1999

1999 Platte River Basin Ecosystem Symposium Proceedings

1999 Platte River Basin Ecosystem Symposium

February 23-24, 1999: Kearney, Nebraska

Program

- 1999 Symposium Program

Forward

Over 100 people attended the Tenth Platte River Basin Ecosystem Symposium which convened in Kearney on 23-24 February 1999. Weather prevented some of the speakers from attending; however, three posters and 26 papers were presented. Comments received from the participants were generally favorable. This year the symposium broadened its charge to include more discussion on community-based environmental protection and policy-making.

The Symposium was sponsored by the University of Nebraska Cooperative Extension's Platte Watershed Program in cooperation with the U.S. Environmental Protection Agency - Region VII, the U.S. Fish and Wildlife Service, and the University of Nebraska's Nebraska Water Center/Environmental Programs.

- Part I of the proceedings contains papers submitted for publication.
- Part II contains a comple set of abstracts of oral and poster presentations.

Disclaimer: The views expressed in these proceedings are those of the author/authors and should not be construed as endorsements, recommendations, or the official position of those of the Platte Watershed Program or any of the other sponsors of this Symposium. None of the materials submitted were peer reviewed for accuracy and their content was not edited in any form.

Gary Lingle
Platte Watershed Program Coordinator

Part I: Papers

Grand Island to Columbus Platte River Corridor Initiative
William S. Whitney, Prairie Plains Resource Institute, Aurora NE

Grain size evolution of the Platte River, 1931-1998
Paul J. Kinzel III, **Jonathon M. Nelson**, **Randy S. Parker**, **James P. Bennett** and **David J. Topping**, U.S. Geological Survey, Water Resources Division, Denver CO

Control of Pesticides and Nitrates in Surface Irrigation Runoff Water
C. Dean Yonts, Irrigation Specialist and **Robert G. Wilson**, Weed Scientist, University of Nebraska Panhandle Research and Extension Center, Scottsbluff NE

Part II: Abstracts

Sandhill crane studies in the Central Platte Valley: A progress report
Gary L. Krapu and **David A. Brandt**, USGS, Northern Prairie Wildlife Research Center, Jamestown ND | Abstract

Spring-staging ecology of greater white-fronted geese, lesser snow geese, and northern pintails in the central Platte River valley and Rainwater Basin of Nebraska
Robert R. Cox, Jr., USGS, Northern Prairie Wildlife Research Center, Jamestown ND | Abstract

Migration chronology and habitat use by sandhill cranes in central Nebraska
Craig A. Davis, Platte River Whooping Crane Trust, Wood River, NE | Abstract

Larval fish studies in the lower Platte River
Cory N. Reade and **Edward J. Peters**, School of Natural Resource Sciences, University of Nebraska, Lincoln NE | Abstract

Pallid sturgeon movement in the lower Platte River
Vaughn A. Snook and **Edward J. Peters**, School of Natural Resource Sciences, University of Nebraska, Lincoln NE | Abstract

Grand Island to Columbus Platte River Corridor Initiative
William S. Whitney, Prairie Plains Resource Institute, Aurora NE | Abstract

The U.S. Geological Survey INATURES Program in the Platte River Valley - a Review
Randy S. Parker, U. S. Geological Survey, Denver, CO | Abstract

Wetland restoration in the Rainwater Basin of south central Nebraska: the Lake Seldom Project
Eric Hellriegel and **Michael Smith**, Department of Geography and Earth Sciences, University of Nebraska-Kearney, Kearney, NE | Abstract

Recent Geologic History of the Central Platte Valley
Michael Beshore, **Joseph Mason**, and **Michael Blum**, Department of Geosciences, University of Nebraska, Lincoln NE | Abstract

Central Platte River biological diversity CD-ROM
Doug Steinke, Central Platte NRD, Grand Island NE | Abstract

Investigation of factors that could lead to destabilization in reaches of the Platte River between Gothenburg and Grand Island, Nebraska
Jacqueline V. Becker and **A. Steele Becker**, Department of Geography and Earth Science, University of Nebraska at Kearney, Kearney NE | Abstract

Changes in value and ownership of Platte River accretion land during the relicensing process for Kingsley Dam 1988-1998
A. Steele Becker, Department of Geography and Earth Science, University of Nebraska at Kearney, Kearney NE | Abstract

The presettlement Platte: Prairie or wooded river?
W. Carter Johnson and **Susan E. Boettcher**, Department of Horticulture, Forestry, Landscape, and Parks, South Dakota State University, Brookings, SD | Abstract

Grain size evolution of the Platte River, 1931-1998
Paul J. Kinzel III, **Jonathon M. Nelson**, **Randy S. Parker**, **James P. Bennett** and **David J. Topping**, U.S. Geological Survey, Water Resources Division, Denver CO | Abstract

Alternative methods to enhance wet meadow habitat along the Platte River: A progress report
Mark M. Czaplewski, Central Platte NRD, Grand Island NE; **James J. Jenniges**, Nebraska Public Power District, Kearney NE; **Mark J. Humpert**, Nebraska Game & Parks Commission, Kearney NE; **Mark M. Peyton**, Central Nebraska Public Power and Irrigation District, Gothenburg NE | Abstract

Development and application of digital geographic data in the central Platte River region
Michael J. Starbuck, U.S. Geological Survey, Rolla, MO | Abstract

Control of Pesticides and Nitrates in Surface Irrigation Runoff Water
C. Dean Yonts, Irrigation Specialist and **Robert G. Wilson**, Weed Scientist, University of Nebraska Panhandle Research and Extension Center, Scottsbluff NE | Abstract

Characteristics and landscape heterogeneity of surface water chemistry in the middle Platte River valley, Nebraska (1996-1998)
Wanli Wu, School of Natural Resource Sciences, University of Nebraska-Lincoln, Lincoln, NE | Abstract

Hydrologic influences on aquatic insect diversity and emergence production from central Platte River sloughs
Matt R. Whiles, Department of Entomology, Kansas State University, Manhattan KS; **Beth S. Goldowitz**, Platte River Whooping Crane Maintenance Trust, Inc., Wood River NE | Abstract

Effects of hydrologic fluctuation on the fish and amphibian fauna of wetlands in the central Platte River
Beth S. Goldowitz, Platte River Whooping Crane Maintenance Trust, Inc., Wood River NE; **Matt R. Whiles**, Department of Entomology, Kansas State University, Manhattan KS | Abstract

Pleistocene, pre-Peorian loess (clay) lenses anomaly bodies within the Platte Valley sediments and their influence with regard to groundwater movements, in and adjacent to the Platte Valley in Central Nebraska
Larry Wells, Mid-America Mapping, Elm Creek, NE | Abstract

Social-cultural attitudes of the mid-Platte River community
John Allen, Dept of Agricultural Economics, University of Nebraska, Lincoln NE | Abstract

The economic impact of hunting and fishing on the middle Platte River in Nebraska
Ted L. Eubanks, Fermata Inc, Austin, TX | Abstract

The Platte Watershed Program - middle Platte socio-economic overview
Allan Jenkins, Dept of Economics, University of Nebraska at Kearney, Kearney NE | Abstract

Riverine Habitat Management at Audubon's Rowe Sanctuary
Paul Tebbel, Rowe Sancturary, Gibbon NE | Abstract

Nebraska Public Power District's Properties Managed for Endangered Species Along the Platte River, Nebraska
Rockford G. Plettner, Nebraska Public Power District, Columbus, NE; **James J. Jenniges**, Nebraska Public Power District, Kearney, NE | Abstract

Restoration, Management, and Habitat Use of Riverine Channel Habitat in the Big Bend Reach of the Platte River in Central Nebraska
Paul J. Currier, Platte River Whooping Crane Maintenance Trust, Wood River NE | Abstract

U.S. Fish and Wildlife Service's Partners For Fish and Wildlife Program Riverine Habitat Restoration on Private Lands
Kenneth F. Dinan, and **Kirk Schroeder**, U.S. Fish and Wildlife Service, Grand Island, NE | Abstract

Central Nebraska Public Power and Irrigation District's Riverine Habitat Management
Mark M. Peyton, Central Nebraska Public Power and Irrigation District, Gothenburg NE | Abstract

Nebraska Game and Parks Commission Habitat Management Program
Daylan Figgs, NGPC, Kearney NE | Abstract

10th PLATTE RIVER BASIN ECOSYSTEM SYMPOSIUM

Program

Tuesday, February 23

8:00 am **Registration** (Ramada Inn Lobby)

8:30 am **Opening Remarks**, Gary Lingle, Platte Watershed Program Coordinator, University of Nebraska Cooperative Extension

8:40 am **Biology** Moderator Mark Peyton

**Sandhill crane studies in the Central Platte Valley: A progress report.* Gary Krapu & David Brandt, Northern Prairie Wildl. Res Center. CANCELLED.

**Spring-staging ecology of greater white-fronted geese, lesser snow geese, and northern pintails in the central Platte River valley and Rainwater Basin of Nebraska: preliminary results.* Robert Cox, Jr., Northern Prairie Wildl. Res Center.

***Migration chronology and habitat use by sandhill cranes in central Nebraska.* Craig A. Davis, Platte River Whooping Crane Maintenance Trust (PRWCMT).

**Larval fish studies in the lower Platte River.* Cory R. Reade and Edward J. Peters, UNL School of Natural Resource Sciences.

**Pallid sturgeon movement in the lower Platte River.* Vaughn A. Snook and Edward J. Peters, UNL School of Natural Resource Sciences.

10:20 am **Break** (with refreshments)

10:40 am **Information & Education** Moderator Dr. Tom Franti

* *Grand Island to Columbus Platte River Corridor Initiative.* William S. Whitney, Prairie Plains Resource Institute.

11:00 am **Agency Update** USFWS, NRCS, USGS, DWR (invited)

12:00 noon **Luncheon.** ***Adaptive Resource Management Introduction***. Dr. Steve Light, Minnesota DNR, St. Paul, MN.

1:00 pm **Habitat/GIS** Moderator Dr. Allan Jenkins

***Wetland restoration in the Rainwater Basin of south central Nebraska: the Lake Seldom Project.* Eric Hellriegel, Dept of Geography & Earth Science, UN-K.

**Recent geologic history of the central Platte Valley.* Michael Beshore, Joseph Mason, Michael Blum, Dept of Geosciences, UN-L. CANCELLED.

