自然保护与生态

基于Markov-CA模型互花米草扩张影响因素与强度辨识

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Identification of Factors Affecting Expansion of *Spartina alterniflora* and Their Intensities Using CA-Markov Model

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摘要 外来物种扩散过程是生态入侵调控研究的重要内容之一。利用江苏盐城海岸带3期遥感数据,借助GIS技术和Markov-CA模型,在不同影响因素条件下,对互花米草(*Spartina alterniflora*)扩张进行模拟,辨识互花米草扩张影响因素及其强度。结果显示:(1)1991—1997和1997—2007年2个时段互花米草实际年均扩张率分别为24.39%和7.76%,表明1991—1997年互花米草迅速扩张,2007年之后扩张有减缓趋势。(2)在海岸带互花米草若任其自由生长,扩张率则最大,1997—2007和2007—2017年其年均扩张率(强度)分别为9.40%和6.78%;受植物种群竞争影响,互花米草沼泽年均扩张率分别减小为7.10%和5.49%;受植物种群竞争和人为干扰的影响,互花米草沼泽年均扩张率则分别为7.10%和5.24%。(3)植物种群竞争因素影响使2个时段互花米草年均扩张率分别减少2.30和1.29百分点,人为干扰使2个时段互花米草年均扩张率变化量分别为0和0.25百分点。(4)Markov-CA模型可用以揭示盐城海岸带外来入侵种群扩张过程与影响因素的关系,为湿地资源合理开发和生物多样性保护提供科学依据。

关键词: 互花米草扩张   Markov-CA模型   影响因素   辨识   盐城滨海区域

Abstract: Expansion process of alien species is an important content of the study on management and control of ecological invasion. Based on the 1991, 1997 and 2007 remote sensing images of the coast of Yancheng, Jiangsu, expansions of *Spartina alterniflora* under different conditions were simulated and factors affecting the expansion and their intensities were identified with the aid of GIS technology and the Markov-CA model. Results show that (1) the actual annual expansion rate of *S. alterniflora* was 24.39% during the period of 1991-1997 and 7.76% during the period of 1997-2007, indicating that the species expanded rapidly in the former period and the expansion slowed down during the latter period; (2) the annual expansion rate of *S. alterniflora*, when the plants were let grow freely, was the highest, reaching 9.40% and 6.78% during the two periods, separately, and declined to 7.10% and 5.49%, separately, when growth of the plants was affected by competition of other species in the community and to 7.10% and 5.24%, separately, when growth of the plants was affected by both competition of other species in the community and artificial disturbance; (3) affected by competition of other plant species in the community, the annual expansions rate of *S. alterniflora* decreased by 2.30 and 1.29 percentage point,respectively, and affected by artificial disturbance, it did by 0 and 0.25 percentage point, respectively;and (4) the Markov-CA model built in this study can be used to get some valuable insights into the relationships between the expansion processes of exotic plant species and its affecting factors, which may provide some scientific basis for rational exploitation of wetland resources and conservation of biodiversity in the coastal zone of Yancheng.

Keywords: expansion of *Spartina alterniflora*   Markov-CA model   affecting factor   identification   coastal zone of Yancheng

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