**“Money Growing on Trees” Instructor How-To:**

Before session:

* Prepare the spreadsheet:
  + Delete data if necessary
  + If desired, add or delete contract periods by pasting copies of worksheets or deleting worksheets respectively
    - You don’t have to delete worksheets for contract periods you will not run, but if you don’t, they might confuse the participants if you share the spreadsheet with them later.
    - If you add or delete contract periods, update the “summaries” worksheet to sum only, and all of, the contract periods that will actually be run.
  + If you want to change any parameters, do so in the “params” worksheet.
  + Decide in advance how you plan to assign participants to communities (if you plan to use the treatments with community decision-making).
* Ensure that Excel on the computer that you will use to project the spreadsheet during the session is set to automatically perform calculations.[[1]](#footnote-1)
* If desired, modify our slides to customize them to your needs. However, if you use slides, you’ll have to switch the projector back and forth between the spreadsheet and the slides. Alternately, instead of slides, you can write information on the board.
* If desired, modify the instructions to match any changes made to the game. You may also want to customize the instructions to cater to local features; for example, you can make the name of the fictional country be a play on a school mascot.
* If possible, send the instructions and any desired reading materials to participants.
* If you want to make decisions anonymous:
  + Prepare some way to assign ID numbers anonymously to participants, e.g. shuffle numbered notecards and hand them out randomly in class
  + Prepare a Google Form in which participants can submit their ID number and decision for each round; you can use a different form for each round, or use a single form and then either include round number as a thing they would enter or simply rely on the timestamp to differentiate rounds.
  + Note: the rest of this document will assume you will use non-anonymous verbal decisions; if you choose the anonymous Google Form, your decision recording will consist of opening the Google Sheet associated with the Google Form, sorting the decisions for that round by ID number, and pasting the IDs and decisions into the recording spreadsheet.

Bring to session:

* If you plan to pay one or more participants their earnings: money (in one dollar bills, up to $10 per payee if possible; you could include change but people rarely mind rounding up); alternately, you can use a payment app. We prefer payment to happen right away at the end of the session so everyone can see that it really happens.
* Playing cards. A full deck well shuffled would work; you want to ensure that about 5-20% of the cards are either jokers or face cards.
* Printed instructions, one for each participant (or, if they will be in teams, for each team).
* If desired, printed background handouts, though we prefer to distribute them in advance.

In the session: (note we suggest some discussion topics in relevant places; more detail is in our accompanying paper)

