Optimization at Wisconsin: CS and WID

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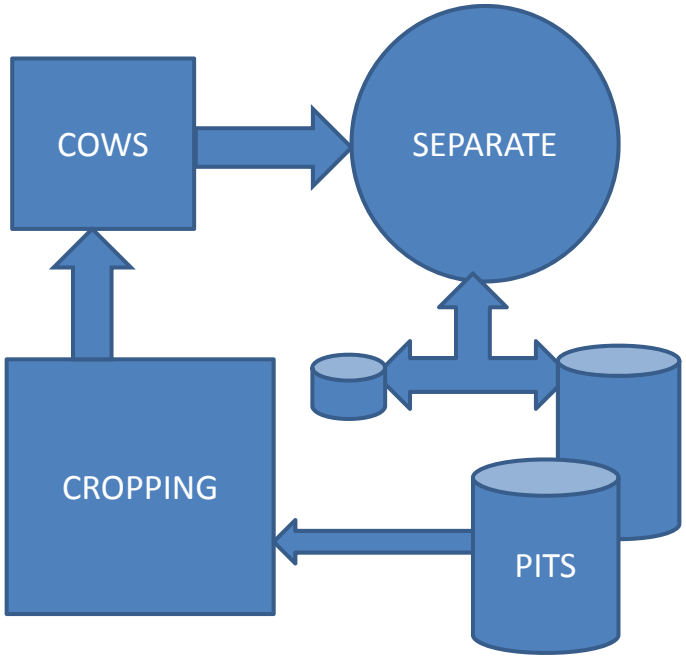
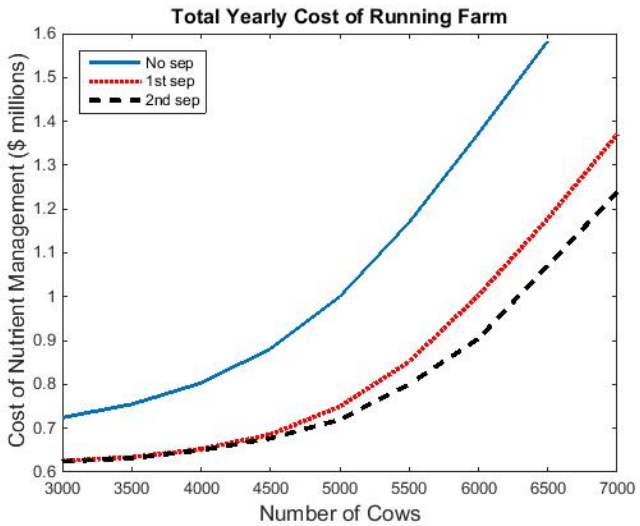
Biomass Research and Development Initiative (BRDI)

