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Habitat Conservation Forum:

Practices that Sustain Virginia's Wildlife and Native Plant Communities

Germanna Community College, Culpeper VA

This event was a REGIONAL Forum sponsored by the VA Department of Game and Inland Fisheries (DGIF) *Habitat Partners© Program*, with support from the *Virginia Coastal Zone Management* (CZM) Program at the VA Department of Environmental Quality. Both DGIF and CZM are co-coordinators of the ***Virginia Native Plants Marketing Partnership***, a consortium of organizations committed to developing and implementing a statewide communication and marketing strategy that encourages the use of Virginia native plants in the landscape.

Event Hosts:

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Overview Presentation: "WILDLIFE ACTION PLAN: A Brief Status of Virginia's Wildlife"

[SPEAKER: Austin Kane, Project Associate, Conservation Management Institute, Virginia Tech; austink@exchange.vt.edu; PH 804-288-4719]

The purpose of the Virginia Wildlife Action Plan is to keep species from becoming endangered. It addresses wildlife species that are "in the middle," i.e. not yet endangered but in decline and in need of conservation. In 2000-2001, Congress enacted a package of funding called State Wildlife Grants, which provided competitive awards to state fish and wildlife agencies to develop wildlife conservation plans. By 2005, each state, including Virginia, had developed an Action Plan that summarized the threats to wildlife species and identified strategies that would "keep common species common." In 2015, the Virginia Department of Game and Inland Fisheries (DGIF) updated the Plan, which serves as a *non*-regulatory "blueprint for conservation across the state."

DGIF can't do this alone. The updated Plan is a "guiding document" intended to be "locally relevant and actionable" by a variety of stakeholders. DGIF worked with many partner organizations to encourage feedback about where conservation actions could be applied within their local planning region or Planning District Commission (PDC). The updated Plan was based on the successful model of the VA Outdoors Plan. There are 21 chapters in the new Wildlife Action Plan, with each chapter corresponding to a different planning region. This makes the document more user-friendly, because each chapter is no more than 30 pages long. Users can search the Plan by locality to determine best practices for wildlife in their area (www.bewildVirginia.org)

The Plan focuses on 884 "species of greatest conservation need," which are ranked in a "Tier System" [ranging from Tier 1—critical to Tier 4—moderate]. The list includes songbirds, shorebirds, raptors, invertebrates (insects and butterflies), mussels, mammals (terrestrial and aquatic), amphibians, fish, bats etc.; it also includes threatened and endangered species as well as game species. The Plan has a "**habitat focus**"—i.e. recommendations are made for whole suites of species within a given habitat, rather than species by species. Habitats include wetlands (tidal and nontidal); open (meadows, savannahs, glades); aquatic (riparian etc.); forests; and caves/karst.

There are many reasons for wildlife species decline, and the Plan identifies "primary threats," which include the following: loss and fragmentation of habitats (due to land conversion, land use, population growth); water quality degradation, due to nutrient pollution and sedimentation from erosion (60% of the 884 species are aquatic or associated with aquatic habitat); invasive species; and climate change (for example, water temperature increase in Rappahannock/Rapidan watershed that adversely impacts brook trout and other fish).

The Plan identifies many "conservation actions" that can be taken to address these concerns. Actions can include riparian buffer plantings; Best Management Practices (for development/land disturbance); land conservation; restoration; improving connectivity between habitats (especially for aquatic habitats, not just land corridors); and "climate smart" actions.

An example of regional recommendations for Open Habitats: address current management actions that may be excluding wildlife; focus on specific practices, such as management after a timber harvest or ag application; control invasive species; **place emphasis on native plant species**; use citizen-monitoring to track changes and success.

Today's Forum focuses on practices that sustain Virginia's wildlife and the native plant communities they depend on.

KEYNOTE PRESENTATION: "A Chickadee's Guide to Creating a Living Landscape"

> **[SPEAKER: DR. DOUGLAS TALLAMY**, PhD, Professor, Department of Entomology and Wildlife Ecology, University of Delaware; dtallamy@udel.edu]

Tallamy showed a web site and mentioned the importance of getting children outdoors – http://www.gardenclub.org/projects/presidents-projects/the-frightened-frog.aspx

"Understanding the needs of life around us" –focus of PowerPoint from the perspective of chickadee's habitat needs

Habitat is all of the things an organism requires to live and reproduce successfully.

