Grand Challenge:
Landscape-scale management for sustainable plant production and ecosystems

CSREES Review

February 2-6, 2009

Landscape-scale management

- Scope/rationale:
  - Land mgmt. and crop prod. decisions often made on piecemeal basis for small mgmt. unit
  - A more systematic approach to choosing appropriate mgmt. for the landscape is needed
- Audience/stakeholders/collaborators
  - State and Fed'l agencies; farmers; consultants; ag. industry; Soil Water Cons. Districts; homeowners; park/recreation mgrs.; watershed groups; non-gov't. orgs.

Overview of Activity

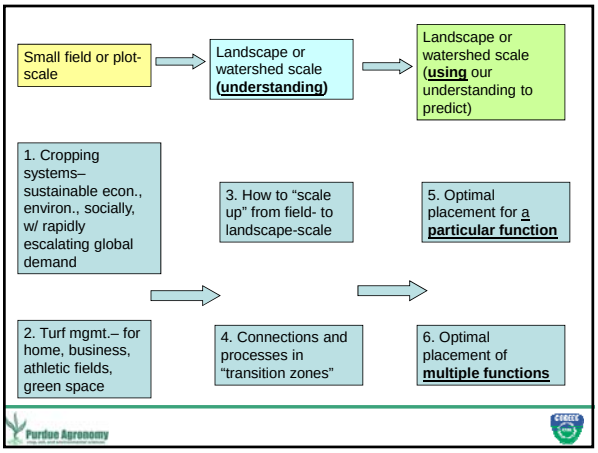
- Long history of research on sust. crop prod. and underpinnings of soil & water quality
- Work in turf and urban/rural interface also long history in dept.
- Scale was usually plot or small field, but often did include multiple functions (corn yield and water quality, for ex.)
- Since last review, faculty specifically hired to help broaden impact to larger scales
- History of service in advisory roles to state and fed'l agencies, and desire to have beneficial impact at broader scale

Current Challenges

- Ever-increasing competition for land, water
- Within ag.: food, feed, fiber, now biofuels
- Urban/suburban, recreation, green space
- Demand for cleaner water resources and wildlife habitat
- Recent flooding inspired calls to rethink use of floodplains, impervious urban design, drainage, river engineering
- Worldwide water shortages suggest more efficient water use, conservation
- Hypoxia Action Plan, TMDLs (Total Max Daily Loads) emphasize reduction of nutrient loads
- Agronomy Dept. has much technical knowledge to help with these issues!

Fundamental issues for next 10 yr

1. Improved cropping systems that are sustainable economically, environmentally, and socially despite rapidly escalating global demand
2. Management of turf for home and business lawns as well as for golf courses and athletic fields and preservation of green space
3. How to "scale up" the results from a field scale project, to the landscape or watershed scale
4. The connections and processes in the transition zones and in the larger scale
5. Optimal placement of various practices for a particular function
6. Optimal placement of multiple functions within the landscape or watershed



Fundamental issues for next 10 yr

1. Improved cropping systems that are sustainable economically, environmentally, and socially despite rapidly escalating global demand
   - Help achieve worldwide food security by ecological intensification of grain crop production systems
   - Optimization of nutrient mgmt. (macro, micro) within context of high nutrient prices, and fluctuations in crop commodity prices
   - Ex: conservation tillage, residue harvesting intensity, cropping systems, soil quality, cover crops, manure mgmt., pest mgmt., organic farming
   - Often on multiple soils/sites, recognizing the large genotype x environment interactions
2. Management of turf for home and business lawns as well as for golf courses and athletic fields and preservation of green space
   - Ex: nutrient and pesticide mgmt., establishment methods, stress tolerance, mgmt. for high and low maintenance needs

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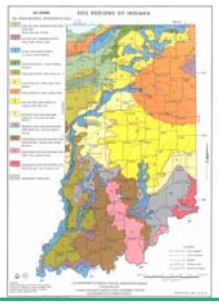
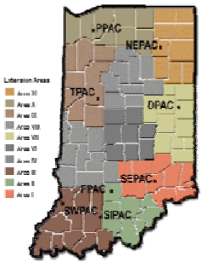
Soil regions of Indiana



