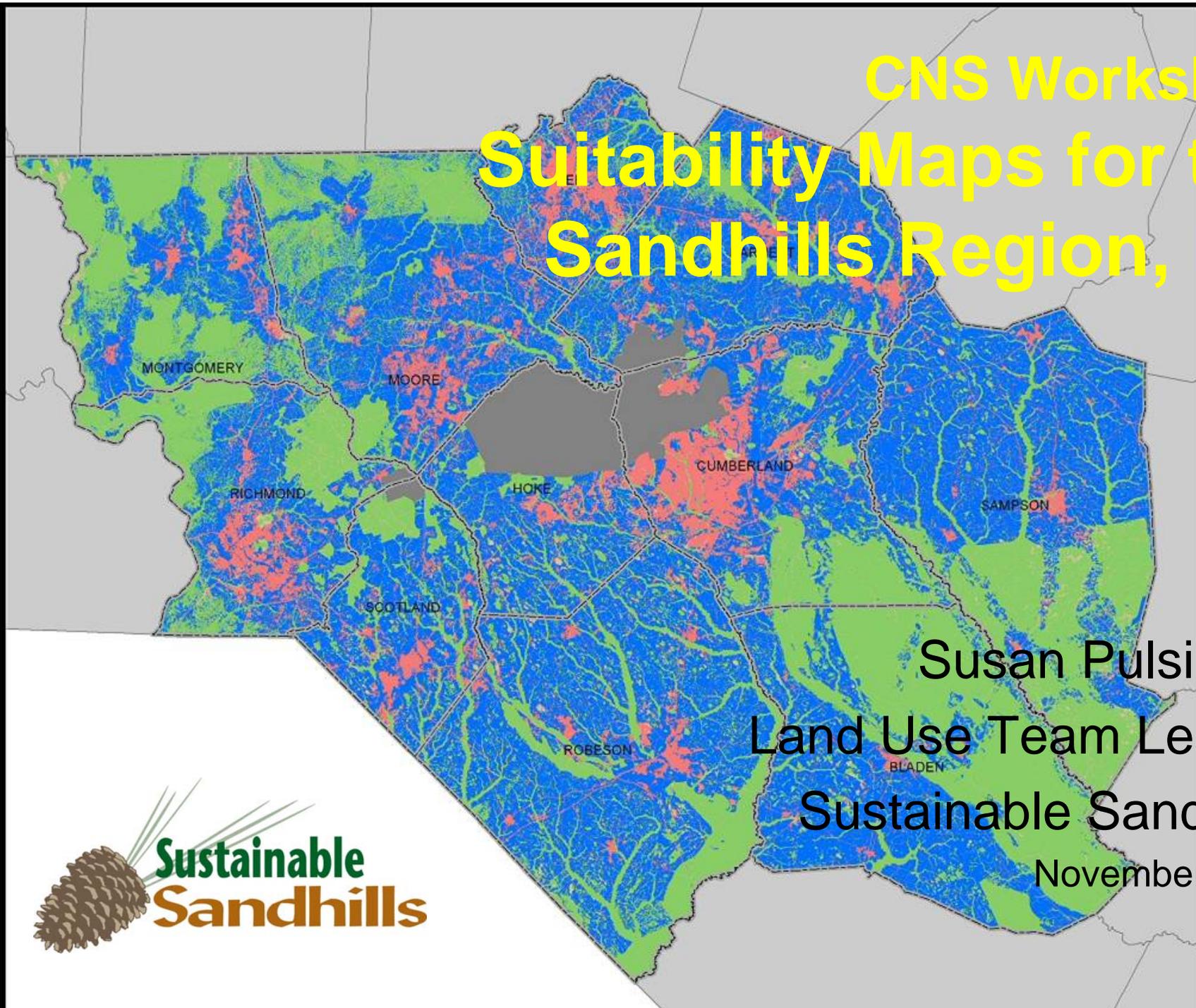


# CNS Workshop Suitability Maps for the Sandhills Region, NC



Susan Pulsipher  
Land Use Team Leader  
Sustainable Sandhills

November 2007



# Presentation Outline

- Who are we?
- What is the problem?
- Solutions
- Technical side
- Application examples
- Collaborations & spin-offs



Sustainable Sandhills promotes consensus, cooperation, shared visions and collaborative actions.

Sustainable Sandhills is a model for regional sustainability planning that preserves natural resources and enhances economic development, improving the quality of life in the region for current and future generations.



About Us ▾ Teams ▾ Regional Progress ▾ Events ▾ Get Involved ▾

## Our Mission

Sustainable Sandhills promotes consensus, cooperation, shared visions and collaborative actions. Sustainable Sandhills is a model for regional sustainability planning that preserves natural resources and enhances economic development, improving the quality of life in the region for current and future generations.



## Our Vision

The Sandhills of North Carolina is a thriving, viable and prosperous region that balances environmental, economic, military and social needs for all in the region. Sustainable Sandhills ensures that this region is sustainable, responding to current needs while not compromising the capacity of future generations to meet their needs.

**BECOME A MEMBER**  
[Join Sustainable Sandhills today](#)

[Donate](#)

[View Newsletter](#)

Be sure to check our **"Teams"** tab for more information regarding your areas of interest and for valuable Resource links! (We update the website as soon as we receive new resource and/or event information.)



### NEWS FLASH

#### Harnett County Recycling Update

The Harnett County Board of Commissioners have established a Harnett County Recycling Task Force (HRTF). For more information go to [HRTF History](#). [Track the progress](#) of the HRTF meetings. The HRTF Final Report will be submitted to the Commissioners in late October.

### UPCOMING EVENTS

#### Fall 2007 Water Resources Conference

**November 8-9, 2007**

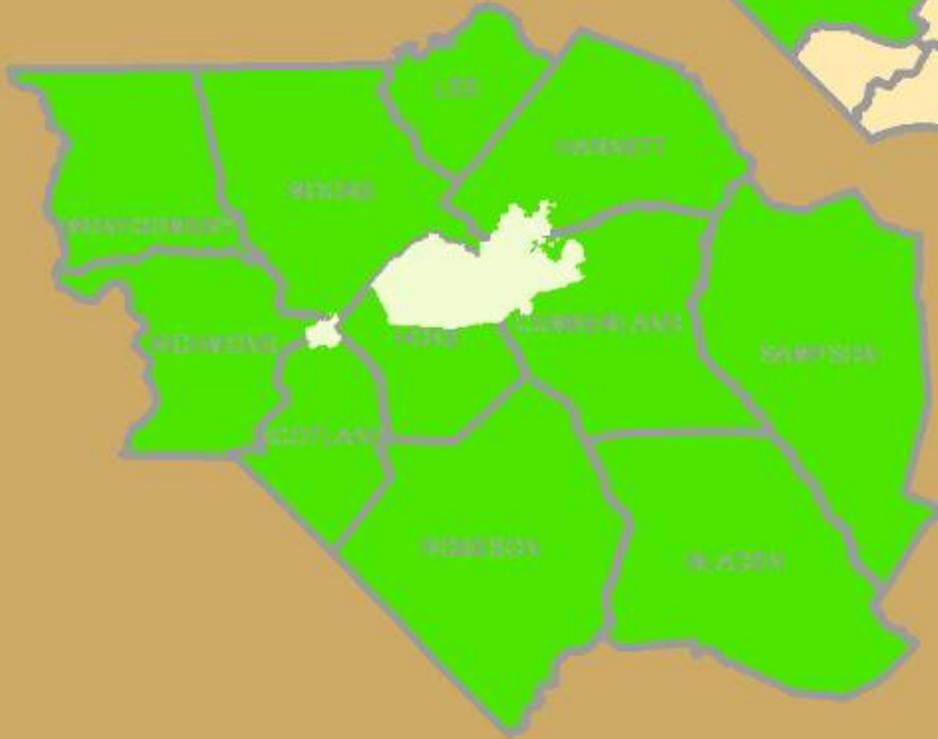
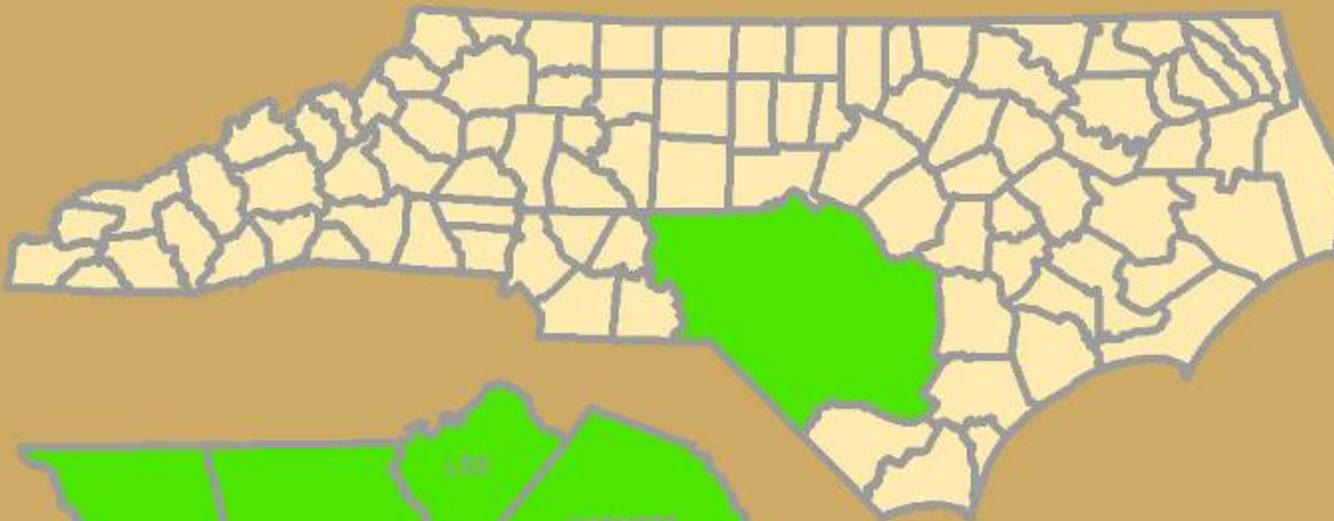
**REGISTRATION IS CLOSED FOR THE CONFERENCE**

