Exercises for Use with the
People in Watersheds/System Integration (PE/WI)
Land-Use Learning Game and Tool

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Play PE/WI online at: www.nrem.iastate.edu/landscape/pewi

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Exercise 1: Ecological Functions
Learning objective: Users should understand that watershed outputs are linked to land use and land cover.
Activity: For year one, design a scenario with all conventional corn and soybeans. Review the scores, maps, and results. For year two, now turn everything to perennial vegetation. Carefully examine the differences. Write a brief (2-3 sentences) description of each scenario in terms of the quantity and arrangement of land cover types. Answer the following questions.

Questions:
• Which scenario has the highest potential to produce the following ecosystem goods: crops, timber, cattle (Hint: click on the upper right buttons to view indicators)?
• Which scenario has the highest potential to produce the following ecosystem services: habitat for biodiversity, carbon storage, and water quality? What is carbon storage? How are you evaluating water quality impacts using the model?
• Which land cover types are perennial types? How does the presence of perennial vegetation in the watershed relate to the delivery of these services?

Exercise 2: Ecological Functions and Conservation Practices
Learning objective: Users should understand how conservation practices, including in-field and edge-of-field (i.e., riparian buffers) practices, impact watershed outputs.
Activity: Start at year one with an all conventional corn and soybean scenario. For year two, go back and use conservation corn and soybean instead. Start changing land covers along the stream to perennial land uses and locations with poor drainage to wetlands. Answer the following questions.

Questions:
What are “conventional” practices and “conservation” agricultural practices?

What is an in-field conservation practice and what are they designed to do? How do they impact gross erosion and the phosphorous index? How about in-stream sediment levels? How about in-stream nitrate concentration? Explain differences in the response of these indicators.

What does it mean for a stream to be “buffered” versus “unbuffered”? Which indicators respond to buffering? Do their responses make sense; why or why not?

Why are the strategic wetland locations optimal places to impact watershed outputs? (Hint: Find strategic wetland locations by clicking the “Physical Features” tab on the left.)

Exercise 3: Targeting

Learning objective: Users should understand that some locations within watersheds have greater positive or negative impact on watershed outputs than others, due to their environmental configuration.

Activities:

Create a scenario that depicts an agricultural production landscape. Record watershed outputs associated with this scenario for later referral (Hint: Exact numbers associated with outputs can be found by clicking the “Results” tab on the right).

Re-design this watershed using the land cover tools on the left. First, attempt to dramatically improve the watershed’s water quality while keeping the loss of crop productivity to a minimum. Use the information displayed in the pre-determined physical feature maps (topographic relief, flood frequency, subwatershed boundaries, strategic wetland areas, and drainage class) to assist in your re-design of this watershed. Once you are satisfied with your new design, briefly describe your amendments to the first scenario and their impacts on watershed outputs (3-5 sentences).

Next, attempt to dramatically improve the watershed’s ability to provide habitat for biodiversity while again keeping the loss of crop productivity to a minimum. Once you are satisfied with your design, briefly describe your further amendments and their impacts on watershed outputs (3-5 sentences).

Answer the following questions:

Questions:

What are topographic relief, flood frequency, subwatershed boundaries, strategic wetland areas, and drainage class, and why are they important?


Examine PE/WI’s flowmap (link provided on LESEM PE/WI webpage). Which factors vary based on location in the watershed? In other words, what specifically needs to be considered when spatially targeting management practices to meet outcomes over watershed scales?

Conceptually, what is RUSLE and what are key variables related to it?

Examine the factors considered in the Biodiversity Index and Game Wildlife Index. Do you find any of the factors considered surprising; why or why not?

Exercise 4: Inter-annual Variability

Learning objective: Users should understand that differences in land-use outcomes are influenced by changes that occur over time.
Activity: Starting from year 1, create a scenario that depicts an agricultural production landscape with at least three crops. Then click on year 2 and year 3. Record the precipitation levels each year (hint: at the bottom of the “Results” page). Click on the “Score” tab and briefly (3-5 sentences) describe how the land-use outcomes vary from year to year. For years with lower scores, try to adjust your design to improve your score. Answer the questions below:

Questions:

- What differences in the watershed occur over time?
- How do the land-use outcomes (Hint: Click on the “Score” tab) respond to those differences?
- What strategies did you use to improve your score?
- Which scores were you successful in improving, and which scores were you not successful in improving?
- Do certain land covers perform better in wet or dry climate years compared to normal years, and what properties of those land covers explain these differences?
- How would you expect a continuous land cover to perform over time compared to rotating land covers?

Exercise 5: Land-use Tradeoffs

Learning objective: Users should understand that tradeoffs exist among land cover types and their location in achieving multiple outputs from watersheds. Users should also understand how to enhance co-benefits (multiple ecosystem goods and services) from land cover types and their locations.

Activity: Starting from scratch, select different land cover types from the “Land Cover” tab to design a watershed that maximizes all watershed outputs, including both ecosystem goods (i.e., crops, timber, cattle) and services (i.e., habitat for biodiversity, carbon storage, and water quality). Once you are satisfied, briefly (3-5 sentences) describe the characteristics of your scenario in terms of land cover composition and placement, as well as key decisions you made in developing it. Record the watershed outputs (hint: use “Results” tab on the right to access specific numbers). Answer the questions below and be prepared to present your results to the entire group.

Questions:

- List six challenges to achieving your design: two economic, two ecological, and two social.
- What government cost-share programs could you access to help achieve your watershed design?
- What organizations or institutions could help increase social, economic, and government support for your watershed design?
- Where in the watershed would these programs be applicable?
- What other trade-offs exist that are not presented in PE/WI?