A80 Introducing Forensic Investigation Research Station (FIRS-TB40): Scavenger Succession and Progression at a High-Altitude Site in Colorado

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Learning Overview: After attending this presentation, attendees will better understand how scavenger guild interaction affects decomposition at high altitude.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by introducing a new human decomposition research site, and the taphonomy of a high-altitude ecoregion, the variables of which are not well understood in a forensic context.

Studies of decomposition at high-altitude are limited and report distinct changes in decomposition with increases in altitude.[1,2] Colorado's Rocky Mountain region bisects the state from north to south and is classified as a fully humid, snowy climate interdigitated by polar regions that reach elevations greater than 14,000 feet Above Mean Sea Level (AMSL). High altitude is correlated with an increased incidence in suicide, sudden-onset high mortality edemas, and a suite of physiological changes associated with the composition of partial pressure of atmospheric gasses. Additionally, remote expanses of wilderness provide ideal locations for clandestine body disposal. These variables yield a high incidence of remote, complex, outdoor human decomposition scenes characterized by prolonged exposure, advanced decomposition, and animal scavenging.

With the support of the Park County Coroner and Commissioners, the Forensic Investigation Research Station at Colorado Mesa University acquired 40-acres of land in the Rocky Mountain Region of Colorado (FIRS-TB40). FIRS-TB40 is 9,500 feet AMSL in the South Park region of the central Rockies. The site is bisected north to south by a steep, rocky, moraine-like ridge covered in short prairie grass and stunted juniper.

Four pigs were placed in the summer of 2018 in anticipation of placing a human cohort in 2019. Of primary interest was the succession and progression of local scavenger guilds. Four carrions (two exposed/two caged) were placed in a longitudinal transect across a 45° slope, each 30 meters apart. Each sample was monitored by a game camera programmed to collect both time lapse photographs and respond to motion in the environment. Carrion were visited three times weekly for a period of eight weeks, photographed, and decomposition documented using the total body score model.[3] When scavenging occurred, a site search was performed in ordered, longitudinal transects to locate scattered skeletal material.

Arthropod and avian communities constituted the first wave of scavenger succession; activity in both communities began almost immediately after deposition. Avian activity was limited to non-caged carrion, despite aerial access to the cages, while arthropods were active at all carrion sites. Turkey vultures (*Cathartes aura*) were the dominant species early in succession, followed by ravens (*Corvus corax*). High inter-species tolerance was demonstrated by co-scavenging, but vultures dominated in population size and tissue exploitation in the initial phase. Scavenging began in rectal tissue and progressed to the retro-otic region, the length of the thorax, and the limbs, in both uncaged carrion. Evidence for avian scavenging included distinct claw marks in superficial perianal tissue and along the length of the thorax, bore holes in the cranial region, shallow, linear beak striae in superficial tissue, and ribboning of connective tissue. Insects preferentially oviposited at the ground/body interface. Two pigs rolled down the slope following bloat. Reorientation of the carrion exposed previously sheltered larvae to the environment, delaying or arresting the development of maggot masses.

Coyotes (*Canis latrans*) arrived seven days postmortem and constituted the second wave of scavengers. While capable of removing greater amounts of tissue in a single visit, reduction was largely limited to circumscribed areas and progressed across 21 days. Scavenging commenced at the hind limbs, followed by the head, the front limbs, and the thorax. Coyotes moved scavenged carrion across and downslope—behavior anticipated based on extant knowledge of slope gravity and the law of least energy expenditure. However, osseous evidence indicated canids carried the carrion up the steep slope to the hill crest to consume, behavior that runs counter to widely published patterns. American black bears (*Ursus americanus*) arrived 21 days postmortem and constituted the final wave of the succession. Bears were anticipated to act as apex scavengers. However, while observed in direct proximity to all carrion, they did not choose to scavenge.

Scavenger behavior is dictated by reflexive patterns or cooperation and competition that are regionally distinct and have the potential to impact human remains recovery. This study demonstrates the necessity of considering scavenger behavior in concert to effectively understand behavior that diverges from the norm and regional patterns of taphonomic change.

Reference(s):

1. Baigent C., Gaither C., Campbell C. The Effect of Altitude on Decomposition: A Validation Study of the Megyesi Method. *Proceedings of the American Academy of Forensic Sciences*, 66th Annual Scientific Meeting, Seattle, WA. 2014. 20:485-6.
2. Allaire M.T. 2002. P*ostmortem Interval (PMI) Determination at Three Biogeoclimatic Zones in Southwest Colorado*. Unpublished Master's Thesis, Louisiana State University and Agricultural and Mechanical College.
3. Megyesi M., Nawrocki S.P., Haskell N.H. Using Accumulated Degree-Days to Estimate the Postmortem Interval From Decomposed Human Remains. *J Forensic Sci.* 2005 May;5(3):618- 626.

High Altitude, Scavenger Succession, Human Decomposition