You are welcome to attend as seats may be available, but will receive no conference packets.

[Click here for detailed information and registration to the Conference.](#)

- To view a preliminary agenda, go to [Agenda](#);
- click [Here](#) for a more Detailed Agenda.
- Click [Restaurants](#) for places to eat

## North Carolina counties in project



Bladen

Cumberland

Harnett

Hoke

Lee

Montgomery

Moore

Richmond

Robeson

Sampson

Scotland

## CORE TEAM

- Jon Parsons, Sustainable Sandhills
- Jeff Brown, CGIA
- Susan Pulsipher, DCA
- Pete Campbell, US F&WS

List of all participants on  
Sustainable Sandhills website

<http://www.sustainablesandhills.org/>

## Participants

- Land Use Team, Sustainable Sandhills (volunteers from many agencies)
- Concerned citizens
- Local jurisdiction officials and staff
- Experts on suitability factors for different landscapes

- Who are we?
- What is the problem?
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# FORT BRAGG/POPE AFB JOINT LAND USE STUDY

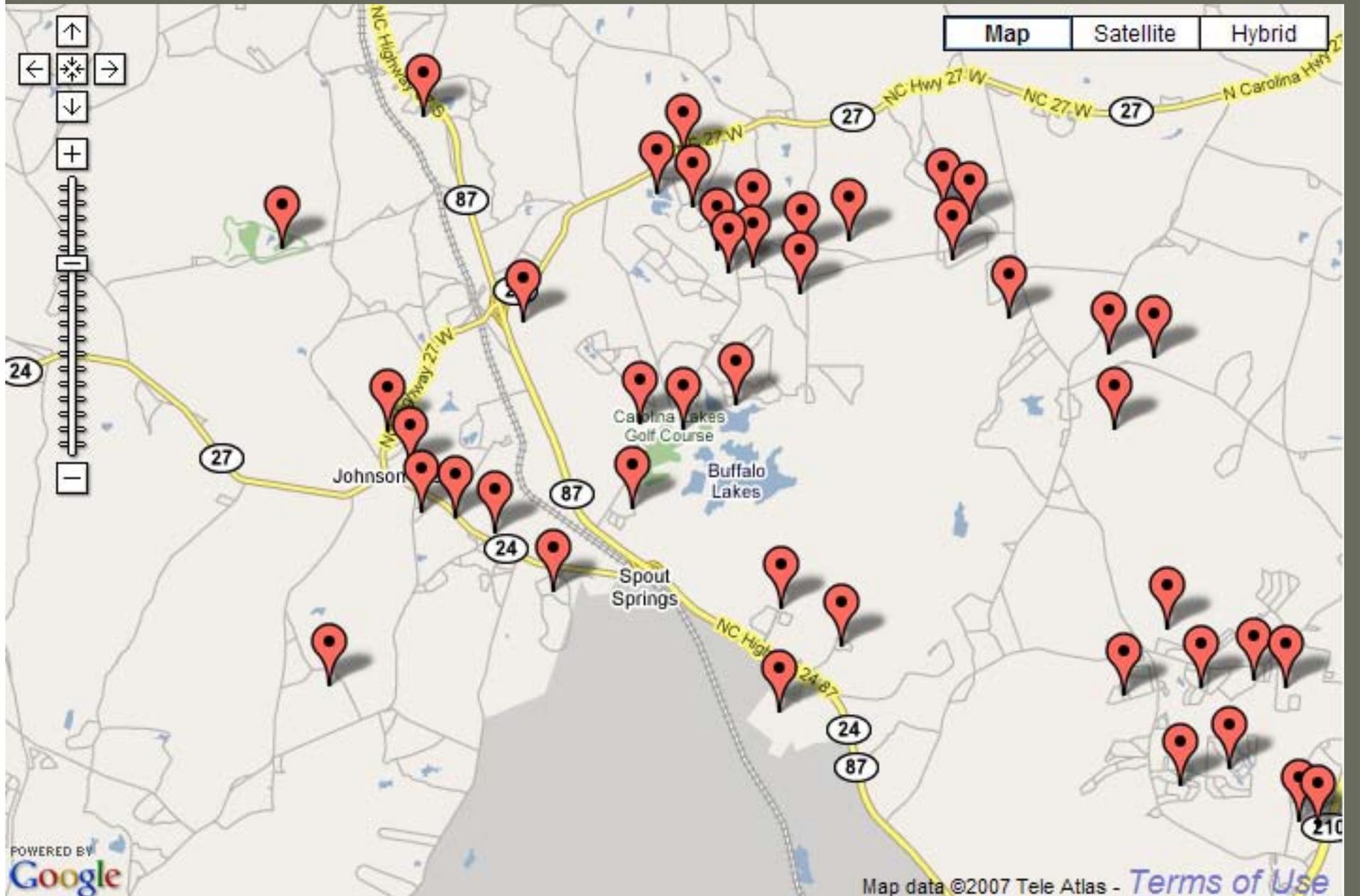


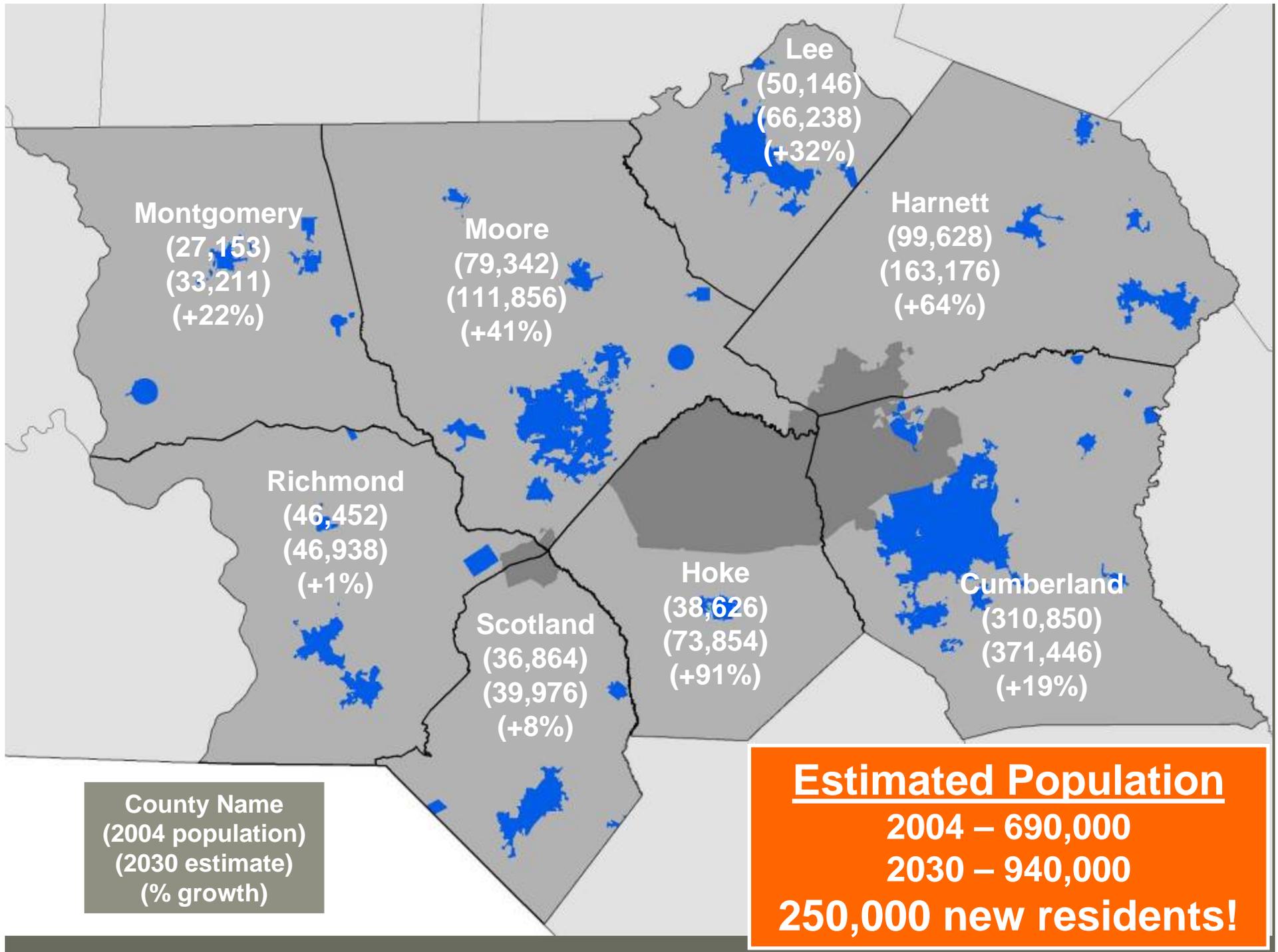
RLUAC lead  
agency on  
JLUS

No longer able  
to drop tanks  
from planes on  
this drop zone.

Houses are  
too close.

# Subdivision sprawl – just north of base





County Name  
 (2004 population)  
 (2030 estimate)  
 (% growth)

**Estimated Population**  
 2004 – 690,000  
 2030 – 940,000  
**250,000 new residents!**

# Base Realignment & Closure

## ➤ Relocation of Forces Command (FORSCOM) & U S Army Reserve Command (USARCOM) to Fort Bragg

- Military, DoD civilians, family members, defense contractors
- Older military personnel, already have degrees
- 25,000 plus people

## ➤ Additions to regular troops

BRAC-RTF lead agency on military realignment effects

# Sustainability in the Sandhills

- Sustaining Fort Bragg as a viable military installation
  - Also important to economic health of surrounding communities
- Sustaining the local ecosystem so that people continue to enjoy living here
- Managing population and economic growth to sustain (and improve) existing environment

- Who are we?
- What is the problem?
- **Solutions**
- Technical side
- Application examples
- Collaborations & spin-offs

## Industrial Development Uwharrie Lumber, Troy



# What Are Land Suitability Maps?

- Suitable = potential to have sustainable value for a type of use
- Based on criteria
- Relative values / low to high
- All locations rated

# What Are Land Suitability Maps?

- Not current land use
- Not predicting land use
- Suitability for different uses
- Competing values
  
- Best available data
- Simple and transparent models

# Sandhills Objectives

- Best available data
- Simple and transparent models
- Relative values now
- Alternative futures next
- Maps and statistics
- Tools for supporting decisions

# Criteria for Suitability

- Framework (previous projects)
