Hydrilla Management Challenges in Florida

Hydrilla verticillata L.f. Royle

- Hydrilla - monocot - Hydrocharitaceae
- Native to tropical SE Asia
  - dioecious and monoecious biotypes
  - separate introductions to the US

Hydrilla

- Submersed - to 35 feet
- Invasive exotic
- SE Asia – 1950s
- Problems
  - flood control
  - navigation
  - recreation
  - environmental

Hydrilla Challenges in Florida

- 1950s
  - introduction via aquarium trade
  - Indian Star Vine
  - Tampa nursery - canals

Hydrilla Challenges in Florida

- 1960s
  - expansion
  - correct identification
  - screen compounds for control

Hydrilla Challenges in Florida

- 1970s
  - parochialism

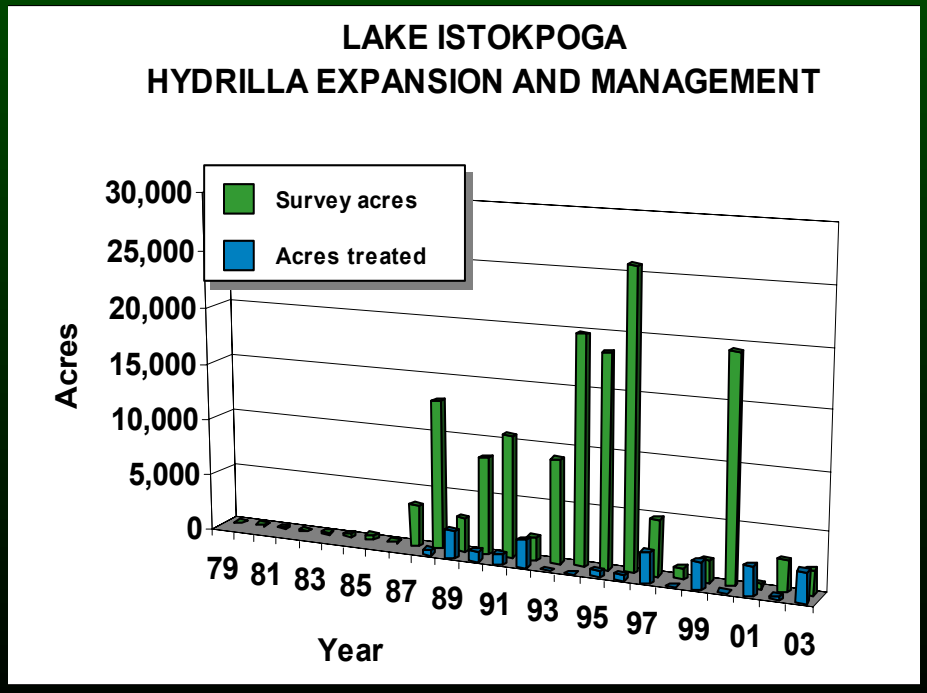
  - control or exploit?

