Adaptive Management Working Group Meeting
23 February 2021

Platte River Recovery Implementation Program

Whooping Cranes – Potential BIG QUESTIONS

- **Q1: What are the conditions that influence whether a WC will stop or flyover the CPR?**

- **Q2: Can we use water to make UOCW for WC use?**

  a) Can we use SDHF (Fall) to maintain UOCW?

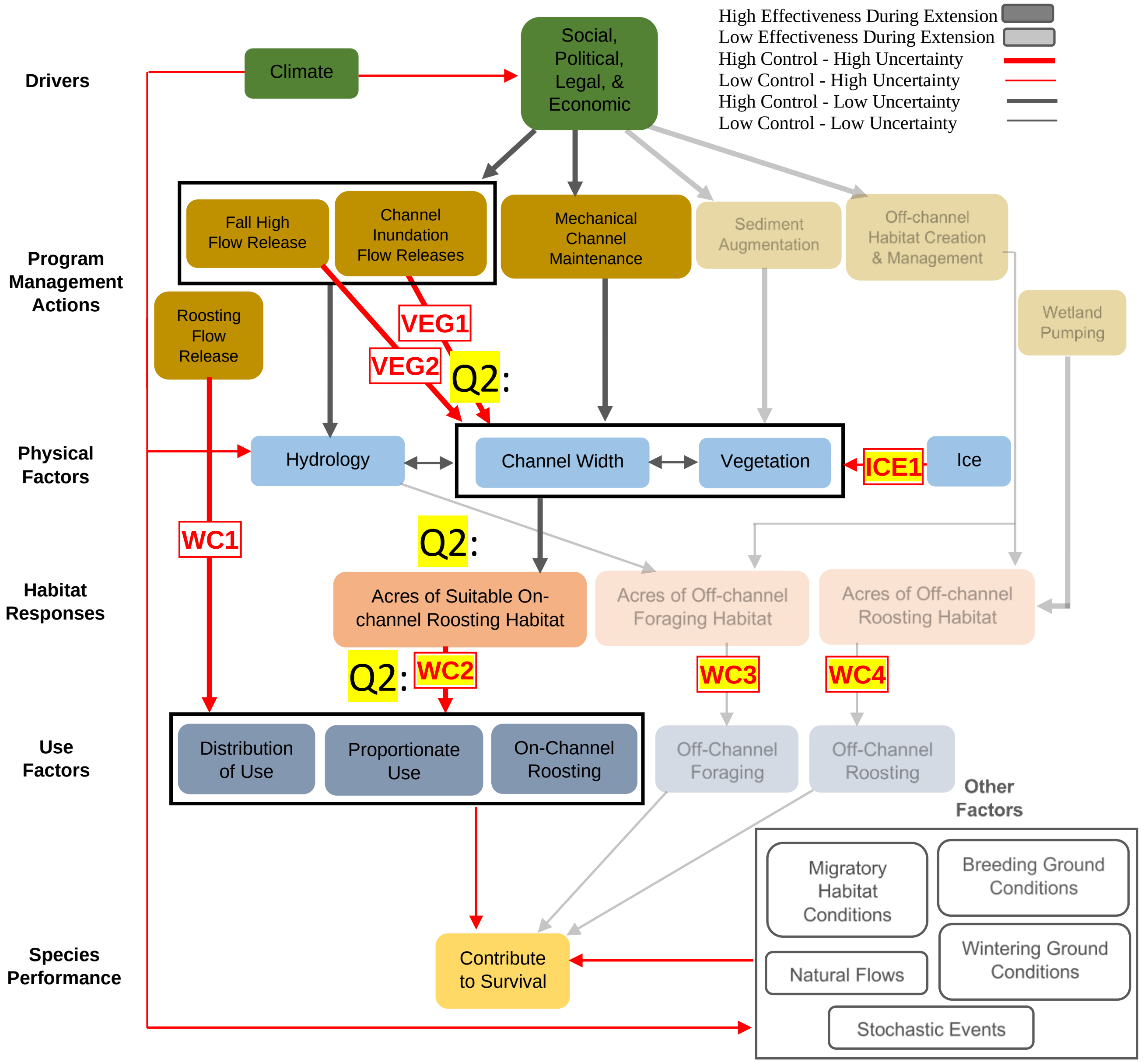
  Does anyone still want to test SDHF? If so, need to pose the specific question.

  b) Can we use germination suppression flows (Spring/Summer) to maintain UOCW?

- **Q3: What are the conditions that influence length of stay on the CPR?**

- **Q4: Are WC that stop on the CPR more fit?**

Figure 2. Whooping Crane Conceptual Ecological Model



Whooping Cranes – Potential BIG QUESTIONS

- **Q2: Can we use channel inundation to suppress germination and maintain UOCW?**
  - What do we already know?
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Whooping Cranes – Potential BIG QUESTIONS

Q2: Can we use channel inundation to suppress germination and maintain UOCW?

- **Target species**
- **Duration – For how long?**
- **Timing – When? Frequency?**
- **Magnitude – How much water do we need? Depth? Volume?**
- **Can we do it? Do we have the volume/operations capacity to do it even through drought?**

Target Vegetation Phenology

Germination Suppression

Phragmites

viable seeds in Nov
few seeds in March, 25% germinability
flood<2wks after dissemination

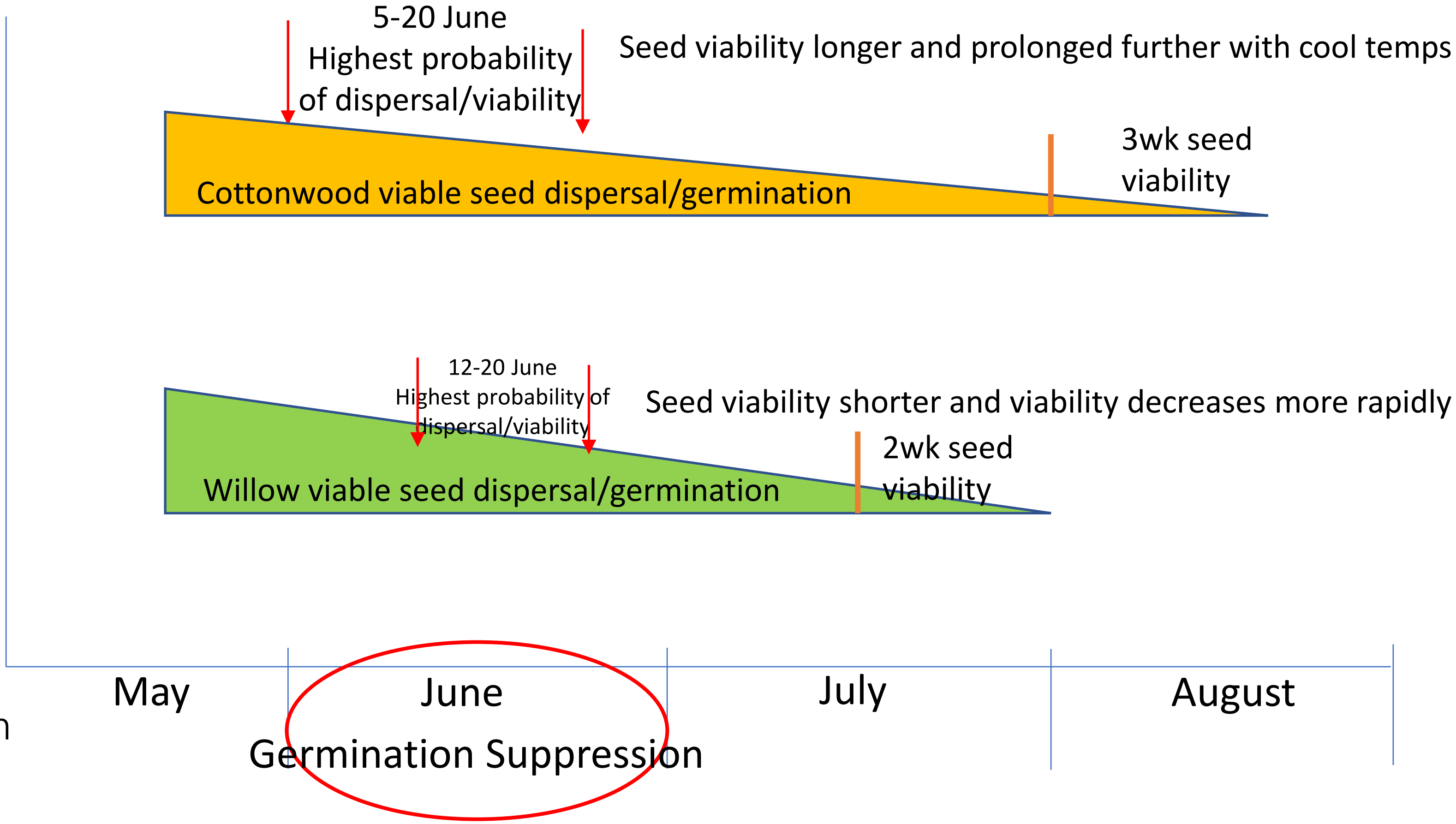
Cottonwood seeds

viable 3 weeks
% germination ↓> 6 days
<5% germination > 16 days

Willow seeds

viable 2 weeks
% germination ↓@ 2-4 days
if wet/warm all germinate, so viability over longer time periods hard to test

Germination/establishment requires high soil moisture and exposure of 1-2 weeks



Target Vegetation Phenology

Seedling Inundation

Cottonwood seedlings (3-4wks)

survive <16 days under 1 ft of water (3" tall Hosner 1958)

50% mortality@ 75days under 6in of water (<1cm tall Marks & Atia 2020)

50% mortality @ 7 days under 22in of water (<1cm tall Marks & Atia 2020)

Willow seedlings (3-4wks)

survive >32 days under 1 ft of water (3" tall Hosner 1958)