- Workshops and score cards
  - What makes an area suitable?
  - How do we represent it on a map?
  - Relative importance?
- Focus groups
  - How near is near?
  - Ratings 1 to 9

# Suitability models



← Commercial  
Working Forest →



← Residential  
Farm land →



← Industrial  
Natural Values →



# Meeting needs

Created a set of tools that

- Graphically illustrate the competing potential uses of land from a variety of viewpoints
- give developers and planners a way to assess a lot of factors quickly before spending a lot of time and money on a piece of land or project
- Can be used in public hearings to inform the public of relationships and possibilities
- Provide elected officials, developers & planners with the same set of base data to work from when assessing how land is best utilized for the well-being of a community and region

# Project timeline

Refresh GIS Data, Rerun Models

Gather Feedback, Revise Models

Distribute Other Stakeholders

Review with other Stakeholders

Oct – Dec 2007 Deliver Grids to Planners, Training

Sept 2007 Regional Planners Meeting

Sept 2007 GIS Models Revised

Feb to June 2007 Expert Focus Groups

Jan 2007 Suitability Models Complete

May to Oct 2006 Stakeholder meetings

Sept 2005 Kickoff Meeting

Aug 2005 EPA Grant Awarded



- Who are we?
- What is the problem?
- Solutions
- **Technical side**
- Application examples
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## Industrial Development Uwharrie Lumber, Troy



# Some of the data layers used

	Industrial	Commercial	Residential	Natural Areas	Farm Lands	Working Forest
City limits	A	A	A	C	C	C
Parcel size	A	A	A			
Value land				C	C	C
Primary roads	A	A	A	C	C	C
Active rail	A					
Wetlands	C	C	C	A		
Public sewer	A	A	A	C	C	C
Woodland soils						A
School rating			A			
100 yr flood	C	C	C			

A = ASSET

C = CONSTRAINT

# Modeling process

- Data – obtained & merged
- Criteria buffers created from feature classes
- Converted to grid on 30-meter cell size
- Used ModelBuilder for as much of data preparation and manipulation as possible
- Map algebra

# Constructing a suitability map

- Industrial
- Commercial
- Residential
- Natural areas
- Working farmland
- Working forests

Commercial Development  
Downtown Rockingham



# Rule-Based Criteria

- Markets and infrastructure (satisfying all four is highest rating)
  - Near urban density and higher income
  - Near primary road
  - In or near public water service area
  - In or near public sewer service area

# Rule-Based Criteria

- Land constraints (any one of four lowers the rating)
  - Steep slope
  - In floodplain
  - Soils are wet (hydric)
  - In wetlands

# Rule-Based Criteria

- Out of bounds for development  
(not counted in map results)
  - Conservation lands
  - Water supply watershed critical and protected areas
  - In large water bodies
  - Inside military installations

