# **2.61 Final Community-Based Ecosystem Goods and Services**

**Project Number & Title**

2.61 - Final Community-Based Ecosystem Goods and Services

**Project Lead and Deputy**

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**Project Period**

FY16 – FY 19

**Project Summary**

An important goal of SHC is to allow community stakeholders and national decision-makers to be better able to assess and predict the interactions between human communities and the natural environment. Project 2.61 will use scientific knowledge of ecosystem services and human health to promote community well-being and maintain or restore high environmental quality. In broadest terms, research in this project will focus on: 1) the specification, classification, measurement, and modeling of final ecosystem goods and services (FEGS; those ecosystem goods and services that people directly use, enjoy, or otherwise benefit from)); 2) linkages of delivery of FEGS to beneficiaries within communities (including to members of vulnerable populations); 3) measurement of the benefits of FEGS with particular attention to human health and human well-being endpoints; 4) examination of the effects of climate change and other co-occurring stressors to the production and delivery of FEGS; and 5) linkages of this research to the EnviroAtlas and other decision support tools. Project 2.61 will involve the development and integration of these research elements, in part, through the utilization of coordinated case studies for conducting research to help inform communities about making decisions with sustainable outcomes, and assess the transferability of FEGS-based decision support tools to other locations. The Products and Outputs from this Project are intended to directly contribute to the sustainability approaches developed in the Integrated Solutions for Sustainable Communities Project (SHC 4.61) and to inform decision-making about sustainability at national, regional, and community scales by EPA Program Offices and the Regions. This project will have specific activities that focus on synthesis including integration and analysis of tool transferability.

**Project Description**

Problem and Decision Context

Community stakeholders and national decision-makers need to be better able to assess and predict the interactions between human communities and the natural environment. Project 2.61 will use scientific knowledge of ecosystem services and human health to promote community well-being and maintain or restore high environmental quality to address the following science questions:

* *How do social, economic and environmental drivers (particularly climate change and co-occurring stressors) impact the production, supply, delivery and benefits of final ecosystem goods and services related to community sustainability?*
* *How do changes in the production, supply, delivery and benefits of final ecosystem goods and services affect how a community approaches decisions (including decision-making processes) about sustainability?*
* *How can case studies demonstrate applicability and transferability of models that estimate the production and delivery of final ecosystem goods and services production, and the attendant benefits to a populace to inform decisions affecting community sustainability?*

Project 2.61 will contribute to sustainability approaches developed elsewhere within SHC, and inform decision-making about sustainability at national, regional, and community scales by EPA Program Offices (such as OW, OAR, OSWER, and OSC), EPA Regions (all), and decision makers in local communities. Project 2.61 will inform specific partner needs, including the need to:

* Have a process by which the demands for FEGS by communities, regions or nation-wide can be identified;
* Have a process by which communities can use research-identified metrics of relevant FEGS, and methods to use (measure, map, model, interpret and report) those metrics, with which communities can better manage the sustained delivery of those FEGS and their attendant benefits;
* Identify and/or target ecological models of ecological production of relevant FEGS (e.g., FEGS production functions), assess whether and how ecological production models can be transferred among communities of interest, understand the data requirements to use those models, and understand the uncertainties associated with applying those models to new contexts;
* Determine demands for, uses of, delivery of, and access (or exposure) to FEGS by a populace (e.g., of a community, region or the nation), especially for focal FEGS;
* Determine how sectors of a community use and benefit from FEGS, particularly for the economic and public health of the population, and identify methods by which communities may quantify some of these benefits;
* Understand how climate change and other major drivers and stressors (including incremental changes of stressors) affect the production, delivery of, and benefits of FEGS, including effects on the intermediate ecosystem services upon which FEGS depend;
* Use conceptual frameworks and decision support tools to characterize relationships among stressors, FEGS production, and the well-being of a populace; and,
* Use these tools to identify potential trade-offs so that decision makers can identify and consider management actions that will affect the sustainable delivery of relevant FEGS. For example, these tools could be used to inform decision-making relevant to community-level adaptations to climate change.

