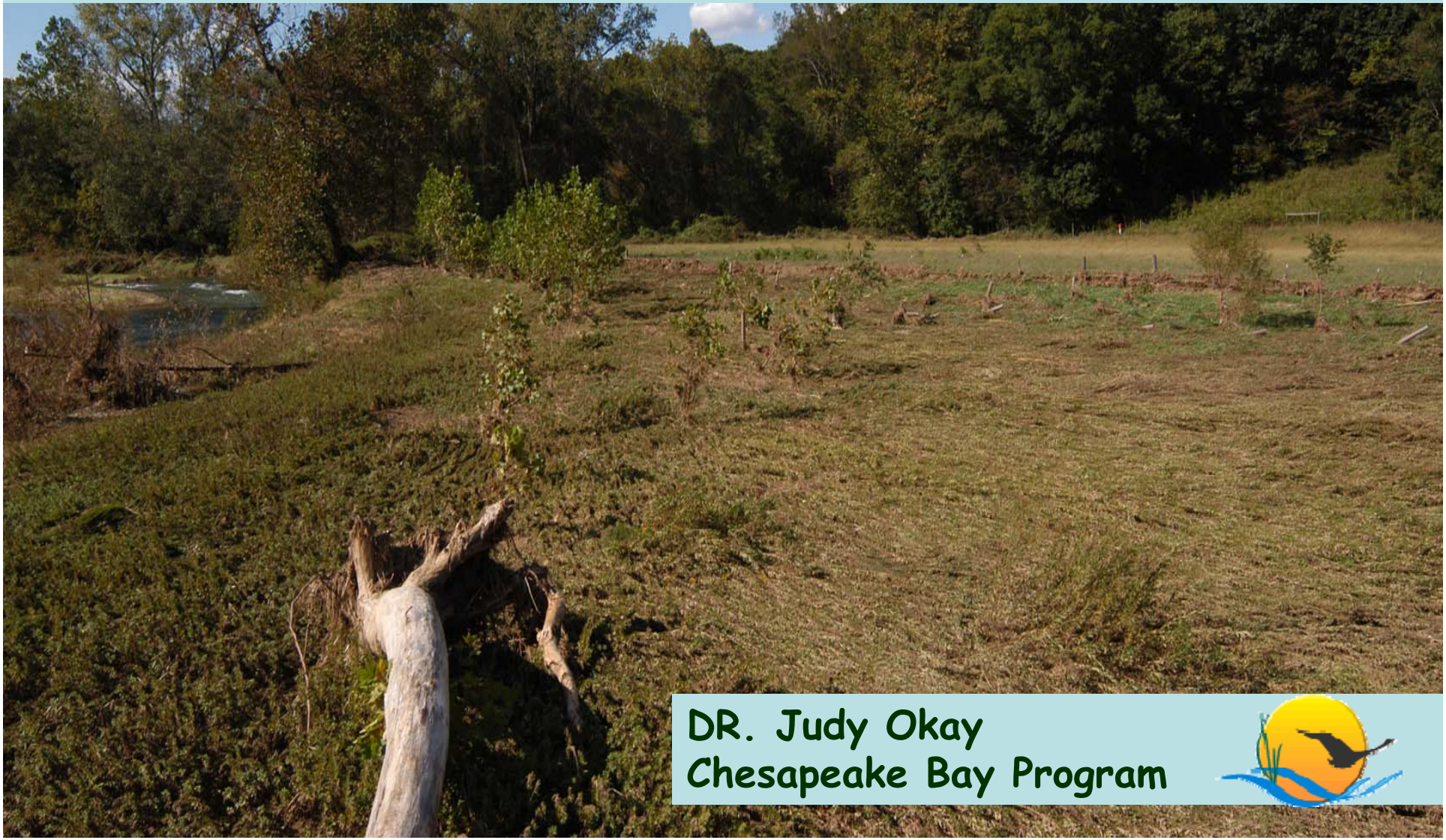
# RIPARIAN BUFFER NUTRIENT REDUCTION EFFICIENCIES



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# Riparian Area

**“A riparian area is defined as a transitional area between the terrestrial and aquatic ecosystem, distinguished by gradients in biophysical conditions, ecological processes and biota. They are areas through which surface and subsurface hydrology connect waterbodies with their adjacent uplands.”**

National Research Council Report, March 2002

# Riparian Buffers are:

Bands of vegetation (*grass, shrubs, trees or combinations of all of these)* that link land and water along streams, shorelines, ponds and lakes,and are managed: to maintain the integrity of stream channels and shorelines; to reduce the impacts of upland sources of pollution; to convert sediments and nutrients and other chemicals; to supply food, cover and thermal protection to fish and other wildlife (Todd 2002)

