A Multi-Criteria Decision Support Model for Ranking Factors Affecting Conservation Practice Adoption in a CEAP Watershed

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Partners

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- USDA-ARS Southeast Watershed Research Lab.
  - David Bosch, Richard Lowrance, Dana Sullivan, Jaepil Cho
- USDA-NRCS
  - Mary Leidner
- South Georgia Regional Development Center
  - Angela Wall
- InfoHarvest
  - Philip Murphy

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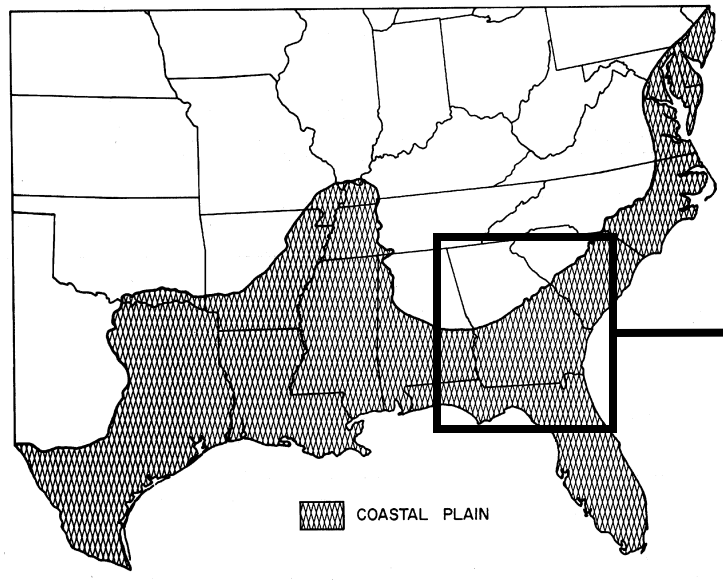
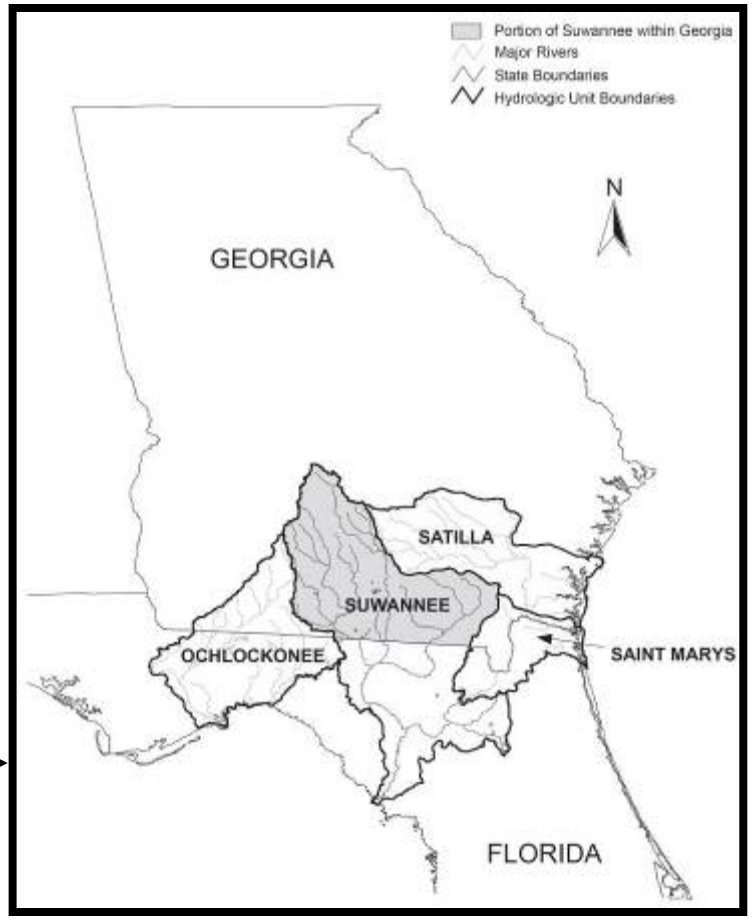
  - and by USDA-ARS CRIS project funds.

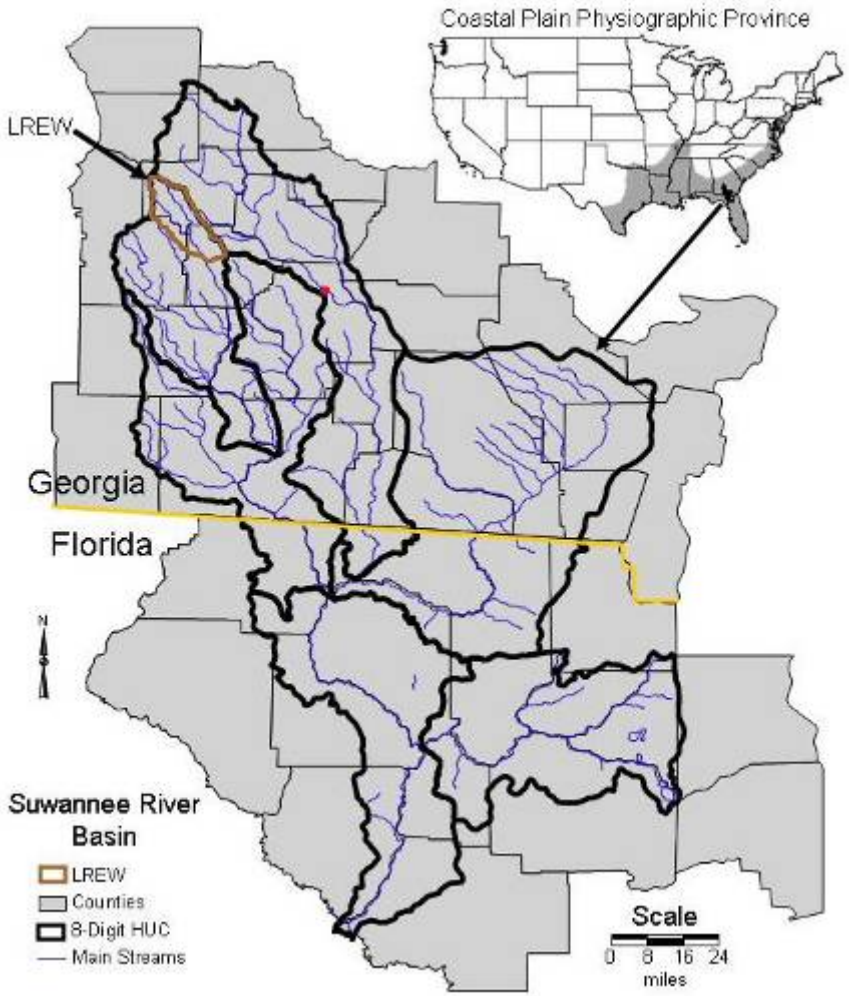
Georgia CEAP Project

- Southeastern Coastal Plain
  - Suwannee River Basin



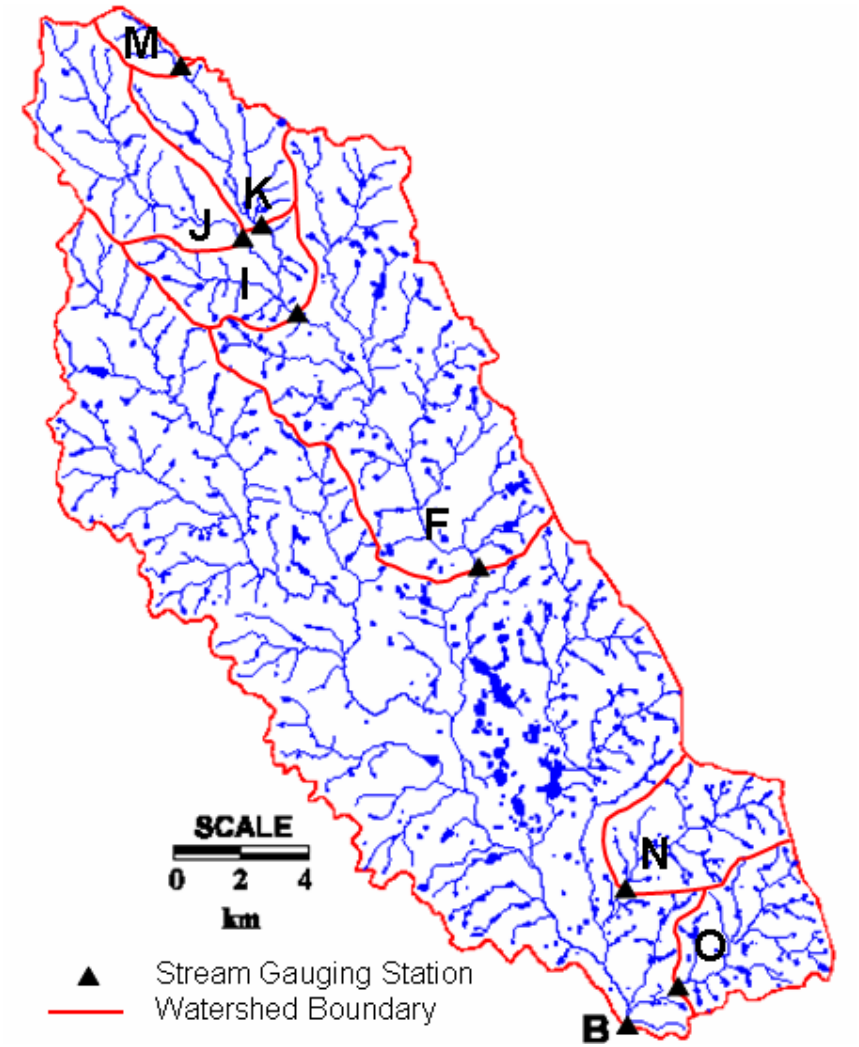


Suwannee River Basin



- Representative of Coastal Plain ecoregions
- 60% in Georgia, 40% in Florida
- Priority watershed
- LREW