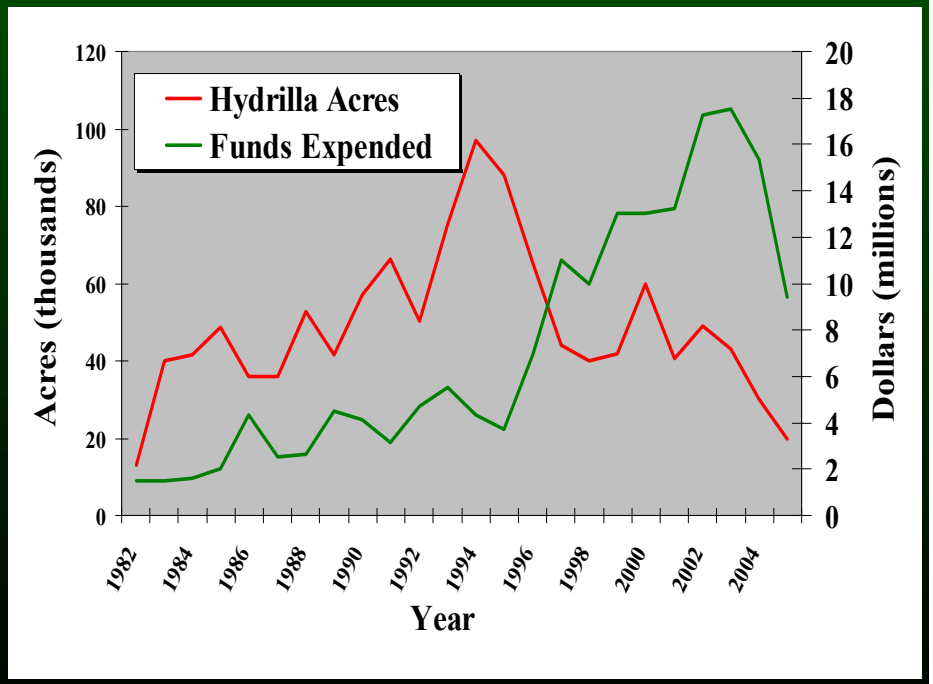
Hydrilla Challenges in Florida

- 1980s
  - expansion
  - need for large-scale management

Hydrilla Challenges in Florida

- 1990s
  - filling in
  - cooperation – united front = funding





Hydrilla Challenges in Florida

- 2000s
  - resistance
  - enhanced microbial degradation
  - additional large-scale control tools

Hydrilla = Invasive

- **Fast growth**
  - **1-4 inches per day**
- **Multiple reproductive modes**
  - **turions, stolons, fragments**
- **Broad environmental tolerance**
  - **temp, light, flood, drought**

- **Grows laterally at surface**
- **Breaks in waves, flow, dark water, wind**

Invasibility of Florida Waters

- Shallow – 8-12ft
- Nutrient rich
- Vast open water expanses
- Year-round growing season
- Suitable pH

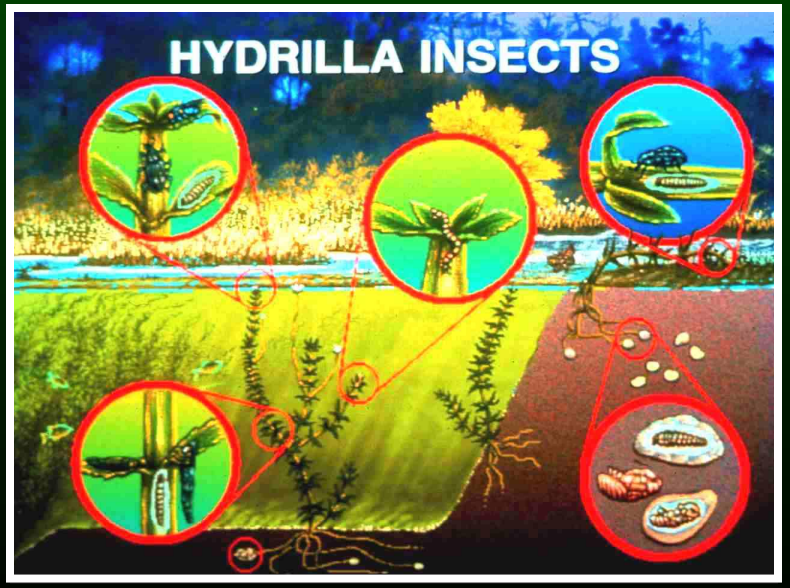
Integrated Management

Assess all potential controls and apply the method or methods most appropriate for the conditions, uses and functions at each location.

- **Early detection / rapid response**
- **Eradicate new infestations**
- **Manage established populations at the lowest feasible levels**
- **$15 - $20 million annually**

