Presentation
to the

Upper Mississippi River Basin Environmental Management Program Workshop

by

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Engineering Design Handbook

Floodplain Restoration

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Agenda

- Resource Problem
- Consulted biologists, foresters, other Districts, Section Chief.
- List of Alternatives Covered
- Alternatives/Design Methodologies
- Questions for YOU
- Questions from YOU

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Resource Problem

- Floodplain habitats are integral components of large river ecosystems because of the seasonal flood pulse that inundates them and connects them to the river.
- Many species of plants and animals are adapted to this flood cycle;
  - Habitat
  - Food resources as they are made available.
  - Many important sediment and nutrient transfers also occur when floodplains are inundated.
- Floodplain habitats throughout the UMRS have been altered for many reasons.
  - In northern river reaches, dams spread water across low elevation floodplain areas to greatly increase aquatic habitat connectivity in the floodplain.
  - Floodplain restoration in the north is a mix of;
    - Protecting some areas with islands
    - Connecting isolated backwaters
    - Restoring tributary channels.
  - In southern river reaches the floodplain is much more developed for crop production and flood protection, and is thus much more isolated from the river (levees).
  - Floodplain restoration in southern reaches includes a mixture of;
    - Water level manipulation in management areas
    - wetland/habitat management in leveed areas (e.g., WRP, CRP, etc.)
    - Restoration of agricultural areas to aquatic, floodplain forest and prairie habitats.

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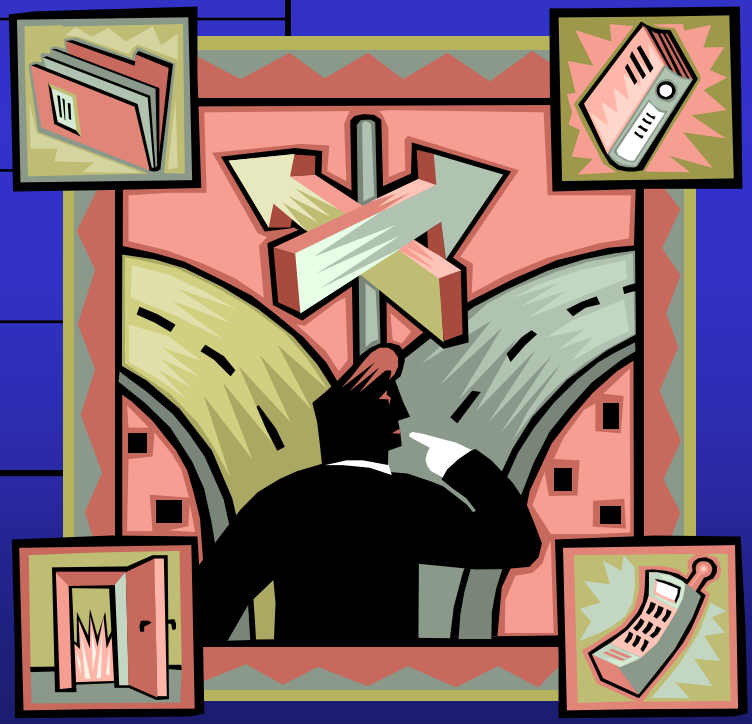
Restoration Alternatives

- Topographic Diversity
- Potholes or Perched Wetlands
- Mast Tree Planting
- Native Grass Planting
- Wetland Species Planting



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Topographic Diversity

- Diversity is essential for maintaining species diversity on floodplains.
  - Relatively small differences in land elevation result in large differences in annual inundation and soil moisture regimes.
  - These differences regulate plant distribution and abundance (Sparks, 1992).
  - Differing temperature zones
- Increased floodplain water table elevation can result in the elimination of flood intolerant tree species that require a dry root zone.
- The severing of floodplains from rivers by levee systems stops the processes of sediment erosion and deposition that regulate the topographic diversity of floodplains.

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Habitat Creation

- Most work on topographic diversity on the UMRS has occurred in conjunction with island creation or dredge management activities.
  - Considerations on topographic diversity for floodplain restoration are similar.
  - Simulates the ridge and swale topography of the natural floodplain.
  - Uses material dredged from the channel.
  - Newly elevated land area may then be planted with oaks and other mast trees.
  - Hydraulically dredged material has been placed in and around existing mature trees, (Johnson Island, 2001)
    - ♦ Tree mortality may occur depending on the type and age of trees.

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Potential Environmental Benefits:

- Increased habitat diversity and benefits for targeted species.
- Potentially improve conditions for the recruitment and development of riparian vegetation.
- Improved riparian conditions would benefit wildlife that depends on this type of habitat.

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Potential Constraints:

- Summer months flows are relatively high due to the un-natural containment systems of the locks and dams.
- Impaired flow regime does not resemble the unimpaired regime either in timing, magnitude, or duration of peak flows.
- Prescribed flow regime is the principal constraint to effectiveness
  - Unless a complementary flow regime is implemented, the created or modified topographic surfaces will not function as habitat.

- Secondary constraints include;
  - the availability of suitable substrate with which to create surfaces .
  - Potential short-term water quality impacts of in-channel construction.

