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Computing for Sustainable Water Project comes to an end

The Computing for Sustainable Water Project has run its course following six months of computation on the World Community Grid. The project has focused on the issues surrounding the quality of water in the Chesapeake Bay area, the largest watershed of the Atlantic seaboard of North America. The researchers behind the project hope to apply the lessons learned here to other watersheds around the world.

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Almost exactly six months after it was first launched, the Computing for Sustainable Water Project has come to a close. The project, run on the World Community Grid (WCG), has been studying the effects of human activity on a large watershed, in the hope of gaining deeper insights into what actions can best lead to restoration, health and

Chesapeake Bay is the largest estuary in the US. Image courtesy
eutrophication&hypoxia, Flickr.

sustainability of the resource. The specific watershed investigated was the Chesapeake Bay area, which at 64,299 square miles (166,530 square kilometers) is the largest watershed of the Atlantic seaboard of North America. However, the investigators hope to be able to apply that which is learned from this project across the globe to other regions facing challenges of sustainable water.

Despite being an abundant resource, over 1 in 6 of the world's people currently lack access to clean, safe water. And, the problem is becoming even more critical as the global proportion of people living in dense urban environments rises. A complex set of interrelated forces, including human

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activities which degrade the quality of available water, makes the problem difficult to address, much less to solve effectively via coordinated policy.

The Chesapeake Bay was an ideal system to study, explain the researchers. Like many estuaries worldwide, it is under increasing stress from nutrient run-off from the land surface. The subsequent degradation of the water quality is not only having a major impact on local ecosystems, but it is also affecting the lives the nearly 17 million people living within the watershed. In 2009, US president, Barack Obama issued an executive order mandating that action be taken to mitigate the impact of nutrient run-off on the bay. Many solutions to the problem have been put forward, but none have been tested in the field on such a large scale. The Computing for Sustainable Water Project tests many of these proposed solutions - or 'best management practices' - though a 20-year simulation model.

"We are looking at whether or not various best management practices currently in use by governments will be effective in the long run for reducing the load of nitrogen, phosphorous, and sediment that is reaching the Chesapeake Bay from municipalities and agricultural areas and causing a decline in the health of the Bay," explains Gerard Learmoth, the lead researcher on the project, in a University of Virginiavideo."We hope that what we learn can not only help restore the health of the

Bay, but also sustain it for future generations," he adds.

The model run on the WCG was actually based on a participatory simulation game created by the researchers three years earlier. The game, simply called 'The UVA Bay Game', was launched to coincide with Earth Day 2009 and incorporates both natural elements and human activity. Originally, players could adopt the roles of crop farmers, land developers, watermen, and assorted regulators. However, the game has been updated several times since its initial release to add more roles, as well as to improve graphics and realism.

The World Community Grid

The World Community Grid, often simply abbreviated to 'WCG', is an attempt to create the world's largest public computing grid. The WCG is funded and operated by IBM and will turn 8 years old later this week. The WCG specifically seeks to help scientists tackle problems which will benefit humanity. Current projects being run on the grid include: 'Help Conquer Cancer', 'Say No to Schistosoma' and 'The Clean Energy Project'. The WCG currently has over half a million members, who have collectively contributed over half a

million years of computing time to projects run on the grid.

The game primarily functions as a learning platform for conveying the issues of complex watershed behavior and management. And, building on its success, the University of Virginia researchers decided to investigate the underlying simulation model - highly aggregated in the game - and develop a much more detailed, simulation-only model. However, it soon became apparent that such a model would require a significant increase in computing capacity to execute.

Learmoth says: "The WCG is the only computing resource that could handle a project of this size. We estimated that it would take some 90 calendar-years to perform these experiments on our university computing grid. In all, we submitted approximately 19,232,000 experiments consuming an average of about 90 minutes of CPU time per experiment. The first experiments had longer run times. Then we fine-tuned the code with IBM's help to accelerate the runtimes. And, as is usually the case with WCG projects, a number of runs needed to be re-run for various reasons. Thus, we are looking at approximately 4,173 years total CPU time donated by WCG members."

The next step is for the researchers to analyze the results generated during the project. This could take at least 6-12 months, explains Learmoth. He and his colleagues hope to discover which public policies might affect watershed health, publish

these findings and possibly apply them to other important watersheds around the world. "We always intended to use this same simulation approach in other parts of the world with similar challenges," explain the researchers in a post thanking contributors to the project. "In fact, the UVa [University of Virginia] Team has visited a number of countries already to explore the opportunity to customize the CFSW [Computing for Sustainable Water] simulation model for their regions."

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