Proactive environmental protection: Modeling north Florida dairy farms and groundwater nitrogen

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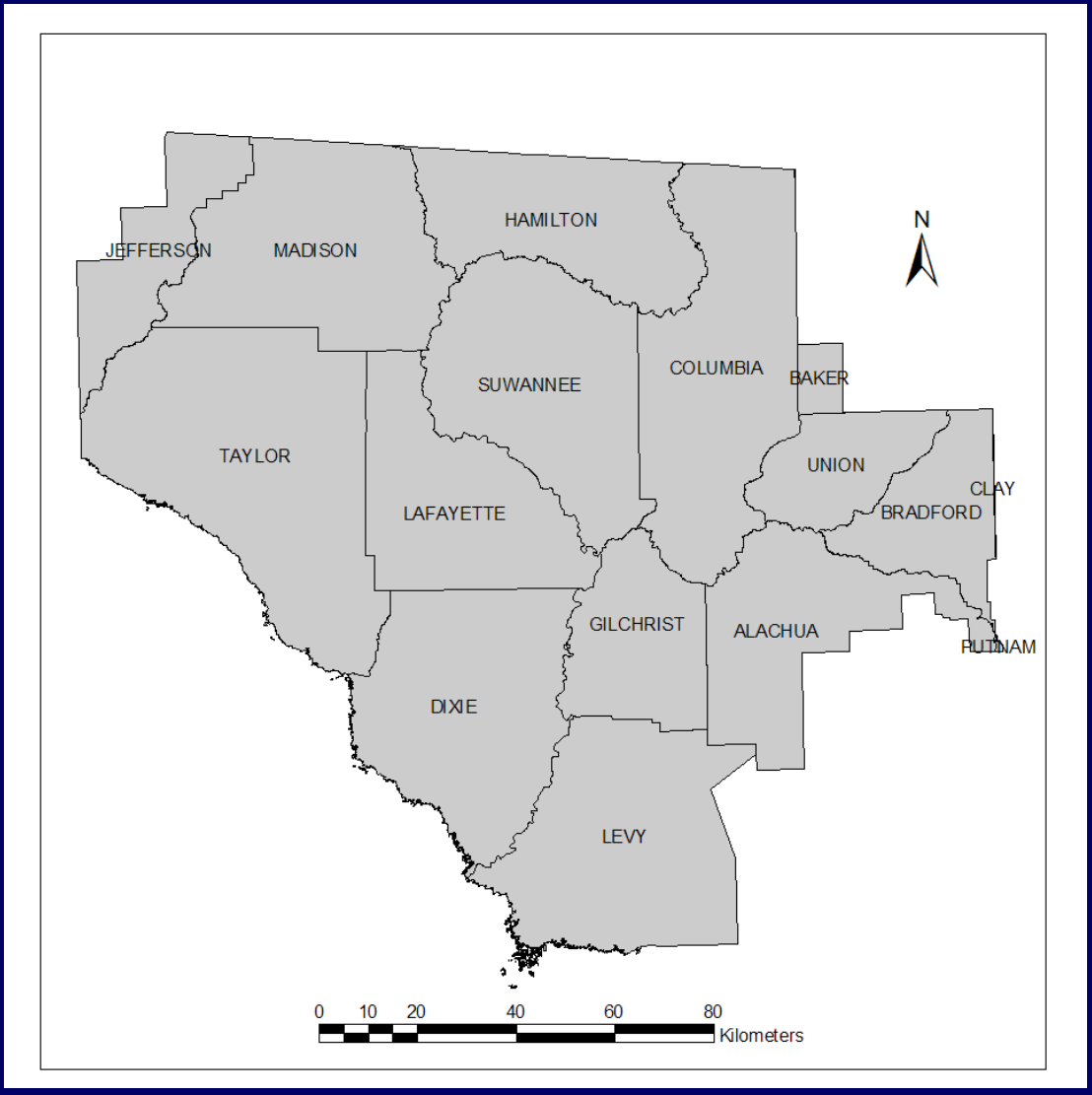
Introduction

- Evidence indicates environmental concerns in north Florida
- Problems due to population growth and water quality degradation
- Nitrogen in water affects human health and ecosystem welfare
- Dairy farms are believed to be the most important factor

