

# Land Use Workgroup Phase 7 Activities

**Peter Claggett<sup>1</sup> and Sarah McDonald<sup>1</sup>**

<sup>1</sup> Lower Mississippi-Gulf Water Science Center, U.S. Geological Survey

**Land Use Workgroup Meeting  
March 20, 2024**

# LUWG Recommendations and Approvals Needed for Phase 7

- Phase 7 Land Use Recommendations
  - Land use classes for Phase 7 modeling.
    - Loads of the new classes?
  - Roll-up of high-resolution Land Use/Land Cover into the Phase 7 classes.
- Phase 7 Approvals
  - High-resolution Land Use/Land Cover for 2013/14-2021/22.
  - Land use back-cast 1985-2013.
  - Land use forecasts 2021-2075 (Chesapeake Bay Land Change Model [CBLCM]).
- Others?

# LUWG Recommendations and Approvals Needed for Phase 7

- Phase 7 Land Use Recommendations
  - **Land use classes for Phase 7 modeling.**
    - Loads of the new classes?
  - Roll-up of high-resolution Land Use/Land Cover into the Phase 7 classes.
- Phase 7 Approvals
  - High-resolution Land Use/Land Cover for 2013/14-2021/22.
  - Land use back-cast 1985-2013.
  - Land use forecasts 2021-2075 (Chesapeake Bay Land Change Model [CBLCM]).

# Chesapeake Bay 1-meter Land Use/Cover Classification (62 classes)

## Water and Water Margins (6)

### 10 Tidal Waters

#### Lentic

- 11 Lakes & Reservoirs
- 12 Riverine Ponds
- 13 Terrene Ponds

#### Lotic

- 14 Streams and Rivers (visible water)

### 15 Bare Shore

## Development (18)

### Impervious

- 20 Roads
- 21 Structures
- 22 Other Impervious (Parking lots, driveways)
- 23 TC over Roads
- 24 TC over Structures
- 25 TC over Other Impervious
- 31 Extractive Impervious
- 32 Solar Field Panel Arrays

### Pervious

- 26 Tree Canopy over Turf Grass
- 27 Turf Grass
- 28 Bare Developed
- 30 Extractive Barren
- 33 Solar Field Barren
- 34 Solar Field Herbaceous
- 35 Solar Field Shrubland
- 36 Suspended Succession Barren
- 37 Suspended Succession Herbaceous
- 38 Suspended Succession Shrubland

## Natural Lands (25)

### Tree Canopy

- 40 Forest
- 41 Tree Canopy, Other

### Open Space

- 42 Natural Succession Barren
- 43 Natural Succession Herbaceous
- 44 Natural Succession Shrubland
- 45 Harvested Forest Barren
- 46 Harvested Forest Herbaceous

### Riverine Wetlands

- 50 Riverine Wetlands Barren
- 51 Riverine Wetlands Herbaceous
- 52 Riverine Wetlands Shrubland
- 53 Riverine Wetlands Tree Canopy
- 54 Riverine Wetlands Forest
- 55 Riverine Wetlands Harvested Forest

### Terrene Wetlands (isolated)

- 60 Terrene Wetlands Barren
- 61 Terrene Wetlands Herbaceous
- 62 Terrene Wetlands Shrubland
- 63 Terrene Wetlands Tree Canopy
- 64 Terrene Wetlands Forest
- 65 Terrene Wetlands Harvested Forest

### Tidal Wetlands

- 70 Tidal Wetlands Barren
- 71 Tidal Wetlands Herbaceous
- 72 Tidal Wetlands Shrubland
- 73 Tidal Wetlands Tree Canopy
- 74 Tidal Wetlands Forest
- 75 Tidal Wetlands Harvested Forest

## Agriculture (13)

### Productive Lands

- 80 Cropland Barren
- 81 Cropland Herbaceous
- 82 Orchards and Vineyards Barren
- 83 Orchards and Vineyards Herbaceous
- 84 Orchards and Vineyards Shrubland
- 85 Pasture/Hay Barren
- 86 Pasture/Hay Herbaceous