Little River Experimental Watershed (LREW)



- 334 km^2 (82,500 ac)
- USDA-ARS regional experimental watershed
- Established in late 1960s
- 5th order stream

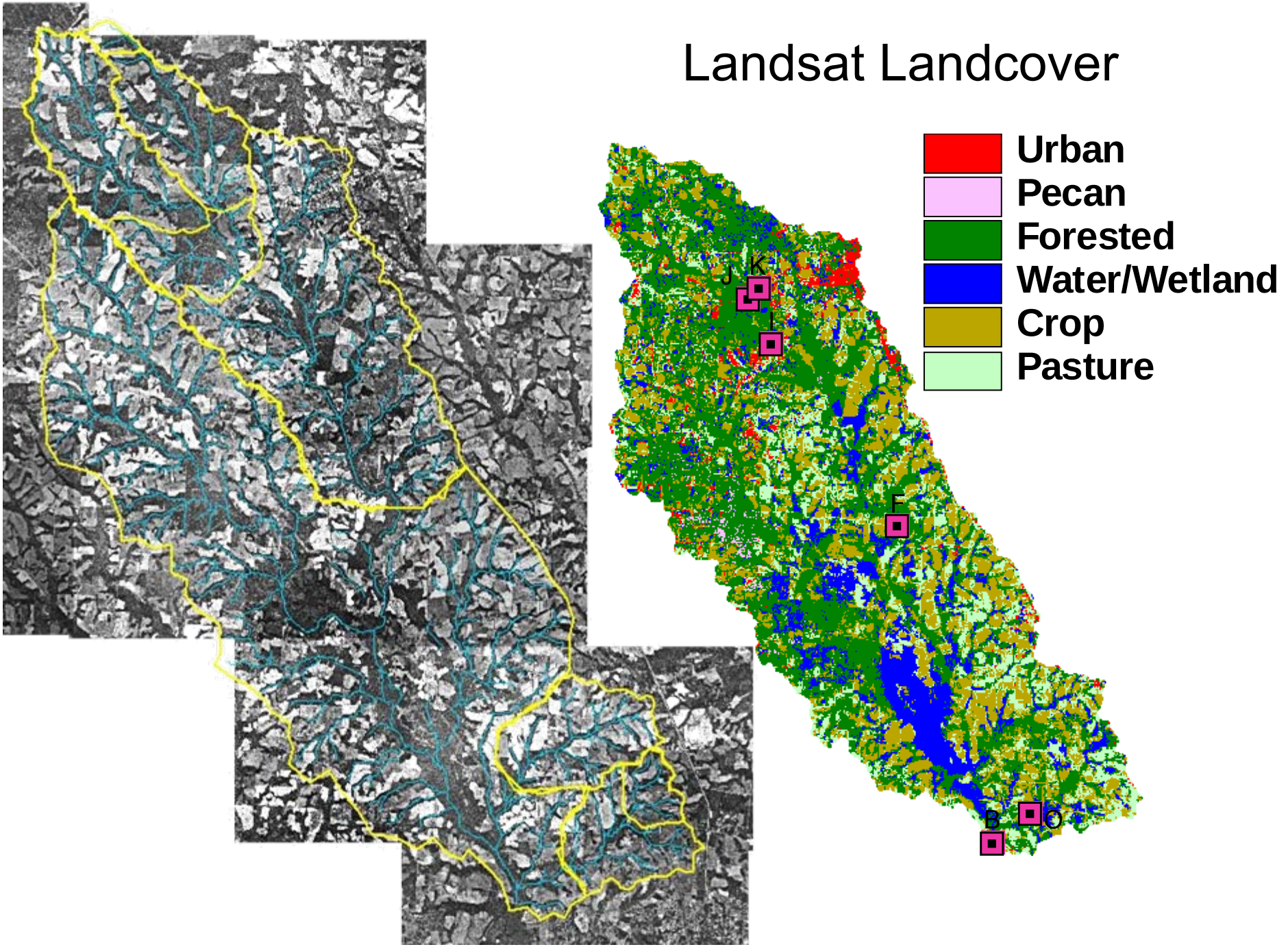
LREW Impairments

- Main stem
  - low DO
- Tributaries
  - low DO, fecal coliform, and sediment
- Typical of impairments in Coastal Plain
- No point sources

LREW Landcover

- Agricultural land 36% to 54%
  - Row crops – 31% to 41%
  - Pasture – 15%
  - Most pasture land used for cow-calf operations
- Remainder of the watershed in forest
  - pine plantations
  - forested wetlands

Landsat Landcover



LREW Cropping History

Percent of Total Crops

	1995	1996	1997	1998	1999	2000
Cotton	54.1	55.8	59.7	57.1	61.5	64.5
Peanuts	43.6	39.7	36.9	34.8	38.5	34.7
Corn	2.3	4.5	3.4	8.1	0.0	0.7

- While small, vegetable acreage is increasing
- No soybeans grown in the watershed over the past few years

USDA Conservation Practices

- 1970s
  - terraces on highly erodible land
  - drainage of wet field margins (typically less than 10 acres) through the early 1980s
- 1980s and 1990s
  - continued installation of terraces
  - more emphasis on grass waterways and cover crops
  - Conservation Reserve Program (CRP)

USDA Conservation Practices

- Late 1990s – present
  - nutrient management
  - manure management
  - conservation tillage (cotton)
  - cover crops
  - filter strips
  - farm ponds

Objectives

- To evaluate the effects of past and potential conservation practices on water quality in a coastal plain watershed;
- To evaluate social and economic factors influencing implementation and maintenance of these conservation practices; and
- Train and educate stakeholders about these issues and the effects that their actions have on watershed-scale water quality.

