Classification and coding of wetland ecological station sites and data

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Abstract: The construction of wetland ecological stations provides an important platform for long-term positioning observation of wetland ecosystems. The digital construction of wetland ecological stations is currently an urgent task. Based on the characteristics of wetland ecological stations and observation indicators, this paper discusses and studies the coding methods for observation sites and observation data of wetland ecological stations from the perspective of observation sites, observation plots and observation data, providing reference for data management and digital construction of ecological stations.

Keywords: Wetland ecological station, Observation site, Observation data, Coding

1. Introduction

The full name of wetland ecological station is Wetland Ecosystem Long-term Observation and Research Station. It is a long-term positioning observation site established in important and typical wetland areas, where long-term positioning observations are conducted on the ecological characteristics, ecological functions, and human disturbances of wetland ecosystems through establishing long-term observation points and observation plots. This reveals the mechanisms and regulation methods of the occurrence, development, and succession of wetland ecosystems, providing scientific basis for the protection, restoration, reconstruction, and rational utilization of wetlands. A number of wetland ecological stations distributed in important wetland type areas across the country constitute the China Wetland Ecosystem Research Network (CWERN), abbreviated as "Wetland Ecological Station Network" in Chinese [1].

One of the core tasks of CWERN is to conduct long-term networked observations on water, soil, atmospheric environmental elements, and organisms of major wetland ecosystems in China, obtaining long time-series data of ecosystem dynamic changes, and revealing their variation patterns and driving factors in different periods. Standardized and unified observation indicator systems, management methods, and service standards are the prerequisites and foundations for effectively integrating observation data from wetland ecological stations and achieving information sharing among stations, and are key links and important contents in the construction of wetland ecological stations. Wetland ecological station data information is diverse and rich in content, involving observation data, remote sensing data, basic data, and many other fields. Only by classifying and coding this wetland ecological station information according to certain standards, storing it orderly in computers, standardizing database entry, and storing, managing, and updating data by category, can various application needs be met. Otherwise, collected data may become ambiguous due to differences in definitions, concepts, units, and classifications, and even lead to the complete loss of database utility.

Currently, research on classification and coding of wetlands in China has been conducted [2]. Based on these studies and combining the characteristics of wetland ecological stations and observation indicators, this paper discusses and studies the coding methods for observation sites and observation data of wetland ecological stations from the perspective of observation sites, observation plots, and observation data, providing reference for data management and digital construction of ecological stations.

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2. Observation sites and observation plots

Each observation site of wetland ecological stations is assigned a fixed code to prevent different codes being given to the same observation site, which would affect data comparability. According to the "Technical Requirements for the Construction of Wetland Ecosystem Long-term Observation and Research Stations" [3], comprehensive observation sites, meteorological observation sites, hydrological observation sites, soil physical and chemical properties observation sites, and community characteristics observation sites are established. The comprehensive observation site of a wetland ecological station refers to a long-term fixed observation site for comprehensive observation of biological, soil, atmospheric, and water elements. The location of the observation site should be the most representative area within the region where the ecological station is located, mainly used for monitoring changes in typical wetland ecosystems in the region and revealing their processes and mechanisms. Meteorological observation sites should be designed and installed uniformly in accordance with national requirements for automatic weather stations, as far as possible reflecting the characteristics of meteorological elements over a larger range of the site, avoiding the influence of terrain and surrounding environment. The classification codes for observation sites are shown in Table 1.

Table 1 Observation Sites and Codes

No.	Observation Site	Code
1	Comprehensive Site	ZH
2	Meteorological Site	QX
3	Hydrological Site	SW
4	Soil Properties Site	TR
5	Community Characteristics Site	QL

The coding adopts a 7-digit format (XXXXXXX), with digits 1–3 from left to right representing the ecological station name code, digits 4–5 representing the observation field category code, and digits 6–7 representing the serial number of the observation field within its category, starting sequentially from 01, 02, 03, etc. The ecological station name is chosen as an abbreviation of the typical region where the station is located. If the abbreviation has fewer than three characters, zeros are added to the end to fill it to three digits; if it has more than three characters, it is appropriately shortened.