* On the computer that will be projected, open the spreadsheet (and, if desired, the slides).
* Distribute to each person or team:
  + Instructions
  + A playing card (don’t let them look through the deck to choose their own card, but once they have their card they need not keep it hidden)
* Tell players to read the instructions and record their card numbers on the recording sheet on the last page.
* We find it useful to give background about the context before playing the game. The slide deck we provide does this. The basic points we make sure to hit are:
  + Climate change is a problem.
  + We can fight it by reducing sources or increasing sinks.
  + Some entities (e.g., firms or countries) are regulated in a way that forces them to reduce their emissions or are self-regulating (voluntarily reducing emissions without being forced to do so).
    - They can do it directly by cutting down on activities that create emissions (sources); for example, they can reduce their energy use.
    - Alternatively, they can cut emissions indirectly by paying a non-regulated entity to reduce an emissions source or increase a sink. This is an offset.
  + Deforestation is a significant source of net greenhouse gas emissions, and afforestation and forest management may have a large potential to increase sinkage of greenhouse gases.
  + People across the world have been working for a while to generate forest-based offsets to integrate into climate change regulation systems.
  + These are often PES systems: since the preserved forest is providing ecosystem services that are a global public good, the PES system monetizes those benefits, i.e., it internalizes the externality to incentivize optimal conservation (if the payment is of the right size).
  + They reduce deforestation as compared to some baseline; here, the baseline is an expectation that that the forest area the offset corresponds to would be cut down if the offset had not been created.
  + An example is the UN-REDD Programme
* Next, summarize basic information about the game:
  + You’re rural households.
  + You do subsistence farming and exploit the local forest to support your family.
  + Your forest exploitation can hurt the forest, which is bad because the forest provides global public goods, including carbon sequestration.
  + Let’s see how a payment for environmental services scheme can change your choices about whether to harvest from the forest.
  + Your earnings in a contract period come from:
    - Farming Income – subsistence (usually $70).
    - Forest Harvesting – if you harvest from the forest, you get a harvest value of $10\*your playing card number (or 0 for jokers and face cards).
    - PES Payment – payment for being in a PES contract (usually $50).
    - (Policing or Fines) – in treatments where there can be illegal harvest, you may lose money to police your community or as fines for cheating.
* As you record information and decisions from the participants, it is useful to project your progress on the screen so participants can correct any mistakes you make.
* Enter participants’ Harvest Values in the spreadsheet, and have them record their ID numbers:
  + Project the spreadsheet on the screen and go to the “enter-harv-val” worksheet
  + Go around the room and have each participant call out their card number (Harvest Value), recording them in the yellow “Harv Val” column.
  + As you do, participants must record the ID number this process assigns them.
  + Make this process brisk (each person calls out their number right away when you get to them and you type it quickly), and proceed around the room in an order you can replicate each time (e.g., go across one row then the next, etc.).
  + Record J, Q, K, or 0 for jokers and face cards – any of these works, and the spreadsheet is not case sensitive.
* Next, you are ready to start your first contract period. Skip up to the bullet point with the contract period you will start with. First, some general thoughts:
  + Even if you are projecting slides with detailed instructions, it’s often helpful to also write basic information on the board because eventually you will return to projecting the spreadsheet and you need participants to remember the rules.
  + When you record decisions, in most cases, they are binary (yes or no) decisions. Be sure to ask the question in an unambiguous way that can be answered with just the word “yes” or the word “no,” and ask it in such a way that their “yes” always corresponds to you typing “1” – this will make recording much faster.
  + After you have collected all decisions, let people check their earnings against the “Earnings” column in the spreadsheet (you may have to zoom and scroll).
  + If desired, after a round you can navigate to the “summaries” worksheet to show the summary table. Alternatively, you can wait to do this at the end of the game.
  + We recommend you keep the spreadsheet projected at all times throughout the game (except when you are showing slides if you choose to do so). Each contract period has its own worksheet that you’ll be working in and projecting.
* Contract Period 0: Baseline
  + Write on the board: “No PES payment; decision: harvest or no”
  + On their Recording Sheets, participants must circle their choice (Harvest or No) and fill out the resulting earnings.
  + Go around the room and have each participant call out their harvest decision, and record them in the yellow “Harvest?” column.
  + Key things to discuss:
    - Each household’s marginal abatement cost in this context is an opportunity cost: the foregone benefits from forest exploitation.
    - Likely, almost everyone, except people with jokers and face cards, chose to harvest because they have positive abatement costs; this establishes a baseline amount of conservation.
    - If anyone diverges from this, you can interrogate that deviation; it might be a result of confusion (which gives you the opportunity to clear that up) or of something like a desire to conserve (which is fruitful to discuss).
* Contract Period 1: Payments for Ecosystem Services (PES)
  + Write on the board: $50 PES payment, no illegal harvest
  + On their Recording Sheets, participants must circle their choice (PES or No) and fill out the resulting earnings.
