For eight weeks during the summer of 2013, I worked alongside three other students as mathematics research interns under Dr. Matthew Rudd of the Sewanee Mathematics Department. We set out to continue work completed by Dr. Rudd and Mary Michael Forrester (C ’12). This previous work used linear combinations of statistical operators on a fixed two-dimensional grid to create solutions in which each point becomes either the mean or median of its four adjacent neighbors. Our most recent work took the same functions and applied them to two-dimensional meshes with fixed boundaries in a Cartesian coordinate system. We also applied these functions to fixed points on a three-dimensional surface.

My focus was on the two-dimensional mesh problem, and for anyone without a background in math, meshes, and statistical operators; this work takes some translation for any sense to come out of the technical jargon. When we consider the two-dimensional mesh, imagine a large piece of white elastic cut into the shape of a disc; dotted with a grid; and with the edges pinned to a board. Now we pinch part of the interior portion of the elastic and bunch up the material. This collection of material and stretching of the rest can be thought of as our initial condition – points on the boundary are fixed and all the interior points are ‘stacked’ in one spot. Once the bunch is released, the elastic stretches back out until the forces pulling each point in a different direction average out; this is the solution to our function. These sorts of meshes serve as mathematical curiosities, but they may also make triangulations of shapes easier to create, which can increase the efficiency of computer programs that generate complex 3D images.

Our analysis of these statistical functions took place primarily in computer simulations, but also as open discussions and examples on chalkboards. We would start with a hand drawn picture of the concept we were trying to demonstrate and a quick discussion of possible routes to the solution. Sometimes the functions might take hundreds of repetitions in order to converge to solution, thus the necessity for computer powers. So we used a free statistical analysis software package called R. While this program was not the first time I had written computer code, R Is the first coding program that I have explored and used extensively. On many occasions, a new program would require me to find an existing function buried within R's pre-existing archives. If the necessary function did not appear, I had to create a new one, which required taking into consideration the structure of inputs and outputs; simplicity of the code; and easily understood visualizations of the output.

These math and coding problems lent themselves to a puzzle or game-like feel, which encouraged me to approach the work with a playful attitude. Since solving these math quandaries was more of a game than work, I easily became wrapped up in the work and sent or presented my progress to Dr. Rudd most days in order to have a more collaborative effort rather than feeling like a drone completing arbitrary tasks. Dr. Rudd also encouraged the other interns and me to explore our own ideas beyond the prescribed goals, which I did and found useful R functions for my interests in environmental policy analysis.

Working with Sewanee's math department this summer has made me realize that math, although enjoyable, is not going to be the focus of my career path. As a result of my avid work ethic and enthusiasm for the project, Dr. Rudd offered me an opportunity to present our research at the University of Tennessee, Knoxville during the Southeastern-Atlantic Research Conference on Differential Equations in September of this year. This upcoming talk will be valuable practice for presentation skills, which will be vital in my preferred field, land-use and environmental policy.

To be sure, math and analysis are crucial tools in any policy field that requires constant evaluations and reforms to improve policy decisions. For me, however, a pure concentration on math leaves behind a desire to apply my findings or collect real world data for our abstract functions. Additionally, this internship lent itself to independent work apart from the other interns, which was freeing, but working on more complex projects that require a team with more interdependence and specialization according to each person's strengths has a strong appeal to me now. Statistical functions have tremendous power in the realm of analysis to inform progressive policy decision, but the numerical calculations are only part of that decision process. Math is an important, and often overlooked or misunderstood, organ in a larger social organism, and I intend to take my experience at this internship with me as I move into environmental policy.