Outputs

2.61.1 Ecosystem Goods and Services Production and Benefit Functions Case Studies Report. (FY16)

2.61.2 Incremental report on the impacts of human actions and environmental forces (particularly climate change), on the production and supply of final ecosystem goods and services (FEGS) and the effects on human health and wellbeing. (FY17)

2.61.3 Provide information about the impacts of actions and environmental forces (particularly climate change) on final ecosystem goods and services (FEGS) for incorporation into community-level decision support tools and the EnviroAtlas. (FY18)

2.61.4 Incremental report on the impacts of human actions and environmental forces (particularly climate change), on the production and supply of final ecosystem goods and services (FEGS) and the effects on human health and wellbeing. (FY20)

Focus Areas

Research in Project 2.61 will be conducted at both a thematic scale (i.e., generalized research on each focus area, below) and at community-level scale within a small set of coordinated case studies. The purpose of case studies is to evaluate and improve those generalized methods and tools at multiple locations around the U.S. using a common conceptual framework, and thus assess which of those may be most readily transferred among other communities. The research in Project 2.61 has five focus areas that will leverage relevant emerging science and represent an innovative way to advance ORD’s research in ecosystem service science:

*Focus Area #1: Final Ecosystem Goods and Services (FEGS) Classification, Metrics and Production –* The scope of this focus area includes quantifying the linkages between the production of ecosystem goods and services to changes in human health (including intermediate and incremental changes and indirect human health endpoints) and other measures of human well-being. Future development of production functions for FEGS will be supported within this Project with targeted linkages to coordinates case studies, EnviroAtlas and other programmatic decision support needs. While the major focus is on FEGS, development of information on intermediate ecosystem services is also important in order to model, manage and assess FEGS. Future FEGS activities will include developing a process to identify and develop metrics and indices to measure FEGS, and to apply that process to develop metrics and indices for specific FEGS needed elsewhere in this Project and SHC. Early efforts in the Project will focus on leveraging the work done to date, including past efforts to identify and quantify metrics and indicators of FEGS, on linking the FEGS-Classification System (FEGS-CS) to the National Ecosystems Services Classification System (NESCS). Research will also identify or generate models to connect those metrics to the ecological processes that underlie the production of the entities that those metrics represent. Two key tools developed under this focus area will be the FEGS-CS website (e.g., describing ecosystem-specific FEGS and their metrics) and the EcoService Models Library (ESML) website (e.g., a tool to help people find ecological models that are useful for estimating production of ecosystem goods and services).

Key products associated with this focus area include:

* + Report on integration of FEGS-CS into the NESCS (collaboration with the Benefits of FEGS focus area and EPA Office of Water)
  + FEGS-CS Website version 2
  + EcoServices Model Library (ESML) version 2 - with increased content and improved functionality for users to find and evaluate ecological models (FEGS)
  + A methodology to assess the transferability of ecosystem service production functions and estimates
  + Transfer of the FEGS-CS and ESML websites to non-ORD owners

*Focus Area #2: Benefits of FEGS –*The scope of this focus area includes identifying how the supply and benefits of FEGS are delivered to different populations, including specific population groups within a community (including vulnerable populations). Quantifying the benefits of FEGS will focus on targeted efforts to establish associative linkages between FEGS (or intermediate ecosystem services, as appropriate) and endpoints or indicators of benefits – specifically to human health endpoints (including intermediate and incremental changes and indirect human health endpoints), and the equitable delivery of FEGS to communities and vulnerable populations (i.e., environmental justice). Most of the benefits research will occur within the case study context, but not exclusively. Research will likely focus on the ability to utilize specific benefit understanding or functions across communities. This Project’s greatest contribution to valuation of ecosystem services is through the coupling of FEGS to national economic accounting systems through our collaboration with the Office of Water on development of NESCS. Research linking FEGS to human health endpoints will receive particular attention. Criteria for human health endpoints may include: integration with Project Plan development for the Community Public Health and Well-Being and Assessing Environmental Health Disparities and Vulnerable Populations Projects (SHC 2.62 and 2.63, respectively); endpoints of concern for coordinated case study communities, EPA Programs and Regions; endpoints with which FEGS can be expected to interact significantly; and availability of the right expertise/resources within this Project.

