Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Farmers and ranchers use tools and farming methods to help them protect the plants and animals they grow as well as our natural resources. Science and technology help farmers manage these resources.

**Instructions:**

Read the following examples of tools and methods farmers use to conserve our natural resources. Under the description, 1) identify the natural resources that are being managed or conserved, and 2) draw a picture of the tool or method based on the description.

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| Conservation TillageAfter farmers harvest a crop an empty field is vulnerable to soil erosion from wind and water. To combat this, farmers practice conservation tillage where they leave crop residue (stalks, stems, seeds) in their fields without plowing it under in the fall. Then, in the spring, they will plant the next crop using an air seeder, a machine that precisely plants the seeds at equal distances, and depth in the soil and then covers them. This eliminates the need to plow the soil which improves water use efficiency in crops.**Resource(s) impacted by method: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ What do you think this looks like in the real world (draw picture below)?** |
| **Drought Tolerant Seeds**Drought Tolerant seeds enable farmers to grow crops in areas that may have a very limited water supply. Genes among various crops that are identified as drought tolerant will help increase yield and decrease water usage. **Resource(s) impacted by method: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** **What do you think this looks like in the real world (draw picture below)?** |
| Capture and Reuse of RunoffA large amount of flood irrigated water is wasted because it runs off the edges of the fields. Farmers can capture the runoff in ponds and pump it back up to where it can be reapplied to the field for the next cycle of irrigation.**Resource(s) impacted by method: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** **What do you think this looks like in the real world (draw picture below)?** |
| Riparian BufferA riparian area, or buffer, is a space between land and a waterway, ideally filled with native grasses, shrubs and trees. Landowners can improve water quality by preserving wetland and riparian areas, which have many benefits. These areas help filter nutrients that are collected as water runs over the land; help control water levels during floods; and provide habitat for animals. **Resource(s) impacted by method: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** **What do you think this looks like in the real world (draw picture below)?** |
| DronesDrones can be used in agriculture for mapping, surveying, monitoring, planting, crop dusting, and spraying. Precise soil analysis maps produced by drones help direct seed planting patterns, irrigation, and nitrogen-level management. Nutrients, moisture levels, and overall crop health is monitored in real-time by drones equipped with hyper-spectral, multispectral, and thermal sensors. Scanning crops with visible and infrared (IR) light, drones can identify plants infected by bacteria or fungus, helping to prevent disease from spreading to other crops. This technology enables detection of some diseases before they are visible to the human eye.**Resource(s) impacted by method: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** **What do you think this looks like in the real world (draw picture below)?** |
| Self-driving tractors Vehicles that use GPS and other wireless technologies to farm land. Self-guidance systems reduce the amount of overlap caused when tractors crisscross a field. Reducing overlap cuts down on seed, fertilizer, and pesticide waste. It also reduces the number of times farm equipment travels over a section of land. Since farm equipment is large and heavy it can cause soil compaction, when soil particles are pressed together reducing pore space. Smaller pores aren’t as affective in moving water downward through the soil. Driving hands-free enables the farmer to manage other aspects of their operation from the cab of their tractor. Farmers are also able to continue working their fields during low visibility conditions such as rain, dust, fog, and darkness. **Resource(s) impacted by method: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** **What do you think this looks like in the real world (draw picture below)?** |
| Precision AgricultureInformation technology-based, site-specific farm management system that collects and responds to data ensuring that crops receive exactly what they need for health and productivity. Precision agriculture technologies help farmers identify and manage variability within fields and can optimize crop yields, maximize crop quality, and minimize the use of resources. Rather than apply water, fertilizer, and pesticides uniformly across entire fields, farmers can use data to target specific areas within the minimum quantities required. More efficient food production means lower costs to consumers, greater consumer choice, convenience, safer food, and greater food security.**Resource(s) impacted by method: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** **What do you think this looks like in the real world (draw picture below)?** |
| Strategic Livestock GrazingPeople can’t eat grass, but cattle and sheep can turn grass into beef and lamb. Ranchers may use their own private land to graze their animals or pay a fee to the government to lease public rangeland. Federal rangeland managers and private livestock owners work cooperatively to ensure that public rangelands are well cared for.Grass covers the soil and holds it in place, slowing runoff of rain, preventing erosion, and reducing the potential for floods. Grass traps and filters sediments and nutrients from runoff and helps water percolate through the soil and back into streams and groundwater. Cattle and sheep are like rangeland lawn mowers that can help care for grassland ecosystems. The moment grass is shorn, it seeks to restore a balance between its roots and leaves. When the tops of the grass leaves are eaten by grazing livestock, the same amount of root is lost. When the roots die, the soil’s population of bacteria, fungi, and earthworms gets to work breaking down the dying roots. This creates fertile organic matter that enriches the soil. Rich soils, in turn, support more grass growth. Grasses regrow from the bottom up. Because their growing point is low to the ground, grasses can usually recover well after grazing. However, repeated, heavy grazing can kill grass. When a grass plant is grazed very low to the ground, a large portion of its roots die, and it has little leaf area left to make energy through photosynthesis. Because the plant can’t generate much energy, it takes a long time for the roots to regrow, and the plant is very susceptible to drought. Proper management of grazing involves moving livestock to a new area before grasses are grazed too low and allowing grasses a period of rest to regrow leaves and roots before grazing them again. Grazing cattle aerate the soil with their hooves, scatter seeds, and trim wild grasses. Wildfires have a harder time taking hold on shorter, cropped grass than on longer vegetation. With proper management, grazing can be a tool for keeping rangelands healthy.**Resource(s) impacted by method: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** **What do you think this looks like in the real world (draw picture below)?** |

**Answer Sheet**

* Conservation Tillage

Resource(s) impacted by method: Soil and water

* **Drought Tolerant Seeds**

Resource(s) impacted by method: Water

* **Capture and Reuse of Runoff**

Resource(s) impacted by method: Water

* Riparian Buffer

Resource(s) impacted by method: Water (may elaborate to ecosystems, wildlife)

* Drones

Resource(s) impacted by method: Water and soil

* Self-driving tractors

Resource(s) impacted by method: Soil and water

* Precision Agriculture

Resource(s) impacted by method: Soil and water

* Strategic Livestock Grazing

Resource(s) impacted by method: Soil (may elaborate to ecosystems)