Solutions for Springs

28th Annual Environmental Permitting Summer School
July 22, 2014

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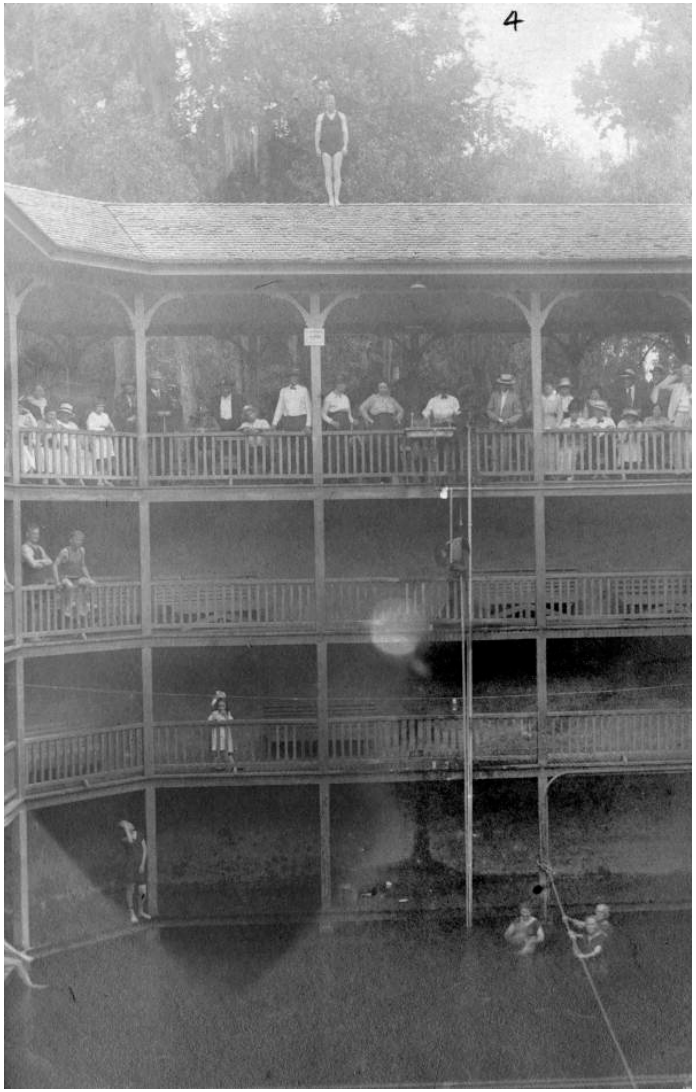
Suwannee River Water Management District

Springs Health

In the late 1800s, European settlers began promoting White Sulphur Springs and many others as having the ability to cure our ailments.

Today, the roles are reversed; springs are the patients and need our care.



Goal

Ensure springs have adequate flows, maintain good water quality, and sustain healthy biological communities

Submerged Aquatic Vegetation
Key Community for Health Evaluation

Silver Springs - Bruce Mozert 1938

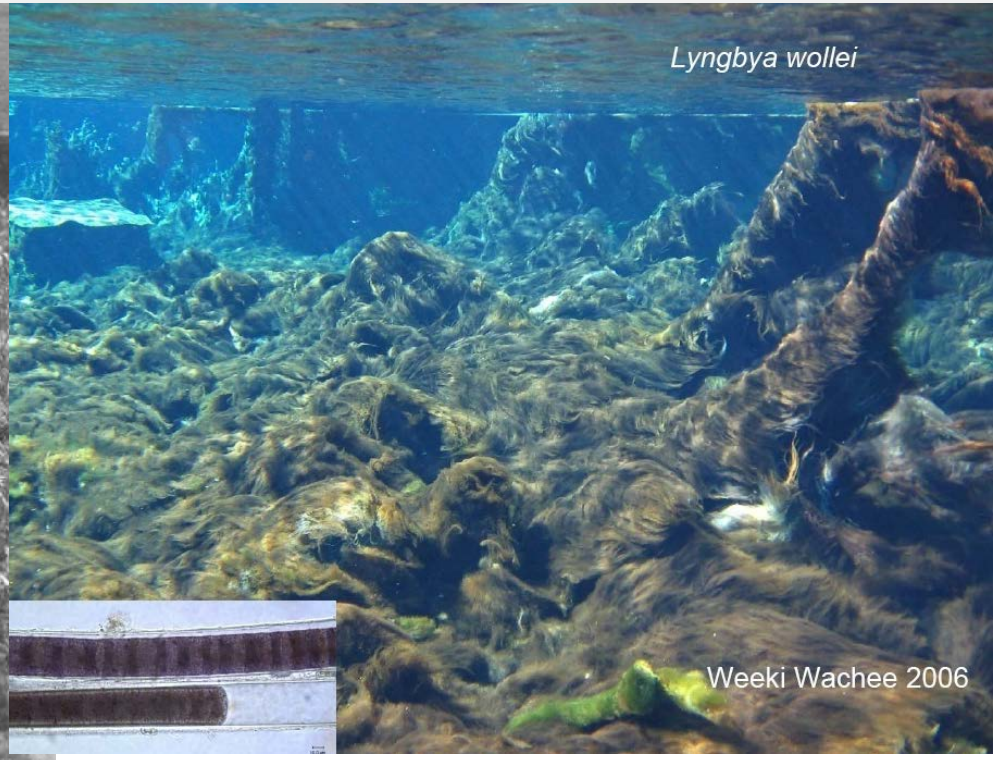
- Primary Producer
- Habitat refuge for young, small & many species of interest
- Mediate exchange between sediments and water

Coal Mine Canary

Protect Submerged Aquatic Vegetation (SAV)

Weeki Wachee 1951

Weeki Wachee 2006



Health Threats

- Flow/Velocity
- Water Quality
- Biological Interactions & Invasive species
- Disturbance

Submerged Aquatic Vegetation Similar Importance in Other Systems

- Spring Runs
- Lakes
- Estuaries & coastal waters
  - Seagrass
  - Coral
  - Sea Fan

Seagrass die-off one of major issues addressed at Indian River Lagoon symposium

By Henry A. Stephens

Posted March 26, 2013 at 8:55 p.m.

