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# The Morphological Resilience of the Seine in Paris: From Ancient Meander to the Contemporary Street Network

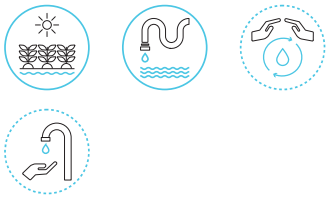
**Hélène Noizet**

**Abstract**
This article considers the heritage of river form in the current urban fabric, specifically in relation to an ancient meander of the Seine located on the right bank of Paris. The resilience of the river's shape appears by crossing texts, maps and archaeological data in historical geospatial mapping (GIS). In the ninth century, the Church of Sainte-Opportune in Paris received from the king the wetland left behind by the ancient channel of the Seine and used it as common pasture until 1150. Then, the canons drained the marsh which was converted for vegetable farming and, since the fourteenth century, for a sewer system. Since the nineteenth century, it has influenced the orientation of urban plots and streets. Finally, during the big flood of 1910, the Seine returned to its ancient bed. This is an example of how forms are passed on over time: because functions change.

KEYWORDS

resilience
urban fabric
wetlands
sewers
flood

WATER ICONS



**Policy Recommendations**

- Identify social practices related to the Seine (for example the new demand for access to the water for baths, and access to the ancient channels and current riverbanks for walkings) and integrate them into legal standards (and not the other way around).

< Fig. 1 View of the Seine, Paris (Source: Gustave Le Gray, 1857. Public domain, Gilman Collection via Met Museum).

## Introduction

This article analyzes the long-term influence of the Seine's course on the urban fabric of Paris. It considers how a wetland created by an ancient channel of the Seine, a paleochannel, ceased flowing early in the Holocene but became a structuring morphogenetic element of Paris's urban landscape in a way that continues in the present day.

Before the Roman era, the Seine did not follow its current course but rather flowed along a meander whose semi-circular shape remains perceptible in the Paris street network (Noizet et al. 2013). How did this shape persist over time, given that the Seine abandoned the channel during the Holocene (geological period starting 11,700 years before present, that means before 1950)?

The alluvial plain of Paris contains former several paths of the Seine, of uncertain age – probably Pleistocene – and in any case predating the Gallo-Roman period (Chaussée et al. 2008). The northernmost of these ancient branches forms a large loop stretching from the Arsenal to Chaillot, skirting the foot of the Ménilmontant-Belleville and Montmartre hills. This paleo-meander was 8 to 8.5 km long (3–3.5 km longer than the current course) and 200–300 m wide. The bed of this ancient channel was carved into the substratum at an average altitude of 20 m. In its upstream section, this branch was later bordered by the wall of Charles V, built between 1356–1383. This wall has been rebuilt in the middle of sixteenth century, and this renovation is partially still visible: it is the lower part of the quay wall, running along the Arsenal harbour, on the Boulevard Bourdon side.

