Seminar 6- Homework

Joan

2025-06-06

Introduction

The livestock sector is a cornerstone of rural livelihoods and national food security in Kenya. However, prevailing production systems—characterized by extended animal rearing cycles, inefficient feeding, and informal marketing—contribute significantly to greenhouse gas (GHG) emissions and environmental degradation. These inefficiencies also undermine profitability for producers and create inconsistent supply for meat processors and retailers.

As climate change intensifies, there is a growing need to transition to more efficient, climate-smart livestock production systems. One high-potential opportunity is to shorten livestock holding periods through improved feeding, finishing, and offtake practices—reducing methane emissions while increasing returns for producers and processors.

A meat processor aims to pioneer a contracted green beef production model, working directly with livestock producers and traders to encourage the supply of younger, better-finished animals. This model aligns with global shifts toward sustainable sourcing, low-carbon value chains, and inclusive business models.

When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:

Emissions redction in cattle farming in Laikipia- Kenya

```
input_estimates <- data.frame(variable = c("Infrastructure_establishment_cost","Establishment_la
bor_cost", "Routine_Labor_cost",
                                           "Farm_management_cost","Biogas_profit",
                                           "Cattle_profit"),
                              lower = c(10000, 5000, 3000, 1000, 1500, 2500),
                              median = NA,
                              upper = c(20000, 10000, 4000, 2500, 5500, 25000),
                              distribution = c("posnorm", "posnorm", "posnorm",
                                               "posnorm", "posnorm", "posnorm"),
                              label = c("Infrastructure establishment cost (USD)", "Establishmen
t labor cost (USD/ha)", "Routine labor cost(USD/ha)",
                                        "Farm management cost (USD/ha)", "Biogas cost (USD/m3)",
                                        "Cattle cost (USD/ha)"),
                              Description = c("Infrastructure cost",
                                              "Establishment labor cost",
                                              "Labor costs in a normal season",
                                              "Management costs in a normal season",
                                              "Biogas profit",
                                              "Cattle profit"))

model_function <- function(){

  # Estimate the income in a normal season
  income <- Biogas_profit + Cattle_profit

  overall_costs <- Infrastructure_establishment_cost + Establishment_labor_cost + Routine_Labor_
cost + Farm_management_cost

  # Estimate the final results from the model
  final_result <- income - overall_costs

  # Generate the list of outputs from the Monte Carlo simulation
  return(list(final_result = final_result))
}


## Run the Monte Carlo simulation using the model function
example_mc_simulation <- mcSimulation(estimate = as.estimate(input_estimates),
                                      model_function = model_function,
                                      numberOfModelRuns = 10000,
                                     functionSyntax = "plainNames")
```

Graph

```
plot_distributions(mcSimulation_object = example_mc_simulation,
                   vars = "final_result",
                   method = "boxplot_density",
                   old_names = "final_result",
                   new_names = "Outcome distribution for profits")
```