

North Carolina Ecosystem Response to Climate Change: DENR Assessment of Effects and Adaptation Measures

DRAFT

Coastal Plain Marl Outcrop

Ecosystem Group Description:

This theme is rather narrowly defined and is very rare. Coastal Plain Marl Outcrop communities occur on the rare outcrops of limestone on the Coastal Plain. Some are true marl while others are coquina or other kinds of limestone. Outcrops are located along stream bluffs or in ravines where recent exposures have not yet been covered by soil or weathered. One unique outcrop is maintained by waves on the north shore of Lake Waccamaw. While they are in some senses a counterpart to the Piedmont Calcareous Cliff community type, Coastal Plain Marl Outcrops generally are shaded by trees. The trees, rooted in soil pockets or in adjacent forests, include calcium-loving species such as black walnut, sugar maple, and pawpaw, as well as more widespread moisture loving species such as beech and tulip poplar. Poison ivy and Virginia creeper vines often run over the bare rocks. Characteristic limestone herbs include ebony spleenwort, wild ginger, bloodroot, columbine, and several mosses.

Ecosystem Level Effects:

Predicted Impacts of Climate Change:

| Climate Change Factor: | Likelihood: | Effect: | Magnitude: | Comments: |
|------------------------|-------------|---------|------------|--|
| Flooding | Med | Neg | Low | Many outcrops are along creeks, and increased flood height may affect their lower parts. |
| Wind Damage | High | Neg | Low | |
| Drought | High | Neg | Med | |

Coastal Plain Marl Outcrops cover a relatively small geographic range in North Carolina. In the southern, outer Coastal Plain, the Climate Wizard mid value for average annual temperature increase by 2050 is 3.4 degrees (Maurer et al., 2007). The range of models is 2.6 to 6.2 degrees. The range in the models for rainfall is also wide: -21 inches to + 15 inches. The general expectations of increased rain event intensity and increased drought presumably apply to all of this range.

Most marl outcrops are in mesic sites, sheltered by topography. Microsites range from very shallow soil to deep soil in crevices. Individual plants are subject to very different moisture regimes over short distances, and vary in their drought tolerance. Seepage is part of what creates varying microhabitats, and drought could have a significant effect on it.

Most marl outcrops are shaded by trees rooted in or adjacent to the community. An increase in severe storms would increase wind throw around them, possibly increasing the drying effect of drought.

Increased flooding, due to increased flood heights or, in a few sites, rising sea level, will affect limited

portions of some outcrops.

Predicted Ecosystem Responses:

| Ecosystem Response: | Likelihood: | Effect: | Magnitude: | Comments: |
|-------------------------|-------------|---------|------------|--|
| Structural Change | Med | Neg | Low | |
| Exotic species invasion | Med | Neg | Med | |
| Compositional Change | Med | Neg | Low | Colonization by new native species is unlikely, so most change will be loss of species richness. |

Marl outcrops are small and isolated communities tied to specialized sites. The communities and their more restricted species will not be able to migrate, and individual occurrences are too far apart to offer much potential for colonization by other specialist species. Drought may cause changes in the community, eliminating some more sensitive species, or restricting them to more mesic microsites within the heterogeneous community. Opening of the canopy caused by increased wind damage may also shift the community to more light-loving species.

Marl outcrops are susceptible to invasion by exotic plants. Some are already badly invaded, and others have populations of Japanese honeysuckle (*Lonicera japonica*), Japanese stiltgrass (*Microstegium vimineum*), and other invasive species nearby. If an increase in severe storms creates a more open canopy, this will increase the likelihood and speed of invasion.

Habitat Level Effects:

Natural Communities:

| Third Approximation Name: | Comments: |
|----------------------------|-----------|
| Coastal Plain Marl Outcrop | |

LHI Guilds:

No guilds have a high concentration of habitats within marl outcrops. Most animal species that occur in marl-influenced habitats also occur in other types of rich, mesic forests, particularly -- in the Coastal Plain -- brownwater river bottomlands and levees.

Species Level Effects:

| <u>Plants</u> | Element Rank: | Endemic | Major Disjunct | Extinction/Extirpation Prone | Status: US/NC | Comments: |
|---------------|---------------|---------|----------------|------------------------------|---------------|-----------|
| Species: | | | | | | |

| | | | | |
|-------------------------------------|-----------|-----|-------|--|
| Cylindrocolea rhizantha | G3?/SH | Yes | /SR-P | Columbus county NC is the northern limit of the species' range. Only occurrence in NC has not been seen in recent years. |
| Lejeunea bermudiana | G3G4/S1 | | /SR-P | NC is the northern limit of the species' range. Occurs in mountains and coastal plain. |
| Adiantum capillus-veneris | G5/S1 | Yes | /E | Globally widespread, but only one population occurs in NC; threatened by erosion near development. |
| Cystopteris tennesseensis | G5/S1 | | /E-SC | |
| Carex basiantha | G5/S1 | | /SR-D | |
| Arenaria lanuginosa var. lanuginosa | G5T4T5/S1 | | /SR-P | |
| Asplenium heteroresiliens | GNA/S2 | | FSC/E | |

Only a few rare plants are associated with this theme in NC, but because the extent of suitable habitat is so limited, all of these plants are extremely rare in NC. Opening of canopy resulting in drying of habitat could cause particular problems for the bryophytes and ferns. Increased rain and wave action from storms could increase the threat of erosion, especially at the Waccamaw River site.

Combined Threats and Synergistic Impacts:

Importance of Climate Change Factors Compared to Other Ecosystem Threats:

| Threat: | Rank Order: | Comments: |
|----------------------|-------------|-----------|
| Logging/Exploitation | 1 | |
| Invasive Species | 2 | |
| Development | 2 | |
| Climate Change | 3 | |

While these communities are small and seldom deliberately exploited, the greatest threat to most examples is indirect degradation by logging or development. The damage by these activities is similar to that caused by climate change -- loss of canopy cover, drying, and invasion by exotic plants. The effect of canopy loss and increased potential for invasion is likely to be worse from these threats than from climate change. A few examples, including the largest, are protected from logging and development, and are most threatened by invasive plants and erosion, threats that may become worse with increased storm disturbance.

Recommendations for Action:

Interventive Measures:

| Intervention: | Importance: | Feasibility: | Comments: |
|---------------|-------------|--------------|-----------|
|---------------|-------------|--------------|-----------|

| | | | |
|-----------------------------------|------|------|--|
| Control Invasive Species | High | High | Exotic species control is laborious, but these communities are small and direct control would generally be feasible. |
| Protect/Expand Remaining Examples | High | High | |

Ecosystem Group Summary:

Coastal Plain Marl Outcrops are most threatened by logging, development, and invasion of exotic species. However, the effects of climate change may cause similar ecosystem responses: loss of canopy from increased storms and wind throw, altered moisture regime, and further invasion of exotic plants. Coastal Plain Marl Outcrops are closely associated with specialized soil types and will not likely be able to migrate. Therefore, it is crucial to protect the remaining examples and control invasive species at these sites to promote long term viability.

References:

Maurer, E.P, L.Brekke, T.Pruitt, and P.B. Duffy. 2007. Fine-resolution climate projections enhance regional climate change impact studies. *Eos Trans. AGU*, 88(47), 504.
