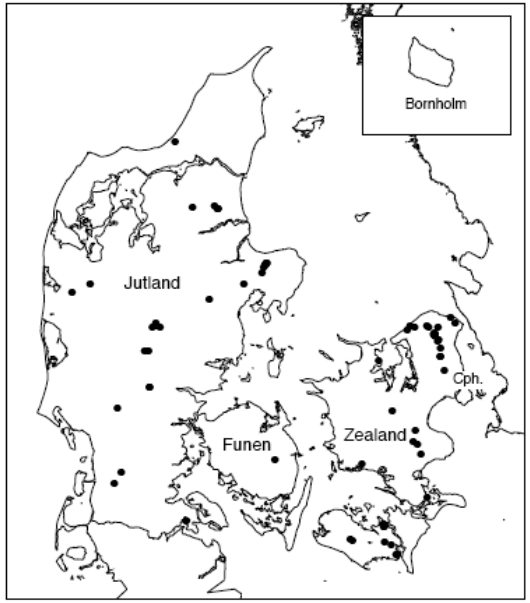
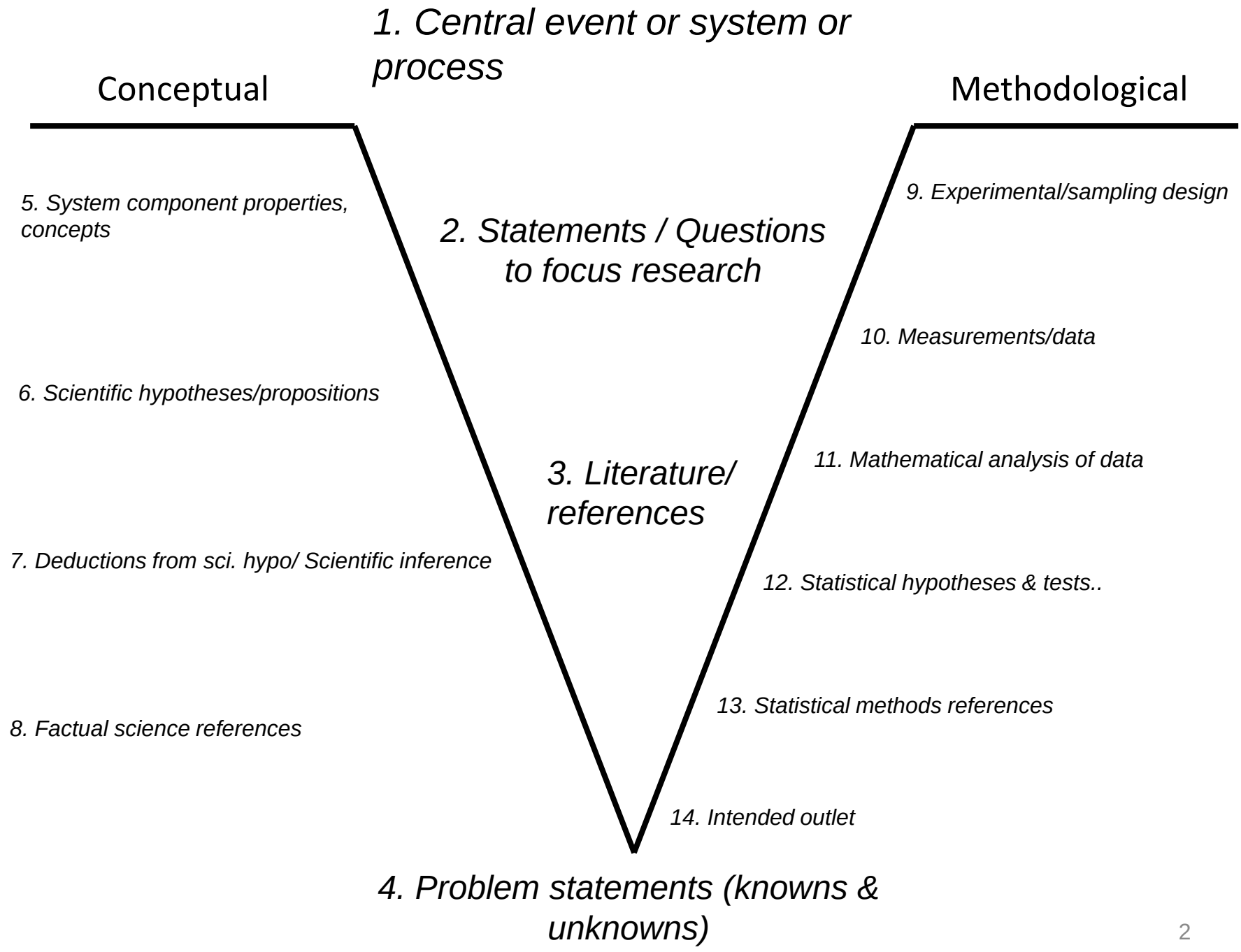
Mathematical models of height growth in Lake States (USA) and Denmark.

R. A. Leary

Example application of Gowin Vee with triangle ontology + Lakehead framework.




