NATIONAL SOCIO-ENVIRONMENTAL SYNTHESIS CENTER

Riverside Farmland in New England.
Photo courtesy of Google Maps, CNES/Airbus, MassGIS, Maxar Tech, USDA/FPAC/Geo, 2022

Lesson: Sustainable Agriculture: Resistance, Resilience, or Transformational Farming

By Heidi Scott, SESYNC | October 21, 2022

Overview:

As the soil health of farms engaged in industrial-style commodity agriculture continues its long decline, advocates for sustainable agriculture point to alternative low-tech management strategies. These strategies could improve soil health and reduce damaging runoff of soil, pesticides, and fertilizer into adjacent waterways. Such strategies include the use of cover crops, no-till planting, tree brakes and hedgerows, bioswales, wetland preservation, agroforestry, polyculture and permaculture design, and rotational planting and grazing. In a recent analysis of investments made by the United States Department of Agriculture (USDA), Basche et al. (2020) reveal that financing to support the most effective sustainable methods amounted to only 0.08% of USDA's total expenditures in 2018. This number suggests there is a great opportunity to re-assess funding priorities and bring them in line with the agricultural challenges of the 21st century. This lesson focuses on analyzing techniques for improving soil health, ecosystem resilience, and ecosystem services, while providing diverse and nutritious food for the public. Learners will review an array of potential strategies and apply them to specific farming geographies. They will analyze ways to integrate multiple benefits and implement the strategies more broadly by referring to USDA/Environmental Quality Incentives Program (EQIP) financial support.

Assumed Prior Knowledge:

Appropriate for undergraduate, graduate, and higher-level learners.

Learning Objectives:

- Learn about the USDA/EQIP program, its funding history, and the opportunity it provides for funding agrarian sustainability adaptation.
- Consider a specific case study of a farm and the extent to which its socio-environmental management strategy reflects a move toward improved soil-related health (i.e., positive adaptation strategies).
- Apply agroecological theory of adaptation strategies to measure the positive impacts of changes like no-till planting, cover crops, bioswales, buffers, polyculture, and integrated uses.
- Speculate on how USDA/EQIP funding histories may need to evolve to support more aggressive transformational farming practices to keep up with climate change, soil degradation, and pests.

Key Terms and Concepts:

sustainable agriculture; agrobiodiversity; resistance; resilience; transformation; climate change adaptation; USDA/EQIP program; biodynamic farming; diversification; cover crops; rotational grazing; no-till planting; bioswales; polycultures; buffers

The "Hook" (suggestions for quickly engaging students):

(5 min) Ask learners: What's the difference between a farm as it's often depicted on a milk or egg carton for consumer appeal and the actual place? List some aesthetic features of the "ideal farm" we see in advertising. Then, list your sense of the aesthetic realities of an industrial-scale milk or egg production facility. Why is there a calculated difference between the ideal and the real? What does this difference conceal, and how does that relate to impacts on farm sustainability, animals, and the regional environment? What are 2–3 changes to current practices that could be made to approach the aesthetic ideal of a small, diversified, more sustainable farm? What are 2–3 hurdles to implementing these changes?

Teaching Assignments:

1. As preparation for class, have learners carefully read all of the Basche et al. (2020) paper, paying special attention to the highlighted areas and taking notes on what the authors call the categories of "adaptive strategies" to improve soil-related health: resistance, resilience, transformation. Learners should also review the summary of the USDA/Natural Resources Conservation Service (NRCS) program EQIP to learn about the program's goals and how an applicant might present their farm as a desirable funding recipient.

   Basche et al. 2020 – Highlighted.pdf

   USDA NRCS – Is EQIP Right for Me?.pdf

2. **(10 min)** In class, review the basics of the Basche et al. paper using the PPT slides below to ensure that learners are familiar with the three adaptive strategy categories that they use as a framework for assessing sustainable interventions. Also, review the four quadrants of farming practice from Basche et al.'s Figure 1 so that learners understand the differences.

