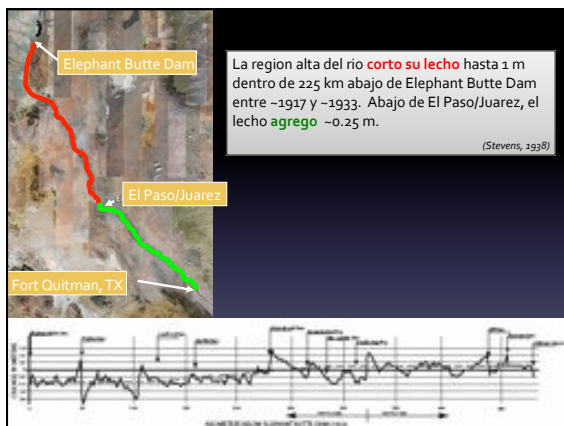
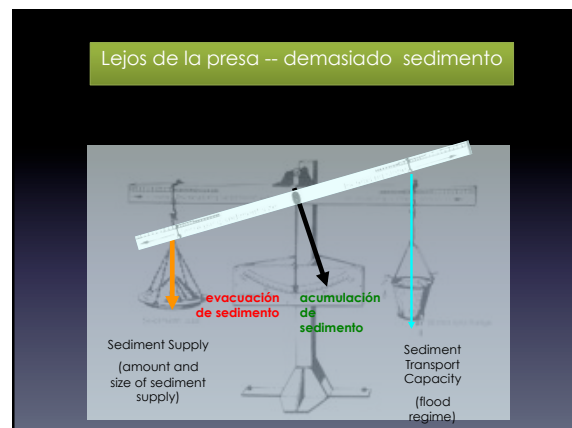
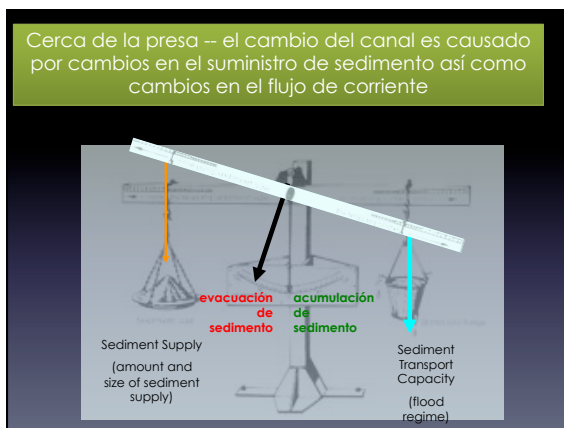
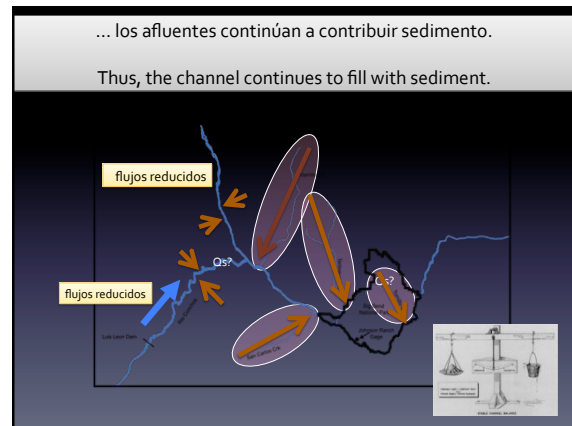
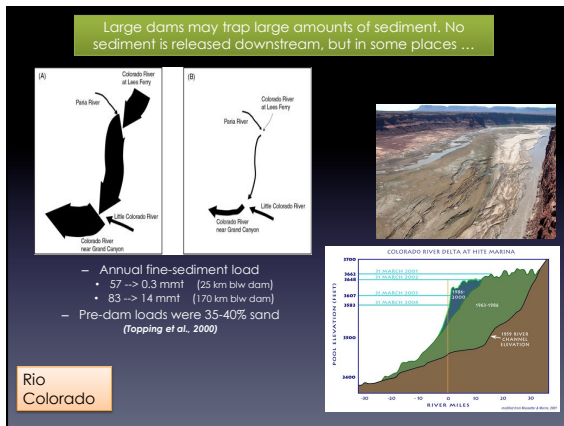