1. Central event or system or process
Conceptual
Methodological
5. System component properties, concepts
9. Experimental/sampling design
2. Statements / Questions to focus research
10. Measurements/data
6. Scientific hypotheses/propositions
11. Mathematical analysis of data
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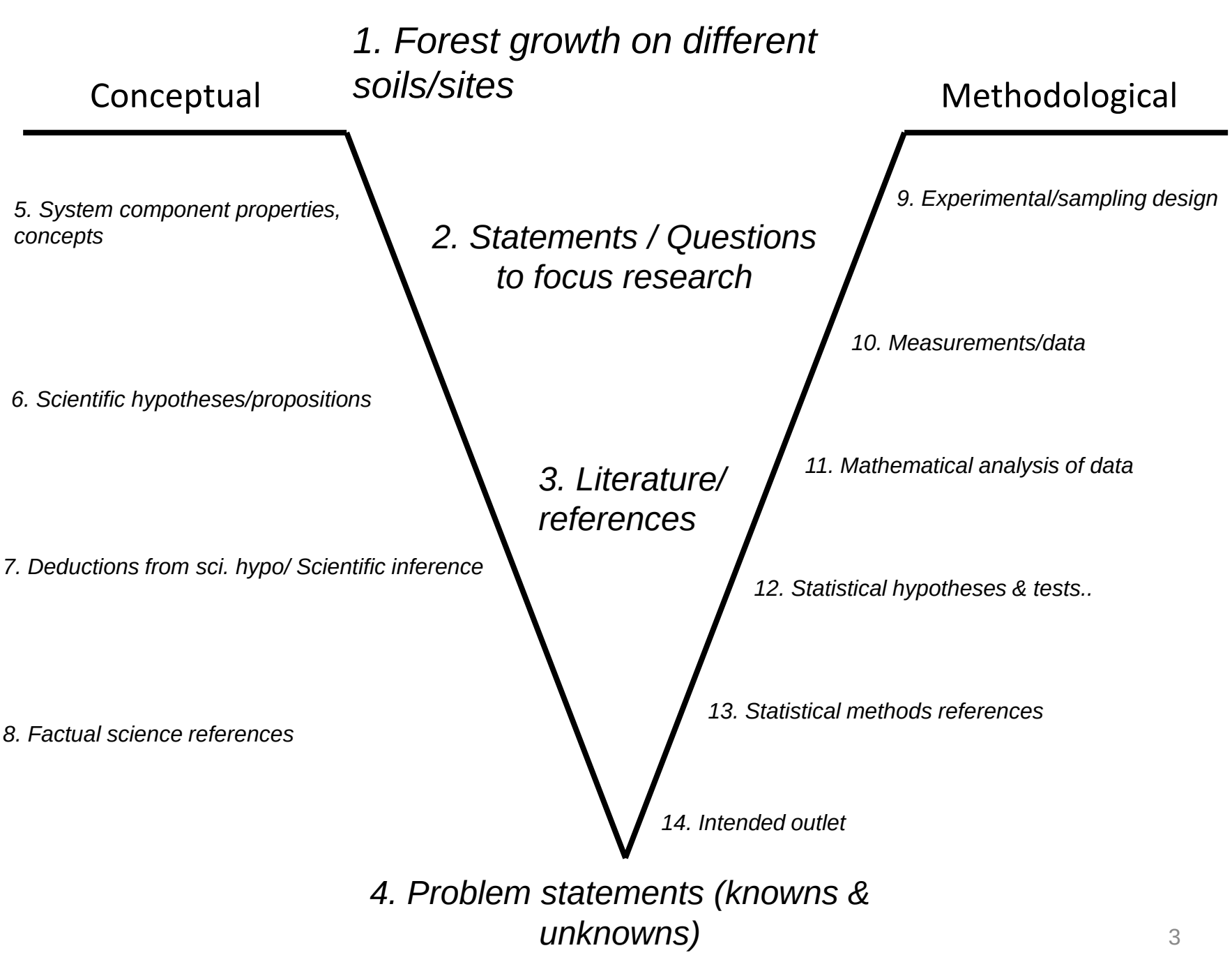
7. Deductions from sci. hypo/ Scientific inference
12. Statistical hypotheses & tests..
13. Statistical methods references
8. Factual science references
14. Intended outlet
4. Problem statements (knowns & unknowns)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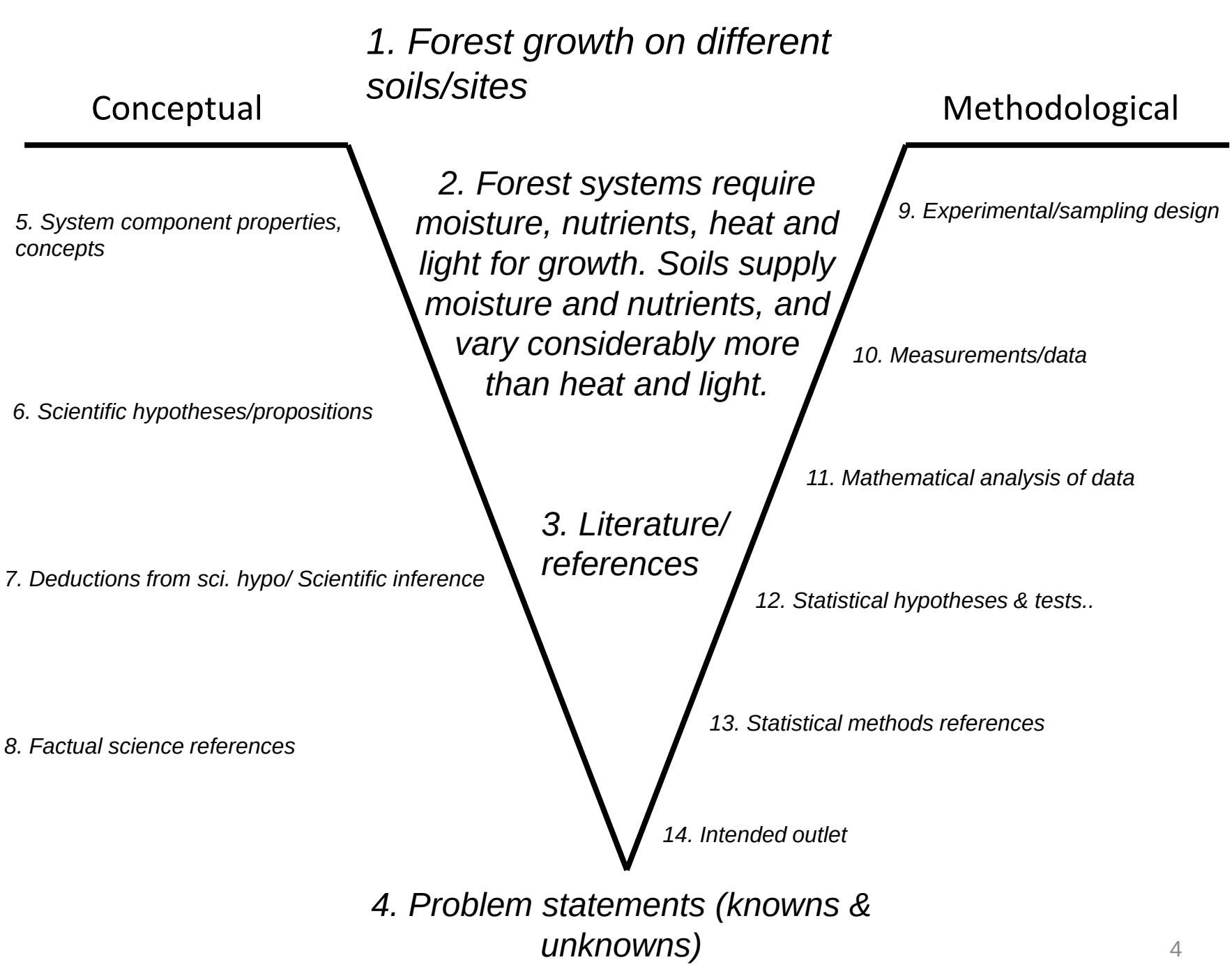
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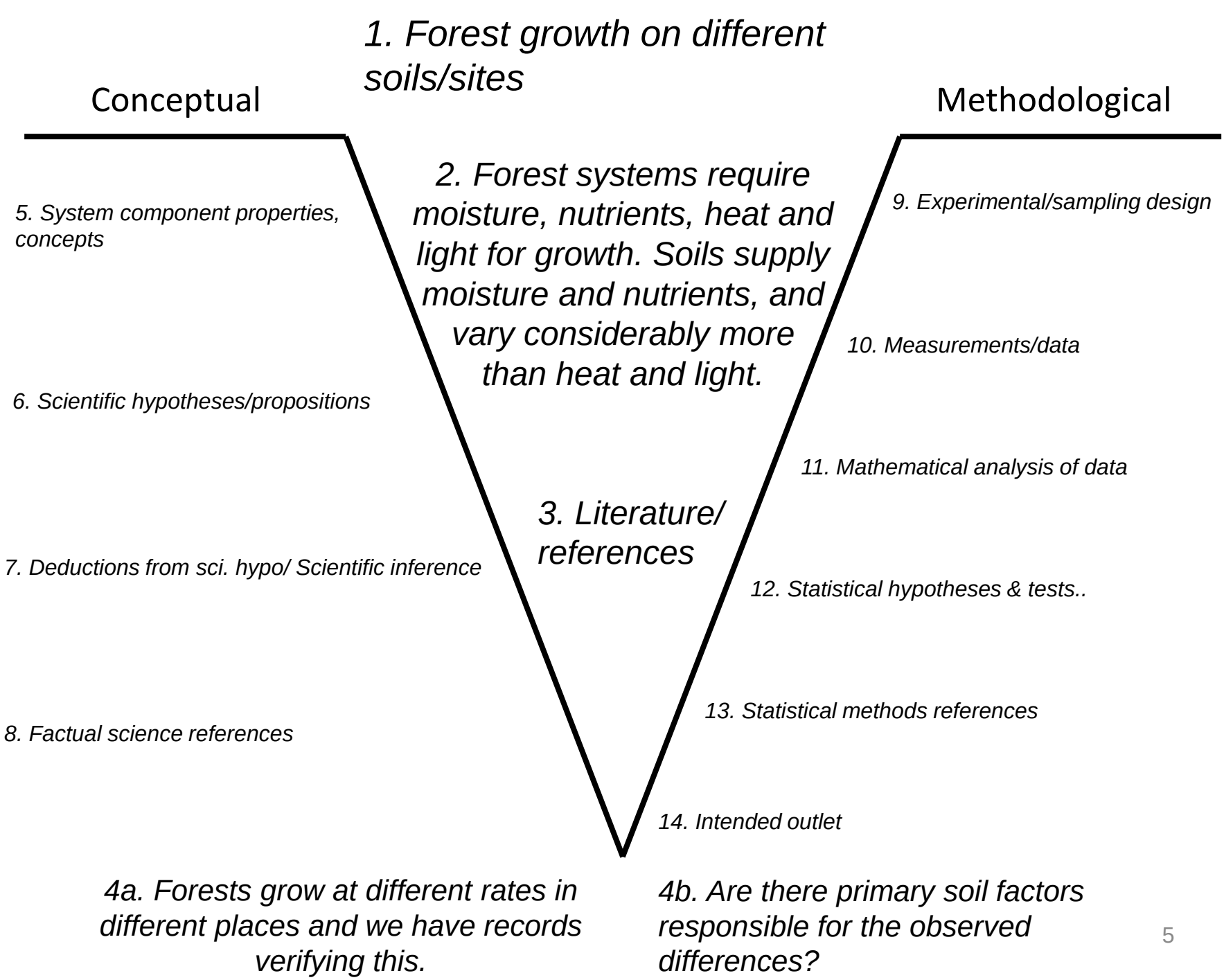
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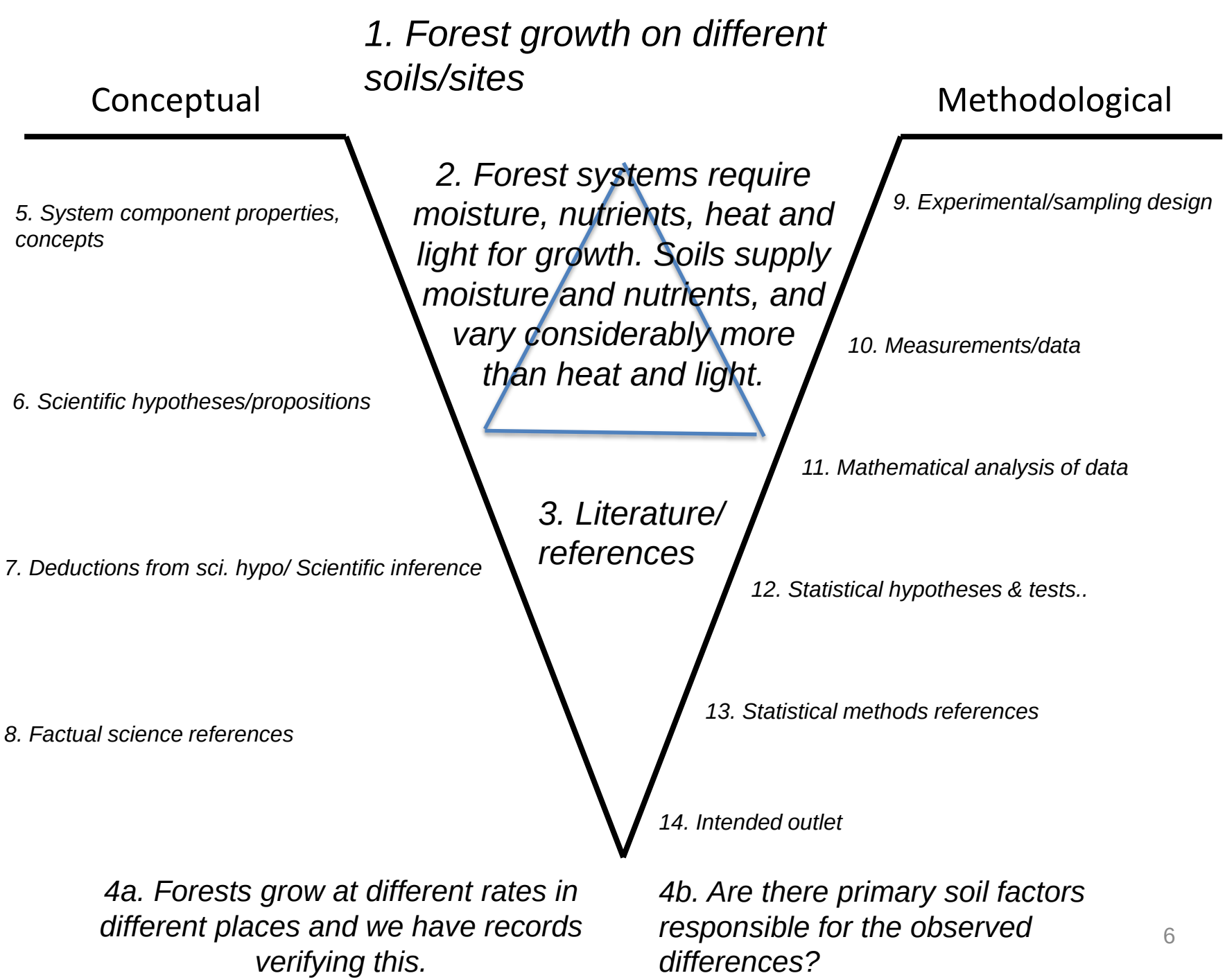
4b. Are there primary soil factors responsible for the observed differences?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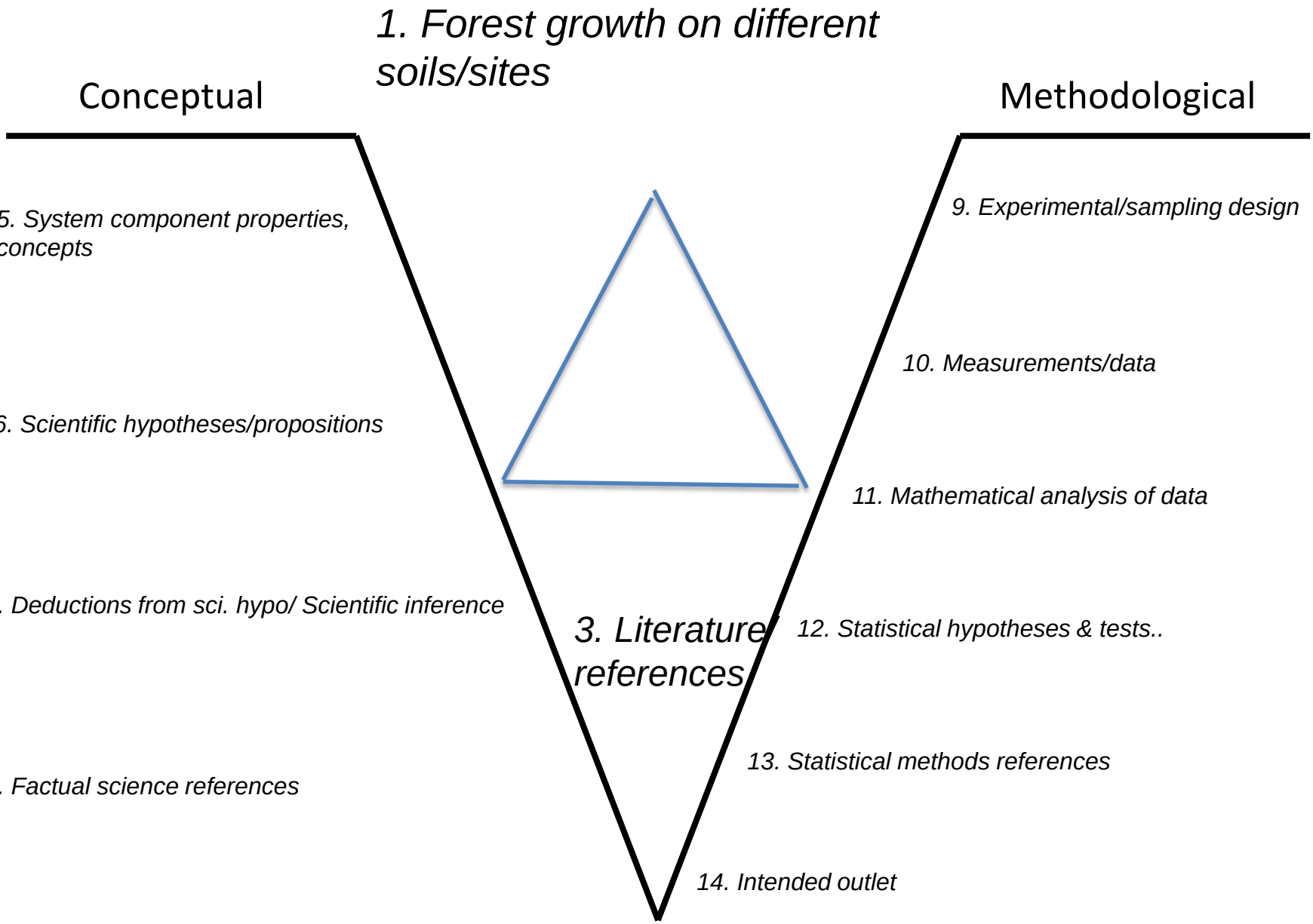
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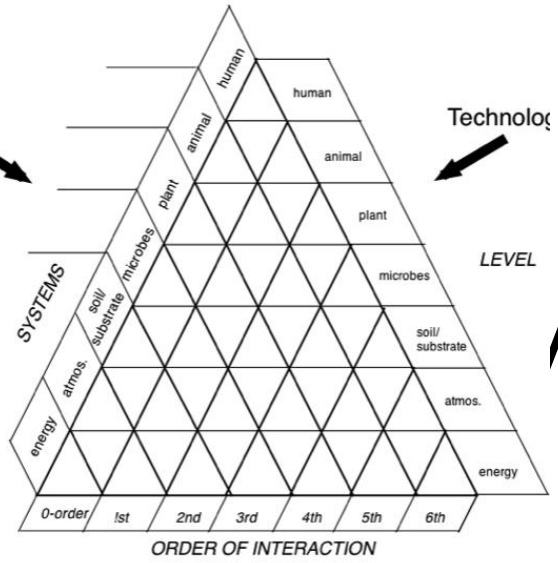