   Resistance, Resilience, or Transformational Farming Slides.pptx

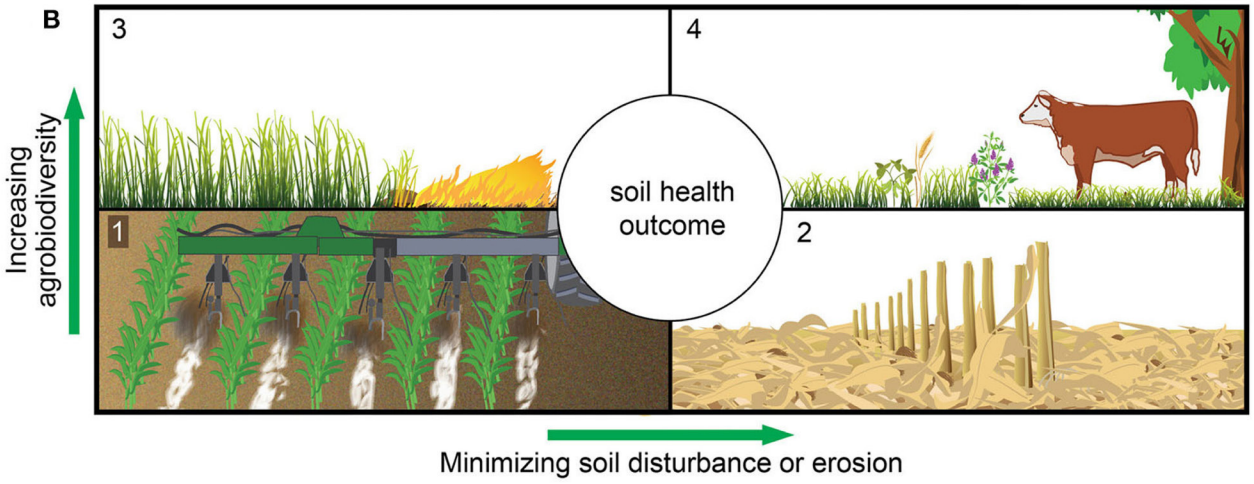

Figure 1 from Basche et al. (2020): (B) illustrates the categories within the "soil health outcome" classification, including: no change or improvement to soil health, represented by Nutrient Management (590); Quadrant 2, reducing soil disturbance or erosion, represented by Residue and Tillage Management, No-Till (329); Quadrant 3, increasing agrobiodiversity, represented by Prescribed Burning (338); and Quadrant 4, both reducing soil disturbance or erosion and increasing agrobiodiversity, represented by Silvopasture (381).

3. **(5 min)** Divide the participants into groups of 3–4 participants, where each will play the role of a farm owner of one of two plots: a small riverside vegetable farm in Massachusetts close to several mid-sized towns and colleges (25 acres); or, a rural, large, industrial commodity (corn) farm in Illinois that includes a small stream (1000 acres). Assign each group a locale (MA or IL) and a strategy: resistance, resilience, or transformation. This results in six groups; if your assemblage is larger, there may be doubles.

4. **(15 min)** Have each group view the aerial shot of their farm (in the PPT slides). They can assume they have control over all the farmland in the picture. Instruct the groups to do the following:
    a. Note adjacent features like mountains, streams, rivers, other farms, and towns.
    b. Speculate on how proximity might affect their sustainability strategy: Is resilience to floods a priority? Does the farmscape have streams, buffers, windbreaks, or swales, or would it benefit from enhancing them? Are there local markets for premium produce or other local economic opportunities to diversify their agronomy?
    c. List features and opportunities to develop their farms sustainably, along the lines of their assigned strategy, to achieve: resistance, resilience, or transformation.

