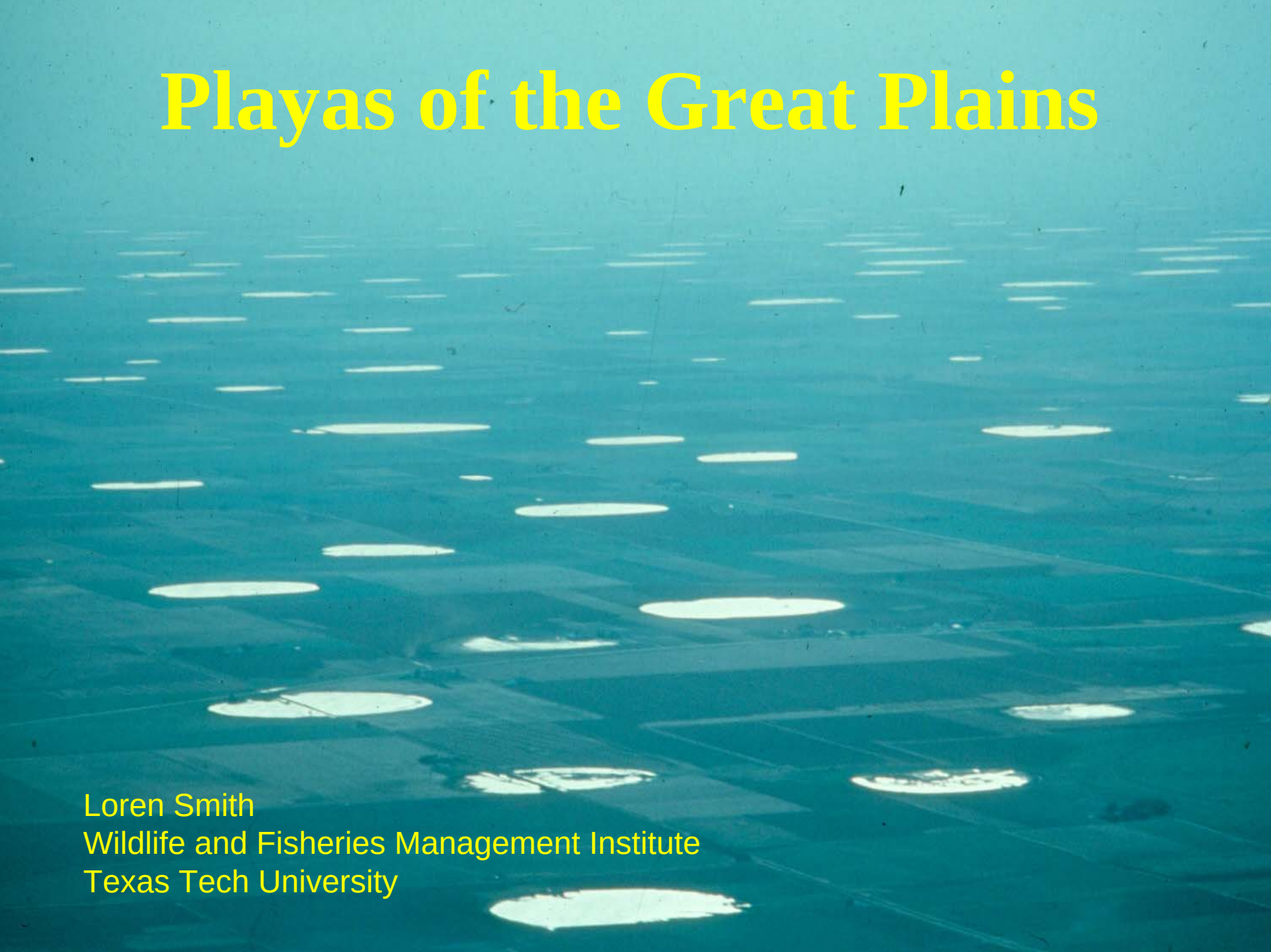
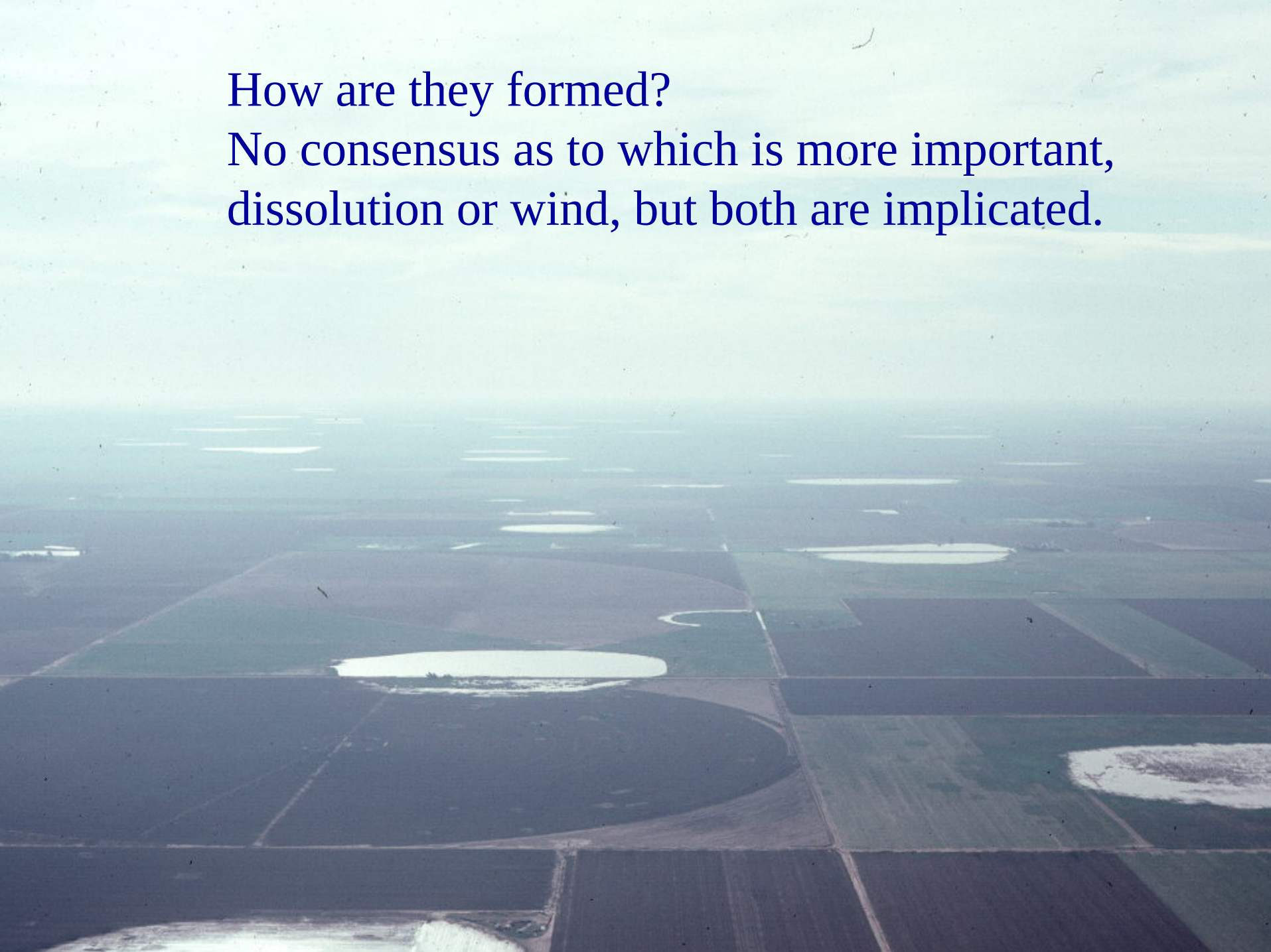
Playas of the Great Plains