Introduction

- Dairy farmers are facing increasing pressure to decrease environmental impacts
- Farmers need to comply with a set of regulations
- Farmers need to manage nutrient leaching while remaining economically viable
- North Florida dairy farmers need help

Study Area


HAMILTON
JEFFERSON
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SUWANNEE
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ALACHUA
PUTNAM
DIXIE
LEVY
0 10 20 40 60 80
Kilometers

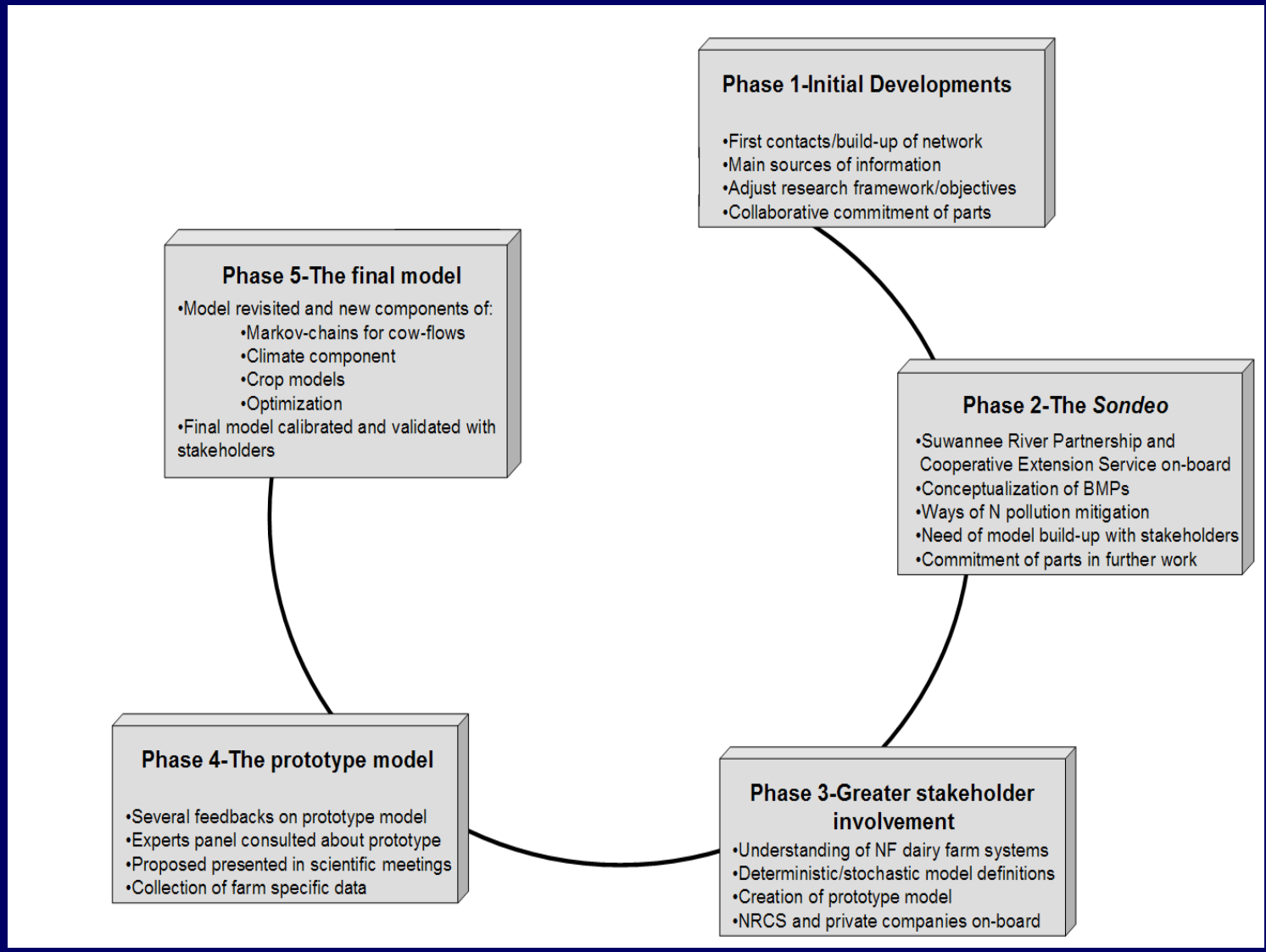
Participatory Modeling

- Give farmers and stakeholders a tool to evaluate and decrease environmental impacts
- Engage farmers in a proactive approach towards collaborative solutions
- Help dairy farmers identify their needs, barriers, and socially acceptable solutions