***Central Platte River biological diversity CD-ROM.* Doug Steinke, Central Platte NRD.

** Investigation of factors that could lead to destabilization in reaches of the Platte River between Gothenburg and Grand Island, Nebraska.* Jacqueline V. Becker and A. Steele Becker, Dept of Geography and Earth Science, University of Nebraska at Kearney

** Changes in value and ownership of Platte River accretion land during the relicensing process for Kingsley Dam 1988-1998.* A. Steele Becker, Dept of Geography and Earth Science, UN-K.

***The presettlement Platte: Prairie or wooded river?* W. Carter Johnson and Susan E. Boettcher, Dept of Horticulture, SDSU, Brookings, SD.

2:40 pm **POSTER PRESENTATIONS** (with refreshments)

**Grain size evolution of the Platte River, 1931-1998.* Paul J. Kinzel III, J. Nelson, R. Parker, J. Bennett, and D. Topping, USGS, Denver.

**Alternative methods to enhance wet meadow habitat along the Platte River: A progress report.* Mark M. Czaplewski, Central Platte NRD; James J. Jenniges, Nebr. Public Power District, Mark Humpert, Nebr. Game & Parks Comm; and Mark Peyton, Central Nebraska Public Power & Irrigation District.

**Development and application of digital geographic data in the central Platte River region.* Michael J. Starbuck, USGS, Rolla, MO.

3:10 pm **Water/Hydrology** Moderator Beth Goldowitz

*** Control of Pesticides and Nitrates in Surface Irrigation Runoff Water.* C. Dean Yonts and Robert G. Wilson, UN Cooperative Ext, Scottsbluff.

**Characteristics and landscape heterogeneity of surface water chemistry in the middle Platte River valley, Nebraska (1996-1998).* Wanli Wu, UN-L School of Natural Resource Sciences. CANCELLED.

***Hydrologic influences on aquatic insect diversity and emergence production from central Platte River sloughs.* Matt R. Whiles, Dept of Entomology, Kansas State University and Beth S. Goldowitz, PRWCMT.

***Effects of hydrologic fluctuation on the fish and amphibian fauna of wetlands in the central Platte River.* Beth S. Goldowitz, PRWCMT and Matt R. Whiles, Dept of Entomology, Kansas State University.

Pleistocene, pre-Peorian loess (clay) lenses anomaly bodies within the Platte Valley sediments and their influence with regard to groundwater movements, in and adjacent to the Platte Valley in Central Nebraska. Larry Wells, Elm Creek, NE.

4:50 pm **Adjourn**

5:45 pm **Dinner** (optional, please pre-register)

6:30-9:00 pm **EPA's Mid-Platte Community-based Environmental Protection Initiative** Moderator Robert Fenemore.

***Social-cultural attitudes of the mid-Platte River community.* John Allen, Dept of Agricultural Economics, UN-L.

** *The economic impact of hunting and fishing on the middle Platte River in Nebraska.* Ted L. Eubanks, Fermata Inc, Austin, TX.

***The Platte Watershed Program - middle Platte socio-economic overview.* Allan Jenkins, Dept of Economics, UN-K.

Wednesday, February 24

7:30 am **Registration** (Ramada Inn Lobby)

8:30 am **Adaptive Resource Management (ARM)**

Platte Watershed example via the Cooperative Agreement. Dale Strickland, Governance Committee Exec. Dir, Cheyenne.

National perspective. Steve Light, Minnesota DNR, St. Paul.

10:15 am **Break** (with refreshments)

10:30 am **Expert Panel Discussion on Riverine Habitat Management** (3 of 6 panelists) Audubon's Rowe Sanctuary, Nebraska Public Power District, U.S. Fish & Wildlife Service, Platte River Whooping Crane Trust, Central Nebraska Public Power & Irrigation District, Nebraska Game & Parks Commission.

11:30 am **Discussion; ARM Feedback**

12:00 **Luncheon**. ***Historical perspectives of the Platte: Ft. Kearny.*** Gene Hunt, Superintendent, Ft. Kearny State Historical Park, Kearney NE.

1:00 pm **Expert Panel Discussion on Riverine Habitat Management con't** (3 of 6 panelists)

2:00 pm **Discussion; ARM Feedback**

2:30 pm **Adjourn until 2000!**

This symposium is partially sponsored by the U.S. EPA Region VII

* =progress report ** =completed research

Grand Island to Columbus Platte River Corridor Initiative

William S. Whitney, Prairie Plains Resource Institute, 1307 L St, Aurora NE 68818, (402) 694-5535, Fax (2231), ppri@hamilton.net

The Platte River Valley grasslands and river channels in Hamilton, Merrick, Butler, Platte, and Polk Counties represent a set of unique public and private resources important to the area's future. Under private ownership in the past this landscape has been maintained as an open agricultural area - a combination of natural river lands mixed with cropland, native rangeland and hay meadows. Under this land use regime there was also recreational use by the public based on farmers and ranchers granting friends and acquaintances access.

Recent times have brought about major changes in the valley that are now accelerating. The population is increasing - a trend projected to continue - especially in the larger towns of Grand Island, Kearney, and Columbus. People are more mobile, therefore more willing to live away from towns, and many are able to afford new homes in scenic surroundings. This may soon create a market momentum that will rapidly drive land uses away from agricultural open space and toward residential use.

There is a similar market trend toward privately-owned hunting lands along the river. This parallels a rising public demand for many different types of recreational opportunities. It will become increasingly difficult to provide such opportunities for a growing population in light of the increasing competition for land. [There only three small public access areas between the Grand Island Highway 34 bridge and Columbus: Bader Park near Chapman, Tooley Park near Marquette, , and the Syas Wildlife Area near Silver Creek.]

Finally, demographic and economic changes in agriculture are in many areas contributing to a marginalization of lands that generate less revenue, such as bluff grasslands. In our area, as opposed to ranching regions like the Sandhills, landowner attention is put into croplands, while management and restoration of rangelands, especially the smaller acreages, is a lower priority. Therefore, for example, a growing tree problem is getting worse on many upland range sites because it is not worth the effort or expense to reclaim the prairie. To many of these landowners it may be more desirable at some point to cash in this declining resource base for home sites.

Who can blame anyone for wanting to live in an area rich in scenic beauty, wildlife, and recreational opportunities? The trouble is that there is not enough land to serve unlimited individual desires, and to protect public values and ag land, without encountering serious problems down the road. One of these future concerns, for example, is the strain that unlimited moderate- and high-density development may create on rural tax-supported public services. At some point many of the best things about the corridor will be negatively impacted by the consequences of unplanned development. It's happening all around the country and can happen here very quickly - perhaps within a decade.

If these trends continue, we will see the future river valley still in the hands of private landowners, but the nature of ownership and land use will be vastly different. The rural character of the corridor will become more urban. There will be be more landowners with smaller parcels, followed by more houses, roads, more and larger sandpit complexes with high-density residential

construction, more weedy tree growth, more demands for services that might not be covered except by higher property taxation, etc. Along with these changes we will see less opportunity and potential for the public to enjoy prairie and river lands close to home, there will be less variety and abundance of many species of plants and wildlife, and ag use will become even more marginal.

Development in this Platte corridor is going to happen one way or another. Development is not all bad - it depends how it is done. It can happen in a way that is complementary to other land uses.

There are two choices: 1) to manage Platte corridor development, trying to make it fit within broad definition of the public interest, or, 2) let development and market forces take their own courses, leaving present and future landowners, natural resource managers, and policy makers to deal in a crisis-oriented way with more intense future resource conflicts, and a variety of inevitable negative environmental consequences.

Prairie Plains Reource Institute stands behind the first option. There are many unique aspects about the local Platte Valley (listed below) that are part of the public trust. They should be protected, restored, and maintained for future generations. Protection of this public trust can best be accomplished if we maintain the rural openness of the landscape, if we protect, restore, and manage the native grasslands and river frontage in large tracts, and if we educate people about natural resources, agriculture, water, nature, and local history so that they care about and understand this valuable cultural and natural resource. Doing this will also create local economic development opportunities that will benefit from protection of the rural scenic and natural corridor.

Native prairie grassland is the best design possible for groundwater recharge, runoff control, surface water filtration, domestic well field buffer areas, floodwater retention and naturally regulated water return to the stream. These grasslands are also habitat for countless native plants and wildlife that are part of the area's prairie heritage, and are a source of recreational enjoyment by the area's population. Also, the most scenic and many of the most historic sites of the County are contained in the grassland hills and floodplains of the Platte Valley.

To trade off the corridor grasslands for unplanned development on the hills and around sandpits in the valley is sure to bring impacts on water management and quality, hunting and other recreational opportunity, wildlife and plant conservation, and continued agricultural use.

Corridor planning, along with protection and restoration of large tracts of native grasslands subsequently managed within a ranching context, can provide for an array of public and private purposes.

Scenic landscape preservation

Education (e.g., our SOAR Program, educational areas like the Olson Nature Preserve in Boone County, and Bader Natural Area)

Recreation (river & bluff access for hiking, camping, swimming, fishing, etc. - variable and dependent on each particular site)

Preservation of the native ecological diversity of plants and wildlife (prairies, wetlands, river areas

including some riparian woodlands)

Archeological and historical preservation (Pawnee burial & village sites such as the Clarks site, historic trail sites, dwellings, etc.)

Maintenance of a sustainable low-input agricultural resource

Ecosystem services (groundwater recharge, flood retention, runoff control, water filtration)

Economic development (desigation of specific developments to acceptable sites that will complement the scenic and natural corridor; also development of new sustainable economic activities that can benefit from the corridor concept)

Something that we believe is negative cannot be changed unless we offer a better alternative. It is best to be pro-active, and to promote something positive that will allow numerous players to see potential. For a corridor scenario such as this to succeed a consortium of participants needs to apply imagination, initiative and dollars to the task. This includes collaborations among institutions such as local city and county governments, local economic development corporations, local, state and federal agencies such as NRDs, NRCS, EPA, NDEQ, etc., farm organizations, civic service groups, sportsman groups, educational institutions, and private businesses and industry. Accomplishing such a vision will also require an effective partnership with many individuals, especially with private landowners.

The tools for land protection, grassland restoration & management, and education available to PPRI include:

Conservation Easements Acquisition via negotiated purchases (full-market or bargain sales from a willing seller) or gifts of perpetual conservation easements; restrictive in nature and tailor-made between the grantor and grantee. Normally a conservation easement outlines the elements of the land resource that are being protected, the management and development activities that are acceptable, and those that are explicitly prohibited. Easements require ongoing monitoring and enforcement by the easement holder.

Fee Simple Acquisition Full title acquisition via gift, bargain sale, or full market purchase (depending on tax situation of seller/donor).