Loren Smith
Wildlife and Fisheries Management Institute
Texas Tech University

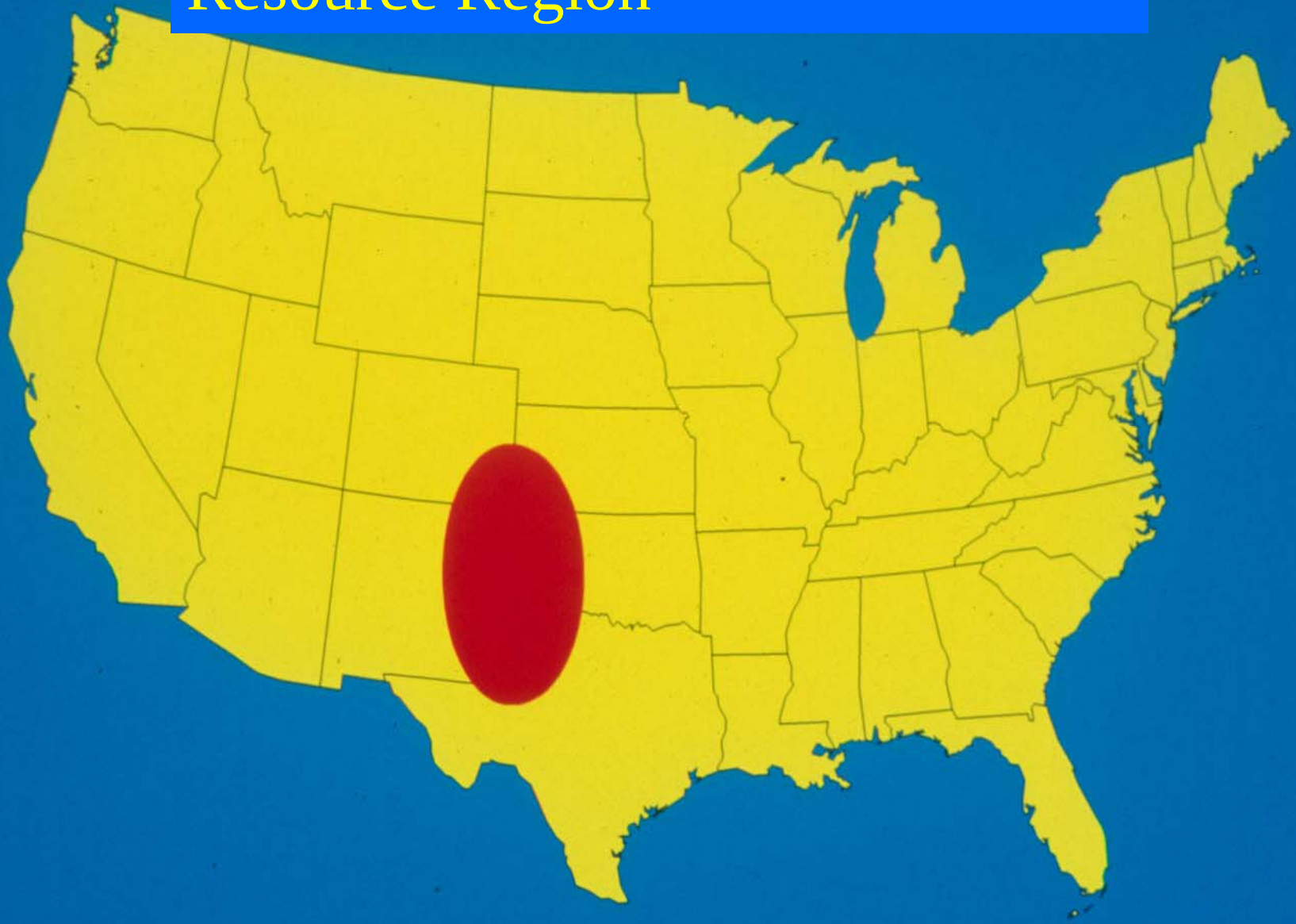

What are playas?
Shallow depressional recharge wetlands
each existing in its own watershed.



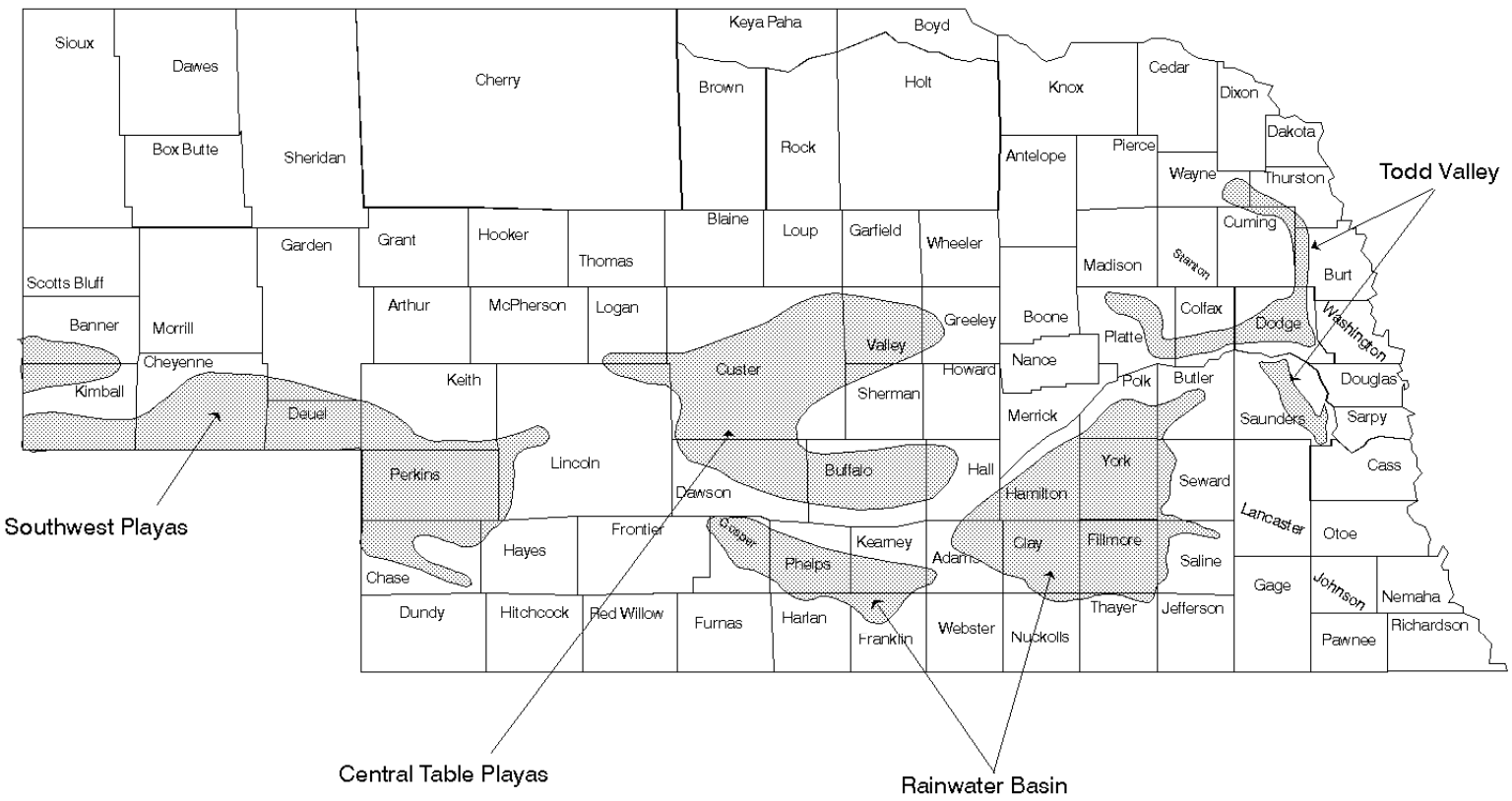
How are they formed?

No consensus as to which is more important, dissolution or wind, but both are implicated.

Historically Considered Playa Resource Region



NEBRASKA'S PLAYA WETLAND COMPLEXES



But, many areas including northwestern KS, northeastern CO, eastern WY, and especially NE have playas.

Average Playa Area is 6.3-ha and 87% of all Playas are less than 12-ha in Southern Great Plains. The remaining Playas in the Rainwater Basin are larger but 90% have been destroyed.

