

Root system ecology of shrubs in Qilian Mountains alpine *rhododendron* shrubland

Cao Wenxia , Zhang Degang , Hong Fuzeng

Grassland Science College , Gansu Agricultural University , Lanzhou 730070 , China . E-mail xaowenxia@sina.com

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Introduction The Qilian Mountains National Nature Reserve located in the northeastern edge of Qinghai-Tibet Plateau is the key areas for global climatic change research . The alpine *Rhododendron*-shrubland survived above 3 000m in protection area has been attracting the attention for its important ecological services function , and is also the summer-pasture for rare white yak and other herbivores . Under global warming background , what or how the impact caused on the shrubland ecosystem by increasing human disturbance are the main reasons of this study . From root system ecology to understand belowground ecological characteristics and response of ecological process to disturbance could provide belowground ecological data and theoretical support for scientific utilization and conservation , however , alpine shrub root system studies were seldom found . The root system architecture and spatial distribution of 16 shrub species existing in alpine *Rhododendron* shrubland were studied , and the relationship with environment were discussed .

Methods The study area was the north slope of the Eastern Qilian Mountains , about 5 km from research station of GSAU . The shrub species existing in alpine *Rhododendron* shrubland were investigated including *Rhododendron thymifolium* (*R . t*) , *R . capitatum* (*R . c*) , *R . anthopogonoides* (*R . a*) , *R . przewalskii* (*R . p*) , *Salix oritrepha* (*S . o*) , *S . rehderiana* (*S . r*) , *S . sclerophylla* (*S . s*) , *Lonicera hispida* (*L . h*) , *L . rupicola* (*L . r*) , *L . ferdinadii* (*L . f*) , *Potentilla fruticosa* (*P . f*) , *Spriaea alpina* (*Sp . a*) , *Caragana jubata* (*C . j*) , *Arctostaphylos rubra* (*A . r*) , *Rubus irritans* (*R . i*) and *Hippophae tibetica* (*H . t*) . Coarse root length and distribution were studied by using traditional skeleton method to expose root systems , and fine root length and distribution were studied by soil core sampling method and wet-sieving method (Mou P . , 1995 ; Robert 2001) .

Results The root system of shrubs spread mainly in the 0-30 cm soil layer (Figure 1) . The shallow root dominant species (*R . t* ; *R . c* ; *R . p* ; *S . o*) and subdominant species (*S . r* ; *S . s* ; *R . a* ; *L . f*) form the constructive synusia of the community ; deep-rooted shrubs (*Sp . a* ; *P . f* ; *C . j*) are only companion species form the middle synusia ; *L . h* ; *A . r* compose the low synusia , other species are rare species in community .

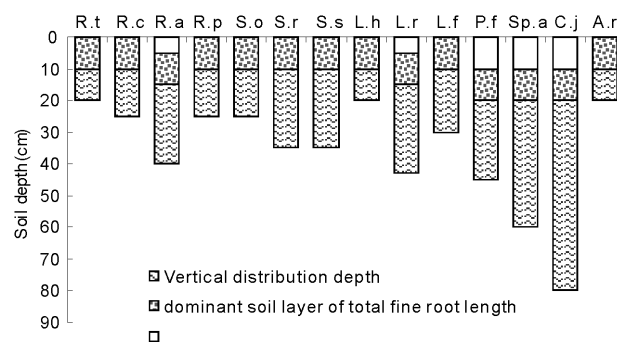


Figure 1 Overlapping and separation of niche of different shrub roots in soil layer .

Discussion By using niche overlapping and separating theory , the role of 16 shrubs species in the community and the relationship with environment can be explained . The dominant species and subdominant species adapt to the alpine freezing and humid environment with shallow and dense root distribution , but deep-rooted shrubs only can survived occasionally in community . Global climate warming and human activity disturbance may lead that the deep-root style shrubs replace the current shallow-roots type's constructive species in succession . The hypothesis is consistent with the status of serious damaged *Rhododendron* shrubland and transitional zone .

References

- Mou P . R . H . Jones R . J . *et al .* , (1995) . Spatial distribution of roots in sweetgum and loblolly pine monocultures and relations with aboveground biomass and soil nutrients . *Functional Ecology* , 9 , 689-699 .
Robert P . Gibbens *et al .* , (2001) . Root systems of some Chihuahuan Desert plants . *Journal of Arid Environments* , 49 , 221-263 .