LIVING
HABITATS

Landscape Architecture
Ecological Services
Environmental Planning
Custom Artworks

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Wisconsin Lakes Partnership Convention

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Paying it Forward

- Share some of my experiences and approaches to creating resilient and ecologically functional landscapes
- Discuss high-level site assessment and design strategies
- Share project examples from a variety of habitats
- Offer insights related to design and project planning

There are many reasons people may be interested in learning about and supporting our environment.

Anglers Healthy habitats improve fisheries and enjoyment of the sport.

Birders Creating layered assemblages of species unique to different plant communities such as wetlands, grasslands, shrublands, and woodlands maximize habitat for declining, as well as more common bird species.

Pollinator Support Our very existence depends on the work and behaviors of invertebrates; doing what we can to minimize harm to and support for this group of creatures is in humankind's broad self interest, along with many other creatures in our food chain.

Outdoor Recreationists

Finding pleasure in the simple act of being out of doors or doing activities that are enhanced in the natural environment such as hiking, biking, boating, camping, rock climbing, creating art, swimming, et cetera.

Plant Lovers and Cultivators

Botanists, gardeners, horticulturalists, farmers, vintners, herbalists, landscape architects/ designers and contractors, artists, health practitioners, and more find work and enjoyment with plants.

Provision of Ecosystem Services

Plants cleanse the air; absorb stormwaters; hold soils; offer habitats; moderate temperature & mitigate urban heat islands; offer us minerals, nutrients, materials for shelter & medicines; function for bioremediation; and can fulfill specific regulatory requirements to offset impacts of development.

RESTORED SEDGE MEADOW WETLAND

Professional services that may be needed to address the interests of these varied groups can include – limnologists, geologists, wildlife ecologists; botanists, horticulturalists, landscape architects/ designers; various site contractors; artists; civil, hydrologic and structural engineers; regulatory expertise; project and construction management and more.

Most projects have site specific aspects that prevent generalization of solutions related to these disciplines, however, most all projects could utilize native plants as part of their solution and with multiple benefits.

Presentation Outline

Designing with Native Plant Communities

1. COEXIST - Importance of species and genetic diversity in our environment

2. LIVING MACHINES - Application of plant communities as synergistic assemblages and how to leverage individual species' morphology

3. EMBRACE - Non-native species need to be better balanced with native plant use wherever possible; integrate cues to care for broader acceptance

4. DEFEND – Importance of stewarding and maintaining our existing and newly created native plantings

COEXIST

Designing with Native Plant Communities

1. COEXIST - Importance of species and genetic diversity in our environment

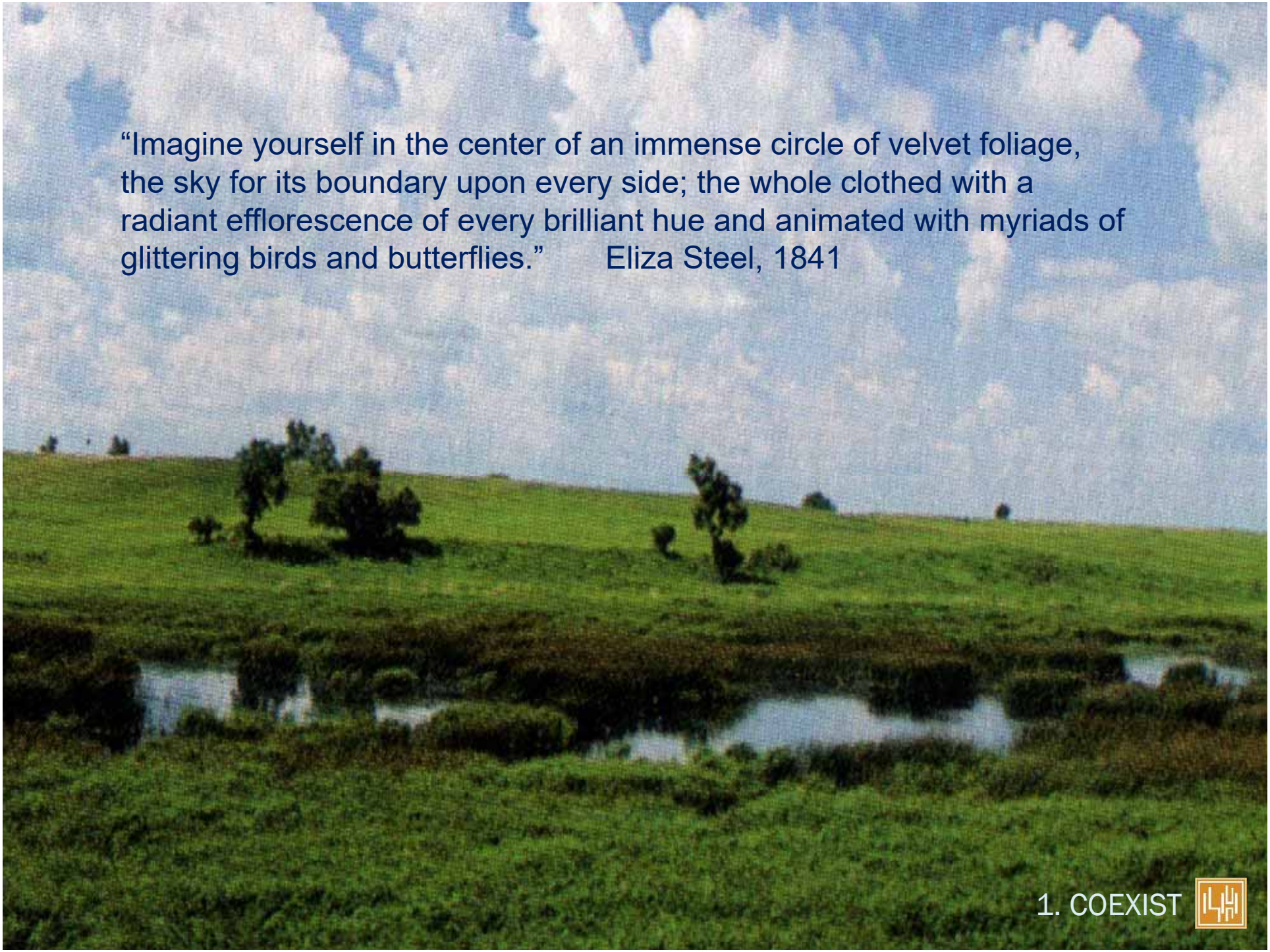
Widely Understood

- Globally, diversity has been declining for many years now, which is problematic for many reasons.

The Holocene Extinction, otherwise referred to as the Sixth Extinction or Anthropocene Extinction, is the ongoing extinction event of species during the present Holocene epoch, mainly as a result of human activity. *Wikipedia*

"Man-made changes are of a different order than evolutionary changes and have effects more comprehensive than is intended or foreseen." *Aldo Leopold*

Out of the estimated 21 million acres of prairie that existed in Illinois prior to European settlement, less than 2,600 acres of functioning grasslands remain, marking a loss of this critical habitat of more than 99.99 percent. *Illinois Dept. of Natural Resources*


“Imagine yourself in the center of an immense circle of velvet foliage, the sky for its boundary upon every side; the whole clothed with a radiant efflorescence of every brilliant hue and animated with myriads of glittering birds and butterflies.” Eliza Steel, 1841

What does it mean to protect our natural resources and their diversity?

There is no place left on our planet that we have not impacted to some degree. Very small changes in environmental condition that are often imperceptible to us over our lifetimes can have massive and profound cascade effects on the environment.

To have any desire to protect or enhance something, humans must bond on an emotional level and come to truly value it.

In the case of our environment, we know we absolutely need it directly and indirectly, but we tend to only protect it when it is on the brink of being lost, otherwise generally taking it for granted.

What can we do differently?

Plants have co-evolved with animals and human culture as one of the primary components of life as we know it.

As residents in their historic habitats, plants created the structure and form of a landscape. As part of new cultural landscapes they provide us with many ecosystem services.

As plants absorb solar radiation, they generate food, components for our clothing & shelter, the air we breath and much more for earth's creatures.

To elevate plants as the critical resource they are, we must start to make choices that better support biodiversity, such as much more broadly using native plants.

Why are native plants so important today?

Homogeneity of our environment is a precarious plan. If we look to our living world as a model for how to do things, the main theme is:

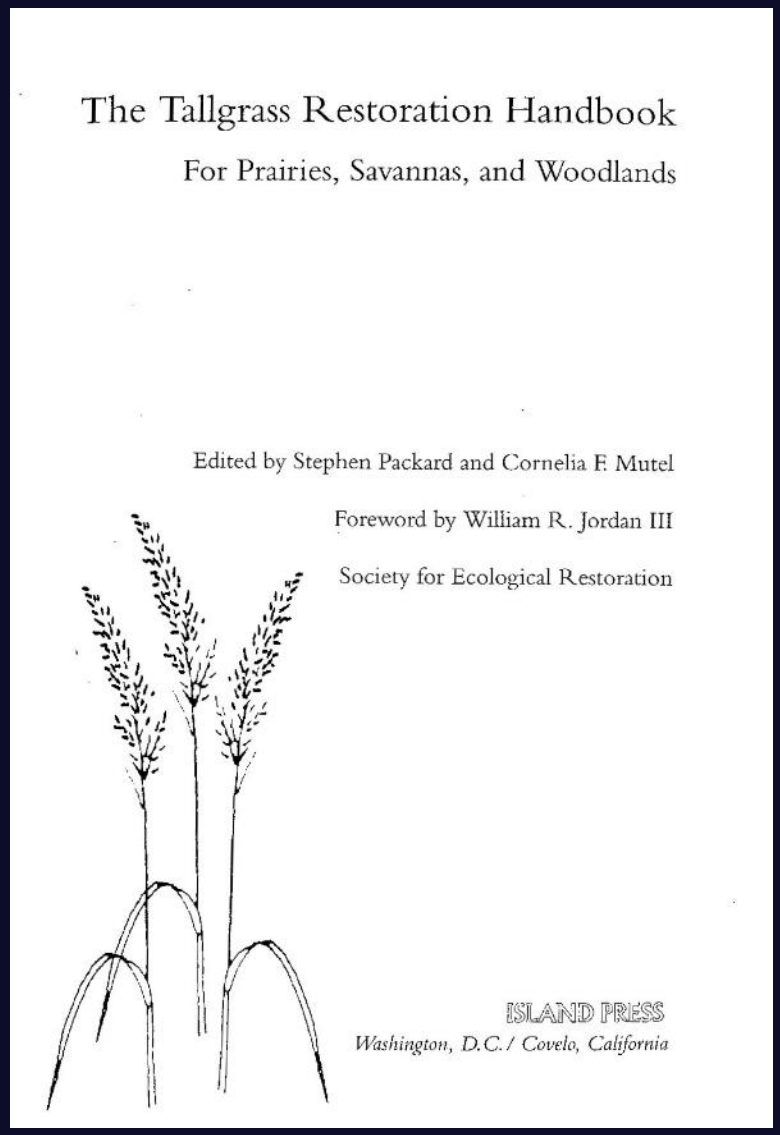
DIVERSITY = Long term resilience

Worldwide, expanding the use of native plants wherever and whenever possible is a critical part of perpetuating a diverse future from a botanic perspective, maximizing the options for biological adaptation.

What is a native plant in North America?