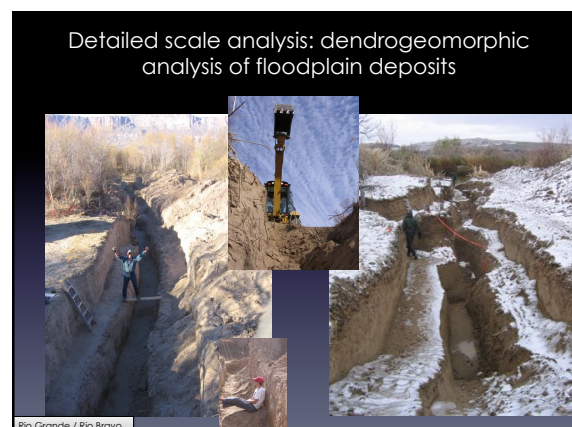
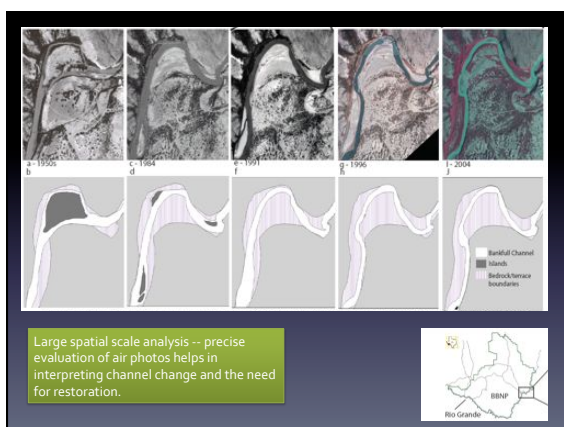
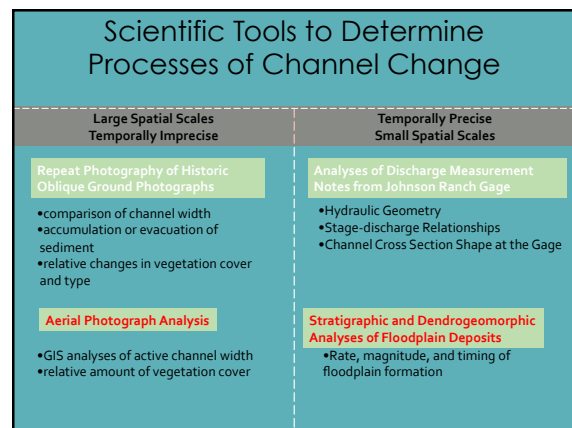
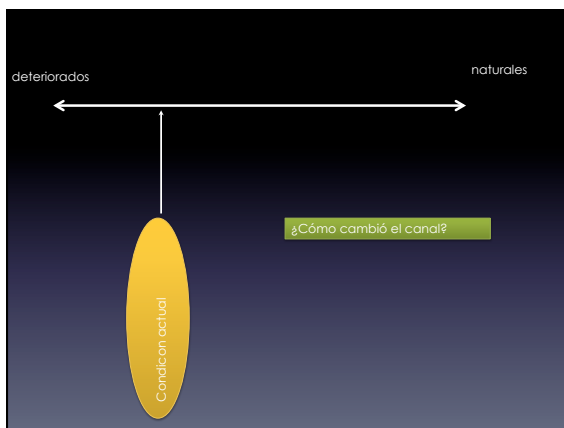
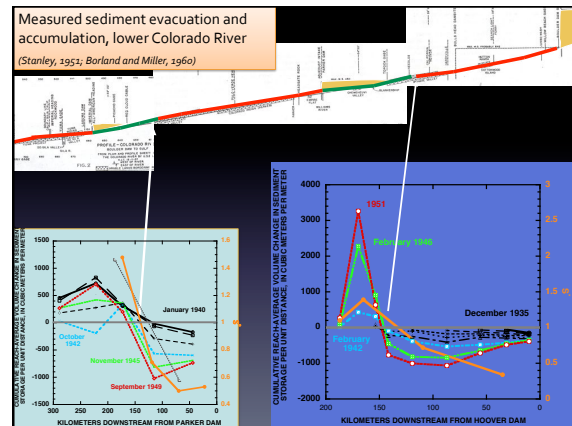
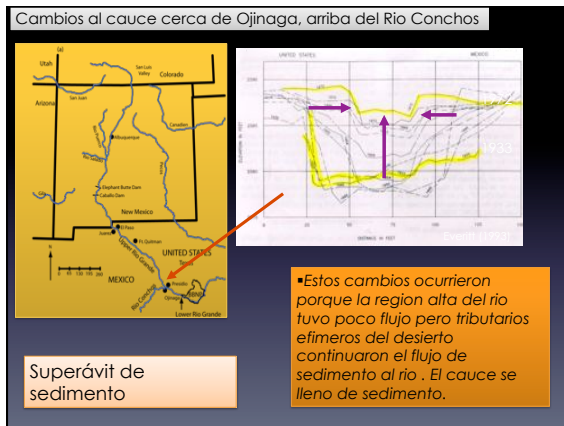