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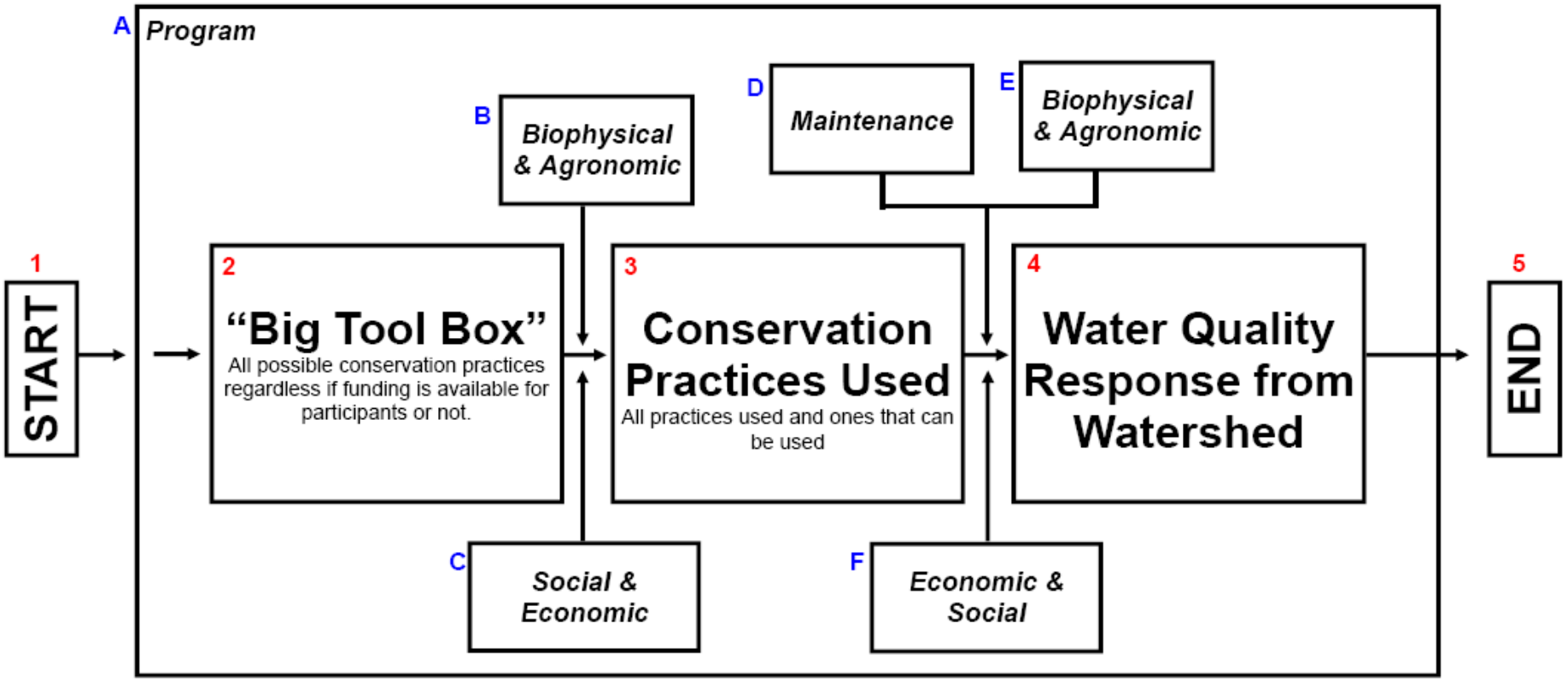
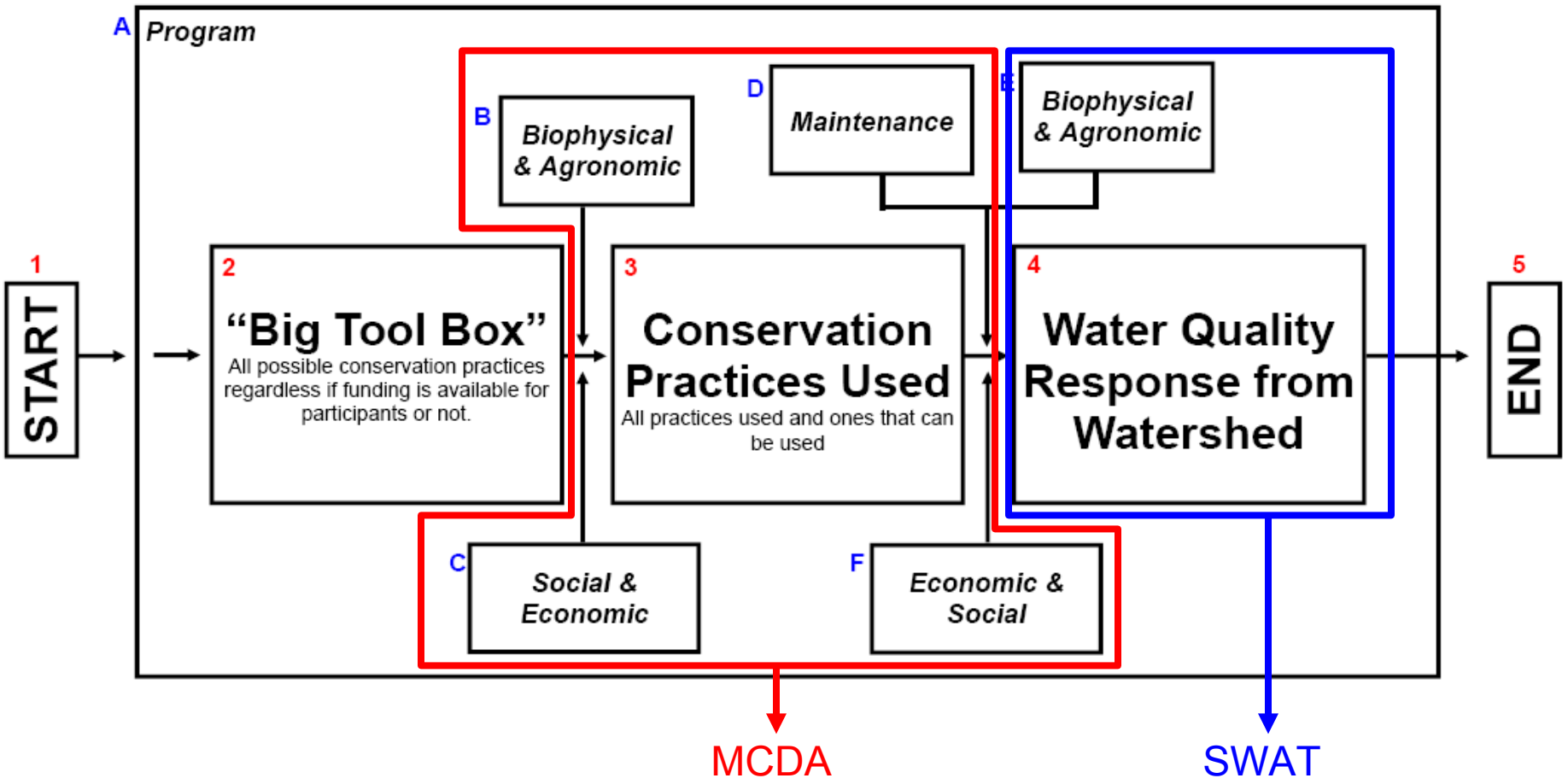
LREW Conceptual Model



LREW Conceptual Model



Multi-Criteria Decision Analysis (MCDA)

- Criterium DecisionPlus 3.0
  - helps users make complex decisions among alternatives involving multiple criteria
  - calculates which alternative best meets the decision-maker's criteria
  - how likely that alternative is to be truly the best choice in the face of uncertainty

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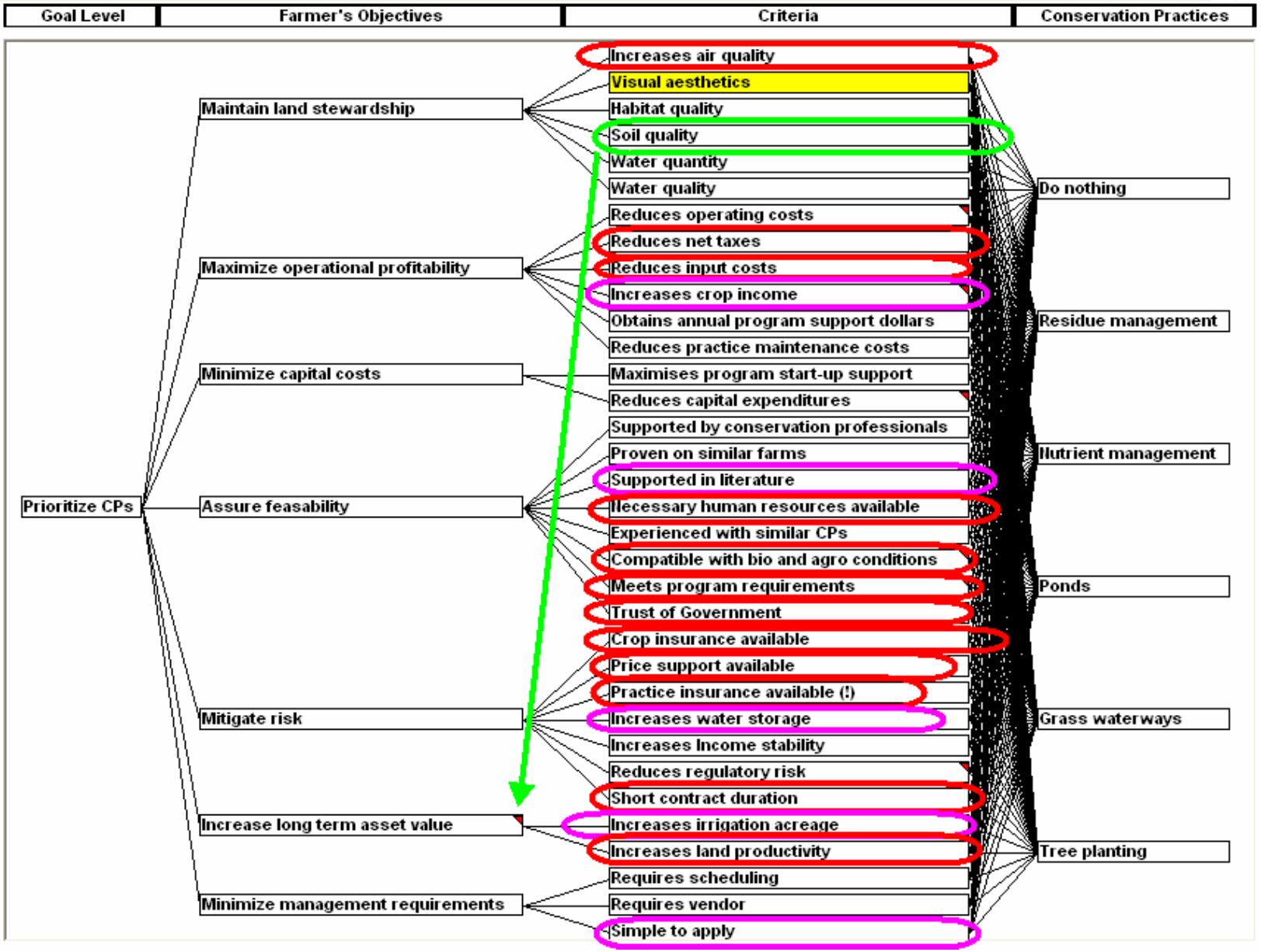
NRCS Conservation Practices

Code	Conservation Practices (All possible in LREW)
1	Conservation Cover
2	Contour Farming
3	Cover & Green Manure Crop
4	Field Border
5	Filter Strips
6	Forest Site Preparation
7	Forest Stand Improvement
8	Grassed Waterways
9	Grazing Management
10	Heavy Use Area Protection
11	Irrigation Storage Reservoir
12	Irrigation Water Management
13	Nutrient Management
14	Pasture & Hayland Management
15	Pasture & Hayland Planting
16	Pest Management
17	Pest Management

