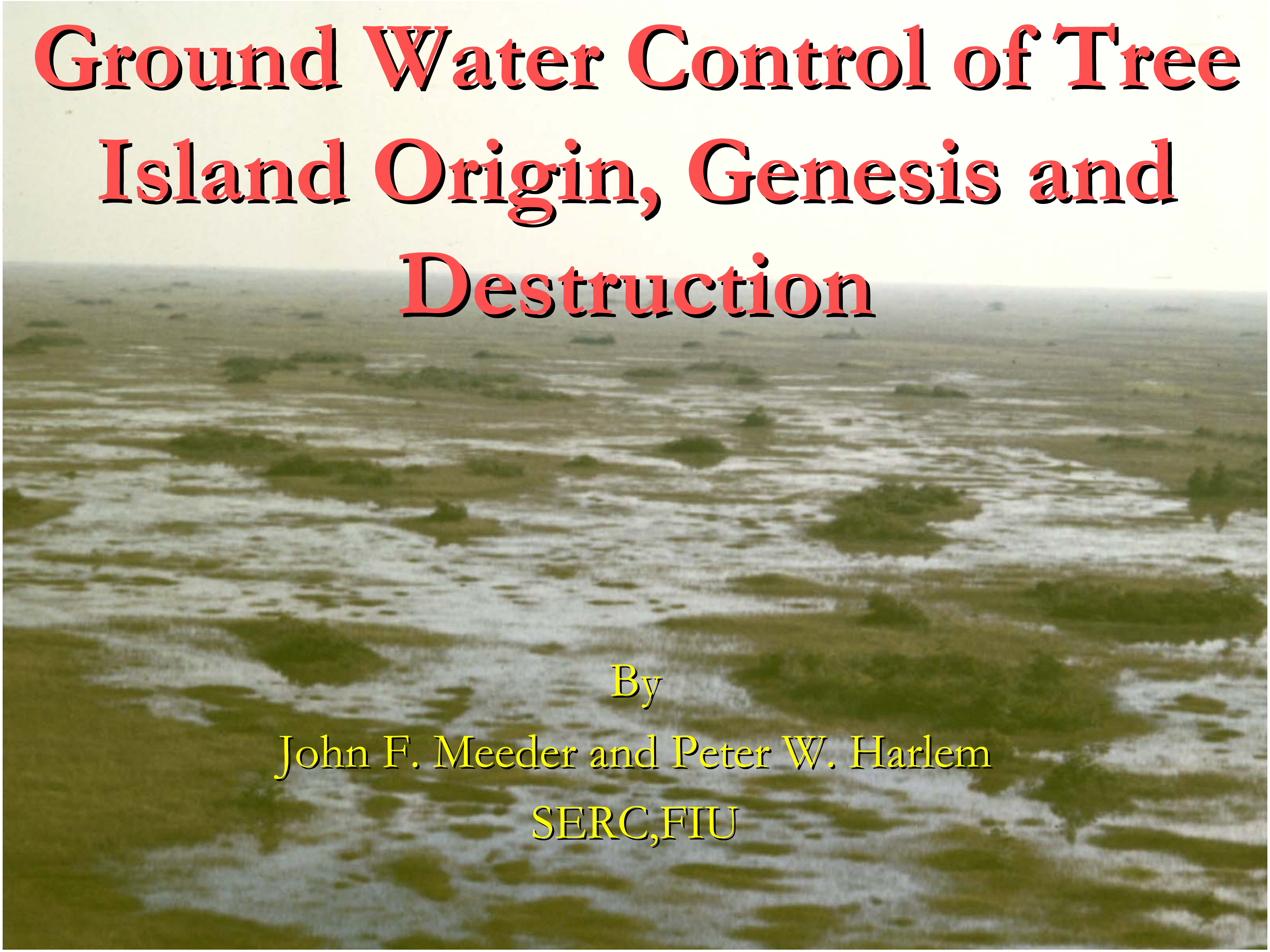

Ground Water Control of Tree Island Origin, Genesis and Destruction

By

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Functional Definition

- Our functional definition of a Tree Island is;

"an isolated scrub or tree community surrounded by either grasslands (marsh) or different upland or swamp forest types"

- related to relative changes in elevation, substrate, and contact with the ground water

“Unified theory” for tree island development

- Based upon similarities between most types of tree islands which includes different:
  - 1. vegetation
  - 2. hydroperiod
  - 3. soil types
  - 4. topography
  - 5. fire regime
  - 6. relationship to ground water,

  - from adjacent areas.

