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Understanding the Historical Geography of Water Use in Estate Landscapes: Learning from the Past to Address Present-Day Water Challenges

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Abstract
In the Netherlands, climate change has brought longer periods of drought alongside short periods of more intense rain, prompting planning and heritage professionals to explore new approaches to water management. One promising method is "learning from the past." Landscape history studies can reveal continuity and change in hydrological practices, offering knowledge, inspiration and potential solutions to today's water challenges. But what does it mean to learn from the past? Historic knowledge must go beyond simply identifying historic water structures in the landscape. This article focuses on country estates, analyzing these heritage sites as spatial and social ensembles in wider landscape systems. Tracing how water shaped the establishment and development of country houses and estates reveals important dynamics and principles. This deeper understanding of the historical geographical dynamics of water use can help present-day estate owners, governments and spatial planners foster more resilient estate landscapes.

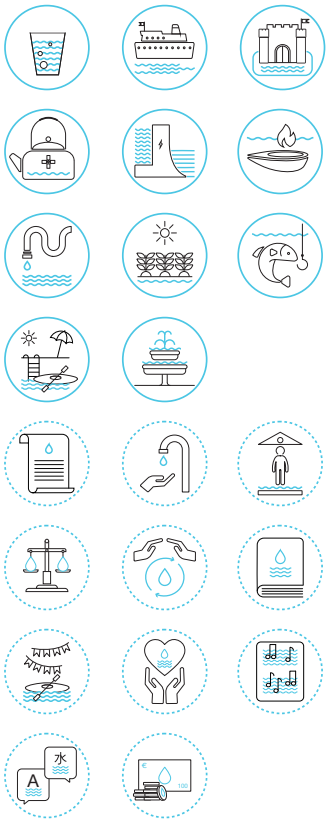
Policy Recommendations

- Policy leaders should apply the approach of 'learning from the past' to contemporary water challenges by analysing continuity and change in the long history of water use at heritage sites such as estates.
- Policy leaders and spatial planners, should consider estates as heritage ensembles within a broader system (estate landscape), rather than focus solely on the protected, monumental (parts of) estates.
- Decision makers should take into account both the spatial-functional and social cohesion of an estate (in the past and present), connecting spatial plans, long-term cooperation and participation.

KEYWORDS

drought
floods
country houses
estate landscapes
heritage

WATER VALUES



< Fig. 1 Sonsbeek estate in Arnhem, with the Sint Jansbeek stream. In the nineteenth and twentieth centuries, parts of the estate were sold off, enabling urban expansion (Source: MVOTV, 2021, CC BY-NC-ND; used with permission).

Introduction

In the Netherlands, a country house is a large house in the countryside, typically owned by a wealthy or aristocratic family, surrounded by an estate. In the Netherlands, country estates can be designated as national heritage sites. The National Heritage Agency of the Netherlands has listed over 550 such sites, with particular attention to the architectonic center of house and garden (Dessing and Holwerda 2024). This article draws on experiences of various country estate projects in the Dutch provinces of Gelderland and Limburg (Nijhuis, Storms-Smeets and Thissen 2023; Tomescu et al. 2021; Storms-Smeets 2023).

The regions are part of the High Netherlands, known for undulating, often sandy, landscapes. In recent years, heat waves and long dry periods have become the norm in the Netherlands (Inspectie Overheidsinformatie en Erfgoed 2020). Particularly in the east and south of the country, drought has resulted in low groundwater levels, with drastic consequences for estate landscapes (Nijhuis, Thissen and Storms-Smeets 2021; Provincie Gelderland 2022). Drought is considered "an assassin or silent killer" (Hartman 2019), because its effects are often only visible after a long time. It can lead to damage to the foundation of historical buildings, decay of historical water objects and structures, damage to green heritage and biodiversity and the impoverishment of agricultural land and forests.