### Agricultural Facilities

- 90 Agricultural Structures
- 91 Animal Operation Impervious
- 92 Animal Operation Barren
- 93 Animal Operation Herbaceous
- 94 TC over Agricultural Structure
- 95 TC over Animal Operation Impervious

## Phase 6 Roll-up of High-Res Land Use Classes

### 1. Impervious, Roads (1)

20 Roads

### 2. Impervious, Non-Roads (6)

21 Structures

22 Other Impervious (Parking lots, driveways)

31 Extractive Impervious

32 Solar Field Panel Arrays (?)

90 Agricultural Structures

91 Animal Operation Impervious

### 3. Tree Canopy Over Impervious (5)

23 TC over Roads

24 TC over Structures

25 TC over Other Impervious

94 TC over Agricultural Structure

95 TC over Animal Operation Impervious

### 4. Turf Grass (1)

27 Turf Grass

### 5. Tree Canopy over Turf Grass (1)

26 Tree Canopy over Turf Grass

### 6. Forest (6)

40 Forest

41 Tree Canopy, Other

53 Riverine Wetlands Tree Canopy

54 Riverine Wetlands Forest

63 Terrene Wetlands Tree Canopy

64 Terrene Wetlands Forest

### 7. Mixed Open (14)

15 Bare Shore

28 Bare Developed

30 Extractive Barren

33 Solar Field Barren

34 Solar Field Herbaceous

35 Solar Field Shrubland

36 Suspended Succession Barren

37 Suspended Succession Herbaceous

38 Suspended Succession Shrubland

42 Natural Succession Barren

43 Natural Succession Herbaceous

44 Natural Succession Shrubland

45 Harvested Forest Barren

46 Harvested Forest Herbaceous

### 8. Wetlands, Riverine Non-forested (4)

50 Riverine Wetlands Barren

51 Riverine Wetlands Herbaceous

52 Riverine Wetlands Shrubland

55 Riverine Wetlands Harvested Forest

### 9. Wetlands, Terrene Non-forested (4)

60 Terrene Wetlands Barren

61 Terrene Wetlands Herbaceous

62 Terrene Wetlands Shrubland

65 Terrene Wetlands Harvested Forest

### 10. Cropland (5)

80 Cropland Barren

81 Cropland Herbaceous

82 Orchards and Vineyards Barren

83 Orchards and Vineyards Herbaceous

84 Orchards and Vineyards Shrubland

### 11. Pasture / Hay (4)

85 Pasture/Hay Barren

86 Pasture/Hay Herbaceous

92 Animal Operation Barren

93 Animal Operation Herbaceous

### 12. Water (4)

11 Lakes & Reservoirs

12 Riverine Ponds

13 Terrene Ponds

14 Streams and Rivers (visible water)

### Water Quality Model Classes (7)

10 Tidal Waters

70 Tidal Wetlands Barren

71 Tidal Wetlands Herbaceous

72 Tidal Wetlands Shrubland

73 Tidal Wetlands Tree Canopy

74 Tidal Wetlands Forest

75 Tidal Wetlands Harvested Forest

## Phase 6 Roll-up of High-Res Land Use Classes

### 1. Impervious, Roads (1)

20 Roads

### 2. Impervious, Non-Roads (6)

21 Structures

22 Other Impervious (Parking lots, driveways)

31 Extractive Impervious

32 Solar Field Panel Arrays (?)

90 Agricultural Structures

91 Animal Operation Impervious

### 3. Tree Canopy Over Impervious (5)

23 TC over Roads

24 TC over Structures

25 TC over Other Impervious

94 TC over Agricultural Structure

95 TC over Animal Operation Impervious

### 4. Turf Grass (1)

27 Turf Grass

### 5. Tree Canopy over Turf Grass (1)

26 Tree Canopy over Turf Grass

### 6. Forest (6)

40 Forest

41 Tree Canopy, Other

53 Riverine Wetlands Tree Canopy

54 Riverine Wetlands Forest

63 Terrene Wetlands Tree Canopy