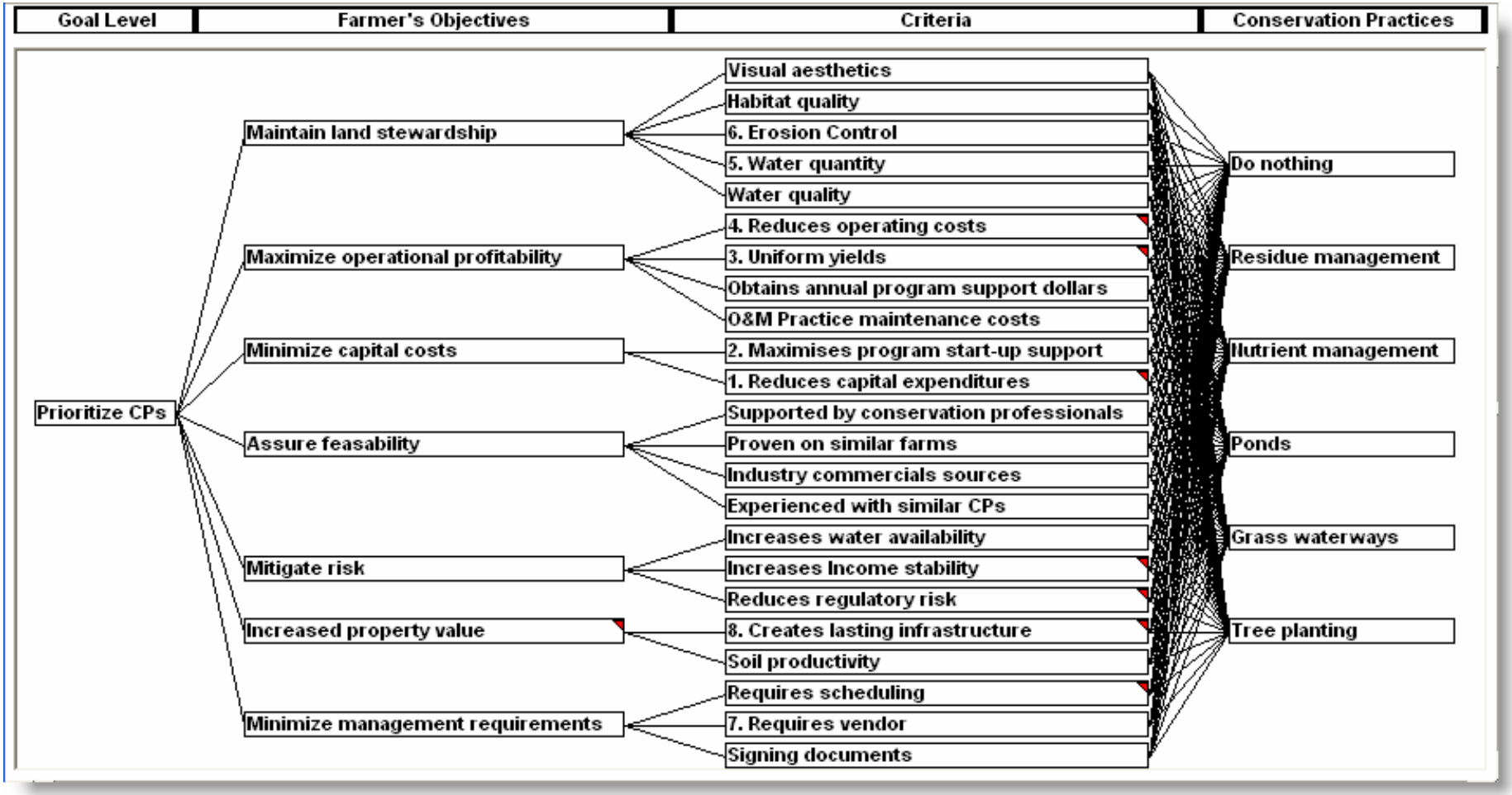
Code	Conservation Practices (All possible in LREW)
18	Pond
19	Prescribed Grazing
20	Residue Management, No-Till & Strip-Till
21	Residue Management, Seasonal
22	Riparian Forest Buffer
23	Silvopasture Establishment
24	Stream Crossing
25	Streambank & Shoreline Protection
26	Strip Cropping (contour)
27	Terrace
28	Tree Planting
29	Tree/Shrub Establishment
30	Trees - Already Established
31	Use Exclusion
32	Waste Storage Facility
33	Water & Sediment Control Basin


Goal Level
Farmer's Objectives
Criteria
Conservation Practices
Prioritize CPs
Maintain land stewardship
Maximize operational profitability
Minimize capital costs
Assure feasability
Mitigate risk
Increase long term asset value
Minimize management requirements
Increases air quality
Visual aesthetics
Habitat quality
Soil quality
Water quantity
Water quality
Reduces operating costs
Reduces net taxes
Reduces input costs
Increases crop income
Obtains annual program support dollars
Reduces practice maintenance costs
Maximises program start-up support
Reduces capital expenditures
Supported by conservation professionals
Proven on similar farms
Supported in literature
Necessary human resources available
Experienced with similar CPs
Compatible with bio and agro conditions
Meets program requirements
Trust of Government
Crop insurance available
Price support available
Practice insurance available (!)
Increases water storage
Increases Income stability
Reduces regulatory risk
Short contract duration
Increases irrigation acreage
Increases land productivity
Requires scheduling
Requires vendor
Simple to apply
Do nothing
Residue management
Nutrient management
Ponds
Grass waterways
Tree planting

Expert Panel

- Natural Resource Economists
  - Leonard Shabman (Resources for the Future)
  - Michele C Marra (NC State)
  - Jimmy Bramblett (NRCS – Georgia State Office)
- Modelers / Water Quality Specialists
  - Rafael Muñoz-Carpena (Florida)
  - Mark Risse (Georgia)
- Regulatory Agencies
  - Rob McDowell (Georgia Environmental Protection Division]
  - Bill Ainslie (EPA Region IV)
- Natural Resources Conservation Service
  - David Ferrell (District Conservationist)
  - Mary Leidner (District Conservationist)

