

RIVERS AS THE IMAGE OF CITIES AND TOURISM

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1. INTRODUCTION

The management of rivers involves many fields of research and disciplines such as hydraulic engineers, public health inspector, administrators, geomorphologists etc. From the geomorphology point of view there is a shearing interest which tend to view the rivers as part of the group of process elements involved in landscape dynamic, whatever the time-scale. Since this include both medium and long term perspective it is going towards the development of an understanding of rivers which is somewhat different from that of professional river managers who have to be much more concerned with the immediate problems. All this frame can be sometimes complicated by lows or acts which force the administrators to operate on the territory in a specific direction, especially if this territory is affected by frequent floods or other geomorphologic disasters.

In this contest hazard monitoring and risk assessment of fluvial dynamics and flood events are very strategic objective for the achievement of correct territorial planning. In Tuscany this is well highlighted by floods events causing severe damage and victims in connection with the growing urbanization in large parts of the main flood plains. As a consequence there has been a progressive increase in risk conditions linked to the fluvial dynamics. On the other hand due to the fact that Arno river flows in an area on which historical cities (Figure 1), such as Firenze and Pisa, are located, its actual state and dynamic evolution become of particular relevance on respect on its physical and socio-touristic aspects.

In order to have a correct approach to the study of this problem, it is necessary to distinguish, and to understand, what fluvial hazard is. The analysis of fluvial hazard can include flood hazard and channel dynamics hazard. The latter is generally underestimated, or sometime not considered, in relation to flood hazard. This is often an incorrect approach because the two effects are closely linked. In fact bank erosion, whether it involves artificial banks or hydraulic manufacts (Figure 2), can be an important flood cause. Depositional processes, especially in flat areas or at the junction between a tributary and its main river, can have the effect of reducing the hydraulic capacity of the section. For this reason the hazard conditions connected to floods and channel dynamics are closely connected and should be studied as part of the same system.



Figure 1. Aerial Photograph of the Arno River in Florence city center



Figure 2. Aerial Photograph of an erosion stream bank (Girone area)

2. FLUVIAL HAZARD

Hazard represents one of the components which contribute to the definition of the risk of natural disasters and it is defined as the probability that a phenomenon may occur in a defined area during a given period of time. Elements at risk include population, properties, economical activities, etc., exposed to the risk in that area. Vulnerability represents the loss degree on an element or group of elements at risk, as a consequence of the occurrence of a natural phenomenon of a given intensity. The risk corresponds to the expected worth of loss, and can be expressed as the product of three terms: 1) probability of the event, 2) vulnerability, 3) worth of elements at risk.

3. FLOOD HAZARD

In order to assess and map flood hazard it is necessary to determine the degree of interest. This objective can be pursued determining the flood frequency distribution, by conventional methods of hydrological data analysis when discharge data are available, or by using rainfall-runoff models. When the discharge with a defined return time has been determined, the next step is to obtain the expected water level. Hydraulic analysis and modeling can be used for different flow conditions (uniform, steady or varied flow) depending on data and boundary conditions availability and on the type of objectives and detail being pursued. In this context G.I.S. and automatic cartography, coupled with hydraulic models, are highly desirable.

4. CHANNEL DYNAMIC HAZARD

Quantification of the occurrence probability of the erosion or deposition processes is usually unobtainable for channel dynamics hazard assessment and mapping. Therefore, in this case, it is necessary to perform a general channel dynamics hazard assessment along the fluvial system without expressing the return time of the processes in an explicit way. A multidisciplinary approach is also highly desirable, in this case, using different methods and techniques, depending on the objectives and the detail required.

5. HISTORICAL CONTRIBUTION

Historical research on maps and documents in Archives and Libraries is useful for assessing the natural form of the river channel, its evolutionary trend, type and degree of human impact. This kind of analysis has been carried out for some of the main alluvial rivers of Tuscany. The retrospective investigation can also concern the erosion or deposition events occurred in the recent past, their location, intensity, and process type. Comparison of topographic maps, air photos and topographic surveys of cross-sections and longitu-

dinal profiles of different years can also be very useful for documenting, recent channel adjustments and evolutionary trends.

