Excessive Rain in the Fall Can Affect Physiology of Pine Seedlings

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Questions

- Does excessive rainfall in the fall (just prior to lifting) affect the physiology and survival of transplanted pine seedlings?
- When it occurs, what can we do to mitigate the problem?

Occurrences

- Wakeley (1954)
- New Zealand (Gilmour 1958)
- Mississippi (Oak 1983)
- Georgia 1994 - Carey
- Alabama 1994 - Carey
- Alabama 1997 - Carey
- Alabama 1998 - Carey

HISTORY

- In a year of extraordinary weather conditions, severe late fall or early winter drought might reduce survival; or **excessive fall rain** might reduce it by lowering the physiological quality of the nursery stock.

  Wakeley 1954

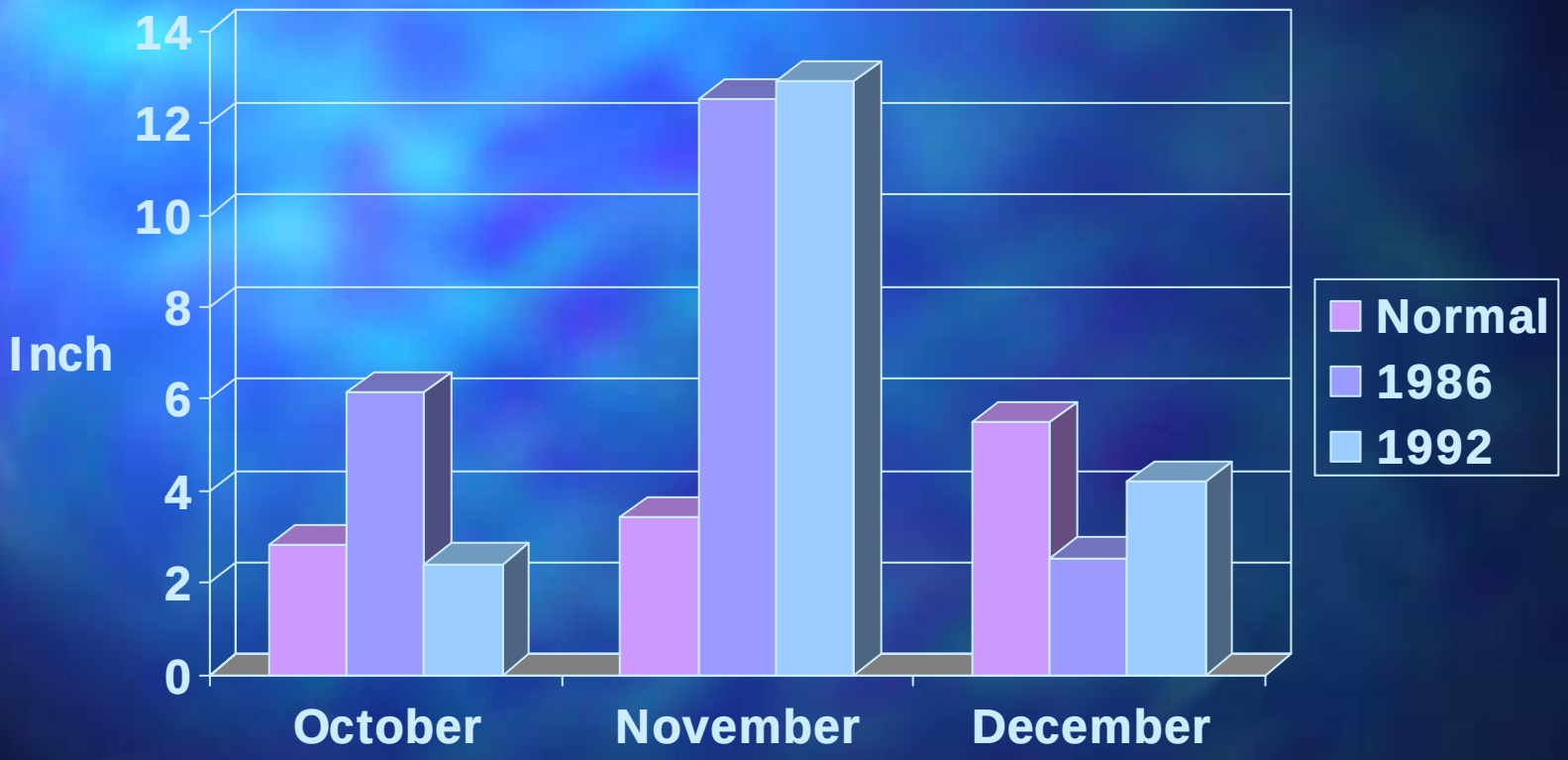
Pinus radiata

- Waterlogging in the nursery reduced mycorrhizal fungi of pine (Gadgil 1972)
- Waterlogging for 1 week cause no change
- 2 weeks purplish black root tips
- 4 weeks black root tips, brown mycorrhiza, and roots dark brown