Refined Model

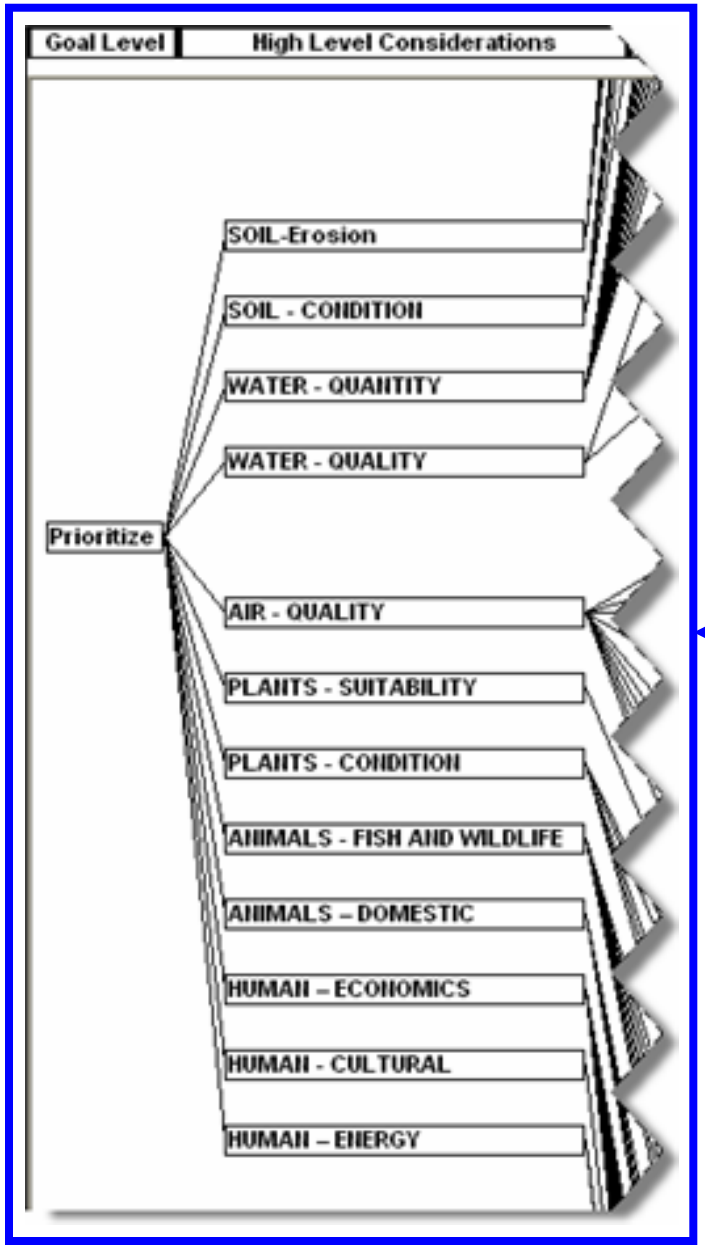


2nd Option – NRCS CPPE

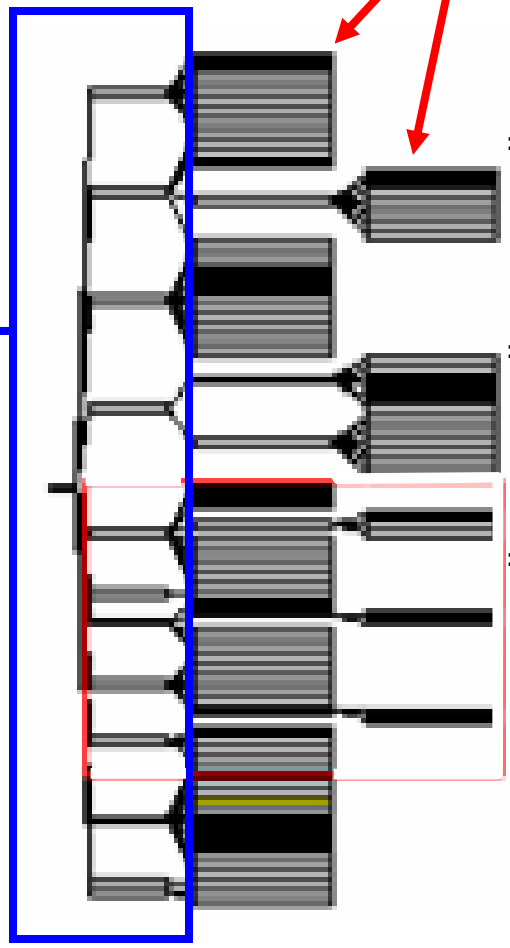
CONSERVATION PRACTICE PHYSICAL EFFECTS WORKSHEET

STATE	Any	FIELD OFFICE	Any	DATE	11/19/2007

PRACTICE: Filter Strip 393	Baseline Setting: Appropriate Land Use(s): All Land Uses	
RESOURCES, CONSIDERATIONS AND CONCERNS	**PHYSICAL EFFECTS**	**RATIONALE**
SOIL - EROSION		
Sheet and Rill	Not Applicable	Not applicable.
Wind	Not Applicable	Not applicable.
Ephemeral Gully	Not Applicable	Not applicable.
Classic Gully	Not Applicable	Not applicable.
Streambank	Not Applicable	Not applicable.
Shoreline	Not Applicable	Not applicable.
Irrigation Induced	Neutral	Captures sediment in tailwater runoff but does not reduce erosion.
Mass Movement	Not Applicable	Not applicable.
Road, Roadsides, and Construction Sites	Not Applicable	Not applicable.
SOIL – CONDITION		
	Substantial Impro	ased erosion, increased less oxidation