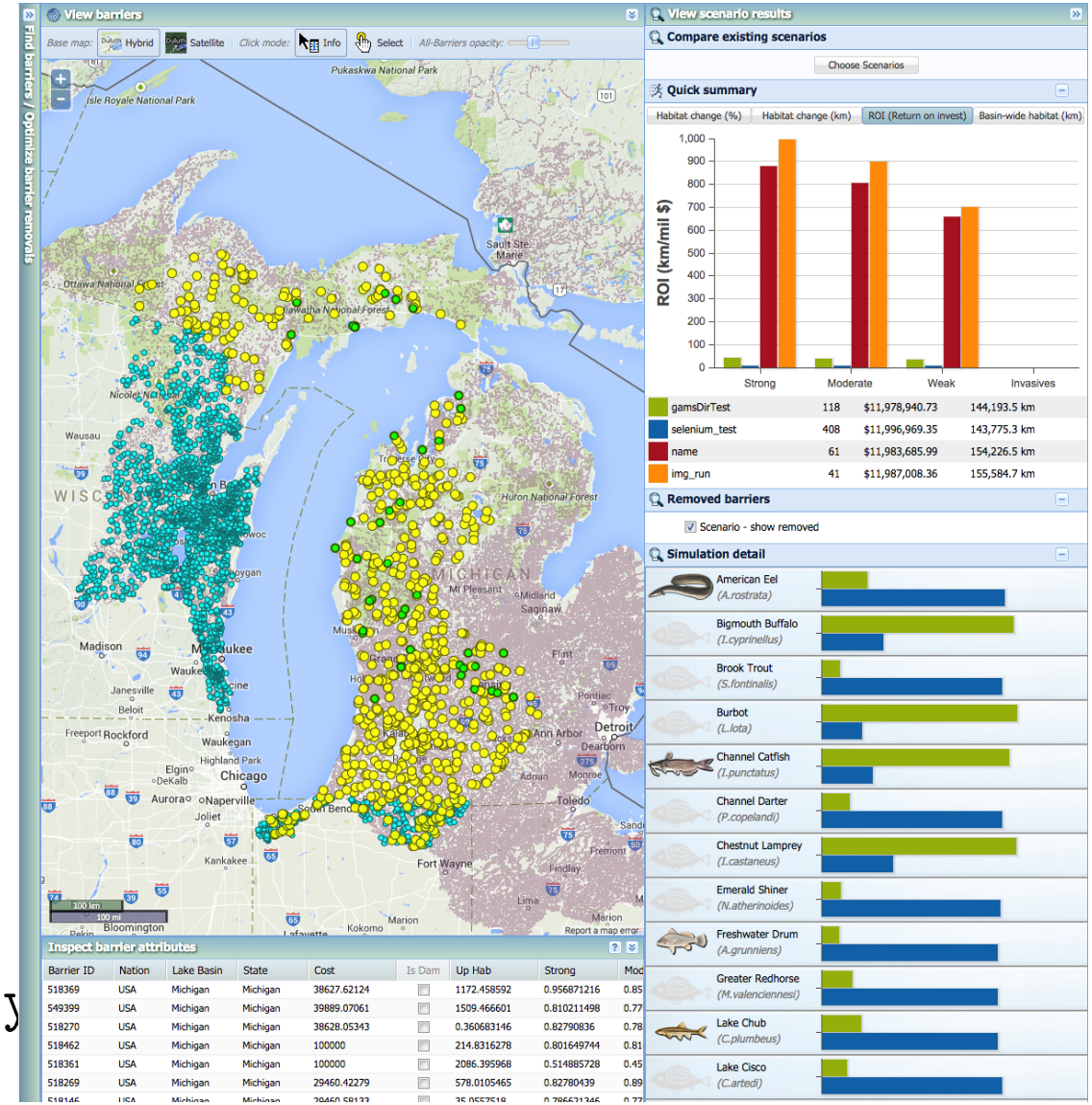




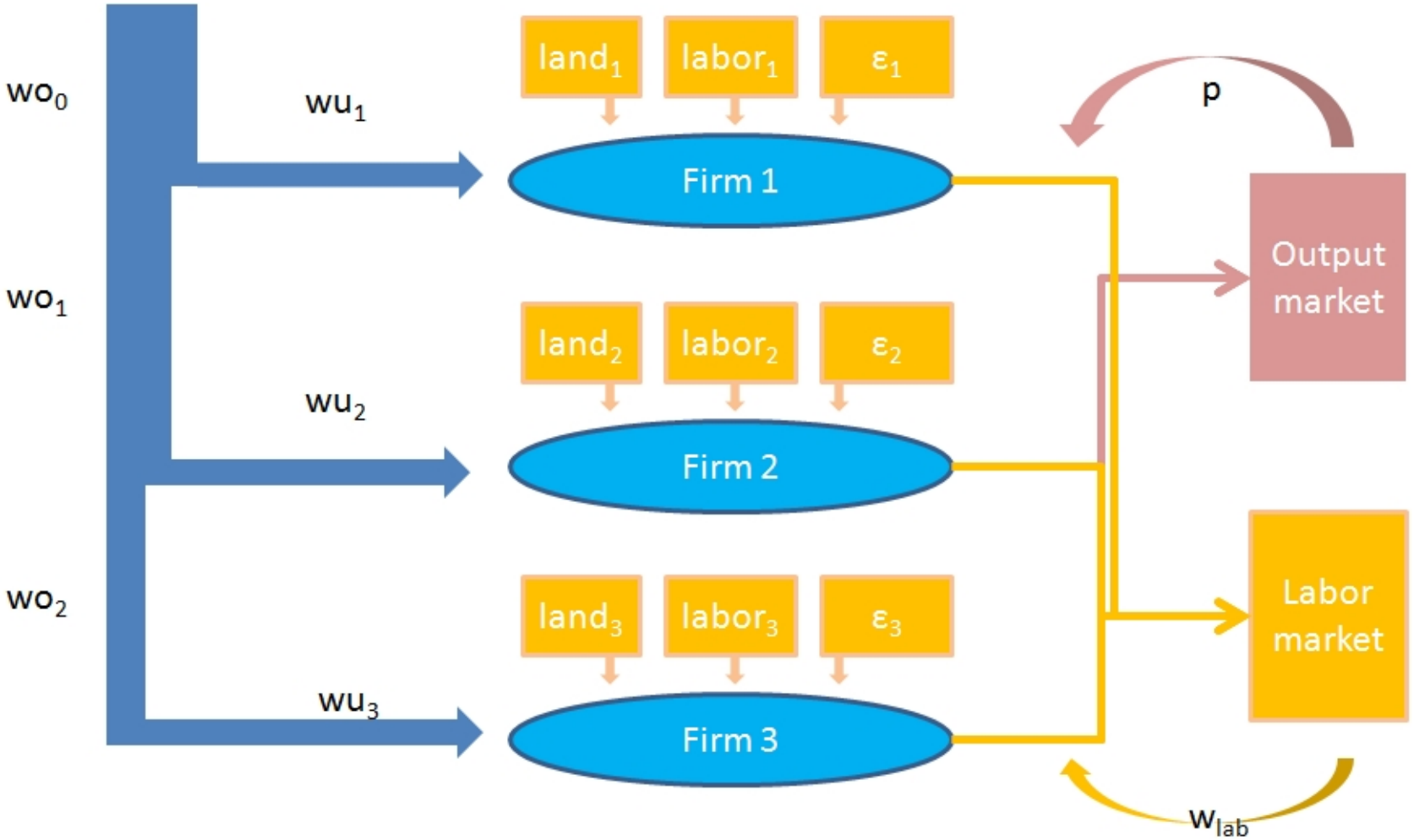
- Whole farm (complex interacting) mathematical model
- Long term sustainable (environment and financial)
- Economic/Logistic Optimization, taking into account phosphorus runoff, other environmental restrictions
- Incorporates data analytics (e.g. SNAP+)
- New insights to operate system efficiently, how to enforce much stricter environmental constraints using blend of rotations, NMP and separations
- Large (mixed integer) optimization

Fishwerks: A decision support tool

- Great lakes basin scale data visualization
- 250,000+ interdependent barriers on a river network
- Crowd sourcing data updates
- Complex optimization for budget constraints, specific fish guilds, invasives
- Adopted for use by Fish and Wildlife Service `www.greatlakesconnectivity.org`



Water rights pricing (Britz/F./Kuhn)



The model IO + trade (mechanism design)

$$\max_{q_i, x_i, wo_i, wr_i^b, wr_i^s \geq 0} \left(q_i \cdot p - \sum_f x_{i,f} \cdot w_f - wr_i^b \cdot (w_{wr} + \tau) + wr_i^s \cdot w_{wr} \right)$$

s.t.

