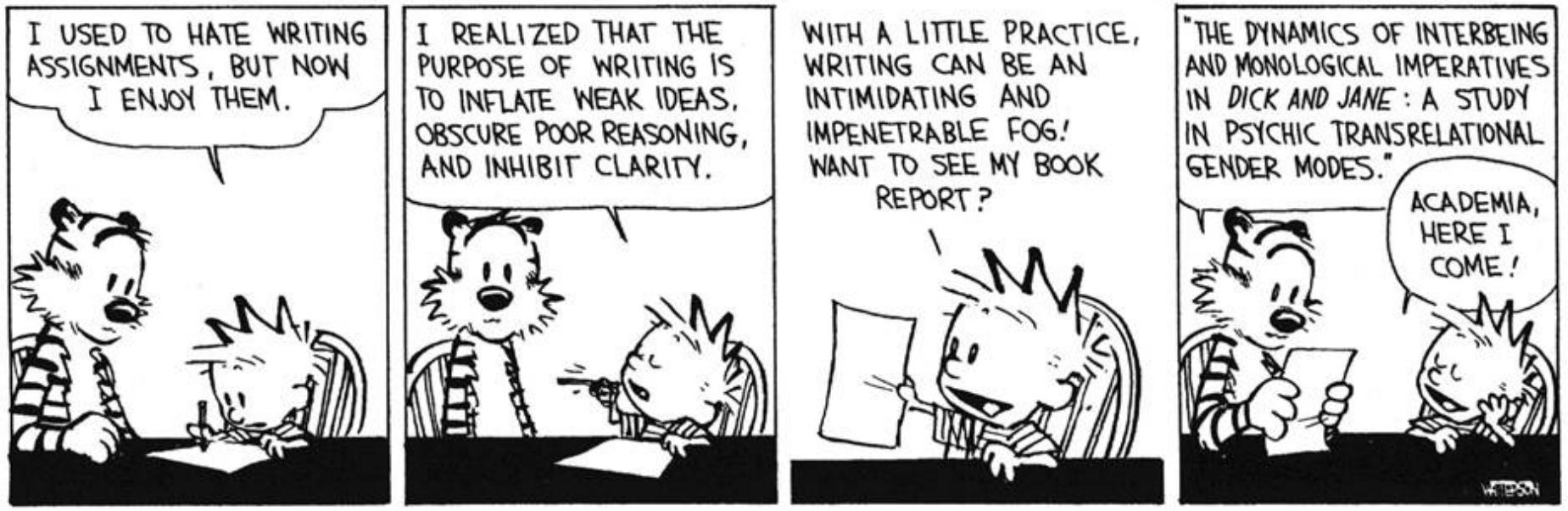
Ag Management Integration Team Efforts

BioEARTH Ag Management Integration Group (some new faces?)


I USED TO HATE WRITING ASSIGNMENTS, BUT NOW I ENJOY THEM.
I REALIZED THAT THE PURPOSE OF WRITING IS TO INFLATE WEAK IDEAS, OBSCURE POOR REASONING, AND INHIBIT CLARITY.
WITH A LITTLE PRACTICE, WRITING CAN BE AN INTIMIDATING AND IMPENETRABLE FOG! WANT TO SEE MY BOOK REPORT?
"THE DYNAMICS OF INTERBEING AND MONOLOGICAL IMPERATIVES IN DICK AND JANE: A STUDY IN PSYCHIC TRANSRELATIONAL GENDER MODES."
ACADEMIA, HERE I COME!

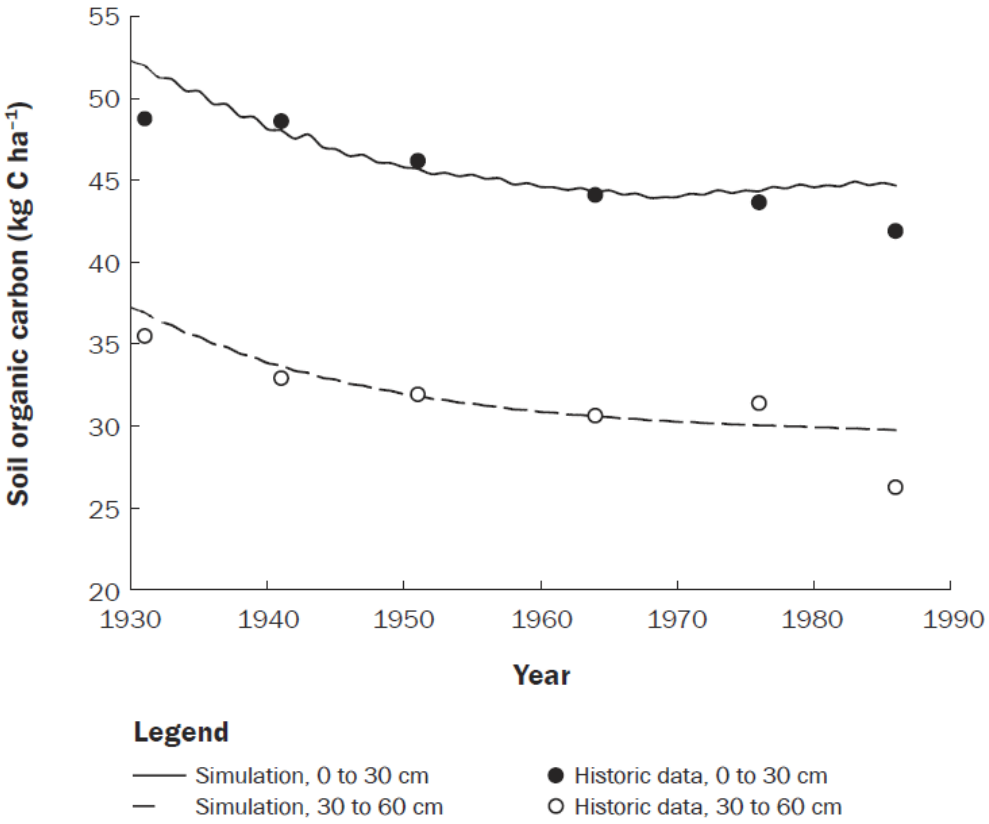
Objectives & agenda

- (30 min) Progress review and create potential linkages among various groups;
- (30 min) Identify the topics of integration papers: the adaptation and mitigation strategies and how policy (e.g. carbon taxes) affect its efficiency
- (30 min) List the titles of potential integration papers, lead authors, and timeline

Progresses

- Field experiments/observations
- Spatial data sets & model developments
- Conclusions from stakeholder engagement

Figure 2
CropSyst simulated organic carbon content (lines) at 0 to 30 cm depth and 30 to 60 cm depth of soil near Pendleton, Oregon. Simulated data are superimposed over historic data (symbols) collected at the Columbia Basin Agricultural Research Center, Pendleton, Oregon, between 1931 and 1986. The agronomic system used was dryland winter wheat–summer fallow under conventional tillage. Prior to 1966, the plots were fertilized with 34 kg nitrogen ha⁻¹; after 1966, the plots received 90 kg nitrogen ha⁻¹.



