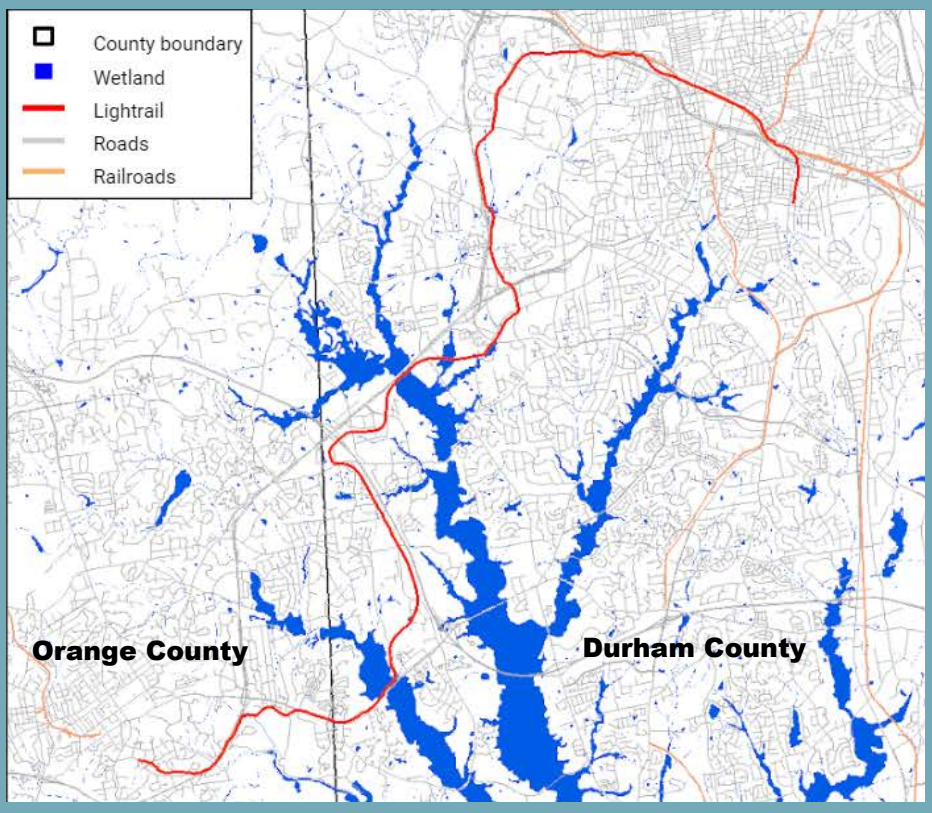
Impacts from the GoTriangle Light Rail Project: A Wetland Analysis Tool

By Avery Zhang

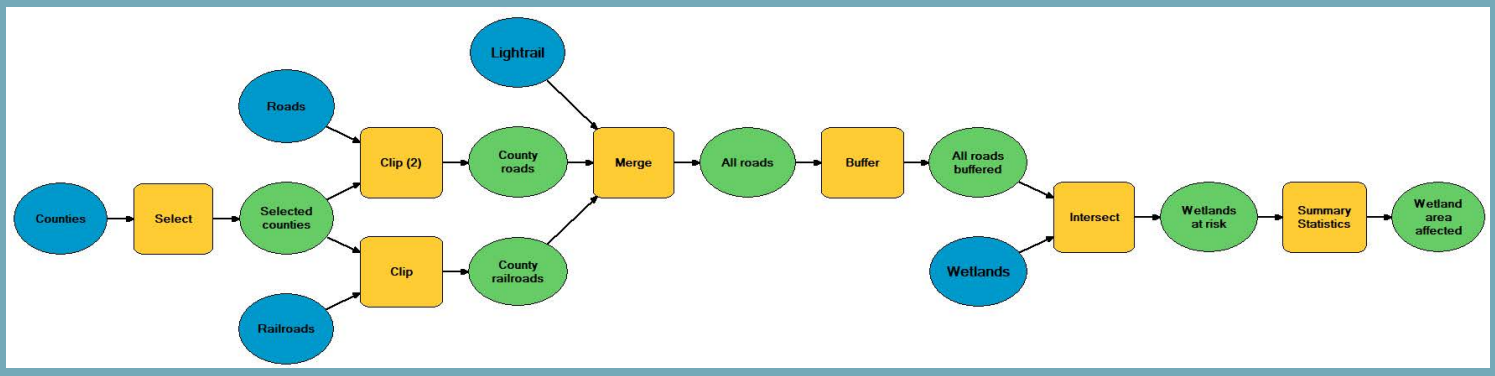
Wetlands provide a variety of essential ecosystem services including flood mitigation, water regulation, wildlife habitats, and food. As a result of anthropogenic activity, wetlands are now suffering from degradation and shrinkage. Because of their crucial role for both humans and the broader ecosystem, many have called on policy makers to take into consideration the effect that future development could have on these areas. At the same time, advocates for GoTriangle's new light rail project cite benefits including the reduction of traffic and improvement in accessibility between Durham and Orange County. However, the proposed path flanks several wetland areas, which will cause pollution.