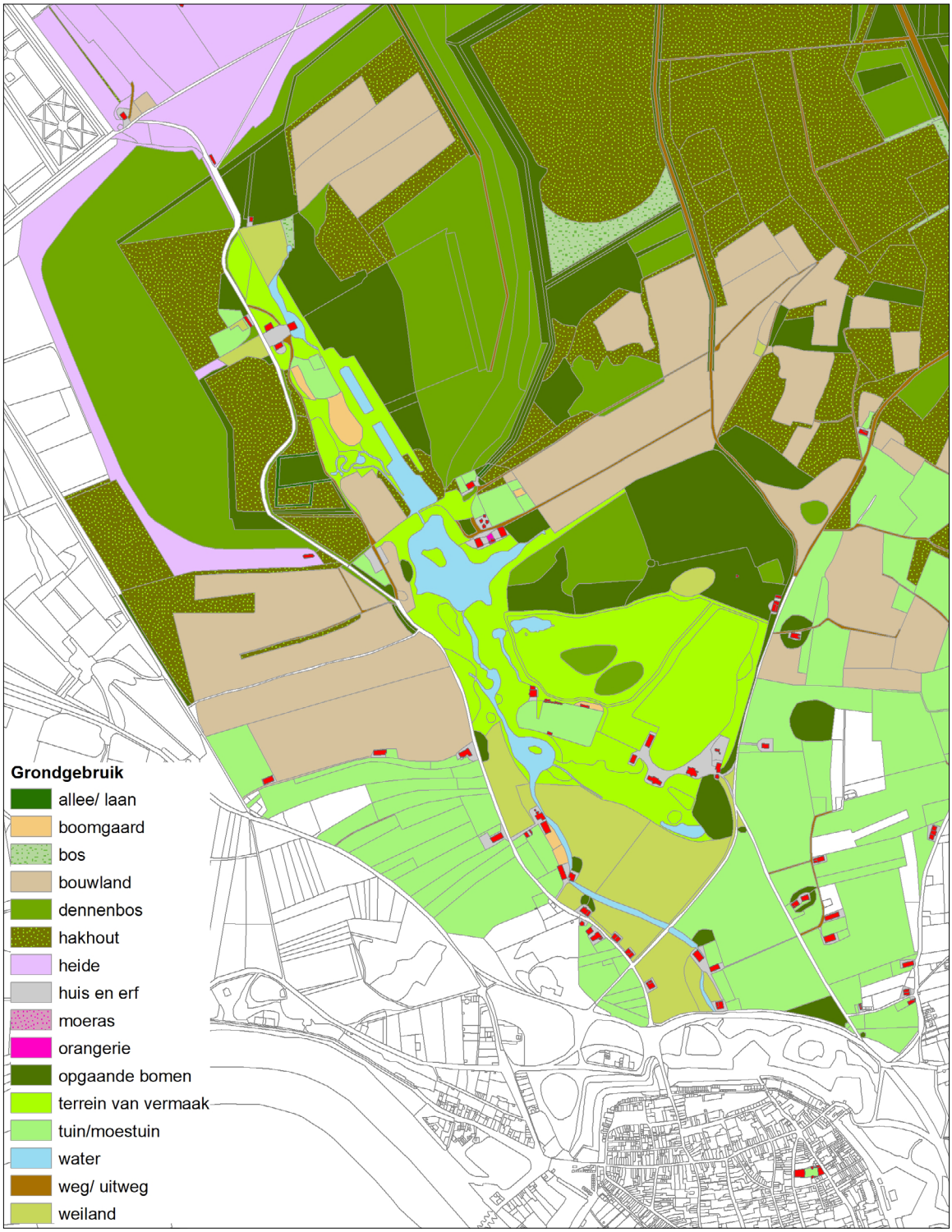
In contrast, damage caused by floods is often sudden and immediately visible (and tangible). Flooding can lead to water safety problems, damage and destruction to heritage (buildings, bridges, trees, landscapes, collections, etc.) and the loss of fertile soil and biodiversity. With the pattern of these climatic extremes (drought and floods), less rainwater infiltrates the soil. At the same time, faster drainage is occurring via sewers and rivers following increased urbanization, infrastructural expansion, surface hardening and excessive groundwater extractions.