Hydrilla Biocontrols

- 4 host-specific insects
- Sterile grass carp
- Research – fungus - Mt

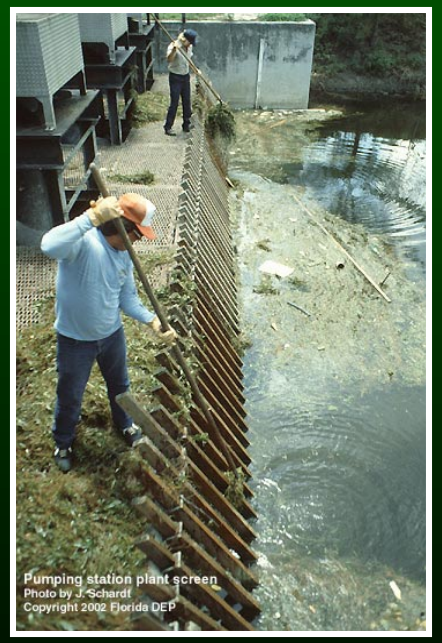


Mechanical

- Non-selective
- Slow (2-8 acres/day)
- Cost prohibitive
- Fragments hydrilla
- Small areas
  - emergency

Cultural / Physical

- **Hand removal**
- **Diver dredge**
- **Drawdown***
- **Flooding***
- **Barriers**
- **Dyes**
- **Rakes**



Chemical

USEPA-FDACS Registered Herbicides

copper	- 3	(c)
diquat	- 2	(c)
endothall	- 4	(c)
fluridone	- 4	(s)

(c) = contact, (s) = systemic

Large-Scale Hydrilla Control

- Herbicide
  - fluridone – large-scale
    - endothall – small scale
- Mechanical too slow / expensive
- Insects not effective
- Carp not selective, leave system (80)
- Whole lake drawdown not feasible

Large-Scale Hydrilla Control

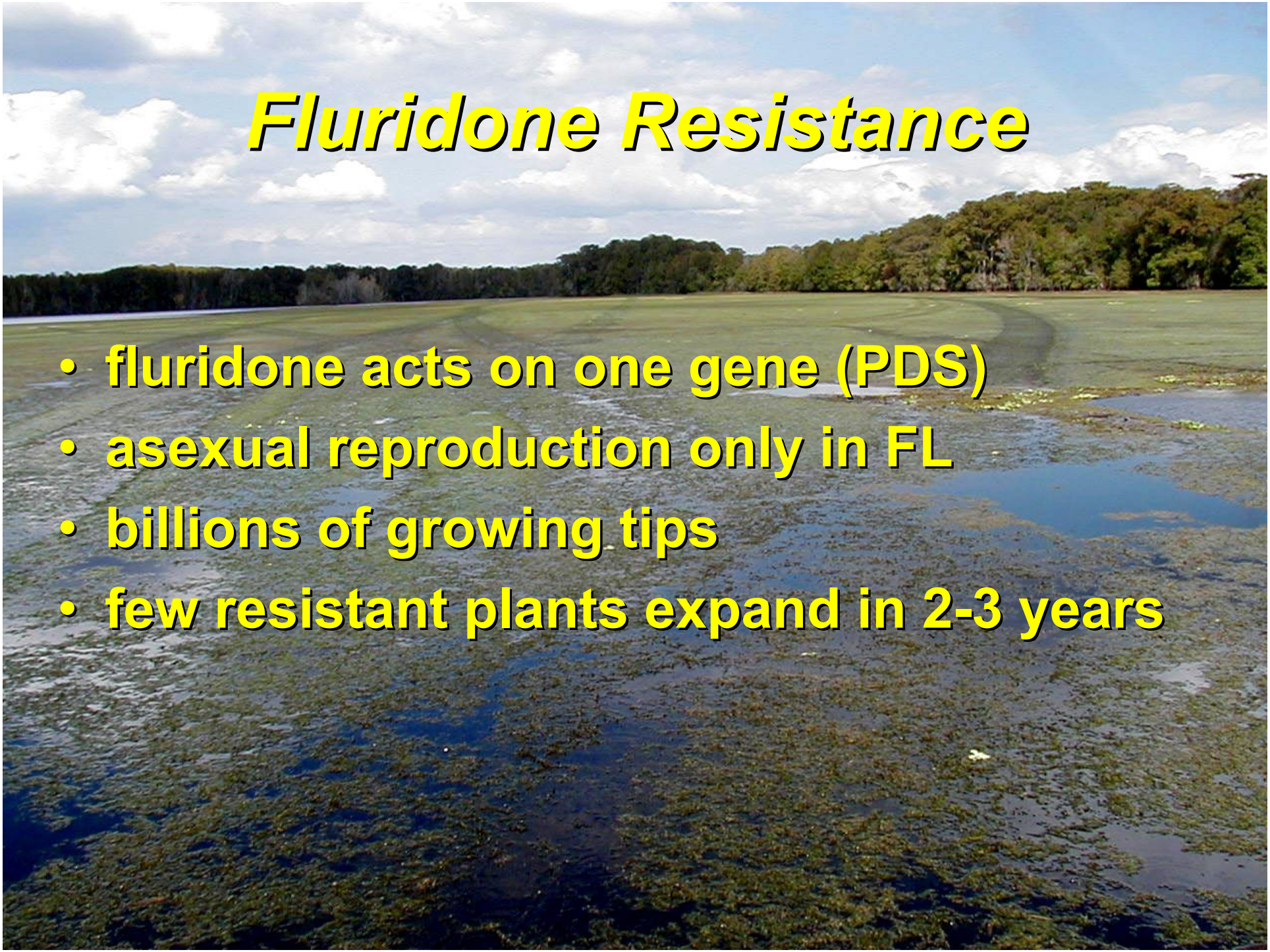
- Fluridone herbicide
  - slow acting – few oxygen problems
  - selective, especially in winter
  - economical - per acre, duration
    - pre- post- endothall treatments
  - 2 years control
    - standing crop and tuber sprout