Each of 12 High Level Considerations have 1 or 2 levels of Benefits / Impacts



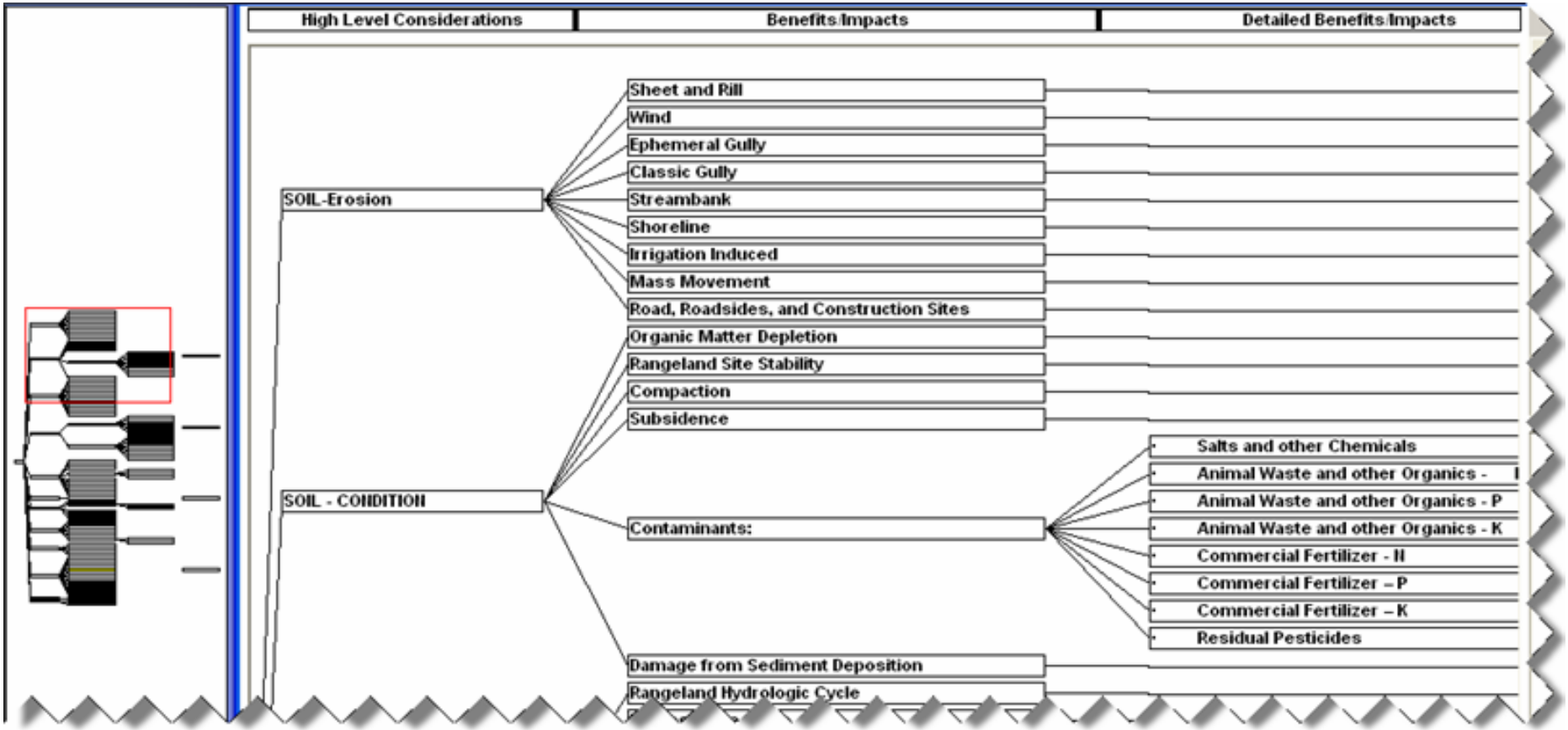
#4 Field Borders

#13 Nutrient Management

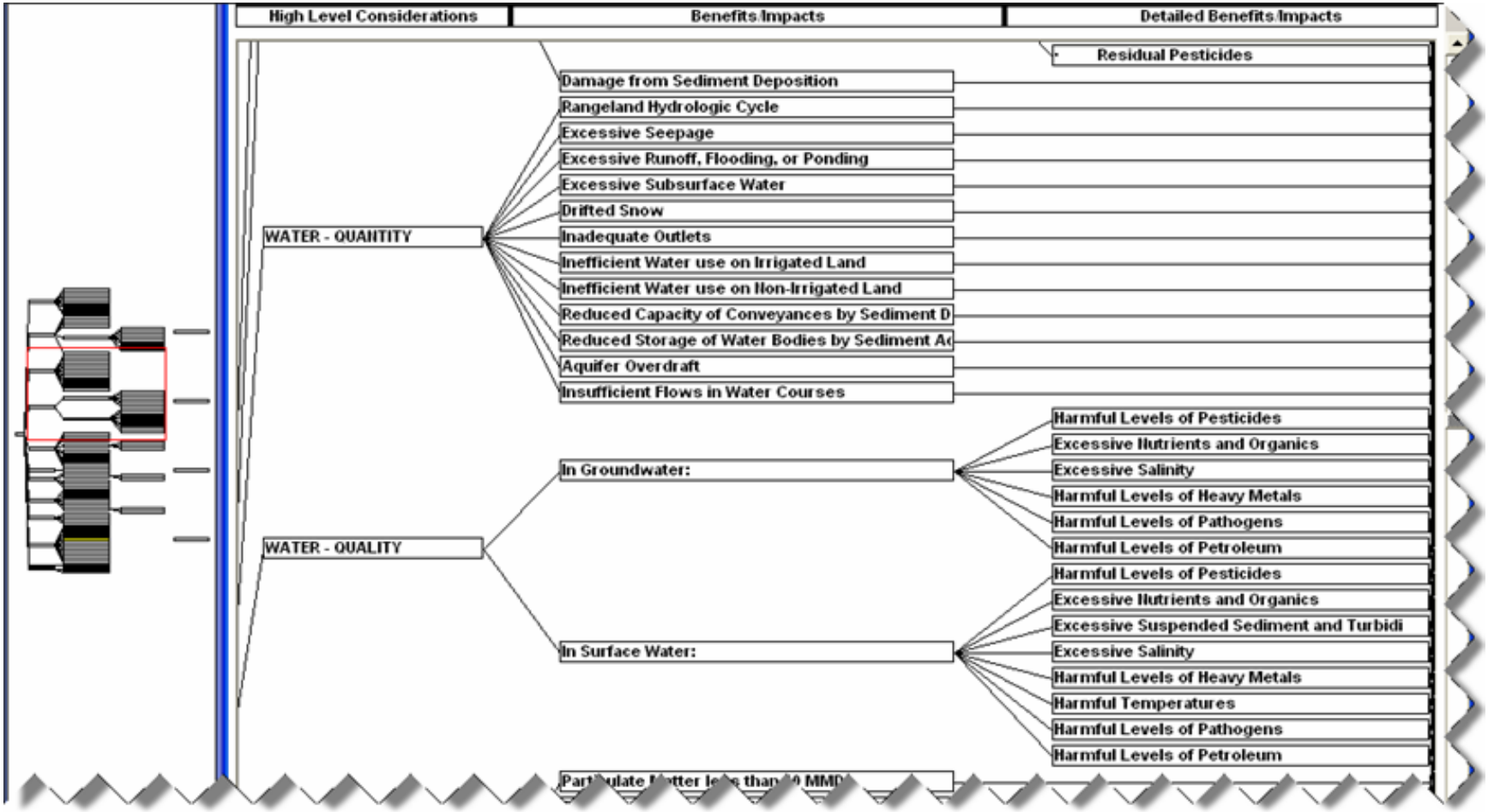
#8 Grassed Waterway

#11 Irrigation Storage Reservoir

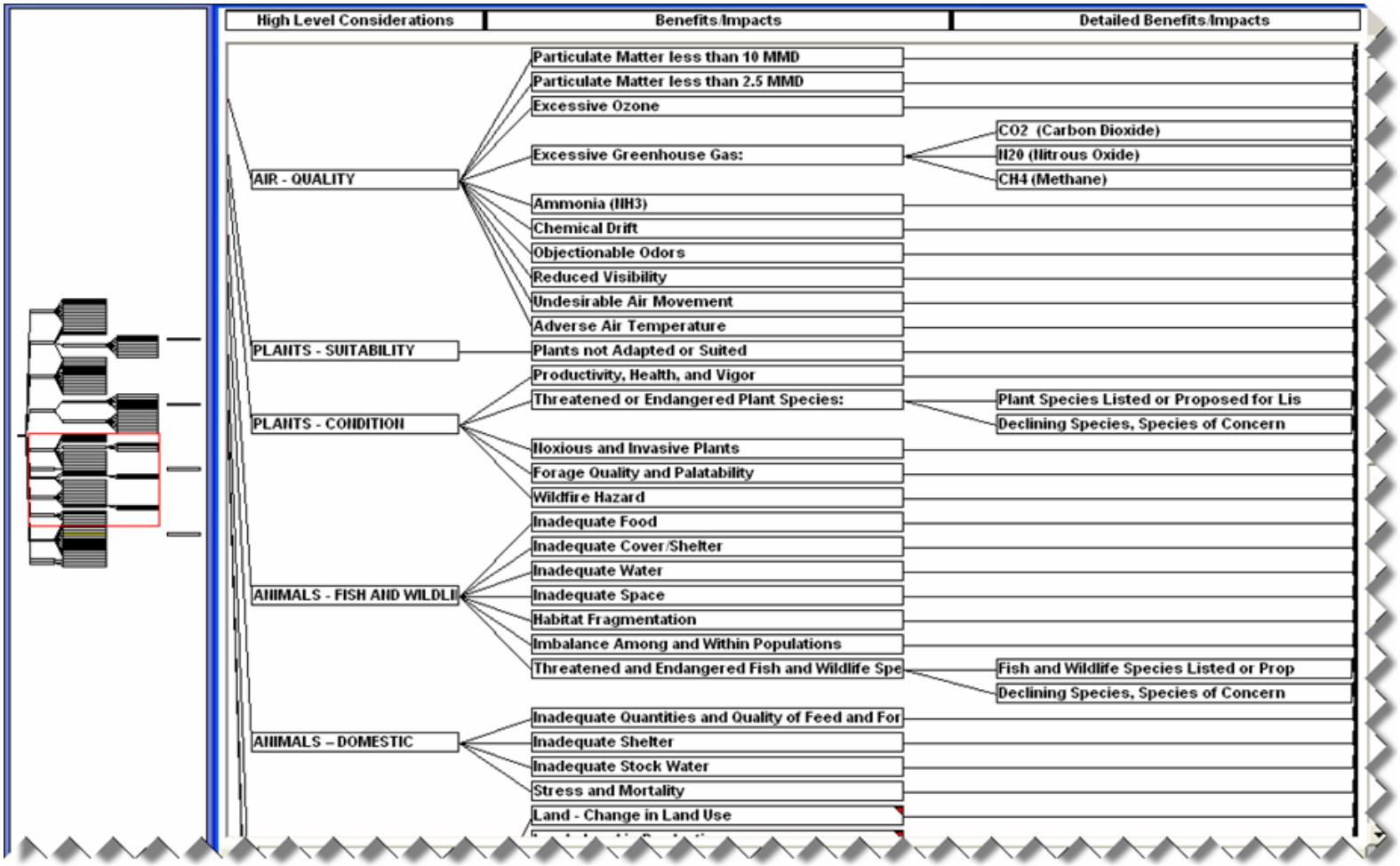
Impacts and Benefits to Soil



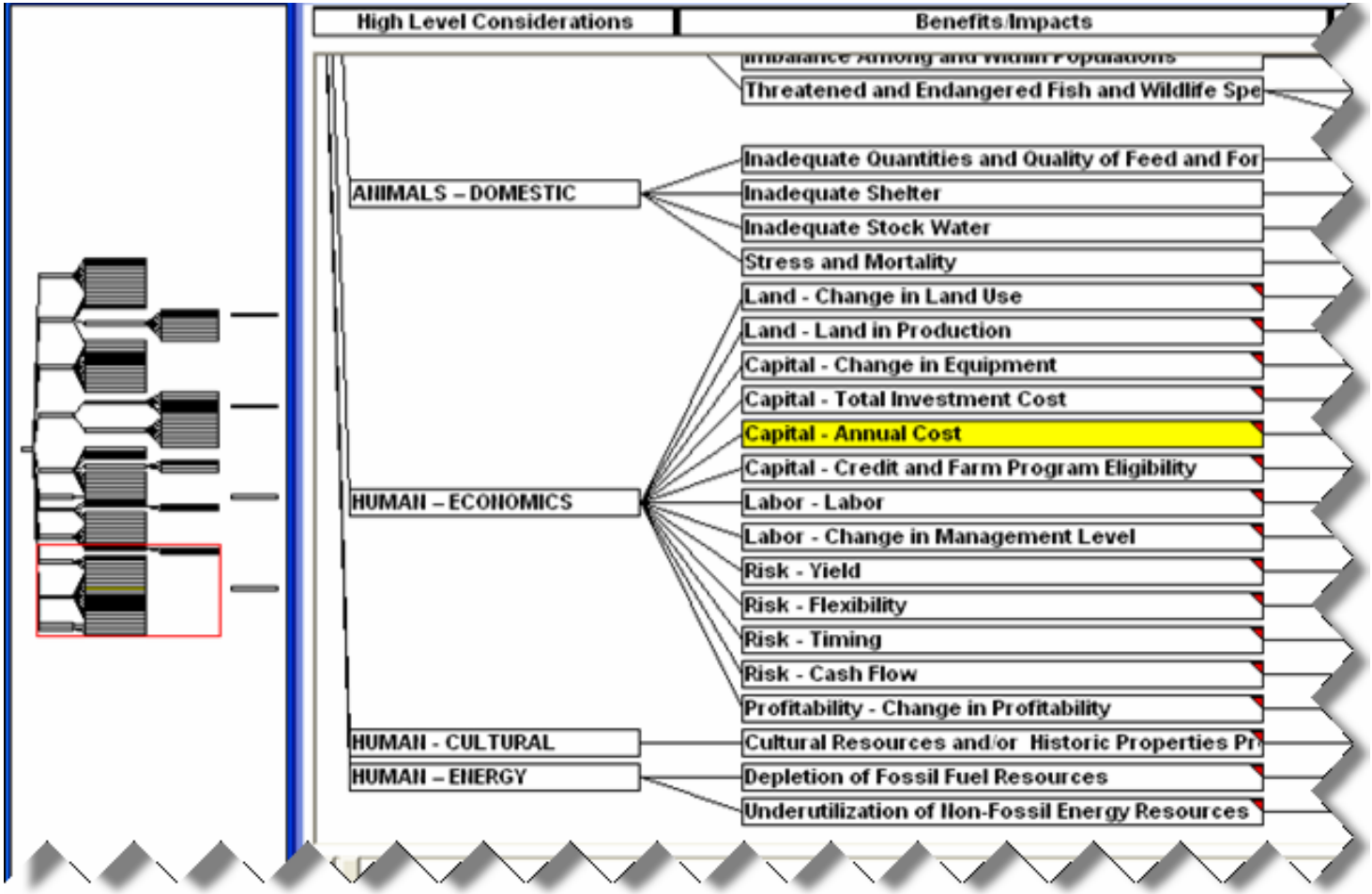
Impacts and Benefits to Water



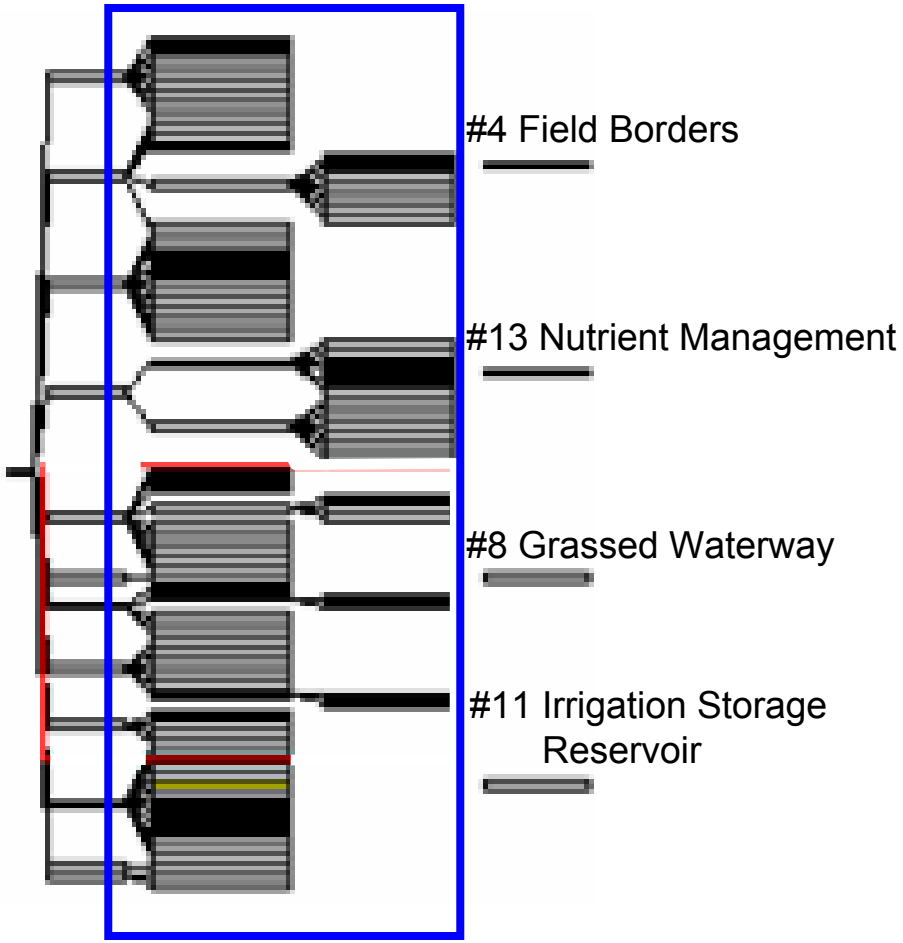
