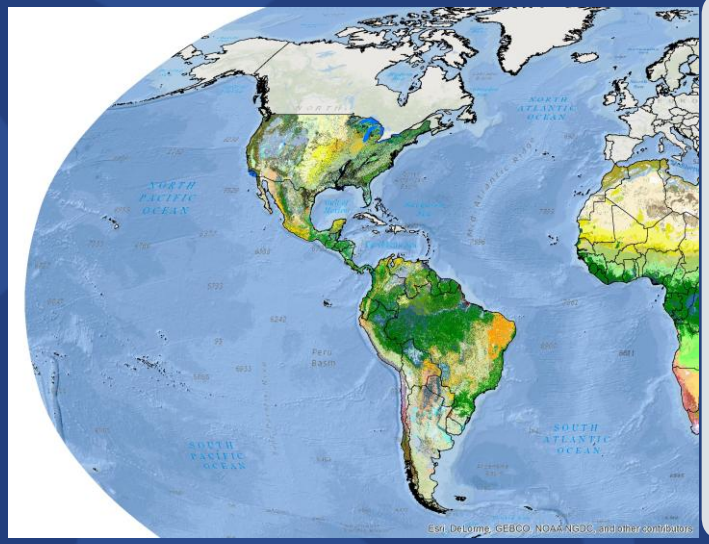
# Map Legend Comparison




Don Faber-Langendoen
and Regan Smyth

NatureServe
A Network Connecting Science With Conservation

# OVERVIEW

The challenge of creating a common map legend among the 4 projects.

1. Lumping/splitting
   - Aggregates
   - Finer scale units
   - Ruderal vegetation
2. Choice of which systems to map.
3. Describing the map classes

# Creating a Common Map Legend

- Systems were target for all efforts, but differences in how they were applied
- Common legend required reconciling:
  - Different versions of classification
  - Different coding schemes
  - Use of non-standard systems
  - Use aggregates
  - Use of finer scale units (modifiers)
  - Different classifications for ruderal & cultural types

# Creating a Common Legend

code aggregate **System** finer-scale unit who (original code)