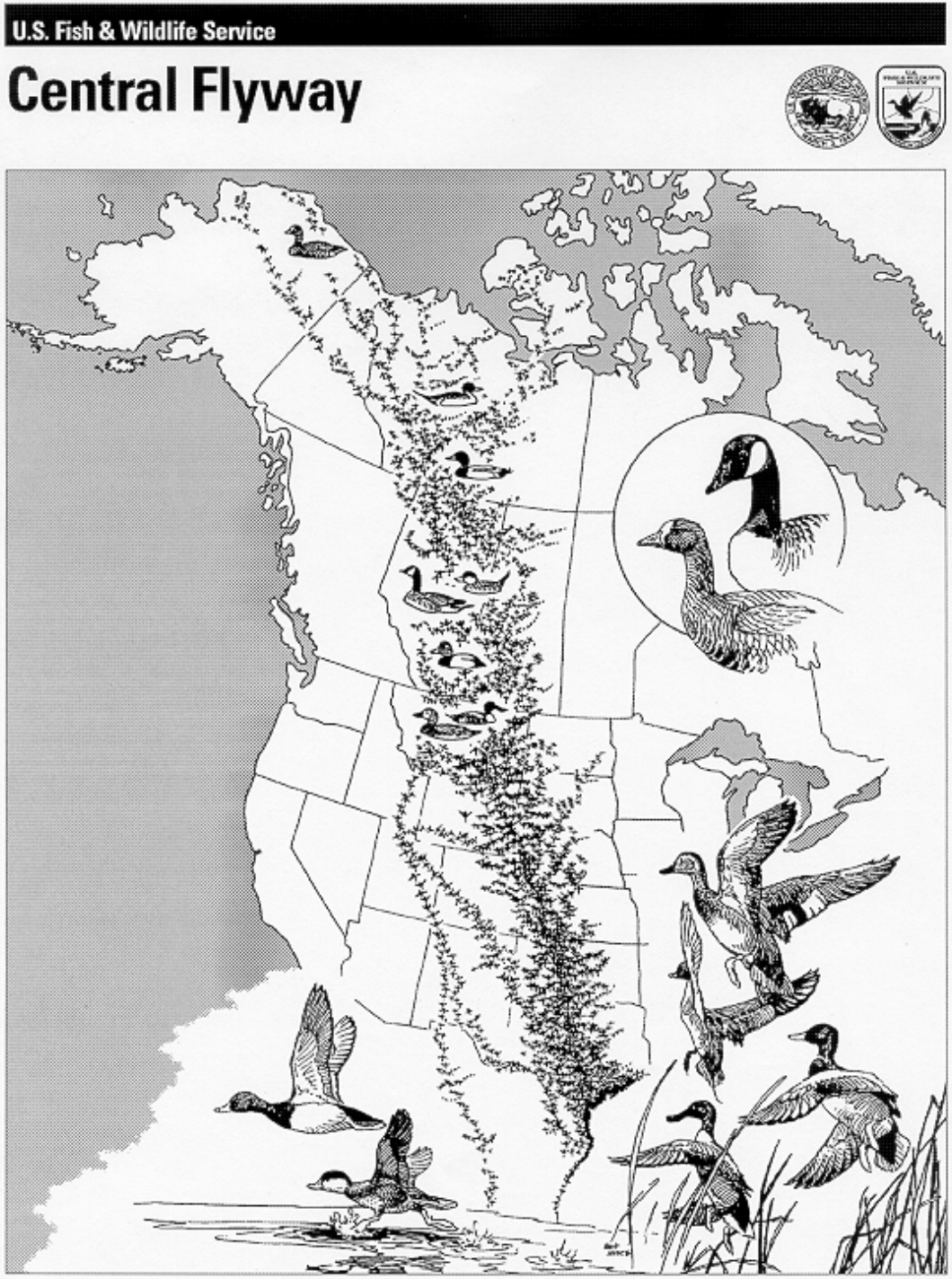

In the High Plains, playas are most often dominated by one of the following vegetation types (short-lived perennials, annuals):
Smartweeds
Barnyardgrass
Spikerush


Playas with tall perennial emergent vegetation such as bulrush are not as common today except in manipulated circumstances (e.g. irrigation).

Although Playas Provide Greater than 160,000-ha of Wetland Habitat they occupy only 2% of the Southern High Plains (TX,NM) Landscape.

Other Values of Playas

- Sites of Aquifer Recharge (key to agricultural industry and urban water)
- Storm Water Retention
- Recreation (including economic inputs from lease hunting and eco-use)
- Aesthetic
- Education (ideal classroom demonstration)
- Research (rare experimental replicates)



Usually reported as second most important migration and wintering area for waterfowl and other migratory birds in the Central Flyway

However, evidence that playas are the most valuable habitats for many species in the Central Flyway is increasing

Initial Playa Waterfowl Management Had Emphasized the Importance of Field-Feeding and Grain Consumption

Simple Study Started by Examining this Assumption

Open Water and Grain vs. Wetland Habitat

Importance of Natural Foods to Waterfowl in Playa Wetlands

Early diet studies were biased from hunter samples; showed >90% diet was grain

Unbiased sampling illustrated importance of wetland foods

Corn	27.0%
Barnyardgrass	10.4%
Smartweed	11.0%
Dock	9.8%
Total non-ag seeds	49.6%
Total inverts	20.5%

Further evidence for the importance of natural foods for waterfowl and other migratory birds

Compared avian ecology during dry and wet years.

Ultimately examined body condition, survival, and population genetics.

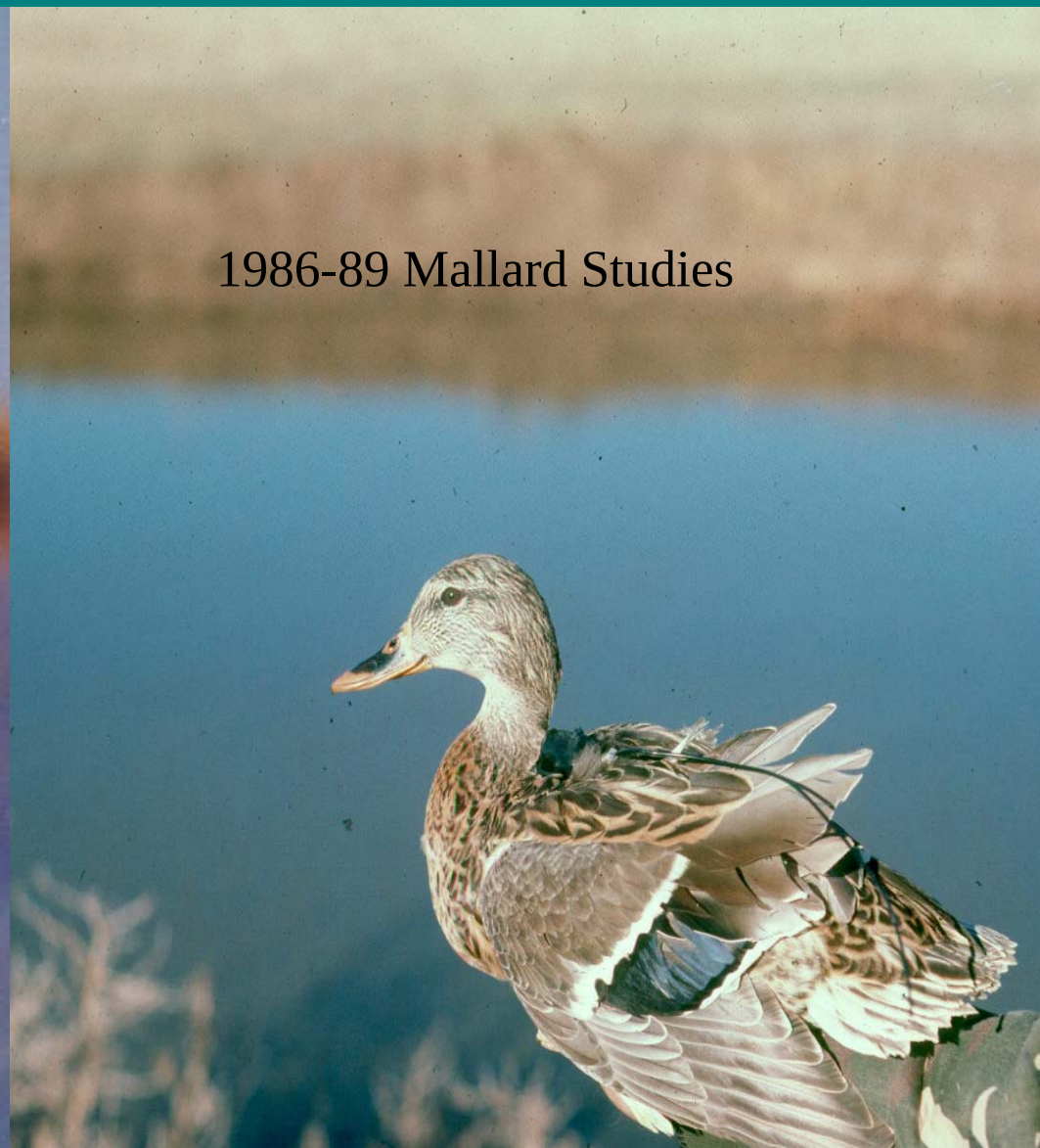
Pintail Ecology

- In wet years
  - Pintails did not field feed until later in winter compared to dry years.
  - Pintails molted earlier in winter.
  - Pintails were in better condition (% lipids).
  - Pintails formed pairs earlier in winter.

