ATLSS SESI MODEL: Cape Sable Seaside Sparrow Breeding Potential Index

Spatially explicit species index (SESI) model provides a relative estimate of quality of pixels as sites for nesting success

M. Philip Nott, Institute for Bird Populations

E. Jane Comiskey, University of Tennessee

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Cape Sable Sparrow SESI Model: Breeding Potential Index

Outline:

- **Background on Cape Sable Seaside Sparrow population and ecology**
- **Critical aspects of ecology and life history included in model**
- **Construction of model**
- **Output of model**
- **Testing of model**

Cape Sable Seaside Sparrow Ecology

Underlying ecological basis for model:

- Breeds in marl prairies typified by graminoid species
- Dry season breeder, generally when water is below ground surface
- Builds nests in vegetation 15 cm above the ground
- Can produce 2 or 3 broods under favorable conditions
- Flooding late in the wet season delays reproduction
- Flooding during nesting will cause nest abandonment

Critical aspects of Cape Sable Seaside Sparrow ecology included in model

- **The Cape Sable sparrow has specific habitat requirements. It prefers Muhlenbergia grass grass or sparse Cladium grass, and the density of nests in an area increases with the percentage of these vegetation types per unit area. Sites with trees within about 500 meters are avoided.**

- **Species reproduces during the dry season and requires dry areas.**

- **Species can produce up to three broods if territory remains dry long enough (about 45 days per brood)**

Ecological Knowledge Must Be Translated into Model Rules

Observations and historical data

Habitat/Model rules

Sparrows prefer dry marl prairie with sufficient fraction of Muhlenbergia or similar grass.

Sparrows will not nest in areas near trees or woody vegetation.

→

Exclude spatial cells < 15% Muhlenbergia/sparse Cladium.

Exclude spatial cells having woody vegetation.

Successful nesting cycle requires 45 days of dry conditions.

Sparrows don't start nest initiation until water depths are below a few centimeters and will abort nesting if water depth exceeds about 15 cm

→

Keep track of water depths between January 1 and June 30. Start a nesting cycle if depth < 5 cm.

Abort cycle if water levels increase > 15 cm. Up to 3 nesting cycles are possible.

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Across Trophic Level System Simulation

Development of SESI Model

The SESI model Breeding Potential Index value, computed for 500-m pixels, is the multiplicative product of two parts:

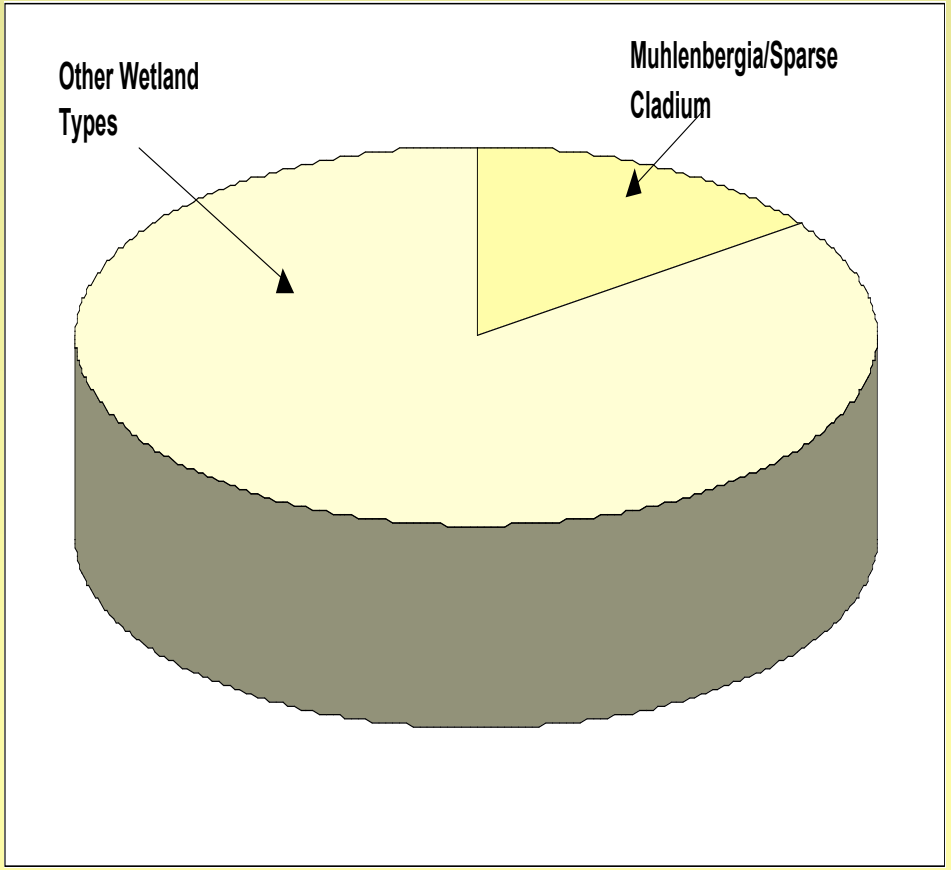
- **A habitat suitability index (*Site_Factor*) based on vegetation type, using the FGAP vegetation map (30-m resolution)**

- **A hydrologic factor that incorporates how long each particular 500-m pixel is sufficiently dry for successful nesting to take place (*Potential_Cycles*). Output from the South Florida Water Management Model, refined to 500-m resolution (see Appendix), is used for daily water depths.**

Construction of SESI: Site Factor (Vegetation Preference)

A spatial cell is not suitable nesting habitat for the Cape Sable seaside sparrow, if:

