

Name: Padrta Species: Yew

9/ 10: Introduction

What does the organism look like? ✓

Life cycle ✓

Niche ✓

Interesting interactions ✓

Why do we care about this species? -1

Citations ✓

43
55

7/ 10: Model interpretation

Parameter meanings? -2

Describe population through time ✓

When is SSD reached, and what does it look like? -1

Long-term forecast, including is it realistic? ✓

what proportion of each stage?

4/ 5: Elasticity analysis

Which parameter is most elastic, and why? -1

Which is least elastic, and why? ✓

6/ 10: Management for constant population size

How to do using the most elastic parameter? -1

Is this practical? ✓

How do using less elastic parameters (three combos)

Are these practical?

Instructions are to first do this with the simplest elastic model parameter. Then to find 3 different alternative modes that also lead to $\lambda=1$.

5/ 5: Summary

Tie everything together

9/ 10: Figures (each with a figure description)

Transition matrix ✓

Population through time graph, with axis titles, etc. ✓

Elasticity matrix -1

3/ 5: Spelling, grammar, and mechanics

Population Growth Rate Modeling

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POPULATION GROWTH RATE MODELING

Taxus brevifolia, the Pacific Yew or western yew is a conifer native to the Pacific Northwest of North America. This tree species ranges from the southernmost tip Alaska, down to central California. Its population is also found in Pacific Coast Ranges with others in British Columbia. *Taxus brevifolia* is not generally a tree but a shrub variety. Its distinguishing feature is its flexible stem which is able to creep on the ground for a short distance before going up as shown in figure 1. Furthermore, its branches grow off from the stem, specifically the upper side as shown in figure 2. The species has been given another name *reptaneta* which means a creeping plant.

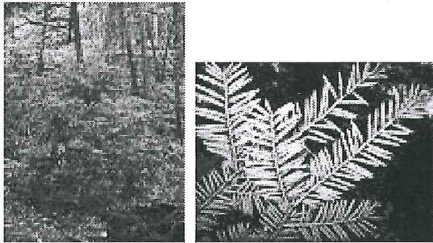


Figure 1

Figure 2

The species also occur along the forest margins in some parts of northwestern Montana, the thicket yew plants do not ascend but rather stays on the ground as shown in figure 3. The form depicts the original or the ancestral form which assumes the upright nature with the branches on the upper side. The pattern evolves from one stem to the other as it develops the upright position from the creeping one

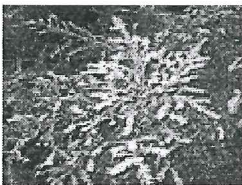


Figure 3

Citations for this page?

Characteristics

The Pacific yew is a small medium evergreen tree. It has a ^{typical} maximum height of 10-15 m tall with a thin trunk of 50 cm. ^{however}, the species has been found to grow to 20 m tall taking place only in the parks and other preserved areas. The species has a redundant growth behavior with tendency of rotting from inside as it develops. The trend provides a hard opportunity for the species to form the rings which may give a true determination of the age. The tree develops a thin scaly brown bark as shown in figure 4 which provides the cover to a thin layer of off-white sap wood with darker heartwood which shows variation in color from brown to purplish hue. ^{citations?}

