2.2.2. Inferences for Two Population Means: Using Two Paired Samples

Example of Paired Design: Research on Impacts of Climate Change on Mangroves in Tanzania

Estimate of the mean difference: $\bar{d} = \frac{\sum d}{n} = -82/10 = 8.2$

Standard deviation of the difference: $s_d = \sqrt{\frac{\sum d^2 - \frac{(\sum d)^2}{n}}{n-1}} = 9.94205$

Standard error of the mean difference: $SE(\bar{d}) = \frac{S_d}{\sqrt{n}} = \frac{9.94205}{\sqrt{10}} = 3.14395$

$$t = \frac{\bar{d}}{S_d/\sqrt{n}} = \frac{\bar{d}}{SE(\bar{d})} = \frac{8.2}{3.14345} = -2.608$$

$df = n - 1 = 9$

P-value: $(0.01 < P < 0.02) \times 2 \rightarrow 0.02 < P < 0.04$
There is strong evidence against H_0.
$P < \alpha(0.005)$, therefore reject H_0.

At the 5% siginifcance level, there was significant change (increase) in mangrove abundance from 2007 to 2009 (since mean basal area was higher in 2009 than 2007 that means there was an increase.)

Example of a Paired t-interval

> calculate a 95% confidence interval for the difference in mangrove basal area in Site SR1 between 2007 and 2009.

df = 10 - 1 = 9

For 95% CI, $\alpha = 0.05, t_{\alpha/2} = t_{0.05/2} = t_{0.025} = 2.262$

$d \pm t_{\alpha/2} \times \frac{S_d}{\sqrt{n}} = -8.2 \pm 2.262 \times 3.14395 = -8.2 \pm 7.11 = (-15.31, -1.09)\ cm^2/25 - m^2$

2.3 Parametric Methods, Transformations and Nonparametric Methods