Sapling Inundation
Cottonwood and Willow

2nd year 15" saplings

all survived 150-day inundation

deeper water reduces root elongation

fall inundation more effective to ↓ growth

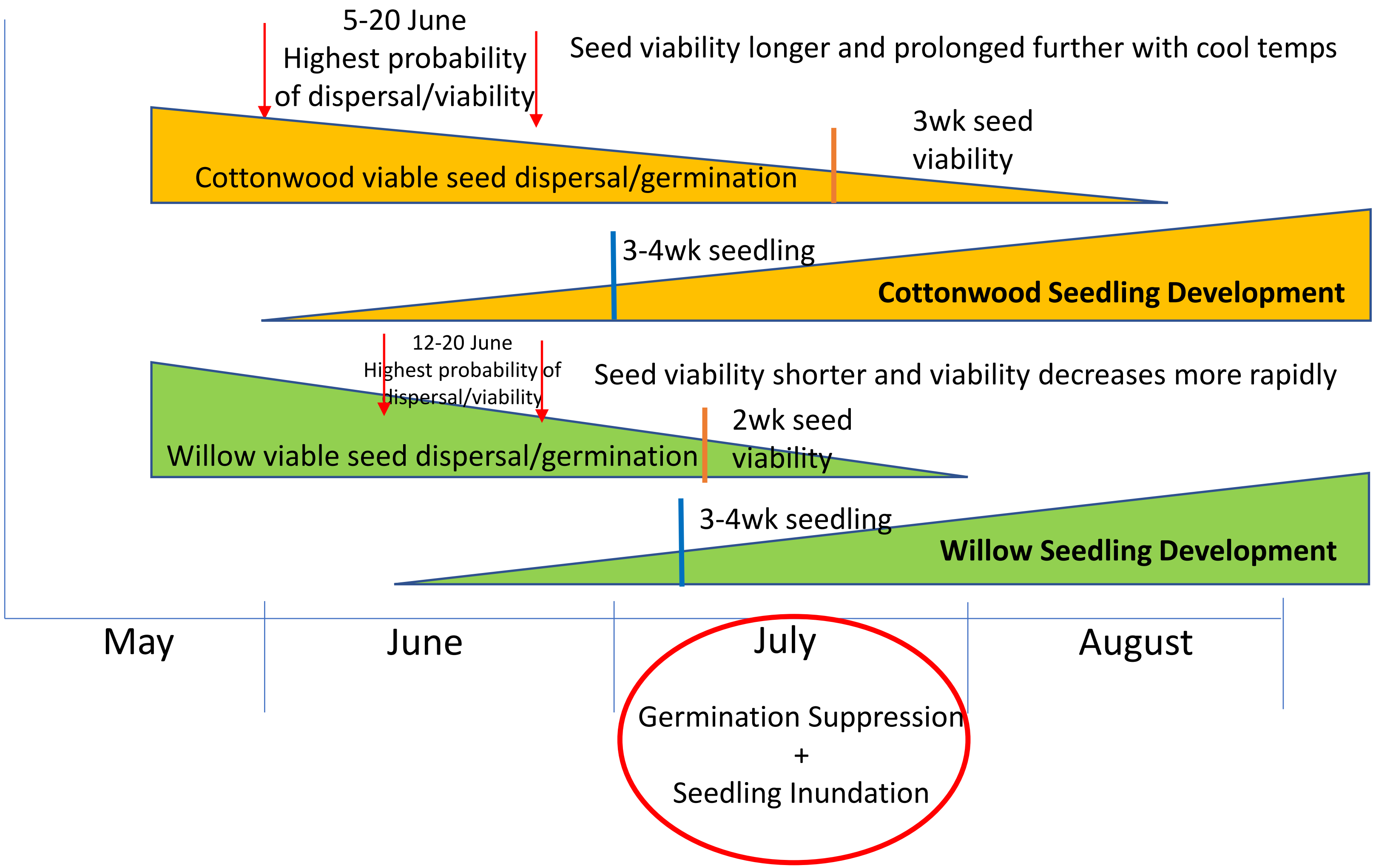


TABLE I. Results of complete submergence for varying periods of time of six species of bottomland hardwoods

Species	Length of Complete Submergence in Days — Under 1 ft of water				
	2	4	8	16	32
Cotton-wood	Dead areas appeared both lower and upper leaves; recovered quickly.	Large dead areas on all leaves; recovered quickly; new leaves appeared within a few days.	All lived; lower leaves lost on all plants; recovered slowly.	All died soon after removal.	All died.
Willow	No apparent effect.	Lost a few lower leaves; recovered quickly; new leaves appeared within a few days.	All lived; all lost some lower leaves; slightly chlorotic; recovered quickly.	All lived; leaves slight to very chlorotic; several lower leaves dropped off; all recovered quickly.	Appeared very chlorotic; all but upper 3-4 leaves dead; recovered quickly and grew well.
Redgum	2 trees showed dead areas on leaf margins; recovered quickly.	All trees showed dead areas; mostly on lower leaves; recovered slowly; new leaves appeared within 8 days.	All lived; slightly chlorotic; recovered slowly.	2 lived; 1 died; only small dead areas on leaves live trees; recovered slowly.	All died.
Ash	No apparent effect.	No apparent effect; new growth appeared within a few days.	All lived; good color; lost some lower leaves; recovered quickly.	All lived, good color upon removal; wilted slightly but recovered quickly.	All died.
Box-elder	No apparent effect.	All slightly chlorotic; recovered slowly; two trees produced new leaves within 9 days.	All lived; moderately chlorotic; terminal leader died on two trees; recovered slowly.	2 died; 1 lived; terminal leader died on 1 living tree, recovered slowly.	All died.
Silver Maple	Wilting of lower leaves; recovered slowly.	All died.	All died.	All died.	All died.

Hosner, J.F. 1958. The Effects of Complete Inundation upon Seedlings of Six Bottomland Tree Species. *Ecology* 39 (2), 371-373.

Cottonwood 1 cm seedling:
50% mortality @ 75 days under 6in of water
50% mortality @ 7 days under 22in of water
Marks-Atia 2020

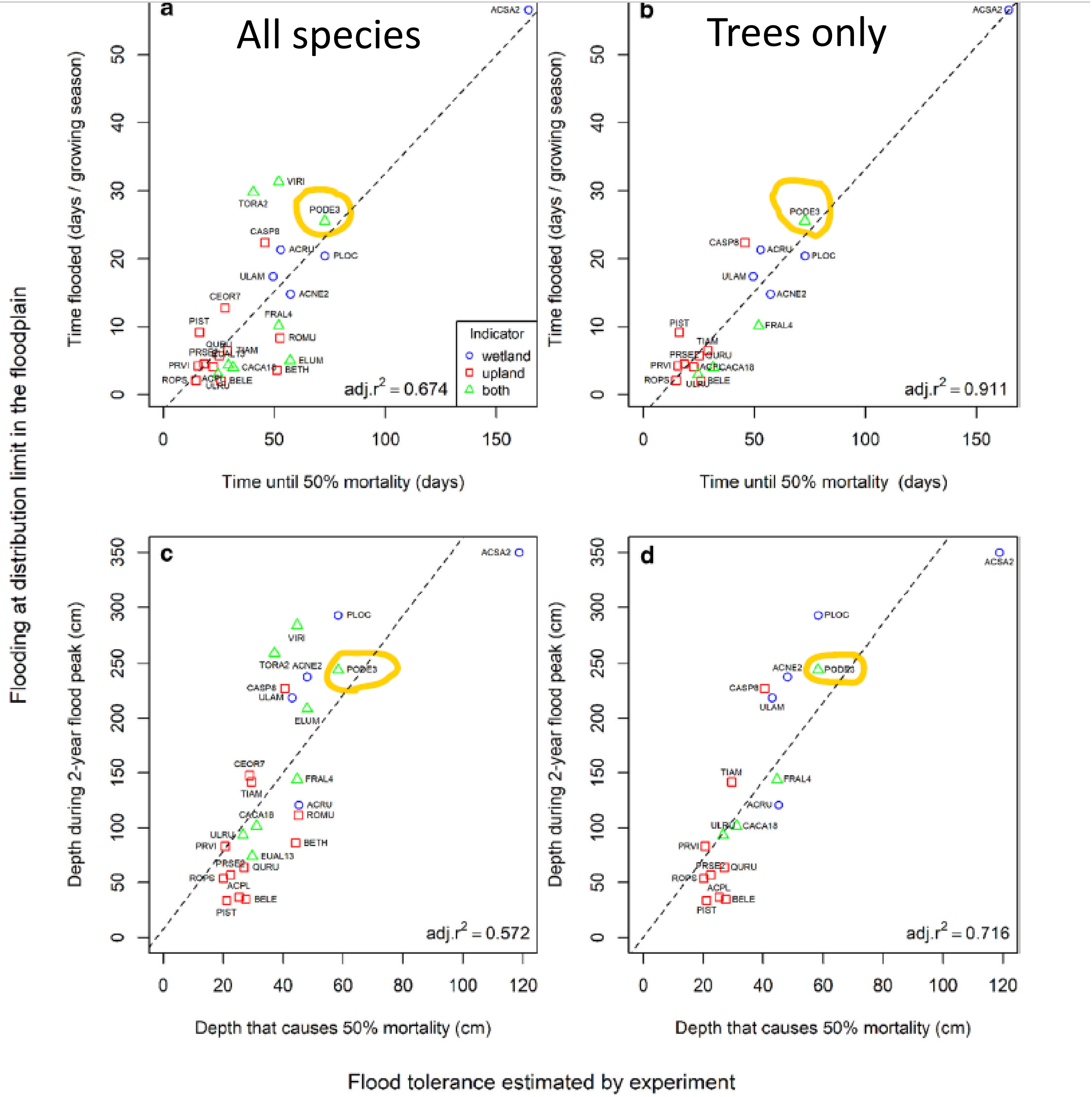


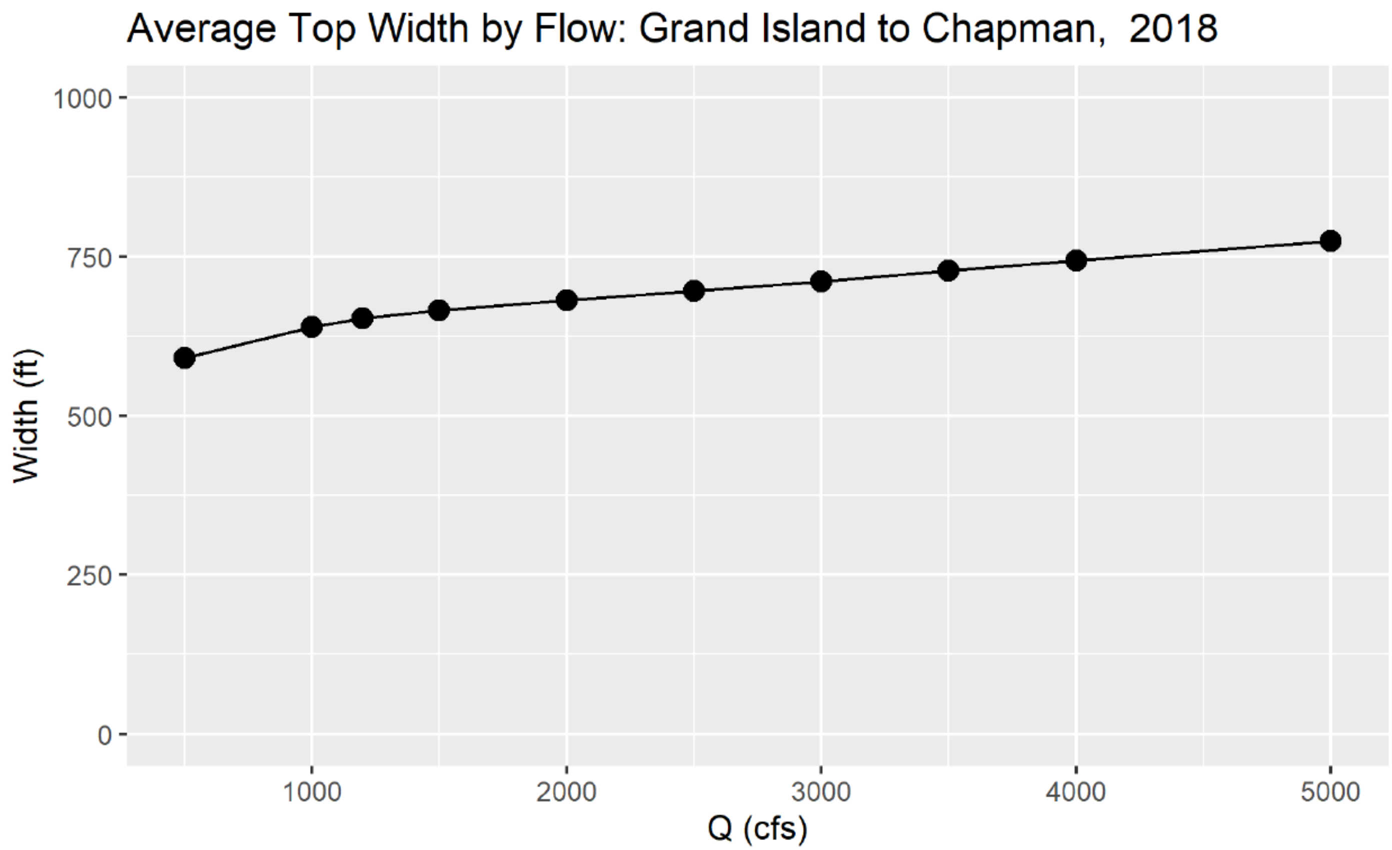
Fig. 2 Linear regression relationship between species distributional limits on flooding gradients in the floodplain and the experimentally determined tolerance of seedlings to complete submergence. Flood survival time estimates (**a** and **b**) are for a depth of 15 cm in clear water. Flood survival depth estimates (**c** and **d**) are for a duration of 7 days in clear water. Plots A and C are for the entire dataset, whereas plots B and D are only for the tree data. If the extremely flood tolerant *Acer saccharinum* (ACSA2) is excluded from the analysis the adjusted r^2 values shown on the plots change to 0.733, 0.739, 0.593, and 0.790 for A, B, C, and D, respectively. See Table 1 for species acronyms and wetland indicator status. Species data are listed in the supplement