64 Terrene Wetlands Forest

### 7. Mixed Open (14)

15 Bare Shore

28 Bare Developed

30 Extractive Barren

33 Solar Field Barren

34 Solar Field Herbaceous

35 Solar Field Shrubland

36 Suspended Succession Barren

37 Suspended Succession Herbaceous

38 Suspended Succession Shrubland

42 Natural Succession Barren

43 Natural Succession Herbaceous

44 Natural Succession Shrubland

45 Harvested Forest Barren

46 Harvested Forest Herbaceous

### 8. Wetlands, Riverine Non-forested (4)

50 Riverine Wetlands Barren

51 Riverine Wetlands Herbaceous

52 Riverine Wetlands Shrubland

55 Riverine Wetlands Harvested Forest

### 9. Wetlands, Terrene Non-forested (4)

60 Terrene Wetlands Barren

61 Terrene Wetlands Herbaceous

62 Terrene Wetlands Shrubland

65 Terrene Wetlands Harvested Forest

### 10. Cropland (5)

80 Cropland Barren

81 Cropland Herbaceous

82 Orchards and Vineyards Barren

83 Orchards and Vineyards Herbaceous

84 Orchards and Vineyards Shrubland

### 11. Pasture / Hay (4)

85 Pasture/Hay Barren

86 Pasture/Hay Herbaceous

92 Animal Operation Barren

93 Animal Operation Herbaceous

### 12. Water (4)

11 Lakes & Reservoirs

12 Riverine Ponds

13 Terrene Ponds

14 Streams and Rivers (visible water)

### Water Quality Model Classes (7)

10 Tidal Waters

70 Tidal Wetlands Barren

71 Tidal Wetlands Herbaceous

72 Tidal Wetlands Shrubland

73 Tidal Wetlands Tree Canopy

74 Tidal Wetlands Forest

75 Tidal Wetlands Harvested Forest

# Phase 6 Roll-up of High-Res Land Use Classes

## 1. Impervious, Roads (1)

20 Roads

## 2. Impervious, Non-Roads (6)

21 Structures  
22 Other Impervious (Parking lots, driveways)  
31 Extractive Impervious  
32 Solar Field Panel Arrays (?)  
90 Agricultural Structures  
91 Animal Operation Impervious

## 3. Tree Canopy Over Impervious (5)

23 TC over Roads  
24 TC over Structures  
25 TC over Other Impervious  
94 TC over Agricultural Structure  
95 TC over Animal Operation Impervious

## 4. Turf Grass (1)

27 Turf Grass

## 5. Tree Canopy over Turf Grass (1)

26 Tree Canopy over Turf Grass

## 6. Forest (6)

40 Forest  
41 Tree Canopy, Other  
53 Riverine Wetlands Tree Canopy  
54 Riverine Wetlands Forest  
63 Terrene Wetlands Tree Canopy  
64 Terrene Wetlands Forest

## 7. Mixed Open (14)

15 Bare Shore  
28 Bare Developed  
30 Extractive Barren  
33 Solar Field Barren  
34 Solar Field Herbaceous  
35 Solar Field Shrubland  
36 Suspended Succession Barren  
37 Suspended Succession Herbaceous  
38 Suspended Succession Shrubland  
42 Natural Succession Barren  
43 Natural Succession Herbaceous  
44 Natural Succession Shrubland  
45 Harvested Forest Barren  
46 Harvested Forest Herbaceous

## 8. Wetlands, Riverine Non-forested (4)

50 Riverine Wetlands Barren  
51 Riverine Wetlands Herbaceous  
52 Riverine Wetlands Shrubland  
55 Riverine Wetlands Harvested Forest

## 9. Wetlands, Terrene Non-forested (4)

60 Terrene Wetlands Barren  
61 Terrene Wetlands Herbaceous  
62 Terrene Wetlands Shrubland  
65 Terrene Wetlands Harvested Forest

## 10. Cropland (5)

80 Cropland Barren  
81 Cropland Herbaceous  
82 Orchards and Vineyards Barren  
83 Orchards and Vineyards Herbaceous  
84 Orchards and Vineyards Shrubland