Ground water availability influences all of the above

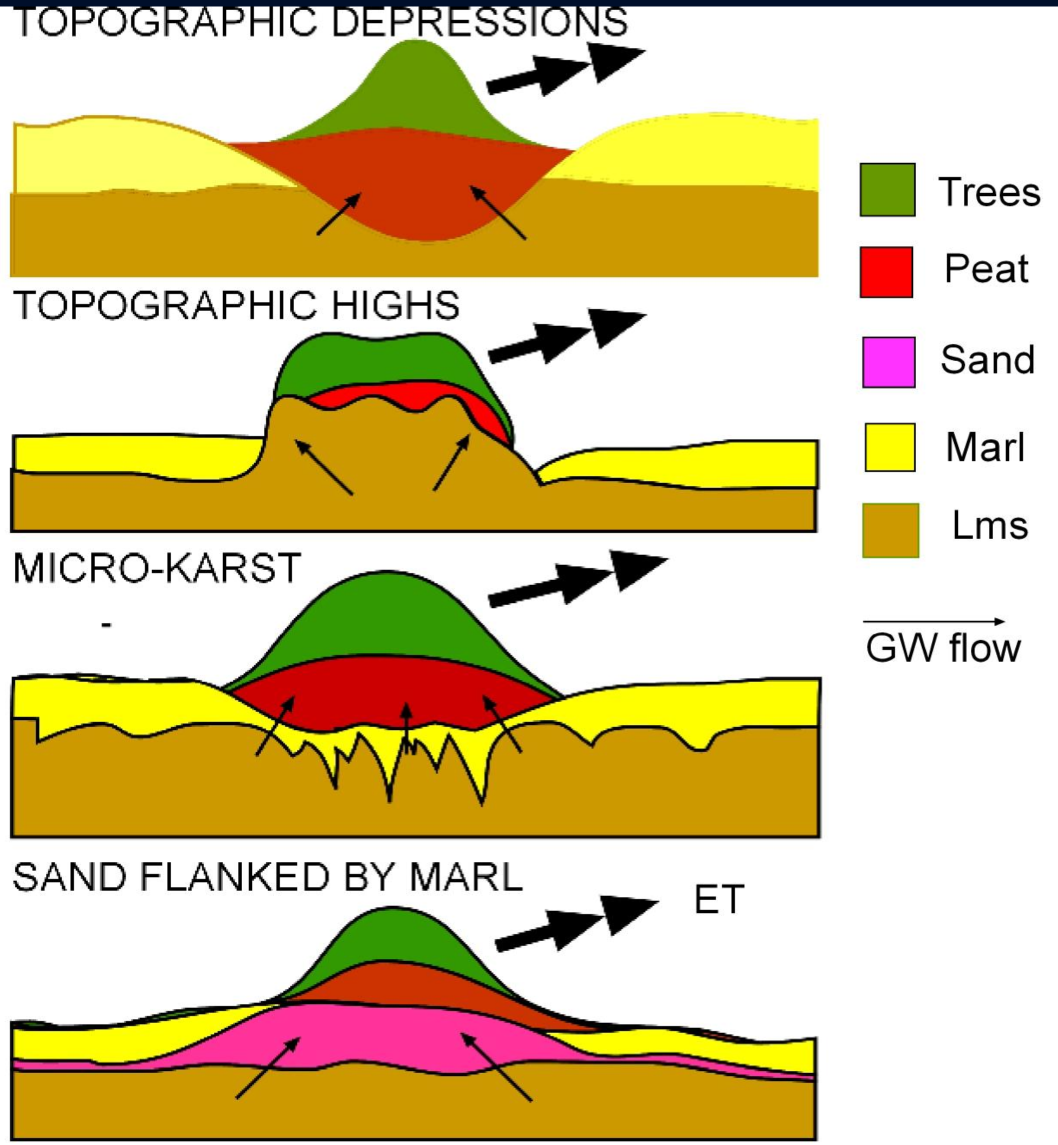
Primary Observations

- Most tree islands develop in areas associated with more contact with groundwater.
- The hydraulic head which drives ground water availability is controlled by the regional ground water table patterns.

Types of tree islands by location

- 1. Uplands or transitional wetlands (short hydroperiod) controlled by:
  - A. Epi-karst trends
  - B. Doline trends
  - C. Karst valleys and escarpments
  - D. Other depositional topographies (relict sand bars and abandoned creek channels))

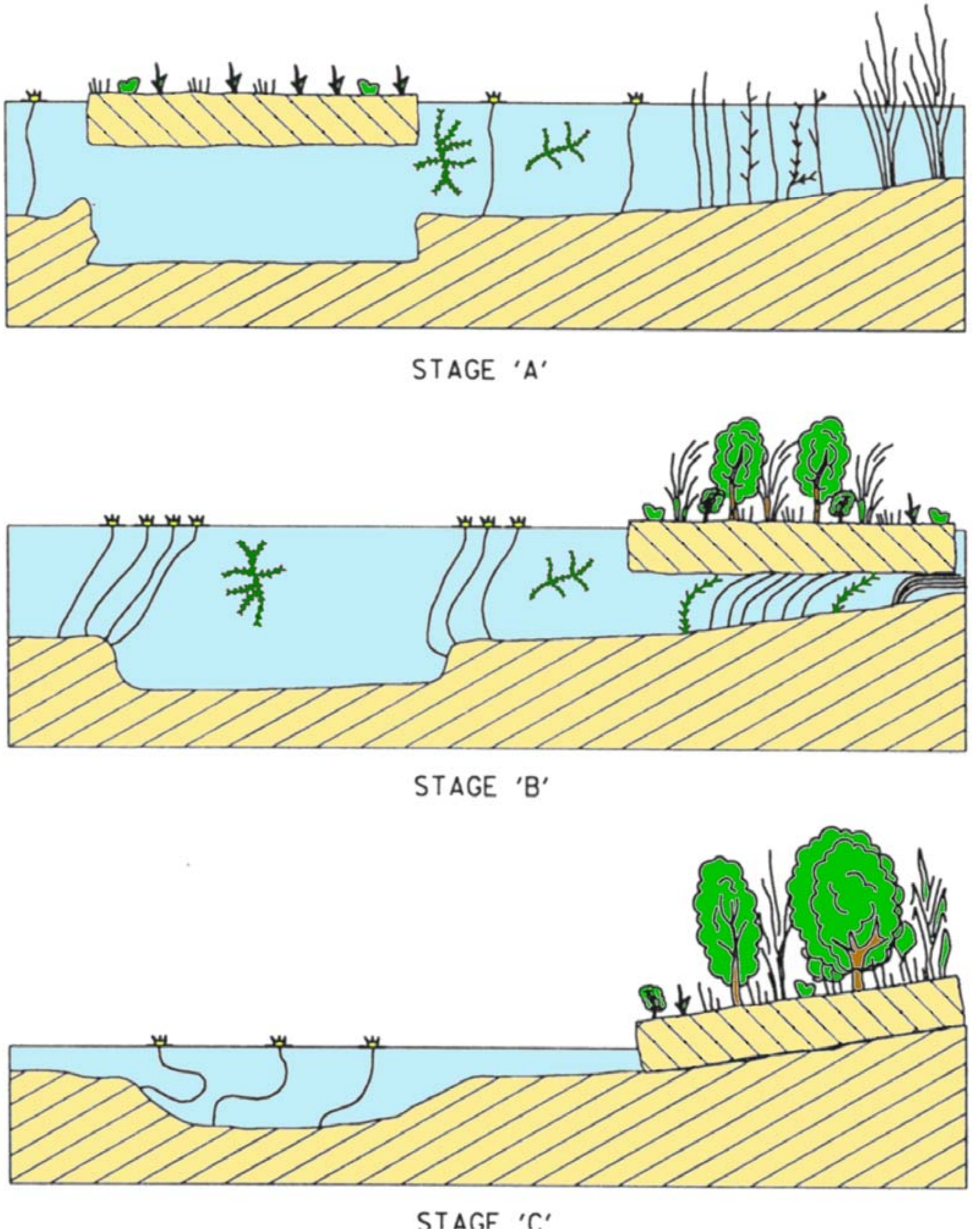
- 2. Marsh Interiors (long hydroperiod) produced by:
  - A. Flooding (battery islands)
    - 1) Planted on ground water or karst surface (marginal)
    - 2) Planted on non-ground water surface (marginal or interior)
  - B. Depositional (areas of higher energy)
    - 1) 100% fluvial doubtful
    - 2) Deposition around an obstruction likely (tree growing in pot hole)
    - 3) Flooded pre-existing topography (sand bars, buried karst)