In a 2017 study, proximity to urban expansion was cited as a primary causal factor for wetland degradation.[1] Infrastructure especially was predicted to lead to further land fragmentation and wetland subsidence without "precautionary measures".[2] Another study found that urban sewage water and runoff furthers degradation as they contribute to eutrophication.[3] Ehrenfeld found that "even small first-order creeks"[4] can act as a channel for human influence in the form of trash and pollutants. These studies all used proximity to a geographical feature as the variable of interest. This project evaluates the potential impact of the light rail on wetlands that border its proposed path, through the development of a Python tool that can be applied to other wetlands and infrastructure projects.



1 Biswajit Mondal et al., "Urban expansion and wetland shrinkage estimation using a GIS-based model in the East Kolkata Wetland, India." Ecological Indicators , vol. 83 (2017), pg. 62-73. doi: 10.1016/j.ecolind.2017.07.037.
2 Ibid.
3 Yangfan Li et al., "The Analysis of Computer Models of Wetland Ecological Changes Based on GIS Technology." The Open Automation and Control Systems Journal , vol. 7 (2014), pg.1709-1714. doi: 10.2174/1874444301507011709
4 Joan G Ehrenfeld, "Evaluating wetlands within an urban context." Ecological Engineering , vol. 15 (2000), pg. 253-265. doi: 10.1016/S0925-8574(00)00080-X