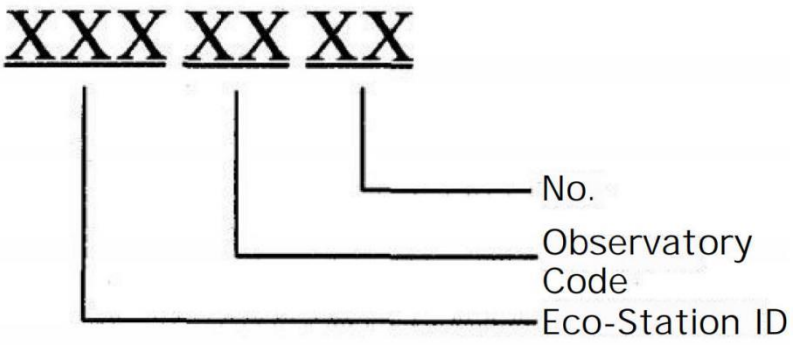

Figure 1: Observation Field Coding Structure

A long-term observation plot is a fixed site established within an observation field for the systematic collection and monitoring of biological, soil, and water samples over an extended period. The coding adopts a 12-digit format. The first 7 digits from left to right represent the observation field code, digits 8–10 represent the observation plot category code, and digits 11–12 represent the observation plot serial number, starting sequentially from 01, 02, 03, etc. If the observation plot code has fewer than 3 digits, it is padded with zeros. The structure of the observation plot coding is shown in Figure 2.

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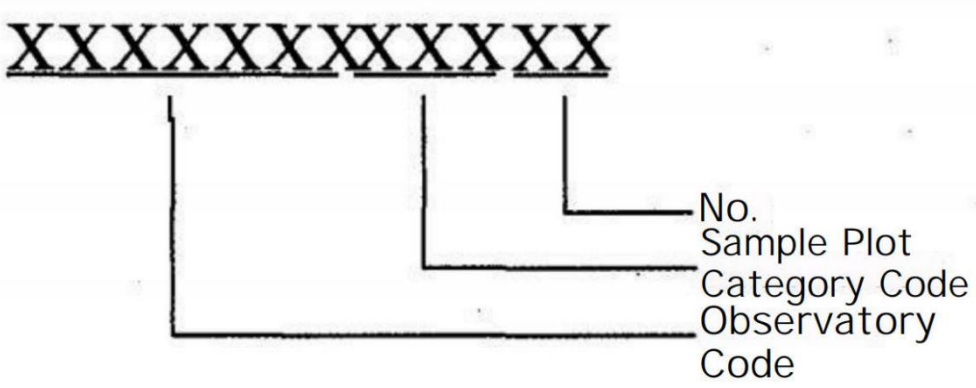

Figure 2: Observation Plot Coding Structure

Ecological station plot codes are shown in the table

Table 2: Observation Plots and Their Codes

Serial Number	Observation Plot	Code	Observation Plot	Code
1	Meteorological Observation Plot	QXC6	Water Quality Observation Plot	SZD
2	Comprehensive Observation Tower	GCT7	Soil Moisture Observation Plot	TSF
3	Flow Measuring Weir	CLY8	Soil Physical and Chemical Properties Plot	TLH
4	Observation Well	CJO9	Biological Observation Plot	SYD
5	Hydrological Observation Plot	SWD10	Fixed Standard Plot	BZD

For example, the code for the meteorological observation plot in the comprehensive observation field of the Sichuan Ruoergai Alpine Wetland Ecosystem Positioning Observation and Research Station is REG-ZH01QXC01.

3. Coding of observation data for wetland ecological stations

Data coding, also known as data dictionary, is the transformation of a certain symbol system representing data into another symbol system that is convenient for computers or humans to recognize and process. It is a tool for data processing personnel to control and manage relevant data information during the stages of database design, implementation, operation, maintenance, and expansion. The classification and coding of data is an important basis for the system to achieve effective management and an important content of the attribute database. Establishing unified coding standards for system data is not only conducive to the calculation, entry, storage, transmission, and operation of data information, but also facilitates the exchange and sharing of data [4]. The purpose of observation data coding for wetland ecological stations is to organize and establish databases for observation data, so as to facilitate integrated data analysis and data sharing and utilization.

3.1. Coding principles

The classification and coding of observation data for wetland ecological stations should follow the principles of scientificity, systematicness, consistency, simplicity, uniqueness, expandability, standardization, and applicability. The coding should be easy to remember, able to cover all situations, and contain only key information.

3.2. Coding method

The observation data structure of wetland ecological stations is defined as three segments: indicator system identification code, indicator category identification code, and indicator element code. That is, the

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code structure is: indicator system identification code + indicator category identification code + indicator element code.

3.2.1. Indicator system identification code

According to the requirements of the "Positioning Observation Indicator System for Wetland Ecosystems" [5], wetland ecological stations involve seven major categories of observation indicator systems: wetland general overview indicators, wetland meteorological observation indicators, wetland soil observation indicators, wetland hydrological observation indicators, wetland water quality observation indicators, wetland biological observation indicators, and wetland disaster observation indicators, totaling 51 classes of indicators. The indicator system identification code is represented by the acronym of key words for each category of indicators, using a 2-digit code: GK, QX, TR, SW, SZ, WG, and ZH respectively.

3.2.2. Indicator category identification code

The indicator category identification code should fully reflect the characteristics of the indicator category, adopting a 4-digit code format, using the first letter of each indicator category to represent it. If less than four digits, it is padded with 0; if more than four digits, it is appropriately abbreviated. The indicator category identification codes are shown in Table 3.