Four models for increased ground water connection. Key is break in the marl seal.

Battery Island Formation

Modified by PWH from Gleason, et al., 1980



Rising water table by either:

1) impoundment or
2) sea level rise can increase:

a) "floatant" or "quaking"marsh area,
b) destabilization of root mat and
c) catastrophic battery island formation, (not from normal scoring flows)

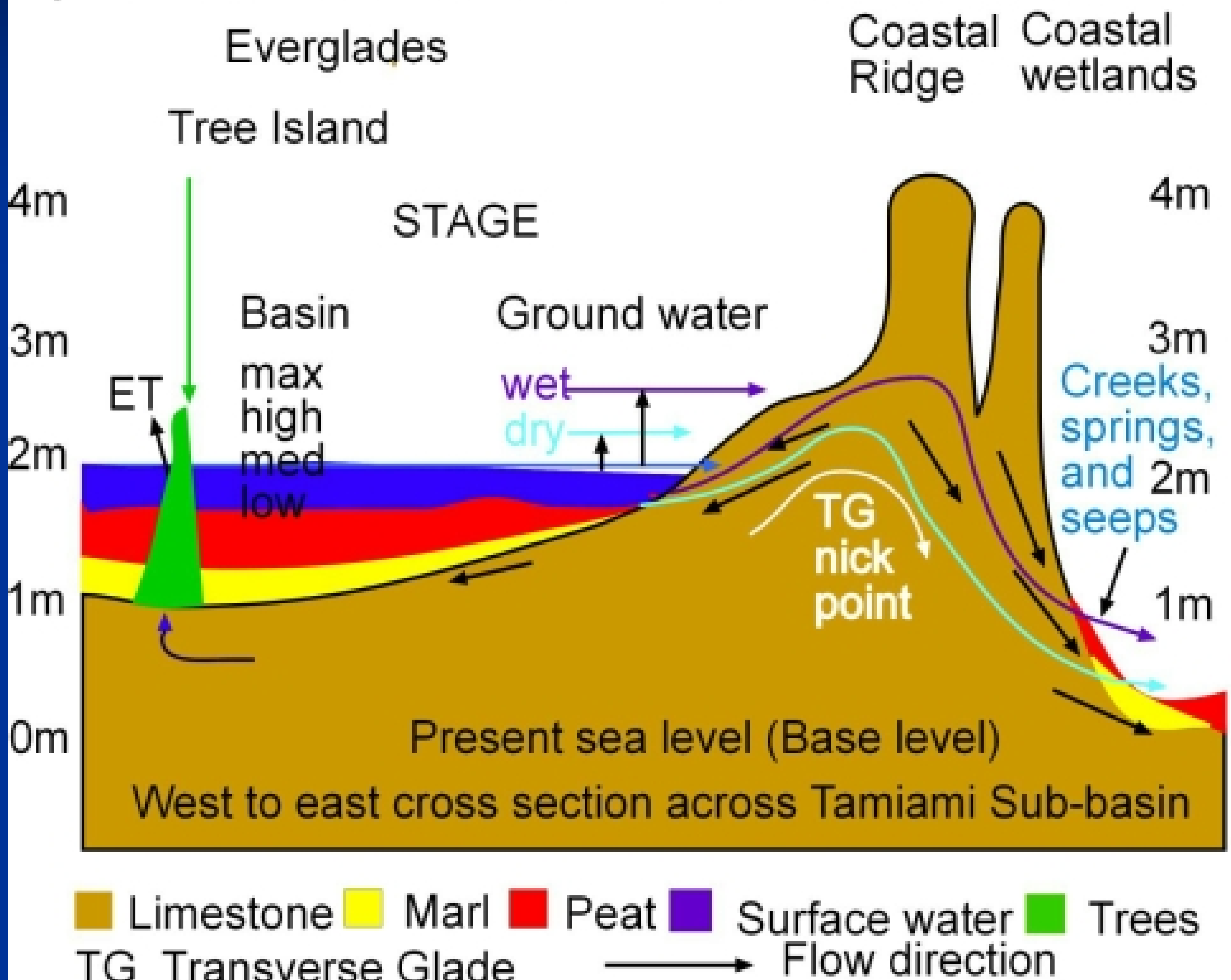
Not all battery root mats form islands.

