Colorado River Basin Eco-hydrology: Dynamic Vegetation Responses in a Changing Climate

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Colorado River Basin Eco-hydrology: Dynamic Vegetation Responses in a Changing Climate

Overview

- Develop integrated tools to assess **dynamic vegetation** responses in a changing **climate**
- Assess changes to **distributed yield** with ensemble GCM projections using a dynamic vegetation model in the **Colorado River Basin**

Motivation

- Models (i.e. VIC) require a priori knowledge of vegetation types and parameters; static
- Mechanistic dynamic vegetation models require long spin-ups and are highly parameterized. Scaling issues with gap models.

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- ***Postulate – there exists an optimal strategy for water use in a given climate that will maximize assimilation and minimize stress.***

$$f(\Theta) = A - \lambda E$$

$$\frac{\partial A}{\partial g_c} - \lambda \frac{\partial E}{\partial g_c} = 0$$

$$g_c = f(Ca, k, VPD, Light, Temp, \lambda)$$

$$\lambda(S, \Theta_{\mathrm{v\{Climate\ \}}})$$

Cowan & Farquhar, 1977
Eagleson, 1978
Katul, 2010
Manzoni, 2011, 2012

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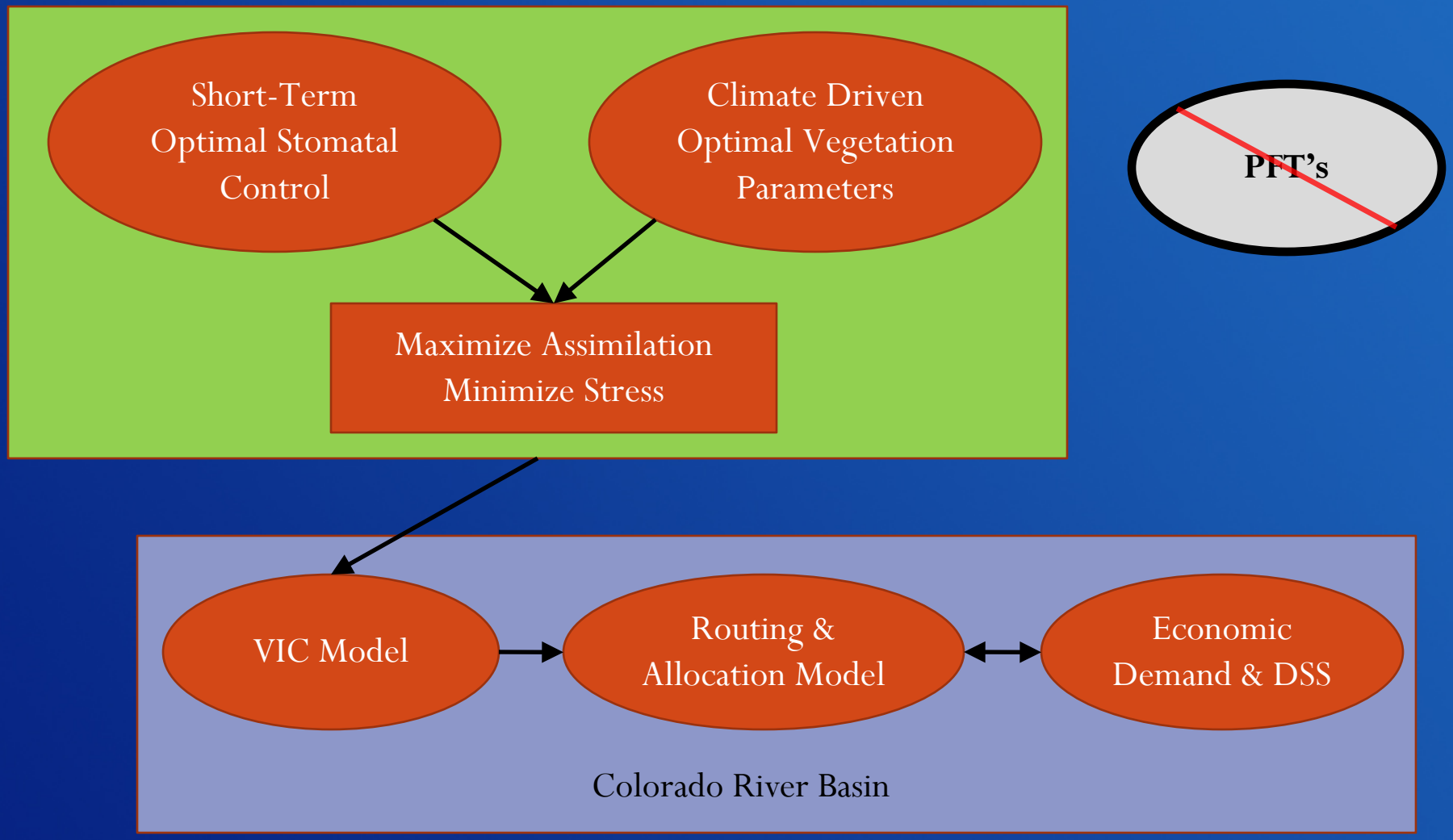
Study Approach