Marks & Atia. 2020. Seedling Submergence Tolerances Accurately Predict Riparian Tree Species Distributions: Insights to Help Design Environmental Flows. *Wetlands* 40:1923–1934. https://doi.org/10.1007/s13157-020-01375-5

Whooping Cranes – Potential BIG QUESTIONS

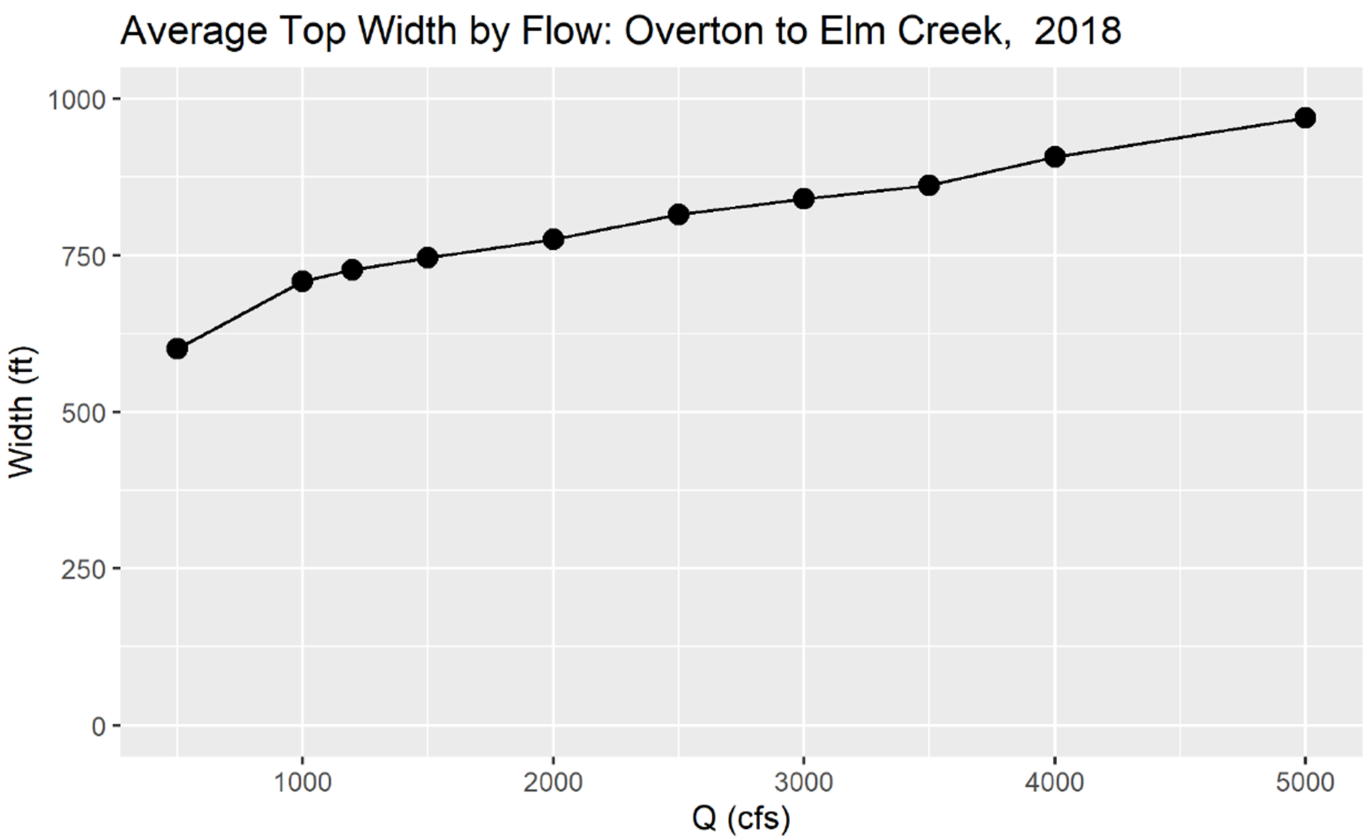
- Q2: Can we use channel inundation to suppress germination and maintain UOCW?
  - Target species
  - Duration – For how long?
  - Timing – When? Frequency?
  - Magnitude – How much water do we need? Depth? Volume?
  - Can we do it? Do we have the volume/operations capacity to do it even through drought? For how long? How often?

How much water do we need?



PLATTE RIVER
RECOVERY IMPLEMENTATION PROGRAM

How much water do we need?



PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM

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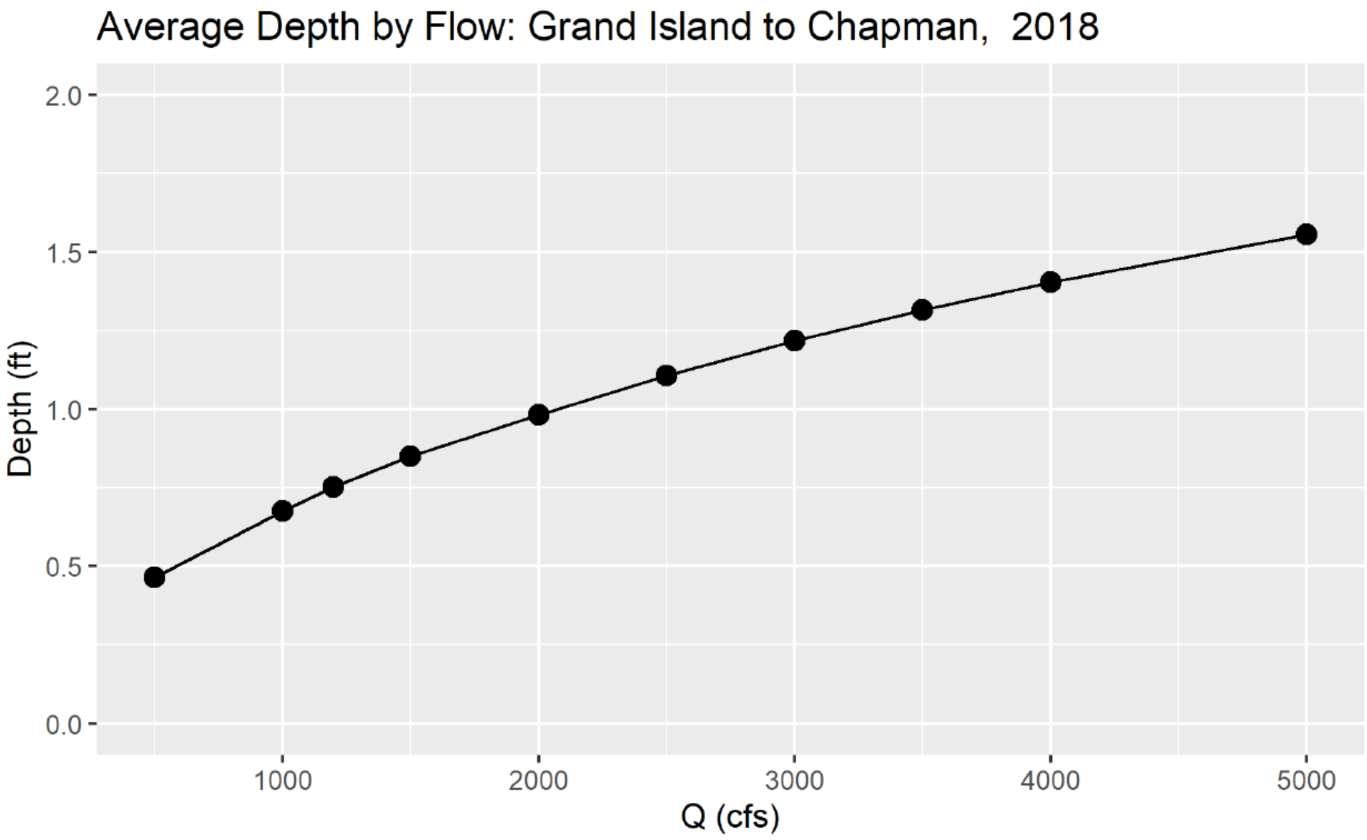
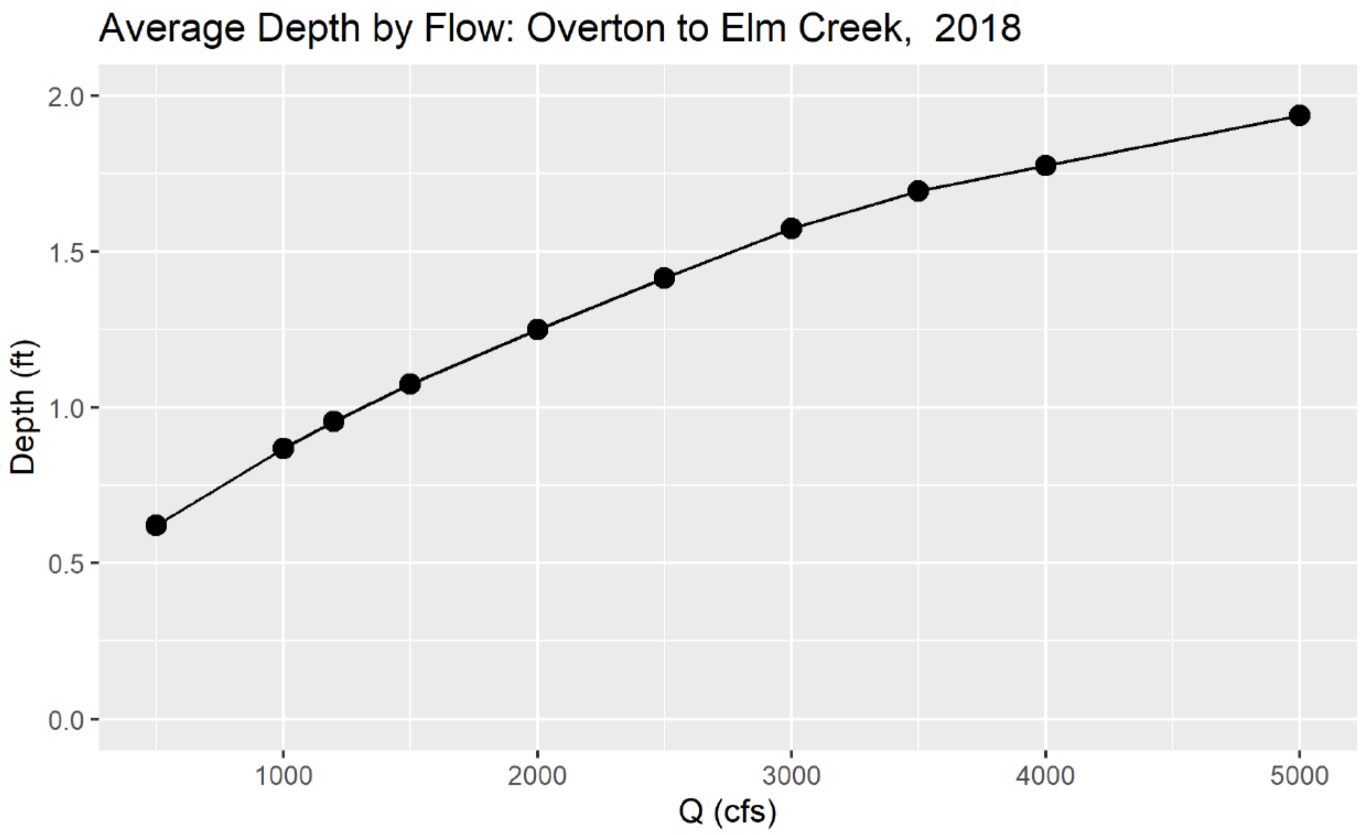


PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM

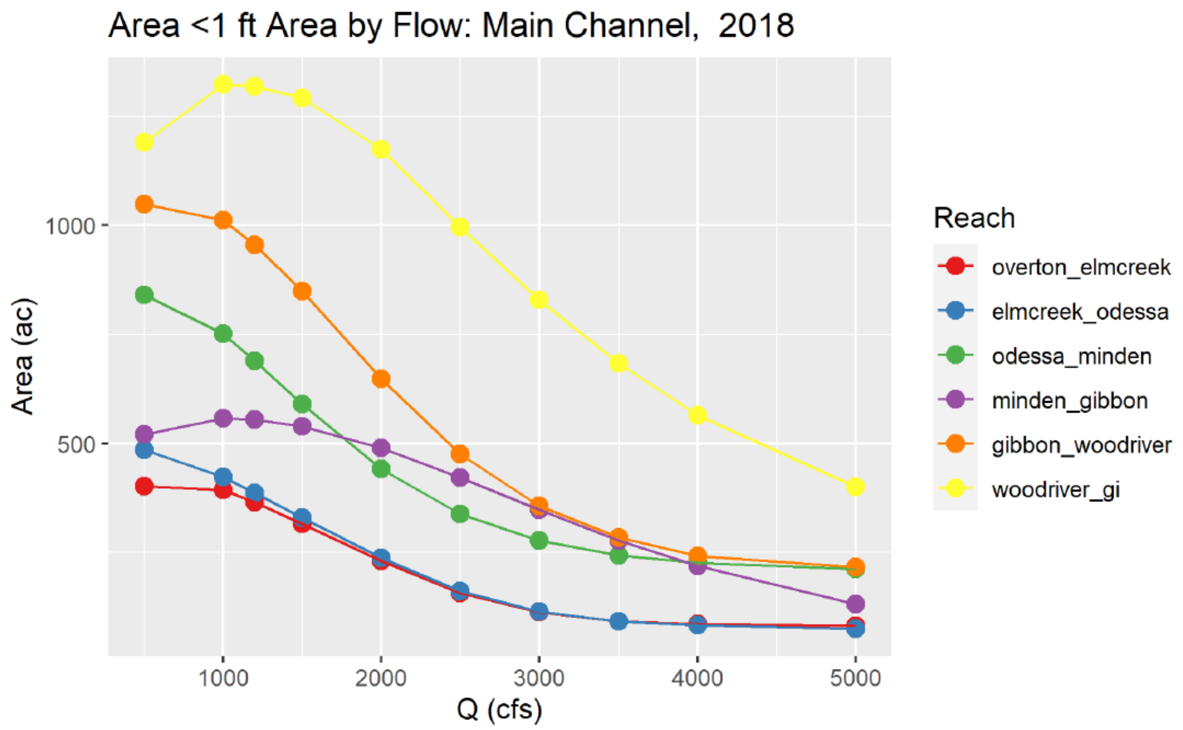
How much water do we need?



PLATTE RIVER
RECOVERY IMPLEMENTATION PROGRAM

How much water do we need?

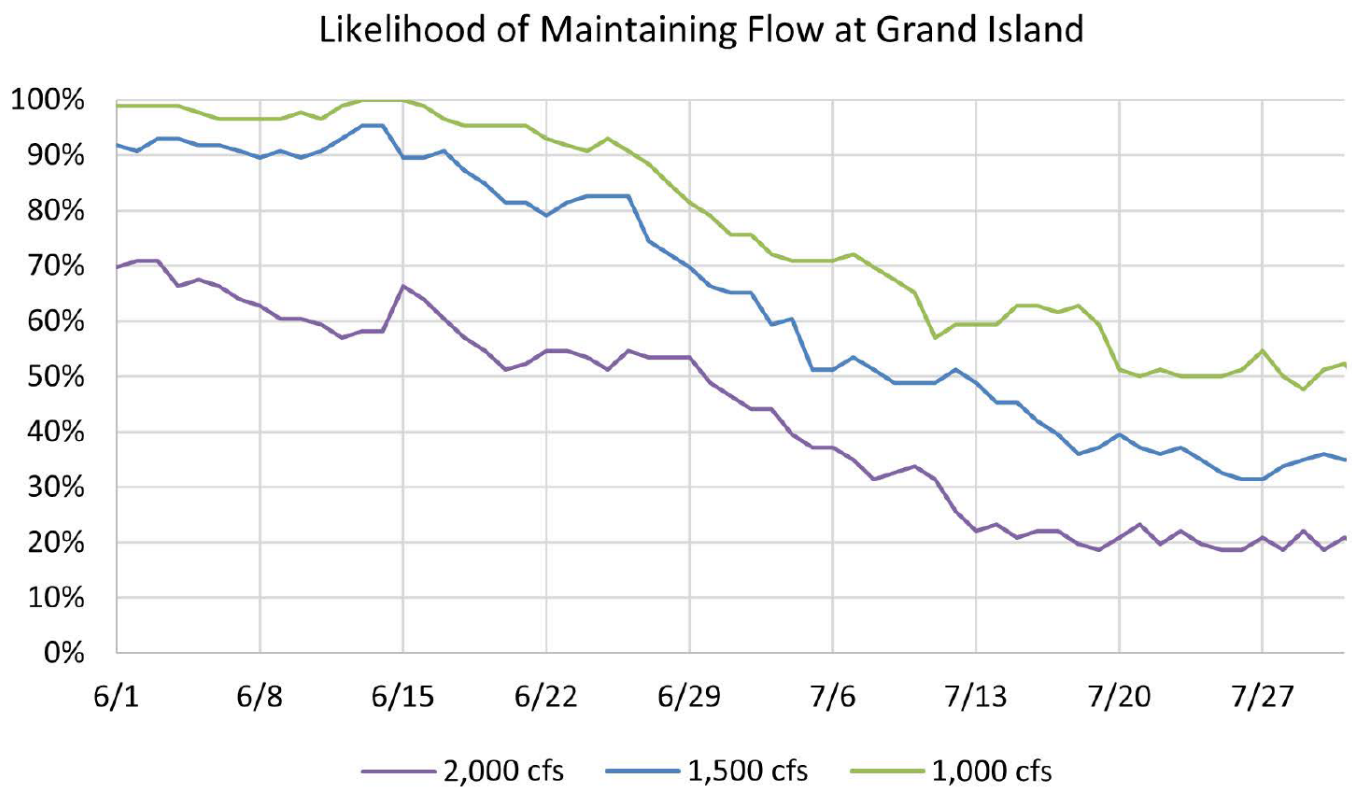
Preliminary Reach Wide Monitoring Results: Whooping Crane Specific



PLATTE RIVE..
RECOVERY IMPLEMENTATION PROGRAM

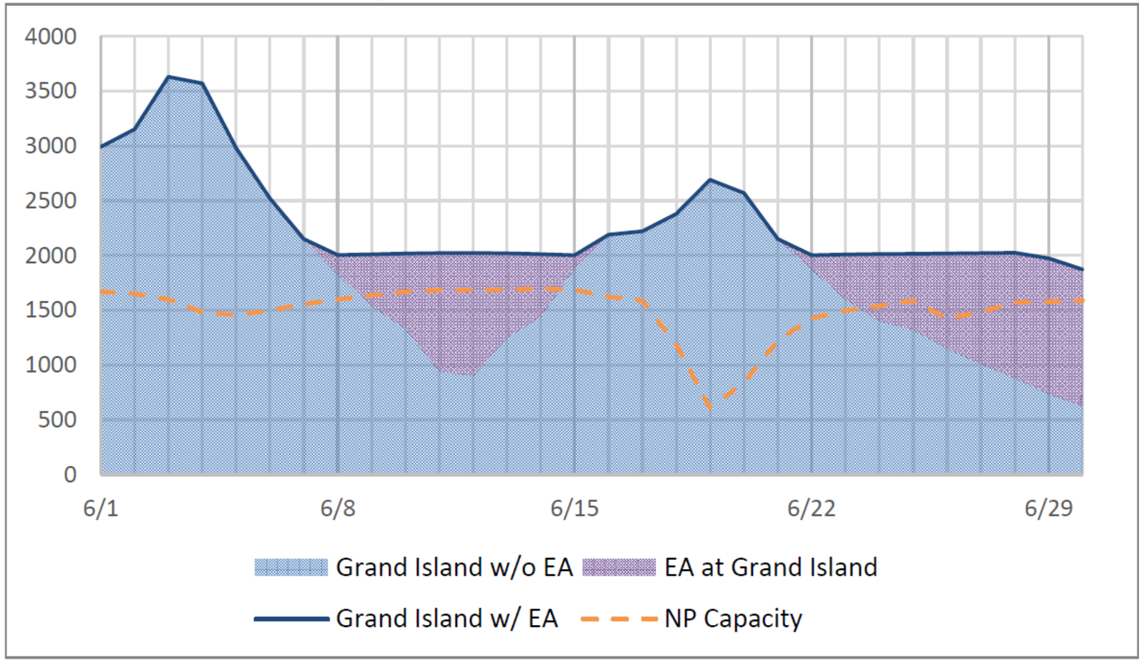
Area less than one foot vs flow , by geomorphic reach

