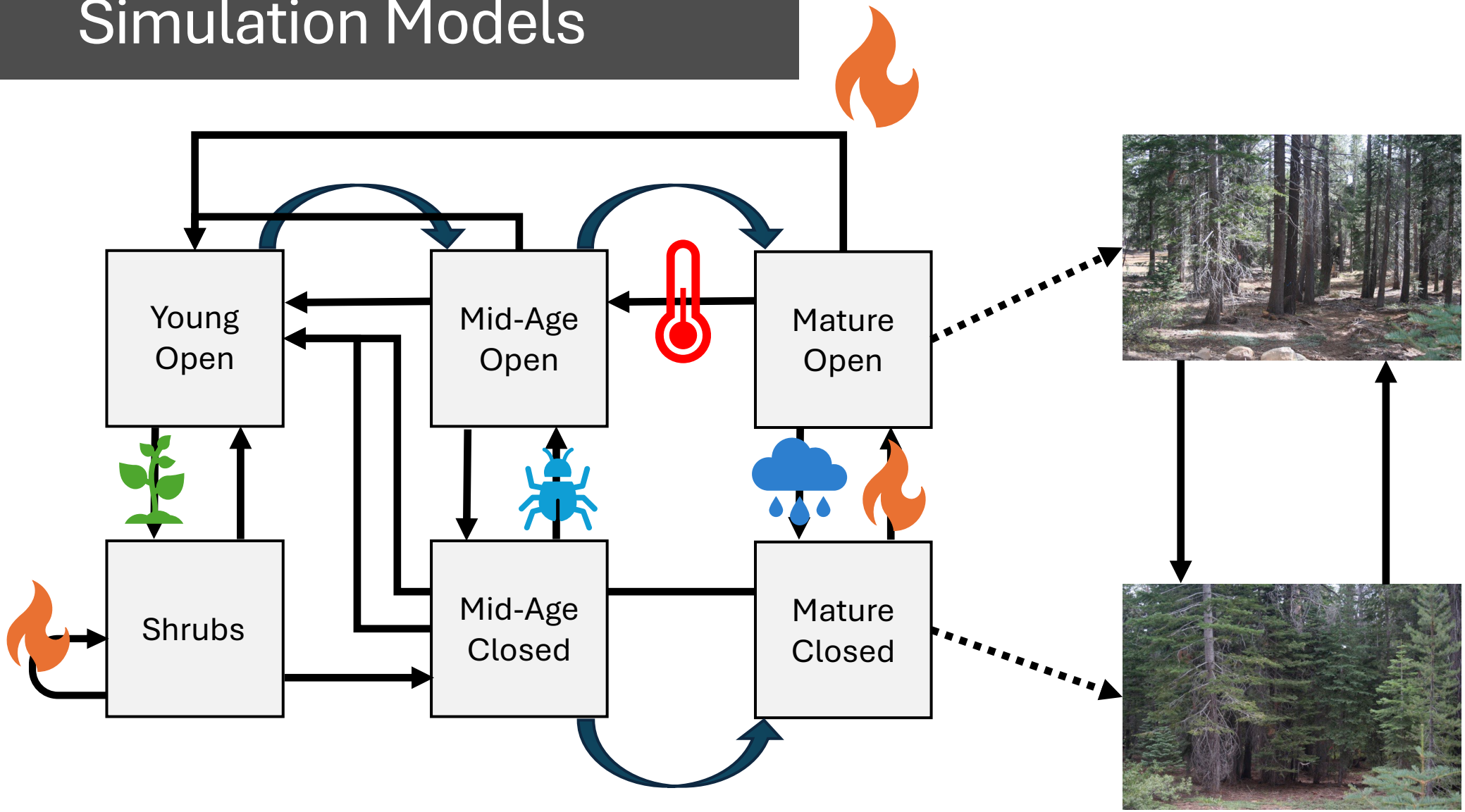
Coupling groundwater modeling with state-and-transition simulation models of vegetation