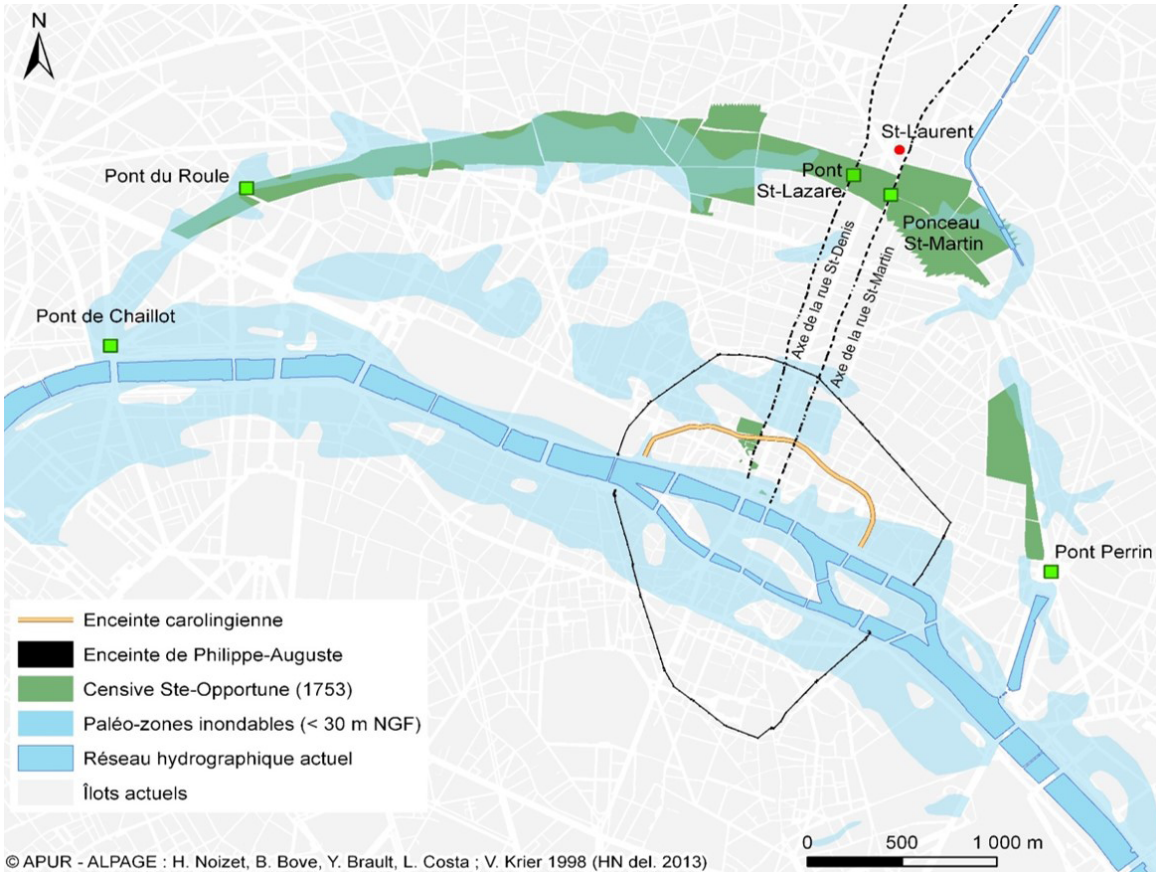
Until the mid-twelfth century, a residual wetland existed at this location and it periodically flooded during high waters, such as in 583. Gregory of Tours recounts that in that year the Seine overflowed its banks and returned to its former bed, flooding the right bank and causing shipwrecks between the Île de la Cité and the Church of Saint-Laurent (fig. 2):

> In the eighth year of King Childebert, on the day before the Kalends of February, … the waters rose beyond their usual level; for by the flooding of the Seine and the Marne around Paris they caused such an inundation that shipwrecks often occurred between the city and the basilica of Saint-Laurent.
>
> [Anno octavo Childeberti regis, pridie calendas februarias … aquae vero extra solitu invaluerunt ; nam tantum inundatione Sygona Matronaque circa Parisius intulerunt ut inter civitatem et basilicam sancti Laurenti naufragia saepe contingerent] (Krusch 1951).

Moreover, small bridges are documented from the ninth to the thirteenth century, which were used to cross the wetland at various points.