Narrowing in the Green River

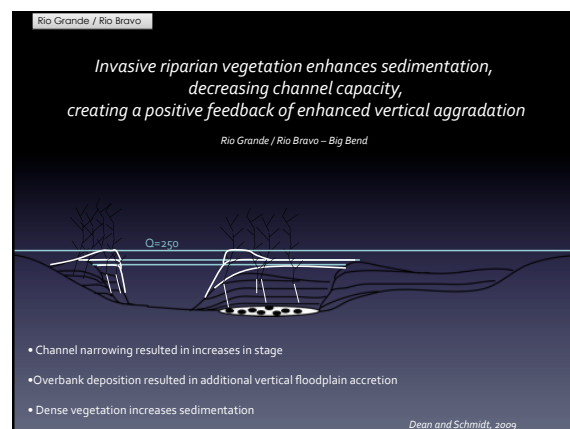
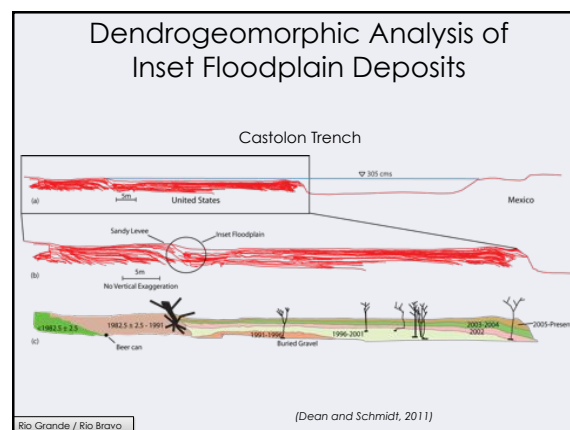
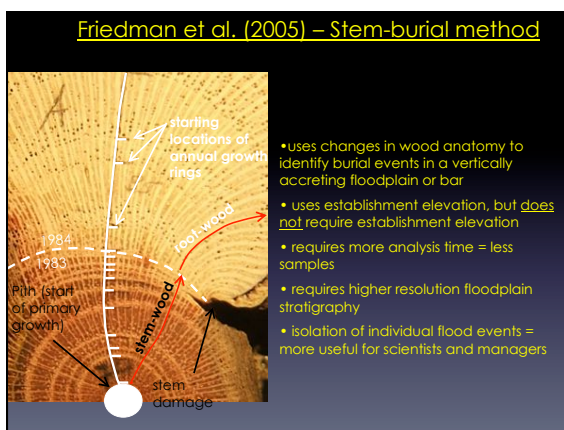
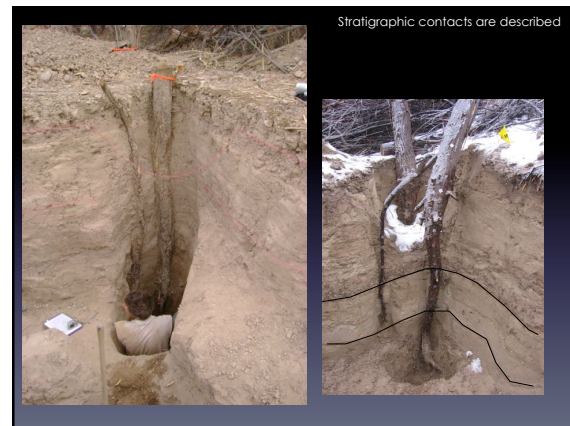
(Grams and Schmidt, 2005)