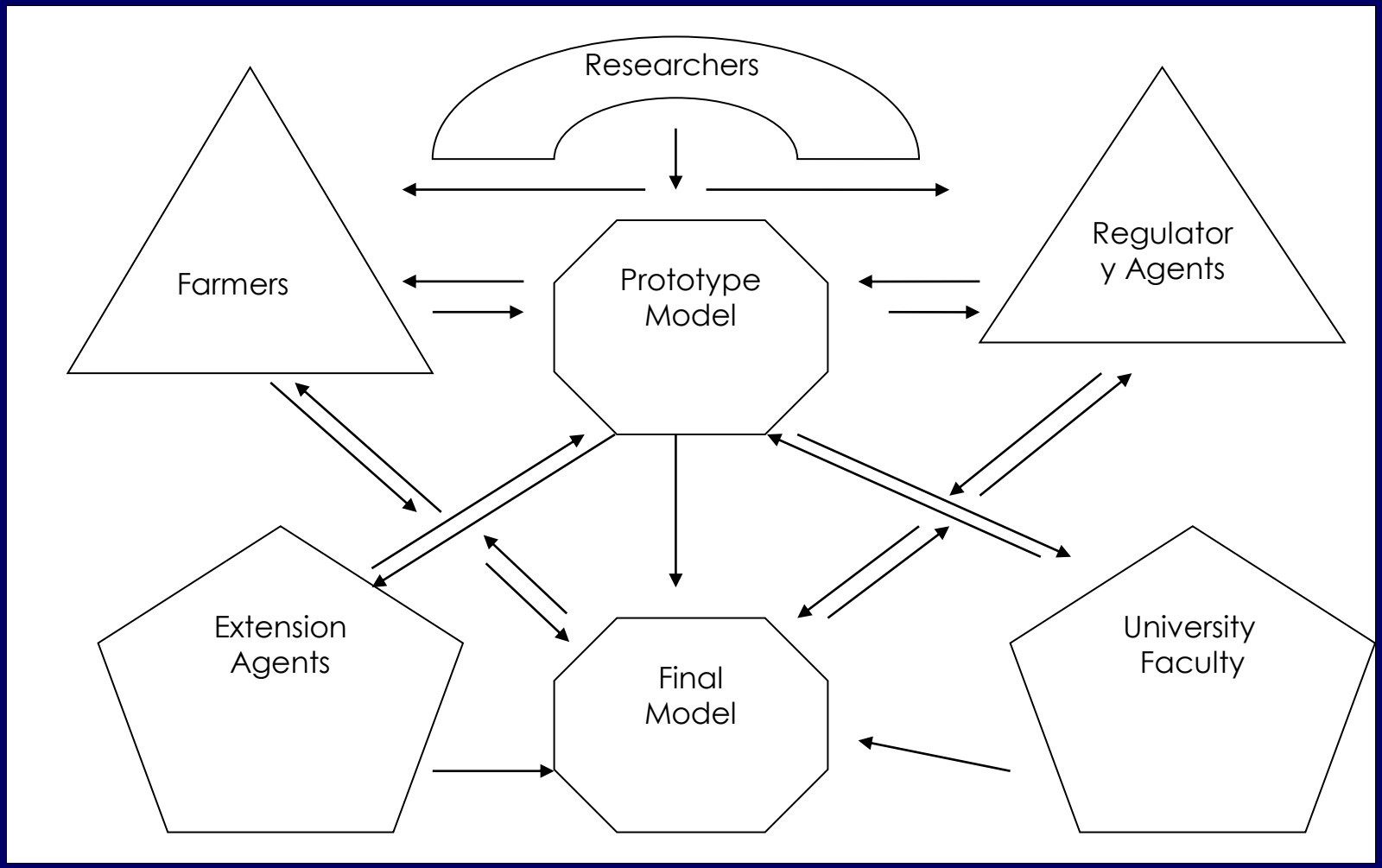
Participatory Modeling

- Recognize the influence and impact of people's heritage on their livelihood systems and strategies
- Develop a whole-dairy farm model that estimates the economic impacts of controlling nitrogen pollution in groundwater
- Present policy makers and regulatory agencies with real assessment of impacts