Migrating bird species - hundreds of miles a night - up to 300 miles in single night. Example – black-throated warbler winters in Costa Rica and flies to North America to reproduce. Migrating birds acquired fat reserves while overwintering – use it efficiently but still need to rest and eat to build up fat reserves to continue migration – they drop from sky. What if it is suburbia? Many dangers along the way: 1 billion birds killed by windows each year; 2.5 to 3 billion birds killed by cats; 100 million birds killed by cars; also cell towers.

What do birds need in the landscape? People are everywhere and we need to consider our yards as important conservation sites. "Our sterile landscapes are starving our birds. If we design landscapes that create food for birds, we'll be supporting a lot of other species."

Carolina Chickadee needs a tree hole to nest – very particular and specific about hole – tree holes are in short supply and there is much competition for them (85 species of North American birds are cavity nesters that breed in dead trees) – and they really like horsehair to line their nests (you can buy a ball)

Food for birds isn't just berries and seeds. ***During the breeding season, birds feed their young almost exclusively caterpillars*** [i.e. ***Lepidoptera* – the caterpillars of butterflies, moths and skippers**.] The reason: caterpillars are soft and ***they are high in protein, lipids and essential carotenoids.***

Carotenoids – compounds produced by plants – some are essential to vertebrate diets – they are antioxidants – they stimulate the immune system and improve color vision – improves sperm vitality and color pigmentation of feathers (which male bird needs for sexual attraction).

Caterpillars – provide twice as many carotenoids as any other insect!

For most birds, caterpillars are necessary, not optional and it takes A LOT! A pair can deliver food once every 3 minutes (birds forage from 6 am – 8 pm) – sometimes many at a time – 17 species of caterpillars over a 3 hr period. The birds forage 50 meters from the nest and stay close to home, so if the caterpillars aren't close enough, they won't find them. A yard can support > 1,000 species of caterpillars (per John Pickering's study at University of GA). A chickadee pair brings 390-570 caterpillars to the nest each day (per Brewer 1961). They feed their young for 16 days before fledging, i.e. a total of 6,000 – 9,000 caterpillars for one clutch of young –it takes a WHOLE LOT OF CATERPILLARS TO FLEDGE. And they continue feeding the young *after* they've fledged. A chickadee weighs only .35 oz; a red-bellied woodpecker weighs 8 times more – so imagine the amount of biomass (caterpillars) that larger birds need! Therefore the plant (tree) species diversity in the landscape is very important ; if it happens to be a bad year for a caterpillar species, then it is a big problem – some species are common enough, but need habitat. We expect to see birds in our yards – but how many species and numbers of caterpillars need to be in your neighborhood to support bird species? ***96% of terrestrial birds in North America feed their young caterpillars.***

Need the plants that make the caterpillars!

What type of landscapes? – we must consider the <u>specialized relationship between insects and plants:</u>

Plants don't "like" to be eaten! They have an effective defense against most insects (phytochemicals or secondary compounds are distasteful to birds and make the nutrients chemically unavailable to birds). Insects have therefore become specialized and adapted to specific plants. For example, red cedar defends its tissue with beta thujaplicine, a toxic monoterpene. The caterpillar of the juniper hairstreak butterfly is one of the few species that can eat red cedar, but in all the (evolutionary) time that it took to acquire that ability, it means it can't eat anything else—i.e. it doesn't have the specialization to eat oak tannins or other plant species. HOST PLANT SPECIALISTS.

In today's world, insect specialization has become a "curse," because as we change the composition of our landscapes at accelerated rates, and insects can't adapt quickly enough . Example: Monarchs and milkweed – we remove milkweed and monarchs are "done" – they have declined 96.4% since 1976—only 3.6 million remain. Monarch is therefore an INDEX of BIODIVERSITY DECLINE. Perfect example of host plant specialist and we can count them – problem is that we can't do that with other insects as easily.