When addressing present-day issues of drought and flooding in estate landscapes "a pure technological approach to water challenges is rarely sufficient" (Kolen 2022), but nonetheless remains dominant. As landscape archaeologist Jan Kolen stated at a 2022 conference on the Maas River:

> We need an intersectoral approach to issues and challenges in river landscapes. We need a long-term perspective on the history of the river, as people have always, continuously learned how to adapt. Actually, it's a long process of trial and error from which we can learn a lot. We should embrace the learning capacity of past communities.[1]

The adaptative skills of past societies are evident in resilient "socio-technical, cultural and environmental systems (SETs)" (Morató, Sánchez and Martin 2025). In recent years, a heritage-based approach for tackling water challenges has been promoted, motivating spatial planners to look "past forward" instead of "fast forward" (Van Paassen 2022; Vreenegoor and Kosian 2022; Janssen and Van Asseldonk 2023). Indeed, knowledge of heritage sites can help address water challenges – an effort that "isn't about protecting the past but using heritage to find solutions for the future" (Historic Environment Forum 2021).

1. See also the publication resulting from this conference (Caljé and N. Randeraad 2025).



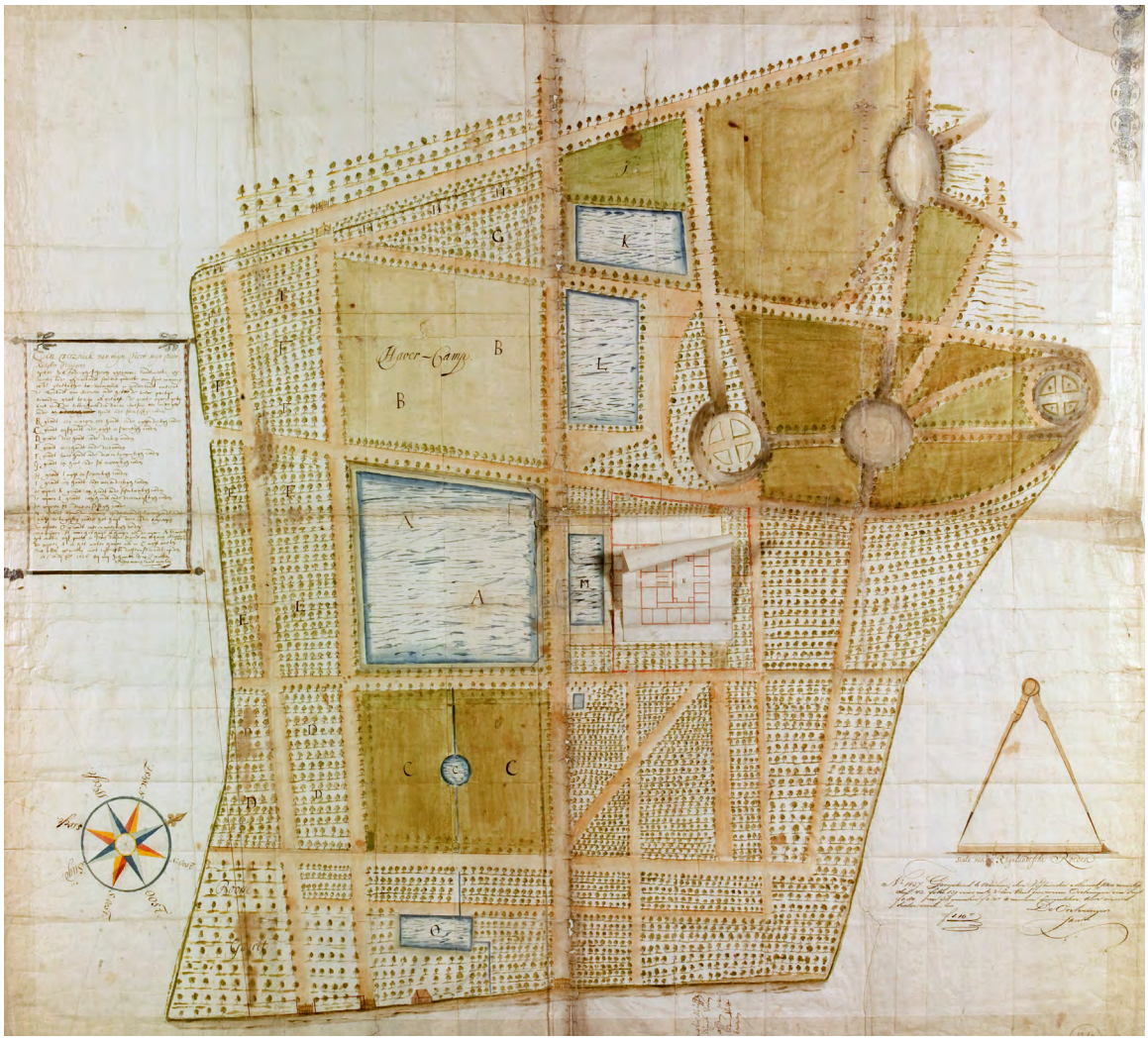
^ Fig. 2 Estates of Zypendaal (north) and Sonsbeek, circa 1832, showing multifunctional landscapes before the urban expansions of the late nineteenth century (Source: Elyze Storms-Smeets, 2025. Based on 1832 cadastral maps from HisGIS, Fryske Akademy © HisGIS open data, www.hisgis.nl).