Tool Model



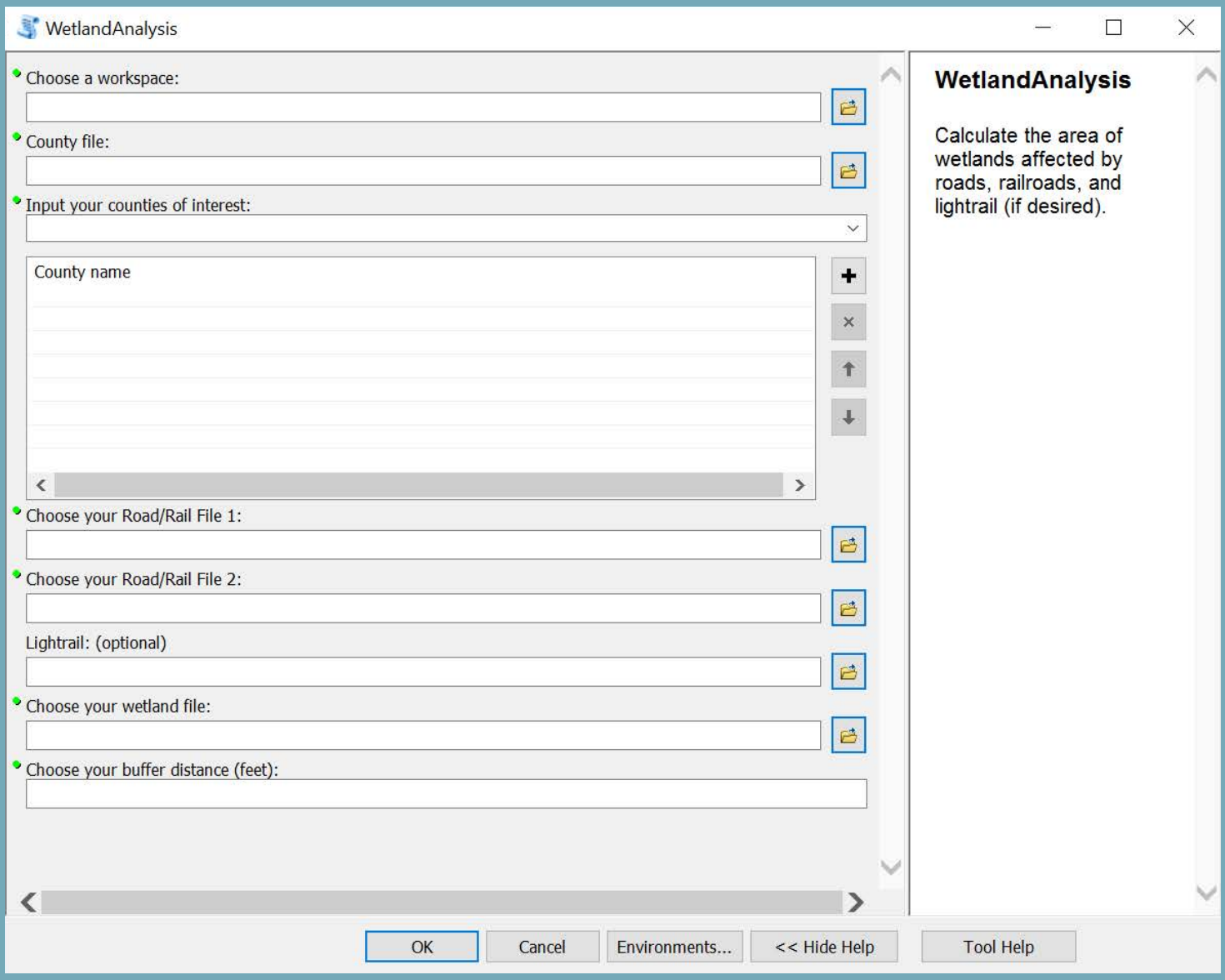
Code Sample #1

```python
class WetlandAnalysis(object):
    def __init__(self):
        """Define the tool (tool name is the name of the class)."""
        self.label = "WetlandAnalysis"
        self.description = "Calculate the area of wetlands affected by roads, railroads, and lightrail (if desired)."
        self.canRunInBackground = False

    def getParameterInfo(self):
        """Define parameter definitions"""
        param0 = arcpy.Parameter(displayName = "Choose a workspace:",
                                 name="Workspace",
                                 datatype="DEWorkspace",
                                 parameterType="Required",
                                 direction="Input")
        param1 = arcpy.Parameter(displayName = "County file:",
                                 name="county",
                                 datatype="DeFeatureClass",
                                 parameterType="Required",
                                 direction="Input")
        param2 = arcpy.Parameter(displayName = "Input your counties of interest:",
                                 name="selCounties",
                                 datatype="GPValueTable",
                                 parameterType="Required",
                                 direction="Input",
                                 multiValue=True)
        param2.columns = [['String', 'County name']]
        param3 = arcpy.Parameter(displayName = "Choose your Road/Rail File 1:",
                                 name = "Road1",
                                 datatype = "DEFeatureClass",
                                 parameterType = "Required",
```