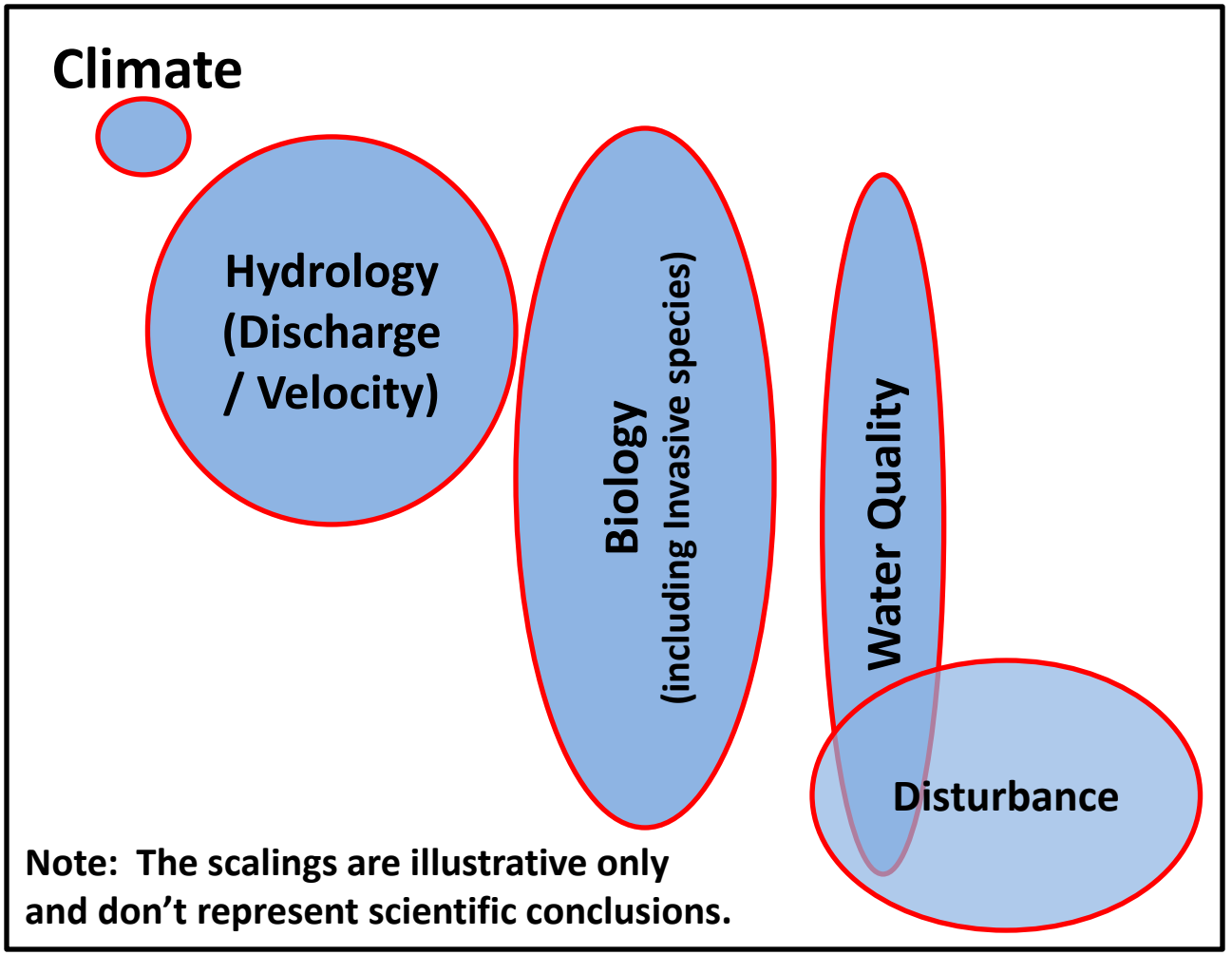
Discuss Print A A A

PHOTO BY SAM WOLFE // BUY THIS PHOTO

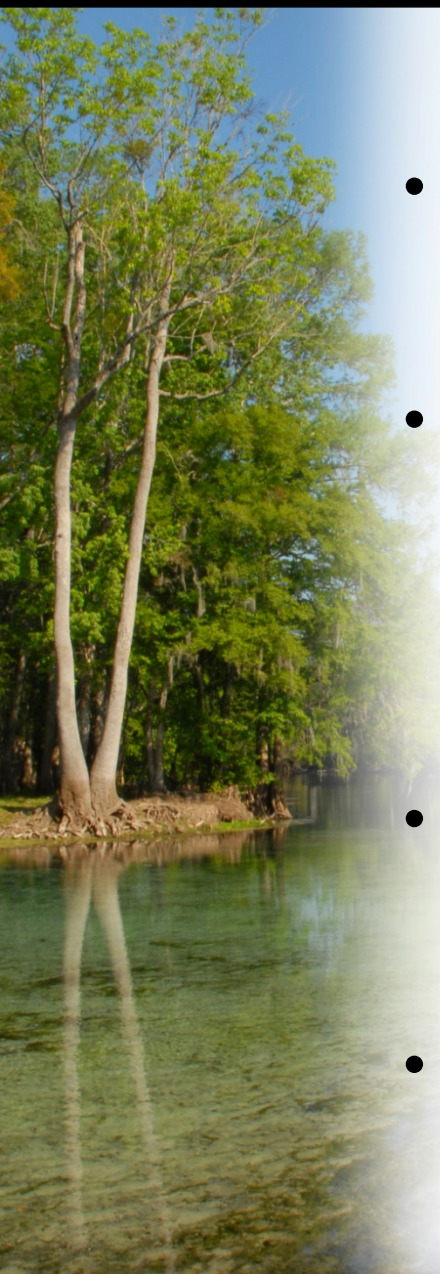
Kayakers enjoy the Indian River Lagoon at Round Island Park in Vero Beach in February.

Seagrasses are "out of sight and out of mind" but provide habitat for juvenile fish and food for manatees.