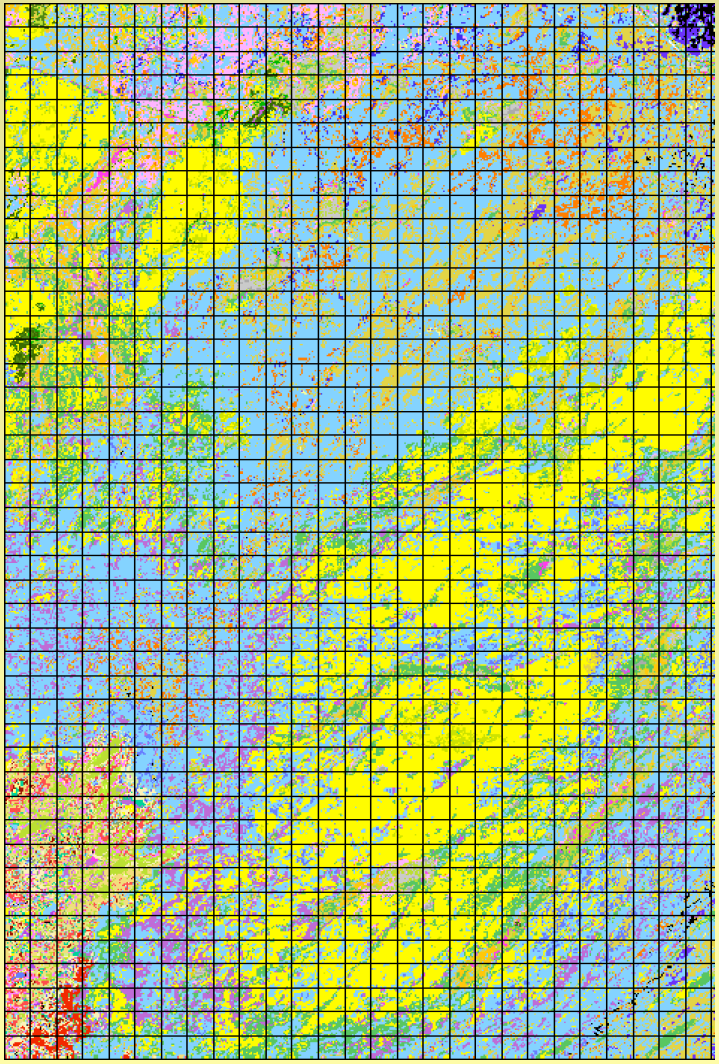
The percentage of the cell occupied by Muhlenbergia/Sparse Cladium is less than 15%



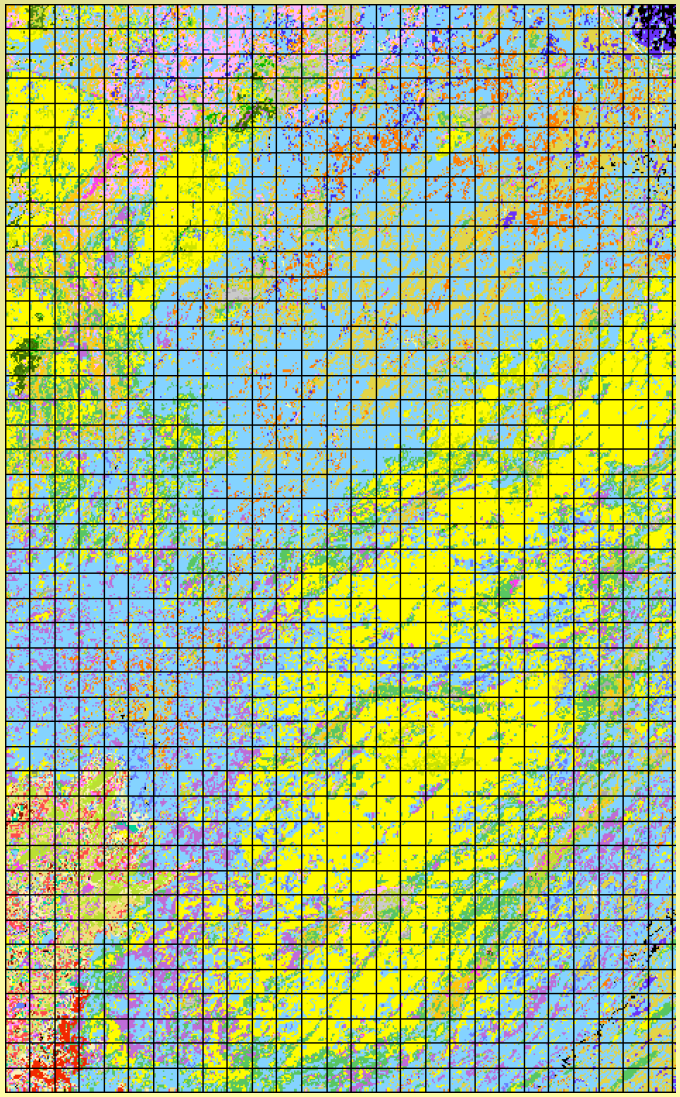
Construction of SESI: Site Factor (Vegetation Preference)

- **And there is no record of nesting in a particular cell or any of the eight cells surrounding it.**

  If both of these are true, then the 'site factor' is assigned the value 0. Otherwise it is given a value between 0 and 1, depending on the percentage of the area that is Muhly and sparse Cladium grass.



Construction of SESI: Site Factor (Avoidance of Trees)



Cape Sable seaside sparrows avoid nesting in a particular cell if:

- **There is a tree or trees in that particular cell or**

- **There is a tree in one of the eight neighboring cells.**

In either case, the 'site factor' is given the value 0.

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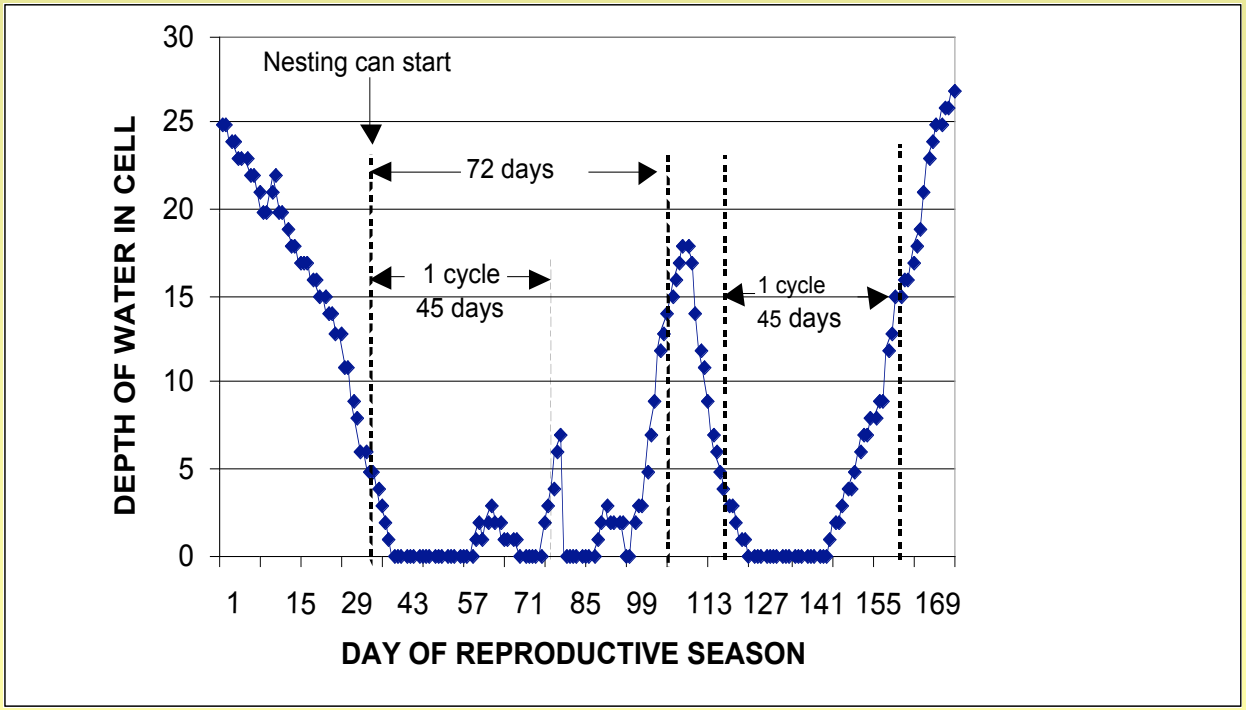
Construction of SESI: Hydrologic Factor - Dry Nesting Site Rule to Compute Potential Cycles