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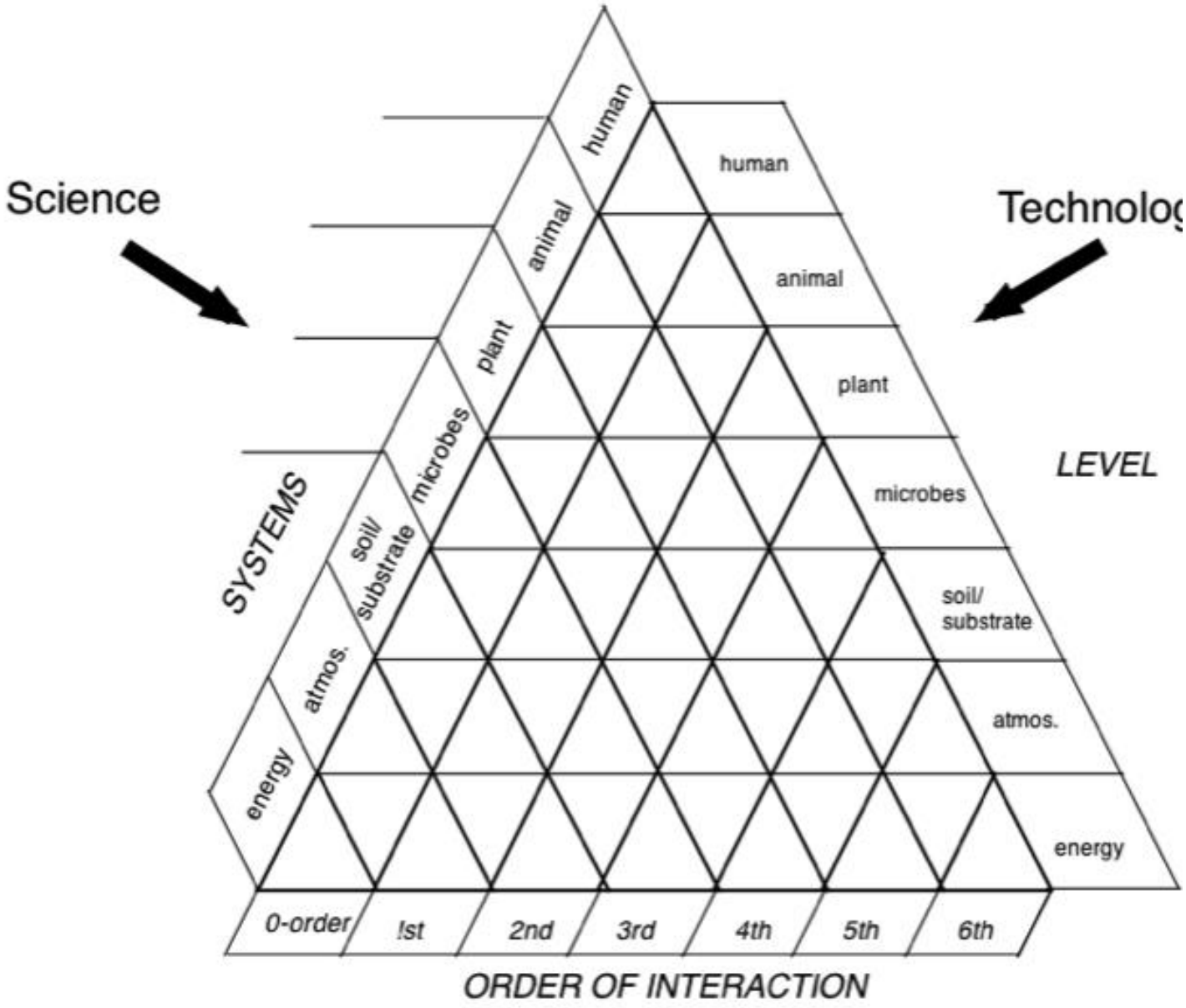
Science
Technolog
human
animal
plant
microbes
soil/
substrate
atmos.
energy
SYSTEMS
LEVEL
0-order
1st
2nd
3rd
4th
5th
6th
ORDER OF INTERACTION