| unique c | Names | | | Lookup Codes | | | |
|---|---|---|---|---|---|---|---|
| code | Aggregate Unit | System | Finer Scale Unit | SEGAP | LF EVT | NS ESLF | TNC |
| 4108 | | Laurentian-Acadian Northern Hardwoods Forest | Laurentian-Acadian Northern Hardwood Forest, high conifer | | | | 5642 |
| 4108 | | Laurentian-Acadian Northern Hardwoods Forest | Laurentian-Acadian Red Oak-Northern Hardwood Forest | | | | 5644 |
| 4108 | | Laurentian-Acadian Northern Hardwoods Forest | Laurentian-Acadian Northern Hardwoods Forest: moist-cool | | | | 5649 |
| 4316 | | Acadian Low-Elevation Spruce-Fir-Hardwood Forest | | | 2373 | 4316 | 5650 |
| 4317 | | Acadian-Appalachian Montane Spruce-Fir Forest | | | 2374 | 4317 | 566 |
| 5210 | | Acadian-Appalachian Alpine Tundra | | | 2386 | 5210 | 567 |
| 5320 | | Acadian-Appalachian Subalpine Woodland and Heath-Krummholz | | | 2389 | 5320 | |
| 3188 | | Laurentian-Acadian Acidic Cliff and Talus | | | | | 569 |
| 3144 | | Laurentian-Acadian Calcareous Cliff and Talus | | | | | 570 |
| 5462 | | N. Appalachian-Acadian Rocky Heath Outcrop | | | | | 571 |
| 5461 | | Laurentian-Acadian Calcareous Rocky Outcrop | | | | | 572 |
| 3189 | | Acadian-North Atlantic Rocky Coast | | | | | 573 |
| 9150 | Laurentian-Acadian Swamp Systems | **Laurentian-Acadian Swamp Systems** | | | 2526 | | |
| 9346 | Laurentian-Acadian Swamp Systems | Northern Appalachian-Acadian Conifer-Hardwood Acidic Swamp | | | | | X |
| 9346 | Laurentian-Acadian Swamp Systems | Northern Appalachian-Acadian Conifer-Hardwood Acidic Swamp | Northern Appalachian-Acadian Conifer-Hardwood Acidic Swamp 1 | | | | 5740 |
| 9346 | Laurentian-Acadian Swamp Systems | Northern Appalachian-Acadian Conifer-Hardwood Acidic Swamp | Northern Appalachian-Acadian Conifer-Hardwood Acidic Swamp 2 | | | | 5742 |
| 9346 | Laurentian-Acadian Swamp Systems | Northern Appalachian-Acadian Conifer-Hardwood Acidic Swamp | Northern Appalachian-Acadian Conifer-Hardwood Acidic Swamp 3 | | | | 5747 |
| 9346 | Laurentian-Acadian Swamp Systems | Northern Appalachian-Acadian Conifer-Hardwood Acidic Swamp | Northern Appalachian-Acadian Conifer-Hardwood Acidic Swamp 4 | | | | 5749 |
| 9345 | Laurentian-Acadian Swamp Systems | Laurentian-Acadian Alkaline Conifer-Hardwood Swamp | | | 2481 | 9345 | X |
| 9345 | Laurentian-Acadian Swamp Systems | Laurentian-Acadian Alkaline Conifer-Hardwood Swamp | Laurentian-Acadian Alkaline Conifer-Hardwood Swamp 1 | | | | 5750 |
| 9345 | Laurentian-Acadian Swamp Systems | Laurentian-Acadian Alkaline Conifer-Hardwood Swamp | Laurentian-Acadian Alkaline Conifer-Hardwood Swamp 2 | | | | 5752 |
| 9345 | Laurentian-Acadian Swamp Systems | Laurentian-Acadian Alkaline Conifer-Hardwood Swamp | Laurentian-Acadian Alkaline Conifer-Hardwood Swamp 3 | | | | 5757 |
| 9345 | Laurentian-Acadian Swamp Systems | Laurentian-Acadian Alkaline Conifer-Hardwood Swamp | Laurentian-Acadian Alkaline Conifer-Hardwood Swamp 4 | | | | 5758 |
| 9345 | Laurentian-Acadian Swamp Systems | Laurentian-Acadian Alkaline Conifer-Hardwood Swamp | Laurentian-Acadian Alkaline Conifer-Hardwood Swamp 5 | | | | 5759 |
| 9210 | Acadian Salt Marsh and Estuary Systems | **Acadian Salt Marsh and Estuary Systems** | | | 2491 | | |
| 9278 | Acadian Salt Marsh and Estuary Systems | Acadian Coastal Salt Marsh | | | | 9278 | 578 |
| 9292 | Acadian Salt Marsh and Estuary Systems | Acadian Estuary Marsh | | | | 9292 | 579 |
| 9146 | Boreal Acidic Peatland Systems | **Boreal Acidic Peatland Systems** | | | 2477 | | |
| 9301 | Boreal Acidic Peatland Systems | Acadian Maritime Bog | | | | | 580 |
| 9177 | Boreal Acidic Peatland Systems | Boreal-Laurentian Conifer Acidic Swamp | | | | 9177 | |
| 9354 | Boreal Acidic Peatland Systems | Boreal-Laurentian Bog | | | | 9354 | 581 |
| 9198 | | Laurentian-Acadian Alkaline Fen | | | | | 585 |
| 9144 | Laurentian-Acadian Floodplain Systems | **Laurentian-Acadian Floodplain Systems** | | | 2475 | | |
| 9328 | Laurentian-Acadian Floodplain Systems | Laurentian-Acadian Floodplain Forest | | | | 9328 | 587 |
| 9113 | Laurentian-Acadian Floodplain Systems | Eastern Boreal Floodplain | | | 2444 | 9113 | 588 |
| 9215 | Laurentian-Acadian Shrub-Herbaceous Wetland | **Laurentian-Acadian Shrub-Herbaceous Wetland Systems** | | | 2494 | | |

# Aggregates

- Primarily Landfire wetland systems
- Example:

| **Laurentian-Acadian Shrub-Herbaceous Wetland Systems** |
| --- |
| Laurentian-Acadian Freshwater Marsh |
| Boreal-Laurentian-Acadian Acidic Basin Fen |
| Laurentian-Acadian Wet Meadow-Shrub Swamp |

- Also some ruderal and non-natural systems
  - *The "agriculture aggregate"*
- TNC system combinations

| | |
| --- | --- |
| 203.264/203.301 | Northern Atlantic Coastal Plain **Dune and Swale** / Northern Atlantic Coastal Plain **Sandy Beach** |

