

BioEarth: Reservoirs, Routing, Economics, Crops

Kirti Rajagopalan, PhD Student
Civil and Environmental Engineering
Washington State University

BioEarth Team of Collaborators

Washington State University:

Bio. Sciences: Dave Evans, Sarah Anderson, Justin Poinsatte

Bio. Systems Eng.: Claudio Stöckle, Roger Nelson, Keyvan Malek

Center for Sustaining Agriculture and Natural Resources: Chad Kruger, Elizabeth Allen, Georgine Yorgey

Civil and Env. Eng.: Jennifer Adam, Michael Barber, Kirti Rajagopalan, Kiran Chinnayakanahalli, Mingliang Liu, Julian Reyes, Shifa Dinesh

Computer Sciences: Ananth Kalyanaraman, Tristan Mullis

Economics: Michael Brady, Jonathan Yoder, Bhagyam Chandrasekharan

Extension: Andy Perleberg

Lab for Atmospheric Research: Brian Lamb, Serena Chung, Joseph Vaughan, Fok-Yan Leung, Tsengel Nergui

School of the Environment: John Harrison, Allyson Beall, Cody Miller

Clark University: Jennie Stephens

Notre Dame: Alan Hamlet

National Center for Atmospheric Research: Alex Guenther, Xiaoyan Jiang

Oregon State University: Yong Chen

Pacific Northwest National Lab: Ruby Leung, Jin-ho Yoon

University of California, Santa Barbara: Christina Tague, Jun Zhu, Janet Choate

University of Washington: Bart Nijssen

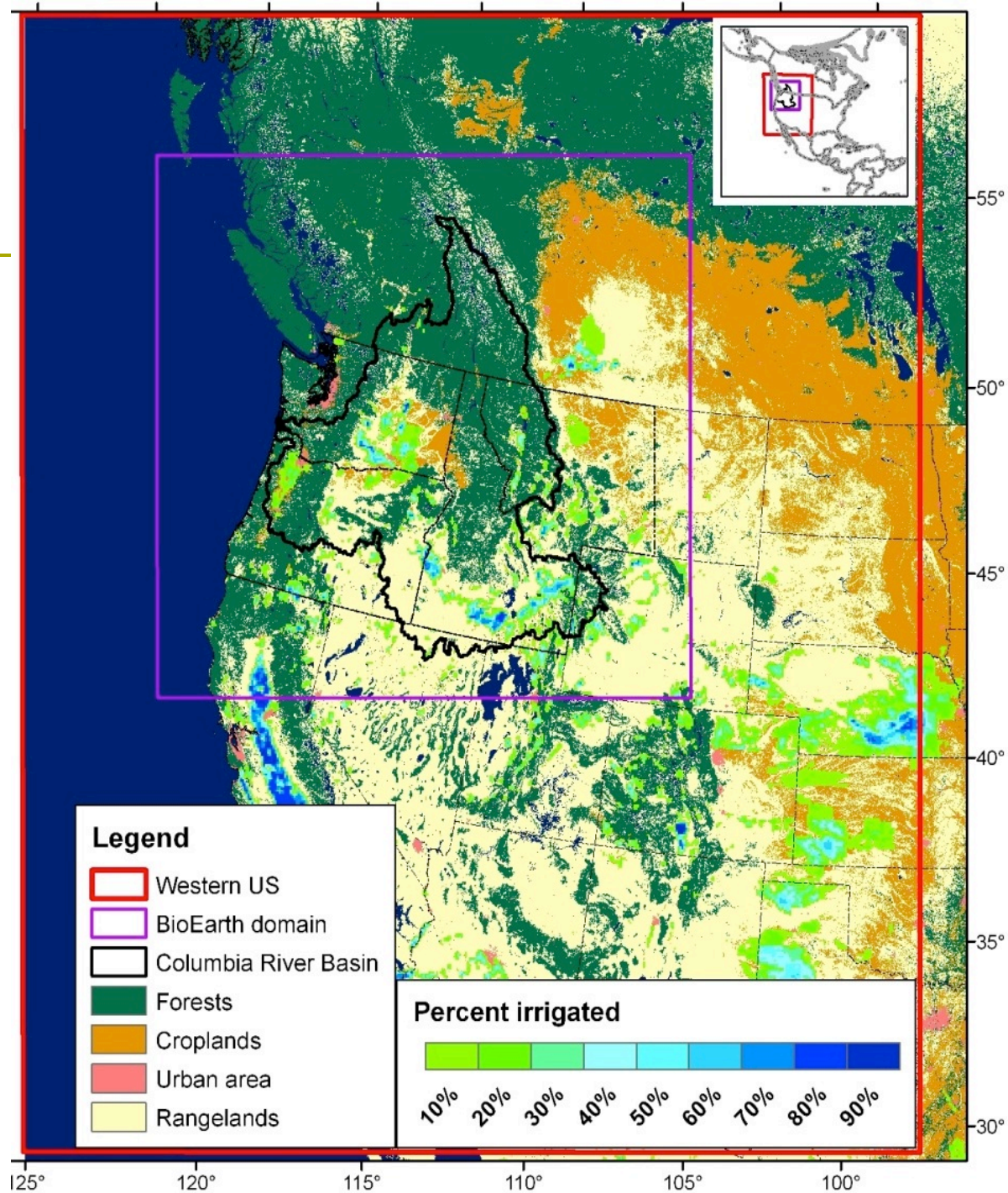
Goal and Objectives

Overarching Goal: To improve the understanding of regional and decadal-scale C:N:H₂O interactions in context of global change to

1. better understand the role that resource and environmental management actions have in impacting earth system dynamics, and
2. inform decision makers involved in natural and agricultural resource management.

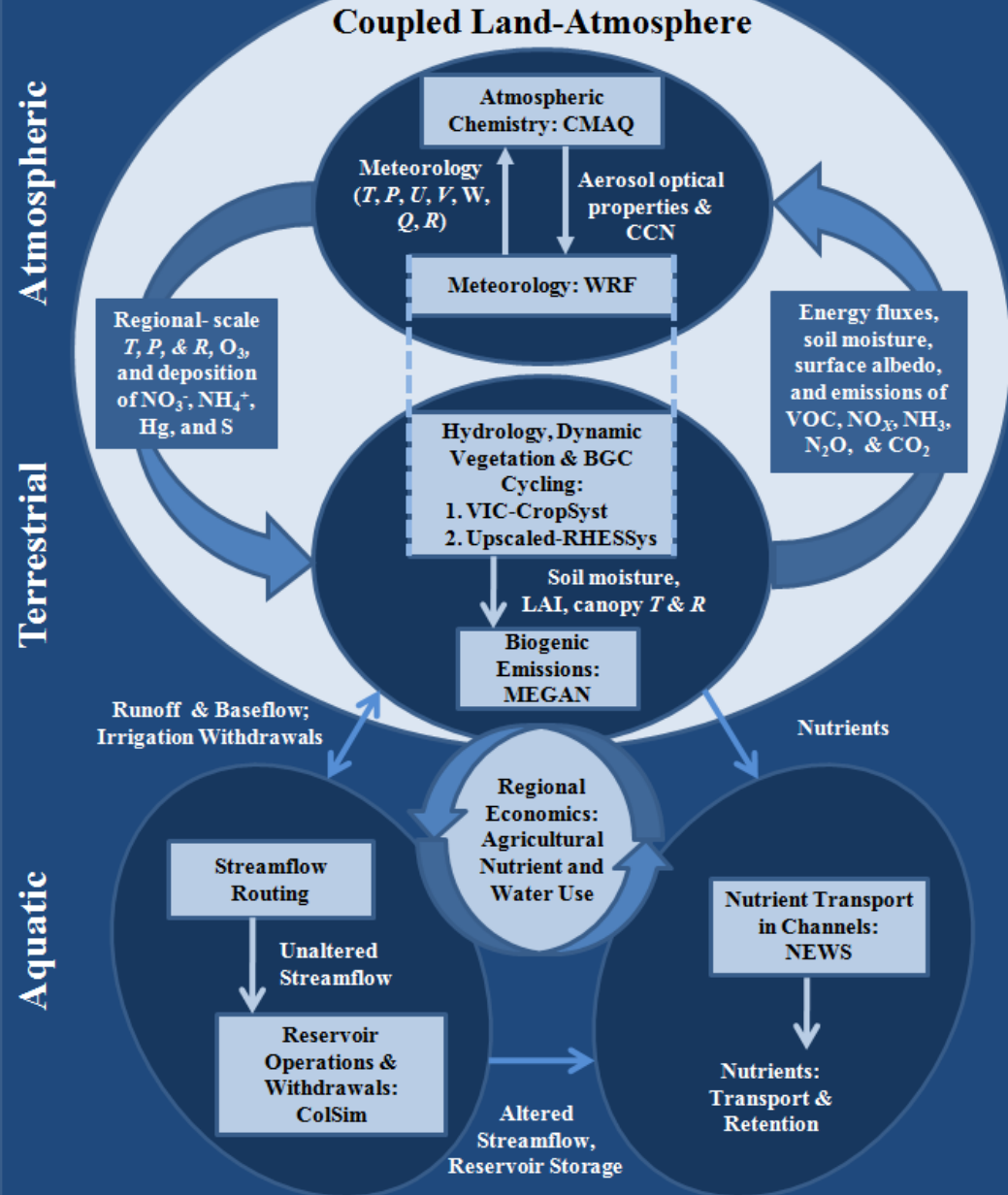
Specific Objectives:

1. ***Air to Land Linkage:*** To investigate the role that atmospheric processes play in land surface C:N:H₂O cycles.
2. ***Coupled Air/Land:*** To explore how ecosystem changes in the PNW affect land/atmosphere interactions.
3. ***Coupled Air/Land/Human:*** To examine how potential policy changes might affect the interactions between C:N:H₂O cycles and regional-scale climate.
4. ***Communication:*** To explore how to best communicate the model results to resource managers and policy makers.



CCSM4: Global Climate

Large-scale T, P, U, V, W, Q, R

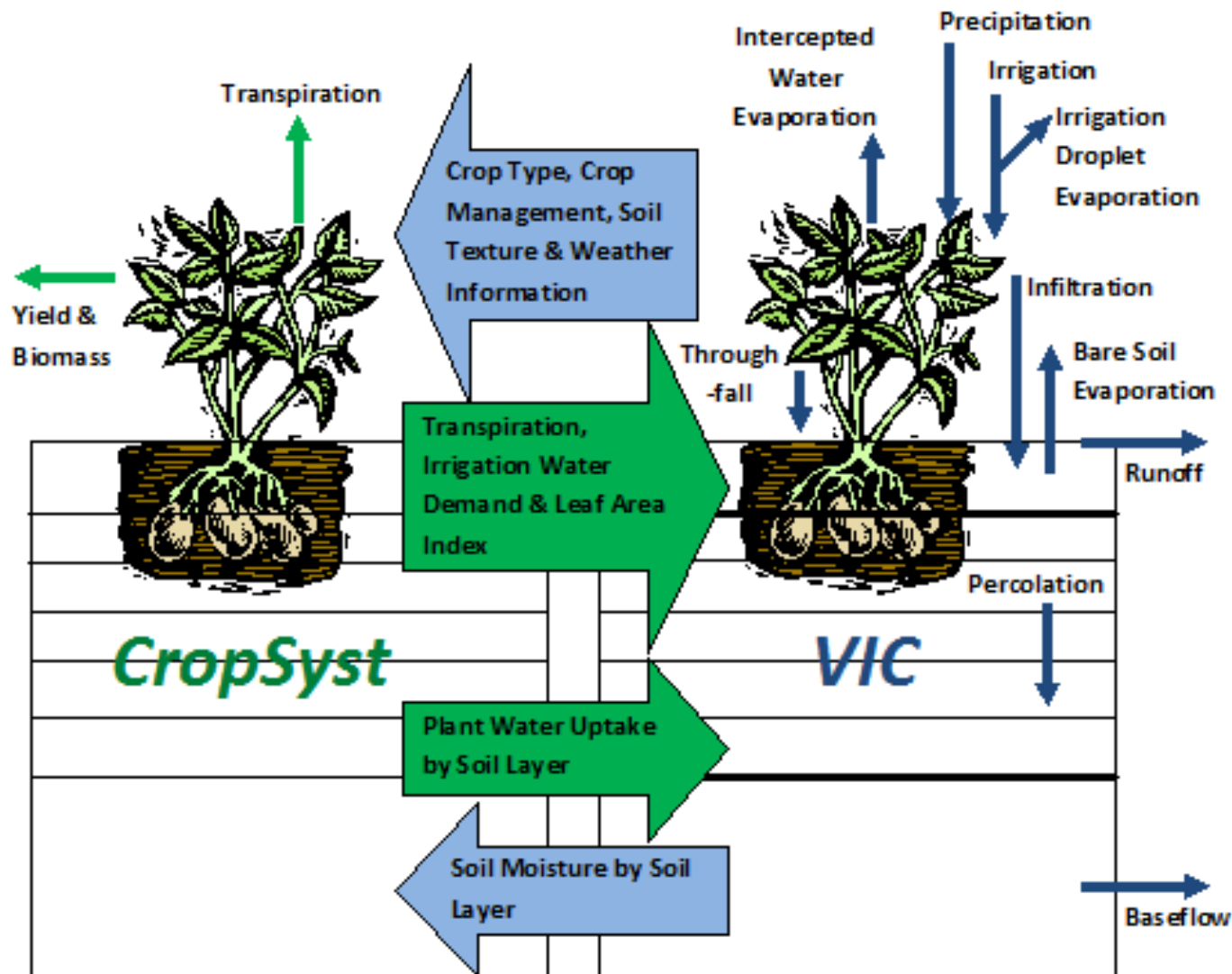


CropSyst

Cropping Systems
Stöckle and Nelson 1994

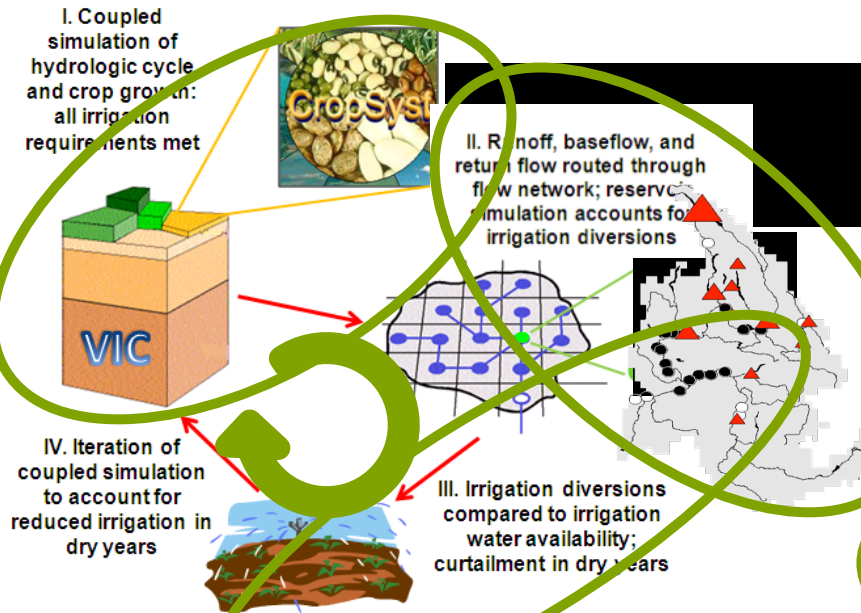
VIC

Macro-Scale Hydrology
Liang et al, 1994



Offline Work

Biophysical Modeling System



Economic Modeling

V. The entire biophysical modeling frame system interacts with the economic model to simulate long term and short term producer response.

