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Changes of persistent soil seed bank in degraded *Seriphidium transillens* desert grassland

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Key words : *Seriphidium transillense* desert grassland , degradation stage , soil seed bank , species diversity

Introduction *Seriphidium* desert is generally the dominant native grassland type and is extensively distributed in central Asia , especially on the northern slopes of the Tianshan Mountains . It playing an important role in stockbreeding and ecosystem . Persistent soil seed bank plays a key role in vegetation restoration after disturbance ,but research about *Seriphidium transillens* desert seed bank is relatively few . In this paper we address the following two questions :(1) what changes happend under different degradation degreea about soil seed bank ? (2) why the changes happened ?

Materials and methods The study area is the spring – autumn pastures of Ashili village (N43°49′～43°56′ ,E87°02′～87°05′) , is open flat alluvial plain and located on the northern side of the Tianshan Mountains , in Xinjiang , China . The dominant flora on the study sites is *Seriphidium . transillense* , the companion species are *Petrosimonia sibrica* , *Tulipa iliensis* , *Trigonella arcuata* and *Ceratocarpus arenarius* . We divided grassland into four types according degradation gradients , non-degradation (ND) , media-degradation(MD) , heavy-degradation(HD) and over-degradation(OD) . Samples of soil seed bank were collected on April 17 , 2006 , sample's area is 38 .5 cm^2 , and soil depth are 0～5 , 5～10 and 10～15 cm respectively , and every degradation stages set four repetitions . Use Germination Method to identify the seeds in greenhouse .

Results and discussions Composition of soil seed bank :ND has 6 species , *Seriphidium transillense* , *Tetracma quadricornis* , *Eragrostis pilosa* , *Chenopodium alubum* , *Amaranthus retroflexus* , and *Malcormia africana* , MD has 8 species , *Seriphidium transillense* , *Petrosimonia sibirica* , *Eragrostis pilosa* , *Tetracma quadricornis* , *Chenopodium alubum* , *Amaranthus retroflexus* , *Trigonella arcuata* , and *Ferula ferulaeoides* , HD has 7 species , *Eragrostis pilosa* , *Tetracma quadricornis* , *Chenopodium alubum* , *Amaranthus retroflexus* , *Trigonella arcuata* , *Peganum harmala* , and *Amaranthus mangostanus* , and OD has 8 species , *Kochia prostrata* , *Petrosimonia sibirica* , *Salsola bracchita* , *Eragrostis pilosa* , *Tetracma quadricornis* , *Malcormia africana* , *Trigonella arcuata* , and *Peganum harmala* . We use Mehinick Richness Index(MRI) , Alatalo Evenness Index(AEI) , Gini Diversity Index(GDI) to study species diversity of the persistent soil seed bank . The three indexes have the same change tendency , and least in ND , increase from ND to MD and then decrease little from MD to OD . In the course of degradation , invasive species occupy the niche of dominant species , so the species diversity of soil seed bank increased . But it will decrease as the degradation enhanced . The seed number are 683 , 455 , 374 , and 611 seeds/m^2 respectively in four degradation stages . In ND , the rate of constructive species seeds , *Seriphidium transillense* , is 50% , but 5% in MD , 0% in HD and OD . Constructive species can not complete its life history under higher grazing stress , so seed number decrease . But in OD , invasive species replaced constructive species gradualy , and their reproductive strategy made seed number increase . To the three vertical layers , the distribution rate of seeds is respectively 62% , 14% , 24% in ND , 72% , 14% , 14% in MD , 44% , 35% , 21% in HD , 83% , 6% , 11% in OD . The total seeds number decrease gradually with soil depth , and 66% of total seeds distribute in 0～5 cm soil depth . Grazing stress made soil compaction increase , so it is difficult for seeds to sedimentate , and most of total seeds exist in surface layer of soil .

The soil seeds of suffrutex artemisia and ephemeral/ephemeroid species are both more than the number of their overground plant seedlings , but result of annual species is reversed . Grazing stress made the two types of species sufferr much more , they have no chance to produce seeds , so convert to agamogenesis strategy , furthermore most of seeds remain dormant in soil , so give annual community an opporunity to grow and propagate .

Conclusions As the grazing stress enhanced , (1) Richness , evenness , and diversity of vegetaton all increase more or less , and species invade severely in MD . (2) Seed number decrease from ND to HD , but increase much in OD . And most of seeds exist in surface layer of soil . (3) Seeds of suffrutex artemisia and ephemeral/ephemeroid species , select temporary dormancy strategy to evade adversity , but these stimulate the seeds of annual species to bourgeon and propagate .

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