We have the power to turn things around!

"No problem – insects will adapt!" - NO!! Fallacy! Adaptations can be made to local conditions, such as climate, soil, etc., but it takes millions of years for insects to adapt to host plants. We will lose our phytophagous insects if we don't have the plants to support them.

We can rebuild food webs if we know what they are comprised of. We can work backwards and find out what caterpillars the birds are eating and what plants the caterpillars need.

Tallamy gave many examples of caterpillars and the plant species they need. For example, **VIREOS** eat:

- blinded sphinx moth (which needs black cherry);
- chestnut schyzura (which needs Viburnums);
- drab prominent (which needs sycamore);

- 8-spotted forester moth (which needs grape);
- Lunate moth (needs cherry);
- Spicebush swallowtail (needs spicebush and sassafras);
- Tufted bird dropping moth (needs black cherry and black walnut);
- And many other Lepidopteran species…

Whippoorwills are in decline- they need large night flying moths, such as silk moths, luna moths, Prometheus and cecropia—but moths are declining as well. Put a motion sensor on your security lights so the lights don't stay on all night. (Leaving outdoor lights on continuously makes moths congregate and attracts predators such as bats; also, moths don't have mouth parts and can't feed, and they waste valuable energy flying around lights at night.)

OAKS ARE THE MOST IMPORTANT TREE WE CAN PUT IN OUR YARD – they support 557 species of caterpillar. **Black cherry is also very important.**

An oak can get 25 feet tall in only 14 years – it doesn't take as long as we think for it to get big. On one white oak in his yard, walked around and counted the caterpillars at 'head height' and found 410 caterpillars from 19 different species. Black cherry had 239 caterpillars from 14 species. By comparison, non-native Callery pear (Bradford pear) only had 1 caterpillar from 1 species; non-native burning bush had only 4 caterpillars from 1 species.

NON-NATIVE PLANTS – plants from outside local food webs. We can measure what happens when we replace native plant communities with plants from outside our native food webs – this is the research that Doug has done in his own yard (example of a 12ft X 12ft section he roped off, to observe changes over time).

Doug highlighted the many Callery Pears (Bradford pears) at the Sunset Beach Inn, and how they're spreading through the area—highly invasive. Non-natives such as this displace native plant community. "Biologically pollutes the environment."

Plant communities that serve as key sources of food are called **FORAGING HUBS** – analogous to airport hubs on a national map—showed map with Willow, Cherry, Pine and Oak.

KEY POINT: Most of the food that wildlife needs is supported by very productive *native* genera – oaks and cherries. If you take the genus out, the food hub will collapse. Not all natives are equally productive; we therefore need to "*build the most productive habitats*" we can, by focusing on the *most productive plants*. Other examples: native goldenrod supports 13 species of specialist bees; non-native Ginkgo ("being pushed by urban foresters") only supports 4 species of caterpillars (which Tallamy thinks isn't accurate and suspects is actually 0); non-native Zelkova supports 0 caterpillars; non-native Pieris japonica supports 2 species; compared to native Viburnum 103 species, and native Prunus (cherry) 456 caterpillar species. "**You own enough property to feed migrating birds. Think of the plants in your landscape as bird feeders."**

We are not fooling birds when we remove these foraging hubs –they will inspect plants and look for food and will not return if they can't find it. [Tallamy's grad student Desiree Narango is researching breeding pairs of Carolina chickadees in Washington D.C. neighborhoods, to track which tree species the birds forage on within their range.]

Re. Berries – Are all berries good for birds? Birds and berries have also co-evolved; plants use birds to disperse their seeds (the seed is "wrapped" in the berry). Birds do eat non-native berries, but unfortunately they help spread the plants (like multi-flora rose). In winter, berries on native plants like Ilex and Aronia become frozen, which concentrates the sugars (carbs) and provides birds w. energy to survive through cold weather. When birds are raising their hatchlings in the spring, they seek caterpillars to feed the young and aren't using berries yet. When they're no longer feeding their young, birds then eat berries of plants like blueberry and elderberry, which are *low fat* and *high in sugar/carbs* for the

summer. In the fall, birds that will be migrating need to feed on *high fat* berries, such as poison ivy, to build up fat in their bodies for the long flight. The problem with non-native shrubs is that many of them tend to provide the 'wrong' kind of berry for the time of year—they are "**phenologically out of synch with the bird's needs**." (Example: autumn olive berries ripen in autumn, but they're high in sugar at a time when birds need berries to be high in fat).