Participatory Modeling



Participatory Modeling



Participatory Modeling

Date	Interaction Format	Participants	Changes Suggested and Incorporated
July 2002	Interaction	4 UF Scientists	Use soil series data Use DSSAT
August 2002	Interview	1 farm manager	Climate important for crop yields
September 2002	Interview	3 soil scientists	Participate in sample collections
September-October 2002	Interviews	3 farmers	Involve other farmers
November 2002	1st Focus group	6 stakeholders	Use 20-farm sample One-hour limit to interviews
November 2003	Dairy farm visit	1 farmer	Main components of a dairy farm
Jan.-Feb. 2003	Sondeo	13 stakeholders	Take heterogeneity of farm sizes and types into account. Use model to test economic feasibility of BMPs
February 2003	Dairy farm visit	3 owners	Diversity stressed

Participatory Modeling

Date	Interaction Format	Participants	Changes Suggested and Incorporated
February 2003	2nd Focus group	8 stakeholders	Deterministic outputs requested
March 2003	Meeting with private consulting company	2 consultants	Importance of crop models, economic module and climate component
March 2003	3rd Focus group	3 people	WATNUT offered as data
March 2003	Private consulting company	2 consultants	Waste management and experimental data provided
May 2003	4th Focus group	6 stakeholders	Improve visuals. Slow down runs. Use color. Follow herd flow
July 2003	5th Focus group	7 stakeholders	Adjust replacement and freshening coefficients. Raise heifers off farm. Reduce prices. Use deterministic prices as well. Include more crop sequences

Participatory Modeling

Date	Interaction Format	Participants	Changes Suggested and Incorporated
August 2003	6th Focus group	5 stakeholders	Include more crop rotations
September 2003	7th Focus group	5 stakeholders	Include all sprayfields. Need a place to input N data
September 2003	Meeting	1 Climate specialist	Refined use of DSSAT with daily weather data
September 2003	Meeting	2 Dairy Specialists	Importance of user friendliness
October 2003-January 2004	Meetings	Farmers	Outputs in tables and graphs. All coefficients calibrated
February 2004	8th Focus Group	8 stakeholders	Keep model in Excel. Keep model user friendly. Use Markov chain flow model

Participatory Model Outcomes

- DyNoFlo applied in three local dairy farms: a small, a medium, and a large farm
- Input of detailed information (biophysical, socioeconomic, and environmental)
- Validation of model outcomes in their own operations
- Real-life application and interaction with the model