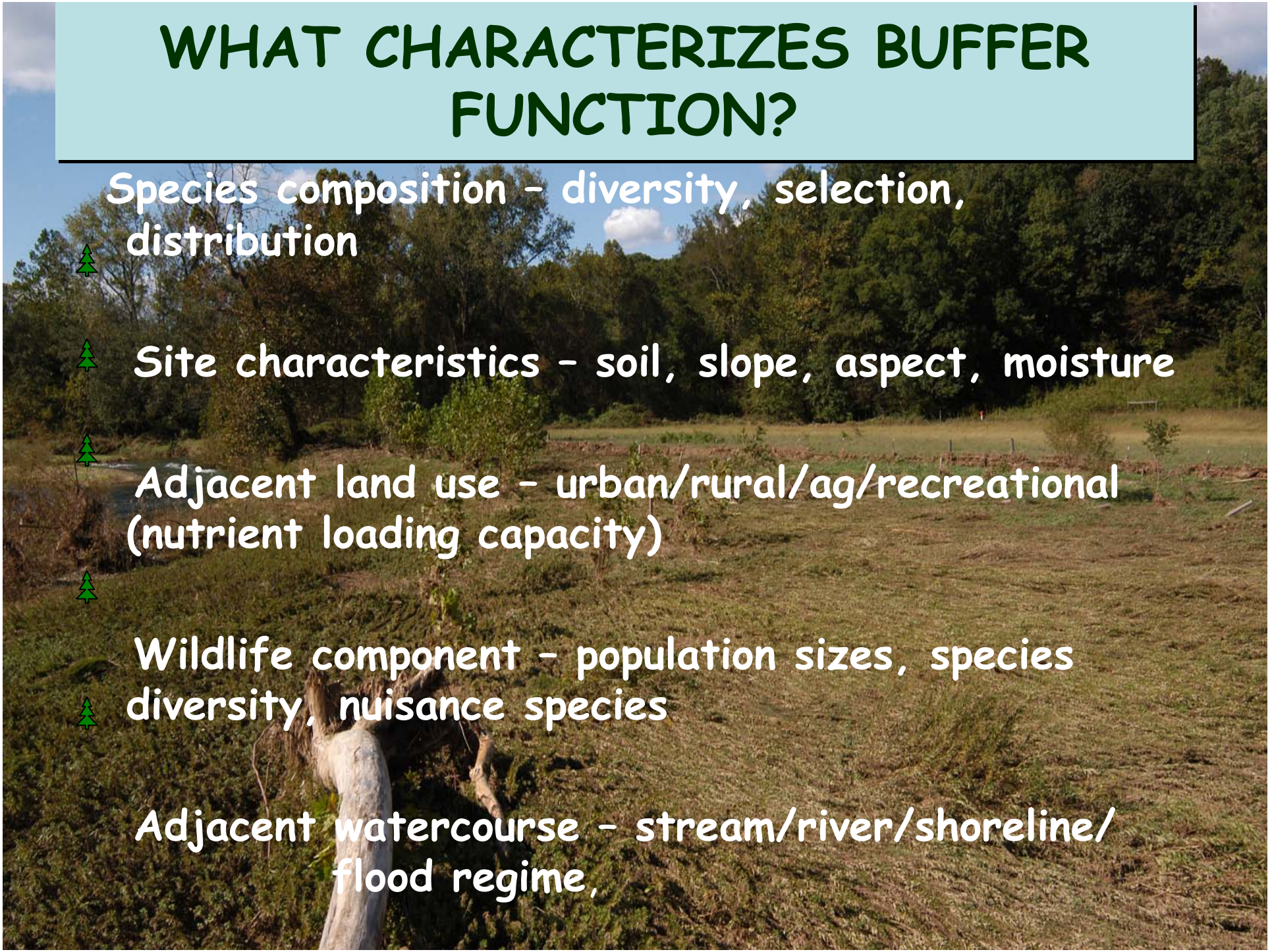
# NRCS Code For Buffers

- Components of the Riparian Forest Buffer Practices include, but may not be limited to the following USDA-NRCS conservation practices:
- **Channel Bank Vegetation ( 322)**
- **Tree/Shrub Establishment (612)**
- **Tree/Shrub Site Preparation (490)**
- **Riparian Forest Buffer ( 391)**

