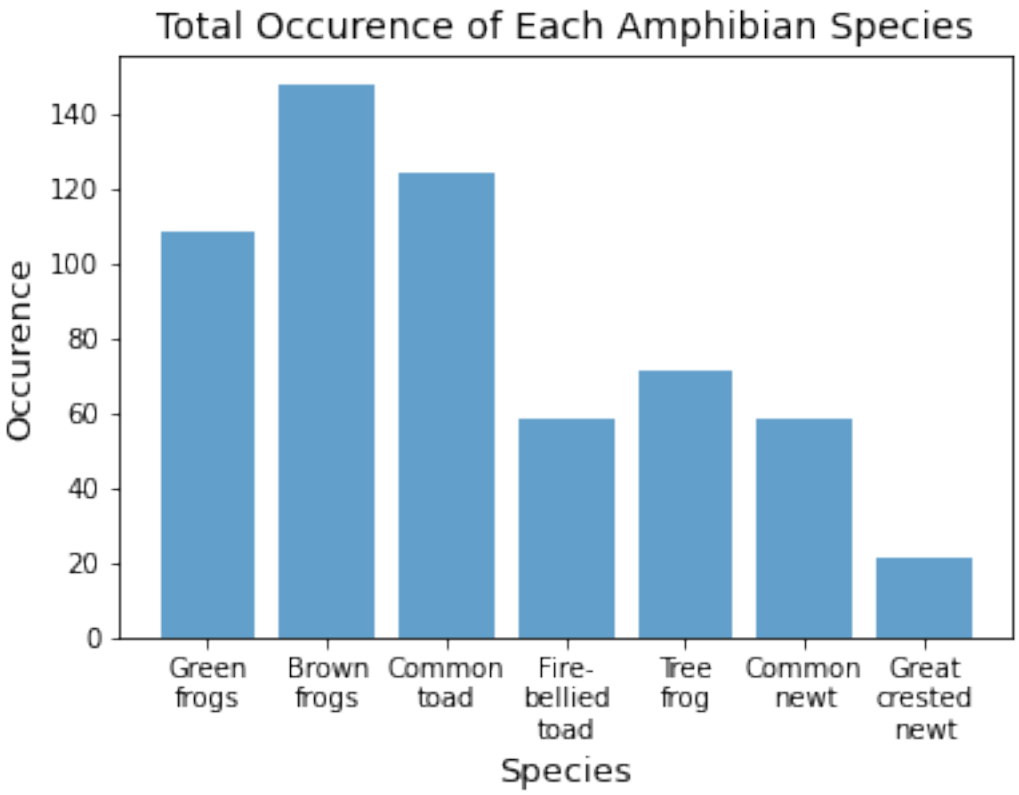
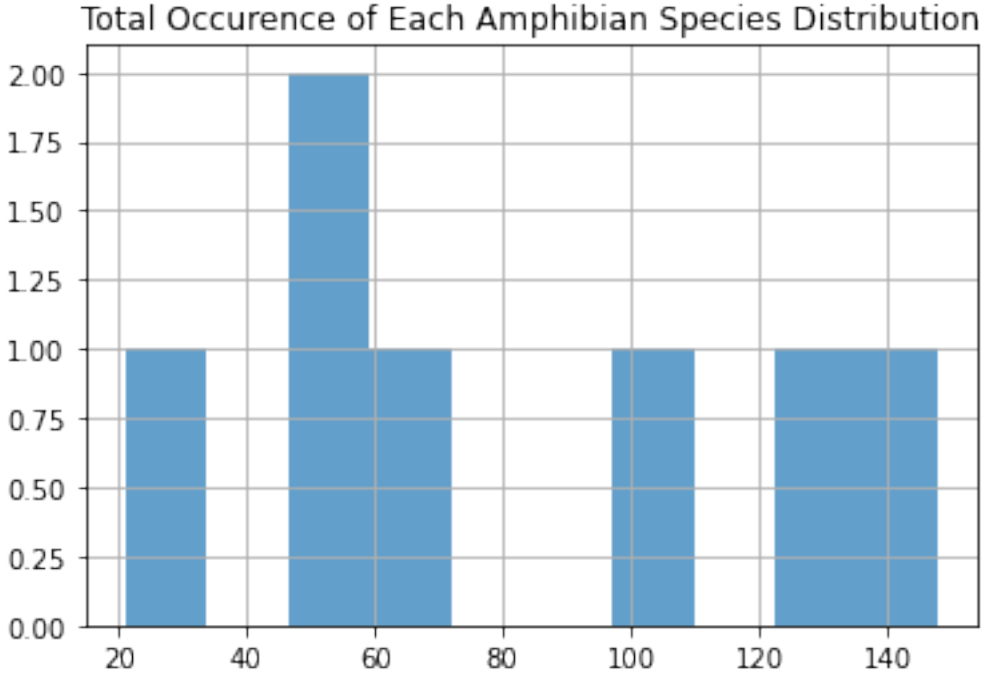
Amphibian_Analyze

November 16, 2020

[2]:
```
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np
from IPython.display import display
import warnings
from mpl_toolkits.mplot3d import Axes3D
from itertools import combinations

warnings.filterwarnings('ignore')

def addition(s):
    return s.replace(" ", "\n").replace("-", "-\n")

mainDF = pd.read_csv("dataset.csv", delimiter=";", skiprows = 1)
mainDF = mainDF.drop(columns = ['ID', 'Motorway'])
amphibian =  mainDF.iloc[:, -7:]
amphibianCount = (amphibian == 1).sum()

#colorMap = ['mediumseagreen', 'sandybrown', 'forestgreen', 'salmon',␣
 ↪'darkgreen',  'turquoise', 'teal']
#colorMap = ['b', 'g', 'c', 'r', 'm',  'y', 'w']
colorMap = np.array(['turquoise', 'forestgreen',  'mediumpurple', 'deeppink',␣
 ↪'salmon', 'orange', 'gold'])
#colorMap = colorMap.reshape(-1,7)

plt.title('Total Occurence of Each Amphibian Species', fontsize = 14)
plt.ylabel('Occurence', fontsize = 13)
plt.xlabel('Species', fontsize = 13)
newLineName = list(map(addition, amphibian.columns))
plt.bar(newLineName, amphibianCount, alpha = 0.7)

print((pd.DataFrame({"Total Occurence of Each Amphibian Species Distribution" :␣
 ↪amphibianCount})).hist(alpha=0.7))
```

```
[[<matplotlib.axes._subplots.AxesSubplot object at 0x7f90e1839490>]]
```


Total Occurence of Each Amphibian Species
Occurence
0
20
40
60
80
100
120
140
Green frogs
Brown frogs
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
Species


Total Occurence of Each Amphibian Species Distribution
0.00
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
20
40
60
80
100
120
140

[3]:
```
site  = mainDF.iloc[:, 0:14]
pondNum = site.loc[:, ["SR", "NR"]]
pondNumAnal = pd.DataFrame({"Mean": pondNum.mean(), "Standard Deviation":␣
 ↪pondNum.std()})
renameColumn = pondNumAnal.reset_index()['index'].replace('SR', 'Reservoirs\'␣
 ↪Surface').replace('NR', 'Number of Reservoir')
pondNumAnal = pondNumAnal.reset_index()
pondNumAnal['Attribute'] = renameColumn
pondNumAnal.drop('index',  axis = 1, inplace=True)
pondNumAnal.set_index('Attribute', inplace = True)
display(pondNumAnal)
```

Attribute	Mean	Standard Deviation
Reservoirs' Surface	9633.227513	46256.078309
Number of Reservoir	1.566138	1.544419

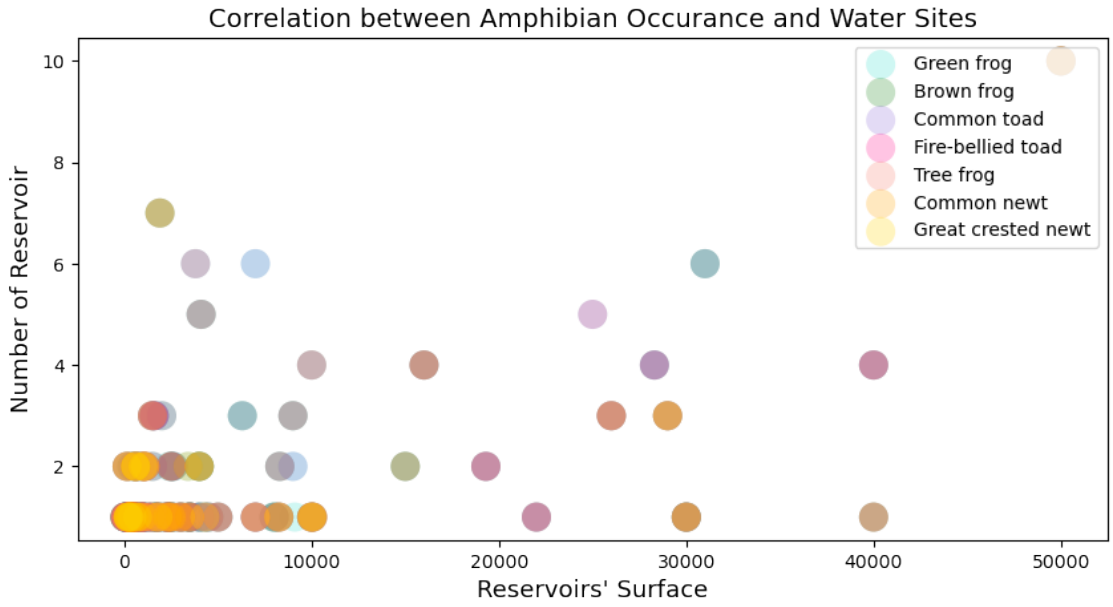
[4]:
```
distanceNum = site.loc[:, ["RR", "BR"]]
distanceAnal = pd.DataFrame({"Mean": distanceNum.mean(), "Standard Deviation":␣
 ↪distanceNum.std()})
renameColumn = distanceAnal.reset_index()['index'].replace('RR', 'Min Distance␣
 ↪to Building').replace('BR', 'Min Distance to Road')
distanceAnal = distanceAnal.reset_index()
distanceAnal['Attribute'] = renameColumn
distanceAnal.drop('index',  axis = 1, inplace=True)
distanceAnal.set_index('Attribute', inplace = True)
display(distanceAnal)
```

Attribute	Mean	Standard Deviation
Min Distance to Building	2.333333	2.520132
Min Distance to Road	2.502646	2.640971

[5]:
```
pondNumWithoutOutLiner = pondNum[pondNum['SR'] < 80000]

gfCol = (pondNumWithoutOutLiner[amphibian['Green frogs'] == 1])
gfData = (list(gfCol.SR), list(gfCol.NR))

bfCol = (pondNumWithoutOutLiner[amphibian['Brown frogs'] == 1])
bfData = (list(bfCol.SR), list(bfCol.NR))

ctCol = (pondNumWithoutOutLiner[amphibian['Common toad'] == 1])
ctData = (list(ctCol.SR), list(ctCol.NR))

ftCol = (pondNumWithoutOutLiner[amphibian['Fire-bellied toad'] == 1])
ftData = (list(ftCol.SR), list(ftCol.NR))
```

```
tfCol = (pondNumWithoutOutLiner[amphibian['Tree frog'] == 1])
tfData = (list(tfCol.SR), list(tfCol.NR))

cnCol = (pondNumWithoutOutLiner[amphibian['Common newt'] == 1])
cnData = (list(cnCol.SR), list(cnCol.NR))

gnCol = (pondNumWithoutOutLiner[amphibian['Great crested newt'] == 1])
gnData = (list(gnCol.SR), list(gnCol.NR))

data = (gfData, bfData, ctData, ftData, tfData, cnData, gnData)
group = ("Green frog", "Brown frog", "Common toad", "Fire-bellied toad", "Tree␣
 ↪frog", "Common newt", "Great crested newt")

fig = plt.figure(figsize=(10,5), dpi= 100)
ax = fig.add_subplot(1, 1, 1)

for data, color, group in zip(data, colorMap, group):
    x, y = data
    ax.scatter(x, y, alpha=0.25, c=color, edgecolors='none', s=250, label =␣
 ↪group)

plt.title('Correlation between Amphibian Occurance and Water Sites', fontsize =␣
 ↪14)
plt.ylabel('Number of Reservoir', fontsize = 13)
plt.xlabel('Reservoirs\' Surface', fontsize = 13)

plt.legend(loc=1)
```

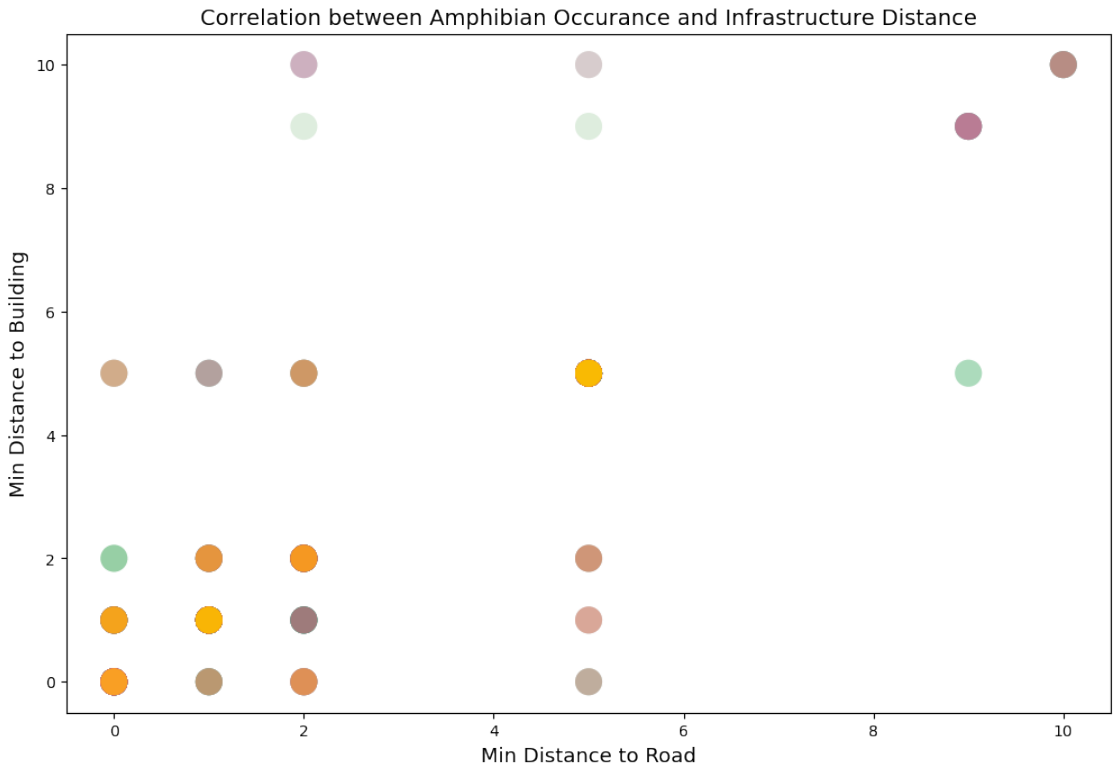
[5]: <matplotlib.legend.Legend at 0x7f90e16d7790>



[6]:
```
distanceNumWithoutOutLiner = distanceNum

gfCol = (distanceNumWithoutOutLiner[amphibian['Green frogs'] == 1])
gfData = (list(gfCol.RR), list(gfCol.BR))

bfCol = (distanceNumWithoutOutLiner[amphibian['Brown frogs'] == 1])
bfData = (list(bfCol.RR), list(bfCol.BR))

ctCol = (distanceNumWithoutOutLiner[amphibian['Common toad'] == 1])
ctData = (list(ctCol.RR), list(ctCol.BR))

ftCol = (distanceNumWithoutOutLiner[amphibian['Fire-bellied toad'] == 1])
ftData = (list(ftCol.RR), list(ftCol.BR))

tfCol = (distanceNumWithoutOutLiner[amphibian['Tree frog'] == 1])
tfData = (list(tfCol.RR), list(tfCol.BR))

cnCol = (distanceNumWithoutOutLiner[amphibian['Common newt'] == 1])
cnData = (list(cnCol.RR), list(cnCol.BR))

gnCol = (distanceNumWithoutOutLiner[amphibian['Great crested newt'] == 1])
gnData = (list(gnCol.RR), list(gnCol.BR))

data = (gfData, bfData, ctData, ftData, tfData, cnData, gnData)
group = ("Green frog", "Brown frog", "Common toad", "Fire-bellied toad", "Tree␣
↪frog", "Common newt", "Great crested newt")
```

```
fig = plt.figure(figsize=(12,8), dpi= 100)
ax = fig.add_subplot(1, 1, 1)

for data, color, group in zip(data, colorMap, group):
    x, y = data
    ax.scatter(x, y, alpha=0.15, c=color, edgecolors='none', s=300, label =␣
 ↪group)

plt.title('Correlation between Amphibian Occurance and Infrastructure␣
 ↪Distance', fontsize = 14)
plt.ylabel('Min Distance to Building', fontsize = 13)
plt.xlabel('Min Distance to Road', fontsize = 13)

#plt.legend(loc=1)
```

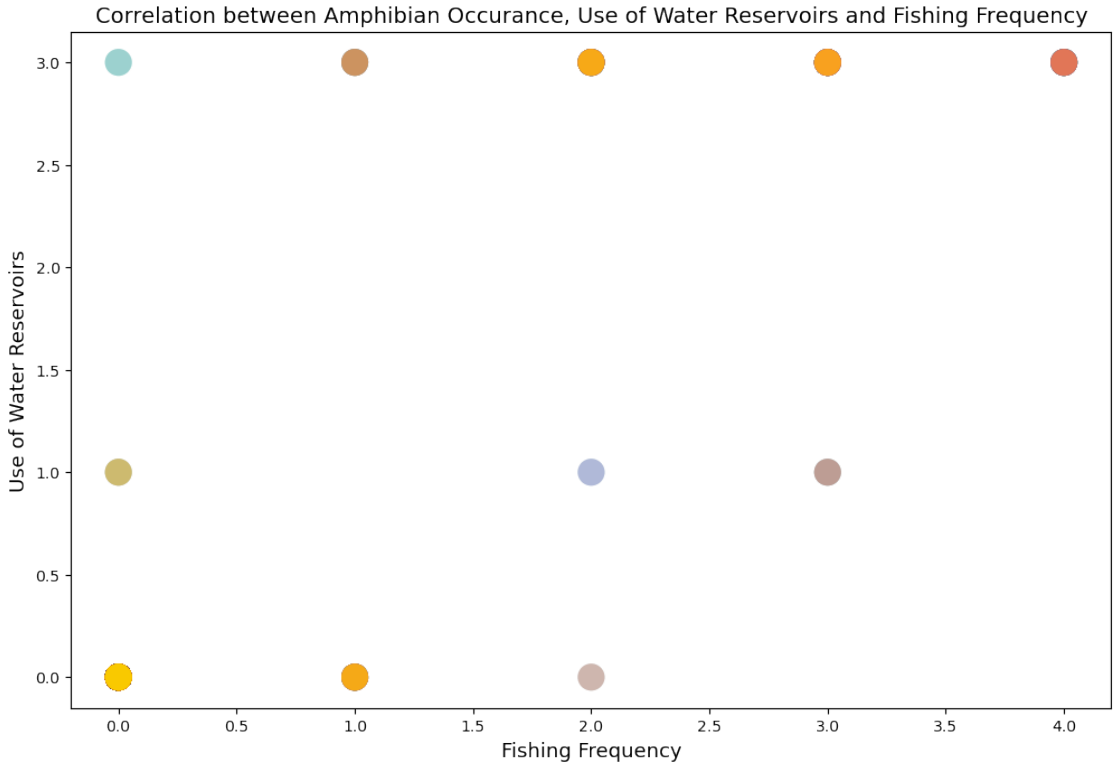
[6]: Text(0.5, 0, 'Min Distance to Road')



[7]:
```
gfCol = (mainDF[amphibian['Green frogs'] == 1])
gfData = (list(gfCol.FR), list(gfCol.UR))

bfCol = (mainDF[amphibian['Brown frogs'] == 1])
bfData = (list(bfCol.FR), list(bfCol.UR))
```

```
ctCol = (mainDF[amphibian['Common toad'] == 1])
ctData = (list(ctCol.FR), list(ctCol.UR))

ftCol = (mainDF[amphibian['Fire-bellied toad'] == 1])
ftData = (list(ftCol.FR), list(ftCol.UR))

tfCol = (mainDF[amphibian['Tree frog'] == 1])
tfData = (list(tfCol.FR), list(tfCol.UR))

cnCol = (mainDF[amphibian['Common newt'] == 1])
cnData = (list(cnCol.FR), list(cnCol.UR))

gnCol = (mainDF[amphibian['Great crested newt'] == 1])
gnData = (list(gnCol.FR), list(gnCol.UR))

data = (gfData, bfData, ctData, ftData, tfData, cnData, gnData)
group = ("Green frog", "URown frog", "Common toad", "Fire-bellied toad", "Tree␣
 ↪frog", "Common newt", "Great crested newt")

fig = plt.figure(figsize=(12,8), dpi= 100)
ax = fig.add_subplot(1, 1, 1)

for data, color, group in zip(data, colorMap, group):
    x, y = data
    ax.scatter(x, y, alpha=0.15, c=color, edgecolors='none', s=300, label =␣
 ↪group)

plt.title('Correlation between Amphibian Occurance, Use of Water Reservoirs and␣
 ↪Fishing Frequency', fontsize = 14)
plt.ylabel('Use of Water Reservoirs', fontsize = 13)
plt.xlabel('Fishing Frequency', fontsize = 13)

#plt.legend(loc=1)
```

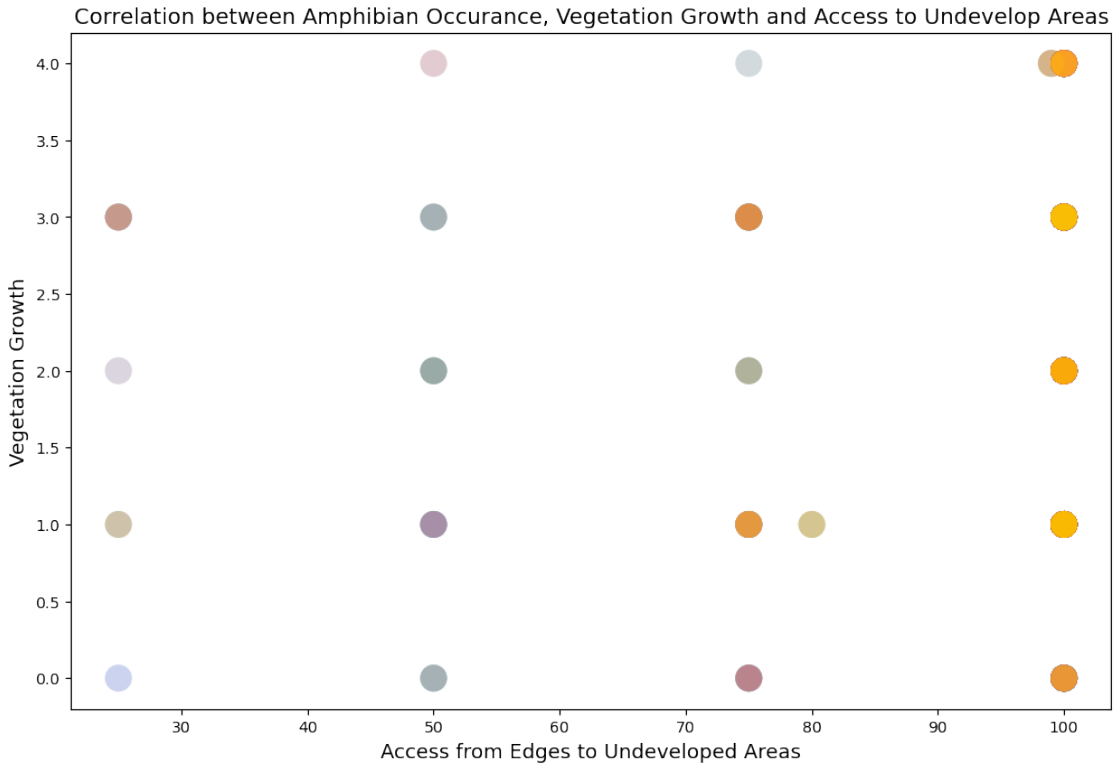
[7]: Text(0.5, 0, 'Fishing Frequency')



[8]:
```
gfCol = (mainDF[amphibian['Green frogs'] == 1])
gfData = (list(gfCol.OR), list(gfCol.VR))

bfCol = (mainDF[amphibian['Brown frogs'] == 1])
bfData = (list(bfCol.OR), list(bfCol.VR))

ctCol = (mainDF[amphibian['Common toad'] == 1])
ctData = (list(ctCol.OR), list(ctCol.VR))

ftCol = (mainDF[amphibian['Fire-bellied toad'] == 1])
ftData = (list(ftCol.OR), list(ftCol.VR))

tfCol = (mainDF[amphibian['Tree frog'] == 1])
tfData = (list(tfCol.OR), list(tfCol.VR))

cnCol = (mainDF[amphibian['Common newt'] == 1])
cnData = (list(cnCol.OR), list(cnCol.VR))

gnCol = (mainDF[amphibian['Great crested newt'] == 1])
gnData = (list(gnCol.OR), list(gnCol.VR))

data = (gfData, bfData, ctData, ftData, tfData, cnData, gnData)
```

```
group = ("Green frog", "BRown frog", "Common toad", "Fire-bellied toad", "Tree␣
 ↪frog", "Common newt", "Great crested newt")

fig = plt.figure(figsize=(12,8), dpi= 100)
ax = fig.add_subplot(1, 1, 1)

for data, color, group in zip(data, colorMap, group):
    x, y = data
    ax.scatter(x, y, alpha=0.15, c=color, edgecolors='none', s=300, label =␣
 ↪group)

plt.title('Correlation between Amphibian Occurance, Vegetation Growth and␣
 ↪Access to Undevelop Areas', fontsize = 14)
plt.ylabel('Vegetation Growth', fontsize = 13)
plt.xlabel('Access from Edges to Undeveloped Areas', fontsize = 13)

#plt.legend(loc=0)
```

[8]: `Text(0.5, 0, 'Access from Edges to Undeveloped Areas')`

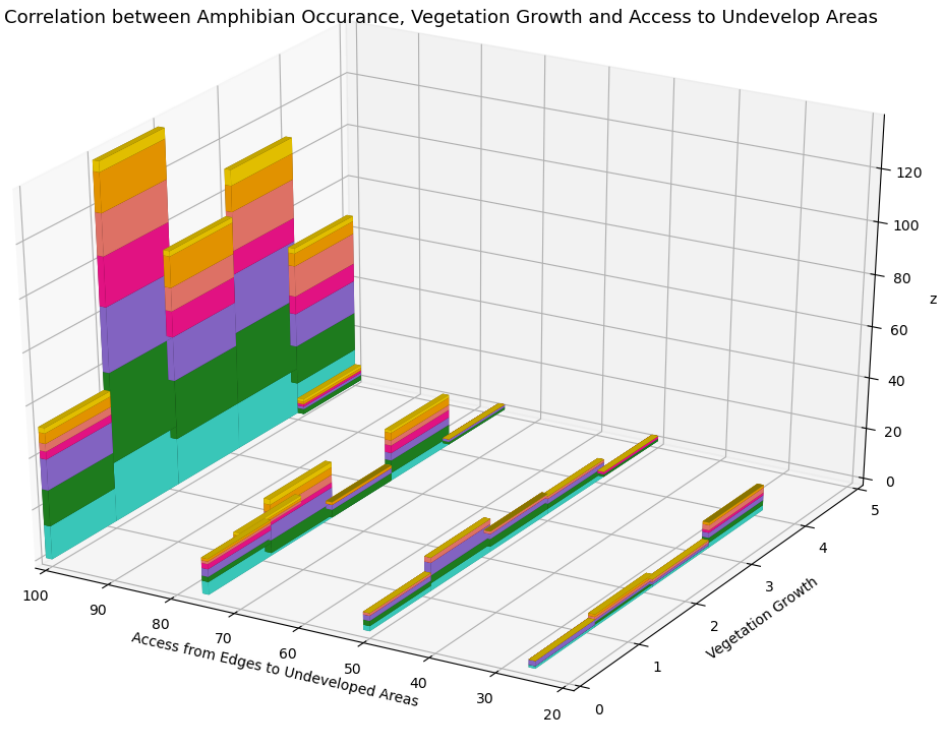


[9]:
```
pair = []
xpos = []
```

```
ypos =  []
dx = np.ones(9)
dy = np.ones(9)
dz = []
encode = {}


gfCol = (mainDF[amphibian['Green frogs'] == 1])
gfData = (list(gfCol.OR), list(gfCol.VR))

for i in range(len(gfData[0])):
    if(str(gfData[0][i]) + str(gfData[1][i]) not in pair):
        xpos.append(gfData[0][i])
        ypos.append(gfData[1][i])
        pair.append(str(gfData[0][i]) + str(gfData[1][i]))
        encode[str(gfData[0][i]) + str(gfData[1][i])] = len(encode)

bfCol = (mainDF[amphibian['Brown frogs'] == 1])
bfData = (list(bfCol.OR), list(bfCol.VR))

for i in range(len(bfData[0])):
    if(str(bfData[0][i]) + str(bfData[1][i]) not in pair):
        xpos.append(bfData[0][i])
        ypos.append(bfData[1][i])
        pair.append(str(bfData[0][i]) + str(bfData[1][i]))
        encode[str(bfData[0][i]) + str(bfData[1][i])] = len(encode)

ctCol = (mainDF[amphibian['Common toad'] == 1])
ctData = (list(ctCol.OR), list(ctCol.VR))

for i in range(len(ctData[0])):
    if(str(ctData[0][i]) + str(ctData[1][i]) not in pair):
        xpos.append(ctData[0][i])
        ypos.append(ctData[1][i])
        pair.append(str(ctData[0][i]) + str(ctData[1][i]))
        encode[str(ctData[0][i]) + str(ctData[1][i])] = len(encode)

ftCol = (mainDF[amphibian['Fire-bellied toad'] == 1])
ftData = (list(ftCol.OR), list(ftCol.VR))

for i in range(len(ftData[0])):
    if(str(ftData[0][i]) + str(ftData[1][i]) not in pair):
        xpos.append(ftData[0][i])
        ypos.append(ftData[1][i])
        pair.append(str(ftData[0][i]) + str(ftData[1][i]))
        encode[str(ftData[0][i]) + str(ftData[1][i])] = len(encode)
```

```
tfCol = (mainDF[amphibian['Tree frog'] == 1])
tfData = (list(tfCol.OR), list(tfCol.VR))

for i in range(len(tfData[0])):
    if(str(tfData[0][i]) + str(tfData[1][i]) not in pair):
        xpos.append(tfData[0][i])
        ypos.append(tfData[1][i])
        pair.append(str(tfData[0][i]) + str(tfData[1][i]))
        encode[str(tfData[0][i]) + str(tfData[1][i])] = len(encode)

cnCol = (mainDF[amphibian['Common newt'] == 1])
cnData = (list(cnCol.OR), list(cnCol.VR))

for i in range(len(cnData[0])):
    if(str(cnData[0][i]) + str(cnData[1][i]) not in pair):
        xpos.append(cnData[0][i])
        ypos.append(cnData[1][i])
        pair.append(str(cnData[0][i]) + str(cnData[1][i]))
        encode[str(cnData[0][i]) + str(cnData[1][i])] = len(encode)

gnCol = (mainDF[amphibian['Great crested newt'] == 1])
gnData = (list(gnCol.OR), list(gnCol.VR))

for i in range(len(gnData[0])):
    if(str(gnData[0][i]) + str(gnData[1][i]) not in pair):
        xpos.append(gnData[0][i])
        ypos.append(gnData[1][i])
        pair.append(str(gnData[0][i]) + str(gnData[1][i]))
        encode[str(gnData[0][i]) + str(gnData[1][i])] = len(encode)

data = (gfData, bfData, ctData, ftData, tfData, cnData, gnData)
group = ("Green frog", "Brown frog", "Common toad", "Fire-bellied toad", "Tree␣
 ↪frog", "Common newt", "Great crested newt")

zpos = np.zeros(len(xpos))

dx = np.ones(len(xpos))
dy = np.ones(len(xpos))
dz = [np.zeros(len(xpos)) for i in range(7)]

for i in range(len(gfData[0])):
    dz[0][encode[str(gfData[0][i]) + str(gfData[1][i])]] += 1

for i in range(len(bfData[0])):
    dz[1][encode[str(bfData[0][i]) + str(bfData[1][i])]] += 1

for i in range(len(ctData[0])):
```

```
    dz[2][encode[str(ctData[0][i]) + str(ctData[1][i])]] += 1

for i in range(len(ftData[0])):
    dz[3][encode[str(ftData[0][i]) + str(ftData[1][i])]] += 1

for i in range(len(tfData[0])):
    dz[4][encode[str(tfData[0][i]) + str(tfData[1][i])]] += 1

for i in range(len(cnData[0])):
    dz[5][encode[str(cnData[0][i]) + str(cnData[1][i])]] += 1

for i in range(len(gnData[0])):
    dz[6][encode[str(gnData[0][i]) + str(gnData[1][i])]] += 1

fig = plt.figure(figsize=(14,10), dpi= 100)
ax = fig.add_subplot(111, projection = "3d")

ax.set_xlabel("x")
ax.set_ylabel("y")
ax.set_zlabel("z")
ax.set_xlim3d(20,100)
ax.set_ylim3d(0,5)

_zpos = zpos

for i in range(7):
    ax.bar3d(xpos, ypos, _zpos, dx, dy, dz[i], color=colorMap[i])
    _zpos += dz[i]

plt.title('Correlation between Amphibian Occurance, Vegetation Growth and␣
 ↪Access to Undevelop Areas', fontsize = 13)
plt.ylabel('Vegetation Growth', fontsize = 10)
plt.xlabel('Access from Edges to Undeveloped Areas', fontsize = 10)
plt.gca().invert_xaxis()
#plt.legend(loc=0)
```

