Disaggregating Statistical Crop Area with Landsat Imagery in Fenhe River Basin ----Aiming at Crop Irrigation Water Requirement Study

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1. Introduction

The Fenhe River basin (FRB), a sub-river basin of the Yellow River basin (YRB), has been experiencing temperature increase, precipitation decrease, and consequently severe water stress for the past several decades. The FRB became drying-up from more than 10 years ago, which was more severe than rest parts of the YRB. The agriculture sector consumes most of the available water resources in the FRB. Differing from domestic and industrial sectors, the area water requirement of agriculture sector is highly spatially heterogeneous. Therefore, it is of importance to derive spatial crop distribution to appropriately estimate crop irrigation water requirement, and its adaptation to climate changes.

There are generally two ways to derive crop distribution information. The traditional way is to obtain statistical data of crops based on administrative boundaries like county or province. There are some merits for statistical data such as relatively easy to achieve long time series, and it is suitable for macro study that does not require fine spatial resolution. Another way is to detect crop distribution by remote sensed data, which can provide high spatial resolution information. However, the validation of classification accuracy, long-term data availability may hurdle the implementation of this method.

The goal of this study is to integrate statistical crop data and classified remote sensed distribution, by disaggregate statistical crop area with Landsat imagery in FRB.

2. Method and data

The major desegregating steps are as follows: 1) classifying and validating remotely sensed data focusing on crop area information extraction; 2) collecting statistical data of crop area in county level of the Shanxi province of China; 3) upscaling the 30-meter TM images to 1km grids. 4) disaggregating statistical crop area with the statistical crop area data as weighting parameter..

For the remotely sensed data, altogether six scenes of Landsat TM images in the year of 1996 covering the FRB were obtained. The crop area was classified into a) dryland A: crop area on slope larger than 25 degree, b) dryland B: crop in plain area, c) dryland C: crop on upland area, d) dryland

D: dryland in mountainous area, and e) paddy field. The classification was implemented by the following steps: 1) TM images were unsupervised to 100 sub-types. 2) Each sub-type was checked manually and some of the sub-types was regarded as satisfactory results. 3) The unsatisfactory sub-types were re-classified by supervised classification. 4) The final classification was achieved with export knowledge mainly by coupling information like elevation, slope and direction derived from Digital Elevation Model (DEM).

For statistical data, the crop areas of counties which have overlay portion to FRB were collected, primarily from the Yearbook of Shanxi Province (see Table.1 for example).

Table 1. Example of county-level statistical data about crop areas in Shanxi Province

	A	B	C	D	E	F	G	H	I	J
1	ID	省	県	1993	1994	1995	1996	1997	1998	1999
2	140101	14	太原市辖区	4		3.0	2		1	6
3	142401	14	榆次市	948	1162	860.0	1015	975	1077.0	465
4	142402	14	介休市	397	527	385.0	405	200	122.0	51
5	142427	14	寿阳县			1.0				
6	142429	14	太谷县	810	910	750.0	819	631	448.0	279
7	142430	14	祁县	957	1272	890.0	927	710	837.0	481
8	142431	14	平遥县	4799	6449	4273.0	2427	2613	1771.0	892
9	142433	14	灵石县	1	1	2.0				2
10	142601	14	临汾市	2373	2431	1623.0	1781	931	542.0	356
11	142602	14	侯马市	805	1017	917.0	576	364	736.0	516
12	142603	14	霍州市	408	416	501.0	503	307	333	346
13	142621	14	曲沃县	2010	1945	1788.0	1078	331	543.0	483
14	142622	14	翼城县	1669	1113	1873.0	1642	852	756.0	432
15	142623	14	襄汾县	3545	6340	5903	3010	306	971	301
16	142625	14	洪洞县	2516	2284	1880.0	2052	931	593.0	722
17	142627	14	古县	97	85	183.0	133	82	93.0	41
18	142636	14	汾西县	34	40	64.0	30	11	37.0	30
19	142701	14	运城市	7500	7985	8021.0	4897	3434	4684.0	3189
20	142702	14	永济市	12238	10341	13255.0	13358	9167	12028.0	11518
21	142703	14	河津市	1173	622	1192.0	939	504	502	465
22	142723	14	芮城县	4029	2653	3070	2674	1328	2172.0	1650
23	142724	14	临猗县	11990	8977	12021.0	12010	7010	7196.0	5579
24	142725	14	万荣县	1636	1311	2311	535	396	1216.0	488
25	142726	14	新绛县	6118	6190	4063.0	3238	1055	1624.0	3200
26	142727	14	稷山县	6827	4558	6132.0	2863	893	1328.0	726
27	142729	14	闻喜县	1518	1352	1914	2109	1360	1828.0	1542
28	142730	14	夏县	3931	4783	5043.0	3800	2899	4261.0	3036
29	142731	14	绛县	961	1197	1413	1018	516	532.0	487
30	142732	14	平陆县	1139	881	1002.0	1251	887	1022.0	854
31	142733	14	垣曲县	1417	1271	1449.0	1269	520	1051.0	1002
32	142333	14	交口县							
33	142401	14	榆次市	948	1162	860.0	1015	975	1077.0	465
34	142402	14	介休市	397	527	385.0	405	200	122.0	51