## 11. Pasture / Hay (4)

85 Pasture/Hay Barren  
86 Pasture/Hay Herbaceous  
92 Animal Operation Barren  
93 Animal Operation Herbaceous

## 12. Water (4)

11 Lakes & Reservoirs  
12 Riverine Ponds  
13 Terrene Ponds  
14 Streams and Rivers (visible water)

## Water Quality Model Classes (7)

10 Tidal Waters  
70 Tidal Wetlands Barren  
71 Tidal Wetlands Herbaceous  
72 Tidal Wetlands Shrubland  
73 Tidal Wetlands Tree Canopy  
74 Tidal Wetlands Forest  
75 Tidal Wetlands Harvested Forest

*\* Represents assumed composition of “mixed open” based on assigned loading rates*

*\*May require reconciliation with reported acreages*



## Phase 7: Potential New Land Use Classes and Roll-Up

### 1. Impervious, Roads (1)

20 Roads

### 2. Impervious, Non-Impervious (1)

21 Structures

22 Other Impervious (e.g., parking lots, etc.)

31 Extractive

32 Solar Field Panel Arrays (?)

90 Agricultural Structures

91 Animal Operation Impervious

### 3. Tree Canopy Over Impervious (5)

23 TC over Roads

24 TC over Structures

25 TC over Other Impervious

94 TC over Agricultural Structure

95 TC over Animal Operation Impervious

### 4. Turf Grass (1)

27 Turf Grass

### 5. Tree Canopy over Turf Grass (1)

26 Tree Canopy over Turf Grass

### 6. Forest (6)

40 Forest

41 Tree Canopy, Other

53 Riverine Wetlands Tree Canopy

54 Riverine Wetlands Forest

63 Terrene Wetlands Tree Canopy

64 Terrene Wetlands Forest

### 7. Mixed Open (14)

15 Bare Shore

28 Bare Developed

30 Extractive Barren

33 Solar Field Barren

34 Solar Field Herbaceous

35 Solar Field Shrubland

36 Suspended Succession Barren

37 Suspended Succession Herbaceous

38 Suspended Succession Shrubland

42 Natural Succession Barren

43 Natural Succession Herbaceous

44 Natural Succession Shrubland

45 Harvested Forest Barren

46 Harvested Forest Herbaceous

### 8. Wetlands, Riverine Non-forested (4)

50 Riverine Wetlands Barren

51 Riverine Wetlands Herbaceous

52 Riverine Wetlands Shrubland

55 Riverine Wetlands Harvested Forest

### 9. Wetlands, Terrene Non-forested (4)

60 Terrene Wetlands Barren

61 Terrene Wetlands Herbaceous

62 Terrene Wetlands Shrubland

65 Terrene Wetlands Harvested Forest

### 10. Cropland (5)

80 Cropland Barren

81 Cropland Herbaceous

82 Orchards and Vineyards Barren

83 Orchards and Vineyards Herbaceous

84 Orchards and Vineyards Shrubland

### 11. Pasture / Hay (4)

85 Pasture/Hay Barren

86 Pasture/Hay Herbaceous

92 Animal Operation Barren

93 Animal Operation Herbaceous

### 12. Water (4)

11 Lakes & Reservoirs

12 Riverine Ponds

13 Terrene Ponds

14 Streams and Rivers (visible water)

### Water Quality Model Classes (7)

10 Tidal Waters

70 Tidal Wetlands Barren

71 Tidal Wetlands Herbaceous

72 Tidal Wetlands Shrubland

73 Tidal Wetlands Tree Canopy

74 Tidal Wetlands Forest

75 Tidal Wetlands Harvested Forest

**\* Land Use WG Decision**



## Phase 7: Potential New Land Use Classes and Roll-Up

### 1. Impervious, Roads (1)

20 Roads

### 2. Impervious, Non-Roads (6)

21 Structures

22 Other Impervious (Parking lots, driveways)

31 Extractive Impervious

32 Solar Field Panel Arrays (?)

90 Agricultural Structures

91 Animal Operation Impervious

### 3. Tree Canopy Over Impervious (5)

23 TC over Roads

24 TC over Structures

25 TC over Other Impervious

94 TC over Agricultural Structure

95 TC over Animal Operation Impervious

### 4. Turf Grass (1)

27 Turf Grass