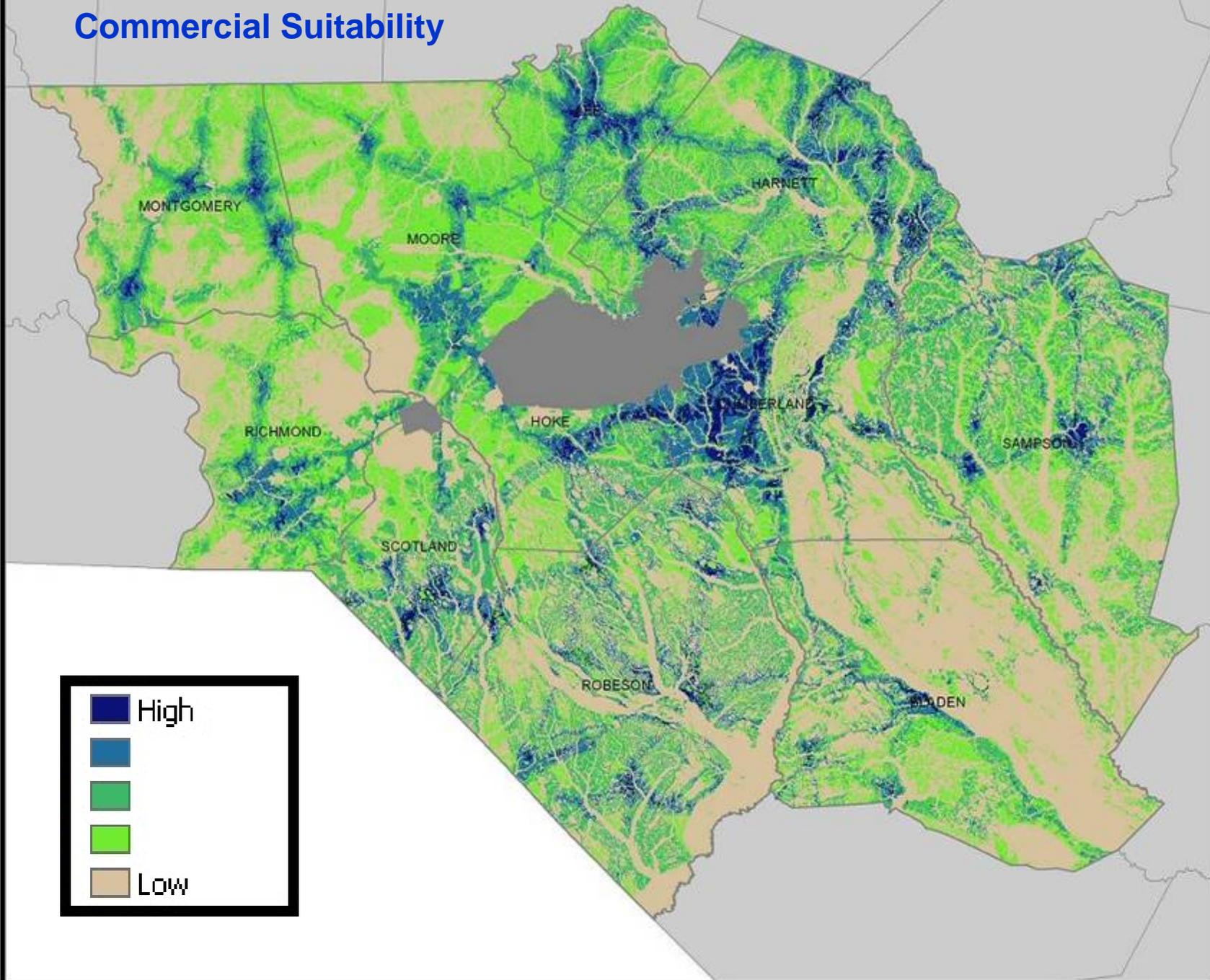
# Layer values or location related to ratings – Commercial

	A	C	D	E	F	G	H	I	J	K
1	<b>Commercial Development</b>	-----Criteria and Rating-----								
2		<b>Lowest Value</b>				<b>Neutral</b>				<b>Highest Value</b>
3	<b>Markets and infrastructure -- Group 1</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>
4	<b>Population density</b>	rural-lower-income	rural-mid-income	rural-upper-income		transition-lower-income	urban-lower-income	transition-mid-income	urban-mid-income and transition upper	urban-upper-income
5	<b>Primary roads</b>		<5000 ft			4000- 5000 ft	3000-4000 ft	2000-3000 ft	1000-2000 ft	< 1000 ft
6	<b>Public sewer service</b>			>4000 ft		3000-4000 ft		2000-3000 ft	1000-2000 ft	<1000 ft
7	<b>Public water service</b>			> 5000 ft		4000- 5000 ft	3000-4000 ft	2000-3000 ft	1000-2000 ft	<1000 ft
8	<b>Total Group 1</b>									
14		<b>Lowest Value</b>				<b>Neutral</b>				<b>Highest Value</b>
15	<b>Land factors -- Group 3</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>
16	<b>Slope (percent)</b>	>25%				15-25%		10-15%	4-10%	<4%
17	<b>Soils (hydric)</b>			hydric A				hydric B		not hydric
18	<b>Floodzone 100-year</b>	100-yr		future 100-yr				500-year		outside zone
19	<b>Wetlands</b>			inside						outside

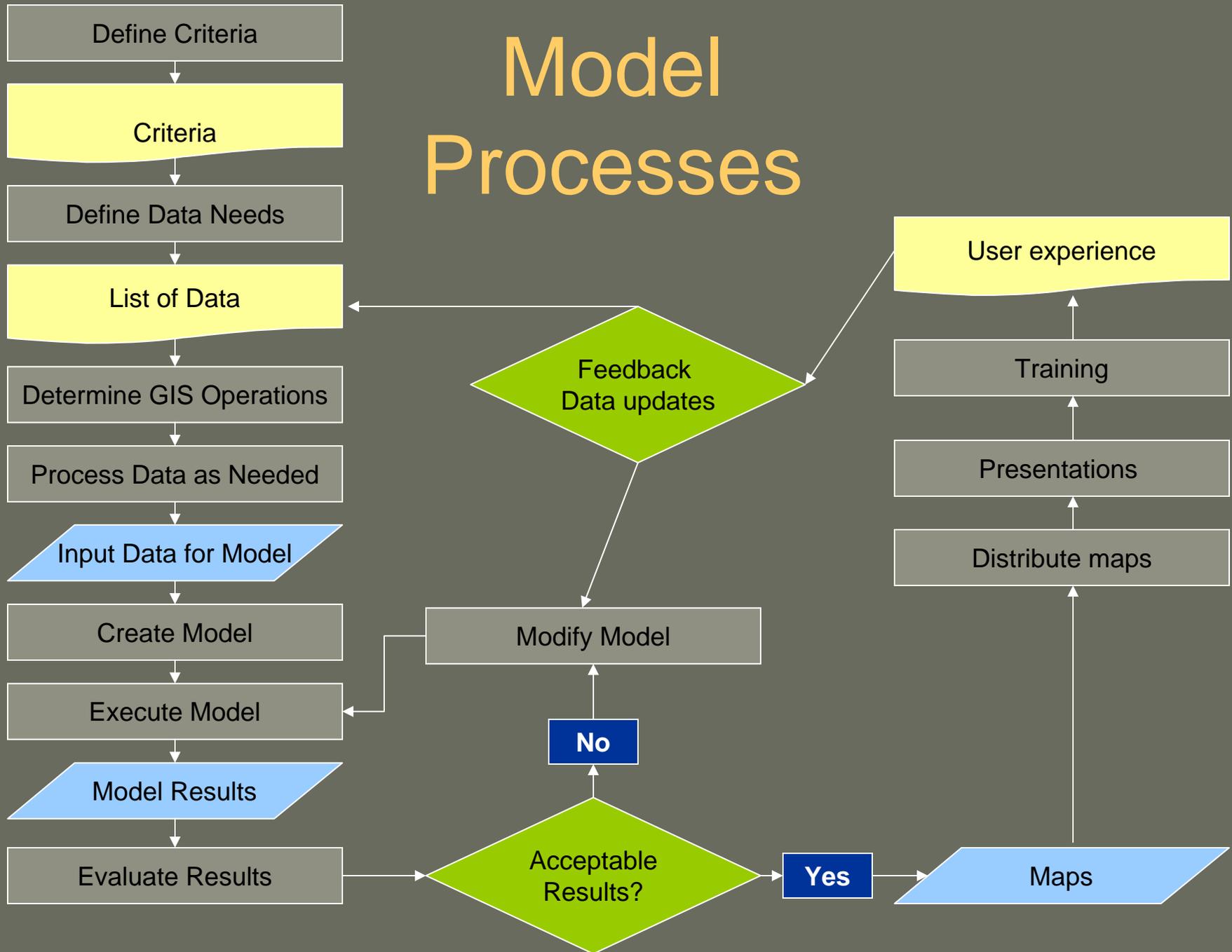
# Operations to combine the Commercial layers; assumptions noted