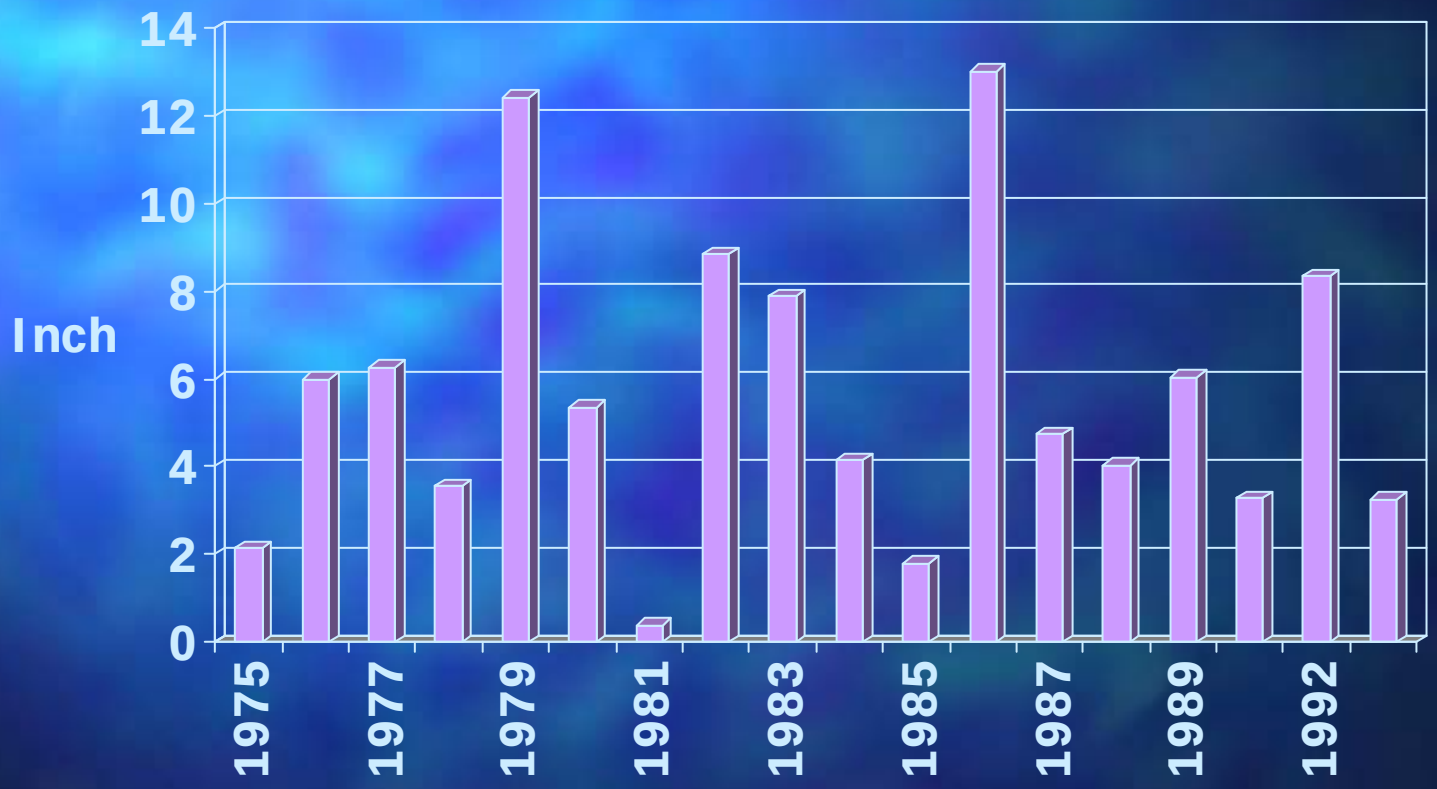
Douglas-fir

- It has long been suspected that very wet soils can have an impact on Douglas-fir seedling quality in the nursery. (Rose 1998)
- Chloropyll fluorescence measurements were taken every 2 weeks from Dec 5 - March 2.