Stöckle et al., 2012

Dr. Sarah Waldo:

Moses Lake (June 2013)

Lind (Oct. 2011)

Cook Farm Non. Till (Aug. 2011)

Cook Farm Till (June 2012)

Moscow Mtn. (July 2012)

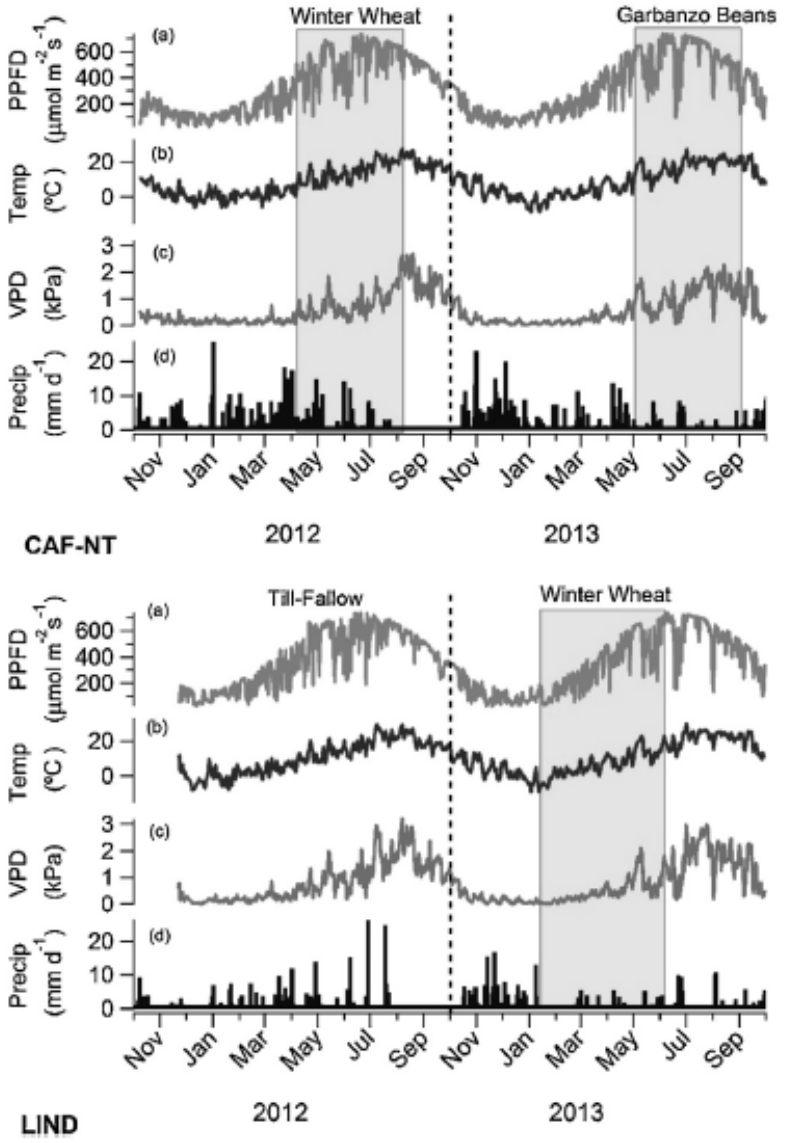
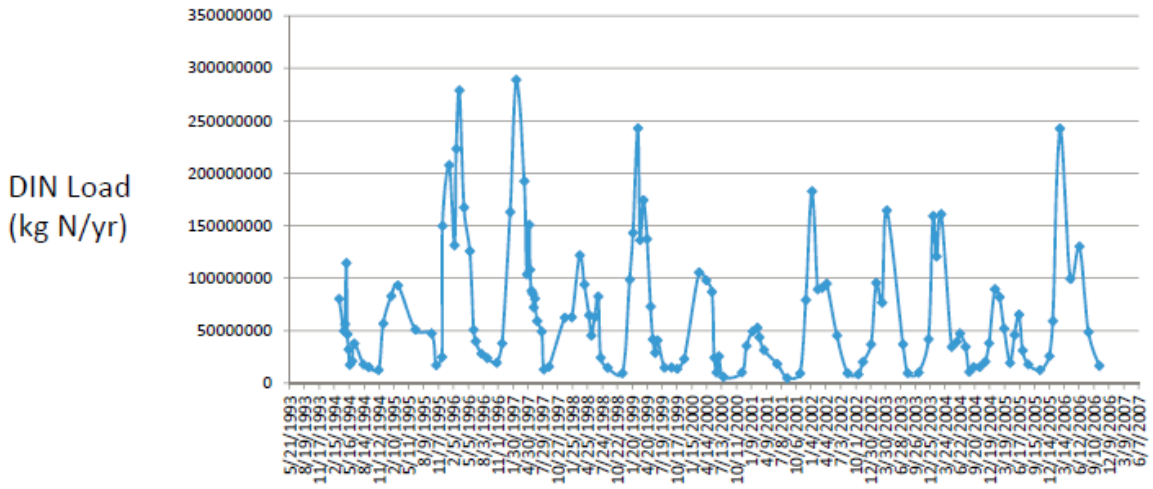


Fig. 2. Time series of meteorological variables at the CAF-NT (top) and LIND (bottom) field site over the two-year study period. The dashed line indicates the separation between crop years, 1 October.

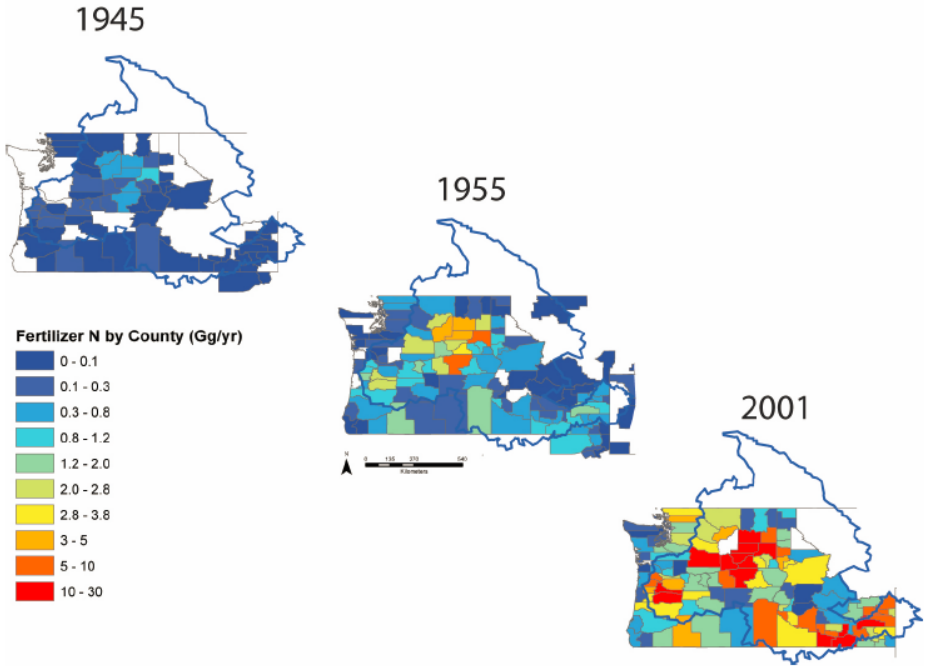
Waldo et al., 2016

DIN Transport to Ocean at Mouth of Columbia
(1994-2006)



- 20 to 30-fold difference in N transport between seasons at mouth of Columbia River

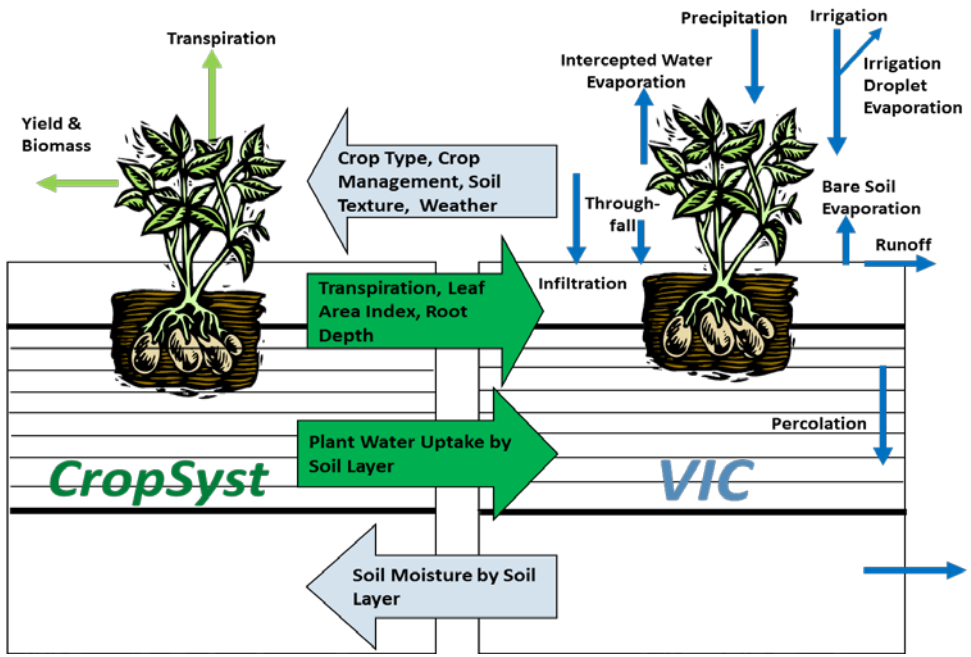
County-level Fertilizer Consumption (1945-2001)