Reading and interpreting surrounding space and reality by landscape interpreters, a part from the typology of each single realization (painting, maps, etc..), has always been conditioned by authors and it reflects the thoughts and the way to see the spatial reality where the author lives. By the way each spatial element is the expression of the culture from which it derives including all kind of optical and ideological distortion due to the time in which the author lived. Each map, even if representing the smallest portion of the land, represents an entire world of ideas, models, thoughts and values that is not so easy to fully explain. Certainly the magnificent Giotto or others famous artists such as Ambrogio Lorenzetti are well known and are included in the group of painters who disseminated all over the Tuscany and the world, in the XIV century [FARINELLI, 2004], masterpieces of outstanding beauty. Such masterpieces have so important characteristics which overcomes the simple esthetic value, in fact looking from an historical point of view they show useful information as for example in landscape reconstructing of the place represented by the masterpiece, the urban landscape and the surrounding countryside represented by Lorenzetti in the painting cycle on the “*Effetti del Buono e del Cattivo Governo nelle città e nelle campagne*” (effects of good and bad government in the city and in the countryside) located in the Municipality Palace of Siena [ALMAGIÀ R. 1922], are so well described that they can be compared to a proto-topographic map even if not properly as graphical representation but as a scenographic ones. This kind of representation is still far from the present cartography built up on the base of geodetic and astronomic bases, but in this general overview it is possible to appreciate proportion and several landscape arrangements as well as the anthropic activities present in that time. All these elements are very important in reconstructing the social activities even if their representation was conceived for other purposes. In this sense the project aims to identify, within the ancient maps, those elements forming the base to detect such proto-information regarding geological features leading to the represented landscape in the painting [ROMBAI, 1993].

To carried out studies on historical maps, it is necessary to built up a frame including specific socio-political evolution so far useful to identify historical documents which still hide inside well known material, but not yet classified.

In assuming a geological characterization on elements by reading historical maps could be sometimes a hazard from the semiological point of view.

But considering the fact that the map itself is just a partial interpretation of reality, it is legitimate to interpret according our point of view, trying to find with in it a correlation between the “past and the present” through the identification of certain elements [BARATTA M. 1912].

The Tuscan cultural environment, before the XVIII century, is characterized by the presence of famous cartographers and their wonderful cartographic works.

After that period a more technical cartographic production is developing , mainly for “civil use” and a particular attention to the “applied design” and to the infrastructural buildings.



Figure 3. Map from the State Archive of Florence to the Capitani di Parte Guelfa.

The evolution from pure painting to thematic maps goes throughout artists such as Piero Del Massaio, or Francesco Rosselli, Egnazio Danti and Stefano Buonsignori who decorated Tuscan public building arriving to precious draws of Leonardo Da Vinci which