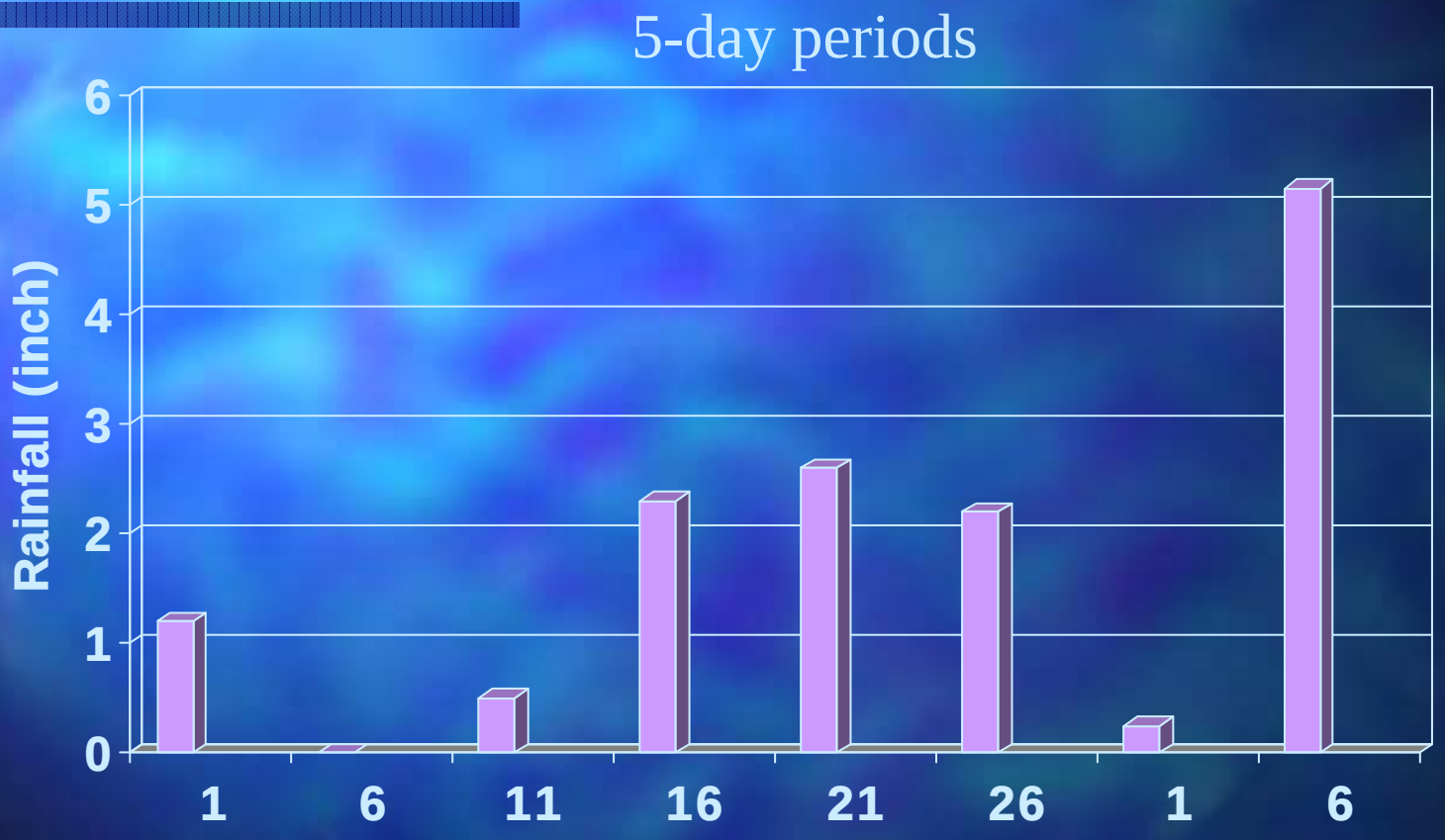
Monthly Precipitation



November Precipitation - Ashe

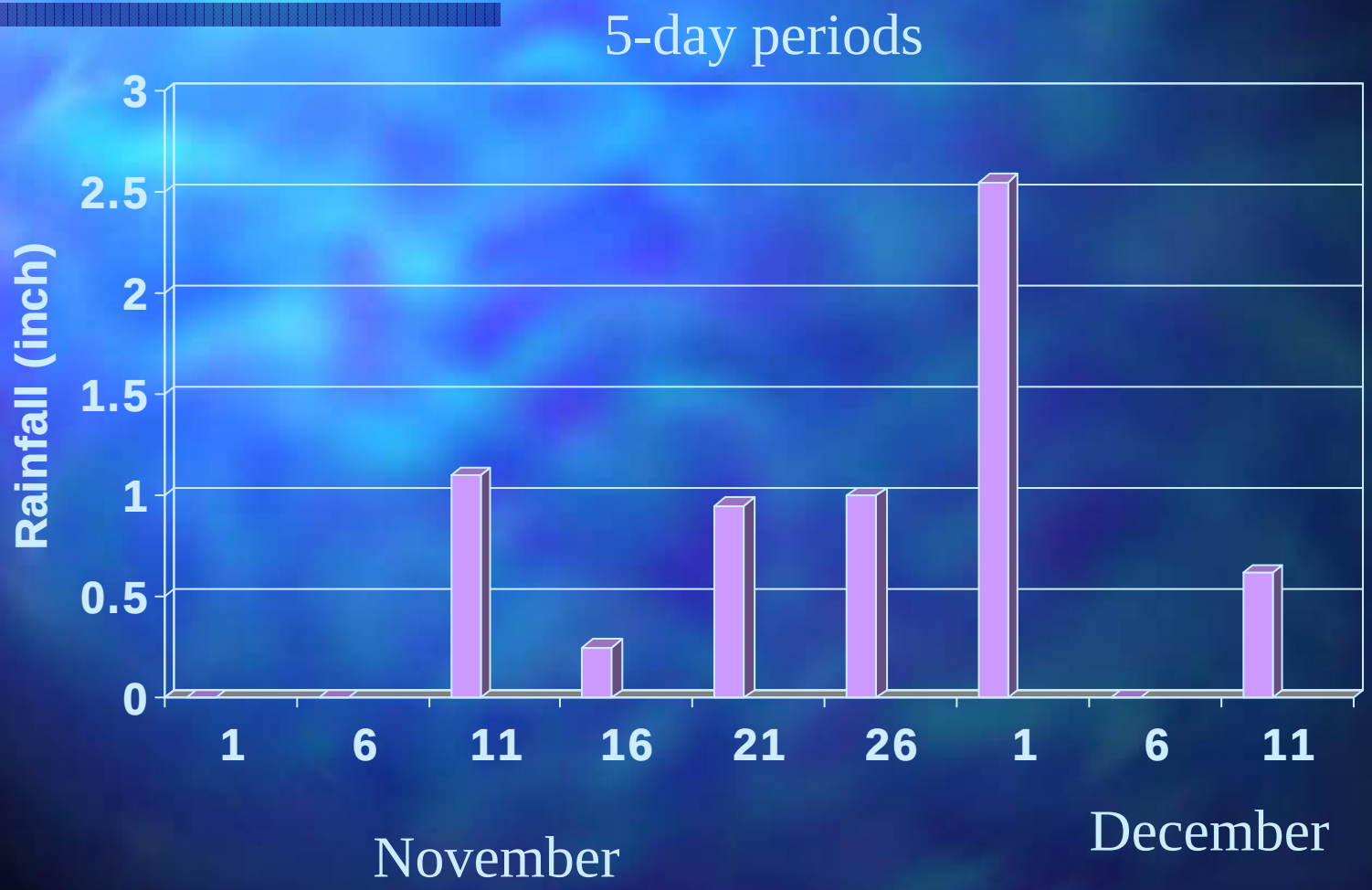


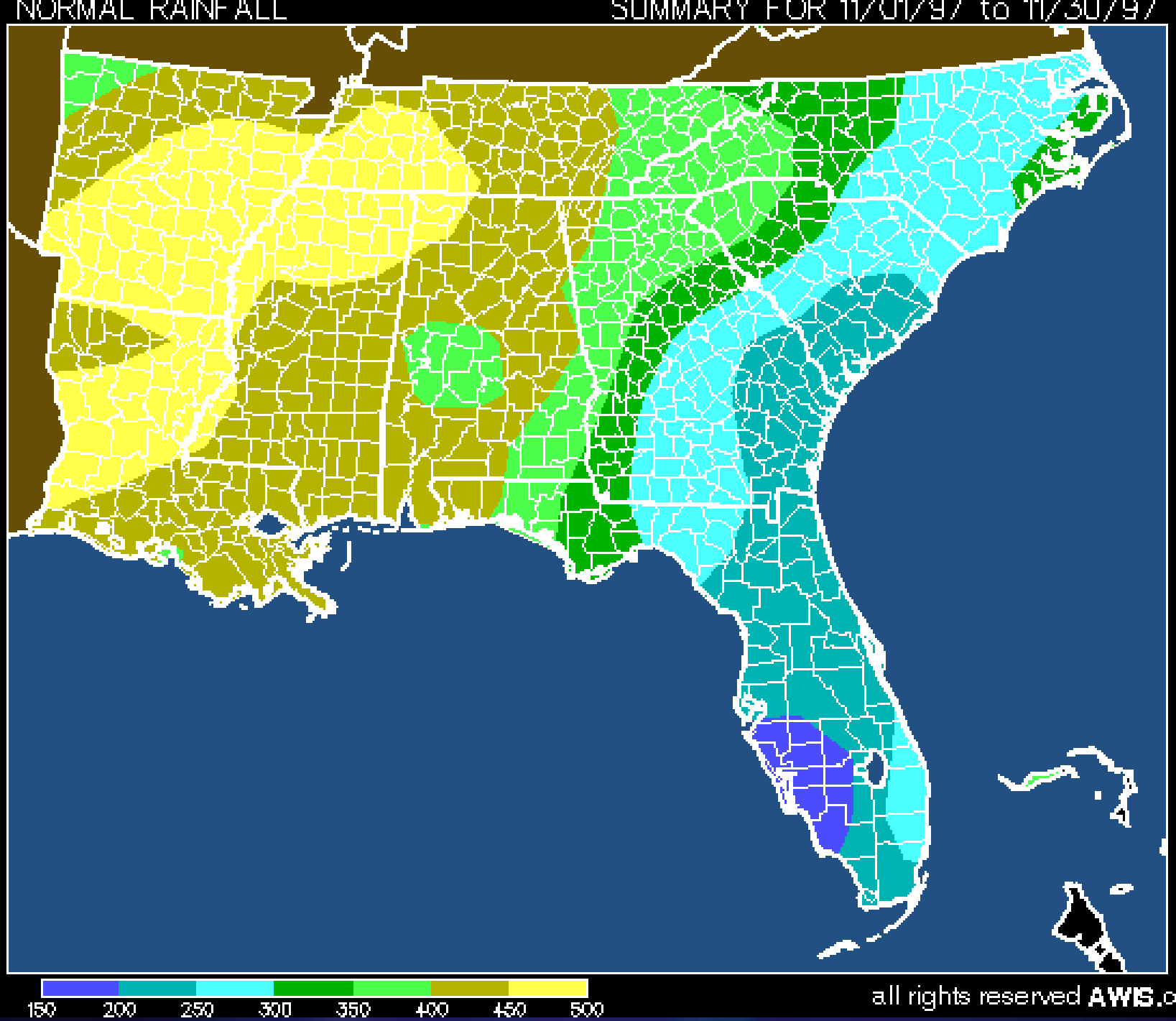