Fluridone Resistance

- Several hydrilla clones (17 - 6)
- Varying fluridone tolerance (2 - 33+ppb)
- Treatment approaches
    - water volume / flow
    - sediment influence
    - fluridone susceptibility
    - monitor fluridone in water
    - monitor hydrilla response

Fluridone Resistance

- 1st example of resistance to bleaching herbicide
- 1st example of somatic mutation leading to rapid wide-spread resistance
- no evidence of fitness penalty



Fluridone Resistance

- fluridone acts on one gene (PDS)
- asexual reproduction only in FL
- billions of growing tips
- few resistant plants expand in 2-3 years

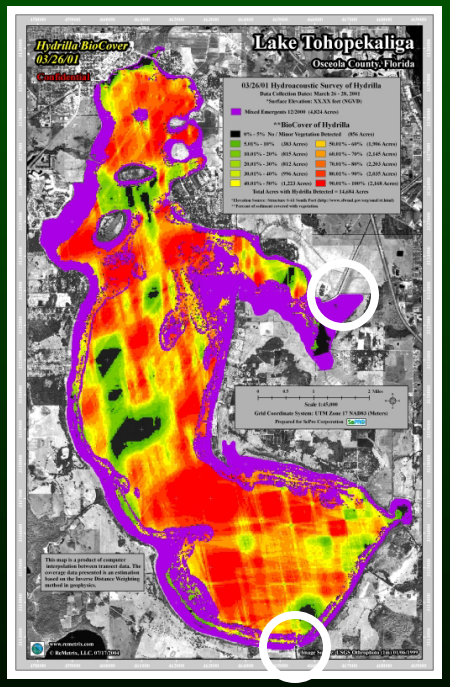
Enhanced Microbial Degradation

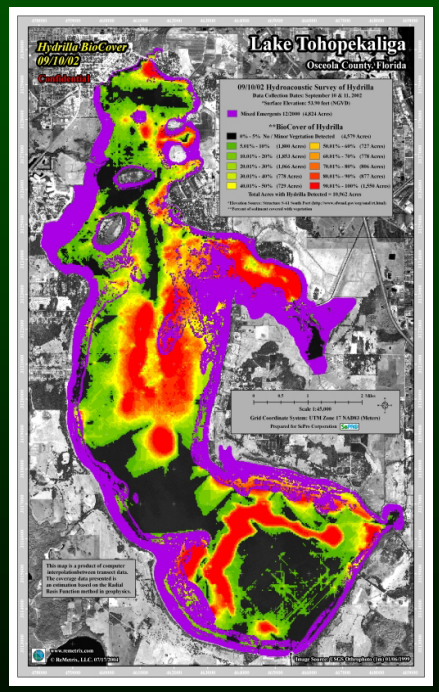
- **Fluridone**
  - **half life from 30d – 7d**