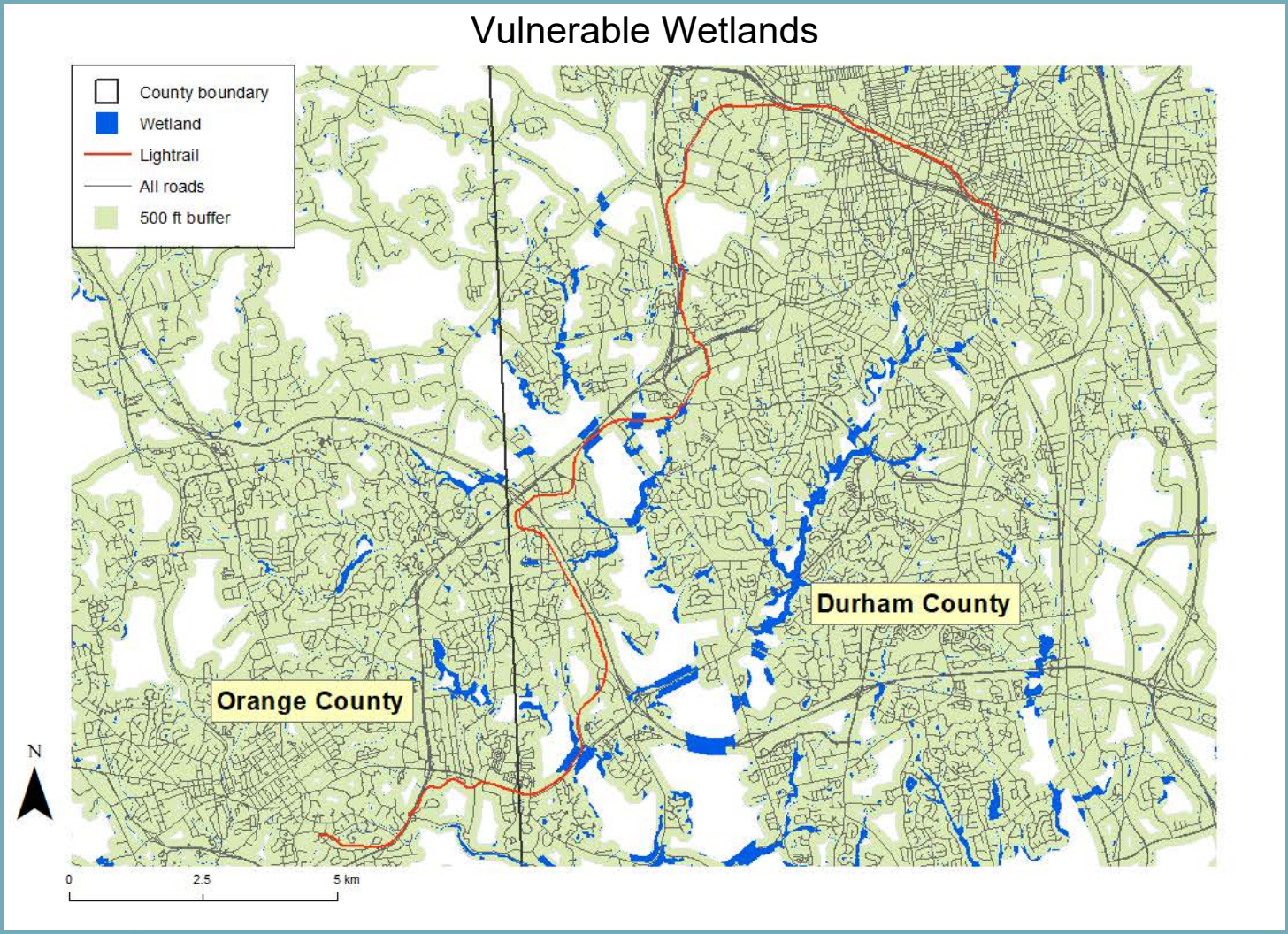
Code Sample #2

```python
        #buffer
        arcpy.Buffer_analysis(allroads_shp, roadsBuf_shp, bufDist, "FULL", "ROUND", "ALL", "", "PLANAR")
        arcpy.AddMessage("The buffer process is completed.")

        #intersect
        arcpy.Intersect_analysis([roadsBuf_shp,wetlands_shp], roadWetland_shp, "ALL", "", "INPUT")
        arcpy.AddMessage("The intersect process is completed.")

        #add area fields and calculate geometry
        arcpy.AddField_management(roadWetland_shp,'wacres','DOUBLE')
        arcpy.CalculateField_management(roadWetland_shp,'wacres','!shape.area@acres!','PYTHON_9.3')

        arcpy.AddField_management(roadWetland_shp,'wsqm','DOUBLE')
        arcpy.CalculateField_management(roadWetland_shp,'wsqm','!shape.area@squaremeters!','PYTHON_9.3')

        #stats
        stats_fields = [['wacres', 'SUM'], ['wsqm', 'SUM']]
        arcpy.Statistics_analysis(roadWetland_shp, wetlandstats, stats_fields)

        fields = ['SUM_wacres','SUM_wsqm']
        acre=0
        sqm=0
        with arcpy.da.SearchCursor(wetlandstats, fields) as cursor:
            for row in cursor:
                acre += row[0]
                sqm += row[0]
        arcpy.AddMessage("The total wetland area affected is {0} square meters, which is {1} in acres".format(str(sqm),str(acre)))

        del row,cursor
        return
```

Wetland Analysis Tool



Findings



Existing infrastructure alone impacts 14,780.66 acres of Orange and Durham County wetlands within a 500 foot buffer. The addition of the light rail would increase that number to 14,907.44 acres. This demonstrates that there is a 0.86% increase in potential wetlands affected by pollution from the presence of the light rail. There are a total of 24,795 acres of wetlands within Durham and Orange County. The analysis finds that, should the light rail be constructed, 60.12% of wetlands would be potentially affected by infrastructure.

It is important to bear in mind that this study considers only the presence of the light rail tracks, which heavily overlaps with operational roads. Should construction ever take place, the light rail project's impact will be far greater due to the need for train stations, parking facilities, and pedestrian paths.