- A species that was documented as growing in a region prior to European settlement.
- Typically part of an assemblage of species that together comprise a self-reproducing and stable ecosystem over very long periods of time.
- Open-pollinated and not created through cultivation.
- In much of the U.S., most often a species that benefits from some sort of regular interface with fire.

The Extents of the Tallgrass Prairie Region



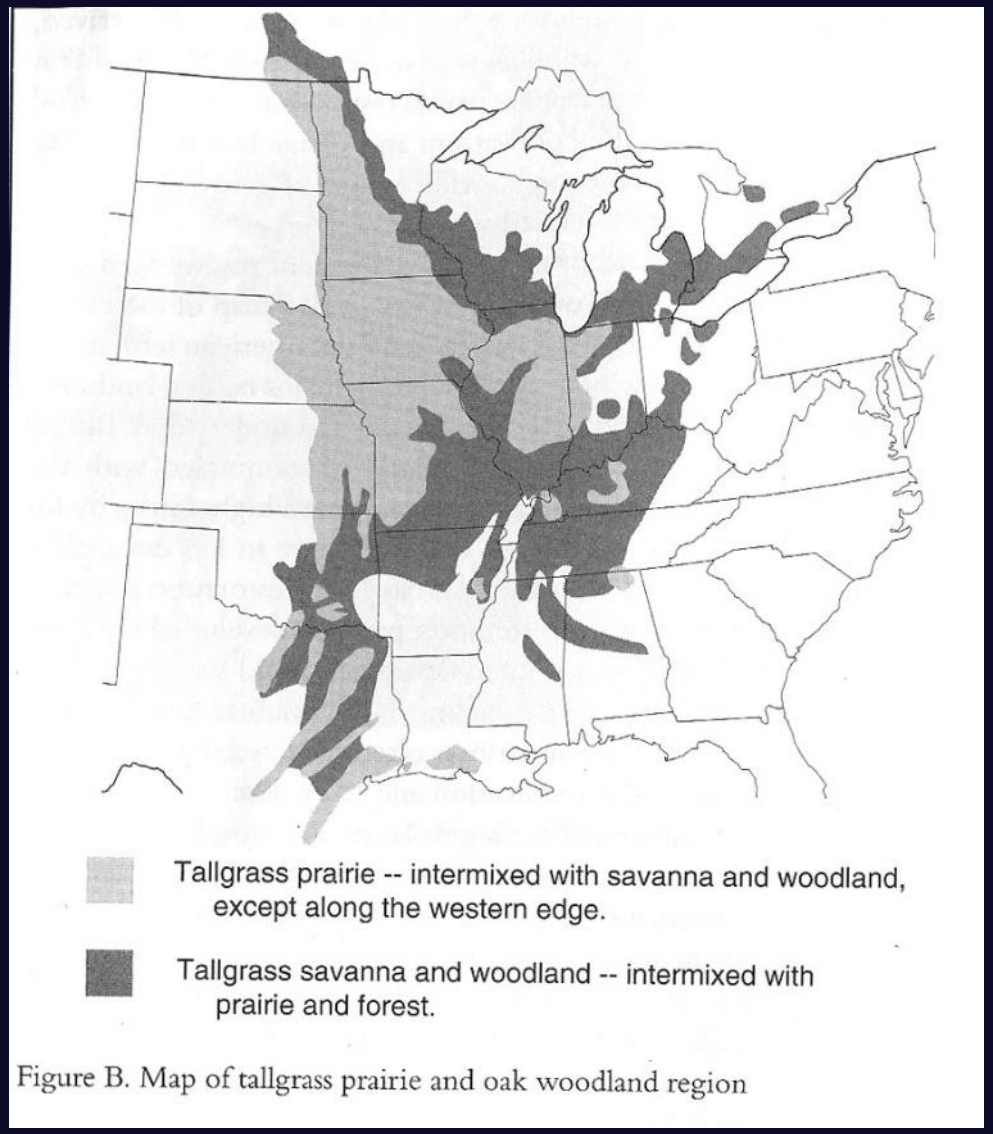


Figure B. Map of tallgrass prairie and oak woodland region

Designing with Native Plant Communities

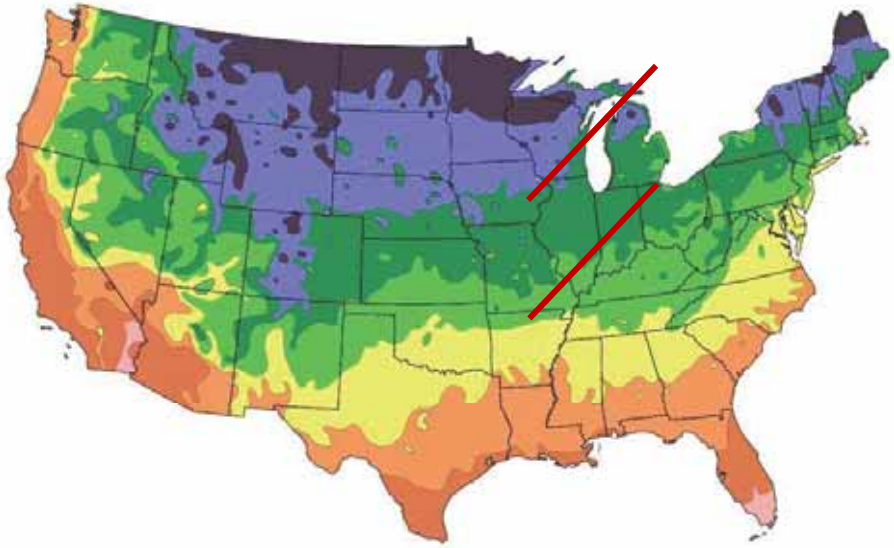
1. COEXIST - Importance of species and genetic diversity in our work

Often Overlooked

- Prioritize protecting and enhancing existing plant communities (both remnant and restored), which takes on evermore importance in our work as individual species populations dwindle. These protected places offer reference for our work, and places to harvest open pollenated seeds.

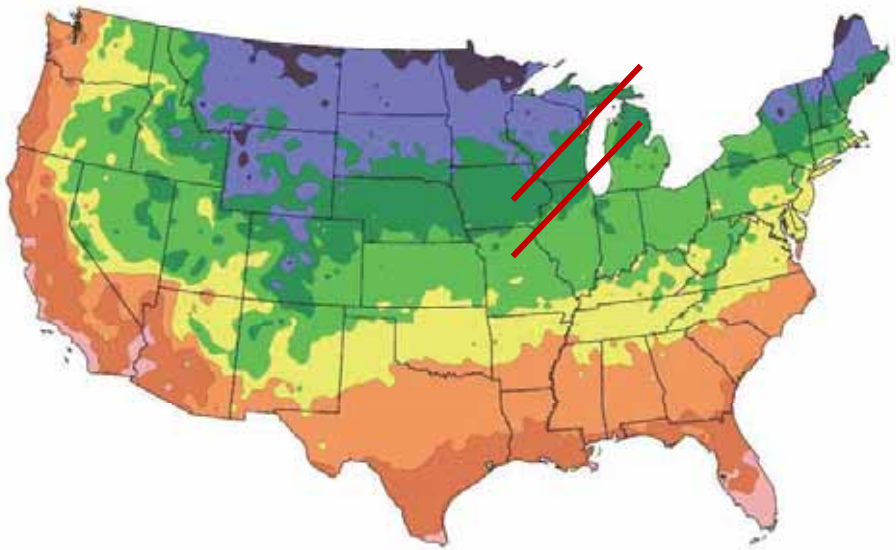
- Within a single species, maximizing genetic diversity is especially important in an era of climate change to support adaptive potential. Best practices for maximizing species and genetic diversity by region should be adopted.

1990 Map



After USDA Plant Hardiness Zone Map, USDA Miscellaneous Publication No. 1475, Issued January 1990

2006 Map



National Arbor Day Foundation Plant Hardiness Zone Map published in 2006.

Zone

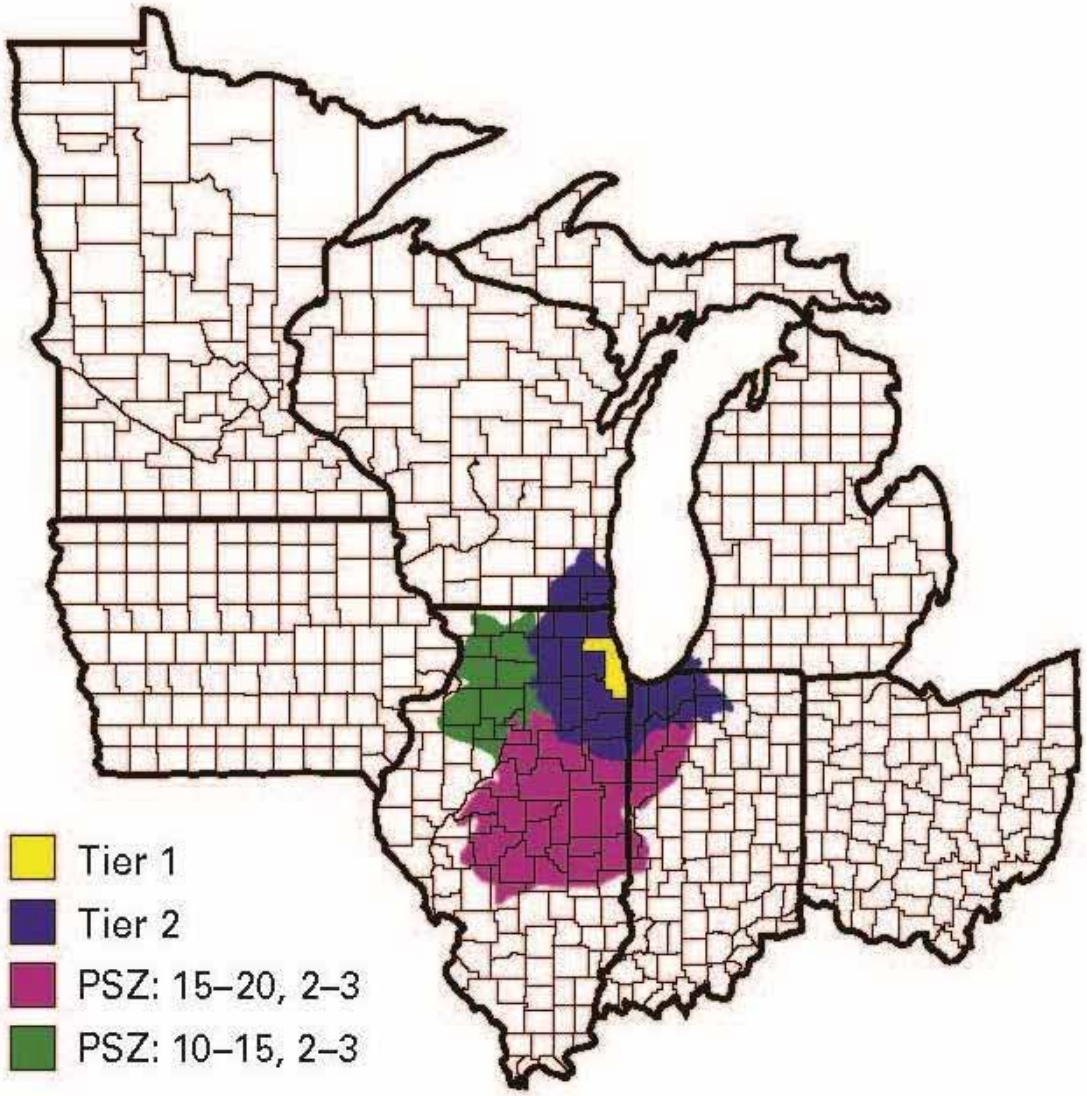


FIGURE 1 Seed sources for FPCC projects. Tier 1—Cook County, Tier 2—within Chicago Wilderness, and Tier 3—Provisional Seed Zones (PSZ 15–20, 2–3 and PSZ 10–15, 2–3; Bower et al. 2014).