# Important physical and biological functions affected by riparian buffers

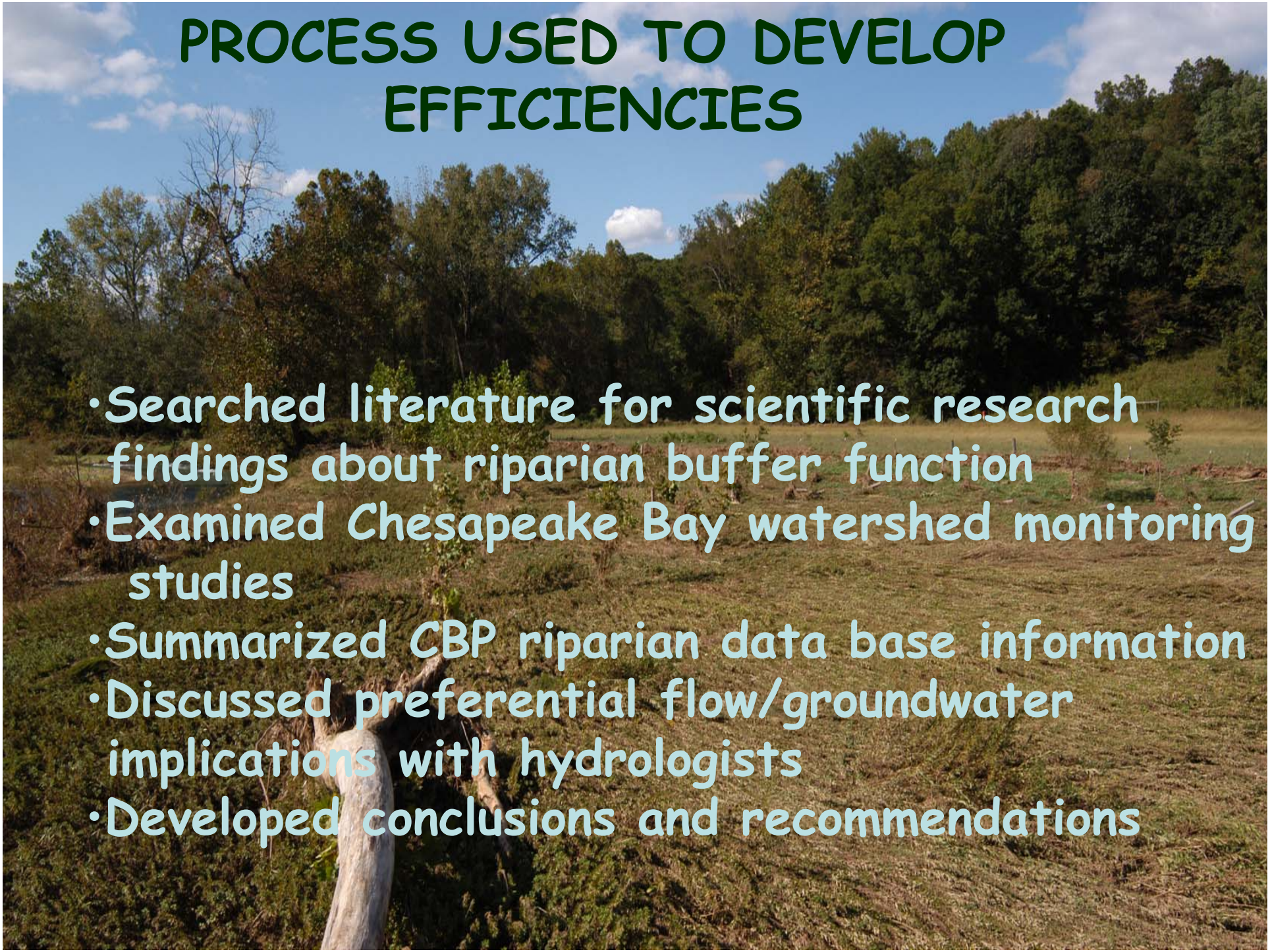
- **Overland storm flows** – removal of sediment, phosphorus, nitrate, and toxics, filter inorganic chemicals
- **Groundwater** – Nitrate removal, dissolved phosphorus removal, and recharge
- **Channel structure and stability** – sediment and gravel storage, bank and bed stability, habitat structure, diversity, aid in the restoration of stream banks.
- **Flood storage/moderation** – reduce downstream damage, sediment and nutrient processing in floodplain
- **Instream flows** – moderate temperature, hyporheic process
- **Aquatic habitat** - food supply, biological production,
- **Wildlife Habitat** - shelter, water, food, diversity

# WHAT CHARACTERIZES BUFFER FUNCTION?



- Species composition – diversity, selection, distribution
- Site characteristics – soil, slope, aspect, moisture
- Adjacent land use – urban/rural/ag/recreational (nutrient loading capacity)
- Wildlife component – population sizes, species diversity, nuisance species
- Adjacent watercourse – stream/river/shoreline/ flood regime,