  + Go around and have each participant call out their decision (to adopt PES or not), and record them in the yellow “PES?” column. Note the “Yes” in this round has an inverse meaning compared to the last round (“Yes” in CP0 means “yes, I will harvest” and in CP1 means “no, I won’t harvest, I will take a PES contract”).
  + Key things to discuss after round is complete:
    - Same as those listed under Contract Period 0, plus…
    - Cost effective conservation minimizes costs of reaching a given amount of conservation.
    - If the regulator knew everyone’s costs, they could choose parcels to conserve to minimize costs. Since they don’t, but households know their own costs, this system lets households opt in based on private information.
    - Additionality:
      * De facto: if you ran CP0, anyone who did not harvest in CP0 but took a contract in CP1 is non-additional
      * Theoretical: any household with a joker or face card that took a PES contract (which all should have) is non-additional
* Contract Period 2: PES + Illegal Harvest
  + Write on the board: $50 PES payment, illegal harvest possible. 25% chance of audit. If caught, lose: PES payment, harvest earnings, AND $70 fine
  + On their Recording Sheets, each participant must circle their choices: (PES or No) and Illegal Harvest (Y or N). They cannot yet record their earnings until you announce the audit outcomes (unless they didn’t harvest illegally).
  + Go around and have each participant call out their contract adoption decision, and record them in the yellow “REDD+?” column; if they took a contract they must also tell you whether they harvest. If they take a PES contract and harvest (illegally), type “1” in the yellow “Harvest?” column to override the formula.
  + Once you have recorded all of the decisions, determine who is audited. The randomizer re-runs each time you type anywhere in the worksheet; you can just use the audits that were determined when you typed the last decision, but we like to run it one more time to add drama (e.g., double-click in a cell then hit enter).
    - To make it stop re-randomizing, select the “Audit?” column, copy it, and paste its \*values\* (using Paste Special) on top of the existing cells.
  + When you show the outcomes, explicitly identify which illegal harvesters were audited.
  + Key things to discuss:
    - Verifiability: explain why it’s hard to verify forest-based offsets and how that can undermine an offset system.
    - Rational crime theories: back to Becker (1968), economists have not used complicated psychology to explain why people commit crimes, but have just assumed people weigh the costs and benefits of so doing.
* Conservation Period 3: Harvest Uncertainty
  + Write on the board: $50 PES payment, no illegal harvest; harvest value has 50% chance of being 20x card and 50% chance of 0
  + On their Recording Sheets, participants must circle their choice (PES or No). If they harvest, they can’t write their earnings yet because they don’t know if they will have a shock.
  + Go around and have each participant call out their PES decision, and record them in the yellow “PES?” column.
  + Once you have recorded the decisions, determine who will receive shocks. The randomizer re-runs each time you type in the worksheet; you can just use the set of shocks that were determined when you typed the last decision, but we like to run it one more time to add drama (e.g., double-click in a cell then hit enter).
    - To make it stop re-randomizing, select the “Shock?” column, copy it, and paste its \*values\* (using Paste Special) on top of the existing cells.
  + When you show the outcomes, explicitly identify who got shocks.
  + Key things to discuss:
    - How did people make their decisions? Was it just based on expected value? Did anyone change their decision versus the baseline round?
* Conservation Period 4: Auction
  + Write on board: auction! Write down dollar bid. Lowest 50% of bids are accepted and receive a PES payment equal to the lowest not-accepted bid
    - This is hard to understand, so use a picture: write a vertical list of (an even number of) bids, ordered from highest to lowest.
    - Draw a line at the median.
    - All bids below the median line are accepted (“win”).
    - The bid just above the median is the *lowest bid not accepted*; the amount of this bid is the PES payment for everyone who won the auction.
  + On their Recording Sheets, participants must write down their bids. They can’t yet fill out the resulting earnings because they don’t know if they won the auction.
  + Go around and have each participant call out their bid, and record them in the yellow “Bid” column.
  + Go to the “summaries” worksheet, where the summary block shows, in the column for the auction treatment, the median bid and the auction payment. Remind participants that everyone who bid BELOW the median bid wins the auction and thus has a PES contract, and everyone else harvests.
  + Key things to discuss:
    - If we know all the opportunity costs, we can design a flat payment and an auction to conserve the same amount of land. Both will be cost effective.
    - But if don’t know the distribution of opportunity costs, the auction should reveal those values and thus achieve the desired conservation target.
    - Auction theory: second price auctions are incentive compatible. This is because if your bid determines both *whether you win* and *what you pay*, you shade your bid down; in this kind of auction, your bid just determines *whether* you win so you have an incentive to bid your true value.
* Contract Period 5: Community
  + Write on board: Community
    - 1. Decide as community (5 minutes to talk):
      * a) whether to be in a PES contract
      * b) how to divide up payments if so
  + Emphasize that PES participation is “all or nothing” within a community: all community members are in a contract, or none are.
  + Defining communities:
    - The blue “Comm #” column has community numbers in it.
    - You can use the pre-populated community numbers, which create 6-person communities, though the last community will be a residual so may be much smaller. Alternatively, you can change community numbers by typing new numbers or formulae in the blue column: count people off (count 1-2-3… etc. and then tell all the 1’s to get together, all the 2’s, etc.), use a different random number generator (with “rand()” or “randbetween()”), or whatever you choose.
