Human-river interactions on a timeline: monitoring the Rohrschollen Island (Rhine River) trajectory

Interactions humain-rivière sur une frise chronologique : suivi de la trajectoire de l'île Rohrschollen (Rhin)

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RÉSUMÉ

A proximité de Strasbourg, l'île du Rohrschollen est un territoire où la forêt alluviale rhénane est en contact avec le Port Autonome de Strasbourg. En 1997, une Réserve Naturelle Nationale a été créée pour protéger un écosystème souvent sacrifié au profit des intérêts économiques et hydroélectriques. Pour comprendre les mutations vécues par cet espace, tant du côté français qu'allemand, nous choisissons de reconstituer la trajectoire de ce socio-techno-écosystème fluvial de 1842 à nos jours au moyen d'une frise. Les différentes données collectées (documents de planification, données climatiques, cartes d'occupation des sols, articles scientifiques...) sont reportées sur une frise chrono-systémique au moyen d'un logiciel dédié, nommément ZAtimeline. Cette représentation permet l'analyse de l'évolution des interactions Humain-Nature Interactions, notamment pour questionner la gestion et la naturalité de cette île construite par l'homme ou évaluer les possibles impacts du changement climatique.

ABSTRACT

Near to Strasbourg, the Rohrschollen island is an area where the Rhine alluvial forest is in contact with the Autonomous Port de Strasbourg. In 1997, a National Nature Reserve was created to protect an ecosystem often sacrificed for the benefit of economic and hydro-power concerns. To understand the changes experienced by this space, on both the French and German sides, we choose to reconstruct the trajectory of this socio-techno-riverine-ecosystem from 1842 to date by means of a timeline. The various data collected (planning documents, climatic data, land use maps, scientific papers...) are reported on a chrono-systemic timeline by mean of a dedicated software, namely ZAtimeline. This representation allows for the analysis of the evolution of Human-Nature interactions, notably to question the management and the naturality of this human built island or to evaluate the potential impacts of the climate change.

KEYWORDS

Ecosystemic services; Human-Nature interactions; Riverine ecosystem; Trajectory; ZAtimeline

1 INTRODUCTION

South of Strasbourg, on the Rhine river (Fig. 1), the Rohrschollen island is an area where the alluvial forest is in contact with the Autonomous Port of Strasbourg (PAS). Since 1997, a National Nature Reserve (RNN) protects this space put under pressure by economic interests. To understand the changes experienced on both the French and German sides and to question the naturality of this human built island, we choose to reconstruct the trajectory of this socio-techno-riverine-ecosystem from 1842 to date.

Several conceptual frameworks (Bretagnolle et al., 2019) were proposed to analyze a socio-ecological system (SES). In a nutshell, a SES may be modeled as social and biophysical components put in relation through management and ecosystem service interfaces, and influenced by external drivers. In a long term social ecological research, these elements may be monitored through timeseries about population, climate, biodiversity, social and natural events in order to capture information about practices, ecosystem services and disservices, socio-ecological processes and Human-Nature interactions. Timeline tools may be mobilized to represent such interdisciplinary chronological information to support the description and to facilitate the analysis of a socio-ecosystem.

The layout of the proceeding is as follows. Section 2 focuses on the timeline approach, including data collection and software aspects. The case study timeline and narrative are reported and analyzed in Section 3. A conclusion and an outlook are provided in Section 4.

2 METHODS

Timeline tools may be mobilized to represent any heterogeneous chronological information in History or in a project management plan. Their interests are numerous in the SES context. Firstly, a comprehensive picture may facilitate the identification and the analysis of the complex relationships occurring in a socio-ecosystem. Secondly, voids in a chart point out possible data or knowledge shortage, inviting researchers to fill the gaps and fostering inter- and trans- disciplinary collaborations for the same goal. Thirdly, timelines may be sketched up in a workshop with stakeholders or other target groups to carry out a collective reflection on environmental questions.

2.1 Heterogeneity of socio-ecosystem data

Data can be quantitative (timeseries, indicators, historical maps…) or qualitative (administrative documents, scientific paper, historical maps, observations, interviews…). The significant indicators and their evolution may be used to support a narrative. Thinking in a timeline chart, the minimum fields to describe a data are a qualifier (name) and dates (start/end) describing an event or a period. At representation time, colored markers (style elements) are welcome to reflect the diversity in the data in an organized manner. Names, dates and styles may be sketched up on a board and/or gathered in a spreadsheet. In the double context of open science and COVID pandemic (2020), we also tested the opportunity for a SES research mainly based on online resources.

2.2 Automation

On the one hand, manual drawing of a timeline remains painful, especially when new information comes to light. On the other hand, automation principles are well-known in project management software where dated information is gathered in a spreadsheet to be interpreted as a Gantt chart. The ZATimeline software (Charpentier, 2020) is a methodological contribution dedicated to the representation of heterogeneous SES information and datasets in a real time manner.

3 RESULTS AND DISCUSSION

The data were collected from online resources such as planning documents, climatic data, land use maps, scientific papers, thesis, institutional sites, open databases.

We used land use maps from 1743 to 1872 (Eschbach, 2018), and aerial pictures from 1966 to 2020 (Geoportail) that were georeferenced and polygonised (Fig. 1) with respect to land cover/use. Percentages were computed showing very different evolutions: harbor activity on the French side, agriculture on the German side and forest on the island.

