



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 13, Issue 7, July 2024

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.423

9940 572 462

6381 907 438

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Evaluation and Improvement Strategy of Drought and Flood Disaster Reduction Efficiency in Rural Hunan Province

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ABSTRACT: Agriculture is the foundation of the country and is easily affected by drought and flood disasters, so the establishment and improvement of rural "resilience" drought and flood disaster reduction system has become an important factor restricting agricultural development. This paper takes Hunan Province as the research area, evaluates the efficiency of drought and flood disaster reduction in rural areas, and formulates the improvement strategy. The main results are as follows: the overall technical efficiency of drought and flood disaster reduction in Hunan Province is low, the five-year average is 0.742, and the efficiency in western Hunan is the highest, which is 1.094. The efficiency of southern Hunan and northern Hunan is the lowest, which is 0.484, and the regional development is unbalanced. Technological progress has a significant impact on the improvement of drought and flood disaster reduction efficiency, and the change of technical efficiency index has a certain limit on disaster reduction efficiency. This study shows that the efficiency of drought and flood disaster reduction in rural Hunan province still has a large room for improvement. By increasing infrastructure investment, promoting technological progress, rational resource allocation and policy improvement, the efficiency of drought and flood disaster reduction in rural Hunan Province can be effectively improved, agricultural production safety can be guaranteed, and the smooth implementation of rural revitalization strategy can be promoted. Future studies should further explore the influencing factors and improvement mechanisms of drought and flood disaster reduction efficiency, so as to provide a more scientific and comprehensive reference basis for policy formulation and practical operation.

KEYWORDS. Drought and flood disasters; Disaster reduction efficiency; Data enveloping method;\

I. INTRODUCTION

The report of the 20th National Congress of the Communist Party of China pointed out that "the most arduous and onerous task of comprehensively building a modern socialist country is still in the countryside"; The comprehensive promotion of rural revitalization requires that rural areas maintain and improve the supply of food and important agricultural products while carrying out economic and industrial development, and optimize the ecological barrier, which puts higher requirements on the management of drought and flood disaster reduction in rural areas. In addition, the intensification of global climate change has increased the possibility and intensity of extreme weather events. In the face of the climate new normal with high incidence of extreme weather, how to establish and improve the rural "resilience" drought and flood disaster reduction system matching the defense against extreme weather has become a hot topic at present. Therefore, from the perspective of optimal management and efficient use of resources for disaster prevention and reduction in rural areas, based on the rural revitalization policy and the country's high attention to the effect and efficiency of disaster prevention investment in rural areas, the disaster prevention index data of rural drought and flood disaster management and response measures in rural Hunan province were collected and the efficiency of input and output for disaster prevention in rural Hunan Province was explored. It provides theoretical and practical suggestions for the optimization and improvement of drought and flood disaster reduction management in rural Hunan Province.

II. MATERIALS AND METHODS

2.1 Data Collection

The input-output index of drought-flood disaster prevention efficiency in rural Hunan Province was constructed according to the requirements of the topic selection, the evaluation area was determined, the input-output data were collected, and the data were processed, such as the number of agricultural employment (10,000 people), the drainage and irrigation machinery (units), and the effective irrigation area (thousands of hectares).

2.2 Data Analysis

The static evaluation model is determined, and the data envelopment analysis method is selected to compare the evaluation efficiency. Malmquist productivity index method was used to evaluate and analyze dynamic efficiency. Based on the efficiency evaluation results of Hunan Province as a whole and 14 cities, the study is carried out on various indicators such as comprehensive efficiency, pure technical efficiency, scale efficiency, scale return and redundancy analysis. Based on Malmquist productivity index and its decomposition index, Technical Progress index (TC) and technical efficiency index (EC), the change of disaster prevention efficiency of drought and flood in rural Hunan Province was analyzed.

III. RESULTS AND DISCUSSION

3.1 Comprehensive technical efficiency

The overall level of comprehensive technical efficiency of agricultural drought and flood disaster reduction in Hunan Province is low, with an upward trend in 2017 and 2019, but a decline in 2020-2021. Among them, the lowest comprehensive technical efficiency of the province is 0.714 in 2021, and the highest is 0.760 in 2019, which is not in the effective state of DEA in five years. The results show that the efficiency of drought and flood disaster reduction in rural areas of Hunan Province is at a poor level in recent years, and the output and input are seriously unreasonable. Therefore, Hunan Province needs to strengthen the technology of drought and flood reduction.