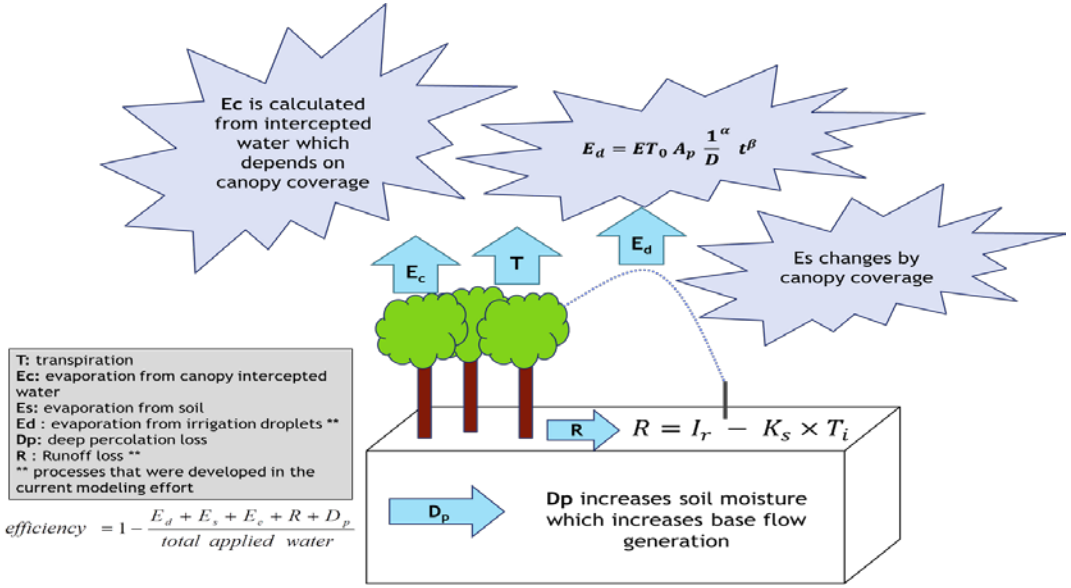


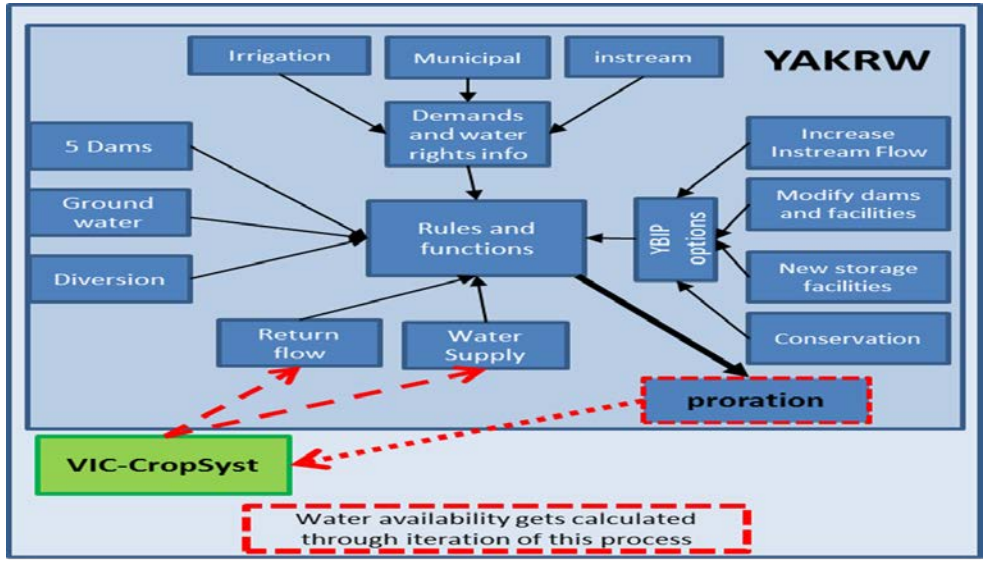
J. Harrison

Model

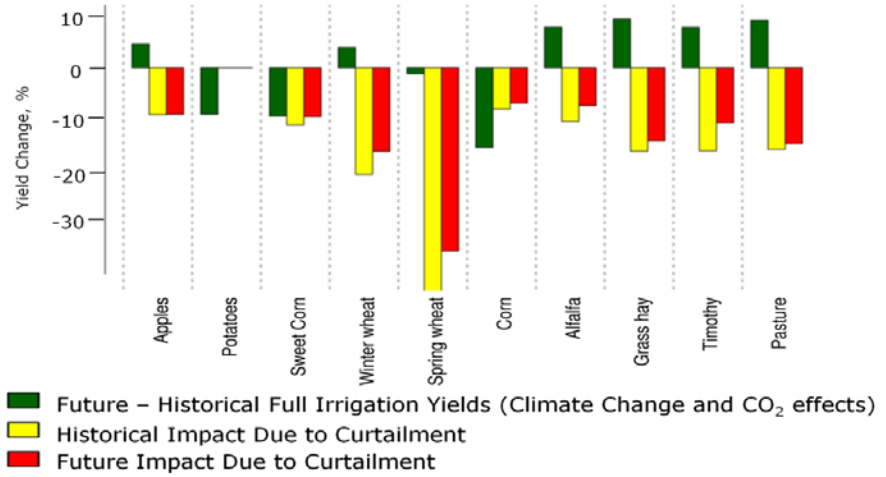
VIC-CropSyst







Keyvan Malek

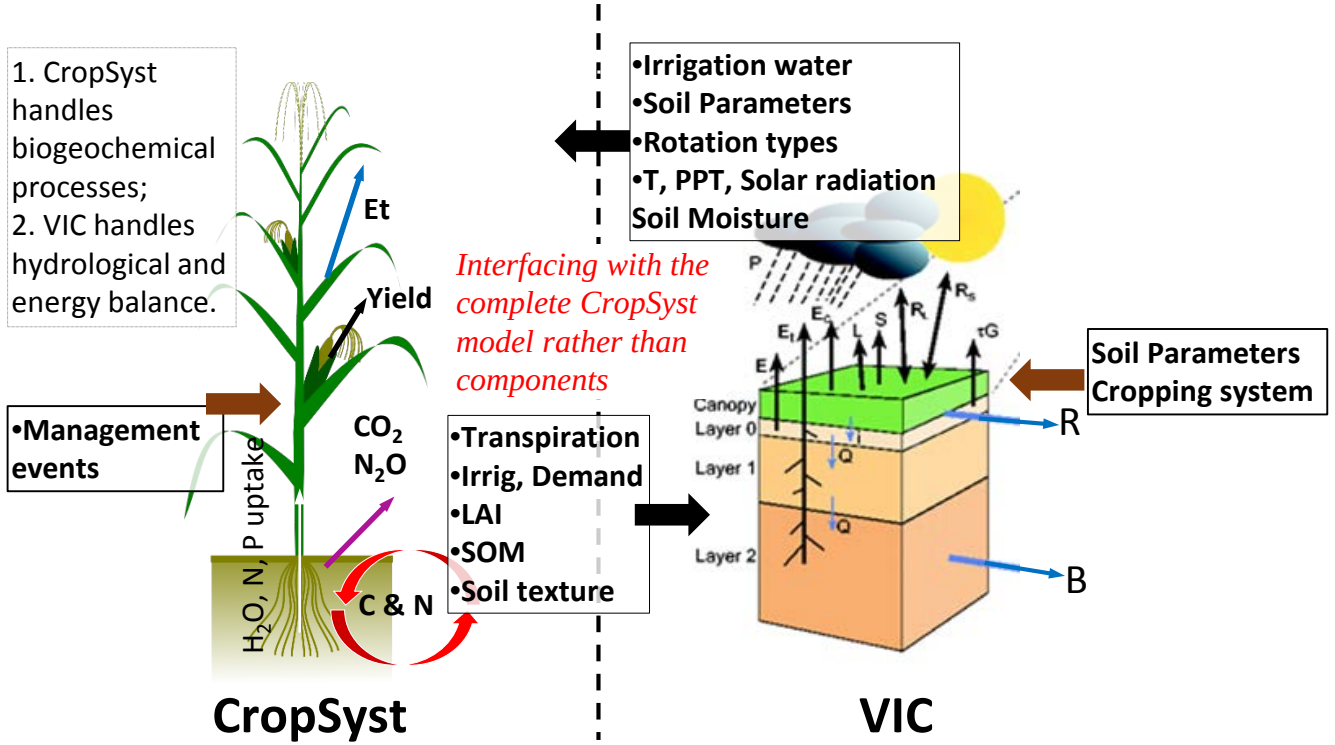


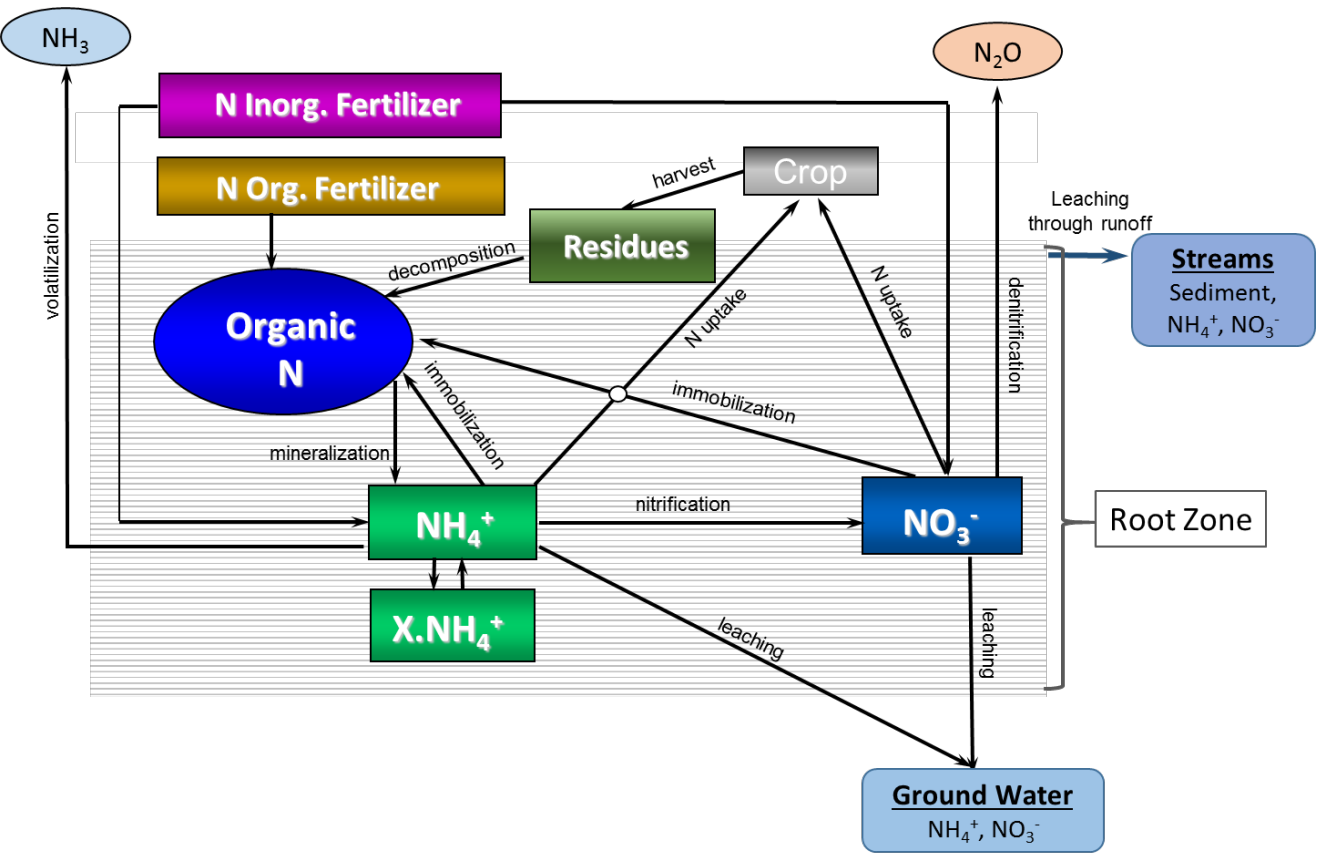
Yield reductions through changes in water availability (K. Rajagopalan)

VIC-CropSyst

Input: climate, managements, biophysical condition

Output: crop yield, water yield, water & N use efficiency, N leaching, soil erosion, irrigation water demand

