

WORKING DRAFT

NISA Sustainability Outcomes, Example Indicators and Metrics, and Documentation Parameters

Productivity and Profitability	Desired Sustainability Outcome	Example Indicators	Example Metrics
	Preservation of farm productivity	Yield crops, livestock or dairy products per unit production	Unit measure of output per unit or value of input or production. ¹
	Sustained farm profitability and farmer livelihoods	Banking ratios; financial health and stability	Operating profit margins; return on equity; debt to asset ratio. ²
	Economic resilience of farming operations	Income variance, risk management measures (e.g., diversification of crops and livestock, crop insurance, diversification, hedging, etc.)	Incorporation of strategies for diversification and effective risk management strategies, such as crop insurance and other risk mitigation tools. ³
	Long-term financial and managerial planning	Farm financial and management plan, farm succession plan, beginning farmer development, risk management measures (e.g., liability, farm, and keyman life/health insurance)	Use of effective farm O&M and financial planning; long-term financial and succession planning; evidence of use of risk mitigation tools, ⁴

Social	Desired Sustainability Outcome	Example Indicators	Example Metrics
	Safe and fair working conditions for farm employees	Human resources planning; Established terms of hire and wage base; Employee safety training for the equipment and inputs they will use; Established	Use of human resources planning and documentation of outcomes to ensure compliance with labor laws, communicate conditions of employment to employees, aid dispute resolution, allow worker feedback, and promote worker safety (e.g., safety training of workers and proper use of equipment). Access to clean water, first aid and safety equipment. Scheduled

¹ **Example measurements to document sustainability efforts:** Benchmarking and records of subsequent seasons' productivity, yields of crops, livestock or dairy, on a per unit of land, animal or other standardized measures of key indicators, inputs versus outputs, or sales.

² **Example measurements to document sustainability efforts:** Benchmarking and records of subsequent seasons' profitability and financial health using standardized ratios reported from current and historical financial statements; evaluation of profit trend and variability through standardized ratios reported from historical financial statements.

³ **Example measurements to document sustainability efforts:** Benchmarking and subsequent seasons' efforts to utilize risk management planning tools and advisors; . Diversification of farming operations (e.g., to include food and nonfood crops, livestock, etc.). Successful use of risk mitigation tools.

⁴ **Example measurements to document sustainability efforts:** Documentation of well-defined management structure, effective use of financial planning and accounting tools, use of consistent/standardized report processes, succession or managerial plan ensuring long-term operating sustainability.

		emergency plan, and safety equipment inspection schedule; Farm equipment preventative maintenance plan.	inspection and maintenance of farm equipment to avoid risks of injury or exposure to hazardous materials. ⁵
	Training of farm workers	Established worker training programs for job function and safety;	Training of workers on safety procedures for use of pesticide and nutrient inputs and equipment (in Spanish where applicable); Access to community <i>English as a Second Language</i> training programs. ⁶
	Local community and watershed engagement	Demonstrated interest in sustainability beyond the farm gate	Participation in watershed protection programs, farm groups, and national wildlife or sustainability initiatives. Civic engagement and leadership. ⁷
	Safe and consistent agricultural product supply	Food pathogen outbreaks, food quality and nutrition	Use of farming methods that comply with food safety requirements and limit potential for food-borne illness. Scheduled inspection and maintenance of methods and equipment to avoid food pathogens. Use of methods of product harvest and storage to maintain consistent quality. ⁸

Land use	Desired Sustainability Outcome	Example Indicators	Example Metrics
	Preservation of topsoil and limitation of soil erosion due to water and wind	Soil erosion, relative to T; depth of topsoil in standardized locations on the farm; percentage of farm that is “highly erodible;” ability of conservation methods and structures to manage stormwater runoff and soil loss	Evaluation of on-farm needs for long-term protection of soils. Determination of levels of soil loss and topsoil levels in standardized locations across the farm. Adopted NRCS, state and local soil conservation initiatives and implemented soil conservation practices. Efforts to manage farming operations, vegetative cover and drainage structures and conveyances to divert stormwater, protect soils from water and wind erosion, and limit soil loss. ⁹
	Preservation of soil structure and tilth, productivity and	Tilth; water infiltration and drainage; physical disturbance; Levels of soil organic matter and nutrients; Beneficial soil organisms	Effective management of soil nutrition, tillage and crop residues to incorporate biomass in soils to increase organic matter, tilth and water infiltration; Scheduling of field work to avoid soil compaction; Use of nutrient best management practices that address the “4Rs” (using the right source of nutrients at the right rate, the right time, and in the right place) in conjunction

