Native Fish Conservation & Climate Variability in Southeastern Arizona

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US Fish & Wildlife Service and **University of Arizona**

INTRODUCTION

FISH

CLIMATE – ***Drought***
Climate change

INTERSECTION OF CLIMATE & FISH CONSERVATION

WHAT'S NEXT?

- **Plan**
- **Protect**
- **Adapt**
- **Salvage**
- **Monitor**
- **Research**

Native fish sites

- **Unsuitable**
  - nonnative fish
  - landowner resistance
- **Unusable**
  - sport fishing
  - degraded water quality
  - other rare aquatic vertebrates

FISH STATUS

- 21 species in southeastern Arizona
- 16 still occur in the area
- 4 are extirpated
- 1 is extinct

- 13 species listed under the Endangered Species Act
  - 9 are listed as endangered
  - 4 as threatened


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USFWS, Marty Jakle

OTHER NATIVE AQUATIC SPECIES

- 3 ranid frogs
  - lowland leopard
  - Chiricahua leopard
  - Tarahumara
- 1 salamander
- several garter snake species

THREATS

- **nonindigenous species**
- **habitat loss**
- **reduction in habitat quality**
  - Habitat destruction and the introduction of nonindigenous species are responsible for the decline of 98% of North American fishes listed as endangered, threatened, or of special concern

DROUGHT & CLIMATE CHANGE

DROUGHT

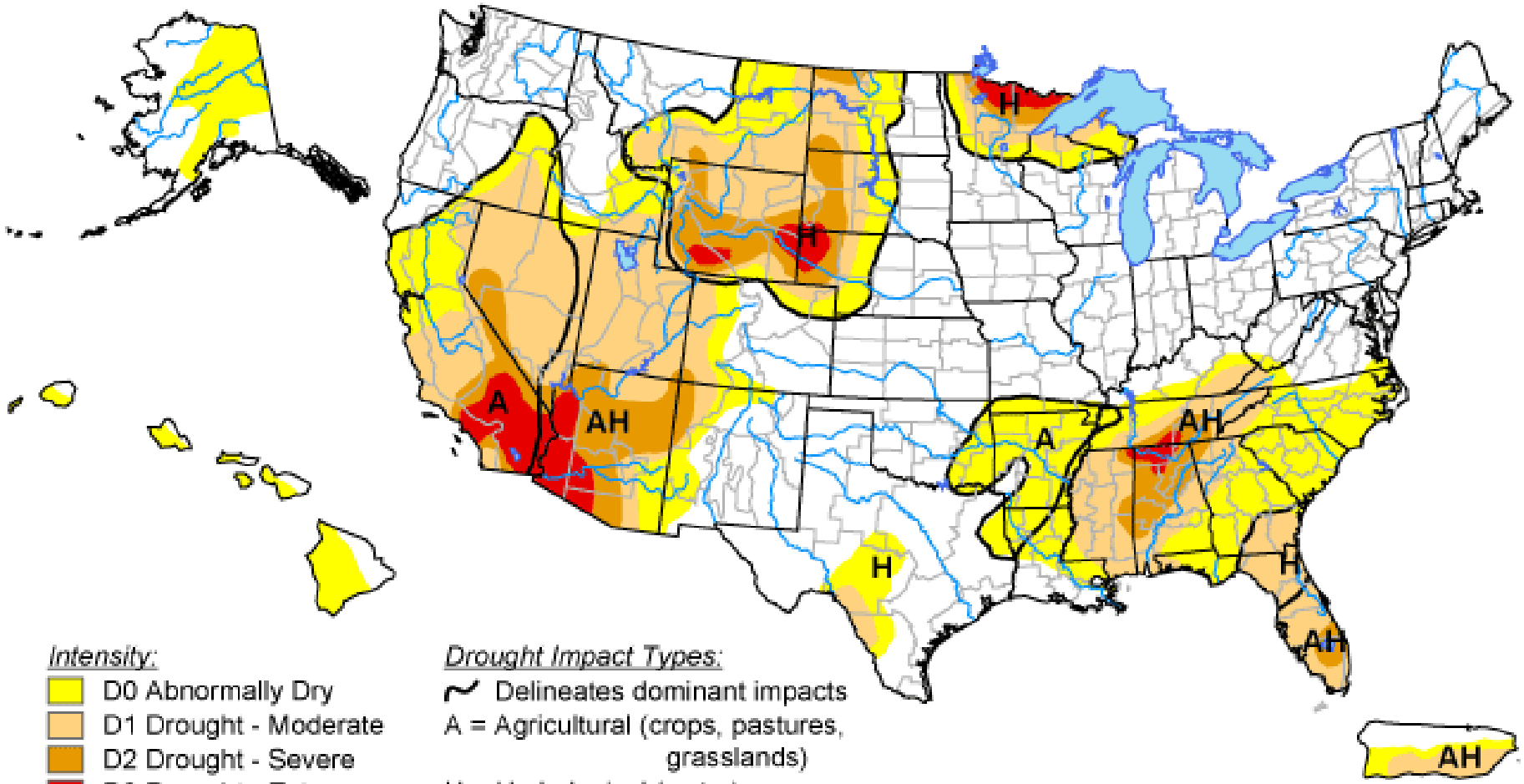
- **Meteorological drought:**
  - **the departure of precipitation from the norm**
  - **the duration of the dry period**
  - **hydrological**
  - **agricultural**

