NEVO Case Study

Reconnecting and improving the River Wey

NEVO Team & Kay Lidgard (Environment Agency)

Introduction

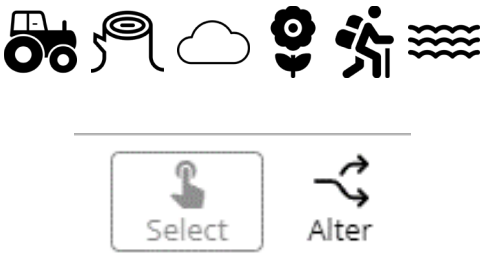
The NEVO Tool is a web application (accessed at https://www.leep.exeter.ac.uk/nevo) developed by the Land, Environment, Economics and Policy (LEEP) Institute at the University of Exeter with support from DEFRA and NERC.

NEVO's primary purpose is to help explore, quantify and make predictions about the benefits that are derived from existing and altered land use across England and Wales. This short case study uses NEVO to add value to reconnect and improve the River Wey. The tool is used to assess current ecosystem service flows and consider the impacts of natural flood management interventions.

The case study then proceeds to consider how NEVO can be used to explore alternative project options and compare their predicted impacts.

Scale, Services and Functionality

2km Grid and County



The Case Study Area

The NEVO interface is a navigable map which illustrates ecosystems services in England and Wales. In *Figure 1*, we have zoomed into the area of the case study on the River Wey, which we centred on Cranleigh, as it was identified as being a good candidate for Natural Flood Management (NFM). In 'Select' mode we are able to choose to view output at the catchment level for the Thames. Clicking on the Thames catchment on the map opens the details panel displaying aggregates outputs for the catchment.

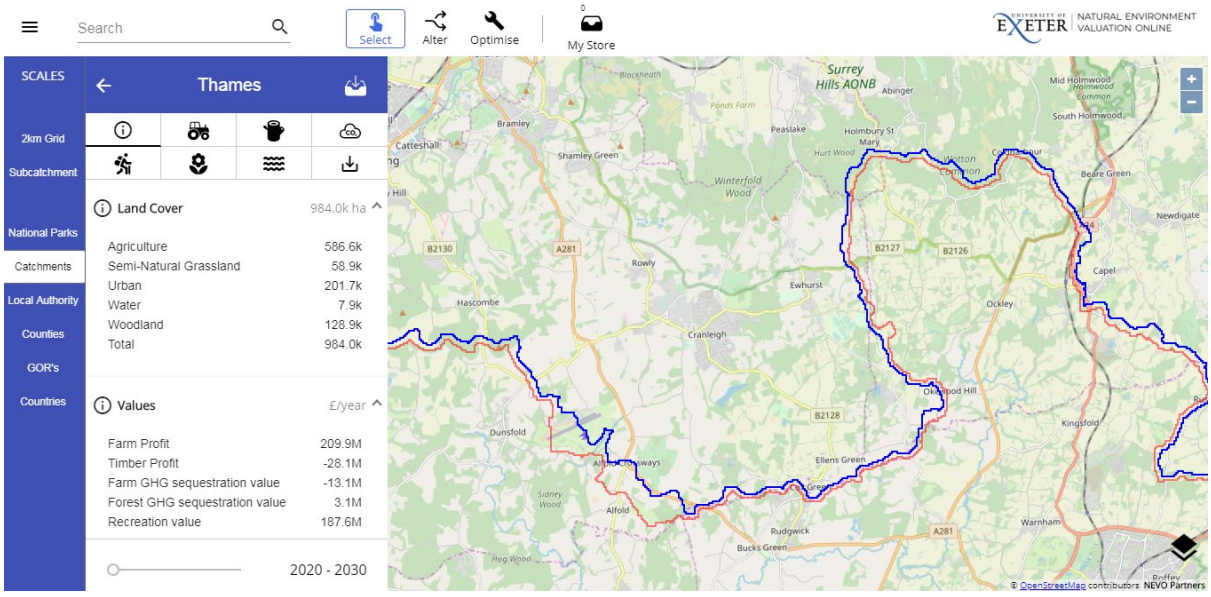


Figure 1: Exploring the River Wey

Exploring ecosystem services in the catchment

The Thames catchment was explored to establish the baseline. Over half (60%) of the land cover in the Thames catchment is identified as agriculture, with urban providing the second-biggest cover (21%), followed by woodland (13%). Semi-natural grassland and water make up the remaining land cover. Switching to view the values in 'Annuity' mode, we can see that the largest value comes from recreation, which accounts for £797.1M/year. Farm profit is valued at £184.3M/year. Forest GHG sequestration is smaller at £2.9M/year. Timber profit and farm GHG sequestration provide negative values per year.

