

高寒草甸生态系统消费者亚系统生物量动态模型的研究

I. 消费者亚系统的主要组成成分及建模代表的选择

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STUDY ON THE BIOMASS DYNAMICS MODEL OF CONSUMER SUBSYSTEM IN THE ALPINE MEADOW ECOSYSTEM

I. THE MAIN COMPONENTS OF CONSUMER SUBSYSTEM AND THE SELECTION OF MODELING SPECIES

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ABSTRACT

The simulation model of biomass dynamics for consumer subsystem in the alpine meadow ecosystem has been described in this paper and, experiences and lessons, both domestic and international, concerning grassland modeling and system analysis have been discussed.

The objective of this model is to simulate biomass dynamics of consumers, the relationship between consumer abundance and food conditions, the competition among the primary consumers, the relationship between the primary and secondary consumers during a specific time of observation and within the limits of a certain area, as well as to lay a foundation for modeling the energy dynamics of consumer subsystem.

We take into consideration only the consumer of grazing food web (biophagic path way) comprising herbivores feeding on plants, which in turn serve as the food for carnivores, and the consumers of the detritus food web (saprophagic path way) containing the decomposer organisms regardless of the existence of their predators.

The main components of consumer subsystem are as follows:

Primary consumers: This category consists of a number of domestic animals, such as Men Yuan horses, yaks and Tibetan sheep, as well as some wild mammals, such as, *Procapra plicicaudata*, *Capreolus capreolus*, *Ochotona curzoniae*, *O. cansa*, *Marmota himalayana*, *Cricetulus longicaudatus*, *Myospalax baileyi* and *Microtus oeconomus*, etc.. Of the wild mammals mentioned above, *Ochotona curzoniae* and *Myospalax baileyi* are not only wide spread, but also the most abundant in quantity. Therefore, they both affected the alpine meadow ecosystem greatly. Of the wild mammals no more than two species of birds are genuine herbivorous, i.e. *Carduelis flavirostris* and *Urocynchramus pylzowi*. The other birds are omnivorous. They are: *Eremophila alpestris*, a resident bird, holding a dominant position in alpine meadow ecosystem, a subdominant species, *Melanocorypha maxima* and some common species—*Montifringilla taczanowskii*, *M. ruficollis ruficollis*, and part of the summer migratory birds—*Tringa totanus*, *T. ochropus*, etc.. Usually they feed on grass seeds but on insects during brood period.

The herbivorous insects are numerous amounting to 47.8% of the total species, such as

Chorthippus brunneus, *C. biguttulus*, *C. fallax*, *C. dorsatus*, *Nysium ericae*, *N. ericae atticola*, *Lugus pratensis*, *Chlamydotus* sp. and *Plagionathus* sp. with *Orgyia aurollimbia* and *Gynaephora alpherakii* added to the record for the first time in the late 60s.

Secondary consumers: This category includes small carnivorous mammals, such as *Mustela altaica*, *M. evermanni*, both of which prey mainly on small rodents and birds. This group also contains *Vulpes vulpes*, *V. ferrilata* and *Felis manul*, etc.. The species of birds belonging to this group are *Aquila chrysaetos*, *Falco tinnunculus*, *Athene noctua*, and some species of birds feeding on insects, such as *Podoces humilis* and part of the summer migratory birds—*Riparia riparia*, *Motacilla citreola*, *M. alba*, *Anthus roseatus*, *Phoenicurus ochruros* and *Locustella certhiola*, etc..

The third consumers: This category includes *Canis lupus*, *Cuon alpinus*, both of which prey on *Vulpes vulpes*, *Vulpes ferrilata* and *Felis manul*. They also feed on small-medium size herbivorous mammals, such as *Procapra picticaudata*, *Ochotona curzoniae* and rodents. This group also contains birds of prey, such as *Aquila chrysaetos* and *Buteo hemilasius*, etc..

The main components of consumer subsystem in alpine meadow ecosystem are too complicated for us to build a model of it. It is impossible for us to put each main component into the model, yet we could select some of the main components. They play an important role in the alpine meadow ecosystem and thus can serve as "representatives". This approach does not effect the truthfulness of the model but simplifies its structure greatly, thus we made the calculation and adjustment more flexible and movement more convenient.

We have selected six representative species at different nutritional levels and carried them into the model. They are as follows:

Primary consumers: A domestic animal—tibetan sheep; herbivorous small mammals—*Ochotona curzoniae* and *Myospalax baileyi*; herbivorous insects—*Orgyia aurollimbia* and *Gynaephora alpherakii*.

The mediate species between primary and secondary consumers is an omnivorous bird, *Eremophila alpestris*.

Secondary consumer: *Mustela altaica* is one of the main natural enemies for *Ochotona curzoniae* and *Myospalax baileyi*.

Since the density of the third consumers is quite low and they do not have much impact in alpine meadow ecosystem, therefore, not included in the model.