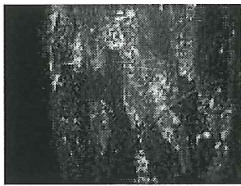


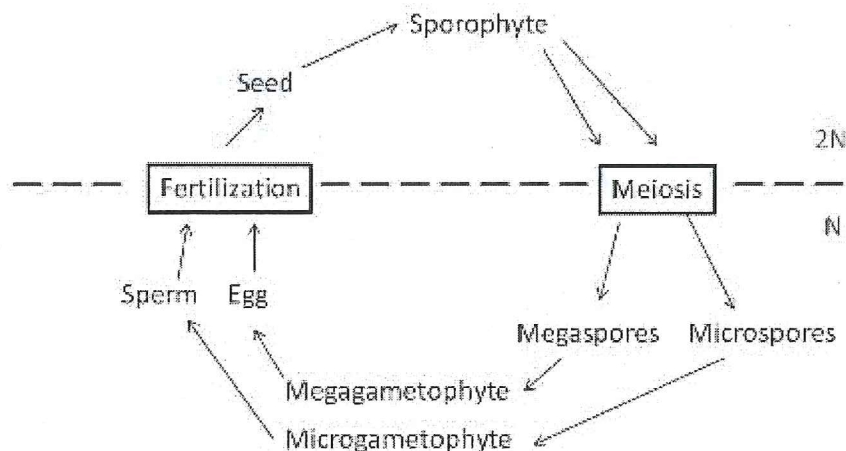
Figure 4

Reproductive cycle

The Pacific yew has separate male and female parts. Therefore, the seeds are produced and forced to travel for the purposes of germination. Birds play an integral role in the seeds dispersion ^{al} process (DiFazio, S., ^{et al.} Wilson, M., & Vance, N. 2011). The seeds are produced on the female tree while the while the pollen grain is developed on the male tree. The general life cycle begins from fertilization of the seed which forms a sporophyte that undergoes meiosis to form the megaspores. Eventually, it forms the megagametophytes and microgametophytes respectively. In addition, the megagametophytes produce the egg while the microspores produce sperm. Fertilization occurs once again to restart the cycle (Walters-Vertucci, C., ^{et al.} Crane, J., & Vance, N. 2009). The life cycle has three basic stages: egg, seed, and meiosis.

↓
this is the process that produces eggs + sperm

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Ecological importance

Through interaction with other species, the plant is able to provide food for the foraging animals like white tail deer, elk and mouse. The fruits produced are eaten by ring-tailed cat and songbirds. However, the relationship is mutualism whereby the birds feeding on the fruits are able to aid in seed dispersion (Stierle, A., et al. (ele...) Stierle, D., Stobel, & G., 2010). The species has an economic importance in terms of synthesizing the drug Taxol which is anticancer.

talk @ this a bit more.

Demographic Matrix Model

<i>Taxus brevifolia</i>							
Demographic matrix							
Stage:	<0.5 m tall	0.5-1.0 m tall	<=1 cm DBH	1-4.9 cm DBH	5-14.9 cm DBH	15-24.9 cm DBH	>=25 cm DBH
<0.5 m tall	0.88	0	0	0.12	0.16	0.2	0.24
0.5-1.0 m tall	0.09	0.88	0	0	0	0	0
<=1 cm DBH	0	0.08	0.89	0	0	0	0
1-4.9 cm DBH	0	0	0.07	0.97	0	0	0
5-14.9 cm DBH	0	0	0	0.025	0.99	0	0
15-24.9 cm DBH	0	0	0	0	0.005	0.99	0
>=25 cm DBH	0	0	0	0	0	0.009	0.993

(Fig 5 stages of growth of the pacific yew plant and the size of the plant at different stages in its life cycle it can also be used to help predict the populations at certain points in a life cycle which is good for conservation biologists looking to save or extinguish species)

I don't understand this sentence

This model displaces the size and population of yew plants they are viewing the size and population of the pacific yew plant during the life cycle. The data is broken down into 7 stages <.5 m tall, 0.5-1.0 m tall, <1cm DBH, 1-4.9 cm DBH, 5-14.9 cm DBH, 15-24.9 cm DBH, > 23 cm DBH Arranged along the Y-axis, And size in cm along the X-axis as well as years. I stated with the initial population of 500 seedlings and ran the model for 70 years to see what would happen to the over-all population. As shown in Fig 6 there was a decrease in population of the course of the first 20 years as the seeding with through the different growth cycles and started to reproduce there own viable offspring. If you see this on the model with the larger trees staring at under 1 on the logarithmic scale. After that you can see that the population has continued to grow finally approaching a stable stage distribution at year 70. At this point here is a similar number of all sizes of yews at this point. When reached the λ value was 1.022, which proves that our population is increasing. If we to run this model for a few hundred years I think that the population would eventually stabilize or begin to decrease. Depending on where these yews are located they could be in a somewhat small area and as the population continues to increase it competitive inhibition begins to take place, which lowers fitness.

$\lambda > 1$, with no $K \Rightarrow$ infinite pop'n size

hence why it's not realistic.

But this is good.