The River Wey

The River Wey was initially assessed by selecting subcatchments. These are broadly similar between the NEVO dataset and our internal dataset. Minor differences were noted where some subcatchments in NEVO are subdivided into smaller subcatchments in our internal dataset, as illustrated in *Figure 2*. The process was intuitive, with the map-based select function proving very easy and simple to use. The Ordnance Survey map layer was found to be the best for showing rivers and woodland. The 'Follow River' function was particularly interesting; the ability to track the river and see how its properties and values change through the catchment was useful. It would be helpful to be able to select multiple scales at once, e.g. catchment and subcatchment. This would aid the initial assessment of the area.

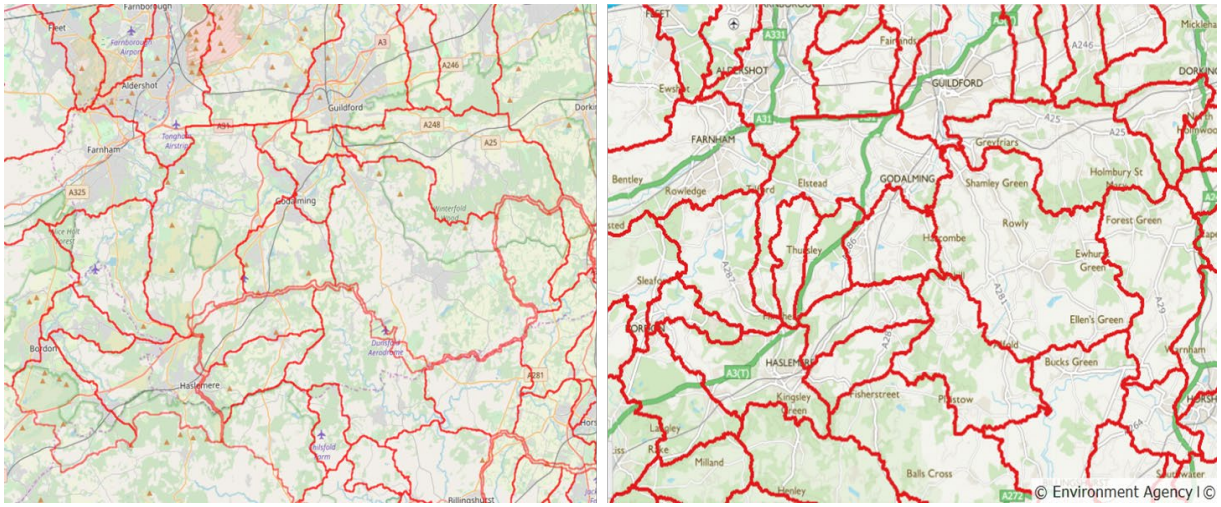


Figure 2. Comparison of subcatchments in NEVO (left) and our internal dataset (right)