# Aggregates

| System | SEGAP | LF EVT | NS ESLF | TNC |
|---|---|---|---|---|
| **Gulf and Atlantic Coastal Plain Sparsely Vegetated Systems** | | 2498 | | |
| Northern Atlantic Coastal Plain Dune and Swale | 203.264 | 2436 | 7149 | |
| Northern Atlantic Coastal Plain Sandy Beach | | | 3124 | |
| Central Atlantic Coastal Plain Sandy Beach | | | 3162 | |
| Northern Atlantic Coastal Plain Dune and Swale/NACP Sandy Beach | | | | 264 |
| Northern Atlantic Coastal Plain Dune and Swale/Central Atlantic Coastal Plain Sandy Beach | | | | 264064 |

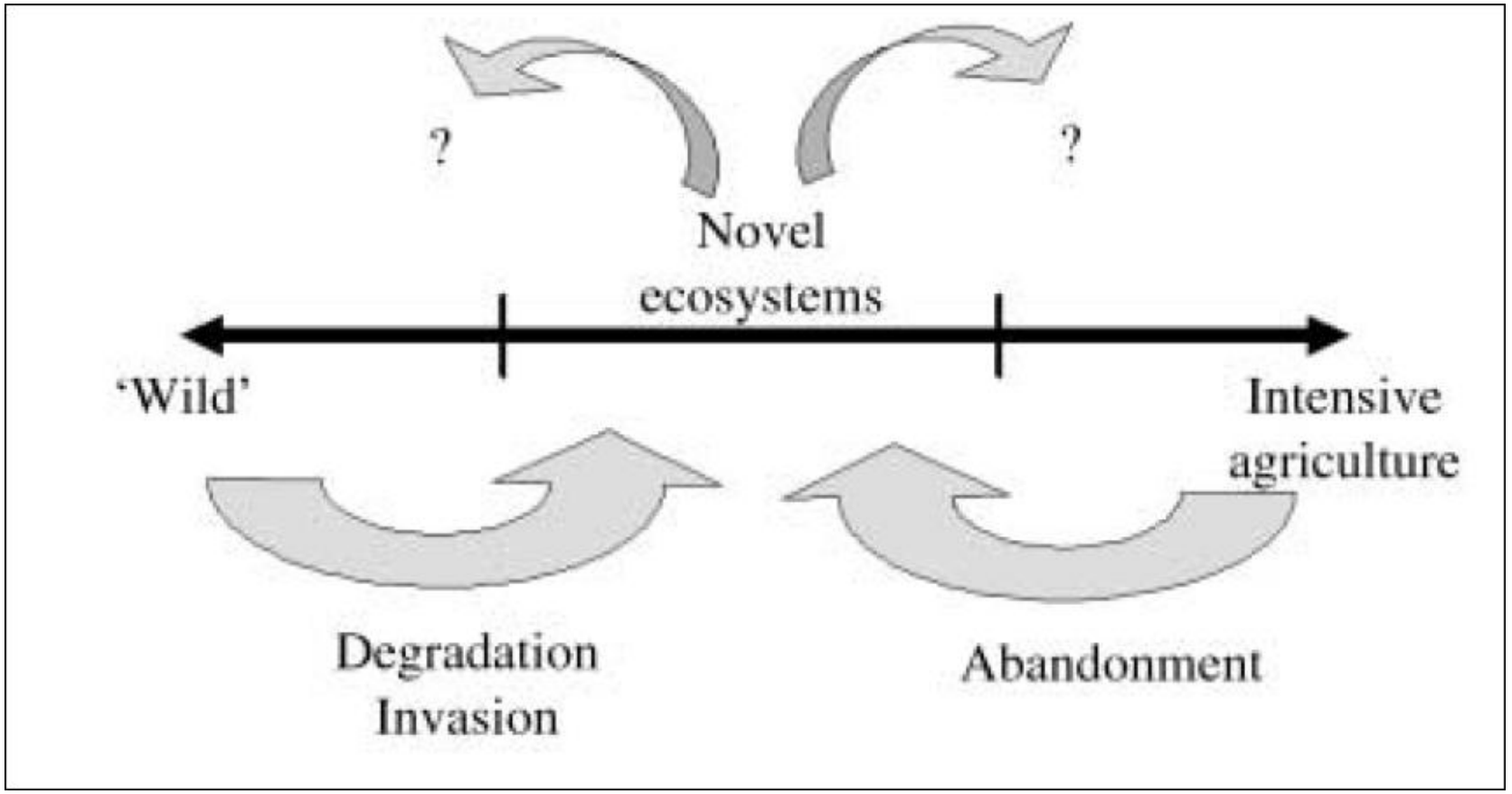
# Finer-Scale Units

- TNC: varied
  - including wetland characteristics
  - moisture gradients
  - pH
  - conifer vs. hardwood dominated
- SEGAP:
  - structural
  - conifer vs. mixed vs. hardwood dominated
- Landfire: structural
- NatureServe: did *not* use. When present in source data, rolled up to systems level.