Nesting can start in a cell as soon as water depths decrease to 5 cm.

Increase in water depth to 15 cm will cause any nesting to cease. It can commence if water depths decrease.

The figure shows 2 possible nesting cyles of 45 days.



Total Cape Sable Seaside Sparrow Breeding Potential Index

To obtain the total breeding potential index for a cell:

- The number of potential breeding cycles, computed from the number of 45-day periods the pixel is dry between January 1 and June 30, is divided by three (maximum possible breeding cycles)

- This is multiplied by the site factor to give a number between 0 and 1:

  BPI = (Potential_Cycles/3) * (Site_Factor)

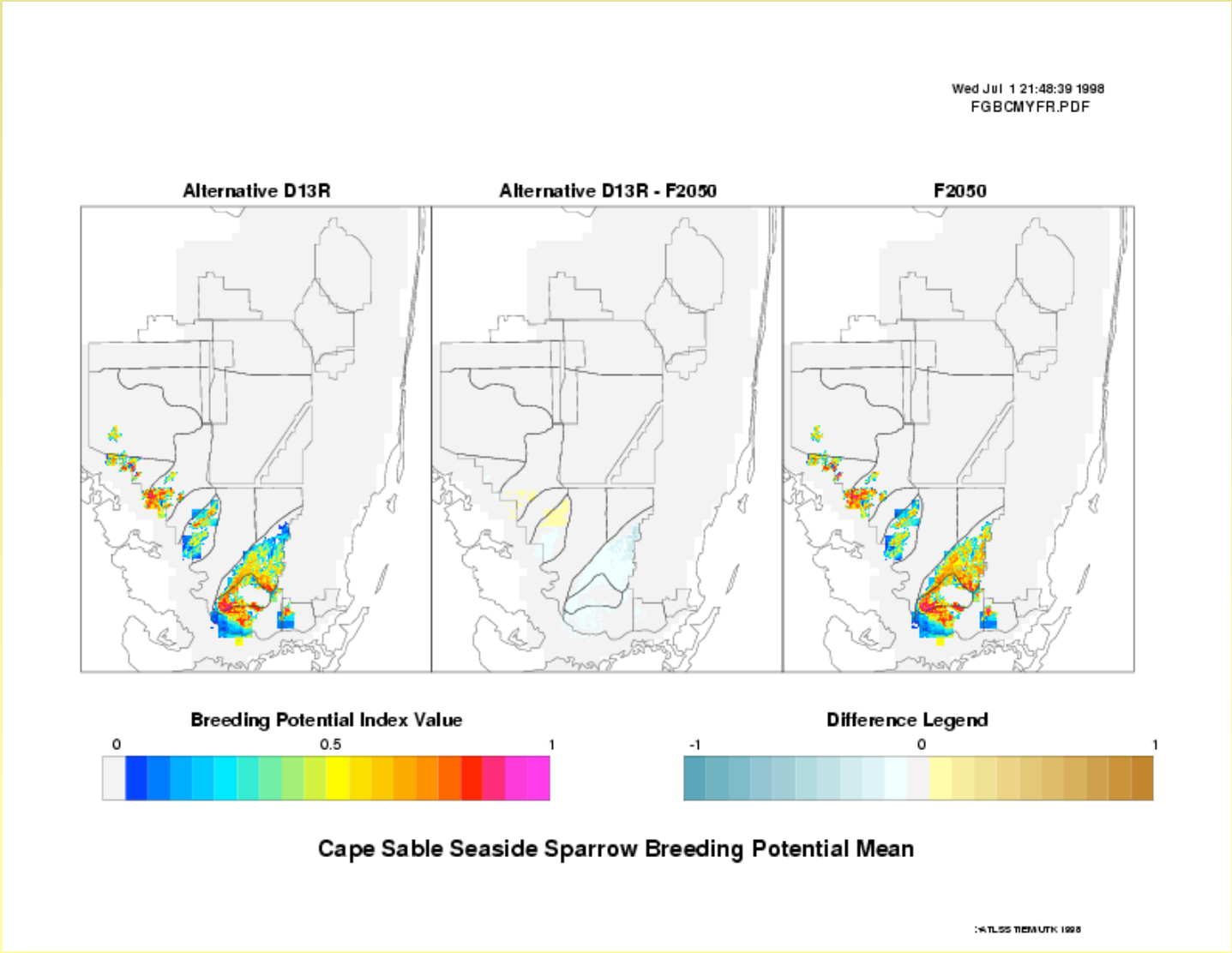
Application of Cape Sable Sparrow Breeding Potential Index Model

The SESI models are intended primarily to be used for making comparisons between scenarios. The following slides show model Index output for:

- The whole region averaged over 31 years
- A subregion for a specific year
- The Index value averaged over all of the pixels in a subregion for the 31-year period