Do these wet year conditions actually influence survival and subsequent population size?

2002-04 Pintail Studies

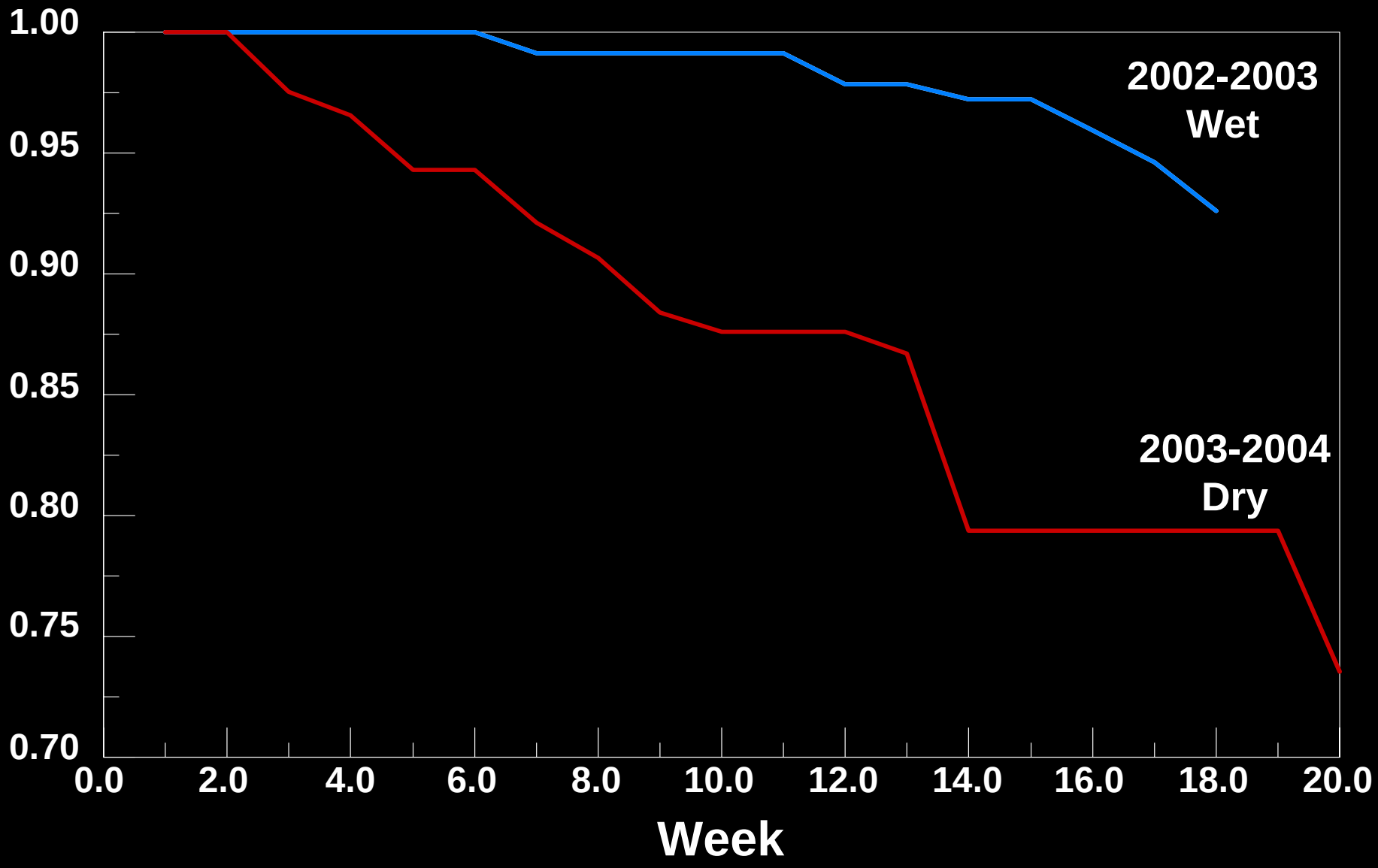
1986-89 Mallard Studies



Mallard Survival Partitioned

Year	Overall Survival %	Hunting Survival %	Natural Survival %
86-87 Wet	78.1	97.6	80.0
87-88 Dry	67.6	95.2	71.0
Overall	75.3	94.1	80.1

Northern Pintail Survival During Winter



Geographic Variation in Pintail Survival

Area	Adult	Juv
Louisiana	71.4	55.0
Central California	75.6	65.4
Sacramento Valley, California	87.4	
Sinola, Mexico	91.0	91.0
Playas-SHP 2002-2003	92.6	92.1
2003-2004	73.6	
Texas Gulf Coast (2002-2004)	40.0 – 50.0	

Conclusions:

- Natural factors (e.g., disease, predation) have more influence on mallard survival than hunting in playas. Similar findings in pintails.
- Female mallards in low body condition had greater mortality than females in higher condition. Female pintail survival highly correlated with body condition during dry years.
- Low rainfall years resulted in lower female body condition and higher mortality for both mallards and pintails.
- Population genetics indicated many different breeding populations arriving throughout winter.

Why are wet winters better for ducks?

Hypothesis: More habitat with better food (natural seed and invertebrates) in wetlands allows birds to stay in playas without field feeding reaching higher condition and surviving at higher rates