Can we do it?
Volume/Operations Capacity

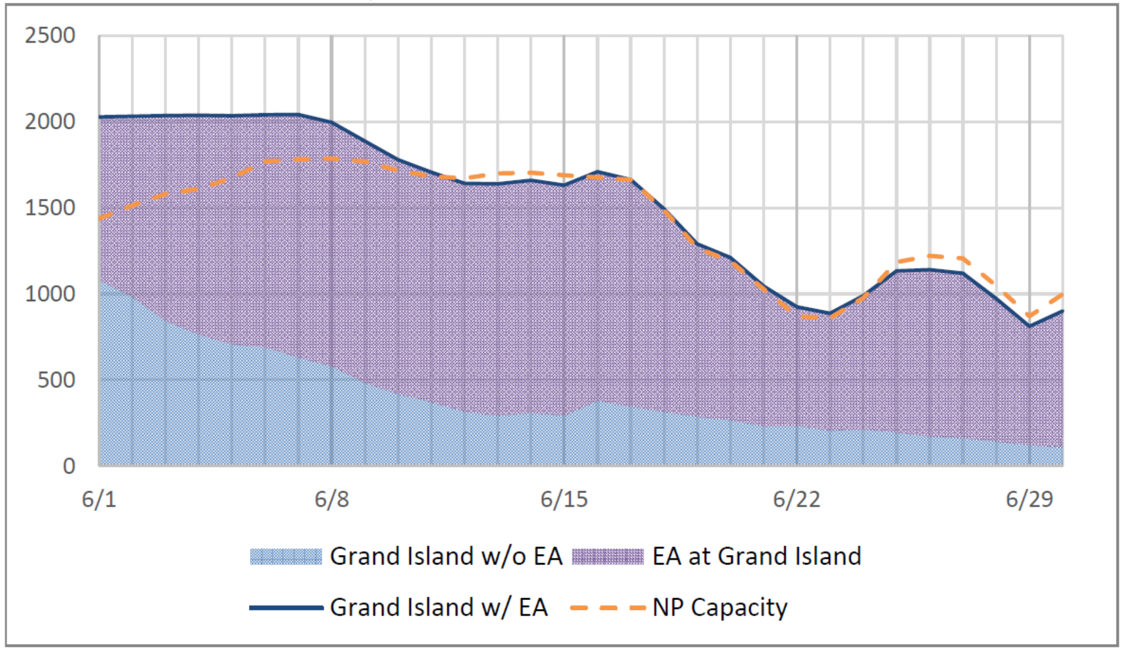


Volume/Operations Capacity – data for additional years on Flow Routing Tool 2020

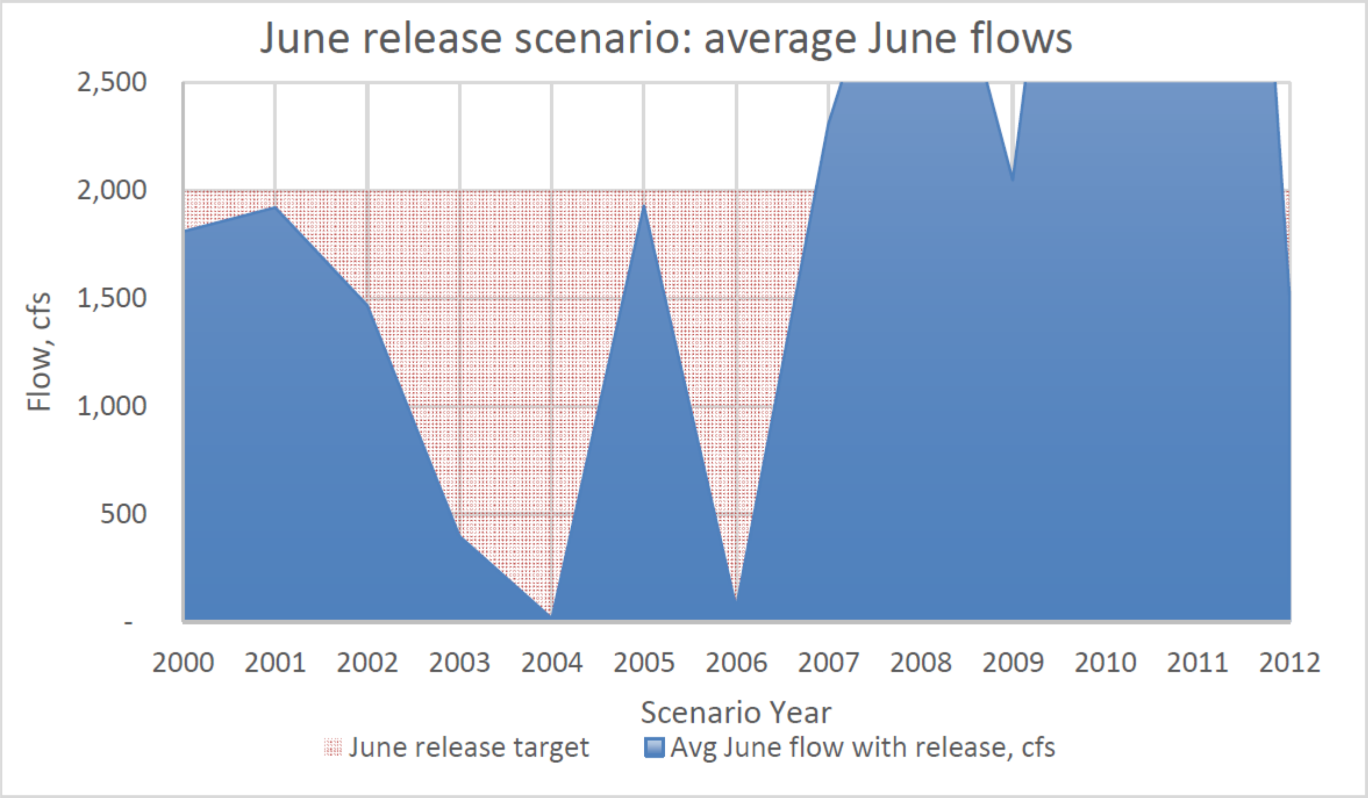
June flow Target:	2,000	EA Start of Year	133,342
Scenario year:	**2007**	EA End of Year	152,135
EA Volume Used:	34,293		



June flow Target:	2,000	EA Start of Year	200,000
Scenario year:	**2012**	EA End of Year	125,781
EA Volume Used:	95,923		



Volume/Operations Capacity



Whooping Cranes – Potential BIG QUESTIONS

- **Q2: Can we use channel inundation to suppress germination and maintain UOCW?**
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Whooping Cranes – Potential BIG QUESTIONS

- **Q2: Can we use channel inundation to suppress germination and maintain UOCW?**
  - What else could be important?
    - How to deal with hydrocycling?
    - Cost/benefit tradeoffs (under potential drought conditions)
      - Germination suppression with water
      - Seedling suppression with water
      - Mechanical options
      - Hybrid options
      - Germination suppression vs. WC flows

Whooping Cranes – Potential BIG QUESTIONS

- **Q2: Can we use channel inundation to suppress germination and maintain UOCW?**
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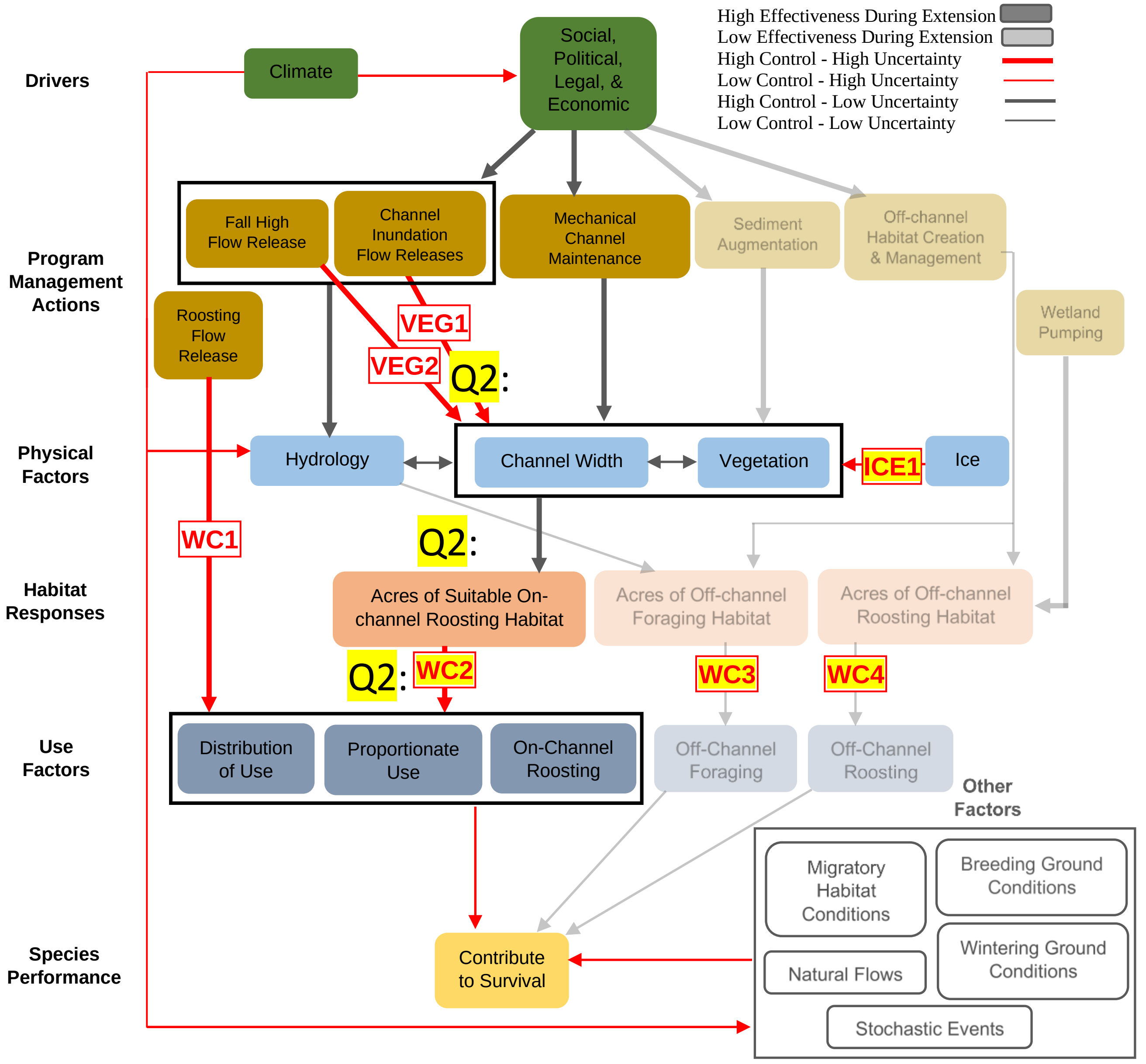
Figure 2. Whooping Crane Conceptual Ecological Model



Hypothesis: Introduce your hypothesis, independent and dependent variables on each axis.
What data support this hypothesis? What are the mechanisms that connect independent variables to the response you predict?

HABITAT RESPONSE
UOCW/MUCW/TUCW (feet)
Proportion of reach with UOCW ≥650 feet
Proportion Unvegetated in-channel landcover (%)
Acres suitable on-channel habitat

Define this variable.
What range of responses are expected?
How will they be measured?

Define this variable.
What range of conditions will be tested?
Over what period of time?
Over what spatial scale?
How will they be created for testing?

FLOW

Description/Link to Program Management:
How is this hypothesis linked to Program management?

Hypothesis: Introduce your hypothesis, independent and dependent variables on each axis.
What data support this hypothesis? What are the mechanisms that connect independent variables to the response you predict?

WC Response

Define this variable.
What range of responses are expected?
How will they be measured?

Define this variable.
What range of conditions will be tested?
Over what period of time?
Over what spatial scale?
How will they be created for testing?

UOCW/MUCW/TUCW (feet)
Proportion of reach with UOCW ≥650 feet
Proportion Unvegetated in-channel landcover (%)
Acres suitable on-channel habitat

Description/Link to Program Management:
How is this hypothesis linked to Program management?

TARGET WIDTH?
650 feet
MUCW
TUCW
Which measure?

