

Logic Model: SDC 354	
<b>Situation</b>	<ol style="list-style-type: none"> <li>1. World livestock production is expected to double by 2050 as a result of increased demand for animal products and population increases.</li> <li>2. Available land, water, and energy resources are declining, putting more pressure on the environment.</li> <li>3. Public interest in livestock and poultry production including food safety, healthy foods, animal welfare, pharmaceutical free meats, organically raised, free range fed livestock, and environmental protection are increasing.</li> <li>4. Potential benefit of existing research has not been fully translated into stakeholder tools.</li> <li>5. Farm management, operation, and demographics of the agriculture sector are changing.</li> <li>6. Complexity of problems, emergence of international corporate/NGO standards and certifications, decline in research budgets, and shift towards integrated research priorities, and a wider range of government and non-government funding sources have increased the importance of trans-disciplinary and non-traditional research teams.</li> </ol>
<b>Mission</b>	Research and educational products for stakeholders (extension, producers, public, and policy makers) to support livestock and poultry by triple-bottom-line (social, environmental, economic) sustainability to feed the world (increase food production and productivity).
<b>Objectives</b>	<ol style="list-style-type: none"> <li>1. (YEAR 1) Establish system framework (Dynamic System) that facilitates an understanding of the interactions between livestock production systems, people, resources, key environmental and ecological variables, economic indicators, and societal concerns and enables the establishment of priorities to sustainably meet the future demands for animal products.               <ol style="list-style-type: none"> <li>a. Identify gaps and opportunity for synergies                   <ol style="list-style-type: none"> <li>i. Meet industry needs</li> </ol> </li> <li>b. Provides background and justification for proposals</li> </ol> </li> <li>2. (Ongoing) Progress in developing, describing, and optimizing processes to reduce environmental stress and resource use imposed by livestock production and clarification of tradeoffs in economics and social sustainability.</li> <li>3. Develop stakeholder educational resources relating to livestock production systems.</li> </ol>

Outputs: Group Specific Activities	Participants	Outcomes - Goals	
		Short Term	Medium – Long Term
Establish/strengthen communication network among researchers and stakeholders to include annual meetings, quarterly virtual meetings, shared data, and subcommittees <ul style="list-style-type: none"> <li>• Annual National or International Conference (Perhaps specialty conference of ASABE or a specialty session at an international meeting)</li> <li>• Virtual quarterly meetings (management plan) – two</li> </ul>	SDC 354 membership, recruits, and collaborators	<ul style="list-style-type: none"> <li>• Initiate Dialog among all Stakeholders.</li> <li>• Enable a clear understanding of problem and a consolidated approach.</li> </ul>	<ul style="list-style-type: none"> <li>• Increasingly multidisciplinary, systems oriented approaches to sustainability of food animal production</li> <li>• Greater Influence of stakeholders – livestock and poultry producers, feed suppliers, ecologists, sociologists, etc. – in development of policy and research directions</li> </ul>

Outputs: Group Specific Activities	Participants	Outcomes - Goals	
		Short Term	Medium – Long Term
presentations or virtual tours per meeting			
A collaborative network, or cooperative framework	SDC 354 membership, recruits, and collaborators	<ul style="list-style-type: none"> <li>• Greater discipline and potentially demographic diversity in SDC 354 membership</li> </ul>	
Refine models, verify system-level tools for holistic evaluation. <ul style="list-style-type: none"> <li>• Define functional units to measure animal agriculture sustainability.</li> <li>• Refine and document existing conceptual framework for the animal agriculture sustainability model.</li> </ul>	<ul style="list-style-type: none"> <li>• SDC 354 membership</li> <li>• S1032 2012 Annual Meeting</li> </ul>	<ul style="list-style-type: none"> <li>• Increased clarity and ability to define functional relationships between causal loop diagram (CLD) nodes</li> </ul>	<ul style="list-style-type: none"> <li>• Improved understanding of processes, other related research, and more meaningful models of production and related systems.</li> </ul>
Synthesize existing knowledge and list gaps. <ul style="list-style-type: none"> <li>• Populate conceptual framework (end year 2)</li> <li>• Vertical, transverse, axial, temporal, other gaps.</li> <li>• EES relationships and gaps</li> </ul>	Working groups derived from SDC 354 membership and other experts	<ul style="list-style-type: none"> <li>• Provide more coherent approach to researching TBL opportunities</li> <li>• Identify potential research topics and team membership needed to be successful</li> </ul>	<ul style="list-style-type: none"> <li>• Substantial reductions in pollutant per unit of animal production.               <ul style="list-style-type: none"> <li>• Energy</li> <li>• Water</li> <li>• Greenhouse Gases</li> </ul> </li> <li>• Increase rural development and jobs.</li> </ul>
Establish teams and write cooperative proposals <ul style="list-style-type: none"> <li>• Write proposals within specific time frames to obtain funding for programming and synthesizing.</li> </ul>	SDC 354 members and collaborators	<ul style="list-style-type: none"> <li>• Identify meaningful and needed Collaborations in the context of well-articulated researchable problems</li> <li>• Provides impetus to move forward in concrete measurable ways</li> </ul>	<ul style="list-style-type: none"> <li>• Consistent progress toward development of holistic models that better define relationships between state variables.</li> <li>• Better understanding of how CLD nodes interact and can be adjusted to optimize production parameters within the context of TBL sustainability.</li> <li>• Provides metric for success of multi-disciplinary systems approach</li> </ul>
Papers and Progress Reports	SDC 354 and		