SHOREBIRD STUDIES

- Migration Ecology and Habitat Management

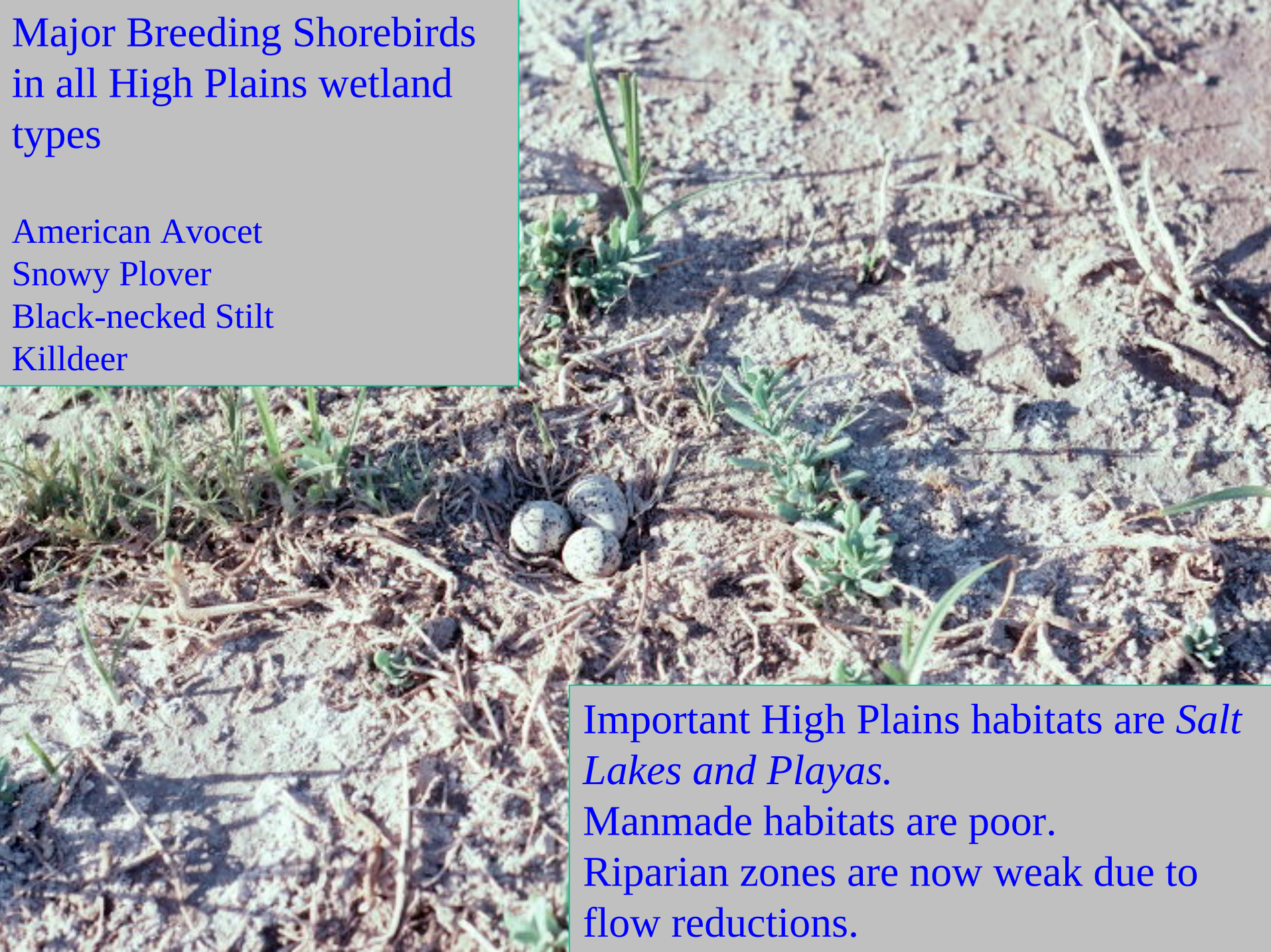
- Breeding Ecology, Distribution, and Mating Systems/Parental Investment

30 Species of Shorebirds Use the Playas of the High Plains

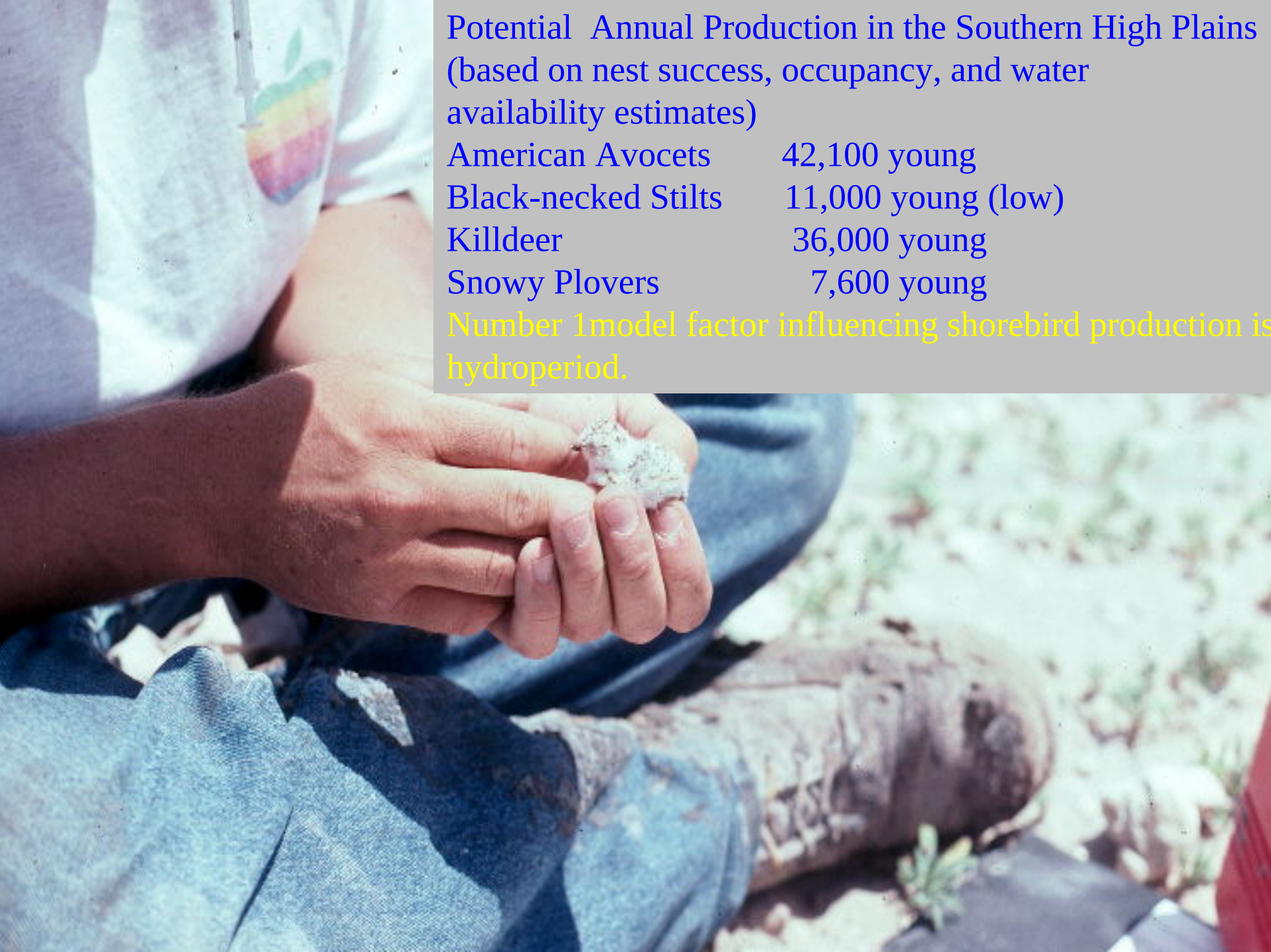
- Spring migration peaks over 2-4 weeks
- Fall migration is protracted over 6-8 weeks
- Playa Use/Behavior is dominated by feeding
- Larger species rested more and fed less than smaller species (size and migration differences)
- Birds selected sparsely vegetated playas that had abundant invertebrates
- Hydroperiod was the major influence on invertebrate production

Major Breeding Shorebirds in all High Plains wetland types

American Avocet
Snowy Plover
Black-necked Stilt
Killdeer



Important High Plains habitats are *Salt Lakes and Playas.*
Manmade habitats are poor.
Riparian zones are now weak due to flow reductions.



Potential Annual Production in the Southern High Plains (based on nest success, occupancy, and water availability estimates)

American Avocets	42,100 young
Black-necked Stilts	11,000 young (low)
Killdeer	36,000 young
Snowy Plovers	7,600 young

Number 1model factor influencing shorebird production is hydroperiod.

Avian community relationships to Landscape in the Rainwater Basins Playas of Nebraska during Migration

