Uncertainty

- Process uncertainty
  - Affects the underlying process
  - Critical for forecast (time-evolving process)
- Observation uncertainty
  - Doesn't affect the underlying process

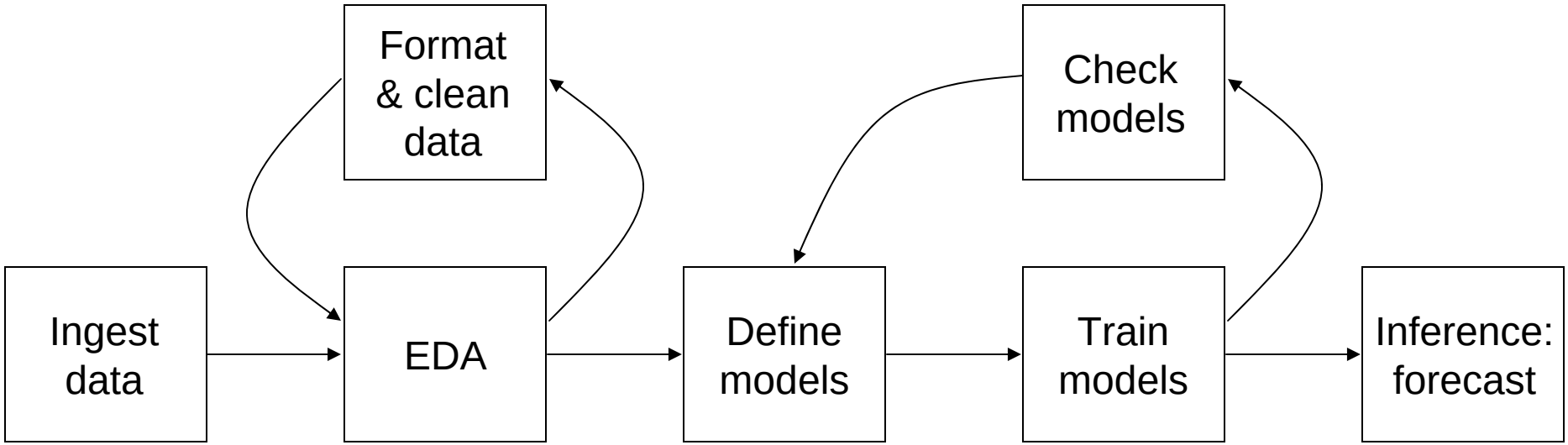
Process uncertainty

- Process model error
- Parameter variability
  - Demographic stochasticity (intrinsic)
  - Environmental stochasticity (extrinsic)
- Reducible (in principle) by improving models
- Ultimately irreducible at the relevant scale
- Improving observations doesn't help