Precipitation - 1982



Lifting began on Dec. 9th

Precipitation - 1994 - GA




NORMAL RAINFALL
SUMMARY FOR 11/01/97 to 11/30/97
150
200
250
300
350
400
450
500
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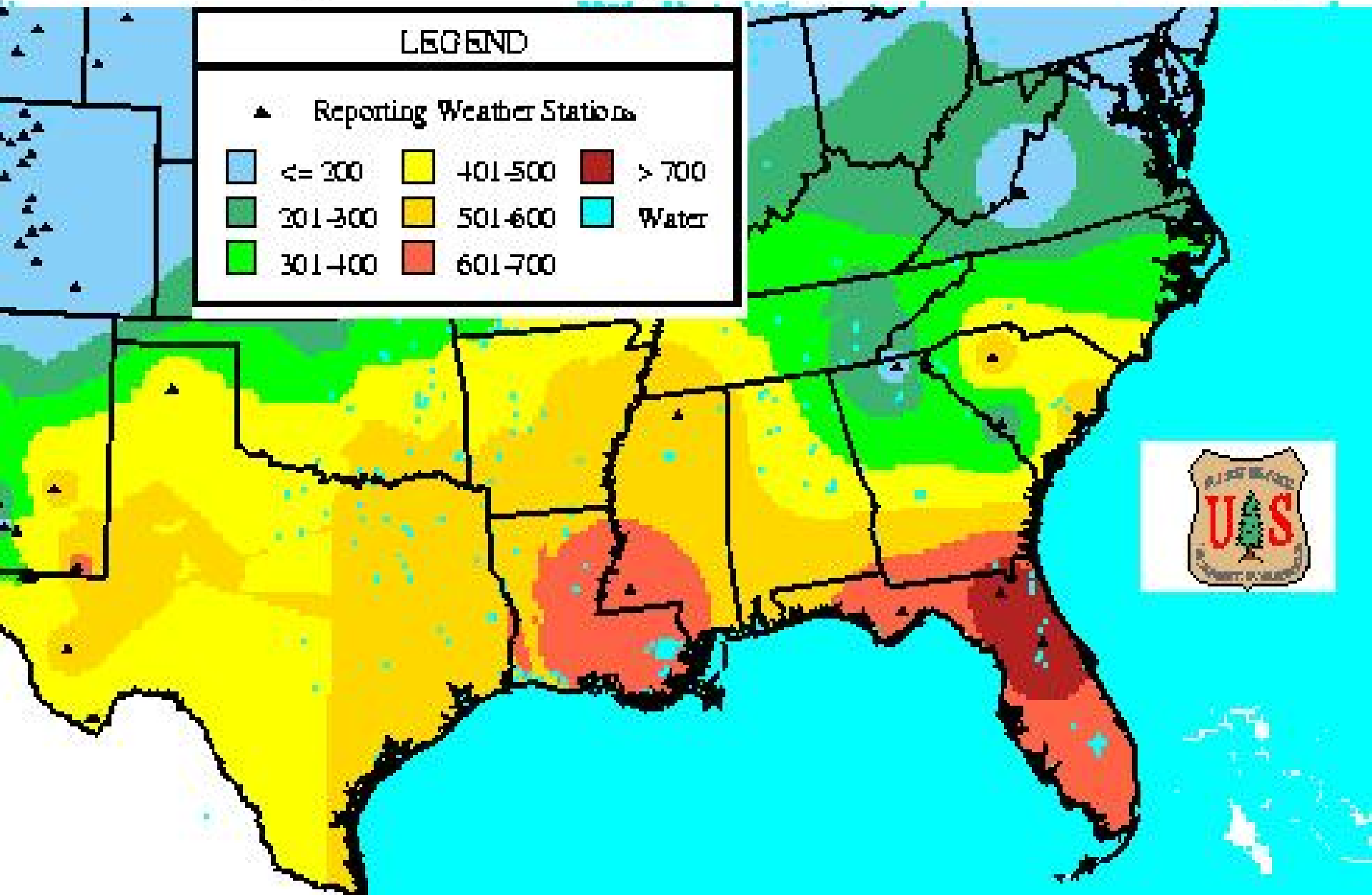
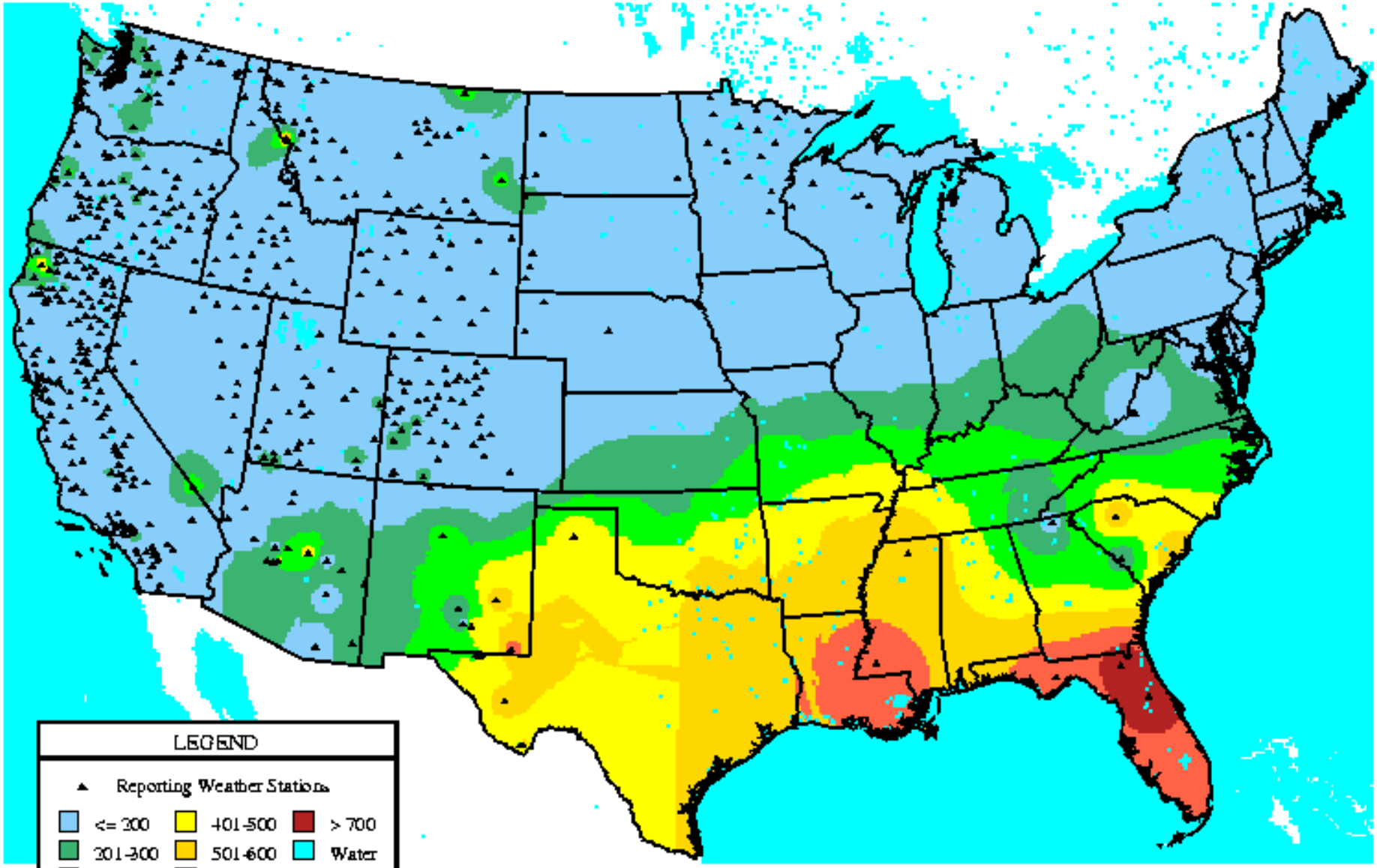
Keetch-Byram Drought Index: 22-JUN-98

