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Optimization of Map Compilation for County-level Land Consolidation Planning

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Abstract Based on practice of the land consolidation planning in Changfeng County of Hefei City, taking full account of reality of land consolidation and its significance as livelihood project, we analyzed map compilation procedure. In combination with actual effect of land consolidation, we carried out consolidation assessment of same elements by overall planning method, and optimized the map compilation for county-level land consolidation planning. Results show that planning map of land consolidation potential is to be improved and legends should be merged. After consolidation of legends, it is convenient to apply in potential planning map and solve complicated problem of reading maps.

Key words Land consolidation, Planning map, Compilation procedure, Optimization

Currently, the overall planning of third-round land utilization has gone into a stage of comprehensive implementation. An important method to implement the overall land utilization planning is to implement the specific planning of land consolidation and the national land consolidation planning is being comprehensively compiled[1]. Therefore, the Ministry of Land and Resources has issued the *Main Points for Compilation of County-Level Land Consolidation Planning* to provide the compilation of land consolidation planning with relevant basis. As an important national control means, the land consolidation is a major guarantee for 1.8 billion mu warning limit of arable land[2] and also the important platform to improve the life quality of farmers. The land consolidation can improve the land utilization efficiency, improve the land productivity and meanwhile provide the support for future mechanization of farming. Better land consolidation planning has significant influence on both national land undertakings and social economy[3]. Planning map is a direct reflection of the planning and also an important basis for government to carry out land control. Therefore, planning map constitutes the most important part of compilation results and has drawn special attention from researchers. We will take the compilation for Changfeng County land consolidation planning map as an example to analyze the problems in the mapping standards for land consolidation planning and propose the corresponding optimization schemes to provide a reference for improvement in county-level land consolidation planning mapping standards.

1 Problems in the mapping standards for land consolidation planning

Changfeng County land consolidation planning is a pilot project of Anhui Province and the mapping standards as set forth in the planning text are somewhat proactive. Therefore, there may be some breakthroughs during the course of standard preparation within the scope of respect for standard preparation.

In the course of Changfeng County land consolidation planning compilation, we found that: firstly, although production of potentiality distribution map of mapping standards can better reflect the potentiality land consolidation for each village and town, its consolidation legend is relatively more complex. Each legend for each potentiality map is different, resulting in nonconformity of map color and finally in the increased difficulty of map reading; secondly, the mapping standard for land consolidation planning layout has not fully taken the need of real working into account and fails to arrange the land consolidation project, both currently and in the future, into the layout.

2 Optimization scheme for mapping standards for land consolidation planning

In view of the problems in the mapping standards of Changfeng County land consolidation planning, we proposes relevant suggestions for improvement.

2.1 Integration of land potential distribution map Potential distribution maps in the land consolidation planning maps include: construction land consolidation potential distribution map, cultivated land consolidation potential distribution map, land reclamation potential distribution map and farming-suitable land development potential distribution map. In the potential distribution map, each consolidation potentiality of areas is rated and each level is then distinguished by applying similar color and reflected in the map. After producing each potential distribution map for Changfeng County land consolidation in accordance with standards, although the potential distribution map completed is able to accurately reflect the potential characteristic, it fails to quickly and conveniently do so and also is not farvorable for evaluation and analysis of comprehensive potential for a specific area. We take Changfeng County cultivated land consolidation potential distribution map and land reclamation potential map as examples for analysis with the relevant maps

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before optimization shown in Fig. 1 and Fig. 2.