Understanding Country Estates as Heritage Ensembles

When addressing water challenges at country estates, spatial planners generally tend to consider legally defined heritage sites. However, the number of 550 nationally listed country estates does not represent all country estates in the Netherlands. In the province of Gelderland, there are 120 nationally listed country estates, yet over 500 sites have been identified (Nijhuis, Storms-Smeets and Thissen 2023).

Furthermore, to really understand a country estate and its relation to water, we must look at the entire ensemble and not just at the core of country house with garden and park. This means taking account of the wider estate landscape with economically productive lands (vegetable garden, orchards, forests, agricultural fields, farms, water mills) and sometimes a church and village.

Moreover, understanding the estate community of owners, staff, tenants and volunteers is



^ Fig. 3 Estate map depicting the former Monnikhuizen Monastery transformed into a regent country estate, incorporating existing waterways, ponds, and watermills, with additional features such as a fountain (Source: Johannes van Swieten, 1656. Public domain, via Gelders Archief, Inv. 70-0002).

equally important as country estates are spatial, functional and social ensembles (Storms-Smeets 2023). Each estate is part of a larger cultural landscape, often with adjacent estates that are spatially connected through natural or man-made waterways. Together, the various individual heritage ensembles form part of a larger system. By gaining a better understanding of the establishment, development, functioning, design and transformation of heritage ensembles over time, we also gain a better understanding of the possibilities and limitations of contemporary conservation and development of heritage in our greater living environment.

Key Properties of Water Use in Estate Landscapes

As multifunctional ensembles, country estates offer lessons for how we can learn from the past. A historical geographical analysis of country estates reveals three major periods of new estate building: castles and large landed estates for nobility (1000–1600), country estates for city regents (1600–1800), and the creation of villa-like country estates for a new elite of bankers, industrialists and lawyers (1800–1940) (Storms-Smeets 2021). The focus here is on the first two categories (the younger villa-like estates were often located on previously undesirable locations with little water at hand). This article explores historical geographic dynamics of estate landscapes and the use of water. The analysis draws on a wide range of historic sources, including topographical maps, manuscript estate maps, eyewitness descriptions, management records and pictorial sources like paintings, prints and photographs. Having studied hundreds of country estates in High Netherlands, particularly Gelderland and Limburg, several key properties can be identified.