Springs Health Drivers



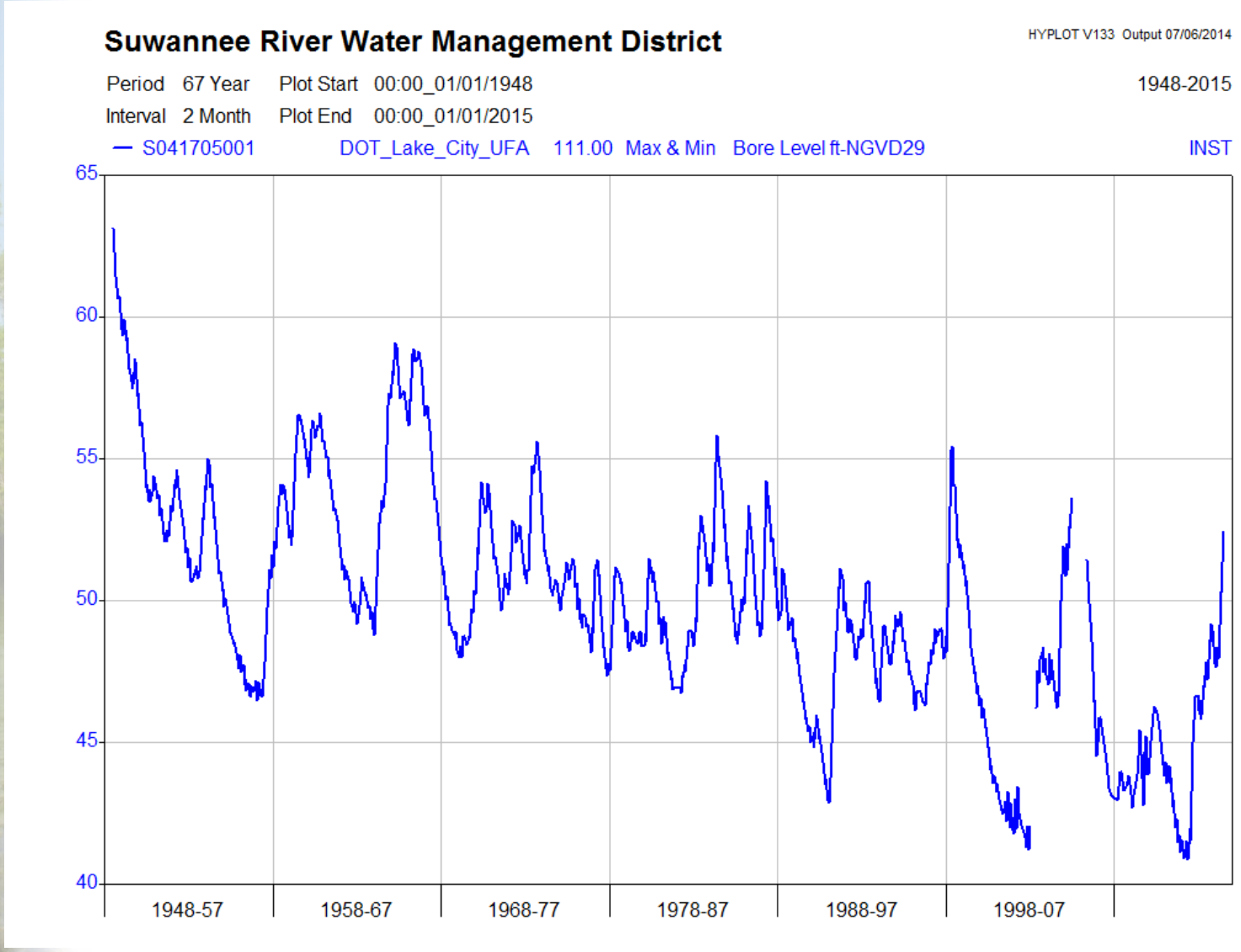
Modified from
Ed Lowe, SJRWMD



Threat #1 - Flow / Velocity

- Determines hydraulic retention time
  - How long are nutrients in the water available to plants and algae, critical for determining water column algal blooms
- Ensures healthy water levels
  - Defines extent of aquatic habitats, refugia (ie. manatees)
  - Floodplain inundation
  - Sufficient depth for animal passage
  - Supports recreation, without excessive harm
- Provides mixing and aeration
  - Brings oxygen into water when low
  - Mixes water between channel, floodplain and hyporheic
- Scours and exports loosely attached material
  - Lessens algal growth on submerged aquatic vegetation
  - Exports particulate matter from run

Groundwater Decline



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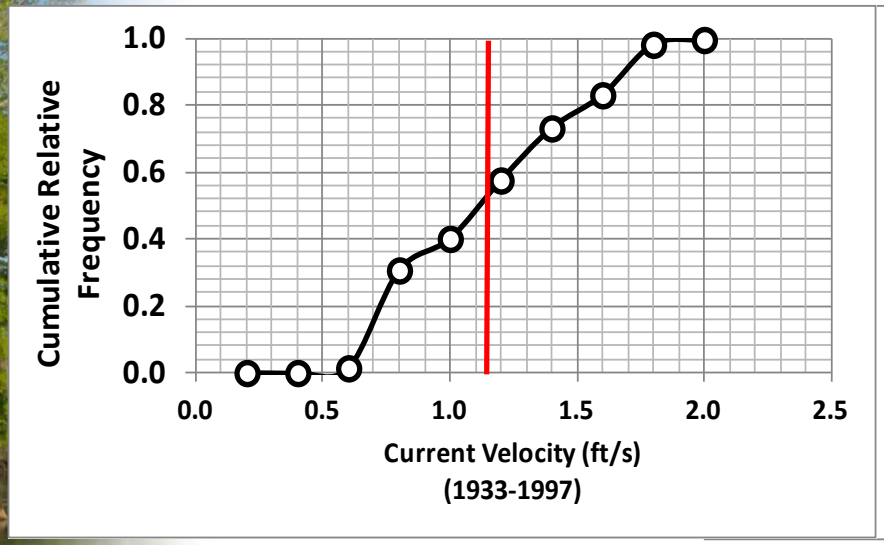
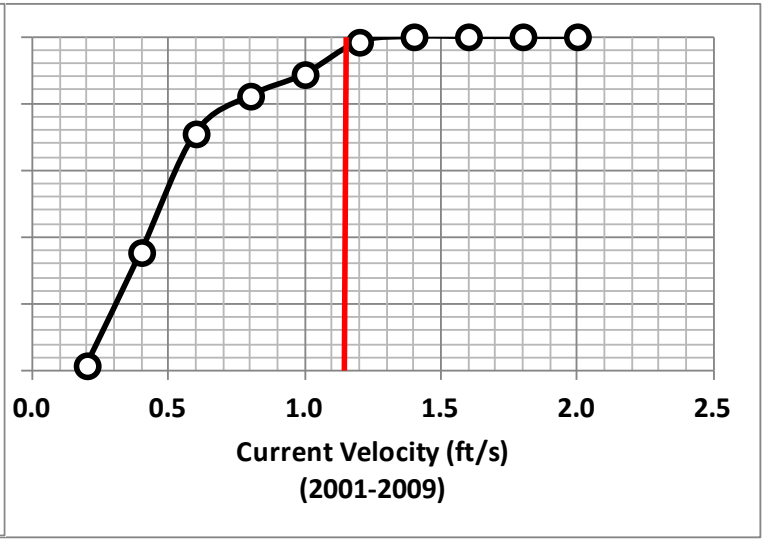
Current velocity may be an important driver of primary producer community structure.

Draft Analysis - Current Velocities at Silver Springs





When current velocity > 1.15 ft/s, filamentous algal abundance is likely to be low (King, 2012). In the early period, current velocity exceeded this level nearly 50% of the time. In later years, current velocity has exceeded this level < 5% of the time. A doubling of current velocity causes a 4-fold increase in drag forces. High velocity tends to occur primarily at a discharges in the middle of the frequency distribution (approx. 600 – 800 cfs).

Modified from Ed Lowe, SJRWMD

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Notice for Santa Fe River in Alachua County

5/24/2012 11:30 AM

This press release put out at the request of the Alachua County Health Department.

ALACHUA COUNTY, FL - The Alachua County Health Department is asking the public to be aware that an algal bloom has been identified in the Santa Fe River near High Springs between the Highway 27 bridge and upstream of Poe Springs in Alachua County.

On May 21, 2012, the Alachua County Environmental Protection Department collected water samples which contained the algae *Anabaena circinalis*. In Florida, this algae has not been confirmed to produce toxins and health effects have not been documented in the past. The Alachua County Environmental Protection Department, Florida Department of Health and Florida Department of Environmental Protection will continue to coordinate monitoring activities for this algal bloom.

The Alachua County Health Department recommends avoiding contact with any visible algal blooms, participating in recreational activities including fishing, or drinking the water when there is the following:

- An algal bloom has been identified
- Water appears greenish or off color
- Water has an foul odor
- Dead or distressed animals are spotted

If there is contact with an algal bloom, wash with fresh water and soap, and avoid swallowing or inhaling water. Keep pets out of the water. If a pet has entered water where a bloom is located, do not let them drink the water, eat pond scum, or lick their fur.