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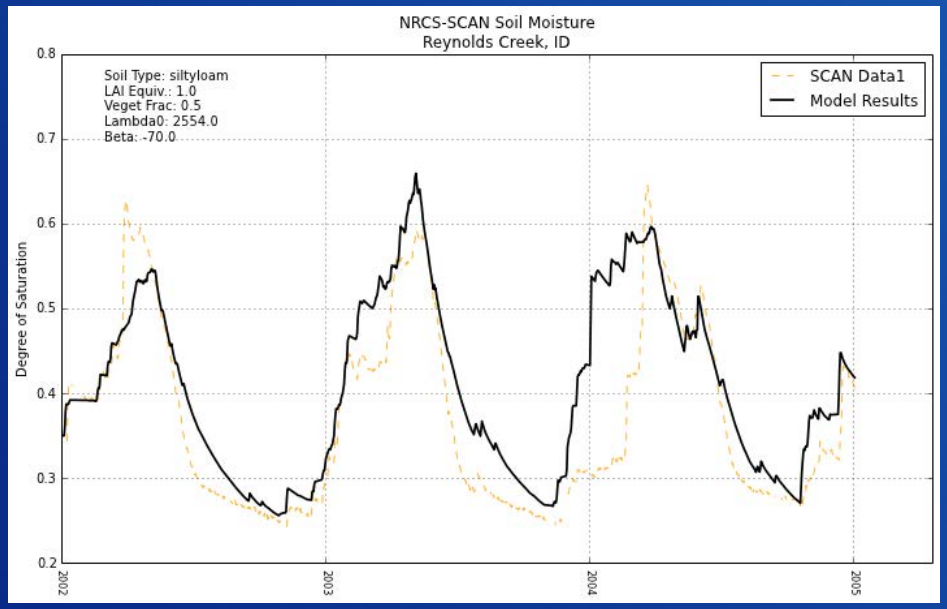
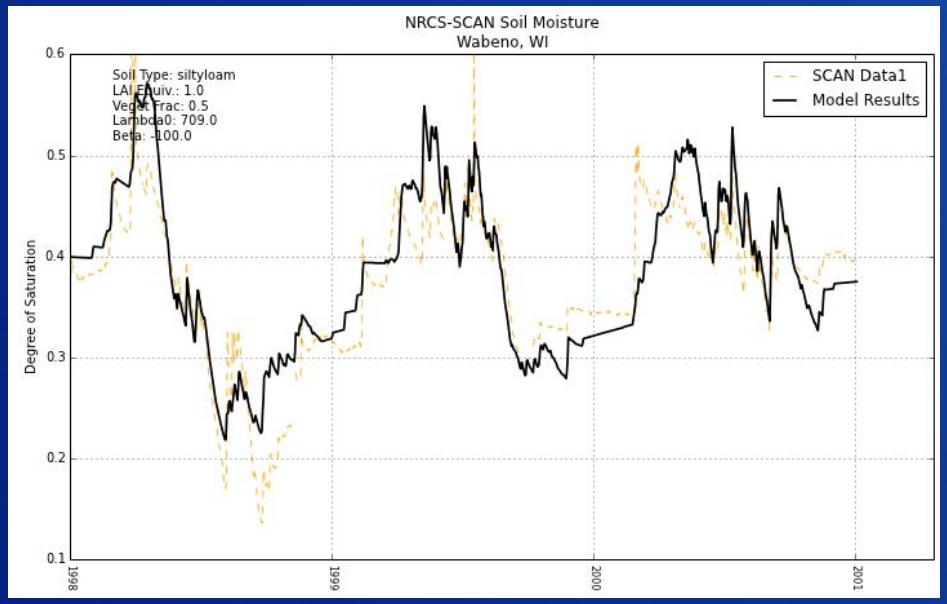
No Specification of Vegetation
No Calibration

Preliminary Results





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Summary

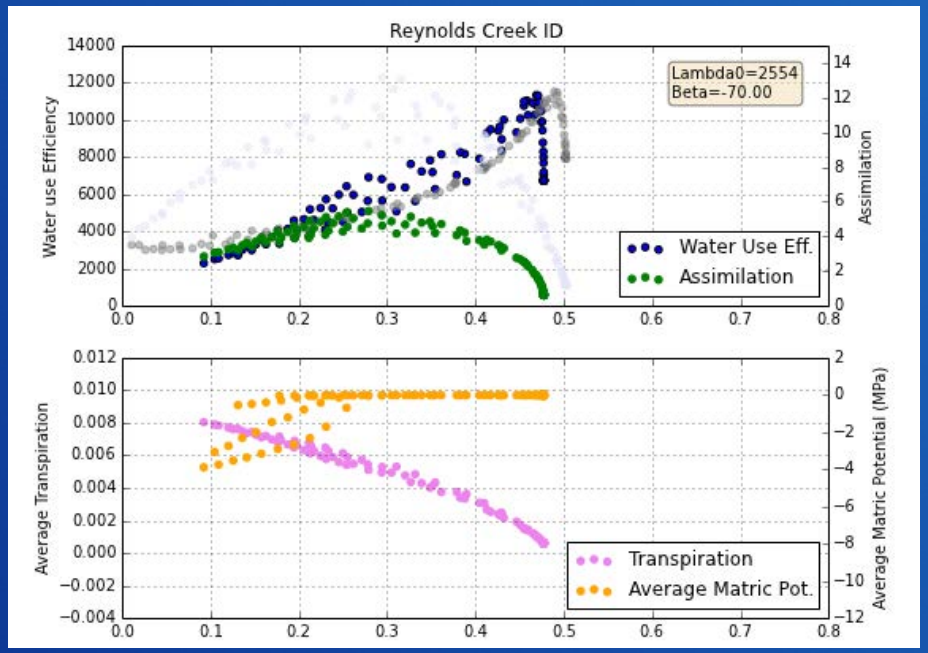
- VIC Model with GA has been built
- Optimal Stomatal Control Theories
  - Maximize Assimilation
  - Minimize Stress
- Vegetation Parameters Dynamic w/ Climate
- Approach to be integrated into VIC for projected yield

Questions

- Regress optimal parameters with actual vegetation classes
- Senescence and Mortality
- Duration of 'Climate' Period

Next Steps

- Further Testing!
- Integration of Optimal Control into VIC
- Ensemble GCM Model Runs



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