From the perspective of the average efficiency of each region over the years, in the regional development of agricultural drought and flood disaster reduction efficiency in Hunan Province in 2016, 2017 and 2019-2021, except for the large fluctuation in southern Hunan in 2017, the other regions were relatively stable. At the same time, it can be obviously seen that the average efficiency of western Hunan is higher than that of other areas in any year, and the efficiency level of drought and flood disaster reduction is maintained at about 1.000 every year. Every city in western Hunan has a good level of disaster reduction efficiency. From 2016 to 2021, the efficiency of drought and flood disaster reduction in every city in western Hunan has reached an effective level, but except Zhangjiajie, every city has a downward trend, and Huaihua City even dropped to 0.729 in 2021. In contrast, the efficiency level of drought and flood disaster reduction in northern Hunan is only about 0.5, and it is less than 0.5 in four years. Among them, Changde City is below 0.4 per year, and the efficiency of disaster prevention and mitigation is seriously insufficient. The disaster reduction efficiency in southern Hunan is also not ideal, only in 2017 reached 0.730 in the past five years, and the rest are about 0.5 each year, and only in 2017 Hengyang City reached the effective level of disaster reduction, and there is no upward trend. Compared with northern Hunan and southern Hunan, the efficiency of drought and flood disaster reduction in central Hunan has not reached the effective level, but the average efficiency of drought and flood disaster reduction in Changsha and Loudi has reached the effective state of DEA.

3.2 Pure technical efficiency

The pure technical efficiency of drought and flood disaster reduction in rural Hunan province did not fluctuate much, and the average of the province was 1.059, maintaining a medium and upper level, but showing a downward trend in general. From 1.125 in 2016 to 1.129 in 2017, although there was an increase, the increase was not significant, falling to 1.053 in 2019, continuing to decline to 1.005 in 2020, and even falling to 0.981 in 2021.

From the comparison of pure technical efficiency of drought and flood disaster reduction between regions, the four regional differences are not very obvious. The western Hunan region maintained the highest level, the five-year average

was 1.290, and the pure technical efficiency of drought and flood disaster reduction every year was effective. The second highest is the north of Hunan, 1.051, also maintained a high level, and the north of Hunan has maintained an effective state for five years. This is followed by 1.011 in Central Hunan. Although the five-year average of Central Hunan is a relatively high level, except for 2017 (1.049), which increased compared with 2016 (1.043), there is a downward trend in the following years, and it even dropped to 0.929 in 2021. The average value of southern Hunan is only 0.914, which is the lowest value of the four regions, and is in an invalid state from 2019 to 2021. Specific to each city, the highest is 2.081 in Zhangjiajie City in 2017; The lowest is 0.678 in Hengyang City in 2021, and the difference between the highest and the lowest is 2.07 times.

In the five years of evaluation, compared with the comprehensive technical efficiency of drought and flood disaster reduction in Hunan province, the number of effective units of pure technical efficiency of drought and flood disaster reduction in Hunan Province is more. There were 13 active units in both 2016 and 2017, falling to nine in 2019 and eight in 2020-2021. This indicates that although the pure technical efficiency of drought and flood disaster reduction in Hunan Province has a good level, it has been in a downward trend. Among them, Changde City, Yiyang City, Changsha City, Zhuzhou City and Zhangjiajie City have maintained five effective units. In terms of the proportion of effective units, the proportion of effective units in northern Hunan is the highest (93.3%), followed by 80% in western Hunan and central Hunan, and the lowest is 40% in southern Hunan.

3.3 Scale Efficiency

The scale efficiency level of drought and flood disaster reduction in rural Hunan Province is generally low. In the five years evaluated, the efficiency fluctuated little and showed a small upward trend. From the average point of view, the scale efficiency value of drought and flood disaster reduction efficiency in rural Hunan Province is 0.701, which is still far from the optimal scale and at a low level. The provincial average rose from 0.641 in 2016 to 0.688 in 2017, then to 0.721 in 2019 and 2020, and finally to 0.735 in 2021, with an overall increase of 12.8%. From the point of view of the number of effective units, in the five years of evaluation, only Loudi City in 2021 has reached the effective level, which more reflects the shortage of scale development across Hunan Province.

