BIO 319 Lab 2

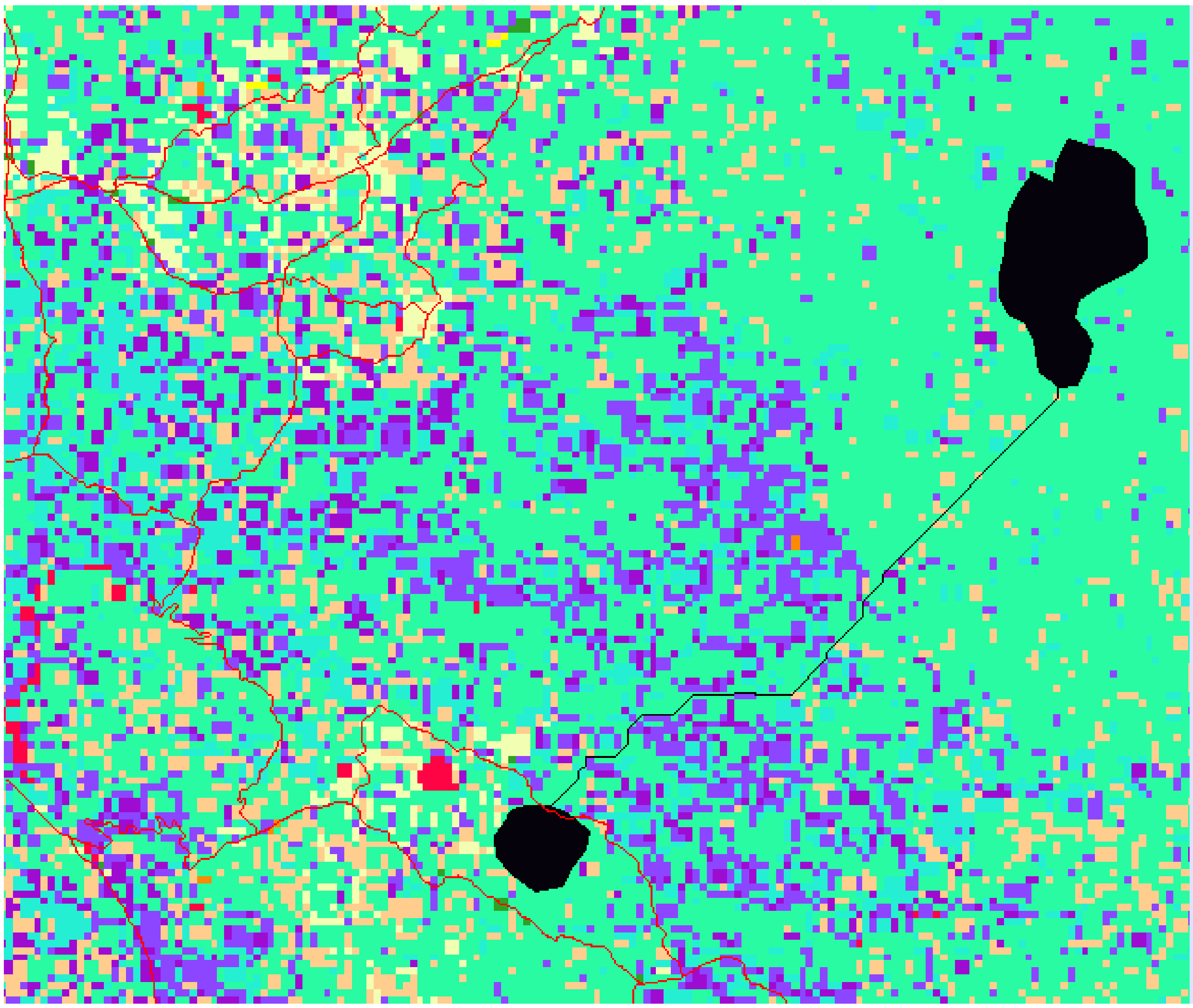
Q *Can you guess just by looking what types of land covers are present in this area? Do you see any urban areas? What about agricultural fields, lakes, or forests? Is it easier to identify land features when viewing the image as a true-color composite as opposed to viewing single color bands in grayscale?*

Land covers present in this map are lakes, agricultural fields, some urban areas, and mountains. It is much easier to view and identify the land cover types when looking at the image as a true-color composite rather than single color bands in grayscale. The grayscale offers no distinction of the land cover types because it is not color coded. Using true color-composites, we are able to view water as blue, agricultural fields as green, urban areas as blue/gray, and mountain areas as brown.

Q *Compare the resulting image to the true-color composite. What is the most striking difference between the two images? Copy and paste both images into your lab report.*

The main difference between these two images is that FALSECOLOR.rst shows vegetation in red.