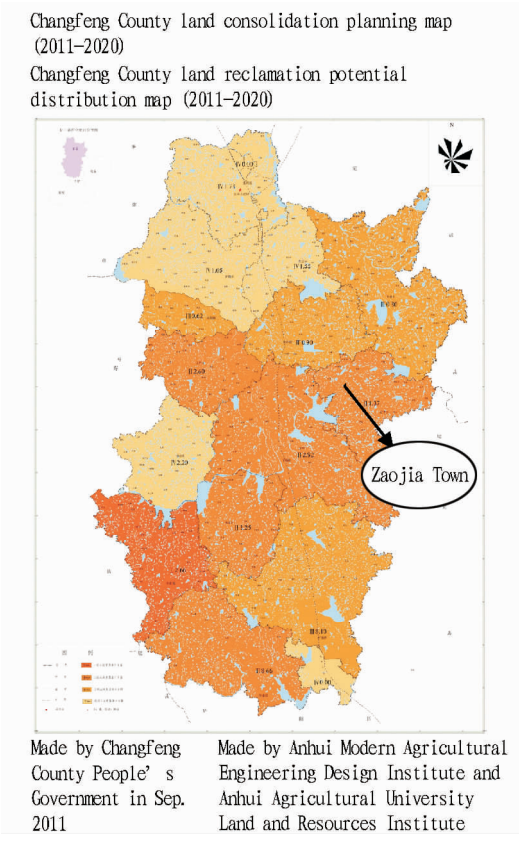

Fig. 1 Changfeng County land reclamation potential distribution (before optimization)

It can be seen from Fig. 1 and Fig. 2 that there are 8 kinds of different legend color in the two figures, and moreover, 4 kinds of potential legend color in the same map are similar, which are difficult for distinguishing[6]. If a specific area is expected to be analyzed, it's difficult to find each potential of the area in the consolidation potential map and then compare them. Take Zaojia Town of Changfeng County indicated by the arrow in the figure as an example, in order to study the land consolidation potential condition of Zaojia Town, it's difficult to find out the potential comparison of Zaojia Town only in terms of Fig. 1 and Fig. 2. Only by comparing legends and careful check, can the conclusion, that the level for land reclamation potential of Zaojia Town is 2 and the level for the cultivated land consolidation potential is 1, be inferred. This is particularly inconvenient and unable to compare them in a parallel way. Therefore, compilation for the potential distribution map can be further improved.

Firstly, each potential map is distinguished by similar color, resulting in being indistinguishable visually. Take the Changfeng County cultivated land consolidation potential distribution map as an example. See Table 1 for 4 levels potential legends. It can be seen from Table 1 that 4 kinds of legend colorings are particularly similar. If the legend area in the figure is larger, it's able to be distinguished. However, it needs carefully distinguishing if the legends need comparing, which is inconvenient for readers.

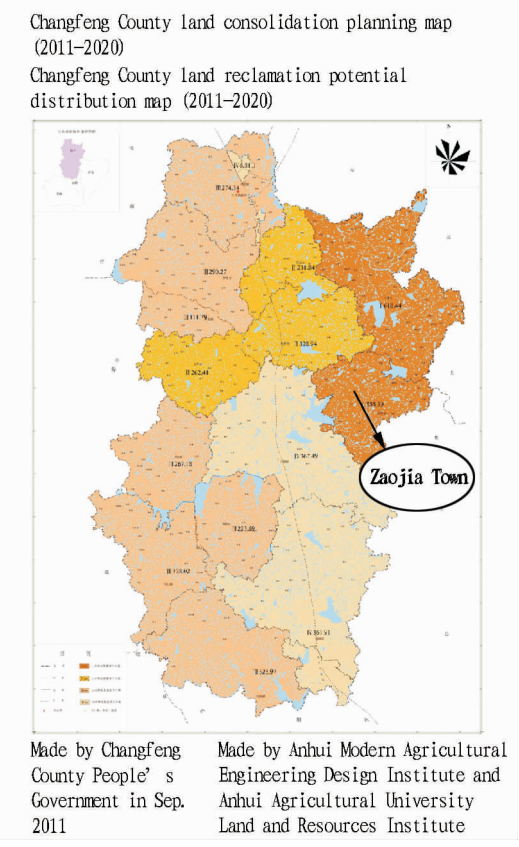

Fig. 2 Changfeng County cultivated land consolidation potential (before optimization)

Secondly, the similar color of each map is different. Take Changfeng County land reclamation potential distribution map as an example and see Table 2 for 4 levels potential legends.