⁵ **Example measurements to document sustainability efforts:** Benchmarking and records of subsequent seasons’ efforts to maintain safe and fair working conditions for farm employees; Documentation of safety training for workers that addresses potential risks and best management practices of their tasks and equipment or farming inputs they use; Record of any reportable farm-related accidents, injuries, or OSHA violations; Written emergency plan; Record of workers’ average wage scale relative to region and position; Employee retention rate; Records of inspection and maintenance of personal safety equipment and farm equipment.

⁶ **Example measurements to document sustainability efforts:** Benchmarking and records of subsequent seasons’ efforts to provide worker training; Records of average hours of training per year per employee per employee category.

⁷ **Example measurements to document sustainability efforts:** Benchmarking and records of subsequent seasons’ efforts to support sustainability efforts beyond the farm gate. Demonstrated participation in watershed or regional sustainability initiatives. Support for local businesses by purchasing locally when possible.

⁸ **Example measurements to document sustainability efforts:** Benchmarking and records of subsequent seasons’ efforts to apply good agricultural practices (GAPs) to manage growth, harvest, handling and packing of produce to meet food safety requirements and avoid microbial contamination; Manage dairy and livestock to meet requirements and avoid microbial contamination; Records of inspection, cleaning and maintenance of equipment.

⁹ **Example measurements to document sustainability efforts:** Initial benchmarking and records of subsequent seasons’ evaluation of the outcome of efforts to protect soils and reduce their vulnerability to erosion, and to protect or increase average topsoil depth; Records kept of NRCS programmatic participation; Records kept of crop rotations, biomass incorporated into the soil, and erosion-control tools and structures used (e.g., conservation tillage, no-till); and establishment of erosion-limiting structures (e.g., shelter belts, windbreaks, contour farming, filter strips, grassed waterways); Selection of standardized locations and annually documenting topsoil levels at these sites; Document effectiveness of stormwater conveyances by visually evaluating siltation in stormwater collected from outfalls during storms. Consider use of Field to Market’s *Fieldprint Calculator* to provide opportunities to benchmark an operator’s soil loss and other sustainability outcomes and compare them to the industry index.

	biological richness		with a site-specific plan that accounts for variations in soil characteristics, weather and cropping history. ¹⁰
	Preservation of ecosystem services provided by wildlife habitat	Habitat for wildlife, pollinators, and other beneficial species in air, water and soil; ecosystem services	Inclusion of wildlife and beneficial species habitat preservation in long-term farm planning and land management decisions. Engagement in local efforts or other programs to enhance wildlife protections and ecosystem services ¹¹
	Preservation of farm bio-security;	Invasive weed species, disease and insect pests	Systematic efforts to exclude and remove noxious weeds and other invasive pests; Ongoing efforts to locate, map, and control pests; Targeted efforts annually to reduce localized pest populations; Systematic efforts to minimize risk of pest resistance to pesticides. ¹²
	Preservation of farmland and related ecosystem services	Environmental easements; wildlife habitat; ecosystem services	Efforts to conserve farmland, woodlots, wildlife habitat and wetlands ¹³

Air & Water	Desired Sustainability Outcome	Example Indicators	Example Metrics
	Optimized water use	Water use efficiency; impact on water resources	Efforts to optimize irrigation and surface/groundwater withdrawals. ¹⁴
	Preservation of high-quality surface water and ground water	Sedimentation of surface water; turbidity; BOD; runoff; nutrient or pesticide runoff or leaching to groundwater; spills; livestock wastewater runoff	Use of methods of soil tillage, nutrient management, and pesticide use that match crop needs and reduce the potential for off-target movement of contaminants to surface and groundwater. Use of methods of storage, handling and application of livestock manure and wastewater to soils according to existing policies and “4R” nutrient application principles. Efforts to optimize input use, application equipment maintenance, and methods to control

