

Construction and Empirical Validation of a Cultural Vulnerability Assessment System for Ethnic Minority Language Toponyms in the Northern Agro-pastoral Ecotone: Postprint

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Abstract

In the farming-pastoral ecotone of northern China, the scale of endangered minority language place names continues to expand, the cultural vulnerability of minority language place names is becoming increasingly prominent, and sustainable development is particularly concerning. Place names constitute an open cultural system composed of multiple elements. Therefore, expanding previous qualitative research on endangered minority language place names to quantitative research on vulnerability degree from a systemic vulnerability perspective holds certain theoretical and practical significance. By introducing the vulnerability research paradigm, and based on extensive field investigations and literature reviews, this study identifies the influencing factors of cultural vulnerability of minority language place names in the northern farming-pastoral ecotone from the perspectives of sensitivity, exposure, and resilience, constructs a vulnerability evaluation system, discusses evaluation scales and methods, and conducts empirical research on typical case study areas. The results indicate that in the case study area, the cultural sensitivity and exposure of minority language place names are prominent, resilience is weak, and vulnerability is relatively evident. Its vulnerability is jointly influenced by internal degradation factors and external disturbance factors of the place name cultural system. Among them, local residents' erroneous cognition of the etymology and semantics of minority language place names, the high popularization rate of Mandarin Chinese and social acceptance of minority language place names translated into Chinese, and the inaccuracy of semantic translation of minority language place names are important driving factors in vulnerability formation. Secondly, the simplification and non-standardization of character usage and transliteration in Chinese translation, the high rate of place name merging, alteration, and abandonment, the limited reserves of place name literature, and the substantial

decline in the population size of minority language speakers are also relatively important single-indicator factors.

Full Text

Abstract

The scale of endangered minority-language place names in the agro-pastoral ecotone of northern China continues to increase, rendering the vulnerability of minority place name culture increasingly prominent and raising serious concerns about sustainable development. Place names constitute an open cultural system composed of multiple elements. Therefore, expanding previous qualitative research on endangered minority-language place names to quantitative assessment of vulnerability from a systematic perspective holds important theoretical and practical significance. This study introduces the vulnerability research paradigm, identifies influencing factors of minority place name culture vulnerability in the northern agro-pastoral ecotone from the perspectives of sensitivity, exposure, and resilience based on extensive field investigations and literature review, constructs a vulnerability evaluation system, discusses evaluation scales and methods, and conducts empirical research on a typical case area. Results indicate that the minority place name culture in the case area exhibits prominent sensitivity and exposure, weak resilience, and obvious vulnerability. This vulnerability is jointly influenced by internal damaging factors and external disturbing factors within the place name cultural system. Among these, local residents' erroneous cognition of the etymology and semantics of minority-language place names, high Chinese language proficiency rates, strong social recognition of Chinese-translated minority place names, and inaccurate semantic translations represent important driving factors of vulnerability formation. Additionally, the simplification and non-standardization of Chinese translation characters and phonetics, high rates of place name merging, alteration, and abandonment, limited documentary reserves, and substantial decline in the size of minority language user groups constitute other significant single-indicator factors.

Keywords: place name culture; vulnerability; minority; agro-pastoral ecotone in northern China; evaluation system

Introduction

Place names represent valuable intangible cultural heritage that records regional natural environments, ecological changes, historical contexts, folk beliefs, and political philosophies. Due to complex and intense human-land relationship evolution and centuries of sinicization, minority-language place name culture vulnerability in the agro-pastoral ecotone of northern China is particularly significant, raising serious concerns about sustainable development and presenting painful dilemmas of rupture and disappearance for its inheritance and development. Place names constitute an open cultural system comprising naming

systems, language systems, user groups, and management systems, closely associated with regional natural, social, cultural, economic, and political environments. Minority place name culture vulnerability refers to a state in which the minority place name cultural system suffers damage due to its inherent sensitivity and exposure and lack of resilience when disturbed by internal and regional environmental changes. This manifests as distorted phonetic translations, deep sinicization, large semantic translation errors, ambiguous semantic explanations, considerable etymological disputes, frequent merging, alteration, and abandonment phenomena, weak stability and continuity, low social recognition, and obvious marginalization trends.