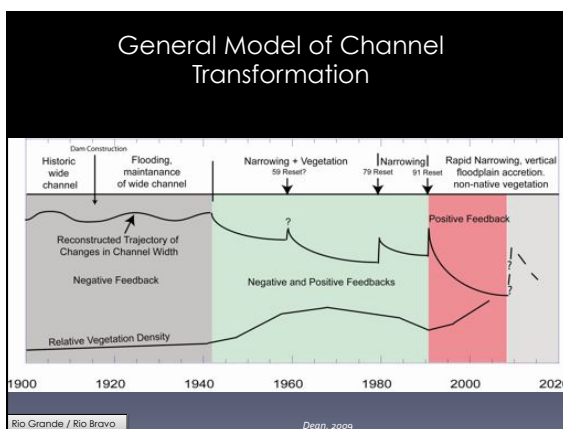
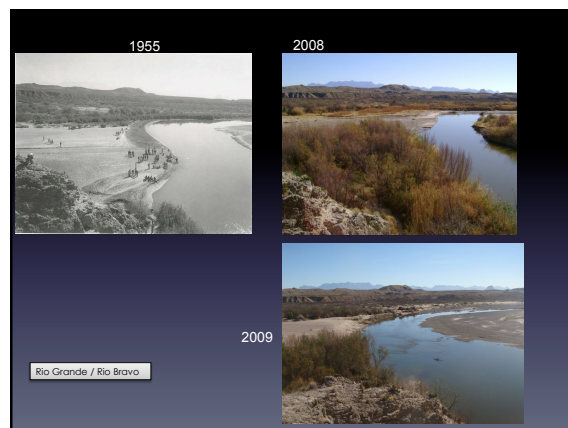
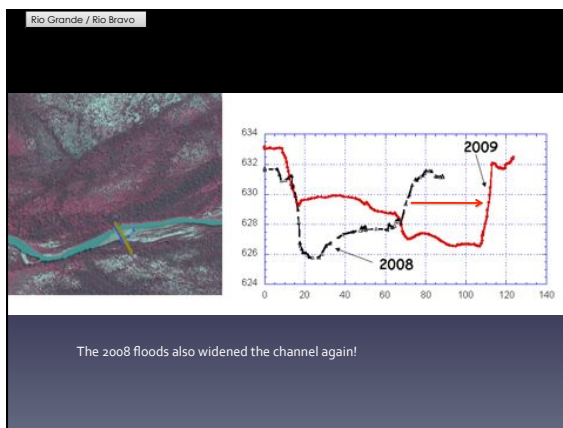
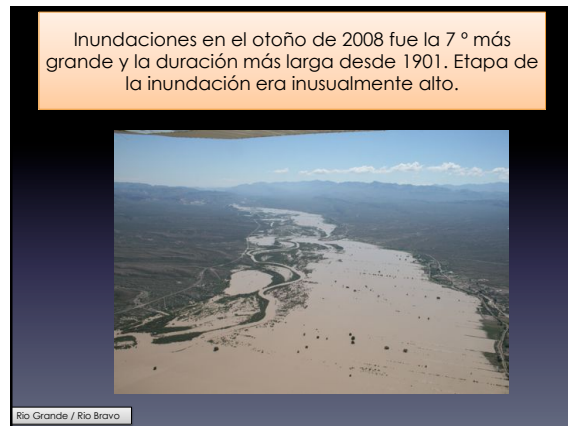
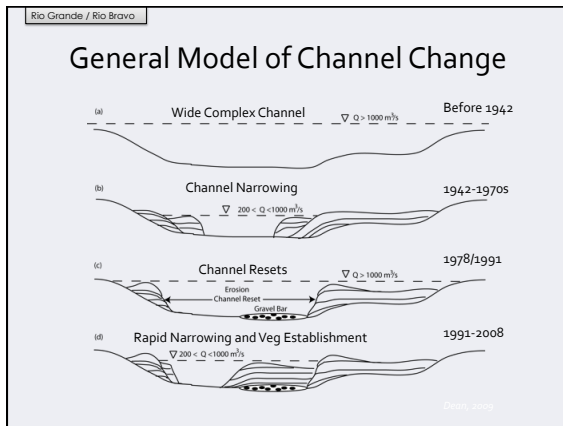










