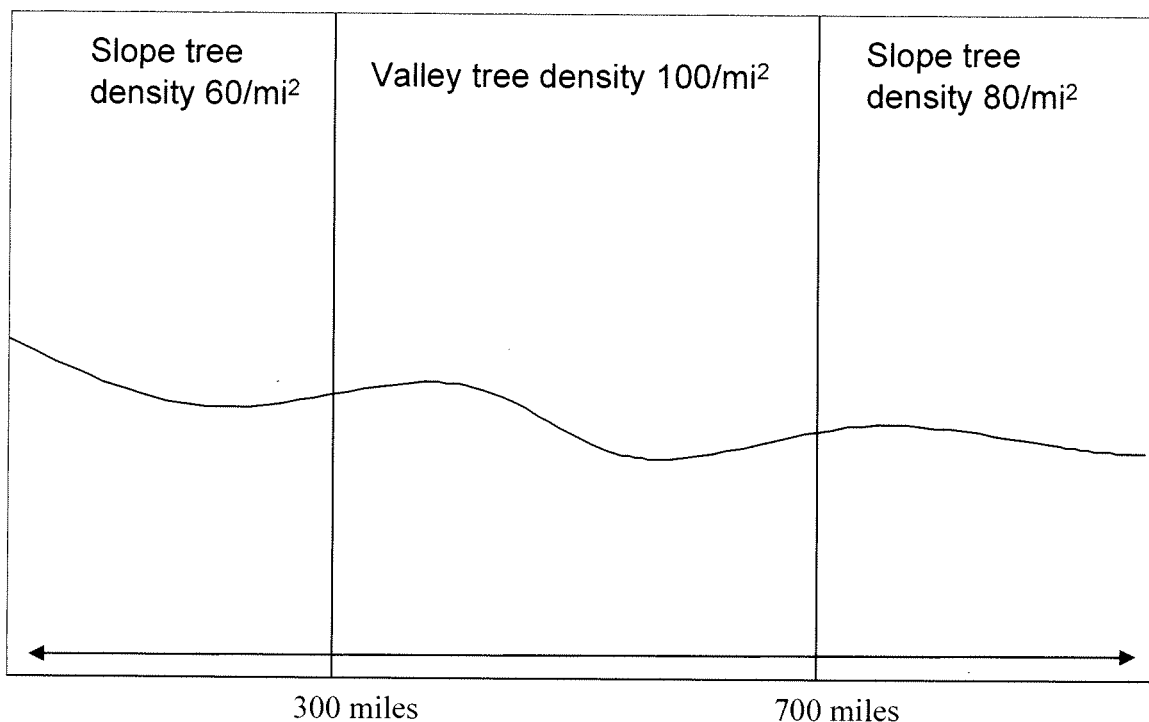


A forest service needs to identify the location and number of collection facilities along a road in the forest. They would like to identify the number and location of facilities that minimizes their cost of transport of the trees between the location they were felled and the collection facilities, and the cost of operating the collection facilities. The cost of operating each new facility is \$25,000. Once felled, they cost \$10/mile to transport. Once the trees are collected at the facilities, the cost of transportation is borne by the trucking firm and not of concern. The trees travel only in the vertical direction prior to hitting the arterial, and then along the arterial to the nearest collection facility.

Identify the number of facilities that minimizes cost, and draw them on the diagram. Provide your best estimate of total cost.



$$\begin{aligned}D'(d) &= 60 \text{ for } 0 < d < 300 \\D'(d) &= 100 \text{ for } 300 < d < 700 \\D'(d) &= 700 \text{ for } 700 < d < 1000\end{aligned}$$

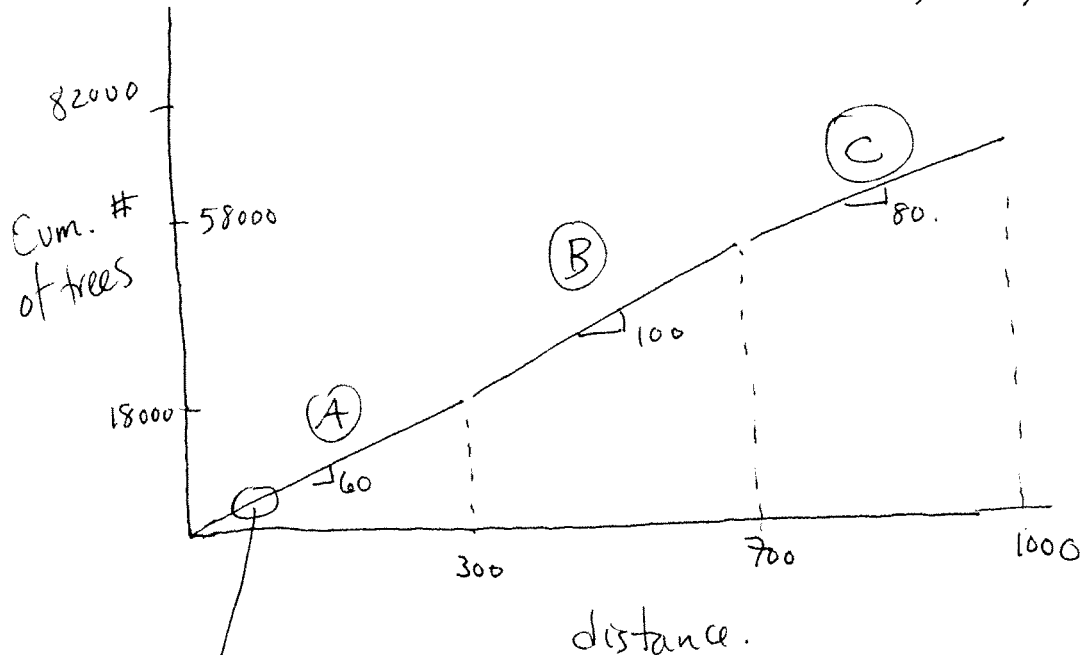
$$\begin{aligned}S^*(d) &= 12.9 \text{ for } 0 < d < 300 \\S^*(d) &= 10 \text{ for } 300 < d < 700 \\S^*(d) &= 11.8 \text{ for } 700 < d < 1000\end{aligned}$$

Number of facilities is thus 23, 40, and 27 for the three regions, with a total of 90 facilities (this may vary slightly depending on rounding), with a total cost of the facilities of \$2,250,000.

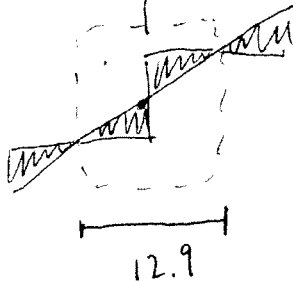
The transport cost is calculated by determining the travel distance of the trees. I asked for your best estimate of cost, and the methods here vary slightly, but should be close to ~~\$4,500,000~~. The total cost is this approximately ~~\$6,720,000~~.

2,326,010.50

4,576,010.50



(A)



$$\text{area} = \frac{1}{2} \cdot 6.45 \cdot 387 \approx 1248$$

$$2 \cdot 1248 \cdot 23 = 57,411.45.$$

(B)

$$\frac{1}{2} \cdot 5 \cdot 500 = 1250$$

$$2 \cdot 1250 \cdot 40 = 100,000$$

Total area =

$$232,601.05$$

$$\times \$10$$

$$= \$2,326,010.50$$

(C)

$$\frac{1}{2} \cdot 5.9 \cdot 472 = 1392$$

$$2 \cdot 1392 \cdot 27 = 75,189.6.$$