### 5. Tree Canopy over Turf Grass (1)

26 Tree Canopy over Turf Grass

### 6. Forest (6)

40 Forest

41 Tree Canopy, Other

53 Riverine Wetlands Tree Canopy

54 Riverine Wetlands Forest

63 Terrene Wetlands Tree Canopy

64 Terrene Wetlands Forest

### 7. Mixed Open (14)

15 Bare Shore

28 Bare Developed

30 Extractive Barren

33 Solar Field Barren

34 Solar Field Herbaceous

35 Solar Field Shrubland

36 Suspended Succession Barren

37 Suspended Succession Herbaceous

38 Suspended Succession Shrubland

42 Natural Succession Barren

43 Natural Succession Herbaceous

44 Natural Succession Shrubland

45 Harvested Forest Barren

46 Harvested Forest Herbaceous

### 8. Wetlands, Riverine Non-forested (4)

50 Riverine Wetlands Barren

51 Riverine Wetlands Herbaceous

52 Riverine Wetlands Shrubland

55 Riverine Wetlands Harvested Forest

### 9. Wetlands, Terrene Non-forested (4)

60 Terrene Wetlands Barren

61 Terrene Wetlands Herbaceous

62 Terrene Wetlands Shrubland

65 Terrene Wetlands Harvested Forest

### 10. Cropland (5)

80 Cropland Barren

81 Cropland Herbaceous

82 Orchards and Vineyards Barren

83 Orchards and Vineyards Herbaceous

84 Orchards and Vineyards Shrubland

### 11. Pasture / Hay (4)

85 Pasture/Hay Barren

86 Pasture/Hay Herbaceous

92 Animal Operation Barren

93 Animal Operation Herbaceous

### 12. Water (4)

11 Lakes & Reservoirs

12 Riverine Ponds

13 Terrene Ponds

14 Streams and Rivers (visible water)

### Water Quality Model Classes (7)

10 Tidal Waters

70 Tidal Wetlands Barren

71 Tidal Wetlands Herbaceous

72 Tidal Wetlands Shrubland

73 Tidal Wetlands Tree Canopy

74 Tidal Wetlands Forest

75 Tidal Wetlands Harvested Forest

**Orchards and Vineyards**

**Animal Operations and Feeding Space**

**\* Agriculture WG and Ag Modeling Team Decision**

Phase 7: Potential New Land Use Classes and Roll-Up

1. Impervious, Roads (1)

20 Roads

2. Impervious, Non-Roads (6)

- 21 Structures
- 22 Other Impervious (Parking lots, driveways)
- 31 Extractive Impervious
- 32 Solar Field Panel Arrays (?)
- 90 Agricultural Structures
- 91 Animal Operation Impervious

3. Tree Canopy Over Impervious (5)

- 23 TC over Roads
- 24 TC over Structures
- 25 TC over Other Impervious
- 94 TC over Agricultural Structure
- 95 TC over Animal Operation Impervious

4. Turf Grass (1)

27 Turf Grass

5. Tree Canopy over Turf Grass (1)

26 Tree Canopy over Turf Grass

6. Forest (6)

- 40 Forest
- 41 Tree Canopy, Other
- 53 Riverine Wetlands Tree Canopy
- 54 Riverine Wetlands Forest
- 63 Terrene Wetlands Tree Canopy
- 64 Terrene Wetlands Forest

7. Mixed Open (14)

- 15 Bare Shore
- 28 Bare Developed
- 30 Extractive Barren
- 33 Solar Field Barren
- 34 Solar Field Herbaceous
- 35 Solar Field Shrubland
- 36 Suspended Succession Barren
- 37 Suspended Succession Shrubland
- 38 Suspended Succession Herbaceous
- 42 Natural Succession Barren
- 43 Natural Succession Herbaceous
- 44 Natural Succession Shrubland
- 45 Harvested Forest Barren
- 46 Harvested Forest Herbaceous

Connected Impervious

8. Wetlands, Riverine Non-forested (4)

- 50 Riverine Wetlands Barren
- 51 Riverine Wetlands Herbaceous
- 52 Riverine Wetlands Shrubland
- 55 Riverine Wetlands Harvested Forest

9. Wetlands, Terrene Non-forested (4)

- 60 Terrene Wetlands Barren
- 61 Terrene Wetlands Herbaceous
- 62 Terrene Wetlands Shrubland
- 65 Terrene Wetlands Harvested Forest