Graphic courtesy of Microdot Inc.

Aerial Photograph - 1938

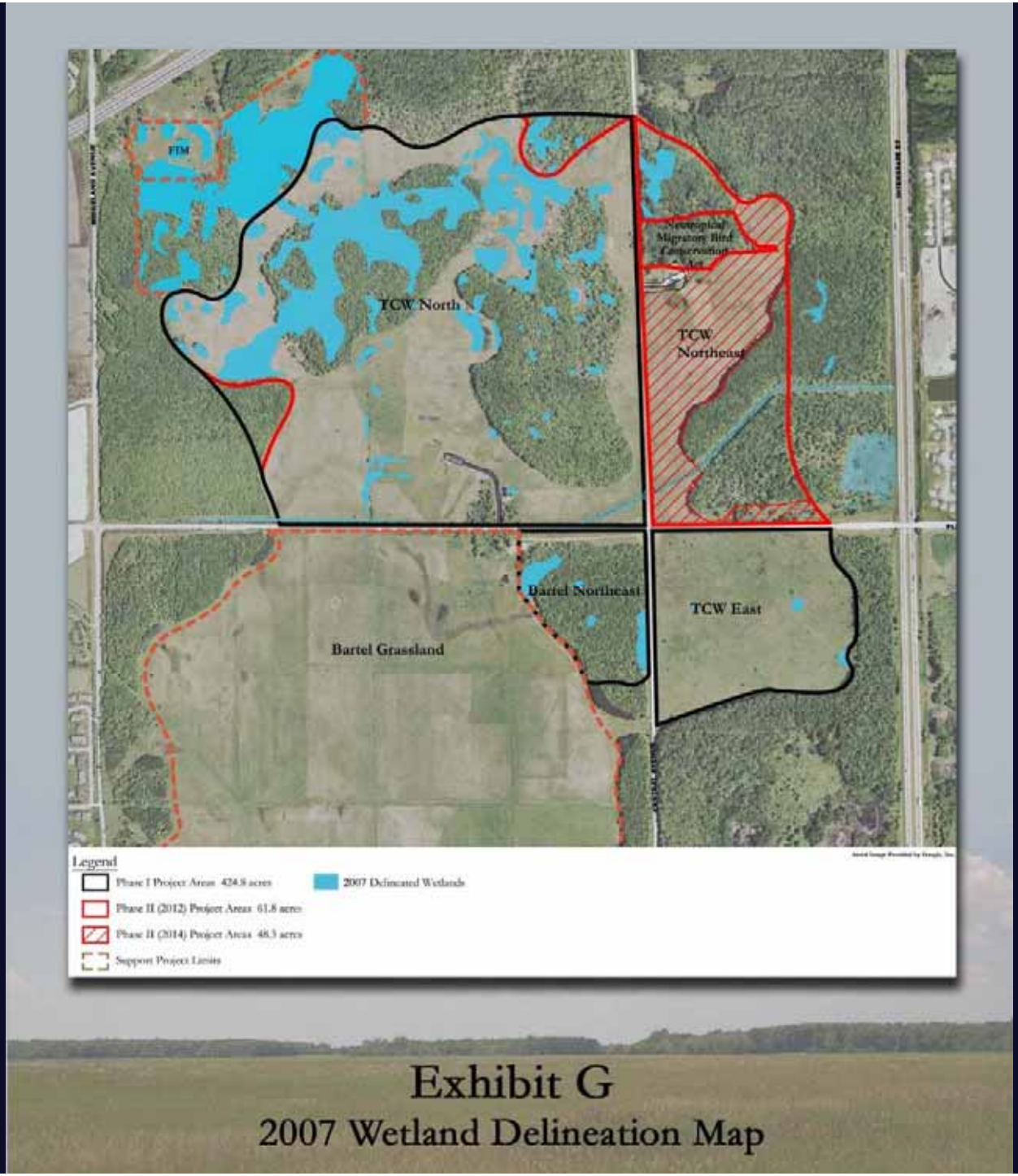
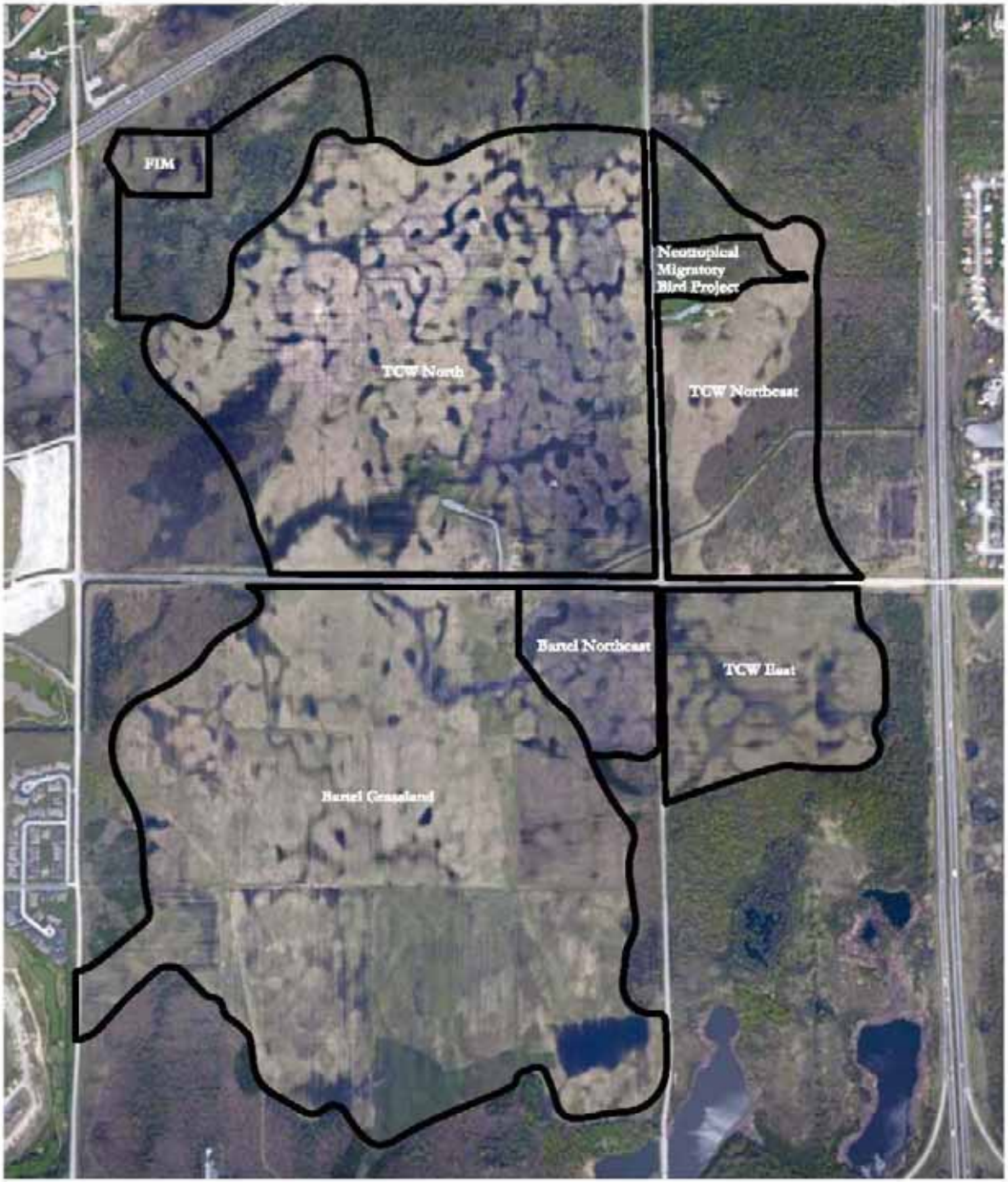


Exhibit G

2007 Wetland Delineation Map

PRE-PROJECT SITE CONDITIONS


FIM
Neotropical Migratory Bird Project
TCW North
TCW Northeast
Bartel Northeast
TCW East
Bartel Grassland