Importance of hydrologic head

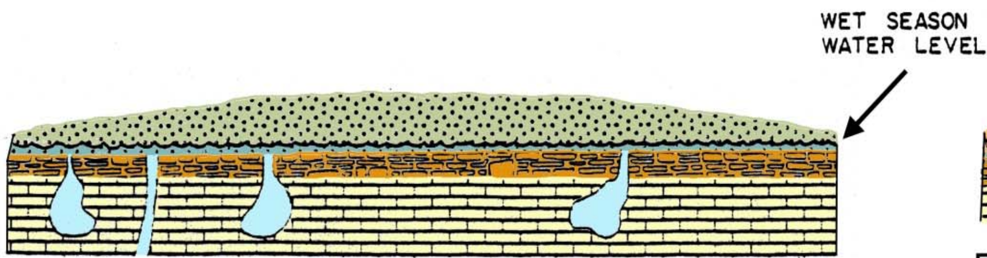
(Higher water table than in adjacent uplands)

- Historically, head was +2 to 4 ft higher than present in adjacent uplands.
- Higher water table in uplands provides a positive head in areas of seal disturbance (under tree islands) during dry seasons.
- Slight head with capillary action keeps tree islands moister.
- Tree islands less likely to burn

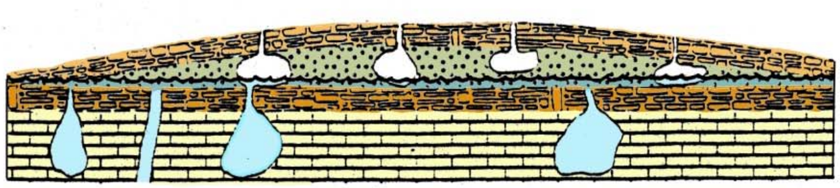
Illustration of historic wet and dry season upland water tables and tree islands



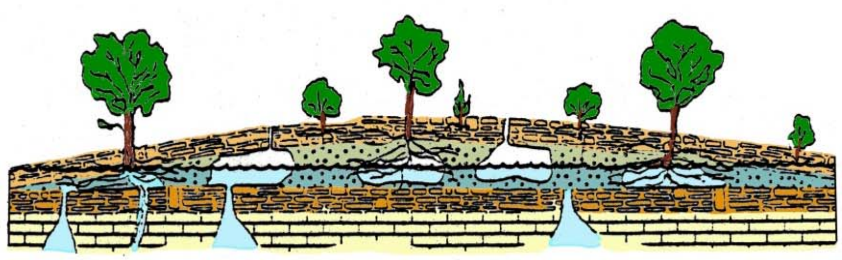
Effect of hardwood hammocks on bedrock



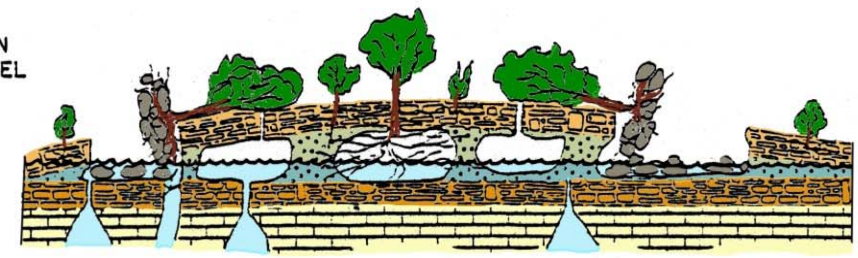
A: Initial bedrock topography



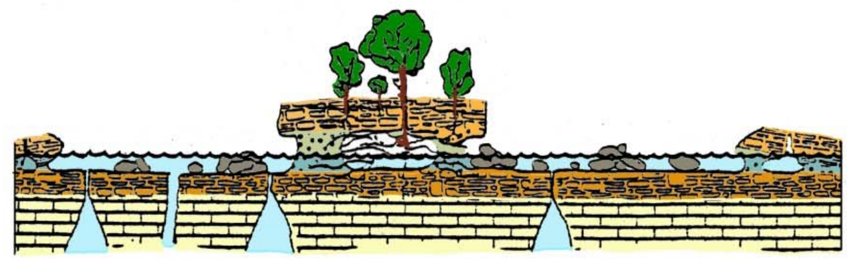
B: Development of solution features and cap rock



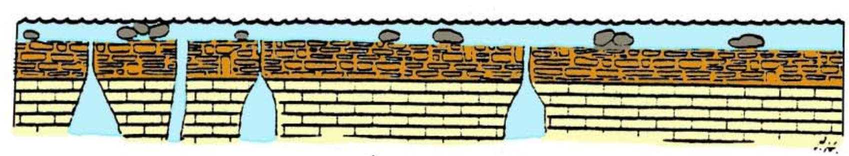
C: Colonization by hardwoods in areas of higher relief