10. Cropland (5)

- 80 Cropland Barren
- 81 Cropland Herbaceous
- 82 Orchards and Vineyards Barren
- 83 Orchards and Vineyards Herbaceous
- 84 Orchards and Vineyards Shrubland

11. Pasture / Hay (4)

- 85 Pasture/Hay Barren
- 86 Pasture/Hay Herbaceous
- 92 Animal Operation Barren
- 93 Animal Operation Herbaceous

12. Water (4)

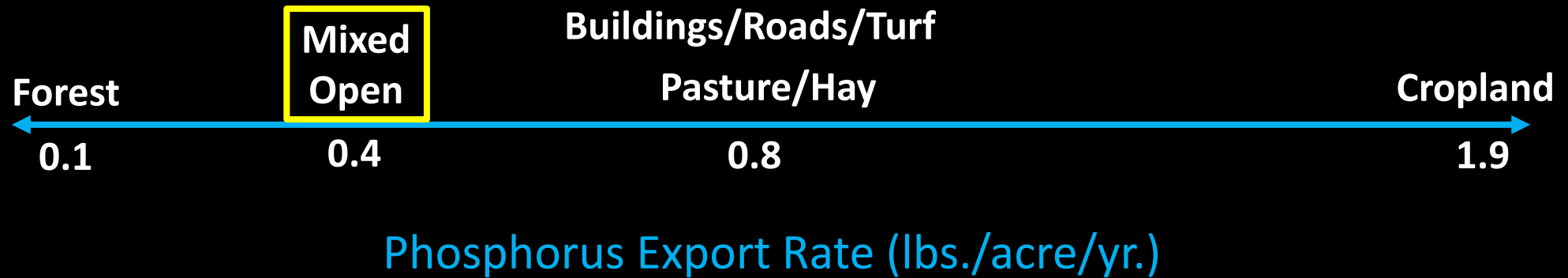
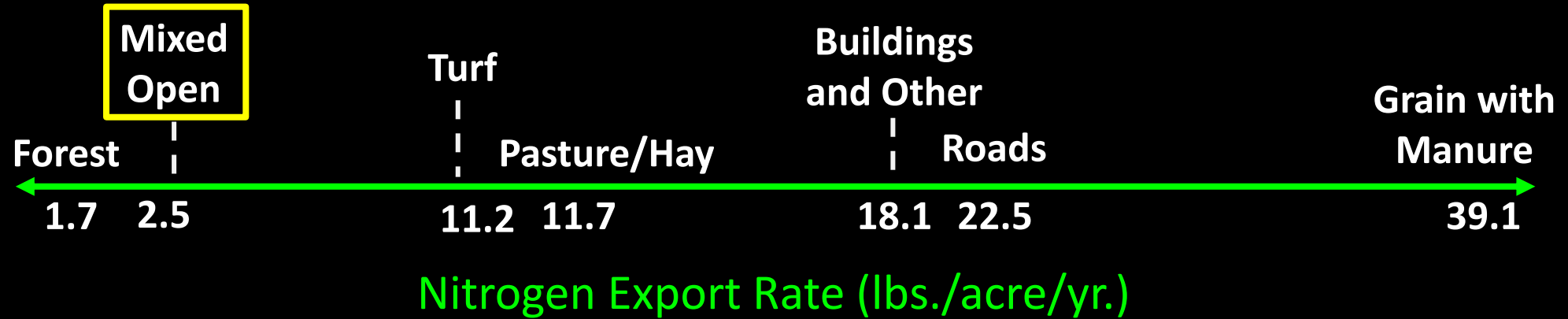
- 11 Lakes & Reservoirs
- 12 Riverine Ponds
- 13 Terrene Ponds
- 14 Streams and Rivers (visible water)

Water Quality Model Classes (7)