Table 1 Legend of Changfeng County cultivated land consolidation potential distribution

Level	Color code of legend	Legend
Level 1 arable land consolidation potential villages and towns	418	Ⅰxxx 一级耕地整理潜力乡镇
Level 2 arable land consolidation potential villages and towns	416	Ⅱxxx 二级耕地整理潜力乡镇
Level 3 arable land consolidation potential villages and towns	415	Ⅲxxx 三级耕地整理潜力乡镇
Level 4 arable land consolidation potential villages and towns	414	Ⅳxxx 四级耕地整理潜力乡镇

Compared with Table 1, the legends in Table 2 have four kinds similar colors. Similarly, it is also inconvenient for readers. Construction land consolidation potential distribution map, cultivated land consolidation potential distribution map, land reclamation potential distribution map and farming-suitable land development potential distribution map has respectively four kinds of similar colors and 16 kinds of colors in total. This is

chaotic and inconvenient for readers. Therefore, it's necessary to formulate a level standard for the potential map and integrate potentials of the same level. See Table 3 for the merged Changfeng County land consolidation planning legends.

Each same potentiality level of 4 merged potential map is integrated into 1 legend. Each map only has such four kinds of color. By merging the former 16 kinds of similar colors of 4 groups in 4 maps into 4 kinds of colors and integrating the legends, the required information of an area can be conveniently found out in each map. See Fig. 3 and Fig. 4 for Changfeng County cultivated land consolidation potential distribution map and land reclamation potential map after legend integration and optimization.

Table 2 Legend of Changfeng County land reclamation potential distribution

Level	Color code of legend	Legend
Level 1 land reclamation potential villages and towns	677	Ⅰxxx 一级土地复垦潜力乡镇
Level 2 land reclamation potential villages and towns	676	Ⅱxxx 二级土地复垦潜力乡镇
Level 3 land reclamation potential villages and towns	675	Ⅲxxx 三级土地复垦潜力乡镇
Level 4 land reclamation potential villages and towns	674	Ⅳxxx 四级土地复垦潜力乡镇

Table 3 Merged Changfeng County land consolidation planning legends

Level	Item	Increased arable coefficient for each potential village and town	Color code of legend	Legend
Merge of level 1 arrangement potentiality	Cultivated land arrangement potentiality	≥4.5%	665	Ⅰxxx
	Rural inhabited areas arrangement potentiality	≥75%		
	Land reclamation potentiality	≥80%		
	farming-suitable land development potentiality	≥30%		
Merge of level 2 arrangement potentiality	Cultivated land arrangement potentiality	4.0% –4.5%	681	Ⅱxxx
	Rural inhabited areas arrangement potentiality	70% –75%		
	Land reclamation potentiality	60% –80%		
	Farming-suitable land development potentiality	20% –30%		
Merge of level 3 arrangement potentiality	Cultivated land arrangement potentiality	3.0% –4.0%	761	Ⅲxxx
	Rural inhabited areas arrangement potentiality	50% –70%		
	Land reclamation potentiality	50% –60%		
	Farming-suitable land development potentiality	10% –20%		
Merge of level 4 arrangement potentiality	Cultivated land arrangement potentiality	<3.0%	953	Ⅳxxx
	Rural inhabited areas arrangement potentiality	<50%		
	Land reclamation potentiality	<50%		
	Farming-suitable land development potentiality	<10%		

It can be easily seen from Fig. 3 and 4 that the legend color codes where Zaojia Town is located are respectively 681 and 665, namely, the level of land reclamation potentiality is 2 and the level of cultivated land consolidation potentiality is 1.

After comparing to the map before adjustment, each level of potential legend as shown in the map after adjustment can be easily distinguished to greatly facilitate the direct mastering of potential information of each area[7]. As a result of the use of potential legend of same standard and great distinguishing degree between each legend, each potentiality can be distinguished at once to be able to conduct a comprehensive grasping of potential status of each village and town, finally achieving the purpose of land consolidation potential planning mapping and providing more visual information to decision-makers.

