Quantitative Thinking in the Life Sciences

October 3rd – Coding in R, sampling error, and measurement error

Today

- Assignment 4 R code
- Measurement error (a part of sampling error)
- Assignment # 5
- More R fun!
  - Chapter 6

Housekeeping

- Schedule

Oct 3	Your system revisited: Concept map, variables and error. Precision and Accuracy	R – measurement error
Oct 10	**Mathematical relationships**	**R – Relationships in your system**
Oct 17	Single variable modeling (e.g., linear models, growth rate models)	R – simulating your system

Assignment 4 R code review

- To R we go!
  - Dropbox\\Quantitative Thinking\\Oct 3 notes_assignment 4 r code.R

Some error terminology

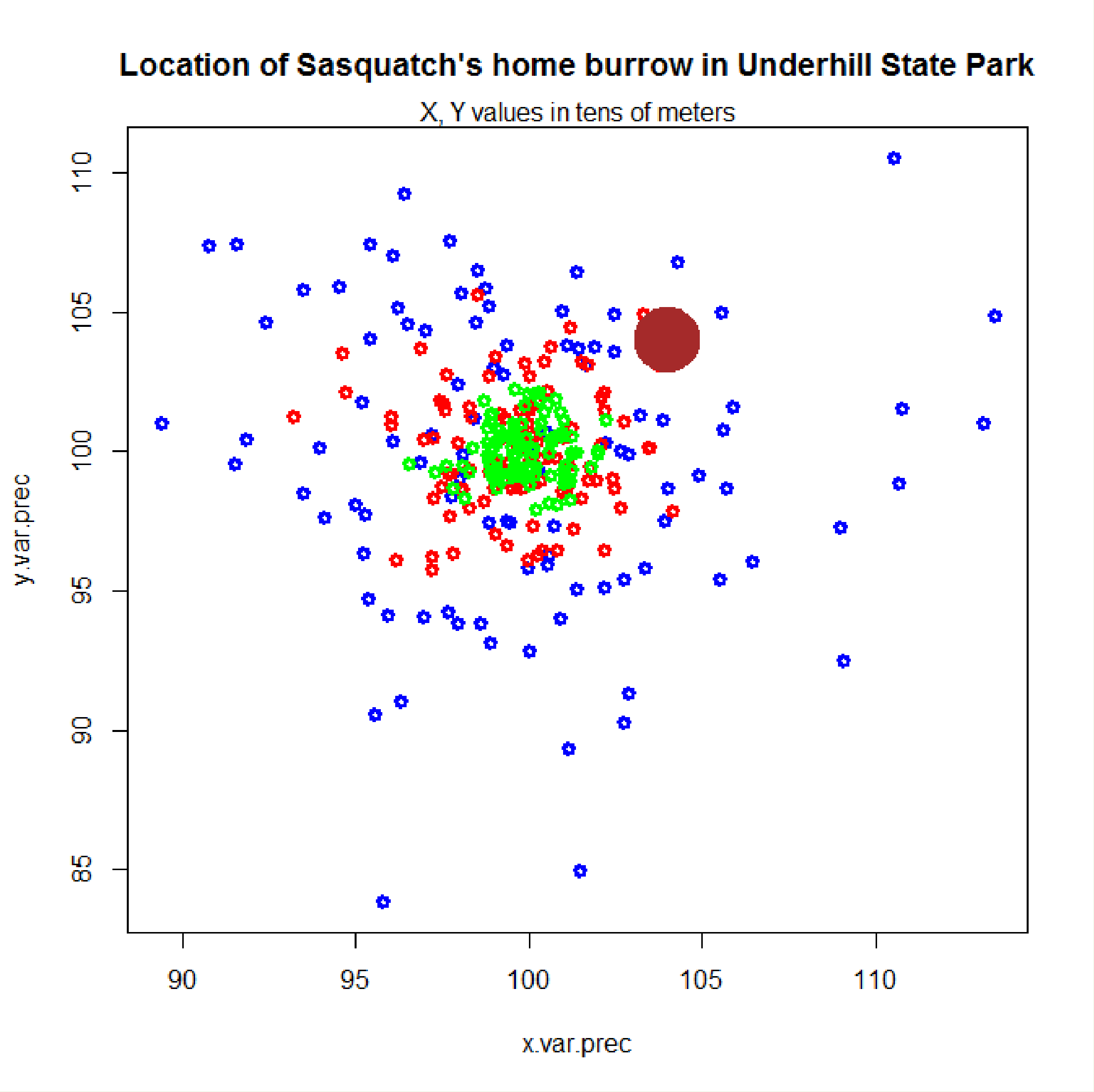
- Standard deviation is a measure of the variability in your true population (frequently unknown)
- Standard error is an estimate of the variability in your measured population
- Measurement or Observational error (part of standard error)

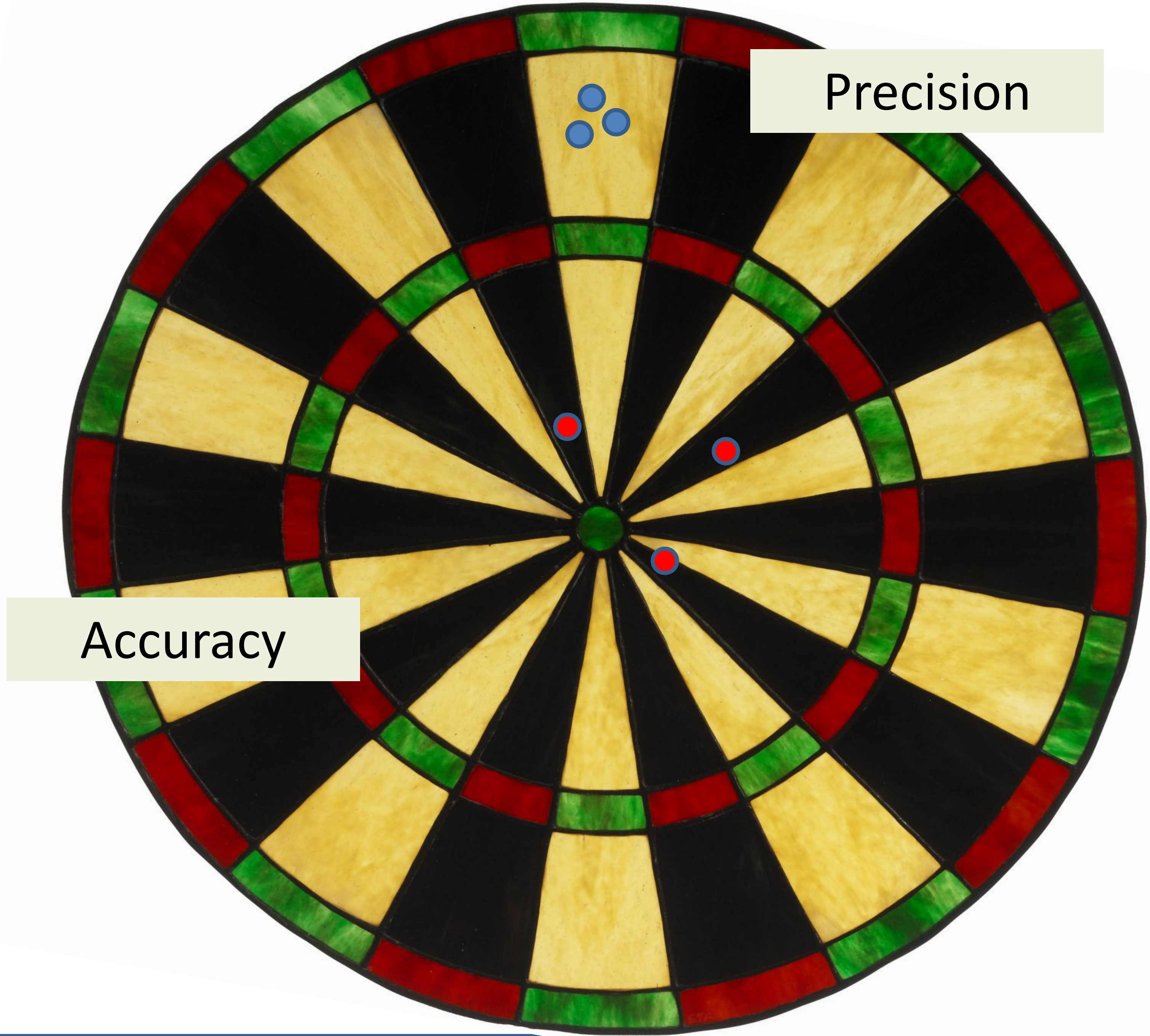
Measurement or Observational error (part of standard error)

These errors are the difference between the true value of a data point and the measured value of a data point.

- Systematic error (bias)
- Random error
  - Precision
  - Accuracy

Precision vs Accuracy




Precision
Accuracy

A more intuitive example (for me anyway)

Precision – How many zeros after the decimal point?

Accuracy – did you tare the machine?

Precise data (with accuracy error)

4.721 g
4.832 g
4.754 g
4.902 g
4.741 g

= 4.500 g

Precise data: correctly tared data

0.221 g
0.332 g
0.254 g
0.402 g
0.241 g

Accurate data but less precise scale (Precision error)

0.2 g
0.3 g
0.3 g
0.4 g
0.2 g

Back to R for measurement error example

Measurement error
Systematic error or bias

- Brown wheat mite example
- Why might consistent sampling error not be important from an applicability perspective?
  - Models will test observed (not actual), predictions will be created for observed (not actual), but many of the action decisions are also based on observed (not actual).
- Russian wheat aphid example
  - CONSISTENT BIAS!

Assignment # 5

- Assignment # 4 is due on Oct 10th
- Worth 50 points
- Part 1: Sampling error
  - What data will you be obtaining to answer your questions (e.g., rainfall, temperature, flower area per plant)? How well will you be able to measure those data?
  - Specifically, for each major component of your concept map:
    - Are you going to be taking data to quantify this component?
    - What measurement error(s) might be associated with these data
- Part 2: Chapter 6 R code found on my website

Endless fun with R!

- Other questions from last week?
- This week – more programming!
- With great power comes great responsibility
  - > require(datasets)
  - > data(ChickWeight)
  - > new.CW = edit(ChickWeight)
  - > new.CW
  - There is NO RECORD, NO UNDO BUTTON, NO HOPE!
  - > new.array = edit(array(sample(1:10,60,replace=TRUE),dim = c(4,5,3)))
  - > psuedo.random = edit(rnorm(50,10,3))
  - > model1 = lm(weight~Diet)
  - > edit(model1)

  You can also edit functions like mean() or matplot(). Don’t do this. EVER!

  It is like blasting apart an asteroid using precisely timed nuclear bombs to create a dust cloud that will shield the earth from precisely 6.58% of the incoming solar radiation, and thus, cooling the earth and preventing global warming. SURE, nothing could go wrong with that!

  http://news.yahoo.com/asteroid-dust-could-fight-climate-change-earth-132248031.html