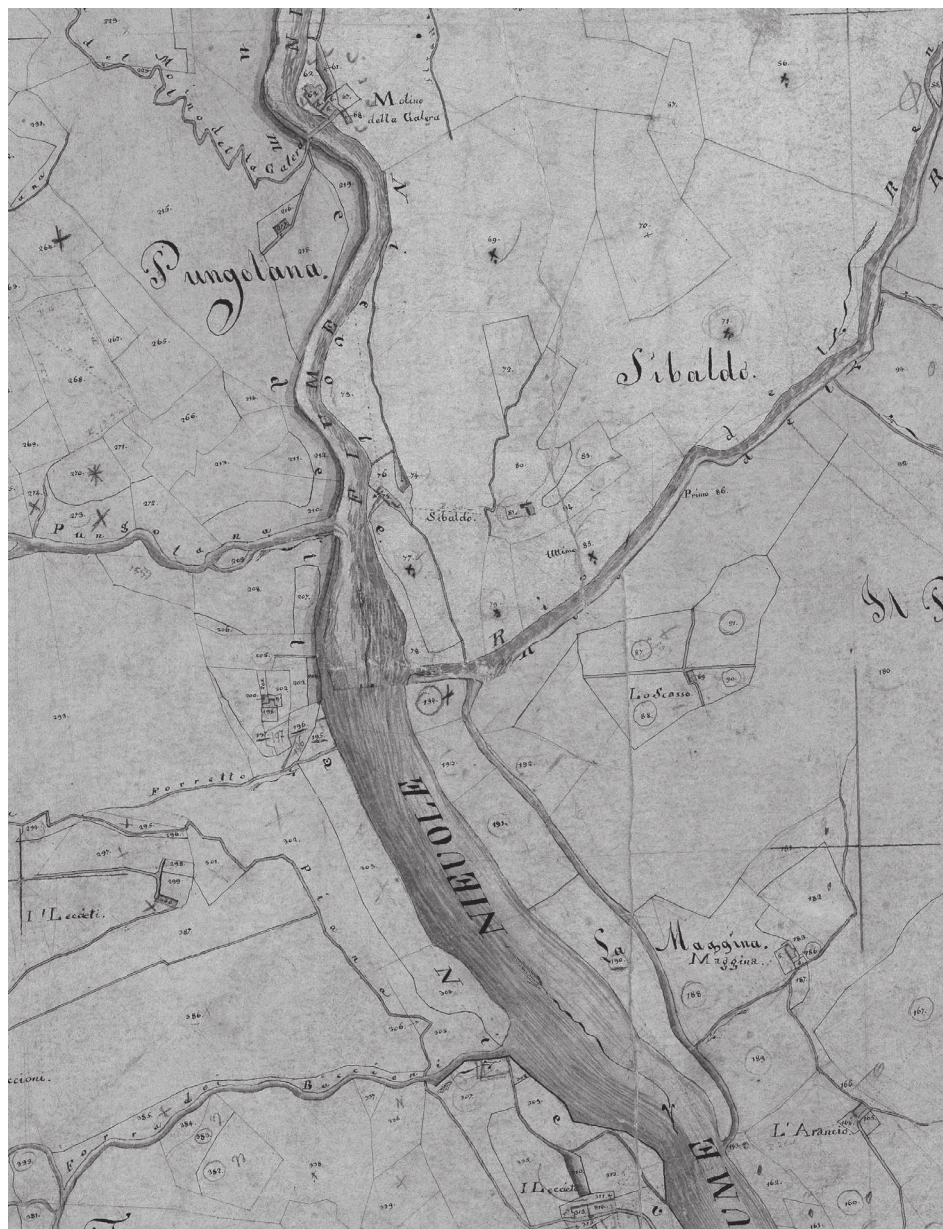


Figure 4. General Tuscany Cadastral map. Section F, Sheet 7.

already represent some of the first elements of thematic cartography and of a better land management. As an example the maps showing Valdarno [BARBIERI G. 1950, BARSANTI D., ROMBAI L. 1986, LODOLINI A. 1933], highlight some details on rivers and their relative regime problems.

Undoubtedly, from an aesthetic point of view, these examples are the most significant, but among these renowned artists there are others who deeply contributed to increase the evolution of cartography without they were recognized masters.

An example is the map collection maintained at the State Archive of Florence that once belonged to the Capitani di Parte Guelfa [ROMBAI L. 1983, ROMBAI L. 1993, ROMBAI L., CIAMPI G. 1979, ROMBAI L., QUAINI M., ROSSI L. 1995]. It is known as the *Piante dei Popoli e Strade* and includes approximately 500 plates drawn during a vast campaign at the end of the XVI century aimed at surveying and describing the road network of the Florentine area. These maps, made in order to comprehend the current state of the roads, bridges and other infrastructures, were produced by the master builders of the Capitani di Parte Guelfa (the Florentine state's equivalent of today's Ministry of Public Works) and represent the oldest and most complete topographic road atlas of Europe. The maps had the stated objective of "representing the extension of the road network of every Florentine neighborhood, the location of the bridges or fords...". In addition to this information many plates also contain towns, tabernacles, single houses and other buildings, particularly if they were located near streams [ROMBY G. C., L. ROMBAI 1993, ROMBY G. C., L. ROMBAI 1994, ROMBY G. C. 1999]. They do not have uniform characteristics concerning geographic position and scale (it is too early for geometric maps), but in general the maps were surveyed with a metric system and in some cases it is possible to note exact relationships with angular distances [PANSINI, 1989].

The positions of bridge parapets, the presence of fords near towns and the conformity of the drainage network, although elements not directly linked to the geology of an area, provide important information for our analyses on the characterization of the geological substrate or on the evolution of the stream network.

The collection of this type of information has an additional value: besides the actual data on the map, the other important characteristic is provided by the possibility to position the "snapshot" in time and therefore obtain a much wider perspective therefore enabling a better comprehension of certain events.