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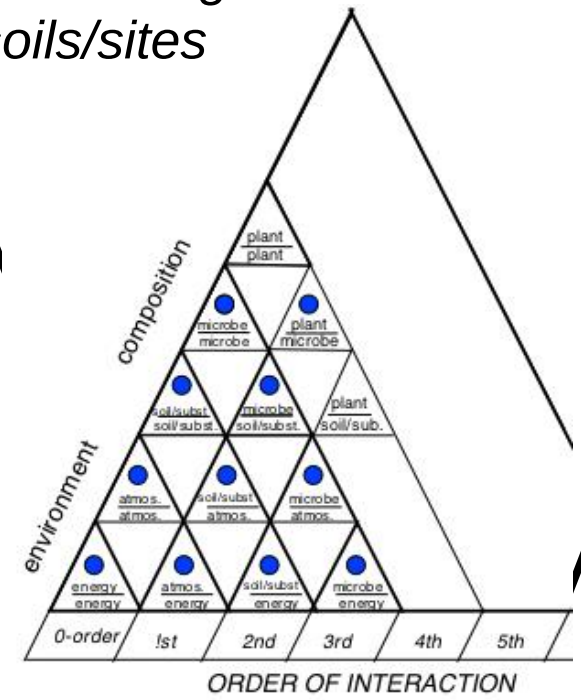

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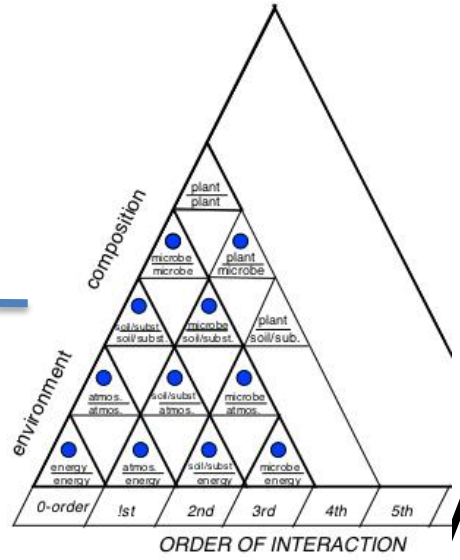

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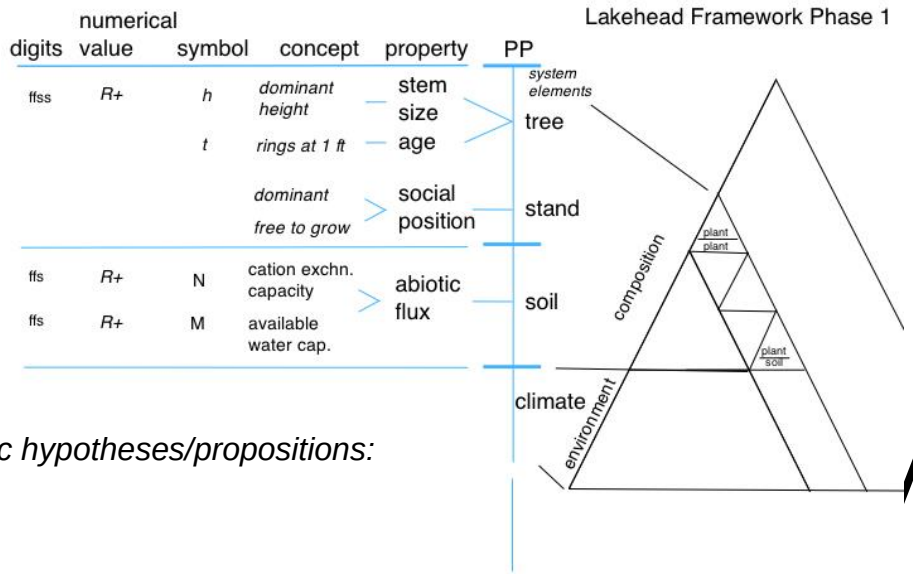

