Which Vegetation Sampling Approach Is More Efficient for a Rangeland Inventory?

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Key words : sampling techniques , canopy cover , precision , accuracy , time/cost consumption , Zagros region

Introduction Iran's rangelands cover about 90 million hectares and provide a wide variety of products and services . Aims of a sampling plan would include maximum efficiency to provide the best statistical estimates with low cost and high precision . It is very important that sampling provides an unbiased estimate of the variance and the mean of the parameters being studied . Designing efficient sampling techniques is a critical processe to all management decisions . On the other hand , the consequences of poor sampling design are loss of both time and money , reduced creditability , incorrect management decisions , and , eventually , rangeland deterioration . The objectives of our study were to compare three vegetation sampling techniques of (1) random (RNDM) , (2) systematic (SYSM) , and (3) random-systematic sampling (RND-SYSM) in terms of precision , accuracy , and time-cost consumption to characterize the vegetation of a mountainous region in Iran .

Material and methods The study area is located in southern part of Zagros mountain in Iran between 52°20′ to 52°23′ E and 29°52′ to 29°54′ N . The mean annual precipitation is 594 mm and mean annual temperature is 14 .9℃ . The study area was stratified based on physical characteristics (slope , aspect , and elevation) by using GIS . In each homogenous unit , three sampling techniques were established to record canopy cover , production , and time/cost consumption .

Results Differences among sampling techniques were significant ($P<0.01$) for all criteria except for accuracy of production (Table 1) . The efficiency of different criteria was ranked and shown in Table 2 .

Table 1 *Comparison of three sampling methods for different criteria .*

Sampling Method	Time/Cost Consumption (min .)		Accuracy		Precision(Variance)	
	Production	Cover	Production	Cover	Production	Cover
RNDM	3 .31[b]	3 .31[b]	57 .52[a]	33 .9[a]	525 .32[a]	219 .33[a]
SYSM	2 .33[a]	2 .33[a]	61 .64[a]	38 .36[b]	532 .16[a]	283 .24[b]
RND-SYSM	2 .13[a]	2 .13[a]	61 .73[a]	37 .15[b]	701 .19[b]	216 .67[a]

Table 2 *The ranking of efficiency for three sampling methods .*

	Time/Cost*		Accuracy		Precision	
	Production	Cover	Production	Cover	Production	Cover
RND-SYSM	1	1	2	1	3	1
SYSM	2	2	1	2	2	3
RNDM	3	3	3	3	1	2

* For time/cost , accuracy , and precision , 1 was the highest efficiency .

Conclusions The results showed that for cover estimation RND-SYSM had the highest precision and accuracy and the lowest time/cost consumption . On the other hand , the RNDM had the lowest accuracy and the highest time/cost consumption . The highest accuracy for production estimation was belonged to SYSM and the highest precision was belonged to RNDM . The highest time/cost efficiency for production and cover estimations was belonged to RND-SYSM .

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