Impacts and Benefits to Air Quality, Plants and Animals



Impacts and Benefits to Humans

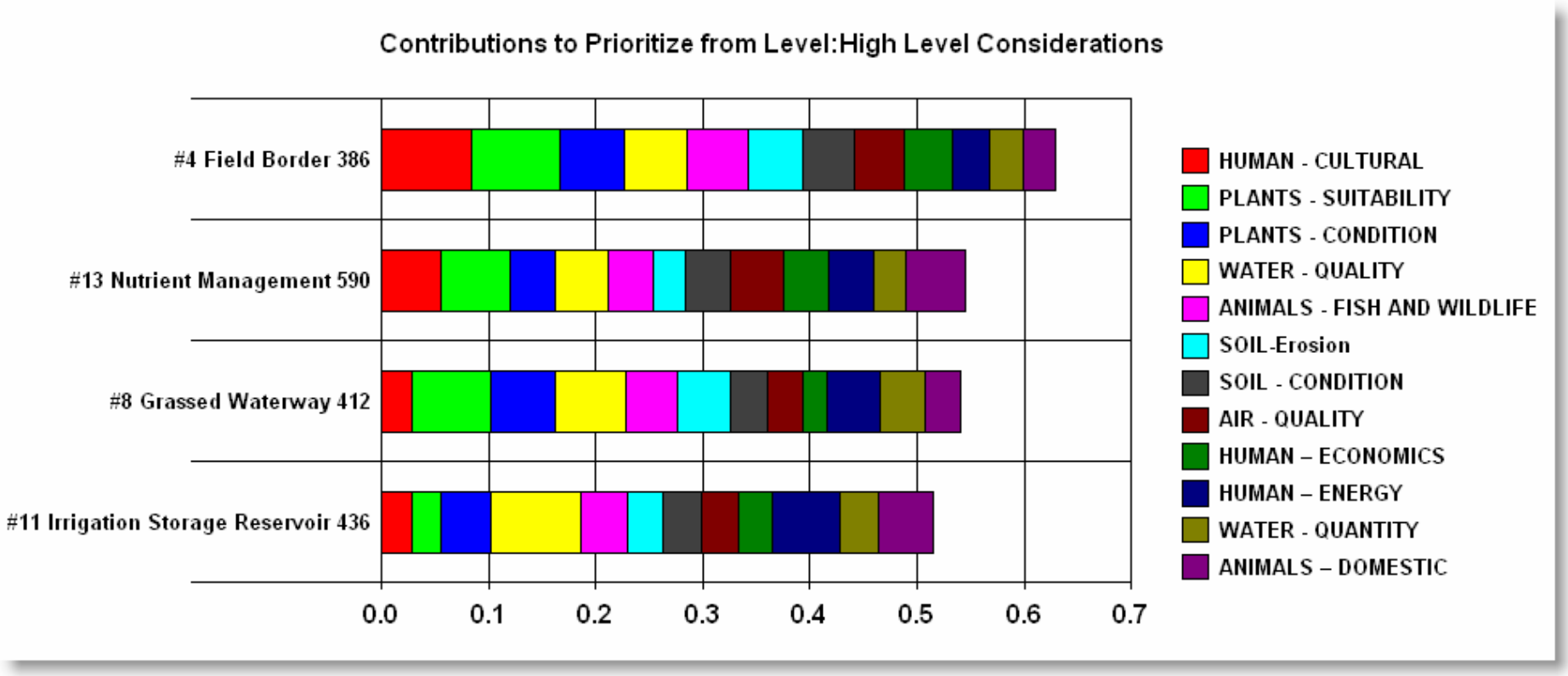


Assigning Weights to These Factors

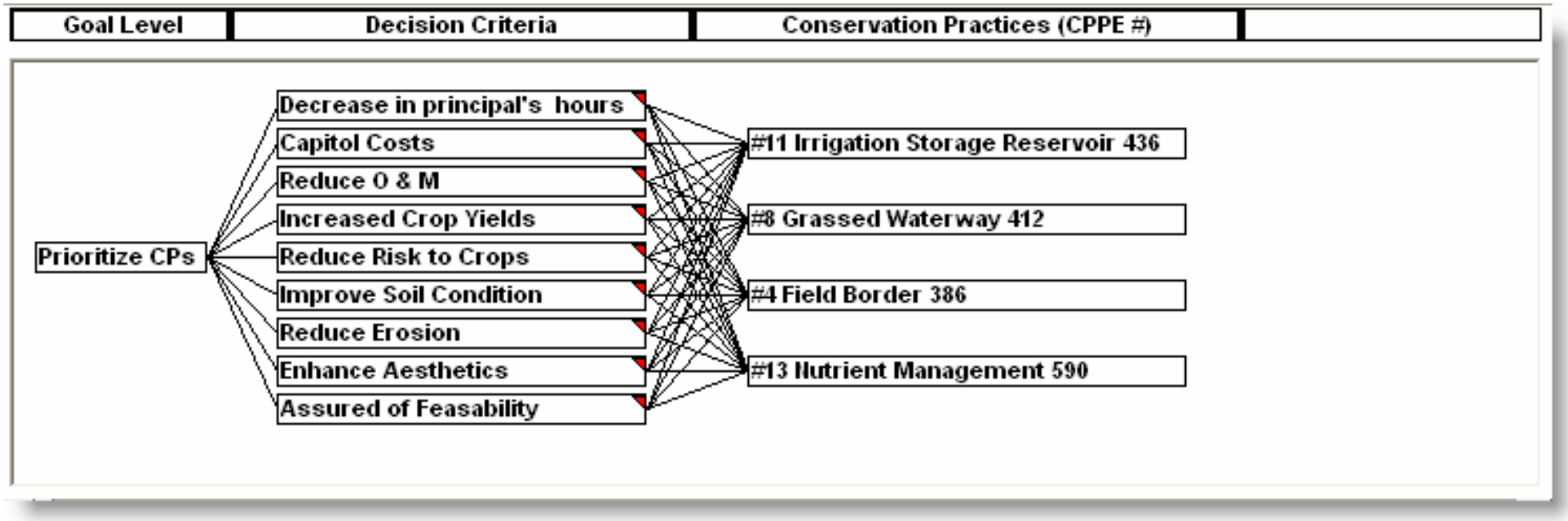


- Elicit farmers' ranking (importance, weight) of each factor
  - Critical
  - Very important
  - Important
  - Not important

Example prioritization results with each of 12 High Level Considerations assigned equal weight (didn't know any better)