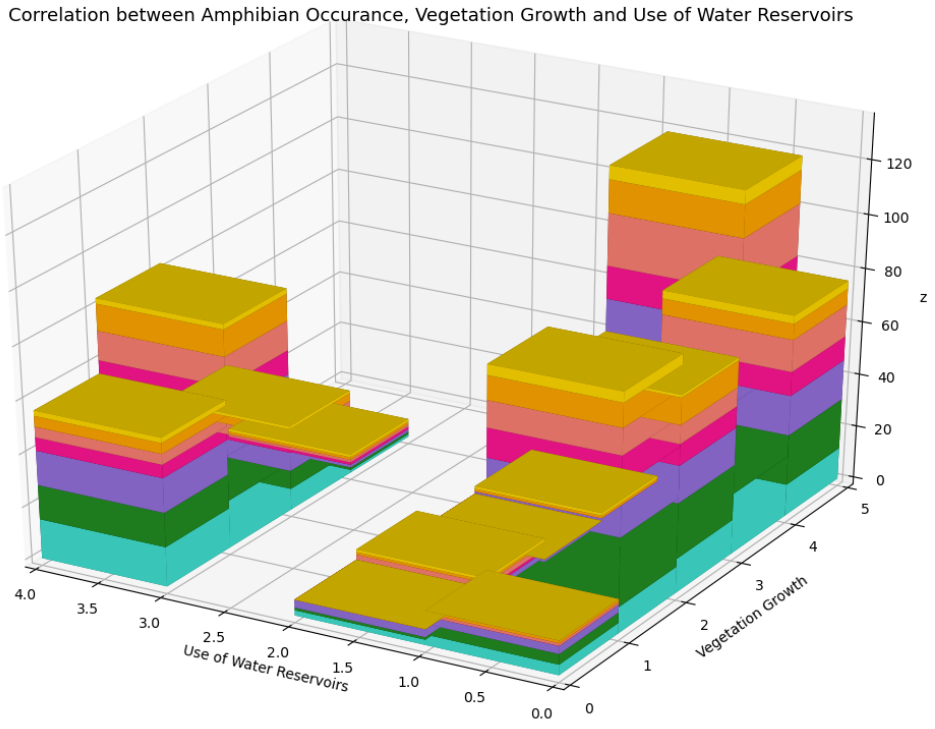


[10]:
```
pair = []
xpos = []
ypos =  []
dx = np.ones(9)
dy = np.ones(9)
dz = []
encode = {}


gfCol = (mainDF[amphibian['Green frogs'] == 1])
gfData = (list(gfCol.UR), list(gfCol.VR))

for i in range(len(gfData[0])):
    if(str(gfData[0][i]) + str(gfData[1][i]) not in pair):
        xpos.append(gfData[0][i])
        ypos.append(gfData[1][i])
        pair.append(str(gfData[0][i]) + str(gfData[1][i]))
        encode[str(gfData[0][i]) + str(gfData[1][i])] = len(encode)

bfCol = (mainDF[amphibian['Brown frogs'] == 1])
bfData = (list(bfCol.UR), list(bfCol.VR))
```

```
for i in range(len(bfData[0])):
    if(str(bfData[0][i]) + str(bfData[1][i]) not in pair):
        xpos.append(bfData[0][i])
        ypos.append(bfData[1][i])
        pair.append(str(bfData[0][i]) + str(bfData[1][i]))
        encode[str(bfData[0][i]) + str(bfData[1][i])] = len(encode)

ctCol = (mainDF[amphibian['Common toad'] == 1])
ctData = (list(ctCol.UR), list(ctCol.VR))

for i in range(len(ctData[0])):
    if(str(ctData[0][i]) + str(ctData[1][i]) not in pair):
        xpos.append(ctData[0][i])
        ypos.append(ctData[1][i])
        pair.append(str(ctData[0][i]) + str(ctData[1][i]))
        encode[str(ctData[0][i]) + str(ctData[1][i])] = len(encode)

ftCol = (mainDF[amphibian['Fire-bellied toad'] == 1])
ftData = (list(ftCol.UR), list(ftCol.VR))

for i in range(len(ftData[0])):
    if(str(ftData[0][i]) + str(ftData[1][i]) not in pair):
        xpos.append(ftData[0][i])
        ypos.append(ftData[1][i])
        pair.append(str(ftData[0][i]) + str(ftData[1][i]))
        encode[str(ftData[0][i]) + str(ftData[1][i])] = len(encode)

tfCol = (mainDF[amphibian['Tree frog'] == 1])
tfData = (list(tfCol.UR), list(tfCol.VR))

for i in range(len(tfData[0])):
    if(str(tfData[0][i]) + str(tfData[1][i]) not in pair):
        xpos.append(tfData[0][i])
        ypos.append(tfData[1][i])
        pair.append(str(tfData[0][i]) + str(tfData[1][i]))
        encode[str(tfData[0][i]) + str(tfData[1][i])] = len(encode)

cnCol = (mainDF[amphibian['Common newt'] == 1])
cnData = (list(cnCol.UR), list(cnCol.VR))

for i in range(len(cnData[0])):
    if(str(cnData[0][i]) + str(cnData[1][i]) not in pair):
        xpos.append(cnData[0][i])
        ypos.append(cnData[1][i])
        pair.append(str(cnData[0][i]) + str(cnData[1][i]))
        encode[str(cnData[0][i]) + str(cnData[1][i])] = len(encode)
```

```
gnCol = (mainDF[amphibian['Great crested newt'] == 1])
gnData = (list(gnCol.UR), list(gnCol.VR))

for i in range(len(gnData[0])):
    if(str(gnData[0][i]) + str(gnData[1][i]) not in pair):
        xpos.append(gnData[0][i])
        ypos.append(gnData[1][i])
        pair.append(str(gnData[0][i]) + str(gnData[1][i]))
        encode[str(gnData[0][i]) + str(gnData[1][i])] = len(encode)

data = (gfData, bfData, ctData, ftData, tfData, cnData, gnData)
group = ("Green frog", "Brown frog", "Common toad", "Fire-bellied toad", "Tree␣
 ↪frog", "Common newt", "Great crested newt")

zpos = np.zeros(len(xpos))

dx = np.ones(len(xpos))
dy = np.ones(len(xpos))
dz = [np.zeros(len(xpos)) for i in range(7)]

for i in range(len(gfData[0])):
    dz[0][encode[str(gfData[0][i]) + str(gfData[1][i])]] += 1

for i in range(len(bfData[0])):
    dz[1][encode[str(bfData[0][i]) + str(bfData[1][i])]] += 1

for i in range(len(ctData[0])):
    dz[2][encode[str(ctData[0][i]) + str(ctData[1][i])]] += 1

for i in range(len(ftData[0])):
    dz[3][encode[str(ftData[0][i]) + str(ftData[1][i])]] += 1

for i in range(len(tfData[0])):
    dz[4][encode[str(tfData[0][i]) + str(tfData[1][i])]] += 1

for i in range(len(cnData[0])):
    dz[5][encode[str(cnData[0][i]) + str(cnData[1][i])]] += 1

for i in range(len(gnData[0])):
    dz[6][encode[str(gnData[0][i]) + str(gnData[1][i])]] += 1

fig = plt.figure(figsize=(14,10), dpi= 100)
ax = fig.add_subplot(111, projection = "3d")

ax.set_xlabel("x")
ax.set_ylabel("y")
ax.set_zlabel("z")
```

```
ax.set_xlim3d(0,4)
ax.set_ylim3d(0,5)

_zpos = zpos

for i in range(7):
    ax.bar3d(xpos, ypos, _zpos, dx, dy, dz[i], color=colorMap[i])
    _zpos += dz[i]

plt.title('Correlation between Amphibian Occurance, Vegetation Growth and Use␣
 ↪of Water Reservoirs', fontsize = 13)
plt.ylabel('Vegetation Growth', fontsize = 10)
plt.xlabel('Use of Water Reservoirs', fontsize = 10)
plt.gca().invert_xaxis()
#plt.legend(loc=0)
```

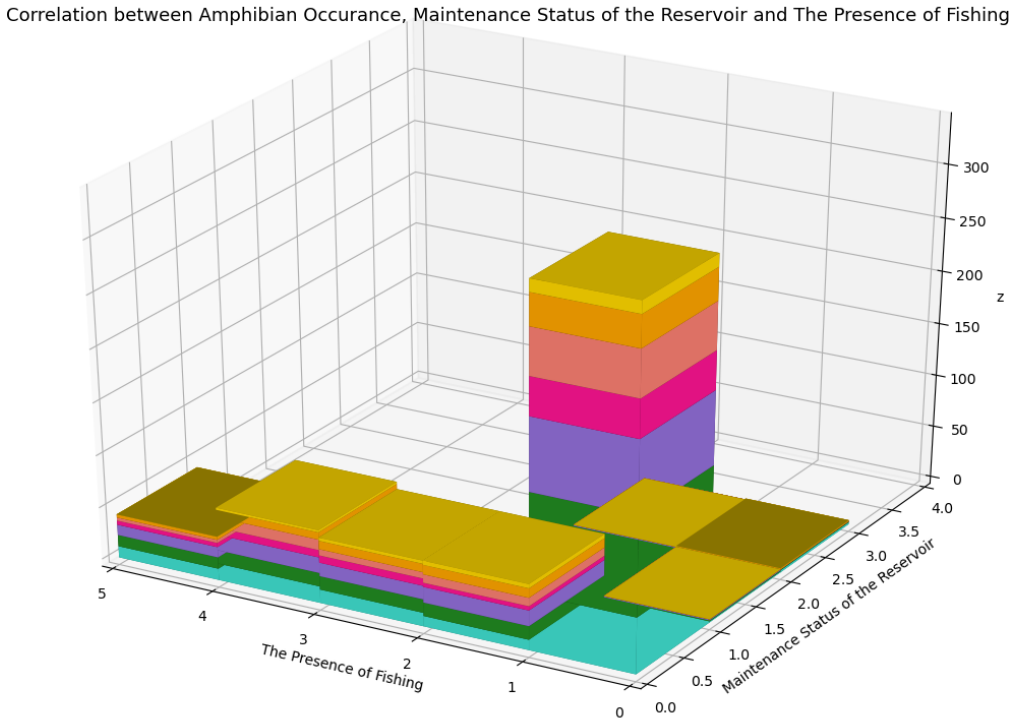


[11]:
```
pair = []
xpos = []
ypos =  []
dx = np.ones(9)
dy = np.ones(9)
dz = []
```

```
encode = {}


gfCol = (mainDF[amphibian['Green frogs'] == 1])
gfData = (list(gfCol.FR), list(gfCol.MR))

for i in range(len(gfData[0])):
    if(str(gfData[0][i]) + str(gfData[1][i]) not in pair):
        xpos.append(gfData[0][i])
        ypos.append(gfData[1][i])
        pair.append(str(gfData[0][i]) + str(gfData[1][i]))
        encode[str(gfData[0][i]) + str(gfData[1][i])] = len(encode)

bfCol = (mainDF[amphibian['Brown frogs'] == 1])
bfData = (list(bfCol.FR), list(bfCol.MR))

for i in range(len(bfData[0])):
    if(str(bfData[0][i]) + str(bfData[1][i]) not in pair):
        xpos.append(bfData[0][i])
        ypos.append(bfData[1][i])
        pair.append(str(bfData[0][i]) + str(bfData[1][i]))
        encode[str(bfData[0][i]) + str(bfData[1][i])] = len(encode)

ctCol = (mainDF[amphibian['Common toad'] == 1])
ctData = (list(ctCol.FR), list(ctCol.MR))

for i in range(len(ctData[0])):
    if(str(ctData[0][i]) + str(ctData[1][i]) not in pair):
        xpos.append(ctData[0][i])
        ypos.append(ctData[1][i])
        pair.append(str(ctData[0][i]) + str(ctData[1][i]))
        encode[str(ctData[0][i]) + str(ctData[1][i])] = len(encode)

ftCol = (mainDF[amphibian['Fire-bellied toad'] == 1])
ftData = (list(ftCol.FR), list(ftCol.MR))

for i in range(len(ftData[0])):
    if(str(ftData[0][i]) + str(ftData[1][i]) not in pair):
        xpos.append(ftData[0][i])
        ypos.append(ftData[1][i])
        pair.append(str(ftData[0][i]) + str(ftData[1][i]))
        encode[str(ftData[0][i]) + str(ftData[1][i])] = len(encode)

tfCol = (mainDF[amphibian['Tree frog'] == 1])
tfData = (list(tfCol.FR), list(tfCol.MR))

for i in range(len(tfData[0])):
```

```
    if(str(tfData[0][i]) + str(tfData[1][i]) not in pair):
        xpos.append(tfData[0][i])
        ypos.append(tfData[1][i])
        pair.append(str(tfData[0][i]) + str(tfData[1][i]))
        encode[str(tfData[0][i]) + str(tfData[1][i])] = len(encode)

cnCol = (mainDF[amphibian['Common newt'] == 1])
cnData = (list(cnCol.FR), list(cnCol.MR))

for i in range(len(cnData[0])):
    if(str(cnData[0][i]) + str(cnData[1][i]) not in pair):
        xpos.append(cnData[0][i])
        ypos.append(cnData[1][i])
        pair.append(str(cnData[0][i]) + str(cnData[1][i]))
        encode[str(cnData[0][i]) + str(cnData[1][i])] = len(encode)

gnCol = (mainDF[amphibian['Great crested newt'] == 1])
gnData = (list(gnCol.FR), list(gnCol.MR))

for i in range(len(gnData[0])):
    if(str(gnData[0][i]) + str(gnData[1][i]) not in pair):
        xpos.append(gnData[0][i])
        ypos.append(gnData[1][i])
        pair.append(str(gnData[0][i]) + str(gnData[1][i]))
        encode[str(gnData[0][i]) + str(gnData[1][i])] = len(encode)

data = (gfData, bfData, ctData, ftData, tfData, cnData, gnData)
group = ("Green frog", "Brown frog", "Common toad", "Fire-bellied toad", "Tree␣
 ↪frog", "Common newt", "Great crested newt")

zpos = np.zeros(len(xpos))

dx = np.ones(len(xpos))
dy = np.ones(len(xpos))
dz = [np.zeros(len(xpos)) for i in range(7)]

for i in range(len(gfData[0])):
    dz[0][encode[str(gfData[0][i]) + str(gfData[1][i])]] += 1

for i in range(len(bfData[0])):
    dz[1][encode[str(bfData[0][i]) + str(bfData[1][i])]] += 1

for i in range(len(ctData[0])):
    dz[2][encode[str(ctData[0][i]) + str(ctData[1][i])]] += 1

for i in range(len(ftData[0])):
    dz[3][encode[str(ftData[0][i]) + str(ftData[1][i])]] += 1
```

```
for i in range(len(tfData[0])):
    dz[4][encode[str(tfData[0][i]) + str(tfData[1][i])]] += 1

for i in range(len(cnData[0])):
    dz[5][encode[str(cnData[0][i]) + str(cnData[1][i])]] += 1

for i in range(len(gnData[0])):
    dz[6][encode[str(gnData[0][i]) + str(gnData[1][i])]] += 1

fig = plt.figure(figsize=(14,10), dpi= 100)
ax = fig.add_subplot(111, projection = "3d")

ax.set_xlabel("x")
ax.set_ylabel("y")
ax.set_zlabel("z")
ax.set_xlim3d(0,5)
ax.set_ylim3d(0,4)

_zpos = zpos


for i in range(7):
    colorx = [colorMap[i]]
    ax.bar3d(xpos, ypos, _zpos, dx, dy, dz[i], color=colorx)
    _zpos += dz[i]

plt.title('Correlation between Amphibian Occurance, Maintenance Status of the␣
 ↪Reservoir and The Presence of Fishing', fontsize = 13)
plt.ylabel('Maintenance Status of the Reservoir', fontsize = 10)
plt.xlabel('The Presence of Fishing', fontsize = 10)
plt.gca().invert_xaxis()
#plt.legend(loc=0)
```

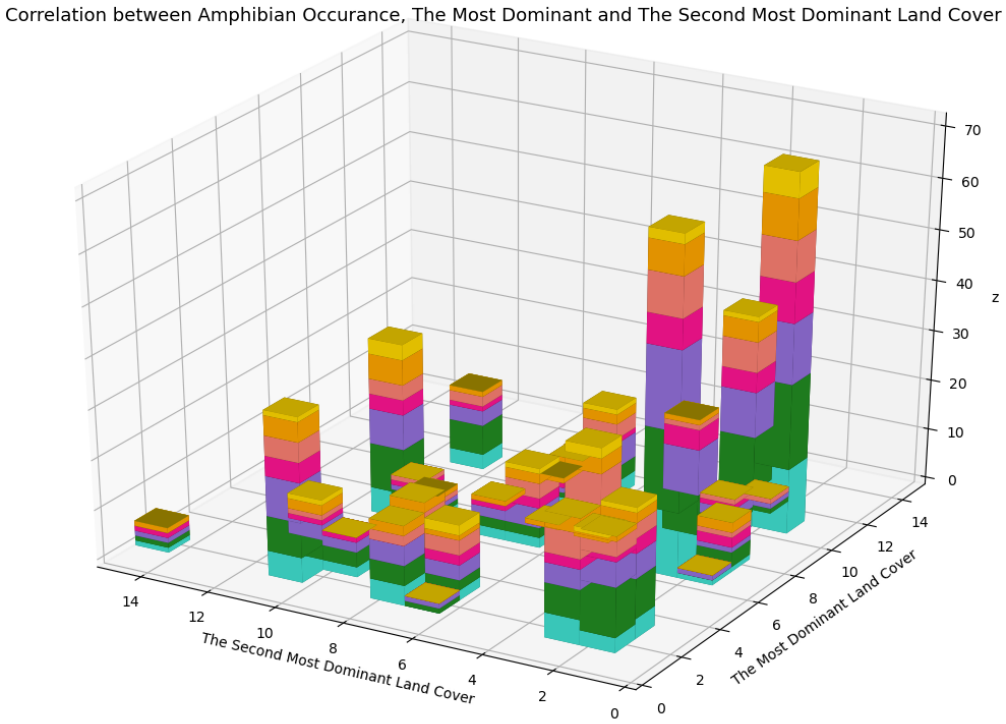


[12]:
```
pair = []
xpos = []
ypos =  []
dx = np.ones(9)
dy = np.ones(9)
dz = []
encode = {}


gfCol = (mainDF[amphibian['Green frogs'] == 1])
gfData = (list(gfCol.SUR1), list(gfCol.SUR2))

for i in range(len(gfData[0])):
    if(str(gfData[0][i]) + str(gfData[1][i]) not in pair):
        xpos.append(gfData[0][i])
        ypos.append(gfData[1][i])
        pair.append(str(gfData[0][i]) + str(gfData[1][i]))
        encode[str(gfData[0][i]) + str(gfData[1][i])] = len(encode)

bfCol = (mainDF[amphibian['Brown frogs'] == 1])
bfData = (list(bfCol.SUR1), list(bfCol.SUR2))
```

```
for i in range(len(bfData[0])):
    if(str(bfData[0][i]) + str(bfData[1][i]) not in pair):
        xpos.append(bfData[0][i])
        ypos.append(bfData[1][i])
        pair.append(str(bfData[0][i]) + str(bfData[1][i]))
        encode[str(bfData[0][i]) + str(bfData[1][i])] = len(encode)

ctCol = (mainDF[amphibian['Common toad'] == 1])
ctData = (list(ctCol.SUR1), list(ctCol.SUR2))

for i in range(len(ctData[0])):
    if(str(ctData[0][i]) + str(ctData[1][i]) not in pair):
        xpos.append(ctData[0][i])
        ypos.append(ctData[1][i])
        pair.append(str(ctData[0][i]) + str(ctData[1][i]))
        encode[str(ctData[0][i]) + str(ctData[1][i])] = len(encode)

ftCol = (mainDF[amphibian['Fire-bellied toad'] == 1])
ftData = (list(ftCol.SUR1), list(ftCol.SUR2))

for i in range(len(ftData[0])):
    if(str(ftData[0][i]) + str(ftData[1][i]) not in pair):
        xpos.append(ftData[0][i])
        ypos.append(ftData[1][i])
        pair.append(str(ftData[0][i]) + str(ftData[1][i]))
        encode[str(ftData[0][i]) + str(ftData[1][i])] = len(encode)

tfCol = (mainDF[amphibian['Tree frog'] == 1])
tfData = (list(tfCol.SUR1), list(tfCol.SUR2))

for i in range(len(tfData[0])):
    if(str(tfData[0][i]) + str(tfData[1][i]) not in pair):
        xpos.append(tfData[0][i])
        ypos.append(tfData[1][i])
        pair.append(str(tfData[0][i]) + str(tfData[1][i]))
        encode[str(tfData[0][i]) + str(tfData[1][i])] = len(encode)

cnCol = (mainDF[amphibian['Common newt'] == 1])
cnData = (list(cnCol.SUR1), list(cnCol.SUR2))

for i in range(len(cnData[0])):
    if(str(cnData[0][i]) + str(cnData[1][i]) not in pair):
        xpos.append(cnData[0][i])
        ypos.append(cnData[1][i])
        pair.append(str(cnData[0][i]) + str(cnData[1][i]))
        encode[str(cnData[0][i]) + str(cnData[1][i])] = len(encode)
```

```
gnCol = (mainDF[amphibian['Great crested newt'] == 1])
gnData = (list(gnCol.SUR1), list(gnCol.SUR2))

for i in range(len(gnData[0])):
    if(str(gnData[0][i]) + str(gnData[1][i]) not in pair):
        xpos.append(gnData[0][i])
        ypos.append(gnData[1][i])
        pair.append(str(gnData[0][i]) + str(gnData[1][i]))
        encode[str(gnData[0][i]) + str(gnData[1][i])] = len(encode)

data = (gfData, bfData, ctData, ftData, tfData, cnData, gnData)
group = ("Green frog", "Brown frog", "Common toad", "Fire-bellied toad", "Tree␣
 ↪frog", "Common newt", "Great crested newt")

zpos = np.zeros(len(xpos))

dx = np.ones(len(xpos))
dy = np.ones(len(xpos))
dz = [np.zeros(len(xpos)) for i in range(7)]

for i in range(len(gfData[0])):
    dz[0][encode[str(gfData[0][i]) + str(gfData[1][i])]] += 1

for i in range(len(bfData[0])):
    dz[1][encode[str(bfData[0][i]) + str(bfData[1][i])]] += 1

for i in range(len(ctData[0])):
    dz[2][encode[str(ctData[0][i]) + str(ctData[1][i])]] += 1

for i in range(len(ftData[0])):
    dz[3][encode[str(ftData[0][i]) + str(ftData[1][i])]] += 1

for i in range(len(tfData[0])):
    dz[4][encode[str(tfData[0][i]) + str(tfData[1][i])]] += 1

for i in range(len(cnData[0])):
    dz[5][encode[str(cnData[0][i]) + str(cnData[1][i])]] += 1

for i in range(len(gnData[0])):
    dz[6][encode[str(gnData[0][i]) + str(gnData[1][i])]] += 1

fig = plt.figure(figsize=(14,10), dpi= 100)
ax = fig.add_subplot(111, projection = "3d")

ax.set_xlabel("x")
ax.set_ylabel("y")
ax.set_zlabel("z")
```

```
ax.set_xlim3d(0,15)
ax.set_ylim3d(0,15)

_zpos = zpos


for i in range(7):
    colorx = [colorMap[i]]
    ax.bar3d(xpos, ypos, _zpos, dx, dy, dz[i], color=colorx)
    _zpos += dz[i]

plt.title('Correlation between Amphibian Occurance, The Most Dominant and The␣
 ↪Second Most Dominant Land Cover', fontsize = 13)
plt.ylabel('The Most Dominant Land Cover', fontsize = 10)
plt.xlabel('The Second Most Dominant Land Cover', fontsize = 10)
plt.gca().invert_xaxis()
#plt.legend(loc=0)
plt.show()
```



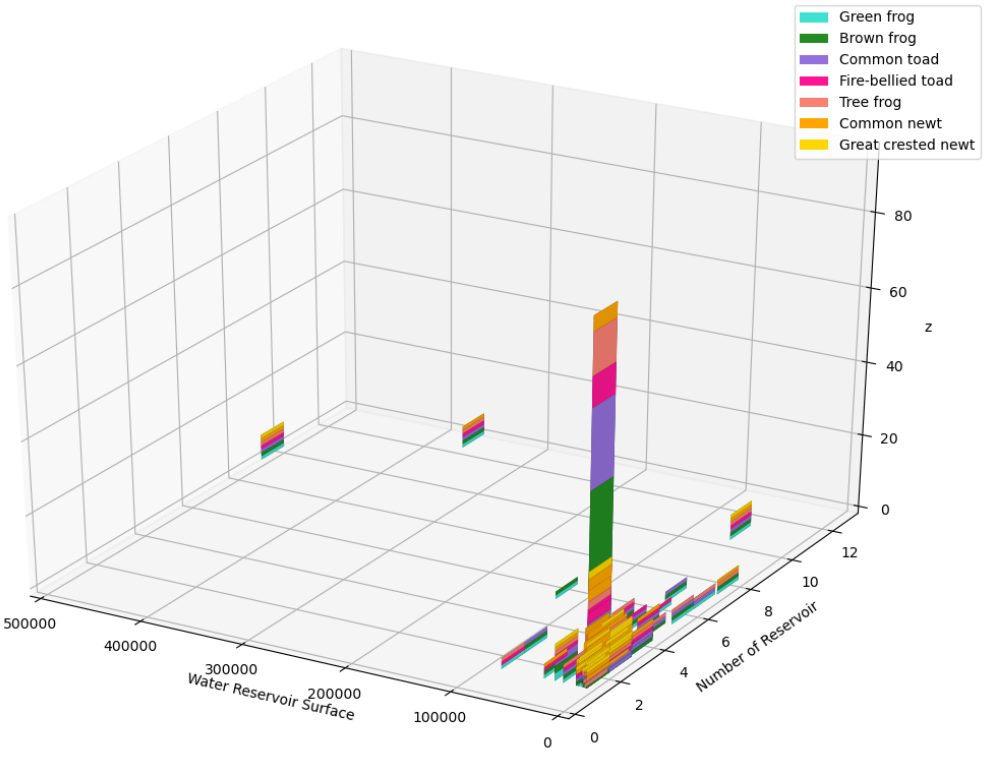
[14]:
```
index = list(i for i in range(14))
comb = list(combinations(index, 2))
for firstIndex, secondIndex in comb:
```

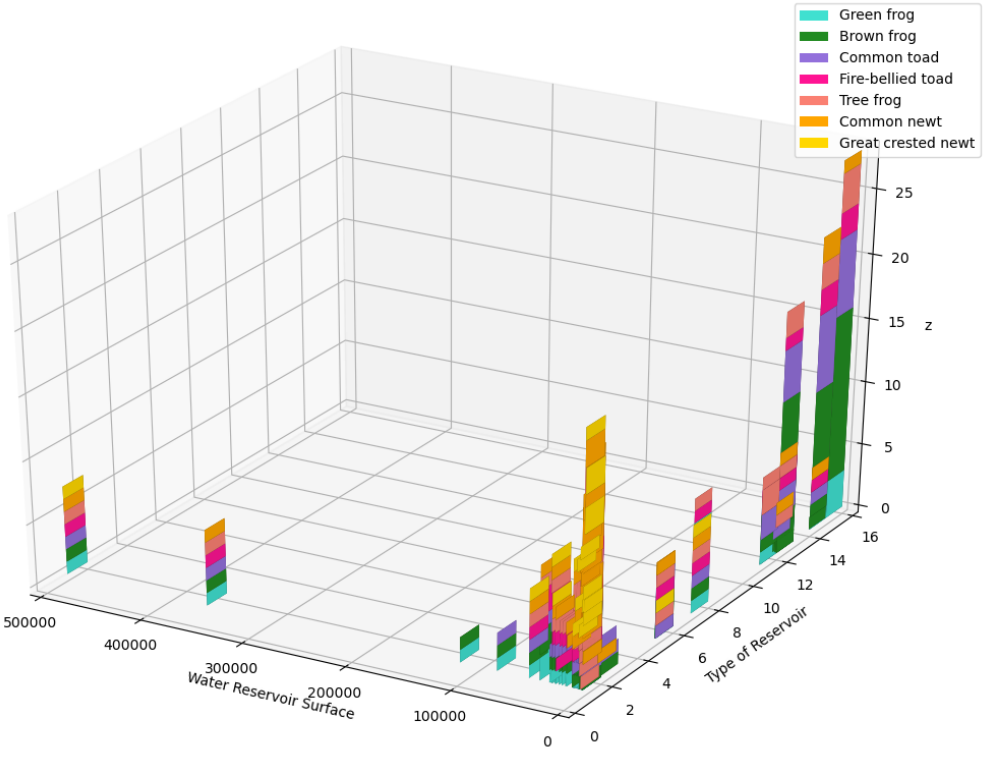
```
   attributeName = ["Water Reservoir Surface", "Number of Reservoir", "Type of␣
↪Reservoir", "Presence of Vegetation", "The Most Dominant Land Type"
                    , "The Second Most Dominant Land Type", "The Third Most␣
↪Dominant Land Type", "Use of Water Reservoir", "Presence of Fishing",␣
↪"Precentage Access to Undeveloped Area"
                   , "Minimum Distance to Road", "Minimum Distance to␣
↪Building", "Maintenance Status of Reservoir", "Type of Shore"]
   attributeAbrr = ((mainDF.iloc[:, 0:14]).columns)

   #print(attributeName[firstIndex], attributeName[secondIndex])

   gfCol = (mainDF[amphibian['Green frogs'] == 1])
   #print((gfCol.loc[:, attributeAbrr[x]]).max())
   #gfData = (list(gfCol.SUR1), list(gfCol.SUR2))

   pair = []
   xpos = []
   ypos =  []
   dx = np.ones(9)
   dy = np.ones(9)
   dz = []
   encode = {}


   gfCol = (mainDF[amphibian['Green frogs'] == 1])
   gfData = (list(gfCol.loc[:, attributeAbrr[firstIndex]]), list(gfCol.loc[:,␣
↪attributeAbrr[secondIndex]]))

   #print(gfData)
   #print((list(gfCol.SUR1), list(gfCol.SUR2)))

   for i in range(len(gfData[0])):
       if(str(gfData[0][i]) + str(gfData[1][i]) not in pair):
           xpos.append(gfData[0][i])
           ypos.append(gfData[1][i])
           pair.append(str(gfData[0][i]) + str(gfData[1][i]))
           encode[str(gfData[0][i]) + str(gfData[1][i])] = len(encode)

   bfCol = (mainDF[amphibian['Brown frogs'] == 1])
   bfData = (list(bfCol.loc[:, attributeAbrr[firstIndex]]), list(bfCol.loc[:,␣
↪attributeAbrr[secondIndex]]))

   #print(bfData)

   for i in range(len(bfData[0])):
       if(str(bfData[0][i]) + str(bfData[1][i]) not in pair):
           xpos.append(bfData[0][i])
```

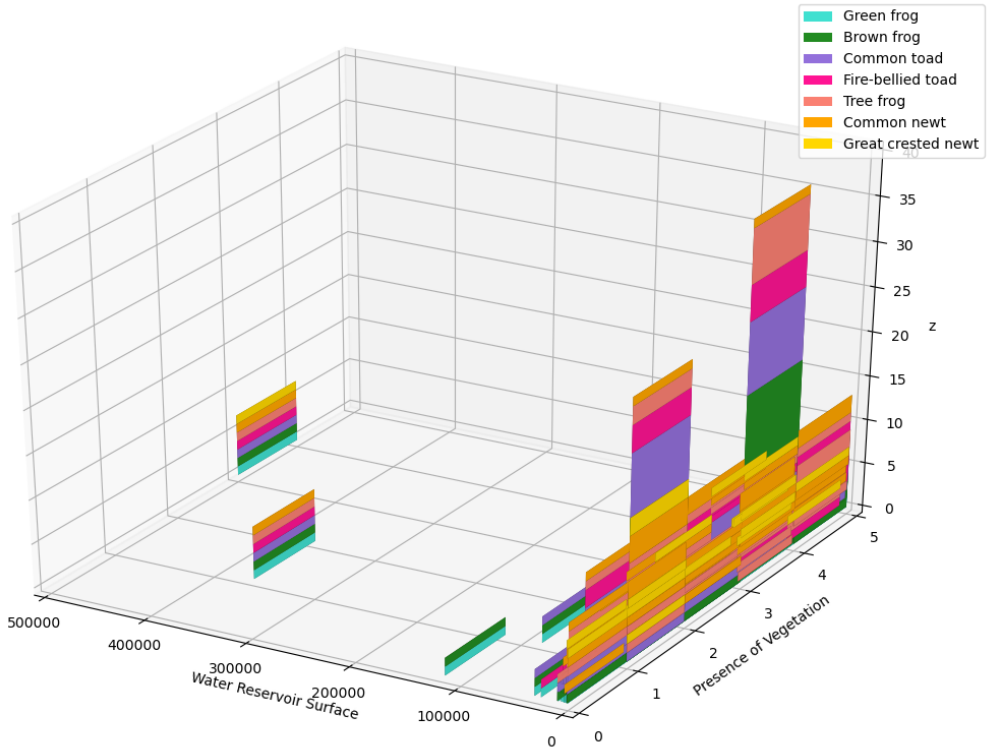
```
            ypos.append(bfData[1][i])
            pair.append(str(bfData[0][i]) + str(bfData[1][i]))
            encode[str(bfData[0][i]) + str(bfData[1][i])] = len(encode)

    ctCol = (mainDF[amphibian['Common toad'] == 1])
    ctData = (list(ctCol.loc[:, attributeAbrr[firstIndex]]), list(ctCol.loc[:,␣
↪attributeAbrr[secondIndex]]))

    for i in range(len(ctData[0])):
        if(str(ctData[0][i]) + str(ctData[1][i]) not in pair):
            xpos.append(ctData[0][i])
            ypos.append(ctData[1][i])
            pair.append(str(ctData[0][i]) + str(ctData[1][i]))
            encode[str(ctData[0][i]) + str(ctData[1][i])] = len(encode)

    ftCol = (mainDF[amphibian['Fire-bellied toad'] == 1])
    ftData = (list(ftCol.loc[:, attributeAbrr[firstIndex]]), list(ftCol.loc[:,␣
↪attributeAbrr[secondIndex]]))

    for i in range(len(ftData[0])):
        if(str(ftData[0][i]) + str(ftData[1][i]) not in pair):
            xpos.append(ftData[0][i])
            ypos.append(ftData[1][i])
            pair.append(str(ftData[0][i]) + str(ftData[1][i]))
            encode[str(ftData[0][i]) + str(ftData[1][i])] = len(encode)

    tfCol = (mainDF[amphibian['Tree frog'] == 1])
    tfData = (list(tfCol.loc[:, attributeAbrr[firstIndex]]), list(tfCol.loc[:,␣
↪attributeAbrr[secondIndex]]))

    for i in range(len(tfData[0])):
        if(str(tfData[0][i]) + str(tfData[1][i]) not in pair):
            xpos.append(tfData[0][i])
            ypos.append(tfData[1][i])
            pair.append(str(tfData[0][i]) + str(tfData[1][i]))
            encode[str(tfData[0][i]) + str(tfData[1][i])] = len(encode)

    cnCol = (mainDF[amphibian['Common newt'] == 1])
    cnData = (list(cnCol.loc[:, attributeAbrr[firstIndex]]), list(cnCol.loc[:,␣
↪attributeAbrr[secondIndex]]))

    for i in range(len(cnData[0])):
        if(str(cnData[0][i]) + str(cnData[1][i]) not in pair):
            xpos.append(cnData[0][i])
            ypos.append(cnData[1][i])
            pair.append(str(cnData[0][i]) + str(cnData[1][i]))
            encode[str(cnData[0][i]) + str(cnData[1][i])] = len(encode)
```

```
    gnCol = (mainDF[amphibian['Great crested newt'] == 1])
    gnData = (list(gnCol.loc[:, attributeAbrr[firstIndex]]), list(gnCol.loc[:,␣
↪attributeAbrr[secondIndex]]))

    for i in range(len(gnData[0])):
        if(str(gnData[0][i]) + str(gnData[1][i]) not in pair):
            xpos.append(gnData[0][i])
            ypos.append(gnData[1][i])
            pair.append(str(gnData[0][i]) + str(gnData[1][i]))
            encode[str(gnData[0][i]) + str(gnData[1][i])] = len(encode)

    data = (gfData, bfData, ctData, ftData, tfData, cnData, gnData)
    group = ("Green frog", "Brown frog", "Common toad", "Fire-bellied toad",␣
↪"Tree frog", "Common newt", "Great crested newt")

    zpos = np.zeros(len(xpos))

    dx = np.ones(len(xpos))
    dy = np.ones(len(xpos))
    dz = [np.zeros(len(xpos)) for i in range(7)]

    for i in range(len(gfData[0])):
        dz[0][encode[str(gfData[0][i]) + str(gfData[1][i])]] += 1

    for i in range(len(bfData[0])):
        dz[1][encode[str(bfData[0][i]) + str(bfData[1][i])]] += 1

    for i in range(len(ctData[0])):
        dz[2][encode[str(ctData[0][i]) + str(ctData[1][i])]] += 1

    for i in range(len(ftData[0])):
        dz[3][encode[str(ftData[0][i]) + str(ftData[1][i])]] += 1

    for i in range(len(tfData[0])):
        dz[4][encode[str(tfData[0][i]) + str(tfData[1][i])]] += 1

    for i in range(len(cnData[0])):
        dz[5][encode[str(cnData[0][i]) + str(cnData[1][i])]] += 1

    for i in range(len(gnData[0])):
        dz[6][encode[str(gnData[0][i]) + str(gnData[1][i])]] += 1

    fig = plt.figure(figsize=(14,10), dpi= 100)
    ax = fig.add_subplot(111, projection = "3d")

    ax.set_xlabel("x")
```

```
    ax.set_ylabel("y")
    ax.set_zlabel("z")
    ax.set_xlim3d(0,min((gfCol.loc[:, attributeAbrr[firstIndex]]).max() + 1,␣
↪800000))
    ax.set_ylim3d(0,min((gfCol.loc[:, attributeAbrr[secondIndex]]).max() + 1,␣
↪800000))

    _zpos = zpos

    for i in range(7):
        colorx = [colorMap[i]]
        ax.bar3d(xpos, ypos, _zpos, dx, dy, dz[i], color=colorx)
        _zpos += dz[i]
    plt.gca().invert_xaxis()

    #plt.title('Correlation between Amphibian Occurance, The Most Dominant and␣
↪The Second Most Dominant Land Cover', fontsize = 13)
    plt.ylabel(attributeName[secondIndex], fontsize = 10)
    plt.xlabel(attributeName[firstIndex], fontsize = 10)
    #group = ("Green frog", "Brown frog", "Common toad", "Fire-bellied toad",␣
↪"Tree frog", "Common newt", "Great crested newt")
    #(['turquoise', 'forestgreen',  'mediumpurple', 'deeppink', 'salmon',␣
↪'orange', 'gold'])
    gfLabel = plt.Rectangle((0, 0), 1, 1, fc="turquoise")
    bfLabel = plt.Rectangle((0, 0), 1, 1, fc="forestgreen")
    ctLabel = plt.Rectangle((0, 0), 1, 1, fc="mediumpurple")
    ftLabel = plt.Rectangle((0, 0), 1, 1, fc="deeppink")
    tfLabel = plt.Rectangle((0, 0), 1, 1, fc="salmon")
    cnLabel = plt.Rectangle((0, 0), 1, 1, fc="orange")
    gnLabel = plt.Rectangle((0, 0), 1, 1, fc="gold")
    plt.legend([gfLabel,bfLabel, ctLabel, ftLabel, tfLabel, cnLabel,␣
↪gnLabel],["Green frog", "Brown frog", "Common toad", "Fire-bellied toad",␣
↪"Tree frog", "Common newt", "Great crested newt"])
    plt.show()
```


Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
20
40
60
80
Water Reservoir Surface
500000
400000
300000
200000
100000
0
Number of Reservoir
0
2
4
6
8
10
12


Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
5
10
15
20
25
Water Reservoir Surface
500000
400000
300000
200000
100000
0
Type of Reservoir
0
2
4
6
8
10
12
14
16


Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
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10
15
20
25
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400000
300000
200000
100000
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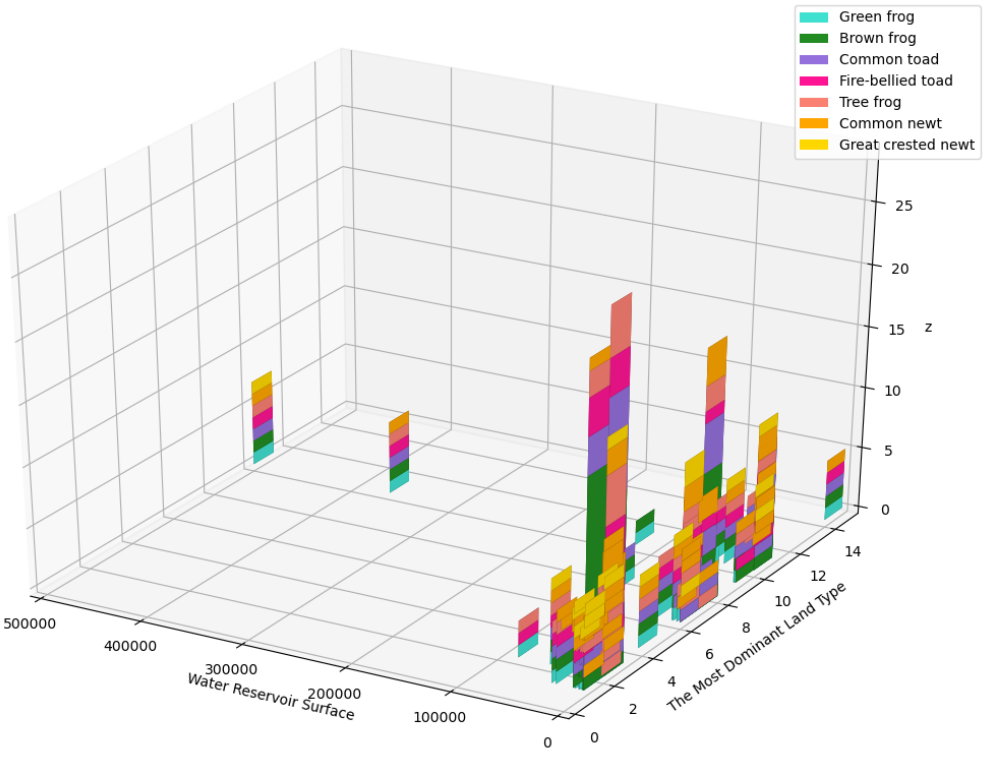
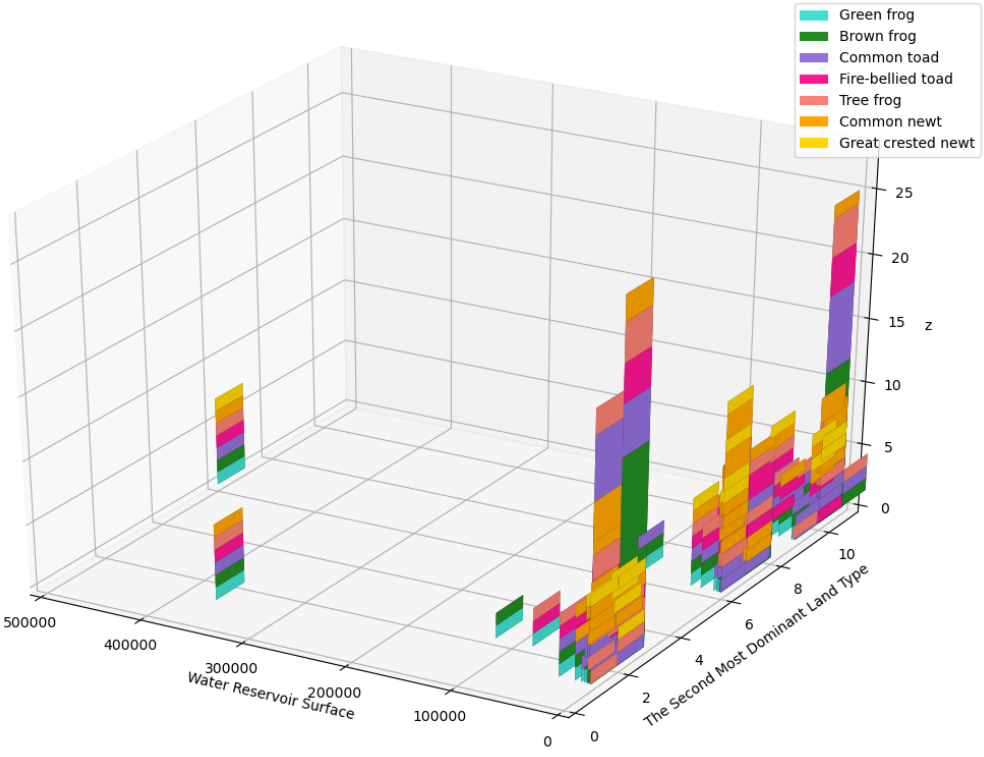
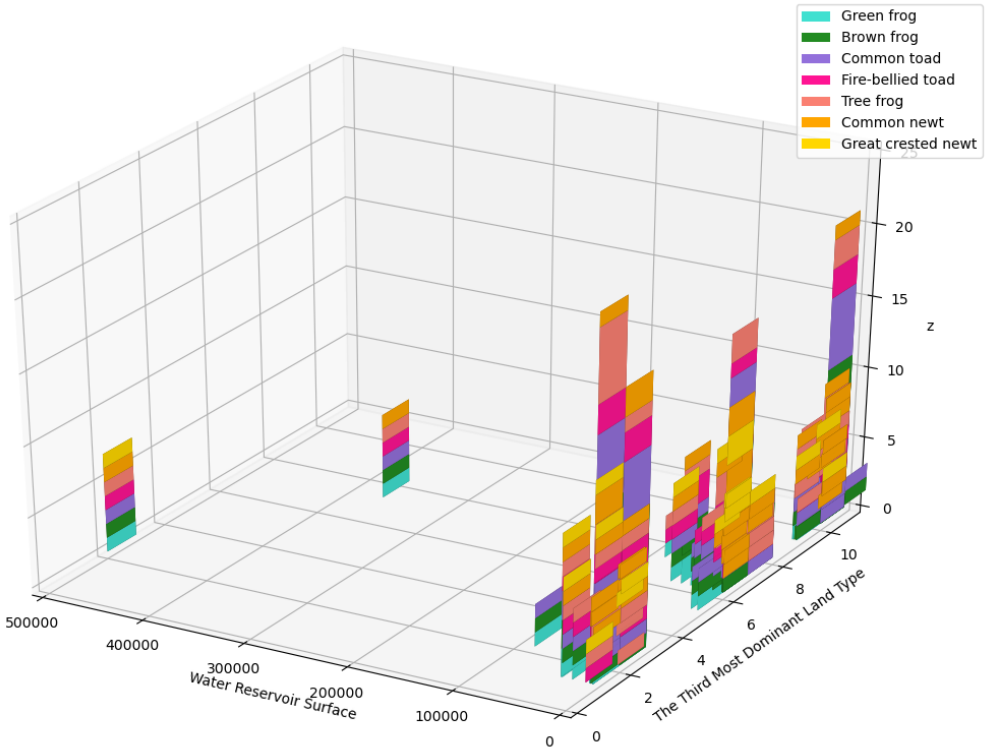
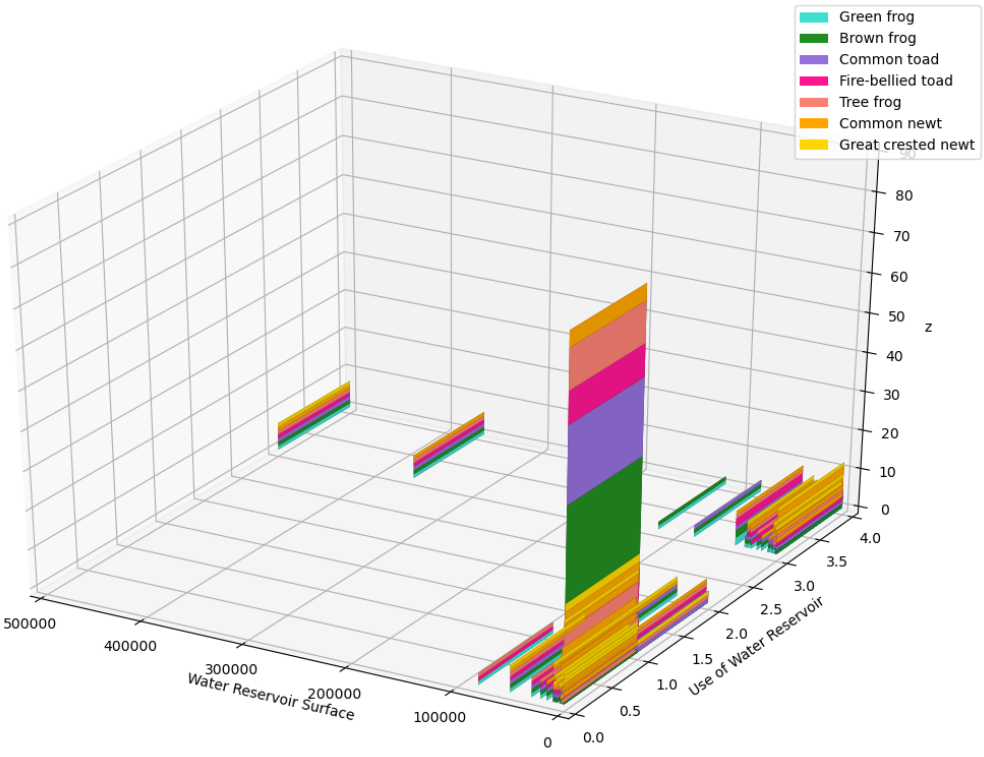
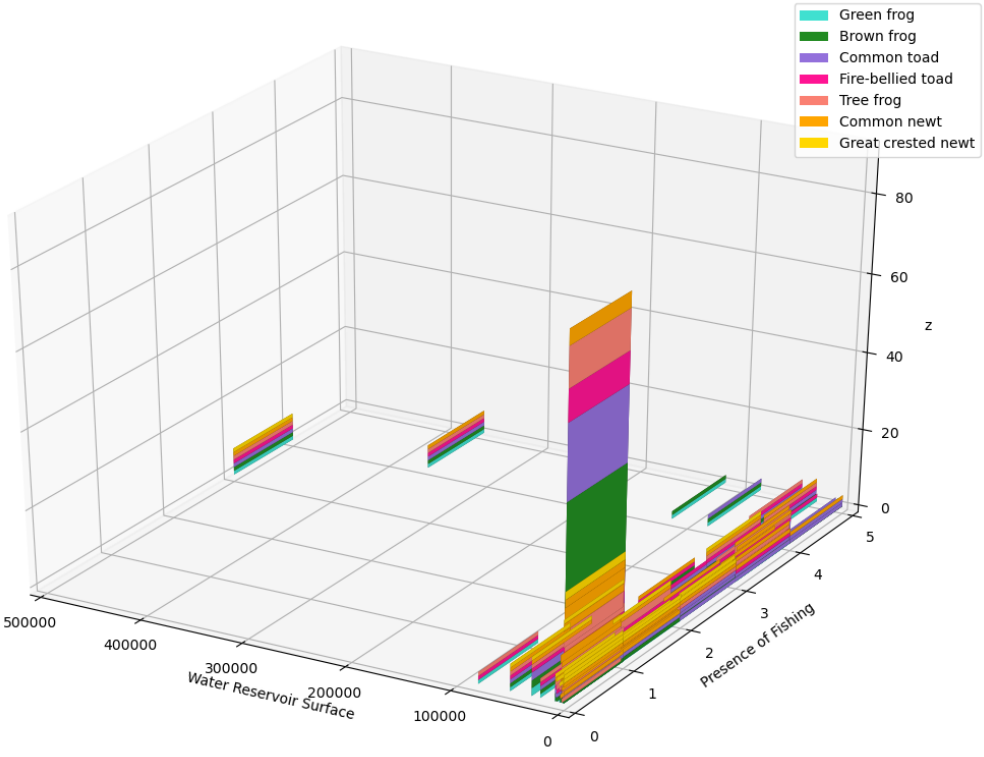
Water Reservoir Surface
0
1
2
3
4
5
Presence of Vegetation

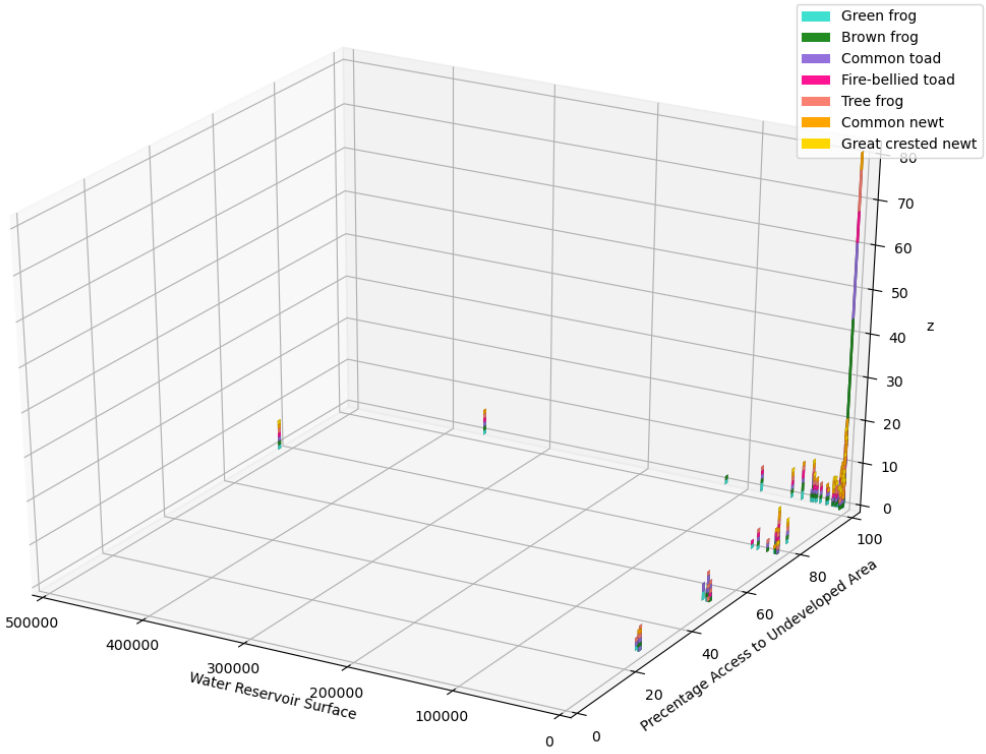

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
5
10
15
20
25
500000
400000
300000
200000
100000
0
Water Reservoir Surface
0
2
4
6
8
10
12
14
The Most Dominant Land Type

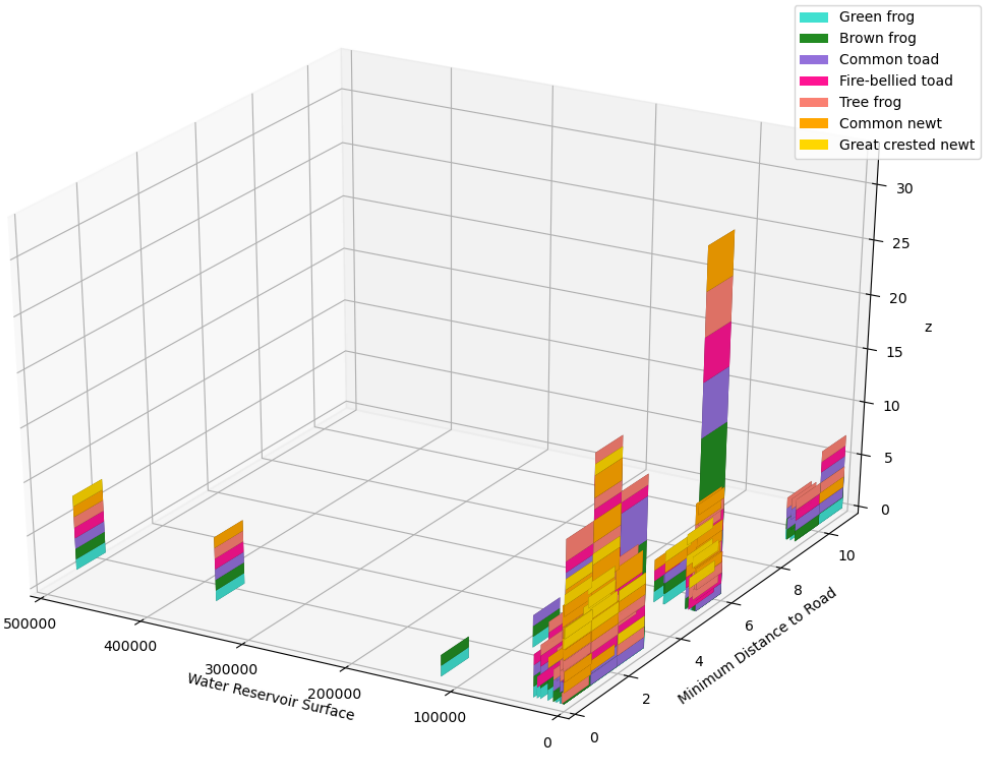

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
5
10
15
20
25
500000
400000
300000
200000
100000
0
Water Reservoir Surface
0
2
4
6
8
10
The Second Most Dominant Land Type

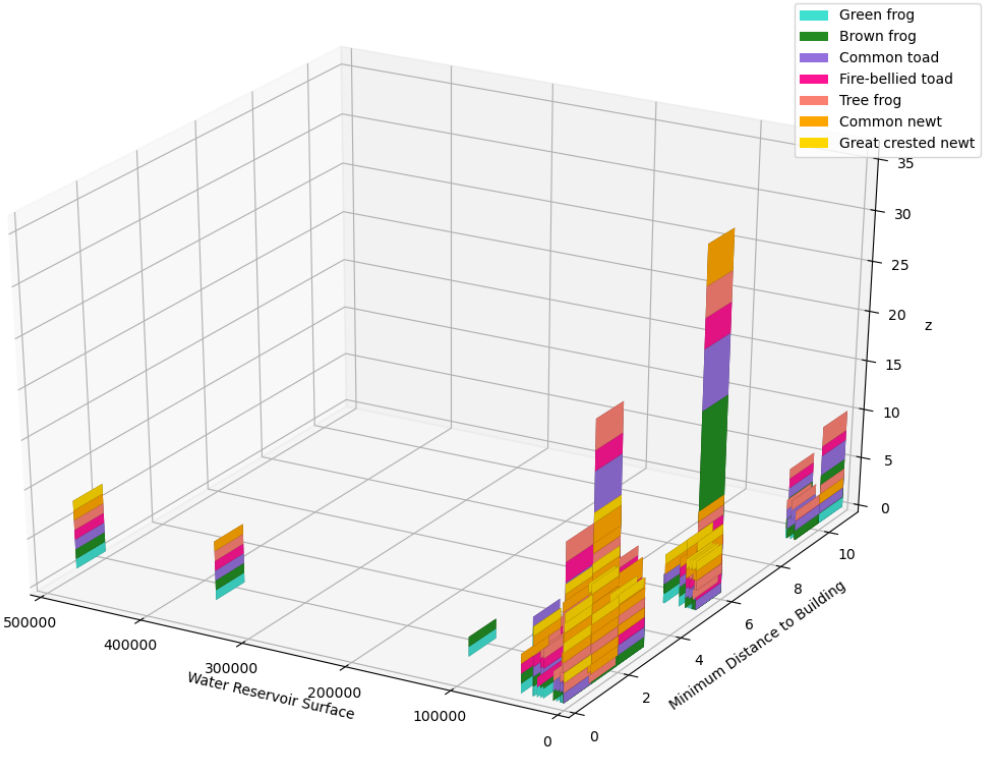

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
500000
400000
300000
200000
100000
0
Water Reservoir Surface
0
2
4
6
8
10
The Third Most Dominant Land Type
0
5
10
15
20
z

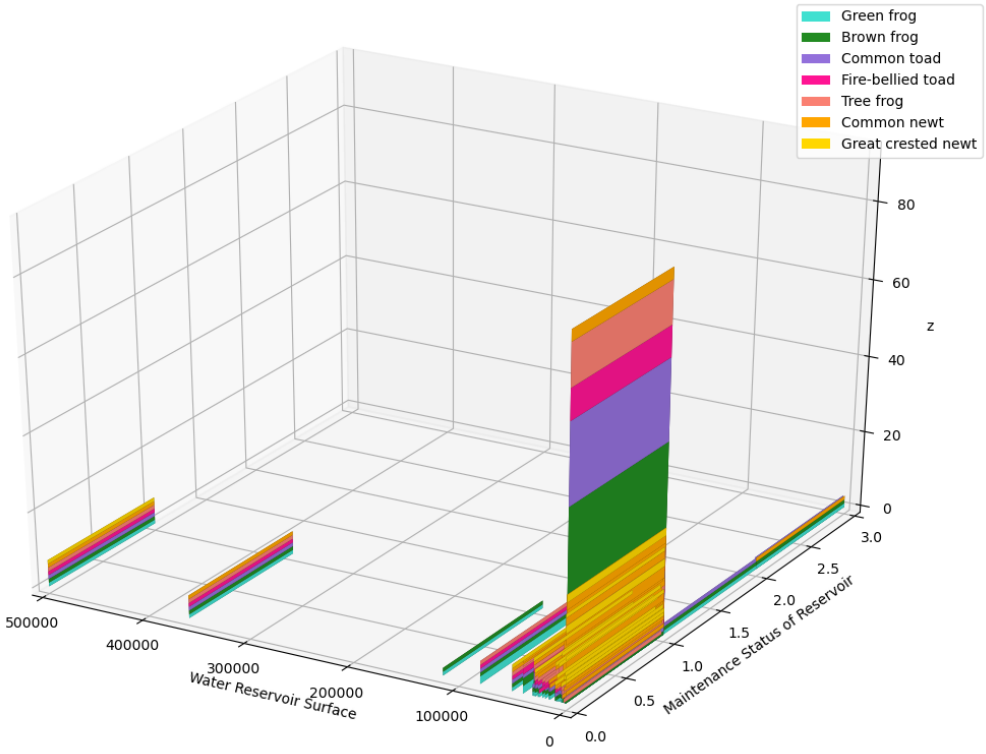

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
Water Reservoir Surface
Use of Water Reservoir

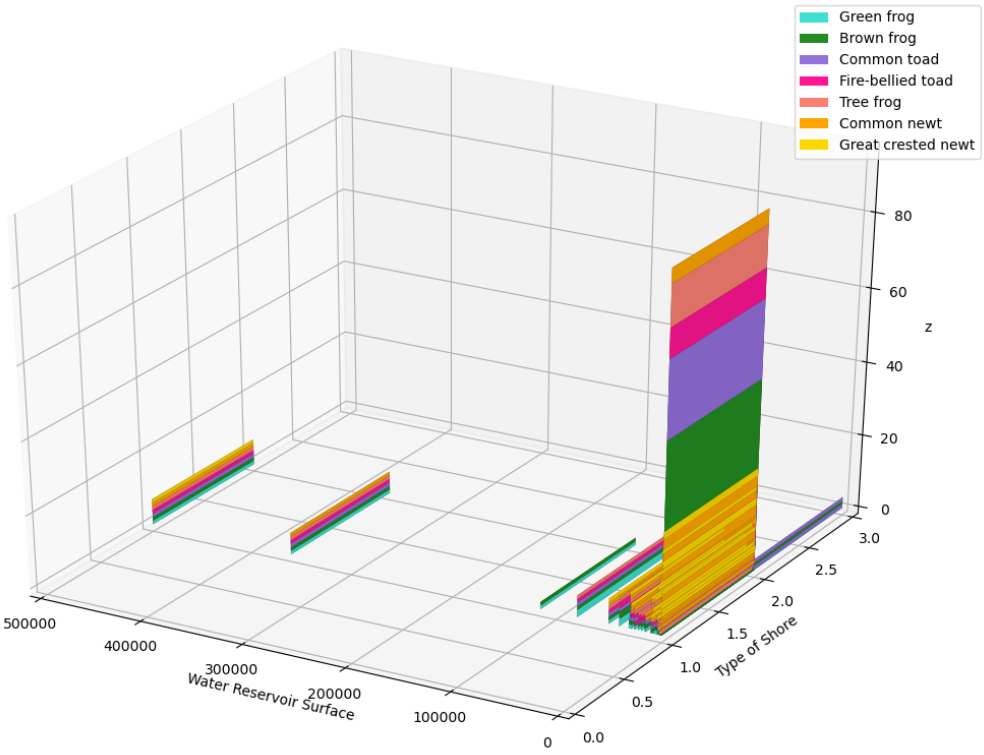

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
Water Reservoir Surface
Presence of Fishing

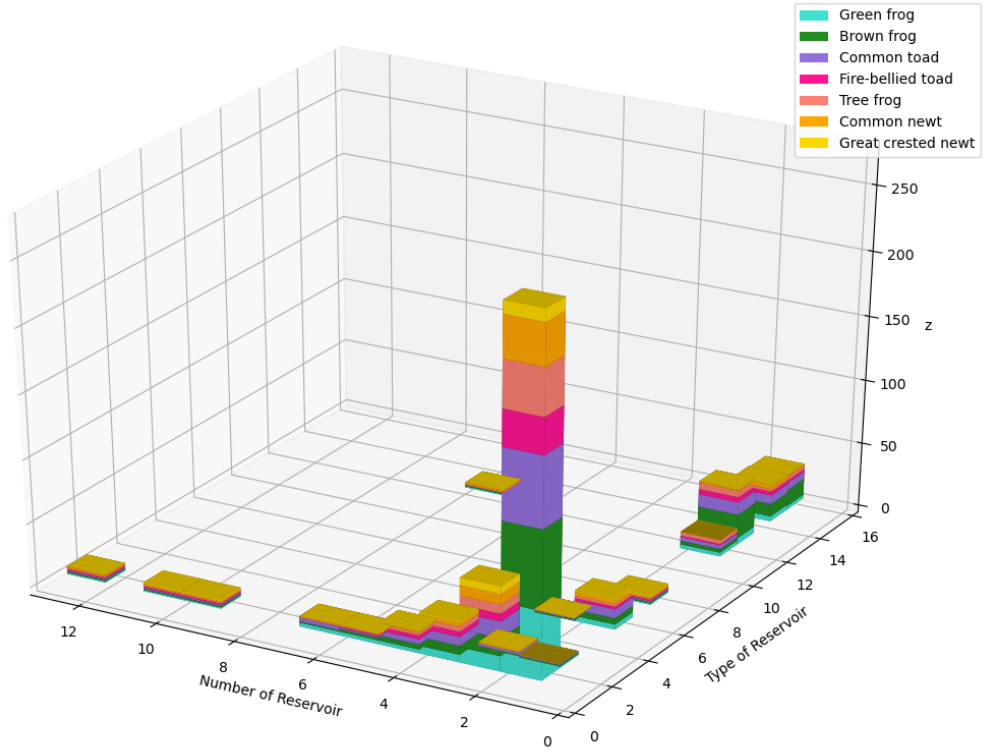

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
10
20
30
40
50
60
70
Water Reservoir Surface
500000
400000
300000
200000
100000
0
Precentage Access to Undeveloped Area
0
20
40
60
80
100

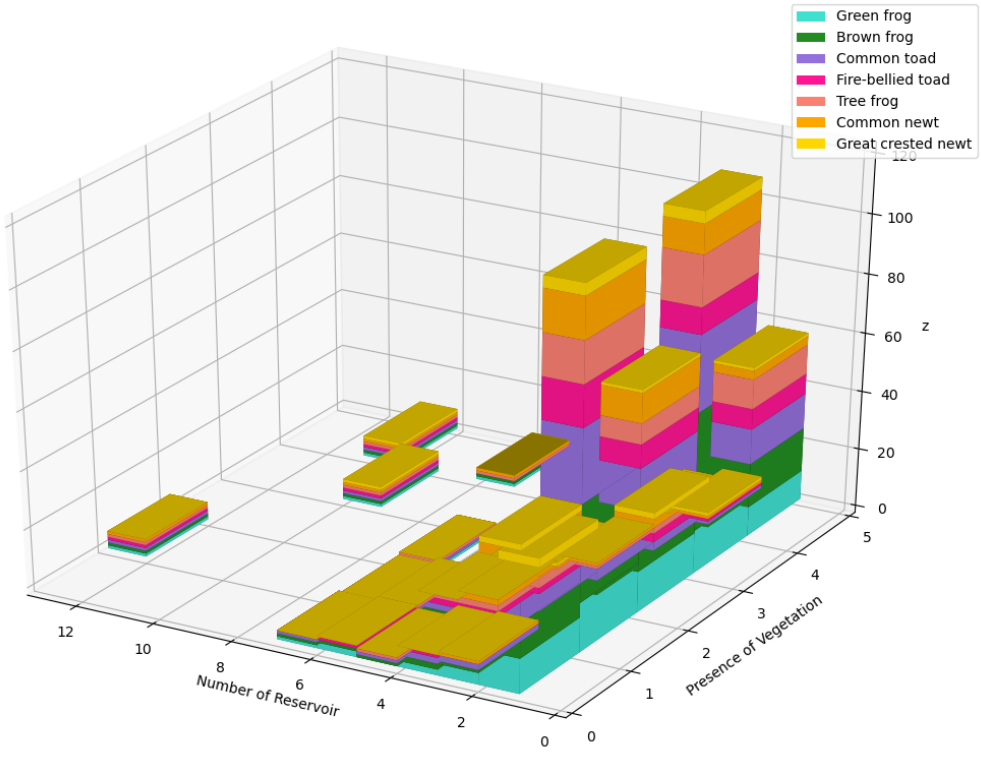

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
5
10
15
20
25
30
500000
400000
300000
200000
100000
0
Water Reservoir Surface
0
2
4
6
8
10
Minimum Distance to Road

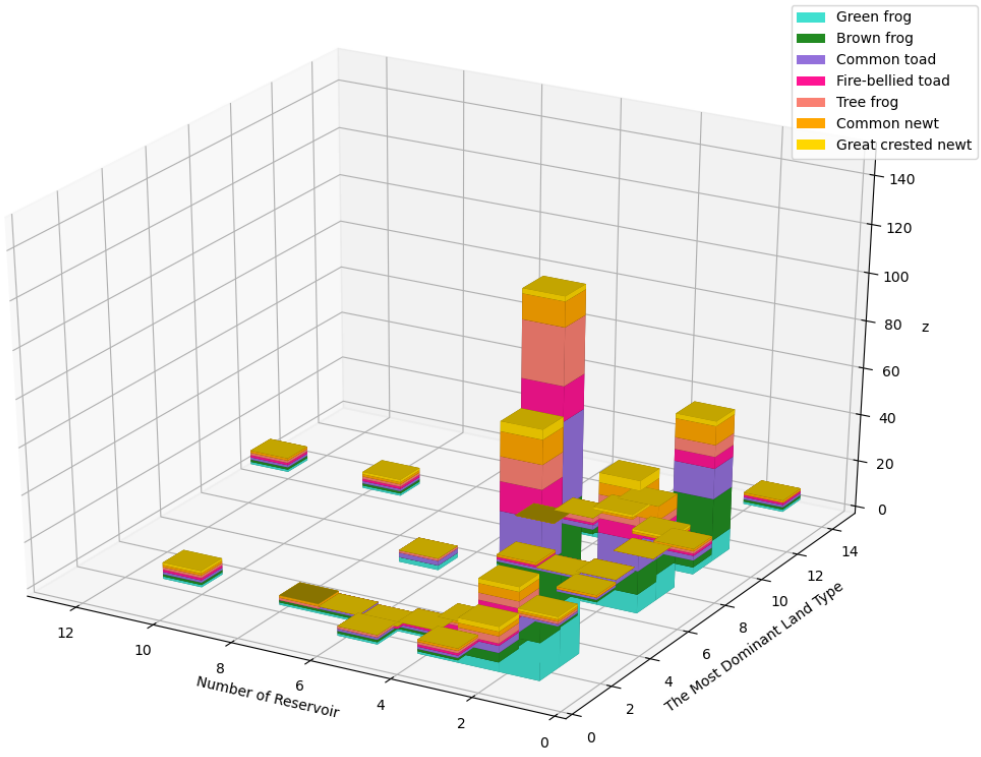

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
5
10
15
20
25
30
35
500000
400000
300000
200000
100000
0
Water Reservoir Surface
0
2
4
6
8
10
Minimum Distance to Building

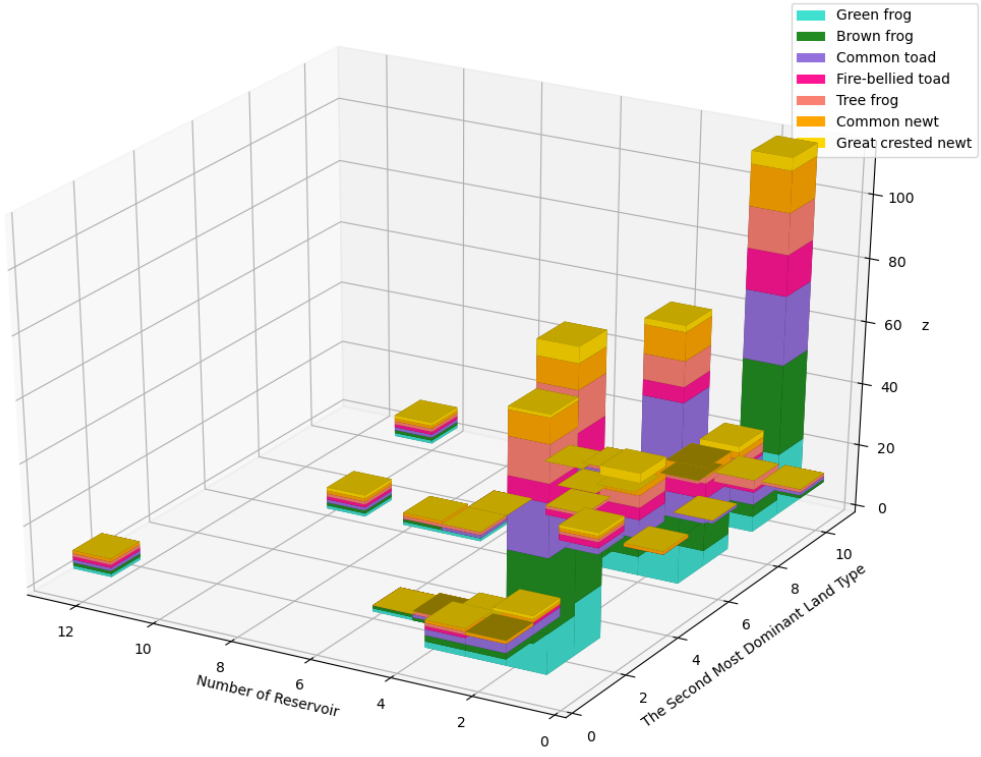

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
20
40
60
80
500000
400000
300000
200000
100000
0
Water Reservoir Surface
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Maintenance Status of Reservoir

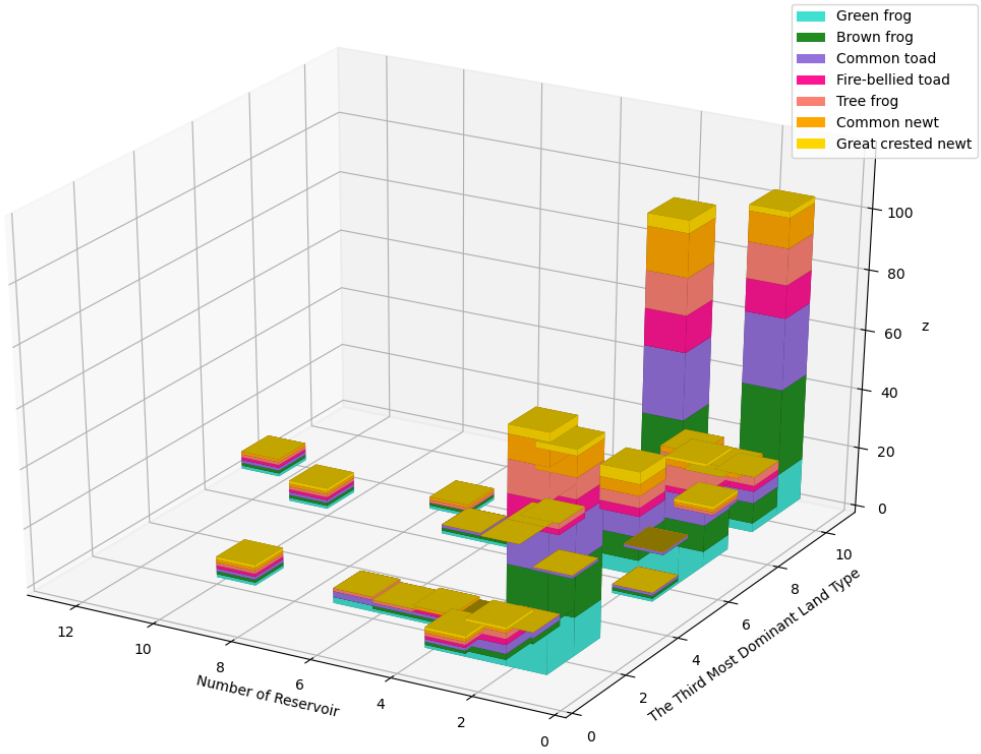

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
20
40
60
80
Water Reservoir Surface
500000
400000
300000
200000
100000
0
Type of Shore
0.0
0.5
1.0
1.5
2.0
2.5
3.0