Breeding Potential Index Model

Output of Cape Sable Seaside Sparrow model - Averaged over all 31 years



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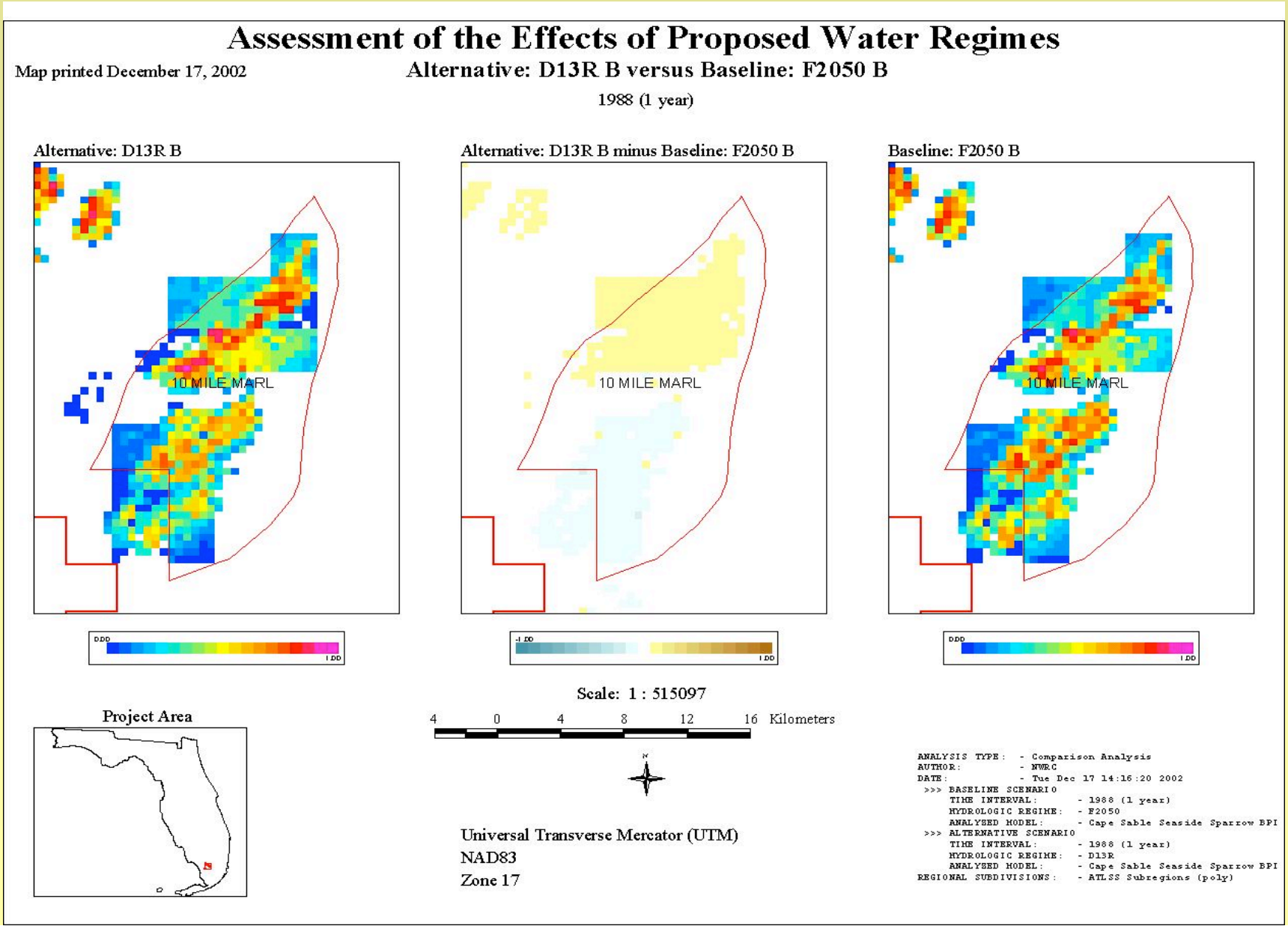
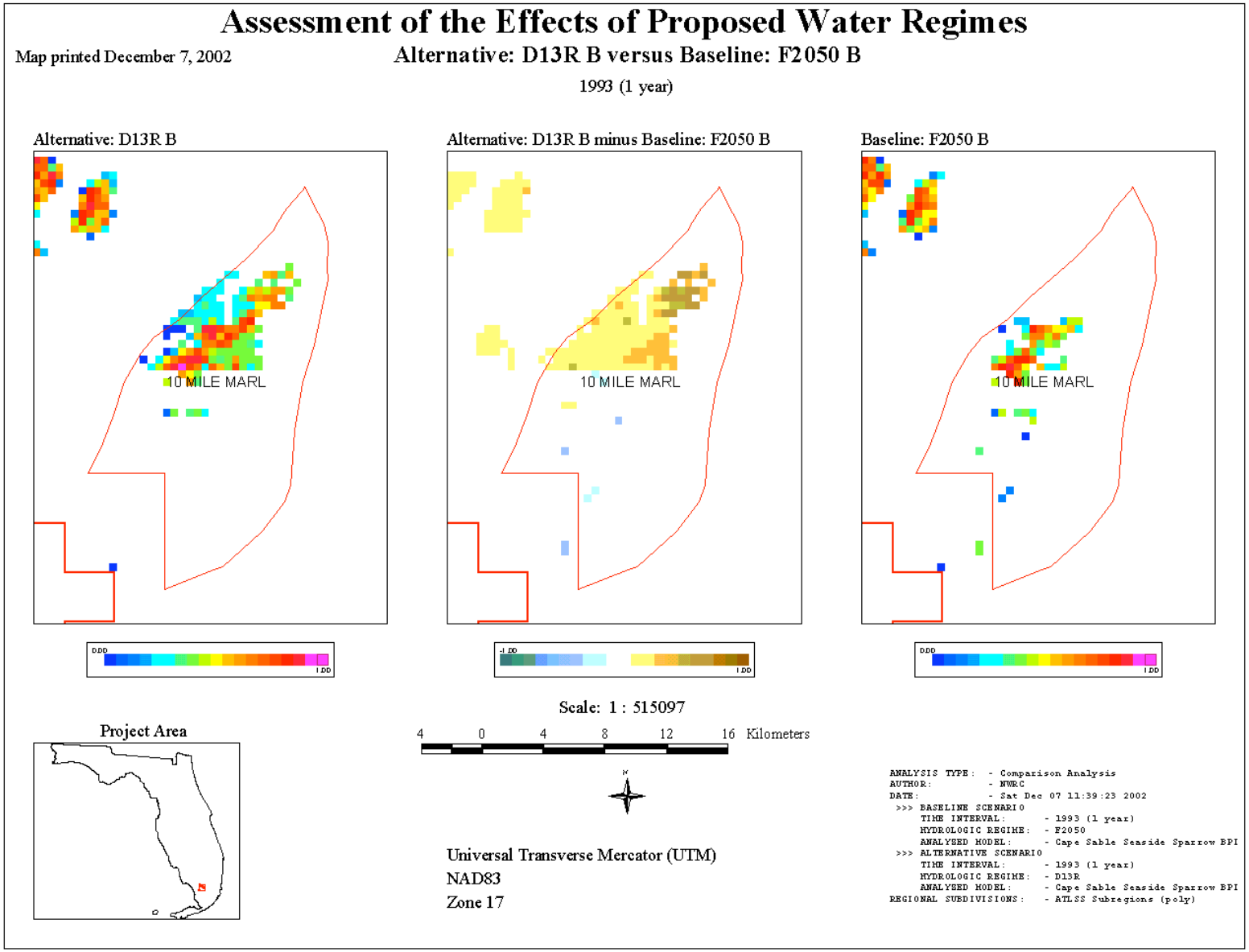
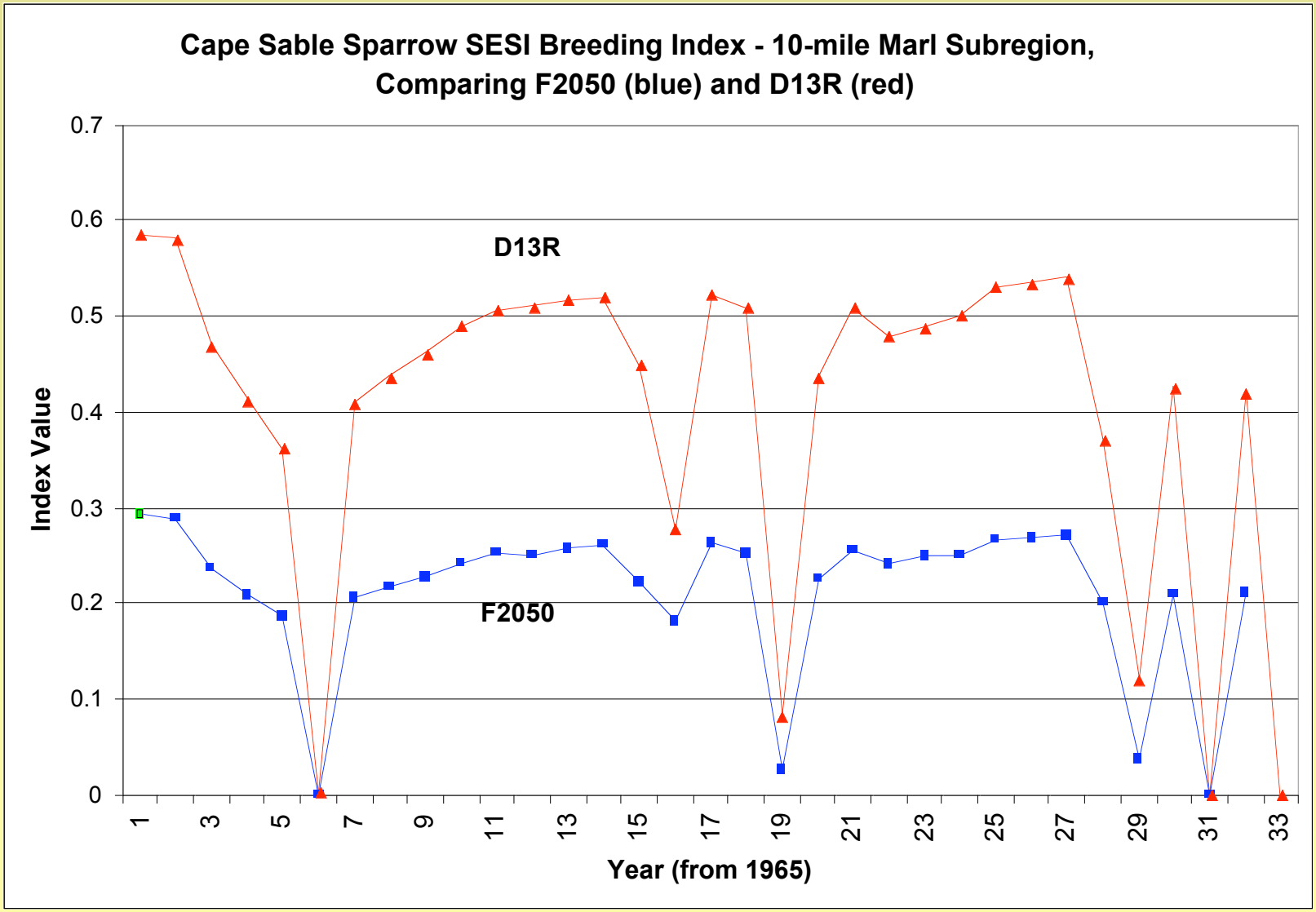
ATLSS Across Trophic Level System Simulation