Locations of 8 regional research farms (Purdue Ag. Centers)



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Fundamental issues for next 10 yr

1. Improved cropping systems
2. Management of turf

3. How to “scale up” the results from a field scale project, to the landscape or watershed scale
   - For ex., if a practice reduces P losses from a field by 30%, how much does it impact P losses at watershed outlet? Involves relative size of field vs. watershed, plus links & intervening processes (#4)
   - Develop “nested” field studies in selected watersheds. Try to place new field studies within watersheds with other studies, and try to locate new watershed studies in areas already containing field studies. Ex: WQFS, ditch, Indian-Pines, Wabash R.

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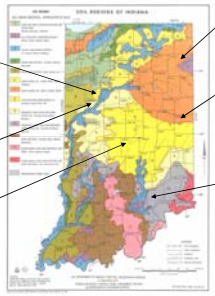
4. The connections and processes in the transition zones and in the larger scale
   - For ex., P or N in drainage ditch determined by runoff/drainage from field, plus reactions w/ sediment/vegetation in ditch, ditch bank sloughing, interactions w/ groundwater/baseflow
   - Many of these "transition zones" fall "between" departments. Currently some work here but need greater effort with other depts. and entities (NSERL, FNR, ABE, IUPUI) to include transition zone. Ex: White Co. ditch process measurements and controlled drainage modeling; Eagle Creek; St. Joe watershed

Water quality field studies (varying scales)

White Co. controlled drainage; Hoagland Ditch and Lake Schafer

WQFS, ACRE, Wabash R.

Eagle Creek Res.



St. Joe watershed

DPAC controlled drainage

SEPAC drainage

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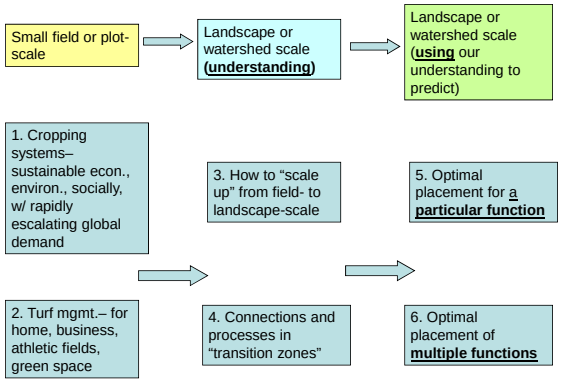
5. Optimal placement of various practices for a particular function
   - Given a suite of practices for nitrate load reduction, for ex., what is optimal placement of practices within landscape? Current IN State Dept. Ag. example for CREP (Cons. Reserve Enhancement Prog., NRCS)
6. Optimal placement of multiple functions within the landscape or watershed
   - Given multiple functions and mixed uses in a watershed, what is optimal placement of each function?



Dissemination of info to decision-makers, scientific community, public

- Several faculty have ongoing relationships with state or federal agencies, communicating findings and helping them assess options (range from formal appointments to gov't boards, to informal advisors or info sources)
- We plan to explore new ways to more regularly and collectively provide timely updates and expertise to help them (agencies)– how?
  - Regular meetings of faculty and agency folks?
  - White papers targeted to current needs of agencies?
- Variety of extension programming and publications, web-based modules, and scientific articles

Recommendations

- Many projects could have even greater impact by better linkage with other scales of measurement & modeling
- Perhaps discuss all current projects in terms of geog. location, scale, and logical connections that could be made to next level up or down?
- Identify one or two watersheds where we'd focus efforts, considering current work plus soil mosaic present?
- For WQ work, frame obj. as testing ways to reduce nutrient loads, for hypoxia and state nutrient criteria, explicitly considering work at field scale linked up to larger scale of ditch, stream, Wabash, and Miss R.
- Also compile data sets (old & new) and assemble in formats/models for dissemination and use? Explore new ways of making data and metadata accessible, with libraries or other data mgmt. strategies?

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Constraints

- Technical/professional support staff (sustained funding)
- Long-term field facilities/sites– funding (sustained)
- Instrumentation for water quality in ditches/streams and air quality (N_2O)

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