Econometric Analysis of Research Papers on the Project of "Turning Vulnerable Farmland into Forests"

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Abstract Taking the *Database of Chinese Scientific and Technical Periodicals* of Chongqing VIP Information Co., Ltd. as the statistical analysis source, we analyze the inter-annual trends, the authors institutions, journals distribution, disciplines distribution, paper subjects and authors' cooperation of research papers on the project of "turning vulnerable farmland into forests" in China during the period 1999 -2010, using the bibliometric method. The results show that during the period 1999 -2010, the research on the project of "turning vulnerable farmland into forests" always captured the attention of academia, and the number of research papers annually averaged more than 300; the relevant forestry functional departments at all levels, forestry-related research institutions and universities have paid close attention to the project of "turning vulnerable farmland into forests" in China; the group of core journals researched is concentrated in journals concerning forestry; in addition to forestry and agriculture, the research areas also touch upon economics, environment and other disciplines; the emphasis and hot spot of research are centered on applications, with few basic researches.

Key words Turning vulnerable farmland into forests, Research papers, Econometric analysis

Since the second half of the 20th century, serious deterioration of the ecological environment has become the global focus of attention, and a number of countries and regions in the world have set an agenda for the governmental governance and improvement. The Chinese government attaches great importance to the governance and protection of ecological environment, and formulates a series of policies and measures. The project of "turning vulnerable farmland into forests" is one of them. In October 1999, the project of "turning vulnerable farmland into forests" was first carried out in Sichuan, Shaanxi, Gansu and other provinces. In March 2000, the pilot work of project of "turning vulnerable farmland into forests" was officially launched in 17 provinces (cities, districts). In June 2002, China promulgated *Several Opinions of the State Council on Further Improving the Policy of Turning Vulnerable Farmland into Forests*, and *Regulations of Turning Vulnerable Farmland into Forests* was implemented on January 20, 2003. Subsequently, the project of "turning vulnerable farmland into forests" was comprehensively carried out in 25 provinces (regions and municipalities) and Xinjiang Production and Construction Corps. After 2004, turning vulnerable farmland into forests and developing the regional economy were organically combined, which not only helped turn vulnerable farmland into forests and protect ecology, but also enabled farmers to get rich[1].

The implementation of the project of "turning vulnerable farmland into forests" has aroused people's close attention. The relevant functional departments at all levels, research institutes, universities, *etc.* jointly participate in the project of "turning vulnerable farmland into forests". From forestry and the related perspective, many researchers have conducted a lot of scientific researches, making remarkable achievements. To fully understand the situation in this regard, this article uses bibliometrics method to analyze the relevant research papers on the project of "turning vulnerable farmland into forests" in China in the past 10 years, trying to use quantitative data to reveal the characteristics and evolving trend of the researches on "turning vulnerable farmland into forests" in China, so as to conduct in-depth study on the project of "turning vulnerable farmland into forests", better improve and protect the ecological environment, provide some reference for forestry teaching and research workers.

1 Data source and method

The data are from the *Database of Chinese Scientific and Technical Periodicals* of Chongqing VIP Information Co., Ltd. Using the advanced search function of the database, we input the key word to obtain 7465 literatures concerning "turning vulnerable farmland into forests", and the retrieval time is April 2011.

According to the research needs, we filter the literatures obtained, deleting the articles concerning popular science, ordinary news reports, literature, advertisement of products, administrative document and notice; the articles whose authors and institutions are not available, or without abstract and key words; the repeated articles. 4 433 research papers on the project of "turning vulnerable farmland into forests" are finally obtained.

Using Excel 2003 software and VBA programming, we conduct the analysis of statistical data, figures and tables.

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2 Results and analysis

2.1 Inter-annual changes of paper publication From Fig. 1, we can find that in the period 1999 – 2010, the number of papers on "turning vulnerable farmland into forests" tended to increase sharply and then decrease slowly. The number peaked in 2003, with 552 papers; in 1999, the number of papers was only 10, only 1.81% that in 2003; in 2010, the number of papers was 309, 55.97% that in 2003. From 2004, there are more than 300 papers annually. This is related to the implementation of the project of "turning vulnerable farmland into forests" in three phases, indicating that the research on the project of "turning vulnerable farmland into forests" in China has drawn attention from academia since 1999, with abundant results.

