Figure S1. Diagram for the 2-year rotation model used in STELLA™.
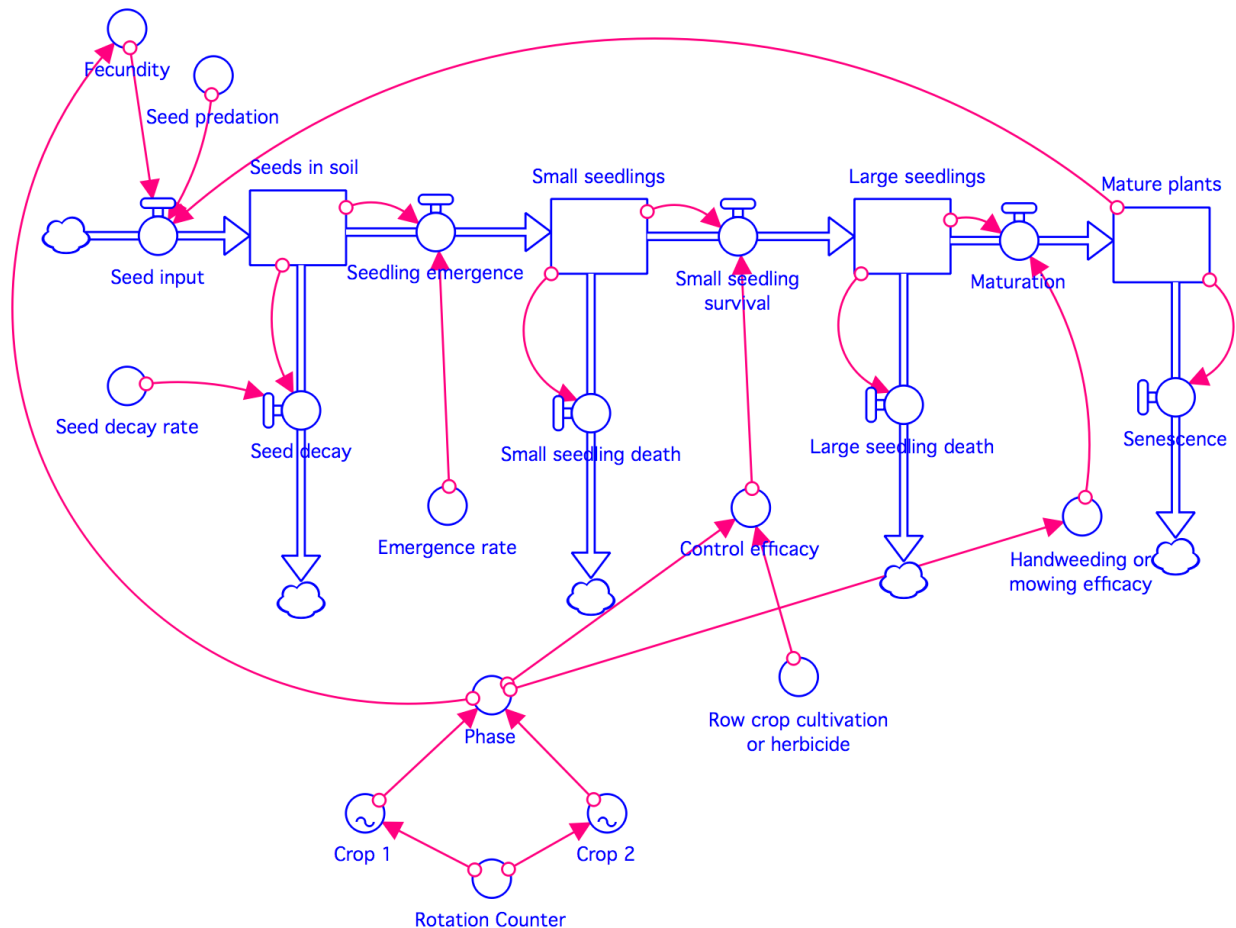

Table S1. Equations for the 2-year rotation model used in STELLA™.