Fee Acquisition and Re-sale with an Attached Conservation Easement This involves fee simple acquisition by the land trust, then re-sale to a private landowner with a conservation easement attached to the deed and held by the trust. Money from the re-sale can be turned over and put toward purchase of another piece of land. During trust ownership period improvements can be made (wells, fences, etc.) and the prairie restored; then land can be sold in restored condition.

Leases Long- or short-term leases. This is not as good a tool for long-term protection, but it can be a flexible short-term method to accomplish some goals.

Geographic Information System (GIS) This consists of computerized aerial photos and data, plus information from surveys on the ground. PPRI can identify and prioritize landscape components with regard to the valley's unique elements (listed in #1-8 above, vulnerability to haphazard developments, and best potential for planned developments of various types (clustered housing,

sand & gravel operations, etc.)

Information, and Technical Assistance Outreach Much like Cooperative Extension outreach, PPRI can work with landowners (farmers, hunters, and small acreage residents) to educate them about their land resources and offer assistance in prairie restoration and management; also informing them about how their lands fit into an overall conservation scheme for the corridor.

Prescribed Fire/Timber Removal Removal of excess woody growth is necessary to reclaim bluff grasslands. We can increase fire management assistance to private landowners, including easement partners.

Diverse Prairie Restoration Lands such as marginal sandy or wet croplands and abused rangeland can be restored back to diverse prairie condition which can serve multiple purposes such as native plant and wildlife conservation, agricultural rangeland production, and specified recreational uses.

Infrastructure Improvements In order to make lands self- supporting as far as paying for their own upkeep and taxes, and allowing rangeland renters a prime resource, and general land management flexibility, PPRI can restore and develop infrastrusture improvements on its land.

Public Education Programs for All Ages Long-term stewardship of the corridor depends on educating present and future generations of local citizens about the resource through programs such as SOAR (Summer Orientation About Rivers) and by creating educational preserves such as the Olson Nature Preserve near Albion which is being used by many Boone County schools and civic groups.

Rangeland Bank/Grazing Coop A rangeland bank or grazing coop can offer management flexibility to participating landowners. Land in the bank can be used to take use pressure off of lands that need some time to recover from over-use, or it can become a grazing safety valve during drought.

Grassland protection on a large scale is not a matter of a land trust entity buying out all private interests and locking the resource up with no use. PPRI does not have the money to do that even if it wanted to (and we don't want to, anyway!). A large-scale protected landscape as envisioned here will be a combination of farmer/rancher-owned tracts and small residential acreages under easements, and a few clusters of land trust-owned lands. Under this scenario all property taxes will paid, and almost all land will have agricultural use (unless too small or too forested). If PPRI land is re-sold with an easement attached it will have an agricultural price to a prospective buyer (i.e., development rights would be restricted by the easement - thus the land will have no development value). Grazing of trust-owned land will be based on local grazing rent rates. In effect, the protected landscape will become a long ranch along the river with multiple owners.

Construction development will still undoubtedly occur in many areas - hopefully within a planning context. Therefore, the new-construction tax base is bound to rise despite the freezing of values at ag levels on the protected river lands.

Depending on the particulars of each area, there will be additional uses of lands which will include education program use, agricultural/scientific research, compatible and controlled public recreation such as hiking, biking, camping, hunting, equestrian use, river access, limited residential

and commercial recreational cabin building developments, etc. Recreation areas will become ever more important in the community economic development plans of local towns.

Other Platte Valley Corridor Thoughts

Clustering building developments along the corridor is more desireable than using a zoning acreage limitation that gradually chops the landscape up into small parcels. Such developments should be limited to those places that are not the most scenic, that are not the largest grassland tracts, and are not unique archeological or historic areas (i.e., protect the special places). Yet, they can occur near these unique areas, and can still be kept off of top quality farmland.

PPRI would like to establish a number of preserves dedicated primarily to educational use (such as PPRI's Olson Nature Preserve or Bader Natural Area) between Grand Island and Columbus. Each of these would be a location for our SOAR Program, places for local schools to run their own similar programs for students, and a site to train educators about natural resources, to teach about science, nature, local history, land management, and agriculture. Some sites should include farmland in addtion to prairie, river, wetlands, and woodlands, making the sites valuable technical training and leadership development sites for youth entering all natural resource fields. Each would involve volunteers and educators in ongoing stewarship activities, and act as demonstration areas for prairie restoration and management.

Very marginal too-sandy or too-wet croplands in the corridor should be restored back to prairie. These lands are perhaps more important for water quality (filtration, recharge, flood retention, etc.) and biodiversity concerns, and can still be agriculturally managed as range or hayland.

The invasion of trees in the existing native grasslands should be reversed. The best wildlife habitat potential of these prairies is as well-managed prairie. People, particularly small acreage residents, are mistaken about the wildlife value of letting trees take over the rangeland or planting more trees for wildlife on their acreage. The best wildlife lands will be the big grasslands adjacent to the riparian forest of the river bottomland. If grassland tracts include as little as 10% trees as island-type stands within the prairie, this is conducive to large game populations, and if these sites contain a lot of prairie plant diversity many more animal species will be attracted to the area.

PPRI would like to restore native diversity of this rangeland through interseeding of plant species, the use of fire, appropriate sustainable grazing intensities, and haying and grazing rotations. Diversity will improve the nutritional quality of the range as well as wildlife diversity and abundance.

Establish a few of the most scenic and larger rangeland tracts, particularly a few that also are adjacent to the river, as multiple-purpose public recreational use areas for hikers, fishermen, equestrian groups, or scouts? Again, it could be possible with careful people management to have rangeland use compatible with some recreation.

Partner with developers in the creation of low-density planned development areas, for example, some recreational cabins could be constructed to accomodate seasonal rental use by tourists; some private cabins and homes could be constructed by local residents; and surrounding areas could have various public uses for outdoor recreation - all in complement to the other and in a natural setting.

Encourage capitalizing on new economic opportunities that could exist due to a corridor plan - related to recreation and tourism, education, ag and land reclamation services, etc., e.g., Elderhostel education, Bed & Breakfasts, River Valley Festivals, Family Range Camp (State Society for Range Management)

Create a demonstration project of an environmentally sensitive gravel operation. It could show and interpret: 1) balanced attention to site selection and land-use tradeoffs, 2) a well-designed mining plan from beginning ground breaking through reclamation, including renderings showing size, relationship to the river and surroundings, bank configuration, depths, wetlands, restored prairie, etc., 3) a proposed limited and strategically planned building development, including waste treatment, storm drainage and other public works concerns, landscaping, etc.). [a sandpit demonstration may occur best under broad-based partnerships between landowners, public agencies, counties, and trusts]

Grain-Size Evolution of the Platte River, 1931-1998

Paul J. Kinzel III, **Jonathon M. Nelson**, **Randy S. Parker**, **James P. Bennett** and **David J. Topping**, U.S. Geological Survey, Water Resources Division, Box 25046, Denver Federal Center, Denver CO 80225, (303)236-5001, Fax (5034)

The research presented in this paper was motivated by a need to supplement historical data related to the sizes of material making up the bed of the Platte River with recent measurements to satisfy two elements of the USGS Platte River Integrated Natural Resource Science (INATURES) Program. The first element (Channel Characteristics and Morphology) involves investigating and documenting any historical trends apparent in previously collected data. The second element (Sediment Transport Modeling) involves utilizing the data and historical trends as a framework for the development of predictive models. Changes in the size distribution of bed material can have a tremendous effect on the sediment discharge characteristics, and, therefore, on the potential for altering channel morphology using available streamflow.

Methods and Materials

In the early 1930's the U.S. Army Corps of Engineers, as part of a general plan for the development of the Missouri River Basin, investigated the sediment characteristics of the Missouri River and its major tributaries. Their investigations along the Platte River were designed "…to determine the nature and quantity of sedimentary material transported by the Platte River and its tributaries…" (Chief of Engineers, United States Army, 1935). In addition to sampling suspended sediment (silt), 159 bed sediment samples were collected along the Platte River between Gothenburg and Plattsmouth, Nebraska, during August 1931. Eight sites along the Platte River were selected and samples were obtained at a number of points across the channel cross-section with an "orange peel bucket" commonly used for well digging. The sampler was deployed from a bridge until it reached the river bottom where it closed watertight. The grain-size distributions of all the samples were measured at ½ (intervals (one phi unit is the -log2D; where D is the grain diameter in units of mm).

During August 1998, we repeated bed-material sampling at five of the eight sites sampled during 1931: Gothenburg, Kearney, Grand Island, Duncan, and Schuyler (Figure 1). A BMH-60 bed-material sampler was deployed at each site from a bridge with the aid of a bridgeboard using the methods described by Guy and Norman, (1970). The size distribution of these samples was determined by dry sieving the samples at ½ (intervals.

The grain-size distributions of every sample from a site were averaged across each size class to produce a composite size distribution for that site. The median grain-size or D50 (size for which 50 percent of the sample is finer) was computed from the composite size distribution of the site.

Results and Discussion

The temporal and spatial variability of median bed-material grain size in the 'Big Bend' reach of the Platte River is illustrated in Figure 2. The 1931 data were characterized by medium sand sizes from Gothenburg to Schuyler with little variation in D50. The 1998 data indicate that over the intervening 68 years the bed material of the Platte River has coarsened from Gothenburg to

Duncan, with median grain size at Kearney increasing by almost a factor of three. Downriver from Kearney the difference between the present-day median and the past median decreases in magnitude to the confluence of the Loup River where median grain sizes are in close agreement with 1931 values.

The coarsening of the bed material depicted in Figure 2 is a characteristic response of alluvial rivers to upstream dams (Williams and Wolman, 1984). Reduction of the supply of sediment to a river reach can affect the size distribution of the bed material. A comparison between 1931 and 1998 data of the amounts of material finer than sand (0.0625 mm) in bed-material samples is shown in Figure 3. The larger percentage of fine material at the Schuyler site in 1931 and 1998 reflects the addition of fine-grained material from the Loup River. In addition, the amount of material finer than sand present in the bed material seems to have decreased significantly from 1931 to 1998 at all sites.

The spatial and temporal variability of grain size at a single cross section is illustrated in Figure 4. Figure 4 shows the median grain size of individual bed samples from the cross section at Kearney as a function of the distance across the channel bed. The median grain sizes from individual bed samples obtained in 1931 are noticeably finer than those obtained in 1998. In addition, there is greater variability in the median sizes of individual bed samples obtained in 1998 across the channel bed than those obtained in 1931. There are bed samples from 1998 that have median sizes that approximate the median sizes from 1931, which suggests that certain portions of the channel may have coarsened more than other portions of the channel. It is also interesting to note the channel width sampled in 1931 is much larger than that sampled in 1998, evidence of a change in morphology of the river.

