Province of British Columbia

Ministry of Forests

STEPS TO CALCULATE CONFIDENCE LIMITS FOR SILVICULTURE SURVEYS

df	95% (.05, 1 TAILED) / 90% (.05, 2 TAILED)
4	2.132
5	2.015
6	1.943
7	1.895
8	1.860
9	1.833
10	1.812
11	1.796
12	1.782
13	1.771
14	1.761
15	1.753
16	1.746
17	1.740
18	1.734
19	1.729
20	1.725
21	1.721
22	1.717
23	1.714
24	1.711
25	1.708
26	1.706
27	1.703
28	1.701
29	1.699
30	1.697
40	1.684
60	1.671
120	1.658
∞	1.645

STEPS TO CALCULATE CONFIDENCE LIMITS

n = # of plots
x_i = # of well-spaced trees in plot
Σ = summation of

$$s = \sqrt{\frac{\Sigma x_i^2 - (\Sigma x_i)^2/n}{n - 1}}$$

p = plot multiplier
LCL = lower confidence limit
MSS = minimum stocking standard
e = desired precision level

1. Calculate mean of well-spaced trees ($\bar{x}$).
2. Calculate standard deviation (s).
3. Calculate standard error of mean

   $s_{\bar{x}} = s/\sqrt{n}$
4. Find t value for 90% & n - 1 df.
5. Multiply t value by $s_{\bar{x}}$ which equals the Confidence Interval (CI)

   $\bar{x} \pm$ CI

   This can be expressed as average per plot or multiplied by 200 (plot multiplier for 50m^2 plots) to convert to stems/ha.
6. Compare $\bar{x}$ and CI to the following decision rules:
   (a) If $\bar{x}$ - CI ≥ MSS, then the area is considered SR. No further plots are required.
   (b) If $\bar{x}$ < MSS, then the area is considered NSR. No further plots are required.
   (c) If $\bar{x}$ > MSS and $\bar{x}$ - CI < MSS, establish more plots to obtain a sample estimate within
   ± 10% when $\bar{x}$ > 1,000 s/ha
   (e = ± .1$\bar{x}$)
   ± 100 s/ha when $\bar{x}$ < 1,000 s/ha at 90% CI
   (e = ± .5 for 50 m^2 plots)

TESTING THE DIFFERENCE BETWEEN TWO MEANS

STEPS TO TEST DIFFERENCE

1. Ho: $| \mu_M - \mu_L | = d$
   THE DIFFERENCE BETWEEN MIN. AND LIC. POP'N IS d.

2. $H_1 : | \mu_M - \mu_L | > d$
   THE DIFFERENCE IS GREATER THAN d.

3. CHOOSE LEVEL OF SIGNIFICANCE $\propto = 5\%$ (1 TAILED TEST).

4. CRITICAL REGION: $T > t \propto$
   WHERE T IS A RANDOM VARIABLE WITH A t DISTRIBUTION AND $n_M + n_L - 2$ df.

5. COMPUTE $\bar{x}_M$ and $\bar{x}_L$ and s_P FROM INDEPENDENT RANDOM SAMPLES OF SIZE n_M & n_L AND CALCULATE:

$$t = \frac{| \bar{x}_M - \bar{x}_L | - d}{s_P \sqrt{1/n_M + 1/n_L}}$$

6. REJECT Ho IF $t > t \propto$, OTHERWISE ACCEPT Ho.

VARIABLE LIST

Ho & H_1	HYPOTHESES BEING TESTED.
μ_M & μ_L	MIN. & LIC. POP'N MEANS
d	ACCEPTABLE DIFFERENCE BETWEEN μ_M & μ_L (.5 or 100 s/ha FOR SURVEYS)
$\propto$	LEVEL OF SIGNIFICANCE (95% COINFIDENT, 1 TAILED)
n_M & n_L	NO. OF PLOTS FOR MIN. & LIC.
t	TEST STATISTIC
$t \propto$	t VALUE FOR $\propto = 5\%$ & $n_M + n_L - 2$ df. CRITICAL VALUE OF THE t DISTRIBUTION.
$\bar{x}_M$ & $\bar{x}_L$	SAMPLE MEANS FOR MIN. & LIC.
s_L & s_M	STANDARD DEVIATIONS FOR MIN. & LIC.
s_P	POOLED SAMPLE STANDARD DEVIATION
$s_P = \sqrt{\frac{(n_M - 1) s_M^2 + (n_L - 1) s_L^2}{n_M + n_L - 2}}$	
$T > t \propto$	CRITICAL REGION
df	DEGREES OF FREEDOM