Why does high drainage density have a short path of overland flow?

Answer

Look at the expression describing drainage density:

$$Drainage\ density = \frac{1}{2 \cdot length\ of\ overland\ flow}.$$

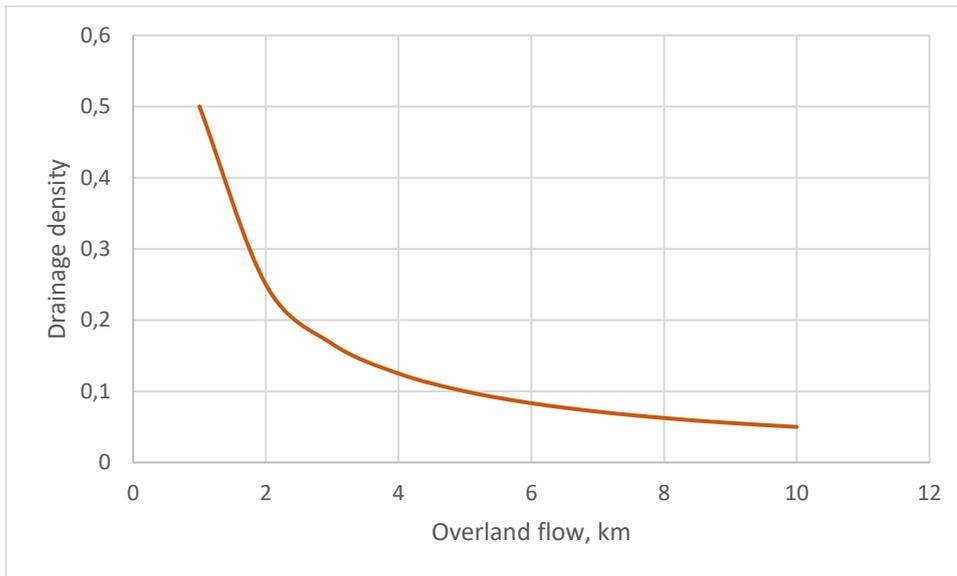Plot a graph of this function:

Figure 1 Dependence of drainage density on overland flow

Since the drainage density is *reciprocal* to two times of the length of overland flow, the shorter the flow is – the higher is the density.