compost distribution

Anaya Hall

i : Index of county $(1, ..., n)$
j : Index of facilities $(1, ..., m)$

$$gCO_2e = \underbrace{\sum_{i=1}^{n}\sum_{j=1}^{m} h \cdot D_{ij} s_{ij} W_i}_{\text{transport from county to facility}} + \underbrace{\sum_{i=1}^{n}(1 - \sum_{j=1}^{m} s_{ij}) W_i \cdot f}_{\text{waste that remains in county}} + \underbrace{\sum_{i=1}^{n}\sum_{j=1}^{m} h \cdot L_{ji} d_{ji} TC_i}_{\text{transport from facility to land}} + \underbrace{\sum_{j=1}^{m}(1 - \sum_{i=1}^{n} d_{ij}) TC_i \cdot g}_{\text{compost that remains in facililty}} +$$

$$\underbrace{XXX}_{\text{soil emissions???}} + \underbrace{\sum_{j=1}^{m} p \cdot s_{ij} W_i}_{\text{spreading compost}}$$

$$Cost = \underbrace{\sum_{i=1}^{n}\sum_{j=1}^{m} d \cdot D_{ij} s_{ij} W_i}_{\text{transport from county to facility}} + \underbrace{\sum_{i=1}^{n}\sum_{j=1}^{m} e \cdot L_{ji} d_{ji} TC_i}_{\text{transport from facility to land}} + \underbrace{\sum_{i=1}^{n} k \cdot TC_i}_{\text{cost to apply}}$$

Intake for each facility is sum of the proportion taken in from c_i for $i = 1, ..., n$

$$I_j = \sum_{i=1}^{n} s_{ij} W_i$$

Output of each facility is equal to intake converted into compost

$$O_j = c \cdot I_j$$

Total compost applied in each county is the sum of the proporion of output from f_j for $j = 1, ..., m$

$$TC_i = \sum_{j=1}^{m} d_{ji} O_j$$

$$D \in \mathbb{R}^{n \times m}$$

cheese

subject to:

$I_j \leq F_j$
$A_i \leq C_i$
$\sum_{j=1}^{m} s_{ij} \leq 1$
$\sum_{i=1}^{n} d_{ij} \leq 1$
$0 \leq s_{ij} \leq 1$
$0 \leq d_{ij} \leq 1$

where

s_{ij} = Proportion of W_i to send to f_j
d_{ji} = Proportion of facility f_j output to send to c_i working land
D_{ij} = Distance to haul to facility j (f_j) from county i (c_i) (km)
L_{ji} = Distance from f_j to c_i working land (km)
W_i = Waste available in county i

F_j = Intake capacity of facility j
C_i = Amount of output county i can take in (based on amount of land)

and

S_i = Sequestration potential compost applied in county c_i (gCO2/ton?)
c = Conversion factor of waste into compost (%) (= .58)
f = Emission factor for waste left in county ($\frac{CO2_e}{ton}$) (landfill!!)
g = Emission factor for compost stranded at facility ($\frac{CO2_e}{ton}$) (0?)
h = Transportation emission factor ($\frac{CO2_e}{ton \cdot km}$) (separate??) (101 g/ton-mi, CARB)
p = Emission factor for compost production ($\frac{CO2_e}{ton}$) (Delonge??)
e = Cost to haul away from facility to land ($\frac{\$}{ton \cdot km}$)
d = Cost to haul to facility from county ($\frac{\$}{ton \cdot km}$)
k = Cost to apply compost to fields ($\frac{\$}{ton}$) ($8.87/cubic yard, Marin RCD) ($0.5 / sq ft????, EPA) ($4/ton)
https://www.epa.gov/sites/production/files/2015-11/documents/highwy3a.pdf