# Central Interior and Appalachian Floodplain Aggregate with Finer-scale Modifiers

| System Name | Finer-Scale Unit | LF | SEGAP | NS | TNC |
|---|---|---|---|---|---|
| **Central Interior and Appalachian Floodplain Systems** | | 2471 | | | |
| Central App River Floodplain | | | X | 9333 | 608 |
| Central App River Floodplain | Central App Floodplain - Forest Modifier | | 202.608a | | |
| SCI Large Floodplain | | | X | 9334 | |
| SCI Large Floodplain | SCI Large Floodplain - Forest Modifier | | 202.705a | | |
| SCI Large Floodplain | SCI Large Floodplain - Herbaceous Modifier | | 202.705b | | |
| Southern Piedmont Large Floodplain Forest | | | | 9324 | 324 |

# Ruderal Vegetation



# Treatment of Ruderal Vegetation

- Not standardized; classifications concepts still under development at time of mapping
- Little documentation provided by mappers
- TNC: did not attempt to capture
- Others: did, but not evenly

# Ruderal Forest

- NatureServe: single class
- Landfire: six distinct classes
- SEGap: Not specifically mapped, but modifiers on natural types
- TNC: NA

# Ruderal Forest types (Landfire)

| System Name | | LF | SEGAP | NS | TNC |
|---|---|---|---|---|---|
| Ruderal Forest | | | | 8311 | |
| Ruderal Forest | Mixed Loblolly-Slash Pine | 2553 | | | |
| Ruderal Forest | Pinus elliottii Saturated Temperate Woodland Alliance | 2551 | | | |
| Ruderal Forest | Pinus taeda Forest Alliance | 2550 | | | |
| Ruderal Forest | Ruderal Forest-Northern and Central Hardwood and Conifer | 2532 | | | |
| Ruderal Forest | Ruderal Forest-Southeast Hardwood and Conifer | 2533 | | | |
| Ruderal Forest | Ruderal Upland-Treed | 2194 | | | |

# Ruderal Grassland & Shrubland

- Attempted to group into broad classes
  - Recently Logged Grassland/Shrubland
  - Successional Grassland & Shrubland
- LF, SEGAP, NS all have multiple finer-scale units beneath broad classes
- Additional LF (and NS) classes for:
  - Recently burned
  - Introduced upland
  - Introduced wetland
  - Modified/managed grasslands
- TNC: NLCD 52/71: shrublands/grasslands class

# Agriculture

- TNC, SEGAP: NLCD
- Landfire: NLCD + NASS
- NatureServe: same as source maps, but rolled up and some modifications
- We combined legend groups into two broad agriculture classes:
  - row crop
  - pasture/hay

# Differences in Mapped Targets

- Once common legend built, able to ask “who mapped what?”