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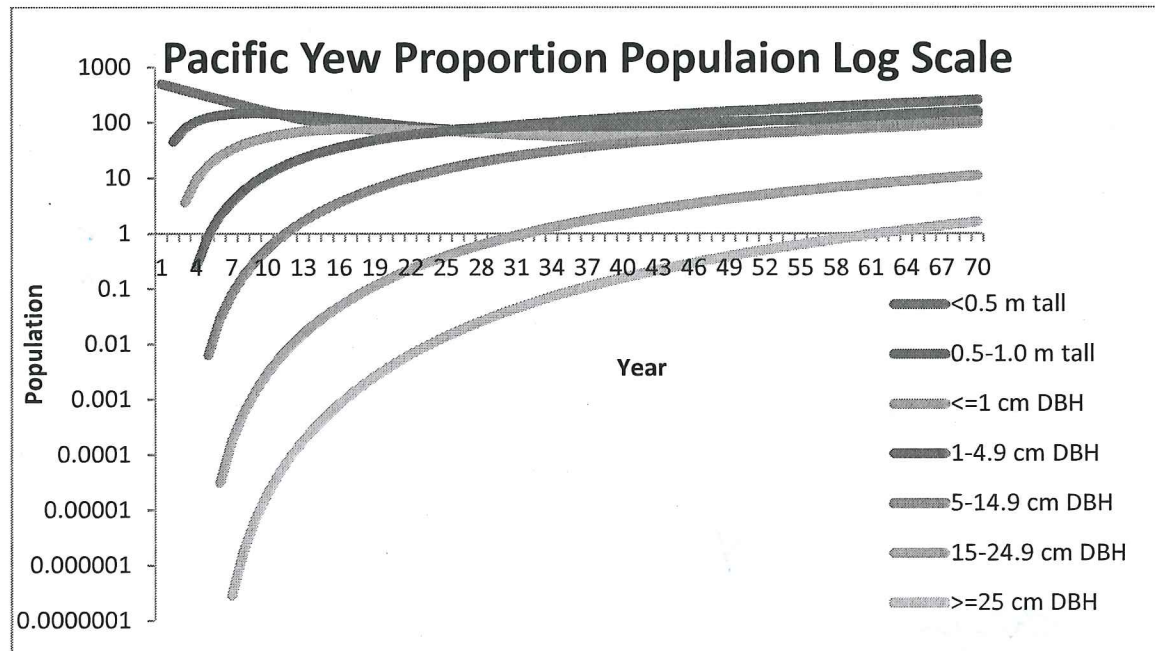


Fig 6 Population Model

Elasticity

An elasticity matrix was conducted using a 10% increase to ^{each} the elasticity of the original ^{model parameters} ^{which} ^{on} ^{growth rate} over all data to see where it would have the greatest impact of the total population. This increase had the biggest effect in the trees between 1-4.9 cm with an increase of 7.55% and 5-14.9 cm DBH with an increase of 8.78%. The smallest impact of the increased elasticity were the really small trees which had a 2% increase. ^{← stage?} This is due to the fact that over time the population is growing and it took 20 years for the larger trees ^{to} start being able to reproduce, ^{so the change in} elasticity. ^{finish sentence?} The other small impact took part in the really large trees. Only one percent of the population falls under this category so this made little impact of this stage.

why
do you
think
this is
so?

Stage:	<0.5 m tall	0.5-1.0 m tall	<=1 cm DBH	1-4.9 cm DBH	5-14.9 cm DBH	15-24.9 cm DBH	>=25 cm DBH
<0.5 m tall	1.03778	0	0	1.02279	1.0229	1.0227	1.02217
0.5-1.0 m tall	1.02368	1.03765	0	0	0	0	0
<=1 cm DBH	0	1.02367	1.3946	0	0	0	0
1-4.9 cm DBH	0	0	1.02366	1.07628	0	0	0
5-14.9 cm DBH	0	0	0	1.0416684	1.0886	0	0
15-24.9 cm DBH	0	0	0	0	1.02232	1.04405	0
>=25 cm DBH	0	0	0	0	0	1.02217	1.02478

Fig 8 Lambda values after a 10% increase in elasticity

Stage:	<0.5 m tall	0.5-1.0 m tall	<=1 cm DBH	1-4.9 cm DBH	5-14.9 cm DBH	15-24.9 cm DBH	>=25 cm DBH
<0.5 m tall	3.70%	0	0	2.20%	2.21%	2.19%	2.14%
0.5-1.0 m tall	2.29%	3.69%	0	0	0	0	0
<=1 cm DBH	0	2.29%	3.87%	0	0	0	0
1-4.9 cm DBH	0	0	2.29%	7.55%	0	0	0
5-14.9 cm DBH	0	0	0	4.09%	8.78%	0	0
15-24.9 cm DBH	0	0	0	0	2.15%	4.33%	0
>=25 cm DBH	0	0	0	0	0	2.14%	2.40%

Fig 9 The percent different after the change in elasticity

These terms are ~correct, but the rest are much larger than expected.

Using the model to manage the species

It's a cool spring afternoon and I was just tasked with this new species my boss wants to bring to Pullman Washington called Pacific Yew he has given me 500 seedlings and its my job to manipulate ^{their} ~~there~~ growth so that the population remains constant or maintain a lambda value of 1. Fig 5 shows the starting matrix for the population and through modeling I was able to after 70 years get it to a stable population with a lambda value of 1.2. When I started ^{growth rate} ~~manipulating~~ the numbers I found that if I lowered the elasticity of only two parameters I was able to maintain with a lambda at exactly 1. The 1st stage I would lower the elasticity at would be the <.5 m tall by 7% at this early stage it would be easy alter the growing patterns at this stage since a good percentage wont even make it to being a large tree. This could be done in a number of way, ^{manipulating} ~~from~~ spraying some with weed killer to maybe covering them with more soil or another type of earth that would slow down the growing process as it must work its way back up through it and some would make it and some wouldn't. This could be done for the first year and see if it worked the way we wanted it to or if it killed off all or none of the little seedlings. Doing it this way we

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aren't ^{at all} deliberating killing any young yew trees and it can be relatively inexpensive depending on the material used. The second stage of growth that I would lower the elasticity of is the 5-14.9 cm trees. By lower the elasticity by 10% it brings us to a lambda value of 1.00001 which is exactly what were looking for as shown in fig 9. To lower this elasticity group we would ^{prune} ~~prove~~ it all the way back to just its stem. This will lower its ability to start reproducing which in return lowers its elasticity. (Instructions <https://video.search.yahoo.com/search/video?fr=spigot-chr-gcmac&p=can+you+prune+pacific+yew+trees#id=2&vid=ec505a64406af9e19becfb7ebc05cdb8&action=click>) ^{of pruning} Yews are very tolerant so this would avoid us having to kill plants and should be relatively ^{from} ~~expressive~~ if we ^{spelling} ~~hire out a cheap landscaping~~. These two manipulations would avoid us killing off any populations while lowering the growth rate.

this is actually OK to do, if it helps lead to $\lambda=1$

Stage:	<0.5 m tall	0.5-1.0 m tall	<=1 cm DBH	1-4.9 cm DBH	5-14.9 cm DBH	15-24.9 cm DBH	>=25
<0.5 m tall	0.8184	0	0	0.12	0.16	0.2	0.24
0.5-1.0 m tall	0.091	0.88	0	0	0	0	0.1
<=1 cm DBH	0	0.08	0.89	0	0	0	0
1-4.9 cm DBH	0	0	0.07	0.97	0	0	0
5-14.9 cm DBH	0	0	0	0.025	0.792	0	0
15-24.9 cm DBH	0	0	0	0	0.005	0.99	0
>=25 cm DBH	0	0	0	0	0	0.005	0.993

Fig 9

In summary, it can be brought out that *Taxus brevifolia* varies from one stage to another. It is equally important to know that not all ^{stabilize} ~~t~~ [?] survive to the adult stage. Correspondingly, these variations of growth rate in each stage provide an advantage in the management of the species. Through ^{this} ~~these~~ modeling we have been able to prove the pacific yew population is increasing with a ^{growth rate} ~~stabling~~ population after 70 years, Data was also provided showing how to maintain a constant population it needed and how it could be done with as little hard to the species as well a companies pocket book.

References

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