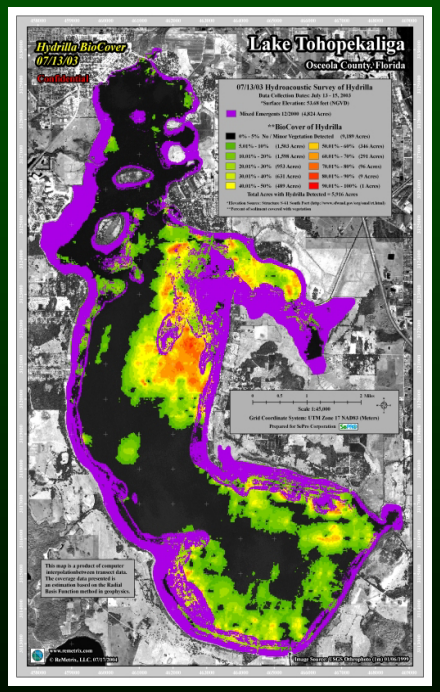
  - **repeated doses (annual vs. 2-3 years) ?**
  - **increased dose (3-5x) ?**
  - **formulation (pellet vs. liquid) ?**
  - **sediment type (org vs. sand) ?**
  - **time of year (warm vs. cool) ?**

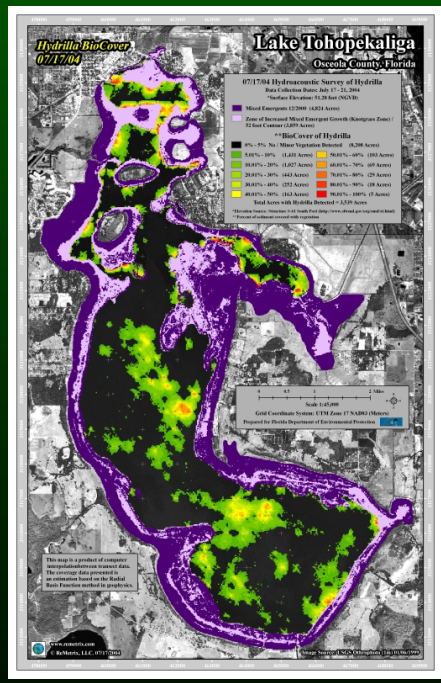
Hydrilla Cover – Lake Toho

Mar 7, 2001	Mar 18, 2002	Apr 22, 2003	Apr 2, 2004