Conclusions and Implications

Spatial and temporal grain-size changes in the Platte River from 1931 to 1998 probably reflect the reduction of sediment inputs from the North Platte River due to regulation of the river by dams in this time period. Changes in the size distribution of the riverbed are important because, in the absence of tributary inputs, the sediment-transport capacity of the Platte River is inextricably tied to sediment sizes on the bed. A coarser riverbed implies that, for the same boundary shear stress on the bed, the post-regulation riverbed is less mobile and less dynamic than prior to regulation. Thus, efforts to use streamflow to modify the existing channel morphology along the 'Big Bend' ultimately may be constrained by the bed sediment sizes available to be mobilized.

The next step to understanding the changes in grain sizes in the Platte River is to develop a model that adequately predicts the spatial and temporal evolution of grain sizes along the 'Big Bend' reach following a reduction in upstream sediment supply. Currently our efforts are focused on using a one-dimensional model to predict grain-size change and bed evolution. In the future, we plan to supplement the model with site-specific investigations, which will examine local morphologic effects of changing sediment supply and input hydrographs to a river reach. These investigations will be accomplished using multi-dimensional flow and sediment-transport models.

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CONTROL OF PESTICIDES AND NITRATES IN SURFACE IRRIGATION RUNOFF WATER

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Nebraska has 8.5 million acres of irrigated land (Irrigation Journal, 1994) Of this total, 4.1 million acres are surface irrigated. Nearly 800,000 acres rely on surface water storage for irrigation. Water plays a key role in the economic viability of agriculture. Quality water plays a key role in the economic viability of the public in general.

In the North Platte river valley of Western Nebraska, surface water is the primary source for irrigating 400,000 acres. Water is diverted from the river into canals and on fields for irrigation. Runoff water drains into canal systems where it is used to irrigate fields down gradient. This process continues through the river system. The use and reuse of water provides the potential for contamination with agricultural chemicals. Few studies have addressed the potential problem associated with contamination of water when surface irrigating.

From April to June of 1991, the U.S. Geological Survey sampled various locations of the Platte river and found that the concentration of atrazine exceeded the maximum contaminant level in 40% of the samples, and alachlor exceeded the maximum contaminant level three times during a six week period (Schulze, 1991). Contamination during this time period would coincide with the spring application of herbicides and when rainfall amounts are relatively high.

Research on Precipitation Runoff in Agricultural Fields

Research has focused on the runoff of chemicals in water due to precipitation. In a study by Hall, et al., (1972), atrazine losses in runoff water and soil sediment averaged 2.4% and 0.16%, respectively, of the total atrazine applied. In this study, soil core samples were taken at varying times after application. A total of 67.9% of the atrazine applied was still present one month after application. After 18 months, there was 5.4% of the atrazine applied still present in the soil.

The effects of residue cover on the rate of pesticide loss were examined by Baker, et al., (1978), Baker, et al., (1982) and Kenimer, et al., (1987). The results of those studies, which compared residue levels to the amount of pesticide loss, found that increased levels of residue would decrease the amount of pesticide lost. These studies were all conducted under simulated rainfall conditions.

The use of vegetative filter strips have been researched as methods to remove chemicals and sediment from the runoff water. In the first of two similar studies using rainfall simulators, Dillaha, et al., (1989), concluded that an established orchard grass filter strip was nearly as effective in removing nitrogen and phosphorus as in removing sediment. In the second study, Magette, et al., (1989), using fescue for a vegetative filter strip, made the following four conclusions. 1) The performance of vegetated filter strips in reducing nutrient losses from agricultural lands is highly variable. 2) Vegetated filter strips are more effective in removing suspended solids from runoff than in removing nutrients. 3) Vegetated filter strips appear to be

less effective in reducing nutrient and suspended solids losses in runoff as more and more runoff events occur. 4) The performance of vegetated filter strips generally diminishes as the ratio of vegetated to unvegetated area decreases. In their study, the ratio of vegetated to unvegetated area ranged from .21 to .42.

Research on Irrigation Water Runoff in Surface Irrigated Fields

There is little information in the literature relating chemical runoff with furrow irrigation. Wauchope (1978) did a review on the pesticide content of surface water draining from agricultural fields. Of the studies that were reviewed, only three, of the nearly ninety studies, looked at irrigation runoff from surface irrigated fields. For the majority of the pesticides used at that time, losses were 0.5% or less of the amounts applied. This held true unless rainfall occurred within a 1 - 2 week interval after application resulting in runoff.

Runoff losses were studied by Baker and Laflen (1979) as affected by wheel tracks. In their study, herbicide loss was increased in the wheel tracks when compared to discing to incorporate the herbicide. In another study, Evans and Duseja (1973) studied the effect of surface irrigation on the movement of chemical from treated alfalfa. The plots were sprinkler irrigated to leach the chemical into the soil and furrow irrigated four days later. Infiltration into the soil and dilution reduced concentrations within a few hundred yards.

Hobson (1994) used straw mulch in the furrow to reduce chemicals in irrigation runoff water. As a result of this project, Shock, et al., (1992) indicated in their abstract that straw mulch had a significant effect on infiltration, water runoff, soil loss, nitrogen loss and phosphorus loss. Season-long sediment loss averaged 110 Mg/ha without straw and 23 Mg/ha with straw.

To address these concerns, we conducted field studies to determine the quality of water in the North Platte River and canal systems supplied by the river. In addition the presence of agricultural chemicals in surface irrigation runoff water was studied. In separate trials, vegetative strips were evaluated for their effectiveness in reducing the agricultural chemical load in surface irrigation runoff water.

The objectives of this project were to:

1) Determine the level of agricultural chemicals in surface irrigation runoff water.

2) Evaluate the effectiveness of vegetative filter strips to reduce agricultural chemicals in surface irrigation runoff waters.

PROCEDURES

River/Canal Sampling

The North Platte river was sampled in 1993 and 1994 over a seven-day period at the beginning and end of each irrigation season. Water samples from the river were collected manually at a point just before the diversion into the canal system and at a point downstream where the canal spillway returns water to the river.

Water samples were taken at three locations in the Farmers canal. Samples were collected at the

beginning, middle and end of the 65-mile canal. Sampling of the canal was done over a 24-hour period using automatic water samplers. Water samples were collected during the same seven-day period that the river was sampled.

Field Runoff Sampling

Field inflow and outflow water samples were collected from selected fields treated with the chemicals being tested for. Within each field, three furrows were selected at random. Field length averaged 250 m, and a field slope between 0.2 - 1%. Water samples were collected in each furrow when water first reached the end of the field and then at 15 minutes, 30 minutes, 1 hour, and 8 hours. For a given chemical water samples were collected from the same field during the first, second, and third irrigation. Sterile bottles were used to collect an approximately 10 ml water sample for each chemical. To test for nitrate, 200 ml water samples were collected. Furrow inflow and outflow was measured in each furrow using V-notched trapezoidal flumes. Nitrogen fertilizer; the herbicides atrazine, alachlor, cyanazine, and 2,4-D; the insecticide carbofuran; and the nematicide aldicarb were tested for in this study. All chemicals were field applied at labeled rates.

Vegetative Filter Strips

The soil was a Tripp very fine sandy loam with a slope of 0.2 percent. Three vegetative filter strip treatments were used and included smooth bromegrass, intermediate wheatgrass and bare soil. Plots were established using a randomized complete block design with four replications. Plant density was determined after establishment for each of the vegetative treatments.

Vegetative filter strip plots were planted 5 ft wide in lengths of 5, 10 and 15 ft. The 5-ft width simulated the width of runoff from a single irrigation furrow. Borders were constructed to maintain runoff flow within each plot. Runoff from the test plots was contained within the test site

A 1000-gal solution of the chemicals being tested was tank mixed and applied to the plots at a rate of approximately 4 gal/min per furrow. This 4 gal/min rate represented the approximate runoff rate measured from the end of surface irrigated fields. Water samples were collected of the tank mix and of the outflow from the vegetative filter strips. Outflow samples were taken of the initial water, at 15 minutes, 30 minutes, and when inflow stopped. Total inflow and outflow volume from each plot was measured using orifice meters and V-notched flumes. Chemicals were mixed to obtain a minimum concentration of 10 ppm for nitrate, 3 ppb for Cyanazine, 5 ppb for Alachlor, 3 ppb for Chlorpyrifos, 50 ppb for 2, 4-D, and 5 ppb for Atrazine.

River, Canal and Field Runoff Analysis

All water samples were analyzed to determine the chemicals in solution using the enzyme immunoassay developed by Ohmicron. The enzyme immunoassay has been shown to be a reliable method of pesticide analysis (Van Emon, et al., 1989). Nitrate analysis was done using a spectrophotometer. All pesticide and nitrate samples were frozen and later thawed when they could be analyzed.

RESULTS

River, Canal and Field Runoff

Results of the river, canal and field runoff water samples for the chemicals tested during 1993 and 1994 are summarized in figures 1 - 7 and 8 - 14, respectively. Given in each figure are analysis of river and canal water samples for both early and late in the irrigation season. Also given for three irrigation events is water runoff rate and the corresponding chemical concentration.

Figure 1 shows the results for nitrate analysis in 1993. Early in the season nitrate concentration in the river and canal were at a near constant level of 0.5 ppm, except in the river after the canal returned to the river. Nitrate concentrations at that point were at 1.5 - 2.0 ppm early in the season. Late in the season, nitrate concentration, although similar to early season, was much more variable. In the field runoff samples nitrate concentration in the runoff water was only slightly higher than the source water and changed little over time. The second irrigation did have higher levels of nitrates during the initial surge of water. Nitrate was the only chemical detected in the source water for all irrigations in both 1993 and 1994 trials.

In figure 2, late season sampling in the river and canal produced more detectable concentrations of cyanazine than early in the season. In the field analysis, the concentration was highest at the initial surge of water at the end of the field. Within one hour, the concentration was near zero for the first irrigation and was not detectable for the other irrigations. Alachlor concentration, figure 3, shows only one detectable sample in the river after the canal returned water to the river. The field analysis showed elevated levels in the early runoff and minimal but detectable levels after eight hours.