    - The default structure may create groups of people who are mostly already sitting near each other because they are adjacent ID’s; it might be more fun to mix it up a bit.
    - If you change the community numbers, sort the spreadsheet by community number (the blue column) to make it easier to enter group decisions.
  + Once communities are defined, people need to gather with their communities.
  + Give them up to 5 minutes with their groups to decide whether to take a PES contract and, if so, how to allocate the PES payments across the members.
    - Let each community decide how the group is to make its decision.
    - They record their decision by circling PES or No on their Recording Sheets, and by each writing the appropriate amount in the PES payment column. They can calculate their final payments right away.
  + Go around and have each group call out their contract adoption decision (record in the “REDD+?” column) and, if they took a contract, how they decided to divide up payments (if the payments are not equal, override the automatically populated “PES Pmnt” column amount by typing the amount each household is to receive).
  + Key things to discuss:
    - Often, individual contracts between the PES authorities and households are not feasible because of high transaction costs or because many forests are community owned or managed, so this configuration is more realistic.
    - The literature on community governance (e.g., Ostrom), shows that sometimes it works well and sometimes not! Why might that be?
    - Equity and power within community can determine whether these contracts are taken and who benefits and loses out.
* Contract Period 6: Community + Illegal Harvest – this is the most complicated treatment, and takes the longest to run. You should run CP5 first so they get the hang of working with their groups. You might want to play this treatment at least twice if you have time!
  + Write on board: community + illegal harvest!
    - 1. Decide as community (3 minutes to talk):
      * a) whether to be in a PES contract
      * b) how to divide up payments if so
    - 2. If they adopt PES, decide as a group whether to police themselves (at $5/household). If they do police themselves, illegal harvest becomes impossible.
    - 3. If they adopt PES and do not police themselves, each household privately decides whether to harvest.
    - 4. Government audits each community that accepted a PES contract and that doesn’t police itself with probability 10% times the number of people who harvest illegally. If they detect any illegal harvest, the PES contract is invalidated (everyone loses the PES payment and any harvest they got) plus the whole community is fined (at $70 per community member).
  + Note that participation in PES is all or nothing within a community, but the illegal harvest decision is at the household level.
    - If your groups are going to be particularly large or small, you might want to change that 10% value by which illegal harvest increases audit likelihood to be smaller or larger respectively. You can do this in the “params” worksheet; it’s the parameter “community per-illegal harvester audit probability increment”
  + Use the same communities as you used in CP5.
    - If you have more than 20 communities, go to the “params” worksheet to add higher “Comm #” values to the block there to get audit outcomes.
  + Give participants up to 3 minutes with their groups to discuss and make decisions.
    - Let each community decide how the group is to make its decision.
    - They record their decision by circling PES or No on their Recording Sheets, and by each writing the appropriate amount in the PES payment column. If they took a PES contract and decided to police themselves, they can write $5 in the “Policing, Fines, etc.” cell.
    - They can calculate final earnings right away if they did not take a PES contract or if they took a contract and policed themselves. Otherwise, wait.
    - Groups that took a PES contract but did not police themselves should have everyone record their Illegal Harvest (Y or N) decision in private (e.g., walk away from the group to decide, then fold the paper to hide their decision).
  + Go around and have each group call out:
    - Their PES decision (record in the “REDD+?” column)
    - If they took a contract
      * How they decided to divide up payments (if the payments are not equal, override the automatically populated “PES Pmnt” column amount by typing the amount each household is to receive)
      * Whether they policed themselves
      * If they did not police themselves, ask each community member whether they harvested illegally. This part can get fun.
  + Once you have recorded all of the decisions, determine who is audited. The randomizer re-runs each time you type anywhere in the worksheet; you can just use the audits that were determined when you typed the last decision, but we like to run it one more time to add drama (e.g., double-click in a cell then hit enter).
    - To make it stop re-randomizing, select the “Audit?” column, copy it, and paste its \*values\* (using Paste Special) on top of the existing cells.
  + Key things to discuss:
    - Community and peer enforcement: people may have motives for and against enforcing rules in their own neighborhoods.
* Pick participants for payment
  + Go to the “summaries” worksheet, and find the orange block for payments.
  + Two IDs will already have been selected randomly as the randomizer reruns each time anything is typed in the workbook.
    - Again, you can use the last-generated random values, or build suspense by typing elsewhere in the sheet.
    - To make it stop re-randomizing, select the “ID” cells in the orange block, copy, and paste \*values\* (using Paste Special) on top of the existing cells.
    - If you want to pay more than two people or teams, you can copy and paste the cells we have provided as many times as you like.
* Review the summary table and graphs, and discuss further

1. On a PC:

   2003: Tools > Options > Calculation > Calculation > Automatic.

   2007: Office button > Excel options > Formulas > Workbook Calculation > Automatic.

   2010 and 2013: File > Options > Formulas > Workbook Calculation > Automatic.

   On a Mac:

   2008: Excel Preferences > Calculation > Automatically. [↑](#footnote-ref-1)