## From Marsh to Market Garden

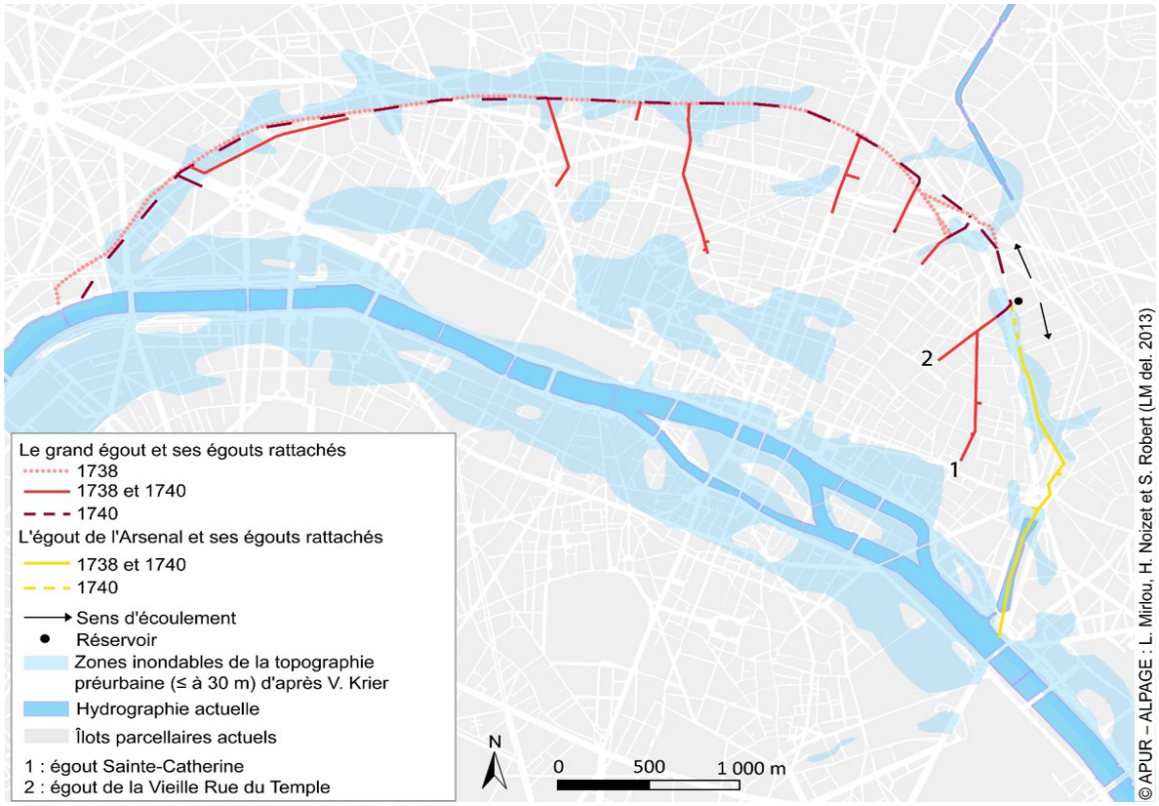
Given to the Church of Sainte-Opportune in the mid-ninth century, the wetland was used as common pasture for livestock grazing until the canons of the church decided to transform the area. After receiving authorization from the king and bishop, they began digging a network of ditches to drain the marsh starting around 1150. By 1232 they had made an agreement with some 60 farmers to grow wheat, the most profitable crop at the time. However, the soil proved too wet and the effort failed. Facing this difficulty, around 1250 the land users shifted focus and began growing vegetables in the area, turning it into a vast market garden. It




^ Fig. 2 Drainage of the wetland inherited from the paleomeander by the Church of Sainte-Opportune (Source: APUR ©ALPAGE: Hélène Noizet, 2013).

was in the thirteenth century that the meaning of the word *marais* evolved: Previously meaning "swamp" ("watery land"), it came to mean "market garden" (Kleindienst 1963). The drainage of this ancient meander ultimately created Paris's green belt, which supplied the city with fresh vegetables from the thirteenth to the seventeenth century.

