

A. Rivers

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1. Interview with Prof. Dr. J. Middelkoop



Research into flood plains: finding a balance between nature and safety

Professor Hans Middelkoop has been involved with the LOICZ research programme right from the start and as a researcher at the Netherlands Center for River Research he wrote the proposal for the rivers theme and supervised this. The project mainly focussed on the flood plains along the Waal and IJssel rivers. Flood plains are interesting for a delta area: besides serving as an emergency containment area during high water, they also act as a filter that traps many contaminants. Middelkoop, who gained his doctorate for research into the behaviour of flood plains, rose to the challenge of combining the abiotic research that “his” Utrecht University specialises in with the ecological research of Radboud University Nijmegen.

Middelkoop: At Utrecht University, we were already doing research on alluvial deposition on flood plains and investigating the quantity of metals found in the sediment. We were curious about the effect of rough vegetation on alluvial deposition. Moreover, we wanted to know how the entire system worked and the effect of climate change on this. How much water will there be in the future, how will the river discharge change and what will the high-water peaks be? How will preventative measures from the Space for the River project affect the flood plains? And what would be the effect of combining these two changes in the flood plains?

How did you start the research?

We first of all reviewed the existing literature and tested Rijkswaterstaat’s river model. We soon realised the effect of rough vegetation on water movement had scarcely been investigated. At high water these shrubs impede the flow of the river, thereby retaining the water. That makes the river area unsafe. It was hard to determine how the height and density of the vegetation affected this process, as these factors scarcely played a role in the then prevailing model. We have now significantly improved the models in this area. However, we still had to come up with a method for measuring the vegetation in the field. In the end, we used the recently introduced technique of laser altimetry to make very detailed recordings from a helicopter. With this data, we then built models for the biotic aspect which clearly showed the effects of the vegetation density on water retention.

But didn’t you investigate more than just vegetation density?

Vegetation patterns reveal more than just the flow at high water. They also say something about the density of heavy metals in the subsoil. Our colleagues of the RU Nijmegen examined the arthropods in the flood plains, such as spiders, as well as mice. Where exactly are the animals found in the flood plain? And what quantities of metals do they take up? A model was built to clarify where the animals were located and took up metals. We also examined the predators that eat the mice. Which metals did they contain and in what quantities?

So a lot of instruments have been developed to gain an understanding of how the system works from both a biotic and abiotic perspective.

We used these instruments to examine the effects of climate change in relation to a range of interventions, such as those from the Space for the River project. We worked with the spiral dynamics model that functions at a range of levels (from primitive to integrated thinking) without value judgements. Using this model we sketched three future scenarios for the year 2050. The first scenario is based on business as usual, simply carrying on as we are doing now. The second has a stronger focus on safety and a future of concrete flood defences. The third is the most integral with nature taking centre stage. We examined climate change, physical processes, metal pollution, biodiversity and species distribution. We discovered that climate change has less impact on the flood plains than the effects of human interventions.

Is that good news?

The ecological patterns become increasingly more favourable if the interventions focus more on constructing secondary channels and wildlife-friendly banks. This increases the habitat diversity for the animals. However, a disadvantage is that such interventions result in twice as much sediment being trapped by the flood plain than is the case now with a concomitant increase in pollutants. Consequently, the filtering function of the large delta changes. It becomes ecologically richer and it captures more heavy metals. This means that we will need to manage the flood plains in a more dynamic manner. Monitoring will become very important. What is happening to the ecology of the flood plains and to the alluvial deposition? We now have models that provide insight into the processes. However, follow-up research must lead to models that show what the flood plains will look like in fifty years' time.

Looking back at the research then, what advice would you give future researchers?

Don't lose sight of the large spatial relationships. Do not limit yourself to individual flood plains. All of the flood plains jointly form the large filter of the delta. Keep monitoring. Make sure that you understand what is happening. Learn from the experiments and interventions that we are carrying out now. Space for the River is an example of a fantastic experiment and the Netherlands forms a superb laboratory for this. Lots of people can learn from this, including researchers in other countries. Fundamental knowledge of the system often leads to practical knowledge.

And the policy makers?

Formulate your questions to the researchers in clear and accurate language. That does not always happen at present. When it comes to decisions the Netherlands prefers the consensus model. Yet it does mean that governing authorities have become masters at negotiating with all parties with the risk that knowledge is trickling away from the organisations. As a result of this, knowledge increasingly has to be outsourced. And I find that disturbing because knowledge is needed to pose good questions and to thoroughly assess plans. An organisation that lacks such knowledge is very vulnerable.