53.7ft	54.0ft	52.8ft	48.7ft









9-12ppb - $ 3.26M	9-12ppb - $5.66M	9-16ppb - $6.38M	18-24ppb - $3.60M

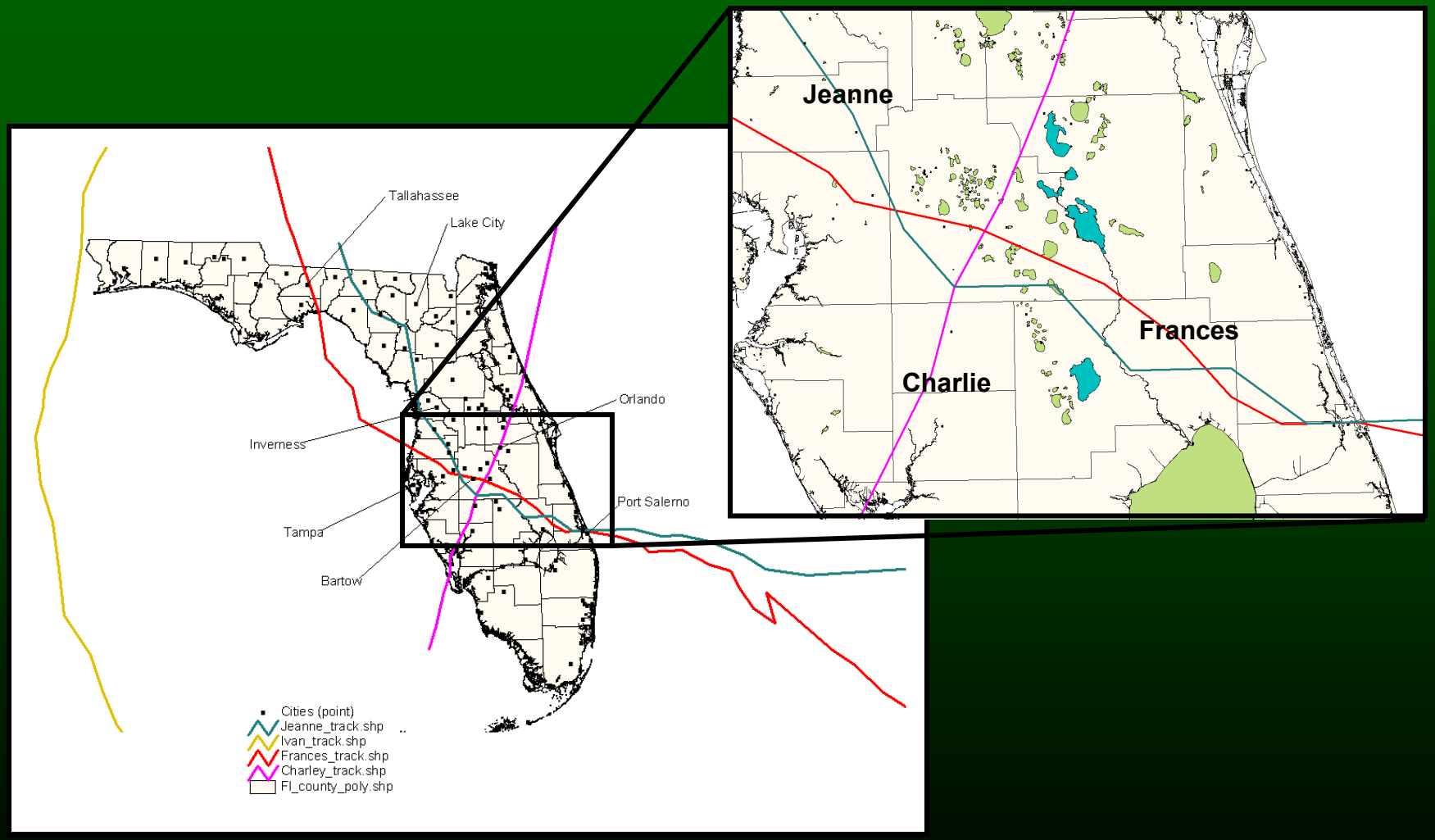
Fluridone Concerns

- only effective large-scale hydrilla control
- losing selectivity
- cost prohibitive
- annual vs. multiple years of control
- increasing resistance
- microbial degradation?