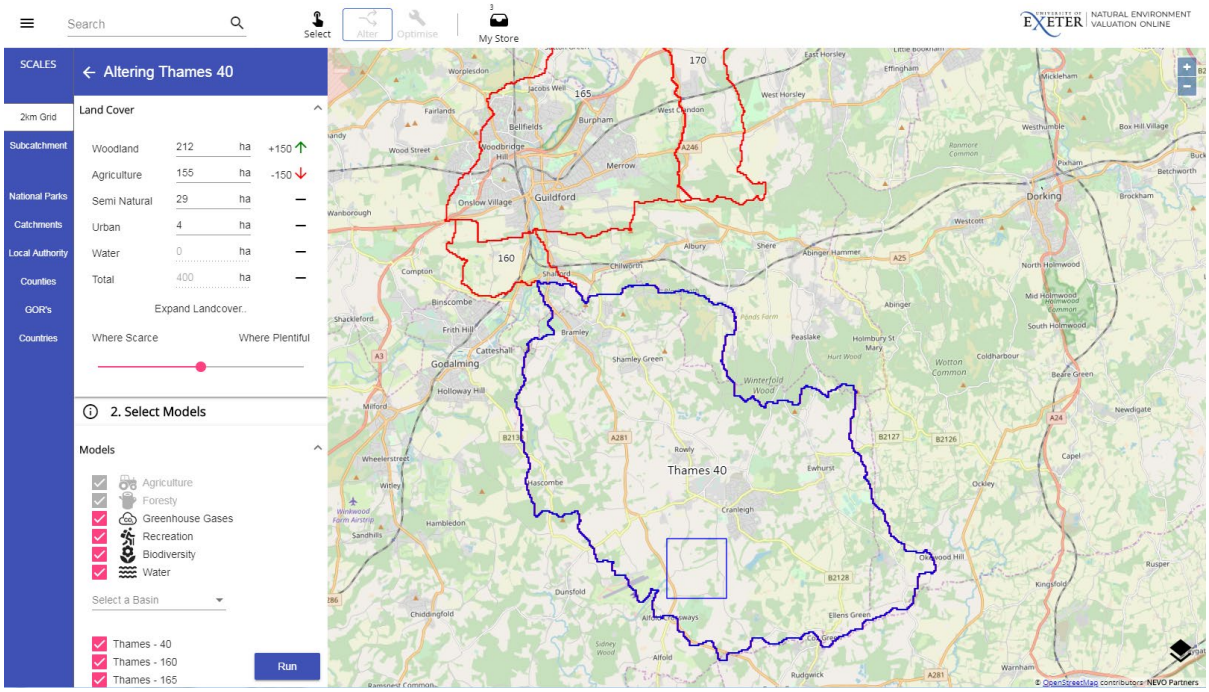


Figure 3. Using the 'Alter' mode for woodland planting in cell #163868, selecting 3 subcatchments for viewing water quantity and quality output

Scenario analysis

NEVO was used to assess the effect of NFM projects on water quantity and quality, as well as the additional benefits such as species richness, GHG sequestration and recreation. The 'Alter' mode was used at the 2km grid scale. In order to simulate NFM woodland planting, approximately 50% of agriculture was replaced with woodland for several grids in the headwaters around Cranleigh.

An example of 'Alter' mode for grid cell #163868 is shown in Figure 3. We assign 150 hectares from agriculture to woodland, run all available models and select 3 Thames subcatchments to view water quantity and quality output.

The effect on water quantity and quality for this change in the Thames 40 subcatchment is shown in Figure 4. As expected, the introduction of woodland has reduced flow levels in the subcatchment. The 5th percentile and mean level of flow have been reduced by 0.011 and 0.002 m^3/s respectively. Water quality has also been improved, with levels of various nitrogen and phosphorus concentrations reducing. For example, the average annual concentrations of organic nitrogen and phosphorus have fallen by 0.072 and 0.017 mg/l respectively. As we move downstream to study the impact in the Thames 160 and Thames 165 subcatchments, the effect diminishes as we would expect.

The additional ecosystem services benefits of woodland planting can be assessed using the Info tab in NEVO, shown in Figure 5. We see that while farm and timber profit is reduced, farm GHG sequestration, forest GHG sequestration and recreation values are increased. Recreation value only increased by £900/year, however this is using the 'alter current paths' option in 'Alter' mode. If instead we allow the new woodland area to provide new recreational access via a new path network, this value increases to around £37,000/year. Further still, if we treat it as a new recreation park the value rises to £170,000/year. In terms of biodiversity, species richness shows a small increase. It was useful to see the breakdown of richness across species.

This process was repeated for several 2km grids in the headwaters around Cranleigh and indicates how NEVO can be used to identify where NFM can yield the most additional benefits and therefore help direct decision making on where to focus projects.

The outputs of NEVO could help us with the challenges of levering funding for multi-benefit schemes. We would be able to show where there is a marked increase in the value of other ecosystem services to facilitate public and investor buy in.