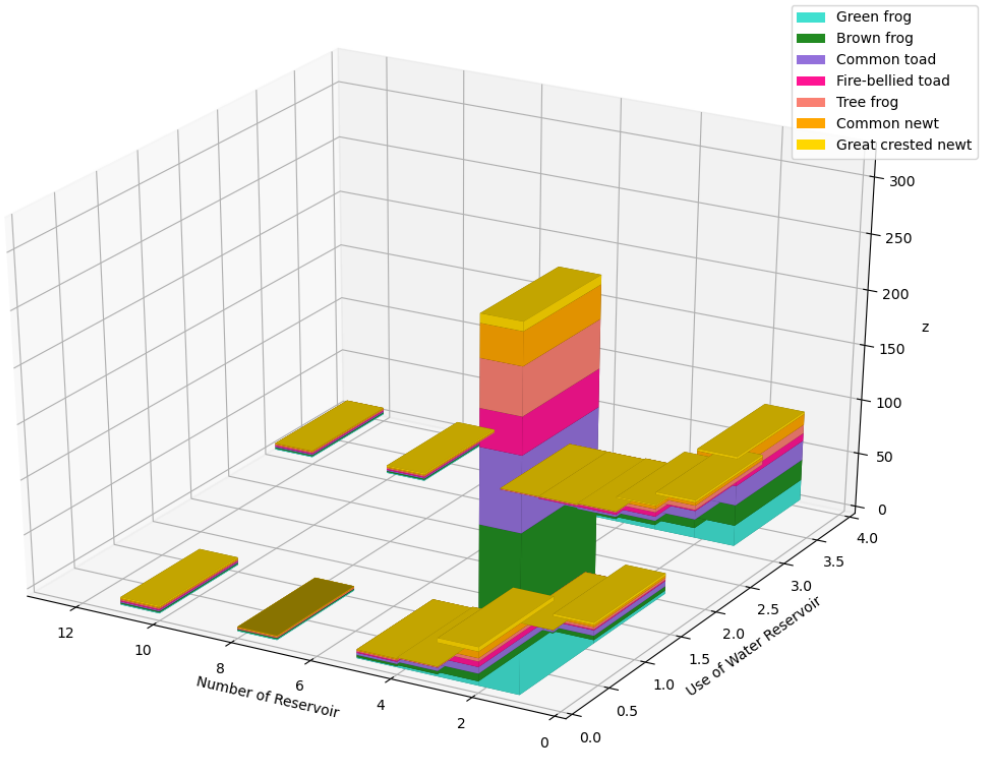

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
50
100
150
200
250
Number of Reservoir
12
10
8
6
4
2
0
Type of Reservoir
0
2
4
6
8
10
12
14
16

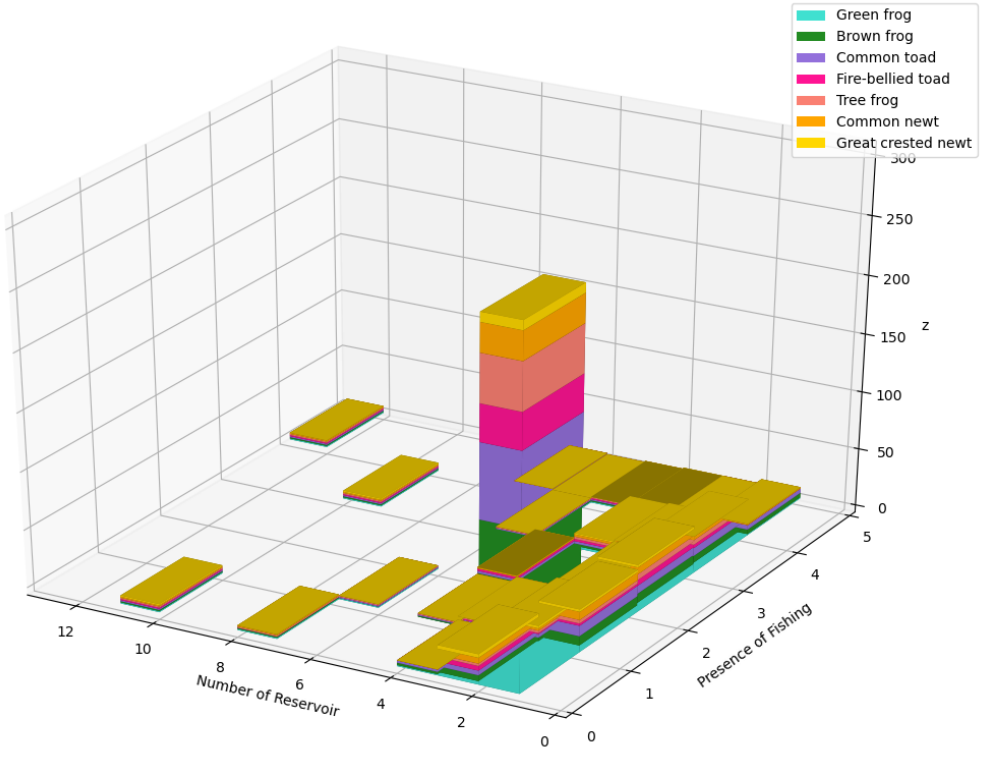

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
20
40
60
80
100
Number of Reservoir
12
10
8
6
4
2
0
Presence of Vegetation
0
1
2
3
4
5

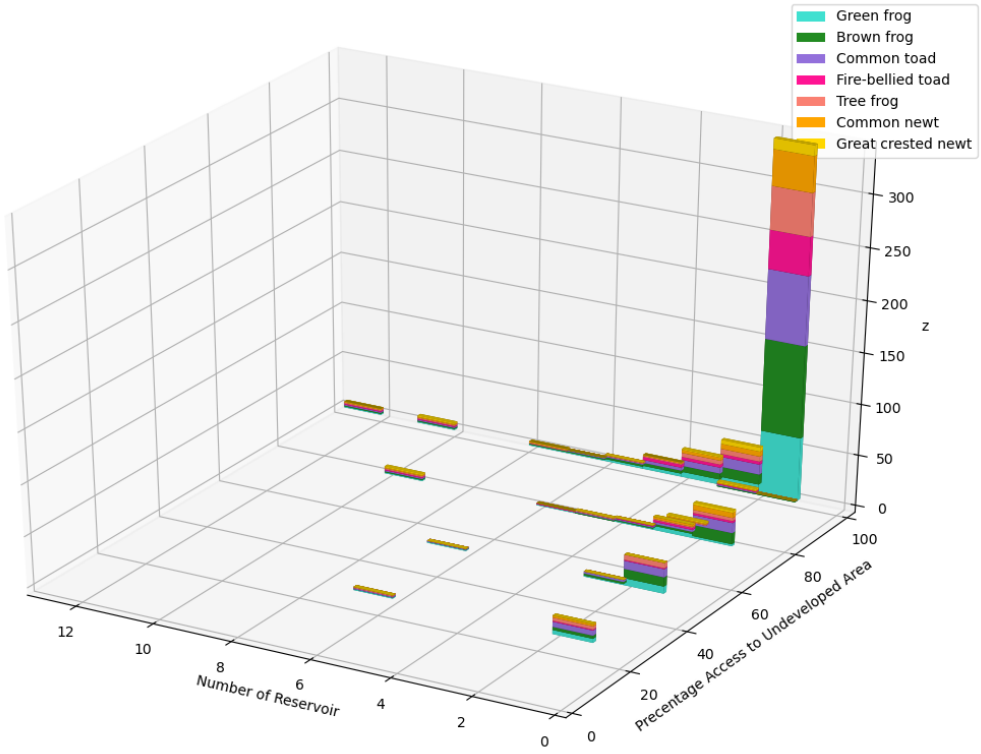

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
Number of Reservoir
The Most Dominant Land Type
z

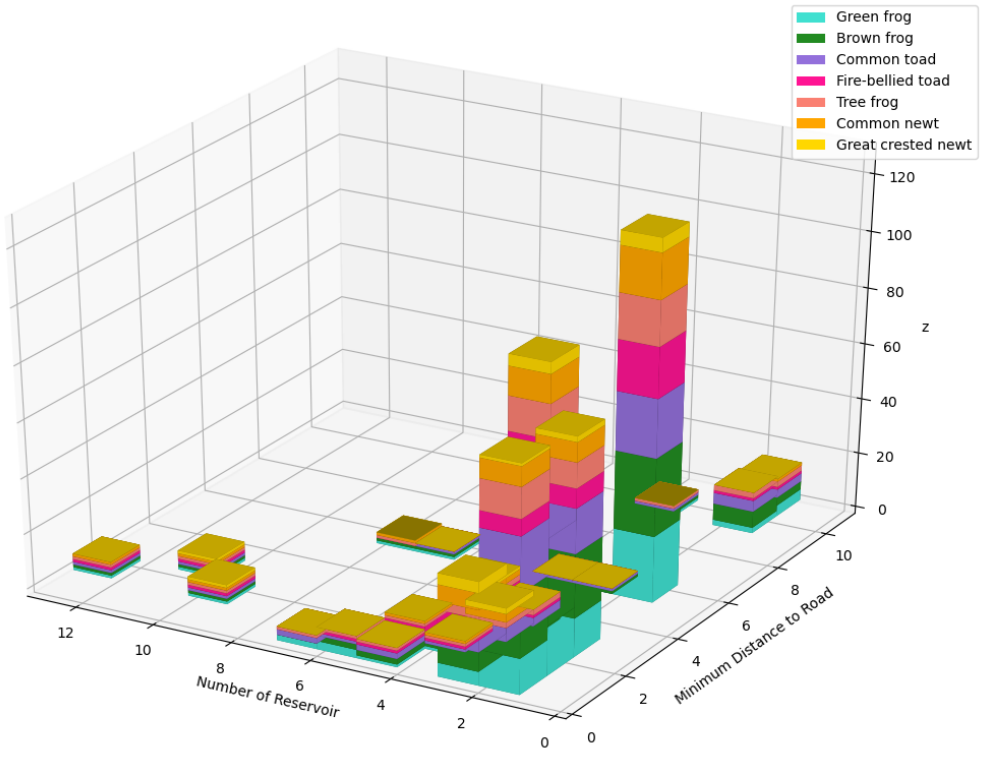

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
Number of Reservoir
The Second Most Dominant Land Type
z

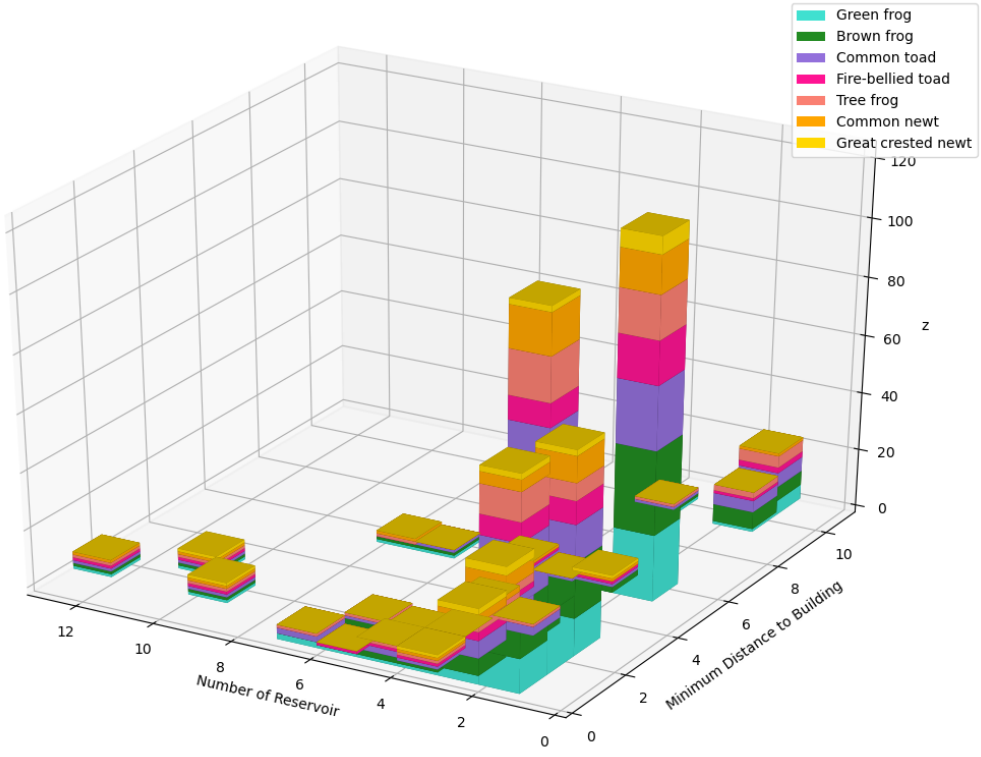

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
100
80
60
40
20
0
Number of Reservoir
12
10
8
6
4
2
0
The Third Most Dominant Land Type
0
2
4
6
8
10

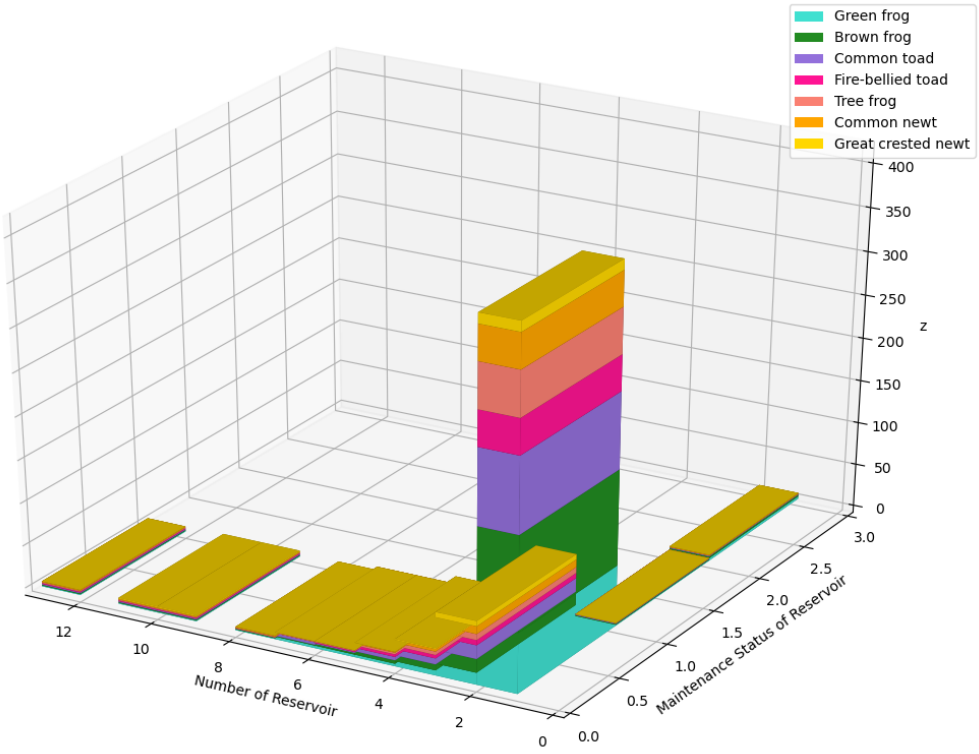

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
300
250
200
150
100
50
0
Number of Reservoir
12
10
8
6
4
2
0
Use of Water Reservoir
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0

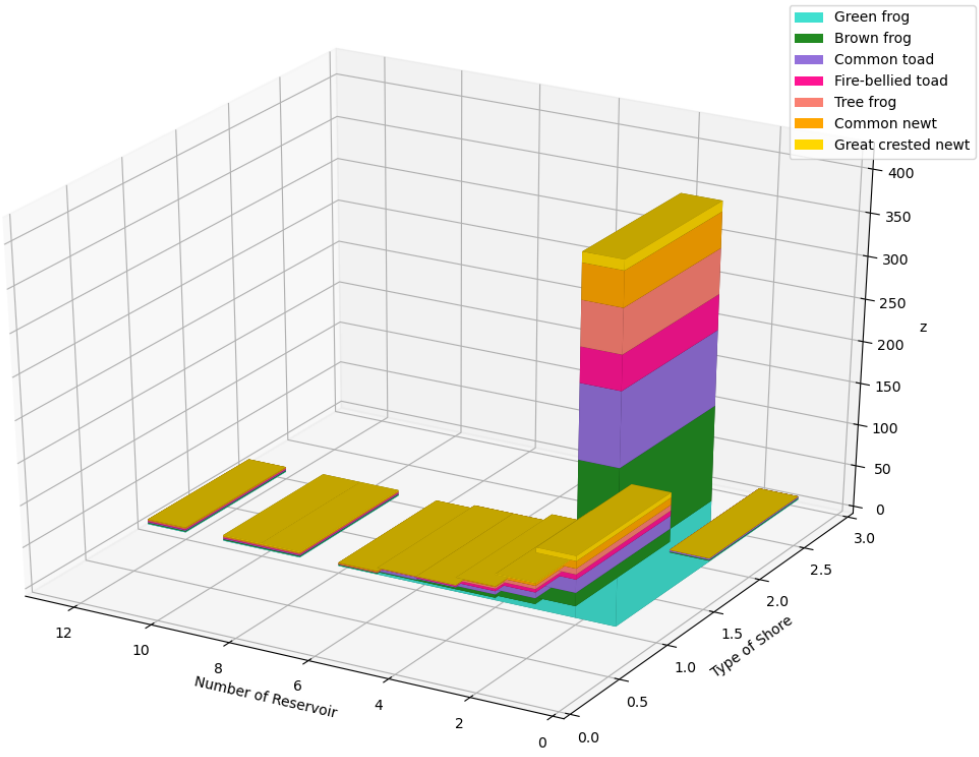

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
250
200
150
100
50
0
Number of Reservoir
12
10
8
6
4
2
0
Presence of Fishing
0
1
2
3
4
5

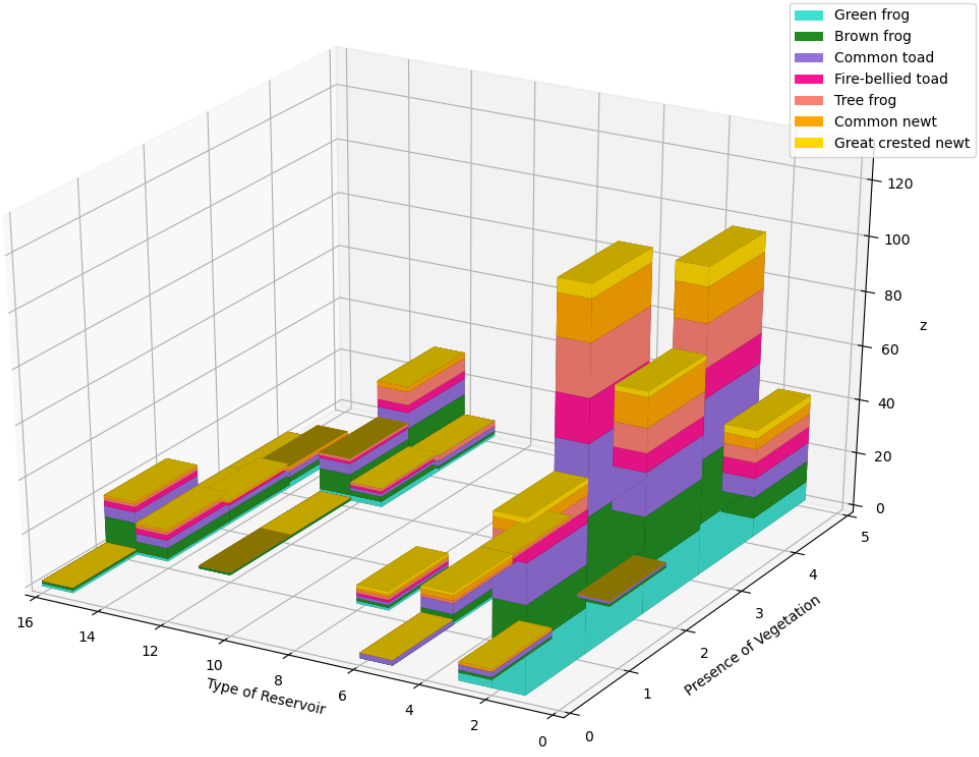

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
300
250
200
150
100
50
0
Number of Reservoir
12
10
8
6
4
2
0
Precentage Access to Undeveloped Area
0
20
40
60
80
100

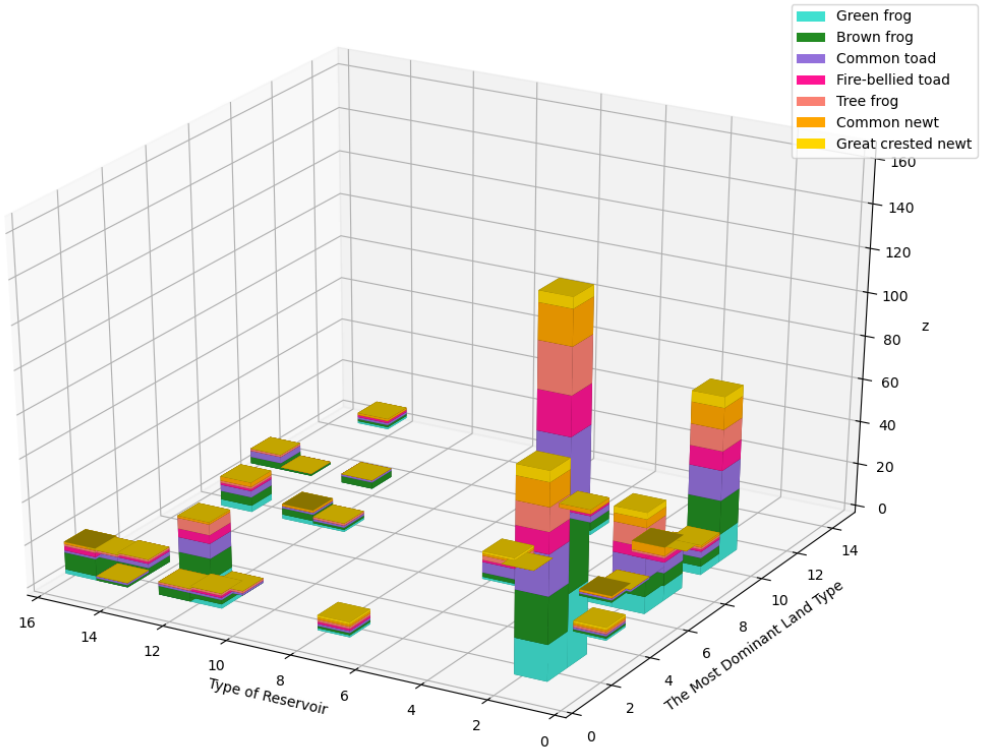

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
Number of Reservoir
Minimum Distance to Road

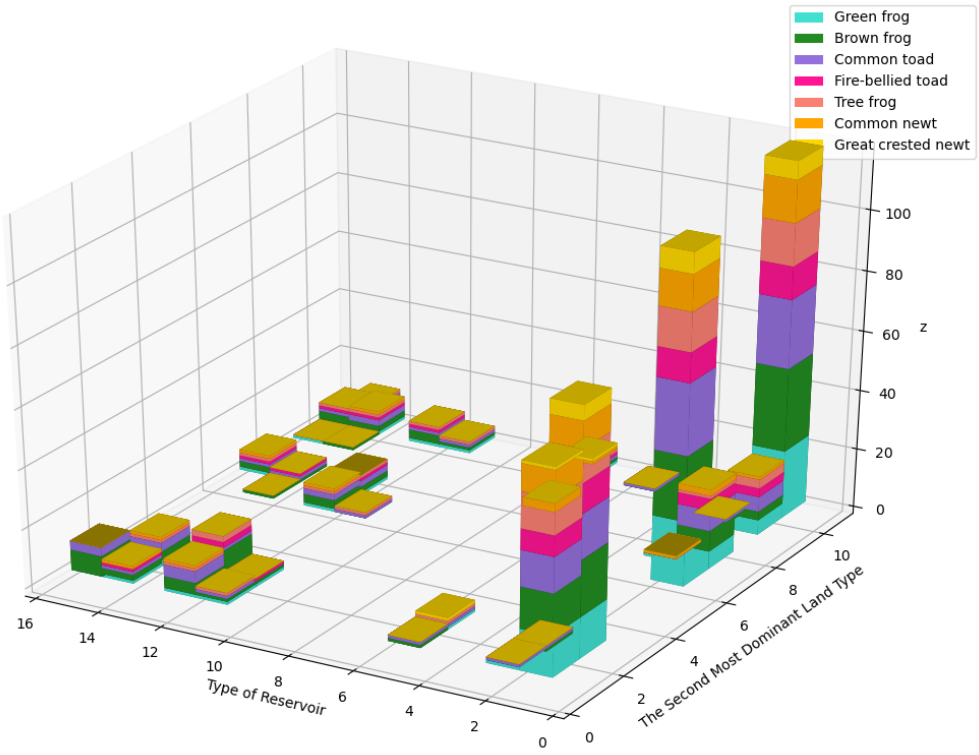

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
Number of Reservoir
Minimum Distance to Building

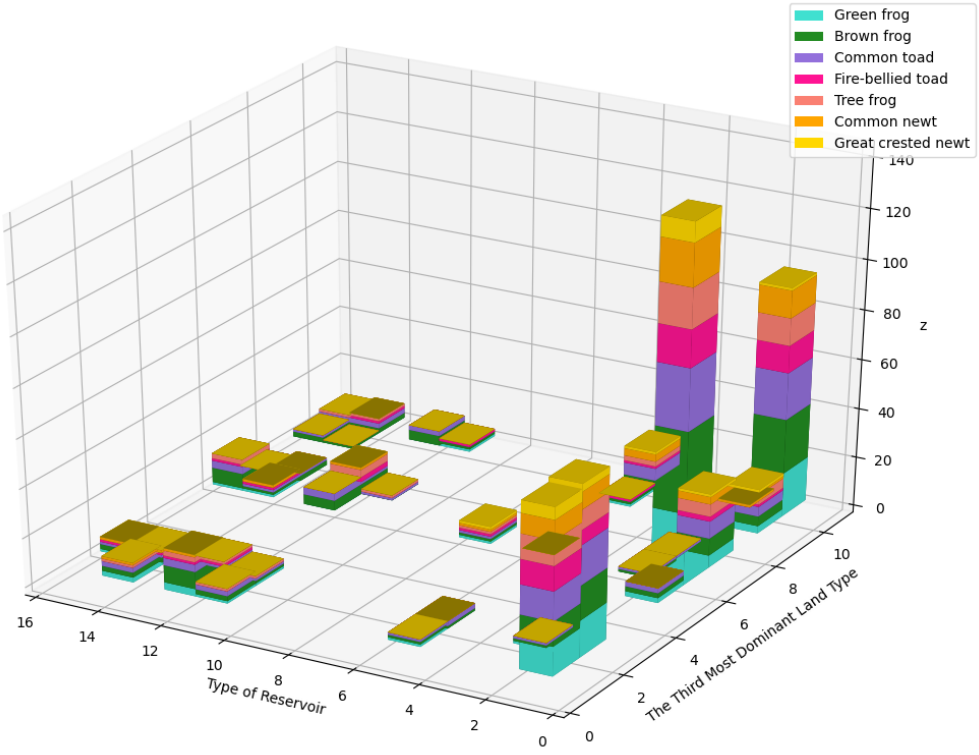

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
400
350
300
250
200
150
100
50
0
z
12
10
8
6
4
2
0
Number of Reservoir
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Maintenance Status of Reservoir

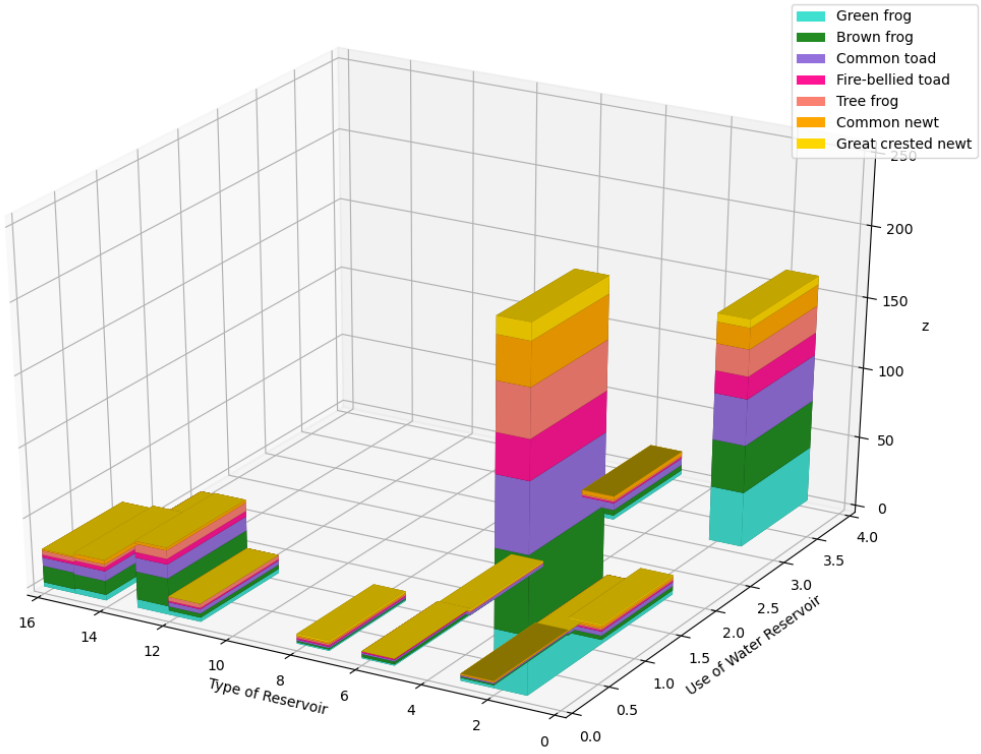

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
400
350
300
250
200
150
100
50
0
z
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Type of Shore
12
10
8
6
4
2
0
Number of Reservoir

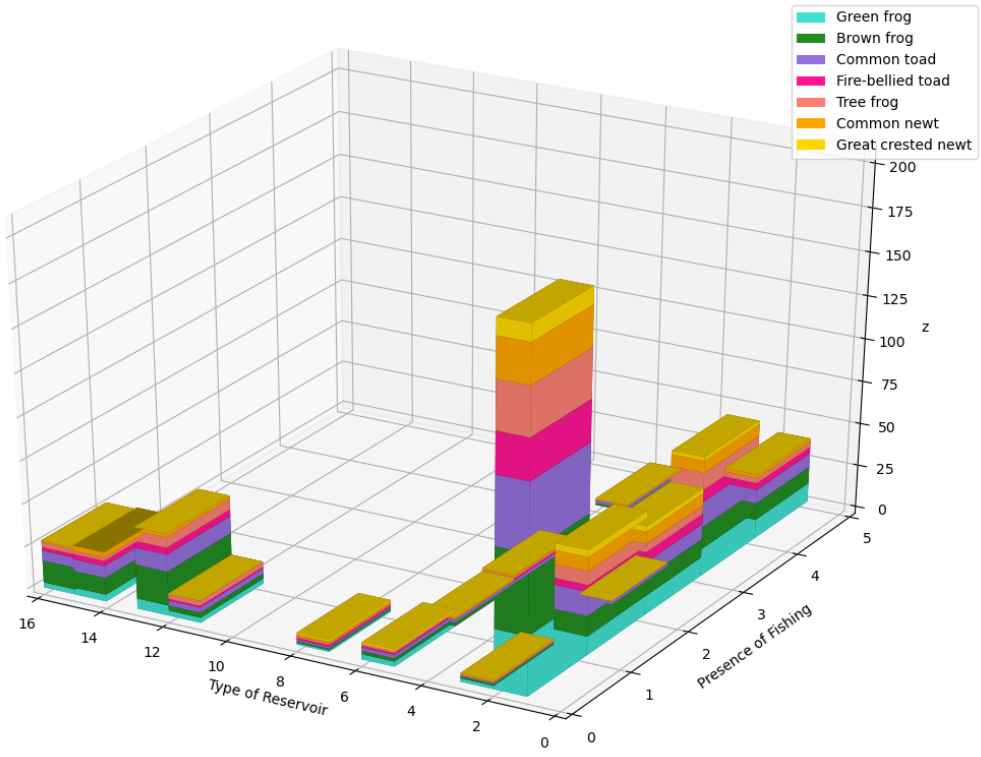

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
120
100
80
60
40
20
0
z
5
4
3
2
1
0
Presence of Vegetation
16
14
12
10
8
6
4
2
0
Type of Reservoir

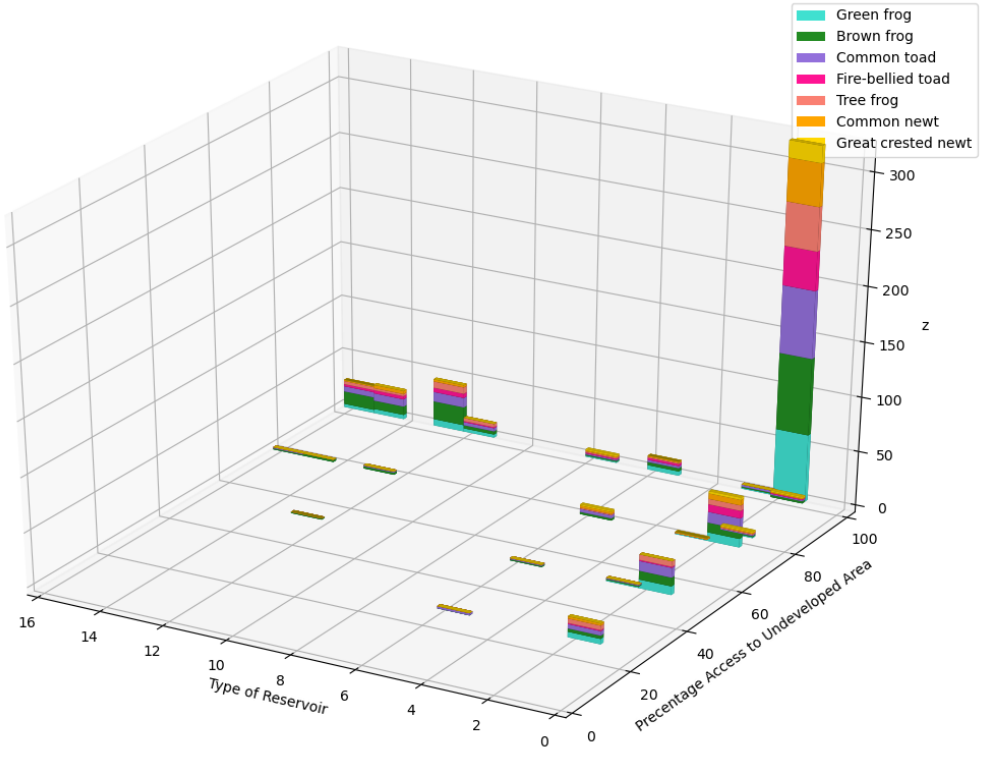

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
20
40
60
80
100
120
140
160
Type of Reservoir
16
14
12
10
8
6
4
2
0
The Most Dominant Land Type
0
2
4
6
8
10
12
14