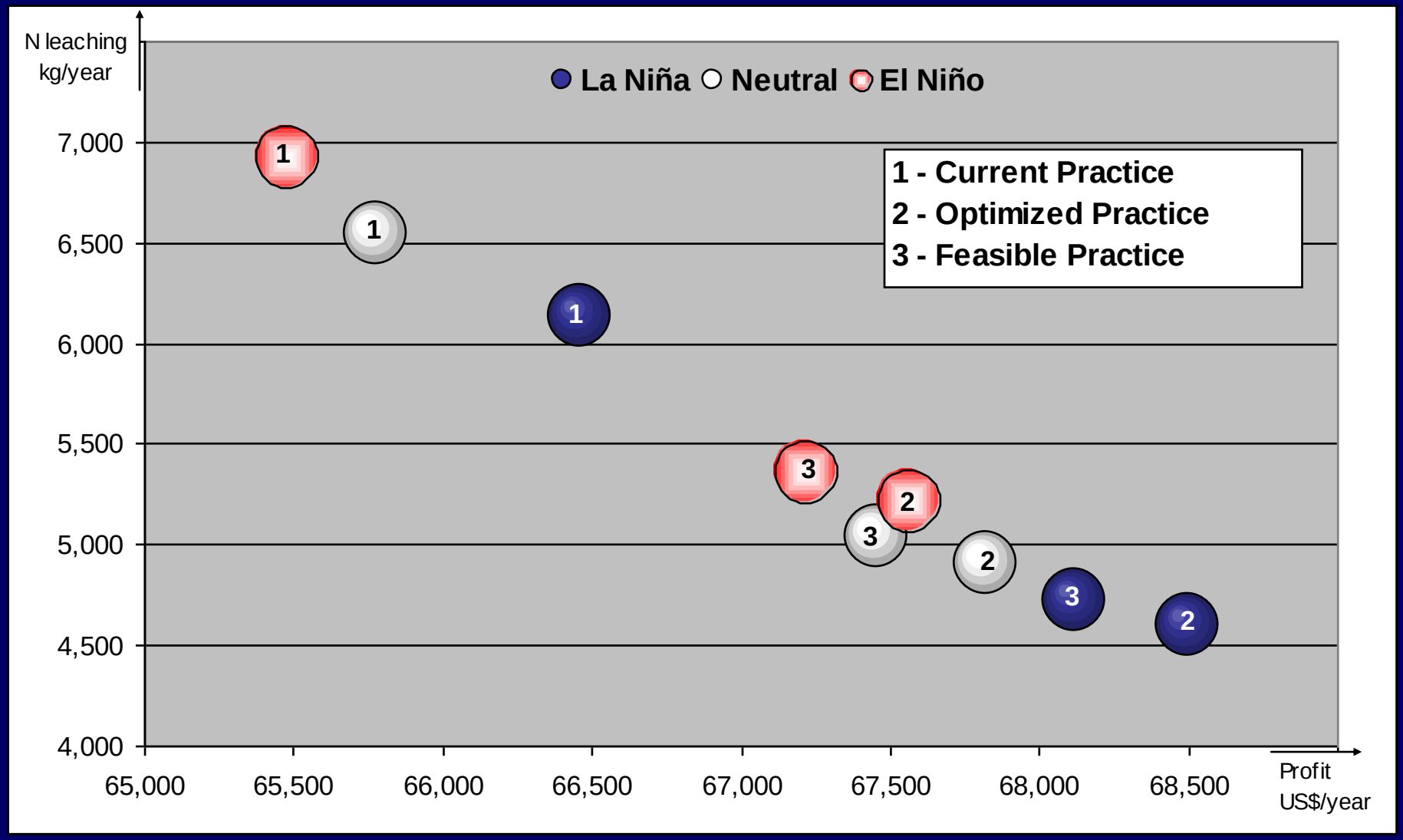
Participatory Model Outcomes

	DyNoFlo Applied to Dairy Farms		
Management Characteristics	**Small**	**Medium**	**Large**
TAC (head)	420	521	3000
TNB (head)	10	0	120
PHR (%)	0	100	100
RHA (kg head^{-1} year^{-1})	6804	10157	9072
POS (%)	100	100	100
ACP (unit)	"high"	"high"	"high"
PCT (%)	17	100	80
Total N lost (%)	31	35	40
N volatilization sprayfields (%)	30	30	30
N volatilization pastures (%)	40	40	40
Sprayfields (ha)	16.2	62.7	182.1
Pasture (ha)	80.9	121.4	323.7
Soil type	2	1	7
Overall profit (US$ Mg milk^{-1})	0.0	21.3	20.1

Participatory Model Outcomes

- Farmers mentioned that model was "about right" in the estimates they could compare
- Nitrogen leaching could be decreased 9, 20 and 25% in the small, medium and large operations without hurting profitability
- Management adjustments should be adjusted according to climate forecasts