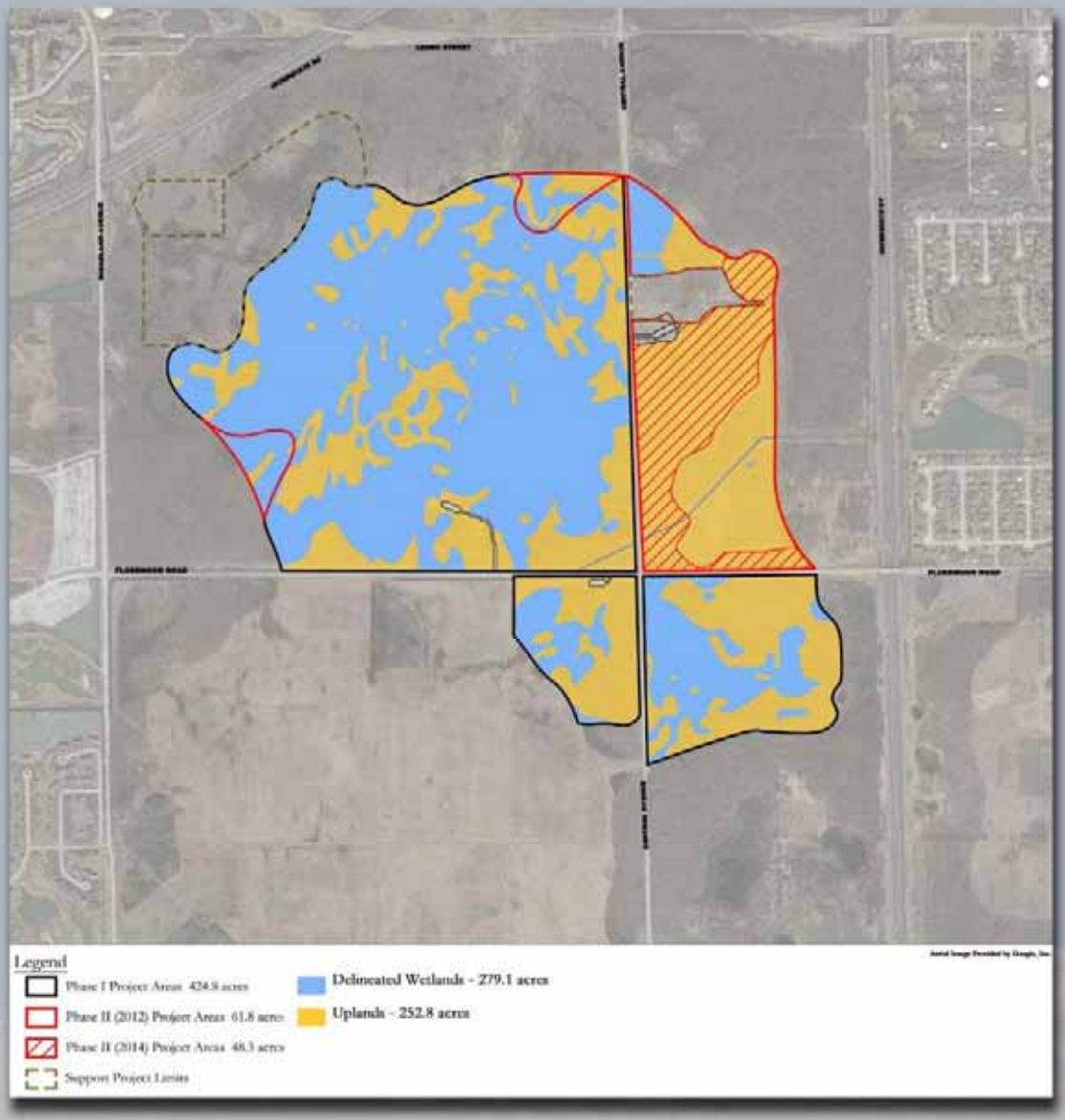


Exhibit H

2015 Wetland Delineation Map


PROTECTED AND ENHANCED WET REMNANTS
& RESTORED MESIC PRAIRIE


RESTORED SEDGE MEADOW WETLAND


RESTORED EMERGENT WETLAND

LIVING MACHINES

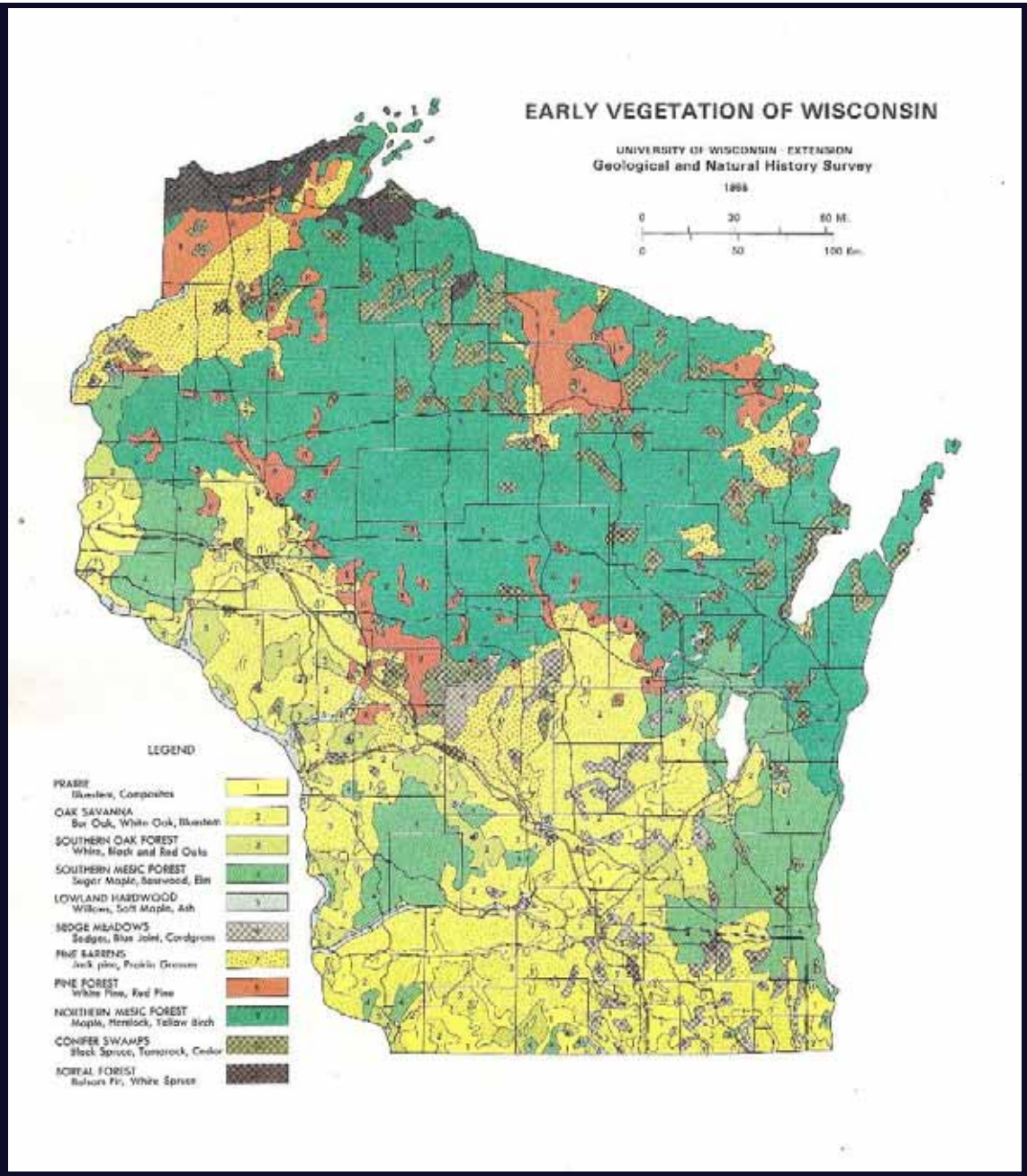
Designing with Native Plant Communities

2. LIVING MACHINES - Application of plant communities as synergistic assemblages and how to leverage individual species' morphology

Widely Understood

- Plant communities are assemblages of native species that work together in specific environmental conditions and can be referenced for insights in design work and guidance about the potential for success when using individual species in the landscape.

- The synergy of the community as a whole has higher habitat value than the inclusion of a single native species in the landscape.


EARLY VEGETATION OF WISCONSIN
UNIVERSITY OF WISCONSIN - EXTENSION
Geological and Natural History Survey
1966
0 30 60 M.
0 50 100 Km.
LEGEND
PRAIRIE
Bluestem, Composites
OAK SAVANNA
Bur Oak, White Oak, Bluestem
SOUTHERN OAK FOREST
White, Black and Red Oaks
SOUTHERN MESIC FOREST
Sugar Maple, Basswood, Elm
LOWLAND HARDWOOD
Willows, Soft Maple, Ash
SEDGE MEADOWS
Sedges, Blue Joint, Cordgrass
PINE BARRENS
Jack pine, Prairie Grasses
PINE FOREST
White Pine, Red Pine
NORTHERN MESIC FOREST
Maple, Hemlock, Yellow Birch
CONIFER SWAMPS
Black Spruce, Tamarack, Cedar
BOREAL FOREST
Balsam Fir, White Spruce

What are the essential components of a site that allows us to pair it with a native ecosystem as our design framework?

- Taking a page from the U.S. Army Corps of Engineer's wetland delineation protocol, analysis of existing HYDROLOGY, SOILS AND VEGETATION in combination offer a high level framework for a site's existing potential for the types of ecosystems we might attempt to restore or replicate to some degree.

- If the site's historic conditions have been completely lost or altered, connecting legacy aspects of the alterations, or tailoring new conditions to a specific type of ecosystem can offer the framework of a successful restoration.

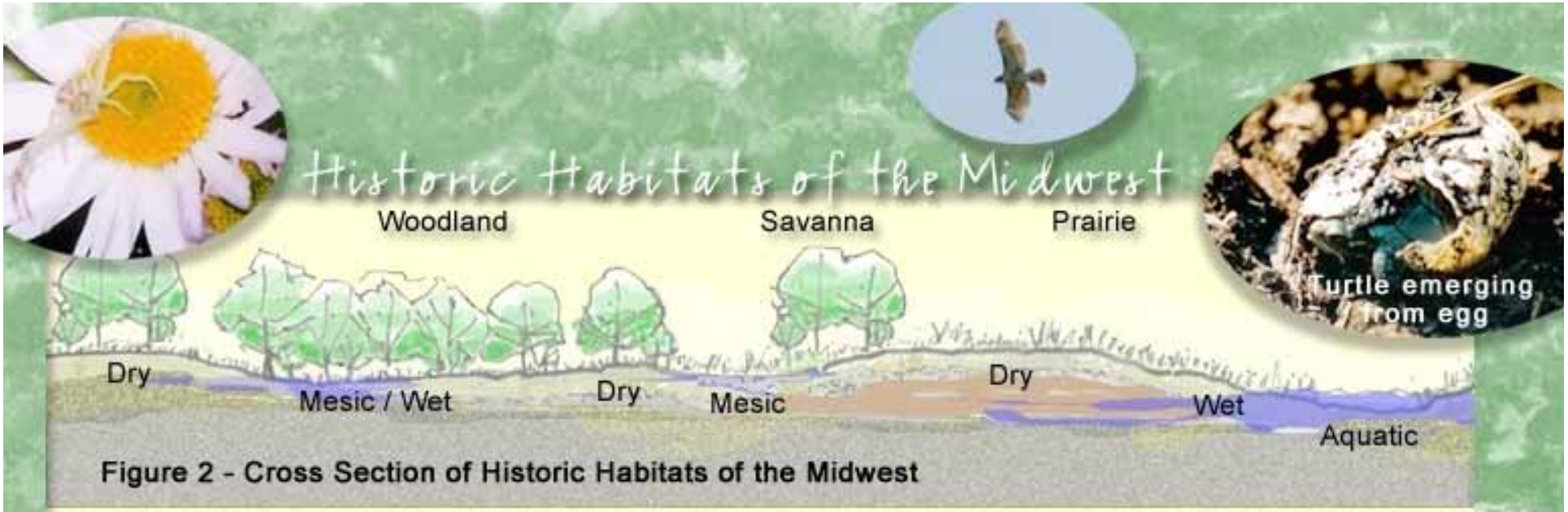


Figure 2 - Cross Section of Historic Habitats of the Midwest

In simple form, historic Midwest habitats consisted of prairie, savanna and woodland (Figure 2 above). Most of these communities were expressed in wet, mesic and dry conditions. The numerous plants and animals that once thrived across the hundreds of thousands of square miles of these habitats throughout the Midwest were ordered according to the amount of precipitation that falls on the land, the lay of the land including soil type, fire, and the force of gravity. Today, these environmental relationships inform us about ecological patterns that can be replicated for the restoration or creation of a healthy habitat in the Midwest, or beyond.

