Available Online: 4 November 2025 DOI: 10.54254/2753-7080/2025.28794

Ecological wisdom of traditional Tibetan settlements

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Abstract. For thousands of years, traditional Tibetan settlements have embodied ecological wisdom that harmonizes the relationship between humans and nature. Based on literature review and field investigation, this paper explores the ecological wisdom of traditional Tibetan settlements from the perspectives of site selection, resource utilization, architectural construction, and cultural belief. From geographical adaptation in site selection and spatial layout, to the circular concept of resource utilization, from climate-responsive architectural forms to the ecological constraints of spiritual beliefs [1], Tibetan ancestors developed a systematic wisdom that balanced survival needs with ecological protection while coexisting with an extreme environment. This wisdom provides practical reference for contemporary urban and rural planning, architectural design, and ecological protection, thereby contributing to sustainable development.

Keywords: Tibetans, traditional settlements, ecological wisdom

1. Introduction

Traditional Tibetan settlements are mainly distributed across the Qinghai–Tibet Plateau, an area with high elevation, strong radiation, and drastic temperature differences, often referred to as the "Third Pole of the World." Although this region is characterized by harsh climatic conditions and is unsuitable for human habitation, Tibetan ancestors explored and experimented over thousands of years, building numerous traditional settlements and creating a unique plateau dwelling civilization. They developed distinctive ecological wisdom that ensures the harmonious coexistence of humans and nature.

The ecological wisdom of traditional Tibetan settlements represents an understanding and application of natural laws that was acquired through long-term survival practices. It encompasses not only specific technical measures such as cold-resistant architectural techniques and water resource management, but also abstract value systems such as nature worship and resource ethics [2]. At present, many settlements face ecological degradation and cultural loss under the accelerating process of modernization, which has prompted a renewed interest in rediscovering and applying this ecological wisdom [3].

2. Ecological wisdom in the site selection of traditional Tibetan settlements

When selecting settlement sites, Tibetans considered the surrounding natural and geographical environment. To achieve harmony with the environment, settlements were often established in river valleys. For example, Tibetan villages in the Yarlung Tsangpo River Basin were located in valleys with flat terrain, abundant water, and fertile land, which facilitated farmland irrigation and crop growth. Valley areas also had relatively higher temperatures, which helped resist the cold climate of the plateau, thereby creating a more suitable living environment.

In mountainous areas, dwellings were often built on sunny slopes. These slopes provided sufficient sunlight, ensuring warmth and dryness for the houses. The sloping terrain also facilitated drainage, reducing the risk of flooding. Additionally, surrounding forest resources supplied essential materials for daily life, such as timber for construction and firewood for heating and cooking.

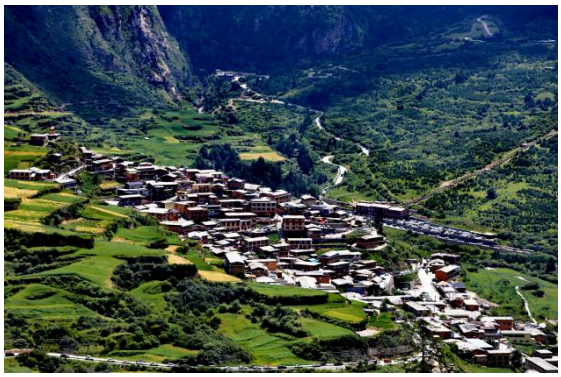

Figure 1. Site selection of Tibetan settlements. Image source: internet

3. Ecological wisdom in the resource utilization of traditional Tibetan settlements

3.1. Ecological wisdom in the utilization of water resources

Water resources on the Qinghai–Tibet Plateau are unevenly distributed in both time and space: abundant in summer due to glacial meltwater, scarce in winter, plentiful in the southeast, but limited in the northwest. Through long-term exploration, Tibetan ancestors developed water management techniques.

At high altitudes, the main source of water was glacial meltwater. People built diversion channels to guide meltwater from mountain slopes into reservoirs or underground cisterns. These storage structures, often stone-built, were constructed in elevated areas so that water could be supplied to settlements and farmlands by gravity.

In arid regions with little rainfall, rainwater was collected from rooftops and courtyards. Roofs were sloped so that rainwater could flow into stone-lined channels under the eaves and then into cisterns. Courtyard floors were often treated with impermeable materials such as clay or stone slabs to reduce seepage and facilitate rainwater collection.