Tallamy showed the nutritional differences between invasive berries and native berries (based on research by Susan Smith et al, 2007, 2013). The nonnative may be higher in sugar, but higher than what the birds need. Birds will eat these berries (because they're there!), but the berries are not meeting the birds' *nutritional* needs.

Best practice is to not "clean up" your plants in the fall – wait until March—because native plants provide seeds all winter long (e.g. black-eyed Susan, New York ironweed, thistle, Joe pyweed, evening primrose).

Re. Bird Seed—Almost 70 million people put out bird feeders. Chickadees hide seeds all fall under the folds of tree bark—they need "nooks and crannies." They grow their brains (hippocampus) by 30% in the fall to remember where they put their seeds, and can find seeds for up to 9 months; then brain size decreases in the spring (Sherry and Hoshooley 2010). Have a messy area in your yard where they can hide their seeds.

Blue jays have a mutualistic association with oak trees and carry their acorns far – up to 2 miles – and they hammer them into the soil. (Squirrels do not move acorns that far.) A single blue jay can hide 4,500 each fall, but they only remember 30% of them, which means that 3,600 acorns are "planted" and contribute to tree population. Acorns are also available to other species such as turkeys, towhees, red-headed woodpecker, flickers, nuthatches, ducks, etc.

Don't mow meadows in fall, because plants left standing will be host to many insects that overwinter as a larva. Example: **goldenrod gall** contains fly larvae (maggots), and birds feed on these in winter for fat content. (Hole in goldenrod gall is from chickadee that fed on larva.) **Bagworms** (on trees) also supply a big source of energy for chickadees.

Can our landscapes support Chickadees? 92% of our landscape is lawn – only 10% of the tree species that could be there are present –and 80% of the landscape is introduced species. We must raise the bar for what we ask our landscapes to do: support life; sequester carbon and enrich the soil (80% of carbon is stored in soil, not in the atmosphere, and when we remove plants, carbon is removed and **not** recycled back into the soil); clean and mange watersheds (water quality); and support pollinators. **SAVE BIODIVERSITY WHERE YOU LIVE.**

Re. Cultivars—"Do Cultivar Traits Affect the Ecological Value of…" –Tallamy has been working on study w. grad student Emily Baisden, which is being funded by Mt. Cuba Center in Delaware; still have another season of field research to complete. A cultivar is NOT a hybrid. A cultivar is a cross between two species, selected for a particular trait or attribute or combination of attributes. Some cultivars are ***natural variants*** created in the wild (by natural selection), while others are created by people (artificial selection). The important difference is that ***when we artificially select for some particular trait, we reproduce the trait clonally, which reduces genetic variability***. Natural variants, in contrast, convey genetic variation through to the offspring. [Example—phlox research by Keith Nevison at Mt. Cuba: Phlox paniculata 'Jeana' has more flowers on its stems than the straight species; it's a natural variant and is 10 times more attractive to butterflies than the straight species.] When we propagate cultivars (**clones**), we reduce the genetic potential for evolutionary attributes such as flowers (size, shape, color), growth habit, leaf color, disease resistance, fruit size, etc.

Some research is being done on flowers, e.g. Annie White pollinator research at University of Vermont. Tallamy currently working with Deborah Delaney of University of Delaware through Mt. Cuba –experimental design on cultivars—not looking at flowers but focused on other attributes, such as disease in elm, leaf color in Viburnum, seasonal leaf damage, etc. What is happening to the leaf eaters? They have selected cultivar species and are measuring the insects using them, looking at total seasonal damage to measure the energy passed on, and the leaf preferences.

