ASSESSMENT OF METHODS FOR INVENTORYING LOW DENSITY SPECIES

By

KISSA DAVID OCAMA

(Makerere University College of Agricultural and Environmental Sciences /ITFC)

Background

- The best sampling technique should provide accurate and representative information about the population studied while requiring the least amount of field effort (Scott & Gove, 2002).
- Statistical efficiency of a sampling method may be described as the ability of the method to yield relatively lesser variation in the estimates of the population (Johnson, 2000).
- Efficiency of any method can be best described in terms of the precision.

- A sampling method would be more suitable for inventorying a population if the coefficient of variation and time required for the inventory are relatively lower.

Objective

To evaluate and compare the effectiveness of the distance and the belt methods in estimating the density of *M. holstii* trees.

Significance

To sustainability manage a resource, a reliable estimate of its potential and the distribution pattern are crucial.

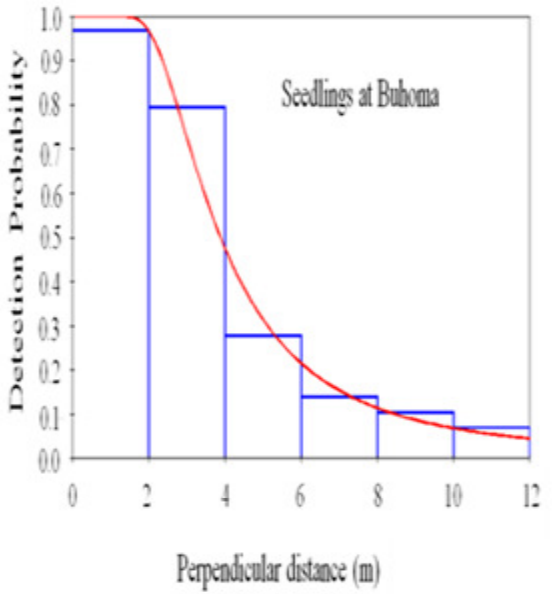
Method

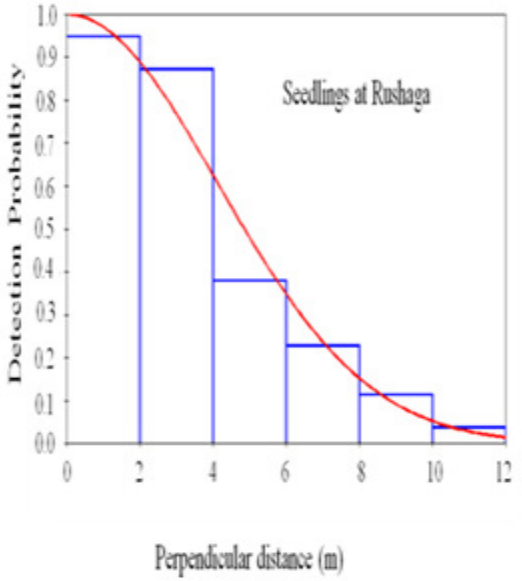
- The sampling method and the design used in an inventory depend on the distribution of the species, the budget and the objective of the inventory.
- The study area was Bwindi Impenetrable Forest National Park and three sites where selected.
- Line transect method was used with two sampling procedures i.e. Distance sampling & fixed belt sampling.
- Eight (8) transects of varying lengths were used

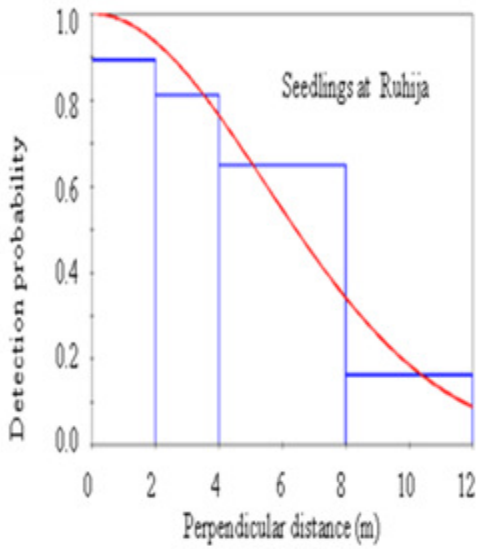
Tree enumeration & data analysis

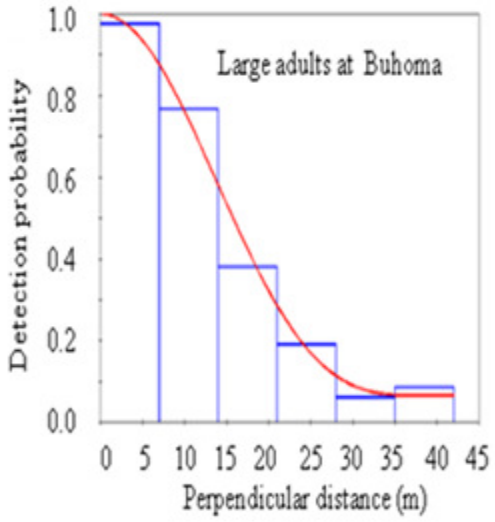
- *Myrianthus holstii* were categorized as seedlings (Dbh ≤ 2.5 cm), saplings (>2.5 to ≤ 5.0cm), small adults (>5.0 to ≤10.0cm) and large adults (>10.0cm).
- The distance along the transect and the perpendicular distance were measured using measuring tape.
- Distance software was used to calculate the tree density from distance data & MS Excel for belt data.