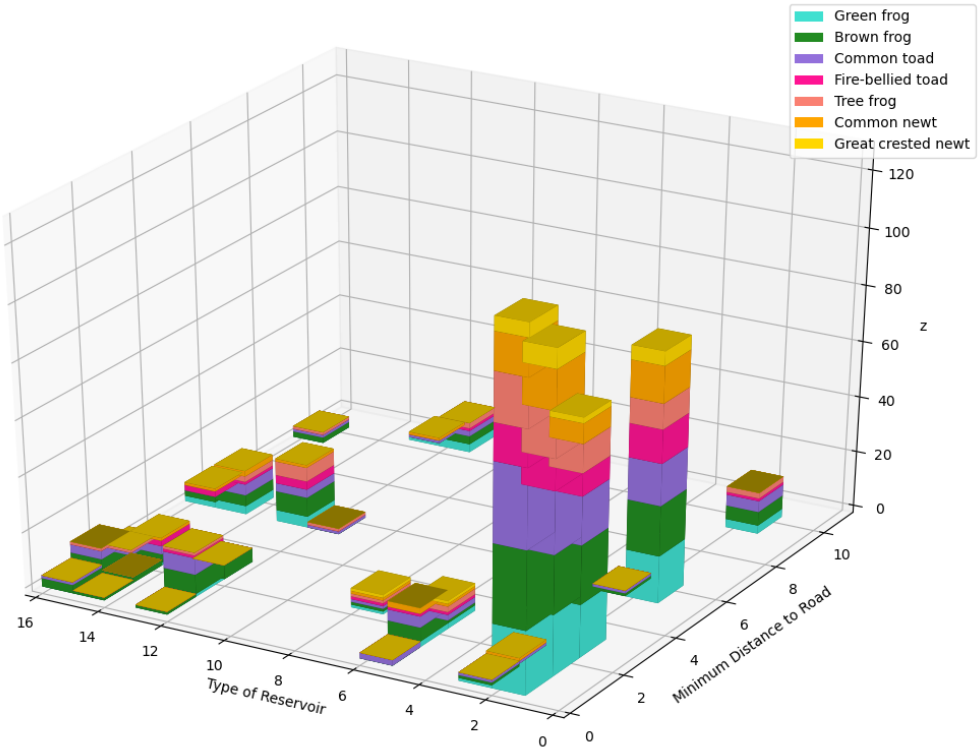

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
Type of Reservoir
The Second Most Dominant Land Type
z

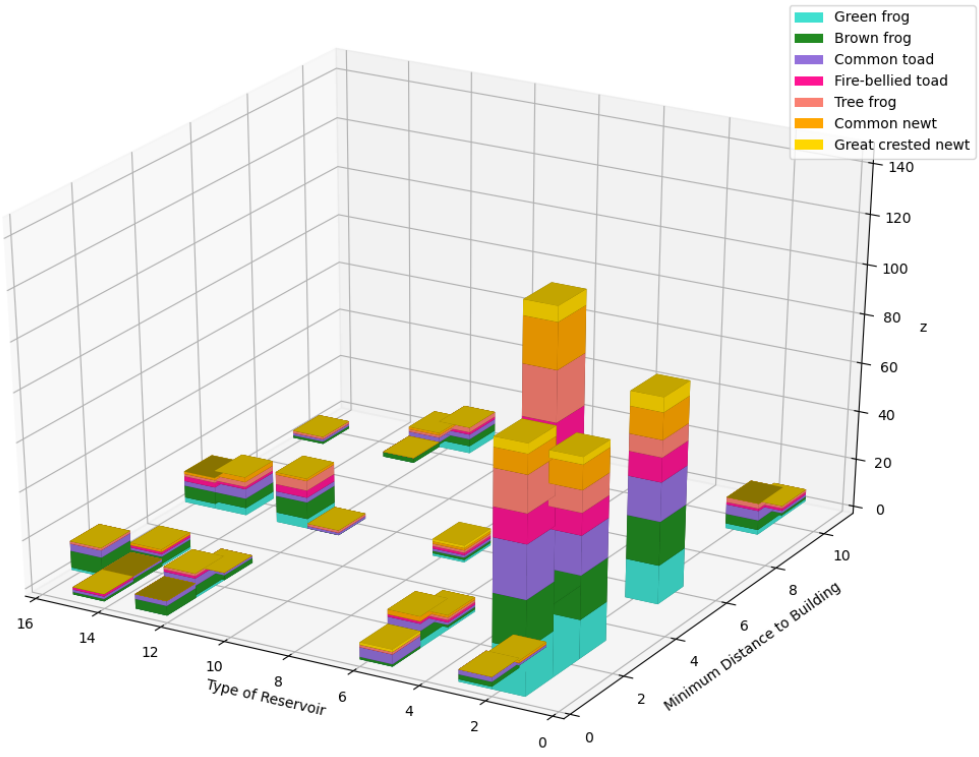

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
Type of Reservoir
The Third Most Dominant Land Type
z

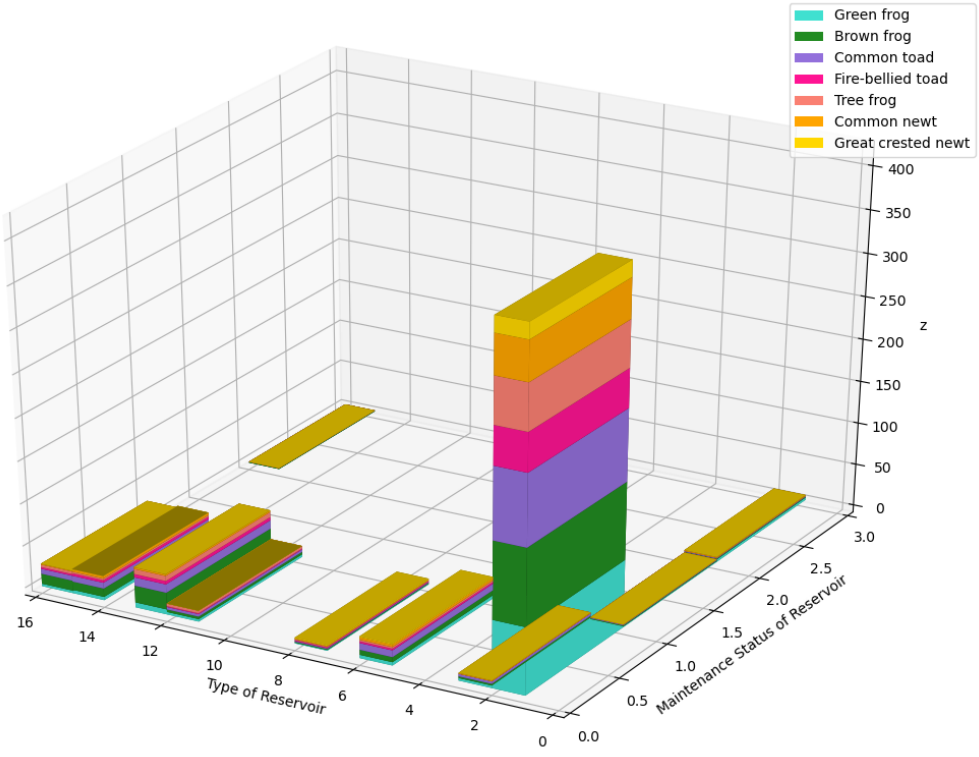

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
50
100
150
200
Type of Reservoir
16
14
12
10
8
6
4
2
0
Use of Water Reservoir
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0

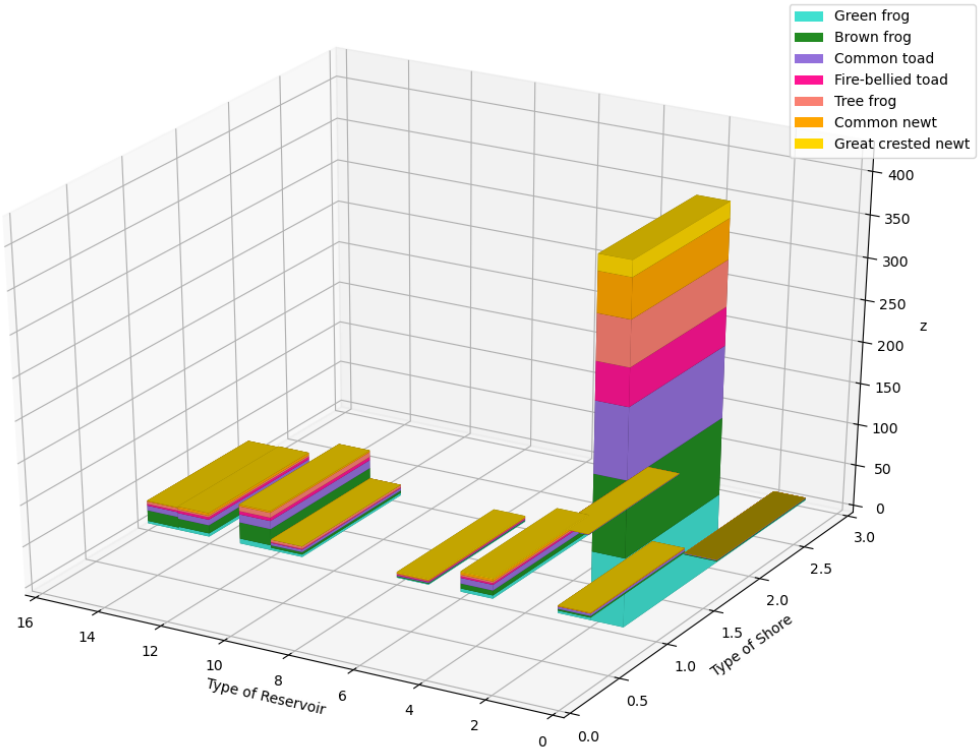

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
Type of Reservoir
Presence of Fishing

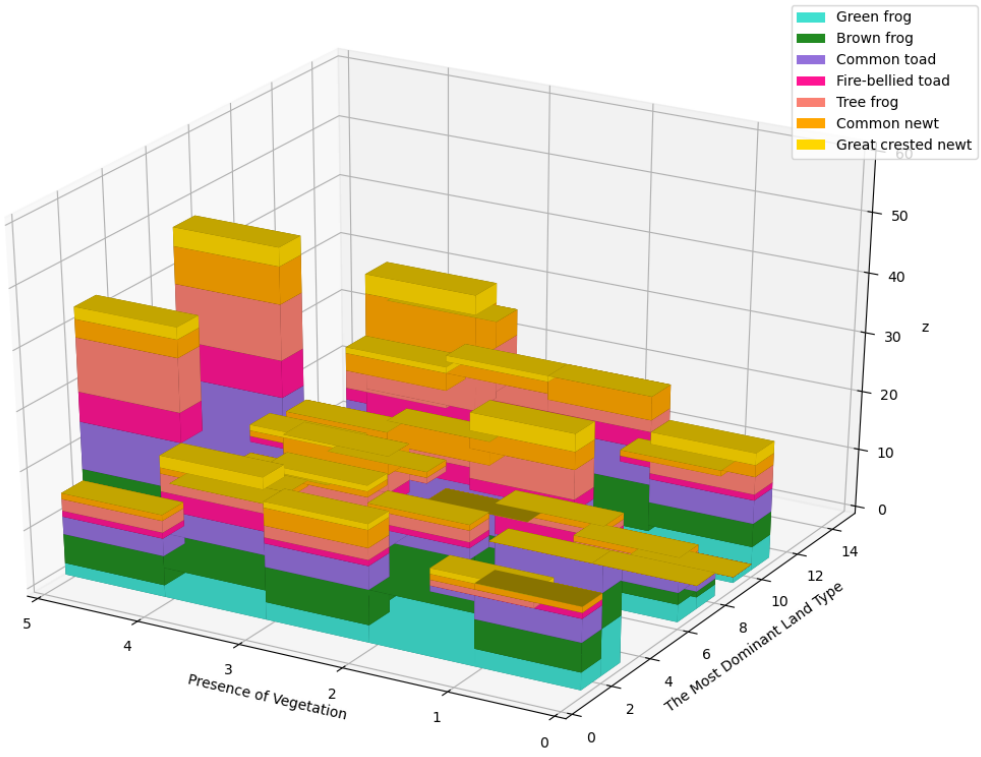

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
Type of Reservoir
Precentage Access to Undeveloped Area


Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
120
100
80
z
60
40
20
0
16
14
12
10
8
6
4
2
0
Type of Reservoir
0
2
4
6
8
10
Minimum Distance to Road


Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
Type of Reservoir
Minimum Distance to Building


Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
Type of Reservoir
Maintenance Status of Reservoir


Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
400
350
300
250
200
150
100
50
0
z
16
14
12
10
8
6
4
2
0
Type of Reservoir
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Type of Shore


Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
10
20
30
40
50
The Most Dominant Land Type
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Presence of Vegetation
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2
1
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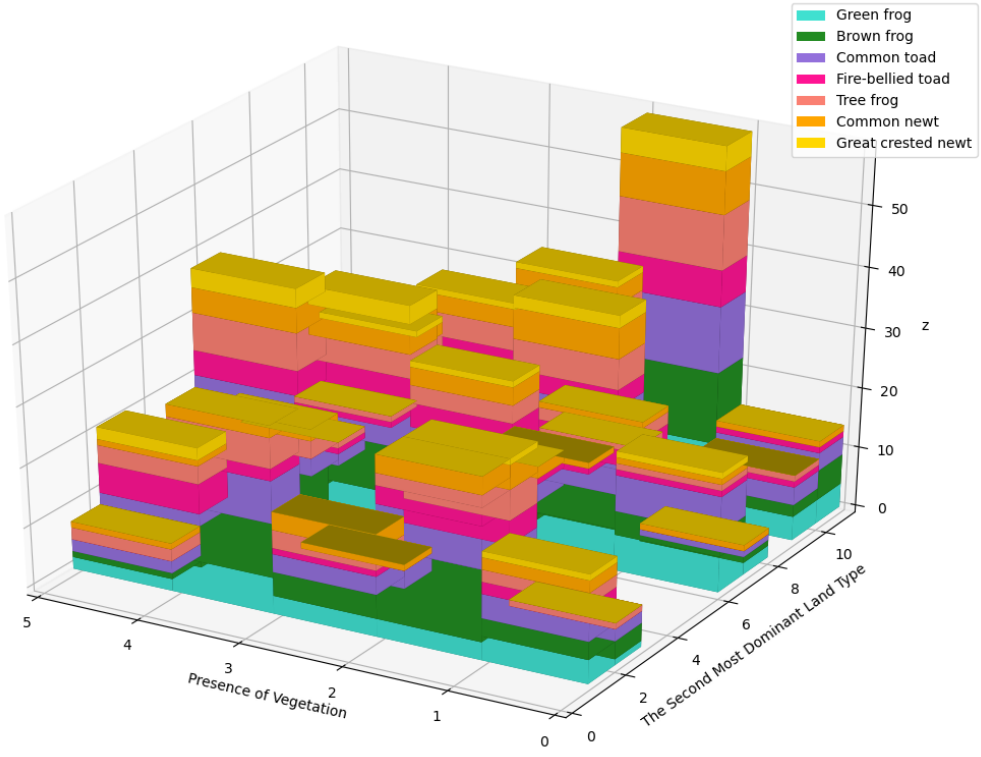
Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
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20
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The Second Most Dominant Land Type
0
2
4
6
8
10
Presence of Vegetation
5
4
3
2
1
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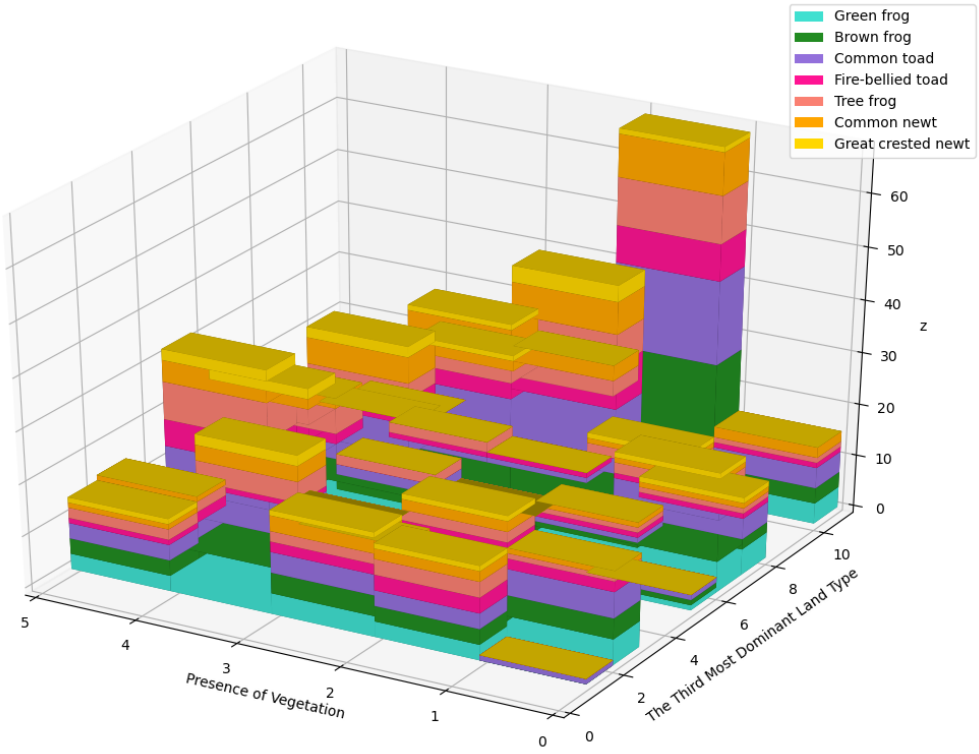
Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
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20
30
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Presence of Vegetation
5
4
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The Third Most Dominant Land Type
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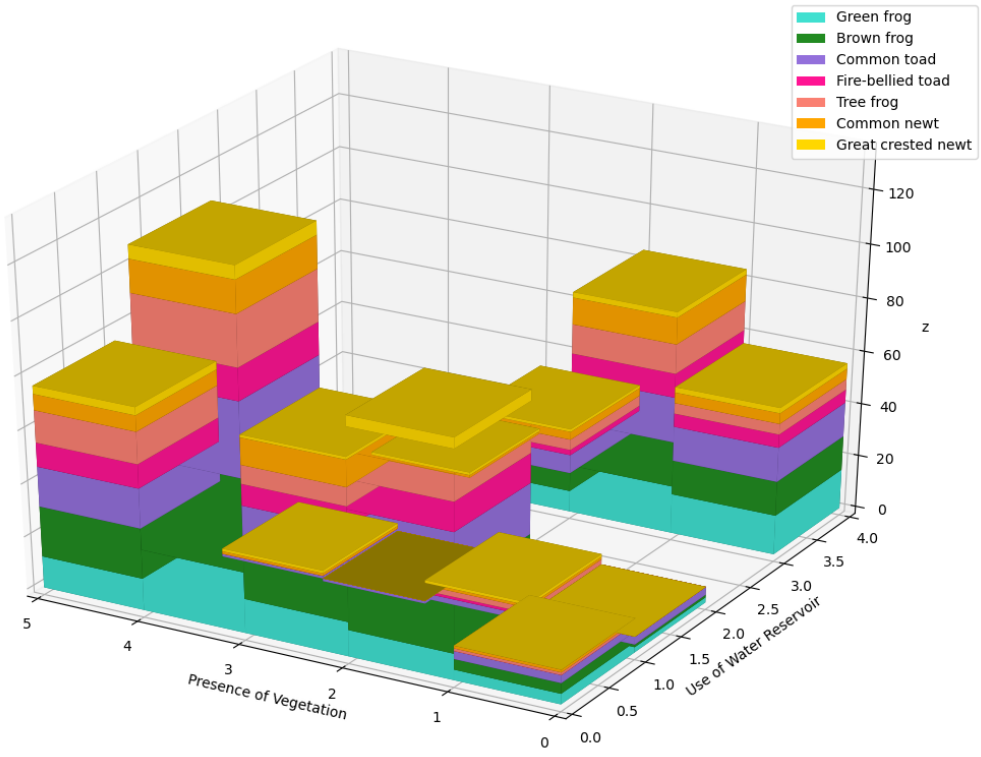
2
4
6
8
10


Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
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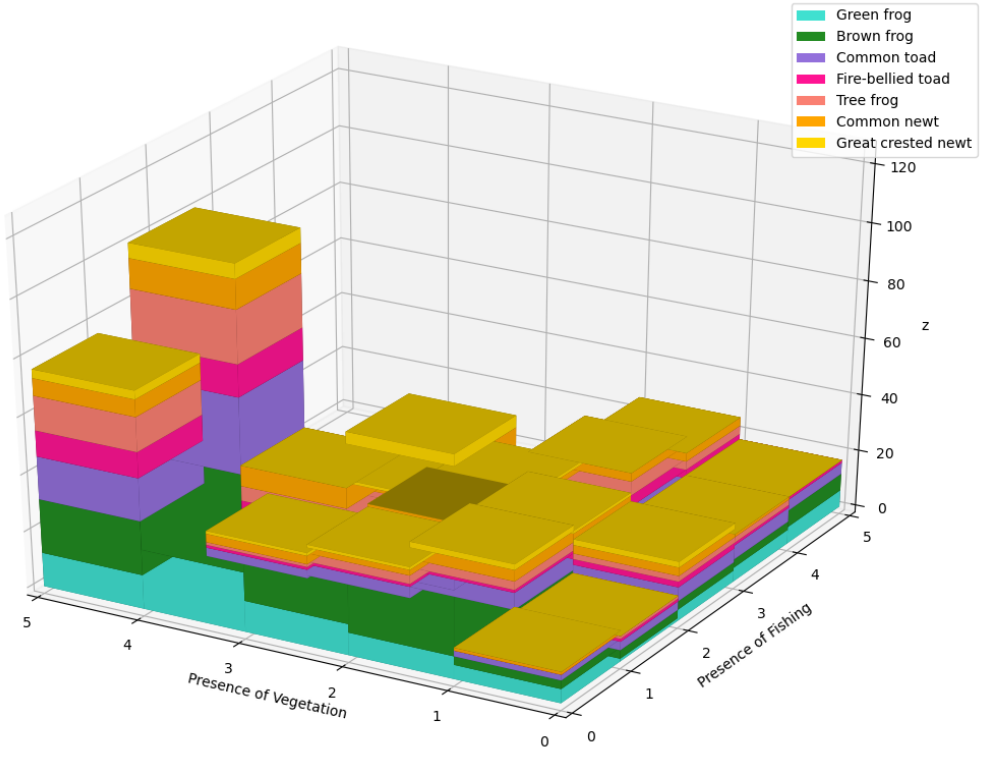
20
40
60
80
100
120
Presence of Vegetation
5
4
3
2
1
0
Use of Water Reservoir
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0


Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
20
40
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100
120
Presence of Vegetation
5
4
3
2
1
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Presence of Fishing
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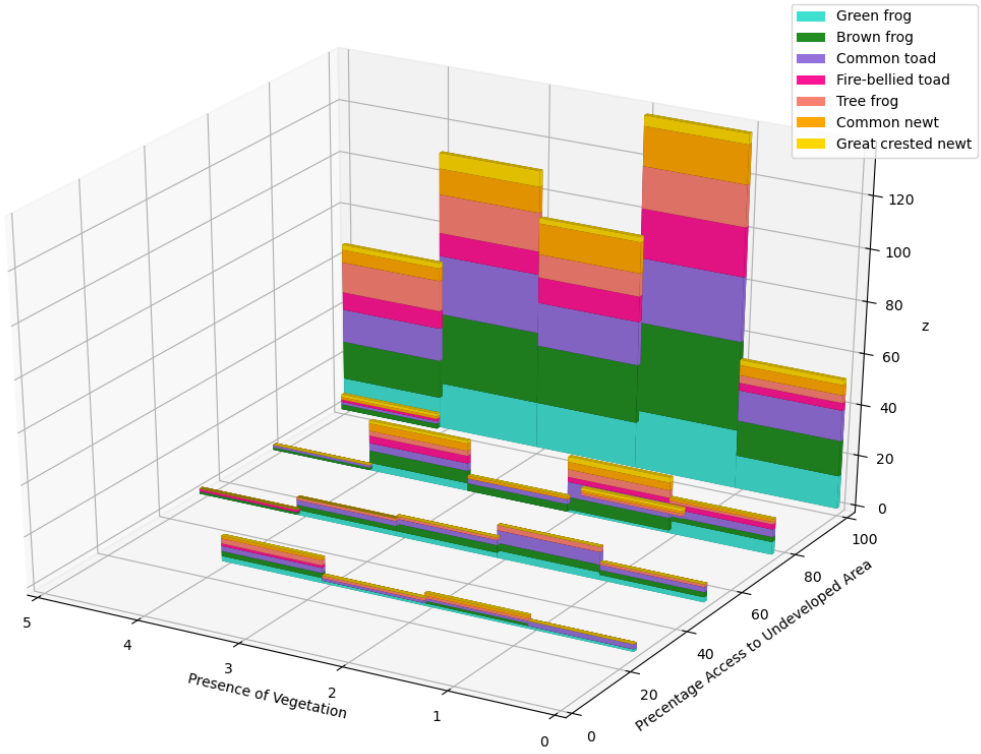
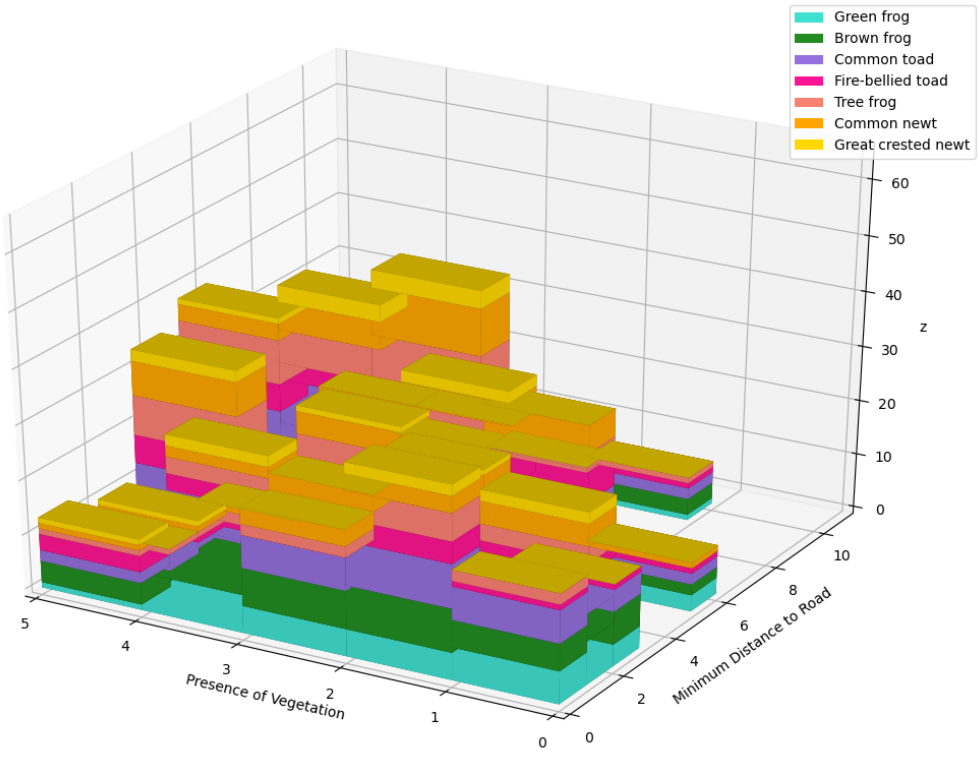
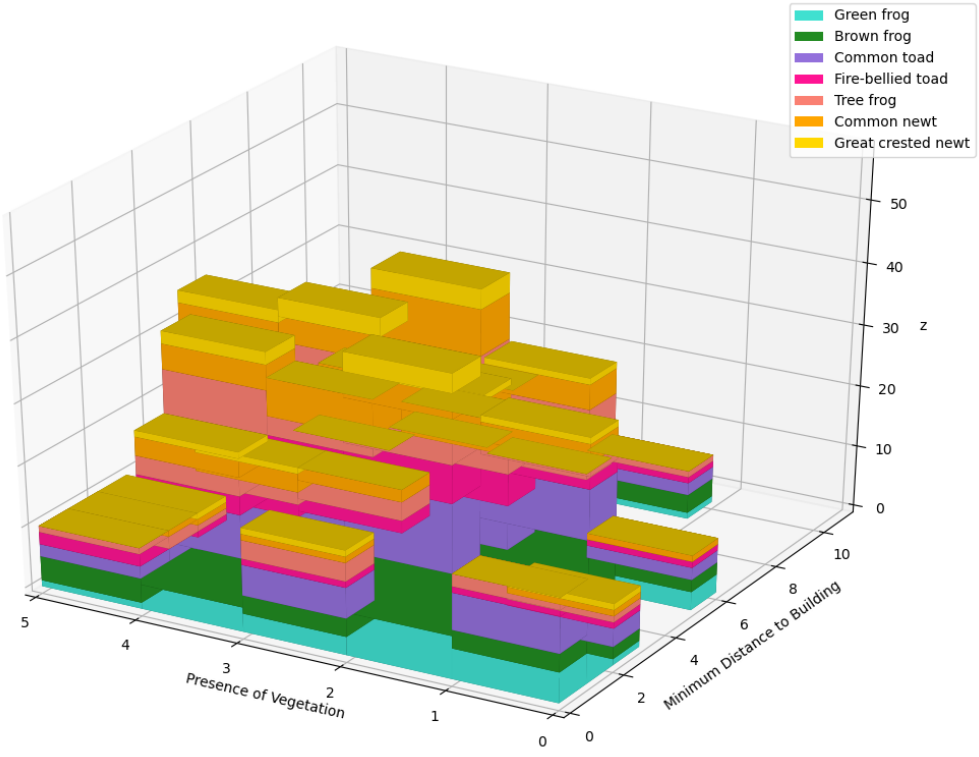
1
2
3
4
5


Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
20
40
60
80
100
120
Precentage Access to Undeveloped Area
0
20
40
60
80
100
Presence of Vegetation
5
4
3
2
1
0


Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
10
20
30
40
50
60
Presence of Vegetation
5
4
3
2
1
0
Minimum Distance to Road
0
2
4
6
8
10


Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
10
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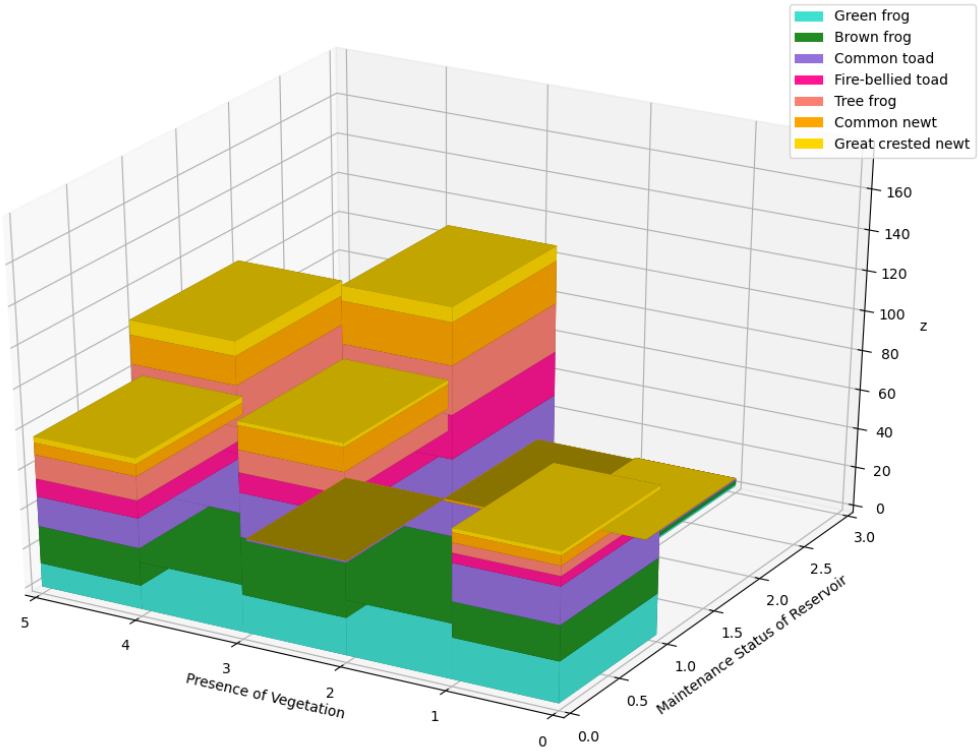
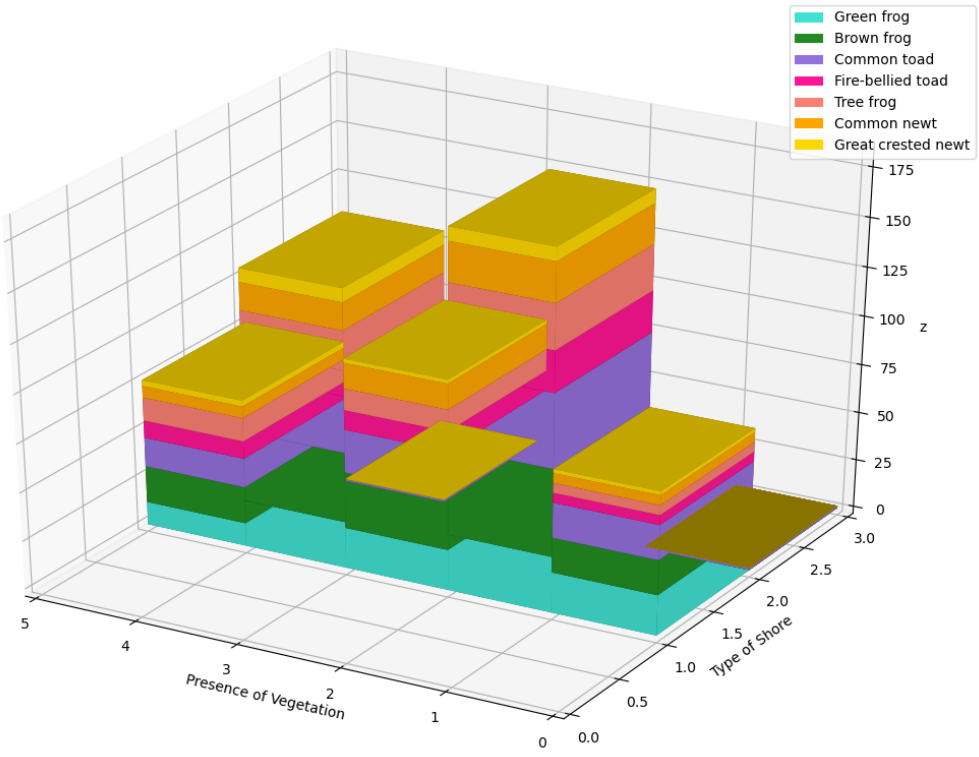
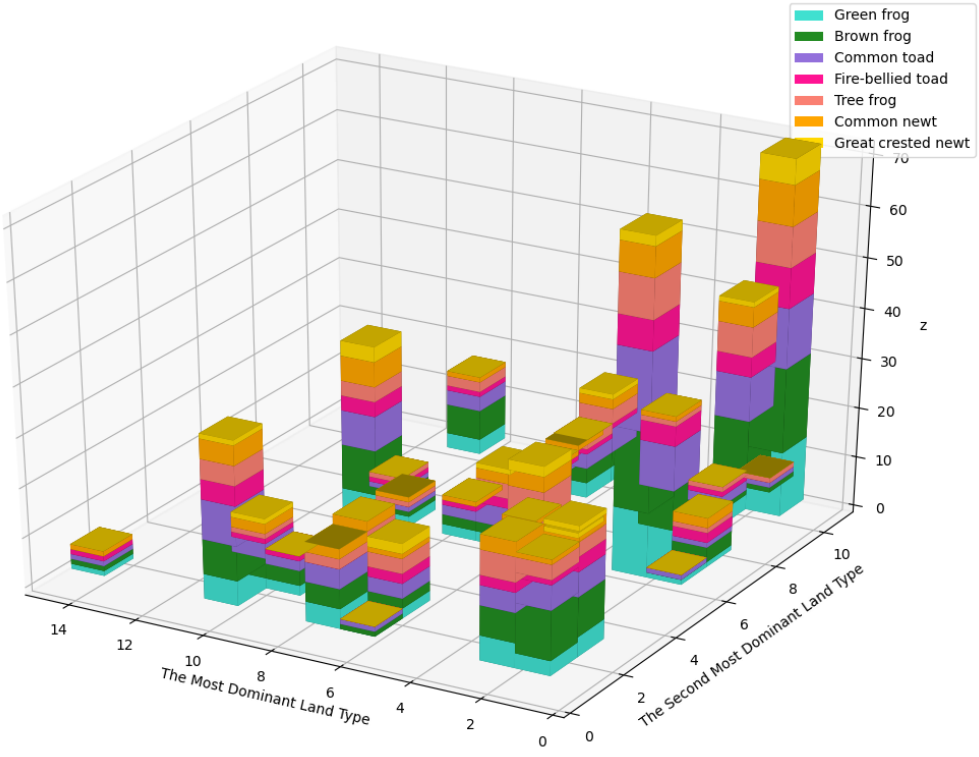
30
40
50
Presence of Vegetation
5
4
3
2
1
0
Minimum Distance to Building
0
2
4
6
8
10


Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
160
140
120
100
z
80
60
40
20
0
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Maintenance Status of Reservoir
5
4
3
2
1
0
Presence of Vegetation


Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
175
150
125
100
z
75
50
25
0
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Type of Shore
5
4
3
2
1
0
Presence of Vegetation


Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
60
50
40
z
30
20
10
0
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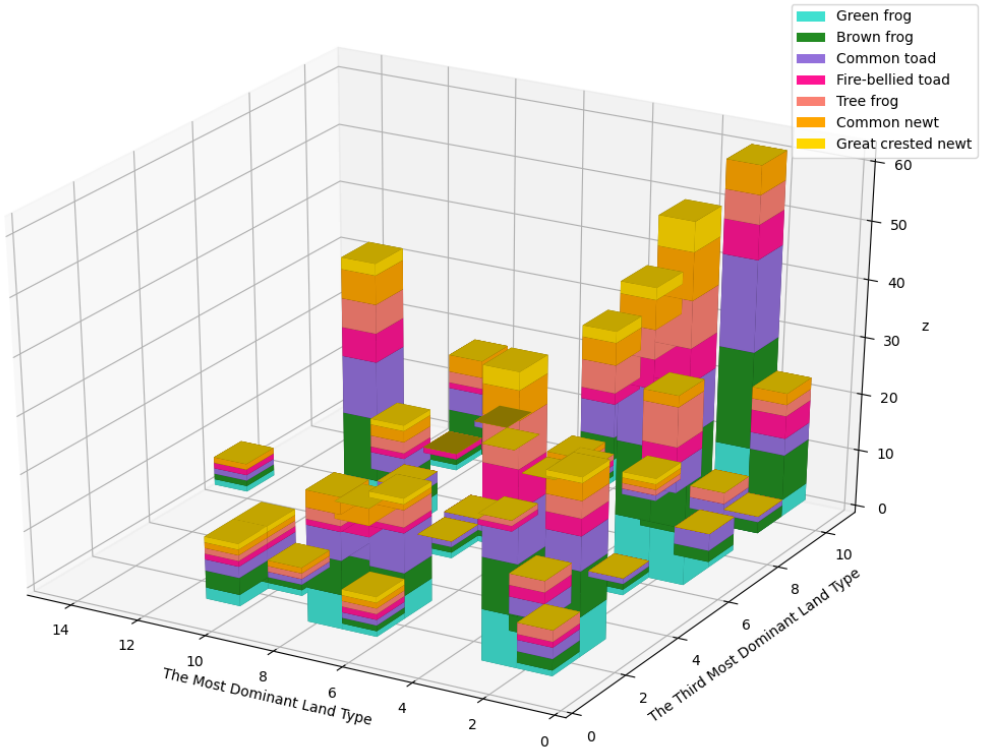
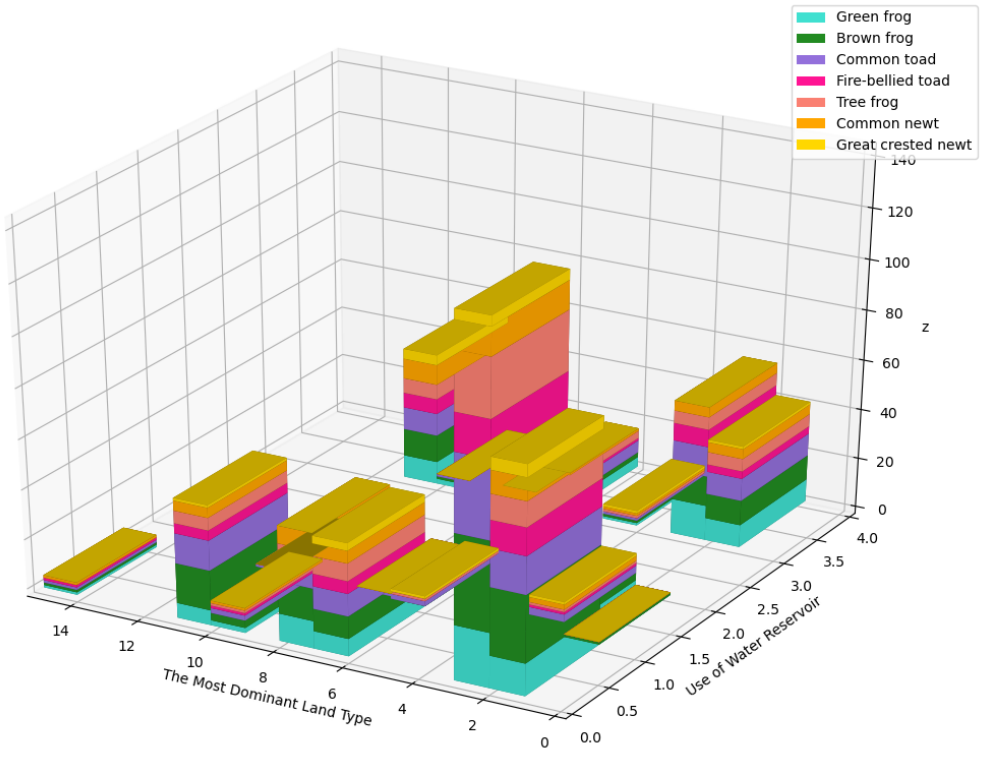
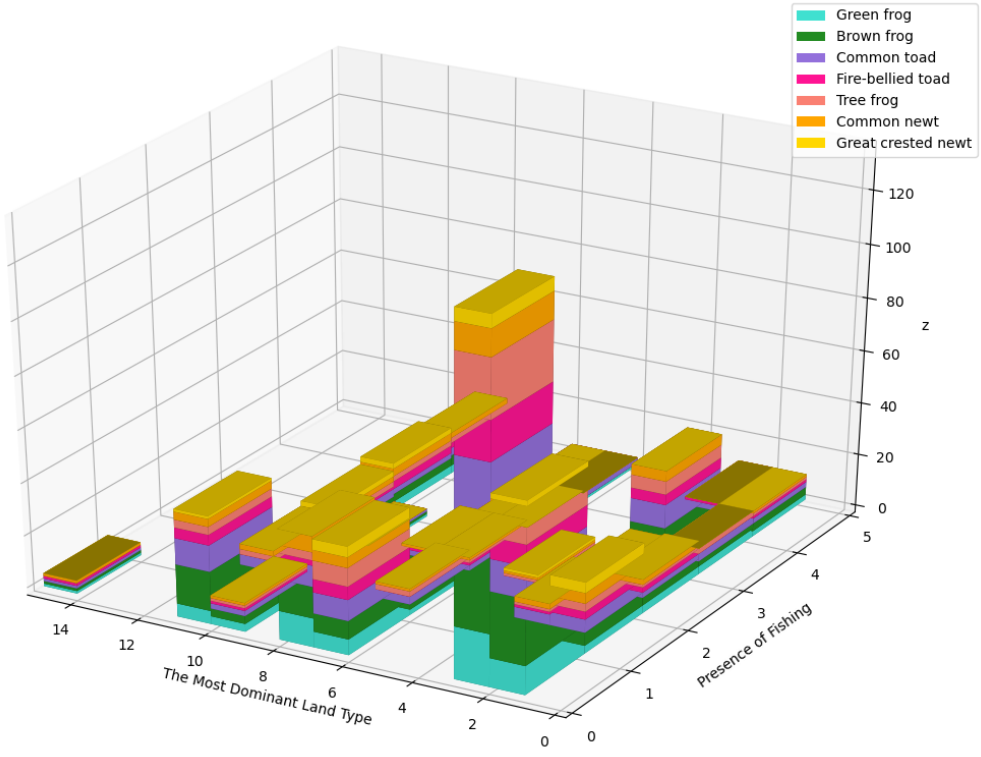
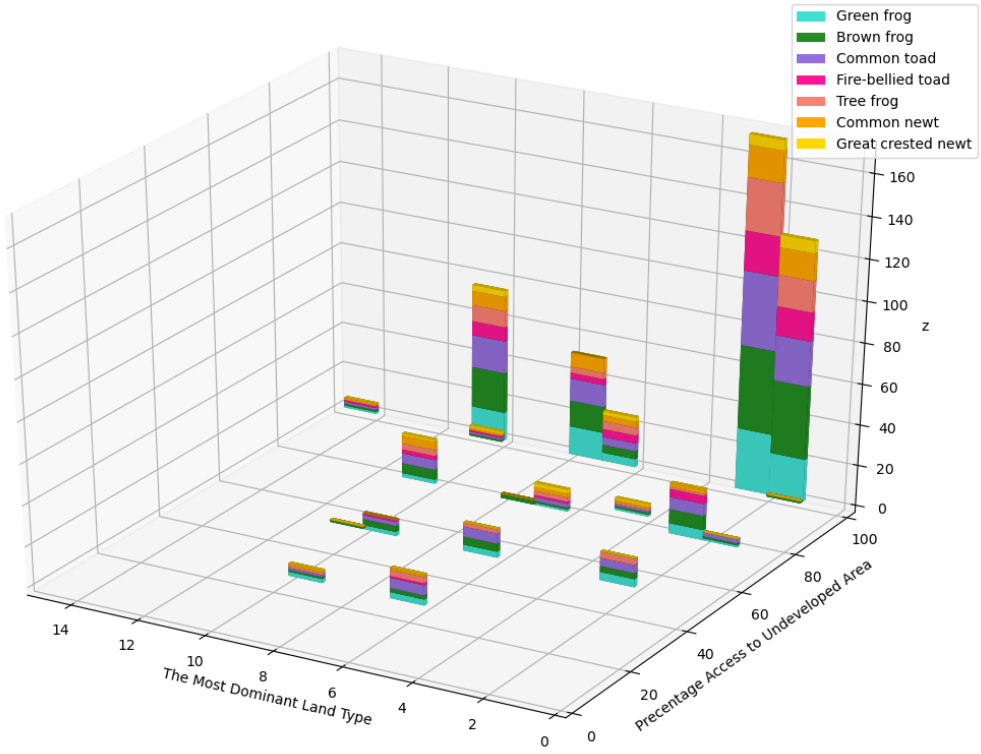
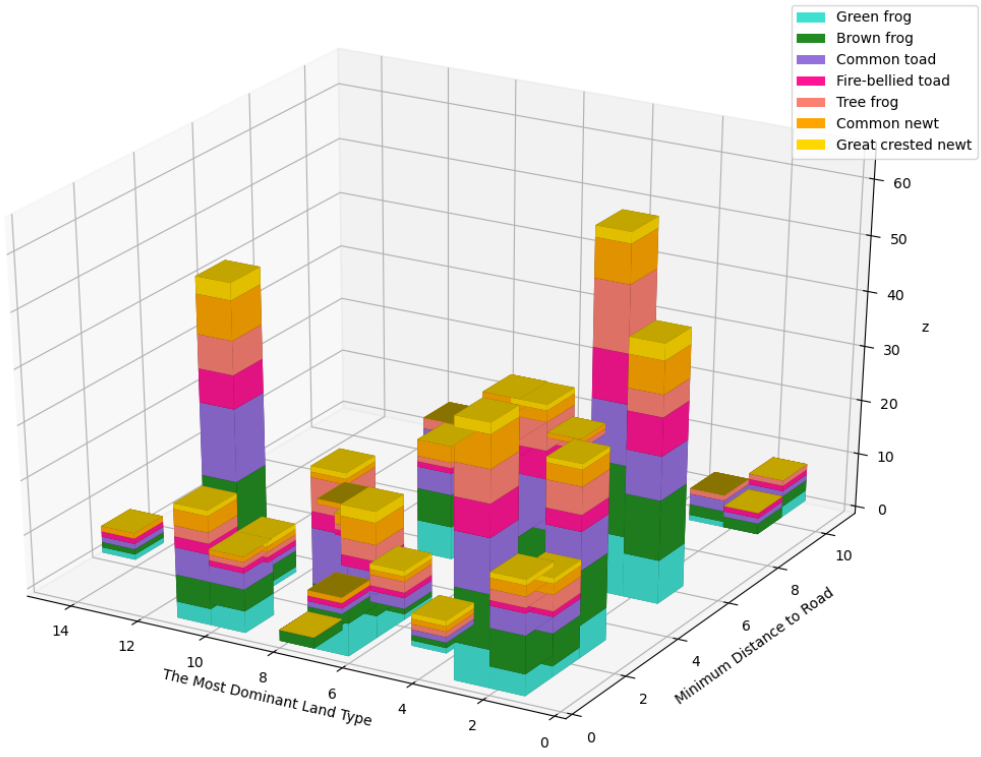
8
6
4
2
0
The Second Most Dominant Land Type
14
12
10
8
6
4
2
0
The Most Dominant Land Type

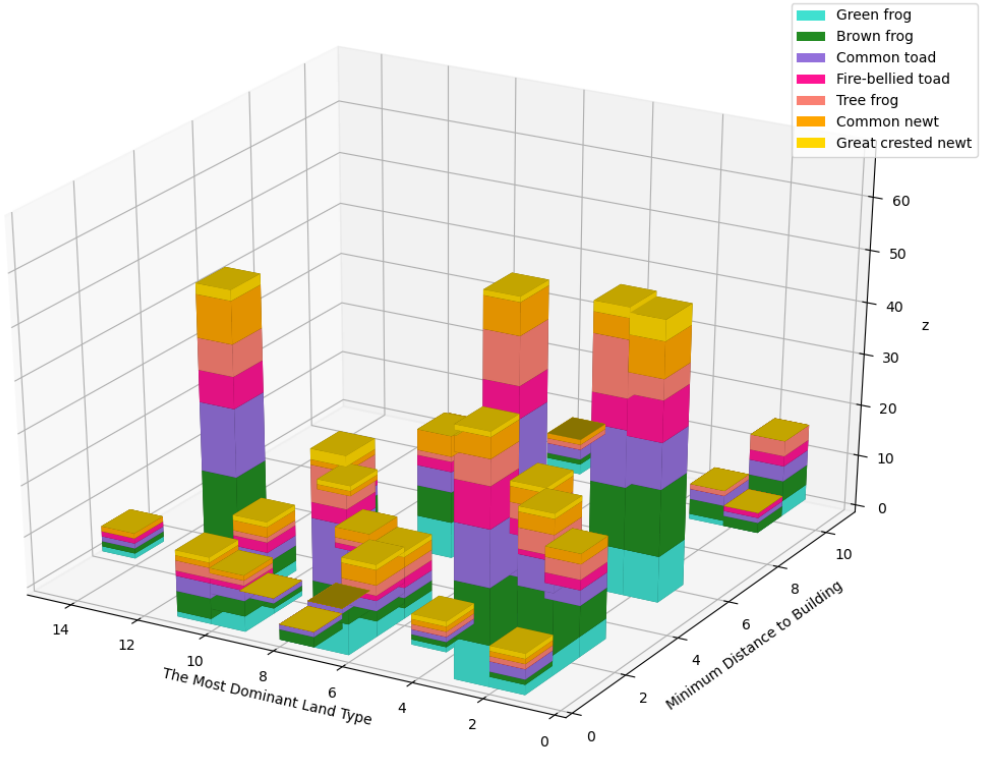

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
10
20
30
40
50
60
The Most Dominant Land Type
14
12
10
8
6
4
2
0
The Third Most Dominant Land Type
0
2
4
6
8
10

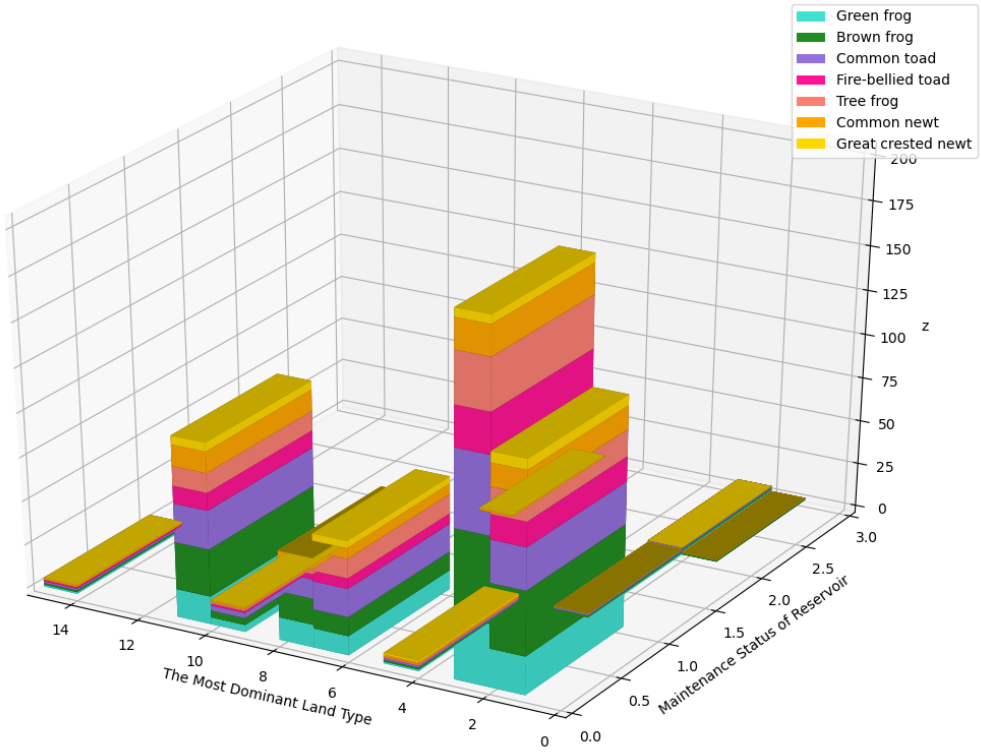

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
The Most Dominant Land Type
Use of Water Reservoir

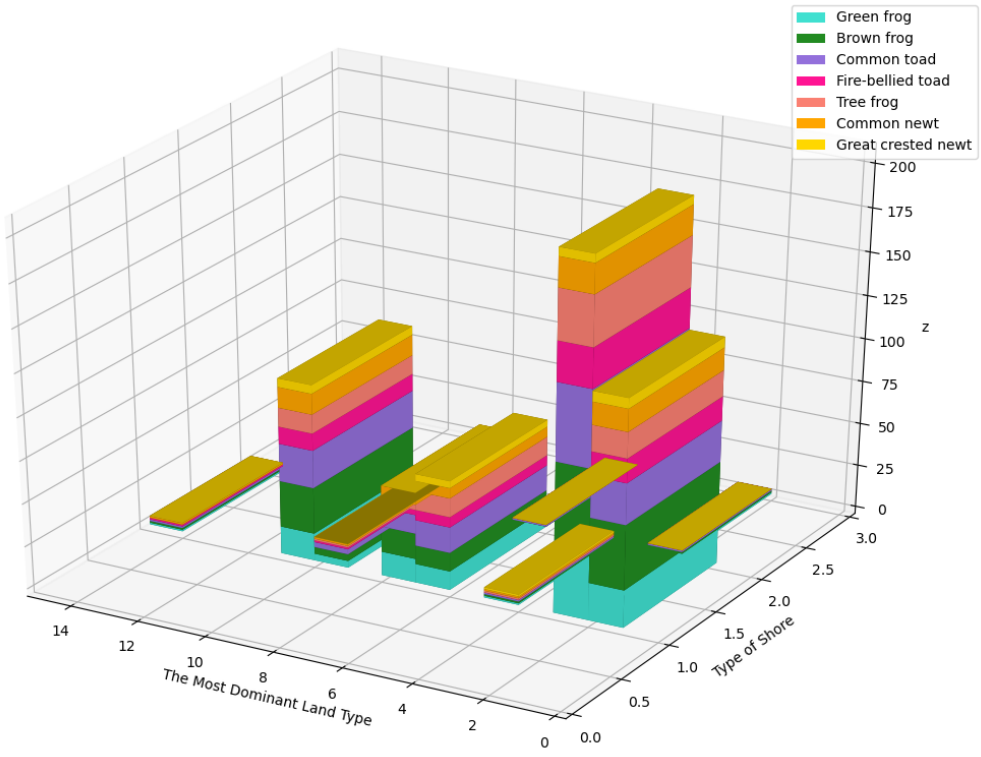

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
The Most Dominant Land Type
Presence of Fishing

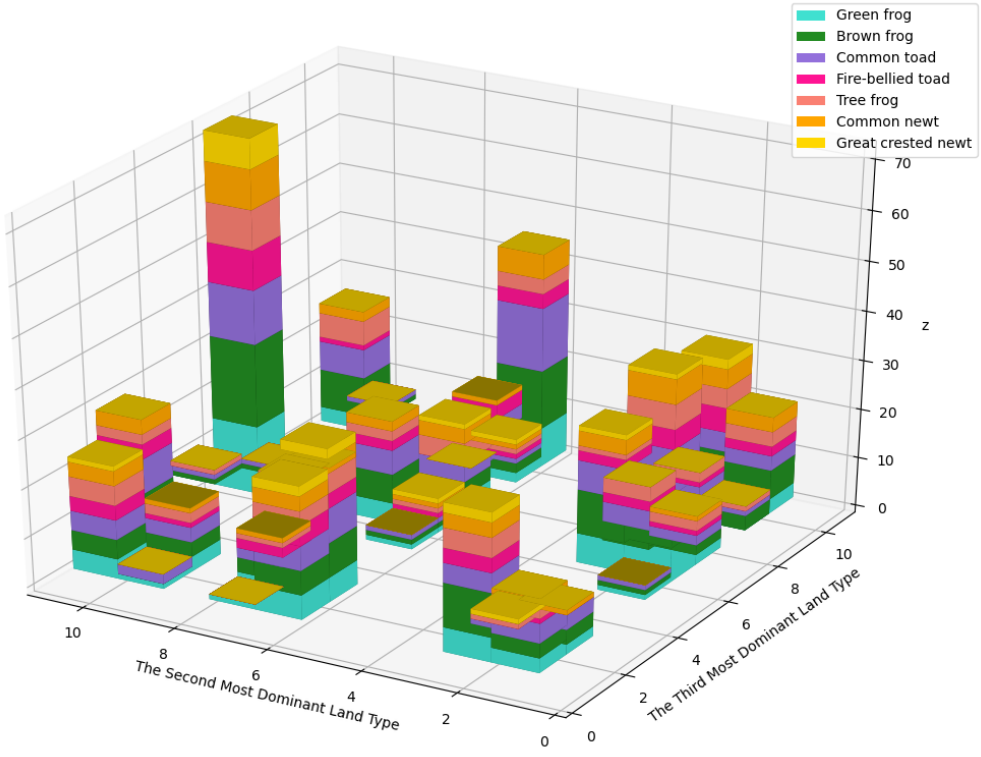

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
20
40
60
80
100
120
140
160
The Most Dominant Land Type
14
12
10
8
6
4
2
0
Precentage Access to Undeveloped Area
0
20
40
60
80
100

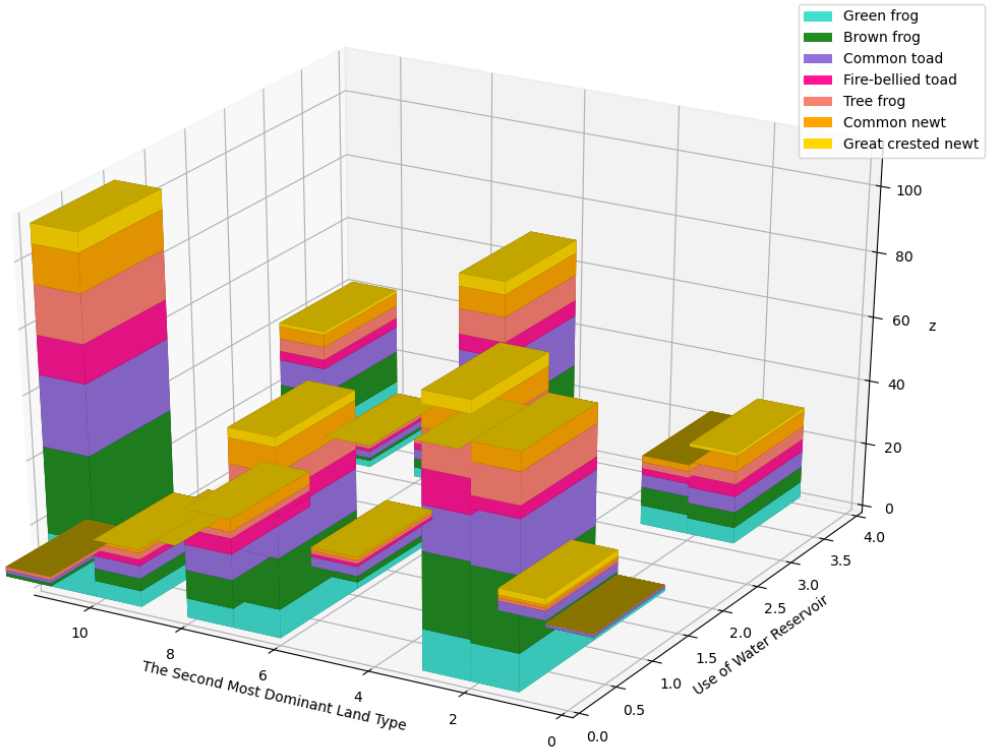

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
10
20
30
40
50
60
The Most Dominant Land Type
14
12
10
8
6
4
2
0
Minimum Distance to Road
0
2
4
6
8
10


Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
10
20
30
40
50
60
The Most Dominant Land Type
14
12
10
8
6
4
2
0
Minimum Distance to Building
0
2
4
6
8
10


Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
25
50
75
100
125
150
175
200
The Most Dominant Land Type
14
12
10
8
6
4
2
0
Maintenance Status of Reservoir
0.0
0.5
1.0
1.5
2.0
2.5
3.0


Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
200
175
150
125
100
75
50
25
0
14
12
10
8
6
4
2
0
The Most Dominant Land Type
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Type of Shore


Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
70
60
50
40
30
20
10
0
10
8
6
4
2
0
The Second Most Dominant Land Type
0
2
4
6
8
10
The Third Most Dominant Land Type


Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
100
80
60
40
20
0
10
8
6
4
2
0
The Second Most Dominant Land Type
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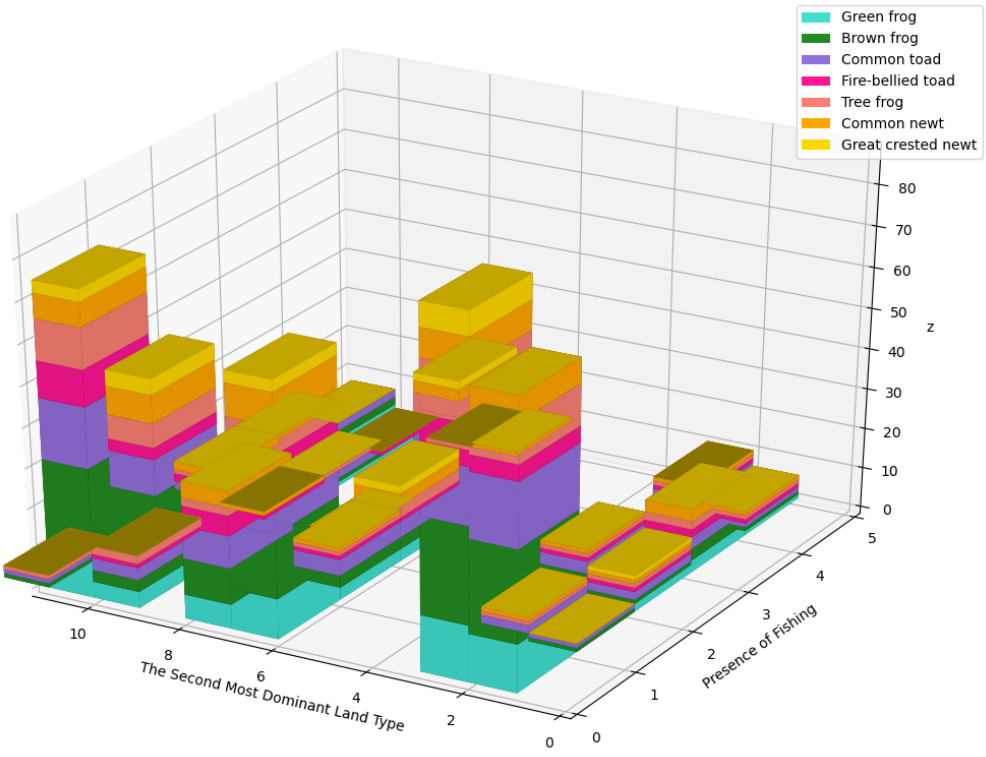
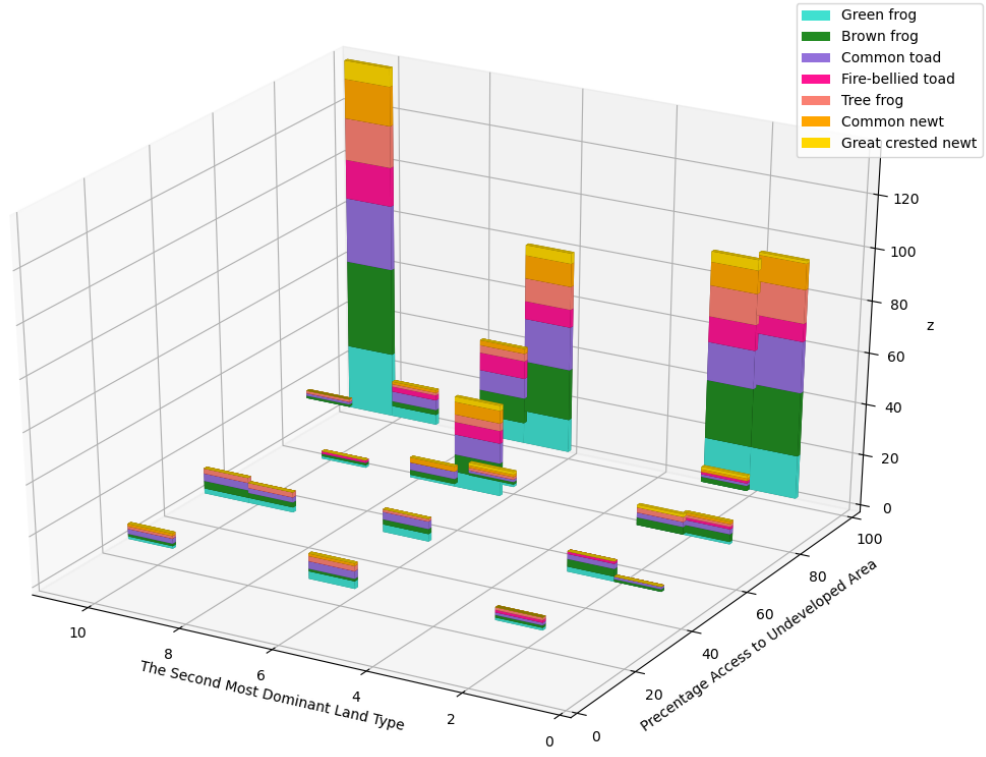
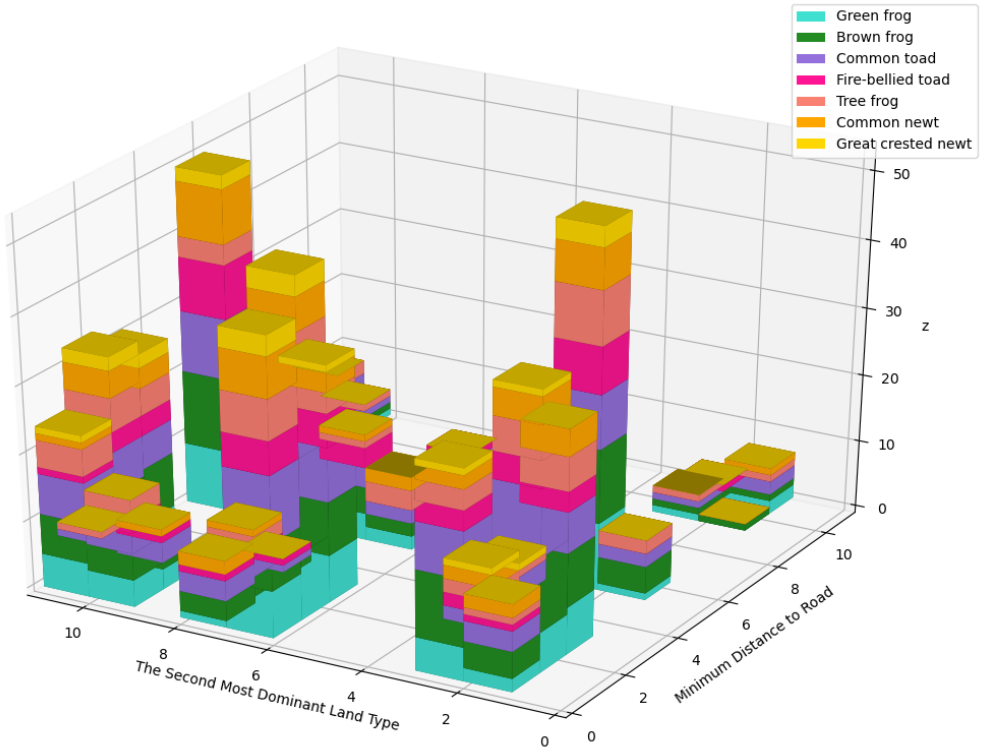
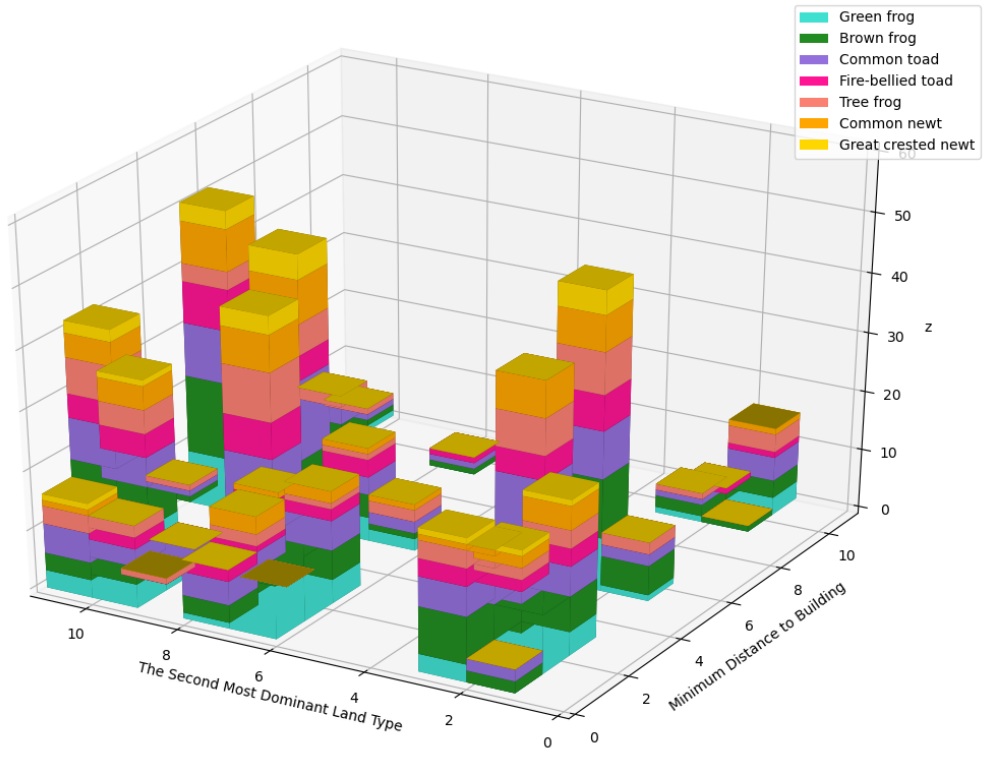
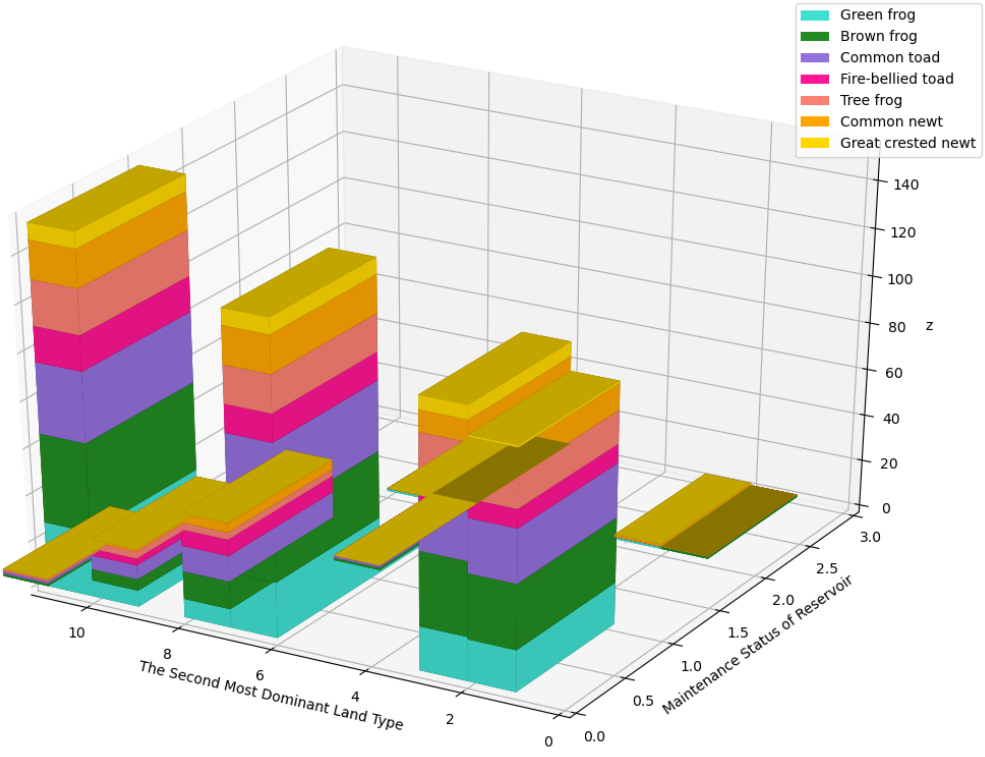
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
Use of Water Reservoir