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Design Considerations and Evaluation:

- New benches created or floodplain surfaces modified, require bank protection.
- Addition of rock (i.e., rip-rap).
- Bioengineering approaches (willow mattresses, ground cover, etc).
- Constructed at elevations corresponding to different magnitudes of flow to simulate a natural floodplain setting.
- Difficult to design as a self-regulating
- Probably the most challenging aspect would be estimating and negotiating the prescribed flow regime.
- Include planting or otherwise establishing vegetation
- Combining topographic and geomorphic restoration with riparian restoration

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Mast Tree Planting

- Tree mortality along the Upper Mississippi River has been positively correlated with flood duration and amplitude.
  - The bigger the better.
  - Tree species that are more flood tolerant.
- Quickly establish vegetation in the littoral zone of newly created islands in order to protect them from erosion.
  - Black and sandbar willow, silver maple

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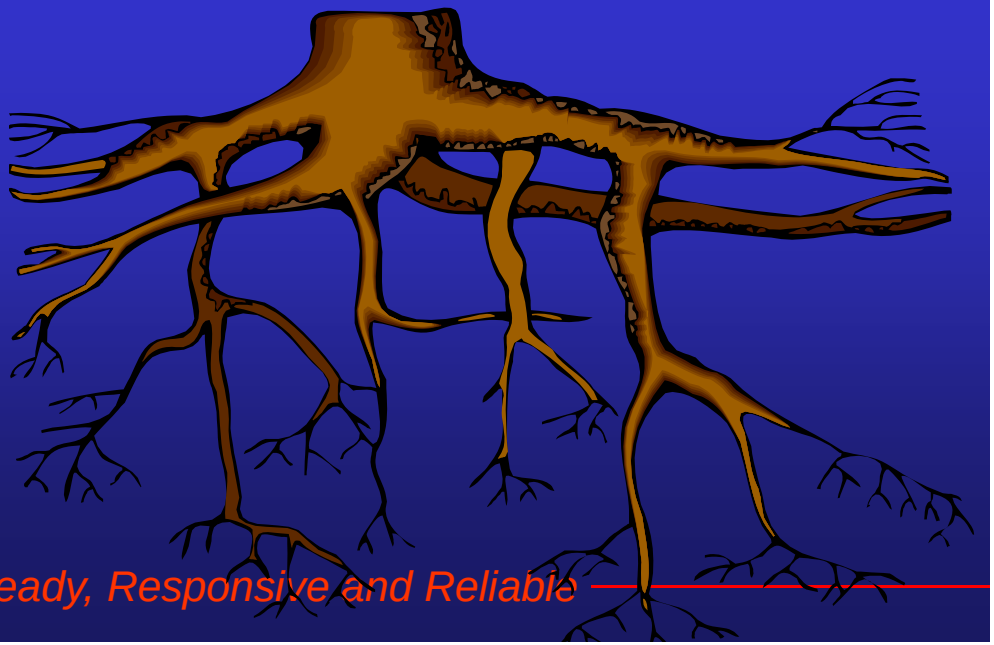
RPM Tree

- Local tree seed can be collected in the vicinity of the project site 18 months prior to construction
- Delivered to the nursery where the seed is grown into RPM seedlings.
- Average seedling height when ready for transplant is 4-7 feet.
- Robust root systems that are produced in the RPM process.
- Greater survivability



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Reforestation

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Tree Planting

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Bay Island Pin Oak after 6 growing seasons

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5 year old RPM

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Things to remember

- Tree plantings have been successfully established in both the spring and fall
- Seedling availability from nurseries is usually better in the spring.
- Plantings need weed control for a minimum of three years.
- Tree mats can provide this and are highly recommended at the time of planting.
  - Depending on the height growth of surrounding grasses, even trees with mats may need weed control for several growing seasons after they are established.

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Native Grass Planting

- Provide habitat, cover, and food sources for indigenous wildlife.
- Much of the native grasslands that once existed throughout the Midwest have been lost due to;
  - Agricultural conversion
  - Urbanization of open spaces
  - Fire suppression
  - Changes in nutrient content of surface water runoff.

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& Establishment

- A mixture of native prairie grasses including switchgrass, Indiangrass, little
- bluestem and Eastern gamma-grass is recommended.
  - A mixture has proven to support more wildlife than a solid stand of any one grass.
  - Acquire seed from a site that is within 100 miles of the restoration site in order to preserve the genetic integrity of local plant populations, (*Prairie Establishment and Landscaping)*.
- Preparation of the seedbed is one of the most important steps:
  - reduce weeds
  - facilitate planting
  - Provide a suitable bed for seed germination.
  - A good seedbed will increase the success of a prairie planting while a poor seedbed will promote failure.
- If planning a spring planting, begin seedbed prep in the fall prior to planting the following spring.