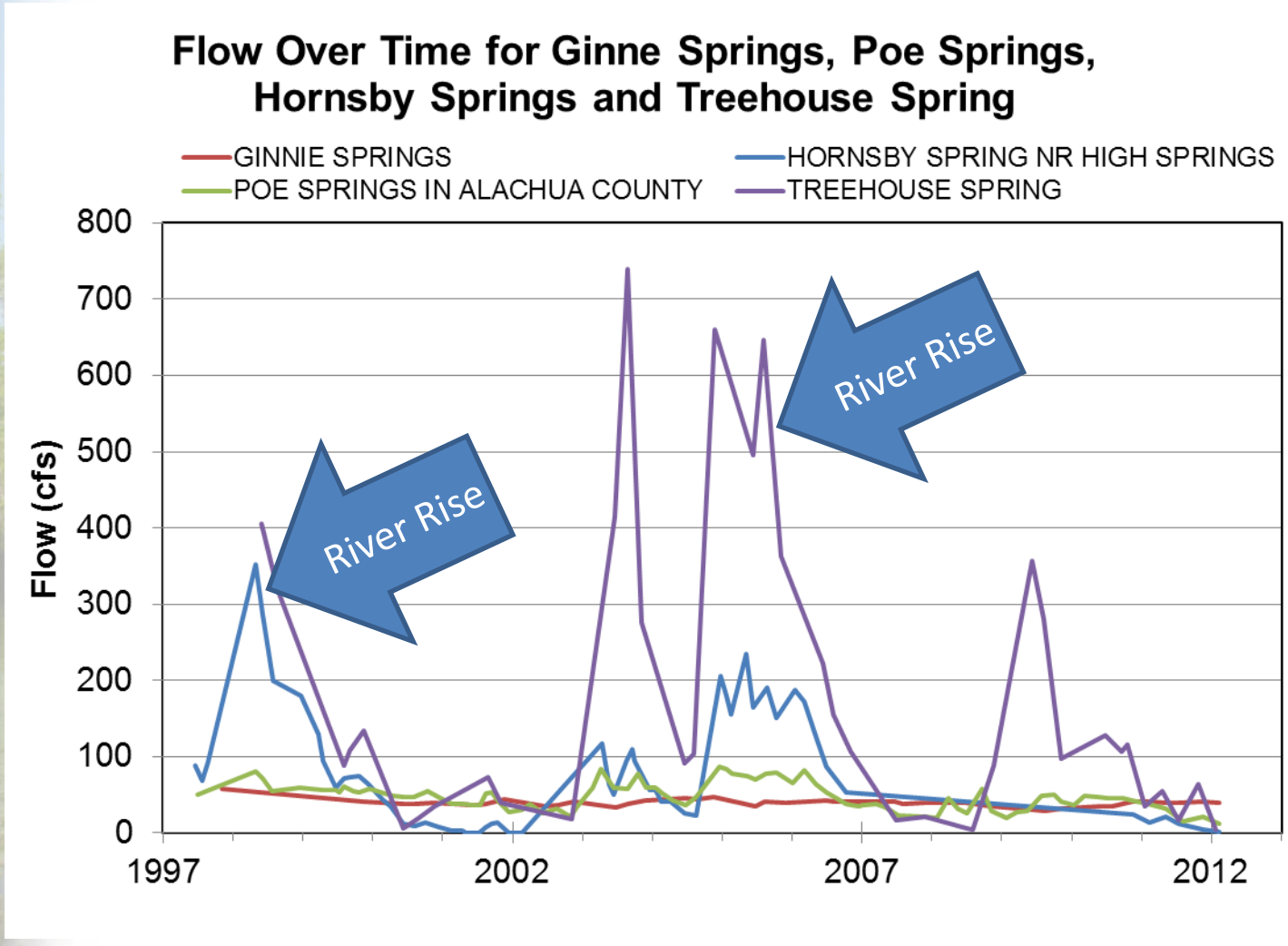
For additional health information on harmful algal blooms, visit the Florida Department of Health's website.

If citizens are experiencing health effects, they should contact their local health provider or the Alachua County Health Department at 352-334-7930.

Phytoplankton Bloom in water column

Algae blooming in the water column on the Santa Fe River. Photo by Merrillee Malwitz-Jipson

Springs & Rises



Dead / Alapaha River Sink

Rum Island Spring

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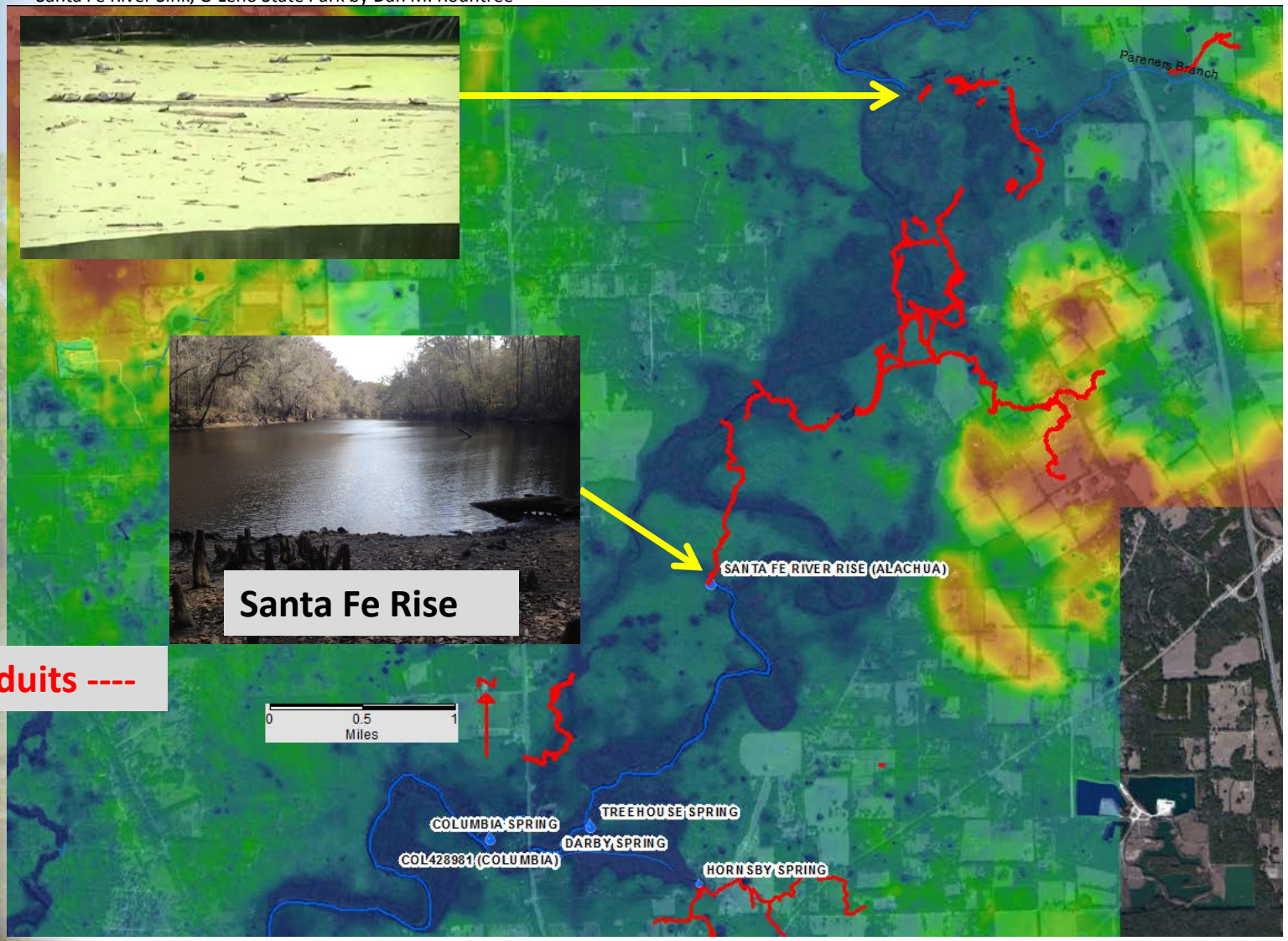
Santa Fe River Swallet & Rise