Key products associated with this focus area include:

* + Report on integration of FEGS-CS into the NESCS (collaboration with the FEGS Classification, Metrics, and Production focus area and EPA Office of Water)
  + Report on the quantitative linkages between Final Ecosystem Goods and Services and human health – a potential collaboration with the Community Public Health and Well-Being Project (SHC 2.62)

*Focus Area #3: Climate/Stressors* **–** The scope of this focus area includes quantifying the effects of climate change and co-occurring stressors (defined as specific additional stressors whose impacts may be compounded with the presence of stressors associated with climate change) on the production and benefits of FEGS, with particular attention to human health endpoints. This Project will prioritize and develop scenarios addressing effects of climate change associated stressors on production and delivery of FEGS. Scenarios for climate change will be selected through discussion with research efforts across ORD and likely will reflect a compromise among tasks within the project, in particular the Case Studies, to maximize both the appropriateness of scenarios for each study and comparability across studies. This Project will encourage ORD to establish a core set of climate scenarios, which we will then use. Barring that, the Project likely will use the climate scenarios recently adopted by the Decision Science and Support Tools Project (SHC 1.61). Additionally, this Project will develop a generalized conceptual framework (or approach) that includes evaluating the effects of co-occurring stressors on FEGS (as prioritized within the coordinated case studies), with the goal that the framework/approach can be transferred to evaluating the effects of other types of stressors on FEGS.

The key products associated with this focus area include:

* + Report on approaches to estimate the effects of climate change and other stressors on the production and benefits of FEGS

*Focus Area #4: Coordinated Case Studies –*The scope of this focus area includes advancing the development (including the utility) and application of transferable and scalable conceptual frameworks, mathematical models, assessment methods, metrics and indicators relating to the identification, sustainable production and benefits of a core group of community-relevant FEGS under a case study umbrella. The case studies will include a core of research elements that will be studied in common at each site, including a common set of methods to identify sets of FEGS and associated metrics, stressors, beneficiaries, and decision support tools. These focal core elements will provide the basis for comparing research results across case studies. Other community-specific research elements will be included for each case study to address site-specific issues of interest to that community. New elements will be folded into the future direction of ecosystem services research within this Project, including the further distinction between intermediate and final ecosystem services and will focus on strengthening connections to elements of human health, environmental justice (especially vulnerable populations), and climate change. Near-term work will look at establishing – and building upon existing – conceptual relationships among those elements, with future efforts focused on developing quantitative relationships among major drivers of change (and their associated stressors), production of FEGS to communities, and consequent changes to human well-being (particularly public health). Selection of case study sites will be based on objective criteria including community typology (using typologies being developed within SHC), interest by EPA Offices or Regions, availability of data, collaborators in other SHC Projects (such as EnviroAtlas: A Geospatial Analysis Tool; SHC 1.62, and Integrated Solutions for Sustainable Communities; SHC 4.61), and willing partners in the local community. At this time, coordinated case study research is likely planned in San Juan, Puerto Rico, and AOC (areas of concern) communities in the Great Lakes region. Additional potential candidate sites include Snohomish River basin (Puget Sound, WA), Long Island, NY, and communities in the Gulf of Mexico. Comparisons of results across case study communities will be the basis for assessing transferability of ecosystem service-based methods, metrics, tools and models to other communities.

