

turtles-own

```
[  
  water    ;; Amount of stored water  
  sugar    ;; Amount of stored sugar  
  adjacent ;; Holds the identity of the adjacent turtles when nutrients are being shared  
]
```

patches-own

```
[  
  moisture ;; Amount of water in the soil  
  light    ;; Amount of light available for the leaves to turn into sugar  
]
```

to setup-patches

```
clear-all  
ask patches  
[  
  ifelse pycor > 0  
  [ ;; Allocate Light  
    ifelse (random (world-width ^ 2)) < (nutrient-density * world-width)  
    [ set light random nutrient-concentration ]  
    [ set light 5 ]  
  ]  
  [ ;; Allocate Moisture  
    ifelse (random (world-width ^ 2)) < (nutrient-density * world-width)  
    [ set moisture random nutrient-concentration ]  
    [ set moisture 5 ]  
  ]  
]  
diffuse-light  
diffuse-moisture  
ask patches  
[  
  ifelse pycor > 0  
  [  
    set pcolor scale-color yellow light 14 -1  
    set moisture 5 ;; No moisture in the light area  
  ]  
  [  
    set pcolor scale-color blue moisture 14 -1  
    set light 5 ;; No light in the moisture area  
  ]  
  ;; draw the ground
```

```
    if pycor = 0 and abs pxcor > 2
      [ set pcolor gray ]
    ]
  reset-ticks
end
```

```
to diffuse-light
  diffuse light 0.1
  if max [light] of patches > 15
    [ diffuse-light ]
end
```

```
to diffuse-moisture
  diffuse moisture 0.1
  if max [moisture] of patches > 15
    [ diffuse-moisture ]
end
```

```
to setup-plant
  set-default-shape turtles "circle"
  ;; Kill the old Plant
  ask turtles [ die ]
  ;; Create the new Plant
  create-turtles 1
  [
    set color brown
    set sugar 5000
    set water 5000
    set heading 0
    hatch 1
    [
      set color green fd 1
    ]
  ]
end
```

```
to grow
  ask turtles [
    ;; Get Nutrients from environment
    ifelse color = green
    [ set sugar sugar + light ]
    [ set water water + moisture ]
  ]
end
```

```

;; Grow Plant
if random 100 < 1
[
  hatch 1
  [
    move
    ;; Five Conditions under which the new growth should be aborted
    if sum [count turtles-here] of neighbors >= 3 [ die ] ;; Overcrowding
    if any? other turtles-here [ die ] ;; Overlapping
    if color = green and pycor < 1 [ die ] ;; Leaves Underground
    if color = brown and pycor > 0 [ die ] ;; Roots Aboveground
    if pcolor = gray [ die ] ;; In the ground
    set sugar 1
    set water 1
  ]
]
share-with-gs
;; Use Resources
set sugar sugar - 0.1
set water water - 0.1
if sugar <= 0 or water <= 0 [ die ]
]
tick
end

```

```

to move
  ifelse cactus?
  [ ;; Plant grows up and down only
    set heading 180 * random 2
    rt 30 - 30 * random 3
  ]
  [ ;; Plant grows in all directions
    rt random-float 360
  ]
  ;; if this is the edge of the world obviously don't grow there.
  ifelse can-move? 1
  [ fd 1 ]
  [ die ]
end

```

```

to share-with-gs
  set adjacent nobody
  if any? turtles-at 1 1

```

```

[ set adjacent one-of turtles-at 1 1
  share-up
]
if any? turtles-at 0 1
[ set adjacent one-of turtles-at 0 1
  share-up
]
if any? turtles-at -1 1
[ set adjacent one-of turtles-at -1 1
  share-up
]
if any? turtles-at 1 0
[ set adjacent one-of turtles-at 1 0
  share-side
]
if any? turtles-at 1 -1
[ set adjacent one-of turtles-at 1 -1
  share-down
]
if any? turtles-at 0 -1
[ set adjacent one-of turtles-at 0 -1
  share-down
]
if any? turtles-at -1 -1
[ set adjacent one-of turtles-at -1 -1
  share-down
]
end

```

```

to share-up
  let old-water water
  set water 0.95 * water + 0.02 * [water] of adjacent
  ask adjacent [ set water 0.98 * water + 0.02 * old-water ]
end

```

;; Nutrients are shared equally, but the sharing is executed by the left turtle

```

to share-side
  let old-water water
  set water 0.95 * water + 0.05 * [water] of adjacent
  ask adjacent [ set water 0.95 * water + 0.05 * old-water ]
  let old-sugar sugar
  set sugar 0.95 * sugar + 0.05 * [sugar] of adjacent
  ask adjacent [ set sugar 0.95 * sugar + 0.05 * old-sugar ]

```

end

to share-down

let old-sugar sugar

set sugar $0.95 * \text{sugar} + 0.02 * [\text{sugar}] \text{ of adjacent}$

ask adjacent [set sugar $0.98 * \text{sugar} + 0.05 * \text{old-sugar}$]

end

; Copyright 1998 Uri Wilensky.

; See Info tab for full copyright and license.