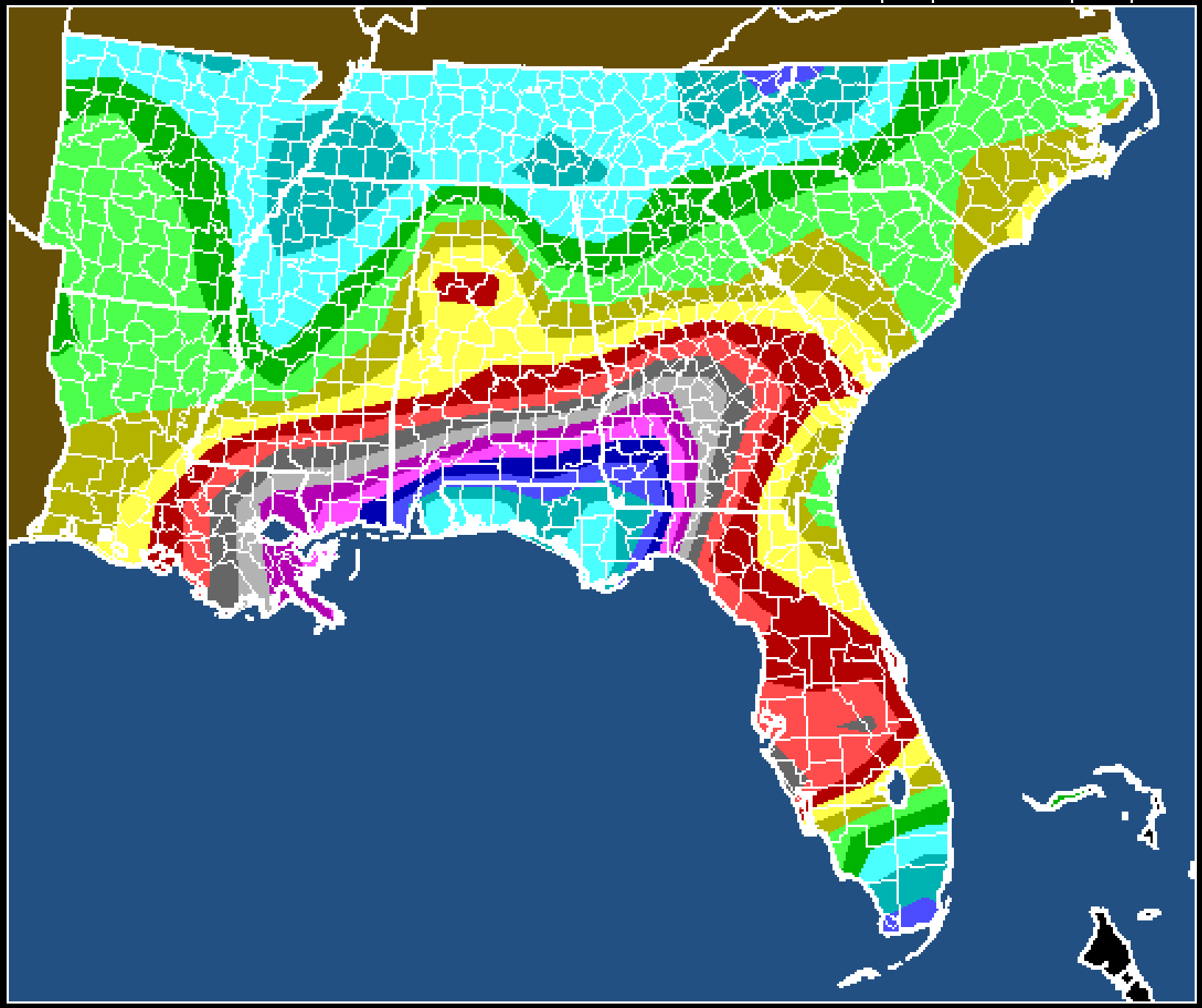


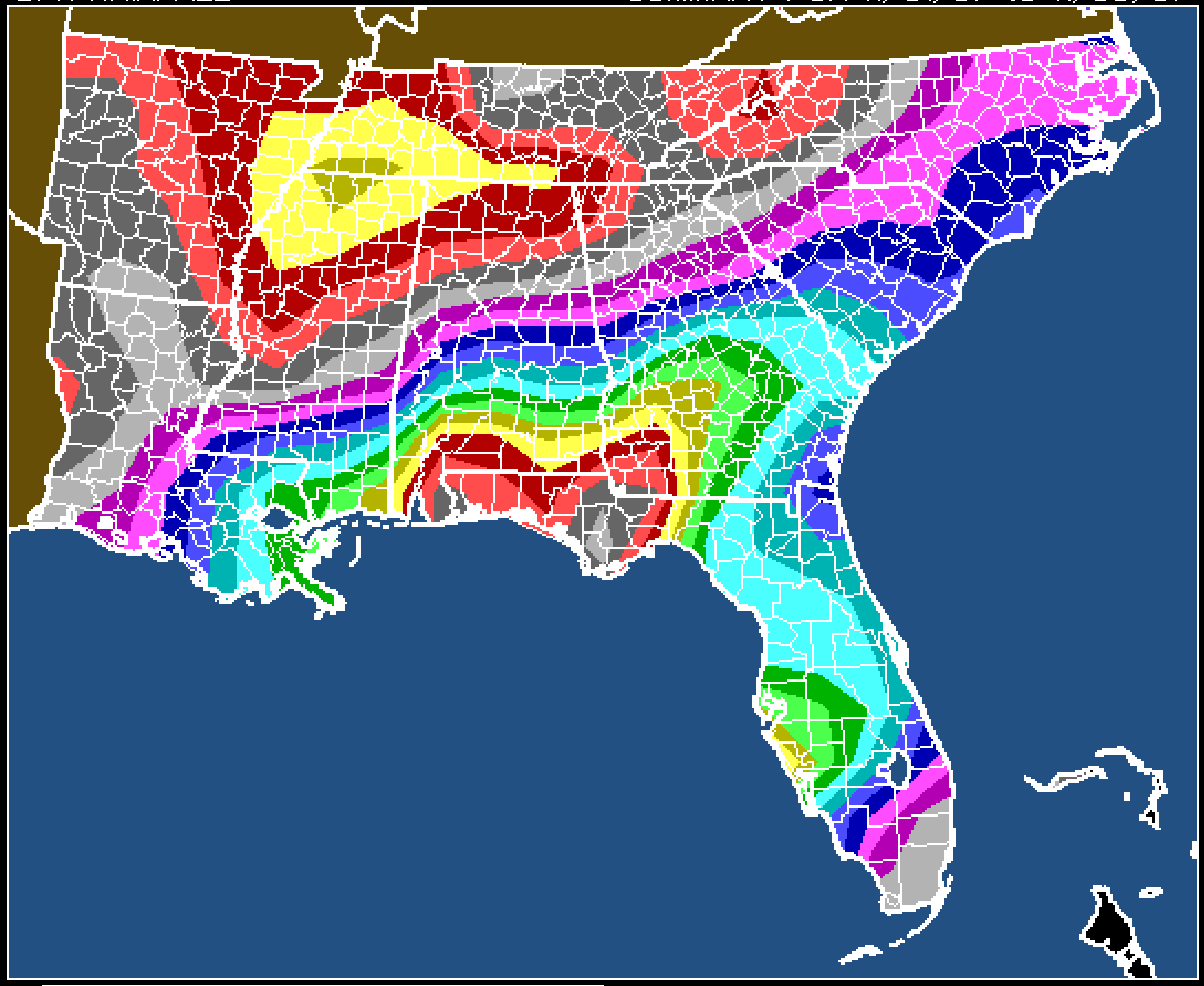
Keetch-Byram Drought Index: 22-JUN-98



(Inv. Dist.^{2} Interp.)