Designing with Native Plant Communities

2. LIVING MACHINES - Application of plant communities as synergistic assemblages and how to leverage individual species' morphology

Often Overlooked

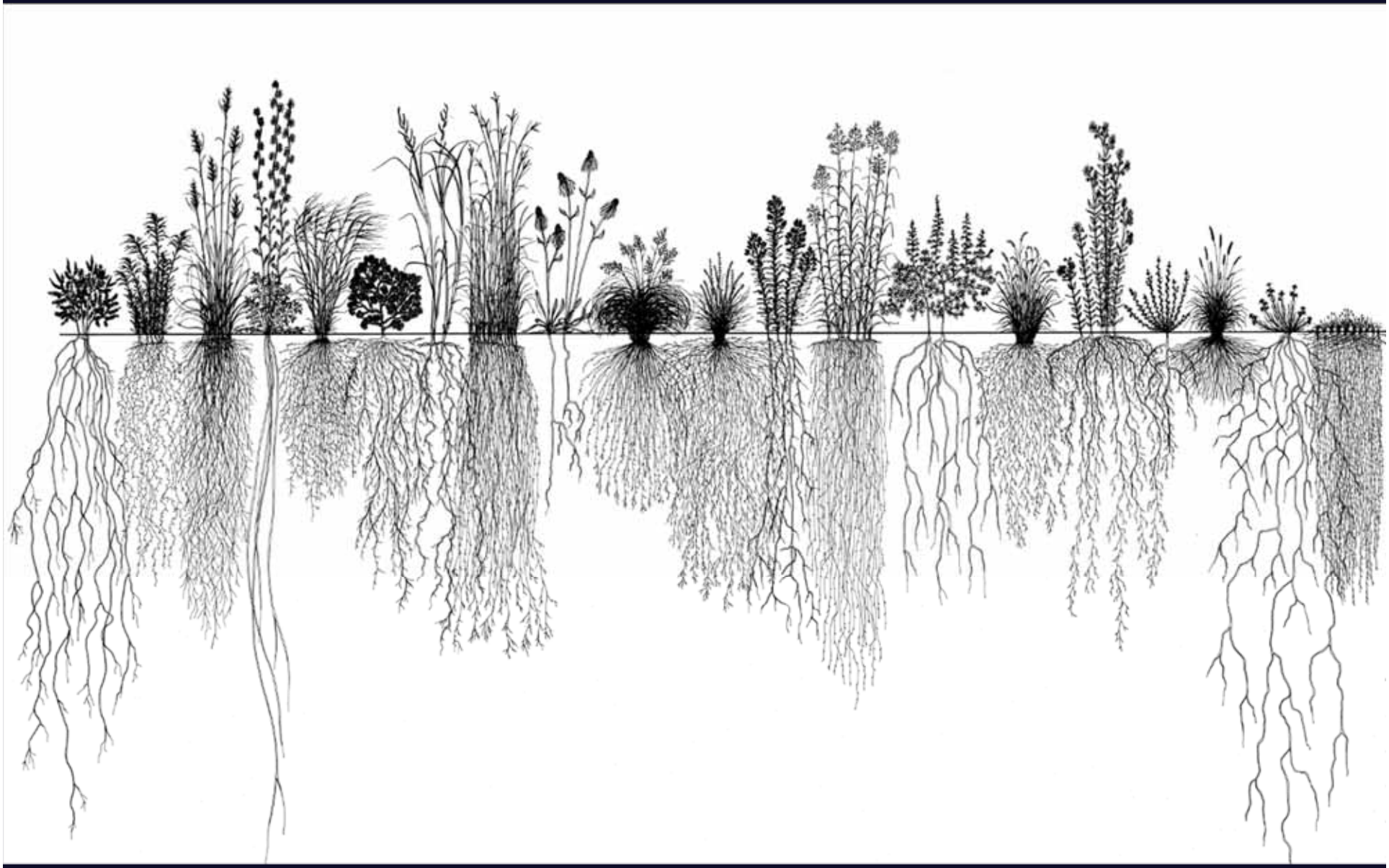
- Individual plant species have evolved to fit ecological niches. The full role each species plays in a given plant community can be hard to appreciate or learn, but general plant morphology can offer insights as to how we might best use plants to gain functional benefits such as infiltrating storm water, stabilizing soils, or offering important habitat.

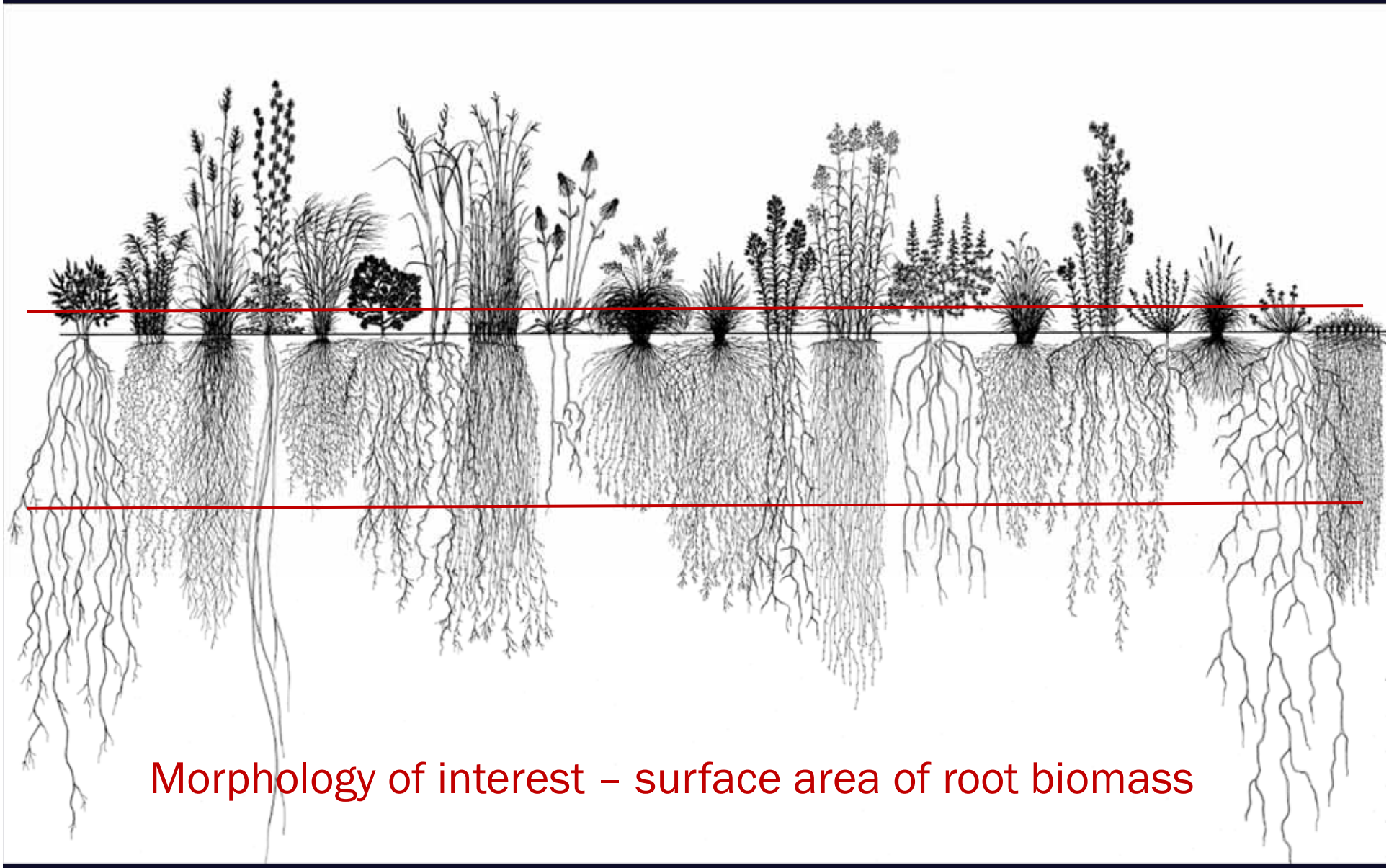
- Good design minimizes disturbance and disruption to existing high quality soils, hydrology, flora and fauna, often having the added benefit of streamlining regulatory approvals. Pair best-matched native plant communities to both preserved existing, and proposed site conditions.

mor·phol·o·gy /môrˈfäləjē/ noun

1. The study of the forms of things, in particular.

2. The branch of biology that deals with the form of living organisms, and with relationships between their structures.

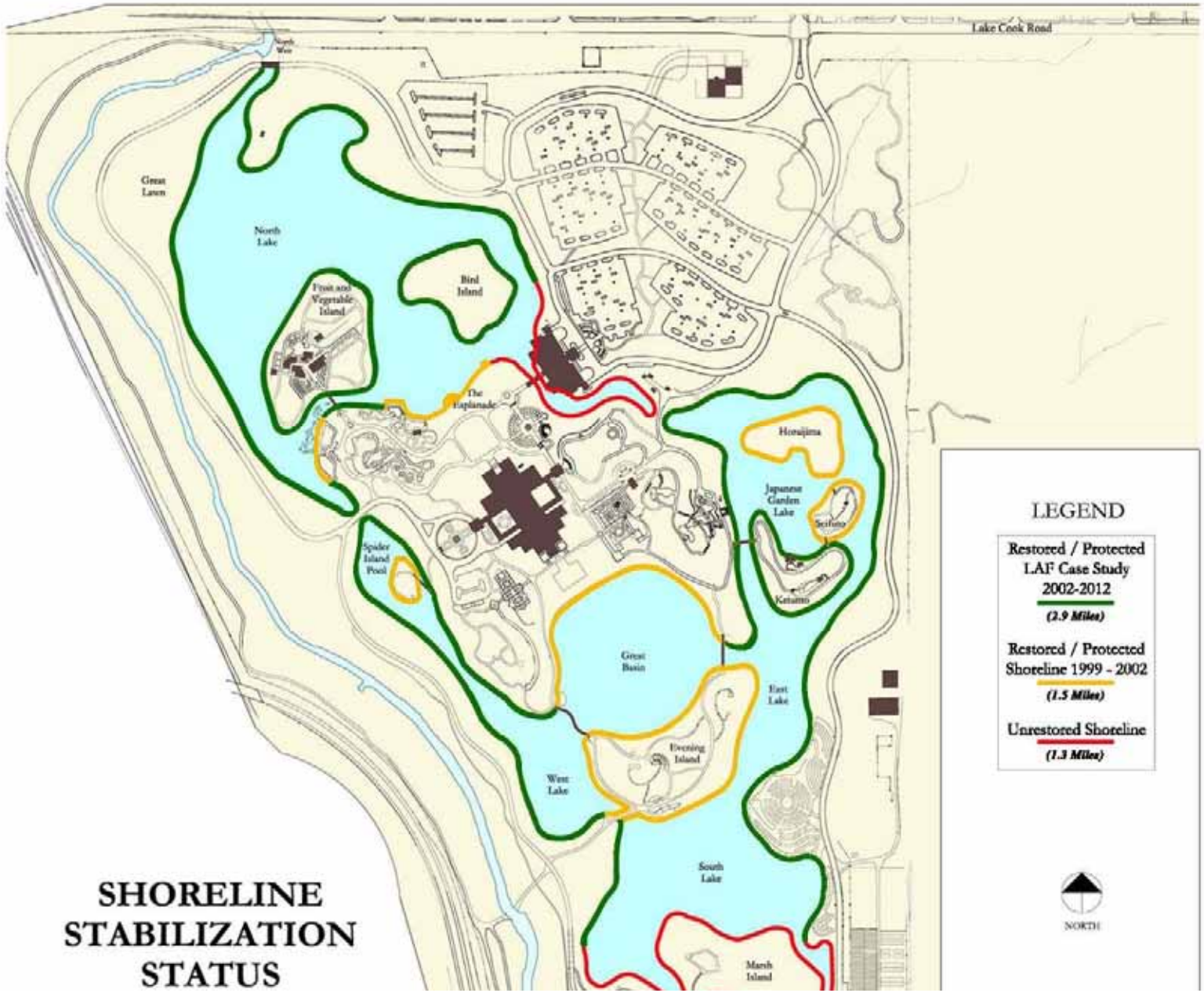




Morphology of interest – surface area of root biomass

SHORELINE RESTORATION MASTER PLAN

Chicago Botanic Garden



SHORELINE STABILIZATION STATUS


CHICAGO BOTANIC GARDEN
“The Garden on the Water”

