Temperature Assessment on a Reclaimed Surface Mine During Northern Bobwhite Breeding Season: Considerations for Habitat Management

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A deposit of fine-grained coal-preparation refuse (slurry) before reclamation

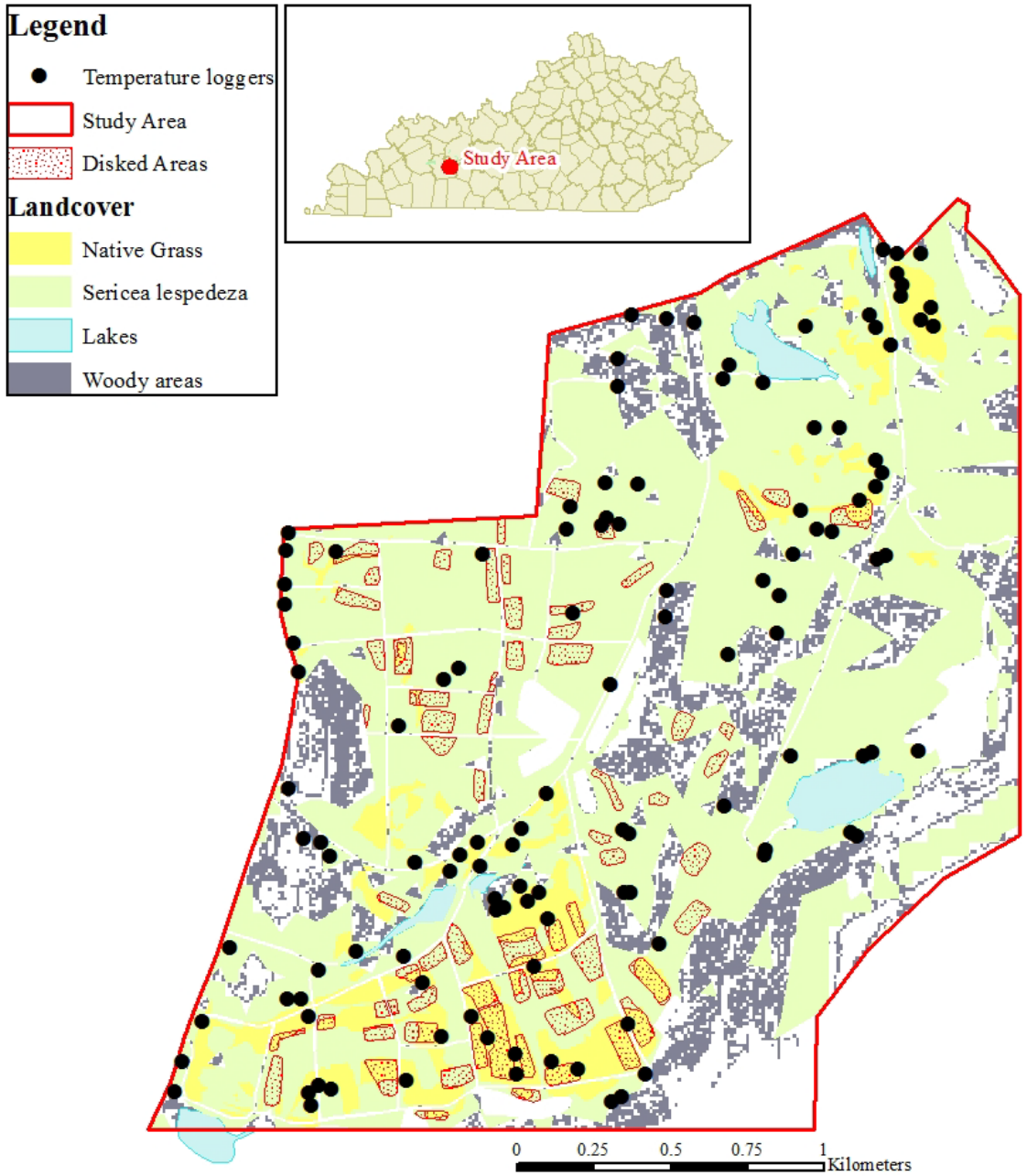
A deposit of fine-grained coal-preparation refuse (slurry) after reclamation.

