# Additional file 3. Classification of outcomes

This hierarchical classification scheme aims to capture all relevant environmental outcomes for our systematic review on invasive plant management.

**All outcomes**

1. Crops
   1. Crop yield (including cash crops and cover crops)
      1. Crop yield
         1. Crop biomass (including inedible components; e.g. the stems of some crops)
         2. Crop propagules (including cuttings and seeds not used for food, feed, fuel, etc.)
         3. Crop yield (including harvest index; also see "land" for land equivalency)
         4. Crop yield, n.e.c.
   2. Crop quality (including cash crops and cover crops)
      1. Crop appearance (including the size and shape of the edible parts)
      2. Crop cooking quality
      3. Crop storage quality
      4. Crop taste (including acidity, texture, etc.)
      5. Ash content of crops
      6. Dry matter content of crops (i.e. proportion or percentage; also see "Crop yield" for dry matter yield)
      7. Fibre content of crops
      8. Toxins in crops
         1. Agrochemicals in crops (e.g. pesticide residues)
         2. Heavy metals in crops (e.g. lead [Pb] or mercury [Hg])
      9. Toxins in crops, n.e.c. (e.g. cyanide)
      10. Chemical elements in crops
          1. Carbon (not including soil organic carbon)
          2. Plant macronutrients
          3. Nitrogen (N) in plants (including biological nitrogen fixation)
          4. Phosphorus (P) in plants
          5. Potassium (K) in plants
      11. Nutrients in crops
          1. Calories
          2. Micronutrients
          3. Minerals (e.g. calcium [Ca] and magnesium [Mg])
          4. Vitamins and provitamins (e.g. vitamin A or beta-carotene)
          5. Macronutrients
          6. Fat
          7. Protein
          8. Starch
          9. Sugar
      12. Crop quality, n.e.c.
   3. Crop damage, infection, and infestation (also see "pathogens, pests, and weeds")
      1. Crop damage or infection by pathogens (e.g. disease severity)
      2. Crop damage or infestation by pests
      3. Crop damage by weeds
      4. Crop damage, n.e.c.
   4. Crop growth and survival
      1. Crop growth
         1. Plant growth rate (e.g. photosynthetic rate or radiation use efficiency [RUE])
         2. Plant size (e.g. canopy cover, ground cover, leaf area index [LAI], or height)
      2. Crop survival (e.g. germination rate)
      3. Crop growth and survival, n.e.c.
2. Soil
   1. Soil structure and function
      1. Soil aggregation and erosion
         1. Soil aggregation
         2. Soil erosion (including soil loss through harvesting)
      2. Soil compaction, porosity, and water content
         1. Soil compaction
         2. Soil bulk density
         3. Soil porosity/infiltration rates (including hydraulic conductivity)
         4. Soil water content
      3. Soil chemistry
         1. Soil salinity (including sodium [Na])
         2. Cation exchange capacity (CEC)
         3. Electrical conductivity (EC)
         4. Soil pH
      4. Soil elements
         1. Soil organic matter (SOM) and soil carbon (C)
         2. Soil inorganic carbon
         3. Soil organic carbon (SOC)
         4. Soil organic matter (SOM)
         5. Soil total carbon
         6. Soil micronutrients and secondary nutrients (e.g. calcium [Ca] and magnesium [Mg])
         7. Soil macronutrients
         8. Nitrogen (N, including ammonium [NH4+] and nitrate [NO3-] in soils)
         9. Phosphorus (P) in soils
         10. Potassium (K) in soils
         11. Soil mineralization (decomposition from organic to inorganic forms)
         12. Soil nutrient leaching (including nitrate leaching [NO3-])
      5. Soil respiration (also see "pollutants (including greenhouse gases)")
      6. Soil temperature
      7. Soil texture (i.e. sand, silt, and clay content)
      8. Soil structure and function, n.e.c.
   2. Soil organisms (also see "biodiversity" and "pathogens, pest, and weeds")
      1. Soil microbes (not including pathogens), n.e.c.