	A	C	D	E	F	G
1	<b>Commercial Development</b>		---Relative Weights---			
2			<b>Workshop Score</b>	<b>Assigned Weight</b>	<b>Percent Weight</b>	<b>Comments</b>
3	<b>Markets and infrastructure -- Group 1</b>	<b>Operation</b>	<b>1 to 5</b>	<b>1 to 5</b>		
4	<b>Population density</b>	Group 1 Overlay	4.1	5	27.8	Population density by block (3 classes) and median household income (3 quantiles) by block group (Census 2000) were grouped to represent market areas.
5	<b>Primary roads</b>	Group 1 Overlay	4.3	5	27.8	Assume cost advantages for projects closer to US and NC highways. Distances based in part on analysis of distance to nearest primary road using point locations of businesses in the Sandhills.
6	<b>Public sewer service</b>	Group 1 Overlay	4.5	4	22.2	Assume cost advantages for projects within or near public wastewater service areas
7	<b>Public water service</b>	Group 1 Overlay	4.5	4	22.2	Assume cost advantages for projects within or near public water service areas.
8	<b>Total Group 1</b>			18	100.0	
14			<b>Workshop Score</b>	<b>Assigned Weight</b>	<b>Percent Weight</b>	
15	<b>Land factors -- Group 3</b>		<b>1 to 5</b>	<b>1 to 5</b>		
16	<b>Slope (percent)</b>	Map Algebra A (minimum of group)	3.3			Assume cost advantages for gentle slopes and constraints on steep slopes
17	<b>Soils (hydric)</b>	Map Algebra A	3.7			Wet (hydric) soils are less suitable for development.
18	<b>Floodzone 100-year</b>	Map Algebra A	4.0			Floodzones are less suitable for development or would be a cost disadvantage
19	<b>Wetlands</b>	Map Algebra A	4.3			Wetlands are problematic for commercial development
20	<b>Lands managed for conservation &amp; open space</b>			0		Out of bounds for development
21	<b>Water supply watershed critical protection area</b>			0		Rules restrict development
22	<b>Lakes and ponds</b>			0		Water out of bounds for development
23	<b>Military bases</b>			0		Long-term public ownership and restricted use

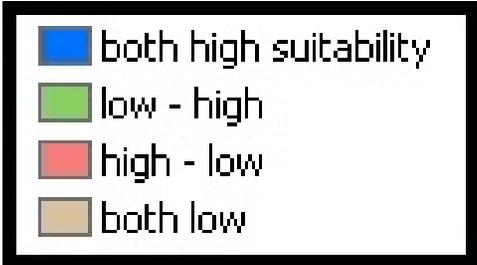
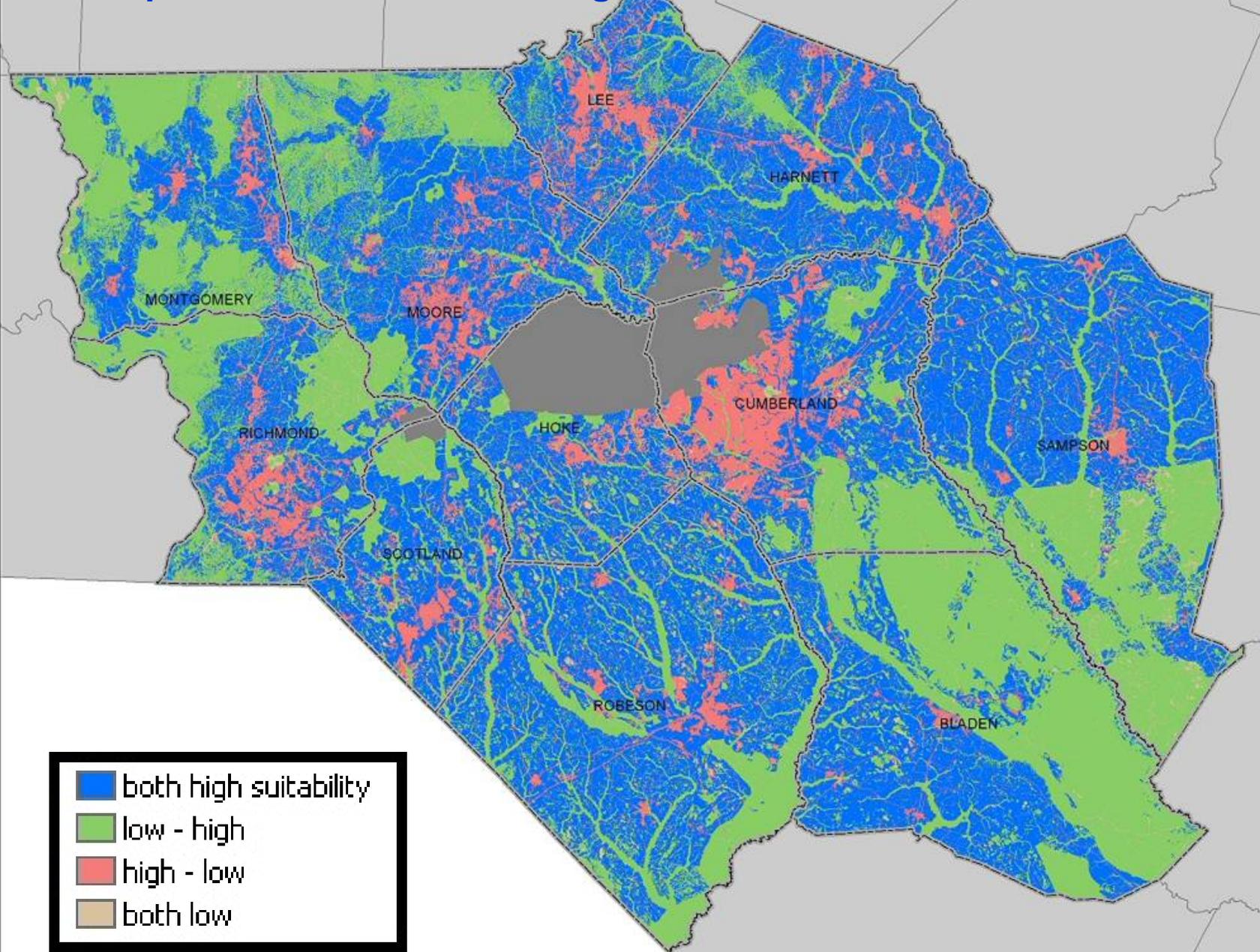
# Commercial Suitability