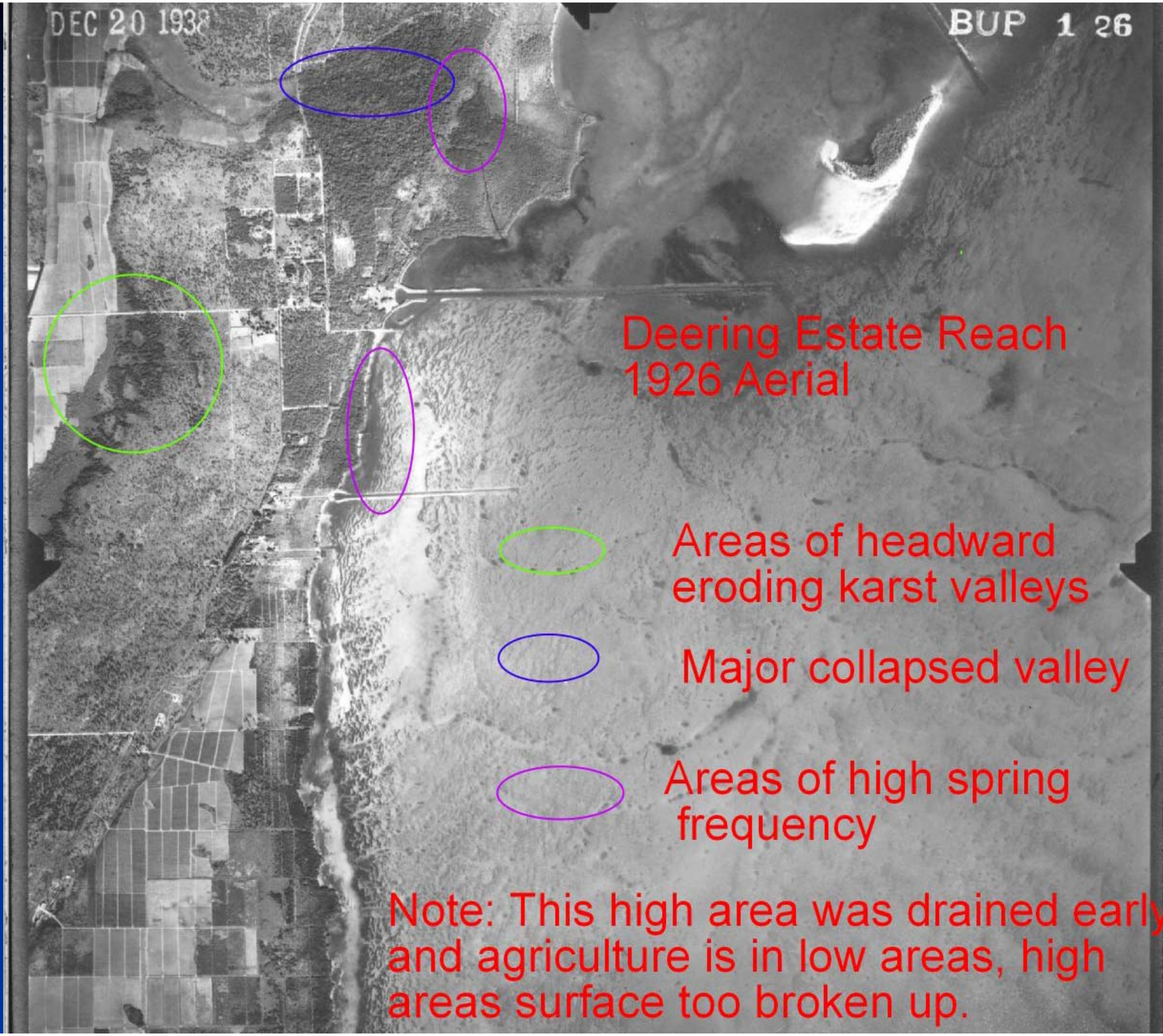
D: Development of moat



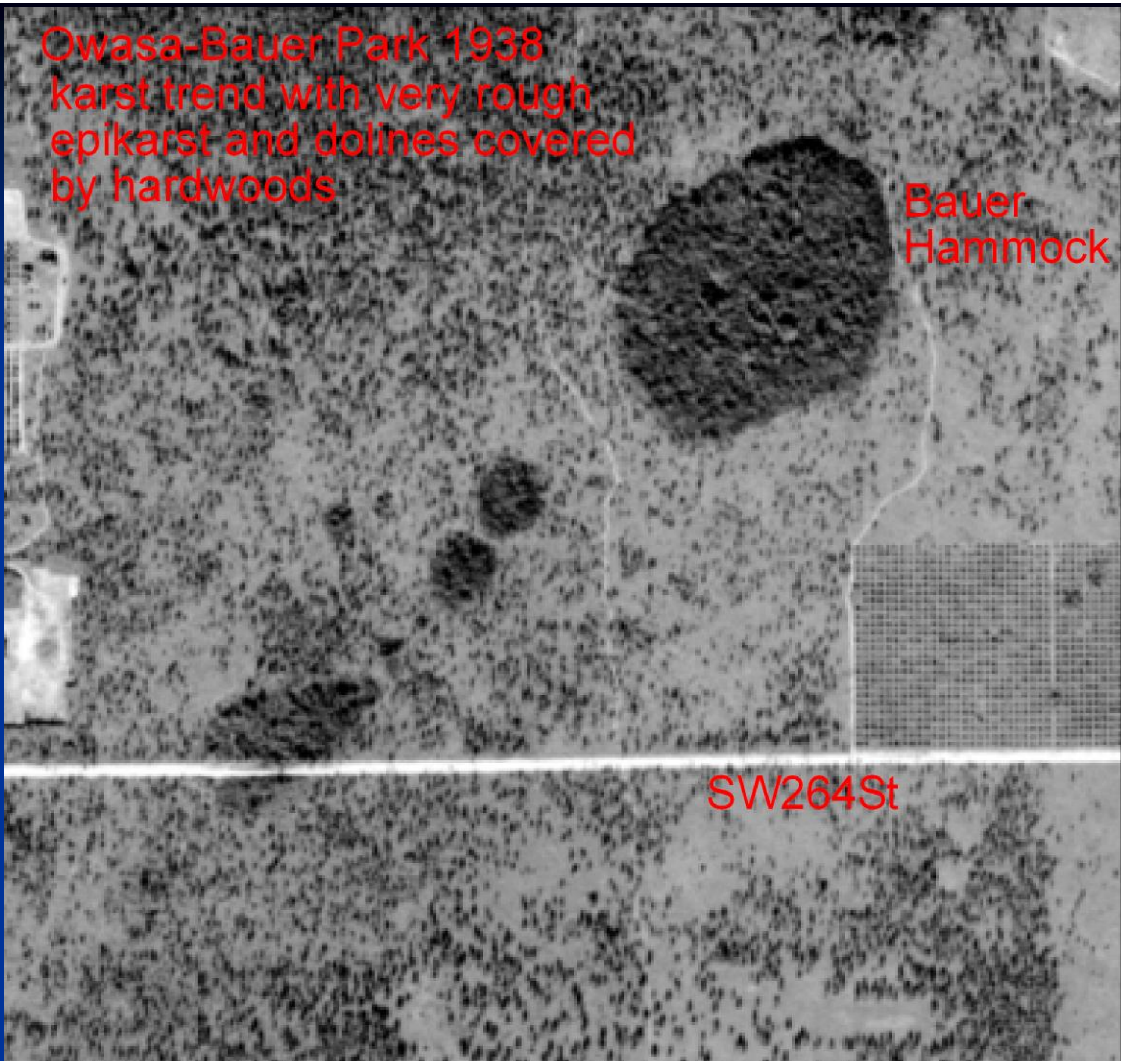
E: Contiual expansion of moat

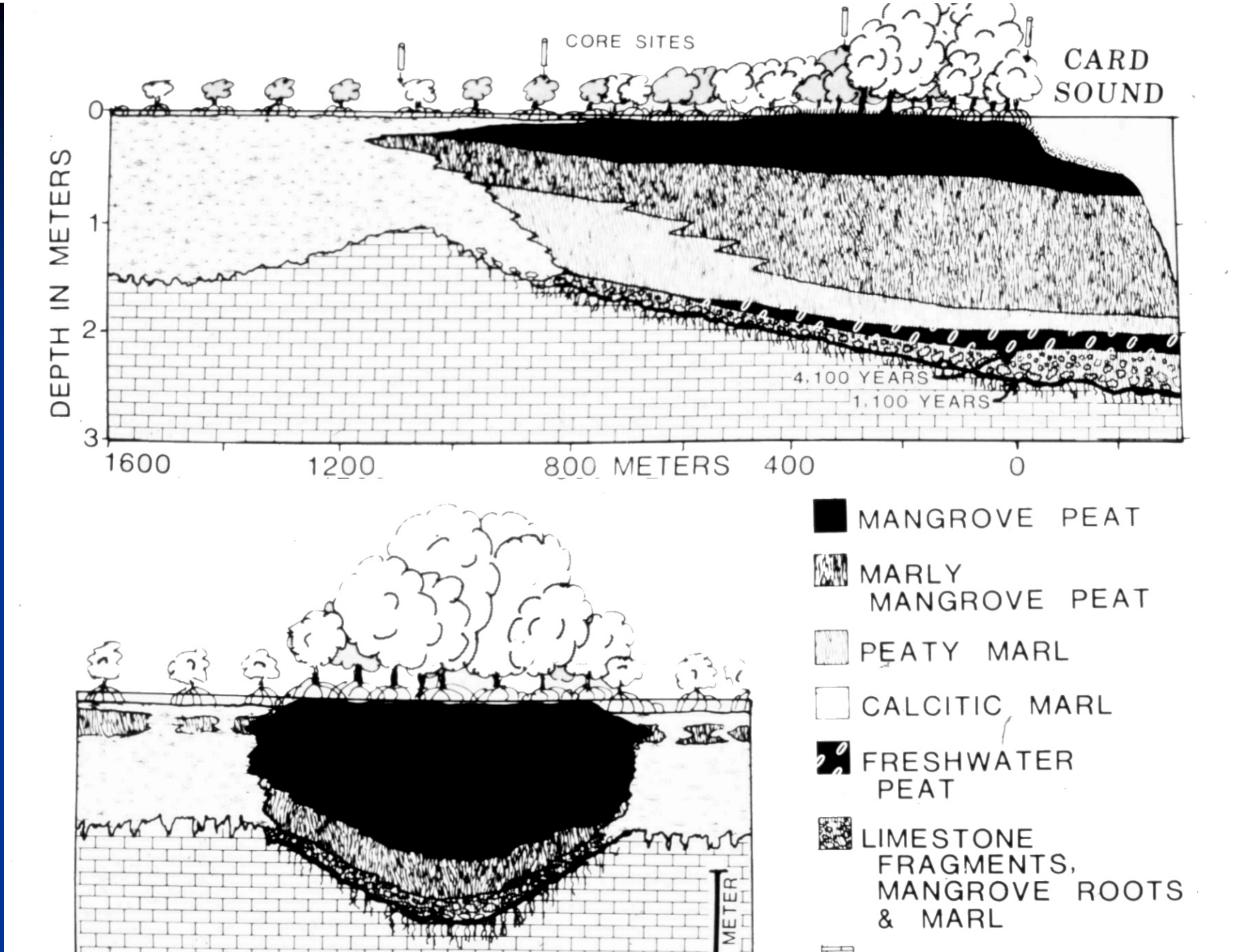


F: Removal of upper rock unit and destruction of the hammock

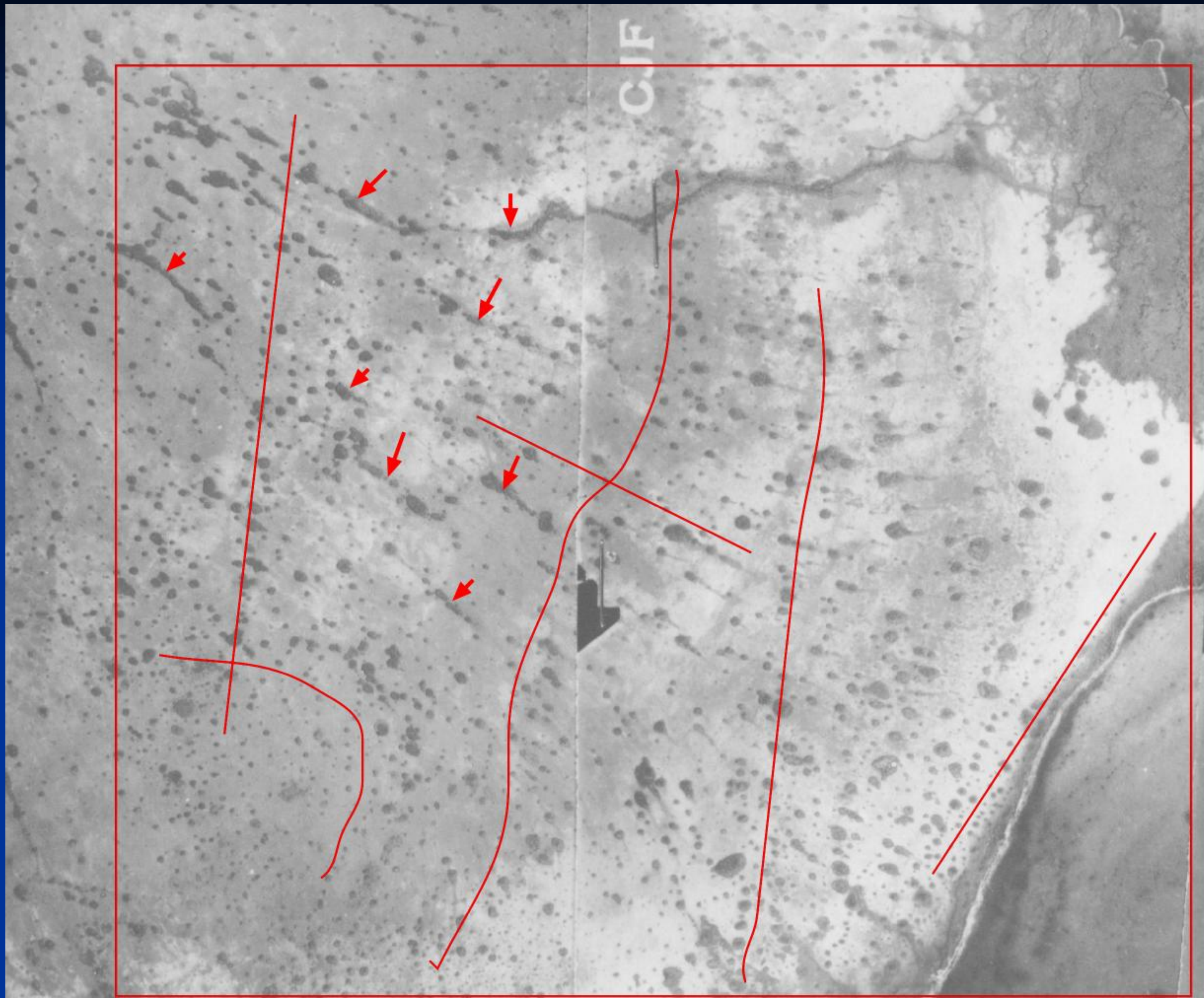

DEC 20 1938
BUP 1 26
Deering Estate Reach
1926 Aerial
Areas of headward eroding karst valleys
Major collapsed valley
Areas of high spring frequency