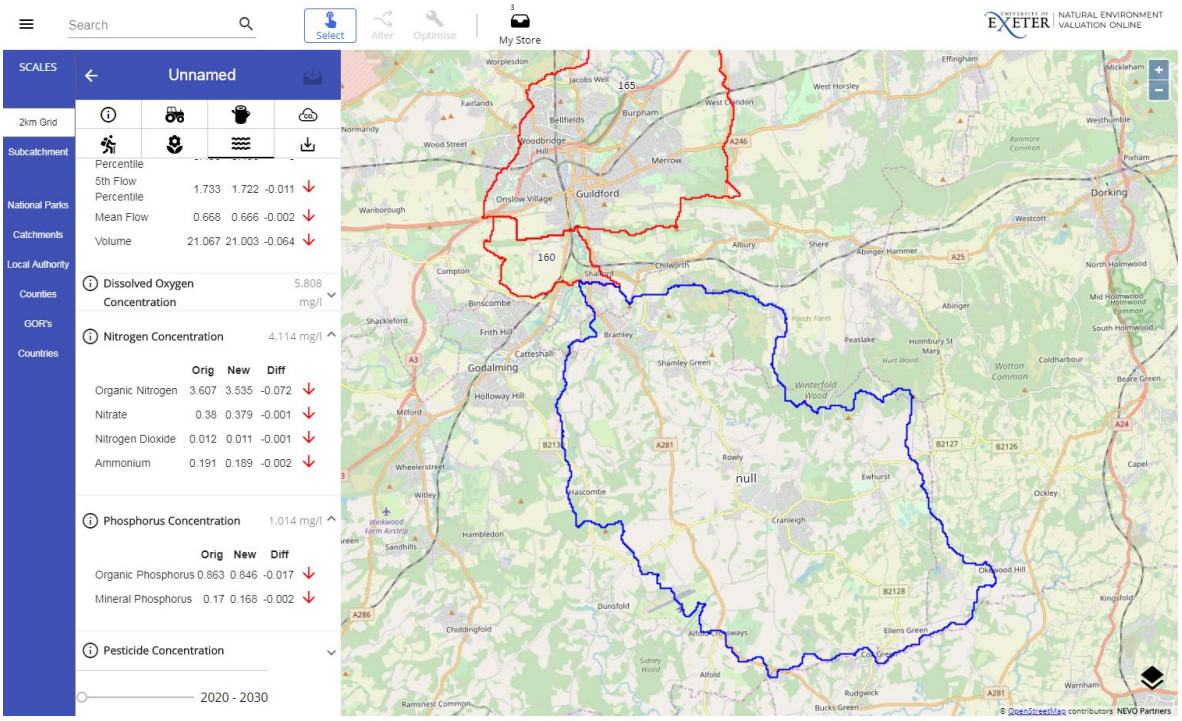


Figure 4. The impact of woodland planting on water quantity and quality for the Thames 40 subcatchment

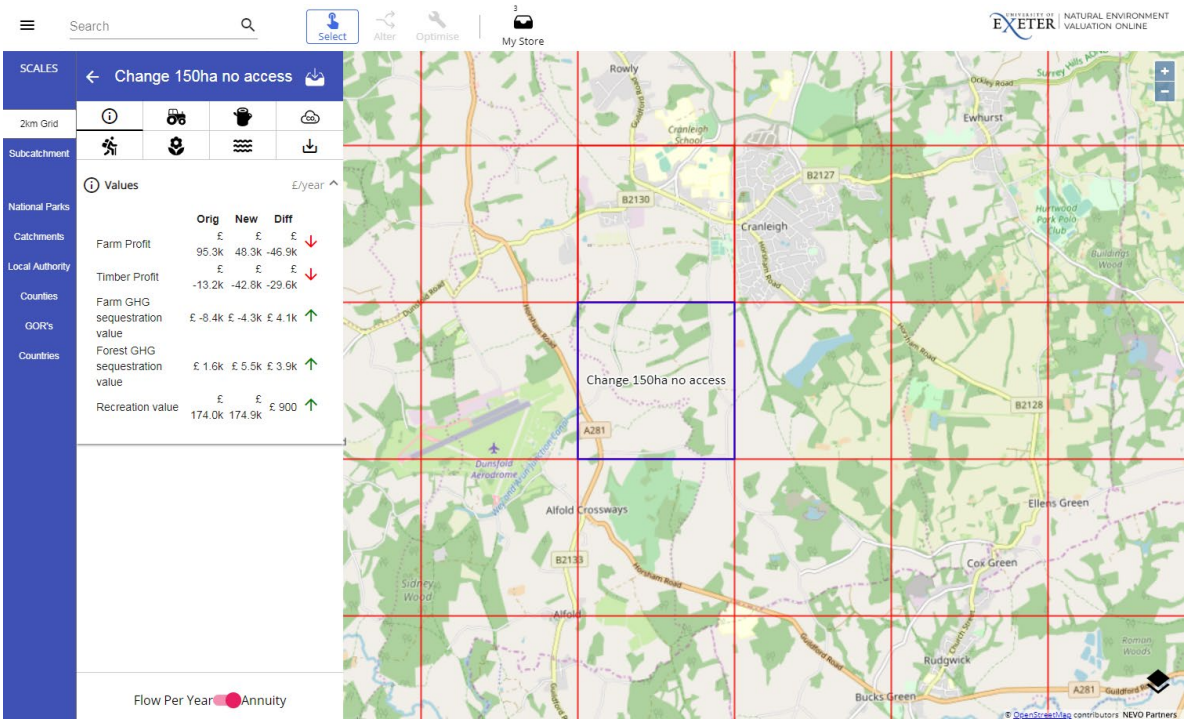


Figure 5. The additional ecosystem service benefits from woodland planting

Potential Extensions

The ability to optimise for water outputs would be useful for helping direct decision making on where NFM projects should be located to achieve the most benefits. A wetland option in the alter tool would be beneficial as at the moment we are only able to assess woodland planting projects. It would also be useful to translate water outputs into Water Framework Directive (WFD) ecological status to allow a direct comparison of the current and potential status as a result of different schemes.

To aid NFM assessment, it would be useful to see floodwater volume as an output, since the water quantity in the tool is based on flow data and not flooding. Flood mitigation summaries would also be helpful.

The option to view land ownership would be useful, for example private versus Local Authority owned land, as this would have a bearing on where to initially direct the location of schemes.

References

NEVO technical documentation

https://www.leep.exeter.ac.uk/nevo/documentation/

Video user guides

https://www.youtube.com/watch?v=b0qKcO8dE0s&list=PLG5Rz1SU4uYcRqLMEosaUucRsVvv9A7ny