総耕地面積 / 糧食耕地面積 / 糧食生産量 / 綿花耕地面積 \ 綿花生産量 / 油料耕地面積 / 油料生

3. Result

The maize, spring wheat, and winter wheat distribution were disaggregated in this study. The classified TM images and disaggregated maize distribution of the Fenhe River basin are illustrated as an example in Fig. 1.

4. Discussion

The results may provide relatively good spatial information of crop distribution in the FRB, which may help understand agriculture water requirement of Shanxi Province. The 1km crop grids in FRB were integrated into a crop water requirement estimation model in the afterwards study.

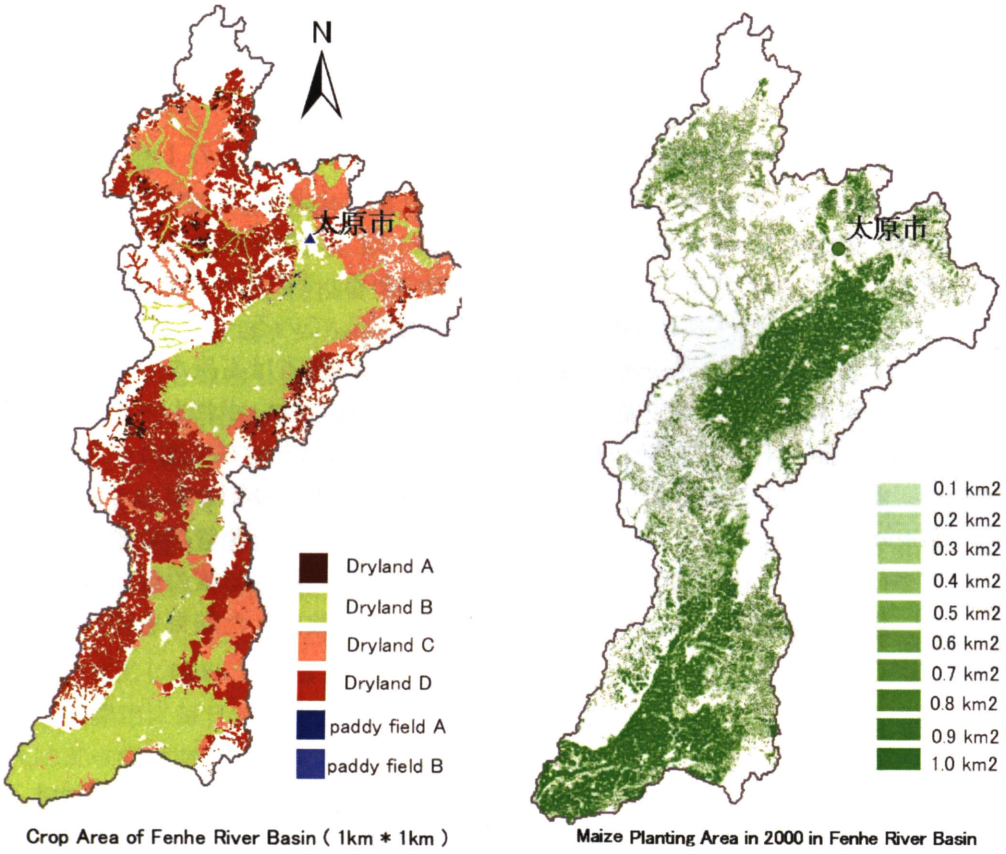

Fig. 1 map of cropland classification (left) and disaggregated maize area in 2000(right).