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More Considerations

- For a pure stand of grass;
  - Seed at a rate of 8 to 10 pounds per acre
- If you desire a mixed stand with numerous prairie flowers:
  - Reduce the amount of grass to 2 to 4 pounds per acre, particularly the larger grasses such as Indian grass and big bluestem.
  - Increase the amount of wildflower seed until the mixture is 60% grass and 40% wildflowers by weight

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Methods

- Reduce the exposure of the grasslands to nutrient-rich runoff.
  - Certain invasive species, (reed canary grass), are highly nutrient tolerant. When dealing with large stands of undesirable or invasive species, herbicides may be needed to kill or weaken the existing plants.
    - ♦ Habitat friendly herbicide, such as Aqua Master® is utilized in this application, as runoff from the upland areas will wind up in wetlands, streams, and rivers prior to chemical degradation, (*Better Wetlands)*
- The seed of prairie plants can be planted by a variety of methods:
  - specially made drills, no till prairie seed drill
  - rotary spreaders
  - hydraulic mulchers.
- "debearding".
  - Grasses should not total more than 6 pounds.
- Any large scale planting which does not drill the seed into the ground will require the use of a harrow to "set" the seed.
- If the conditions are suitable, and the seed viable, it should germinate within two or three weeks.

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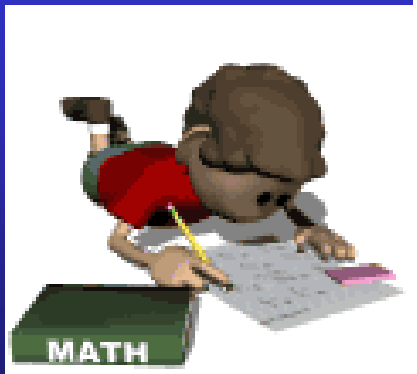
Lessons Learned

- Fine material increased the density of vegetation (both planted and naturally occurring). Coarse, sandy dredged material is a poor medium for plant growth.
- A higher percentage of seeded species were dominant on sites with more than 1 foot of fine material (68%) than on sites with less fine material (56%).
- Six inches of fine material should be the minimum used for capping.
- Fine material sites with more than 35% silt/clay had a higher average percent cover than sites with lesser amounts.
- At least 15% fines in the topsoil is sufficient to establish vegetation.
- Fine material should contain sufficient coarse material to allow for aeration and water infiltration.
- After grasslands are treated with herbicides, large amounts of dead biomass exist on the ground. It is difficult for new seeds to germinate under this biomass.
  - Prescribed burning consumes this excess biomass, preparing the soil for future new growth, (*Prairie Establishment and Landscaping*).
- Broadcast seeds that are may not reach the ground surface.
- The first year of growth most prairie plants establish their root systems.
- It may take three to six growing seasons before vegetation reaches a desired/maximum density.



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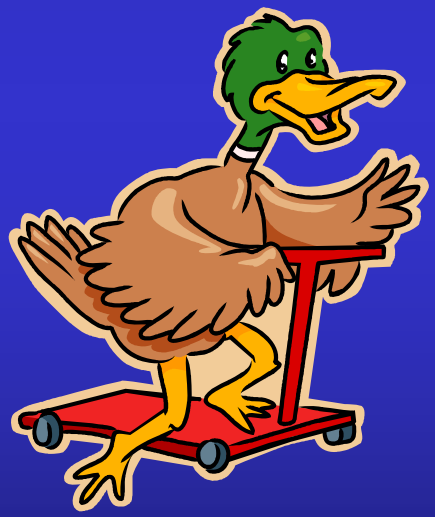
Wetland Species Planting

- Consider their primary goals.
  - For instance, water levels may be regulated differently for waterfowl benefits than for water quality improvement.



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Waterfowl

- Wetlands designed for waterfowl should be managed so that at least 50 percent of the surface area is less than 18 inches deep.
  - This will enable emergent vegetation such as cattails to become established and grow vigorously.
- The other half of the wetland can range from 2 to 6 feet deep.
- 3 to 4 feet of water is all that is necessary to assure water for duck broods.

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Water Quality

- Where water quality improvement is the primary goal, water depths should be less than 3 feet with vegetation over 75 percent of the wetland.
- Water control structures can be used to periodically drain water off wetlands to enhance plant germination and otherwise manage wetland plants.
- The control structure can also be used to increase water depths to create open water areas.
- Slow drawdowns ultimately result in more food and habitat for waterfowl and shorebirds.
- The drawdowns must be timed carefully to avoid adversely affecting invertebrates and amphibians, however.
- It's a good idea to seed the adjacent land to a restored wetland to forbs and native

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Lessons Learned

- Studies have shown that it is not necessary to plant any wetland plants in the wetland itself.
- Simply returning water to the area results in aquatic vegetation developing within two years.
- The aquatic plants that will likely grow include , (*Better Wetlands)* :
  - Prairie cordgrass
  - Arrowhead
  - Cattails sedges
  - Marsh milkweed
  - Water smartweed
  - and bulrushes.

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Questions for YOU

- How many people have successfully constructed these features in their projects?
- Unsuccessfully?
- Was their an obvious reason for the difference?
- Combinations?
- What are some of the scenarios to overcome?
- Have you? How?

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Questions from YOU