5. **(20 min)** Instruct groups to modify their copy of the aerial farm picture to indicate suggested changes. They may use an art editing program like Adobe Photoshop, the free software Gimp, or another program of their choice. It should allow them to draw in color and place icons in the photo, and save in a common format like PDF or JPEG.
(Instructor note: Resistance groups may have less input on their farm plans than resilience or transformation groups because resistance is closer in strategy to existing industrial farm practices. If resistance groups finish early, invite them to create a timeline of implementation for more transformational changes to their farmscape.)

6. **(20 min)** Have each group post their modified map to a shared space along with their list of suggested modifications and explanations for how these acts fall within their strategic category. As a whole class, first review the resistance plans, then the resilience plans, and last, the

transformation plans. Instructors may choose to proceed through all ideas for each farm scenario (MA or IL) or toggle back and forth between locations to show commonalities of strategy across farm type.

7. As homework, have individuals post praise and/or critique of two other farm plans. While the least transformative (resistance) plans may invite more critique because they suggest the continuation of existing practices like plowing or pesticide use, note that Basche et al. calculated that 77% of EQIP funding went to resistance plans, versus only 2% for transformational plans. So, as part of their post, ask learners to consider how to change the priorities of USDA/EQIP funding so that more money goes toward paradigmatic shifts in farming methods. This may include a long-term plan to transform a farm, beginning with resistance tactics, but proceeding within 10 years through resilience and toward transformative management.

Background Information for Instructor

1. USDA's Environmental Quality Incentives Program

- This web page contains EQIP information on the financial and technical assistance offered to farm owners and forest managers to address natural resource strains and provide environmental benefits and greater resilience to increasing agrarian stressors.
- U.S. Department of Agriculture, Natural Resources Conservation Service. (n.d.). *Environmental Quality Incentives Program*. https://www.nrcs.usda.gov/programs-initiatives/eqip-environmental-quality-incentives

2. Special Issue: Towards a More Sustainable Agriculture

- This special issue compiles 12 new essays on various aspects of sustainable agriculture, including fossil fuel use, organic vs. conventional methods, pest control, and rotational planting.
- Paoletti, M.G., Gomiero, T., & Pimentel, D. (Eds.). (2011). Special Issue: Towards a More Sustainable Agriculture. *Critical Reviews in Plant Sciences, 30*(1-2). https://www.tandfonline.com/toc/bpts20/30/1-2

3. What is Sustainable Agriculture? A Systematic Review

- This structured literature review aims to advance the definition and understanding of sustainable agriculture from the perspective of sociology and governance. Authors identify overall ideals and aspects; identify patterns of adoption and application; and, evaluate how different ideas are combined in scientific debate to manage the issue's complexity and multiplicity
- Velten, S., Leventon, J., Jager, N., & Newig, J. (2015). What Is Sustainable Agriculture? A Systematic Review. *Sustainability,* 7(6), 7833-7865. https://doi.org/10.3390/su7067833

Related SESYNC Content:

- Doran, E.M.B., Doidge, M., Aytur, S. et al. (2022). Understanding farmers' conservation behavior over time: A longitudinal application of the transtheoretical model of behavior change. *Journal of Environmental Management, 323*, 116136. https://doi.org/10.1016/j.jenvman.2022.116136
- Read, Q.D., Hondula, K.L., & Muth, M.K. (2022). Biodiversity effects of food system sustainability actions from farm to fork. *Proceedings of the National Academy of Sciences, 119*(15), e2113884119. https://doi.org/10.1073/pnas.2113884119

- Zimmerer, K.S., Duvall, C.S., Jaenicke, E.C. et al. (2021). Urbanization and agrobiodiversity: Leveraging a key nexus for sustainable development. *One Earth, 4*(11), 1557-1568. https://doi.org/10.1016/j.oneear.2021.10.012
- J Mason, R.E., White, A., Bucini, G. et al. (2020). The evolving landscape of agroecological research. *Agroecology and Sustainable Food Systems, 45*(4), 551-591. https://doi.org/10.1080/21683565.2020.1845275

This work was supported by the National Socio-Environmental Synthesis Center (SESYNC) under funding received from the National Science Foundation DBI-1639145.