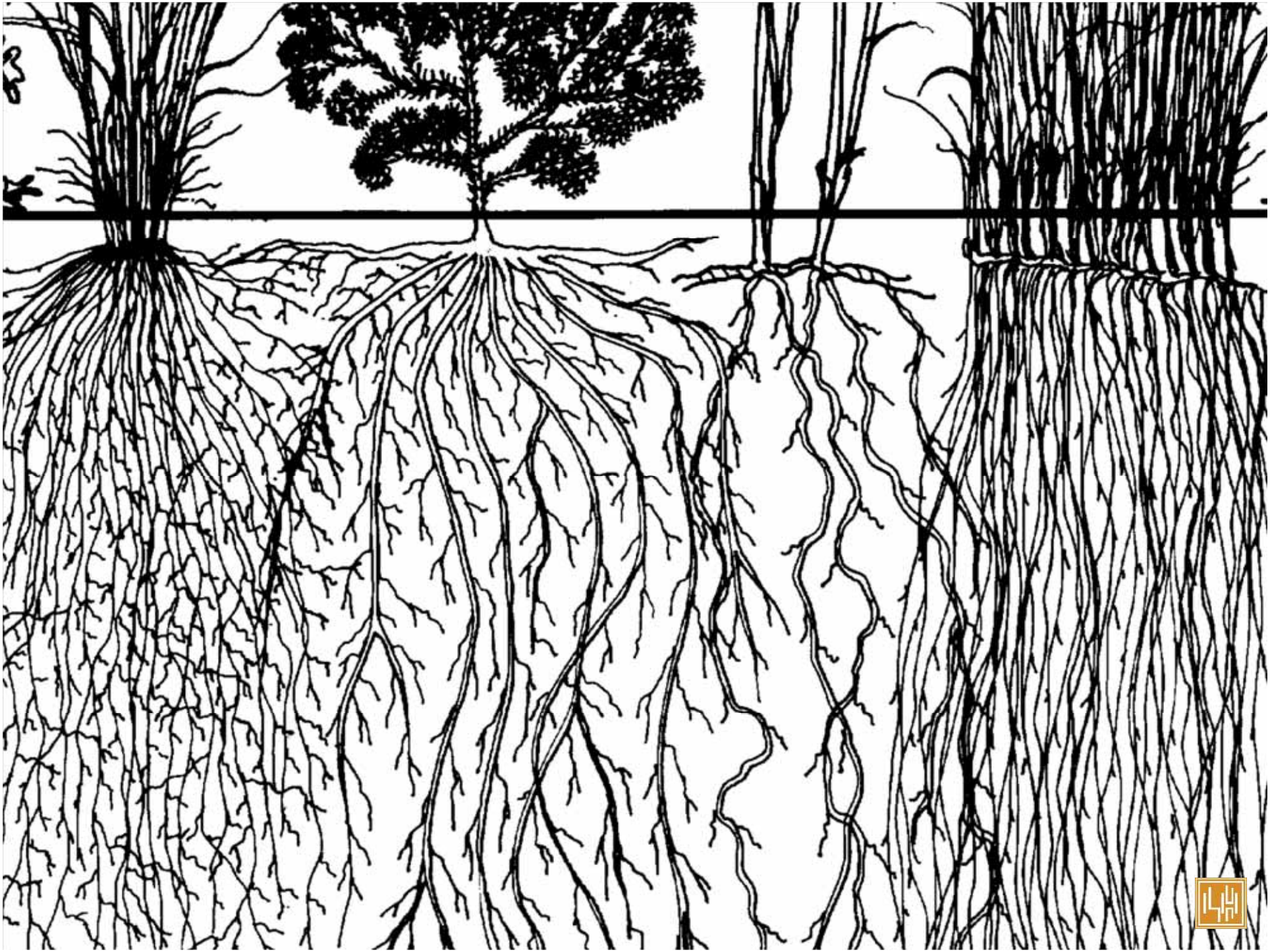

"The Garden IN the Water"


2. LIVING MACHINES


2. LIVING MACHINES

Workhorse plants for the shoreline…

- have dense, deep/rhizomatous/fibrous roots;
- grow and “fill in” quickly;
- are tolerant of wide range of inundation, soil moisture, soil nutrients, light, etc.;
- are not overly-favored by wildlife as food;
- are readily available from the nursery trade; and
- have a sturdy structure that plant easily, establish readily, and resist trampling.




Carex stricta – Tussock Sedge

2. LIVING MACHINES

2. LIVING MACHINES


2. LIVING MACHINES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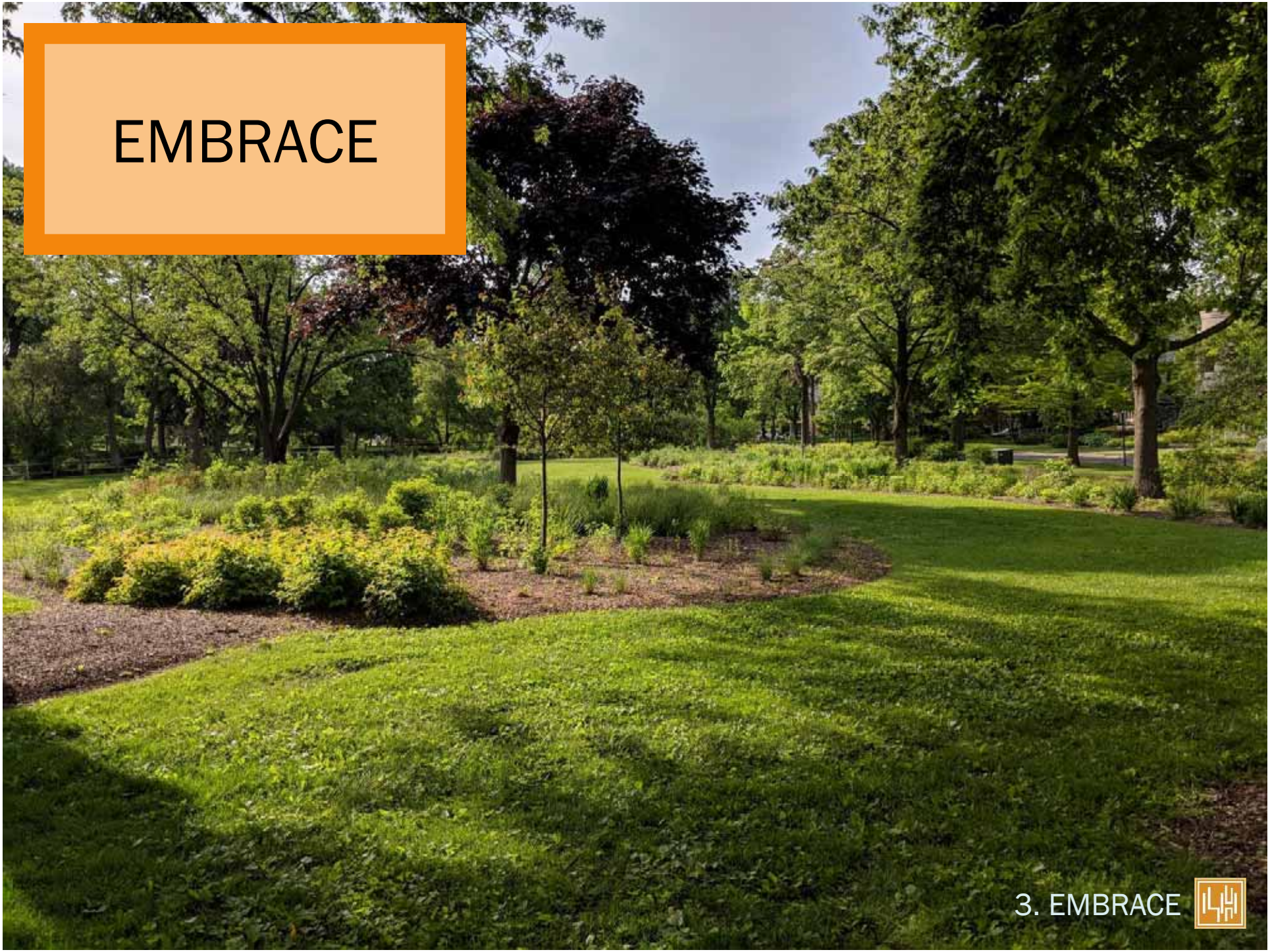
2. LIVING MACHINES

A few lessons learned related to *Plant Installation:*

- Insist on quality plants
- Favor local genotype
- If new soils are brought in, consider the source
- When in doubt, plant shallow
- Plant early enough to allow root establishment
- Ensure good root-to-soil contact; staple them down if below the water line

EMBRACE



Designing with Native Plant Communities

3. EMBRACE - Non-native species need to be better balanced with native plant use wherever possible; integrate cues to care for broader acceptance

Widely Understood

- Non-native species are heavily relied upon by humans for many important reasons, however, they need to be better balanced with native plant use wherever possible, and should never be used if they are invasive.

What are some of the consequences of non-native plant use?

Our cultivation of the land has had serious environmental and cultural consequences, reducing species diversity and quantity, and destroying natural areas at paces that are generational verses evolutionary.

Non-native plants most often demand much greater inputs in support of their health than native plants. This translates into broader environmental degradation such as excessive water use, pesticide pollution, gas powered maintenance equipment related air pollution, etc.

Many non-native species can exhibit aggressive or even invasive tendencies, which at worst can threaten entire ecosystems and demand significant inputs to control.

Should non-native plants never be used?

This is not a reasonable option as most of our landscapes are mostly covered with non-natives now.

Properly considered and better balanced with a much larger application of native flora where possible, non-native plants can serve important roles.

- Functional uses, e.g. food, lawns for recreation, green walls and roofs for storm water management, street plantings for urban heat island mitigation, etc.

- High aesthetic performance, i.e. when an area deserves special highlight or beautification, or a more formal landscape design style in targeted areas.

Designing with Native Plant Communities

3. EMBRACE - Non-native species need to be better balanced with native plant use wherever possible; integrate cues-to-care for broader acceptance

Often Overlooked

Native plant communities were often destroyed because they were not inherently valued and “higher” uses prevailed. Even good quality native plantings and remnants are often considered weedy and unkept. Integrating cues-to-care can make the difference in public acceptance.

Joan Nassauer, FASLA – A continuing theme of her research is that evidence of human care [and involvement] in the landscape has a powerful normative effect on human perceptions and behavior to change landscapes. Her research has influenced green infrastructure design, ecological restoration, urban and rural watershed management, transportation planning, and the development of metropolitan neighborhoods, and brownfields.