# PROCESS USED TO DEVELOP EFFICIENCIES



- Searched literature for scientific research findings about riparian buffer function
- Examined Chesapeake Bay watershed monitoring studies
- Summarized CBP riparian data base information
- Discussed preferential flow/groundwater implications with hydrologists
- Developed conclusions and recommendations

| | | | | |
|---|---|---|---|---|
| **Sediment** | **Meters** | **Feet** | | |
| | **19** | **62.7** | **89.90%** | **Lowrance et al., 1995** |
| | **21.3** | **70.3** | **75- 81% TSS** | **Young et al., 1980** |
| | **60** | **198** | **90 – 94% TSS** | **Peterjohn & Correll 1984** |
| | | | | |
| **Phosphorus** | **5 – 18** | **15-60** | **20 – 85% reduction** | **Maggette 1987,1989; Mander 1997,** |
| | | **15-55** | **96% reduction** | **Vought 1994** |
| | **19** | **63** | **70% reduction** | **Lowrance et al. 1995** |
| | | | **24-80% reduction** | **Peterjohn & Correll 1984; Lowrance et al. 1983** |
| | **23.6** | **78** | **78.5% reduction** | **Lowrance 1995** |
| | **28.2** | **93** | **77.2% reduction** | **Lowrance 1995** |
| | | | | |
| **Nitrogen** | **50** | **165** | **86% surface runoff red.** | **Correll 1985 reported by Wenger** |
| | **31** | **102** | **94% shallow gr. Water** | **Hanson et al. 1994 rep. by Wenger** |
| | **60** | **197** | **95% subsurface reduction** | **Jordan et al. 1993 rep. by Wenger** |

# RFB survival

| Author/s | # sites | Location | Age of planting | % survival |
|---|---|---|---|---|
| Sweeney, Czapka,Yerkes 2002 | 2 | MD | 4 years | 88.8% |
| Pannill, Hairston – Strang, Bare, Robbins 2001 | 130 | MD | | 67% mean |
| Starr 2006 | 84 | VA | 3-8 years | 61-70% |
| Jackson 2006 | 1 | PA | 2 years | 85-95% |
| Okay 2006 | 1 | VA | 4 years | 76% |
| Mean for all studies | | | | 77.3% |

# ALL RIPARIAN BUFFERS ARE NOT EQUAL

- **Location- Location- Location**

  **Coastal, piedmont, mountain/ Urban, Rural**

  - **Soil**

    **Rock, Clay, Sand, Silt**

  - **Width**

    **35 – 300 feet**

  - **Plant Selection**

    **Moisture, Light, Zone**

## Base BMP Efficiency As Decided and Approved by CBP Work Groups and MAWP for Riparian Buffers

- Apply a 65% N reduction

- 45% P reduction

as the baseline riparian forest buffer efficiencies.
( This is a 20%reduction from scientific literature values and previous values credited to RFBs).

- This is also drawn from known riparian restoration project conditions for buffers reported to CBP.

- Adjust efficiencies for physiographic province differences in geology, soil, and topography.

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| Riparian Buffers- Nutrient Reduction Efficiencies by Physiographic province | | | | **Grass buffers rated at n at 70% of Forest buffer function. | | | | |
|---|---|---|---|---|---|---|---|---|
| Forest | TN | TP | TSS | Grass | TN | TP | TSS | |
| Inner Coastal Plain | 65 | 42 | 56 | | 46 | 42 | 56 | |
| Outer Coastal Plain Well Drained | 31 | 45 | 60 | | 21 | 45 | 60 | |
| Outer Coastal Plain Poorly Drained | 56 | 39 | 52 | | 39 | 39 | 52 | |
| Tidal Influenced | 19 | 45 | 60 | | 13 | 45 | 60 | |
| Piedmont schist/gneiss | 46 | 36 | 48 | | 32 | 36 | 48 | |
| Piedmont Sandstone | 56 | 42 | 56 | | 39 | 42 | 56 | |
| Valley and Ridge – marble/limestone | 34 | 30 | 40 | | 24 | 30 | 40 | |
| Valley and Ridge – sandstone/shale | 46 | 39 | 52 | | 32 | 39 | 52 | |
| Appalachian Plateau | 54 | 42 | 56 | | 38 | 42 | 56 | |

# Model Application for Buffers

Efficiency + land use change

Applied at a 1:4 acre ratio for N

Applied at a 1:2 acre ration for P

This has not changed from previous model applications and can be supported by scientific research .