Preliminary results: in some cases, cultivar leaf color did discourage herbivory, and straight species appeared to be preferable in that component. However, the "conclusion" is: No conclusions so far! Study will be done in the fall of 2016. But emphasizing that we do not want to clone because we lose genetic variability, and straight species need to be sold **with** cultivars at local nurseries.

Presentation: "Habitat Management to Support Pollinators and Other Beneficial Insects"

> **[SPEAKER: DR. NANCY ADAMSON**, PhD, Pollinator Conservation Specialist, Xerces Society for Invertebrate Conservation, and USDA Natural Resources Conservation Service; Nancy.Adamson@gnb.usda.gov]

2008 & 2014 Farm Bill makes pollinators a priority for all USDA managers and conservationists.

Pollinators Matter!

Cross-pollination increases quality and yield: Example—squash has male and female flower s. Female flower has nectar, and male flower has pollen; insects carry pollen between the plants. Soybeans are self-fertile, but when cross-pollinated by insects, production is doubled.

One-third of our food production depends on pollinators. In VA, apples very important… also Cucurbits (cantalopes, pumpkins, cucumbers), cotton, tomatoes, berries, etc.. Can get 10% - 15% better production with pollinators. Same for alfalfa and clover seeds, which come from other states. (Slide shows important crop products)

Honeybees (introduced species) have been in decline since 2006 – annual loss 35% , due to colony collapse disorder (varroa mites and diseases they spread).

Re. North American bumblebees—we have good data – two species common in VA are Yellowbanded and Rusty patched. Native bumblebees are used for greenhouse tomatoes and also sometimes for blueberries and watermelons; but when the bumblebees were raised, they were likely exposed to diseases from European bumblebees, and may have accidentally introduced or reintroduced and spread diseases in large scale breeding operations. Higher losses in summer.

Wild bee abundance has declined 23% between 2008 and 2013 (per Koh et al 2016).

2014 Farm Bill included monarchs (but focused on central U.S. corridors). 2015 National Pollinator Strategy signed by Obama. EPA then asked each state to develop pollinator plan (but it's not a legally binding document, only voluntary). Some states focusing on the bees used for agricultural crops, i.e. "managed pollinators." In Virginia, Department of Agriculture and Consumer Services (VDACS) plan is focused on managed species and pesticide use. Can be a great tool to raise awareness; Adamson suggested it would be great if it also highlighted **native** pollinators (bees), in addition to the managed ones.

Meet the Pollinators: 700 species of butterflies; 13,000 species of moths. Flies should not be forgotten, but bees are our most important pollinators – hairiness and other adaptations – collecting pollen all the time for food and to feed their young – they exhibit "flower constancy," which means they keep revisiting the same flowers to conserve their energy. Because of bees' small size, forage area is limited – they tend to forage closest to nest and limit distance due to energy expended.

Bees evolved from wasps into plant eaters. Have branched hairs on body. Vast majority of native bees are solitary. They emerge and mate, then single female locates a nest, collects nectar and pollen for the eggs, and seals off nest—i.e. native bees are solitary nesters, whereas honeybees live in colonies and are "perennial" nesters. Solitary bees are not

defensive of nest, because female would die if stung you, and then not able to care for its young. Therefore do not kill bees in solitary nests (such as mud daubers).

Native bee specialists can digest pollen more efficiently, for example 3 species of squash bees in VA, also hibiscus bee, okra bee, etc.

Most native bees have "buzz pollination." Many flowers are adapted not to release pollen until buzzing occurs, based on frequency of vibration. Bee vibrates and collects some of the released pollen. Example: tomato flowers—honeybees cannot vibrate at right frequency to pollinate them, hence farmers bring native bumblebees to tomato farms. Wild bees improve fruit set twice as much as honeybees.

Good to understand why native pollinators can be more effective; Pollinator Plan needs to include native bees.

Beneficial insects for agriculture: soldier beetle; parasitoid wasps and beetles; syrphid fly larvae eats aphids; new research at Penn State – sand wasps feed brown marmorated stink bugs to their young. (Sand wasps are solitary and do not sting – do not kill them if see in sand box.)

Insect pollinators are ecological keystones

Bugs drive the system.