3.2. Ecological wisdom in the utilization of land resources

The Qinghai–Tibet Plateau has poor soil and limited arable land and pasture. Tibetan ancestors employed strategies of "three-dimensional utilization" and "crop rotation with fallowing." In mountainous areas, residents created a vertical agricultural system based on altitude: alpine pastures on mountain tops, woodlands on mid-slopes, and farmland at the foot of mountains. Farmland at lower altitudes, with warmer temperatures, was suitable for crop cultivation, while mountain tops, with steep slopes and lower temperatures, were unsuitable for crops and trees but appropriate for grass planting to support animal husbandry. Crop rotation and fallowing helped maintain soil fertility. In agricultural areas, a "barley–pea" rotation system was practiced: barley consumed significant amounts of nitrogen fertilizer, while nitrogen-fixing rhizobia in peas replenished soil fertility. Alternatively, a "two years of cultivation, one year of fallow" model was adopted, allowing land to naturally recover fertility.

On grasslands, nomadic herders practiced "seasonal rotational grazing." In spring, livestock were taken to low-altitude river valley pastures where grass regrew early due to higher temperatures. In summer, they moved to alpine pastures, which had a cooler climate and lush grass. In autumn, mid-slope pastures were used, and in winter, livestock stayed in sheltered, sunny low mountain pastures that protected them from wind and cold. This system prevented overgrazing and allowed pastures sufficient time for regrowth.

3.3. Ecological wisdom in the utilization of energy

For heating and cooking, Tibetan residents relied on yak dung as fuel. Herdsmen collected yak dung, dried it into patties, and used it as a biofuel. This method exemplified resource recycling, reduced dependence on electricity, and mitigated environmental pollution.

4. Ecological wisdom in the architecture of traditional Tibetan settlements

4.1. Ecological wisdom in building materials

In most areas of Tibet and eastern Qinghai, stone is abundant and has long been used as a building material. The use of local stone reduces costs and transportation expenses. Strong and durable, stone was typically used for walls and foundations. When

constructing walls, residents often employed locally sourced slate and rubble stone, using dry masonry or mud mortar techniques. Wall thicknesses ranged from 0.8 to 1.5 meters, taking advantage of stone's slow thermal conductivity to maintain warmth and resist freezing. For example, the stone towers of Tibet were built with local granite, with rubble and soil packed into the middle of the walls to form a "sandwich" structure. In winter, this design could maintain an indoor–outdoor temperature difference of 15–20°C.

Figure 2. Stone dwellings of Tibet. Image source: internet

In southeastern Tibet and western Sichuan, where timber is plentiful, wood was widely used for house construction, which also helped lower costs. Buildings were often constructed with fir timber, a material known for its weather resistance, light weight, corrosion resistance, and frost durability. Tibetans observed a customary rule of "cut one, plant three": for every tree cut, three saplings had to be planted. This practice ensured that forest resources were not depleted.

In the river valley regions of Tibet, earthen construction was common. Soil was mixed with sand and wheat straw to make adobe bricks, with walls up to one meter thick. This low-energy, pollution-free method provided excellent thermal mass, keeping interiors warm in winter and cool in summer, often eliminating the need for air conditioning. Roofs were covered with thatch, which was both lightweight and waterproof.

Figure 3. Rammed-earth dwellings of Tibet. Image source: internet

4.2. Ecological wisdom in building structures

To cope with the severe cold climate, walls were constructed with thicknesses of 0.8 to 1.5 meters. Houses were generally low, with floor heights of only 2.5 to 3 meters, minimizing the surface area of the building and thus reducing heat exchange with the outside environment. Roofs were typically flat or gently sloped, reducing wind loads, enhancing wind resistance, and providing additional functional space for drying barley and storing goods, thereby improving land use efficiency and reducing the need for additional open drying grounds. For example, Tibetan stone towers were designed with square floor plans, walls tapering from

wide at the base to narrow at the top, and flat roofs. The overall form was solid and fortress-like, resistant to cold and earthquakes while also offering space for grain drying.

Figure 4. Tibetan stone tower. Image source: internet

In timber architecture, mortise-and-tenon joints were commonly used. Small gaps were intentionally left at structural joints, allowing for slight deformations. During earthquakes, the elasticity of the structure absorbed seismic energy, thereby reducing damage.

Windows and doors in Tibetan houses were designed to be small and often double-layered, with outer wooden shutters and inner glass or gauze layers. This minimized heat loss and protected against wind and sand. In winter, closing the outer wooden layer kept interiors warm, while in summer, opening the inner gauze or glass layer ensured good ventilation.

4.3. Ecological wisdom in functional layout

Tibetan dwellings adopted a stratified functional layout, typically built with two or three stories, following the principle of "livestock below, people above" and "cold below, warm above." The ground floor or semi-basement was used for keeping livestock, storing fodder, and housing farming tools, as it was damp and cool. The upper floors, especially the top floor, served as living and activity spaces, benefiting from higher solar radiation and warmth. For instance, in Huangzhong, Qinghai, Tibetan dwellings were arranged with bedrooms and chapels on the top floor, livestock pens on the ground floor, and kitchens and storage rooms in between. This arrangement allowed people to live in the warmer upper levels while maintaining sanitary separation between humans and animals.