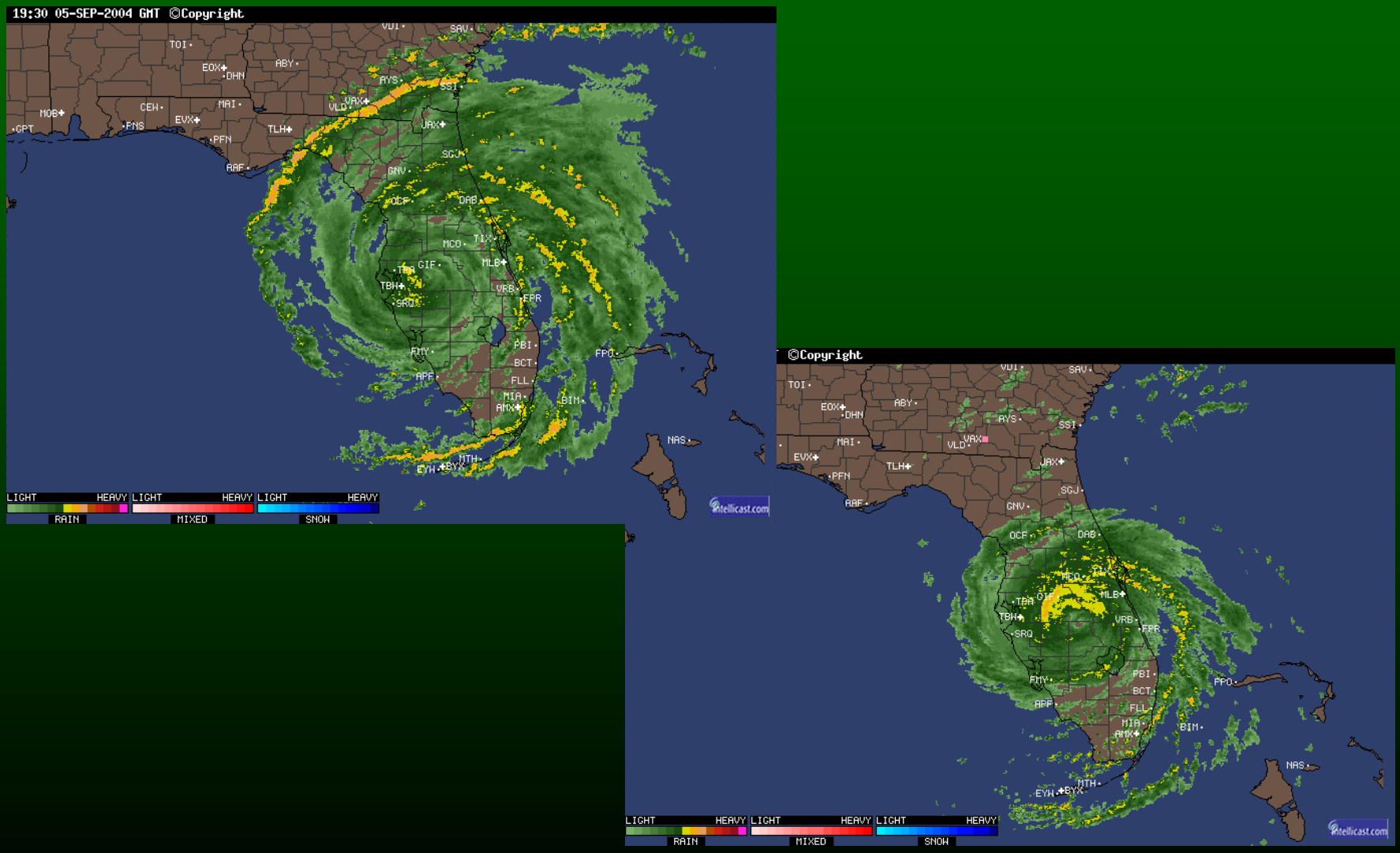
Hydrilla Management Review

- July 13, ‘04 - tolerance workshop
- ~~Aug 12-13 - Sept 16-17 - Oct 8-9~~
- Dec 6-7, ‘04 - UF hydrilla issues summit
- June 15, ‘05 - white paper
- Dec 6-7, ‘05 - researchers / managers
  - management strategy workshop