As for this last consideration, the work that perhaps concludes the cartographic evolution and forms the common base for a homogenization of geographic data for Tuscany is certainly the creation of the General Cadastre of Tuscany. It is the first one that uses plots based on geometric construction and was developed starting from the early XIX century: its fundamentals derive from the French, that under the reign of Napoleon had drafted the "general cadastre".

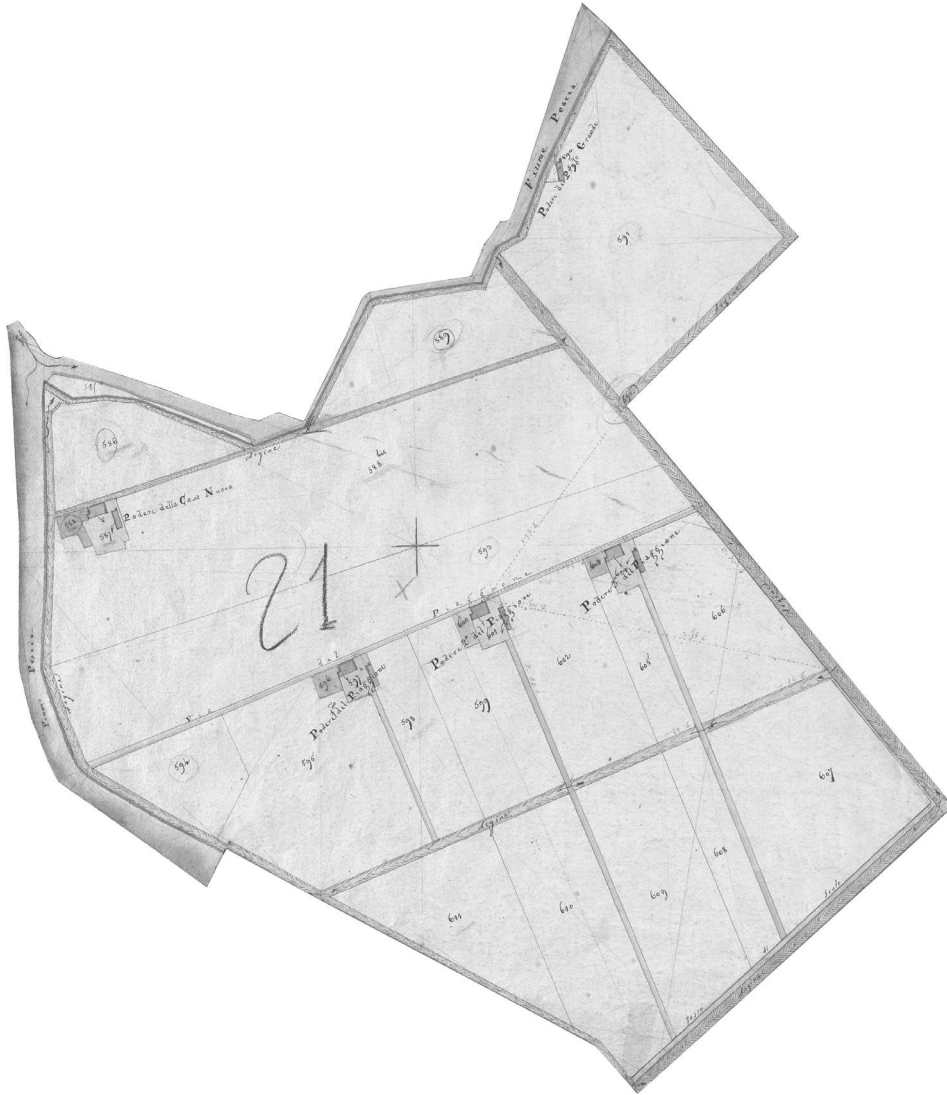


Figure 5. General Tuscany Cadastral map. Section A, Sheets 1 and 2.

The most refined techniques, the descriptive information (relative to each single particle) – put along the side of the map and contained in 2 series of registers : “ancillary tables” ordered according to the progressive number of the particles; and the “samples” ordered according to the alphabetical order of the owners – and the scale factor make the informative value extremely important.

By importing in GIS environment the historical documents (maps and other cartographic elements) it would be possible to draft the morphology and the land use of Tuscany in the 1829.

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