2.2 Merge of land consolidation planning layout During the real working, the map is a direct reflection of planning to the decision-makers. Therefore, it's necessary to simplify and maximize the reflection information of the planning map to make information easily accessible. During the Changfeng County land planning practice, we find out that the land consolidation planning project layout only reflects the completion of each project. However, what shall be reported when reporting to relevant land and resource authorities includes mapping of all projects and reporting by different level of arrangement of current-term projects, medium-term projects and forward projects. Therefore, it is necessary to reflect distribution & arrangement of current-term projects, medium-term projects and forward projects in the entire county in the land consolidation project layout planning map.

In the overall layout planning map of Changfeng County land consolidation, the type of a project is shown in the map. Z, F, K and H respectively represent different consolidation

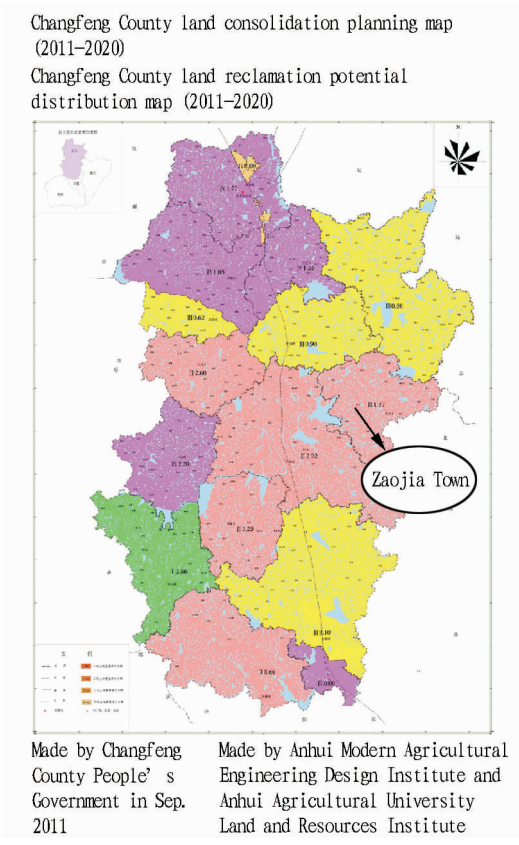

Fig. 3 Changfeng County land reclamation potential distribution (after optimization)

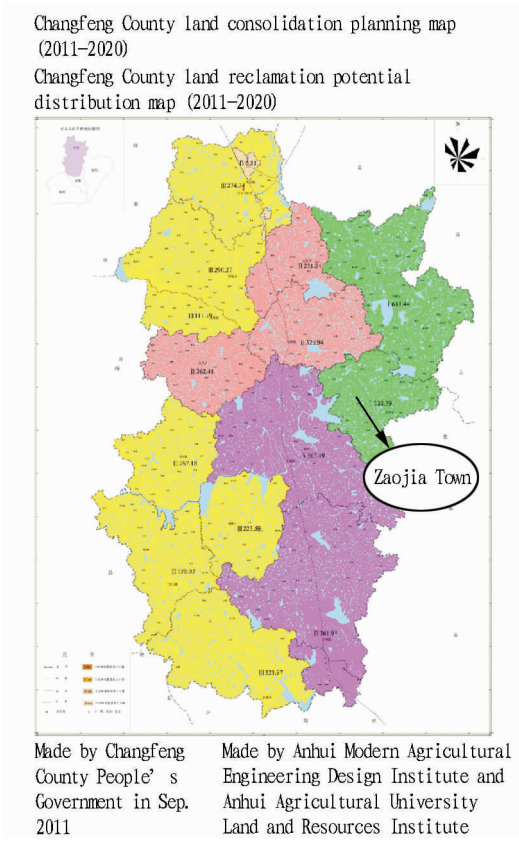

Fig. 4 Changfeng County cultivated land consolidation potential (after optimization)

types with Z for land consolidation project, F for land reclamation project, K for land development project and H for comprehensive land consolidation project. The numbers of "XXX" following the letters represents corresponding project number. There are two ways to reflect the arrangement of current-term projects, medium-term projects and forward projects in the map.

