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?

• **Were any thresholds exceeded?**

• **Which areas are warmest?**
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 $T_{\text{max}}$ than other aspects ($\alpha=0.05$)
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
References