HABITAT NEEDS—for bees: How can we best support pollinators and other insects? Plant as many native species – diversity – as possible.

There are > 3,600 native bee species in U.S., and most are solitary; 700 native bee spp. in eastern U.S.; Virginia has about 500 species of native bee—groups are bumble bees (social), ground-nesting bees (solitary) and mason bees.

A "big" colony for a bumblebee is 400, versus the great size of honeybee colony, which is 10,000 – 40,000.

Conserve brush piles and un-mowed places (safe space from predators - and dry)—leave "messy areas" in your yard, such as brush piles, leaves, native grasses, etc. (ref. Sara Stein's book, *Noah's Garden*). Bumblebees like to go under bunch grasses and also need cavities, especially where rodents have burrowed (bees attracted to scent of rodent urine).

Some bees are leaf cutters—they choose certain plants based on their chemical properties, such as redbud, blackgum, tick trefoil, roses –which have antibacterial and anti-fungal properties. Bees more active later in season. Bee chews the leaves and provisions hollow stems with food. You can use bamboo or other hollow-stemmed plants to create suitable spaces for this. However, bee blocks drilled with holes have shown evidence of becoming a "sink" for disease, and therefore need to be "cleaned" each season. We may be better off using stems of hollow plants instead of bee blocks.

Roughly 70% of bee species build nests underground. You can therefore provide forage, scout for nests, and conserve sandy soil and bare ground.

Roughly 30% nest in hollow plant stems or old beetle borer holes. Therefore conserve snags and leave dead areas (i.e.d downed plant materials); provide brush piles and pithy-stemmed plants (such as raspberries, elderberry, sumac, viburnum), and don't mow brambles in the fall. Install signs to advertise that you are conserving space and places for pollinators. Other practices mentioned include prescribed fire for managing natural areas, and protection of riparian areas to promote flowering plants in summer.

Slide of flowers that support pollen specialist bees, e.g. asters, thistles, hibiscus, ipomea, chrysopsis, helianthus, oenothera, violet, etc.

Showed video (available online) of bees on redbud and other plants (www.youtube.com/watch?v=HhC5iY0ijJM) It's the pollen that bees don't clean off their hairs which is effective in pollinating plants.

Presentation: "Ecological Planting Design"

[SPEAKER: CLAUDIA WEST, MLA, Ecological Sales Manager, North Creek Nurseries; claudia@northcreeknurseries.com PH 610-255-0100]

Plants are the foundation of life. People are accustomed to neat and tailored spaces. However, conventional design isn't very sustainable, because of intensive maintenance required (herbicides/pesticides) to keep it "clean" (weed free). This also requires much labor.

It matters how we design and put the plants back in ground. In nature, plants don't grow in straight rows with lots of bare space (mulch) in between. Rather, plants grow in patches. Bare ground in our landscape is a problem – we are leaving too much space between plants – this is not the way they grow in the wild – they want to "mingle" and not be confined; monoculture is extremely rare in the wild. But, conventional design is still widely taught, without ability for plants to "mingle." If we stopped using herbicides (or stopped using mulch treated w. herbicides), then weeds will fill in the spaces and cause maintenance issues. However, ***weeds are the result of how we arranged the plants—with too much space between them.*** "Plants don't want to be in solitary confinement, they want to grow in plant communities."

Today we have more access to plants than ever before – nurseries grow top quality landscape plants – and solutions are available to small and large growers to grow safe plants (reduced pesticides and insecticides) – we need to "plant salad bars for insects."

Natural Plant Community vs. Horticultural Planting: Design plantings that take the best of two worlds –us**e the design *principles* of our traditional horticultural plantings (color and texture), but design for a plant *community* by blending the two, to create a "*designed* plant community."** This will make the planting more beautiful and ecologically functional, lower management and easier to maintain. This practice of "Plant Community-Based Design" comes from the research of Hansen, Stahl and Mussel of University of Munich.

Remaking nature out of concrete jungle with higher ecological value – bringing nature back home to cities which is critical – many inspiring solutions, and people gravitating toward these plantings. Plants are essential for our health and quality of life. (Green is a magical color for psychological health.)