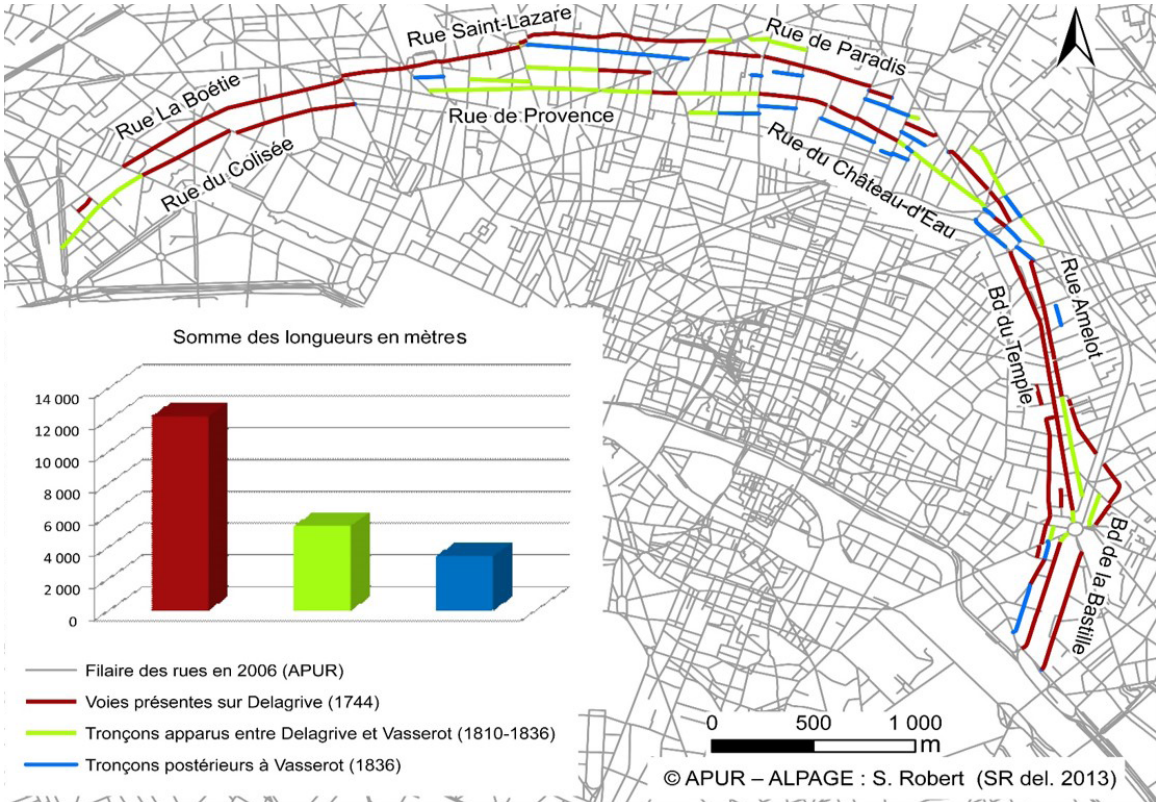
The creation of drainage ditches also prompted the development of a sewer network in the late Middle Ages, with the central collector corresponding to the paleochannel. Beginning in the fourteenth century, the central ditch – earthen and regularly cleaned by residents – was used as the main sewer for the right bank. *The Chronicle of the Monk of Saint-Denis*, written by Michel Pintoin about the reign of Charles VI (1380–1422), describes the actions of Hugues Aubriot, provost of Paris from 1367 to 1381: "He had skilled workers build underground conduits and sewers in the low-lying areas of the city, intended to carry away rainwater which, in turn, would sweep away the accumulated waste and transport it to the surrounding meadows." The chronology is significant because at the same time, in property records, the royal ditch network – which served as boundary markers for land sales in the area – underwent a name change: between 1380




^ Fig. 3 The sewers of the right bank before and after the works of 1738–1740 (Source: APUR ©ALPAGE: Laurent Mirlou, 2010).

and 1403, the term *fossés-le-roi*, attested since the thirteenth century, disappeared in favor of *égouts de Paris*. At the time, this sewer was still an earthen ditch, which gradually silted up over time. Its blockage prompted authorities to create a canal and line it with masonry, a project completed in 1740 (fig. 3).