¹⁰ **Example measurements to document sustainability efforts:** Benchmarking and records of subsequent seasons’ evaluation of soil nutrient levels across fields and soils. Annual nutrient applications based on carryover in soils, seasonal needs of crops, and use of NRCS best practices in the 590 standard. Benchmarking of soil ecology and beneficial soil organisms. Benchmarking estimates of soil organic matter, tillage and water infiltration at standardized locations across the farm, and subsequent evaluation and documentation of changes. Records of farm activities “4R” principles adoption, and planning to minimize nutrient losses and soil compaction. Consider use of DMI’s *Farm Smart* Decision Support Tool to help producers utilize precision agriculture techniques that reduce producers’ environmental impact and increase their bottom line or Field to Market’s *Fieldprint Calculator*.

¹¹ **Example measurements to document sustainability efforts:** Benchmarking and records of subsequent seasons’ evaluation of mechanisms to protect or enhance wildlife refugia (e.g., establishing cover cropping, filters and buffer strips, crop residues, windbreaks, hedgerows); use of biofilters to limit sedimentation and shade plants along waterways to lower temperature and stabilize stream banks; planting of food sources; maintenance of woodlots and other wildlife refugia; organic matter additions to soils to enhance soil beneficial organisms. Document efforts to manage pests while encouraging beneficial organisms and native/managed pollinators. Document efforts to manage uncultivated areas to provide wildlife habitat, passage corridors and pollinator habitat. Document efforts to maintain or enhance aquatic, wetland and riparian areas to support diverse wildlife species and habitat. Document efforts to time harvest and other mechanical activities, within the window of opportunities available, to minimize impacts on reproducing or migrating wildlife. Participation in local watershed or wetlands protection efforts.

¹² **Example measurements to document sustainability efforts:** Benchmarking and records of subsequent seasons’ evaluation of pest occurrence and control difficulty; Document efforts to identify and control localized areas of intense pest pressure. Document efforts to minimize risk of pest resistance through crop rotation, use of unrelated pest controls, cultivation, etc.

¹³ **Example measurements to document sustainability efforts:** Benchmarking and records of subsequent efforts to engage in farmland conservation easements; participation in long-term conservation agreements; sale of farmland development rights

¹⁴ **Example measurements to document sustainability efforts:** Benchmarking and records of subsequent seasons’ efforts to optimize water use efficiency in irrigation through an irrigation efficiency evaluation and implementation of the technical service providers’ recommendations. Consider use of Field to Market’s *Fieldprint Calculator* to provide an opportunity to benchmark an operator’s water use and other sustainability outcomes and compare them to the industry index. Consider use of irrigation management calculator tools, such as Irrigation Manager 4.0, CropWat 8.0, AquaCrop, ClimWat 2.0, ETo evapotranspiration calculator, or other available tools.

			off-target movement of inputs. Use of methods of storage, handling, and recycling or disposal of unwanted materials and empty plastic containers. ¹⁵
	Preservation of air quality	Emissions, dust	Use of methods to reduce unnecessary air emissions (e.g., alternatives to burning; soil tillage methods that reduce wind erosion and dust). ¹⁶ Mitigation of nitrous oxide and ammonia emissions from nutrient application via “4R” nutrient stewardship principles and use of N stabilizers.