- **seasonal predictions, for 3-month seasons, 2 weeks in advance**
- **predictions based on statistical & dynamical climate models & insights from past climate**
- **science does not support multi-year or decadal drought predictions**
- **instrumental & paleoclimate records indicate the SW has a history of multi-year and multi-decadal drought**

- **multi-decadal drought is controlled by Pacific Ocean-atmosphere interactions, which effect winter precipitation**
- **persistent Atlantic Ocean circulation is theorized to have a role in multi-decadal drought in the Southwest- particularly summer precipitation**
- **Given multi-decade “regimes” of ocean circulation, and the severity and persistence of the present multi-year drought, there is a fair likelihood that this drought will persist for many more years**

U.S. Drought Monitor

April 3, 2007
Valid 8 a.m. EDT



Intensity:
- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

Drought Impact Types:
- Delineates dominant impacts
- A = Agricultural (crops, pastures, grasslands)
- H = Hydrological (water)

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

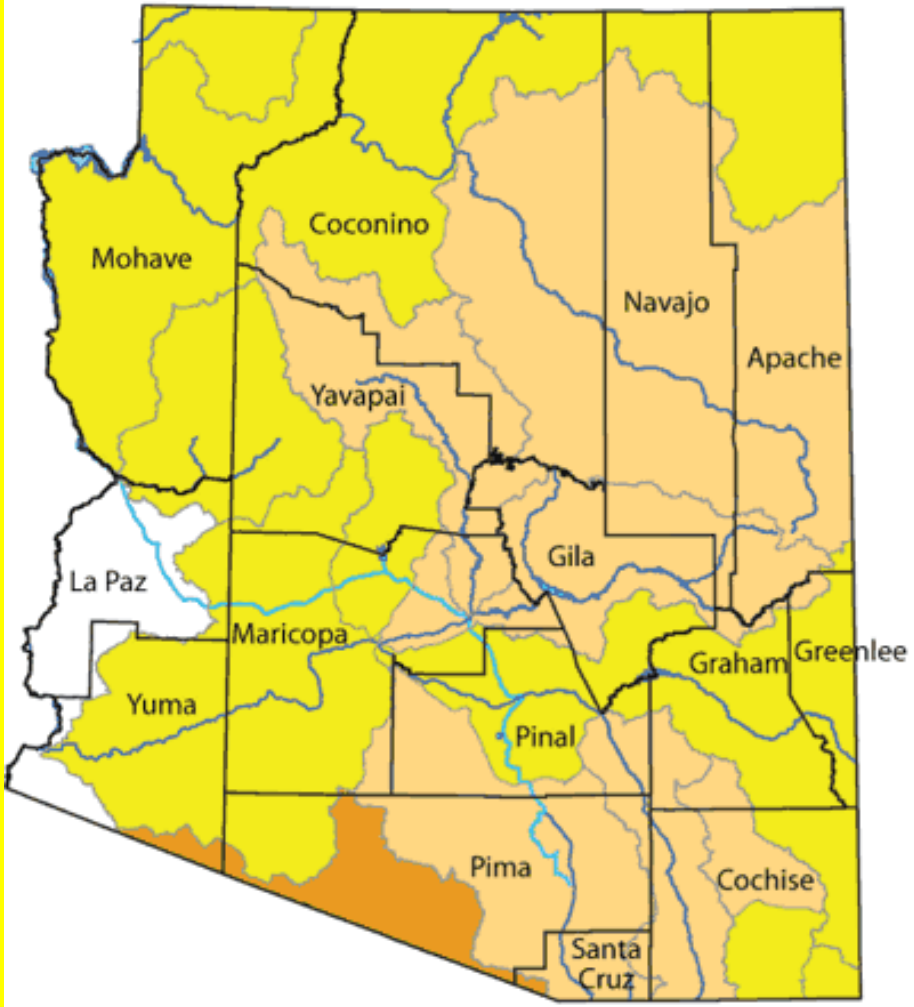
http://drought.unl.edu/dm

USDA | National Drought Mitigation Center

Released Thursday, April 5, 2007

Author: Thomas Heddinghaus, CPC/NOAA

Figure 4b. Arizona long-term drought status for February 2007.



Source: CLIMAS & NRCS

CLIMATE CHANGE

- climate change scenarios are less certain than drought
- virtually all climate change scenarios predict that the American southwest will get warmer during the 21st century
- precipitation predictions show a greater range of possibilities, depending on the model and emissions scenario
- to maintain the present water balance with warmer temperatures, precipitation will need to increase to keep pace with increased evaporation & transpiration

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KEY PROJECTIONS:

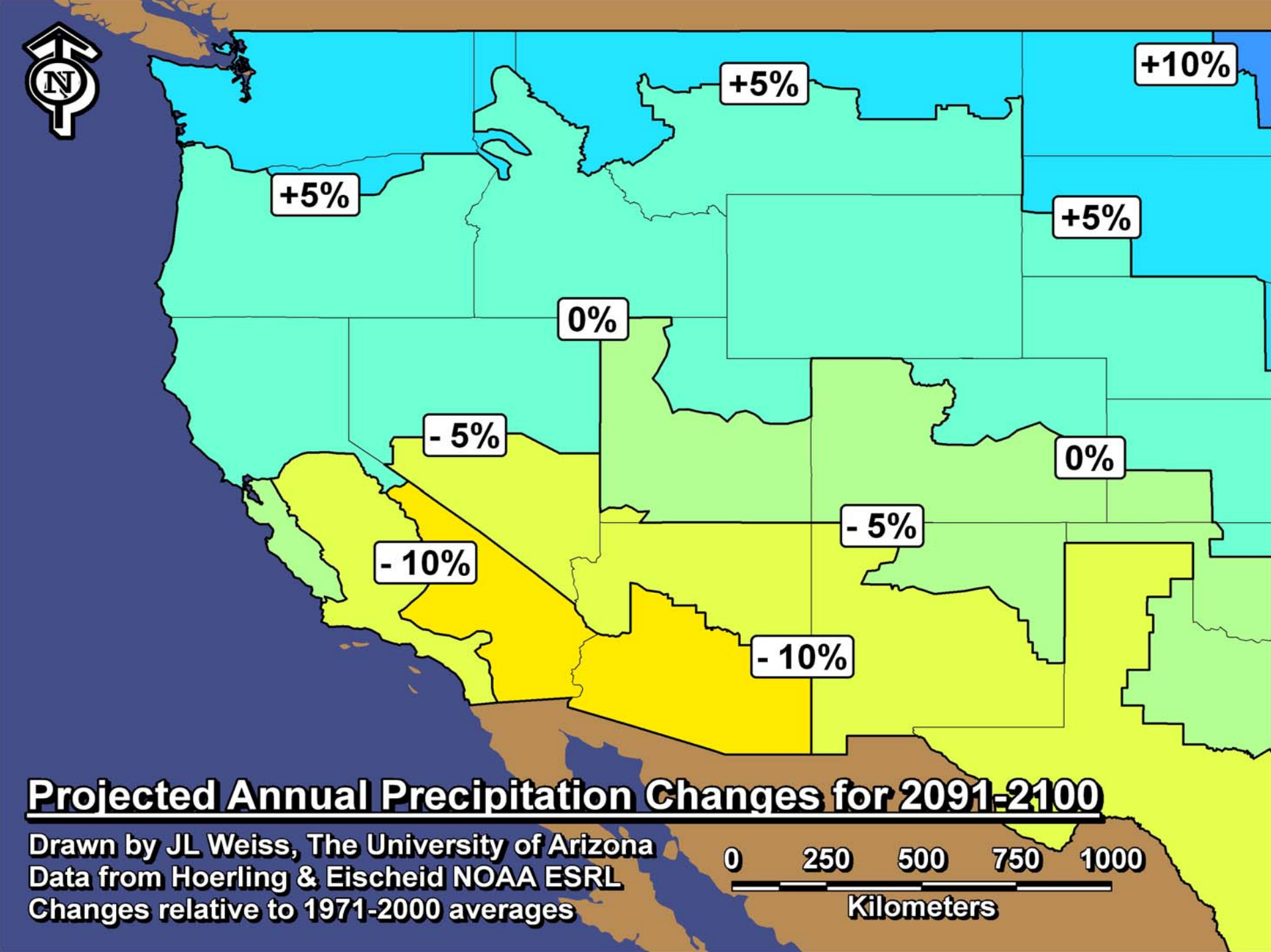
- **decreased snowpack** — > rain vs. snow, snowpack accumulation could be shorter, & snowpacks could be smaller
  - ironically, due to changes in snow-precipitation characteristics, runoff may decrease even if total precipitation increases
- **earlier snowmelt** — > minimum winter & spring temperatures could melt snowpacks sooner, causing peak water flows to occur much sooner than the historical spring & summer peaks
- **enhanced hydrologic cycle** - in a warmer world an enhanced hydrologic cycle is expected; flood extremes could be more common causing larger floods; droughts may be more intense, frequent, & longer-lasting

KEY PROJECTIONS:

- **Precipitation:** is likely to change in amount and seasonality

- **Runoff:** probably will be less

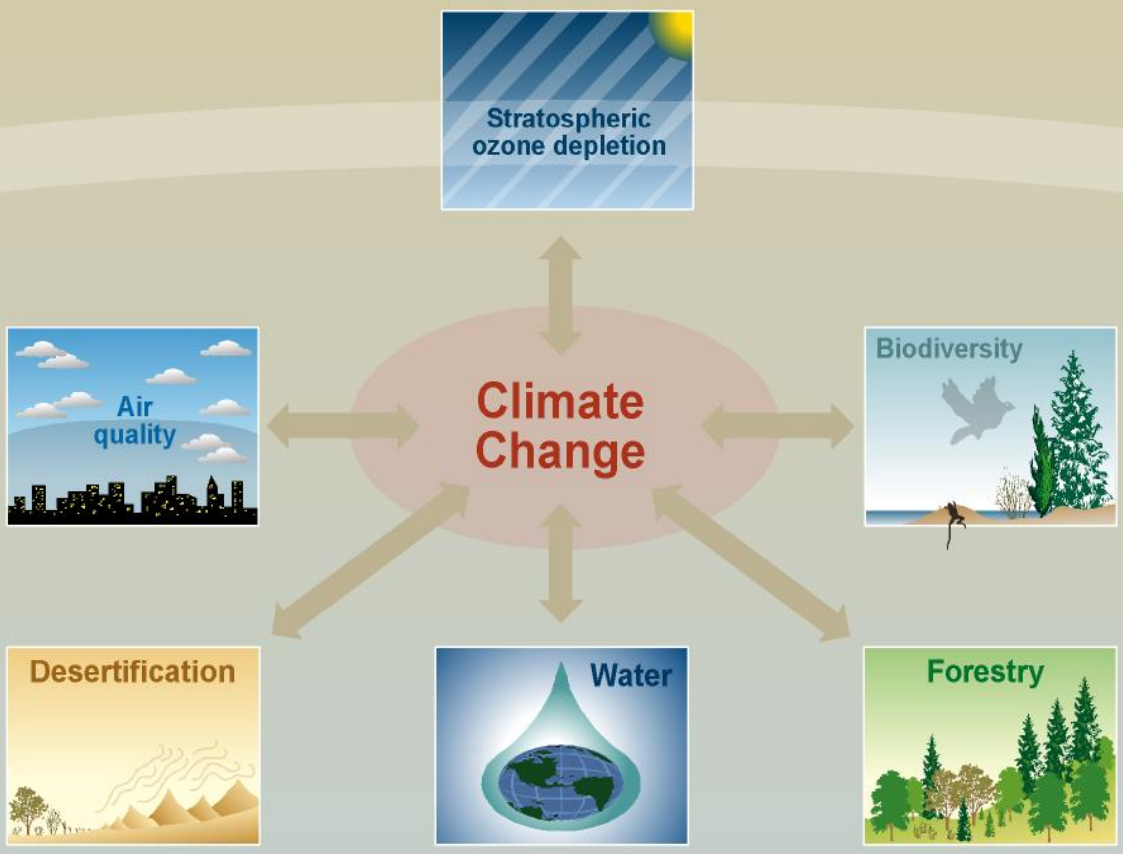
- **Less water for in streams** -


+10%
+5%
+5%
+5%
0%
- 5%
0%
- 5%
- 10%
- 10%
Projected Annual Precipitation Changes for 2091-2100
Drawn by JL Weiss, The University of Arizona
Data from Hoerling & Eischeid NOAA ESRL
Changes relative to 1971-2000 averages
0
250
500
750
1000
Kilometers

IMPACTS

- **Drought and climate change will:**
  - **impact watersheds**
  - **will impact how ecosystems and watersheds function**
  - **these changes will cause a cascade of ecosystem changes**
    - **be hard to predict**
    - **are likely to occur non-linearly**
    - **Interrelated and interdependent**

Linkages between climate change and other environmental issues



SYR - FIGURE 8-1

INTERSECTION OF CLIMATE & FISH

- **drought & climate change, plus historical & continuing threats, will make native fish conservation in SE AZ even more difficult**
- **The impact of site desiccation is obvious**
  - **Less obvious effects can occur with drought & a warmer climate. Sites with reduced streamflow, or ponds or pools with low water could become fishless from reduced DO**
- **We have seen this occur at important natural Gila topminnow sites**


3.30
3.20
3.10
3.00
2
2.60
2.50
2.40
2.30
2.20
2.10
2.00
1.90
1.80
1.60
1.50
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3.20
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.80
.70
1.60
1.50
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0.80
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0.40
0.30


DATE 11 - 03 - 05
STREAM
Cienega Creek above
SEGMENT or SITE NO.
Gardner Canyon
NOTES

RECOMMENDATIONS

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- Conservation planning should address climate variability through adaptive management
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- **Important fish populations should be replicated**
  - **Genetic information crucial in determining important populations**

RECOMMENDATIONS

- **agencies should begin work on identifying & creating potential replication sites**
  - **captive and wild**

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RECOMMENDATIONS

- monitor important aquatic sites & fish populations
- expanded monitoring programs are essential to enhancing drought preparedness for fish conservation
- research on specific impacts of climate variability in southeastern Arizona

FINALLY

- **uncertainty requires flexibility & adaptive management**
  - **agencies do not have a good track record of effectively implementing adaptive management, but the conservation of native fish and other aquatic vertebrates requires it**

QUESTIONS?

For additional information

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FWS Arizona Office: http://www.fws.gov/arizonaes

CLIMAS: http://www.ispe.arizona.edu/climas/