There were no detectable levels of Aldicarb found in the river or canal, figure 4. In the field, concentrations were detected after eight hours. The highest level occurred with the first runoff water. Atrazine, figure 5, was detected in the river after the canal and midway and at the end of the canal during the late season sampling. Atrazine was detected in the runoff water up to 30 minutes after initial runoff began for the first and third irrigations. Concentrations were elevated in the initial surge of water moving through the field.

No 2,4-D was detected in the river or canal, figure 6. In the field, concentration was highest during the initial surge of water for the first irrigation. Concentrations were zero for the second and third irrigation except for the initial sample of the third irrigation. Carbofuran, figure 7, was not detected in the canal, river or in field runoff.

Figure 8 begins the results for 1994 and shows the results of nitrates. In the river and canal samples nitrate levels were variable for both early and late season. In the field runoff samples, nitrate levels were only slightly higher than the source water.

Cyanazine, figure 9, was not detected in the river or canal water samples. In the field cyanazine was detected for one hour during the first irrigation, 30 minutes during the second irrigation, and for 15 minutes during the third irrigation. Alachlor, figure 10 was not detected early in the season in the river or canal but was detected four out of seven days in the late season sampling. The field runoff samples were detected up to eight hours after runoff began.

There was no aldicarb, figure 11, found in river or canal samples. In the field aldicarb was present

only in the initial surge of runoff water for all irrigations. Atrazine, figure 12, was found at low levels early in the season in the river and canal and detected twice in the canal late in the season. The field runoff samples show declining concentrations in the runoff with time and was still detected after eight hours for all irrigations.

In the river and canal samples, 2,4-D(figure 13) was detected at one point in the canal late in the season. In field runoff, 2, 4-D was detected in the initial runoff water for the first two irrigations. Carbofuran, figure 14, was detected only one day in the canal during the early season. Field runoff concentrations was zero for irrigations one and two and detected at low levels through eight hours for the third irrigation.

Chemical concentration calculated for the total volume of surface irrigation runoff water is given in Table 1. All chemicals were found to be well below the maximum contaminant level or life time health advisory.

Vegetative Filter Strips

Plant density in the vegetative filter strip treatments are given in Table 2. Table 3 gives the chemical concentrations for the six chemicals tested in the vegetative filter strip treatments. The results of the chemical concentrations found in the outflow from the vegetative filter strips do not show a distinct pattern. Cyanazine and Chlorpyrifos did have slightly lower outflow concentrations compared to inflow concentration for both trials in 1995. Chemical concentration for the bare soil treatment was similar to the bromegrass and wheatgrass treatments. Chemical concentration was also similar among the three filter strip lengths tested.

CONCLUSIONS

There were no significant chemical concentrations found in either the canal or river system during the early and late part of the irrigation season. Our results show that water from surface irrigation runoff has greater concentration of agricultural chemical in the initial runoff water. Chemical concentration decreased over time for all chemicals. Because the quantity of water at the beginning of runoff is small and chemical concentration decreases as runoff volume increases, chemical concentration in the total volume of runoff water was well below the maximum contaminant level or lifetime health advisory for all chemicals tested.

Vegetative filter strips were not effective in reducing the agricultural chemical load using smooth bromegrass or crested wheatgrass and was similar to the bare soil treatment.

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Sandhill Crane Studies in the Central Platte Valley; A Progress Report

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Preliminary results for the 1998 field season, the first field season of a multi-year study of staging ecology of sandhill cranes in the Central Platte Valley (CPV), are compared to findings from 1978-79. Cranes began arriving in the CPV in early February linked to an exceptionally mild winter. Time cranes spent feeding and walking increased while resting declined from 1978 to 1998 suggesting food was less available in 1998. Juveniles spent more time feeding than adults in both years and rested less. Corn dominated the diet in 1998 as previously, with soil invertebrates continuing to account for all animal matter taken. Cranes arrived with higher fat levels in 1998 than 1978-79 and maintained slightly higher levels at departure from the CPV. Higher fat levels in 1998 may have been linked to the mild winter and more corn residues being available as a result of a storm in October 1997 prior to harvest. Post harvest corn residues declined from fall 1997 to fall 1998 which will allow further evaluation of effect of corn availability on staging behavior and fat storage rates. A pilot study conducted in 1998 indicates satellite telemetry offers an effective technique for delineating breeding grounds, migration routes, and wintering grounds of cranes that stage in spring in the CPV. Two of the satellite-monitored sandhill cranes radio-marked in the Platte Valley migrated to breeding grounds in northeastern Siberia, providing the first documentation of cranes staging in the Central Platte Valley breeding in Asia. Field work in 1999 will involve repeating several measurements taken in 1998 and 16 cranes will be radio-marked with satellite transmitters.

Spring-staging Ecology of Greater White-fronted Geese, Lesser Snow Geese, and Northern Pintails in the Central Platte River Valley and Rainwater Basin of Nebraska

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The central Platte River Valley (CPRV) and adjacent Rainwater Basin Area (RBA) of Nebraska are major stopover areas for migratory waterfowl during late winter and spring. Fat and protein reserves accumulated during spring migration are important determinants of subsequent reproductive success in white-fronted geese (*Anser albifrons*), snow geese (*Chen caerulescens*), and northern pintails (*Anas acuta*). I presently am completing the second field season in a two-year study to examine diet and nutrient reserves of these species, and to examine movements and time-activity budgets of the goose species. During 1998, diets of snow geese and white-fronted geese were dominated by corn (*Zea mays*; >98% aggregate dry mass). Diets of female pintails were composed primarily of corn and smartweed (Polygonum spp.) seeds, but the proportion of these foods varied depending on collecting method (pass-shooting in late evening vs. observing birds feed in wetlands prior to collecting). Body condition (ingesta-free body mass adjusted for body size) of adult white-fronted geese did not differ in relation to date during 1998. This pattern contrasts with condition dynamics during 1979-80 when adults increased body condition at 18-21 g/day while in Nebraska. Body condition of adult snow geese and female pintails appeared to be influenced by a severe spring storm that occurred in mid-March, during which body condition of both species declined. Although these species of waterfowl concentrate primarily in the RBA, the importance of the CPRV was evident during the spring storm, when most waterfowl remaining throughout these regions were concentrated in the CPRV while wetlands in the RBA were frozen. Species differences in time budgets of white-fronted geese and snow geese were not consistent among regions (eastern RBA, western RBA, and CPRV). Together, energetic parameters measured in this study will be used to estimate the number of use-days by migratory waterfowl that the RBA and CPRV can support.

Migration Chronology and Habitat Use by Sandhill Cranes in Central Nebraska

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During spring 1998, Trust staff conducted ground and aerial surveys of staging sandhill cranes (*Grus canadensis*) along the Platte River. We conducted ground surveys from 15 February through 25 April. Ground survey routes were delineated along roads in the Platte River Valley from Chapman to Overton and were generally located within 1-2 miles of the river. To minimize biases associated with conducting surveys during the same time period, we conducted surveys during early (sunrise-1100), midday (1101-1500), and late (1501-sunset) time periods. We counted all sandhill cranes along the route and recorded habitat-use. Five aerial surveys of the river were conducted between 20 February and 10 April to determine distribution patterns of sandhill crane roost sites from Chapman to Overton. Aerial surveys were initiated at sunrise and continued for approximately 2 hours. During each flight, one staff member videotaped crane roost locations with an 8 mm video camera, while another staff member recorded roost locations on aerial photos of the river. Estimates of crane abundances were later determined from the video tape. We also determined channel widths of individual roost sites and randomly selected sites not used by cranes and recorded if roost sites occurred in sections of the river that had been cleared.

Sandhill cranes began arriving in the Platte River Valley in late January. Approximately 5,000-10,000 sandhill cranes were along the Platte River by 14 February. By late February, over 66,000 cranes were within our study area. Crane numbers continued to increase through most of March with peak numbers (232,023 cranes) occurring during the sixth week (22-28 March). By the ninth week (12-18 April), most of the cranes had departed the valley. Sandhill crane distribution was not uniform among the 12 bridge segments. During the peak of the staging period (sixth week), nearly 75% of the cranes were observed among 4 bridge segments (3, 6, 7, and 8). Most of the sandhill cranes were observed in 3 habitat types. Overall, 52% of the daytime observations were in corn fields, 29% in wet meadow-lowland grasslands, and 15% in alfalfa fields. Early in the staging period (first and second weeks), most of the sandhill cranes (59-74%) were observed in wet meadow-lowland grasslands, but after the second week, most of the cranes (46-64%) were in corn fields. From the third week to the ninth week, 17-42% of the cranes were observed in wet meadow-lowland grasslands.

Sandhill crane numbers recorded during aerial surveys ranged from 1,825 birds on 20 February to 207,725 birds on 28 March. During the peak of the staging period, over 80% of roosting cranes were observed within 2 bridge segments (3 and 7). Sixty-five percent of the roost sites were located in cleared sections of the river, while 35% were located in sections that had not been cleared. The mean width for sections of the river used by sandhill cranes for roosting was 908 feet, while the mean width of randomly selected sections not used by sandhill cranes was 275 feet. Clearing of channel vegetation appears to be benefiting sandhill cranes.

The Trust plans to continue monitoring sandhill cranes on a long-term basis. Further analyses will incorporate GIS techniques to examine long-term trends in sandhill crane distribution patterns relative to habitat changes. Compositional analysis will be used to assess spatial and temporal sandhill crane habitat-selection patterns.

Larval Fish Studies in the Lower Platte River

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The occurrence, distribution, and relative abundance of larval fishes are being assessed in the lower Platte River from Columbus to Plattsmouth. This work is being done to evaluate the effects of river discharge on fish reproduction in the Platte and to estimate the Platte's contribution of larvae to the Missouri River. Small mesh seines and paired drift nets are being used to collect fish larvae at four sites in the lower Platte River. In 1998, sampling took place between the beginning of May through the summer until densities of drifting larvae declined in early August. Early analysis of midnight samples shows the highest density of drifting larvae .(.968 larvae/m3) occurring the week of June 21-27. Enumeration of larval fish is in progress and data analysis will follow. Sampling will resume May of 1999.

Pallid Sturgeon Movement in the Lower Platte River

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Pallid sturgeon (*Scaphirhynchus albus*) are classified as an endangered species and are infrequently collected in the Platte River in Nebraska. In 1998 we implanted 10 hatchery reared pallid sturgeon with radio transmitters and assessed their summer and early fall movements and habitat use. Implanted individuals moved distances of up to 11km downstream from the stocking site but the majority of fish remained within 6km downstream. Most observations occurred in depths of 0.3 to 1.0m with mean column velocities of 0.30 to 0.90m/sec and bottom velocities less then 0.70m/sec. Additional sturgeon are scheduled for implantation and release in the spring of 1999 and will be monitored following the same protocol.