WFAS-MAPS Graphics FIRE BEHAVIOR RESEARCH MISSOULA, MT




DFN RAINFALL
SUMMARY FOR 11/01/97 to 11/30/97
-300 -200 -100 0 100 200 300 400 500 600 700 800
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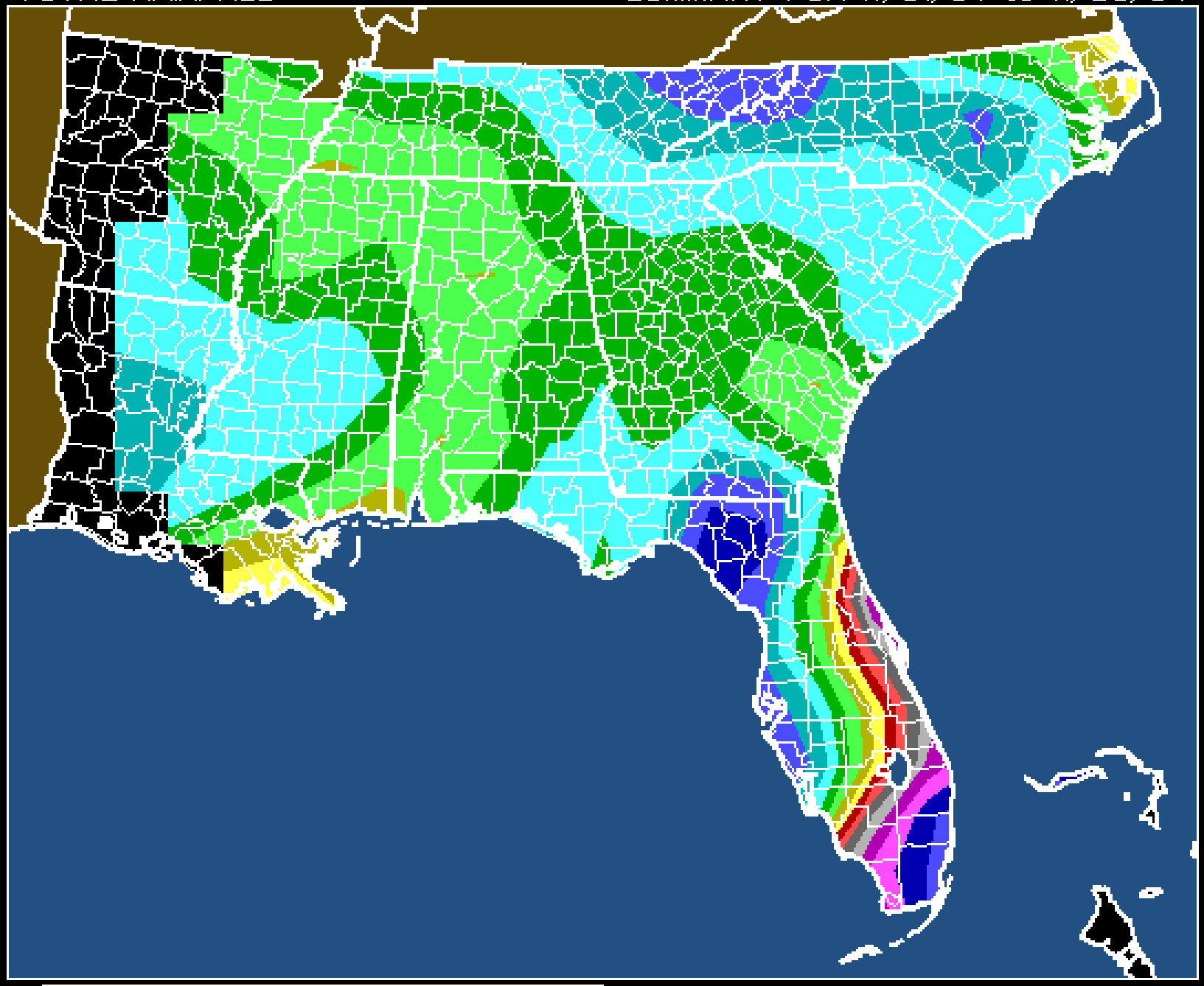
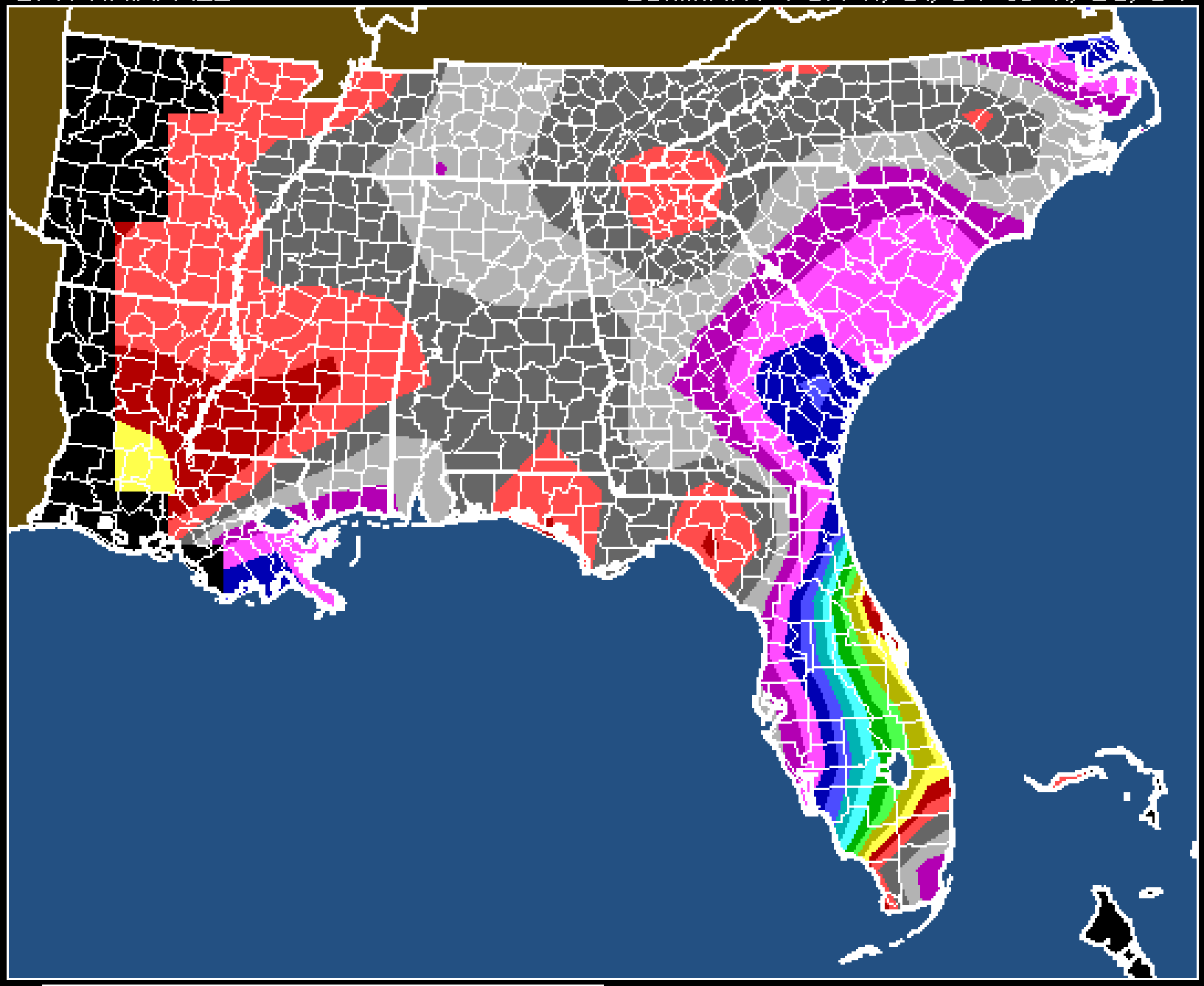
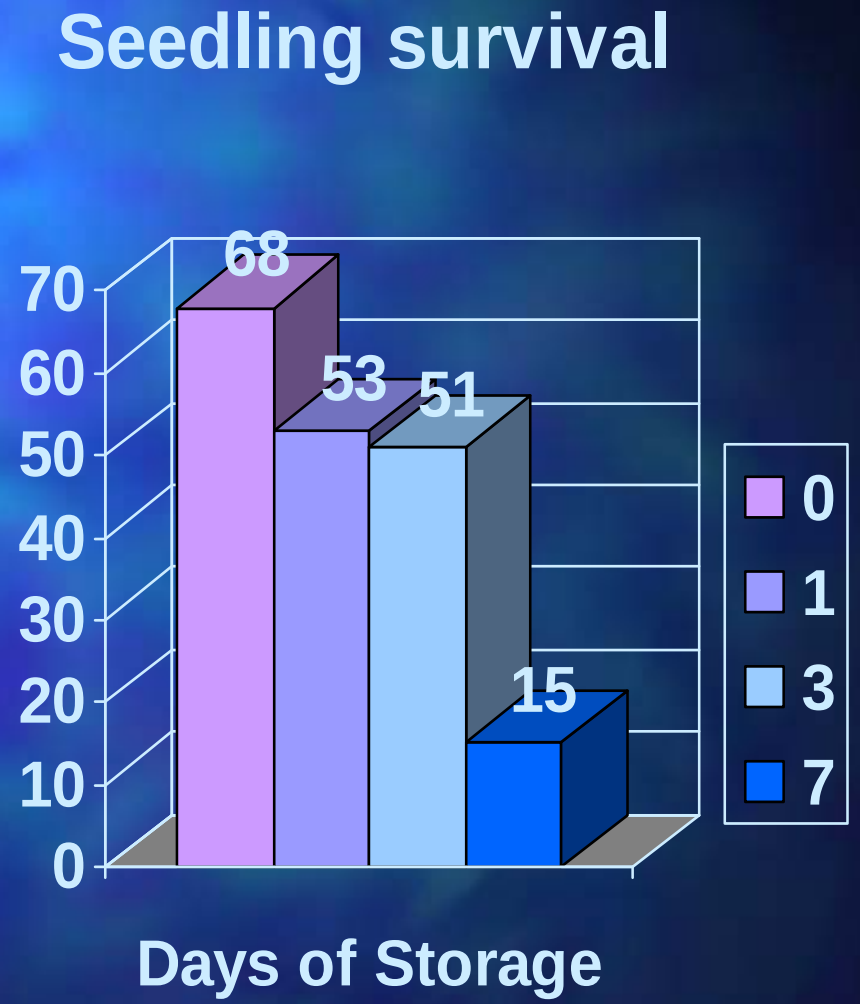