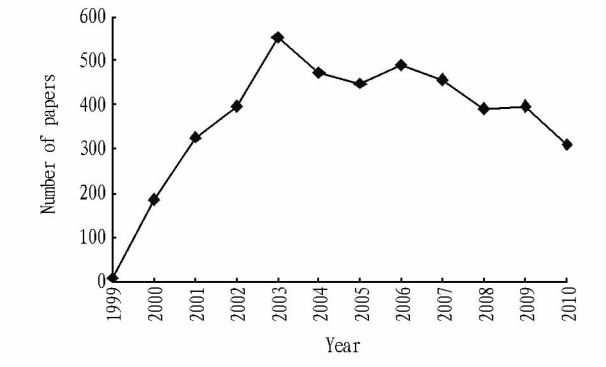

Fig. 1 Inter-annual changes of papers on "turning vulnerable farmland into forests"

2.2 Distribution of journal publishing papers Through the statistical analysis of source journals, we can learn the disciplinary background of the journal, thus indirectly deriving the disciplinary background of research on "turning vulnerable farmland into forests". 885 kinds of journals are retrieved, publishing research papers on "turning vulnerable farmland into forests" in the period 1999 – 2010, with 5 papers published in each kind of journal on the average, and 103 journals publishing more than 10 papers. 2 630 papers are published in total, accounting for 59.32% of all research papers. There are 23 kinds of core journals publishing more than 10 research papers each, and 642 papers are published in total, accounting for 14.48% of all research papers. According to Bradford's law, the number of papers published in core journals accounts for about one third of the total number of papers, thus we derive that there are 29 core journals publishing research papers on "turning vulnerable farmland into forests", which are concentrated in forestry and related types; most of the journals are not listed in *A Guide to the Core Journal of China*, and only 7 journals are core journals.

Top 10 journals in terms of the number of papers on "turning vulnerable farmland into forests" can be seen in Table 1. Among them, *Forestry Economics* publishes the most papers, up to 101, and *Sichuan Forestry Exploration and Design* ranking tenth publishes 56 papers. It can also be seen from Table 1 that most of the journals are not included in *A Guide to the Core Journal of China*, and some journals enjoy wide reputation, but the number of papers is small. This shows that the researches on "turning vulnerable farmland into forests" have the trend of generalization, and the overall level of research needs to be further enhanced.

Table 1 Top 10 journals in terms of the number of papers on "turning vulnerable farmland into forests"

Journal name	Number of papers	Share in total journals//%
Forestry Economics	101	2.28
Forest Inventory and Planning	98	2.21
Forestry of China	88	1.99
Protection Forest Science and Technology	86	1.94
Hunan Forestry Science & Technology	82	1.85
Research of Soil and Water Conservation	69	1.56
Journal of Sichuan Forestry Science and Technology	58	1.31
Modern Agricultural Sciences and Technology	58	1.31
Forestry of Shanxi	56	1.26
Sichuan Forestry Exploration and Design	56	1.26

2.3 Distribution of disciplines Using the Chinese Library Classification Method, we collect the statistics on research papers, and determine the first as statistical source when there are two Chinese Library Classification numbers. Distribution of disciplines with more than 20 papers on "turning vulnerable farmland into forests" can be shown in Table 2.

The results show that there are 1873 papers on economics (F), accounting for 42.25% of all papers, of which the papers on agricultural economy (F3) are the most, accounting for 38.10%; there are 2 145 papers on agriculture (S), accounting for 48.38%, of which the number of papers on forestry is 1 137, accounting for 25.64%. It indicates that the project of "turning vulnerable farmland into forests" is an integrated project focusing on forestry and agriculture, involving economics, environment and other disciplines.

2.4 Paper publication in research institutions According to the calculation formula developed by Price, the institutions publishing more than 8 academic papers are regarded as the core research institutions. The retrieval results show that 4 433 papers are from 367 research institutions, 70 of which have published more than 8 papers each, 3 731 papers published in total, accounting for 77.39% of total papers, indicating that there are many research institutions engaging in the project of "turning vulnerable farmland into forests", and the core research institution is large.

Table 3 lists the top 10 research institutions in terms of the papers on "turning vulnerable farmland into forests" published. The number of papers published by Northwest A & F University is the greatest, reaching 154, accounting for 3.47% of all papers; Chinese Academy of Sciences and Beijing Forestry University rank second and third, respectively, with 145 and 118 papers published, accounting for 3.27% and 2.66% of all research papers; Sichuan Agricultural University, Ningxia University, Chinese Academy of Forestry, *etc.* follow. It shows that the majority of institutions engaged in the study of "turning vul-

nerable farmland into forests" are forestry-related, agriculture-related colleges and universities, relevant research institutes.