Intervention



2004 Hurricanes




Hydrilla uprooted…


…and blown away

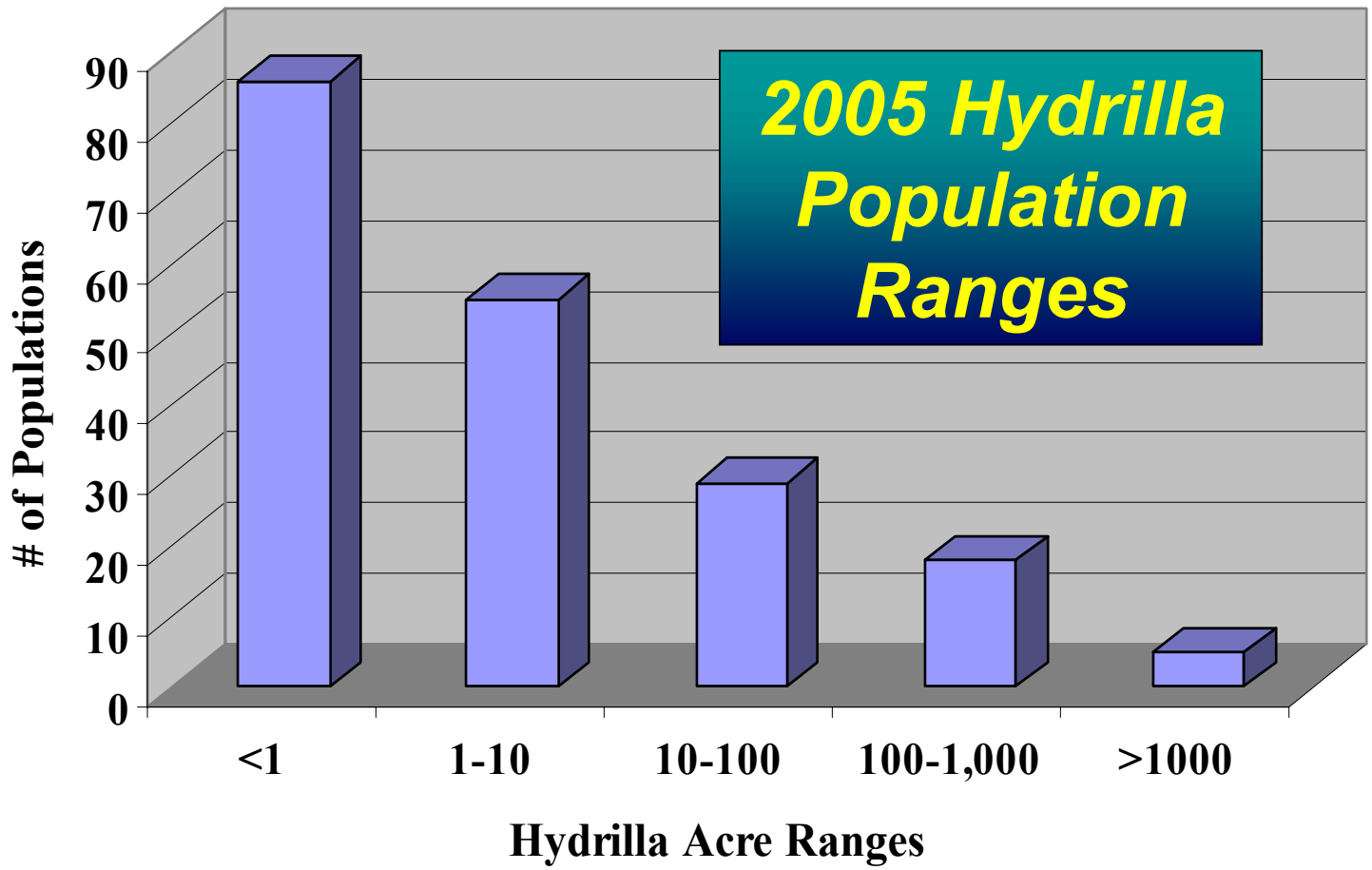
Hydrilla Suppression

- turbidity
- tannins
- algae blooms
- deep water

Hydrilla Stats.

- 193 waters infested (from 280)
- ~ 90,000 acres infested (from 140,000)
- ~ 20,000 acre standing crop (from100,000)
- Grows ~ 1 - 4”/day
- Soil to surface (10-15’) in 1 season

Hydrilla Populations



Summit Recommendations

- More aggressive small-scale control
- Re-visit sterile grass carp (80)
- Increase research effort
  - overseas exploration – biocontrol
  - work with industry - new compounds
- Stewardship plan – herbicide rotation

New Herbicide Development

- **Imazamox – ALS (systemic)**
  - **Special Local Needs Registration**
- **Penoxsulam- ALS (systemic)**
  - **Request for Emergency Use Permit**
- **Bispyrabac – ALS (systemic)**
  - **Experimental Use Permit**
- **Flumioxazin – Protox (contact)**
  - **Experimental Use Permit**

- **All four target plant enzyme systems !!**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