

Natural Resource Ecosystem Logic Model
North Central
Agricultural and Natural Resources Program Leaders

Situation: Ecosystems provide basic life-support services and products that we all depend upon. Managing our valuable ecosystems is ever important as our population and demand for goods and services increases. As humans continue to use the products (water, trees, plants, animals, etc) and services (pollination, nutrient cycles, decomposition, etc) from ecosystems the need for integrative decision making and land management plans to sustain these resources for food, economic growth, recreation, and wildlife increases.

In 2005 the United Nations [Millennium Ecosystem Assessment](#), produced the report *Ecosystems and Human Well-Being* involving more than 1,300 scientists' worldwide and classified ecosystems into four categories for operational purposes. ⁱ

1. Provisioning services: products (food, fiber, water, fuel, genetic resources, biochemicals)
2. Regulating services: benefits from regulating ecosystem processes (water treatment/purification, air quality, erosion control, pollination, biological control, storm protection)
3. Cultural services: non-material benefits (recreation, spiritual, educational, aesthetic, social, cultural)
4. Supporting services: necessary for all other services, long term, & indirect (soil formation, nutrient cycling, pollination)

Assumptions: Ecosystem services are threatened due to population growth, increase consumption of products provided by ecosystems and the technologies we utilize to produce goods. Lack of knowledge, assumption that the services are “free”, and the complexity of integrating the four categories are all factors that create challenges to sustain ecosystems services in the future.

External Factors: Some external factors will include:

- Increase demand for food production to meet global needs
- Increase demand for water resources for food production and energy resources
- New technologies, new demographic realities, new economic necessities, new political perspectives, and new environmental imperatives

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| Inputs | Outputs | | Outcomes – Impact | | |
|---|---|---|---|--|---|
| | <i>Activities</i> | <i>Participation</i> | <i>Short</i> | <i>Medium</i> | <i>Long/Condition</i> |
| <p>Research</p> <ul style="list-style-type: none"> • Researchers such as social scientists, public engagement, evaluation, ecology, soil & water resource managers, agronomists, economists, foresters, climatologists and community and rural development. • Research & Outreach Centers <p>Extension</p> <ul style="list-style-type: none"> • Specialists & educators with expertise in social science, public engagement, curriculum development, adult learning, ecology, agronomy, water, soils, forestry, farm business, engineering, pest management and community & rural development. • Local connection through extension educators with landowners, farmers, and community leaders • eXtension resources • Curriculum and other educational products <p>Partnerships with</p> <ul style="list-style-type: none"> • Commodity associations • USDA NIFA and National Water Program • NRCS • Local, state, & federal govt • Departments of Ag • Local & state agricultural and environmental regulatory agencies • Private sector environmental and other organizations. <p>Other</p> <ul style="list-style-type: none"> • Capacity (formula) and competitive funding; state funds; program revenue | <p>Research</p> <ul style="list-style-type: none"> • Conduct research on and develop innovative, regionally-appropriate methods, tools, and technologies for assessing ecosystem services in a timely manner. • Conduct research on and develop management practices specific to an ecosystem • Conduct research on and develop tools and methods to protect and restore ecological resources • Conduct research on and develop tools for ecosystem service valuation. • Determine the stage/level of vulnerability of ecological resources • Economic tools to value the “free” services provided by ecosystems • Collaborative management, participatory decision making and how it effects decisions on social, economic, and environmental issues <p>Extension Program planning/development</p> <ul style="list-style-type: none"> • Professional subject matter development of county and state staff • Engagement process of partnerships & collaboration is necessary for success. • Develop decision making principals that the NC region will share • Demonstration projects, case studies, etc • Develop guidelines/BMP’s, education tools, activities, etc based on the research identified above (management practices, protect & restore ecological resources) <p>Extension Program delivery</p> <ul style="list-style-type: none"> • Level I (Awareness) mass media , newsletters, social media application • Level II (Access to Expertise) State web resources, eXtension, Ask an Expert, networks, public engagement, one-on-one consultation by educators and specialists, extension publications. • Level III (medium dosage education) field days, local and regional workshops, grower focused events • Level IV (In-depth education) educational experiences through conferences and curriculum based trainings, demonstration, and professional development of faculty and advisors. <p>Levels refer to four levels of transformational education model</p> | <p>Those Implementing Change</p> <ul style="list-style-type: none"> • Land owners • Agriculture professionals • Natural resource professionals • Landscape managers • Urban/suburban/rural businesses • Homeowners • Public land managers <p>Those Advising Change</p> <ul style="list-style-type: none"> • Public agency staff • Local decision makers • Elected officials • Business owners <p>Those Developing and Implementing Public Policy:</p> <ul style="list-style-type: none"> • Local & state agency personnel (NRCS, SWCD, DoA,...) • Communities and community leaders | <p>Knowledge Gain:</p> <ul style="list-style-type: none"> • Ecosystem services & functions literacy: 4 categories, value of (economic, social environmental, medical,...), use and demand. • Understand the different management options and alternative futures when restoring, conserving, and over-using ecological resources <p>Skills Development:</p> <ul style="list-style-type: none"> • More people have and use skills to assess ecosystem health, to monitor ecosystem services, and to communicate the results • Ability to quantify the benefits of ecosystem services • Fundamental change on how Extension works internally: agriculture, natural resources educators, community development work together. <p>Scope of Participation</p> <ul style="list-style-type: none"> • Local decision makers • Ag & NR professionals • Public & private organizations | <p>Behavior Change:</p> <ul style="list-style-type: none"> • Greater use of ecosystem service valuation by decision makers • Management plans include the financial value of the “free” services provided by ecosystems • Decision makers take into account impacts to ecosystem services when evaluating policies • Increase ability for collaborative management approaches to ecosystem conservation and restoration • Ability to evaluate the effects of actions and decisions <p>Scope of Participation</p> <ul style="list-style-type: none"> • Local decision makers • Ag & NR professionals • Public & private organizations | <p>Environmental:</p> <ul style="list-style-type: none"> • Ecosystems services from natural & restored ecosystems are sustained for future generations (pg 14)ⁱⁱ • Ecosystem services are conserved or enhanced while maintaining use of ecosystem resources (pg 14)ⁱⁱⁱ <p>Economic:</p> <ul style="list-style-type: none"> • Ecosystem services contribute to the economic well-being and growth of communities • Communities that report economic growth/savings increases <p>Civic:</p> <ul style="list-style-type: none"> • Policies and guidelines that reflect the conservation and management of ecological resources for future generations <p>Scope of Participation</p> <ul style="list-style-type: none"> • Local decision makers • Ag & NR professionals • Public & private organizations |