Top-Level Model:
Large_seedlings(t) = Large_seedlings(t - dt) + (Small_seedling_survival - Maturation - Large_seedling_death) * dt
INIT Large_seedlings = 0
INFLOWS:
Small_seedling_survival = PULSE(Small_seedlings*(1-Control_efficacy), 2, 4)
OUTFLOWS:
Maturation = PULSE(Large_seedlings*(1-Handweeding_or_mowing_efficacy), 3, 4)
Large_seedling_death = PULSE(Large_seedlings, 3, 4)
Mature_plants(t) = Mature_plants(t - dt) + (Maturation - Senescence) * dt
INIT Mature_plants = 0
INFLOWS:

Maturation = PULSE(Large_seedlings*(1-Handweeding_or_mowing_efficacy), 3, 4)
OUTFLOWS:
Senescence = PULSE(Mature_plants,4,4)
Seeds_in_soil(t) = Seeds_in_soil(t - dt) + (Seed_input - Seed_decay -
Seedling_emergence) * dt
INIT Seeds_in_soil = 100
INFLOWS:
Seed_input = PULSE(Fecundity*Mature_plants*(1-Seed_predation),4,4)
OUTFLOWS:
Seed_decay = Seeds_in_soil*Seed_decay_rate
Seedling_emergence = PULSE(Seeds_in_soil*Emergence_rate, 1, 4)
Small_seedlings(t) = Small_seedlings(t - dt) + (Seedling_emergence -
Small_seedling_survival - Small_seedling_death) * dt
INIT Small_seedlings = 0
INFLOWS:
Seedling_emergence = PULSE(Seeds_in_soil*Emergence_rate, 1, 4)
OUTFLOWS:
Small_seedling_survival = PULSE(Small_seedlings*(1-Control_efficacy), 2, 4)
Small_seedling_death = PULSE(Small_seedlings, 2, 4)
Control_efficacy = IF Phase=1 THEN Row_crop_cultivation_or_herbicide ELSE IF
Phase=2 THEN Row_crop_cultivation_or_herbicide ELSE 0
Crop_1 = GRAPH(Rotation_Counter)
(0.000, 1.000), (0.500, 1.000), (1.000, 1.000), (1.500, 1.000), (2.000, 1.000), (2.500, 1.000),
(3.000, 1.000), (3.500, 1.000), (4.000, 0.000), (4.500, 0.000), (5.000, 0.000), (5.500, 0.000),
(6.000, 0.000), (6.500, 0.000), (7.000, 0.000), (7.500, 0.000)
Crop_2 = GRAPH(Rotation_Counter)
(0.000, 0.000), (0.500, 0.000), (1.000, 0.000), (1.500, 0.000), (2.000, 0.000), (2.500, 0.000),
(3.000, 0.000), (3.500, 0.000), (4.000, 1.000), (4.500, 1.000), (5.000, 1.000), (5.500, 1.000),
(6.000, 1.000), (6.500, 1.000), (7.000, 1.000), (7.500, 1.000)
Emergence_rate = 0.18
Fecundity = IF Phase=1 THEN 985 ELSE IF Phase=2 THEN 1400 ELSE 0
Handweeding_or_mowing_efficacy = IF Phase=1 THEN 0 ELSE IF Phase=2 THEN 0
ELSE 0
Phase = IF Crop_1=1 THEN 1 ELSE IF Crop_2=1 THEN 2 ELSE 0
Rotation_Counter = COUNTER(0,8)
Row_crop_cultivation_or_herbicide = 0.9899
Seed_decay_rate = 0.25
Seed_predation = 0.60