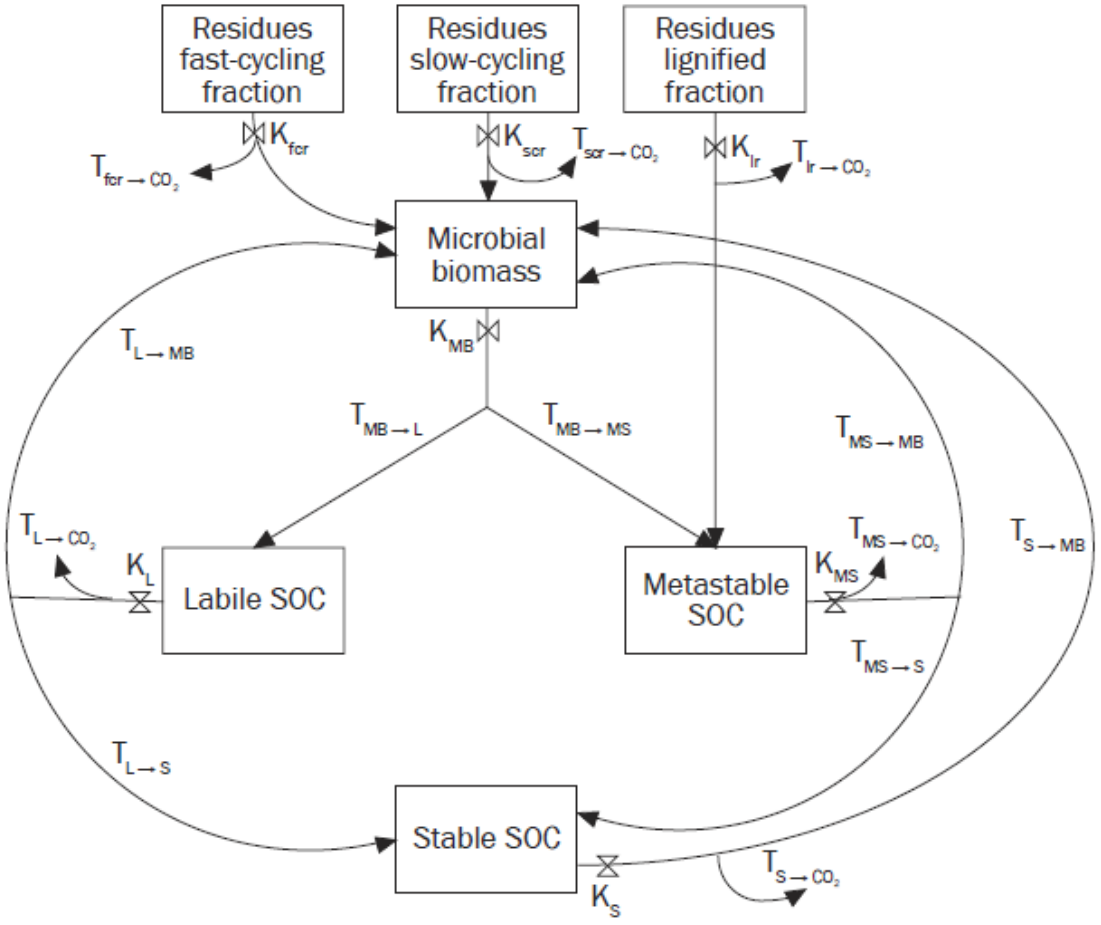




Nitrogen Cycling in CropSyst Model (Courtesy of Stöckle et al.)

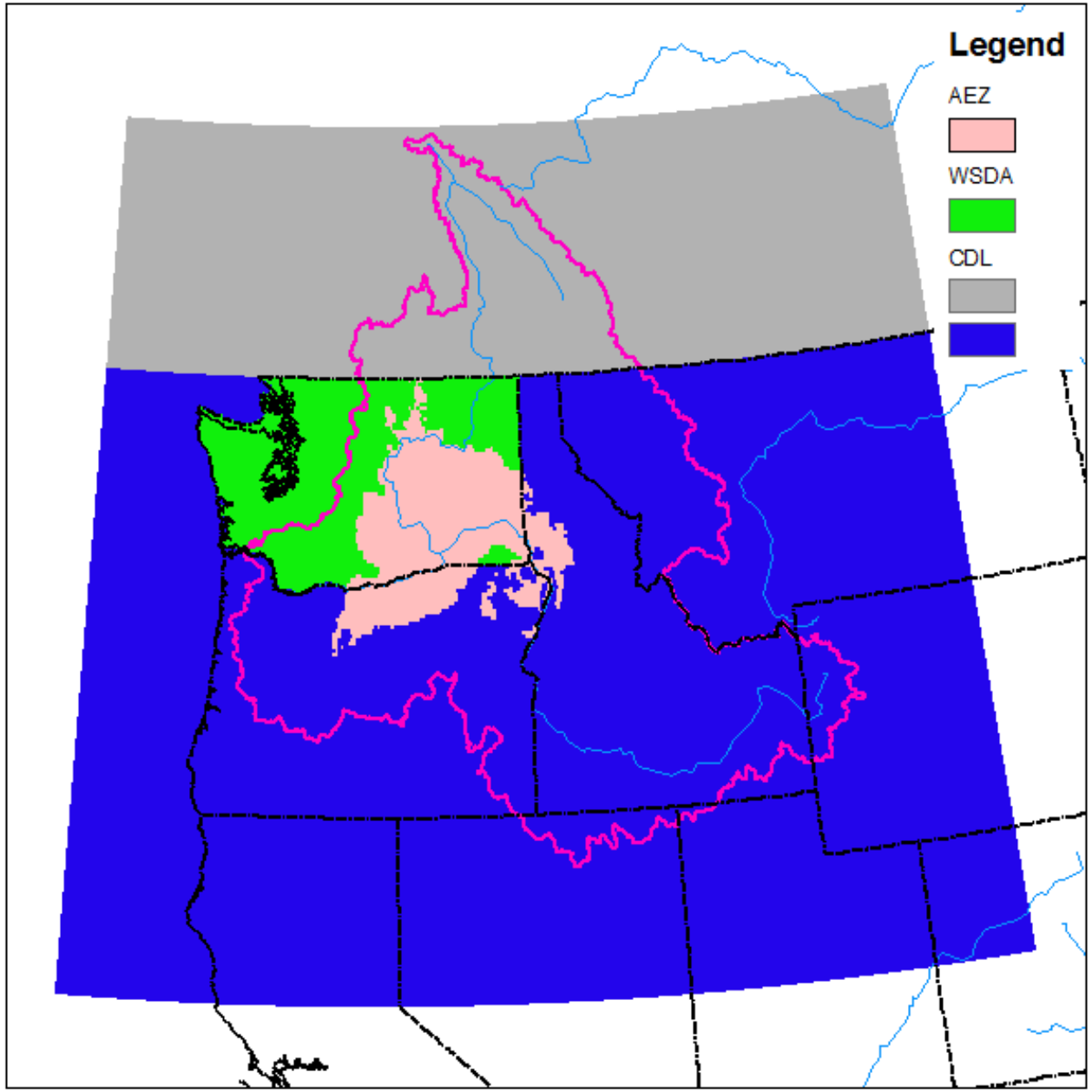
Figure 1

Pools and carbon flows of the soil organic carbon (SOC) submodel in CropSyst (fcr = fast-cycling residue pool, scr = slow-cycling residue pool, lr = lignified residue pool, MB = microbial biomass pool, L = labile SOC pool, MS = meta stable SOC pool, and S = stable SOC pool).



Stöckle et al., 2012

Spatial Dataset



Major crop rotation types:

Permanent crops (normally are irrigated): including hops, orchards, etc.

Irrigated annual crops

Irrigated crop rotations:

Potato-Winter_Wheat-Corn;

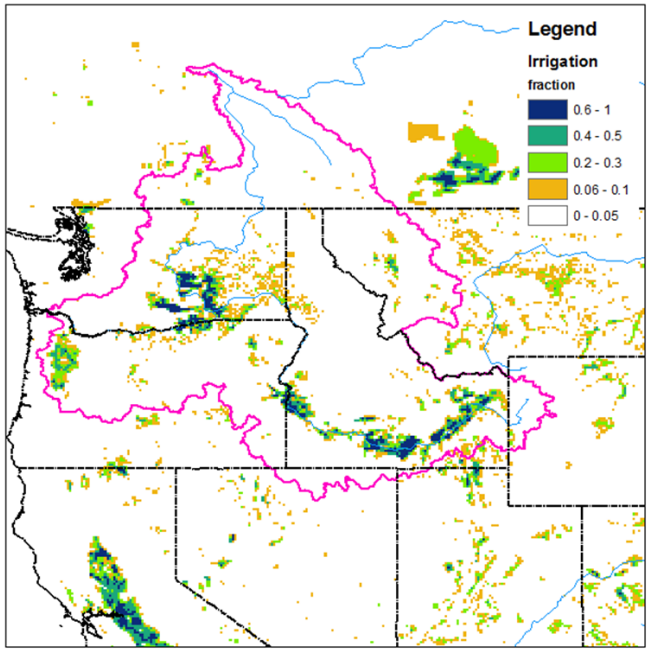
Potato-Sugar_Beat-Corn

dryland: Winter_Wheat-Spring_Fellow

dryland: Spring_Wheat-Spring_Pea-Winter_Wheat

dryland: Spring_Fellow-Winter_Wheat-Spring_Wheat

Dryland: Continuous annual crops



BioEarth_Metdata

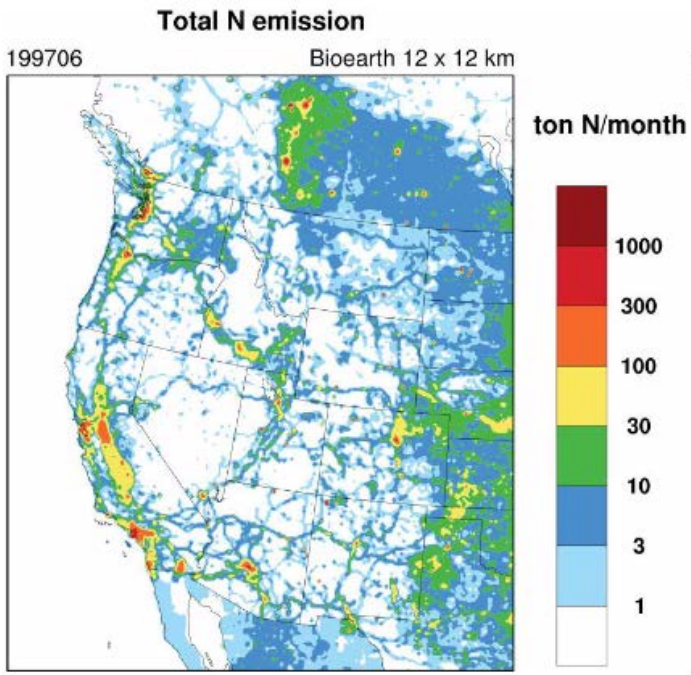
File Edit View Insert Format Data Tools Add-ons Help All changes saved in Drive