Firstly, indicate current-term projects, medium-term projects and forward projects in the map respectively with three kinds of different colors for differentiation. We attempted to apply such way to the compilation of Changfeng County land consolidation planning map and found out that the map after being adjusted in such a manner can better reflect the arrangement of current-term projects, medium-term projects and forward projects, while the entire map seems crowded. This is because projects of Changfeng County have a total number of more than 70 and spread the entire region. Application of such way makes the entire map changed into a three-color puzzle which is not so pleasing to the eyes. This way is not suitable for Changfeng County, but for those counties with less projects. The effect is obvious and the type, location and time arrangement of projects can be easily found out in the map.

The other way is to mark with information in the legend. Use A, B and C to represent current-term, medium-term and forward projects which are marked at the bottom central corner of the letter. By this, when reading the map, readers can obtain time arrangement of each project without need to find out page by page in the project schedule. This way is suitable for counties with a number of projects, such as Changfeng County. It only adds an information item which is represented by the letter to the legend, while it can clearly reflect time arrangement of many projects in the map, which has a great significant on relevant personnel to grasp arrangement of projects.

3 Conclusions

After analyzing the potential map and by combining the needs of real working with the map, we find out the legend overburdened problem in the mapping standards and adjust it. Merge of 2 land planning maps as set forth in this study, along with comparison of two planning project layout schemes, does not have an influence on the main part of land consolidation planning[8], while having certain influence on perfection of land consolidation planning map. It can make the map not only achieve the function as a decision-making basis, but also used as a tool for parallel comparison. Especially, it can unify the grading of potential planning map to greatly enhance the intuitionism of planning map and can better compare each potentiality of each villages and towns, which is an additional function[9]. The land consolidation planning is a continuously developed career. In the future practical process, more reasonable improvement schemes can be found out.

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factors, agricultural policies, market factors, and so on. People often attach great importance to these macroeconomic factors. At the same time, the impact of micro-factors also can not be ignored. Among them, gender, age, years of education , the number of family members who go to school, the level of household income in local areas , the area of land contracted by household , the number of working days of operating agricultural land , the number of migrant workers in the family, and whether or not to subcontract land, have a negative impact on labor force transfer, that is, they have a reverse effect on surplus labor forces' working outside the home, not conducive to the transfer of rural surplus labor forces. The number of family labor forces, the number of the elderly aged more than 60 in the family, annual number of working days, and whether to participate in training, have a positive impact on the transfer of surplus labor forces, that is, they have a positive effect on surplus labor forces' working outside the home, conducive to the transfer of rural surplus labor forces.

Age, the level of household income in local areas, the number of family labor forces, and the number of the elderly aged more than 60 in the family, pass the test. But the impact of some micro-factors is not significant, and this may be caused by regional differences.

4.2 Recommendations

(i) From the perspective of entire province, paying equal attention to macroscopic factors and microscopic factors influencing the transfer of surplus labor.

(ii) Focusing on the factors concerning the rural households and individual farmers to find out the factors influencing the rational transfer.

Some factors play the role in promoting transfer, so when formulating relevant policies, it is necessary to give priority to these factors. For example, the study results show that age plays a significant role in the transfer of surplus labor, so we should strengthen young people's opportunities of working outside the home.

(iii) Shifting the employment concept of surplus labor in rural areas.

We should lay stress on the transfer of labor forces, step up publicity efforts to redress farmers' misconceptions of labor transfer, transform the outmoded small farmer consciousness, learn to adapt to market economy to seek our own way of development. In addition to agriculture, there are many ways to survive.

(iv) Speeding up the construction of small towns and developing the secondary and tertiary industries.

The construction of small cities and towns has obvious advantages in absorbing surplus labor in rural areas. For the poverty-stricken areas, the development of small cities and towns plays significant role in promoting non-farm employment. In the context of the construction of small towns, a number of township enterprises are bound to burgeon, which will absorb some surplus labor forces in rural areas to work in the township enterprises. The construction of small cities and towns can ease people's concept of employment outside the home. They can be engaged in non-farm employment in the township, do not have to work outside the home. Thus, they will not lose land as a guarantee. "Diversified employment" will be a long-term trend in the process of surplus labor transfer.

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