Grand Island to Columbus Platte River Corridor Initiative

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The Platte River corridor between Grand Island and Columbus contains significant tracts of upland and lowland native prairie, wetlands, archeological and recent historic sites, and scenic areas, in addition to the riparian zone and main channel of the Platte. Presently the corridor is relatively undeveloped compared to other sections of the Platte. However, due to its proximity to the eastern, more populous part of Nebraska, and the desirability of sandpits and scenic landscapes for home building and private recreational uses, this section of the river may change rapidly in the next decade. There is strong likelihood that developments will impact biodiversity, water quality, public recreational access, and agricultural use in the corridor. The corridor will evolve from a rural agricultural landscape to a semi-urban, more ecologically fragmented landscape.

Prairie Plains Resource Institute (PPRI) is leading a large-scale initiative along this corridor to:

1) Protect large contiguous tracts of native grasslands, wetlands, archeological sites, and riparian areas from future unplanned development through fee simple and conservation easement acquisition, and through cooperative relationships with private landowners;

2) Restore ecological diversity and agricultural production potential to the grasslands, and manage the developing reserve system for combined purposes of ranching, resource preservation, and public use;

3) Develop educational programs on project lands such as SOAR (Summer Orientation About Rivers) and the "Community Preserve Model" such as is developing on PPRI's Olson Nature Preserve; to connect local people to the landscape, to provide outreach information and management assistance to landowners, and to promote broad understanding of the importance of the Platte and associated grasslands' ecological services regarding water quality protection, quality of life, etc.;

4) Promote and facilitate a community planning and visioning process in the corridor.

Early stages of this project will involve acquiring at least 500 acres of land in the next three years, beginning the planning and publicizing process, and educational development.

The U.S. Geological Survey INATURES Program in the Platte River Valley - a Review

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In the Platte River basin, changes in water and land use have transformed the river channel and altered adjacent wet meadows. With changes in the hydrology of the river and the structure of riparian habitats, the sustainability of migratory and resident birds and other biota have been brought into question. In developing successful strategies to sustain or rehabilitate the riparian ecosystem of the central Platte River, the linkages between hydrology, river morphology, biological communities, and ecosystem processes need to be understood. The USGS Platte River Integrated Natural Resource Science (INATURES) Program uses resources from all Divisions within the USGS to build interdisciplinary teams to examine these physical and biological linkages. The Program is a collaborative effort with a number of other Federal and State agencies and private entities. One component of coordination is being conducted through USGS participation in working groups related to the Platte River Endangered Species Partnership.

The USGS program is now focusing on: 1) Developing a data base containing integrated information on the geology, hydrology, ecology, geography, and socio-economic features of the Platte River basin, and providing access to the data through the internet; 2) determining nutrient storage in sandhill cranes and investigating factors responsible for any change in crane condition; 3) describing the geological setting of the Platte River and characterizing the fluvial architecture of sediments in the valley floor; 4) characterizing the interactions among streamflow, hydraulics, sediment transport, riparian vegetation, and channel morphology; 5) developing and applying multidimensional flow and sediment transport models to examine water and land management alternatives on channel maintenance; 6) developing an understanding of the relationships between the plant and animal communities of wet meadows and other riparian habitats and the hydrology and geomorphology of the river; 7) determining the diets, nutrient-reserve dynamics, and time-activity budgets of lesser snow geese, greater white-fronted geese, and northern pintails during spring migration; 8) determining the potential for rehabilitation measures to improve habitat quality and quantity, and evaluating their success and effect on the ecosystem; and 9) assessing the regional characteristics of ground water / surface water interactions.

Wetland Restoration in the Rainwater Basin in South Central Nebraska: The Lake Seldom Project

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Wetland are vital to the biological environment in South Central Nebraska, especially for migratory birds and marshland animals. The purpose of this project was to develop a plan to restore a previously altered wetland, near Holdrege, NE, while creating a park-like environment where public education and wetland awareness are emphasized. It was possible to reconstruct maps of the original landscape and hydrology by utilizing hand-drawn maps and aerial photographs of the area from the period when the original wetland existed. The design for the proposed park was then displayed as an overlay on the newly constructed base map.

Recent Geologic History of the Central Platte Valley

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This paper is a progress report on detailed (1:24,000) geologic mapping of the Platte/Loup valley near Central City, supported by the USGS and the Conservation and Survey Division (UNL). The broader objective of this study is to understand the long term dynamics of the Platte River, and how it responds to climate-controlled variations in sediment load and discharge. The Platte River of the Great Plains represents a dynamic fluvial system that drains a regional scale basin with a tectonic hinterland source, and supplies large amounts of sediment to the Missouri-Mississippi-Gulf of Mexico system. Current research indicates that many fluvial systems of the Great Plains document Late Quaternary climate change through major phases of aggradation and degradation.

Map units have been identified using color infrared air photos (CIR), Landsat Thematic Mapper (TM) imagery, topographic maps, and soil survey data. The subsurface stratigraphic relationships have been interpreted through hollow-stem auger coring and logs of existing test holes and registered irrigation wells. The ages of stratigraphic units have been assessed through optically stimulated luminescence (OSL) dating. Initial work conducted in the valley has led to the identification of 2 major terrace surfaces of the Platte River, and 3 surfaces of the Loup River within the present-day combined valley, which is constrained to the north and south by Pleistocene loess-covered bluffs. The Platte displays several low-relief paleo-channel belts, whereas the Loup has a floodplain inset against several terraces. Older terraces are covered by significant thicknesses of eolian sand and silt, and show evidence for 2 episodes of dune activation, as defined by alternating eolian sediment and paleosols.

Central Platte Biological Diversity CD-ROM

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The purpose of this project was to develop a CD-ROM for distribution and use by agencies, organizations, schools and the general public. The CD-ROM provides an exchange of data and information relating to the biodiversity of the Platte River Valley. The information is displayed in two formats, the Bio-diversity Encyclopedia and through a Geographical Information System (GIS). This project was made available by funding from the U.S. Fish and Wildlife Service, the Central Platte Natural Resources District, and the Environmental Protection Agency.

Investigation of Factors That Could Lead to Destabilization in Reaches of the Platte River Between Gothenburg and Grand Island, Nebraska

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The Big Bend region of the Platte River in Nebraska has changed greatly since it was first seen by Europeans. Both flows and area have been significantly altered in the last 100 years for various purposes, resulting in a general system reduction. Studies over the preceding 20-odd years, such as those by Becker and by Johnson, indicated that certain reaches within the region have become stable, with minimal additional changes taking place.

Examination of recent aerial photographs suggests that factors may now be present that threaten this stability. This study seeks to identify those factors and determine their possible impact upon river stability.

Changes in Value and Ownership of Platte River Accretion Land During the Relicensing Process for Kingsley Dam 1988-1998

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Accretion land along the Platte River in Buffalo County, NE. was significantly affected by the construction of Interstate 80 in the 1960s. A study completed in 1997 showed that values had increased far faster than adjacent agricultural land during the preceding 20 odd years, with the primary motivator being recreational use. Number of owners likewise increased.

During the relicensing process for Kingsley Dam, accretion land became the focus of increased attention, resulting in additional changes in ownership patterns, accessibility, and skyrocketing values. This study examines the history of these changes and implications for the future.

The Presettlement Platte: Prairie or Wooded River?

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Many contemporary writers have considered the presettlement Platte River to have been virtually treeless...a prairie river, not a wooded river. Severe floods, sweeping prairie fires, and trampling herds of bison are given as reasons why so few trees grew along the river. This perspective implies that trees now growing on islands and banks of the river are unnatural and detrimental to open channel avifauna such as cranes, terns, and plovers.

Careful study of land survey records and other historical sources indicates otherwise. The lower and central reaches of the Platte were well-timbered prior to exploration and settlement; however, the river was deforested during the mid-1800's by pioneers using the Great Platte River Road, settlers, soldiers building and maintaining Fort Kearny, and railroad woodcutters. The scarcity of woodland on islands and banks, creating an openness to the river early in the 20th century, is an artifact of deforestation rather than of the natural inhospitability of the river to trees. The discovery of new historical information confirms that the presettlement Platte was a wooded river traversing a prairie landscape.

Trees began to return to the central Platte in the 1930's, with peak woodland expansion associated with the drought in the 1950's. Reduced streamflow caused by upstream water development was the principle cause, but there were other factors such as rural electrification reducing the demand for fuelwood and the spread of seeds from tree plantings.

Now a second episode of deforestation is underway in the river. This time large areas of trees are being cleared by private and public conservation groups, rather than by farmers, soldiers, and railroad wood-cutters. Their purpose is to increase the width of river channel, unobstructed by trees and shrubs, for Whooping and Sandhill Cranes.

Perhaps we should re-evaluate our purpose in clearing this biologically-diverse, native woodland. Should the goal of clearing be to re-create the open, deforested river as it existed early in this century or should it be the well-wooded, presettlement river? The answer to whether current clearing operations constitute "restoration" will depend on which vision we adopt.

Grain-Size Evolution of the Platte River, 1931-1998

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Investigation of the grain-size distribution of bed-material in the 'Big Bend' reach of the Platte River indicates that the riverbed has coarsened over the past 70 years. Comparison of historical measurements by the U.S. Army Corps of Engineers made in 1931 with more recent measurements indicates that the grain sizes of sediment making up the Platte River bed have adjusted in response to diminished supplies of upstream sediment. In the years between 1931 and 1998, water projects in the Platte River Basin have increased reservoir storage along the North Platte River. Lake McConaughy, the most downstream reservoir on the North Platte River, is a critical barrier to the transport of sediment to the Platte River downstream. The first significant tributary adding fine-sediment to the Platte River is the Loup River and our work shows that bed grain sizes only return to predevelopment values downstream of this confluence. With the fine-sediment supply decreased upstream of the Loup River, fine-grained sediment originally present in the bed has been winnowed over the past 70 years. As a result, the bed of the 'Big Bend' reach is much coarser and more stable than it was under predevelopment conditions.