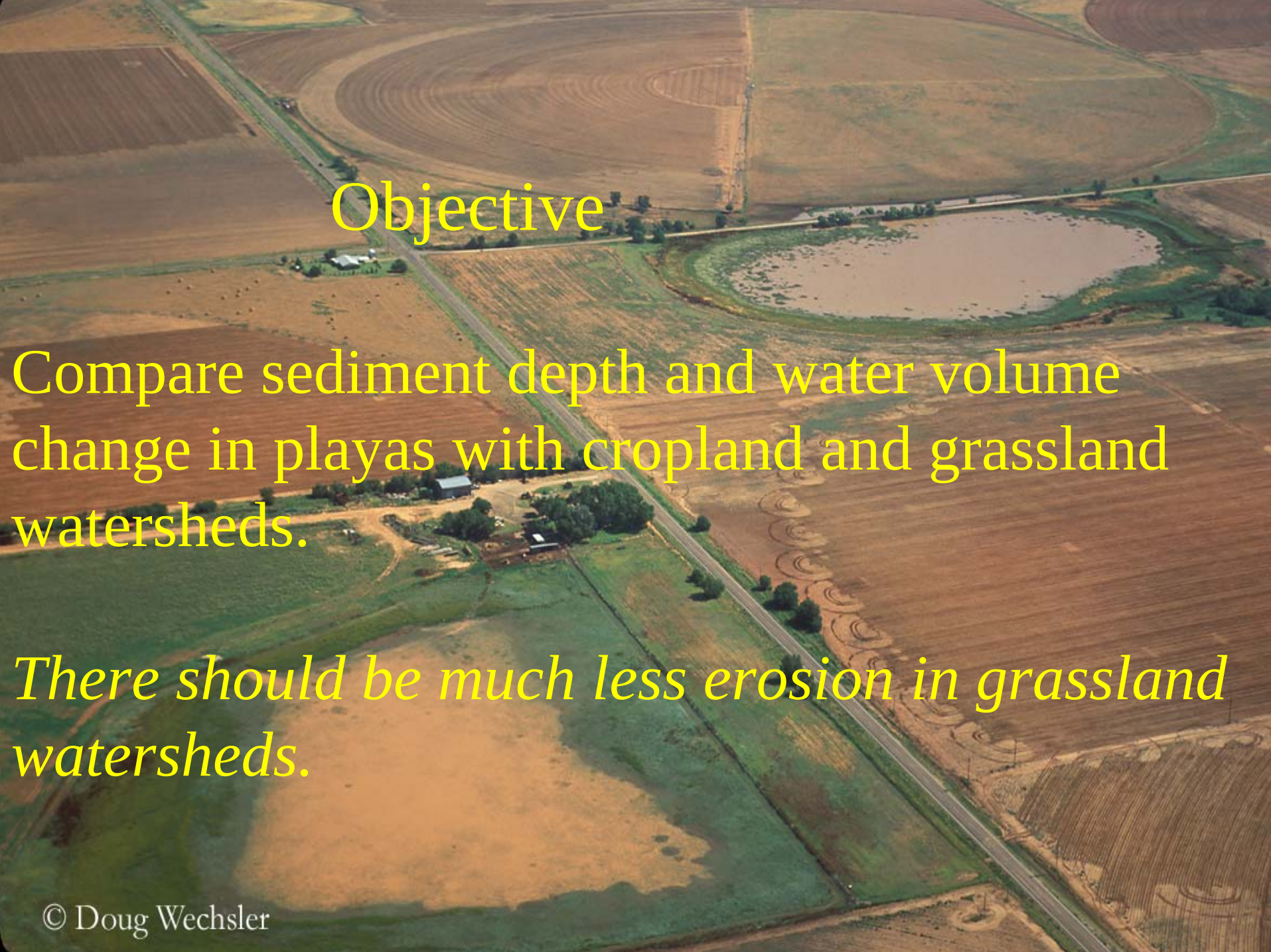
RWB Findings- 3yr study (surveyed 115 playas 0.3 to 727 ha)

- Avian diversity and richness were best predicted by water area, amount of persistent emergent vegetation, and survey week.
- As predicted in basic Island Biogeography theory larger wetlands had higher diversity.
- The amount of persistent emergents negatively (>50%) influenced diversity (related to land use;same in our Cheyenne Bottoms,KS studies).
- Peak overall avian diversity occurred in April after peak waterfowl migration, so wetland ability to maintain seasonal water is key to the entire avian community.

All studies have shown that hydroperiod (water availability) is key to population health of migratory birds in playas.

In addition to climate, what factor then most influences the amount of time a playa has water and therefore the status of waterfowl and shorebird species in the region?

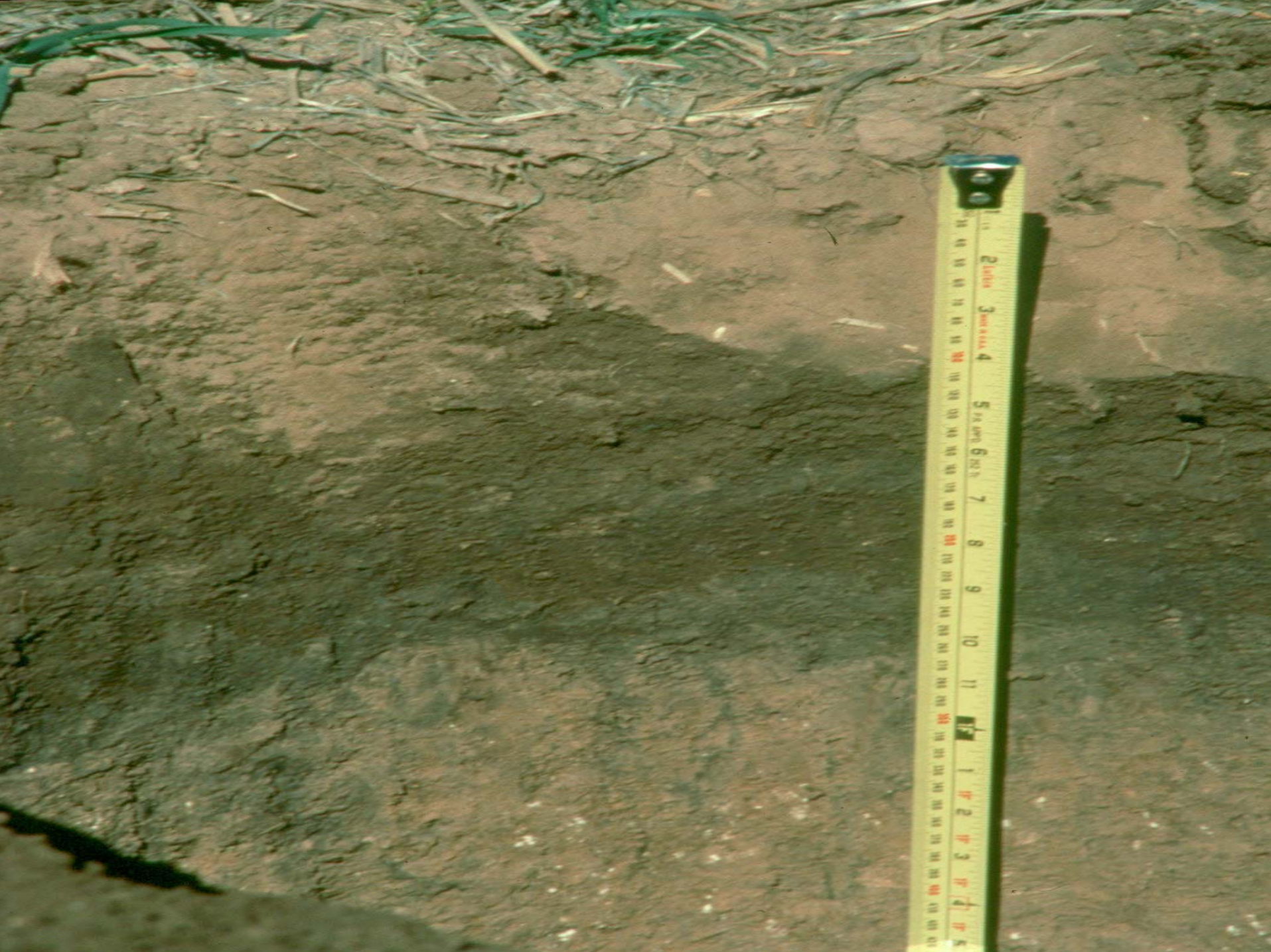
Effects of soil erosion on playa hydroperiod



Objective

Compare sediment depth and water volume change in playas with cropland and grassland watersheds.

There should be much less erosion in grassland watersheds.



Sedimentation of Playa Wetlands by Soil Zone

	Crop				Range			
	Fine		Medium		Fine		Medium	
Variable	$\bar{x}$	SE	$\bar{x}$	SE	$\bar{x}$	SE	$\bar{x}$	SE
Sediment depth (cm)	29	4	58	5	5	4	4	5
Volume Loss (%)	133	41	378	45	49	41	33	45

Most playas in cropland have lost more than 100% of their hydric soil defined volume!

Grassland playas have minimal sediment inputs.

Eroded soils from cultivated watersheds are causing drastically lower hydroperiods.

Spreading water over larger area subjects it to higher evaporation and more porous upland soils.