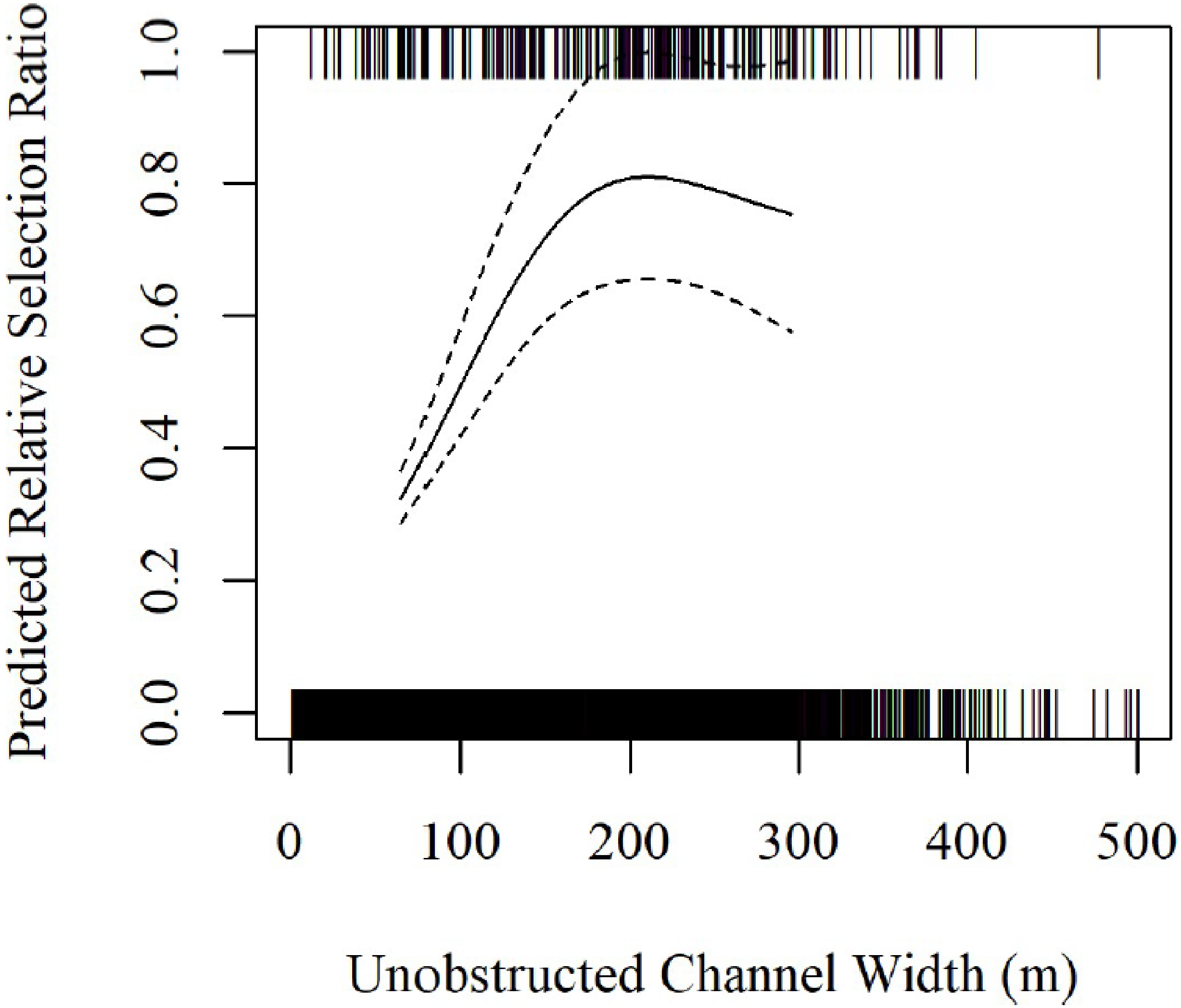
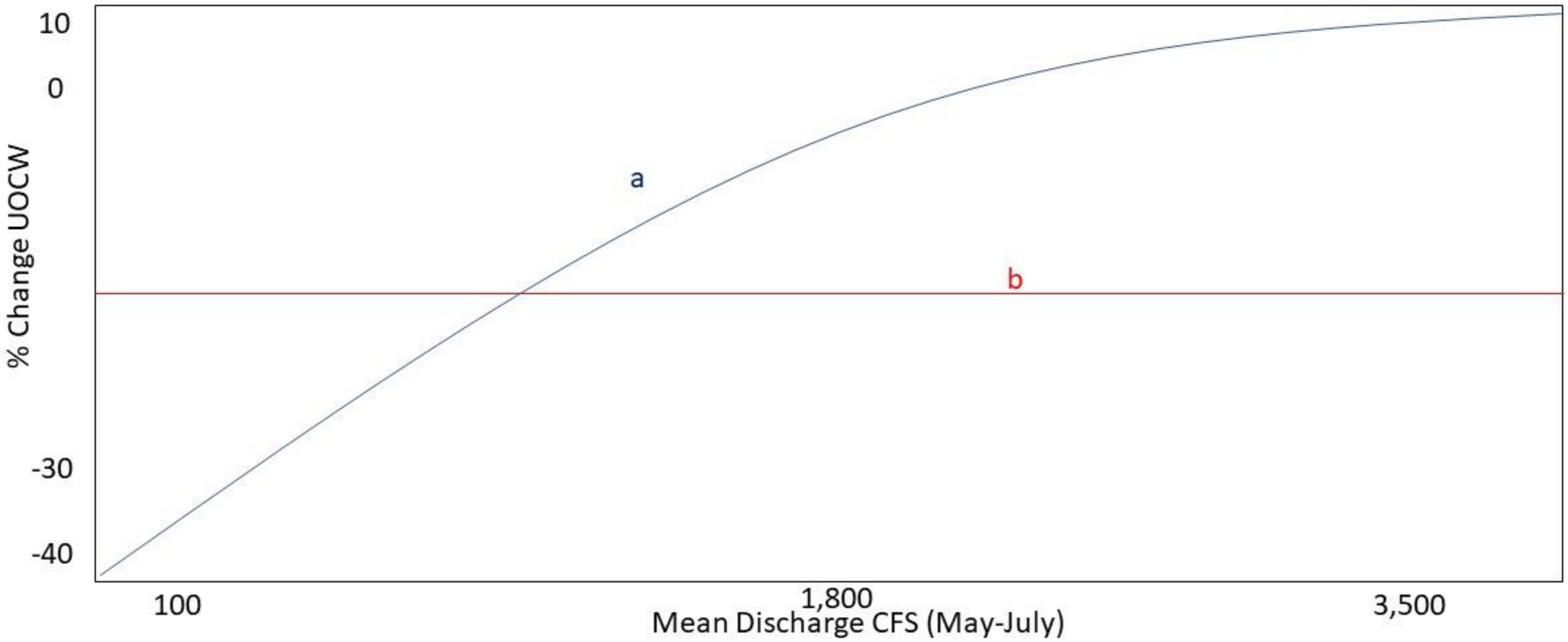


Fig 4. Predicted, relative selection ratio of unobstructed channel width (UOCW) based on all systematically collected whooping crane (n = 235). Tick marks indicate actual data (use points are presented at y = 1 and available points are presented at y = 0). Data is displayed from the 10th to the 90th percentile of use locations with 90% confidence intervals.

https://doi.org/10.1371/journal.pone.0209612.g004

Baasch et al. 2019 WC use of riverine stopover sites

Hypotheses: Mean discharge from 15 May to 15 July has a positive and non-linear relationship with percent change in unobstructed channel width as measured in the fall (October) compared to the previous year holding all else constant (e.g., disking effort).

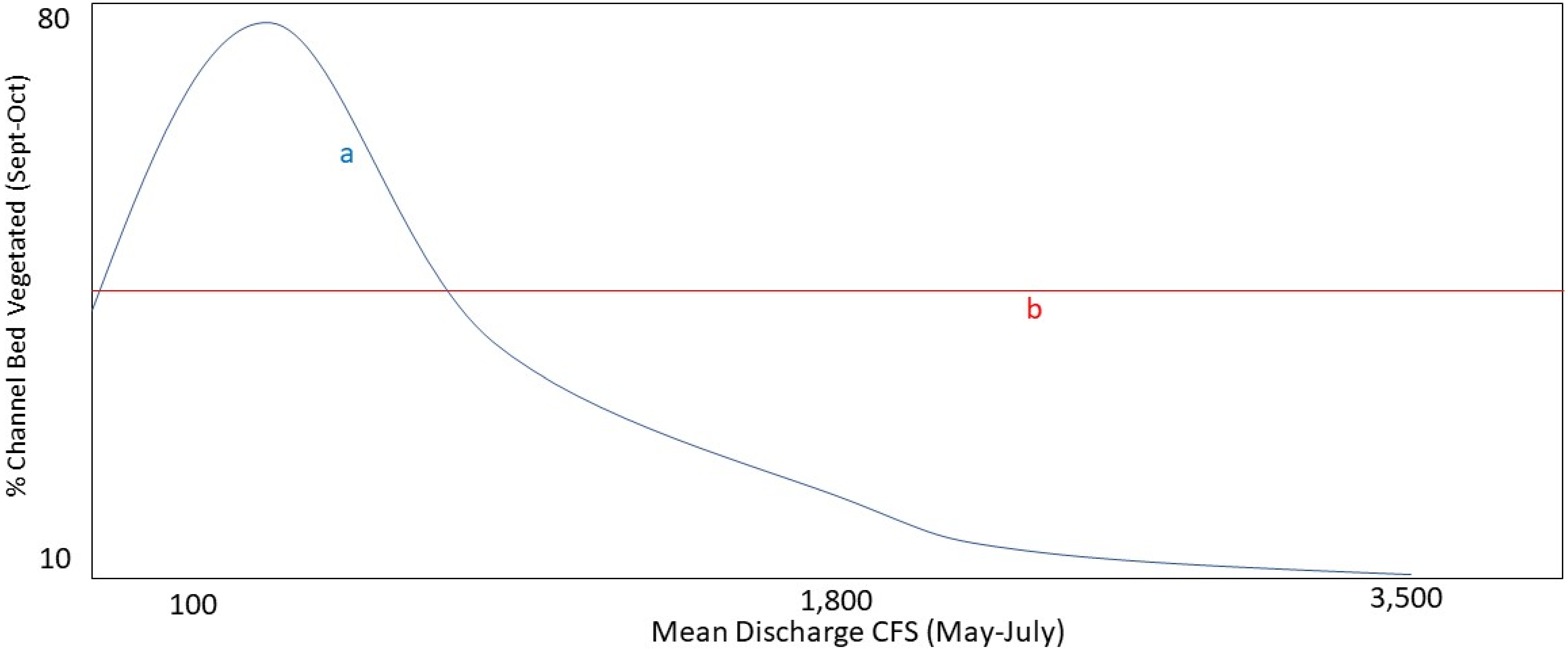


Description/Link to Program Management:

a) Increased flows during this period would limit losses in unobstructed channel widths and the PRRIP could act accordingly to maintain UOCWs appropriate for WHCRs.

b) There is no relationship between germination prevention flows and unobstructed channel width.

Hypothesis: The percent of the active channel in which vegetation becomes established during the growing season (measured at end of growing season: Sept.-Oct.) demonstrates a generally inverse but non-linear relationship to mean discharge from 15 May and 15 July holding all else constant (e.g., disking effort).



Description/Link to Program Management:

a) Vegetation is more likely to become established when "wet sand" conditions predominate from 15 May to 15 July than when the river is very dry or when annual mean discharge is exceeded during this period. Over a certain threshold (e.g., >300 cfs) there is an inverse relationship between vegetation establishment and mean seasonal discharge. The PRRIP can use water to maintain UOCWs appropriate for WHCRs.

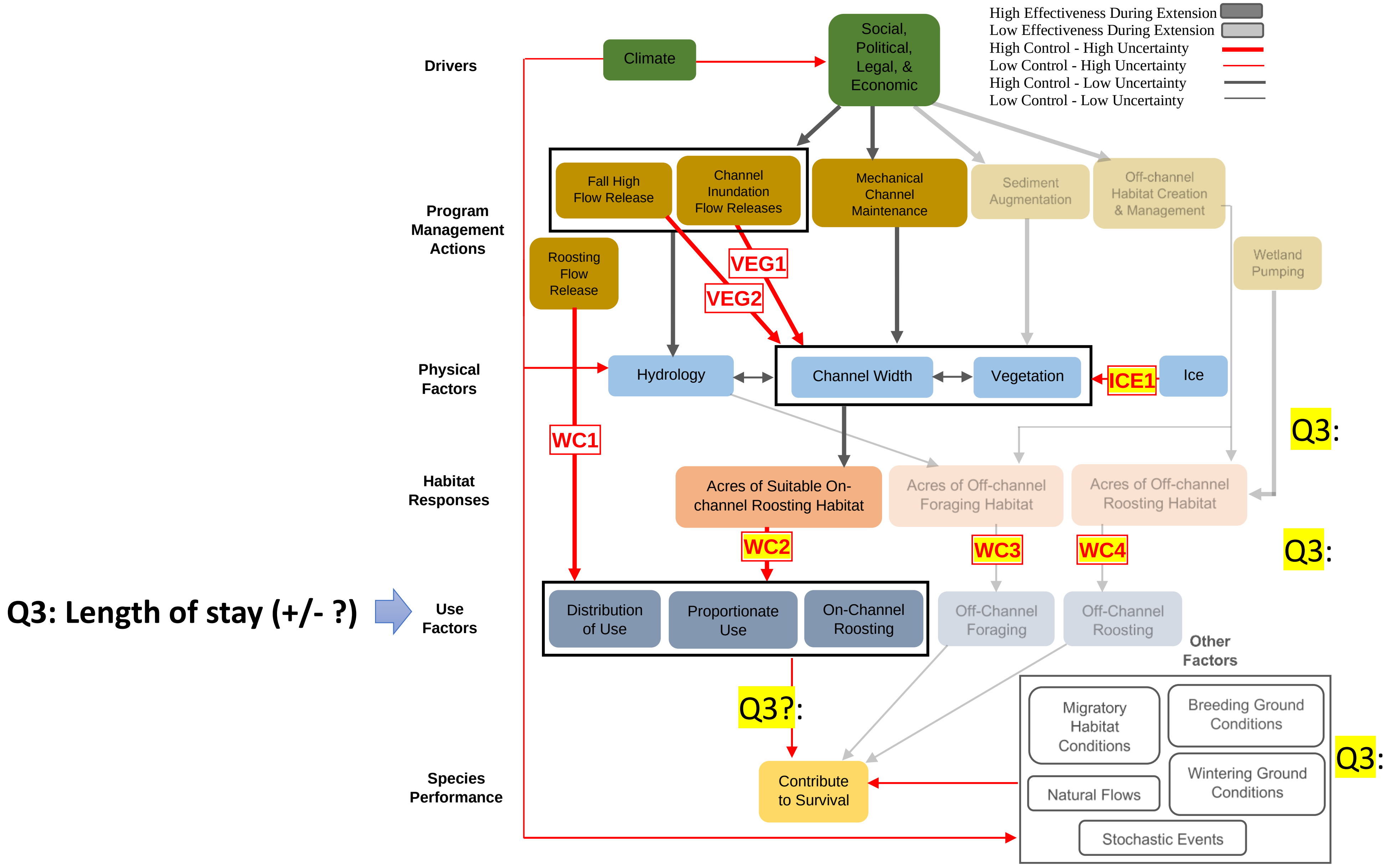
b) There is no relationship between May-July river discharge and vegetation establishment within the active channel bed at the end of the growing season (Sept.-Oct.)