From the analysis of inter-regional scale efficiency, it can be clearly seen from Figure 3.3 that western Hunan and Central Hunan have better development, both of which are higher than the average level of the whole province, while southern Hunan and Northern Hunan have not reached the average level in the five years assessed. Specific to the year, the highest is 0.929 in the west of Hunan in 2021, and the lowest is 0.413 in the north of Hunan in 2017, a difference of 1.23 times. It can be seen that the scale efficiency of drought and flood disaster reduction in Hunan Province has great regional differences. Western Hunan has the best development, while northern Hunan is seriously under-developed. From the dynamic analysis, the development of the four regions has fluctuated, the western Hunan region first decreased, then increased and then decreased, the highest fluctuation of 10.2%; In central Hunan, the highest fluctuation was 19.3%. 28.5% in southern Hunan; The development of northern Hunan is similar to that of western Hunan, with a maximum fluctuation of 19.2%. Specifically, in the comparison of various cities over the years, the scale efficiency of Loudi City in 2021 is the highest of 1.000, and the lowest of Changde City in 2017 is 0.275, which is nearly three times the difference between the two. In general, although the scale efficiency of drought and flood disaster reduction in Hunan Province is relatively balanced, the development between regions and regional development over the years is not balanced.

3.4 Returns to Scale

Scale efficiency can reflect the difference between the current scale of input and the reasonable scale. In the five years studied, most areas in Hunan Province for drought and flood disaster reduction are in the stage of diminishing returns to scale, which indicates that Hunan Province has too much investment in drought and flood disaster disaster and insufficient efficiency. Therefore, it is not necessary to continue to increase the investment in drought and flood disaster reduction resources, but should pay attention to improving disaster prevention efficiency.

Specifically, Zhangjiajie is the only city in Hunan Province with increasing scale efficiency, which indicates that the efficiency development of drought and flood disaster reduction in Zhangjiajie is completely insufficient at this stage, and the investment in disaster reduction does not meet the reasonable utilization of resources. Therefore, Zhangjiajie can increase the investment in drought and flood disaster reduction resources and improve the scale of disaster reduction. In addition, only Tujia and Miao Autonomous Prefecture of Xiangxi is in the alternating state of increase and decrease, which indicates that the return to scale in this region fluctuates greatly, and the efficiency of drought and

flood disaster reduction will be affected no matter the investment is too large or insufficient. Therefore, the Tujia and Miao Autonomous Prefecture of Xiangxi should reasonably arrange the investment of resources according to the level of technology and management for comprehensive development and steady improvement. In addition to Zhangjiajie City and Xiangxi Tujia and Miao Autonomous Prefecture, 12 prefectural cities are in a state of full decline, which indicates that the current level of technology and scale is equivalent, increasing investment will no longer have a positive impact on the efficiency of drought and flood disaster reduction. For these areas, it is necessary to properly control the input of drought and flood disaster reduction resources, pay attention to the improvement of the quality of disaster reduction input, and avoid investment excess, resulting in resource waste.

IV.CONCLUSIONS

In general, the efficiency of drought and flood disaster reduction in Hunan Province is not high on the whole, and there is a large difference between regions and cities, showing a spatial pattern of highest efficiency in western Hunan, middle and lower level in central Hunan, and low efficiency in southern and northern Hunan. The efficiency of Zhangjiajie City, Xiangxi Tujia and Miao Autonomous Prefecture and Changsha City is relatively high, while the efficiency of cities in southern and northern Hunan region is generally low, and the difference between different regions is large. The reason is the excessive investment of three kinds of input resources, resulting in the current stage of technical equipment, scale and other insufficient to absorb the excessive investment of resources, resulting in the waste of resources and the reduction of disaster reduction efficiency.

Acknowledgements

This study was financially supported by the Key Project of Social Science of Yiyang City (grant no. 2023YS013).

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