Full irrigation demand

Water availability

Compare demand against water availability and in stream flow targets

Compare excess demands against demands from interruptible grid cells

Calculate deficit by crop

Iterate to account for deficit irrigation

Adaptations to ColSim

- ▣ Agricultural withdrawals are explicit
- ▣ Water right interruptions estimated by comparing demands compared against instream flow targets

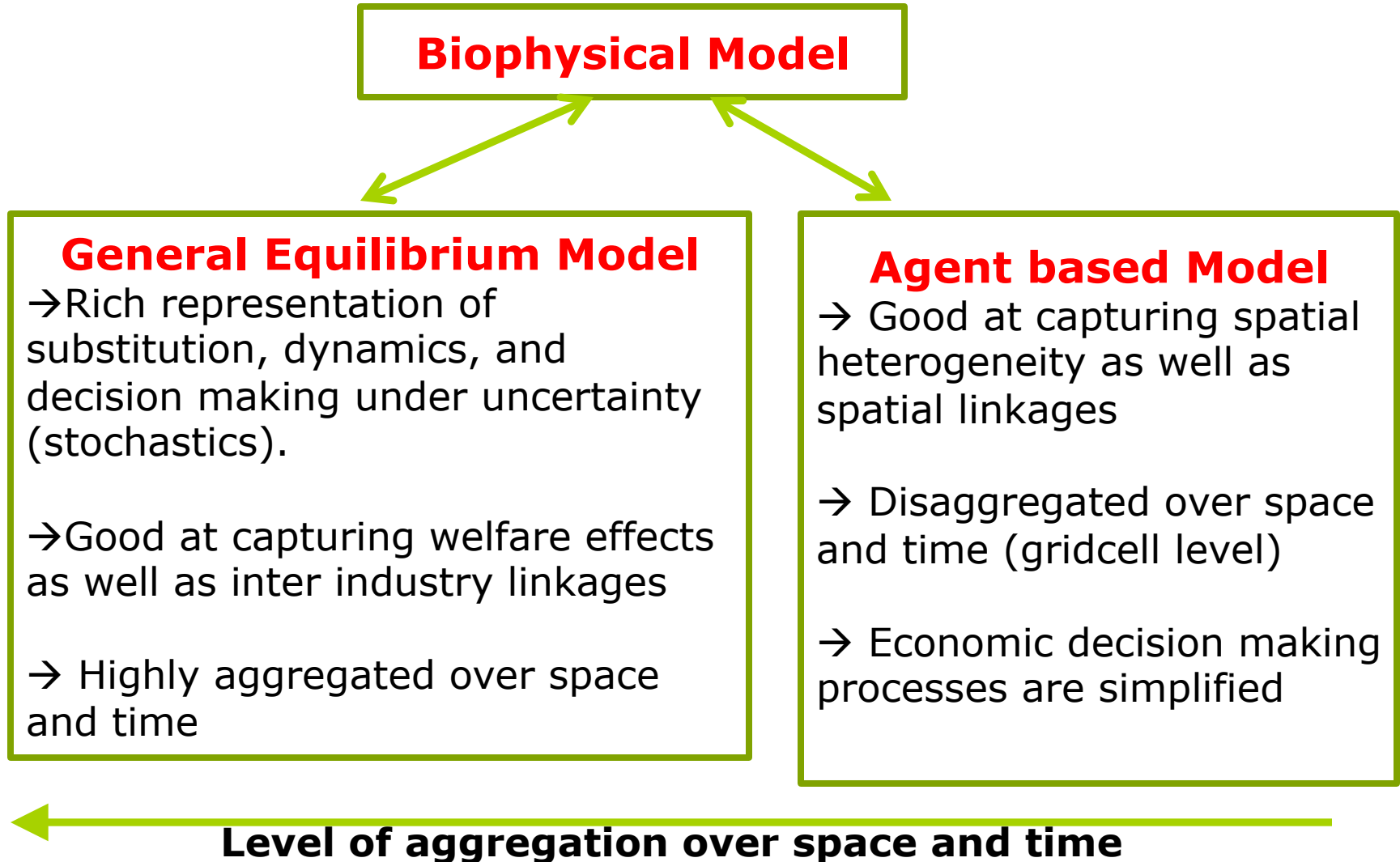
Biophysical Model and Economics

Examples of information the economics model informs the biophysical model

- ❑ Changes to crop mix
- ❑ Planting decisions
- ❑ Producer decisions under water shortages (deficit irrigations/fallowing)
- ❑ Irrigation technology changes