Cape Sable seaside sparrow SESI model output, 10-Mile Marl, 1988: Comparison of F2050 and D13R scenarios, with D13R - F2050 values in the center panel



Cape Sable seaside sparrow SESI model output, 10-Mile Marl, 1993: Comparison of F2050 and D13R scenarios, with D13R - F2050 values in the center panel




Cape Sable Sparrow SESI Breeding Index - 10-mile Marl Subregion,
Comparing F2050 (blue) and D13R (red)
Index Value
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
D13R
F2050
1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
31
33
Year (from 1965)

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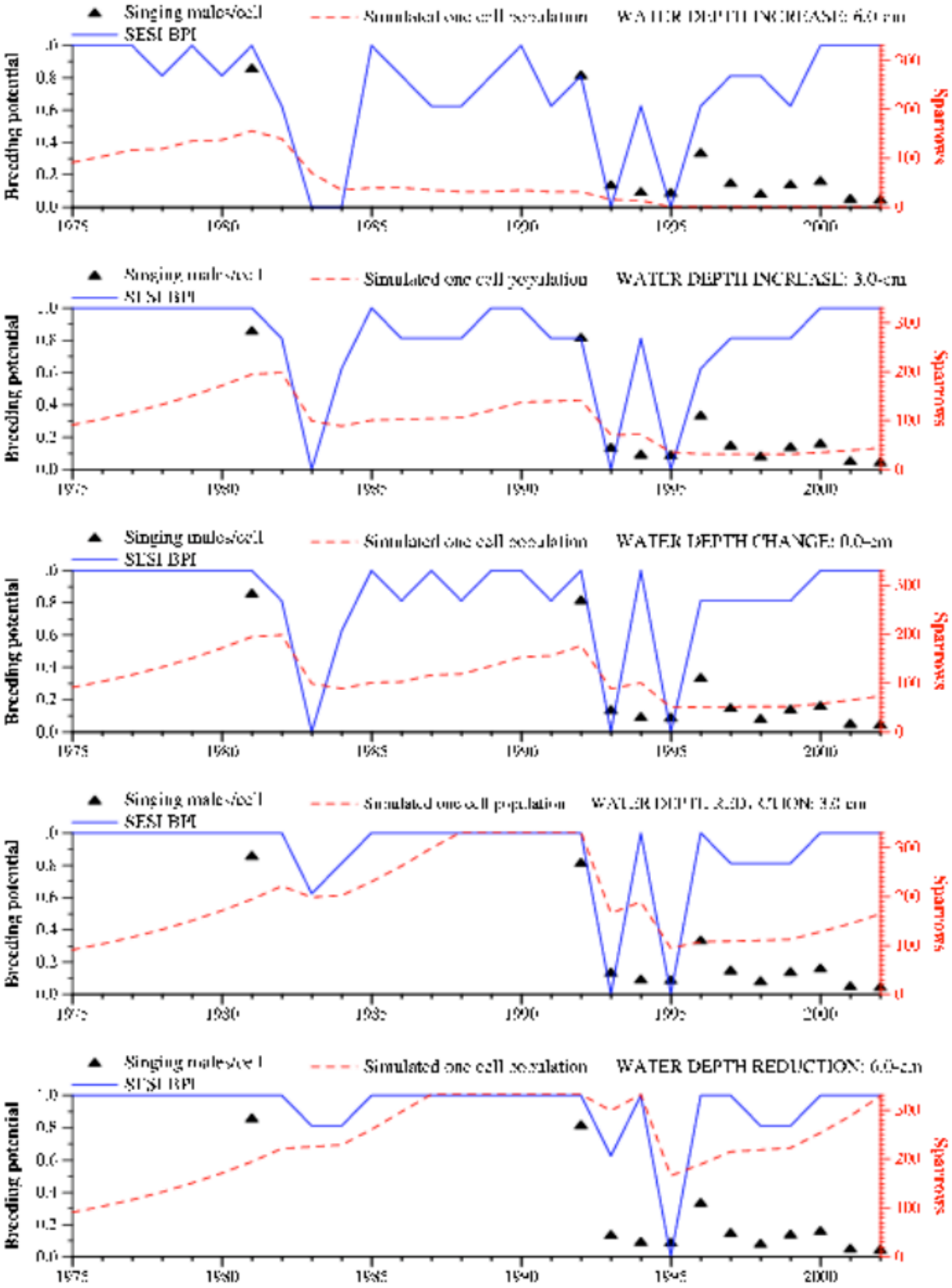
Testing of Model

Both sensitivity analysis and preliminary testing of the model area actively being pursued at this time. The next slides show:

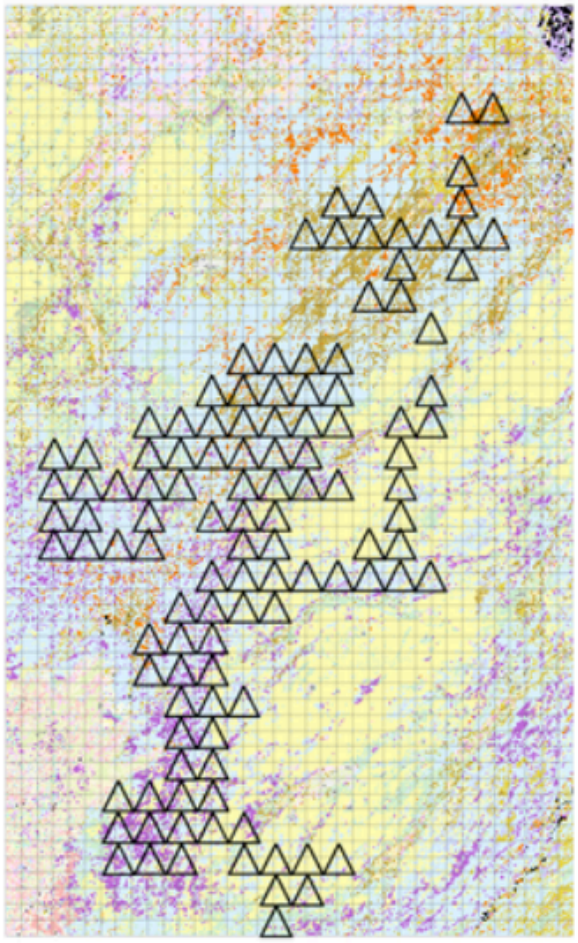
- **Output from some of the sensitivity analysis (rotated). Changes in mean value of SESI index in response to changes in mean water depths (to be expanded on later)**

- **Comparisons of SESI index values in Western area (Subpopulation A) and data on singing males for three years. Rigorous testing is awaits SFWMM2000 Calibration/Validation output.**

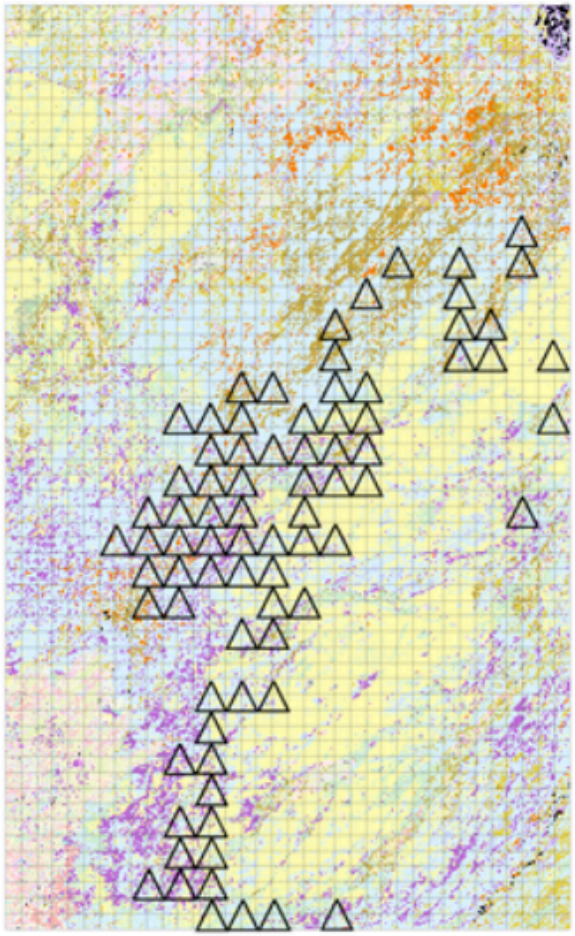


Simulation results for combined CSS Sparrow breeding potential/population model, in one 2-mi cell. Hydrologic input (from NP205 gage data) is varied in 3-cm increments to test model sensitivity to changes in water depth.