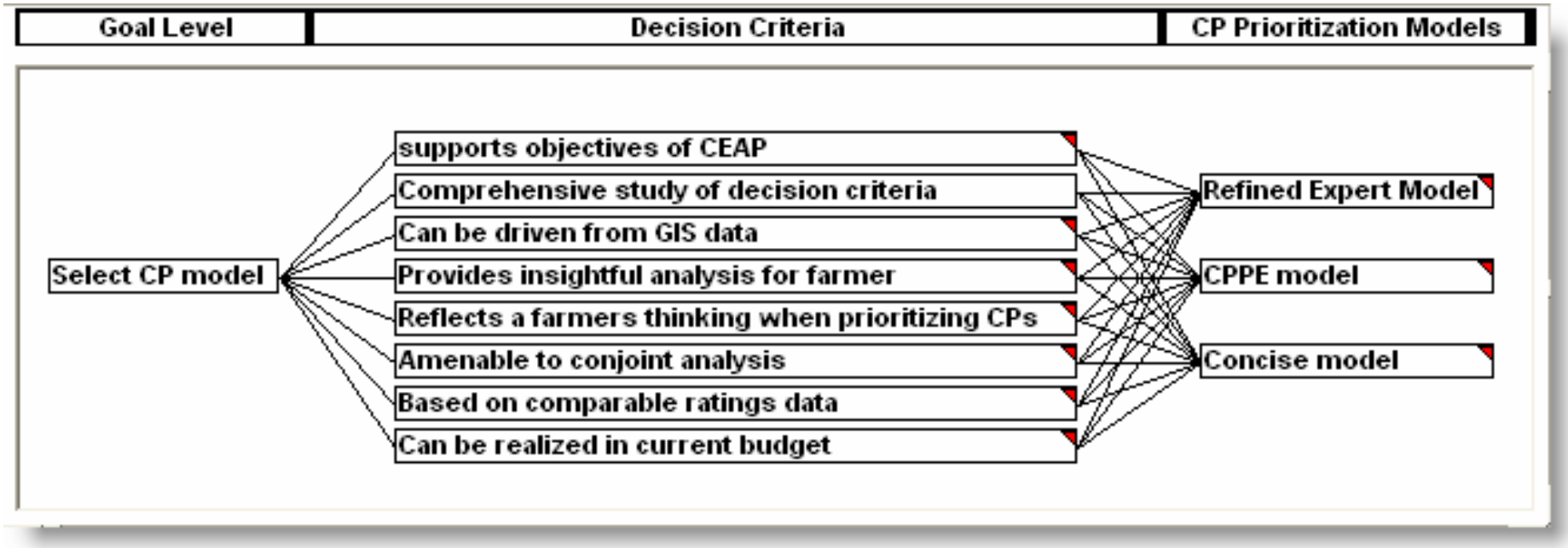


3rd Option – Concise Prioritization Model

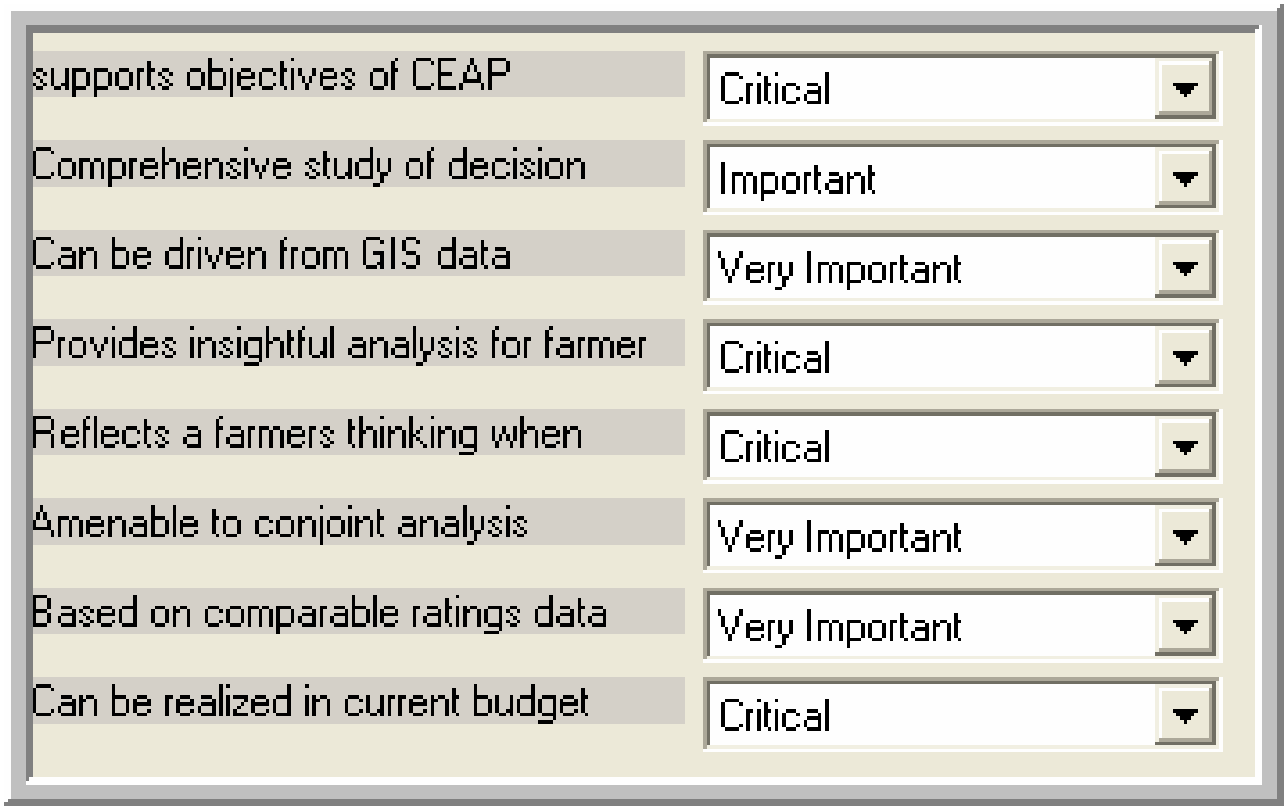


Proposed by NRCS District Conservationist

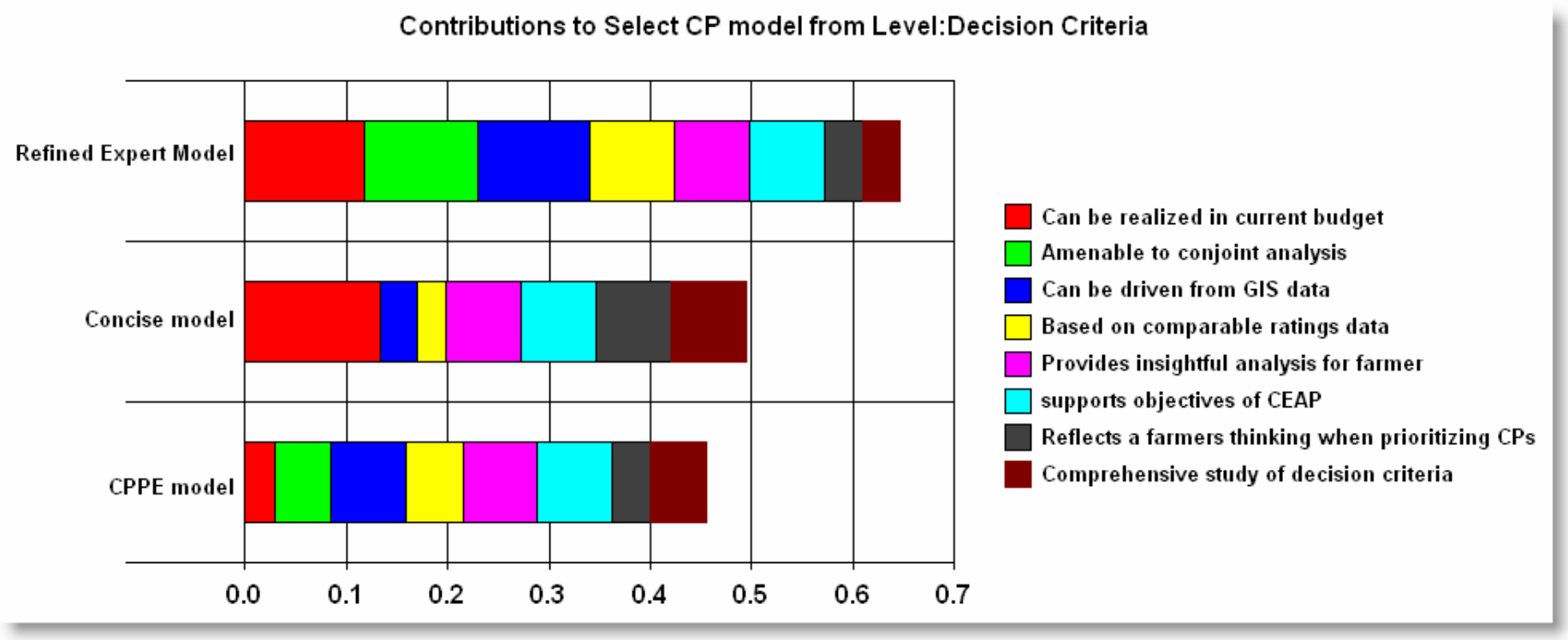
Deciding on Which Model to Select



Assigning My Weights



Results Based on My Weights



Next Steps

- Complete model selection
  - may develop Concise Model even if it isn't top choice
- Farmer panels / interviews to develop weights for criteria of chosen model(s)
- Farmer validation
- Use for developing alternative conservation practice scenarios for SWAT modeling

Thank you for your attention !!

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