Biophysical Model and Economics

Two Pronged Integration Approach

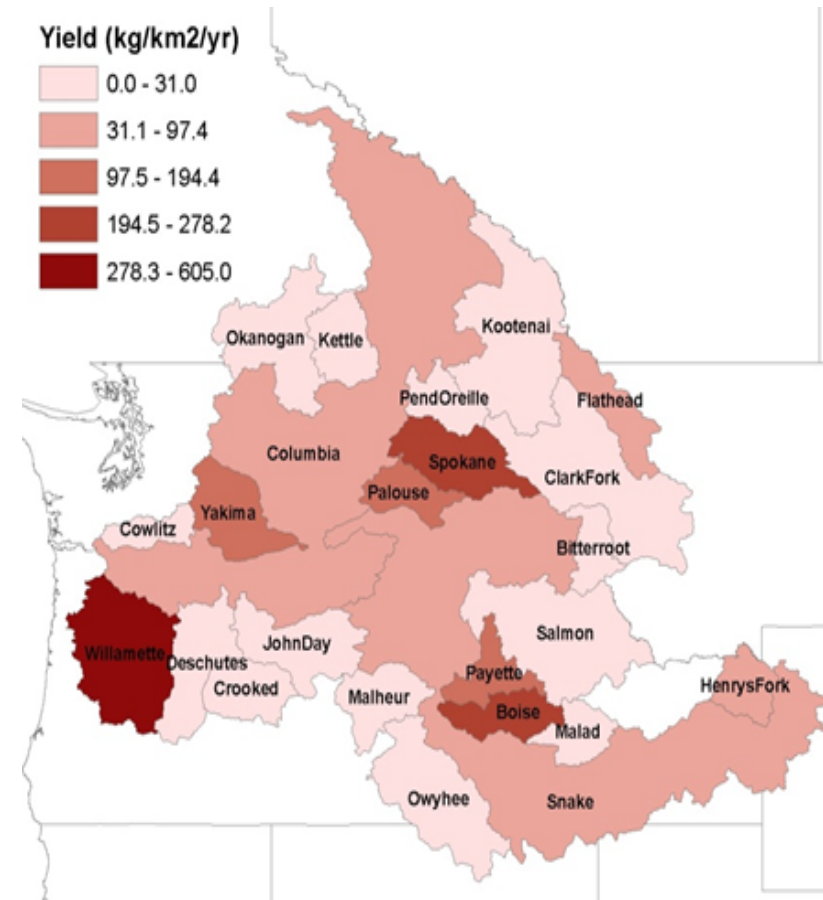


Global Nutrient Export from Water(S)heds (Global NEWS)

- ▣ River basin scale sub models that estimate natural and anthropogenic sources of and predict export of nutrients into the coast (DIN, DIP, DOC, DON, DOP, TSS, POC, PN, PP and DSi)
- ▣ For BioEarth, the focus is on the DIN sub model

NEWS

- ▣ Downscale NEWS DIN to a sub basin scale in the CRB, integrate a wetland component
- ▣ Investigate sensitivity of river DIN export to inter-annual climate variability , land use changes, changes in nitrogen inputs, wetland extent



Vision for the fully integrated version (of Land, Aquatic and Economics components)

□ Includes

- Online routing and simple reservoir
 - How about bias correcting routed flows?
- Feedback of water deficit on irrigation water rights curtailment
- Economic decision look up table

Vision for offline work

- Includes
 - Offline reservoir model
 - Economics
 - Nutrient export

Avenues of Collaboration

- Unique contributions via BioEarth
 - VIC-CropSyst
 - Land cover
 - Linkages to economics
 - Nutrient export
 - Reservoirs?

Questions/Discussion