Note: This high area was drained early and agriculture is in low areas, high areas surface too broken up.

Karst escarpment along Snapper Creek Transverse Glade at (Sardowski Park)


Owasa-Bauer Park 1938
karst trend with very rough
epikarst and dolines covered
by hardwoods
Bauer
Hammock
SW264St



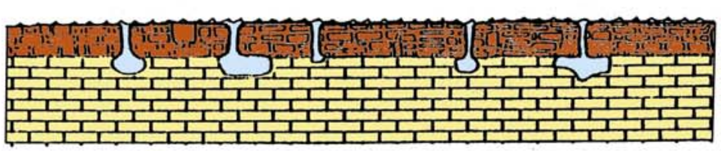
Turkey Point Sediment Profile



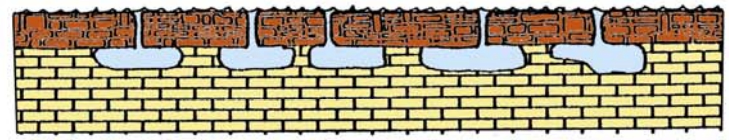
1940 aerial photo of the Turkey Point Area. Doline orientations (red line) and examples of coalescing dolines forming valleys (red arrows).

Karst origin of Cypress domes and sloughs

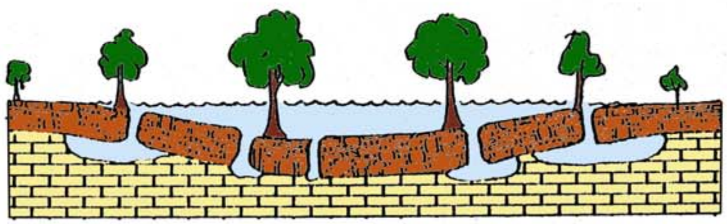
Geological aspects of Cypress dome formation



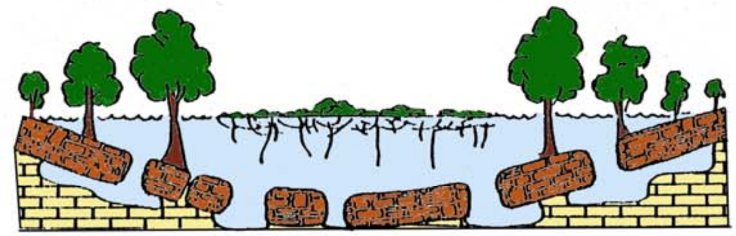
Development of cap rock and solution pipes on nearly horizontal surface with little runoff