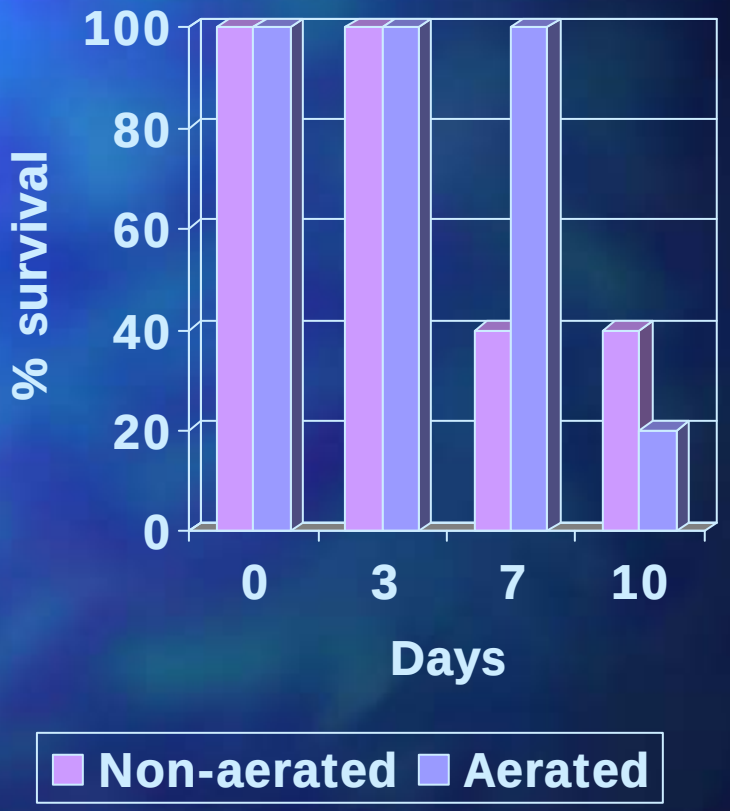
Flooding

- With slash and longleaf pine, Wakeley (1954) reported a 15% reduction survival with just 1 day of storage in water
- (in tubs).



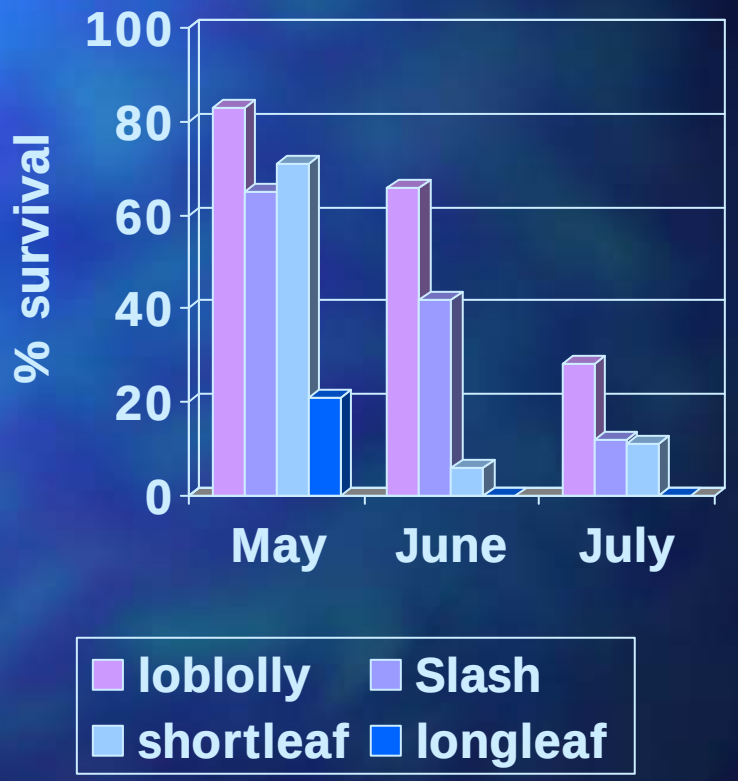
Submergence of Lodgepole pine

- Most actively growing seedlings of western conifers (pine, spruce, Douglas-fir) were killed after 10 to 14 days of submergence
- (McCaughey and Weaver 1991)



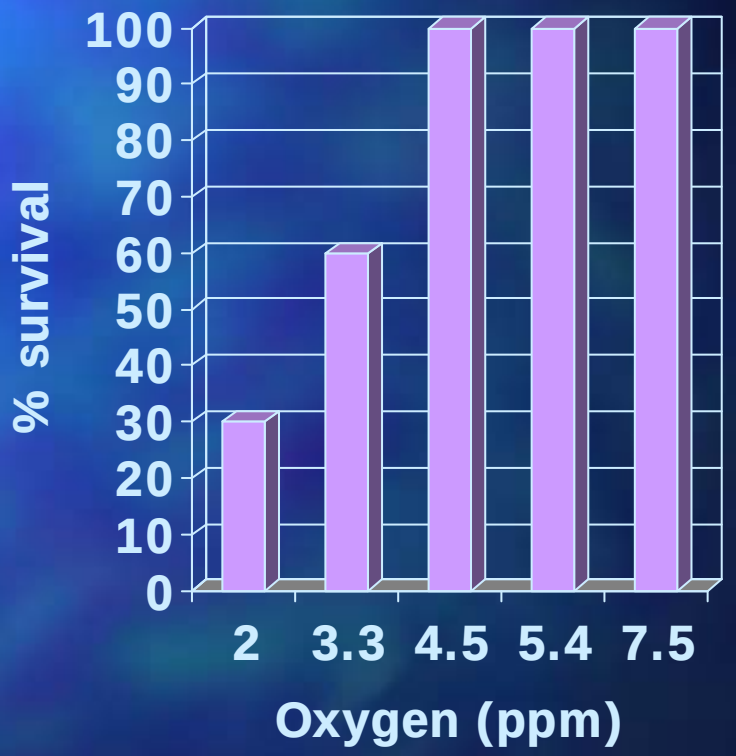
Submergence of 25-day-old seedlings

- Young seedlings submerged in a pool died quicker in warm water
- (74-85° F) than in cooler water
- (57-73° F).
- (McReynolds 1960)



Oxygen and mortality of jack pine

- A 60-day hydroponic growth-chamber study shows that growth and survival of 4 conifers is related to oxygen content in bubbling gas.
- (Zinkan et al. 1974)



Ectomycorrhizae

- “Ectomycorrhizae are generally more sensitive to soil water content than VAM…” (Jurgensen et al. 1997)

HISTORY

- All kinds of forest trees may be, and nearly all should be pruned at time of transplanting. As it is almost if not quite impossible to take up a tree without destroying a portion of the roots, or at least disturbing them, it is well to reduce the number or length of the branches to fully compensate for any loss sustained by the roots.
  Fuller (1884)

SUMMARY

- Excessive rainfall in the fall can affect seedling physiology and mycorrhiza if soil oxygen levels are reduced for an extended period of time.
- Lifting seedlings just after a period of low soil oxygen could reduced survival.
- A