Inputs	Desired Sustainability Outcome	Example Indicators	Example Metrics
	Optimized use of farming inputs	Use of inputs in a manner that promotes long-term economic return, resource use efficiency, pest control, and productive crops and livestock while minimizing waste, off-target movement, and adverse environmental impacts.	Use of methods to optimize use of energy, fuel, seed, feed, pesticides, irrigation water, nutrients and other soil amendments. Select products in quantities and formulations that are consistent with seasonal needs. Management of input use, equipment maintenance and calibration to control off-target movement of inputs. Evaluation of nutrient use efficiency while accounting for optimized productivity. ¹⁷
	Limitation of environmental risks associated with pesticide use	Preventative pest management strategies (biological, cultural); Off-target movement; non-target effects; Waste product disposal and empty container recycling.	Use of methods and equipment to optimize pest control while reducing risks of leaks, spills, miscalibrated applications or off-target pesticide movement. Use of strategies and a suite of practices to limit risks to environment and wildlife (e.g., employee training, implementation of integrated pest management (IPM), field buffers, and protections of sinkholes/abandoned wells). ¹⁸
	Preservation of effective pest resistance tools	Occurrence of pest resistance	Use of multiple pest control mechanisms and products to reduce incidence of unintended genetic resistance to pest control products ¹⁹
	Limitation of environmental risks associated	Nutrient management planning and timing/form/amount of application; Off-target movement or adverse effects,	Use of nutrient management planning and site-specific considerations in conjunction with “4R” nutrient stewardship principles. Use of a suite of practices (e.g., soil/tissue testing; N stabilizers for fall nutrient applications) that optimize crop performance while reducing risks

¹⁵ **Example measurements to document sustainability efforts:** Benchmarking and records of subsequent seasons’ use of: no-till, conservation tillage, and field buffers to reduce waterway sedimentation; farm planning efforts to balance nutrient use and timing with crop needs; documented strategies to maintain and calibrate pesticide and nutrient application equipment, including training or professional application; documented efforts to minimize off-target spray drift and to maintain no-spray buffers around streams and sink holes, drain tile inlets or abandoned wells; Documented efforts to properly store and apply livestock manure and wastewater to fields. Evidence of recycling and disposal of unwanted materials, such as salvage of waste chemicals, empty plastic pesticide containers, equipment, buildings and maintenance waste products. Consider use of DMI’s *Farm Smart* Decision Support Tool or Field to Market’s *Fieldprint Calculator*.

¹⁶ **Example measurements to document sustainability efforts:** Benchmarking and records of subsequent seasons’ efforts to implement: alternatives to burning; reduce unnecessary vehicular idling; reduce unnecessary dust formation. Consider use of DMI’s *Farm Smart* Decision Support Tool. Identify measures that are applied to meet state implementation plans (SIPs).

¹⁷ **Example measurements to document sustainability efforts:** Benchmarking and records of subsequent seasons’ efforts to optimize purchasing and scheduling of input deliveries to maximize transport efficiency and to limit spoilage/waste. Evidence of strategies to optimize input use efficiency, such as calibrating application equipment for delivery of pesticides, nutrients, feed and seed; Evidence that preventative maintenance and use of farm equipment is practices, such as engine tune ups, avoiding unnecessary engine idling, obtaining more efficient irrigation pumps are practiced. Evidence of efforts to use farm-generated renewable energy, such as manure methane digesters; Evidence of proper storage and field application of livestock manure and wastewater; Evidence of use of USDA’s “Energy Estimator for Irrigation” or other tools for optimizing irrigation energy use. Consider use of DMI’s *Farm Smart* Decision Support Tool or Field to Market’s *Fieldprint Calculator*.

¹⁸ **Example measurements to document sustainability efforts:** Benchmarking and records of subsequent seasons’ efforts to train pesticide workers, maintain and calibrate application equipment, implement drift-reduction technologies and strategies to minimize off-target spray drift; recycling of empty plastic pesticide containers; Evidence of efforts to implement integrated pest management (IPM) efforts; use no-till, conservation tillage, and field buffers to reduce movement of pesticide residues in stormwater; protect sink holes, drain tile inlets and abandoned wells with no-spray buffer surrounds.