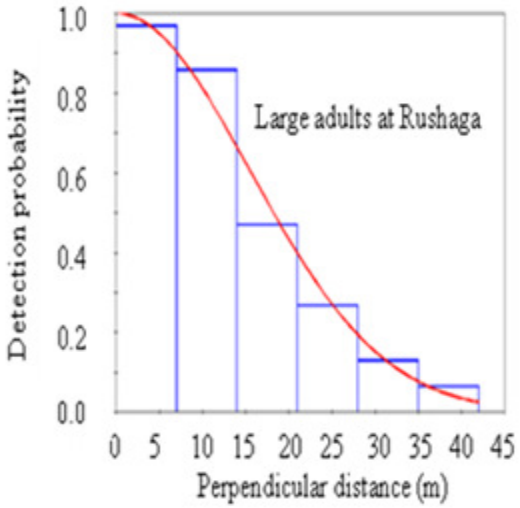
Results & Discussion











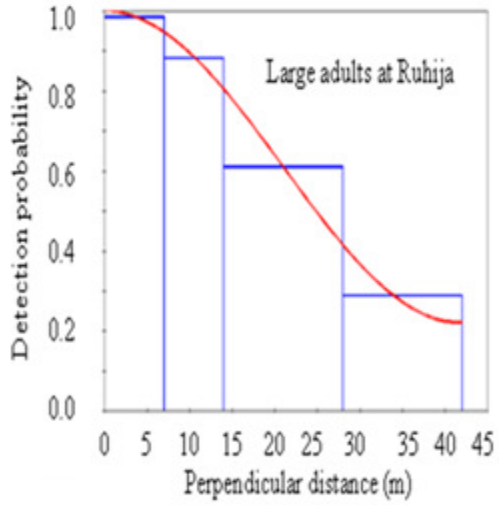


Table 1 Comparison of coefficient of variation (% CV), per cent relative bias (PRB) of the distance density estimates and the belt density estimates for different size-classes of *M. holstii* trees at Ruhija, Rushaga and Buhoma, BINP.

		Density (trees/ha)		*% CV*	*% CV*	*PRB*
Site	*Tree category*	*Distance method*	*Belt method*	*Distance method*	*Belt method*	
Ruhija	Seedlings	2.05	1.56	13.58	29.43	-23.90
Ruhija	Saplings	1.28	0.92	10.8	55.99	-28.13
Ruhija	Small adults	**1.01**	**0.50**	7.38	108.18	-50.50
Ruhija	Large adults	1.22	1.04	7.90	57.57	-14.75
Ruhija	All combined	4.82	3.99	8.69	21.02	-17.22
Rushaga	Seedlings	**5.08**	**2.70**	11.54	13.05	-46.85
Rushaga	Saplings	2.59	1.90	14.67	20.41	-26.64
Rushaga	Small adults	1.92	1.55	9.30	22.93	-19.27
Rushaga	Large adults	4.45	4.41	4.50	8.80	-0.90
Rushaga	All combined	10.38	10.24	4.61	5.08	-1.35
Buhoma	Seedlings	3.91	3.09	14.51	15.03	-20.97
Buhoma	Saplings	**3.17**	**1.83**	9.87	17.84	-42.27
Buhoma	Small adults	3.32	3.04	12.30	12.55	-8.43
Buhoma	Large adults	6.78	6.21	6.55	8.80	-8.41
Buhoma	All combined	14.47	14. 17	5.65	5.90	-2.07

- The densities estimated by the distance approaches are higher than the densities estimated by the belt method (Table 1) and were significantly different across the entire study sites (Wilcoxon test $p < 0.002$).
- PRB shows the extent of underestimation of density by the belt method (Table 1).
- The dense climbers/undergrowth and the long nature of the transect.

- The distance approach had lower values of %CV for all the different sizes at every site. This means distance method is good at minimizing standard error with few observations. Buckland (2001) suggested minimum no. of observations (30). Sufficient sampling can reduce the standard errors because variance reduces as no. of observation increases. Plumptre (2000) recommended %CV of 25 – 30 % as a good estimator of species population. % CV ranged from 4.50 – 14.67%.

Table 3 Comparison of economic efficiencies of the belt and distance sampling methods at Ruhija, Rushaga and Buhoma study sites in BINP.

Study Site	*a) Belt sampling*			*b) Distance sampling*		
	Efficiency Parameters			*Efficiency Parameters*		
	Man – hours/transect (hr)	*Trees within a transect/ man-hrs (No/hr)*	*Cost of sampling a tree (Shillings/tree)*	*Man – hours/transect(hr)*	*Trees within a transect/ man-hrs (No/hr)*	*Cost of sampling a tree (Shillings/tree)*
Ruhija	1.1	1.06	1478	1.96	4.81	580
Rushaga	1.25	2.88	618	2.13	10.65	285
Buhoma	1.23	3.77	465	2.03	14.02	206

Same number of field crews was employed in each of the method and cost of man-hour (Ug. Shs) = 1424.

- The number of trees recorded per man-hours was higher using the distance method compared to the belt method at all sites (Wilcoxon signed-rank test of $p < 0.012$ at all the sites). The cost of sampling a tree is lower using the distance method compared to the belt method at all the study sites. More *M. holstii* trees were sighted beyond the 5 m half strip width using the same field effort. This concurs with Buckland *et al (*2001).

Conclusions

- Both methods have bias associated with them e.g. underestimation by belt method, detection probability modeling if not well done leads to either underestimation or overestimation.
- The density of juveniles was lower compared to the density of mature trees at all the study sites.
- The number of females was significantly higher than males at lower altitude.
- *M. holstii* trees had clumped distribution in all the three study sites.

Recommendations

- The distance method is the most reliable compared to the belt method in estimating density of low species such *M. holstii* trees due to its better precision.
- Legalizing fruit harvesting to a limited quantity may not be a problem because the number of female *M. holstii* trees are relatively high especially at low altitude zones.
- Further research needs to be carried on factors affecting fruit availability within BINP in order to add more information for decision making.