Sinuosity indices were deduced from previous maps, assessing the impacts of the major landscape and river management plans, namely canalization, rectification, island creation.

Meteorological data from ECAD, (4) discharge data from Hydro, (5) population data from Cassini (France) and Wikipedia (Germany) are the other data we easily browsed online. As key drivers, the political events and governance at local, regional and national scales were also compiled in the timeline spreadsheet.

Biodiversity databases were more difficult to find exploit: we browsed data from documents, focusing on trees (Eschbach, 2018), and invasive species.

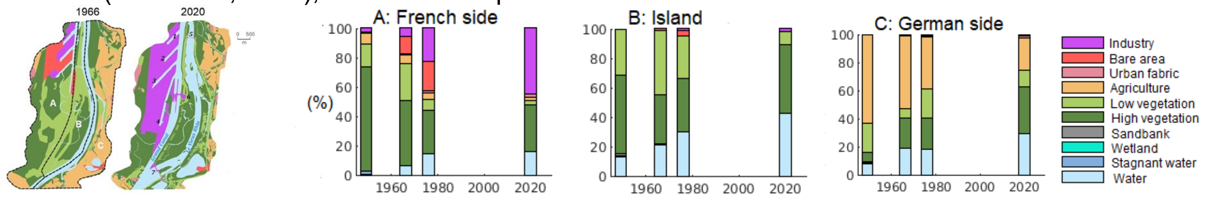
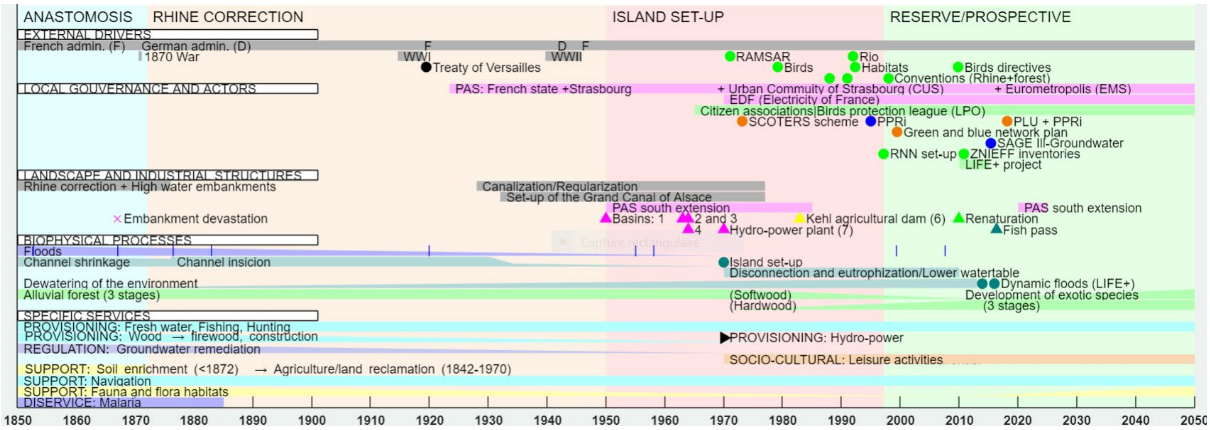


Fig. 1. Land cover and land use from 1950 to 2020.

Figure 2 presents the timeline information as plotted by ZAtimeline. Sinuosity indices were interpreted as main phases and plotted as large rectangular polygons.



Timeline reporting chrono-systemic information for the Rohrschollen island and its surrounding area.

The Rhine water management evolves along the French-German relationships. World War I and the Treaty of Versailles reserved to France the right to divert the Upper Rhine flow into a canal for navigation and hydro-power production, creating a number of islands. Near to Strasbourg, this explains why harbor facilities and industries occupy the French side, while the economic activity is limited to agriculture on the German side of the Rohrschollen island. The two countries now cooperate through institutions such that the International Commission for the Protection of the Rhine.

However, many of the ecosystem services (soil fertilization, groundwater purification...) initially supplied by the Rhine floodplain and its alluvial forest have faded away. After 200 years controlling flow and limiting floods with dams and canalization, territorial actors adapted their management to new ecological concerns about water quality, fauna and flora, notably by triggering dynamic floods to restore some of the biogeophysical process of the Island. Similarly, north of the island, the Freiburg Government Office managed a dam built for agriculture use to counter the lowering of the water table.

More generally, this timeline illustrates the paradigm shift initiated in the 1970s, local representatives and citizen attach new importance to biodiversity, which was translated into national natural reserves, Rohrschollen island and Neuhof forest, both located in France. Besides, this space that people want to be "natural" is included in a socio-eco-techno-system with major port activities, as underlined by the future extension of the PAS (40 ha) in 2025.

4 CONCLUSION

Gathering heterogeneous data, the timeline and its representation can be used to conduct a collective reflection on the factors (origins, causes and consequences) that influences human-nature interactions within this socio-ecosystem, and with regards to climate change. Indeed, as a by-product of flood control and hydroelectric activity, the Rohrschollen island classified as RNN remains an anthropogenic creation as shown on the maps and timeline.

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