Participatory Model Outcomes



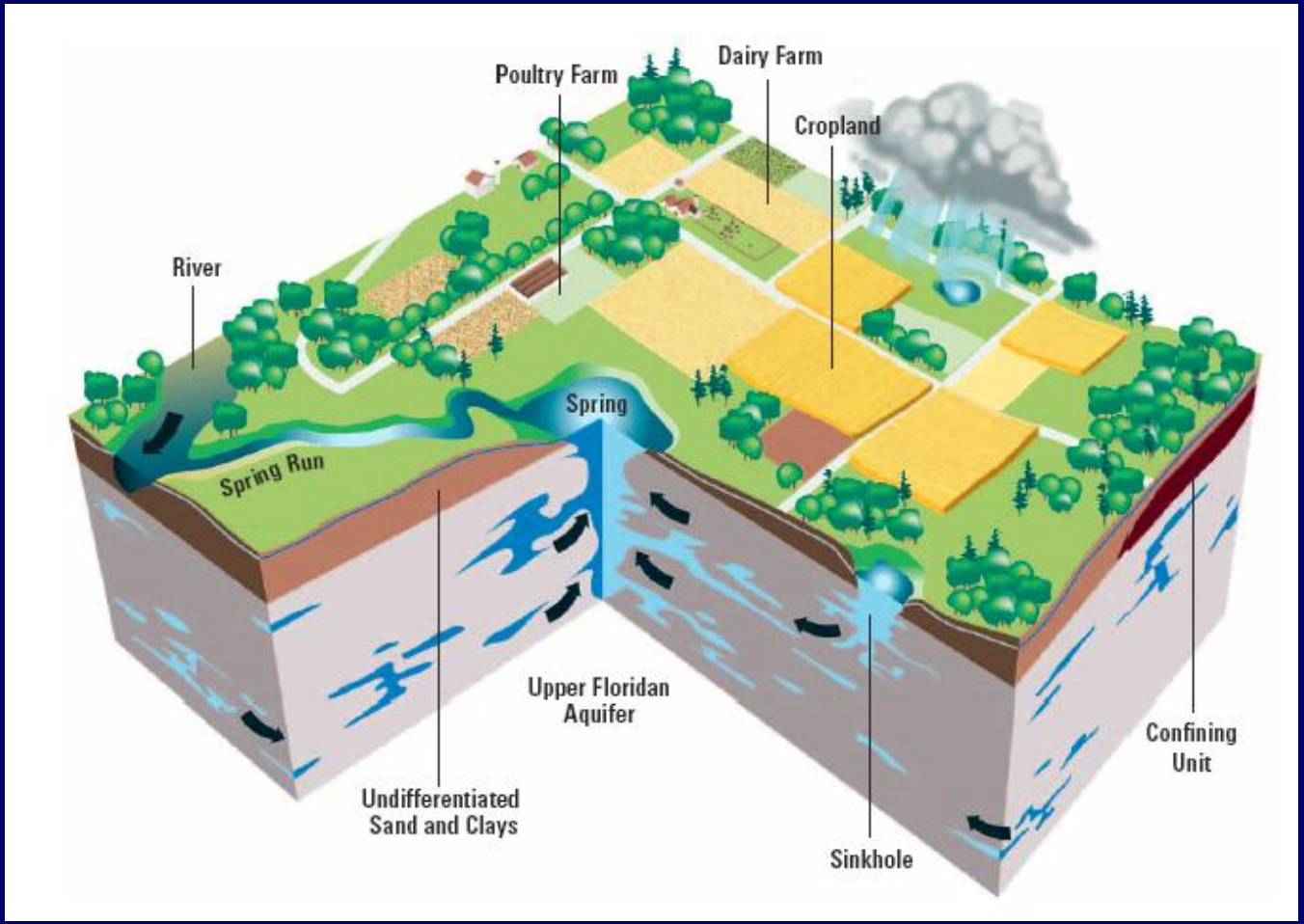
Conclusions

- The DyNoFlo is a participatory tool that helps farmers to reach economic and ecologic sustainability while they maintain their cultural heritage
- A feeling of ownership exists among the stakeholders because of their active involvement in the development of the final model

Conclusions

- The inclusion of the interests of stakeholders improved the overall quality of the final model
- Participatory modeling that recognizes the importance of influence and impact of people's heritage on their livelihood systems and strategies enhances the creation of adaptable and adoptable tools

Thanks


Poultry Farm
Dairy Farm
Cropland
River
Spring
Spring Run
Upper Floridan
Aquifer
Undifferentiated
Sand and Clays
Sinkhole
Confining
Unit