^ Fig. 4 Map of the Klarenbeek estate, 1635 (Source: Nicolaas Geelkerken, 1635. Public domain, via Archives of the Klarenbeek house, Inv. 21).

^ Fig. 5 Boundary of the nationally listed country estate of Well (Limburg). The water board initially focused only on this part of the former estate, but through collaboration with heritage advisors and a long-term landscape analysis, more appropriate solutions emerged (Source: Cultural Heritage Agency of the Netherlands (RCE), 2024. CC BY-NC-ND).

The proximity to water was often decisive when choosing a location and many castles and country houses are built near a river, stream or canal. Most castles can be found close to rivers, for instance Maas (Well, Geijsteren, Blitterswijck), Geul (Schaloen, Genhoes), Rijn (Doorwerth, Rosande), IJssel (Middachten, Gelderse Toren) and Baakse Beek (Hackfort, Vorden, 't Medler, De Wildenborch) (Hupperetz, Olde Meierink and Rommes 2005; Jas et al. 2013). Together with early settlements, castle estates occupied prime riverside locations. The country homes of regents were established near cities, often making use of older farmsteads and monasteries located in smaller valleys with natural springs. For example, in the Gelders Arcadia region around the city of Arnhem, regent families took advantage of the dissolution of Catholic monasteries, creating their own country estates with the already existing arable fields, meadows, roads, lanes, brooks, ponds and watermills. Such regent estates include Mariëndaal and Klarenbeek (Storms-Smeets 2021). Castle estates were originally very large, ranging between 500 and several thousand hectares. Regent country estates were smaller, with approximately 100 to 500 hectares.

The use of water at country estates is varied and often the same water was used for various reasons. Corresponding with the "intangible and tangible water icons" (Hein et al 2025) the following properties of water use at country estates have been identified, showing the interwovenness of multiple water functions, values and practices.

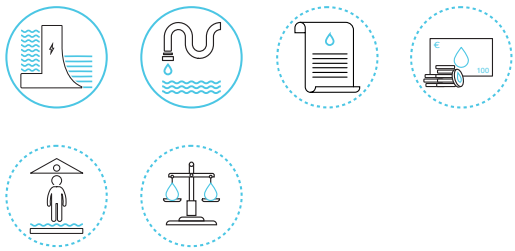
- Above all, water was (and is) a basis for life. Water was derived from natural springs, brooks, rivers and man-made water wells (collecting rainwater or groundwater). It was used as drinking water for humans and animals, for watering vegetable gardens, and in ponds for keeping fish and waterfowl. This corresponds with Hein et al. 'water icons' (Hein et al. 2025):

- Natural and man-made waterways have been the main transport routes in the Netherlands for centuries, and members

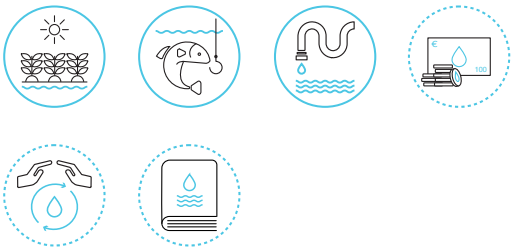
of the elite chose to build their castles and country homes close to these routes in order to move more easily and quickly between city and countryside. The location also included possibilities for ferries to cross the river and for the owners to collect tolls.

- Castles were surrounded by a (double) moat for defense reasons (both military and to stop thieves). If country houses of regents were moated, it was probably due to the older layout (e.g., the farm that existed there previously was moated) or for aesthetic reasons. The location had no military function, but a moat was still useful for keeping out thieves.