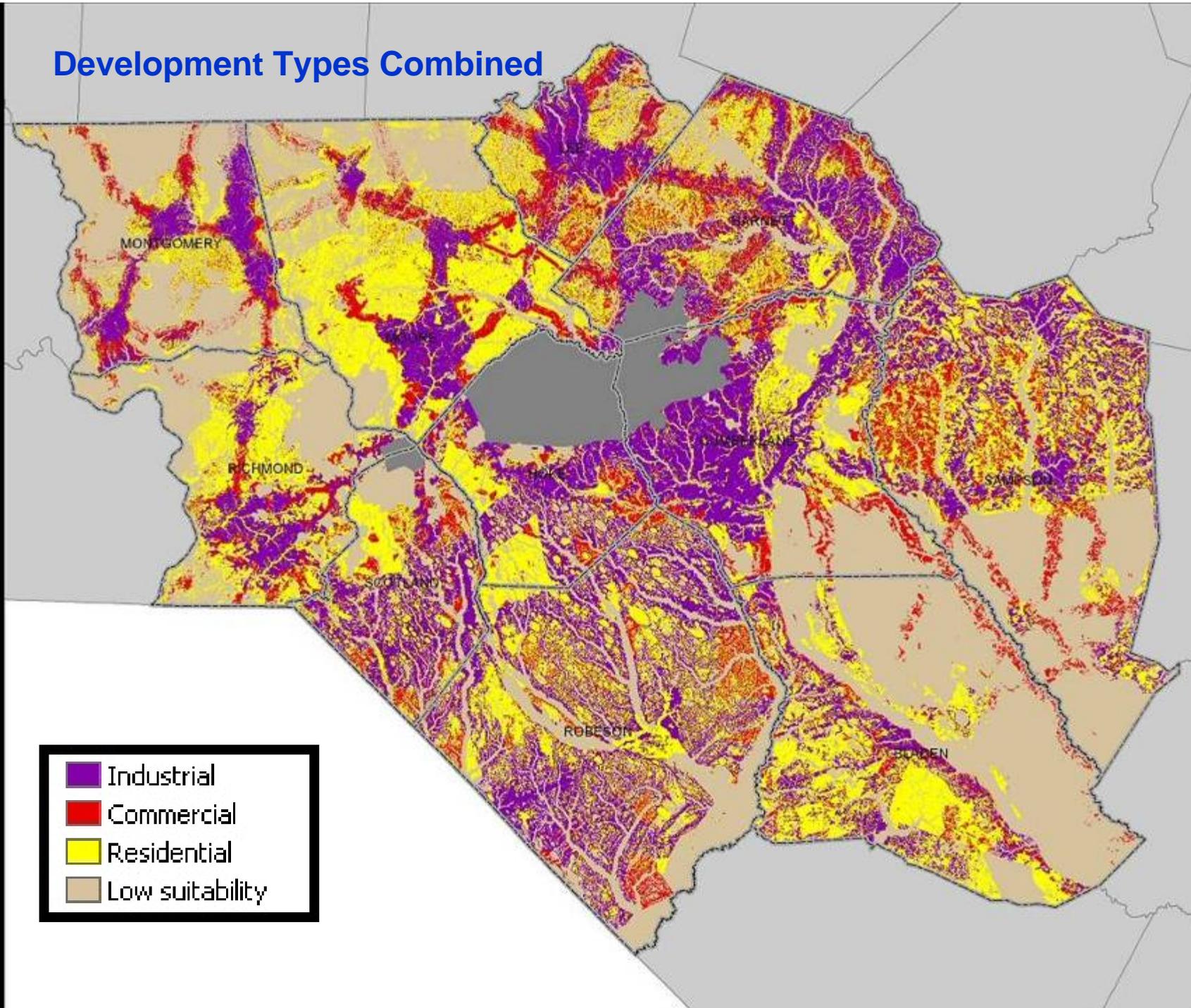
# Model Processes



# Development and Natural/Working Lands Combined



## Development Types Combined



# Feedback

- Modeling process designed to obtain feedback which was immediately used to modify models
- Model design steps, documentation, and presentation methods monitored and altered by members of Sustainable Sandhills Land Use Team
- Beta version distributed to two planners for detailed analysis against local knowledge. Feedback incorporated into models and documentation
- Workshop with regional planners designed to obtain feedback. Feedback incorporated into data utilized for creation of Release 1; into release schedule and approach with different stakeholder groups

# Surprising Results / Lessons

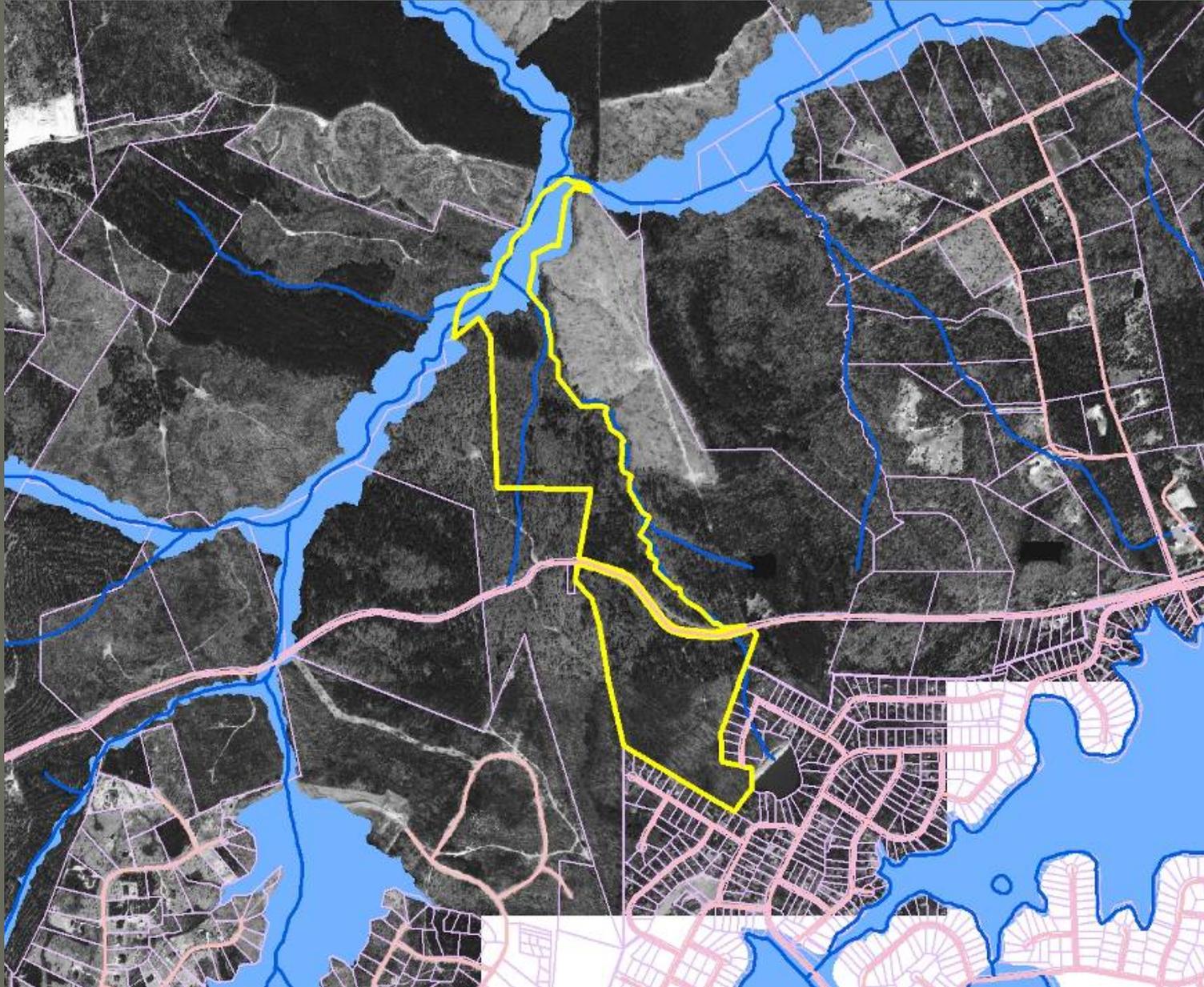
- Enthusiasm of representatives from different stakeholder groups
- Frustration of local data holders and regional transportation planners with GIS-based state level transportation data; people KNOW their local road systems
- Delight when first planner to use maps tried the maps on projects on her desk and the information was relevant and informative

- Who are we?
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Industrial Development  
Goodyear Plant – Fayetteville



# Example 1 – subdivision proposal

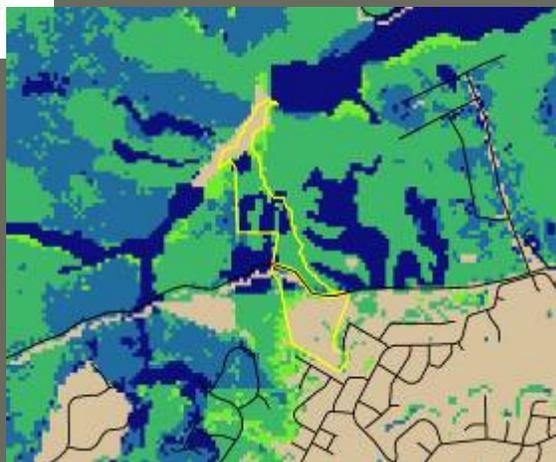


# Suitability of land at proposed subdivision site

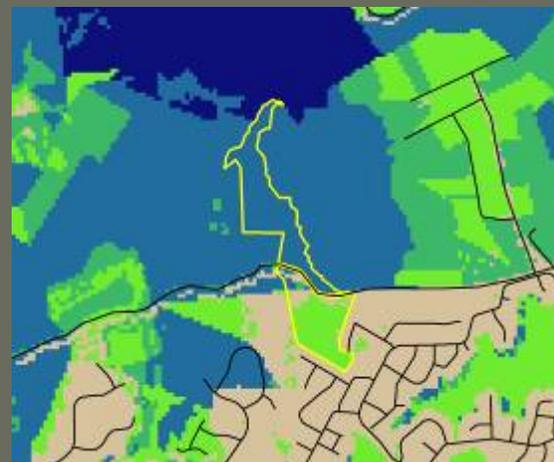
## Legend

- low suitability
- somewhat suitable
- suitable
- very suitable
- highest suitability