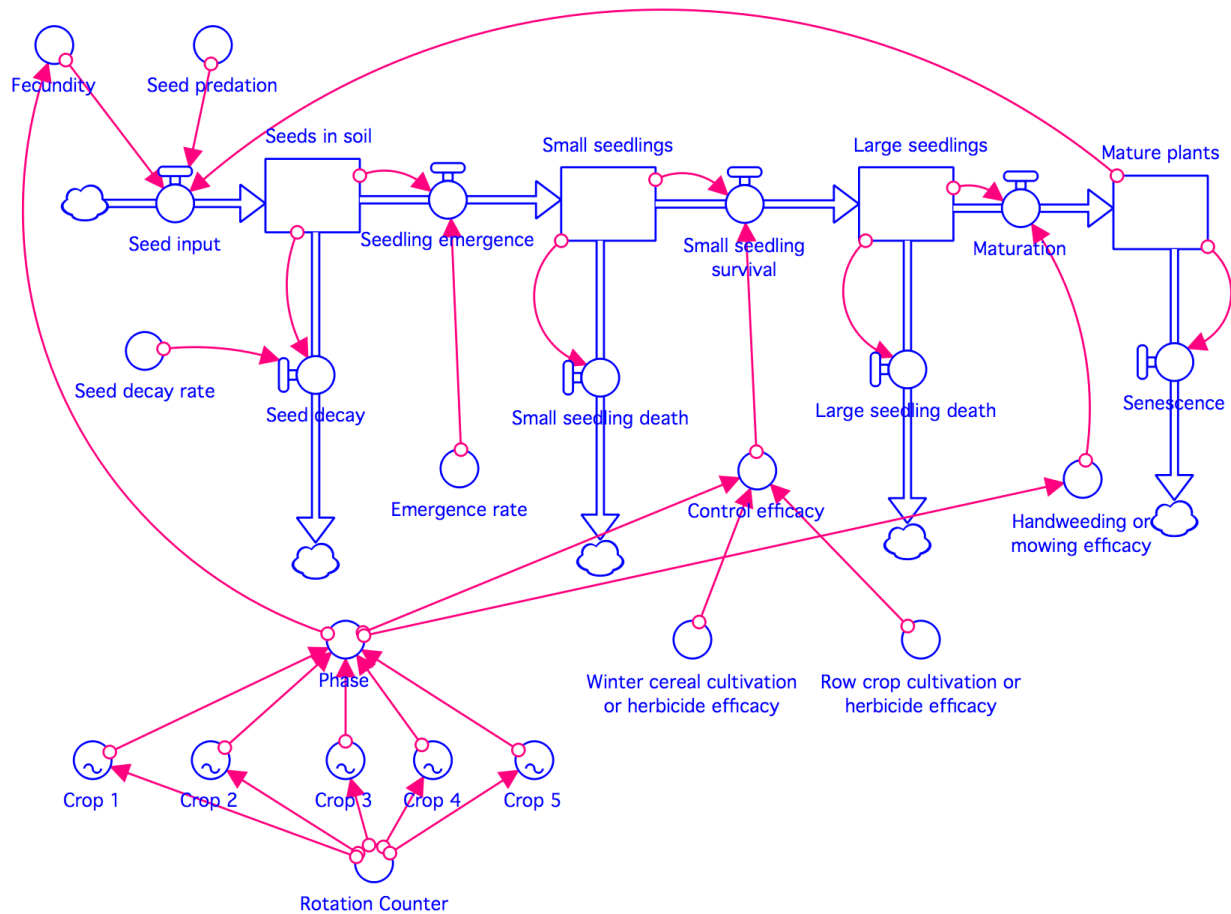**Figure S2.** Diagram for the 5-year rotation model used in STELLA™.

Table S2. Equations for the 5-year rotation model used in STELLA™.

Top-Level Model:
Large_seedlings(t) = Large_seedlings(t - dt) + (Small_seedling_survival - Maturation - Large_seedling_death) * dt
   INIT Large_seedlings = 0
   INFLOWS:
     Small_seedling_survival = PULSE(Small_seedlings*(1-Control_efficacy), 2, 4)
   OUTFLOWS:
     Maturation = PULSE(Large_seedlings*(1-Handweeding_or_mowing_efficacy), 3, 4)
     Large_seedling_death = PULSE(Large_seedlings, 3, 4)
Mature_plants(t) = Mature_plants(t - dt) + (Maturation - Senescence) * dt
   INIT Mature_plants = 0
   INFLOWS:
     Maturation = PULSE(Large_seedlings*(1-Handweeding_or_mowing_efficacy), 3, 4)