Key products associated with this focus area include:

* Report on the synthesis of results from previous SHC case studies, and the transferability of the methods, data, tools, and models from those studies to support community-scale, sustainability decision-making
* Report on development of transferable frameworks and tools to inform community level decision making for sustaining the availability of core ecosystem goods and services
* Report on incorporation of methods to estimate the production and benefits of FEGS into decision support tools

*Focus Area #5: Integration, Synthesis and Strategic Communication –*The scope of this focus area includes the coordination and integration of research across the focus areas and among the case study locations, and the communication of our results to our EPA partners, the general public, and the scientific community. The goal of this focus area is to assess the transferability, scalability, applicability, and relevance of ecosystem service-related frameworks, models, methods (including involving community engagement), and tools that link the production of FEGS to human health and well-being. Those assessments then may be used to inform sustainability-related decision-making, as conducted under the auspices of EPA Regions, other SHC Projects (e.g., Integrated Solutions for Sustainable Communities; SHC 4.61), or independently by communities. This Project will have an “integration and synthesis” Task that synthesizes the work done by all Tasks (such as use of decision support tools, generic frameworks, and efforts from community engagement); that tracks the collaborations and information flows among Tasks and between this Project and other SHC Projects; and that manages communication with this Project’s Key Clients. This Task will be staffed by research leaders of all other Project 2.61 Tasks to better insure that integration, synthesis, and communication efforts will be a shared responsibility of all Tasks for this Project.

Key products associated with this focus area include:

* + A managed vocabulary for natural and social scientists to agree on common and useful ecosystem service vocabulary
  + A comparison of approaches that model the production and benefits of Final Ecosystem Goods and Servicesto inform community level decision-making
  + A report on the transferability of methods and tools developed in Project 2.61 to support sustainability-focused decision making at community and national scales.
  + Periodic self-assessments on the success of Project 2.61 at achieving the goals outlined in this Charter, the integration of research across Tasks and case studies, and the communication of our results to EPA Offices and Regions, community stakeholders, and the scientific community.

**Nature of the Work**

Project 2.61 research will involve a combination of field, lab- and computer-based work, and community and stakeholder engagement. Project 2.61 will require ecologists, ecological modelers, statisticians, physical scientists, and epidemiologists and other human health disciplines. Social scientist needs for Project 2.61 include expertise in sociology, anthropology, decision sciences, policy analysis, and economics. Informational science needs include GIS specialists, web developers and web services (e.g., GeoPlatform, EnviroAtlas), computer programming, communication specialists, database programming and management, QA/QC specialists, and Contracting Officer Representatives. No more than 50% of the work in the focus areas will be dependent upon extramural funding for GIS specialists, statistical modeling and analysis, economics and social science, programming, data entry, data purchases, web development, web services, ORISE Post-docs and SSCs. Project 2.61 would benefit from opportunities to participate in the RESES or RARE/RM programs and opportunities for ecological and decision-support modeling work.

**Collaboration**

Project 2.61 will work with colleagues in other SHC Projects to integrate metrics, models, and other tools into decision support tools (i.e., the Decision Science and Support Tools and EnviroAtlas: A Geospatial Analysis Tool Projects [SHC 1.61 and 1.62, respectively]), community public health and well-being (i.e., the Community Public Health and Well-Being and the Assessing Environmental Health Disparities and Vulnerable Populations Projects [SHC 2.62 and 2.63, respectively]), systems-scale integration of environment, economy, and human well-being (i.e., the Integrated Solutions for Sustainable Communities Project [SHC 4.61]), and incorporation of ecosystem services into environmental restoration, remediation, and community revitalization (referred to as R2R2R). Expectations and commitments for achieving Products from collaborations will need to be documented during early Project Plan development. The following SHC Projects elements have been identified as potential project collaborations:

Decision Science and Support Tools Project (SHC 1.61)

1.61.2 Methods to allow communities to calculate indicators and indices of sustainability and well-being using local data (FY17)

1.61.3 Searchable Library of Available Community Decision Support Tools and Modules; Software to Help Users Identify and Use Appropriate Tools for Their Needs (FY18)

