**A spatially explicit model to predict white-tailed deer radiocesium body burdens on the Department of Energy’s Savannah River Site**

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**INTRODUCTION**

**Purpose:** To develop a spatially explicit prediction model that interpolates radiocesium (137Cs) body burdens of white-tailed deer (Odocoileus virginianus), at the Department of Energy’s Savannah River Site (SRS).

**Objectives:**
1. Determine the proper scale to investigate deer 137Cs for the SRS.
2. Within a Geographic Information System (GIS), develop a predictive surface at the aforementioned scale that will supply an interpolated estimate of 137Cs for any individual deer residing on the SRS.

**METHODS**

**Geographic Information System**
- Develop base radiological data set for 22 year time period (split into 3 time periods)
  - Overlay 100 ha (deer core area) hexagonal mesh over SRS.
  - Determine mean body burden (bq/kg) for all deer harvested in each hex over each time period.
  - Implementation of geostatistical analyses
    - Semivariogram fitting
    - Ordinary Kriging

**STUDY SITE**

- The Savannah River Site is an 805 km² former nuclear production facility located in west-central South Carolina.
- This facility occupies portions of Aiken, Allendale, and Barnwell Counties.
- Radiocesium was released into the environment during the operation of a high-level waste storage system, 2 radiochemical processing facilities and daily functions of 5 production reactors.

**RESULTS**

- The 3 krige models predict white-tailed deer body-burden concentrations and distributions. Separate models were constructed to account for the half-life of 137Cs (30.2 years).

**PREDICTION SURFACE**

- The hexagonal approach where each hex represents the deer core area is the most biologically relevant scale to estimate the body-burdens of deer on the SRS.
- This scale allows for the determination of “Hot Spots” due to increased bioavailability of 137Cs to deer.
- All cross validation regression lines indicate there is an over-prediction of low level radiocesium concentrations and an under-prediction of high level concentrations.
- Overestimation likely due to hot spots.
- The majority of deer are acquiring their body burden from radiological fallout from atomic testing.
- The cross-validation gives a powerful insight to the source of 137Cs in white-tailed deer inhabiting the SRS.
- Managers can use the cross-validation model, coupled with the interpolated surface for risk assessment purposes to limit access to high risk areas (all deer are monitored prior to removal).

**FUTURE ANALYSES**

- 137Cs has a decreased rate of mobility in presence of fine fraction clays.
- Develop a cokriging model using the soil composition and clay content.

**HABITAT**

- Cover type has the potential to intercept 137Cs from atmospheric fallout
- Use vegetation and soil composition to develop a better model that would predict the bioavailability of 137Cs to white-tailed deer on the SRS.

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