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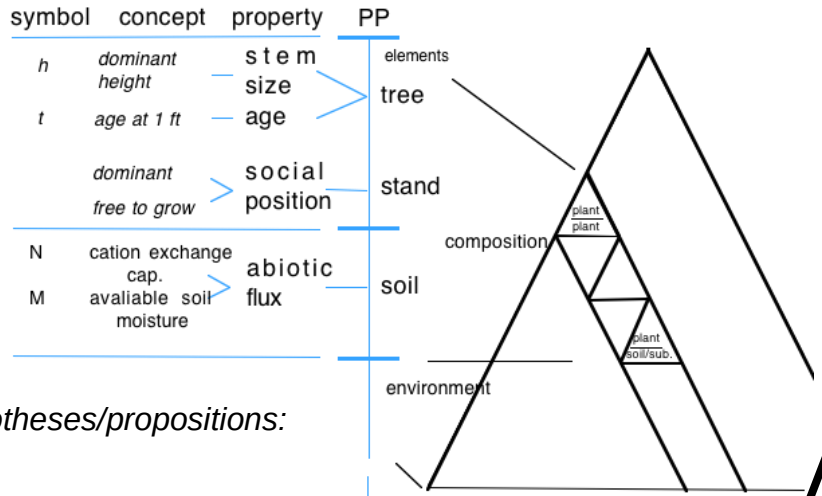

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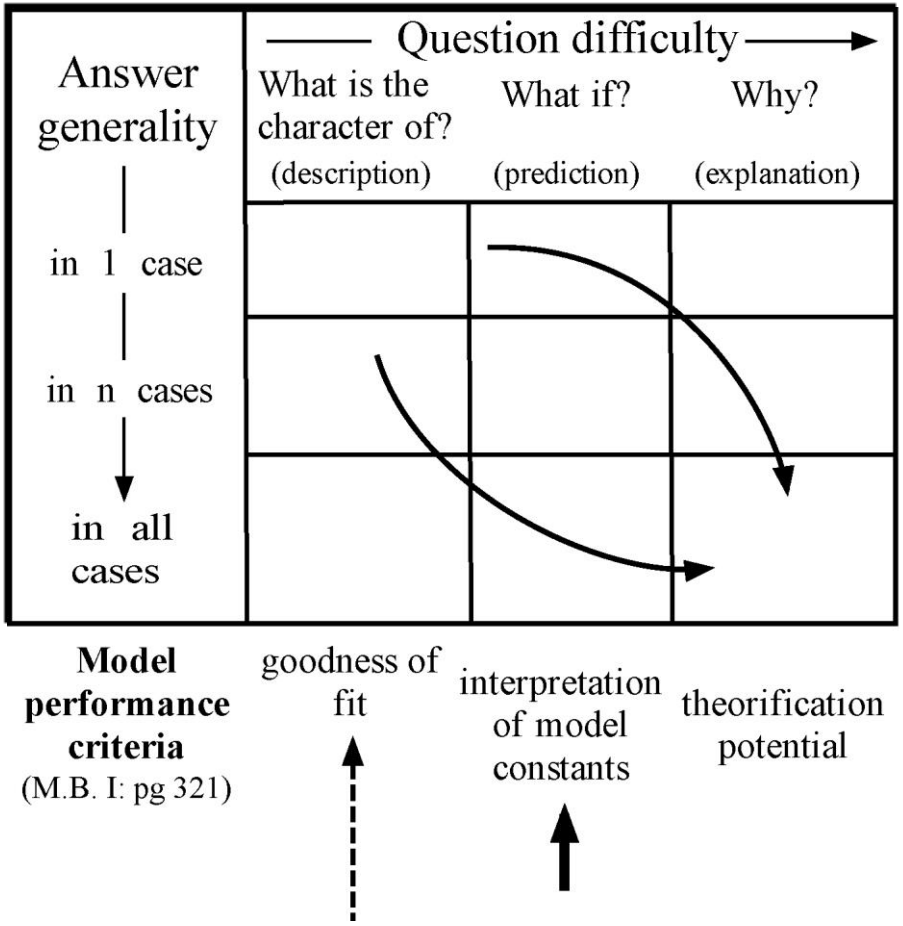

Question difficulty
Answer generality
What is the character of?
(description)
What if?
(prediction)
Why?
(explanation)
in 1 case
in n cases
in all cases
Model performance criteria
(M.B. I: pg 321)
goodness of fit
interpretation of model constants
theorification potential

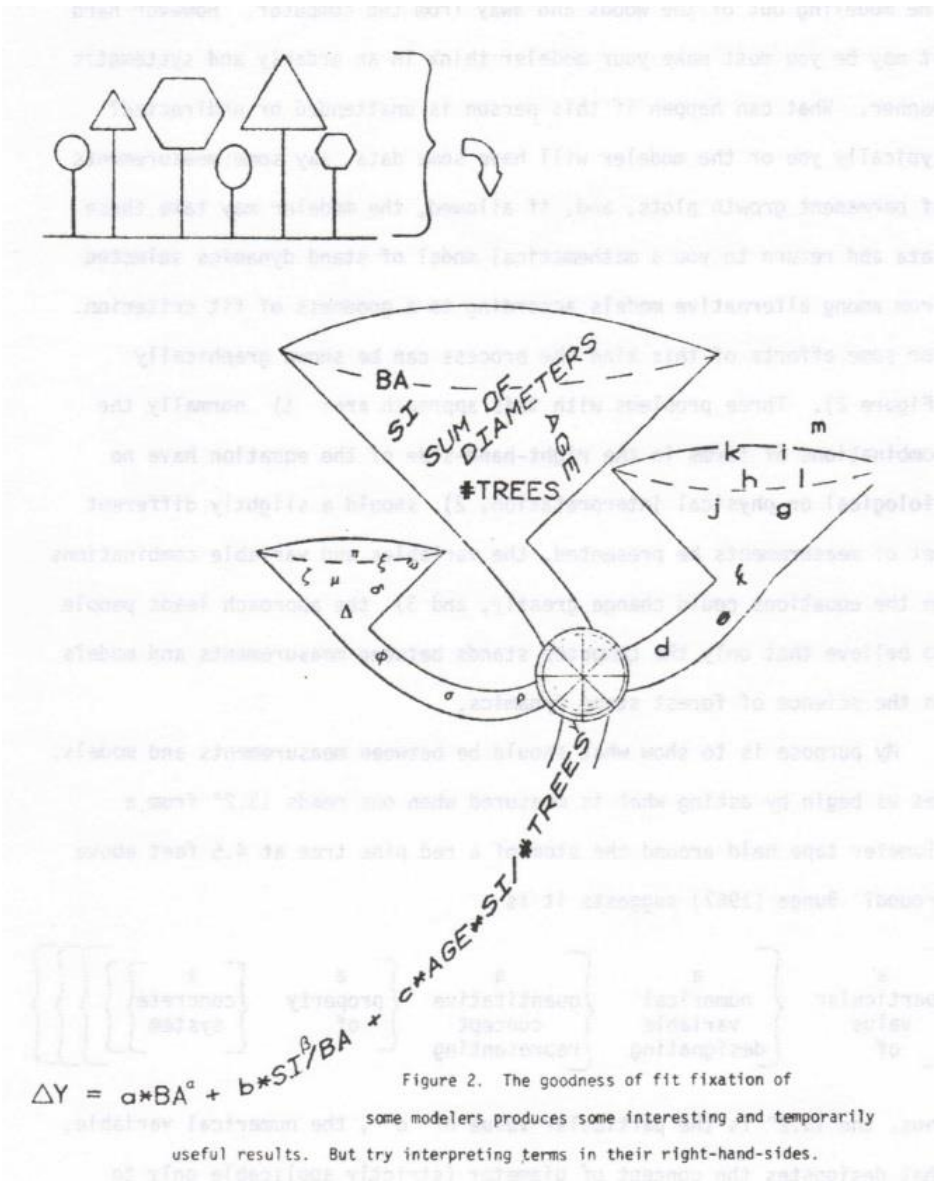
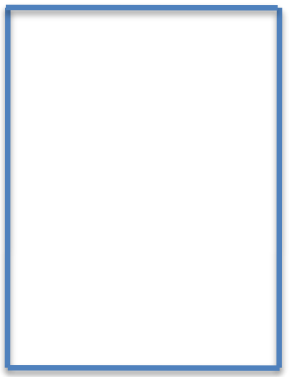
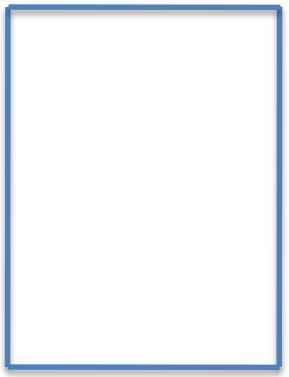


Figure 2. The goodness of fit fixation of some modelers produces some interesting and temporarily useful results. But try interpreting terms in their right-hand-sides.

A design for survivor growth models: pp 62-81 in Proceedings of a Workshop at Lakehead University: Forecasting forest stand dynamics. 1980. K. M. Brown and F. R. Clarke (eds)



The elusive formula of best fit.
A comprehensive new machine program.
1958 – USDA Forest Service



All possible regressions with less computation. 1971

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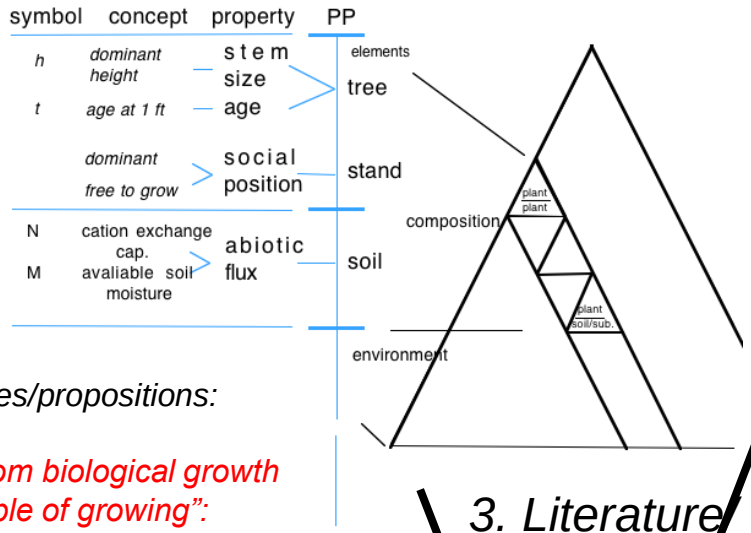

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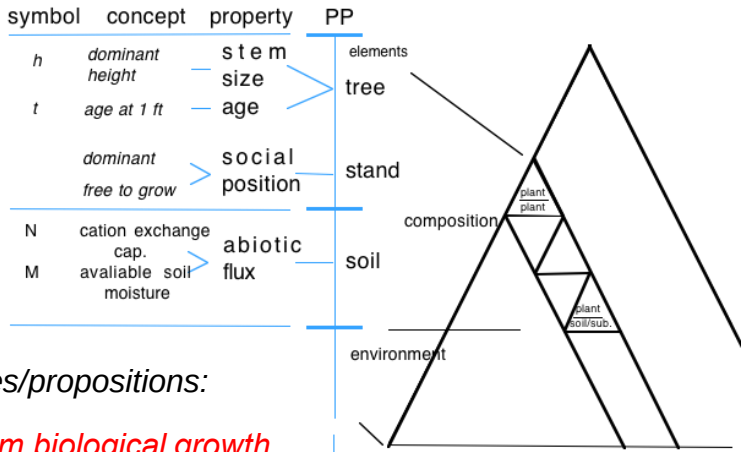

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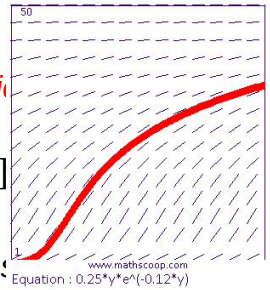

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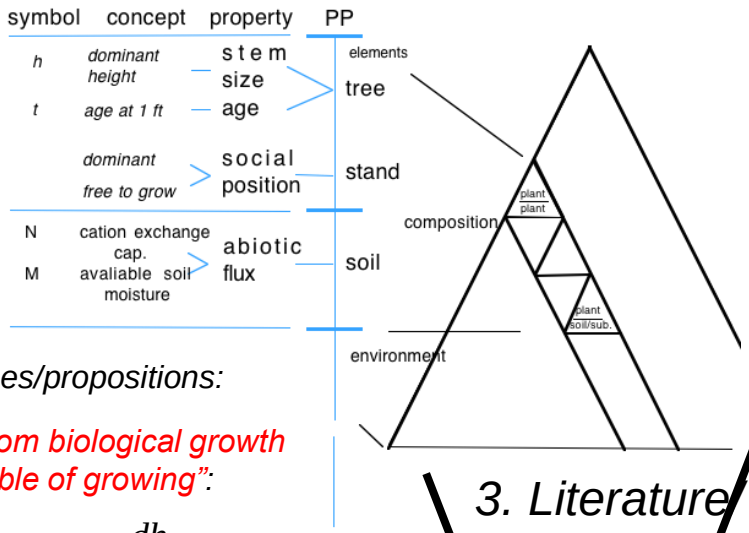

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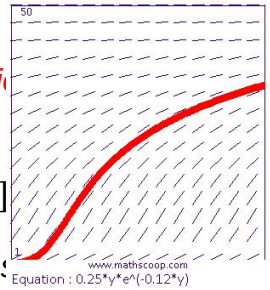

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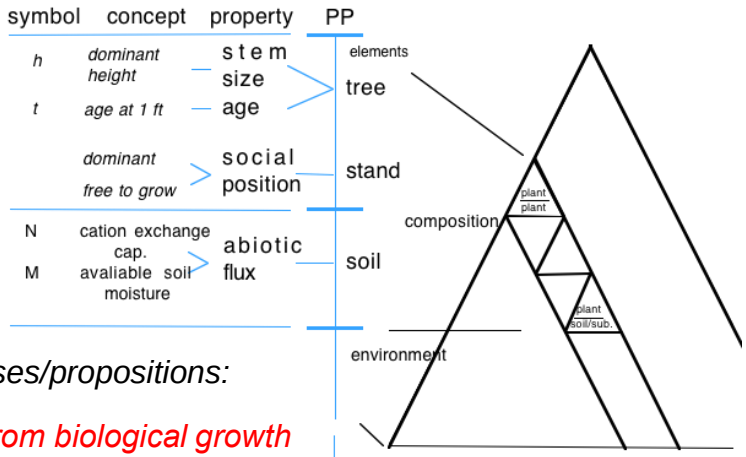

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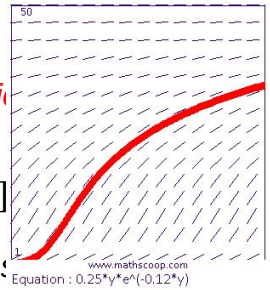

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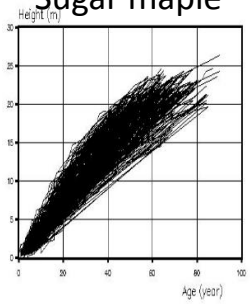

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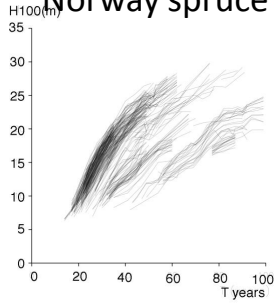

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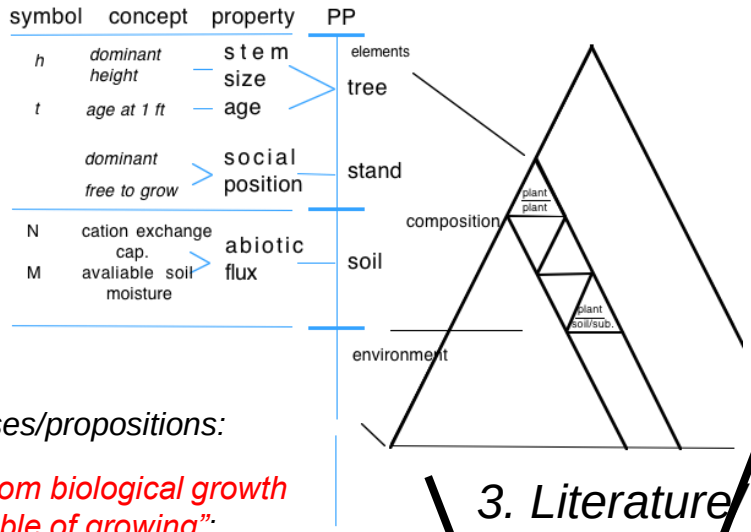

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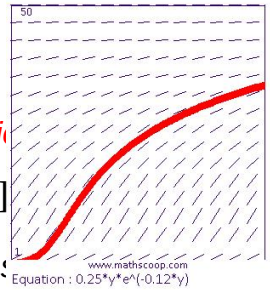

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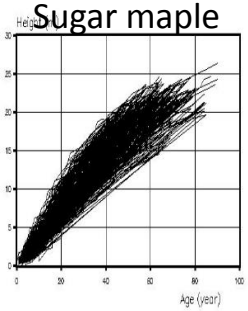

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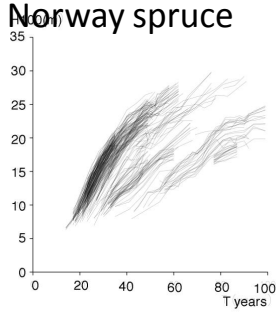

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fit :

$$dh_{i,j}/dt_i = a_j h_{i,j} Exp[-b\,h_{i,j}]$$

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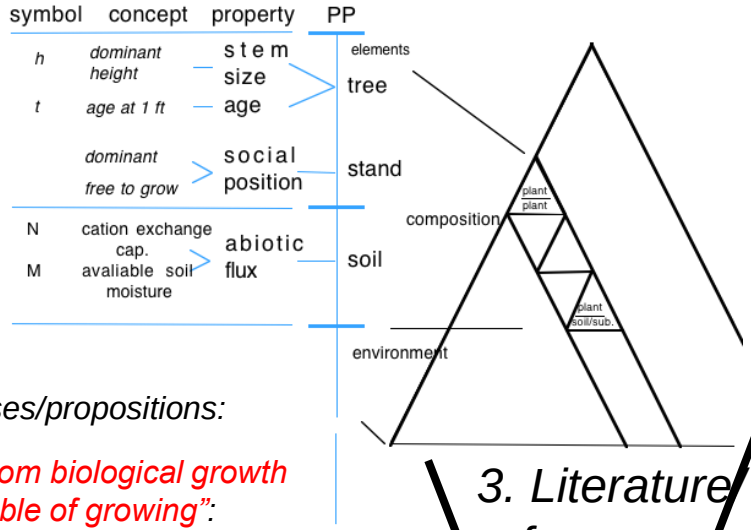

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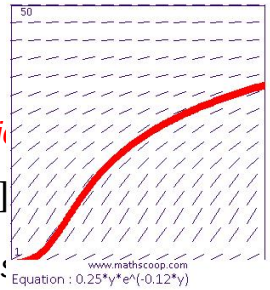

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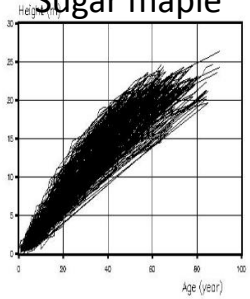

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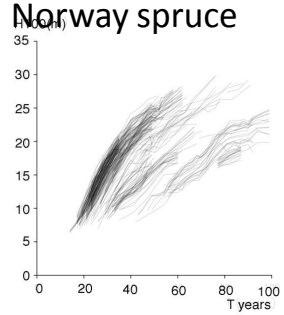

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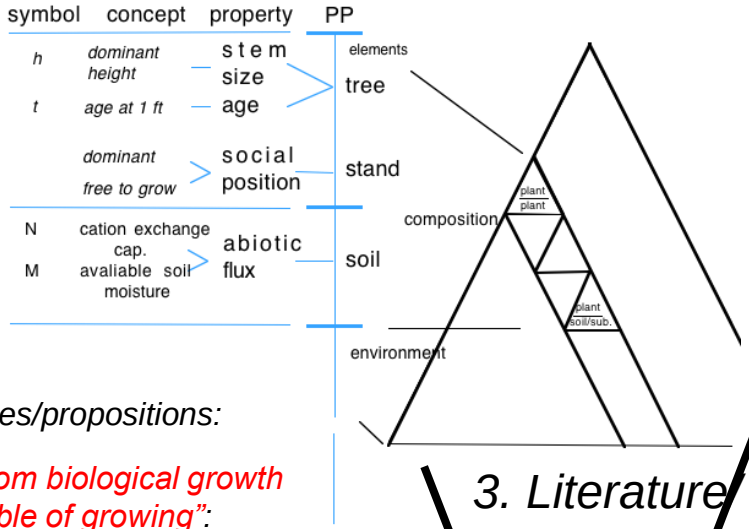
1. Forest growth on different soils/sites

Conceptual

5. System component properties, concepts



6. Scientific hypotheses/propositions:

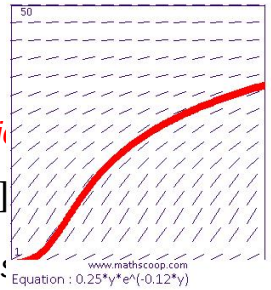
"That which results from biological growth is itself typically capable of growing":

$$\frac{dh}{dt} = f(h), \quad \frac{dh}{dt} = f(h, N, M), \quad \frac{dh}{dt} = f(h, a(M), b(N))$$

7. Deductions from sci. hypo/ Scientific inference

slope fi

$$dh/dt = a\,h\,Exp[-b\,h]$$



http:// www. mathscoop.com

8. Factual science references

3. Literature references

Methodological

9. Experimental/sampling design

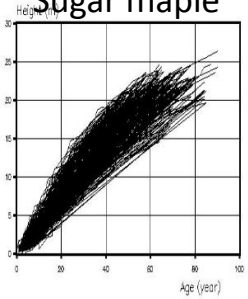
Historical ht meas'ts on permanent plots

Destructive sampling (stem analysis)

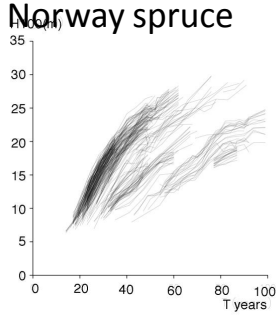
Soil and site properties

10. Measurements/data

Sugar maple



Norway spruce



11. Mathematical analysis of data

fit :

$$dh_{i,j}/dt_i = a_j h_{i,j} Exp[-b\,h_{i,j}]$$

$h_{i,j}$ = *top height of jth plot at ith time*

$\hat{a}_j$ = *specific parameter for jth plot*

$\hat{b}$ = *common parameter for all plots*

12. Statistical hypotheses & tests..

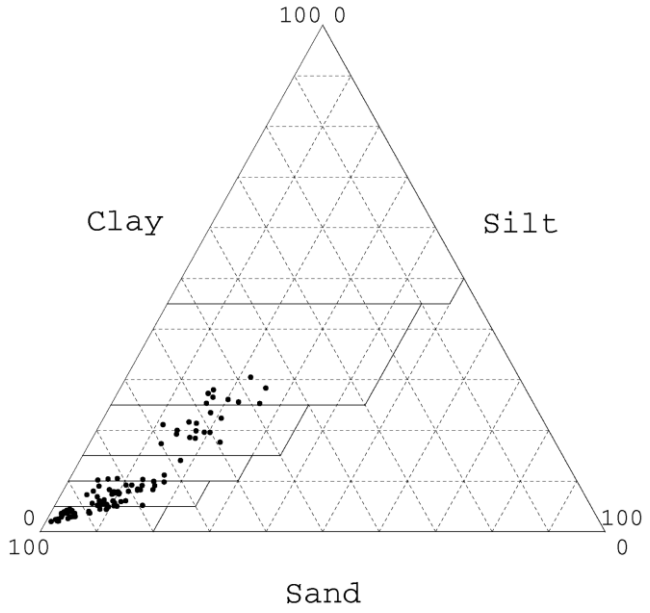
$$\hat{a}_j \overset{?}{=} f(soil,\ site\ properties)$$

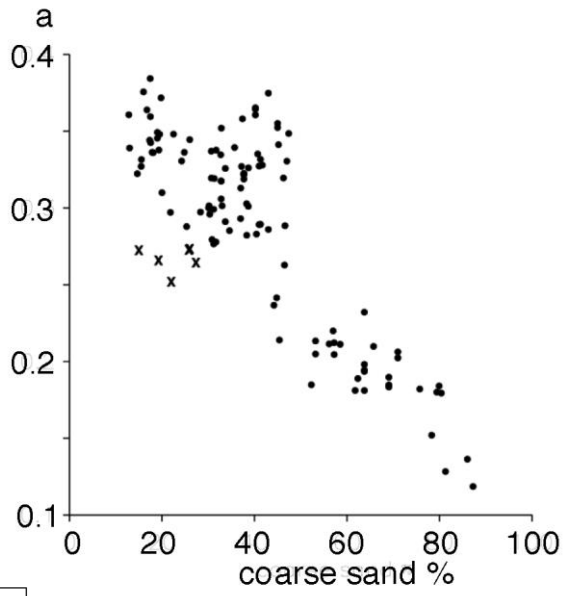
13. Statistical methods references

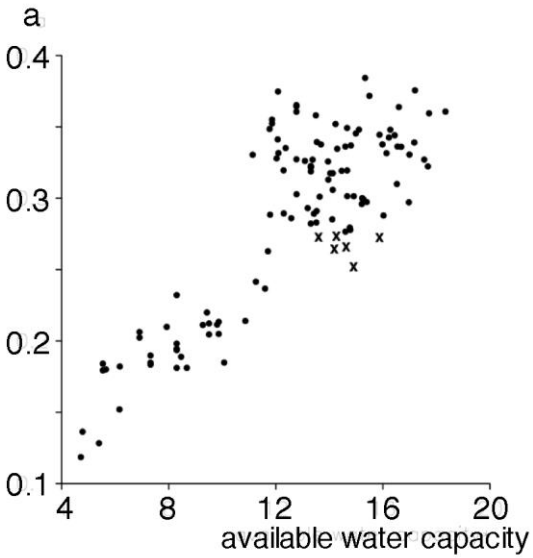
4a. Forests grow at different rates in different places and we have records

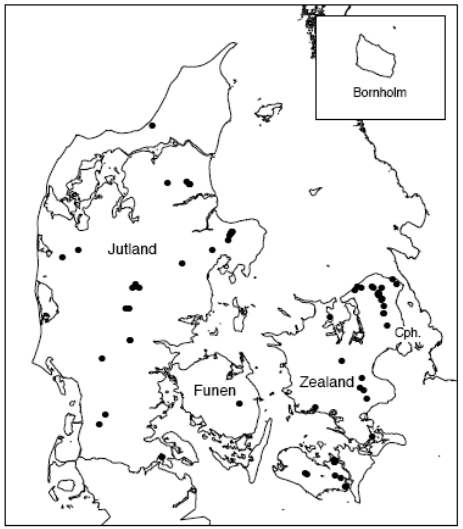
4b. Are there primary soil factors responsible for the observed

4b. Are there primary soil factors responsible for the observed differences?







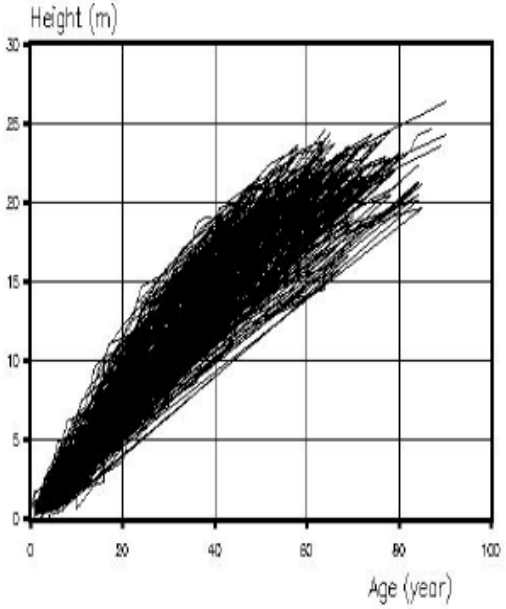


European standards:

- coarse sand (0.2-2.0 mm),
- fine sand (0.02-0.2 mm),
- silt (0.002-0.02),
- clay (<0.002 mm).

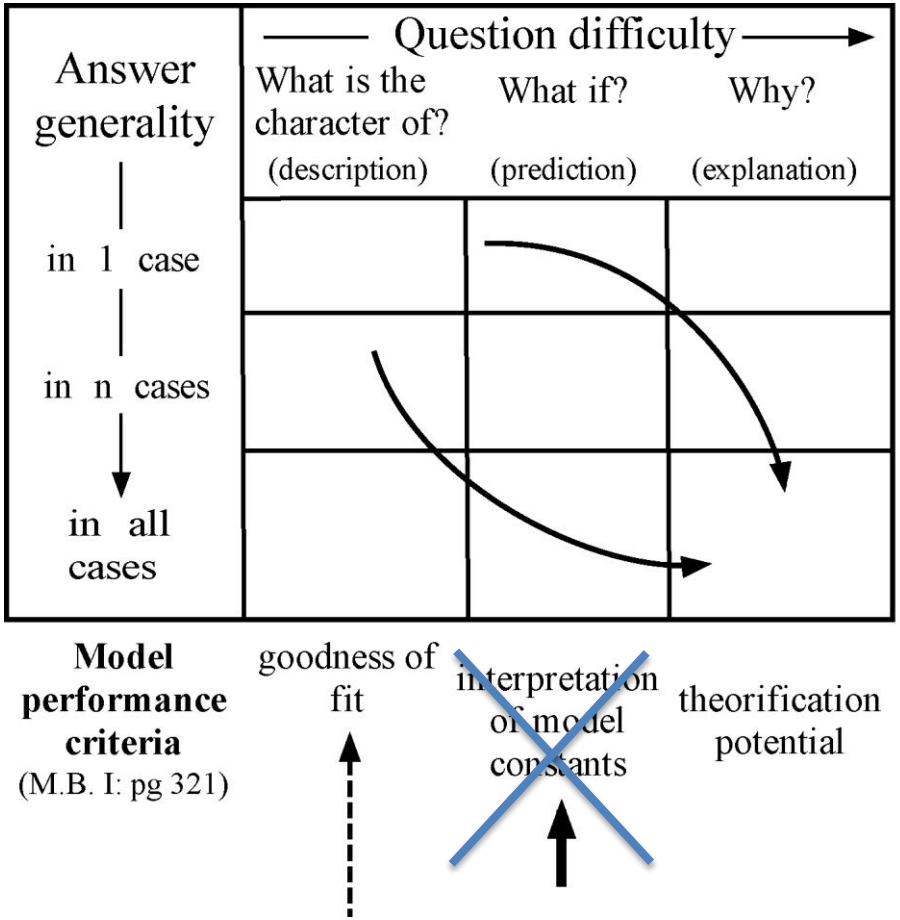
Running - Rich Diesslin © 1984,2003
Drawing for Animation

http://www.the-cartoonist.com/portfolio/cell_animation/running.html


Height (m)
30
25
20
15
10
5
0
0
20
40
60
80
100
Age (year)


Michigan
OTTAWA
HIAWATHA
CHEQUAMEGON
NICOLET
Wisconsin

USA sand is just plain sand,
doesn’t matter how fine or coarse!!

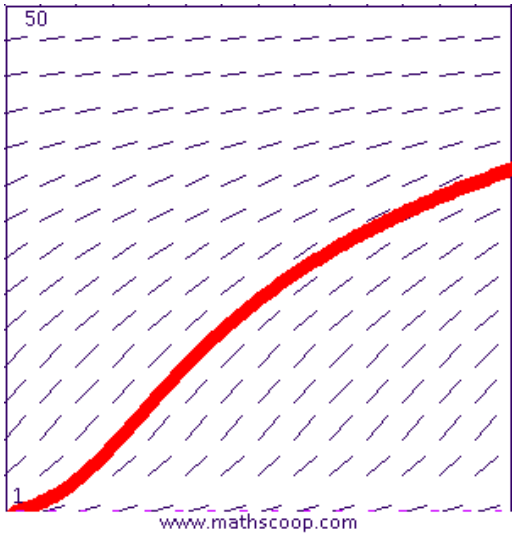

Question difficulty
Answer generality
What is the character of?
What if?
Why?
(description)
(prediction)
(explanation)
in 1 case
in n cases
in all cases
Model performance criteria
(M.B. I: pg 321)
goodness of fit
interpretation of model constants
theorification potential

Thank you

European standards:
coarse sand (0.2-2.0 mm),
fine sand (0.02-0.2 mm),
silt (0.002-0.02),
clay (<0.002 mm).

Madsen and Platou (1983) developed a model for available water capacity for Danish conditions. Their model is:

AWC (%) = 1.96*organic matter % + 0.02*clay % + 0.34*silt % + 0.17*fine sand % + 2.26



Equation : 0.15*y*e^(-0.10*y)

1) (2.00, 1.00)
2) (3.00, 1.14)
3) (4.00, 1.29)
4) (5.00, 1.46)
5) (6.00, 1.65)
6) (7.00, 1.86)
7) (8.00, 2.09)
8) (9.00, 2.34)
9) (10.00, 2.62)
10) (11.00, 2.92)
11) (12.00, 3.25)
...
99) (100.00, 34.05)