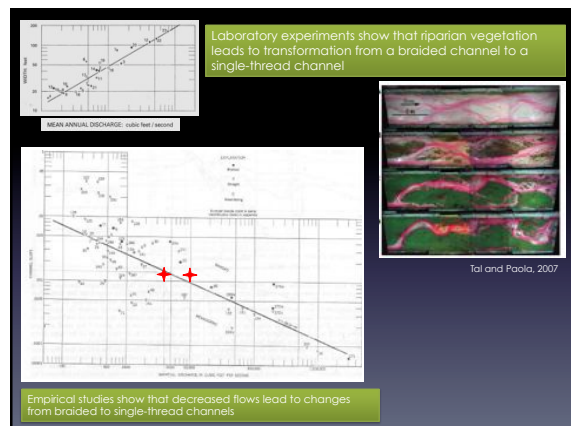
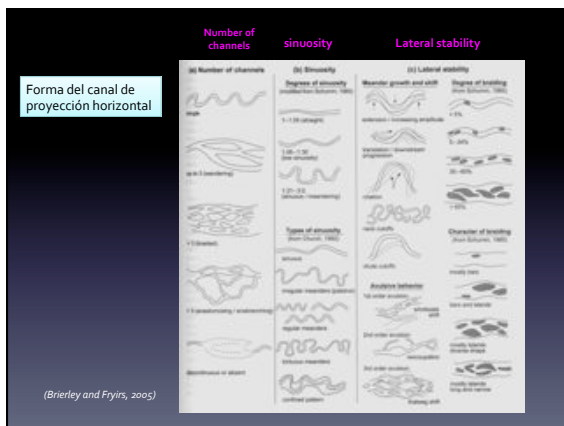
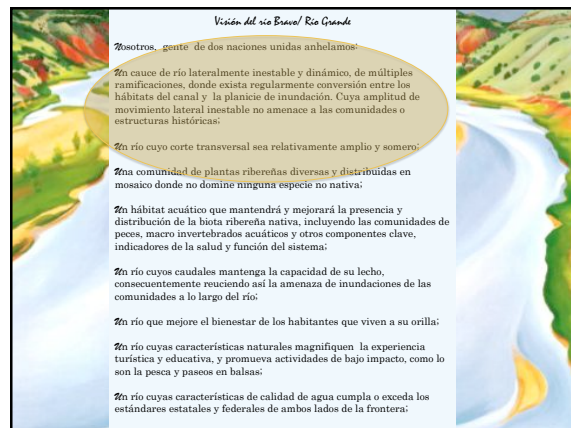
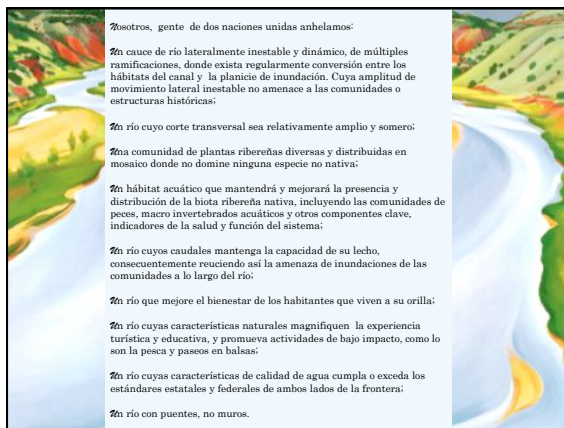
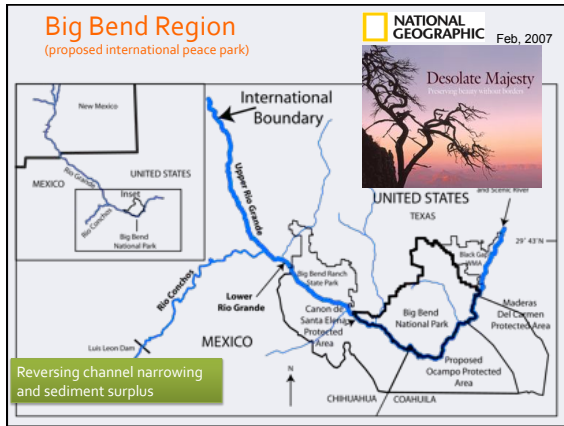


Should present river conditions be reversed?