$$q_i \leq \prod_f \left(x_{i,f} + e_{i,f} \right)^{\epsilon_{i,f}}$$

$$x_{i,land} \leq e_{i,land}$$

$$wo_{i-1} = x_{i,wat} + wo_i$$

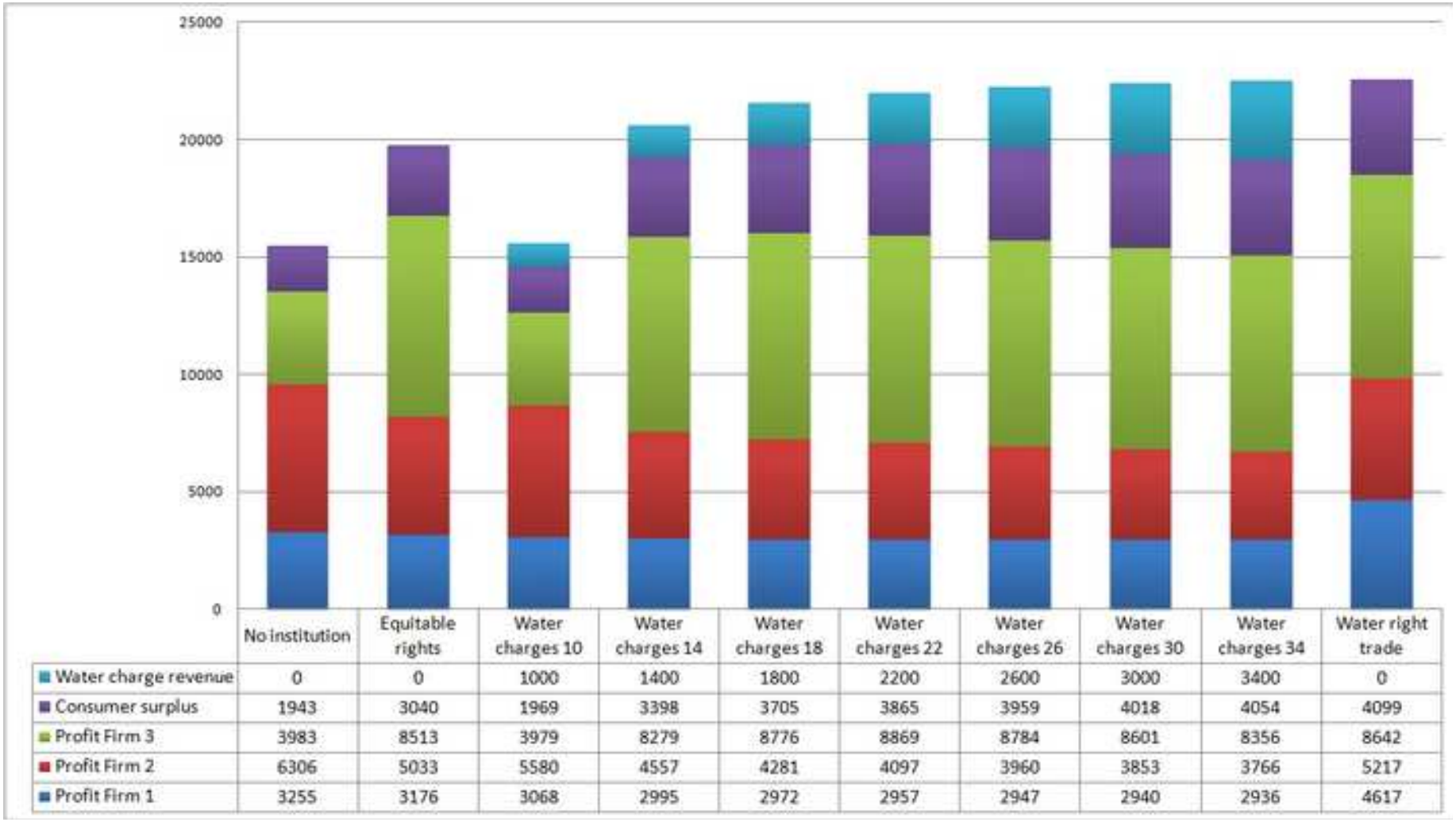
$$wr_i + wr_i^b \geq x_{i,wat} + wr_i^s$$

$$0 \leq \quad p \quad \perp \quad \sum_i q_i - d(p) \geq 0$$

$$0 \leq \quad w_{lab} \quad \perp \quad \sum_i e_{i,lab} - \sum_i x_{i,lab} \geq 0$$

$$0 \leq \quad w_{wr} \quad \perp \quad \sum_i wr_i^s - \sum_i wr_i^b \geq 0$$

Different Management Strategies



	No institution	Equitable rights	Water charges 10	Water charges 14	Water charges 18	Water charges 22	Water charges 26	Water charges 30	Water charges 34	Water right trade
Water charge revenue	0	0	1000	1400	1800	2200	2600	3000	3400	0
Consumer surplus	1943	3040	1969	3398	3705	3865	3959	4018	4054	4099
Profit Firm 3	3983	8513	3979	8279	8776	8869	8784	8601	8356	8642
Profit Firm 2	6306	5033	5580	4557	4281	4097	3960	3853	3766	5217
Profit Firm 1	3255	3176	3068	2995	2972	2957	2947	2940	2936	4617