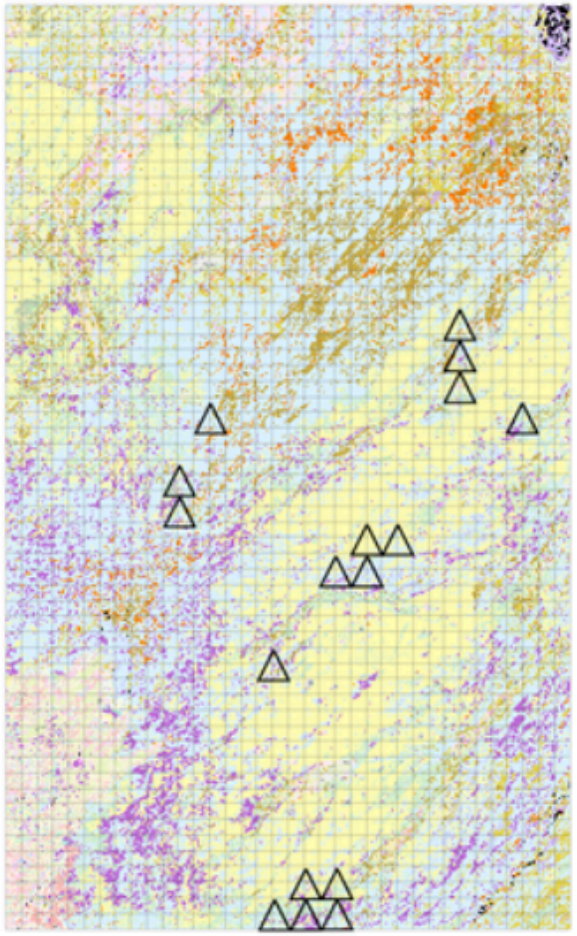
Singing Male Observations - 1981, 1992, 1993