OUTFLOWS:

Senescence = PULSE(Mature_plants,4,4)

Seeds_in_soil(t) = Seeds_in_soil(t - dt) + (Seed_input - Seed_decay - Seedling_emergence) * dt

INIT Seeds_in_soil = 100

INFLOWS:

Seed_input = PULSE(Fecundity*Mature_plants*(1-Seed_predation),4,4)

OUTFLOWS:

Seed_decay = Seeds_in_soil*Seed_decay_rate

Seedling_emergence = PULSE(Seeds_in_soil*Emergence_rate, 1, 4)

Small_seedlings(t) = Small_seedlings(t - dt) + (Seedling_emergence - Small_seedling_survival - Small_seedling_death) * dt

INIT Small_seedlings = 0

INFLOWS:

Seedling_emergence = PULSE(Seeds_in_soil*Emergence_rate, 1, 4)

OUTFLOWS:

Small_seedling_survival = PULSE(Small_seedlings*(1-Control_efficacy), 2, 4)

Small_seedling_death = PULSE(Small_seedlings, 2, 4)

Control_efficacy = IF Phase=1 THEN Winter_cereal_cultivation_or_herbicide_efficacy ELSE IF Phase=2 THEN 1 ELSE IF Phase=3 THEN 1 ELSE IF Phase=4 THEN Row_crop_cultivation_or_herbicide_efficacy ELSE IF Phase=5 THEN Row_crop_cultivation_or_herbicide_efficacy ELSE 0

Crop_1 = GRAPH(Rotation_Counter)

(0.00, 1.000), (0.50, 1.000), (1.00, 1.000), (1.50, 1.000), (2.00, 1.000), (2.50, 1.000), (3.00, 1.000), (3.50, 1.000), (4.00, 0.000), (4.50, 0.000), (5.00, 0.000), (5.50, 0.000), (6.00, 0.000), (6.50, 0.000), (7.00, 0.000), (7.50, 0.000), (8.00, 0.000), (8.50, 0.000), (9.00, 0.000), (9.50, 0.000), (10.00, 0.000), (10.50, 0.000), (11.00, 0.000), (11.50, 0.000), (12.00, 0.000), (12.50, 0.000), (13.00, 0.000), (13.50, 0.000), (14.00, 0.000), (14.50, 0.000), (15.00, 0.000), (15.50, 0.000), (16.00, 0.000), (16.50, 0.000), (17.00, 0.000), (17.50, 0.000), (18.00, 0.000), (18.50, 0.000), (19.00, 0.000), (19.50, 0.000)

Crop_2 = GRAPH(Rotation_Counter)

(0.00, 0.000), (0.50, 0.000), (1.00, 0.000), (1.50, 0.000), (2.00, 0.000), (2.50, 0.000), (3.00, 0.000), (3.50, 0.000), (4.00, 1.000), (4.50, 1.000), (5.00, 1.000), (5.50, 1.000), (6.00, 1.000), (6.50, 1.000), (7.00, 1.000), (7.50, 1.000), (8.00, 0.000), (8.50, 0.000), (9.00, 0.000), (9.50, 0.000), (10.00, 0.000), (10.50, 0.000), (11.00, 0.000), (11.50, 0.000), (12.00, 0.000), (12.50, 0.000), (13.00, 0.000), (13.50, 0.000), (14.00, 0.000), (14.50, 0.000), (15.00, 0.000), (15.50, 0.000), (16.00, 0.000), (16.50, 0.000), (17.00, 0.000), (17.50, 0.000), (18.00, 0.000), (18.50, 0.000), (19.00, 0.000), (19.50, 0.000)

Crop_3 = GRAPH(Rotation_Counter)