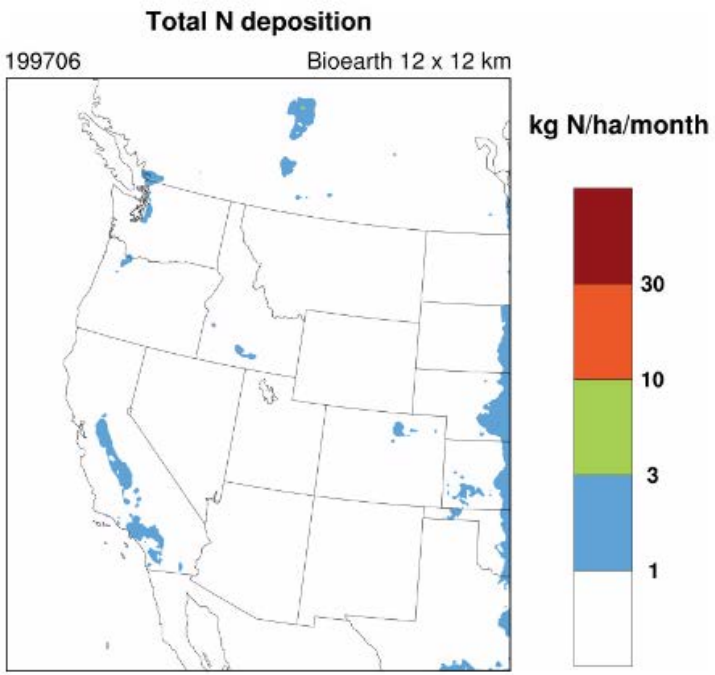
	A	B	C	D	E	F	G	H	I
1	Name	Time_Period	Spatial_Domain	Resolution	Data Format	Variables	Models_Direc	Progress	Lo
2	MACA V1_4km	1950-2100	Western US	1/24th degree	NetCDF	PPT, RHMAX, RHMIN, SWRAD, TMAX, TMIN, WIND_U, WIND_V		done	Ac
3	UI_Historical_4km_orig	1979-2013	Western US	1/24th degree	NetCDF	PPT, RHMAX, RHMIN, SWRAD, TMAX, TMIN, WIND, PPT_DUR		done	Ac
4	UI_Historical_4km_orig	2014	Western US	1/24th degree	NetCDF	PPT, RHMAX, RHMIN, SWRAD, TMAX, TMIN, WIND, SPH		done	Ac
5	UI_Historical_4km_RHESSys	1979-2014	Western US	1/24th degree	ASCII	PPT, RHMAX, RHMIN, SWRAD, TMAX, TMIN, WIND, SPH	RHESSys	Need fix error on Rmax, Rr	Ac
6	UI_Historical_4km_RHESSys_NetCDF	1979-2013	Western US	1/24th degree	NetCDF	PPT, RHMAX, RHMIN, SWRAD, TMAX, TMIN, WIND, SPH	RHESSys	done	Ac
7	UI_Historical_6km_RHESSys_NetCDF	1979-2013	Western US	1/16th degree	NetCDF	PPT, RHMAX, RHMIN, SWRAD, TMAX, TMIN, WIND, SPH	RHESSys	done	Ac
8	UI_Historical_6km_VIC_Binary	1979-2013	Western US	1/16th degree	Binary	PPT, TMAX, TMIN, WIND	VIC	done	Ac
9	UI_Historical_6km_VIC_Ext_Binary	1979-2014	Western US	1/16th degree	Binary	PPT, TMAX, TMIN, WIND, SPH, SWRAD, RHMAX, RHMIN	VIC	Need fix error on Rmax, Rr	Ac
10	MACA_Livneh_V1.2_VIC	1950-2099	Western US + Canada	1/16th degree	ASCII	PPT, TMAX, TMIN, WIND	VIC	done	Ac
11	MACA_Livneh_V1.2_Orig	1950-2100	Western US + Canada	1/16th degree	NetCDF	PPT, TMAX, TMIN, WIND, SPH, SWRAD		done	Ac
12	Livneh V1.2	1915-2011	Western US + Canada	1/16th degree	ASCII	PPT, TMAX, TMIN, WIND	VIC	done	Ac
13	Maurer	1949-07/31/2000	Western US + Canada	1/16th degree	ASCII	PPT, TMAX, TMIN, WIND	VIC	done	Ac
14	MACA V1_VIC	1950-2100	Western US	1/16th degree	Binary	PPT, TMAX, TMIN, WIND	VIC	partially done	Ac
15	MACA_V2_METADATA	1950-2100	Continental US	netcdf4.3.1.1-bin	NetCDF	pr,rsds,tasmax,tasmin,uas,vas	UI nc file	doweloaded	/d

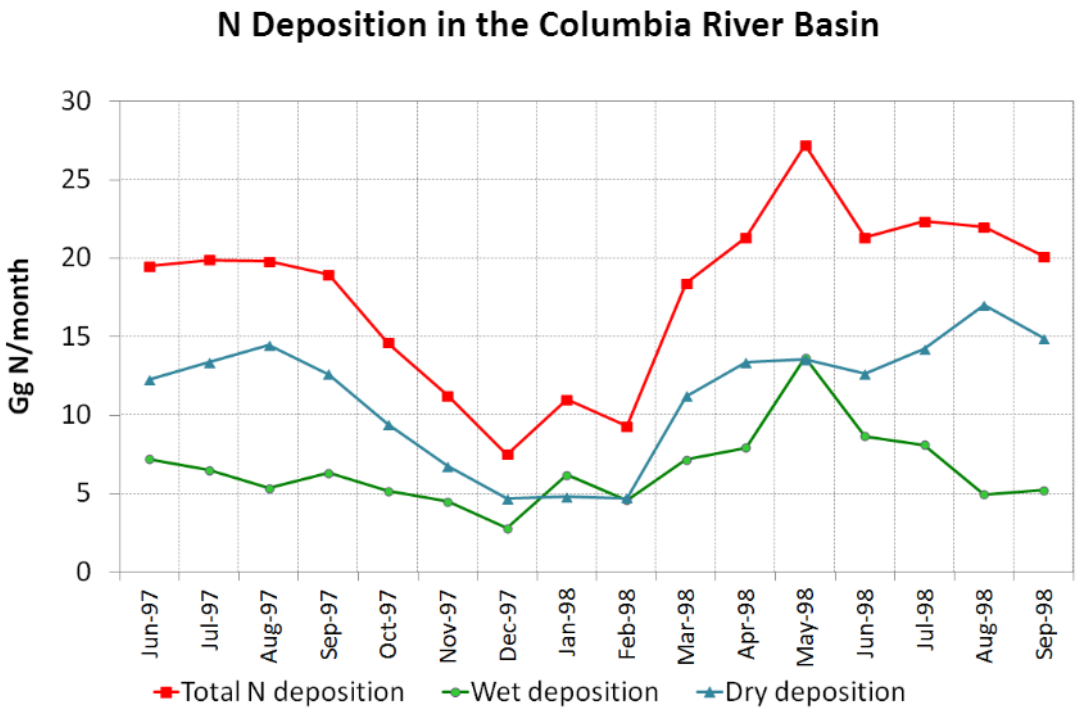
A	B	C
GCM\Variable	VIC-Binary	date
bcc-csm1-1	done	10/23/2015
bcc-csm1-1-m	done	10/23/2015
BNU-ESM	done	10/28/2015
CanESM2	done	10/23/2015
CCSM4	done	10/28/2015
CNRM-CM5	done	10/23/2015
CSIRO-Mk3-6-0	done	10/23/2015
GFDL-ESM2G	done	10/23/2015
GFDL-ESM2M	done	10/23/2015
HadGEM2-CC		
HadGEM2-CC365	done	10/23/2015
HadGEM2-ES		
HadGEM2-ES365	done	10/23/2015
inmcm4	done	10/23/2015
IPSL-CM5A-LR	done	10/23/2015
IPSL-CM5A-MR	done	10/23/2015
IPSL-CM5B-LR	done	10/23/2015
MIROC5	done	10/23/2015
MIROC-ESM	done	10/23/2015
MIROC-ESM-CHEM	done	10/23/2015
MRI-CGCM3	done	10/23/2015
NorESM1-M	done	10/21/2015
Note: CRB region		
historical: 1950-2005		

