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## Type 9:

## Mid-sized fine to coarse substrate dominated siliceous highland rivers

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**Distribution in river landscapes and regions according to Briem (2003):**

Schist, gneiss, granite and similar rocks, Buntsandstein sandstone, volcanic regions, large floodplain over 300 m wide

**Picture:**



*Orke (Hesse). Photograph: T. Ehlert*

**Short description of morphology:**

This stream type exhibits different morphological forms, depending on the width of the valley floor, the channel bedload and valley slope. In narrow valleys, the channel is straight or sinuous, with numerous side channels; in wide u-shaped valleys with limited slope, the single stream channel is sinuous to meandering. With increasing valley slope, the channel becomes slightly sinuous to meandering and forms anabranching sections and numerous side channels.

In general, cobbles and rocks dominate the channel substrates. Gravel is less frequent and forms pronounced bars. Fine sediments like sand and loam are found in the calmer flow sections along shore and between large rocks. The channel profile is usually very shallow and wide. There is a typical alternation of riffle and pool sequences. Pronounced gravel and cobble bars with a distinct, well developed interstitial are typical for streams of this type.

**Abiotic profile:**

<b>Size class:</b>	100 - 1.000 km <sup>2</sup> catchment area
<b>Slope of the valley floor:</b>	2 - 6 ‰
<b>Flow category:</b>	predominantly fast to turbulent currents, with high current diversity.
<b>Channel substrates:</b>	cobbles and boulders dominate with high amounts of gravel mixed in; to a lesser degree sand and loam deposits in slowly flowing areas

**Physico-chemical water conditions:**

siliceous

**Conductivity [µS/cm]:** 75 - 350

**pH-value:** 7,0 - 8,0

**Alkalinity [°dH]:** 1 - 6

**Total hardness [°dH]:** 6 - 10

**Flow regime & hydrology:**

Large fluctuations in discharge over the year, with pronounced individual events of extreme discharges.

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<b>Characterisation of the macroinvertebrate community:</b>	<p><b>Functional groups:</b> As a result of high habitat diversity, the macroinvertebrate community is very diverse. On stable rocks and boulders of turbulent riffle sections, rheophile species with high oxygen demands dominate. The sandy and muddy deposits in calm sections between large rocks, in side channels or along shore are colonised by species preferring fine sediments. In this river type, species typical for smaller and cooler streams are frequently found.</p> <p><b>Selection of type-specific species:</b> Characteristic species for the well-oxygenated, turbulent cobble bars are e.g. the mayflies <i>Baetis lutheri</i> and <i>Ecdyonurus insignis</i> or the caddis fly <i>Micrasema setiferum</i>. Numerous moss tufts on rocks are inhabited by the water beetle <i>Hydraena</i> spec. In the gravel and sand deposits large mussels like <i>Unio crassus</i> and <i>Margaritifera margaritifera</i> are found. Otherwise typical species include the mayfly <i>Ecdyonurus dispar</i>, stoneflies of the genus <i>Leuctra</i>, the true bug <i>Esolus parallelepipedus</i> and the caddis flies <i>Allogamus auricollis</i> and <i>Brachycentrus maculatus</i>.</p>
<b>Characterisation of macrophyte and phytobenthos communities:</b>	<p>Compared to other highland stream types, this stream type is relatively rich in macrophytes. Numerous water mosses (e.g. <i>Scapania undulata</i>, <i>Rhynchostegium riparioides</i>, <i>Fontinalis antipyretica</i>, <i>Fontinalis squamosa</i>, <i>Chiloscyphus polyanthos</i>, <i>Hygroamblystegium fluviatile</i>, <i>Jungermannia exsertifolia</i>, <i>Racomitrium aciculare</i>, <i>Schistidium rivulare</i>, <i>Marsupella emarginata</i>) and higher plants like <i>Ranunculus fluitans</i>, <i>R. peltatus</i>, <i>R. penicillatus</i>, <i>Callitriche platycarpa</i>, <i>C. stagnalis</i> and <i>Myriophyllum alterniflorum</i> occur.</p>
<b>Characterisation of the fish fauna:</b>	<p>Streams of this type generally support fish typical for the grayling region. Besides the character species of this region, brook trout are also found frequently. So are populations of the rheophile, gravel-spawning stream cyprinids like nase and dace. In the Danube region the huchen occurs. Side channels and backwaters also allow for indifferent species and even lenitic species to find suitable habitat. In some cases anadromous fish like salmon can occur.</p>
<b>Comments:</b>	<p>This stream type represents the „classic“ highland river, dominated by coarse substrates, fast currents, with regularly alternating riffle and pool sequences. This dynamic stream type is characterised by expansive lateral channel movement and formation of numerous side channels.</p> <p>Because of their siliceous character „mid-sized fine substrate dominated highland rivers“ are included in this stream type, although the higher amount of fine sediments, especially in Buntsandstein sandstone streams, results in biocoenotic differences. The somewhat species poorer fauna – analogous to stream type 5.1 – typically lacks interstitial species. That is also why the fish fauna does not include typical gravel-spawning species. On the other hand, brook lamprey are abundant.</p>
<b>Examples of typical streams</b>	<p><b>Macroinvertebrates:</b> Eder, Orke (Hesse), Prüm (Rhineland-Palatinate), Wutach (Baden-Württemberg), Sieg (North Rhine-Westphalia) <b>Makrophyten- und Phytobenthos:</b> Fulda (Hesse), Zschopau (Saxony)</p>
<b>Comparative literature (selection):</b>	<p>LUA NRW (2001) „Schottergeprägter Fluss des Grundgebirges“</p>