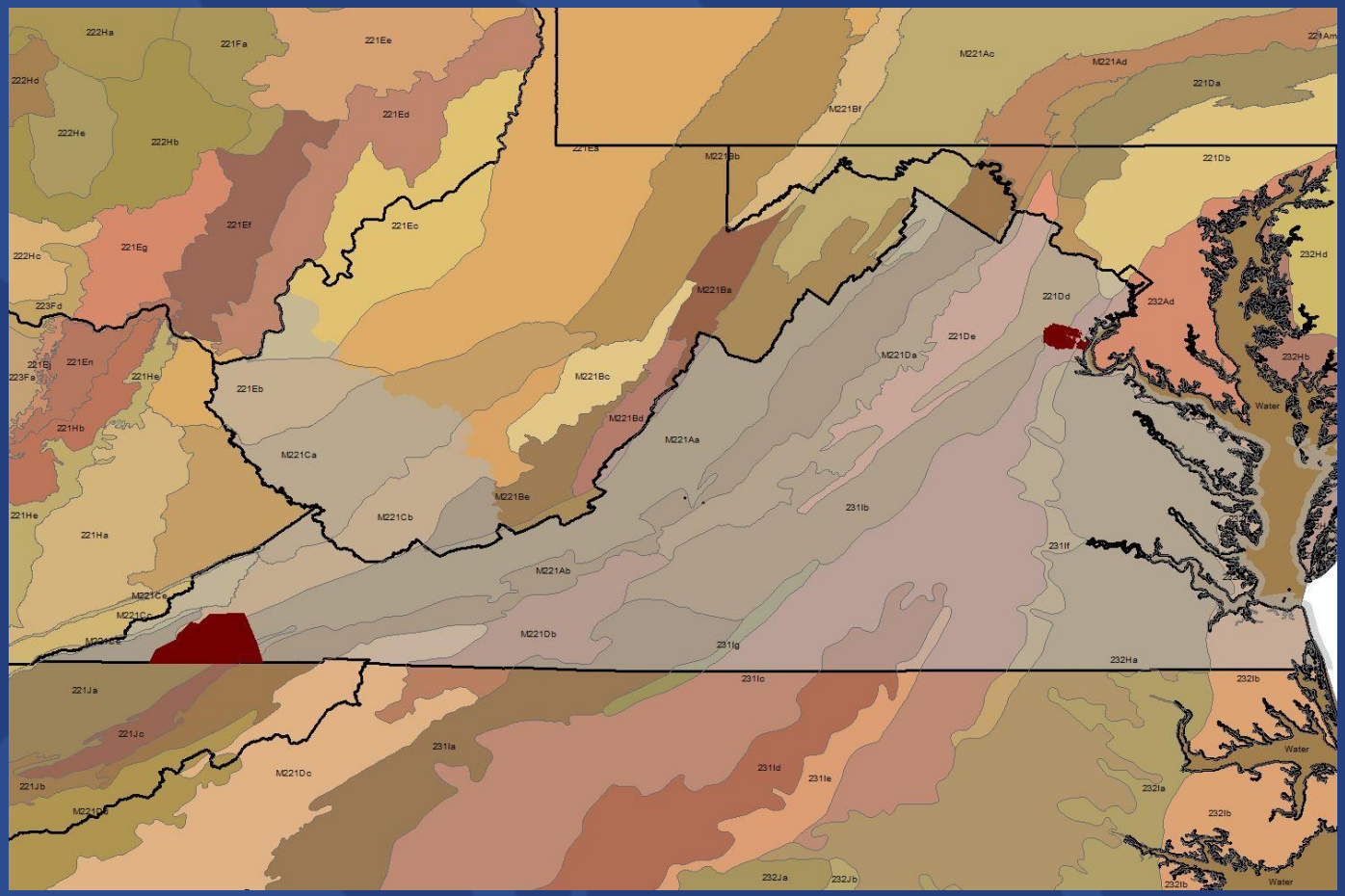
| System | Finer-Scale Unit | SEGAP | LF | NA | TNC |
|---|---|---|---|---|---|
| Laurentian Pine-Oak Barrens | | | 2407 | 5423 | |
| Laurentian-Acadian Northern Pine-(Oak) Forest | | | 2362 | 4265 | 719 |
| Great Lakes Alvar | | | 2409 | 5458 | 721 |
| Great Lakes Wooded Dune and Swale | | | 2466 | 9135 | 726 |
| C. Interior Highlands and Appalachian Sinkhole and Depression Pond | | | | | X |
| C. Interior Highlands and Appalachian Sinkhole and Depression Pond | Large River FP | | | | 18 |
| C. Interior Highlands and Appalachian Sinkhole and Depression Pond | Small River FP | | | | 10018 |
| Southern Ridge and Valley Calcareous Glade and Woodland | | | | | 24 |
| Great Lakes Wet-Mesic Lakeplain Prairie | | | 2411 | 7124 | |
| Central and Southern Appalachian Spruce-Fir Forest | | 202.028 | 2350 | 4253 | 28 |
| Southern Appalachian Northern Hardwood Forest | | 202.029 | 2309 | 4115 | 29 |
| **Great Lakes Coastal Marsh Systems** | | | 2492 | | |
| Great Lakes Freshwater Estuary and Delta | | | | 9268 | |
| Northern Great Lakes Coastal Marsh | | | | 9296 | |

