

Assessment of ecosystem vulnerability to climate change with CEVSA model in Korea

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Abstract

Ecosystem has been affected by climate change on its structure and functions. Quantitatively assessing vulnerability of ecosystem to climate change is essential for understanding climate change effect on ecosystem and preparing adaptation approaches.

Vulnerability can be defined with relation to sensitivity and adaptation. In this study, for assessing the vulnerability of Korean ecosystem, CEVSA (Carbon Exchange between vegetation, soil, and atmosphere) model, a process-based ecosystem model, is employed. A new quantitative approach in CEVSA model is developed to assess the vulnerability of ecosystems with two aspects: vegetation distribution and ecosystem function. Regarding vegetation distribution, sensitivity and adaptation to climate change are quantitatively assessed by change frequency and direction in vegetation distribution change, respectively. Annual variability and its changing trend in ecosystem functions quantified the sensitivity and adaptation of ecosystem function to climate change.

The vulnerability of Korean ecosystem under contemporary (1977~2006) and future (2007~2100) climate was assessed with the CEVSA model in vegetation distribution and ecosystem functions. In result, high vulnerability of vegetation distribution under future climate shows in north-eastern area. And the percent of extreme high vulnerable area is assessed to increase from 28.70% to 36.11% compared to current vegetation distribution vulnerability. The vulnerability of ecosystem function under future climate is estimated to be generally in extreme low class (75.51%) spreading on whole Korean peninsula, but the extreme high vulnerable area will be shown sporadically in center and south coast of Korea. As the result of integrating them, the vulnerability of Korean ecosystem under future climate is estimated to be low, but the percent of high vulnerable area will increase 0.92% to 13.53%.