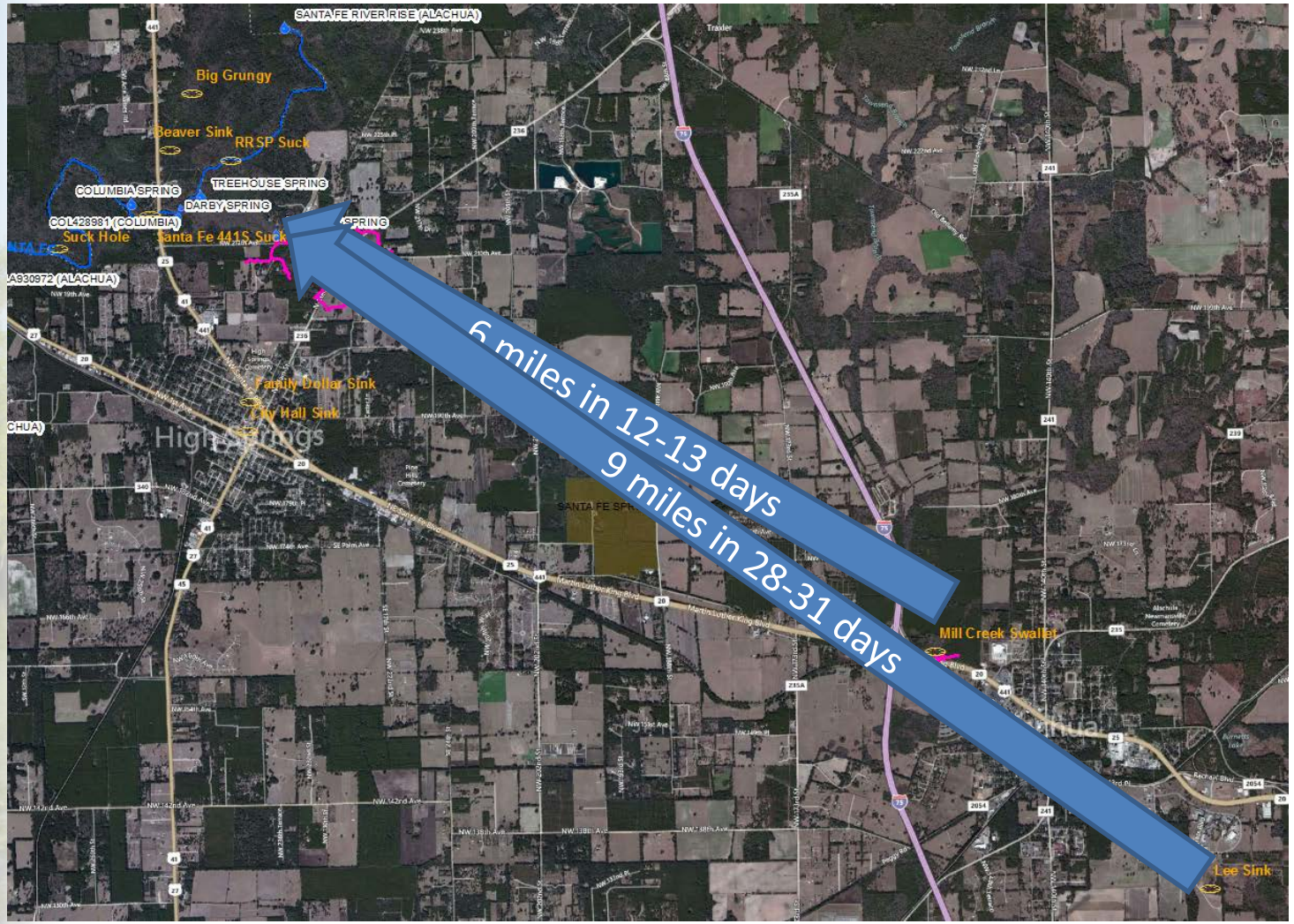
Santa Fe River Sink, O'Leno State Park by Dan M. Rountree