Q Are there any areas where roads might interfere with the dispersal of the fishers to the new area? What might be done to mitigate the risks that the presence of roads might pose to the fishers?



According to the map above, there are no points where the road intersects the path of the fisher. Thus, there should not be any problems for the fisher traveling to its new habitat. Although there might not be any intersection, this is not a definite path of each fisher. It is important to note that the “entrance” to the new habitat has roads on each side of it. If a fence built that funnels the fishers safely into the new habitat is made, the roads will pose less risks.

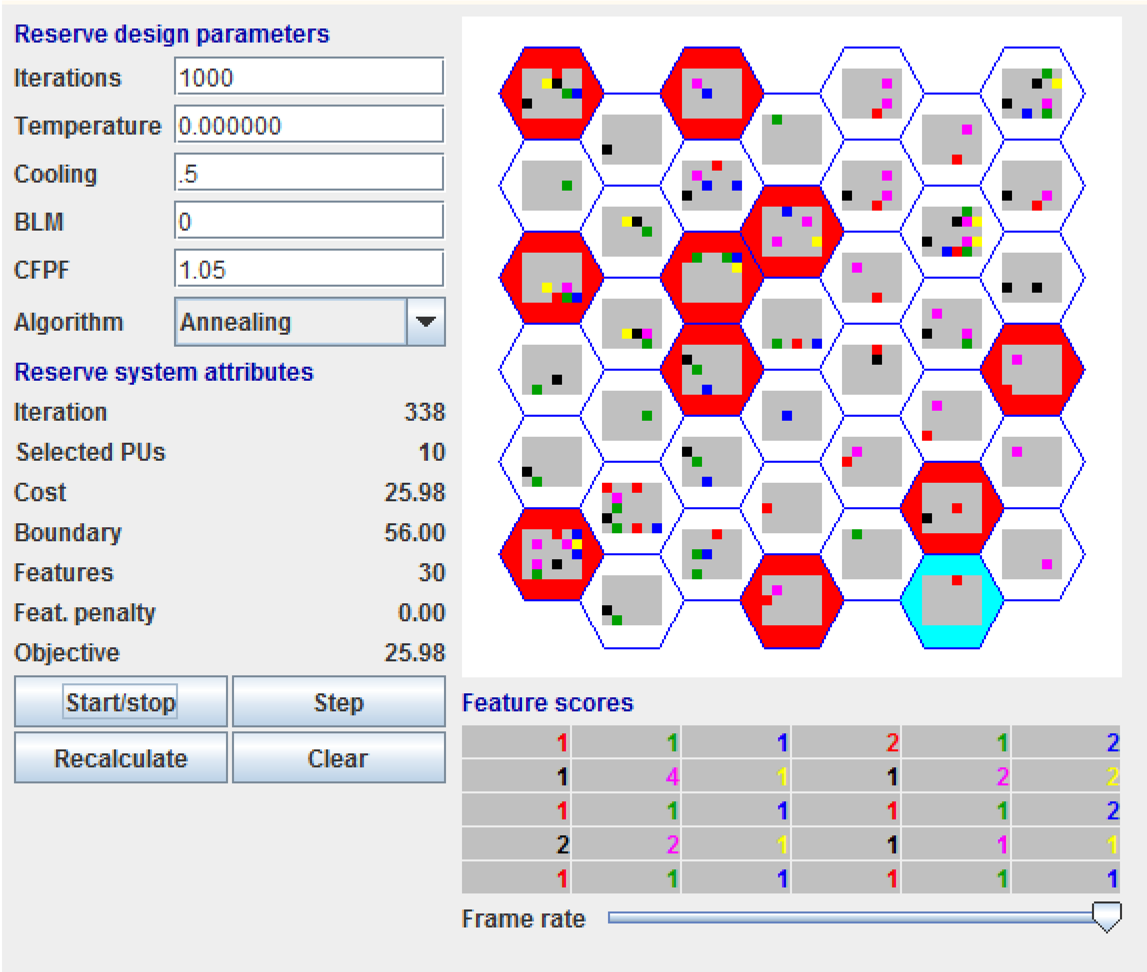
Q The last exercise focused on the predicting the dispersal patterns of fisher. Discuss why a conservation agency or organization might be interested in these predictions. What might be some of the reasons predicting this species’ dispersal might be important for its conservation?

In the event of a migration, a conservation agency might want to prevent hunters from entering this area, as they might potentially be a threat and interfere with the fisher migration. It is also possible that fisher will be traveling between these two habitats. Therefore, if we plan to create roads or highways in the area they travel, we must create a safe habitat corridor for them.

Q Discuss some of the factors that may cause species to have clumped versus uniform dispersion patterns.