Whooping Cranes – Potential BIG QUESTIONS

- **Q3: What are the conditions that influence length of stay on the CPR?**

- **Q4: Are WC that stop on the CPR more fit?**

Figure 2. Whooping Crane Conceptual Ecological Model



Factors influencing length of stay?

Suitable On and Off-channel Habitat

- Water (wetted width, depth, velocity, flow)
- Water quality
- Unobstructed Views (UOCW, nearest forest, proportional short vegetation landcover)
- Safety from predators
- Wet meadows vs upland grasslands vs ag land
- Food availability
    - Opportunistic and very wide range of consumed sources including: frogs, fish, tubers, crayfish, insects, and agricultural grains.
- Protection from human disturbance

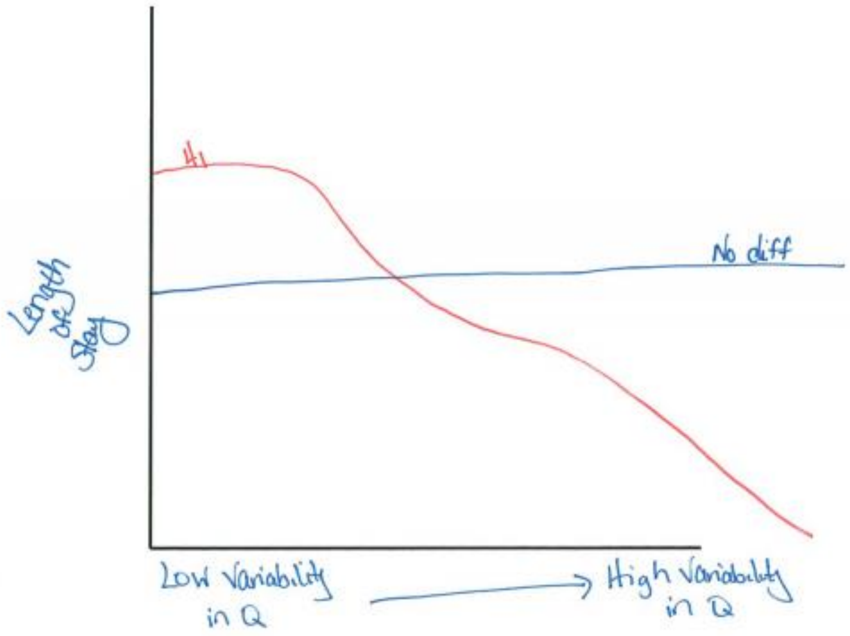
Out of Program control

- Adult/Juvenile
- Body condition upon arrival
- Conditions in other migratory habitat
- Conditions at Breeding or Wintering grounds
- Sandhills present
- Fall/Spring
- Weather

Hypothesis and Alternative Hypotheses

H_0: No difference between low/high daily/weekly flow rates + length of stay
H_1: Diff. in the variability of flow rates influences stay length

X-Y Graph



Description/Link to Program Management

If flow ~~variability~~ variability has an impact, may want to release H_2O.

Do hourly/daily flow rates vary much during spring/fall whooping crane season to even consider this?

Is there enough **variability in flows** encountered by WC over the years/seasons as they intersect with the Platte to detect selection for this variable?

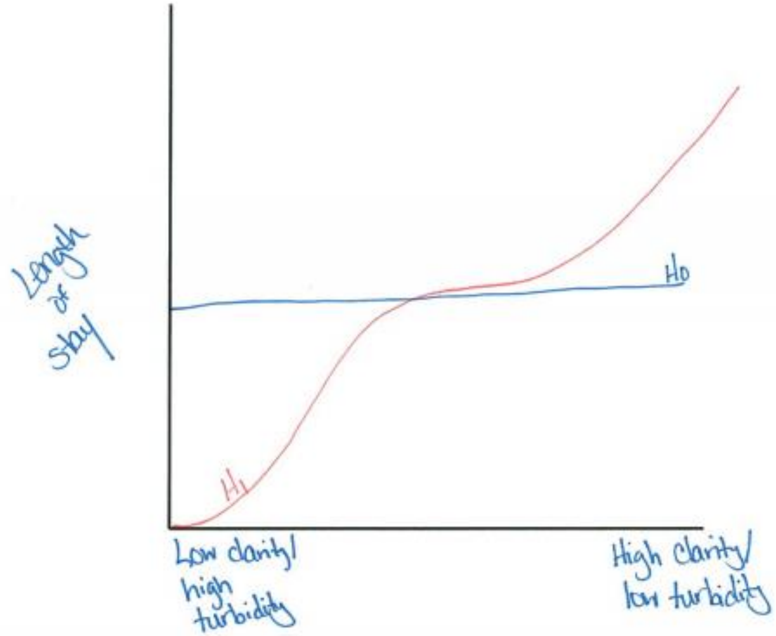
Turbidity

Hypothesis and Alternative Hypotheses

H_0: H_2O Clarity/turbidity has no correlation/impact on whooping crane length of stay

H_1: H_2O Clarity/turbidity is correlated to whooping crane stay length

X-Y Graph



Description/Link to Program Management

Good to know if determining factor is out of our control

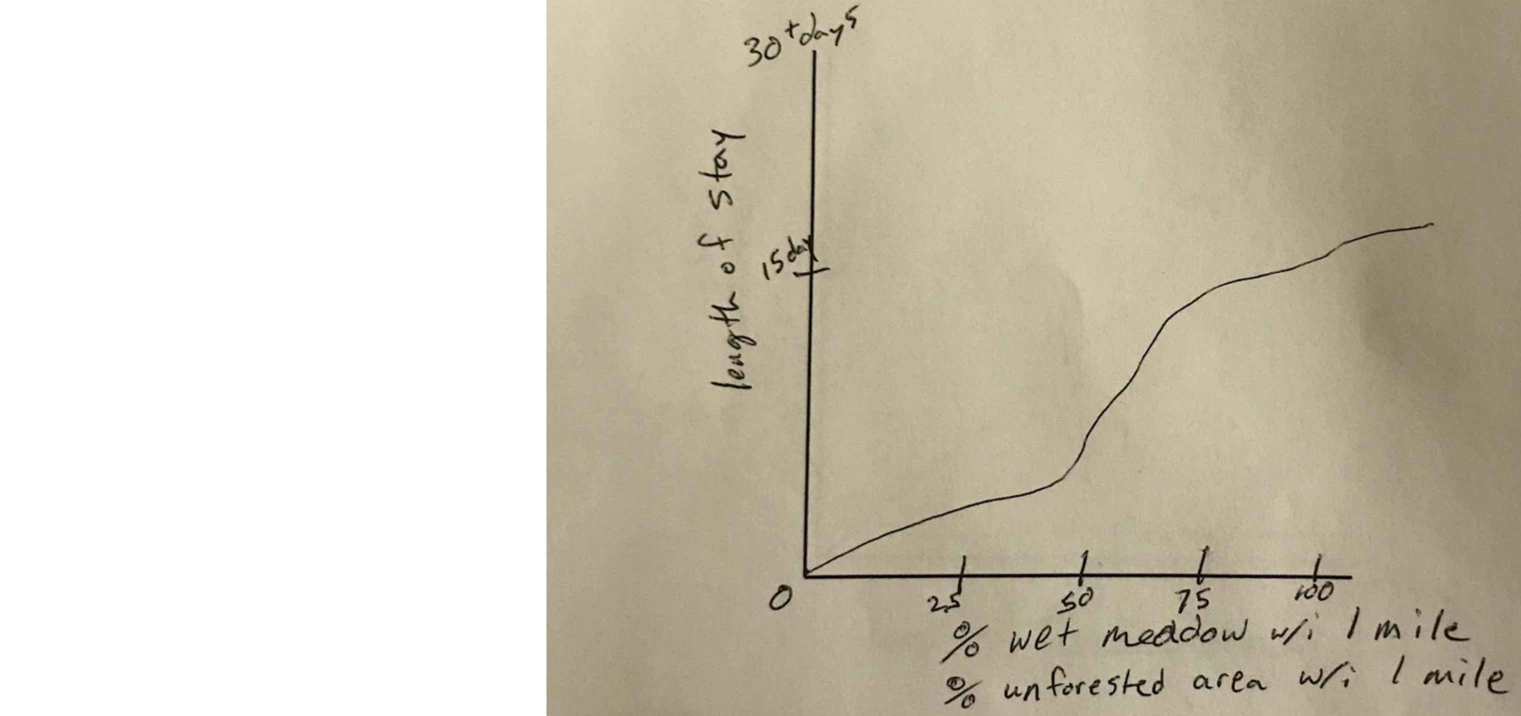
1) Is turbidity in the Platte so tightly correlated to Q that this is irrelevant?

2) During the spring/fall seasons does turbidity vary so little that this is irrelevant?