But not every garden is a highlight – good examples of rich ecological landscapes are still very rare.

Why is this happening? Too much focus on ecology can go wrong and get very messy – we need good plant design too. Native plants then get a bad reputation – we have a huge issue with aesthetics. We need to meet the challenge of aesthetic plant combination. On the other side is super control – and it requires herbicides and pesticides to keep them "clean" – not a sustainable planting method.

Typical rain garden planting recommendation - may have the right plant choices, but if you do not plant enough plants, it is not a good sustainable landscape. This is a problem with designing functional and ecologically sound landscapes - plants do not grow like paints on canvas.

"Every plant designer should provide living groundcovers – forget mulch!" Groundcovers are incredibly diverse and stable.

"THREE PILLARS" of Designed Plant Communities:

1. **Relate plants to people**—make the plantings attractive.
    a. Use the art of abstraction – abstract the visual essence of wild landscape on a smaller scale – very private and subjective process – It makes the emotional connection more accessible to people. Ecological planting inspired by big, dynamic moments in nature .
    b. Interpret and amplify nature (mimic patterns)
    c. Create "orderly frames," borders and lines (find ways to surround or enclose planted areas, such as with low walls or benches, to make the planting look neater). You can meet people's aesthetics and frame and have ecological value – naturalistic and bio-diverse, but framed (it doesn't look overpowering and messy- makes it more palatable to people). Examples: Children's Museum in Pittsburgh – bioretention area next to concrete seating; Pittsburgh Convention Center – has a natural meadow on top of roof.
2. **Relate plants to place**
    a. Create a plant design that mimics the natural conditions of a wild landscape (organic matter does not equal how healthy your plants will be) – plants can grow in difficult environments – if you amend soils, then the delicate and beautiful species that favor sites with dry and poor soils will go away. The nutrition you add (compost, amendments, mulch) doesn't necessarily equal healthy plants, because plants specialize depending on the particular site conditions. "Use the site's constraints as assets"—don't just add compost wherever you go. Find the right plant palette for your site conditions, based on similar habitats in nature.
3. **Relate plants to other plants** –it's O.K. to plant them **densely**!
    a. Plants want to grow in community – layered structures – ground layer and then taller species – they are ecologically adapted to take these places and share resources – their root systems are shallow to deep – they do not directly compete with one another – they fit together like a 3-d puzzle – they have an ecological niche – do not be afraid to plant plants closely if they are morphologically adapted to fit together. [See graphic "Root Systems of Prairie Plants" in Illinois Native Plant Guide.]
    b. ***Design with layers*. The first is the *Functional Layer*** (groundcovers and forbs). Start with a dense layer of **ground covers**—e.g. grasses, forbs, mixed sedums, strawberries—shallow root systems. This layer prevents erosion; prevents weeds; and is essential for stable plant community. (Packera- Golden Ragwort is a ground cover that also provides a seasonal theme) – use ground covers like a sponge, rather than mulch. ***Ferns are not a groundcover***; their stems are bare because something else is supposed to grow underneath and around them (such as Carex pennsylvanica, or native Pachysandra).
    c. **Next is the *Design Layer,*** which is made up of **2 layers**:

        1) **Structural Layer** – these are the plants that "stand out" and "hold things together" – it provides a framework and looks deliberate – important for "legibility" of the site– these mimic colorful or "textural moments" in nature and are a powerful design tool. Examples- Joe pyeweed, Liatris, grasses, shrubs and trees—they don't' have many lower leaves because they're morphologically adapted to grow tall and spindly, i.e. their roots are deeper than the groundcovers around their 'feet,' and they won't compete.
        2) **Seasonal Theme Layer** – groupings of species that all bloom at one time, en masse. These provide "textural moments." Examples – coneflowers; Asclepias tuberosa – plant 20%-40% of your area with this and imagine how it will look when it all blooms at one time- be bold; Solidago odora; Symphotricum; Iris and Veronica. [See examples of naturalistic planting design by Heiner Luz.]

    d. Planting method does not need to be overwhelming. Step 1: start with the Structural species- arrange them first in the design in groupings here and there. Then Step 2: arrange big drifts of plants with

Seasonal Themes. Step 3: Fill in the matrix with a mix of ground covers, under and between the other layers (it will become a complex planting but is installed one step at a time).