1.61.4 Next-generation decision support tools that capitalize on existing re-useable software and advances in information technology to ensure interoperability while filling gaps in tools currently available to inform community decisions that promote sustainability (FY19)

EnviroAtlas: A Geospatial Analysis Tool Project (SHC 1.62)

1.62.2 Crosswalk between ecosystem services mapped in the EnviroAtlas with those in the final ecosystem goods and services classification scheme (FY16)

1.62.3 Community metrics for EnviroAtlas (FY17)

1.62.4 Climate change implication tools and data layers for EnviroAtlas (FY17)

Community Public Health and Well-Being Project (SHC 2.62)

2.62.1 Demonstrations of applying tools, methods, and community engagement to mitigate environmental health impacts in at-risk communities (FY16)

2.62.2 Synthesis of best practices learned from community participatory studies that address environmental health concerns within communities (FY17)

2.62.3 Methods for cumulative, integrated assessments of chemical and non-chemical stressors and pilot application of these assessments to reduce community environmental health risks and promote community health and well-being (FY16)

2.62.4 A report on the state of the practice for integrating ecosystem good and services, human health and human well-being research for assisting communities in decision-making (FY18)

Assessing Environmental Health Disparities and Vulnerable Populations Project (SHC 2.63)

2.63.1 Development of a systems level approach to understanding children’s environmental exposures, health and environmental diseases (FY15)

2.63.2 Translational research to incorporate data and information on children’s environmental health (CEH) into tools to inform community actions (FY19)

2.63.3 Research to inform Tribal sustainability (FY19)

2.63.4 Evaluation of tested approaches to resolving health disparities in vulnerable populations and lifestages (FY19)

Indicators, Indices, and Report on the Environment Project (SHC 2.64)

2.64.2 Provide indicator information necessary for the incorporation of environmental indicators into SHC Decision Support Tools (FY17)

2.64.3 Draft Report on the Environment (ROE) – 2017 with interpretation of trends (FY17)

2.64.4 Incremental report on the State of the Practice for Environmental Indicators, including Community Sustainability and Indicators of Well-Being (FY19)

SHC Theme 3: Contaminated Sites; Oils and Fuels; Materials Management) (SHC 3.61, 3.62)

Potential collaboration will provide 2.61 with application and grounding of FEGS production, benefits and response to stressors in real environmental scenarios to link remediation to ecological restoration and community revitalization (R2R2R). Evaluating effects of stressors on FEGS is a strong element of Project 2.61 and thus may be relevant for Theme 3 (most likely the contaminated sites project). The potential exists to transfer FEGS and benefit endpoints into activities related to damage assessments, remediation, and restoration.

SHC Theme 4: Integrated Solutions for Sustainable Communities (SHC 4.61)

Within the scope of this Project, coordination will occur with the Integrated Solutions for Sustainable Communities Project (SHC 4.61). This will be done through an exchange of information on methods and tools to examine community sustainability and lessons learned from previous place-based research on Ecosystem Goods and Services (FY16). Additionally, this Project will also collaborate to identify potential opportunities for ecosystem goods and services work in the SHC 4.61 demonstration projects.

Other Collaborators

Potential collaborations with key stakeholders will need to be initiated and documented during Charter review and early Project Plan development. At the time of drafting, the Project has identified the following Program Offices and Regional POCs:

* EPA Regional partners – Mike Morton (R6); Matt Small (R9)
* National Center for Environmental Economics (NCEE)
* Office of Water (OW) – Joel Corona
  + Healthy Watersheds Program (Laura Gabanski)
  + Recovery Potential Assessments (Doug Norton)
* Office of Sustainable Communities (OSC) Office of International and Tribal Affairs (OITA ) – Bill Sonntag
* Office of Air and Radiation (OAR) – Rick Haeuber (OAR/OAP)
* Office of Air Quality Planning and Standards (OAQPS) – Randy Waite
* Office of Solid Waste and Environmental Remediation (OSWER ) – Kathleen Raffaele
* Stakeholders in communities that were part of recent SHC ecosystem services research, including Tampa Bay (FL), Guánica Bay and San Juan (PR), Pensacola Bay (FL), Sweet Home (OR), and Duluth (MN).
* Stakeholders in future coordinated case study communities
* RARE and RESES are potential additional resources