¹⁹ **Example measurements to document sustainability efforts:** Benchmarking and records of subsequent seasons’ efforts to implement pesticide rotations and dosage strategies to minimize pest resistance; incorporation of IPM strategies as warranted.

	with fertilizer and manure use	including odor.	of losses to the environment. Management of fertilizer and manure handling, application, and equipment maintenance and calibration to control misapplication, wastewater runoff, or manure applications that are sensitive to neighbors' odor concerns. ²⁰
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Energy & GHGs	Desired Sustainability Outcome	Example Indicators	Example Metrics
	Enhanced productivity of direct energy inputs	Farm fuel and electricity use per unit production.	Farm fuel and electricity use per unit of production; Use of certified energy audits coupled with energy saving decisions. Improvements in energy use efficiency made through choices among fuel and energy sources, equipment choices and maintenance, and farm building design, maintenance, and operational options. ²¹
	Enhanced productivity of indirect energy inputs	Inputs (feed, pesticides, fertility inputs)	Effectiveness of inputs use per unit of crops harvested, or per animal weight gain or milk production. ²²
	Improved on-farm energy self-sufficiency	Renewable energy, on-farm renewable energy production	Use of renewable energy sources, on-farm energy generation. ²³
	Optimized carbon, nitrogen and other GHG-related cycles	Soil carbon, denitrification, methane, N ₂ O production, GHG emissions per unit production	Use of methods and materials to reduce GHG emissions and optimize C/N cycles; Mitigation of nitrous oxide emissions from nutrient application via N stabilizers and "4R" nutrient stewardship principles; Incorporation of cropping systems and practices that optimize nutrient cycling; GHG emissions per unit of production. ²⁴

²⁰ **Example measurements to document sustainability efforts:** Benchmarking and records of subsequent seasons' efforts to balance nutrient use and timing with crop needs; proper storage and field application of livestock manure and wastewater; use of N-stabilizers whenever making fall nitrogen applications before soils drop to 50 degrees; maintenance and calibration of fertilizer and manure applicators to avoid leaks, spills or misapplication; use of a suite of practices (e.g., soil/tissue testing) that address all "4R" areas in aggregate to optimize crop performance while reducing risks of losses to the environment. Time applications of animal manure and wastewater to minimize offensive odor for neighboring entities, especially during weekends or holidays.

²¹ **Example measurements to document sustainability efforts:** Benchmarking and records of subsequent seasons' efforts to gain efficiencies in energy use per unit production: Farm fuel, propane and electricity records; Equipment hours of operation logs; Field activity log maintained to allow energy analysis; Gallons of Diesel Fuel Equivalence per unit of livestock, milk or crop yield or per acre (conversion of all forms of energy into BTU and then equated to aggregated measure of direct or indirect energy inputs). Records demonstrating creation of operational benchmarks from certified energy audits, and subsequent decision making based on energy efficiency improvements, complexity, capital outlay and payback potential. (e.g., changes to enhance productivity of direct energy inputs in crop production, harvest and grain drying, or livestock buildings and equipment for heating, lighting, ventilation, feeding and manure handling, milk cooling). Use of energy audits from ASABE or NRCS (e.g., www.ensave.com/sample-audits.html).

²² **Example measurements to document sustainability efforts:** Benchmarking and records of subsequent seasons' efforts to gain production enhancements per unit of input used. Records of feeds supplied vs. weight gain/milk produced per animal; all pesticide and nutrient applications, including product name and rate/date of use vs. crop growth stage and nutrient need (as determined by soil analysis, stalk or leaf sampling, remote sensing) and yield at harvest.

²³ **Example measurements to document sustainability efforts:** Benchmarking and records of subsequent seasons' efforts to employ solar, wind, biofuel or other renewable energy sources on the farm; Records of use of anaerobic digesters for animal manure coupled to heat or electricity generators

²⁴ **Example measurements to document sustainability efforts:** Benchmarking and records of subsequent seasons' efforts to optimize nutrient efficiency and reduce GHG emissions, such as soil-incorporation of applied nutrients; Delay fall nutrient application until soils reach 50 degrees or lower, or 60 degrees and lower if commercial N-Stabilizers are used. Reduce soil emissions of GHGs (e.g., N₂O) with nitrification inhibitors following nutrient application; Consider use of Field to Market's *Fieldprint Calculator* to provide an opportunity to benchmark an operator's climate impact and other sustainability outcomes against the industry index.