Plant the RIGHT plants and MORE of the right plants!

Q: How to handle mildew if plants are installed so close together? A: mildew is rare in nature; problem is not the density of plants, but that there's not enough diversity. Need to add more diversity.

Q: Aggressive plants? A: There are some "bullies"; may be able to use aggressive plants as the ground layer, and the plants above it will occupy a different niche.

Presentation: "The Limits of Restoration (Invasive Plants)"

[SPEAKER: ROD SIMMONS, Natural Resource Manager, Plant Ecologist, Department of Recreation, Parks and Cultural Activities, City of Alexandria VA; Rod.Simmons@alexandriava.gov]

Slides of old-aged forest and bogs. **"Large scale natural land preservation is the only effective and appropriate means of preserving biodiversity." We can't create these areas, but we need to look at protecting and conserving what we still have—stewardship.**

Deer – "are like mini plows," and their hooves bring the seeds in, helping to "plant" non-natives. "You can almost date a forest by the invasives that are in it." Invasions tend to follow overbrowsing by deer. Example- Japanese stiltgrass.

The presence of non-native invasive plants is largely the result of soil and habitat disturbance. Japanese honeysuckle comes in because of light. Birds drop English ivy seedlings in degraded floodplains (e.g. sanitary sewer easements).

Use BMPs - as little foot print as possible—but if needed, remove invasives and allow native seed bank to fill the site in. Native material that has been suppressed will eventually regenerate – this will just take time (heal the site) – see slide on misapplied plantings (smother seed banks, introduce non-natives and invasives, etc.)

Unfortunately, many people are now trying to restore biodiversity in too short of a time frame, not allowing for natural succession. For example, "let's take a chunk out of the Battlefield and plant milkweed"—but is milkweed native to that community? Simmons calls these "misapplied plantings." "You don't have to have 10 kinds of milkweed in an area, or so much 'diversity' that it looks like a plant nursery."

"Less is more" (slide of Mayapple in understory).

Most important plants in the landscape are the **TREES** – you damage them when you strip away the surrounding plant community. Urbanization/construction /development (for utilities, foundations, etc.) –bringing in or moving soil around = INFILL has contributed to dropping the water table, and therefore oak trees can't regenerate (sprout) here anymore. Climate change will exacerbate this.

"Freedom Lawn" – Example – poverty oatgrass (Danthonia spicata) planted under oak-hickory (acidic soils).

Eastern redcedar—one of the most important wildlife food and habitat plants. Sumac- important native shrub edge (but don't use "fragrant sumac" or "grow low" sumac). Don't use aralia alata (non-native devil's walking stick).

Native crabapples are increasingly less common. Bradford/Callery pear has intercrossed with natives and changing gene pool. ***Get rid of Asian species first, then plant natives, otherwise the Asians will just cross with the others.***

Use New Jersey tea and pasture rose from your local area, not crossed from other natives at a huge nursery. ***We need to distinguish between what's a cultural landscape vs. a natural landscape*** – and be careful of the juxtaposition of the two when planting - suburban gardens with remnant forest are important refuge for wildlife, especially adjoining parks and natural areas.

Don't plant in natural landscapes.

To restore an area, subtract invasives carefully, then carefully reintroduce the historical plant species that should be there.

Ernst Seed and others are providing noxious weed seed – creating monocultures and eliminating/extirpating natural material.

Responsibly collected, local provenance native plant material – seeds – is the foundation of ecological plantings (Earth Sanga, Chesapeake Natives, VNPS, Potowmack chapter propagate locally sources plants

Re. Cultivars—it's a clone – they took one characteristic from one plant and made hundreds of them—this is **not** what we should plant. Example – the Tiarella varieties –they have been mass-produced and wouldn't occur in nature like that, it's an anomaly. Don't plant cultivars near waterways, or in parks.

"Don't just plant a lot of diverse plants around that tree stump—that's not what a land manager does."