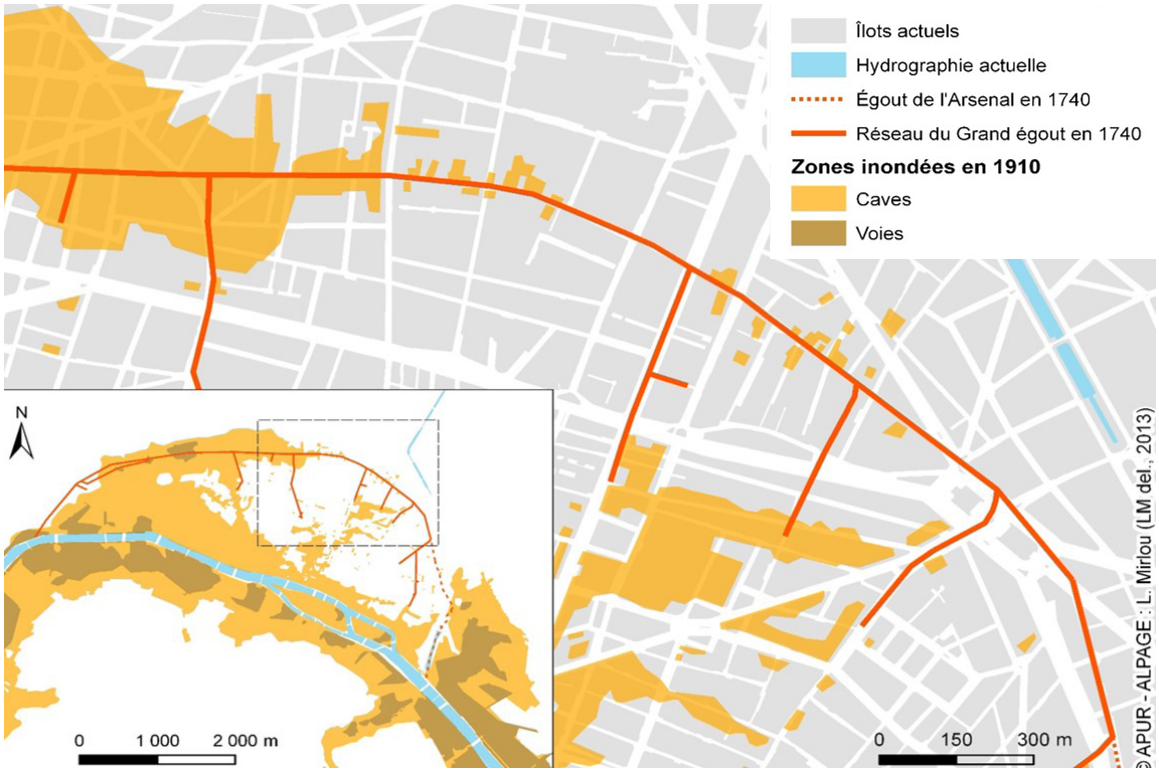
Starting in the seventeenth century, apartment rentals became more profitable than vegetable cultivation (Kleindienst 1963), and the garden plots were gradually replaced by streets and buildings, in the context of uncoordinated private developments constrained by the existing environment. This tension between agricultural heritage and new urban use is evident in Jean Delagrive's 1730 map of Paris: the market gardening belt, with its clearly identifiable ring shape, is beginning to become urbanized, particularly in the Chaussée d'Antin area. Each landowner sought authorization from the City to build and develop their lot to benefit from rental income, as for example Jean de Laborde. In 1771, this landowner between rue Neuve-Grange-Batelière and Chaussée-d'Antin had covered the sewer at his own expense between Chaussée-d'Antin and rue du Faubourg-Montmartre. He had opened rue de Provence on the site of the former canal, as well as rue d'Artois (Lazare 1844). The main sewer was eventually covered, but a series of streets were laid out following the orientation of the semi-circular shape inherited from the ancient channel, which in this way was transmitted to the present urban morphology – independent of any surface water flow (fig. 4).