Outputs: Group Specific Activities	Participants	Outcomes - Goals	
		Short Term	Medium – Long Term
<ul style="list-style-type: none"> <li>Annual progress reports and developed for each experiment station involved in the multi-state research committee</li> <li>Papers are the normal outcome of research with well-defined and measurable objectives</li> </ul>	collaborators	<ul style="list-style-type: none"> <li>Annual reports provide venue for assessment of progress toward objectives</li> <li>Papers provide opportunity to measure the quality of progress</li> </ul>	<ul style="list-style-type: none"> <li>Strengthen the research collaboration network by creating visibility for the work, thus encouraging new partners</li> </ul>
Develop educational materials for extension educators.	<ul style="list-style-type: none"> <li>Leadership: SDC 354 membership with extension appointments</li> <li>SDC 354 membership</li> </ul>	<ul style="list-style-type: none"> <li>Improved understanding by membership of materials needed for clear and effective communication and education</li> </ul>	<ul style="list-style-type: none"> <li>Better informed educators, producers, and general public</li> </ul>
Develop educational materials for stakeholders (industry, regulators, researchers, public).	<ul style="list-style-type: none"> <li>Leadership: SDC 354 membership with extension appointments</li> <li>SDC 354 membership</li> </ul>	<ul style="list-style-type: none"> <li>Improved engagement by stakeholders</li> </ul>	<ul style="list-style-type: none"> <li>Better informed stakeholders <ul style="list-style-type: none"> <li>Understand TBL sustainability</li> <li>Understand influence of nodal interactions upon response and response time</li> </ul> </li> </ul>
Evaluation <ul style="list-style-type: none"> <li>Quarterly gap analysis</li> <li>Review of progress for SDC 354 annual meeting</li> </ul>	<ul style="list-style-type: none"> <li>SDC 354 members through annual station reports</li> <li>SDC 354 leadership team</li> </ul>	<ul style="list-style-type: none"> <li>Identify progress made and gaps revealed</li> </ul>	<ul style="list-style-type: none"> <li>Holistic approach to TBL sustainability in animal protein production and related fields (feed supplies, waste management, environmental quality, etc.)</li> </ul>

Assumptions	External Factors
The larger issue of triple bottom line sustainability of livestock and poultry must be approached incrementally through the development of an overall framework followed by a modular programming approach in which subsets are modeled then integrated into the larger framework	Demands upon the time of the various multi-state research committee members will influence their ability to contribute as must a desired toward the completion of program objectives
The actual relationships between many variables is poorly understood and significant effort must be expended to articulate those	The ability to secure funding to better identify the relationships between the various variables may limit progress toward objectives
	The ability to attract meaningful collaborations with researchers in other disciplines may limit holistic understanding of the interactions. <ul style="list-style-type: none"> <li>Current membership is largely concentrated in animal science (poultry and</li> </ul>

	<p>livestock), engineering, and economics.</p> <ul style="list-style-type: none"> <li>• Disciplines perceived to expand understanding of the interactions include ecology, sociology, more experienced and qualified systems dynamicists, agronomists, soil scientists, technocrats who influence policy makers, among possibly many others.</li> </ul>
<b>Evaluation</b>	
Leadership (includes elected officers and other most active participants) evaluation of progress prior to multi-state research committee annual meeting	Progress toward identifying solvable problems
	<ul style="list-style-type: none"> <li>• Collaborative, multi-disciplinary research proposals submitted</li> <li>• Research proposals funded through competitive process</li> <li>• Research proposals funded through non-competitive process</li> </ul>
	<ul style="list-style-type: none"> <li>• Progress on model development               <ul style="list-style-type: none"> <li>○ Number of subsystems successfully modeled</li> <li>○ Integration of sub-models (modules) into larger framework</li> </ul> </li> <li>• Number of new collaborators</li> <li>• Number of new institutions</li> <li>• Number of new disciplines</li> </ul>

Figure 2. The logic model for the proposed Multi-State Research Committee *SDC 354: Animal Production Systems: Synthesis of Methods to Determine Triple Bottom Line Sustainability from Findings of Reductionist Research* provided context for much of the narrative of the proposal and demonstrates the benefit of such an activity while recognizing the complexities involved.