Santa Fe Rise

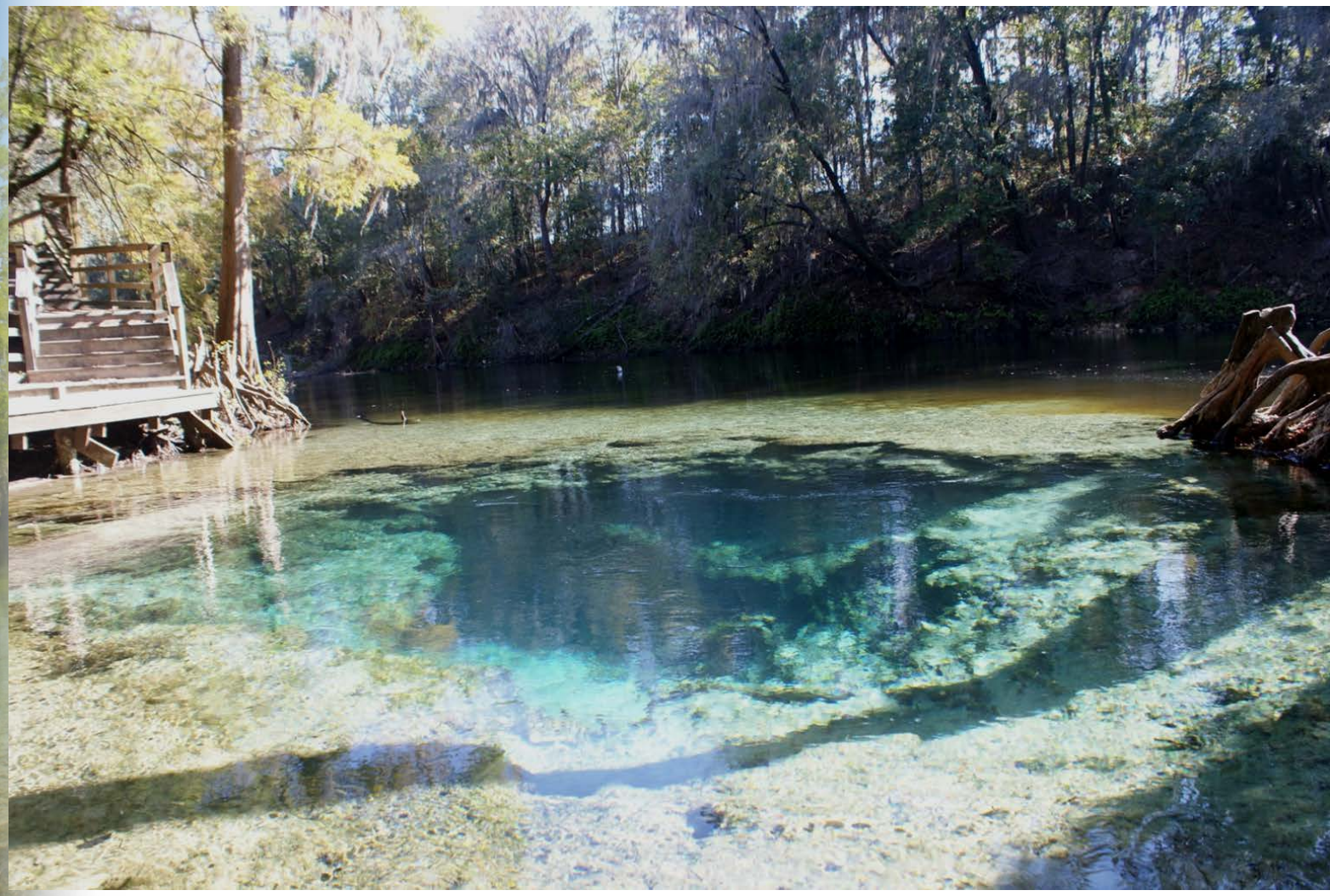
Mapped Conduits ----



Sinks & Springs



Threat #2 - Water Quality



Nutrient Pollution

- Nutrients, often simplified to Nitrogen (Nitrate) in springs
  - Need to evaluate potential phosphorus, salt, color, clarity conditions
- Nutrient Enrichment Leads to Eutrophication
  - Excessive growth and accumulation of plants (plants, algae)
  - Transition from healthy distribution of species to fewer species tolerant of pollution
    - Cyanobacteria (bluegreens) are poorer food quality and can produce a variety of toxins
    - Shift to weedy or invasive exotic species
  - Low Oxygen Fish Kills
  - Direct Toxicity
    - Ammonia (NH_3) and Nitrate (NO_3) are both toxic to aquatic organisms at a variety of concentrations
  - Can enhance wildlife disease effects

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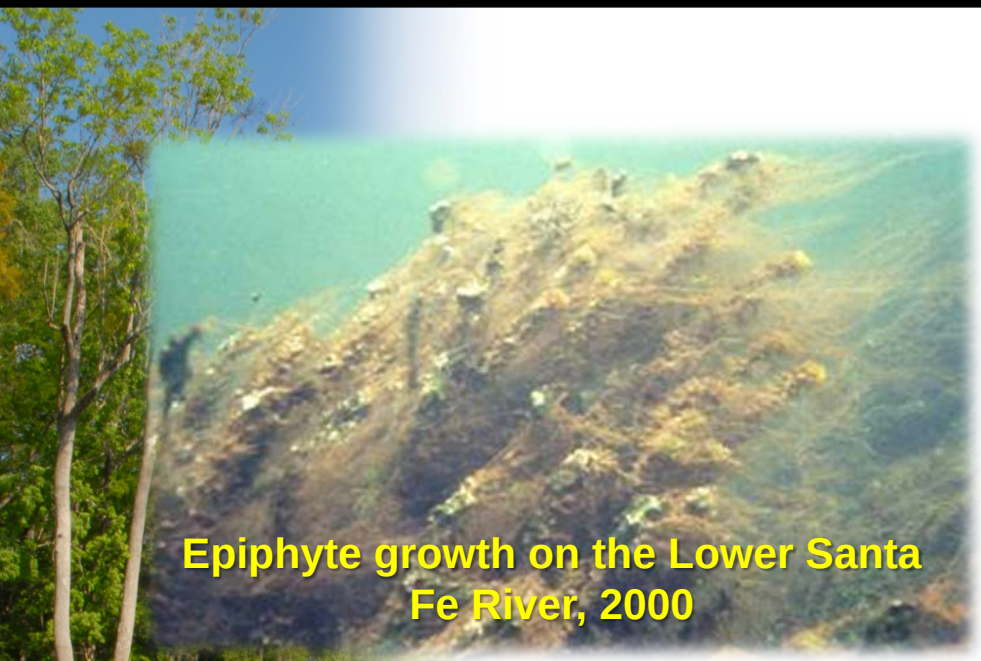
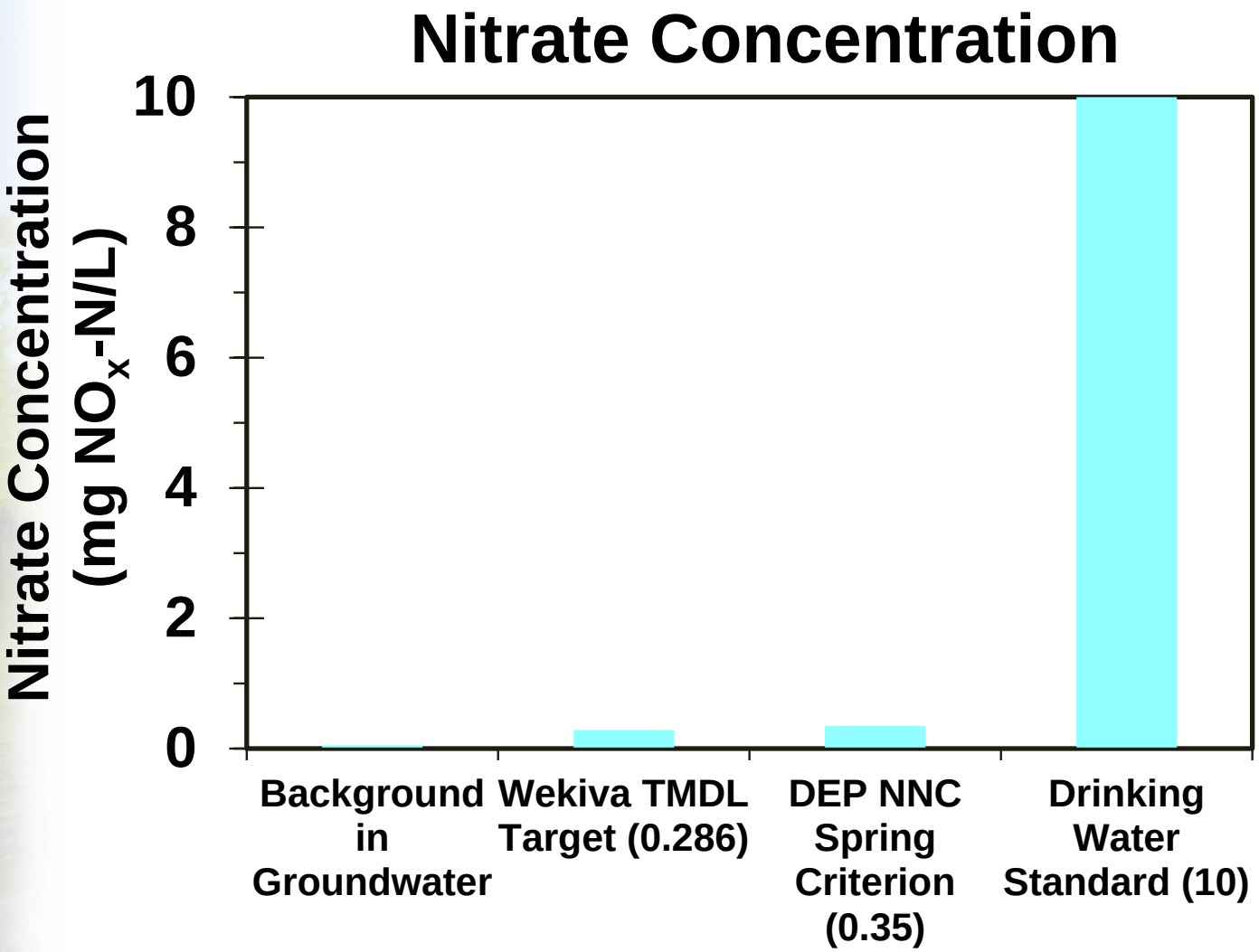


