

Spatio-temporal characteristics of water budget due to the paddy field expansion in Naoli River Basin

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Since early 1990s, the agricultural structure of Naoli River Basin had been greatly changed with large amount of dry land transformed into paddy field. This resulted in serious water resources insufficiency. We were trying to reveal the water profit and loss situation under the cultivated land resources variation in this river basin, so as to predominate the overall spatial and periodical situation of water budget in Naoli River Basin and provide scientific basis for adjusting the layout of farmland. We analyzed the condition of Naoli River basin by using related model to compute the actual evapotranspiration (ET), and calculated the farmland water needs of the cultivated land in this basin by modeling the rice planting proportion coefficient which could show the cultivated land structure. Also through using the established water profit and loss degree evaluation model, which could reflect the potential shortage of water budget, it structured the order of evaluation standard to analyze the variation of area changes at different levels of moisture shortage. We discussed the water profit and loss situation of cultivated land resources in Naoli River Basin under the situation where the cultivated land was constantly changed in the basin between 1990 and 2014, and modeled future scenarios by using the CA-Markov model. All above analysis used the remote sensing image data, the long-term sequenced meteorological data and the DEM data as its fundamental data resources. Results showed that the changes between the paddy field and the dry land in Naoli River Basin were incredibly violent. The growth rate of cultivated land decreased gradually from 1990 to 2014, and different periods showed different changing characteristics. During the period between 1990 and 2002, the paddy field area increased dramatically, while the dry land increased slightly. From 2002 to 2014, the growth rate of paddy field area showed significantly decreased characteristics and the total dry land area decreased in a certain degree. The changes of the cultivated land's water profit and loss degree were obvious and the spatial distribution differences of the profit and loss index evaluation grades were great. The change magnitude was also not the same in different periods. From 1990 to 2002, the farmland types, which were evaluated by the cultivated land's water profit and loss grades, were dominated by moderate and serious moisture shortage in this river basin, and basically, there were no severe moisture shortage farmland types. In the period between 2002 and 2014, the biggest change happens to the mild moisture shortage types. On the other hand, the severe moisture shortage area decreased slightly. Among them, the proportion of farmland with normal water shortage was the biggest during these two periods. We also concluded that the water deficit of the farmland in this river basin would be further intensified, and the area with the higher grades of MPLD was more centralized, and partial high evaluated grades for the moisture shortage would expand in future. Except for the slight increase of the farmland with mild moisture shortage, the rest four evaluation grades farmland area all kept increasing, and the area of serious moisture shortage evaluation grades increased intensely. These research results can be used as references and consultancies for the farmland irrigation schemes in Naoli River Basin.

Keywords: farmland, moisture budget, simulation, Naoli River Basin