Alternative Methods to Enhance Wet Meadow Habitat Along the Platte River: A Progress Report

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The Platte River system is one of the most highly developed river basins in the world. At the same time, the central Platte River and its associated wet meadows are an important habitat resource for regional biodiversity, numerous migratory birds and other species. Central Platte habitats are host to species federally listed as endangered (e.g., whooping crane, interior least tern, American burying beetle) and threatened (e.g., piping plover, western prairie fringed orchid, bald eagle). Wet meadows once occurred extensively along the Platte River; however, substantial reductions have occurred during the past century. Many wet meadows have been drained, leveled and converted to cropland.

The sponsors of this Project, Central Platte Natural Resources District, Nebraska Game and Parks Commission, Nebraska Public Power District and The Central Nebraska Public Power and Irrigation District, with the aid of grants from the Nebraska Environmental Trust Fund, have joined together in an attempt to study alternative methods for maintaining and enhancing Platte River wet meadows. Specifically, the Project goal is to assess the feasibility of enhancing the ecological integrity of Platte River wet meadows at three southcentral Nebraska demonstration sites using means other than streamflow. Success will be measured by gaining additional insights into developing alternative methods in enhancing and maintaining wet meadows. Information gained through this study will be useful in developing other habitats along the Platte River. The three demonstration sites are the Cottonwood Ranch property near Overton, the Grand Island Wellfield site located south of the city of Grand Island and the Wyoming property located southeast of Kearney.

Project sponsors developed site enhancement plans with input from participants of a Wet Meadow Workshop. Two independent experts reviewed revised draft plans. Baseline biological and hydrologic monitoring began in early 1997. Site enhancements were implemented during 1998 and post-treatment monitoring efforts underway.

Development and Application of Digital Geographic Data in the Central Platte River Region

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One of the most useful tools a land resource manager can have is a comprehensive set of well-documented geographic data layers. A major component of the U.S. Geological Survey (USGS) Platte River Ecosystem Project is the development of a database containing various geographic data sets. This database will allow project scientists and other stakeholders access to data they need to perform their investigations. Many studies have been done in the central Platte River Valley and many more are under way or are planned. These activities have created and will continue to add a considerable amount of data holdings that are relevant to the investigations of the Platte River Ecosystem Project. Where other organizations are creating new data sets in the Platte River region, we intend to coordinate with them to prevent duplication of effort and ensure the most efficient use of resources. Non-USGS data sets will be linked to the main USGS database. The exchange of geospatial data sets and the creation of new data will be aided by the application of consistent data standards and the use of metadata that comply with Federal Geographic Data Committee guidelines. Accomplishments to date include establishing a project Web site (http://mciweb.er.usgs.gov/platte/), creating regional views of the area topography, digitizing hydrologic maps, visualizing historic river channels, and joining digital orthophotographs with land management descriptions.

Control of Pesticides and Nitrates in Surface Irrigation Runoff Water

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Water samples were collected from the North Platte river, the Farmers irrigation canal and from irrigated fields in the North Platte Valley to determine the presence of agricultural chemicals in surface irrigation water. Samples were collected in the river and canal for a 24-hour, seven-day period at the beginning and end of the irrigation season at several locations. No significant concentration of chemicals were found in either the canal or river system. Furrow inflow and outflow were sampled from selected fields to determine chemical concentration in irrigation water. Initial runoff volume was small and increased with time. Chemical concentration was highest in the initial outflow and decreased with time for all chemicals. Chemical concentration in the total volume of runoff water was well below the maximum contaminant level or lifetime health advisory for all chemicals. Chemicals tested included nitrate, 2, 4-D, atrazine, aldicarb, alachlor, cyanazine, and carbofuran.

Narrow (1.5 - 4.6 m) vegetative filter strip plots were established to test the effectiveness of reducing the amount of agricultural chemical in furrow irrigation runoff water. Vegetative strips were established using smooth bromegrass, crested wheatgrass and bare soil. During the second year of data collection, the vegetative filter strip plots were fully established. Runoff volume used was 0.25 l/s and was similar to runoff volumes measured in the field. Chemicals were mixed in a solution to obtain a minimum concentration of 10 ppm for nitrate, 3 ppb for cyanazine, 5 ppb for alachlor, 3 ppb for chlorpyrifos, 50 ppb for 2, 4-D, and 5 ppb for atrazine. Even with added growth, the vegetative filter strips tested in the second year were not effective in reducing the agricultural chemical load.

Characteristics and Landscape Heterogeneity of Surface Water Chemistry in the Middle Platte River Valley, Nebraska (1996 - 1998)

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The purposes of this study were to investigate water chemistry and to examine how hydrologic alteration and land use management may affect on surface water chemistry and ecological integrity of the seventy-five miles reach of the middle Platte River valley. Concentrations, spatial and temporal distributions of nutrients, ions, trace elements, and other properties of surface water chemistry in the middle Platte River valley was analyzed and used to evaluate the aquatic ecosystem at habitat and landscape scales. Within the river system, aquatic landscape was classified as five basic habitat types. Water samples were collected from twenty-five cross-section survey transects. Surface water properties and chemical analysis data were statistically analyzed to determine the quantities and trends of their changes in seasons and types. Riverine landscape structure and function have been characterized based on the results of investigation. Contributions of this study for management of the middle Platte River ecosystem include: (1) distinguishing the side-channel, the wet meadow slough habitats from the backwater habitat according to their hydro-physio-chemical parameters; (2)indicating the key roles of side-channel and backwater habitats in a) hydrological connection between wet meadow and main channels, b) transportation of nutrients, c) buffer of nonpoint pollution of surface waters; and (3) providing fundamental quantitative information about spatial heterogeneity of surface water geochemistry in different aquatic habitats, and their seasonal changes. Recommendations from this study can be used for ecological assessment and conservation of the middle Platte River valley.

Hydrologic Influences on Aquatic Insect Diversity and Emergence Production from the Central Platte River Sloughs

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We examined aquatic insect emergence from 5 backwater sloughs in the central Platte valley with different hydrologic regimes. Three emergence traps (625 cm^2 each) were placed in each site from April - Nov., 1997. Insects were identified to genus, and individual dry mass (DM) determined. Hydroperiods at each site ranged from 94 - 365 days/yr. Trap catches were dominated by dipterans, primarily Chironomidae, Culicidae, and Ceratopogonidae. Abundance of emerging insects (24,124 individuals/m^2) and emergence production (5.1 g DM/m^2/yr.) were highest from a site with a hydroperiod of 296 days, whereas sites with longer and shorter hydroperiods had much lower emergence production. Emergence production from the perennial site, where fish were present, was only 0.256 g DM/m^2/yr. Seasonal emergence patterns also differed among sites. Like emergence production, taxa richness and number of taxa unique to a site were also highest at intermediate hydroperiods. A quadratic equation best described the relationship between taxa richness and hydroperiod across all sites (r^2 = .78, $p<0.05$), and this relationship follows intermediate disturbance hypothesis predictions. Results indicate hydrology has a significant influence on insect species richness and emergence production in these backwaters, and that sites with intermediate hydroperiods harbor higher insect diversity and produce more emergent insect biomass.

Final Report entitled *Investigations of Fish, Amphibians, and Aquatic Invertebrate Species within the Middle Platte River System* is available for PWP.

Effects of Hydrologic Fluctuation on the Fish and Amphibian Fauna of Wetlands in the Central Platte River

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We examined the responses of amphibians and fishes to water level fluctuations in sloughs of the central Platte River. Five sloughs with hydrologic regimes that vary from ephemeral to permanent were studied for two years. At each site, we monitored amphibian populations and migrations daily using drift fences and pitfall trap arrays. In the two wetlands which contain fish, we monitored fish populations by electroshocking monthly. Amphibian populations used distinctly different types of breeding habitat in these sloughs. Leopard frogs (*Rana blairi*) were most abundant in the permanent wetland, chorus frogs (*Pseudacris triseriata*) were most abundant in an intermittent slough, and Woodhouse's toad (*Bufo woodhousii*) utilized an ephemeral site almost exclusively. Both species richness and abundance of fishes were highest in the permanent slough, which provided both seasonal and year-round habitats for various species. In contrast, fish used the intermittent slough seasonally only, as a spawning and nursery habitat. Hydrologic fluctuation, and a larger scale mosaic of hydrologically varied slough habitats, are important determinants of species diversity in these wetlands.

Final Report entitled *Investigations of Fish, Amphibians, and Aquatic Invertebrate Species within the Middle Platte River System* is available from PWP.

Pleistocene, Pre-Peorian Loess (Clay) Lenses Anomaly Bodies within the Platte Valley Sediments and Their Influence with Regard to Groundwater Movements, in and Adjacent to the Platte Valley in Central Nebraska

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In recent years growing importance has been placed on the development of Regional Hydrology Models in order to understand and manage one of Nebraska's important natural resource's, groundwater. To this end it becomes increasingly clear that little effort or thought has been put forth with respect to understanding the effect of "Local Effects" on these Regional Groundwater Models. Local effects such as topography, depression-focused recharge and overall physical make-up of the aquifer all contribute to create conditions that are not adequately represented by Regional Models.

"*For confined aquifers, which are extensively tapped by wells for water supply, there has grown up a traditional concept that is not particularly sound but which is firmly entrenched in usage. If the water-level elevations in wells tapping a confined aquifer are plotted on a map and contoured, the resulting surface, which is actually a map of hydraulic head in the aquifer, is called a potentiometric surface. A potentiometric map of an aquifer provides an indication of the directions of groundwater flow in the aquifer. The concept of a potentiometric surface is only rigorously valid for horizontal flow in horizontal aquifers. If there are vertical components of flow, as there usually are, calculations and interpretations based on this type of potentiometric surface can be grossly misleading. It is also possible to confuse a potentiometric surface with the water table in areas where both confined and unconfined aquifers exist."* (Groundwater, R. Allan Freeze, John A. Cherry, 1979, page 49.)

This paper focuses on the presence of (clay) loess lenses and wedge-outs in and adjacent to the aquifer sediments of the Platte Valley of Central Nebraska and their possible influence which can create vertical flow components of both confined and unconfined nature within the groundwater movements in Central Nebraska. The complex structure of the Platte Valley Alluvial demands that greater emphasis be placed on multi-disciplinary approaches in order to gain better understanding of the complex inter-relationships between surface and groundwater in Central Nebraska.

Social-cultural Attitudes of the Mid-Platte River Community

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Presentation only.

The Final Report of this study is available from PWP.

The Economic Impact of Hunting and Fishing on the Middle Platte River in Nebraska

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As part of the United States Environmental Protection Agency's (EPA) risk assessment of the Middle Platte River Watershed of Nebraska (Middle Platte), Fermata Inc. studied a variety of wildlife-associated activities and participants and estimated the economic value of such recreations to the region. By using a variety of data gathered by other researchers and us, the economic contributions of these outdoor recreations have been estimated. Although general in substance, these estimations add credence to the contention that the Middle Platte has values that expand and magnify the traditional characterizations of the region.