3.2.3. Indicator element codes are codes for specific observation elements

Table 3 Observation Indicator Categories and Identification Codes

No.	Indicator Category	Code	No.	Indicator Category	Code
1	Geographic Coordinates	DLZB	27	River Wetland	HLSD
2	Average Elevation	HBGD	28	Lake Wetland	HPSD
3	Landform Type	XTLX	29	Marsh Wetland	ZZSD
4	Primary Wetland Type	SDLX	30	Physical Properties	SZWL
5	Wetland Formation Type	CYLX	31	Chemical Properties	SZHX
6	Total Wetland Area	ZMJ0	32	Dissolved Gases	RJQT
7	Wetland Water Source Type	SYLX	33	Wetland Vegetation Characteristic	ZBTZ
8	Wetland Water Storage	XSLO	34	Wetland Plant Community Characteristics	QLTZ
9	Surface Water Status	JSZK	35	Wetland Plant Community Biomass	SWLO
10	Wetland Soil Type	TRLX	36	Wetland Plant Litter	DLWO
11	Bottom Mud Type	DNLX	37	Wetland Wildlife	YSDW
12	Human Disturbance Intensity	GRQD	38	Wetland Soil Fauna	TRDW
13	Weather Phenomena	TQXX	39	Wetland Zooplankton	FYDW
14	Air Pressure	SDQY	40	Wetland Phytoplankton	FYZW
15-	Wind	SDF0	41	Wetland Benthic Fauna	DQDW
16	Air Temperature	KQWD	42	Wetland Microorganisms	WSWo
17	Ground Temperature	DBWD	43	Wetland Endangered Species	BWWZ
18	Atmospheric Moisture	KQSD	44	Zoonotic Diseases	YYYB
19	Solar Radiation	FSO0	45	Invasive Alien Species	RQWZ

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20	Precipitation	DQJS	46	Insect Pest	CH00
21	Evaporation	ZFLO	47	Plant Disease	BH00
22	Soil Physical Properties	TRWL	48	Animal Damage	SH00
23	Soil Chemical Properties	TRHX	49	Wildfire	HZ00
24	Peat Layer	NTC0	50	Algal Bloom / Red Tide	SHCC
25	Permafrost Layer	DTC0	51	Meteorological Disasters	QXZH
26	Coastal and Near-shore Wetland	BHSD			

The indicator element code mainly refers to the specific observation element indicators in the system, adopting a 4-digit code format, using the first letter of each indicator category to represent it. If less than four digits, it is padded with 0; if more than four digits, it is appropriately abbreviated. The coding structure of observation data for wetland ecological stations is shown in Figure 3.

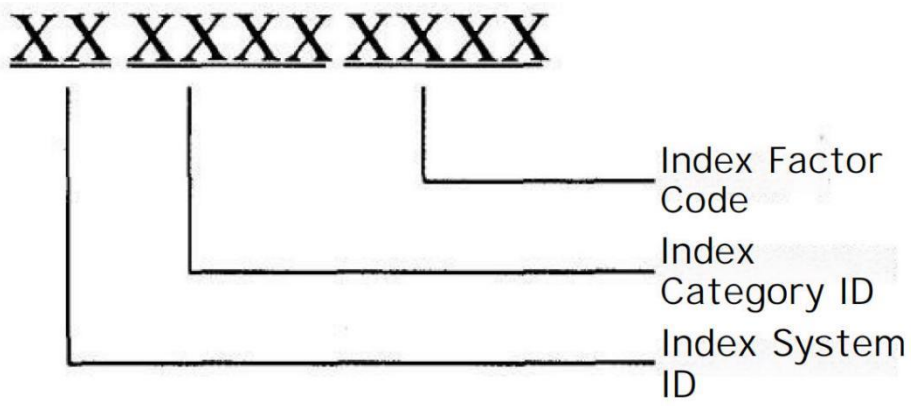

Figure 3 Coding Structure of Observation Data

For example, the code for the chemical oxygen demand (COD) observation indicator of wetland water quality is SZSZHXCOD0.

4. Conclusion

The "Ecological Environment Monitoring Network Construction Plan" issued by the General Office of the State Council points out that ecological environment monitoring is the foundation of ecological environment protection and an important support for the construction of ecological civilization. It is necessary to align the capacity of ecological environment monitoring with the requirements of ecological civilization construction. The construction of wetland ecological stations provides an important platform for conducting long-term positioning observation of wetland ecosystems. The digital construction of wetland ecological stations is currently an urgent task. The coding of observation sites and observation data is one of the key issues for achieving data information exchange, integration, and sharing. Therefore, research on data coding methods for ecological stations is of great importance. The coding method presented in this paper still has room for improvement, and the code length, character specifications, etc., need further discussion.

5. References

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