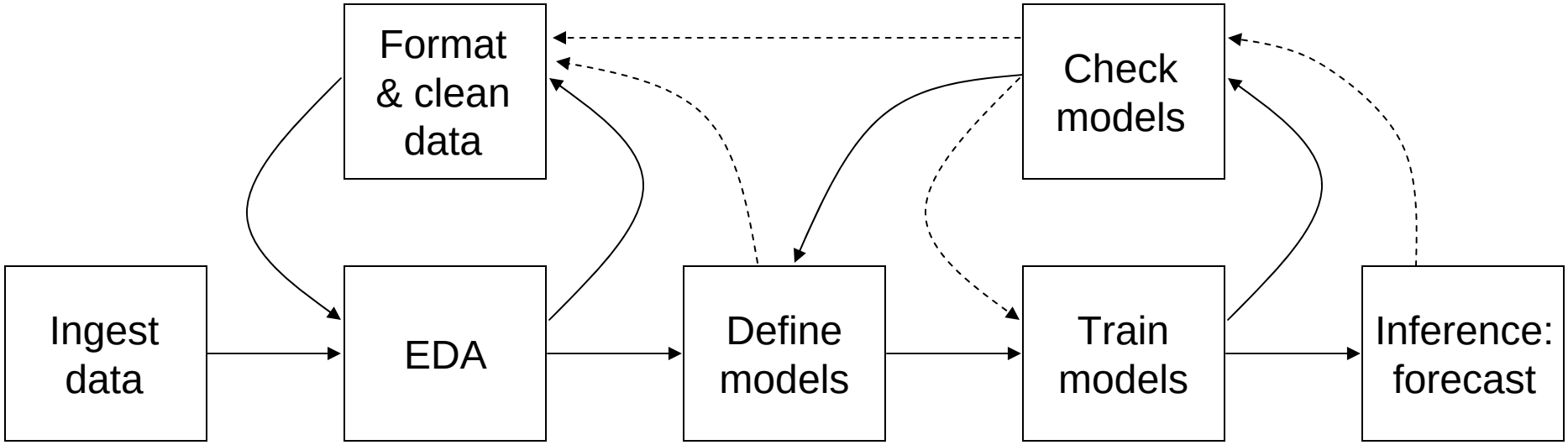
Observation uncertainty

- Measurement error (fundamental)
- Sampling error (fundamental)
- Parameter uncertainty
- Model structure uncertainty (model choice)
- Initial condition uncertainty
- Driver uncertainty
- All can be reduced with better/more observations
- Latter 4 are typically outcome of first two

Our project workflow

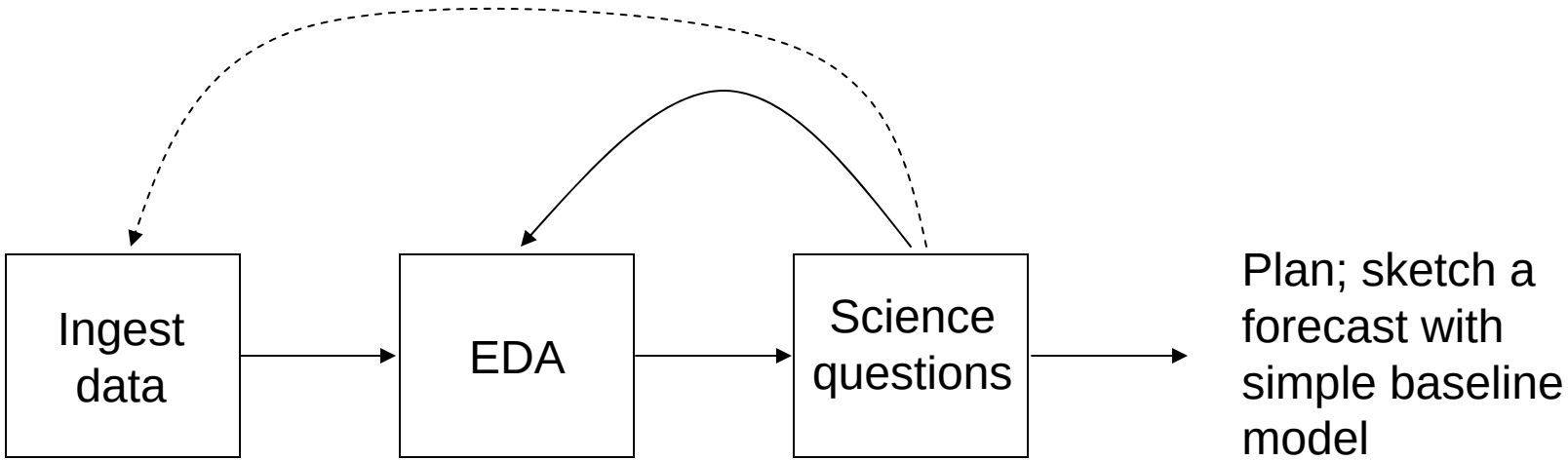


Our project workflow



Our project workflow

Start with a rapid iteration for idea exploration



Goals for end of next week:

1) Write down specific question(s)
2) Ideas for analysis

EDA - questions

- Are there enough data of needed quality?
  - how many replicates in time and space?
  - spatial/temporal match of variables?
  - taxonomic resolution?

EDA - code

- ggplot, dplyr, %>%
- head(), tail()
- class(),unique(), range()
- histogram, boxplot, violin plot, density, scatterplot, dotplot, jitter(), ...
- group_by, summarize, filter, arrange, mutate
- facet plots (plots by goups)