TOP 5 CUES-TO-CARE

3. EMBRACE

Summary of my top five cues-to-care:

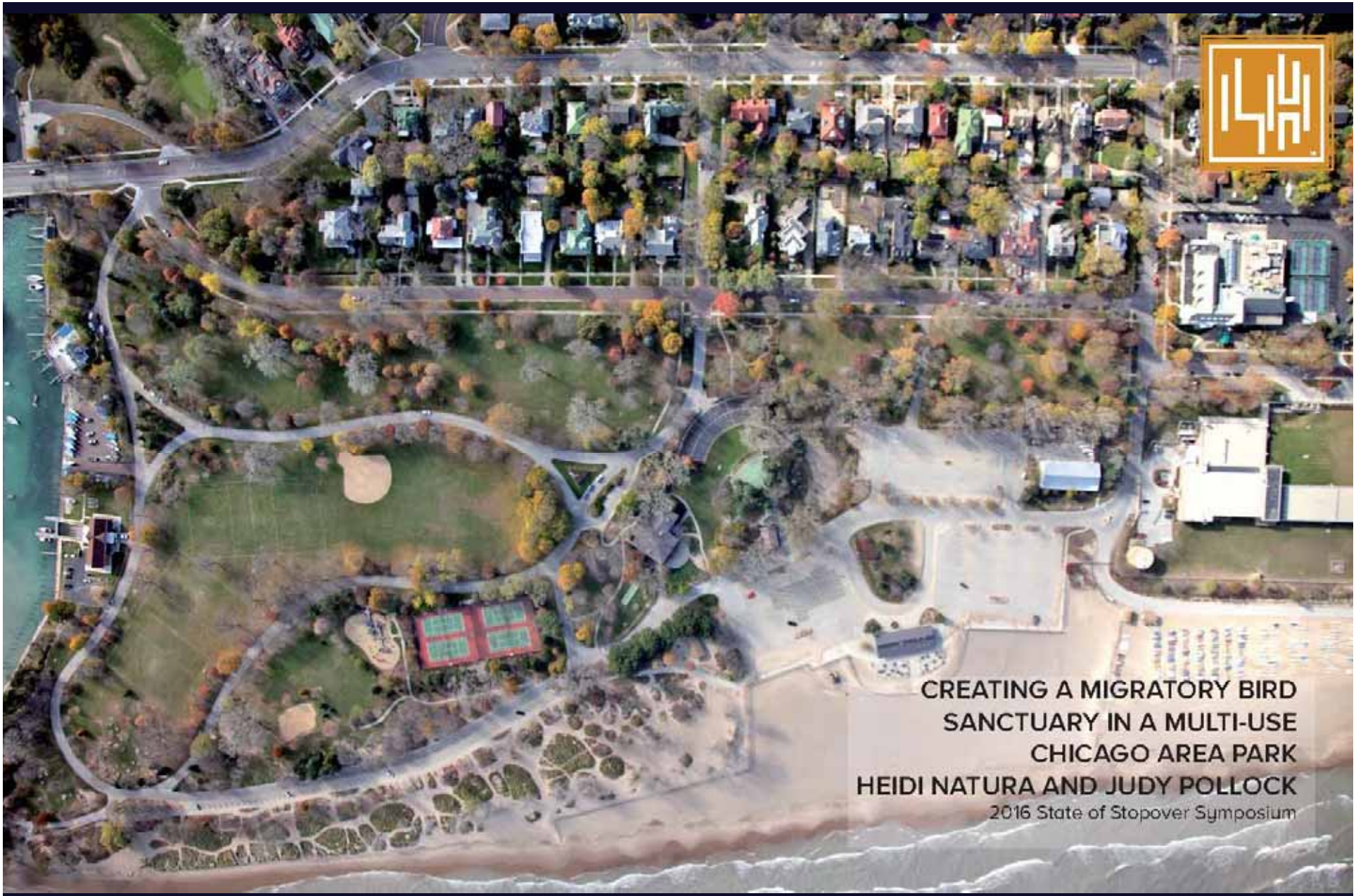
1. Use turf as border and for paths or active use areas. The more open sky or lack of enframement, the bigger the borders and paths should be.

2. Organize plantings into minimalist garden beds, applying traditional garden design principles like color theory, rotational blooms, and plant heights stepping back from paths. Maintain as such long term, even if it means weeding native species.

3. Plant communities with integrity include all their structural parts (or as many as can be assembled). Don't forget the shrubs, grasses, sedges, rushes, ferns, and fungi. Don't include things that should not be there.

4. Use hardscape and art elements to imply human intention.

5. Commit to stewardship and adaptive management in perpetuity (DEFEND) to insure best appearance and inherent quality of plant communities.



CREATING A MIGRATORY BIRD SANCTUARY IN A MULTI-USE CHICAGO AREA PARK

HEIDI NATURA AND JUDY POLLOCK

2016 State of Stopover Symposium

Turf as borders and for paths

Use turf as borders and for paths or active use areas. The more open sky or lack of enframement, the bigger the borders and paths should be.

Turf as borders and for paths

Existing turf along the walking path is inconsistent. In this widest area, it works well to define intention for the less organized adjacent vegetation.

Turf as borders and for paths

In this narrow area, it does not work to define intention for the less organized adjacent vegetation. Dimension is important for this cue.

Turf as borders and for paths

Pros and Cons:

- Inexpensive to implement
- Maintenance well understood
- Sacrifices natural area space to invasive non-natives

Plant natives like a traditional garden

- Organize plantings into minimalist garden beds, applying traditional garden design principles like color theory, rotational blooms, and plant heights stepping back from paths. Maintain as such long term, even if it means weeding native species.

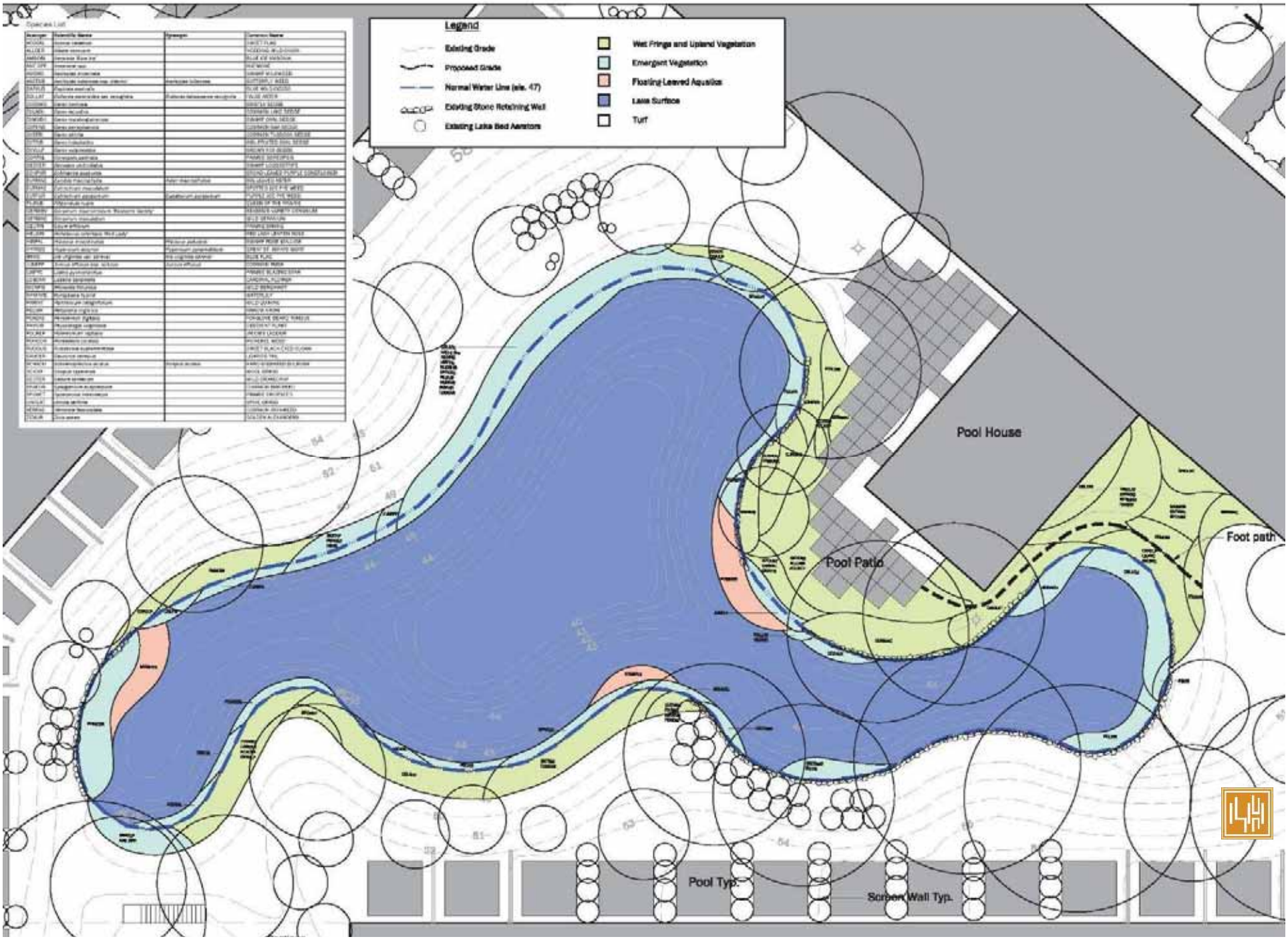
Plant natives like a traditional garden

Single species flushes over large areas can provide impact without organized beds. Overall, native species tend to be less showy, especially in shade during the summer, thus appreciation of more subtle beauty is partly required. Most species have variable blooms over several weeks.

Gardens and human culture have a long history. In their most popular forms, gardens can be places of beauty, contemplation, recreation, and food production.

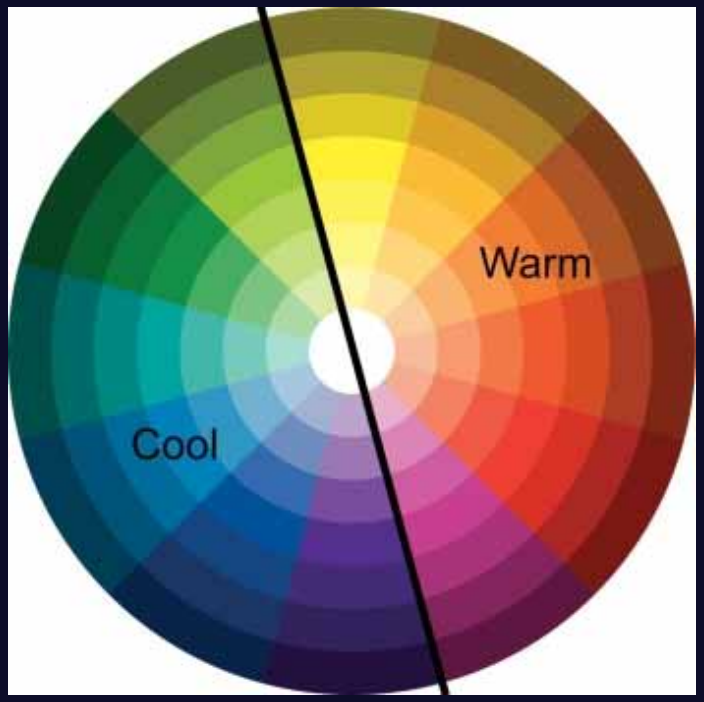
All of these things can still be achieved with the integration of native plants. Beyond their compatibility with local climate and weather patterns, together native plants can comprise a “living habitat” that produces viable offspring, is not in great need of irrigation, fertilizers or pesticides, and supports wildlife.

Beyond ecosystem function benefits, most people will make a decision to include native plants in their landscape based on aesthetic performance and the capacity for native plants to be socially acceptable. To bridge the gap from a ‘field of weeds’ to a beautiful garden, several art principals should be considered and integrated, beyond cues to care.