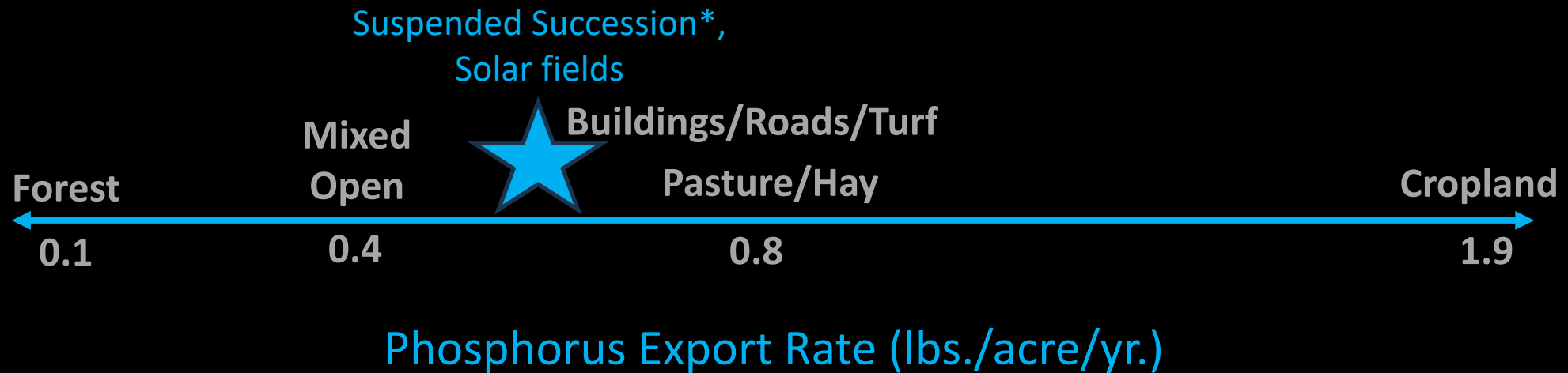
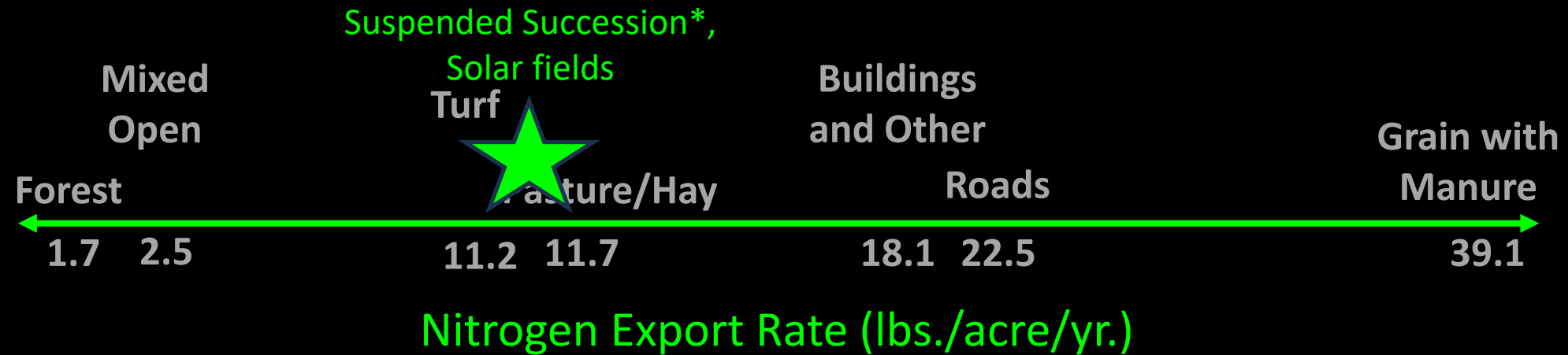
- 10 Tidal Waters
- 70 Tidal Wetlands Barren
- 71 Tidal Wetlands Herbaceous
- 72 Tidal Wetlands Shrubland
- 73 Tidal Wetlands Tree Canopy
- 74 Tidal Wetlands Forest
- 75 Tidal Wetlands Harvested Forest

\* Urban Stormwater WG Decision

# Average P6 Land Use Nutrient Export Rates



# Loads of New Land Uses: Where do they fall compared to the average P6 Land Use Nutrient Export Rates



\*Suspended succession = road rights-of-way, landfills, reclaimed surface mines, utility transmission lines



science for a changing world