(0.00, 0.000), (0.50, 0.000), (1.00, 0.000), (1.50, 0.000), (2.00, 0.000), (2.50, 0.000), (3.00, 0.000), (3.50, 0.000), (4.00, 0.000), (4.50, 0.000), (5.00, 0.000), (5.50, 0.000), (6.00, 0.000), (6.50, 0.000), (7.00, 0.000), (7.50, 0.000), (8.00, 1.000), (8.50, 1.000), (9.00, 1.000), (9.50, 1.000), (10.00, 1.000), (10.50, 1.000), (11.00, 1.000), (11.50, 1.000), (12.00, 0.000), (12.50, 0.000), (13.00, 0.000), (13.50, 0.000), (14.00, 0.000), (14.50, 0.000), (15.00, 0.000), (15.50, 0.000), (16.00, 0.000), (16.50, 0.000), (17.00, 0.000), (17.50, 0.000), (18.00, 0.000), (18.50, 0.000), (19.00, 0.000), (19.50, 0.000)

Crop_4 = GRAPH(Rotation_Counter)

(0.00, 0.000), (0.50, 0.000), (1.00, 0.000), (1.50, 0.000), (2.00, 0.000), (2.50, 0.000), (3.00, 0.000), (3.50, 0.000), (4.00, 0.000), (4.50, 0.000), (5.00, 0.000), (5.50, 0.000), (6.00, 0.000), (6.50, 0.000), (7.00, 0.000), (7.50, 0.000), (8.00, 0.000), (8.50, 0.000), (9.00, 0.000), (9.50, 0.000), (10.00, 0.000), (10.50, 0.000), (11.00, 0.000), (11.50, 0.000), (12.00, 1.000), (12.50, 1.000), (13.00, 1.000), (13.50, 1.000), (14.00, 1.000), (14.50, 1.000), (15.00, 1.000), (15.50, 1.000), (16.00, 0.000), (16.50, 0.000), (17.00, 0.000), (17.50, 0.000), (18.00, 0.000), (18.50, 0.000), (19.00, 0.000), (19.50, 0.000)

Crop_5 = GRAPH(Rotation_Counter)

(0.00, 0.000), (0.50, 0.000), (1.00, 0.000), (1.50, 0.000), (2.00, 0.000), (2.50, 0.000), (3.00, 0.000), (3.50, 0.000), (4.00, 0.000), (4.50, 0.000), (5.00, 0.000), (5.50, 0.000), (6.00, 0.000), (6.50, 0.000), (7.00, 0.000), (7.50, 0.000), (8.00, 0.000), (8.50, 0.000), (9.00, 0.000), (9.50, 0.000), (10.00, 0.000), (10.50, 0.000), (11.00, 0.000), (11.50, 0.000), (12.00, 0.000), (12.50, 0.000), (13.00, 0.000), (13.50, 0.000), (14.00, 0.000), (14.50, 0.000), (15.00, 0.000), (15.50, 0.000), (16.00, 1.000), (16.50, 1.000), (17.00, 1.000), (17.50, 1.000), (18.00, 1.000), (18.50, 1.000), (19.00, 1.000), (19.50, 1.000)

Emergence_rate = 0.18

Fecundity = IF Phase=1 THEN 3 ELSE IF Phase=2 THEN 0 ELSE IF Phase=3 THEN 0 ELSE IF Phase=4 THEN 985 ELSE IF Phase=5 THEN 1400 ELSE 0

Handweeding_or_mowing_efficacy = IF Phase=1 THEN 0 ELSE IF Phase=2 THEN 1 ELSE IF Phase=3 THEN 1 ELSE IF Phase=4 THEN 0 ELSE IF Phase=5 THEN 0 ELSE 0

Phase = IF Crop_1=1 THEN 1 ELSE IF Crop_2=1 THEN 2 ELSE IF Crop_3=1 THEN 3 ELSE IF Crop_4=1 THEN 4 ELSE IF Crop_5=1 THEN 5 ELSE 0

Rotation_Counter = COUNTER(0,20)

Row_crop_cultivation_or_herbicide_efficacy = 0.9140

Seed_decay_rate = 0.25

Seed_predation = 0.60

Winter_cereal_cultivation_or_herbicide_efficacy = 0.90