https://docs.google.com/spreadsheets/d/1vgZnIbIekRz4MTLnys6hyOAVnp-bxg3jBLI1AzJVYc8/edit#gid=0

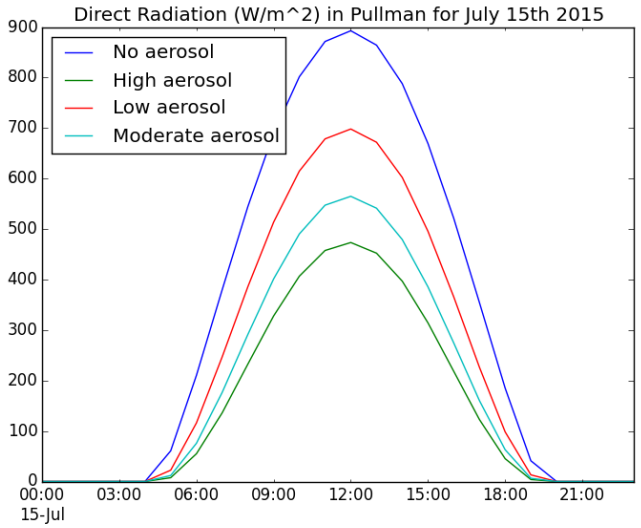
June 1997

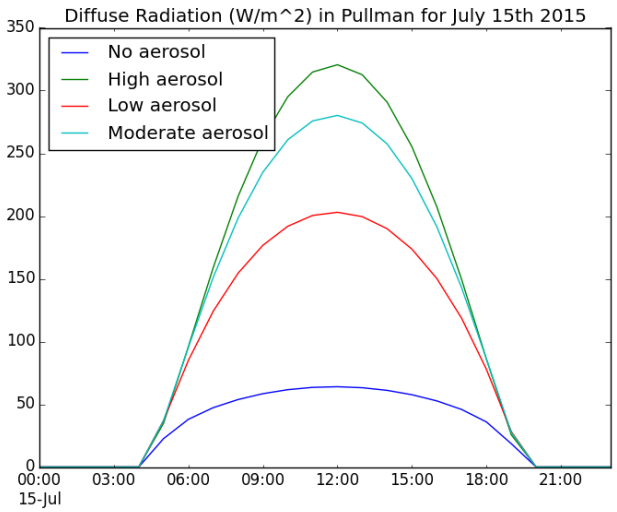






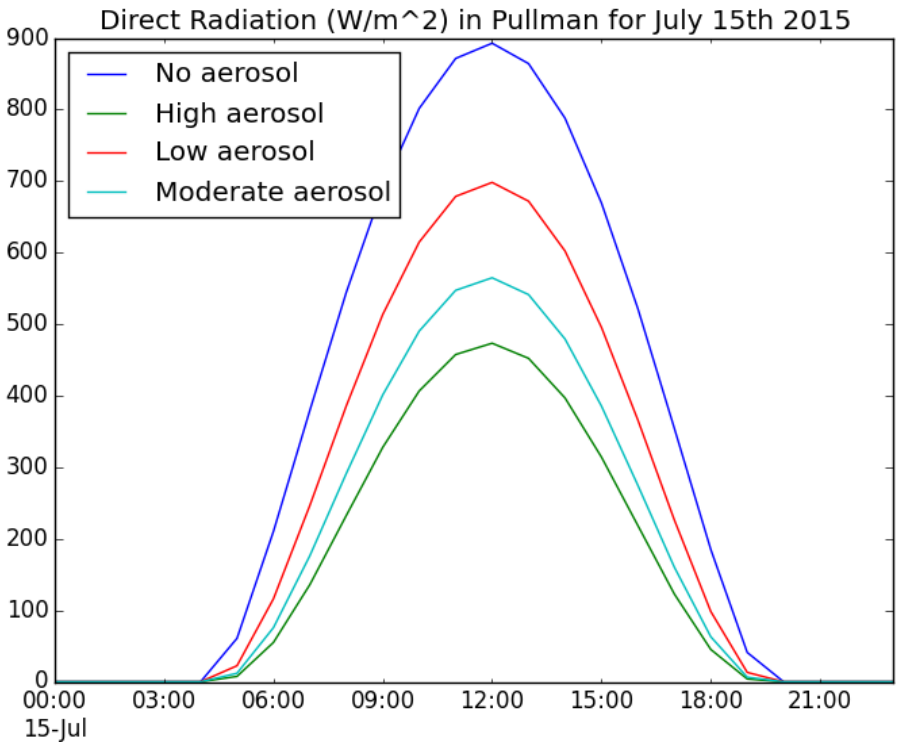
S. Nergui

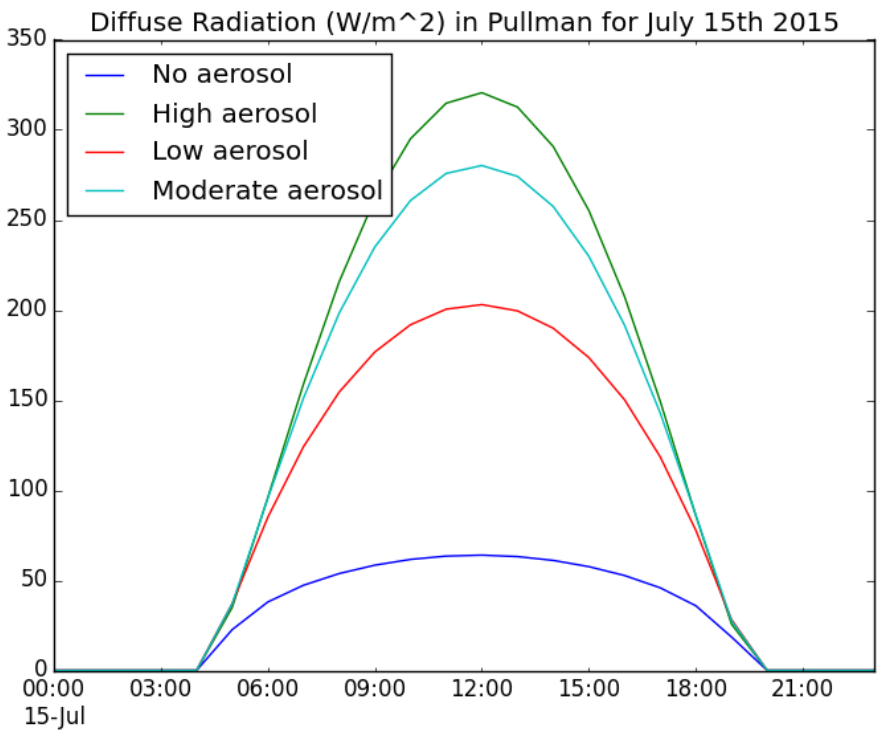




Q. Baret

V. Scenarios for crop model





Stakeholder engagement

Reflections on model scale: Federal agencies typically plan on a 5-20 year cycle and are responsive to projections at this scale. For agricultural producers, time horizons of interest vary according to the cropping systems in question. In terms of spatial scale of interest, most stakeholders would be most interested in watershed or sub-watershed scale reports. The value of region-wide projections was also recognized.