Intro. to State-and-Transition Simulation Models

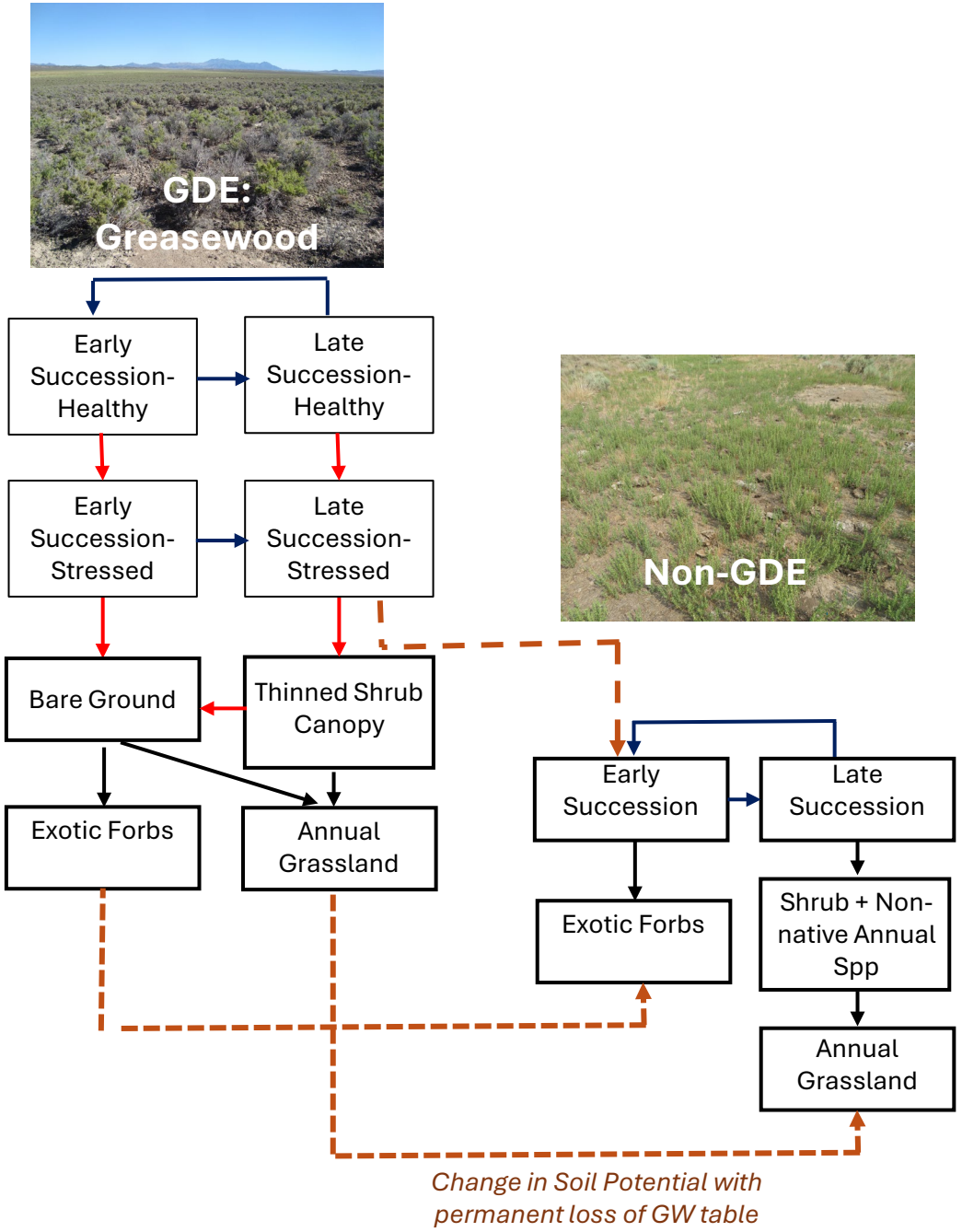


Connecting the models

- Created STSM for each of the unique combinations of soil type and rooting depth
  - E.g., Sandy loam at 0.5 m rooting depth , Sandy loam at 2 m rooting depth, and 3.6 m rooting depth
- Generic models
  - States and transitions don’t change
  - Probability that transition occurs do change

STSMs and groundwater

- Focus on transition between healthy, water stressed, and non-GDE states through drop in groundwater depth
- Can combine with other ecological processes (e.g., exotic species invasion)



Modified from Provencher et al. 2020; greasewood picture: L. Provencher;

Non-wet transitions in the models

- Grazing
  - Proper grazing = little impact
- Fire
  - Probability for 0.5 m rooting depth based on average meadow/riparian habitats
  - Probability for 2 m rooting depth based on average across aspen habitats
  - Probability for 3.6 m rooting depth based on average greasewood habitats
- Non-native invasion
  - Non-native annual grasses and forbs
  - Noxious weeds

Wet transitions in the models

- Depth to groundwater and Annual Water Deficit
  - Add stress or rewater
- Each impact vegetation differently based on soil texture and rd
- Can have interactive effects with other transitions
- These parameters come out of Christine’s and Steve’s modeling efforts

Scenario testing to understand changing vegetation

- Develop scenarios to test situations of management interest
  - Examples: Changing depth to water, increasing/decreasing drought, management approaches, etc.

Year	Scenario 1- DTW (m)	Scenario 2- DTW (m)	Annual Water Deficit
1	1.0	1.0	-200
2	1.5	1.0	-200
3	1.5	1.0	-200
4	2.0	0.5	-200
5	2.5	0.5	-200
6	3.0	0.5	-200

Scenarios allow us to look at potential futures