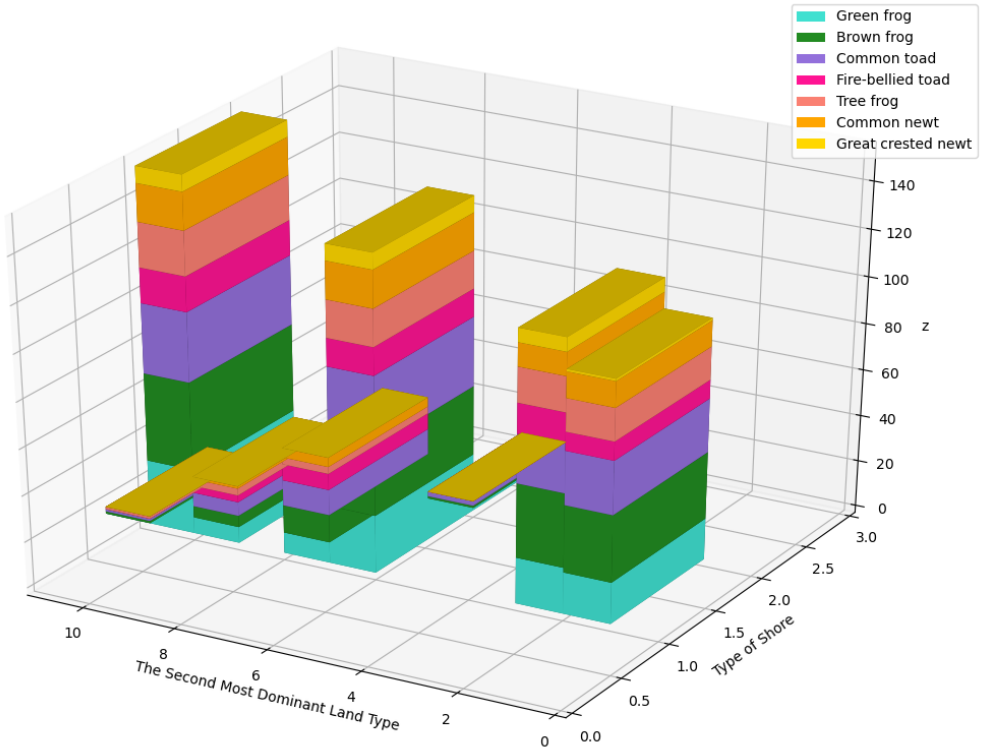

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
10
20
30
40
50
60
70
80
The Second Most Dominant Land Type
0
2
4
6
8
10
Presence of Fishing
0
1
2
3
4
5

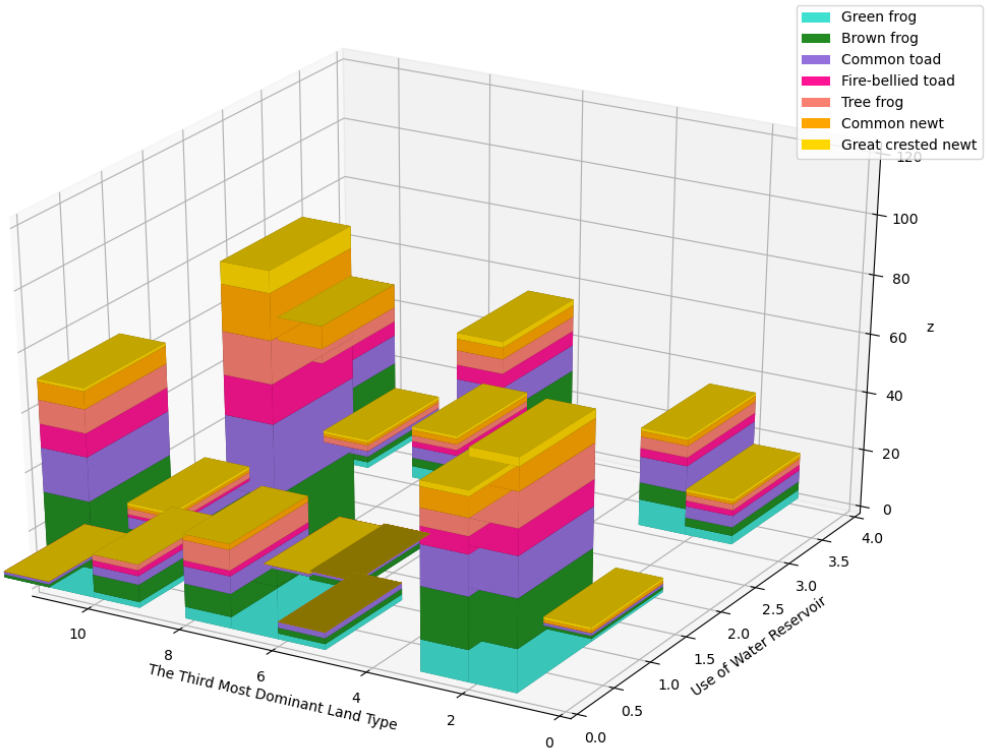

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
20
40
60
80
100
120
The Second Most Dominant Land Type
0
2
4
6
8
10
Precentage Access to Undeveloped Area
0
20
40
60
80
100

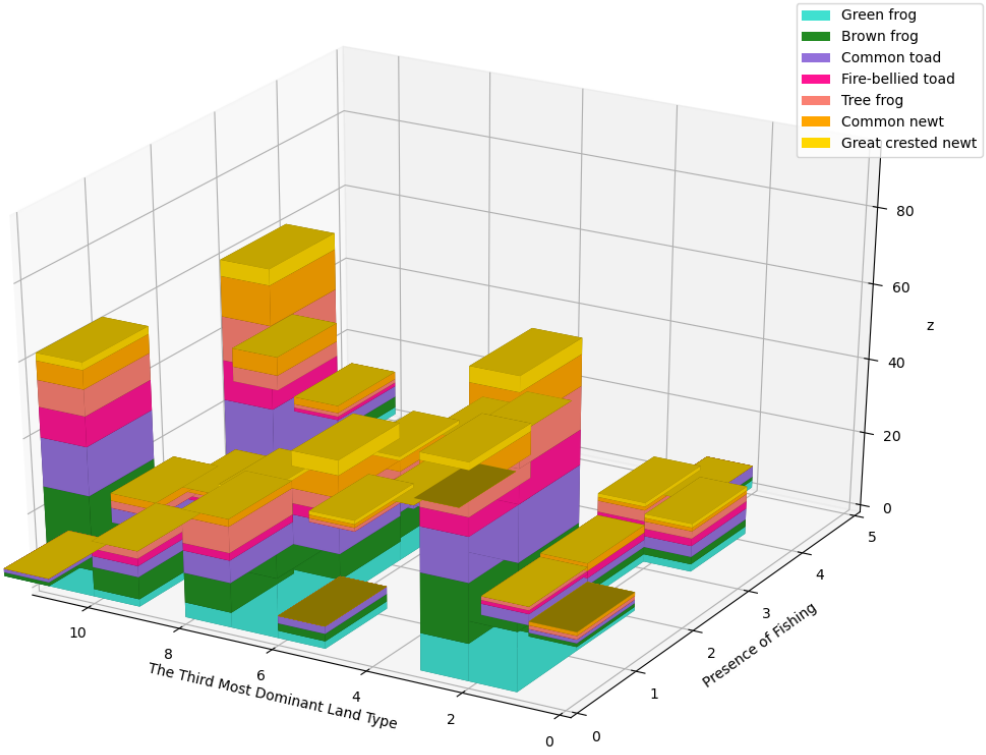

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
50
40
30
z
20
10
0
10
8
6
4
2
0
The Second Most Dominant Land Type
0
2
4
6
8
10
Minimum Distance to Road

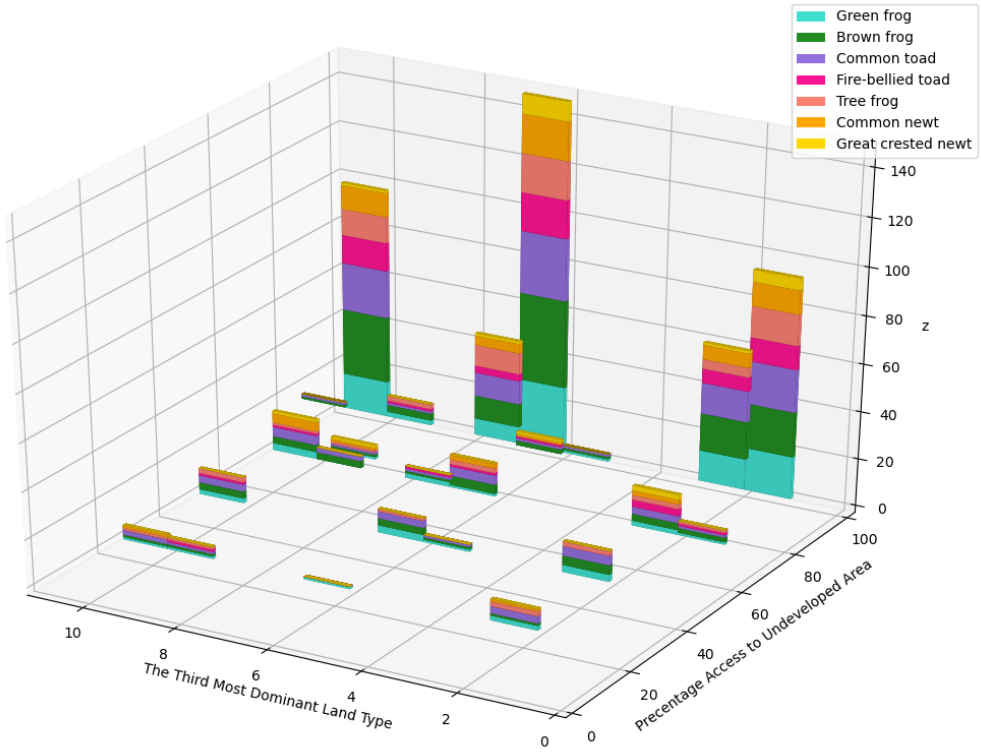

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
10
20
30
40
50
Minimum Distance to Building
0
2
4
6
8
10
The Second Most Dominant Land Type
0
2
4
6
8
10

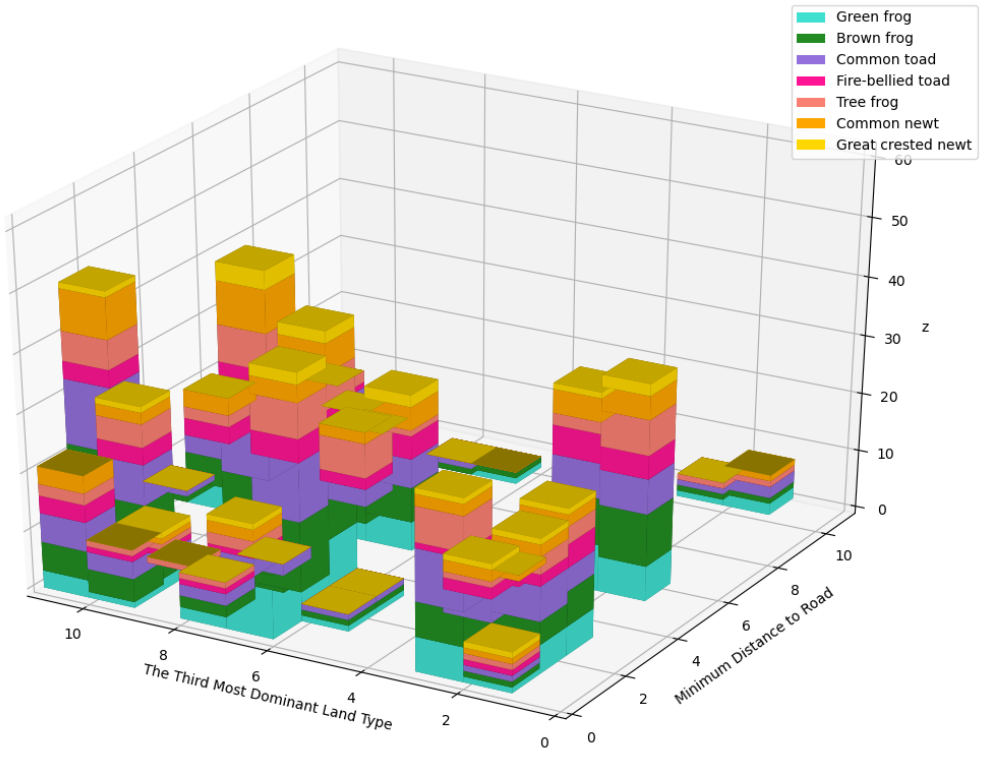

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
20
40
60
80
100
120
140
Maintenance Status of Reservoir
0.0
0.5
1.0
1.5
2.0
2.5
3.0
The Second Most Dominant Land Type
0
2
4
6
8
10

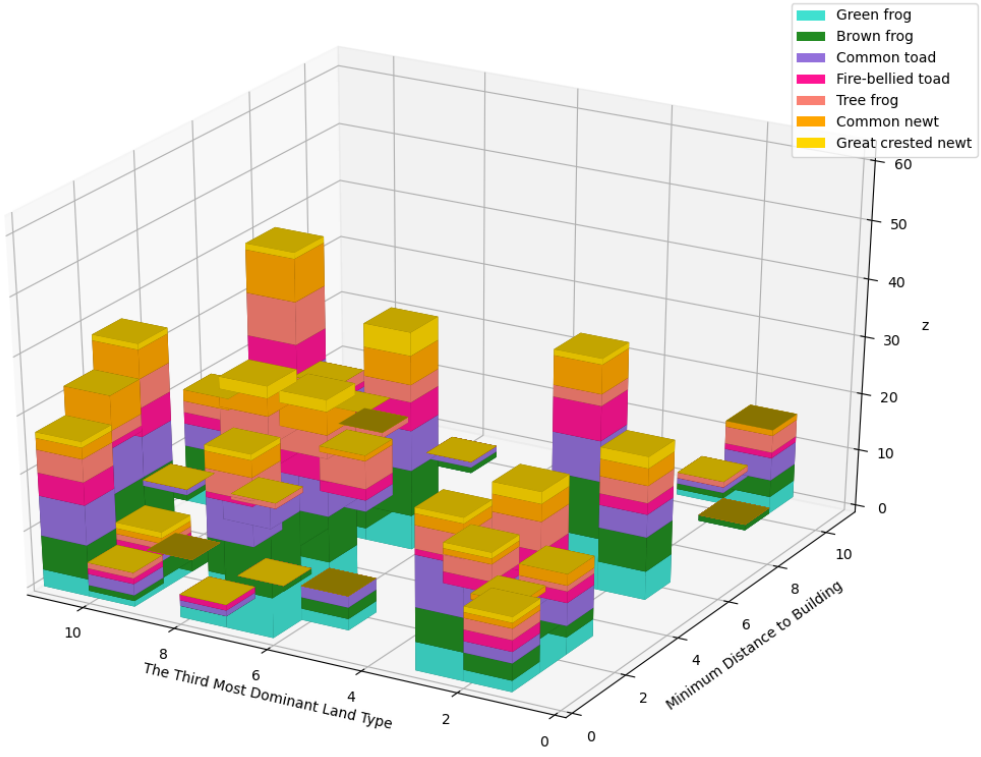

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
140
120
100
80
z
60
40
20
0
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Type of Shore
10
8
6
4
2
0
The Second Most Dominant Land Type


Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
20
40
60
80
100
The Third Most Dominant Land Type
10
8
6
4
2
0
Use of Water Reservoir
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0


Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
20
40
60
80
The Third Most Dominant Land Type
10
8
6
4
2
0
Presence of Fishing
0
1
2
3
4
5


Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
140
120
100
80
60
40
20
0
z
10
8
6
4
2
0
The Third Most Dominant Land Type
0
20
40
60
80
100
Precentage Access to Undeveloped Area


Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
10
20
30
40
50
60
The Third Most Dominant Land Type
0
2
4
6
8
10
Minimum Distance to Road


Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
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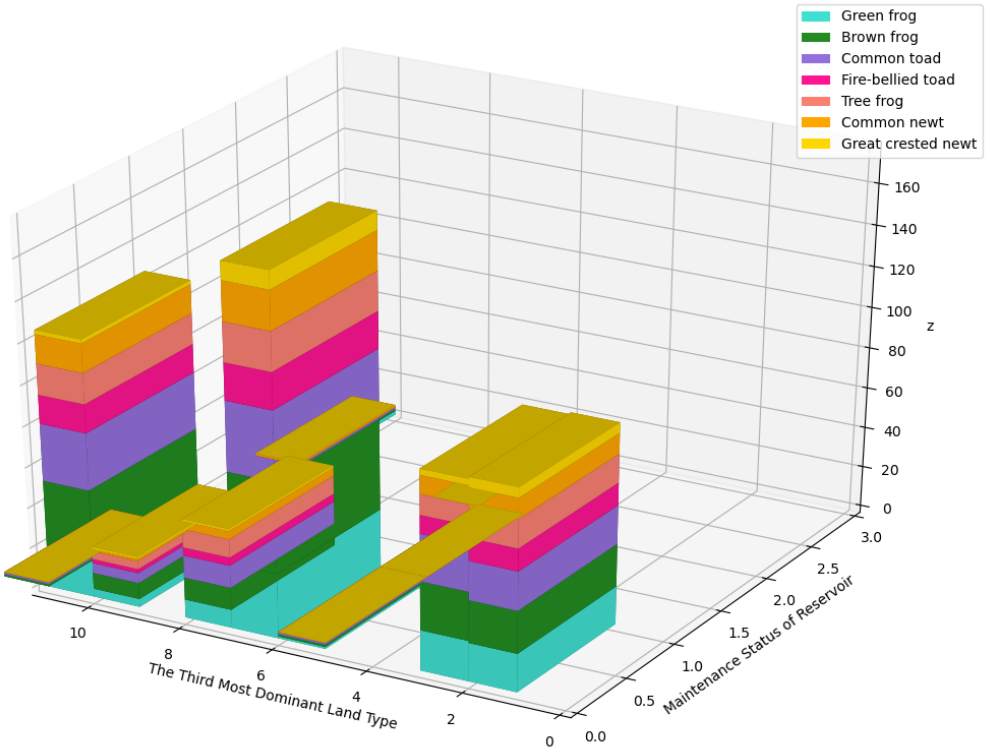
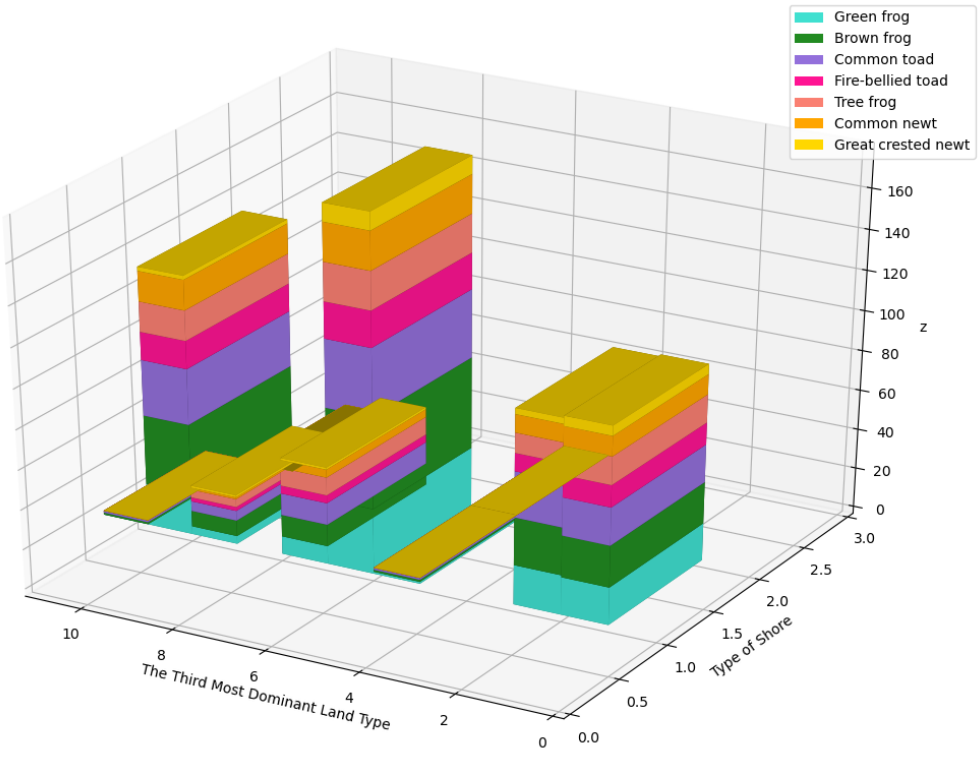
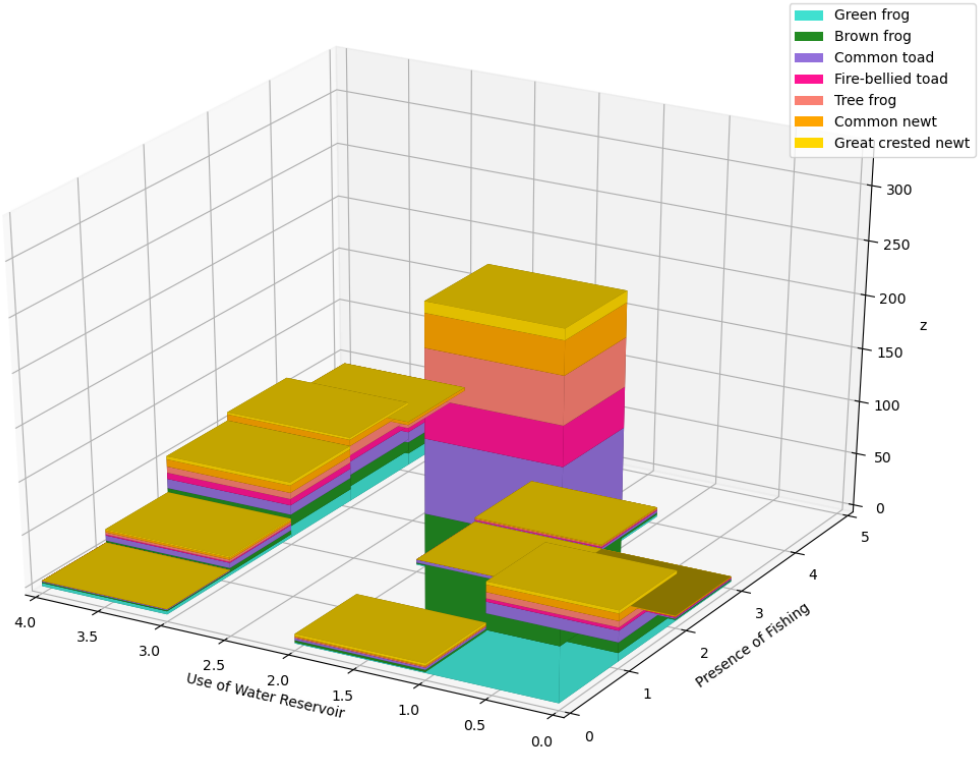
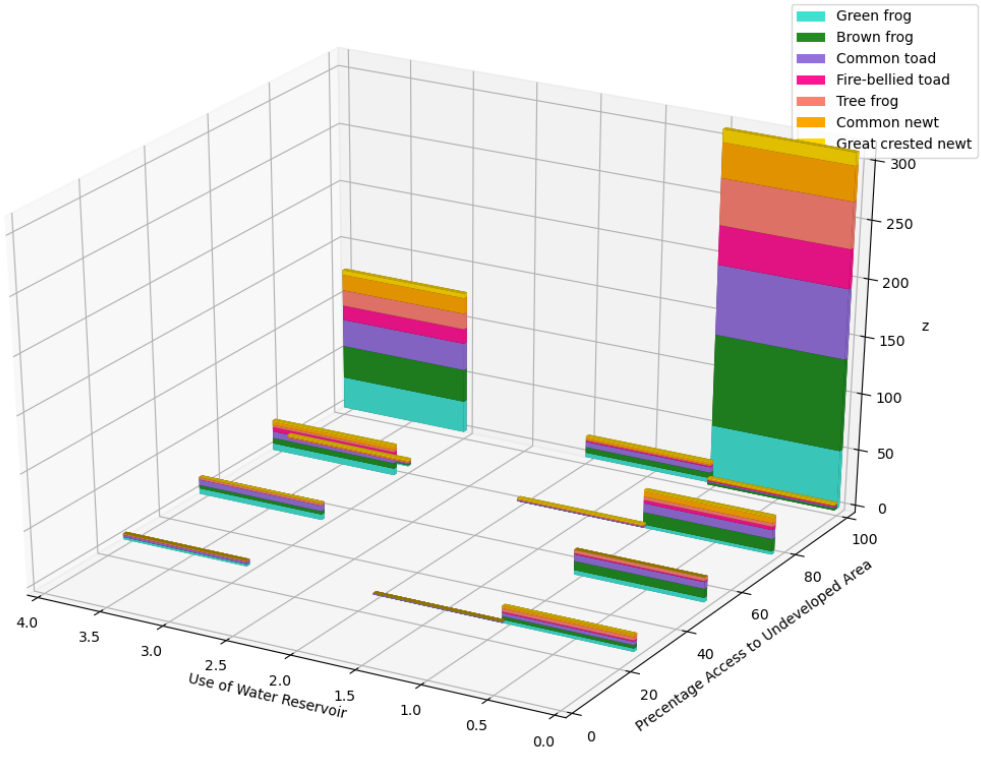
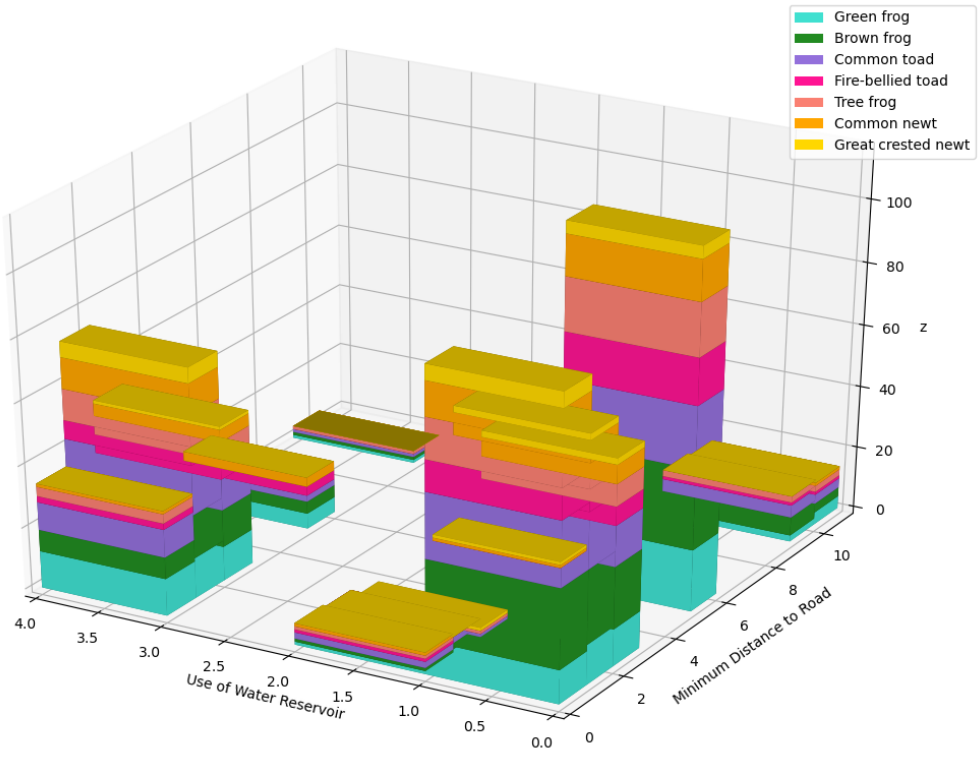
20
30
40
50
60
The Third Most Dominant Land Type
0
2
4
6
8
10
Minimum Distance to Building

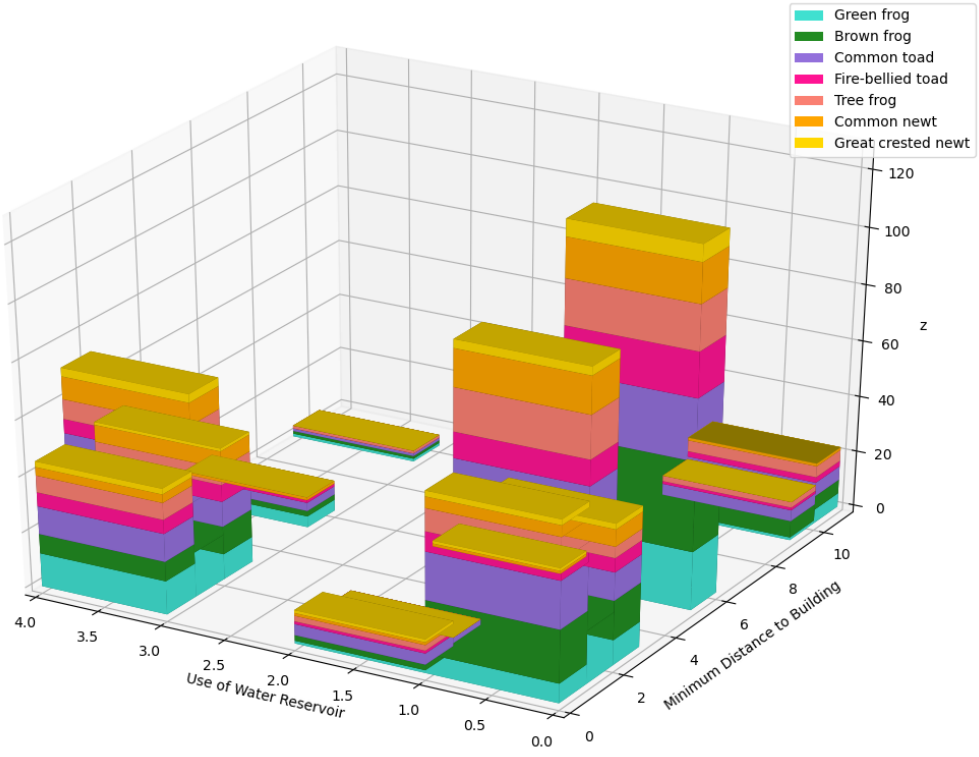

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
160
140
120
100
z
80
60
40
20
0
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Maintenance Status of Reservoir
10
8
6
4
2
0
The Third Most Dominant Land Type

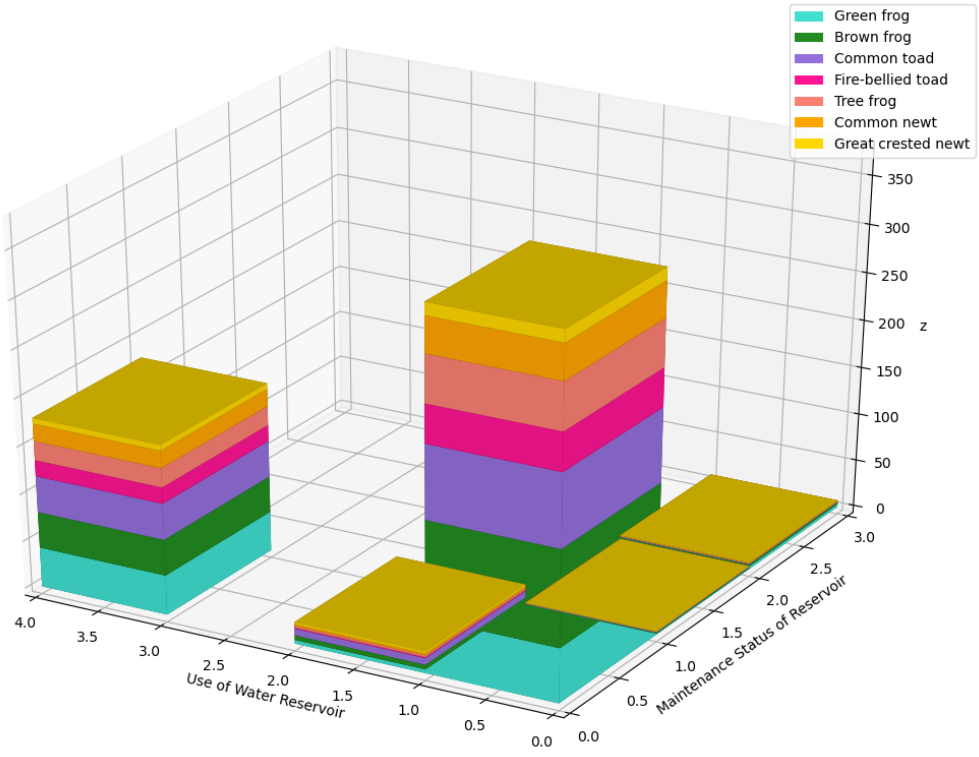

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
160
140
120
100
80
60
40
20
0
10
8
6
4
2
0
The Third Most Dominant Land Type
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Type of Shore

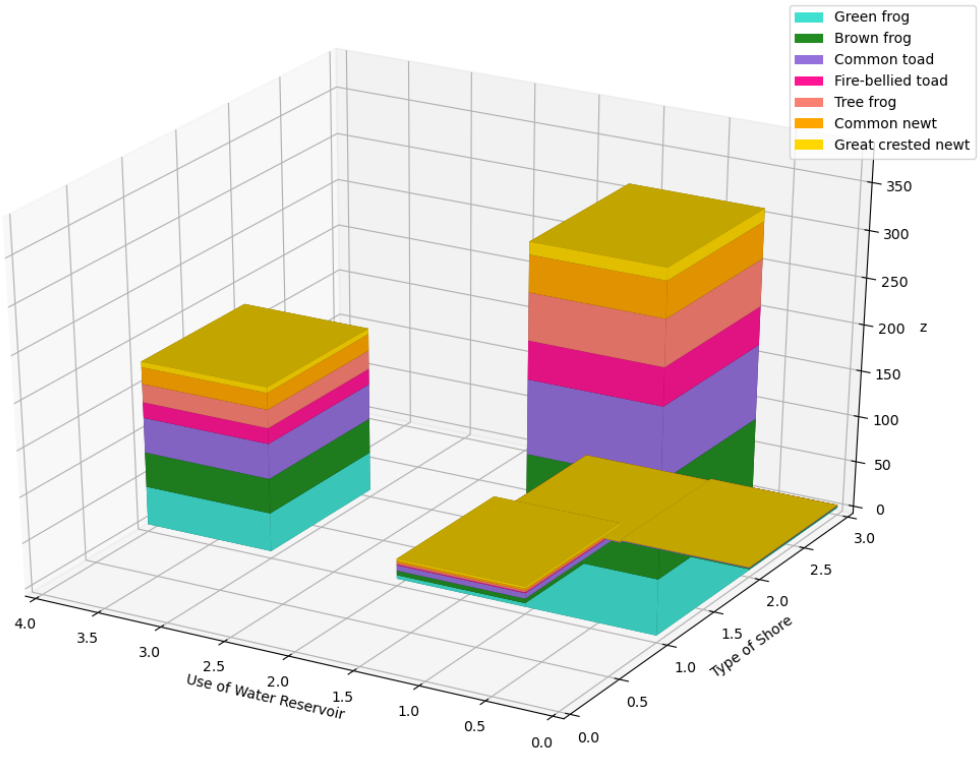

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
300
250
200
150
100
50
0
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Use of Water Reservoir
0
1
2
3
4
5
Presence of Fishing