Some species might have clumped dispersion patterns as a way to defend themselves from predators. More of them can be safer instead of being preyed on one by one. Other reasons can include conspecific attractions and

Q Run the process several more times, each time adjusting the temperature and cooling parameters. Try to find a combination of the two that seems most optimal. What combination seems to work best?



The best combination of the two is a temperature of zero and a cooling value of 0.5. With this combination, I get a cost of 25.98 and a boundary of 56. These are the lowest values of any of the combinations tested.

Q On average how many planning units do your best reserve designs have? What is the lowest objective score you were able to achieve?

On average there are 12 planning units. The lowest objective score was 25.98.

Q Compare these results to the reserve design obtained using the greedy algorithm from exercise 8.4. How do they differ?

This reserve design only has 10 planning units and the greedy design has 12. Compared to greedy, it has a lower cost and a smaller boundary. This is a better reserve design.

Q What were your optimal temperature, cooling and BLM values? How many planning units were in your best reserve system?

The optimal temperature was 0, cooling was 0.5, and boundary length modifier was 0. There are 11 planning units in my best reserve system.

Q *Our prediction models for the year 2000 seemed to underestimate the amount of change that actually occurred. Why do you think this might have occurred (be specific, don't just say "because it is a bad model")?*

With all predictions, we can expect errors. Regardless of all the variables and trends that we can account for, a predicted model will always be different from the actual model. However, by adding dynamic variables, our model will become more accurate. For example, when we began to include dynamic variables such as distance from disturbance and distance from roads, the amount of underestimation had begun to decrease. Even with all these improvements, we cannot foresee human activity on the land.

Q *Now that you know how landscapes change, and how to build a model of landscape change, how would you incorporate these results into a metapopulation model for a species?*

By analyzing how the landscape changes, we can calculate the relative contribution of different predictor variables and their potential for changing the landscape. We can also understand how different variables interact. A soft projection map of a metapopulaion model for a species will give us the vulnerability of each pixel to change in land type. We can create many plausible scenarios to predict the change in a metapopulation model for a species to better improve their habitat because metapopulations are fragmented most commonly by human activity. These results can be incorporated into a metapopulation by using this data to predict possible its outcomes. Certain parameters that may change over time may negatively affect the viability of metapopulations. For example, as new disturbances emerge, the distance of a metapopulation from that disturbance will change. Disturbances may also decrease the dispersal from one sub-population to another. The disturbance in the matrix of a metapopulation will most likely increase, causing a reduction in the viability of these sub-populations. By analyzing the contribution of these disturbances, we can impose more regulation on them.

Q *Record the final abundance, expected number of patches, and risk that the population will reach or exceed 100,000 individuals.*

Final abundance is 112464.28 individuals. Expected number of patches is 346.3. There is a 97% chance the population will exceed 100,000 individuals.

Dispersal

Q *Describe how the species spreads across the landscape. Do you notice any differences visually in the way the species spreads across the landscape from the model with no management?*

The species grows radially from one point. There seems to be less dispersal and thus less occupied populations compared to the model with no management.

Q *Record the final abundance, expected number of patches, and risk that the population will reach or exceed 100,000 individuals.*

Final abundance is 77896.14. Expected number of patches is 248.8. There is a 0% chance that the population will reach 100,000 individuals.

Firebreak

Q *Describe how the species spreads across the landscape. Do you notice any differences visually in the way the species spreads across the landscape from the model with no management?*

The species spreads to all areas surrounding it across the landscape. It is much more confined and occupies fewer populations compared to the model with no management.

Q *Record the final abundance, expected number of patches, and risk that the population will reach or exceed 100,000 individuals. Also record the risk that the population will reach 50,000 individuals in 100 years.*

Final abundance is 51299.61 individuals. Expected number of patches is 186.2. There is less than a 1% chance that the population will reach 100,000 individuals. There is a 44% chance that the population will reach 50,000 individuals in 100 years.

Q *Think of at least one other technique to manage this invasive species. You can modify one of the techniques you already tested, combine two different techniques, or make up one of your own. Describe what you did both in terms of the parameters you modified in the model and what management actions that would simulate.*

Since the firebreak model proved to be most effective, I combined it with the dispersal model because that solution is cost effective. I attempted to simulate a species that feeds on the invasive plant, but it did not prove to be effective. I decided to keep the parameters the same as the original values in the lab for both models.

Q *Run your model and record your results. Are you able to control the invasive species with very little risk of it escaping into the rest of the landscape?*

Final abundance is 19737.26. Expected number of patches is 91.3. There is a 0% chance that the population will exceed 31,000 individuals. Looking at the simulation, there is very little spread of the species and it seems to end much more abruptly than any of the solutions previously proposed. Based on the results, we can conclude that there is very little risk of it escaping into the rest of the landscape. There are fewer than 100 patches occupied.