Photos from Indiana Geological Society https://igs.indiana.edu/Reclamation/Features.cfm

Study Area & Research Questions

- Managed reclaimed surface mine in western KY
  - Aprox. 580 ha (1400 ac) on Sinclair unit of Peabody Wildlife Refuge
  - 4 Habitat types
    a) Native grass
    b) Disked native grass
    c) Sericea lespedeza
    d) Disked sericea lespedeza
- Low bobwhite success, especially in summer
  - High temperature?
- **<u>Were any thresholds exceeded?</u>**
- **<u>Which areas are warmest?</u>**

Temperature Measurement



- HOBO pendant loggers and homemade radiation shields
  - NOT blackbulb temperature
  - 30 were randomized spatially in each of 4 habitat types
- Quality control
  - Pre (KY Mesonet)
  - Post (Field notes)
- 10-minute observations
  - 26 Jun-17 Jul 2015 (Peak brood rearing)

Threshold Temperatures

- Reyna and Burggren (2012) specifically identified **40°C** as the upper limit for bobwhite egg survival
- The highest ground-level air temperature observed at Peabody during our study period was **37.3°C.**

- Guthery et al. (2005) found that approximately 90% of incubating adult bobwhites tracked in their study were employing gular flutter to regulate body temperature when air temperature exceeded **35°C**
- Only 8% of stations observed Ta > 35°C
  - 89% of those stations were disked