Hypothesis and Alternative Hypotheses

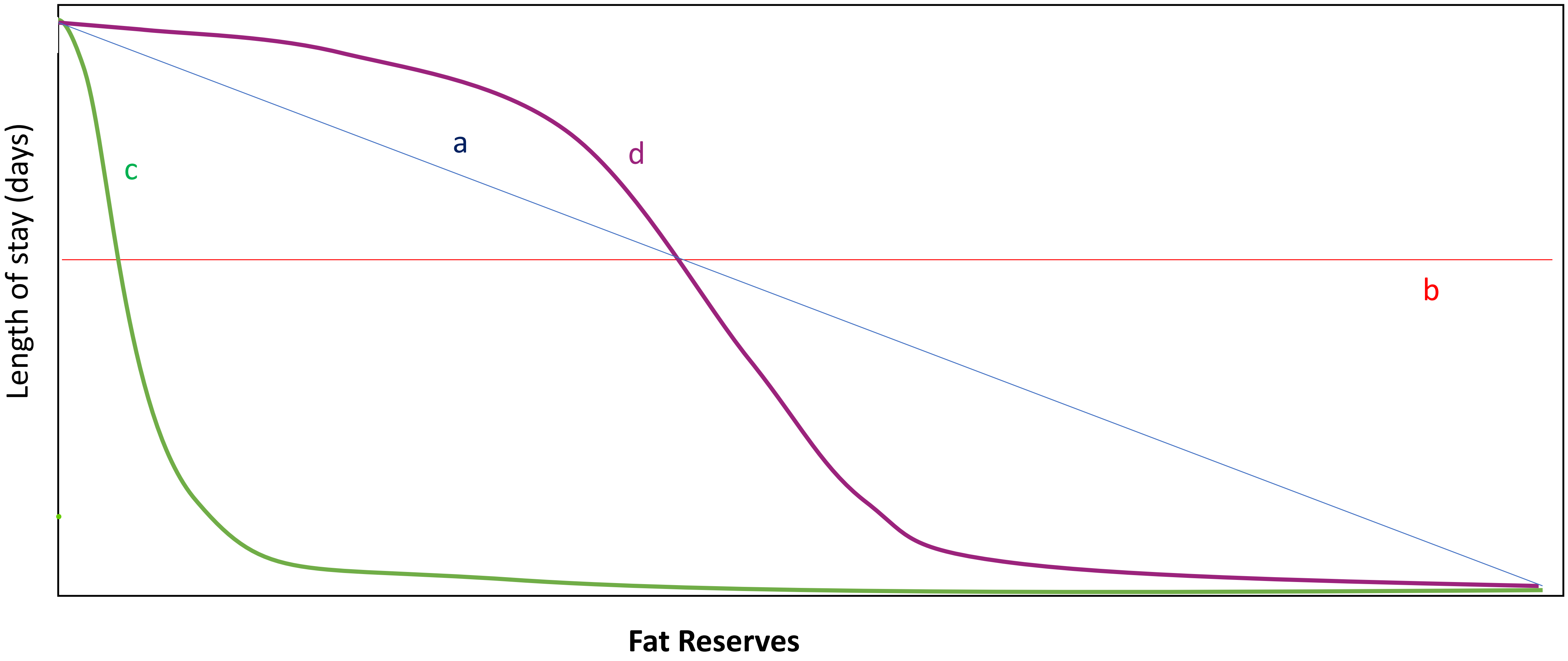
Length of stay is/is not proportionate to % of wet meadow land cover w/i 1 mile (could choose diff #)
- Could do same analysis w/ proportion non-forest land cover

X-Y Graph



Description/Link to Program Management

Hypothesis:

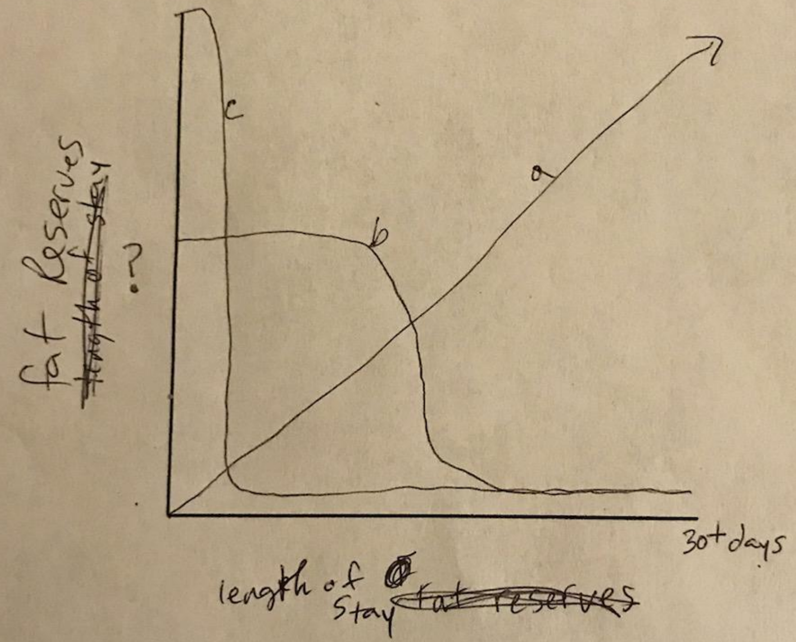


Description/Link to Program Management:

Hypothesis and Alternative Hypotheses

Length of stay is/is not proportionate to WC fat reserves
- Birds that arrive w/ lower fat reserves a) stay longer & b) gain fat reserves

X-Y Graph



Description/Link to Program Management

Birds that show up in poor condition Stay longer & increase fat reserves until fitness levels sufficient to migrate

Birds that show up w/ sufficient fat reserves have short stopovers

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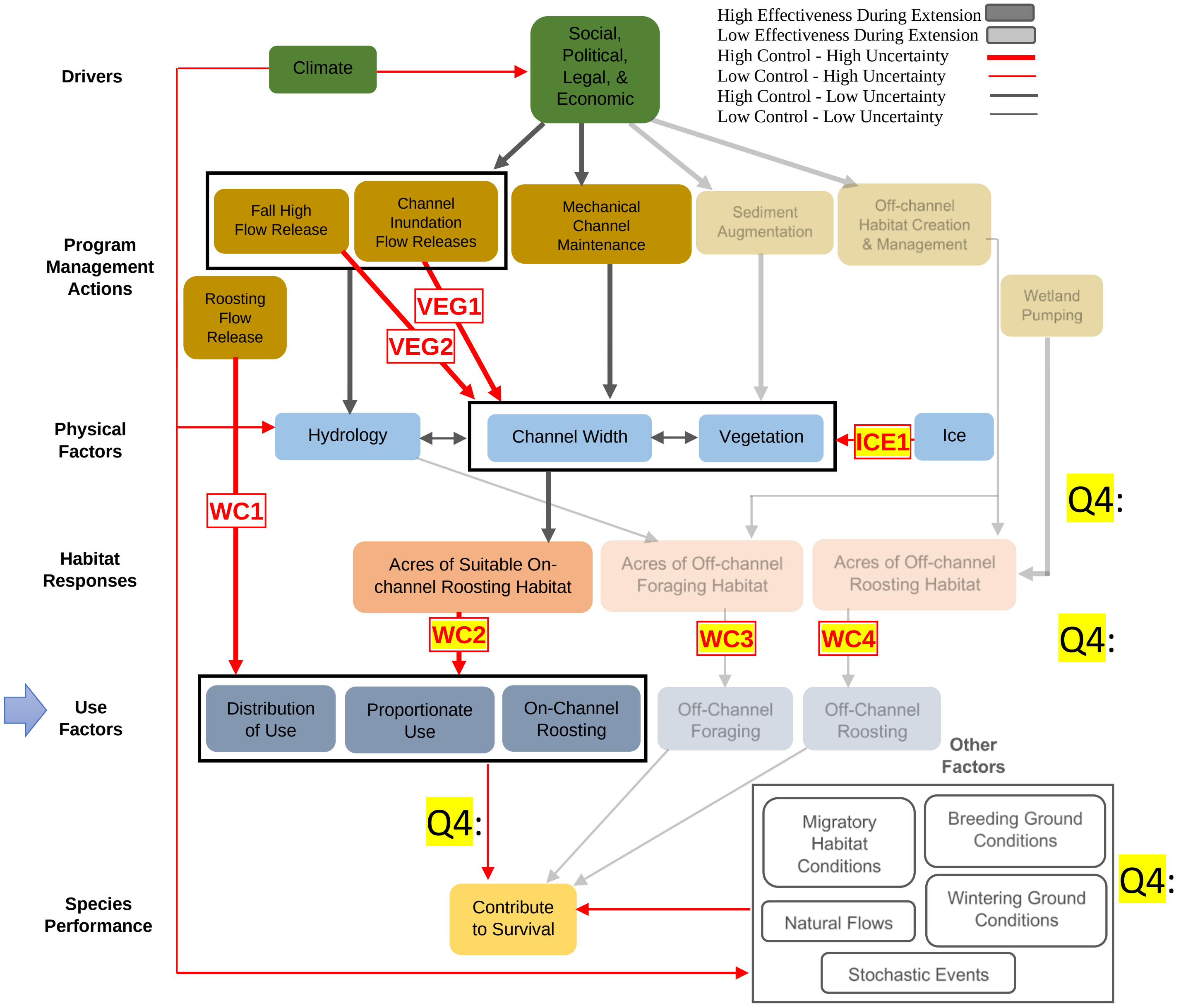


Q4: Body condition
Survival
Reproduction

Are WC that stop along the AHR more fit?

Differential body condition, survival, reproduction

Suitable On- and Off-channel Habitat

- Water (wetted width, depth, velocity)
- Water quality
- Unobstructed Views
- Safety from predators
- Food availability
  - Opportunistic and very wide range of consumed sources including: frogs, fish, tubers, crayfish, insects, and agricultural grains.
- Protection from human disturbance

Out of Program control

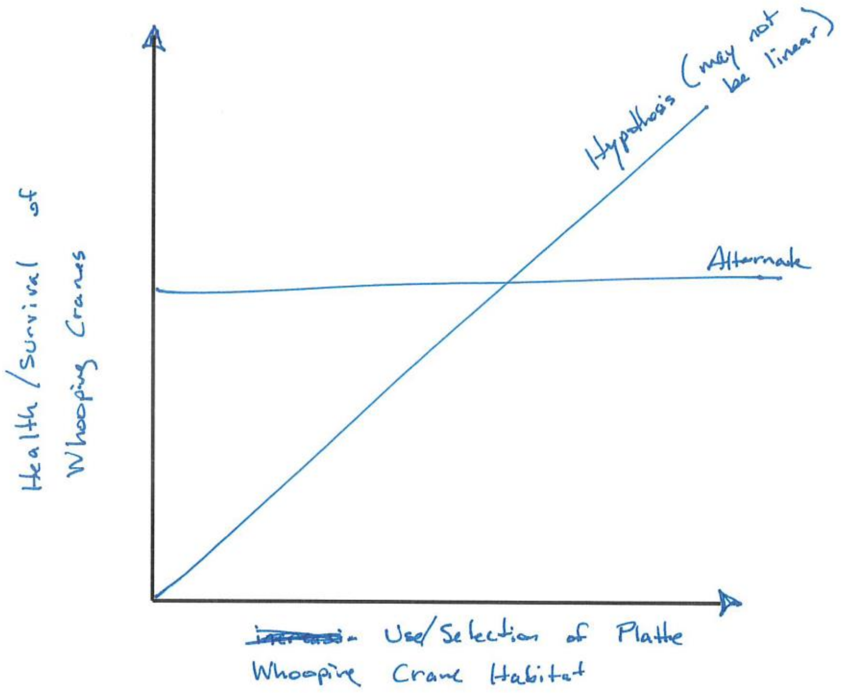
- Winter and breeding ground conditions
- Migratory habitat conditions
- Arrival body condition
- Energetic costs of migration
- Mortality outside AHR

Hypothesis and Alternative Hypotheses

Hypothesis: Increased selection/use of Platte habitat by cranes improves health/survival of cranes

Alternate: Increased selection/use of habitat does not result in improved health/survival

X-Y Graph



Description/Link to Program Management

Even if our activities result in increased Whooping Crane use, how do we know whether or not that actually matters for survival and recovery? What is the basis for concluding use equals need?

Whooping Cranes – Potential BIG QUESTIONS

- **Q1: What are the conditions that influence whether a WC will stop or flyover the CPR?**

- **Q2: Can we use water to make UOCW for WC use?**
  - **a) Can we use SDHF (Fall) to maintain UOCW?**
  - **b) Can we use germination suppression flows (Spring/Summer) to maintain UOCW?**

- **Q3: What are the conditions that influence length of stay on the CPR?**

- **Q4: Are WC that stop on the CPR more fit?**

Meeting Review and Wrap-Up

- Meeting Feedback
- Action Items
  - Continued hypotheses formulation
  - What do you need from the EDO?
- Agenda suggestions for next meeting
- Upcoming Meetings:
  - AMWG Meeting March 9th, 1-5 PM
  - GC Meeting March 10th, 9:30 AM - 3:00 PM
  - AMWG Meeting March 23rd, 1-5 PM