# Differences in Mapped Targets

- Once common legend built, able to ask “who mapped what?”

| System | Finer-Scale Unit | SEGAP | LF | NA | TNC |
|---|---|---|---|---|---|
| Laurentian Pine-Oak Barrens | | NA | 2407 | 5423 | |
| Laurentian-Acadian Northern Pine-(Oak) Forest | | NA | 2362 | 4265 | 719 |
| Great Lakes Alvar | | NA | 2409 | 5458 | 721 |
| Great Lakes Wooded Dune and Swale | | | 2466 | 9135 | 726 |
| C. Interior Highlands and Appalachian Sinkhole and Depression Pond | | | | | X |
| C. Interior Highlands and Appalachian Sinkhole and Depression Pond | Large River FP | | | | 18 |
| C. Interior Highlands and Appalachian Sinkhole and Depression Pond | Small River FP | | | | 10018 |
| Southern Ridge and Valley Calcareous Glade and Woodland | | | | | 24 |
| Great Lakes Wet-Mesic Lakeplain Prairie | | NA | 2411 | 7124 | NA |
| Central and Southern Appalachian Spruce-Fir Forest | | 202.028 | 2350 | 4253 | 28 |
| Southern Appalachian Northern Hardwood Forest | | 202.029 | 2309 | 4115 | 29 |
| **Great Lakes Coastal Marsh Systems** | | **NA** | 2492 | | |
| Great Lakes Freshwater Estuary and Delta | | | | 9268 | |
| Northern Great Lakes Coastal Marsh | | | | 9296 | |

# West Virginia / Virginia:
# The one area where all 4 project maps overlap



# Targets of WV - VA mapping

- ~85 ecological systems mapped
- 25 of those mapped by everyone
- 8 additional TNC systems / system-combos
- 14 mapped systems not expected in region
- 30 systems known to occur not mapped by anyone

# Only Mapped by TNC (9 systems)

- Central Interior Highlands and Appalachian Sinkhole and Depression Pond
- Southern Ridge and Valley Calcareous Glade and Woodland
- Southern Piedmont Glade and Barrens
- Southern Piedmont Granite Flatrock and Outcrop
- Southern and Central Appalachian Mafic Glade and Barrens
- Southern Interior Calcareous Cliff
- North-Central Appalachian Acidic Swamp
- Northern Atlantic Coastal Plain Riverine Peat Swamp
- Southern Atlantic Coastal Plain Tidal Wooded Swamp

# Only Mapped by NatureServe/SEGAP (6 systems)

- Southern and Central Appalachian Bog and Fen
- Southern Piedmont Cliff
- South-Central Interior Large Floodplain
- South-Central Interior Small Stream and Riparian
- Atlantic Coastal Plain Blackwater Stream Floodplain Forest
- Northern Atlantic Coastal Plain Fresh and Oligohaline Tidal Marsh

# Only Mapped by Landfire (2 systems)

- Atantic Coastal Plain Streamhead Seepage Swamp, Pocosin and Baygall
- Atlantic Coastal Plain Upland Longleaf Pine Woodland

# Systems (>10 km$^2$) Mapped Outside Their (reported) Range

| System | Area (sq km) | | | |
|---|---|---|---|---|
| | TNC | LF | NS | SEGAP |
| Atlantic Coastal Plain Small Blackwater River Floodplain Forest | | | 965 | 965 |
| Central Atlantic Coastal Plain Sandy Beach | | | 6 | |
| Central Interior Calcareous Cliff and Talus | 0.3 | | 7 | 147 |
| Laurentian-Acadian Freshwater Marsh | 388 | | | |
| Laurentian-Acadian Wet Meadow-Shrub Swamp | 175 | | | |
| NCI and Appalachian Rich Swamp | 15 | | | |
| NCI Wet Meadow-Shrub Swamp | | | 93 | |
| S. Atlantic Coastal Plain Dune and Maritime Grassland | | | 25 | 25 |

# Systems Not Mapped

- Mostly small patch: seeps, glades, cliffs, ponds
- Also linear types: riverscour, ravines, beaches and bluffs
- Large patch types include seagrass and aquatic beds, tidal marshes, peatlands, lakeshores
- One matrix system [but edge of range]: Central Atlantic Coastal Plain Wet Longleaf Pine Savannah and Flatwoods

# MAP CLASS DESCRIPTION

Our review of the 4 map projects suggests the following:

- Map class types of ecological systems are not the same as the ecological systems classification types, even though the map is attempting to express the spatial (ecological, geographic) pattern of the ecosystem type.
- Map class description should summarize
  - map to classification relations
  - mapping process, and
  - ecological content of the map class

# MAP CLASS DESCRIPTION: EXAMPLE OF A TEMPLATE

**NAME**

A. Map Class Name:

B. Relation of map class to ecological system type(s)

- E.g. a) aggregate, b) directly equivalent, c) complex, d) new system.
- Reason for relationship.
- Classification type name reference.