Table 2 Distribution of disciplines with more than 20 papers on "turning vulnerable farmland into forests"

Classification	Discipline	Number of papers	Proportion//%	Classification	Discipline	Number of papers	Proportion//%
F3	Agricultural economy	1689	38.1	F1	Basic problems of economics	72	1.62
S7	Forestry	1137	25.64	S4	Plant protection	45	1.01
S1	Agricultural basic science	328	7.39	F2	Economic planning and management	35	0.78
X1	The basic theory of the environment science	207	4.66	F0	Political economics	34	0.76
S6	Gardening	180	4.06	S3	Agricultural science(agronomy)	28	0.63
S8	Animal husbandry, animal medicine	148	3.33	F8	Finance	23	0.51
S2	Agricultural engineering	142	3.2	X3	Administration of environmental protection	22	0.49
S5	Crop	101	2.27	F7	Trade	20	0.45

Table 3 Top 10 research institutions in terms of the papers published on "turning vulnerable farmland into forests"

Ranking	Institution	Number of papers	Proportion//%
1	Northwest A & F University	154	3.47
2	Chinese Academy of Sciences	145	3.27
3	Beijing Forestry University	118	2.66
4	Sichuan Agricultural University	52	1.17
5	Ningxia University	35	0.79
6	Chinese Academy of Forestry	33	0.74
7	Yunnan Institute of Forest Planning, Inventory and Design	33	0.74
8	Southwest Forestry University	31	0.69
9	Agricultural University of Hebei	28	0.63
10	Huazhong Agricultural University	23	0.51

2.5 Paper content distribution The key word is the generalization of the main content. The frequency of a key word is tantamount to the number of academic papers including this key word. The higher the frequency of one key word, the more the relevant research results, the stronger the concentration of research content. Thus through the analysis of key word frequency and change, we can find the hot spots and development trends of the corresponding scientific researches[5]. Based on this, by analyzing the key words in the relevant papers on "turning vulnerable farmland into forests", this article aims to reveal the hot spots and development trends of the main researches on the project of "turning vulnerable farmland into forests".

When collecting the statistics on frequency of key words, in order to facilitate data collation and analysis, we do not collect various kinds of specific words concerning "turning vulnerable farmland into forests", such as "turning vulnerable farmland into forests" and "turning vulnerable farmland into forests (grass)"; the broad key words, such as the status quo, countermeasures and impact. We collect the statistics on the key words with frequency more than 20 (As the range of key words with frequency below 20 is broad, it is difficult to use the appropriate theme words for comprehensive generalization), according to 10 themes ("animal husbandry", "project effect", "agriculture", "farmers", "countryside", "land use", "ecological environment construction", "forestry", "project implementation", "project area"). In order to eliminate the impact arising from differences in description and fluctuations in the number of key words in different years, we use the proportion of frequency of a certain key word in a particular year to the total number of key words in the papers in the same year, as the word frequency value of this key word in this year[6]. China's "turning vulnerable farmland into forests" is carried out on the basis of vast population, limited farmland and underdeveloped economy, and the direct purpose is to solve the problem of soil erosion and improve the ecological environment. Therefore, in the process of implementing "turning vulnerable farmland into forests", we should protect farmland, to ensure food security and farmers' rights, achieve joint development of "turning vulnerable farmland into forests" with ecology, society, and economy[7].

We can find the following results from Table 4. (i) At three stages of the project of "turning vulnerable farmland into forests" in the period 1999–2010, project implementation, project effect and agriculture draw much attention, which have always been the focus and hot spot of research. (ii) Forestry, ecological environment construction, project area of "turning vulnerable farmland into forests", receive much attention at the first and second stages, but after the third stage, the attention significantly declines. It is also consistent with the main goal of implementation of project "turning vulnerable farmland into forests (grass)" at three stages. (iii) The three themes (animal husbandry, land use, countryside) receive little attention, indicating that although the project of "turning vulnerable farmland into forests" touches upon the three aspects, they are not the research focus. (iv) The research on farmers receives much attention at the second stage, indicating that only after better solving the livelihood issues of farmers, can the project of "turning vulnerable farmland into forests" be successfully carried out.

These results suggest that the researches on the project of "turning vulnerable farmland into forests" in China are mainly concentrated in the area of application; there is a shortage of basic researches, and the work in this area needs to be strengthened.

2.6 Author analysis In 4 433 papers, there are 3 615 first authors, each publishing 0.81 papers on the average, of which there are 494 people publishing more than 2 papers each, with 1 312 papers published in total, accounting for 29.59% of total

papers; the remaining 3 121 papers are published by 3121 people, accounting for 70.41% of all papers. Peng Keshan in the Chinese Academy of Sciences publishes the most papers, 35 papers in total. It indicates that there are many scholars engaged in the research on the project of "turning vulnerable farmland into forests", but few of them obtain many research results.

Table 4 Inter-annual distribution of frequency value of subject of papers on "turning vulnerable farmland into forests"

Subject	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Animal husbandry	0.00	0.23	0.11	0.25	0.30	0.15	0.11	0.18	0.00	0.15	0.00	0.06
Land use	2.44	1.60	0.69	0.78	0.64	0.45	0.71	0.76	0.51	0.46	0.56	0.59
Ecological environment construction	2.44	10.30	6.01	6.23	6.30	4.77	2.67	2.20	2.48	2.33	1.73	1.82
Agriculture	0.00	2.06	2.00	1.77	1.79	1.97	1.71	2.20	2.06	1.87	1.31	1.65
Farmers	0.00	0.34	0.34	0.83	0.94	1.32	1.08	1.08	0.73	0.76	0.75	0.65
Countryside	0.00	0.23	0.40	0.34	0.47	0.42	0.30	0.25	0.17	0.15	0.09	0.41
Forestry	2.44	1.60	1.09	1.27	1.72	1.29	1.11	0.65	0.68	0.81	0.94	1.12
Project implementation	4.88	6.86	6.92	4.80	5.63	5.45	3.56	3.86	4.36	4.81	4.78	4.41
Project area	2.44	8.12	5.03	4.71	3.13	2.95	1.63	1.19	1.15	1.42	0.75	0.88
Project effect	4.88	2.17	2.69	2.30	2.39	2.76	2.04	2.85	2.61	3.64	2.63	2.82
Total	19.51	33.52	25.29	23.28	23.32	21.54	14.92	15.22	14.74	16.39	13.55	14.41

Note: Project implementation (the western development strategy, planning, surveys, policy, project management, application of geographic information systems, operation design, organization and leadership, comprehensive control, protection of natural forests, forest conservation, pasturing prohibition, vegetation restoration, reforestation, tree species selection, the survival rate, ecological compensation, evaluation, pest control, *etc.*); project effect (overall efficiency, benefit analysis, ecological benefit, social benefit, economic efficiency, economic development, sustainable development, results); agriculture (ecological agriculture, adjustment of agricultural structure, the industrial structure of agriculture, the follow-up industry, food production, food security); the construction of ecological environment (soil erosion, soil conservation, ecological construction, ecological restoration, ecological environment protection, ecology, ecological project); forestry (ecology forest, forest resources, forest coverage, forestry construction, forestry development, forestry, economic forest, afforestation); project area (the western region, Sichuan, the Loess Plateau, Qinghai, Gansu, Shanxi, Guizhou, Ningxia, Shaanxi, Yunnan, the loess hilly region, Three Gorges Reservoir area, Inner Mongolia, Chongqing, Wuqi County, "four types of wasteland", *etc.*); animal husbandry (animal husbandry); land use (abandoned land, land use, slope land, farmland area); countryside (rural economy, rural industrial structure adjustment, rural areas); farmers (farmers' income, farmers, peasant households).

The core author plays the role in orienting and leading the research. According to Price's law, the lower limit of core authors $N_{min} = 0.749 \times Sqrt(\eta_{max})$, $\eta_{max} = 35$, so $N_{min} = 4$ (papers). The number of authors who publish 4 papers or more each is 61, with 363 papers published in total, that is, 1.68% of the authors have contributed 8.18% of the workload. It indicates that the core authors engaged in the research on the project of "turning vulnerable farmland into forests", have made great contribution.

2.7 Paper coauthoring With incessant deepening of scientific research, the disciplines cross each other, and many research projects must rely on the strength of multi-disciplinary collective, thus there are more and more phenomena of paper coauthoring. Table 5 shows coauthoring of research papers on "turning vulnerable farmland into forests"; 54.24% of the papers are coauthored, 3 coauthors per paper on the average. This also reflects that many research projects on the project of "turning vulnerable farmland into forests" need joint participation of scholars of different disciplines.

3 Conclusions

In summary, during the period 1999 – 2010, the research on the project of "turning vulnerable farmland into forests" always captured the attention of academia, and the number of research papers annually averaged more than 300; there are many scholars engaged in research on the project of "turning vulnerable farmland into forests", and some of them have achieved rich research results; most of the authors are mainly from the relevant forestry functional departments at all levels, forestry-related research institutions and universities; the core journals publishing the research papers on the project of "turning vulnerable farmland into forests" are mainly the journals concerning forestry, and few journals appear in A Guide to the Core Journal of China; in addition to forestry and agriculture, the research areas also touch upon economics, environment and other disciplines; the emphasis and hot spot of research are centered on applications, and the basic researches need to be further strengthened.

Table 5 Coauthoring of papers on "turning vulnerable farmland into forests"

Number of authors	Number of papers	Proportion//%
1	2025	46.76
2	1219	28.15
3	585	13.51
4	297	6.85
5	195	4.5
6 and above	112	2.58

The project of "turning vulnerable farmland into forests" is a huge project involving considerable areas and disciplines, and this project is far from over. This paper mainly studies the literatures on the project of "turning vulnerable farmland into forests" in China, included in the Database of Chinese Scientific and Technical Periodicals of Chongqing VIP Information Co., Ltd. in the period 1999 – 2010; the inclusion situation of other databases is yet to be further researched. At the same time, there is a large number of literatures on the project of "turning vulnerable farmland into forests" in China, therefore,

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come increase rely on the information symmetry in rural areas. The advent of Alibaba, Nonging, and other web sites, has subverted the global retail industry, especially the traditional trading patterns of agriculture, forestry, animal husbandry and fishery. Agricultural e-commerce has become a necessary means to exploit new markets and participate in the global competition [8]. Through the network, the farmers can conveniently and rapidly complete credit, guarantee, transactions, payments, foreign exchange and other links. The network can make farmers closer to the market, and quickly make us know consumers' preferences, buying habits, and consumer demand, thereby contributing to the prosperity and development of agricultural trade.

2.4.1 Cultivating farmers' awareness of business. Now the problem is not technology, capital, and service, but ideological change and update of management philosophy. The agriculture-related enterprises and leadership in China generally lack knowledge on information technology and e-commerce, restricting the development of agricultural e-commerce. Only by changing the ideas of farmers and managers of relevant government departments, can we promote the further development of agricultural e-commerce.

2.4.2 Developing the flow of information. In the information age, those who first obtain information and first use information, will be able to obtain markets, and profit. Information needs show the following characteristics: comprehensive systematicness, comprehensive integration, normativeness, continuity, regional and seasonal differences, timeliness [9]. The agricultural information service should be well directed, timely, and convenient, with low cost; after the use of the agricultural information service, the economic efficiency will be high. In the context of soaring urban and rural online payments, we should establish safe exchange of cash.

2.5 Enhancing network information security and prevention

2.5.1 National network security issues. In 2009, half of Internet users experienced network security incidents, and the service expenses of Internet users dealing with the security events reached 15.3 billion yuan in total. Virtual property damage becomes one of the major economic losses in the network, and the virtual property protection should be urgently strengthened. Over 90% of Internet users encounter phishing sites, and web download and browsing becomes the main channel of the spread of viruses and Trojans. The degree of attention paid to the network security events is significantly enhanced. The Internet users' sense of security declines, and they are more careful than ever to provide online personal information. Nearly 21 million Internet users lack awareness of the protection of the password settings. 99% of Internet users all take certain precautions for the personal computer. Nearly 70% of Internet users realize that the personal network security issues can influence the public network and the safety of others. 28.4% of Internet users have never heard of or paid attention to the integrity identity of web sites, so the publicity and promotion efforts need to be strengthened. Nearly half of Internet users do not attach importance to online security bulletin, easily triggering network security incidents. 71.2% of Internet users have heard of the concept of "cloud security", but only half of Internet users are willing to try it [10].

2.5.2 Cultivating rural Internet users' safety awareness. Government should step up safety management efforts, and strengthen network security education for farmers through various channels to improve safety awareness. It is the most practical way at present. Strengthening the anti-virus awareness to check and kill the virus is a necessary means to ensure the security of network systems.

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it is necessary to use other methods for research, and the basic research content remains to be further sorted.

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