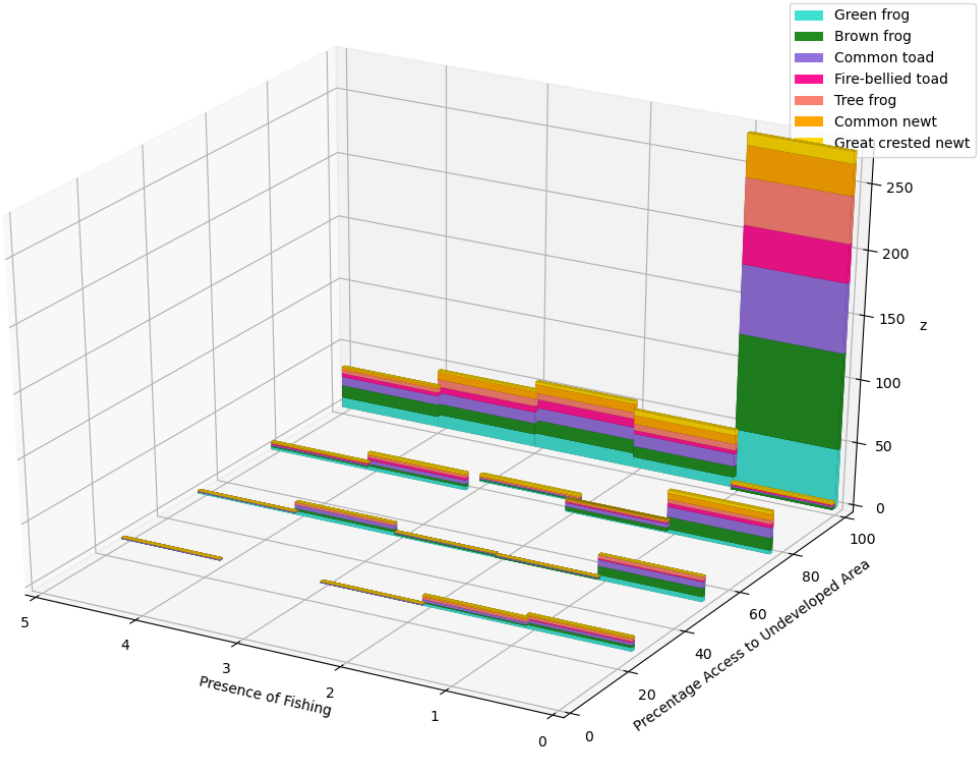

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
300
250
200
150
100
50
0
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Use of Water Reservoir
0
20
40
60
80
100
Precentage Access to Undeveloped Area

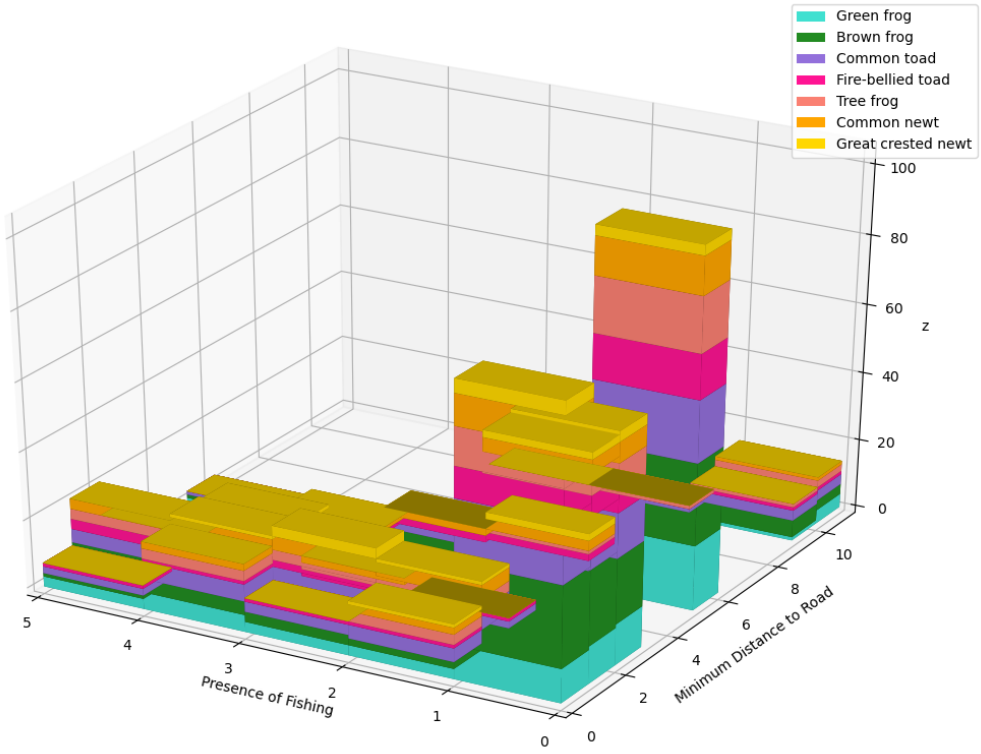

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
Use of Water Reservoir
Minimum Distance to Road

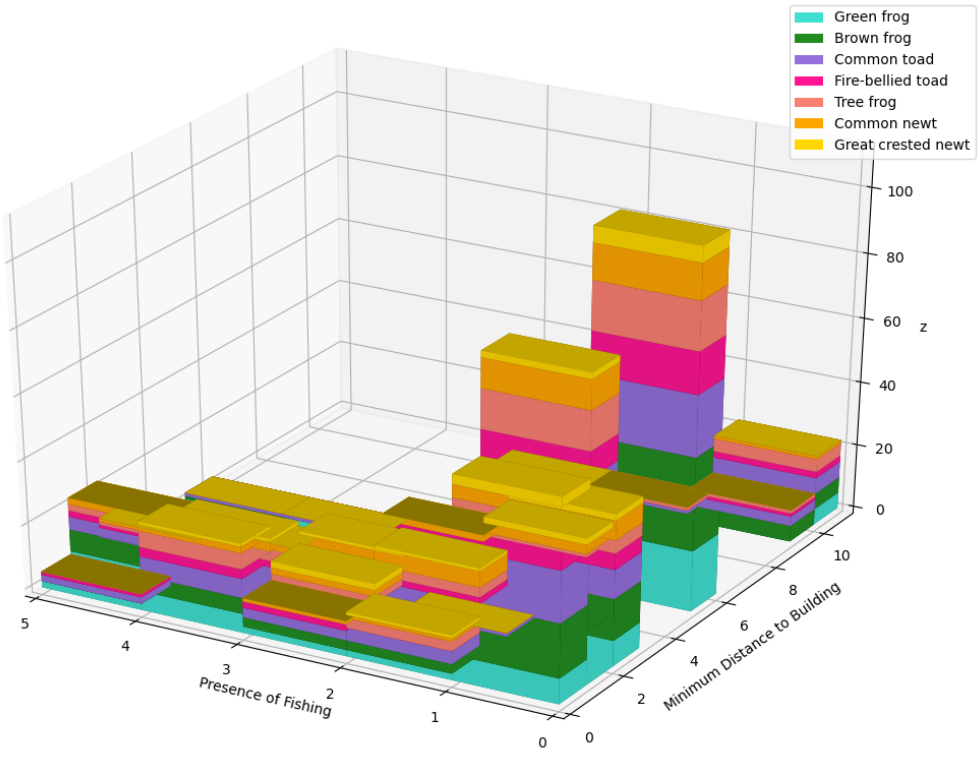

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
Use of Water Reservoir
Minimum Distance to Building

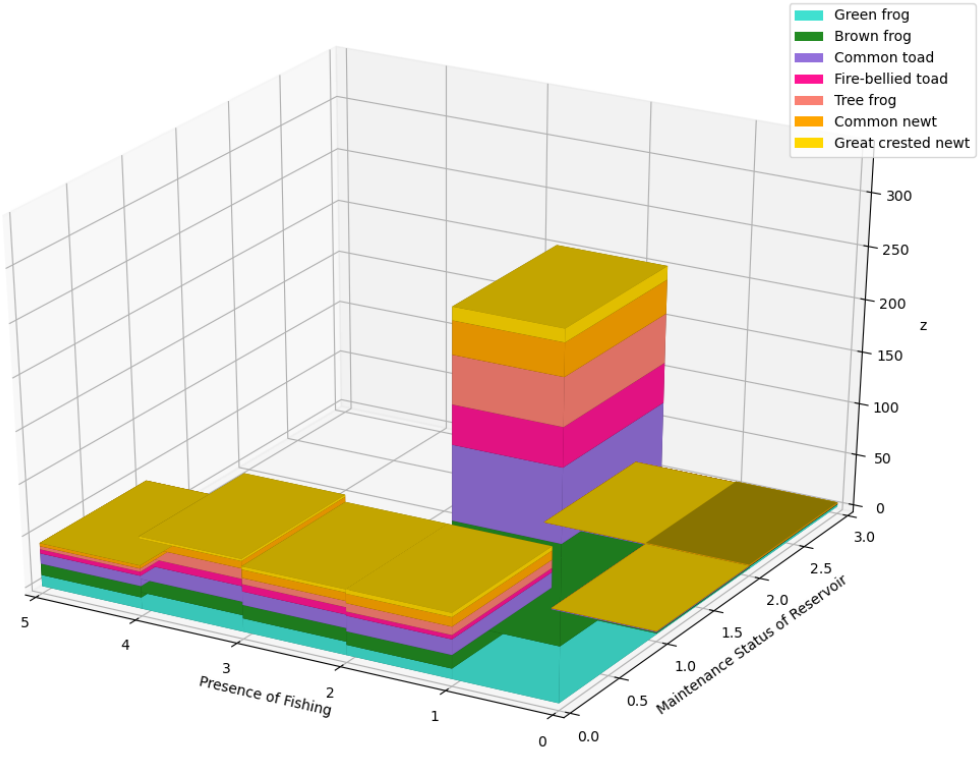

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
350
300
250
200
z
150
100
50
0
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Use of Water Reservoir
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Maintenance Status of Reservoir

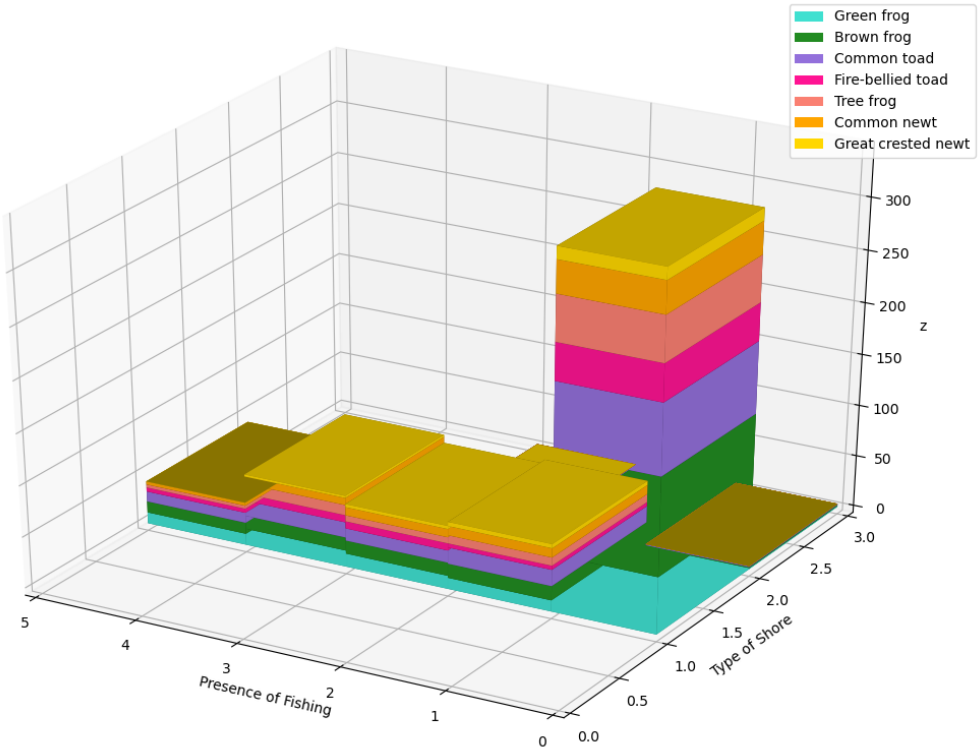

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
Use of Water Reservoir
Type of Shore

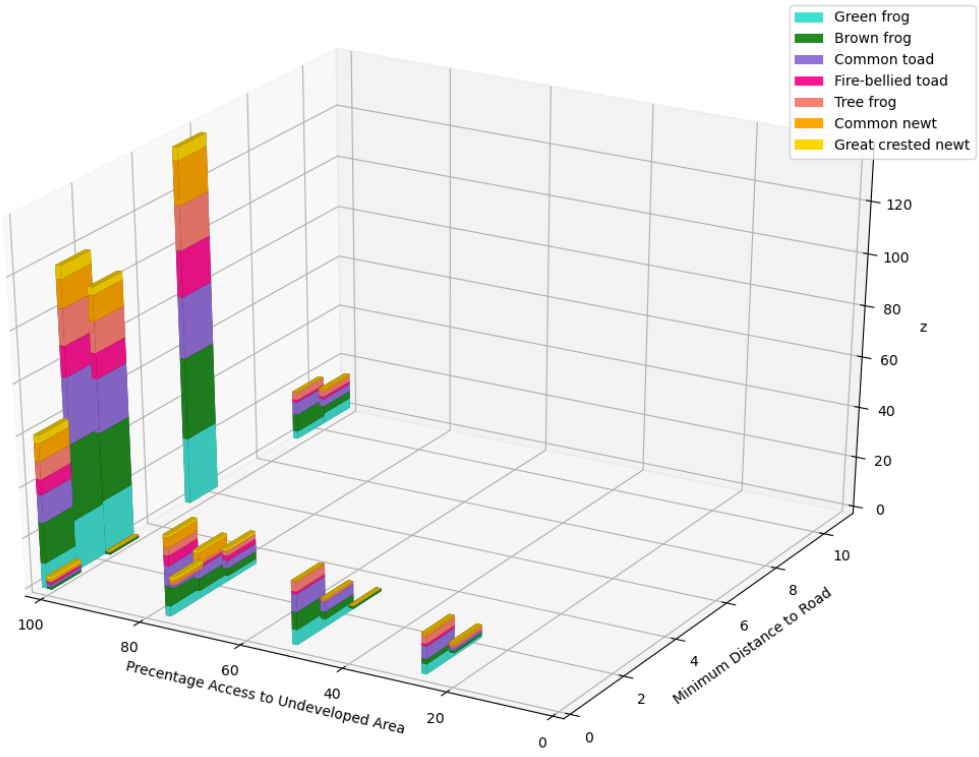

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
Presence of Fishing
Precentage Access to Undeveloped Area

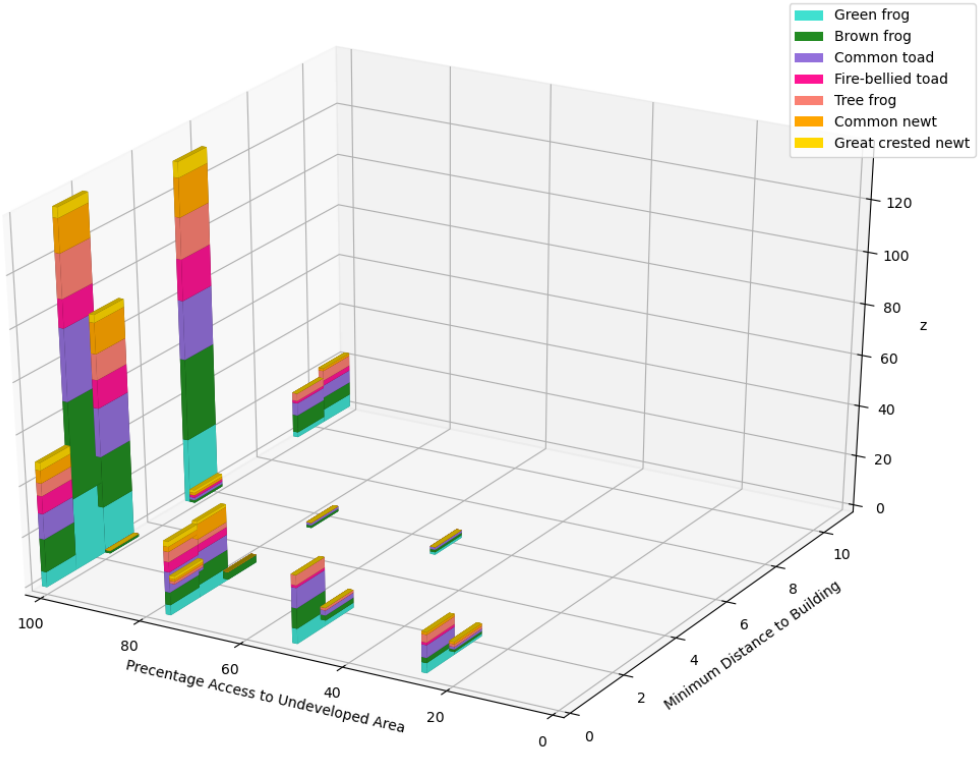

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
100
80
60
z
40
20
0
10
8
6
4
2
0
Minimum Distance to Road
5
4
3
2
1
0
Presence of Fishing

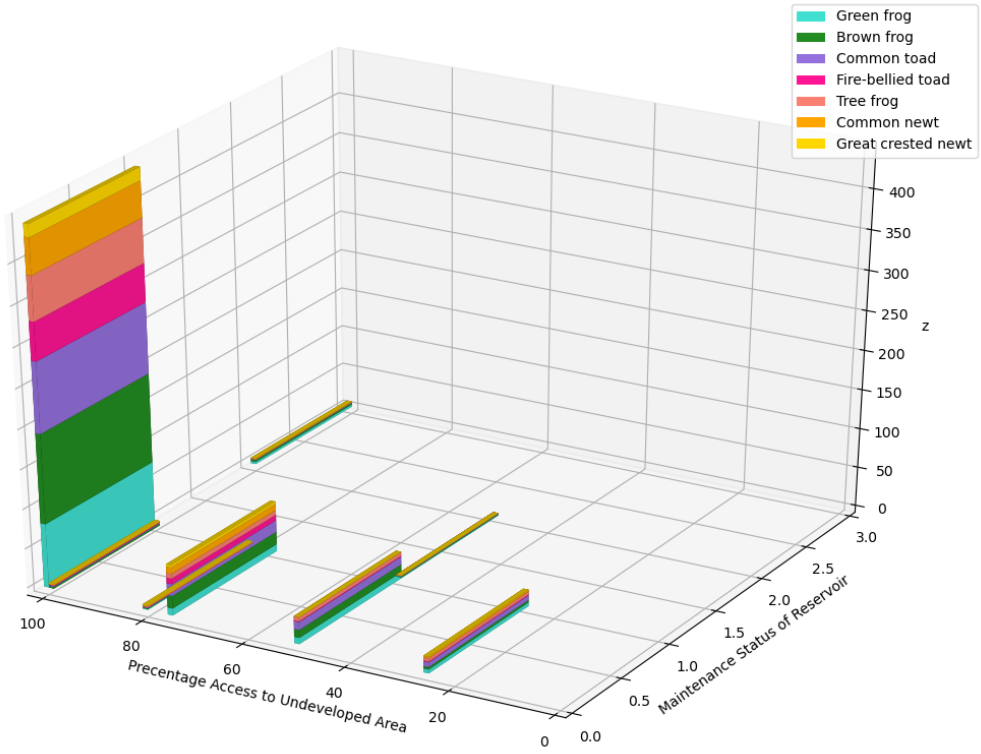

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
100
80
60
40
20
0
Presence of Fishing
5
4
3
2
1
0
Minimum Distance to Building
0
2
4
6
8
10

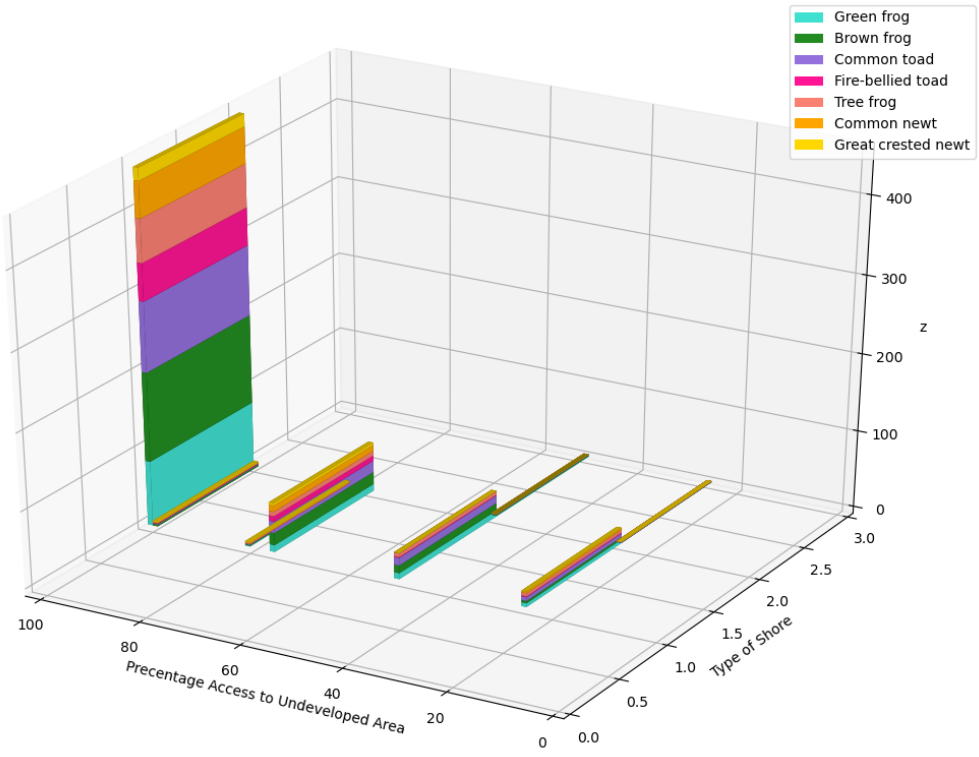

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
300
250
200
150
100
50
0
Presence of Fishing
5
4
3
2
1
0
Maintenance Status of Reservoir
0.0
0.5
1.0
1.5
2.0
2.5
3.0

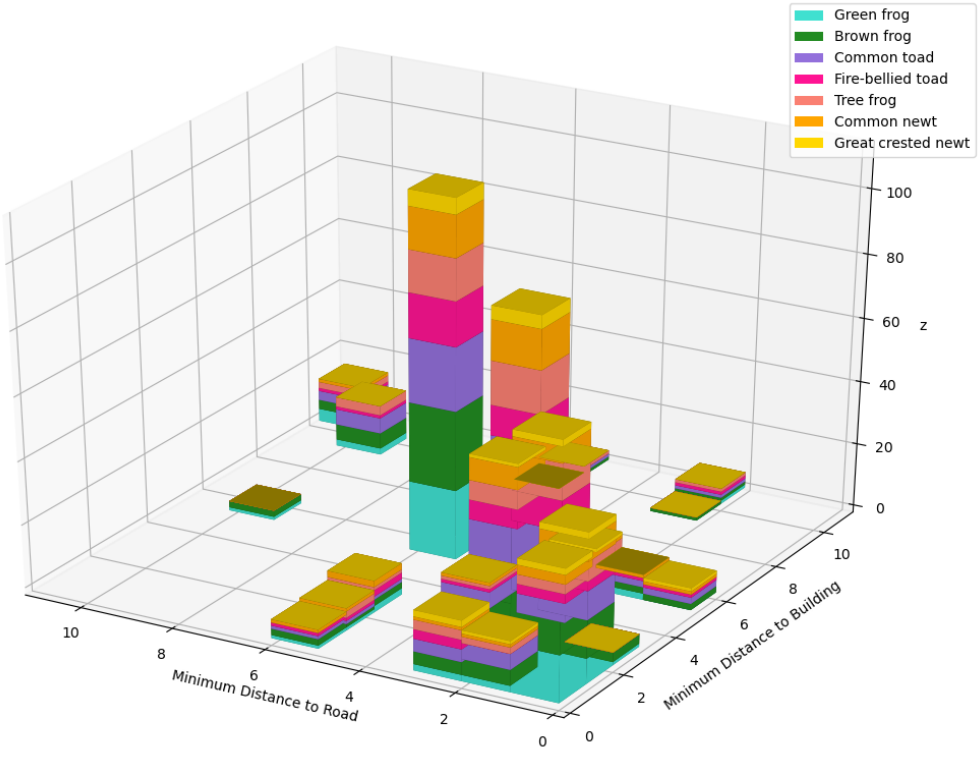

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
300
250
200
z
150
100
50
0
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Type of Shore
5
4
3
2
1
0
Presence of Fishing

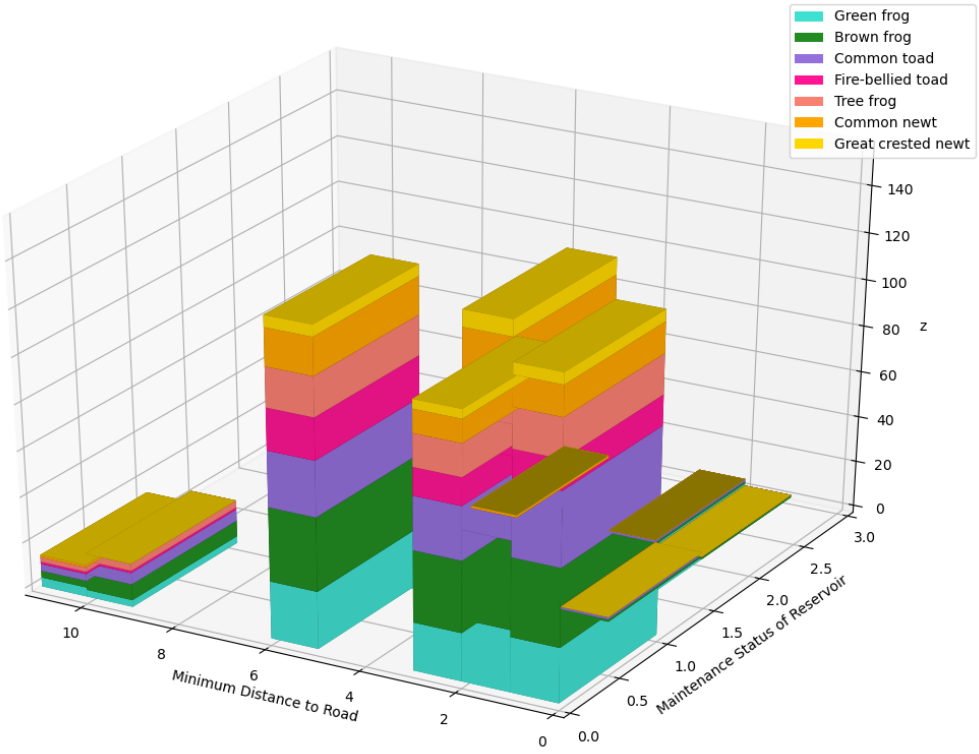

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
20
40
60
80
100
120
Precentage Access to Undeveloped Area
100
80
60
40
20
0
Minimum Distance to Road
0
2
4
6
8
10

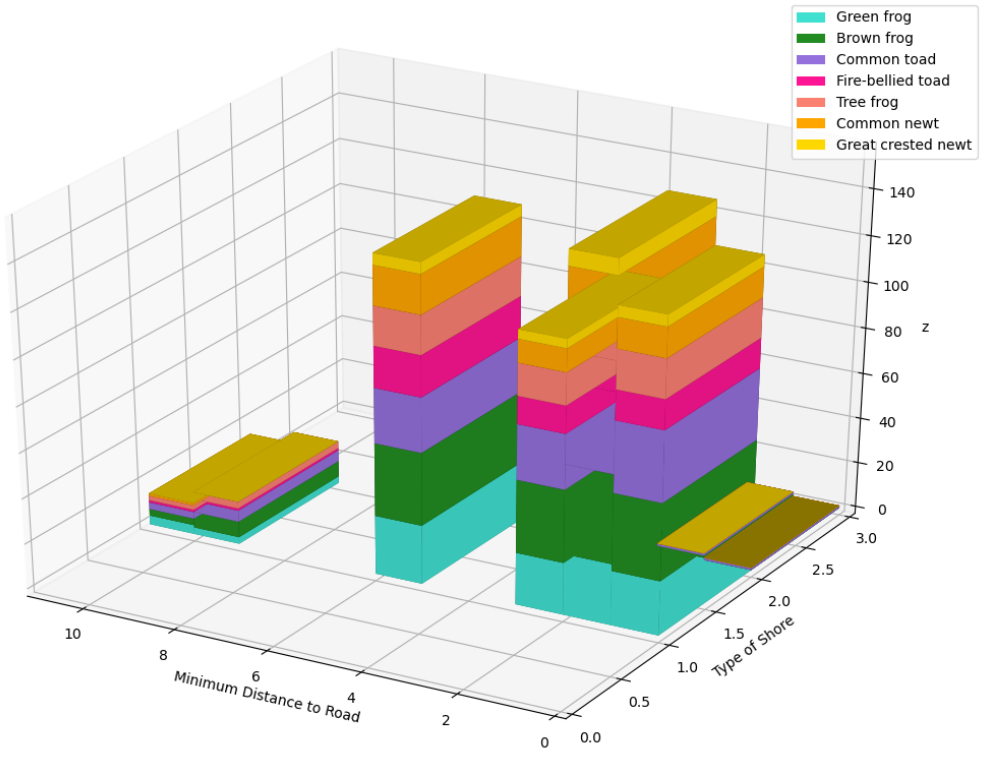

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
20
40
60
80
100
120
Precentage Access to Undeveloped Area
100
80
60
40
20
0
Minimum Distance to Building
0
2
4
6
8
10

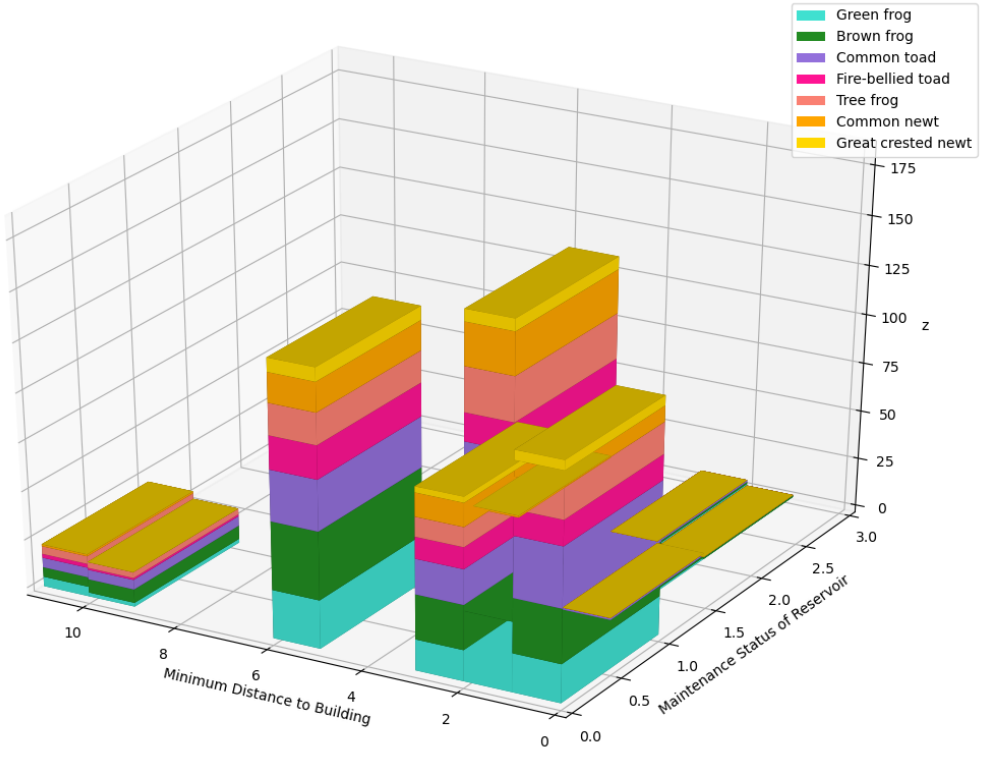

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
400
350
300
250
z
200
150
100
50
0
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Maintenance Status of Reservoir
100
80
60
40
20
0
Precentage Access to Undeveloped Area

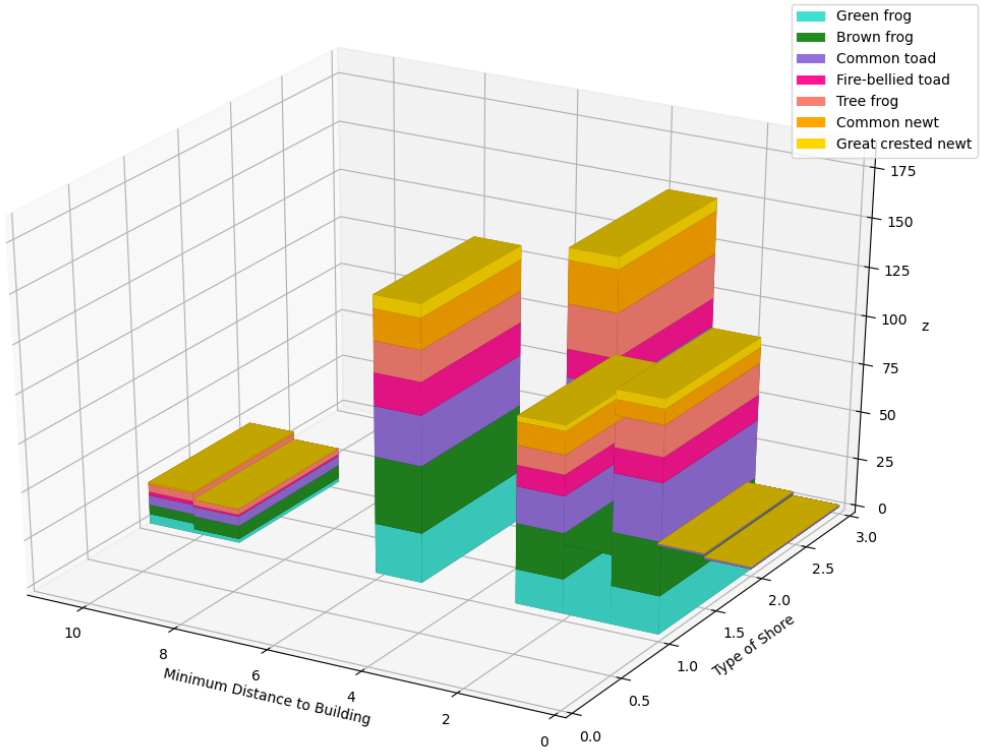

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
100
200
300
400
Precentage Access to Undeveloped Area
100
80
60
40
20
0
Type of Shore
0.0
0.5
1.0
1.5
2.0
2.5
3.0

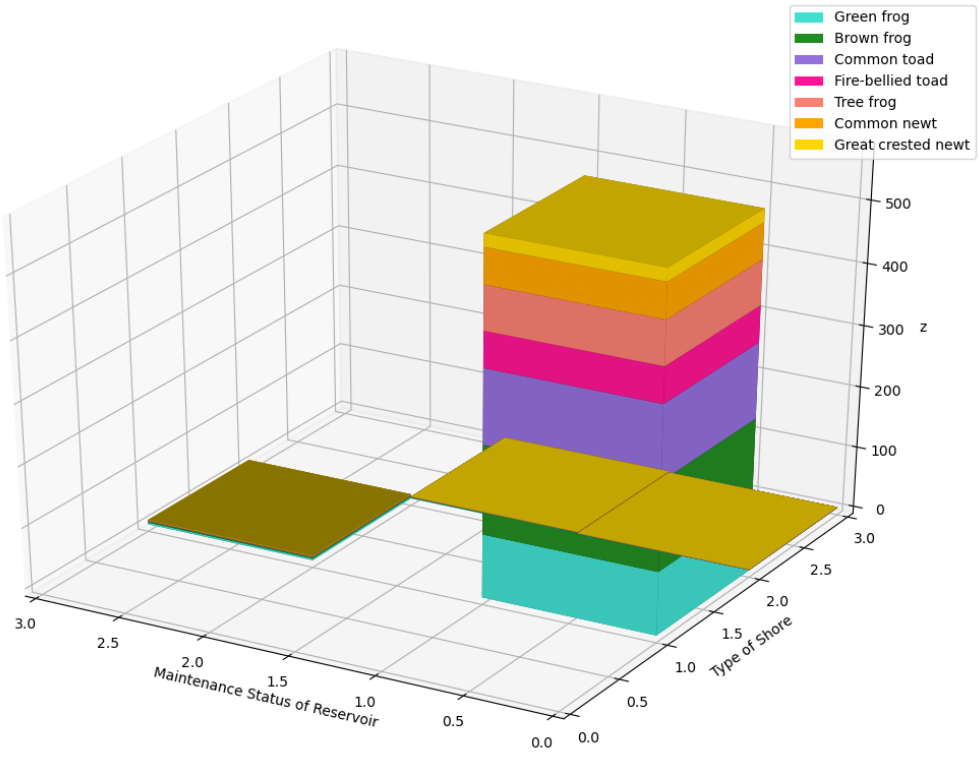

Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
z
0
20
40
60
80
100
Minimum Distance to Road
10
8
6
4
2
0
Minimum Distance to Building
0
2
4
6
8
10


Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
140
120
100
80
z
60
40
20
0
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Maintenance Status of Reservoir
10
8
6
4
2
0
Minimum Distance to Road


Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
140
120
100
80
z
60
40
20
0
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Type of Shore
10
8
6
4
2
0
Minimum Distance to Road


Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
175
150
125
100
z
75
50
25
0
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Maintenance Status of Reservoir
10
8
6
4
2
0
Minimum Distance to Building


Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
175
150
125
100
z
75
50
25
0
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Type of Shore
10
8
6
4
2
0
Minimum Distance to Building


Green frog
Brown frog
Common toad
Fire-bellied toad
Tree frog
Common newt
Great crested newt
500
400
300
z
200
100
0
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Maintenance Status of Reservoir
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Type of Shore

[141]: