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RIVER AND STREAM ECOSYSTEMS

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ATLANTIC RIVER SYSTEMS OF EUROPE (France, Belgium, The Netherlands)

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INTRODUCTION

The river systems considered in this chapter are those of the Atlantic frontage of Western Europe (Fig. 12.1). Many of these rivers have been extensively studied, although rarely in an integrated way. Very often, however, the results of these studies have only been documented in theses or reports of limited distribution. A major difficulty in reviewing the literature concerning these systems is, therefore, to organize a very large amount of information into a coherent picture.

The rivers we consider in this chapter (Garonne, Loire, Vire, Seine, Schelde, Meuse and their tributaries) comprise a wide range of environments. One common feature shared by all these rivers is that their structure and function has been severely affected by the very long and changing history of their relationships with man. Indeed, human impact has modified morphology, hydraulics and ecological functioning of many of these streams, either for the needs of navigation or as a consequence of land use in their catchments. From southern France to the Netherlands, however, a distinct gradient is offered, with increasing population density, intensification of agriculture and industrialization. The sample of river systems considered in this chapter offers a unique opportunity for studying how anthropogenic effects can alter the functioning of stream ecosystems and their succession along the river continuum.

Accordingly, the objective of this chapter is twofold: (i) to establish what could be considered as the “natural trends” of the functioning of stream ecosystems in the geographical area considered; and (ii) to distinguish what is the result of human impact on this functioning. A typology of human alteration of

lotic ecosystems, in the scope of the River Continuum Concept, will emerge from this analysis.

GEOGRAPHICAL FEATURES OF THE RIVER SYSTEMS AND THEIR CATCHMENT AREAS

Geology and geomorphology

The area covered by this chapter comprises two large low plateaus of Secondary and Tertiary sedimentary rocks (the Paris and Aquitaine basins), surrounded by three uplift Hercynian massifs (the Massif Central, Bretagne and the Ardennes). The mountains of the Pyrénées isolate the area at its southern end. Large zones of alluvial lowlands exist along the Atlantic and North Sea coast (Landes, Vlaanderen). As a result of the geologically young history of the area, rivers are relatively short and their basins are small. Fig. 12.2 summarizes some morphologic characteristics of the major river systems considered. The similarities in the relationships between mean catchment area, length and slope, and stream order is striking. Only the Schelde, located entirely within the flat Vlaanderen lowlands, can be clearly distinguished from the other rivers, the headwaters of which drain regions of more pronounced relief.

Climate and vegetation

A temperate marine west-coast climate characterizes the whole area. Mean winter air temperatures vary from 1 to 8°C, and mean summer temperature from 17 to 21°C, along a northeast–southwest gradient.

Mean annual precipitation ranges from 2000 mm on the highest mountains to 530 mm in the central