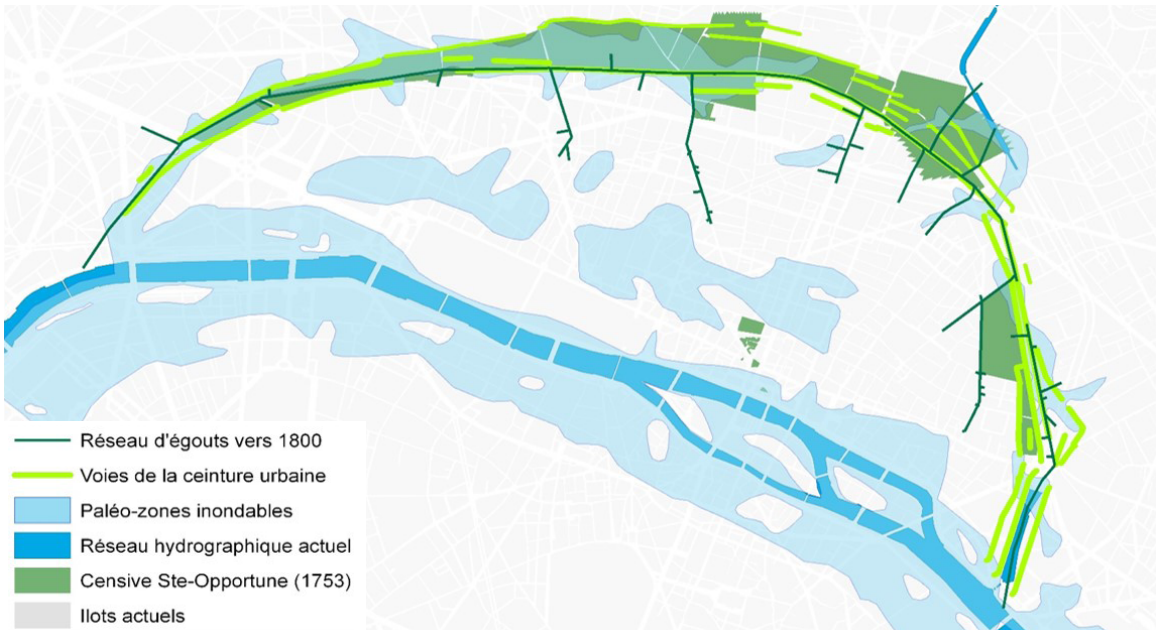

^ Fig. 4 Reactivation of the original fluvial form in the current street network (Source: APUR ©ALPAGE: Sandrine Robert, 2013).

In total, 21 km of street segments in Paris are still directly influenced today by the shape of the vast peri-urban belt. These include today's rue La Boétie, rue Marbeuf, rue de Penthièvre, rue Roquépine, rue Saint-Lazare, rue de Paradis, rue de la Victoire, rue de Provence, rue Richer, rue des Petites-Écuries and rue du Château-d'Eau. However, the transmission of the original form did not occur through a coherent layout precisely aligned with the covered canal's route or systematically following alongside it. Instead, it emerged as a pattern that spread around the paleochannel through a process of self-structuring, developing over several decades and ultimately forming a consistent shape that preserved the memory of the sewer long after its disappearance. In fact, no fewer than 8.75 km of streets that follow the semi-circular form (i.e., 41 per cent of the total) were laid out between 1744 and today, well after the social configurations linked to market gardening and the reconstruction of the main sewer; 25 per cent were built between 1744 and 1836, and 16 per cent after that date. These streets thus transmitted the form of the main sewer – originally shaped by the market gardening activities of a previous configuration – at a time when the sewer was no longer visible.

To complete this spatiotemporal evolution, we can recall the physical reactivation of the original fluvial form during the centennial flood of 1910. Mapping the various areas flooded at that time – whether directly by the Seine's overflow or indirectly through water rising into




^ Fig. 5 Reoccupation of the former Seine riverbed during the 1910 flood (Source: APUR ©ALPAGE: Laurent Mirlou, 2013).




^ Fig. 6 Fluviaire corridor inherited from the Seine's paleomeander (Source: APUR ©ALPAGE: Hélène Noizet, 2018).

basements – clearly shows that, in times of flooding, the Seine tends to return to its former bed (Noizet et al. 2011). The overlap between the flooded basements and the old main sewer is particularly revealing in the area of rue du Château-d'Eau and rue des Petites-Écuries (fig. 5). The 1910 flood reactivated this ancient watercourse, which had completely disappeared from the surface but continues to shape the urban plan and to drain the subsoil during high water events.

Since this morphologic transmission evolved from the initial water flow into the current street network, the resulting feature can be referred to as a "fluviaire corridor," combining the words fluvial and viaire, which means road/street-related (fig. 6) (Chouquer 2003, 234).

## Conclusion

To answer the initial question: If the current urban fabric is marked by the form of an ancient channel of the Seine, it is because uses of the space continually shifted. This ongoing transformation allowed for the shape to be preserved in the urban plan. What is crucial to understand is the structuring capacity of societal practices dealing with inherited spatial forms. It is precisely because this former river-branch-turned-wetland was continually reappropriated and reused by successive societies, from antiquity to the present day, that we can observe the reemergence of its shape today. People often assume that respecting heritage means avoiding change, but in fact there can be a complex relationship between persistence and change: The two are not only not mutually exclusive but can be mutually supportive.

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