Epiphyte growth on the Lower Santa Fe River, 2000

Filamentous algae in Branford Spring (Suwannee River), 2000

- **Both N and P influence algal growth in 27 major Florida springs.** (Stevenson & others 2004)
- **N and P were the major nutrient pollutants in the Wekiva River Pollutant Load Reduction Goal assessment.** (Mattson & others 2006)
- **Increases of nitrate in Wekiwa, Rock and Silver Springs are associated with increased epiphytic and filamentous algae and disruption of ecosystem function.**
- **N and P are factors in the proliferation of nuisance and toxic macroalgae (*Lyngbya*) in springs.** (SWFWMD studies; Stevenson & others 2004)

Nitrate Thresholds



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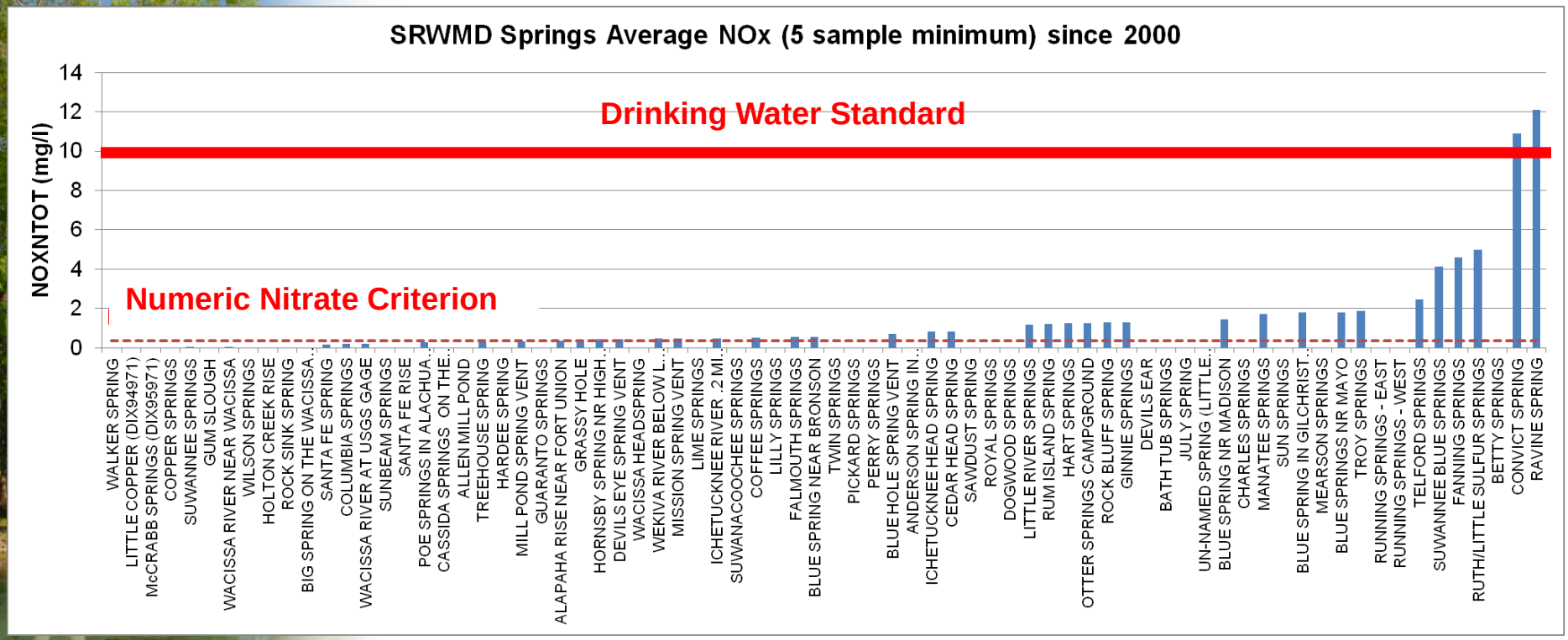
SRWMD Springs Vs. DEP's Nitrate Criterion



Source: SRWMD data, all springs listed have at least one nitrate value, however only those with 5 or more samples since 2000 show a bar.

Human Health Impacts

Springs bring mystery illness

The state is investigating ailments that are afflicting swimmers. Pollution is suspected.

By CRAIG PITTMAN, St. Petersburg Times
Published August 24, 2006

Some swimmers in Florida's most famous springs are developing skin rashes, and state officials are investigating whether the cause could be pollution-fueled algae blooms.

Many of the victims were children, but adults who reported problems ranged from a 20-year-old man to a woman in her 50s, according to state records obtained by the St. Petersburg Times.

Some of the swimmers reported

[Times photo (2005): Terry Tomalin]

Most rash complaints have come from Ichetucknee Springs, the focus of a state health department study.

Threat #3 - Biological Threats to Springs Health

- Invasive Exotic Species
  - Hydrilla
  - Crayfish & clams
  - Various species of apple snails
  - Fish, brown hopolo, sailfin catfish