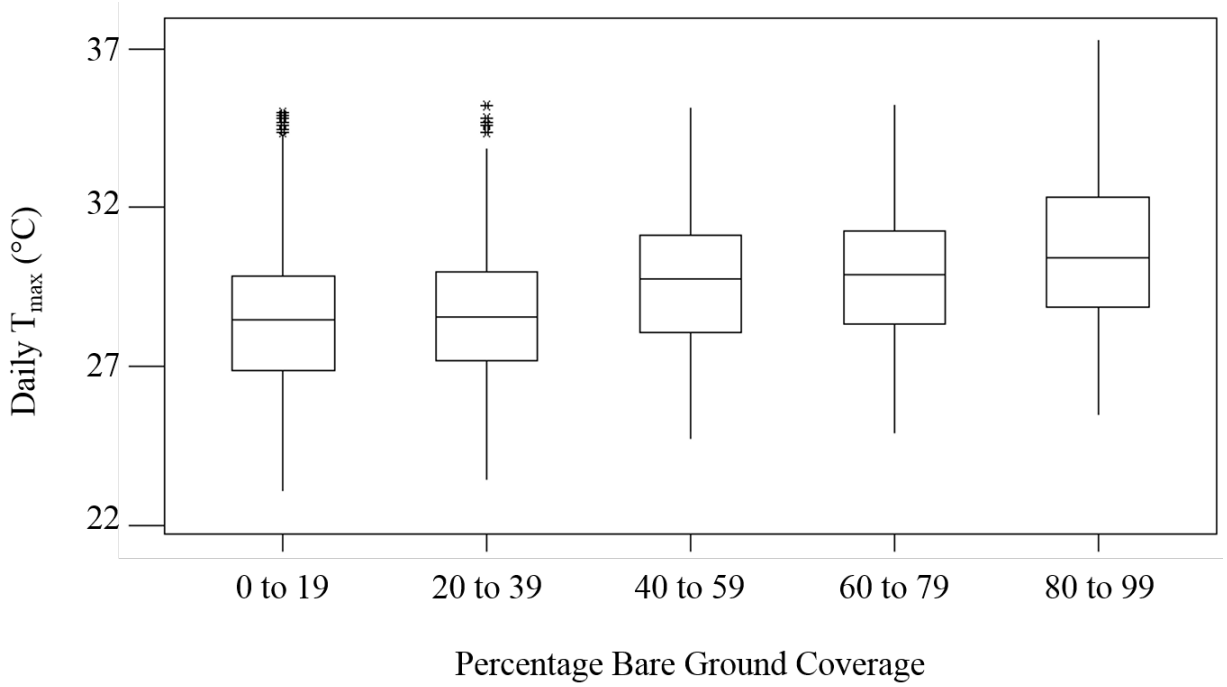
Characteristics of observation sites

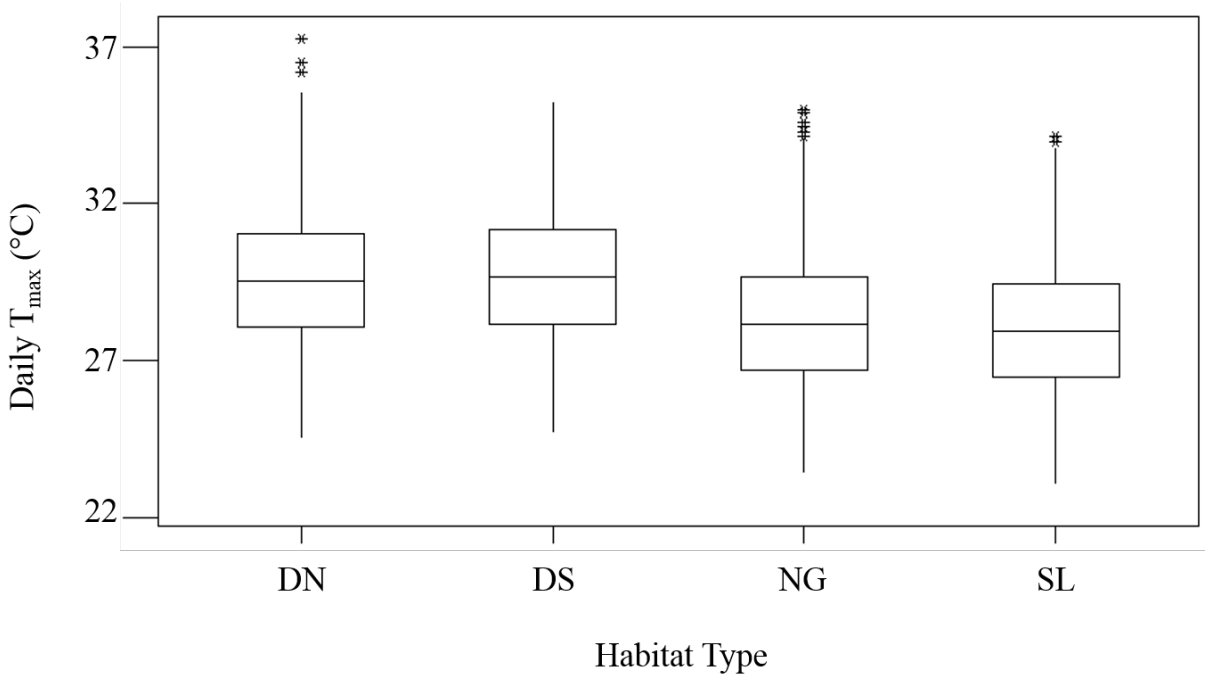
- Slope and orientation
- Percent ground cover of primary vegetation categories quantified using a 1-m x 1-m Daubenmire cover frame and a vertical cover–profile board
  - Grass
  - Forb–Legume
  - Bare Ground
  - Leaf Litter

- Strongest correlation with maximum air temperature was leaf litter depth (r=-0.442)
- West slopes sig. higher T_{max} than other aspects (α=0.05)

Warmest Areas

- Highest maximum temperatures observed during our study occurred at locations with the highest percent of bare ground
  - Percent bare ground explained 15.2% of the variation in daily Tmax
  - Areas of sericea lespedeza coolest





Climate Change

- Most of KY experienced remarkably consistent annual precipitation and mean annual temperature over the period 1950–2010
  - A few places in western KY saw warming in mean annual temperature of 0.01 °C/year
- Climate models predict that average temperatures in our study area will increase 2–3°C by the end of this century
- Days warmer than 32.2°C (90°F) will become more common
- Those same models predict a 0–20% increase in Kentucky's annual precipitation over the same period.
- Phenology changes and species distribution shifts

Habitat management considerations

- Disking
  - Many benefits
    - Serecia control
    - Increased bird mobility
    - Perhaps more invertebrates
    - Enhanced amounts and diversity of forbs and legumes present at Peabody
      - Planting select native species
- **Optimal interval?**
    - Balance positives with shade and leaf litter

- Thermal refuges

  Esp. West facing slopes

  Service learning opportunities

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