

Day 2 - Introduction

SSA 200

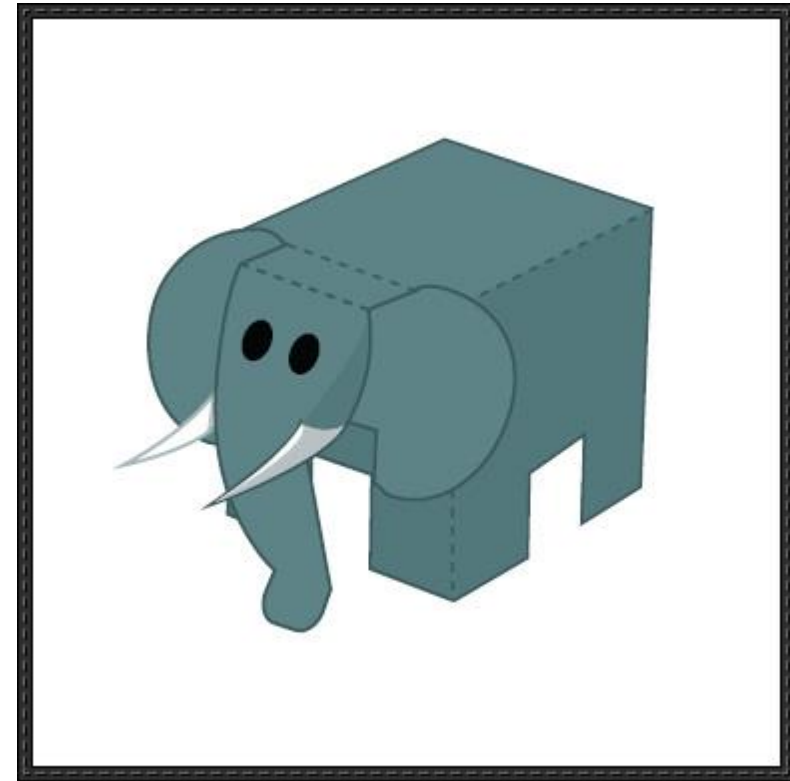
Data models yesterday...

- We reviewed some methods for analyzing data:
 - Descriptive
 - Occupancy
 - Count data, etc.
- Focused on estimating population parameters and ecological relationships
- Also estimated observation uncertainties (e.g., detection) and environmental variation

Today...

- Making predictions for the future!
 - Use results of previous data analysis (yesterday's focus)
- Accounting for demographic and environmental Stochasticity
- Accounting for “parametric uncertainty”

All models are wrong, but some models are useful – G. Box



Projection models are focused on

- Creating useful predictions
 - Do not require all system details
 - Decision context dependent

As simple as possible to be useful

Projection modeling platforms

- Rely on repeated execution codes/functions to project over time and replicate the projection
- Programs:
 - MS Excel
 - Netica
 - RAMAS, Vortex, PopTools
 - R, MatLab, SAS, Python, etc.

Time projections and replications

- Repeat a set of instructions (function) over a number of years
- Replicate that process multiples of times
 - estimate variability in predictions

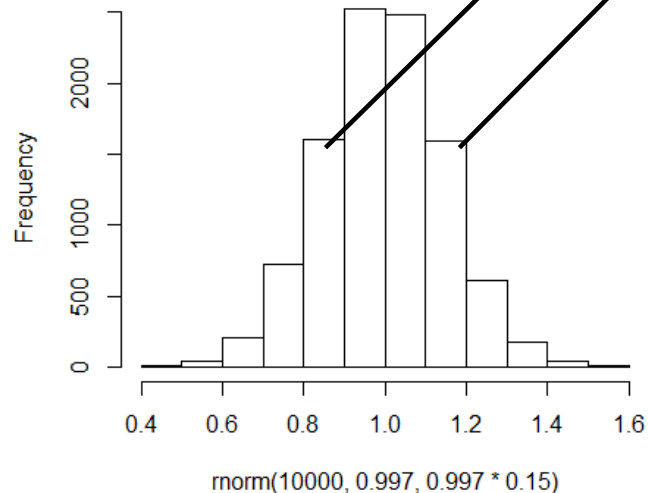
	year						
replicate	1	2	3	4	5	...	
1	200	186.6482	193.396	197.942	194.3061	...	
2	200	200.9691	214.6901	224.4521	240.7295	...	
3	200	180.0984	191.3048	189.7989	195.8254	...	
4	200	212.4143	235.5381	237.627	230.6926	...	
5	200	204.5244	192.3505	199.2723	196.0467	...	
...	200	197.8708	194.1572	188.8351	203.3035	...	

Variation over time

- Population growth model where population growth varies by time

	D	E	F	G	H	I	J	K	L	M	N	O
		Pop growth - mean	0.997									
		Starting population size	300									
		Year	1	2	3	4	5	6	7	8	9	10
		Population growth rate	0.933961	0.825215	1.121103	1.045677	1.026822	0.886291	0.763697	1.07203	0.810384	1.019358
Varying		Population size	300	280.1882	231.2154	259.2162	271.0565	278.3269	246.6785	188.3876	201.9571	163.6628
Static		Population size	300	299.1	298.2027	297.3081	296.4162	295.5269	294.6403	293.7564	292.8751	291.9965

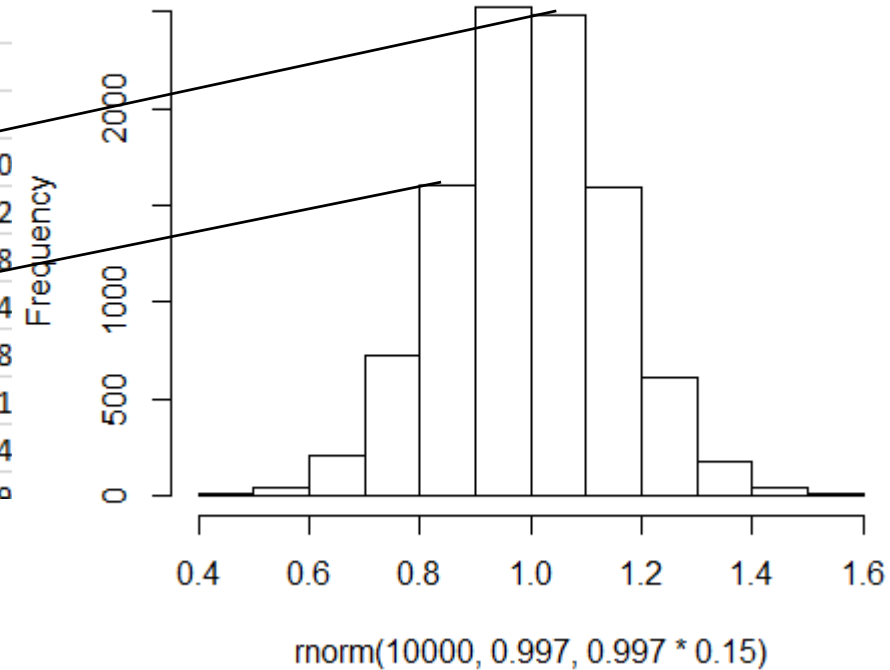
Histogram of $\text{rnorm}(10000, 0.997, 0.997 * 0.15)$



Parametric and temporal variability

Pop growth - mean	0.997			
Starting population size	300			
		Year		
replicate		1	2	
1	1.200520757	300	332.8176	407.0
2	1.114541484	300	371.7275	363.2
3	0.958625909	300	303.3772	292.8
4	0.975508032	300	297.841	329.4
5	0.859690952	300	261.0721	218.8
6	0.913709624	300	249.889	210.1
7	0.666555143	300	206.933	134.4
8	1.218621722	300	314.1001	272.8

Histogram of rnorm(10000, 0.997, 0.997 * 0.15)

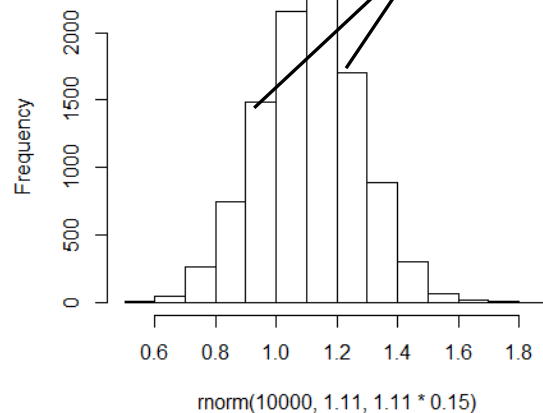


10
1444.621
654.1016
208.1437
445.9992
84.49791
73.32344
8.283678
1021.000

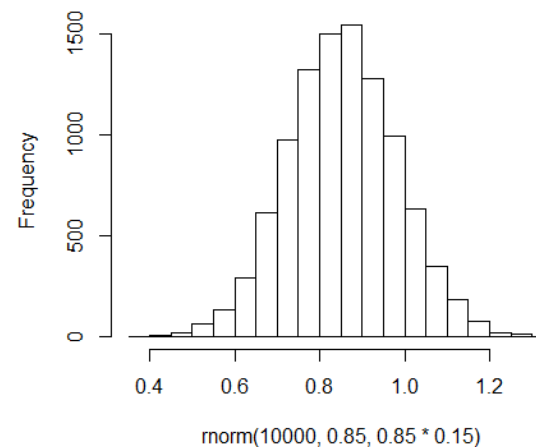
Parametric and temporal variability

Pop growth - mean	0.997											
Starting population size	300											
		Year										
replicate		1	2	3	4	5	6	7	8	9	10	
1	1.200520757	300	332.8176	407.0632	467.1851	604.1243	748.9818	852.9331	1011.004	1171.795	1444.621	
2	1.114541484	300	371.7275	363.2077	418.4604	510.1079	538.6505	634.8908	670.1832	531.367	654.1016	
3	0.958625909	300	303.3772	292.8195	296.7144	250.1102	274.3683	273.8828	224.8709	224.8354	208.1437	
4	0.975508032	300	297.841	329.4491	372.2212	381.3507	381.2646	338.8536	306.383	367.6172	445.9992	
5	0.859690952	300	262.0721	218.8139	195.196	153.1104	161.5736	144.3585	116.0443	92.66651	84.49791	
6	0.913709624	300	249.889	210.1519	153.134	120.603	110.3201	106.0793	88.98964	74.51839	73.32344	
7	0.666555143	300	206.933	134.4341	104.2813	58.66601	39.02855	26.95334	19.5935	13.14025	8.283678	
8	1.218621722	300	314.1001	372.8508	462.5426	602.1204	742.6728	800.2556	1295.922	1545.201	1921.888	

Histogram of $\text{rnorm}(10000, 1.11, 1.11 * 0.15)$



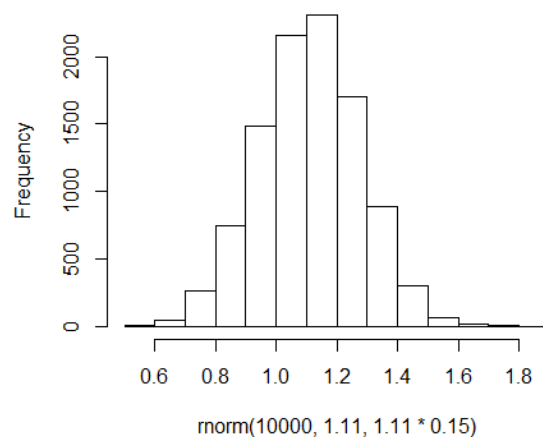
Histogram of $\text{rnorm}(10000, 0.85, 0.85 * 0.15)$



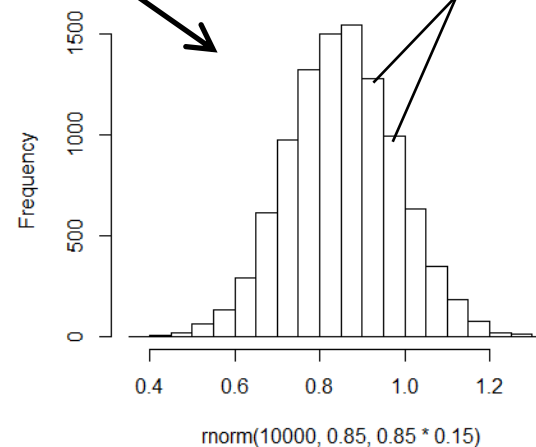
Parametric and temporal variability

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Histogram of $\text{rnorm}(10000, 1.11, 1.11 * 0.15)$



Histogram of $\text{rnorm}(10000, 0.85, 0.85 * 0.15)$



Projection models for today

- Occupancy / site persistence models
- Multi-state occupancy models
- λ growth models and Poisson projection models
- Demographic/matrix projection models
- Key issues
 - Conceptual → quantitative
 - Linking population parameters to environmental variables
 - Environmental stochasticity and parametric uncertainty
 - Sensitivity analyses

Questions?