If the model could give explicit, quantitative scenarios about soil carbon management and how that affects water supply and water availability, this would help policy makers.

A private water resources consultant

You need to have intimate knowledge of specific stakeholders' decisions. You need to sit with them and understand how they make decisions to understand it well enough to see how science could be brought to bear.

A Soil and Water Conservation District scientist

What do Agricultural Decision-Makers in the Northwest US Need to Know about Climate Change?

ELIZABETHALLEN[A*] JENNIESTEPHENS[B] GEORGINEYORGEY[C] CHADKRUGER[C] SONYAAHAMED[B] JENNIFERADAM[D]

[A] School of the Environment, WSU
[B] Rubenstein School of Environment and Natural Resources, UVM
[C] Center for Sustaining Agriculture and Natural Resources, WSU
[D] Civil and Environmental Engineering, WSU
* Contact: lizb.allen@wsu.edu

Integration topics: the adaptation and mitigation strategies and how policy (e.g. carbon taxes) affect its efficiency

- Identify the potential management approaches for adaptation and mitigation over the CRB, such as early sowing date, cover crops, changing crop types, no-tillage or less tillage, new irrigation technology, etc.
- Investigate what efficiency, economic (e.g. costs and income from ag) and environmental consequences (e.g. GHG emission, ET, N leaching etc.) of these adaptation or mitigation approaches (or sustainable managements) under the climate change and/or social-economic scenarios.

Liz Allen

	SCENARIO A (climate and socioeconomic)			SCENARIO B (climate and socioeconomic)			SCENARIO C (climate and socioeconomic)		
Adaptation or mitigation management approach in the CRB	Efficiency Impacts (impacts on yields)	Economic impacts (costs of implementation and ag. income impacts)	Environmental consequences (GHG emissions, ET, N leaching)	Efficiency Impacts (impacts on yields)	Economic impacts (costs of implementation and ag. income impacts)	Environmental consequences (GHG emissions, ET, N leaching)	Efficiency Impacts (impacts on yields)	Economic impacts (costs of implementation and ag. income impacts)	Environmental consequences (GHG emissions, ET, N leaching)
Early sowing date									
Cover crops									
Changes to cropping systems									
No-tillage or reduced-tillage									
New irrigation technology									

Adaptation to Climate Change

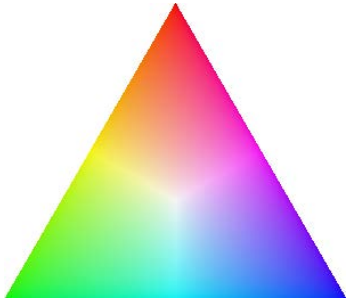
	Adaptation strategy
1	**Crop related adaptation strategies**
	i- cropping pattern
	ii- Cropping acreage and location of cropping activities
	iii- Timing of planting and harvesting date
	iv- using new variety of the same crop
2	**Long term strategic water management adaptations**
	i- Switching to New Irrigation Systems
3	**Seasonal adaptations to respond to temporal availability of water**
	i- Deficit irrigation magnitude
	ii- Deficit irrigation timing in a season
4	**Short term adaptations to minimize the impacts of heat stress**
	i- Supplementary/over irrigation
	ii- Irrigation frequency
	iii- Irrigation intensity

Keyvan Malek

List the titles of potential integration papers, lead authors, and timeline

- Regional scale model evaluations: Greenhouse gas emissions, ET, N leaching, soil moisture, irrigation water demand
- Effects of crop managements (tillage & irrigation & fertilization & cover crops) on ET, soil moisture (infiltration capacity), and carbon storage across the CRB
- How climate change affect stakeholders' decision making processes in agriculture activities? E.g. through changing crop responding curve etc.
- How policy (e.g. water cap or carbon tax) or market behaver could affect agricultural ecosystems (through crop distribution, crop types, management intensity, irrigation technologies, etc.).
- The resilience of cropping systems in the PNW to the extreme environmental events (drought, heat wave, wildfire, spring frost, etc.) in terms of crop yields, agriculture income, and water demand.

Nitrogen: N fertilizer use, N leaching, N_2O emission, soil NO_3 & NH_4 & Organic N storage



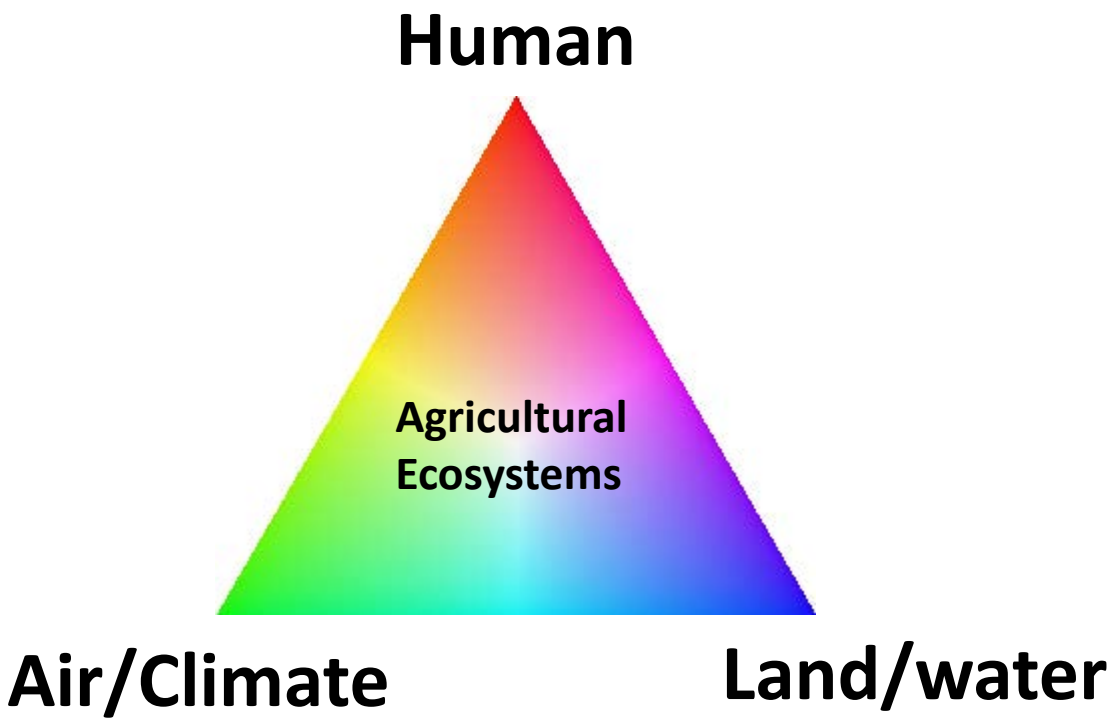
Carbon: soil carbon storage, CO_2 fluxes, Biomass & crop yield

Water: Runoff, ET, soil moisture, groundwater storage, irrigation water demand

- **Storage and fluxes**
- **Long-term trends and interannual variations**
- **Spatial variations**
- **Coupled nature-human system: effects of environmental change and economic impacts**

W & N use Efficiency??

Historical & Forecast??



- Mitigation
- Sustainability
- Policy