Ecosystems Services: Indicators Proposed for Measurement

| Short | Medium | Long |
|--|--|---|
| <p>Knowledge Gain:</p> <p>Ecosystem services & functions literacy: 4 categories, value of (economic, social environmental, medical,...), use and demand.</p> <ul style="list-style-type: none"> Indicator: Increase in knowledge of ecosystem services. Topics include what ecosystem services provide, the value of free services, the interactions, and the role people play. * # <p>Understand the different management options and alternative futures when restoring, conserving, and over-using ecological resources</p> <ul style="list-style-type: none"> Indicator: Knowledge level improvement on topics such as alternative land management options; effects of extreme weather events; nutrient cycles; soils & fertility; air & water, etc *(water quality) # Indicator: Number and portion of educational programs that include adopting best practices relative to one or more ecosystem services (to be determined by each state, region, locale) that have direct effect on an ecosystem service have increased. *(water quality & air) # Indicator: Knowledge level improvement on how ecosystem services are threatened: runoff/stormwater; invasive species; soil erosion; deforestation; pollution (air, water, land); overharvesting (fisheries); and development. *# <p>Skills Development (short term): More people have and use skills to assess ecosystem health, to monitor ecosystem services, and to communicate the results.</p> <ul style="list-style-type: none"> Indicator: Number and portion of educational program participants adopting best practices relative to ecosystem services topics. * (water) # <p>Ability to quantify the benefits of ecosystem services</p> <ul style="list-style-type: none"> Indicator: Development of 'enterprise' tools to help people make decisions that include ecosystem services variables. For example, the 'Should I buy a Hybrid Car?' by Doug Tiffany. | <p>Skills Development (medium)</p> <p>Increase ability for collaborative management approaches to ecosystem conservation and restoration</p> <ul style="list-style-type: none"> Indicator: Number and portion of educational program participants adopting best practices. For example, local poultry industry conducts a life cycle assessment on the environmental impact of nitrates on stream water quality and adopts land management practices that reduce dissolved nitrates in area waterways. Indicator: Multi-discipline approaches to ecosystem services issues exist. For example, Pollution Control Agencies, ag producers, and watershed districts working together to address an water quality issues in a watershed or a water body. <p>Ability to evaluate the effects of actions and decisions</p> <ul style="list-style-type: none"> Indicator: Development of evaluation tools that demonstrate a direct relation and actions the contributed to an outcome and/or impact. *# <p>Behavior Change:</p> <p>Greater use of ecosystem service valuation by decision makers.</p> <ul style="list-style-type: none"> Indicator: Local units of government incorporate ecosystem services valuation in planning documents and land use decisions. <p>Investments in green infrastructure by government agencies or private firms.</p> <ul style="list-style-type: none"> Indicator: Reduced costs. E.g., reduced insurance costs due to reduced risk of flooding; Farmers change practices and modify habitat to maintain pollinator habitat Indicator: Increase in the number of functioning carbon markets. Indicator: Water quality improved based on flood mitigation processes. Or payments schemes for WQ management Indicator: Pollination services----is our current approach Indicator: What is the link of business wanting to become more green, what about socially responsible investors. <p>Management plans include the financial value of the "free" services provided by ecosystems</p> <ul style="list-style-type: none"> Indicator: Land use plan and/or water plans (county and state wide land use plans) include the financial costs of drained wetlands or building on flood plain or soil erosion or air pollution. <p>Decision makers take into account impacts to ecosystem services when evaluating policies.</p> <ul style="list-style-type: none"> Indicator: Local units of government incorporate ecosystem services valuation in planning documents and land use decisions. Revise current planning documents. | <p>Conditional Changes associated with:</p> <p>Environmental: Ecosystems services from natural & restored ecosystems are sustained for future generations (pg 14)ⁱ</p> <p>Ecosystem services are conserved or enhanced while maintaining use of ecosystem resources (pg 14)ⁱ</p> <p>Economic: Ecosystem services contribute to the economic well-being and growth of communities (rural, suburban, urban) and businesses.</p> <p>Communities that report economic growth/savings increases</p> <p>Civic: Policies and guidelines that reflect the conservation and management of ecological resources for future generations</p> <p>*impacts are difficult to determine as this is a new and will be based on outcomes achieved overtime.</p> |

Most important in defining impact

Most important in defining and measurable

Benefit to your state

* Currently being measured

Might be measured & aggregated

ⁱ Millennium Ecosystem Assessment (MEA). 2005. Ecosystems and Human Well-Being: Synthesis. Island Press, Washington.

ⁱⁱ Ecological research Program Research Multi-Year Plan (2008-2014); U.S. Environmental Protection Agency, Office of Research and Development

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