UCFWG
Floodplain Session
July 8, 2021

UPPER CLARK FORK RIVER
FLOODPLAIN ECOLOGY &
RESTORATION

CLARK FORK MILLTOWN SITE
10 YEARS POST
REMEDINATION & RESTORATION
Heterogenous and connected natural floodplain

(Noe 2013 *Treatise of Geomorphology*, modified from NRC 2002 Riparian Areas)
Floodplain Hydrologic Connectivity

- Flood Pulse Concept (FPC) – pulsing of river discharge drives the degree of connectivity
- Riparian and floodplain function is maximized by connectivity with the river – lateral, longitudinal, vertical and temporal
- Linked to frequency, seasonality and duration of surface flooding and groundwater and river channel water levels
- Timing of connectivity linked to life histories of some riparian plant species

DRIVES MOST ECOLOGICAL PROCESSES AND MANY BIOLOGICAL AND BIOGEOCHEMICAL PROCESSES
The success of initialization of the sequence in riparian vegetation succession depends on:

• Availability of seeds
• Availability of colonizable habitat
• Possibility of seedlings to develop enough before the next disturbance
• Resilience of the established populations to the next disturbance

Tabacchi et al. 1998
We are STUCK HERE

Some inset floodplain creation, tailings recruitment

FUNCTIONAL FLOODPLAIN
Floodplain is static and ecologically resilient and will resist shifting back to any pre-disturbance condition...
Reduced Cottonwood Abundance

Contamination present?

COTTONWOOD STAND AT TRIBUTARY CONFLUENCE

COTTONWOOD AND SANDBAR WILLOW SEEDLINGS

DENSE COTTONWOOD SEEDLINGS

NO COTTONWOOD SEEDLINGS
UPPER CLARK FORK SUCCESSIONAL MODEL AND POST-REMEDIATION TRAJECTORY

PRE REMEDIATION AND RESTORATION

POST REMEDIATION AND RESTORATION: SHORT-TERM
Post-Restoration Trajectories

Garbin, 2015

1. Early successional
2. Successional trend maintained
3. Alternate stable state
4. Retrogressive succession
Is the historic condition a viable target?

- Climate Change
- Invasive Species
- Ecological Legacies of Human Actions

Restoration should work with current natural processes and aim to restore ecological function.
Floodplain high flow surface connectivity = rapid woody pioneer vegetation expansion

Willow expansion 2 years post flood activation of side channel
Streambank Treatment Response - willow expansion

SUBSTRATE THAT ENCOURAGES WILLOW EXPANSION PLACED 10’ BEHIND TREATMENT

PHASE 1
7 YEARS POST RESTORATION

AVERAGE WIDTH OF WILLOW EXPANSION BEHIND BANK 15’ *MUCH LESS IF DENSE COVER BY SEEDED GRASSES ESTABLISHES FIRST
Streambank Treatment Response - Heterogeneity

Loss of fabric & coir logs = source of clean sands and gravels to help build floodplain.

Coir logs intact = overhanging vegetation and undercut bank habitat.
Site Response - point bar building and early succession initiation (colonization)

CONSTRUCTED POINT BARS HELP BUILD FLOODPLAINS...
Close contact with late season groundwater speeds up recovery time

PHASE 1 WETLAND 3 YEARS POST ACTION
WHAT WILL THESE DRY SEEDED AREAS BECOME IN THE ABSENCE OF NATURAL FLOOD DISTURBANCE?

ARE WE CREATING NOVEL FLOODPLAIN ECOSYSTEMS?
RESTORED CONDITION = IMPORTED SOIL PLACED 12-18” DEEP OVER IMPORTED GRAVEL/SAND/Cobble (FLOODPLAIN ALLUVIUM) WITH COMPOST (1.5%) MIXED INTO SURFACE

- <1 CM) O-HORIZON DEVELOPMENT
- NO OTHER CHANGE

- >1 CM O-HORIZON DEVELOPMENT
- REDOXIMORPHIC FEATURES FORMING >12” DEEP SOIL PROFILE
- ORGANIC MATTER DEEPER IN SOIL PROFILE
Planted Fall 2013
Individual browse protectors (good herbivory protection)
Non drought year
High flows out of banks
= >90% survival + willow expansion

Planted Fall 2014
4-ft wire fences (poor herbivory protection)
Drought year
High flows not out of banks
= <20% survival + no willow expansion

Upper Clark Fork River Phase 1
10 Years and 8 high flow events, timed closely with seed release and sustained hydrologic conditions needed to create this.
MILLTOWN SITE 10 years post Remediation and Restoration –

Areas of concern are areas that 1) lack connectivity with flood surface waters and late season groundwater; or 2) have residual metals present.
What can we do to enhance floodplain function and process in restoration?

Maximize Flood Connectivity and Routing
What can we do to enhance floodplain function and process in restoration?

Maximize Diversity

MACRO SCALE – wetlands, swales, large depressions, side channels, oxbows, etc.

MICRO SCALE – extend wood below ground to increase below ground diversity and break potential barriers
What can we do to enhance floodplain function and process in restoration?

Mimic Vegetation Recruitment Processes

SEEDING OF WILLOWS & COTTONWOODS TIMED WITH HIGH FLOW RECESSION

USE OF SAND AND GRAVELS ON POINT BARS AND BANKS TO ENCourage WOODY PIONEER SPECIES COLONIZATION AND EXPANSION & INPUT FLOODPLAIN BUILDING SUBSTRATES INTO SYSTEM
RESTORATION TAKES TIME AND SHOULD BE THOUGHT OF AS AN ADAPTIVE MANAGEMENT EXPERIMENT…

- Monitoring and research are integral to improving floodplain restoration
- Creating resiliency through restoration is critical in these areas, particularly in the light of climate change
- There is a need to develop clear ideas of where we want to go and trajectory paths that reflect that – meeting performance targets along do not always tell us if we are creating resilient ecosystems
- There is a need for further research to better understand floodplain processes and functions specific to the Upper Clark Fork and which of those are critical for remediation/restoration success