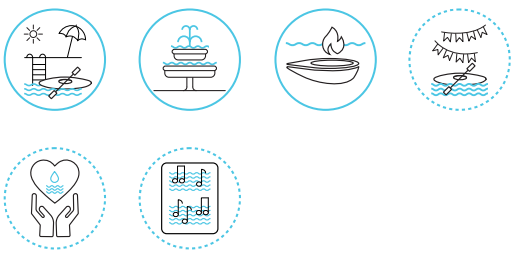
- Most castle estates would have one or more watermills. Younger country estates in spring valleys also had watermills; already in medieval times these springs had been dug out to feed man-made brooks (then as part of a monastery or farmstead). Each watermill had a mill pond (in Dutch: *wijer*), a weir (*stuw*), and surface waters (like streams, ditches and canals). The estate owners enjoyed manorial rights on the water, including the right to use water power for watermills. Originally watermills were primarily used for agricultural purposes (grinding grains into flour), but became more industrial as they were used to produce lumber, textiles and paper.



- Drought and floods are not new to this region. Inhabitants adapted the landscape or their practices to respond to changes in water availability. In Gelderland and Limburg, both castle estates and regent country estates had multifunctional landscapes with meadows, hay fields and ponds in the low-lying wet landscapes. Arable lands, orchards and vegetable gardens were situated on the higher lands close to the water, and woodlands and heathland on the steep, high and dry landscapes. In the Baakse Beek area, estate owners created water meadows and so-called rabbatten woodlands (coppice on ridges) in wetlands. The use of the landscape was based on local conditions of water, soil and relief in such a way to get the best results and create a resilient landscape. Thus, flooding was allowed (desired even) in the (water) meadows and hay fields because it increased fertility. Planting woodlands on steep hills prevented erosion. The landscape was designed to make water flow as effectively as possible (including rainwater streaming down the relief).



- Beginning in 1600, water became increasingly important in the aesthetic landscapes of gardens and parks, which included ponds, cascades, fountains and other waterworks. Famous water works can still be seen at Rosendael, Sonsbeek and Biljoen and Beekhuizen. Although in the seventeenth century, geometric designs represented one's status and power in society, the more romantic landscape style from about 1750 allowed owners to express their personal feelings and emotions (often in poems and songs, but also in the landscape). Statues of Greek and Roman water gods represented spirituality and symbolized the owner's position of power and status. Fountains, cascades and other aesthetic water sites represented life, beauty, art, transience and purity.



- Particularly in Catholic regions, like Limburg, water was (and is) important for religious practices and values. For instance, the Saint Gerlachus well at the St. Gerlach estate was known for its healing properties and became a pilgrimage site. At the castles of Schaloen and Genhoes (Oud-Valkenburg), yearly religious processions through the landscape also incorporate indicate the importance of water. The names of these wells, and their meaning, are still widely known in local communities.

Conclusion

The abundance and shortage of water resulting from climate change greatly affects the management of heritage sites like estate landscapes. This goes beyond the heritage field. Spatial planners, however, still tend to view heritage only as legally listed tangible monuments that need protection, and don't look at the wider ensemble and system. Viewing estates and estate landscapes as spatial, functional and social ensembles and systems helps find solutions to spatial problems, but also contributes to better cooperation and participation. Without social connection it would not be possible to execute spatial plans.

At country estates in Gelderland and Limburg, water has been used (and reused) for utility and beauty in the estate landscape, creating complex and integrated ensembles and systems. Analyzing continuity and change in the long history of estate ensembles gives us new knowledge and deeper understanding of the historical use of water and developments that can help with solutions for contemporary challenges. In the Baakse Beek area, for instance, the water board worked together with local governments and estate owners to deal with

^ Fig. 6 Preliminary climate-proof design for the Well estate using a "learning-from-the-past" approach (Source: Martijn Al, Veenenbos and Bosch Landscape Architects, 2024. CC BY-NC-ND).

drought by restoring historic water systems (including rabbatten woodlands, water meadows and castle moats). Their cooperative efforts were awarded with the Gelderland Spatial Quality Award in 2022 (Provincie Gelderland 2022). We should, more than before, learn from the past and find solutions in the preservation and improvement of the integral values (heritage, nature, social, economic, etc.) of our living environment.

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