It is important to have a clear vision of the goal of river management

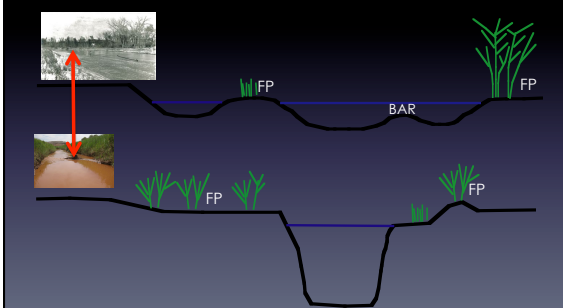
- A guiding image exists
 - A dynamic ecological endpoint is identified and used to guide the project
- Ecosystems are improved
 - Ecological conditions of the river are measurably enhanced
- Resilience is increased
 - River ecosystem is more self-sustaining than before
- No lasting harm is done
 - Implementing the project does not inflict irreparable harm
- Ecological assessment is completed

(Palmer et al., 2005)



Complex, heterogeneous habitat (aggregation of pools and riffles, backwater) provide areas for spawning and rearing (Pearson et al, 1992)

Channel-floodplain connection provides source of biological activity, organic matter, and nutrients and habitat for rearing (Sparks et al, 1990)

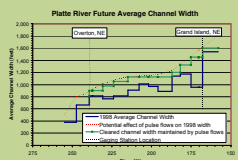
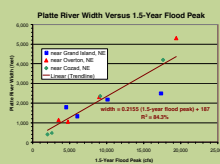


Strategies for restoring lost aquatic habitat on rivers in sediment surplus

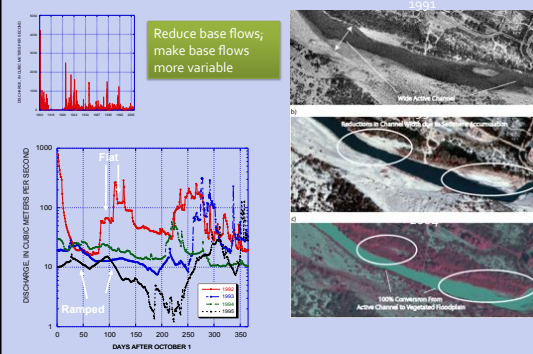
- Local scale solutions:
 - Remove non-native riparian vegetation
 - Mechanical removal
 - Herbicides
 - Biological controls
 - Remove excess sediment that is now in the channel
- Watershed scale solutions:
 - Reduce delivery of sediment to channel
 - Increase the magnitude and duration of floods (pulsed flows)
 - Change the timing of floods to favor native vegetation

Strategies for restoring lost channel habitat on the Platte River in Nebraska (Murphy et al., 2004)

- 1) Restore part of the former flood flows
- 2) Remove vegetation from part of the channel
- 3) Restore part of the former supply of medium sand
- 4) Widen part of the river in specific places
- 5) Block some secondary channels and focus flow elsewhere.

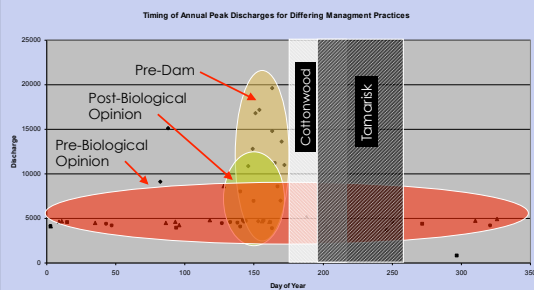


Riparian vegetation increases when there are steady baseflows that are high during the growing season



Shift the timing floods to favor native vegetation

- Pre dam flood timing and seed windows for cottonwood and tamarisk



Removal of undesired vegetation and reestablish floods

- Hand excavation
- Large equipment



Trinity River, California



Green River, Colorado