Western Sparrow Breeding Area – 1981

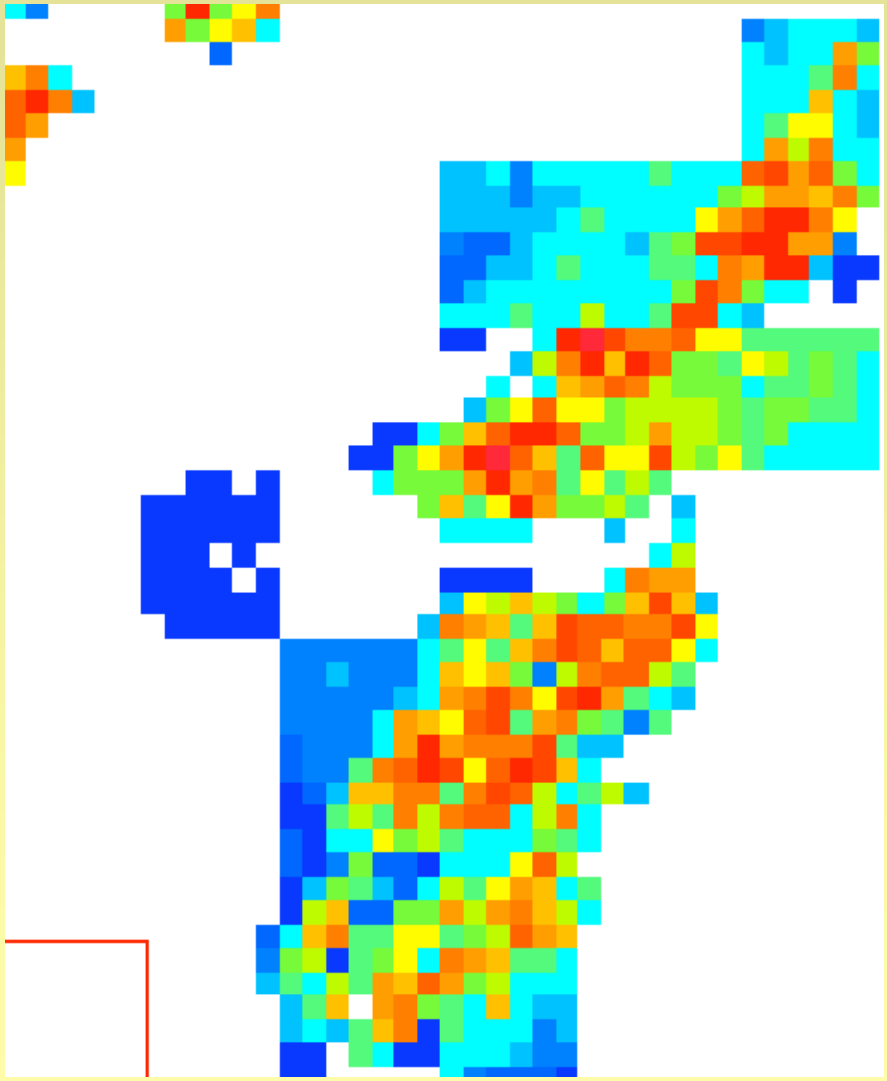


Western Sparrow Breeding Area – 1992



Western Sparrow Breeding Area – 1993

Cape Sable Sparrow SESI Values: 1981



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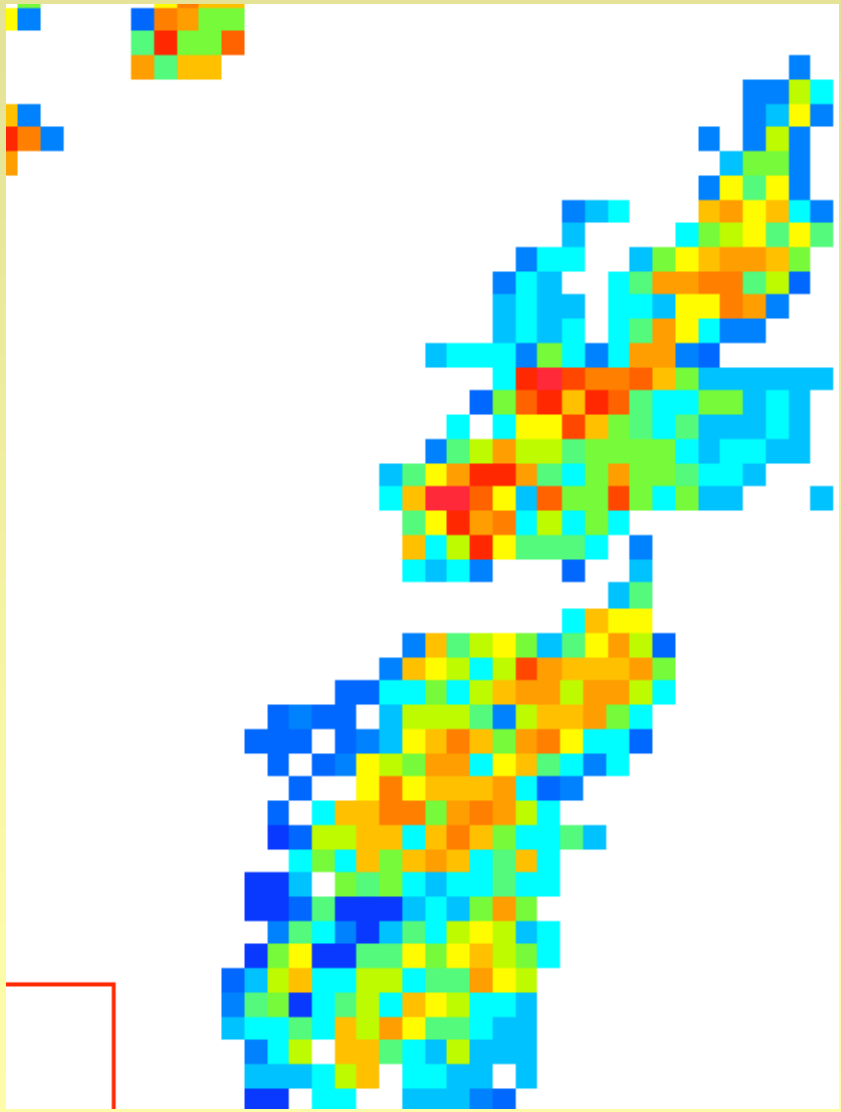
Cape Sable Sparrow SESI Values: 1992



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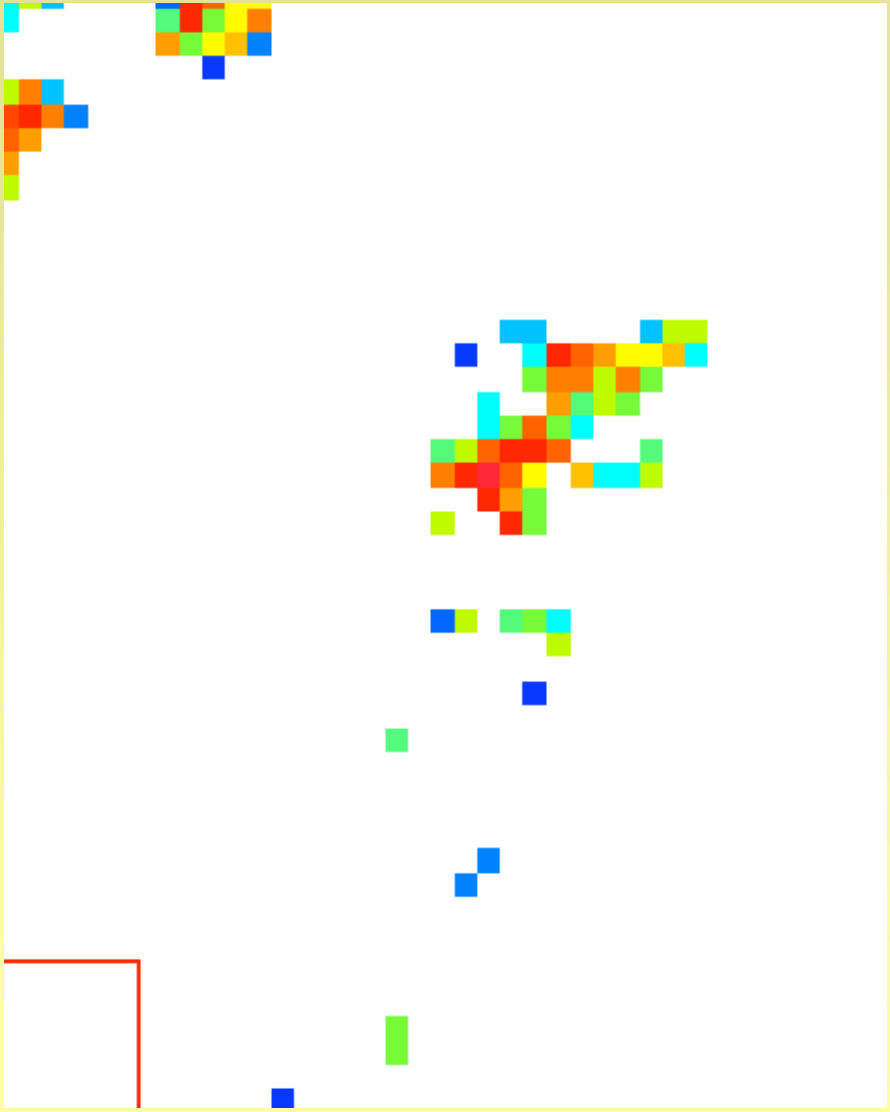
Cape Sable Sparrow SESI Values: 1993



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Future Plans

The most important plans at this point are for

- **Continued testing and improvement of the model, particularly as SFWMM2000 Calibration/Validation output becomes available.**

- **Improving the usefulness of model output. This will be done in part through allowing users to look at different 'layers' of the index as well as the whole index. This will allow better determination of the factors influencing the index values.**

Appendix: High resolution landscape representation

ATLSS models all share common landscape information, based on

- **High Resolution (500 x 500 m) Hydrology (HRH Version 1.4.8), derived from SFWMM at 2 x 2 mile scale.**
- **Vegetation data (30 x 30 m pixels), based on FGAP**

This sort of resolution is essential, as the modeled wildlife responds to this level of variation in the environment.

Appendix: High resolution landscape representation

Initially, ATLSS 500 x 500 m High Resolution Hydrology (HRH) was derived using

- **the SFWMM 2 x 2 model**
- **vegetation data based on FGAP**
- **known relationships between ranges of hydroperiod and vegetation type**
- **an algorithm that distributes 2 x 2 water depths onto 500 x 500 m cells, but conserves total water volume, staying consistent with SFWMM**

Now, the USGS's High Accuracy Elevation Data (HAED) at 400 x 400 m is replacing the HRH