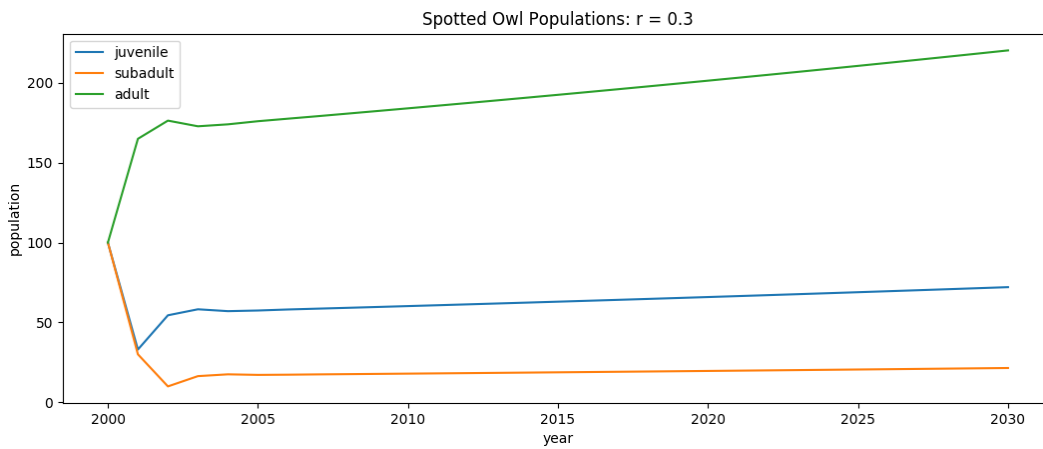
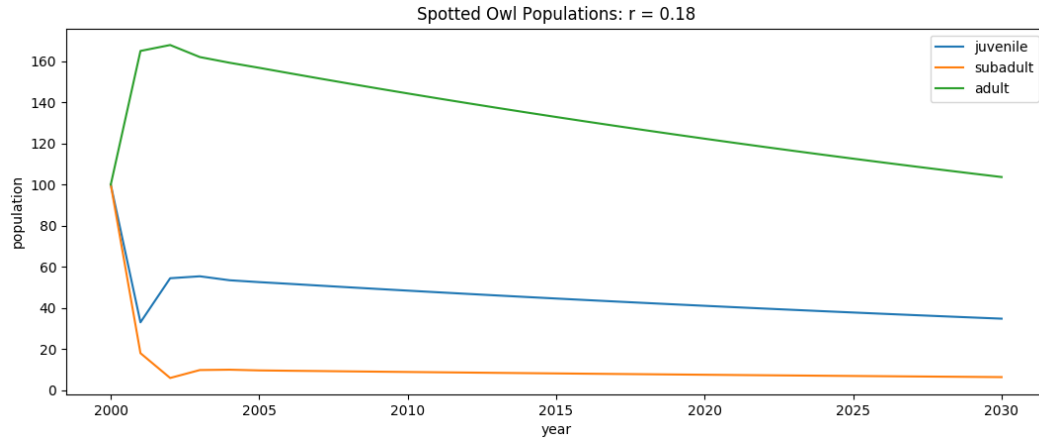


MA339 Project 1: Spotted Owl Populations

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```
import numpy

table = {}

R = numpy.arange(0.18, 0.31, 0.02)

for r in R:
    X = numpy.empty((31, 3))
    X[0] = numpy.asarray([100, 100, 100])

    for i in range(1, len(X)):
        A = numpy.asarray([
            [0, 0, 0.33],
            [r, 0, 0],
            [0, 0.71, 0.94]])

        X[i] = A.dot(X[i-1])
    table[round(r, 2)] = X
```

```

import numpy
import matplotlib.pyplot as pyplot

from table import table

r = 0.30

pyplot.title(f"Spotted Owl Populations: r = {r}")
pyplot.xlabel('year')
pyplot.ylabel('population')
pyplot.plot(numpy.arange(2000, 2031), table[round(r, 2)])
pyplot.legend(('juvenile', 'subadult', 'adult'))
pyplot.show()

```

Table 1: Populations when the juvenile survival rate is $r = 0.18$

Year	2000	2001	2002	2003	2010	2020	2030
Juvenile	100	33	54	55	48	41	35
Subadult	100	18	6	10	9	8	6
Adult	100	165	168	162	144	122	104
Total	300	216	228	227	201	171	145

Table 2: Populations when the juvenile survival rate is $r = 0.30$

Year	2000	2001	2002	2003	2010	2020	2030
Juvenile	100	33	54	58	60	66	72
Subadult	100	30	10	16	18	20	21
Adult	100	165	176	173	184	201	220
Total	100	228	240	247	262	287	313

Table 3: Total populations at year 2030

Juvenile survival rate r	Total population at year 2030	Do the owls survive?
0.18	145.0	NO
0.2	166.0	NO
0.22	190.0	NO
0.24	216.0	NO
0.26	245.0	YES
0.28	278.0	YES
0.3	313.0	YES