Vulnerability research initially focused on natural environmental systems but has increasingly penetrated human and social systems. Multi-angle academic discussions have continuously enriched vulnerability elements, largely promoting conceptual exchange across different research fields. Currently, vulnerability has evolved from a general concept in natural environmental system research into an independent and complete conceptual system, with basic consensus reached across different research domains that vulnerability represents “the degree to which a system, subsystem, or system component may be damaged due to exposure to disturbances and pressures.” As an important component of diversified Chinese place name culture development, minority-language place names have long attracted scholarly attention. Research represented by Liu Nanwei and Sun Donghu on South China Sea islands has examined historical evolution, naming backgrounds, folk customary place names, and systematic and standardized naming, as well as the historical influence of foreign place names. Qin Ninglang’s research has focused on vocabulary systems, word formation, and categorization from a linguistic and cultural perspective. The rise of GIS technology has transformed empirical research on multi-ethnic place names. Research by scholars such as Situ Shangji, Zhu Hong, and Wang Bin on Guangdong and Hainan provinces has been particularly thorough, covering distribution patterns, place name zoning, sensitive zones of change, place name strata, replacement during rapid urbanization, and cultural diffusion processes reflected in place names. Wang Fahui et al. employed GIS technology and mathematical statistical analysis to examine distribution patterns and influencing factors of multi-ethnic place names, laying a foundation for subsequent research. Research by Niu Ruchen and Zhong Xingqi on Western Regions multi-ethnic place names represents exemplary historical textual research, including semantic and etymological analysis, Chinese pinyin annotation, English and Latin transliteration, place name strata, and inter-place name relationships. Recent scholarship has begun focusing on Tibetan and Mongolian place names within China. Tibetan place name research has examined ancient Tibetan place name characteristics, Chinese translation of Tibetan place names, linguistic features, spatial patterns, generative mechanisms, and protection strategies. Mongolian place name research remains relatively limited, concentrating in Qinghai and focusing on cultural representation and historical evolution, belonging to descriptive and historical verification categories. Renqin Daoerji was among the earliest scholars

to address Mongolian place name protection within China, discussing phonetic and semantic translation errors, systematic classification, formation causes, and protection measures for endangered Mongolian place names. In summary, existing research on minority-language place names is rich, covering historical verification, linguistic characteristics, geographical patterns, formation mechanisms, and management protection. However, vulnerability of minority place name culture has not yet received attention. Although some scholars have examined dilemmas and deep causes in inheritance and development of minority place name culture, these remain empirical and qualitative judgments lacking quantitative evaluation of endangerment levels, with regional empirical research also requiring further development.

This study introduces the vulnerability research paradigm to identify influencing factors of minority place name culture vulnerability in the northern agro-pastoral ecotone, construct a vulnerability evaluation system, discuss evaluation scales and methods, and conduct empirical research on typical case areas. The research aims to: (1) construct a minority place name culture vulnerability evaluation system to quantify vulnerability degree, transforming previous qualitative research on endangered minority place names into quantitative vulnerability research and providing new ideas and paradigms for related research; (2) provide beneficial references for later research on spatiotemporal characteristics of vulnerability and for protection of minority place name culture in the northern agro-pastoral ecotone.

1.1.1 Basic Attributes of Place Names

Historically, limited by production and lifestyle patterns, minority-language place names in the northern agro-pastoral ecotone were mostly preserved through oral transmission with few written records. Consequently, the longer the naming history, the greater the difficulty of textual verification. The simplification degree and standardization level of Chinese translation characters and phonetics, along with translation accuracy, are fundamental to the complete preservation and inheritance of minority-language place names in the ecotone. Although official efforts continue to use minority-language place names, they are typically recorded only on carriers written in minority scripts and in socially mandated public texts. For the general public, including minority ethnic groups themselves, Chinese-translated minority place names are used extensively, leading to divergence between official and popular naming practices. Additionally, prominent phenomena of multiple names for one place and one name for multiple places easily confuse minority-language place names, causing numerous difficulties in social life and inconveniencing place name management.

1.1.2 Place Name User Groups

Place names are not merely proper names for geographical entities but cultural entities rooted in local residents' daily lives. Correct cognition by local residents

of minority-language place names, along with minority language user groups, constitutes the key to embedding and sustaining minority place name culture. When increasing numbers of local residents cannot correctly pronounce the original phonetics of local minority-language place names, do not understand their etymology and semantics, or even mistake Chinese-translated minority place names for Chinese place names, minority-language place names become difficult to truly preserve and use. Meanwhile, as the size of minority language user groups in the northern agro-pastoral ecotone continues to decrease, it undermines the stability and transmission of linguistic and cultural connotations such as character usage, phonetic translation, and semantic translation of minority-language place names.

1.2.1 Policy Environment

Local resettlement policies for ecological migration were initiated across the northern agro-pastoral ecotone in the late 1990s. For herders who had lived for generations in deep grassland areas, migration meant the disappearance of geo-culture, causing place names in relocation areas to exist increasingly as a form of memory and cultural microcosm, gradually forgotten or disappearing from herders' daily lives. Since the founding of the People's Republic of China, with the abolition of the league-banner system, administrative adjustments below the banner and county level in the northern agro-pastoral ecotone, particularly in Inner Mongolia, have been frequent, leading to prominent merging, alteration, and abandonment of minority-language place names.

1.2.2 Social, Economic, and Cultural Environment

Place names emerge on the basis of language and spread through language. With increasing Chinese language proficiency rates, the linguistic and cultural environment of the northern agro-pastoral ecotone continues to be reconstructed, hindering the promotion and use of minority-language place names. The influx of Han immigrant populations increases the scale of Chinese place names while accelerating and deepening the sinicization of minority-language place names. Settlements are carriers of settlement place names; settlement changes concern the continuation of settlement place names. As minority settlements decrease, minority-language settlement place names will gradually lose their foundation. Regional land use patterns and economic activity types mirror regional cultural ecology; therefore, indicators such as farmland scale and agricultural economic activity scale can indirectly reflect the influence of Han immigrant culture on place name cultural changes in case areas. Under the influence of social ideology in special historical periods, some minority-language place names have been replaced by Chinese place names with distinctive era characteristics (such as Hongxing, Hongqi, Fengshou, Fanrong, Xianjin, etc. from the founding period and people's commune period). For easier pronunciation, time-saving expression, and convenient use, minority-language place names are increasingly replaced by simplified Chinese translations, raising social recognition of Chinese-translated

minority place names while marginalizing minority-language place names in daily life.

1.3.1 Place Name Management and Protection Work

Thorough place name protection and management work is significant for the stable development of minority place name culture in the northern agro-pastoral ecotone. As an important component of basic national condition surveys, place name censuses help clarify the basic situation of minority-language place names across regions in the northern agro-pastoral ecotone and enhance the capacity of minority place name culture to adapt to and resist external influences.

1.3.2 Place Name Documentation

Combing through historical documents related to minority-language place names in the northern agro-pastoral ecotone not only helps grasp current documentary reserves but also facilitates tracing the origins of minority-language place names in future protection and management work, thereby improving the resilience of minority place name culture.

2.1 Evaluation System Construction

Based on influencing factors of minority place name culture vulnerability in the northern agro-pastoral ecotone, this study introduces the “Sensitivity-Exposure-Resilience” analytical framework to construct an evaluation system. Evaluation indicator selection follows systematic, scientific, and operational principles. First, the systematic principle emphasizes examining vulnerability by treating place names as a cultural system. Second, given the comprehensive and interdisciplinary nature of place name research, vulnerability assessment should proceed from a scientific perspective: place names are linguistic codes conforming to basic linguistic laws, while also belonging to history and geography disciplines that should respect history and follow regional principles. Finally, given problems of village-level data scarcity and acquisition difficulty, enhancing data availability and achieving reasonable quantification and scoring to improve indicator system operability is particularly important.

2.2.1 Index Collection and Quantification Methods

The minority place name culture vulnerability evaluation system involves both quantitative and qualitative indicators, with each indicator affecting vulnerability differently. Indicator system data were collected through a combination of literature review, field visits, and in-depth interviews. Specifically, data on basic place name attributes were collected through literature review, in-depth interviews, and field visits. First, literature review was used to gather information on X. Then, through in-depth interviews with relevant experts and key informants, the expert scoring method was employed to request scoring of X.

Since all collected minority-language place names were Chinese-translated versions, etymology was determined based on relevant literature before interviews, with disputed cases clarified during interviews with experts and key informants. X represents the average score given by experts and key informants. Data on X were investigated through in-depth interviews with local residents. Interview content involved presenting a list of settlement place names (by township) and asking respondents to identify each name's language and briefly explain its meaning, while inquiring about their willingness to use Mongolian versus Chinese-translated Mongolian place names in daily life and scoring this willingness. Then, expert scoring was used to have experts and key informants score the degree of error in residents' judgments about place name language and meaning explanations. Data on X were investigated primarily through literature review supplemented by field visits. For X , in-depth interviews with key informants combined with literature review were conducted. Interview content inquired about the basic situation of local place name census materials, including whether censuses had been completed, what archived materials and census results had been compiled, and how many place name entries had been surveyed. Then, through in-depth interviews with experts, expert analysis was used to score the completeness of census materials, requesting interviewees to score completeness from perspectives such as the number of place names covered, explanations of semantics and etymology, naming time and basis, and historical evolution.

2.2.2 Evaluation Model

Comprehensive Index Weighted Summation Model. The comprehensive index weighted summation model [Eq. (1)] synthesizes indicators through mathematical and statistical methods to measure the minority place name culture vulnerability evaluation system. The model calculates scores for secondary subsystems and specific indicators using the weighted summation model, then calculates vulnerability degree using the function model.

Function Model. The function model can measure vulnerability from the perspective of interactions among vulnerability components [Eq. (2)], where vulnerability is positively correlated with exposure and sensitivity and negatively correlated with resilience.

$$R = f(S, E, R_s)$$

Where: R is the vulnerability index; R_s is the sensitivity index; E is the exposure index; R_r is the resilience index.

2.2.3 Index Weighting and Grading Assignment

Index Weighting. As indicators differ in effect and influence, the Analytic Hierarchy Process (AHP) was used for weighting. First, comparative quantified

values between indicators were determined . Specific indicators' comparative judgment matrices were constructed through in-depth interviews with relevant experts and key informants using the expert scoring method. After normalization, indicator weights were obtained. The consistency ratio ($CR = CI/RI$, where CI is the consistency index and RI is the average random consistency index) was used to test matrix consistency and judge weight calculation result rationality.

Grading Assignment. Original data in the evaluation system differ in magnitude, direction, and unit, requiring consistent scoring standards. First, indicator scores undergo hierarchical assignment; second, qualitative and quantitative indicators are scored separately . For qualitative indicators, grading assignment follows survey scores directly. For quantitative indicators, Eq. (3) first determines grading standards:

$$i = \begin{cases} 1 & \text{if } x_j \in [\bar{x} - \sigma, \bar{x} + \sigma] \\ 2 & \text{if } x_j \in [\bar{x} + \sigma, \bar{x} + 2\sigma] \\ 3 & \text{if } x_j \in [\bar{x} + 2\sigma, x_{\max}] \\ 4 & \text{if } x_j \in [x_{\min}, \bar{x} - 2\sigma] \\ 5 & \text{if } x_j \in [\bar{x} - 2\sigma, \bar{x} - \sigma] \end{cases}$$

Where: x_j represents quantitative indicator values ($j = 1, 6, 7, 9, 10, 11, 12, 13, 14, 15, 16$); $\bar{x}$, $x_{\min}$, and $x_{\max}$ represent mean, minimum, and maximum values respectively; i represents grading standards for each interval ($i = 1, 2, 3, 4, 5$), corresponding to not vulnerable (1 point), slightly vulnerable (2 points), moderately vulnerable (3 points), severely vulnerable (4 points), and extremely vulnerable (5 points). When quantitative indicators (x_j) fall within the range of Eq. (3), $i = 1$; when falling within Eq. (4), $i = 2$; when falling within Eq. (5), $i = 3$; when falling within Eq. (6), $i = 4$; when falling within Eq. (7), $i = 5$. Finally, hierarchical assignment follows i values. For specific indicators within the resilience subsystem (indicators x_{17} to x_{19}), opposite grading assignment methods are applied .

3.1 Case Study Area Overview

Damao Banner is located in the central part of the northern agro-pastoral ecotone [Figure 1: see original paper], administered by Baotou City, Inner Mongolia Autonomous Region, covering an area of $11.1 \times 10^3 \text{ km}^2$ with a total population of 1.7×10^5 (92,000 Mongolian, 76.86% Han). In 1952, Darhan Banner and Maoming' an Banner merged, giving Damao Banner its full name: Darhan Maoming' an United Banner. Damao Banner lies in a mid-temperate semi-arid continental climate zone, roughly along the 300-450 mm isohyet. Since the late Ming Dynasty, immigrants from Shanxi, Shaanxi, and Hebei provinces successively "walked westward" to Damao grasslands, thoroughly opening economic and cultural channels between the Central Plains and Mongolian grasslands and

making Damao Banner a knot region for northern nomadic and agricultural cultural exchange and integration. Official and private cultivation also converted nearly half of Damao Banner's grasslands into farmland. Currently, boundary definition of the northern agro-pastoral ecotone based on land use elements is one of the most widely applied methods. Following Zhao Halin et al.'s research, this study uses land use patterns for geographical boundary definition. Settlement place names constitute the main body of regional place name systems and effectively reflect regional human-land relationships. Damao Banner has 1,079 settlement place names, including 695 Mongolian settlement place names. This study uses Mongolian settlement place names as examples.

3.2 Evaluation Results

First, AHP consistency test results show $CR = 0.0033 < 0.1$ and $RI = 1.63$, indicating reliable expert scoring and reasonable judgment matrix structure and weight calculation results. Second, the comprehensive index weighted summation model calculated scores for secondary subsystems and specific indicators, then the function model calculated Mongolian place name culture vulnerability in the case area.

Overall, Mongolian place name culture in Damao Banner exhibits certain vulnerability, with both sensitivity and exposure contributing substantially. Mongolian place name culture vulnerability is jointly influenced by internal damaging and external disturbing factors. Specifically, basic place name attributes and regional social, economic, and cultural environments are important influencing factors. Additionally, place name user groups substantially affect Mongolian place name culture vulnerability. Specific indicator results reveal that local residents' erroneous cognition of Mongolian place name etymology and semantics, high Chinese language proficiency rates, strong social recognition of Chinese-translated Mongolian place names, and inaccurate semantic translations constitute important driving factors of vulnerability. Furthermore, simplification and non-standardization of Chinese translation characters and phonetics, high rates of Mongolian place name merging, alteration, and abandonment, limited place name documentary reserves, and substantial decline in Mongolian user group size also represent important single-indicator factors.

4 Discussion

The evaluation system for minority place name culture vulnerability in the northern agro-pastoral ecotone constructed in this study was completed through rigorous indicator screening and construction based on long-term field investigations and literature review. The indicator system can accurately and comprehensively assess vulnerability degrees of minority place name culture in the northern agro-pastoral ecotone, deeply revealing dilemmas and causes in inheritance and development. The research transforms previous qualitative studies on endangered minority place names into quantitative vulnerability research, providing

new ideas and paradigms for place name studies, laying foundations for later research on temporal evolution patterns and spatial distribution characteristics of minority place name culture vulnerability, and offering beneficial references for protecting minority place name culture in the northern agro-pastoral ecotone.

This study represents a vulnerability assessment at a single time section for a case area in the northern agro-pastoral ecotone. However, vulnerability and its influencing factors in this narrow belt exhibit temporal dynamics and regional differences. Future research should further conduct multi-scale, multi-level spatiotemporal differentiation studies. In other words, continuous tracking studies of specific regions should be conducted to analyze temporal evolution patterns, while comparative analyses across different spatial scales should be performed to achieve spatial visualization and distribution characteristic research, thereby comprehensively revealing vulnerability and driving factors of minority place name culture in the northern agro-pastoral ecotone and advancing place name culture research paradigms.

5 Conclusion

The realization of the Chinese Dream of the great rejuvenation of the Chinese nation cannot be separated from cultural prosperity, which often begins with research and protection of cultural heritage. As an important component of intangible cultural heritage, place names concern regional culture and ethnic identity, carry national historical contexts, and embody national spiritual values and modes of thinking. Minority-language place names constitute an important component of diversified Chinese place name culture development and represent cultural resources with inheritance value. Research on minority place name culture holds important theoretical and practical significance for promoting traditional Chinese culture, enhancing national cultural confidence, and strengthening Chinese national cohesion.

In the historical process of multi-ethnic exchange and integration, the scale of endangered minority-language place names in the northern agro-pastoral ecotone continues to increase, vulnerability becomes increasingly apparent, and inheritance and protection dilemmas grow more prominent. This study introduces the vulnerability research paradigm to construct an evaluation system for minority place name culture vulnerability in the northern agro-pastoral ecotone, including three core systems (sensitivity, exposure, and resilience), six secondary subsystems (basic place name attributes, place name user groups, policy environment, regional environment [social, economic, and cultural], place name management and protection work, and place name documentation), and 19 specific indicators. Empirical research was conducted on Mongolian settlement place names in a typical case area.

Empirical results demonstrate that Mongolian place name culture in the case area exhibits prominent sensitivity and exposure and weak resilience, resulting in obvious vulnerability. As an open cultural system, the formation of Mongo-

lian place name culture vulnerability results from combined effects of multiple internal and external factors. Specifically: (1) In the sensitivity subsystem, basic place name attributes and user groups constitute internal damaging factors. Basic attributes include simplification and non-standardization of Chinese translation characters and phonetics and inaccurate semantic translations, while user groups manifest as local residents' erroneous cognition of Mongolian place name etymology and semantics and substantial decline in Mongolian user group size. (2) In the exposure subsystem, regional social, cultural, and policy environments constitute external disturbing factors. From a policy perspective, ecological migration resettlement projects since the 1990s and frequent administrative adjustments have led to continuous merging, alteration, and abandonment of many Mongolian place names. Regarding linguistic and cultural environments, increasing Chinese language proficiency rates continuously reconstruct the linguistic environment, hindering promotion and use of Mongolian place names. From a social perspective, higher social recognition of simplified Chinese-translated Mongolian place names leads to their replacement of Mongolian place names, causing continuous marginalization in daily life. (3) In the resilience subsystem, documentary reserves on place names provide powerful bases for historical verification and tracing origins, representing key factors for improving place name culture resilience and capacity to adapt to and resist external influences. However, current documentary reserves on Mongolian place names in the case area remain limited, primarily because: first, nomadic production and lifestyle were relatively backward with short written histories, making written records of place names scarce; second, nomadic activities were highly mobile with poor settlement stability, making place name preservation and continuation difficult.

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