In the initial assessment of the economic value of wildlife watching along the Platte River, the survey results indicated that, depending on the economic multiplier used, the annual gross economic value of wildlife watching along the Middle Platte River ranged between $27.9 million and $57.5 million. Now, combined with the contributions of hunting and fishing, the cumulative annual gross economic value in 1996/1997 of wildlife-associated recreation in the region is projected to have ranged between $70.6 million and $115.8 million. Even at its most conservative estimate (with cautious estimates of participants, economic stimulation, and equipment-related investments), wildlife-associated recreation along the Middle Platte must be recognized as an industry of significant economic importance and potential.

The Final Report of this study is available from PWP.

The Platte Watershed Program - Middle Platte Socio-Economic Overview

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Since 1995 the Platte Watershed Program has included a socio-economic component to complement its ongoing biological risk assessment. This approach recognizes the human component in the Platte ecosystem, and recognizes that sustainable use of the Platte is only possible if human cultural and economic needs are met. This report is a compilation of results from several independent research projects. It includes information regarding public attitudes from surveys completed by Dr. John Allen, information regarding the economic impacts of crane-watching and outdoor recreation from FERMATA, Inc, and the description of a region specific economic impact model by Dr. Ron Konecny.

The report is intended to serve as a basic reference for decision-makers and discussants regarding the Platte River. It contains background information regarding current economic conditions, settlement patterns, cultural influences, the development of irrigation, power and irrigation districts, and public policies and laws which are impacting the Platte River.

The Final Report of this study is available from PWP.

Riverine Habitat Management at Audubon's Rowe Sanctuary

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Rowe Sanctuary, part of the National Audubon Society, a private non-profit, includes 1150 acres of riverine and grassland habitat along the Hwy 10 -Gibbon Rd. segment of the Platte River. In addition, we have a conservation easement on 442 acres, including 1 mile of river, and Cooperative Agreements with landowners and the Fish and Wildlife Service over an additional 2 miles of river channel. Thus our riverine management covers 5.2 of the 5.5 mile segment.

Our primary management goal is providing habitat for cranes and waterfowl, with improved habitat for other waterbirds, and perching birds as a secondary focus. Our primary river management scheme is vegetation clearing. For the past three years we've cooperated with the Platte River Trust and cleared all our river islands and some of our accretion ground along 5.2 miles of river. This clearing leaves the islands available for use by cranes in the spring. We have recorded piping plovers and least terns nesting on sandbars in our section of river but have not had any nests for the last 2 summers due to high water. Initial clearing costs are estimated at about $700 per acre with annual maintenance at about $100 per acre.

Nebraska Public Power District's Properties Managed for Endangered Species Along the Platte River, Nebraska

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Nebraska Public Power District (NPPD) owns and operates hydroelectric Project No. 1835 licensed under the authority of the Federal Energy Regulatory Commission (FERC). The original 50-year license for Project 1835 expired in 1987. In 1990 the FERC amended NPPD's license to operate Project 1835. Part of the imposed conditions required NPPD to develop and maintain eight permanent sites for least tern (Sterna antillarum) and piping plover (Charadrius melodus) nesting habitat in the central Platte River. In response to the FERC Order NPPD has developed three artificial nesting islands in the Platte River, Elm Creek (1991), Lexington (1992), and Overton (1993) near the respective cities of Elm Creek, Lexington, and Overton, Nebraska. The development costs of the three island sites was approximately $435,000 for an average cost per acre of suitable nesting substrate of about $40,277. Each site was designed to have approximately 3.6 acres of actual nesting area (bare sand) however, this cost also includes channel development and tree removal on adjacent islands and buffer areas around or near the nesting site. In addition to the three island habitats NPPD has also developed three sandpit habitat sites, Johnson and Blue Hole sandpits both located near Elm Creek and Lexington sandpit located near the city of Lexington, Nebraska. Two of the sandpits, Blue Hole and Lexington are located on properties owned by NPPD and the Johnson sandpit was developed and maintained via lease agreement with the landowner. Each of these sandpits differs in size of actual nesting habitat. The Blue Hole sandpit is currently being mined so nesting area changes with the mining operation. We estimate a total of about 27 acres of suitable nesting substrate for the three sandpits and an initial development cost of approximately $197,100 for an average cost per acre of nesting habitat of $7,300. The development costs include the purchase of Lexington sandpit, 70 acres in size, including water and land around the sandpit lake. Annual maintenance of both artificial islands and sandpits includes sign replacement, installation and maintenance of electric fences and solar-powered fencers, strobe lights, vegetation control (pre- emergent herbicide application), predator management, tree removal, burning and/or mowing of buffer areas, maintenance of property fences, placement of driftwood, erosion control, and some hand removal of vegetation. Average maintenance costs are $7,000 - $9,000 per site per year. Costs per site vary depending on management activities implemented. In July, 1998 FERC issued a new 40-year license to NPPD, Project 1835, which included the continued monitoring and maintenance of the above referenced six sites developed for tern and plover nesting.

NPPD also owns approximately 2,700 acres of riverine habitat between the Elm Creek and Overton bridges on the central Platte River. To date, little management of the habitat has occurred.

Restoration, Management, and Habitat Use of Riverine Channel Habitat in the Big Bend Reach of the Platte River in Central Nebraska

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The Platte River Whooping Crane Maintenance Trust has been involved in restoration and management of riverine habitat for cranes and other migratory birds for nearly 2 decades. The Trust has used a variety of techniques including chemical applications, heavy equipment to remove trees and shrubs, contract equipment operators to knock-down, pile, and burn larger trees, and mowing and disking to reclaim and maintain open river channel habitat for cranes, waterfowl, and other birds. These techniques have been aimed at maintaining a 1,000 foot-wide, open channel area, free of visual obstructions. Costs have ranged from $150 an acre for mowing/disking to $900 an acre to clear large trees (an average of $200 to $400). Habitat plans developed in 1984 and revised in 1998 have directed at providing a 2-mile long open river channel segment in each of the major bridge segments in the Big Bend Reach. Although techniques have been modified over the years, efforts have been directed at clearing and disking islands within the active channel, mowing and maintaining herbaceous and wetland habitat along the river bank, and leaving woodland and forest vegetation on the river fringe as habitat for other species. Areas being maintained by the Trust have continued to be used by thousands of roosting sandhill cranes. Most recent whooping crane sightings have also been in manage areas.

U.S. Fish and Wildlife Service's Partners For Fish and Wildlife Program Riverine Habitat Restoration on Private Lands

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The central Platte River has long been recognized as a major stopover for migratory birds traveling through the Central Flyway. The combination of broad open river channels, its shallow braided character, adjacent wet meadows, and abundant food supplies attracts millions of birds each year including several federally listed threatened or endangered species. Open channel habitat for roosting sandhill cranes and whooping cranes as well as other native species has declined substantially during the last 100 years. An increase in scrub-shrub and forested areas within the high banks of the river has occurred at the expense of active, open riverine channel habitat.

The U.S. Fish and Wildlife Service (Service), Platte River Whooping Crane Maintenance Trust, National Audubon Society, The Nature Conservancy, and the Nebraska Game and Parks Commission are actively working with private landowners along the central Platte River to restore and maintain riverine habitat for cranes and other species. The partnerships that have been forged among these groups and the private landowners along the river has been instrumental in accomplishing numerous riverine habitat restoration projects on private land along the central Platte River. Numerous private landowners along the central Platte River have restored riverine habitat on their land with technical and financial assistance from the above mentioned partners and numerous additional landowners have expressed an interest in restoring riverine habitat on their land.

The Service along with the other partners and cooperators jointly develop a restoration plan for each project site with an emphasis on the development of open channel areas surrounding existing water-filled channels. Individual agreements with the private landowners detail the restoration work to be completed and the cost of the work to the wildlife cooperator and the other funding partners. The partners jointly work with the private landowner to clear trees and brush from sandbars, islands and accretion lands within the river channel through mechanical means. Heavy equipment (e.g., dozers, excavators, crawlers, Klearway) is used to remove tree and shrub growth and to maintain open sites through discing and mowing.

The overall goal of these efforts is to restore and enhance riverine habitat along the central Platte River for the benefit of federally listed species (i.e., whooping cranes, interior least terns, and piping plovers), sandhill cranes, and migratory waterbirds (e.g., shorebirds, waterfowl, wading birds, etc.,) and other fish and wildlife species native to the area.

Central Nebraska Public Power and Irrigation District's Riverine Habitat Management

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The Central Nebraska Public Power and Irrigation District (Central) holds a 17-year lease with an option to buy approximately 4,000 acres of Platte River land located between Lexington and Overton in Dawson County. Adjacent to the property leased, Central owns 150 acres. This land is a part of Central's license conditions and will be managed primarily for migratory waterfowl and least terns and piping plovers.

The property consists of 2,000 acres of open grassland, 1,200 acres of riparian forest, and 800 acres of river gravel, ephemeral islands, and sandbars. The habitat management objectives for this site are to covert approximately 600 acres of riparian woodland to open grassland, promote native warm-season grasses on both existing and future grassland areas, and maintain and improve sand and gravel areas for least tern and piping plover nesting.

We will attempt to meet these objectives through physical removal of woody vegetation, pasture rotation, burning, and some chemical applications. Costs for initial woody vegetative removal is estimated at $300 - $400/acre with O&M of the property projected at $10 - $15/acre/year thereafter. Maintaining vegetation free nesting areas for least terns and piping plovers is estimated at $50/acre/year.

Nebraska Game and Parks Commission Habitat Management Program

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The Nebraska Game and Parks Commission's (the Commission) Wildlife Management Area goals as stated in the Commission's Strategic Plan is to provide outdoor recreational and education opportunities while protecting, enhancing, and sustaining diverse wildlife, fish and plant resources. Six WMA's totaling approximately 1750 acres and 10 river miles are found along the Platte River between Lexington and Chapman, NE. Big game and waterfowl hunting are the primary activities conducted on these properties; however non-consumptive wildlife related activities increase annually. Wide scale tree clearing has not been conducted on any property but is scheduled at one location for the spring on 1999. Estimated cost for removal of mature trees totals approximately $800/acre and $300/acre for smaller trees and shrubs. Other tree clearing activities are being considered as tree clearing activities progress into the vicinity of Commission properties.