B. Continued development of solution features and dissolution of underlying rock



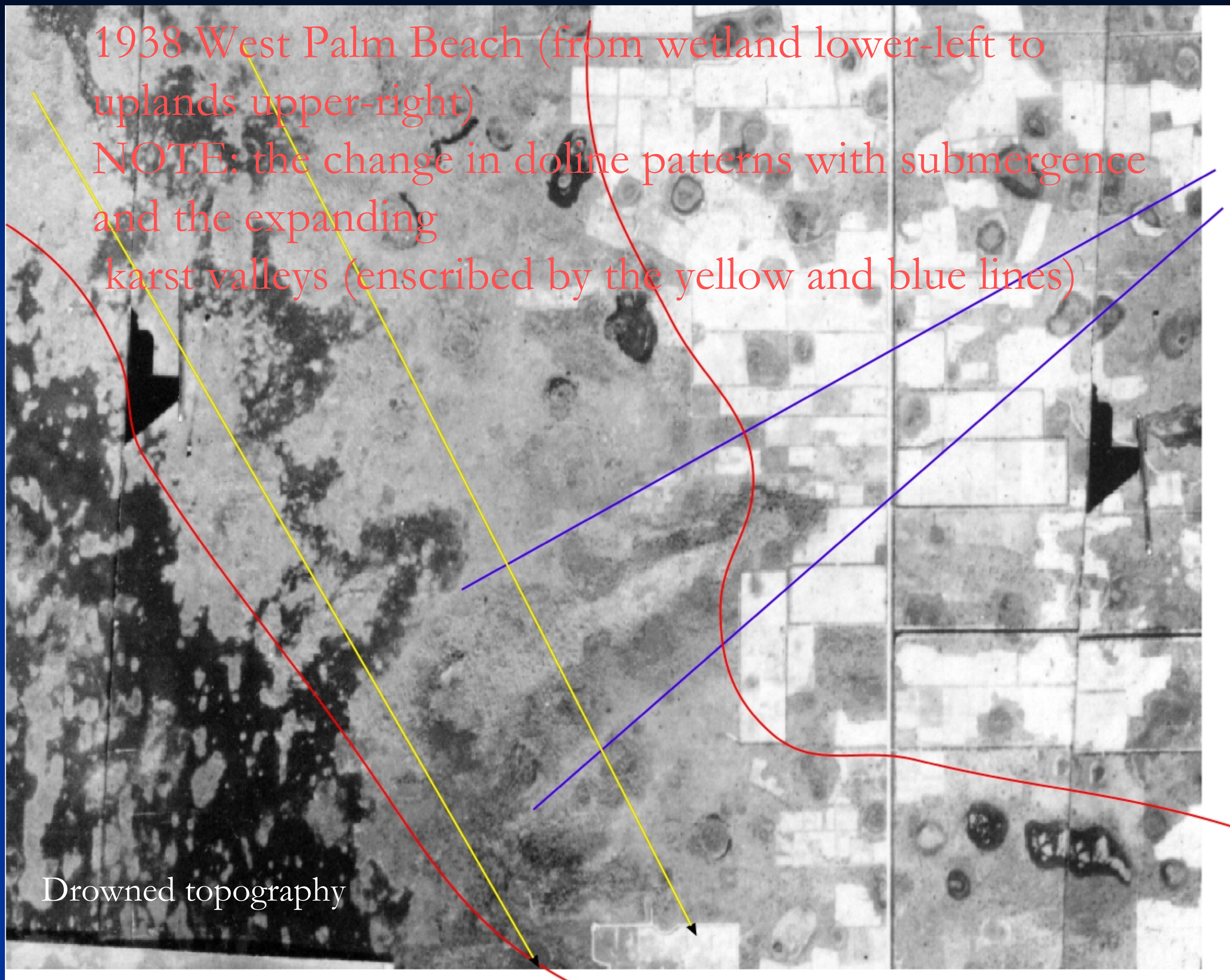
Slow subsidence of bedrock surface, resulting in longer hydroperiod and subsequent cypress colonization



D. Continued lowering of bedrock surface by dissolution and mechanical break-up of cap rock by trees, resulti in hydroperiod too long for cypress and consequent development of a pond in center of dome

With relatively stable regional hydrological regime, no further reduction of bedrock surface, but lateral growth due to mechanical processes continues enlarging dome until domes grow together, resulting in reduction of bedrock surface over extensive areas.

Figure 3.29. Cypress domes in bedrock depressions.


1938 West Palm Beach (from wetland lower-left to uplands upper-right)
NOTE: the change in doline patterns with submergence and the expanding
karst valleys (enscribed by the yellow and blue lines)
Drowned topography

CONCLUSIONS

- Many types of tree islands are associated with breaks in marl seal (frequently by karst)
- High water table in adjacent uplands during the dry season creates positive hydraulic head
- Break in seal and head produce wetter surface conditions
- Tree island trends often associated with shallow groundwater movement

Significance for Tree Island Restoration

- Restoration will only work well at large spatial scale ,
- Restoration should focus on hydraulic head
- Final methodology needs to be determined after "post restoration" water table goals are set and reached.
- Restoration methods will be different for future conditions of either rising or dropping water table (sea level), and
  - Lowering the adjacent marsh elevation to return the historic head might be injurious to other ecosystem components,
  - Elevating flooded tree islands with organic sediments (temporary relief),
- If incorrect management choice is made the rate of continued loss will be accelerated.

Acknowledgements

- SERC-FIU for support

North of Corkscrew Swamp

Effects of upward discharge of groundwater

- Reduce oxidation of organics
- Reduce fire frequency
- Positive topographic relief
- Mounding of ground and surface water
- Reduced salinity
- Increased soil moisture
- Increased humidity
- Dispersal of nutrients

- Most of these breaks in continuity are the results of karst processes, either doline formation, solution pipes and surface dissolution features or erosional remnants.