         1. Bacteria (including nitrogen-fixing bacteria)
         2. Fungi (including mycorrhizae)
         3. Soil enzymes
         4. Soil microbial biomass
      2. Earthworms
      3. Nematodes (not including pests)
      4. Soil organisms, n.e.c.
3. Water
   1. Water use/loss
      1. Irrigation
      2. Evapotranspiration (including water use efficiency [WUE])
      3. Runoff
      4. Drainage
      5. Water use/loss, n.e.c.
4. Pathogens,and invasive animals and plants
   1. Pathogens
      1. Pathogens (bacteria)
      2. Pathogens (fungi)
      3. Pathogens (viruses)
      4. Pathogens, n.e.c.
   2. Invasive animals
      1. Invasive invertebrates
      2. Invasive vertebrates
      3. Invasive animals, n.e.c.
   3. Invasive plants
      1. Invasive plant abundance
         1. Invasive plant density
         2. Invasive plant biomass
         3. Invasive plant cover
      2. Invasive plant diversity
5. Pollutants (including greenhouse gases)
   1. Greenhouse gases
      1. Carbon dioxide
      2. Methane
      3. Nitrous oxide
   2. Air pollution
      1. Particulate matter (including dust)
      2. Air pollution, n.e.c.
   3. Soil pollution
      1. Biocides in soils (e.g. herbicides/pesticides)
      2. Heavy metals in soils
      3. Soil pollution, n.e.c.
   4. Water pollution
      1. Anoxia and eutrophication
      2. Biocides in water (e.g. herbicides/pesticides
      3. Nitrates in water
      4. Sediments in water
   5. Water pollution, n.e.c.
6. Chemicals and energy
   1. Agrochemicals
      1. Biocides (e.g. herbicides/pesticides)
      2. Fertilizers and other soil amendments (e.g. nitrogen use efficiency [NUE])
      3. NEC. Agrochemicals, n.e.c.
   2. Energy
      1. Electricity
      2. Fuel (e.g. tractor fuel)
      3. Energy, n.e.c.
7. Money, labor, and time
   1. Money
      1. Money, n.e.c.
   2. Labor
      1. Animal labor
      2. Human labor
      3. Labor, n.e.c.
   3. Time
      1. Time, n.e.c.
8. Land
   1. Agricultural land
      1. Agricultural land use (e.g. land equivalency ratio [LER])
      2. Agricultural land, n.e.c.
   2. Semi-natural land
      1. Semi-natural land use (e.g. area conserved)
      2. Semi-natural land, n.e.c.
9. Biodiversity (excluding crop, livestock, and pest/invasive species)
   1. Animals (not including livestock or pests)
      1. Amphibians
         1. Amphibian abundance
         2. Abundance of amphibians as natural enemies of crop pests
         3. Amphibian diversity
         4. Diversity of amphibians as natural enemies of crop pests
      2. Birds
         1. Bird abundance
         2. Bird diversity
      3. Invertebrates (including insects and other arthropods)
         1. Invertebrate abundance
         2. Invertebrate diversity
      4. Mammals
         1. Mammal abundance
         2. Mammal diversity
      5. Reptiles
         1. Reptile abundance
         2. Reptile diversity
      6. Animals, n.e.c.
   2. Plants (not including crops or weeds)
      1. Plants (functional form not specified)
         1. Plant abundance
            1. Plant density
            2. Plant biomass
            3. Plant cover
         2. Plant diversity
      2. Grasses
         1. Grass abundance
            1. Grass density
            2. Grass biomass
            3. Grass cover
         2. Grass diversity
      3. Forbs
         1. Forb abundance
            1. Forb density
            2. Forb biomass
            3. Forb cover
         2. Forb diversity
      4. Shrubs
         1. Shrub abundance
            1. Shrub density
            2. Shrub biomass
            3. Shrub cover
         2. Shrub diversity
      5. Trees
         1. Tree abundance
            1. Tree density
            2. Tree biomass
            3. Tree canopy cover
         2. Tree diversity
      6. Plants, n.e.c.
   3. Fungi (not including crops or mycorrhizae)
      1. Mushrooms
         1. Mushroom abundance
         2. Mushroom diversity
      2. Fungi, n.e.c.