Implications

*Grassland Buffer (best option)

*Sediment Removal (protect watershed 1st , studies ongoing in RWB)

*Physical Barrier (difficult, limits flow)


ARMSTRONG PLAYA
A CONSERVATION EASEMENT DONATED BY
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INCLUDING ANY WATER BELOW ELEV. 3,858 FEET, TO WILDLIFE!
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PLAYA LAKES JOINT VENTURE PROJECT NO.1


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LAKE

FLORA STUDIES

>Landscape Influence on Plant Communities
(Native Grassland vs. Cultivation)

>Biogeographic Influences on Floral Diversity

224 Playas Surveyed
in 5 States (OK,TX, CO,KS,NM)

Plant Community Characteristics of Playas as Influenced by Watershed Type

Characteristic	Crop	Grassland
Richness	19.6	19.1
No. of Annual Species	8.9	6.7
% Annuals	30.0	11.9
No. of Perennial Species	9.8	10.9
% Perennials	47.0	62.7
No. of Exotics	4.7	2.3
% Exotics	15.6	6.3

Playa Area and Diversity Relationships

- For all plant species there were only marginal ($r < 0.1$) relationships between area and richness. Playa density only explained slightly more of the diversity relationship.
- Relationship for just wetland plants was much stronger because large playas stay wet longer.
- Conservation efforts should focus not only on the area of the wetland but on the condition of its watershed (i.e. exotics).
- Conservation of playa flora requires protection of hundreds of playas (350 existing species)
  - 50 playas will conserve 80 native species
  - 100 playas will conserve 102 native species
  - 200 playas will conserve 125 native species


Land use and area influences on avian community composition in playas of the Southern High Plains

Results

- Preliminary results from
  - June 2003 – May 2004 &
  - June 2004 – Feb 2005
- No differences in mean species richness between land uses
- Wet playas had higher mean species richness than dry playas

Table 1. 2003-04(Continued)

		Combined (Cropland and Grassland) Playas		
		Mean	SE	n
Wet				
	Summer	17.85a[1]	1.05	40
	Fall	18.92a	1.94	16
	Winter	7.25b	2.07	6
	Spring	12.97c	1.28	32
Dry				
	Summer	3.69a	0.44	22
	Fall	4.78b	0.59	36
	Winter	3.10c	0.49	40
	Spring	4.88b	0.50	32

1 Means species richness in season by wet/dry conditions followed by the different letters represent significant difference ($p<0.1$)

Table 2. 2004-05
(Continued)

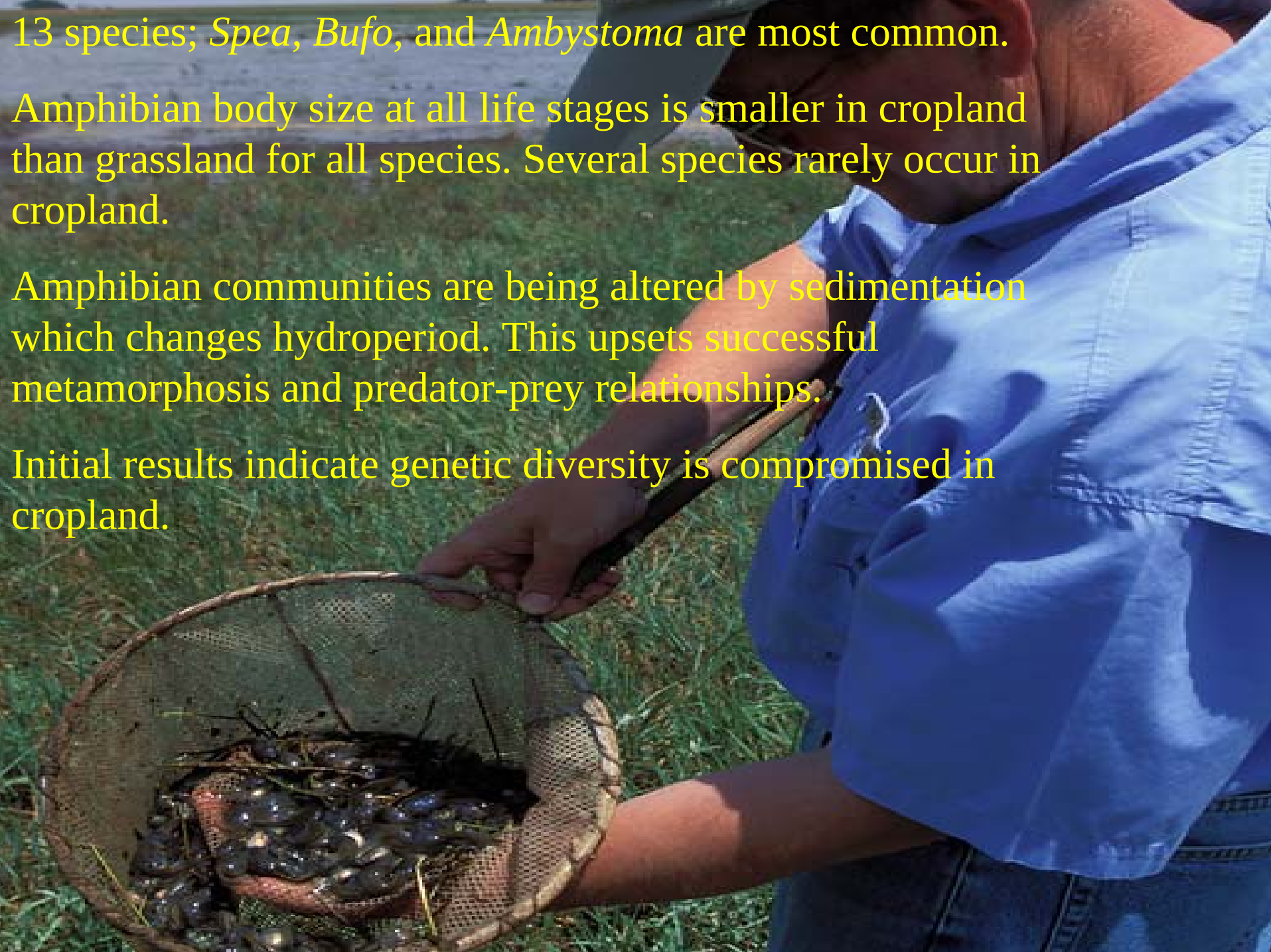
		Combined (Cropland and Grassland) Playas		
		Mean	SE	n
Wet				
	Summer	16.65a[1]	1.08	40
	Fall	14.13b	1.33	39
	Winter	6.67c	0.66	38
Dry				
	Summer	1.83a	0.36	7
	Fall	1.62ab	0.40	18
	Winter	1.30b	0.33	16

1 Means species richness in season by wet/dry conditions
followed by the different letters represent significant difference ($p<0.1$)

Results

- Differences in species composition
  - More exotic species in cropland playas ; $p < 0.01$
  - Some species restricted to grassland playas (i.e. long-billed curlew)
    - 2003-2004
      - 4/20 for cropland
      - 14/20 for grassland

Influence of Landscape on Playa Amphibians



13 species; *Spea*, *Bufo*, and *Ambystoma* are most common.

Amphibian body size at all life stages is smaller in cropland than grassland for all species. Several species rarely occur in cropland.

Amphibian communities are being altered by sedimentation which changes hydroperiod. This upsets successful metamorphosis and predator-prey relationships.

Initial results indicate genetic diversity is compromised in cropland.

Application of Playa Conservation Research

(priority order)

1. Protect playas in pristine prairie with intact watersheds for fewer exotics(birds and plants)

2. Select large playas for high wetland plant and avian diversity

3. Conserve playas in clusters for high diversity and population health

What should we do in the most common real life situations like this?

First, always protect the watershed, otherwise any restoration will be short-lived.

Next, restore hydrology/hydroperiod. To do that remove sediments and/or fill pits.

Current Support for Landuse Influence Research on Playas

National Science Foundation-Amph. Larvae and Immunology.

Environmental Protection Agency- Global Warming and Birds.

Kleberg Foundation-Tadpoles, Contaminants, and Lipid Use.

Rainwater Basin Joint Venture- Landscape and Avian Communities.

U.S. Dept of Agriculture-ARS and Panhandle Underground Water District- Sediments and Recharge.