This Project has identified several potential collaborators outside EPA, including:

NOAA Northwest Fisheries Science Center (Ecosystem Sciences group)

USGS Science and Decision Center

US Forest Service

US Department of Interior

Earth Economics

Natural Capital Project

Marine Ecosystem Services Partnership

Harte Research Institute for Gulf of Mexico Studies

OSTP's Subcommittee on Ecosystem Services (Sarah Gerould; USGS)

**Assumptions/Constraints**

Successful incorporation of new research elements into SHC Project 2.61 will depend on strong cooperation and collaboration with experts from other SHC Projects, ORD national programs, EPA Program Offices and Regions, and outside the Agency. In addition to requiring the suite of expertise resources outlined in the Nature of the Work section, the additional primary assumptions and constraints for each of the different research elements within this Project are:

FEGS: A group of focal FEGS need to be articulated clearly in Project Plan development that will be a common element of research under all of the focus areas. Development of metrics of the focal FEGS must be completed by FY16 so that they may be incorporated into the coordinated case study research. Some of the ecosystem service-based tools and decision-frameworks may be limited to what develops based on these focal FEGS.

Beneficiaries: A typology for linking FEGS to classes of beneficiaries must be developed so that the delivery and use of FEGS within communities can be assessed in a comparable fashion within the coordinated case studies.

Human health and environmental justice benefits: Strong connections are needed between the ecosystem services, human-health, and environmental justice research communities, especially given the limited human-health and social science expertise among federal staff assigned to Project 2.61. Linkages for human health responses to changes in ecosystem service availability cannot be solely descriptive. Nor can the availability of FEGS to vulnerable populations be solely qualitative. Potential linkages between FEGS and human health-endpoints and vulnerable populations need to be defined in FY15 and mechanistic work must start no later than FY16 so that these connections can be included in the coordinated case study research. This could be accomplished by close collaboration with the Community Public Health and Well-Being and Assessing Environmental Health Disparities and Vulnerable Populations Projects (SHC 2.62 and 2.63, respectively).

Economics/Valuation of FEGS: FEGS valuation work will be conducted in support of specific FEGS within case studies. It will not be feasible to comprehensively address valuation of FEGS because of limited staff with required expertise associated with Project 2.61. There are numerous other efforts going on around the country and the world to develop databases and tools for valuation of ecosystem services that this Project can leverage.

Transferability: An approach for objectively assessing the transferability of FEGS-based metrics, data, and decision-support tools needs to be developed to evaluate whether research-results in Project 2.61 can be used in communities other than those studied herein. That transferability approach may be based on the Project 2.61 research to develop methods to assess transferability of estimates and models of ecosystem service production.

Climate change/stressors: The selection of climate change scenarios, leveraging other ORD work for scenarios where available, and other co-occurring stressor elements will be constrained by what is available from existing information or work by others outside the Project. This Project will encourage ORD to establish a core set of climate scenarios. Barring that, the Project likely will use the climate scenarios recently adopted by the Decision Science and Support Tools Project (SHC 1.61).

Collaborations: The EPA and other collaborators list should not be considered all-inclusive, nor should be viewed as the de facto criterion for soliciting or funding external partners.

Strategic Coordination: Comparison of results across focus areas and among case studies, and the assessment of the transferability of methods, data, and tools developed in each Task depends on the willingness of staff within Project 2.61 to coordinate their research and prioritize their efforts on focal FEGS, benefits, metrics, stressor scenarios, and decision-support tools. Task and research leaders must agree to be objective in defining success of the research and transferability of the results to new locations.

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