Hydrilla in Wakulla Spring

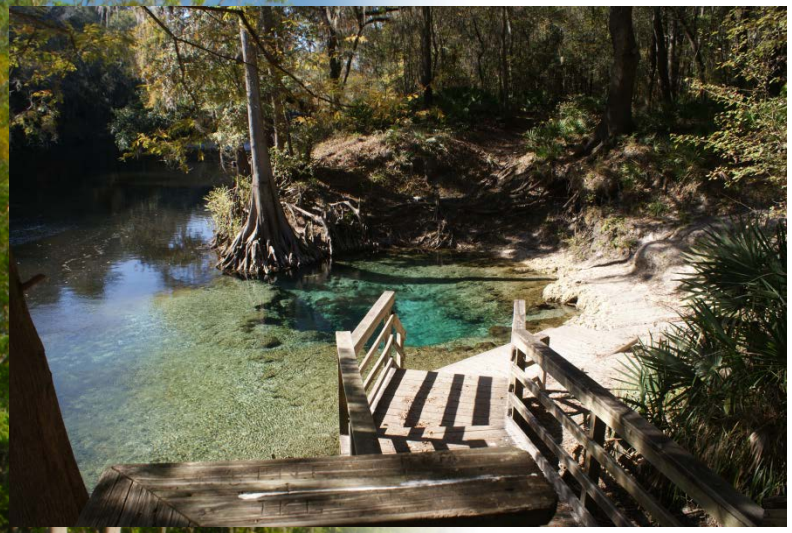
Threat #4 - Disturbance

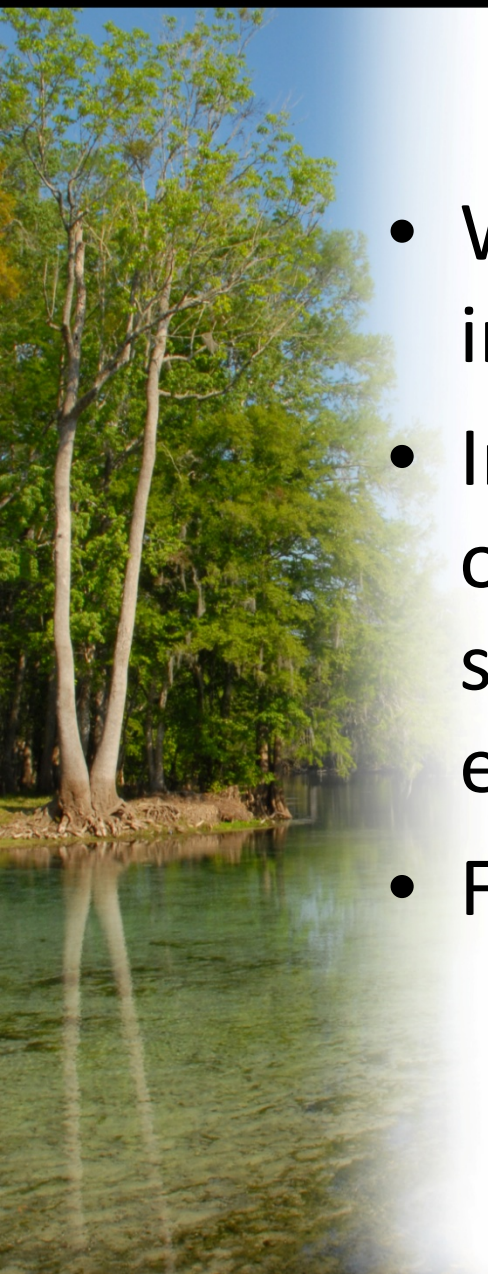
Threats to Springs Health

- Human Impacts
  - Bank erosion
  - Wading, paddling, uprooting submersed aquatic vegetation
  - Prop scars and turbulence
- Restrictions to Movement/Migration
  - Dams, ie. Rodman restricts access by a variety of species (manatees, grazing fish)
- Others
  - Manatee overcrowding and overgrazing

Disturbance

Public Access & Disturbance

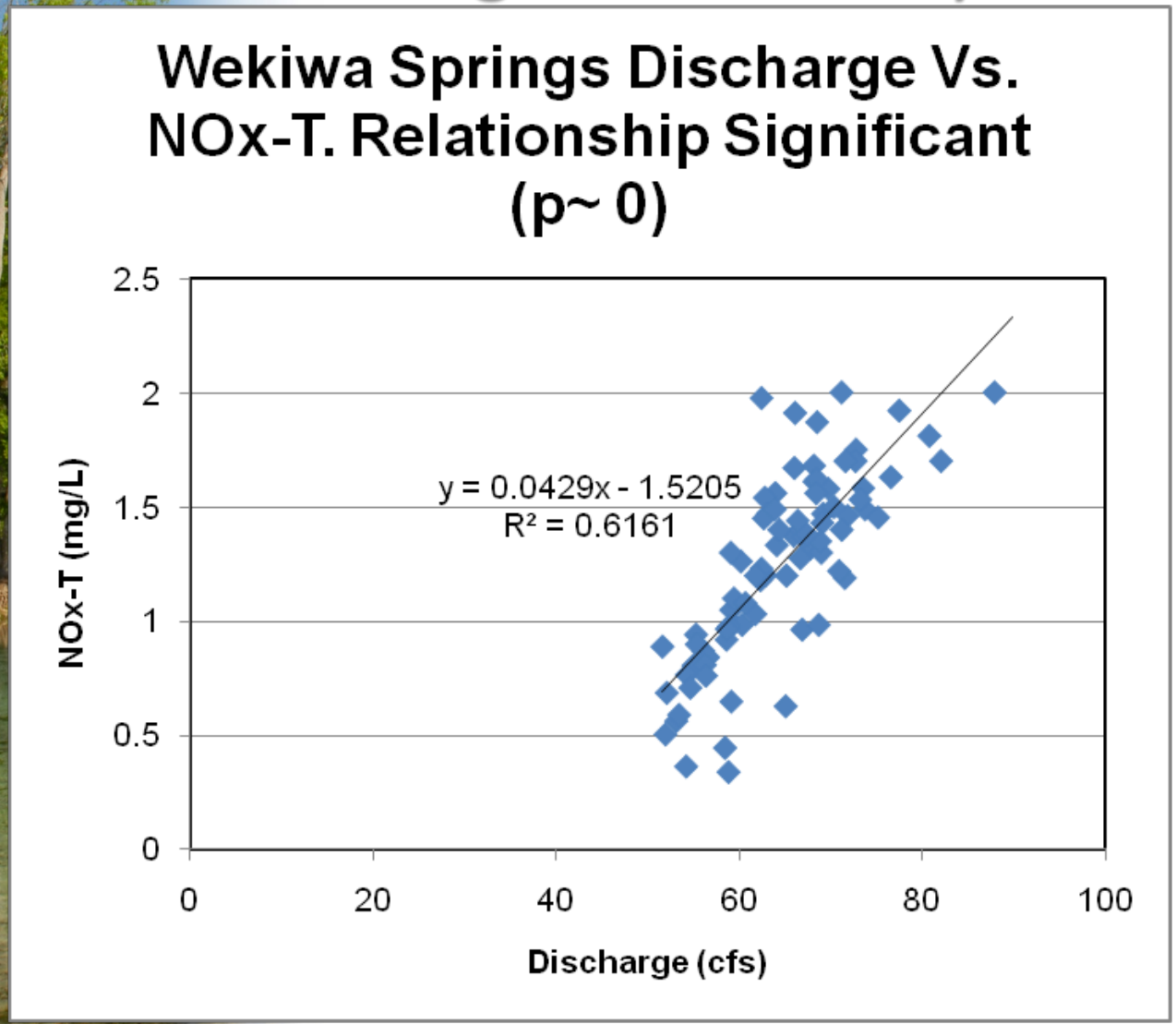




Interactions

- We know each health stressor can individually alter a spring
- Interactions between stressors can occur, and require that relative strength of individual stressors be evaluated and addressed
- Find cures for true causes of ill health

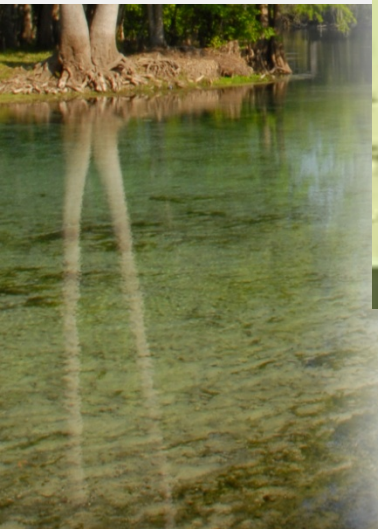
Discharge : Chemistry Relationships



Strong positive correlation supports a view that spring flows are a mix of older less enriched water and younger, shallower water. Identifying these shallow locations is important.

Questions as the Santa Fe River Flows Underground?

Santa Fe River Sink
O'Leno State Park
by Dan M.
Rountree



The health of our waters is the principal measure of how we live on the land

Luna Leopold, USGS Chief Hydrologist 1956-1966