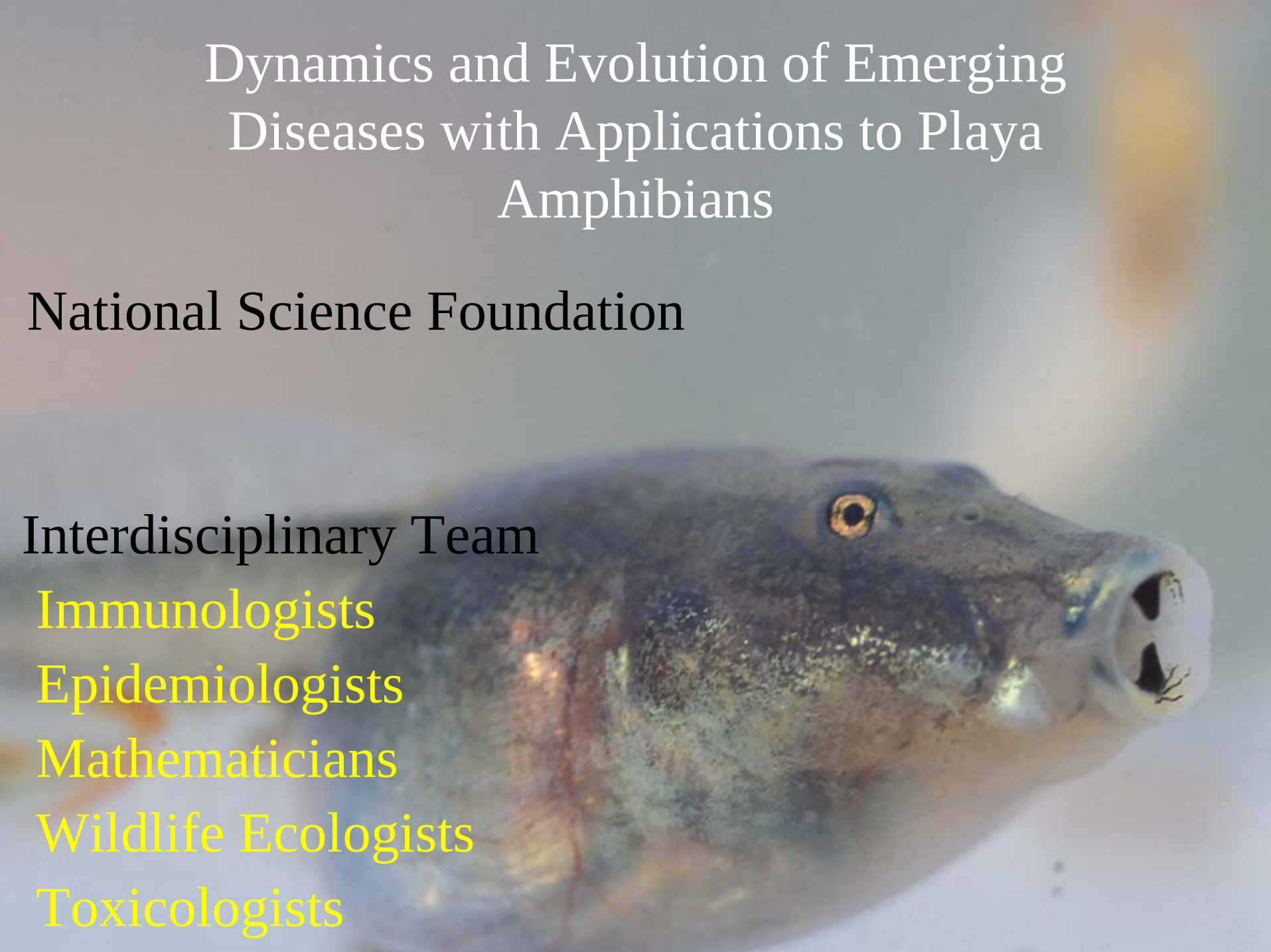
Interactions among climate, humans, and playa wetlands on the Southern High Plains

Environmental Protection Agency
Interdisciplinary Project

Agricultural Economists
Environmental Toxicologists
Wildlife Ecologists
Molecular Biologists
Climatologists

Dynamics and Evolution of Emerging Diseases with Applications to Playa Amphibians

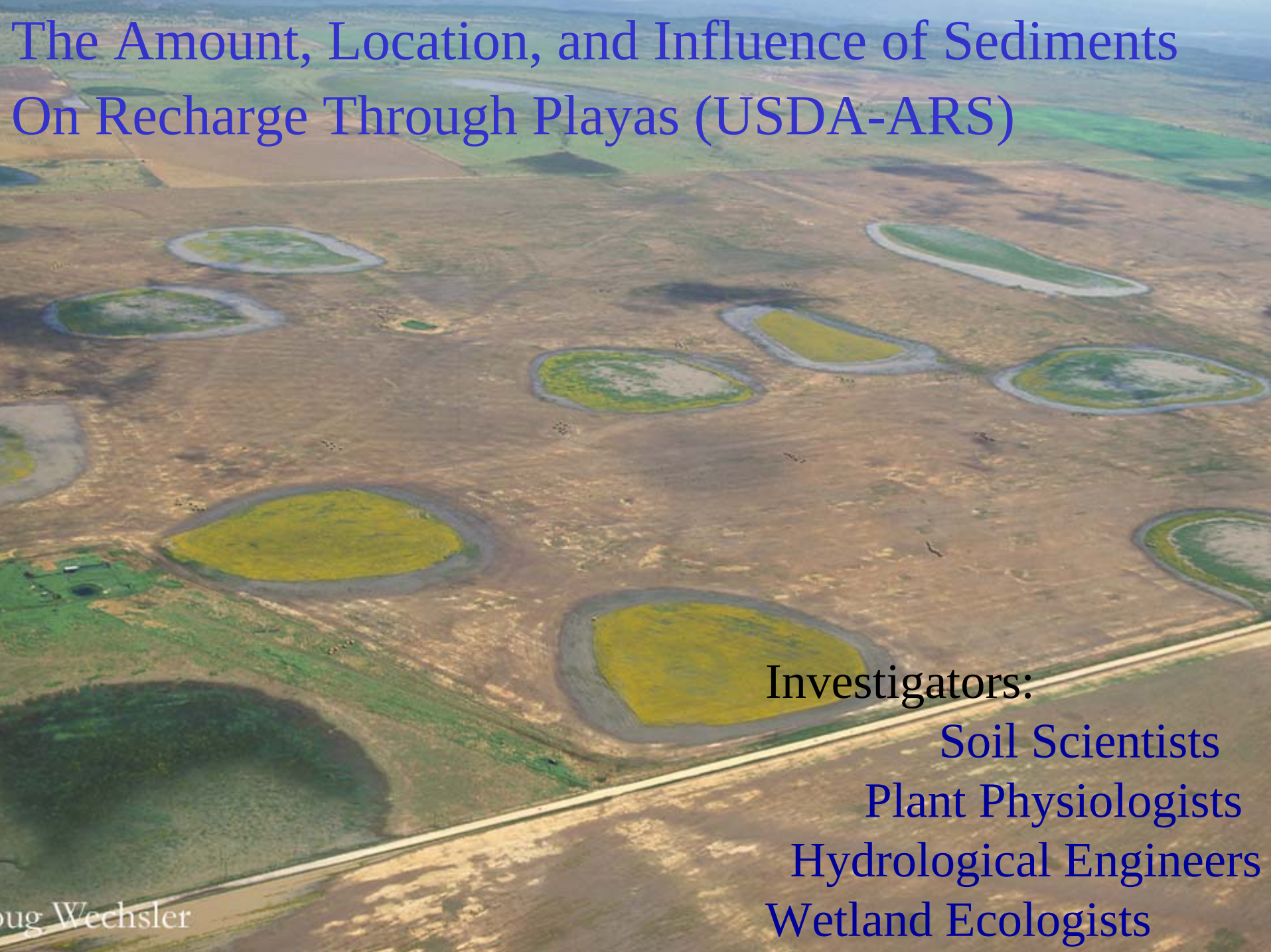
National Science Foundation



Interdisciplinary Team

- Immunologists
- Epidemiologists
- Mathematicians
- Wildlife Ecologists
- Toxicologists

The Amount, Location, and Influence of Sediments On Recharge Through Playas (USDA-ARS)



Investigators:

Soil Scientists

Plant Physiologists

Hydrological Engineers

Wetland Ecologists

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