Dwellings also featured "winter rooms" and "summer rooms." Winter rooms, located on the south side, had small windows and thick walls to provide better insulation, while summer rooms, on the north or east side, had larger windows for ventilation. In traditional houses in Shigatse, Tibet, the main south-facing rooms were designed as winter quarters with fireplaces, while the north-facing side rooms served as summer living spaces. Residents switched between the two seasonally, reducing energy consumption.

Multi-purpose spaces were also a common feature of Tibetan houses. A single room often served multiple functions—for example, a living room doubling as a kitchen and bedroom. During the day, it was used for cooking and receiving guests, while at night it became a sleeping space. Similarly, the family chapel also served as a meeting room for household discussions and sometimes as a space for religious activities. Such compact layouts reduced building volume and lowered the demand for both materials and energy.

5. Ecological wisdom in the culture of traditional Tibetan settlements

Tibetan culture embodies a profound reverence for nature, which reflects a deep ecological consciousness. Tibetans believe that all elements of the natural world are imbued with spirituality—mountains, rivers, trees, and animals are regarded as manifestations of deities. To honor these deities, sacred mountains are designated near settlements, believed to be the dwelling places of divine powers. Rituals and ceremonies are held on these sacred mountains to pray for peace, happiness, and favorable environmental conditions for the villagers. At the same time, activities such as tree cutting, mining, and hunting are strictly prohibited on sacred mountains, which effectively preserves the local forest ecosystems.

Rivers and lakes are also objects of great reverence. They are viewed as “holy waters,” believed to possess the power to purify both body and mind. Villagers pray at these waters for safety and blessings and bathe in them with the hope of dispelling illness and avoiding misfortune. Out of respect for the sanctity of these waters, people are prohibited from dumping garbage or discharging sewage into rivers and lakes. Such beliefs have helped maintain the cleanliness and sacredness of water sources, encouraging Tibetans to protect the environment in their daily lives and to uphold ecological balance.

In addition, many taboos and customs within traditional Tibetan settlements play an important role in ecological protection. For instance, in dietary practices, Tibetans traditionally avoid eating hoofed animals and certain bird species. These taboos, to some extent, have helped protect wildlife populations and maintain biodiversity.

6. Conclusion

Traditional Tibetan settlements embody rich and unique ecological wisdom. From site planning and resource utilization to architectural construction and cultural beliefs, they demonstrate how the Tibetan people have lived in harmony with nature. This ecological wisdom is not only the accumulated experience of Tibetans adapting to their environment over millennia but also a valuable treasure of human civilization. In the contemporary era, studying and inheriting the ecological wisdom of traditional Tibetan settlements carries significant practical value. Such wisdom provides useful references for modern urban and rural planning, architectural design, and ecological conservation, [4] thereby contributing to sustainable development and the realization of harmonious coexistence between humans and nature. It is essential to cherish this ancient wisdom and integrate it into the development of modern society, so that it may gain renewed vitality and relevance in the new era [5].

Funding

This paper is a research outcome of the 2023 Higher Education Teaching Research and Reform Project of Huizhou University, Research on the Application of Role-Playing Method Combined with VR in Architectural Design Teaching; the 2023 Higher Education Teaching Reform Project of the Department of Education of Guangdong Province, Reform of the “Five-Dimensional Integrated” Virtual Simulation Teaching Model in Architectural Design (Yuejiao Gaohan [2024] No. 9); and the 2024 Guangdong Provincial Education Science Planning Project (Higher Education Special Project), Application of Curriculum Ideology and Politics in Virtual Simulation Teaching of Architectural Practice Courses (Project No. 2024GXJK346).

References

[1] Yu, Q., Yin, S., & Gao, C. (2025). Ecological wisdom in the ancient Jingzhou city dyke-water system [J/OL]. *Landscape Architecture*, 1–17 [2025-08-19].

[2] Tong, F., & Yang, J. (2025). Construction of an index system for measuring ecological service demand in park cities under the concept of ecological wisdom [J]. *Environmental Science and Management, 50*(07), 146–150.

[3] Song, Q., Zheng, Y., Yan, Z., et al. (2025). Research and application of key technologies for large-scale canal water ecological wisdom management and control platforms [J]. *China Water Transport*, (14), 63–65.

[4] Liu, K., & Sun, L. (2025). Research on ecological culture in the cultures of ethnic minorities in Yunnan [J]. *Comparative Research on Cultural Innovation, 9*(19), 172–176.

[5] Qu, Z., & Chen, S. (2025). On the creative transformation and innovative development of traditional Chinese ecological wisdom [J]. *Poyang Lake Journal*, (03), 5–16+155.