Farmland



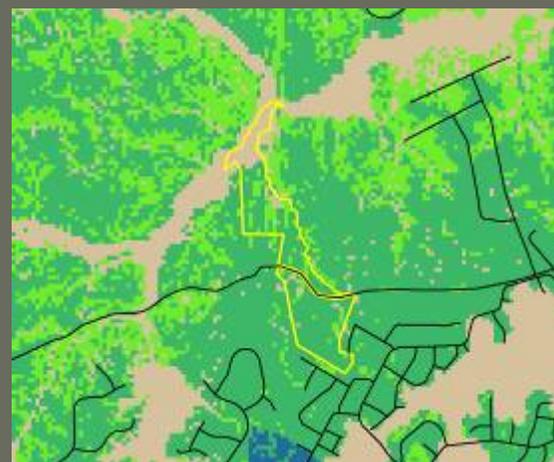
Working forest



Natural Values



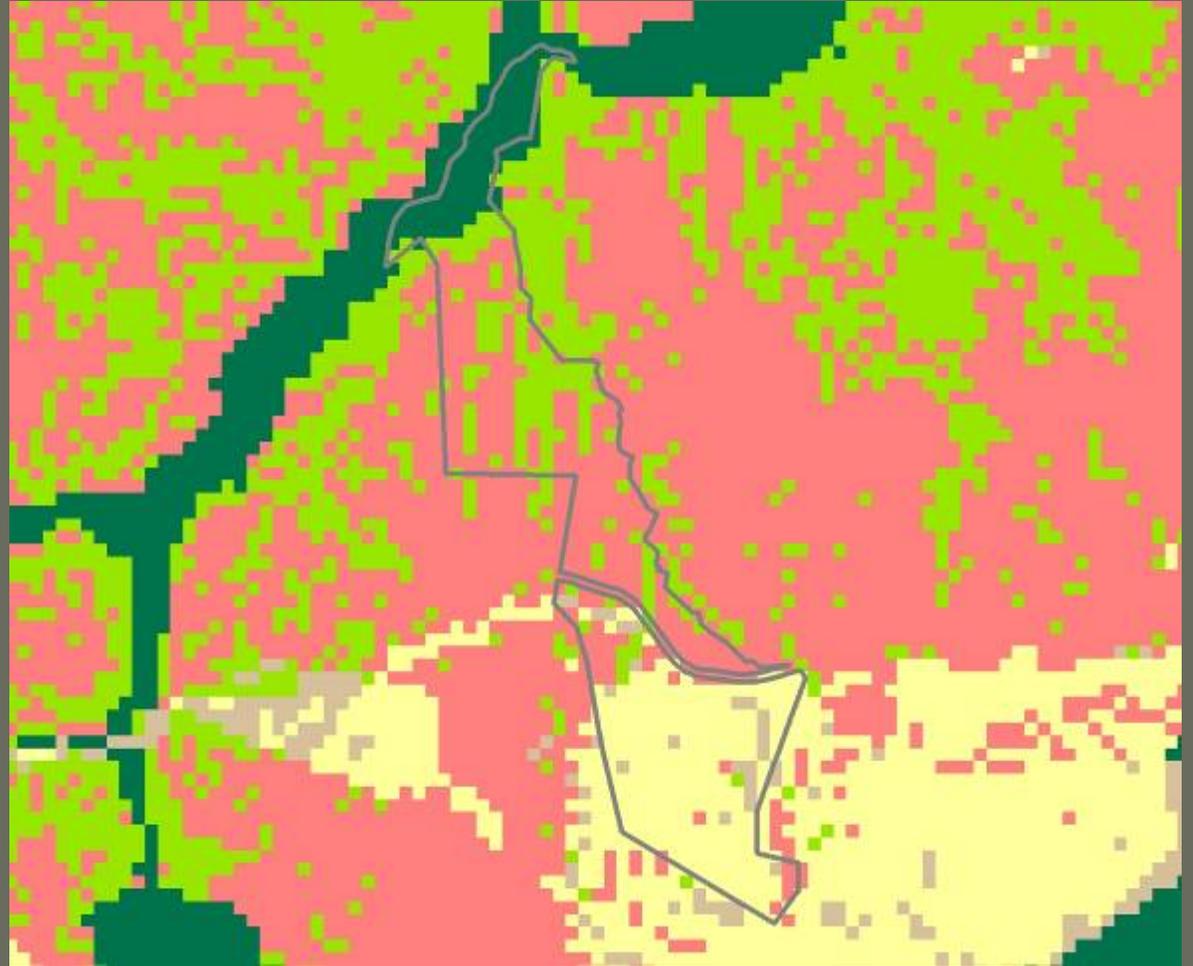
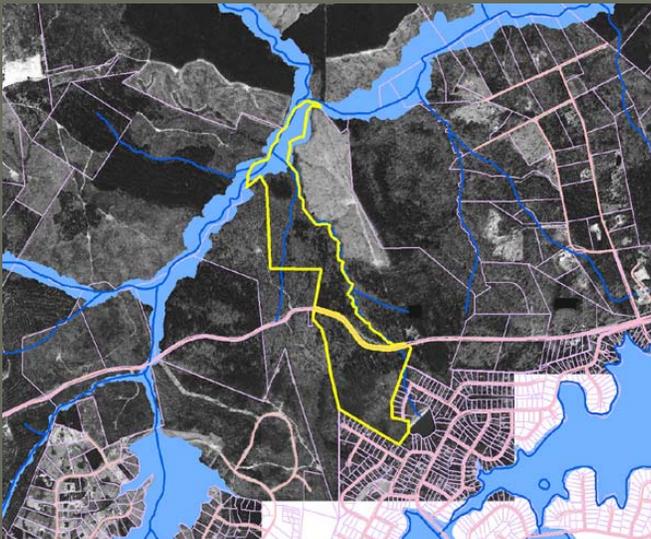
Residential



# Combination suitability map

## Legend

- Low suitability all
- Residential only
- Working lands only
- Natural not residential
- Working lands and Residential
- Natural and Residential high suitability

