

REDUCTION OF DISCHARGE PEAKS

effects of the construction of a water retention pond

Martin W. van den Hoorn¹, Piet F.M. Verdonschot

Introduction

Most Dutch lowland streams experience increased discharge fluctuations, both peaks and droughts, as a result of increasing drained and paved areas (fig. 1). Large discharge fluctuations result in changes in stream morphology and macroinvertebrate communities. Measures to retain runoff water during wet periods can reduce discharge fluctuations and restore both morphology and biodiversity.

fig 1. Lowland stream with a deep stream bed incision due to a highly fluctuating discharge regime.



Retention of water

We investigated the effect of the construction of a water retention pond (in 1995) between a drained agricultural area and the upper course of a spring fed lowland stream. We studied changes in discharge patterns, stream morphology, substrate patterns, and macroinvertebrate species composition.

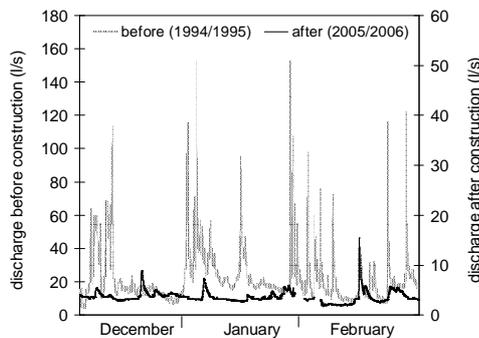


fig 2. Winter discharge pattern before and eleven years after construction of the retention pond.

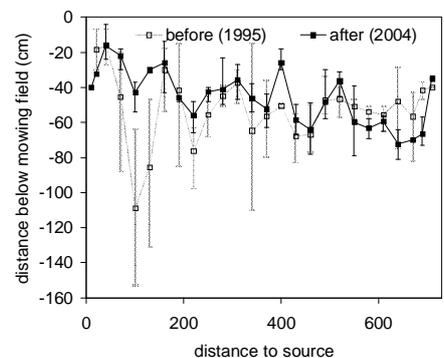


fig 3. Stream bed incision before and nine years after construction of the retention pond.

Changes in hydromorphology and substrate patterns

After the construction of the water retention pond, the discharge pattern became more constant with less peaks and drops (fig 2). Overall, base flow dropped. Through natural causes, like collapsing of banks and macrophyte growth, and by the construction of small dams made of trunks, branches, and small stones, the stream bottom raised (fig 3). Also the relative importance of different substrates changed and showed a decline of gravel banks, an important substrate in sandy lowland streams (fig 4).

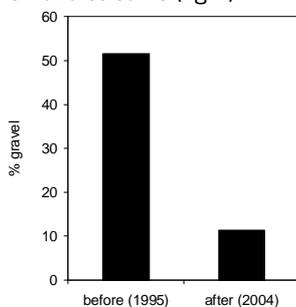


fig 4. Percentage of gravel before and nine years after water retention pond construction.

Community shifts

In the years after completion of the measures characteristic stream species returned or recovered (fig 5). All these species took advantage of the more stable stream bottom as a consequence of a more constant discharge regime.

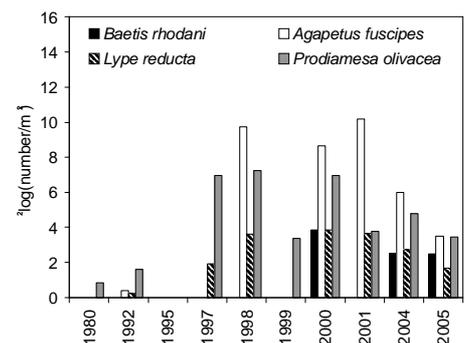


fig 5. Increase in numbers of individuals of four characteristic stream species.

Conclusion

Retention of water runoff proved to be an effective technique to reduce discharge fluctuations and improve the hydromorphological and ecological quality of this lowland stream.