**MODELING PROCESS**

C. General citation for mapping methods.

D. Mapping approach (including post processing)

E. Model parameters (number of plots, ancillary data, etc).

F. Validation and AA.

**MAP CLASS DESCRIPTION**

H. Map class ecological description(?) (geography, acres, ecology).

# MAP CLASS DESCRIPTION: Name

## NAME

A. Map Class Name: **Gulf and Atlantic Coastal Plain Sparsely Vegetated Systems**

**B. Relation to Ecological Systems: Aggregate**

- Northern Atlantic Coastal Plain Dune and Swale
- Central Atlantic Coastal Plain Sandy Beach
- Northern Atlantic Coastal Plain Sandy Beach

Comment:

# MAP CLASS DESCRIPTION: Mapping Approach

**EGCP Jackson Prairie and Woodland:** (Kleiner 2007 – SEGAP):

This class was manually burned in. Known occurrences from the original point dataset (see Table 4) were overlaid on DOQs and the prairie patches were digitized.

# MAP CLASS DESCRIPTION: Mapping Approach

Mapping Approach: Ferree and Anderson 2013 (TNC)

| System-code | System-name | Basic_model | Landcover |
|---|---|---|---|
| 201.57 | Acadian-Appalachian Montane Spruce-Fir-Hardwood Forest | lower elevation limit = ( -100 * latitude ) + 5129; upper elevation limit = ( -83 * latitude ) + 5150; latitude in decimal degrees, results in meters | Upland natural landcover, any class |
| 201.56 | Acadian Sub-boreal Spruce Flat | Acadian Low-Elevation Spruce-Fir-Hardwood Forest model from matrix forest analysis | Natural landcover, any class |
| 201.57 | Acadian-Appalachian Alpine Tundra | to identify areas above upper elevation limit for spr-fir: upper elevation limit = ( -83 * latitude ) + 5150; latitude in decimal degrees, results in m; exclude any cliff-talus model occurrences | Any landcover class above montane spruce-fir-hardwood model; classes 32,52,71 within 10-cell distance of basic model |

# MAP CLASS DESCRIPTION: Validation and AA

- Validation and AA: Ferree and Anderson 2013 (TNC)

Table 6: Comparison of error rates across ecoregions and system type.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| HAL: 800 trees, 10 variables, sampsize1 = c(200,200,200,135,200) | | | | | | | | |
| Looks like all 52 variables | | | | | | | | |
| OOB estimate of error rate: 27.06% | | | | | | | | |
| | AHNHF | CADOPF | LANHF | LAPHHF | NEIDMOF | class.error | Known_Occ's | Adjusted_KOs |
| AHNHF | 444 | 39 | 26 | 9 | 46 | 0.2128 | 564 | 200 |
| CADOPF | 26 | 170 | 6 | 4 | 58 | 0.3561 | 264 | 200 |
| LANHF | 27 | 4 | 179 | 16 | 3 | 0.2183 | 229 | 200 |
| LAPHHF | 13 | 4 | 19 | 92 | 7 | 0.3185 | 135 | 135 |
| NEIDMOF | 42 | 29 | 0 | 0 | 134 | 0.3463 | 205 | 200 |
| | | | | | | | Total: 1397 | Total: 935 |

# Map Class Description: end of story

- Given that large-area maps need to model the ecosystem types, documentation of the method is essential.
- Providing a map class description for each type allows users to readily understand how the map was created.
- Users will often be interested in description and accuracy of individual types, rather than the whole map!

# SUMMARY

A common map legend among the 4 projects had to overcome a number of challenges

1. Lumping/splitting of systems.
   - Aggregates
   - Finer scale units
   - Ruderal vegetation

2. Choice of which systems to map.

3. Understanding how each system was treated in the mapping process. Map class descriptions, which some projects provide, make the interpretation of the map much easier.

# List of Systems not mapped