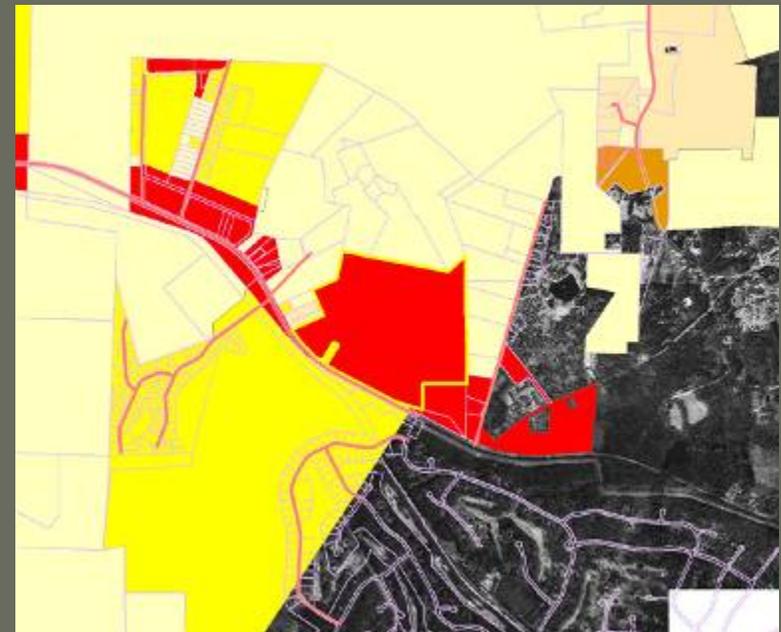


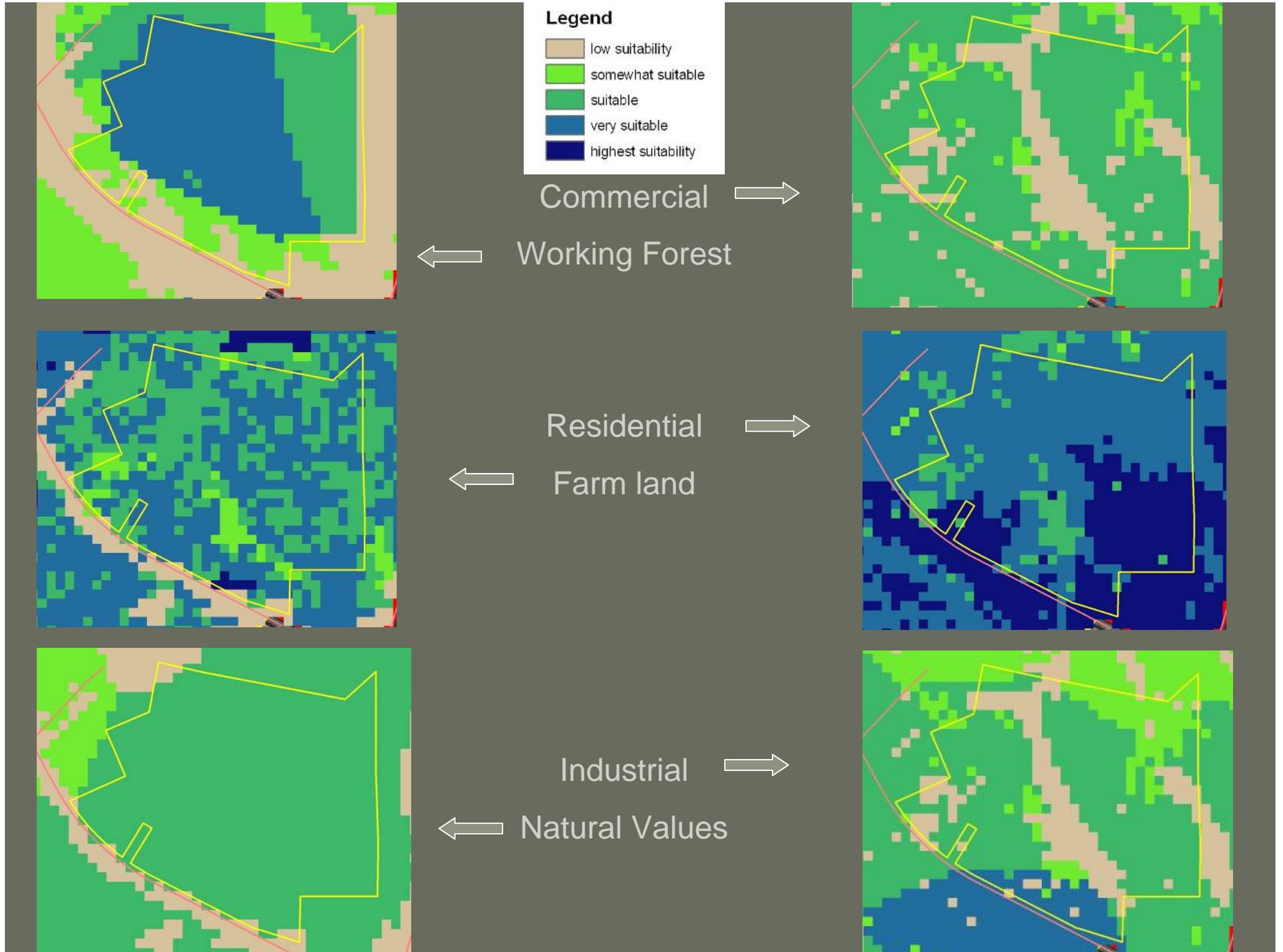
# Example 2: is existing zoning appropriate?



**Legend**  
**ZONING**

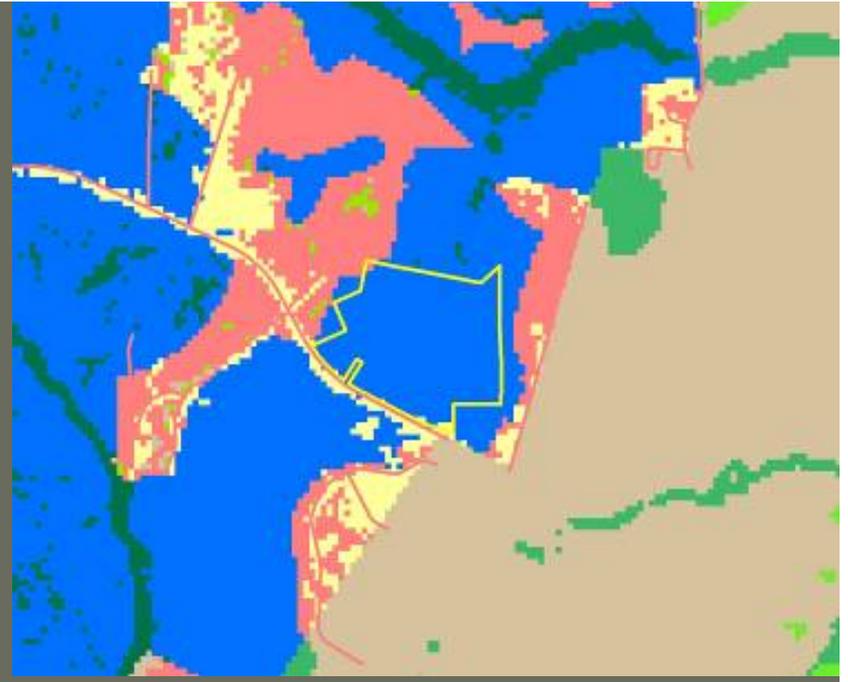
	B-2
	R-MH
	RA-2
	RA-20
	RA-5







Natural values – wider area



Combination map

Factors consider:  
long range  
planning / trails /  
open space



Constraint on  
commercial &  
industrial use?  
-- hydric soils

**Legend**

- Low suitability all
- Residential only
- Working lands only
- Natural not residential
- Working lands and Residential
- Natural and Residential high suitability

- Who are we?
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BRAC-RTF



NC DOT



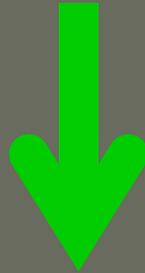
Local jurisdictions

SECCURE /  
SERRPAS



# SUSTAINABLE SANDHILLS EPA GRANT PROJECT

Lead organization on this  
regional land use planning project.



**RLUAC**

RESULTS WILL BE:  
used in 2008 JLUS  
update (5 mile study area)



**BRAC RTF**

RESULTS WILL BE:  
incorporated into  
Comprehensive Regional  
Growth Plan



# Additions to project

## ➤ From BRAC-RTF

- Added data for 3 new counties
- Predictive modeling
- New data layers for Release 2 (under review)

## ➤ From NC DOT

- cultural data
- Revise models for Release 2

# Collaboration

- Development of suitability models involved many individuals from different stakeholder groups
- Feedback on beta version obtained from planners at workshop in September; Release 1 run
- Now distributing grid maps to planning offices
- Preparing presentations for developers and related groups
- Providing information on project to elected officials by short presentations at their regional meetings
- Future
  - formal presentations to agricultural community & elected officials
  - feedback gathered for future Release 2

# Other collaboration & spin-offs

- Results being used in 2008 Joint Land Use Study update (by RLUAC) of five mile area around Fort Bragg
- Results will be incorporated into the Comprehensive Regional Growth Plan of the BRAC-RTF
- Both RLUAC and BRAC-RTF participating in suitability map development & assisting with meeting logistics
- SS project & models forming basis for military funded land use modeling project covering another 13 counties in SE NC (SECCURE, part of SERPPAS)
- Original plan was to include the location of cultural resources in model; data not available; grant just funded; new partner - NC Dept of Transportation
- Forming a Cultural Resources Team

# Future

- Use by planners, conservation groups, all types of developers, extension agents, & elected officials to inform decision-making
- Release 1 findings incorporated into 2007 JLUS and BRAC-RTF growth management plan
- Annual update of data and redistribution of maps (grid & PDF formats)
- Development of Release 2 with cultural data and predictive modeling added; feedback on data layers & weighting incorporated

# For More Information:

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