Legend
Existing Grade
Proposed Grade
Normal Water Line (ele. 47)
Existing Stone Retaining Wall
Existing Lake Bed Aerators
Wet Fringe and Upland Vegetation
Emergent Vegetation
Floating Leaved Aquatics
Lake Surface
Turf
Pool House
Pool Patio
Foot path
Pool Typ.
Screen Wall Typ.

Some Artistic Aspects

- Style – consider architectural context
- Form – formal or naturalistic
- Proportion and Scale – harmonious, in balance
- Repetition, Accent and Contrast - emphasis
- Color Theory – complementary or analogous
- Resting Moments – green or simple backdrops
- Seasonal Interest – something going on

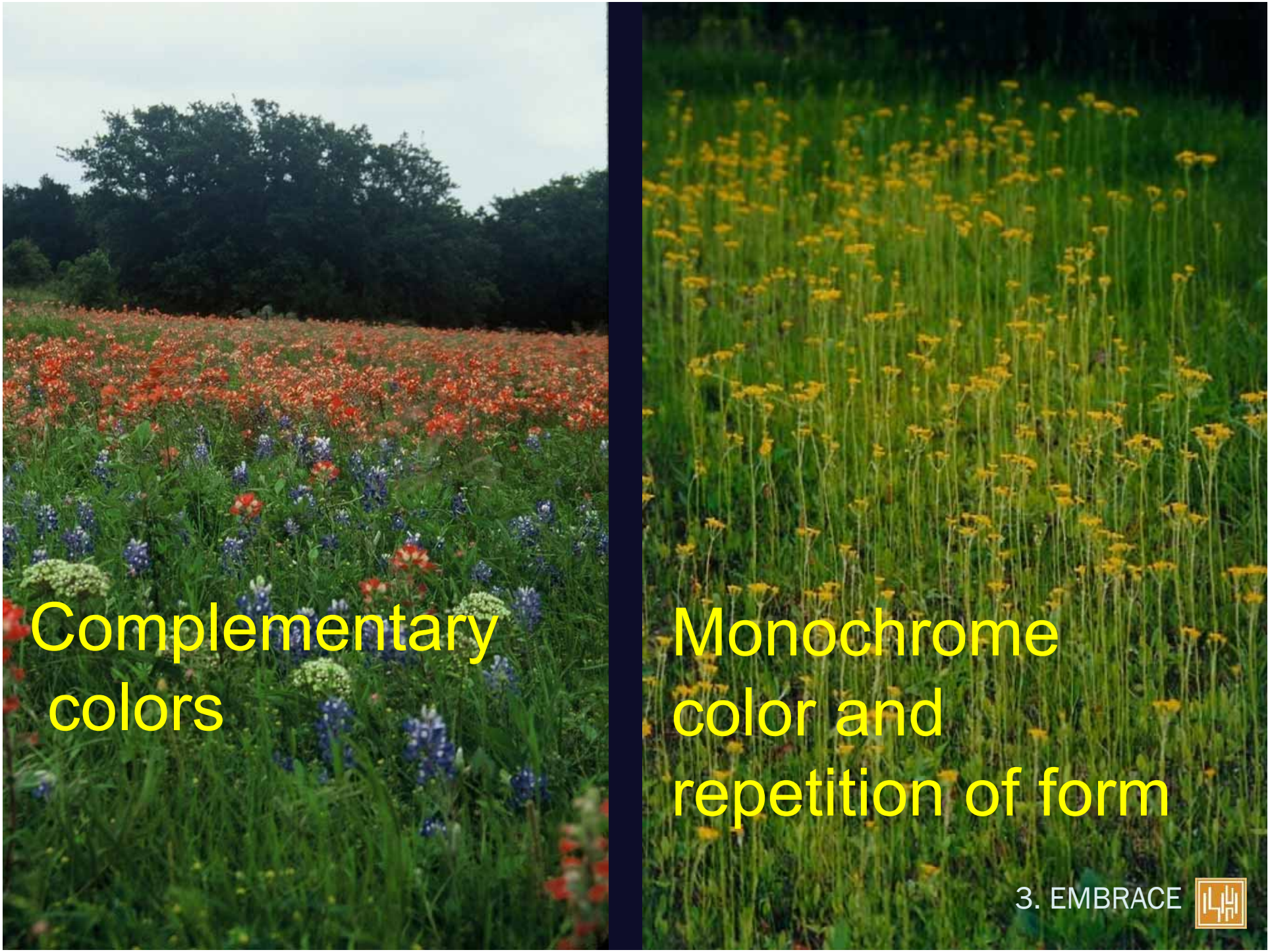


analagous colors: ADJACENT on wheel; “soothing/calming”

complementary colors: OPPOSITE on wheel; “dramatic/bold”


Seasonal rotation
Accent color
Green resting backdrop


Analogous colors relative to architecture
More formal arrangement of plants


Complementary colors
Monochrome color and repetition of form


Seasonal interest – fall and winter color too
3. EMBRACE

Plant natives like a traditional garden

Pros and Cons:

- Expensive to implement; initially plants must be watered
- Maintenance fussy and requiring an artistic eye to perpetuate design
- Additional maintenance time needed to care for these gardens, timed for best appearance
- Can still leave traditional gardeners wanting for more amped-up results, especially in shady environments

A few lessons learned related to *Plant Care and Maintenance*:

- Pamper the new plantings – native does NOT mean maintenance-free
- Apply double-shredded hardwood mulch after planting
- WATER, WATER, WATER!
- WEED, WEED, WEED!
- **Protect from wildlife**

Install plant communities with integrity

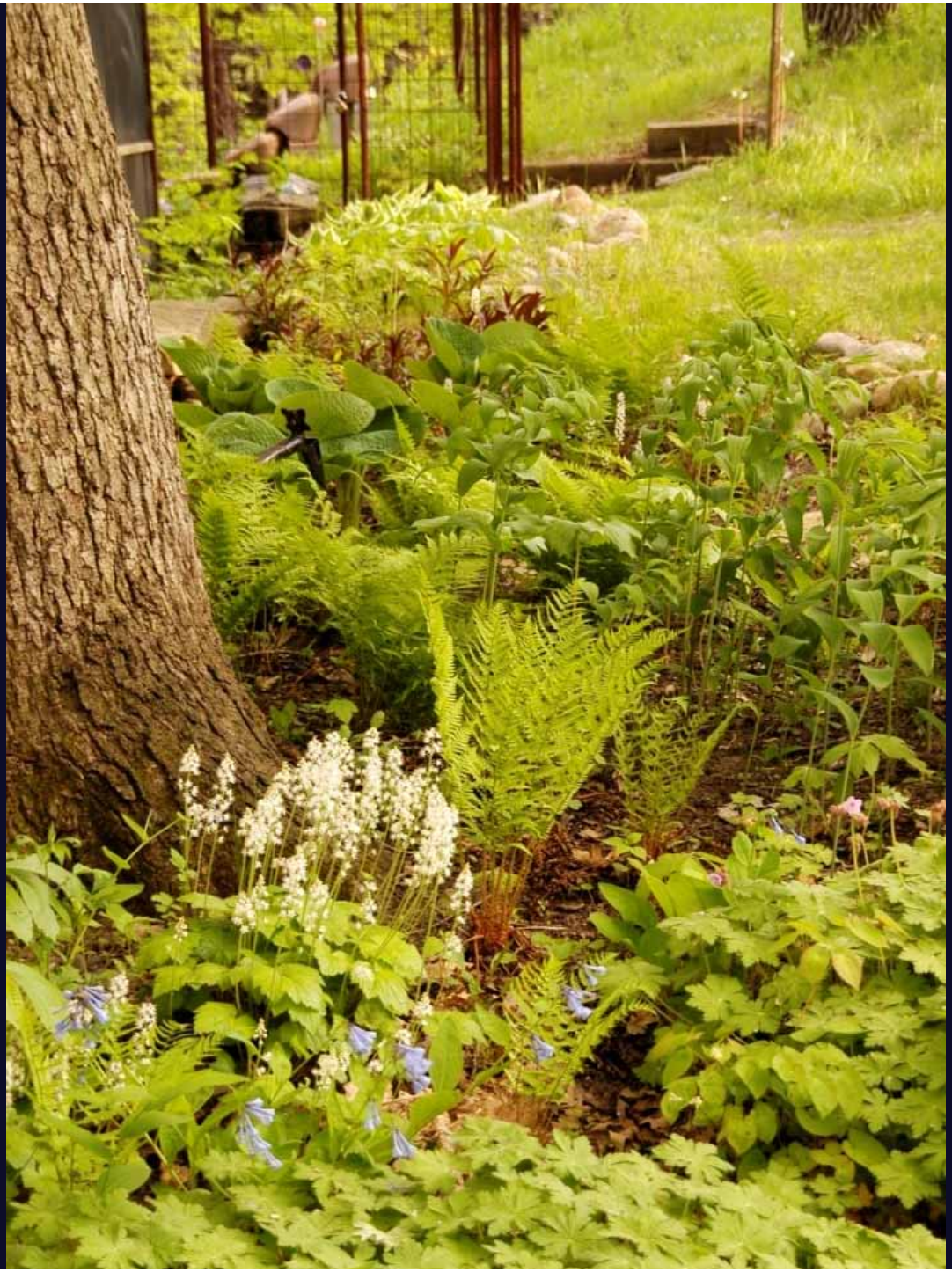
Plant communities with integrity: include all their structural parts (or as many as can be assembled). Don't forget the shrubs, grasses, sedges, rushes, ferns, and fungi. Don't include things that should not be there, within reason.

Install plant communities with integrity

Including all the structural components helps to cope with seasonal aspects and provide habitat for other creatures to use.

Install plant communities with integrity

Including all the structural components provides fuel for annual burns.



Install plant communities with integrity

Pros and Cons:

- Expensive to implement; initially plants must be watered and diversity can add other costs
- Too naturalistic a layout can be interpreted as untended/unintended
- Additional maintenance time needed to care for these gardens, timed for best appearance; too fuzzy a layout can be difficult to see to maintain
- Offers the best attempt to preserve all the parts of functioning ecosystems and to steward them with historical practices such as annual prescribed fire.
- Can thus be relied on to provide maximum ecosystem functions such as erosion control, stormwater infiltration, greenhouse gas sequestering, pollinator support, etc.

Integrate Hardscape

Use hardscape and art elements to imply human intention.

Integrate Hardscape

Art elements can be functional or whimsical, sophisticated or simple.

DEFEND

Designing with Native Plant Communities

4. DEFEND - Importance of stewarding and maintaining our existing and newly created native plantings

Widely Understood

- Invasive species are a massive, multi-faceted threat that must be contained.

- Humans move organisms around all the time. When non-native plants, animals, or pathogens rapidly take over a new location and alter the ecosystem, we consider them to be invasive species.

"We can no longer hope to coexist with other animals if we continue to wage war on their homes and food supplies. This simple tenet provides an imperative to fight invasive aliens as if it really matters and to re-evaluate our centuries-old love affair with alien ornamentals." *Douglas Tallamay*

Why should we care about invasive species?

Economics

In the United States alone, expenses associated with ecological damage and control of invasive species is estimated at $137 billion per year and increasing.

Recreation

Invasives can significantly alter recreational activities. Hunters, boaters, hikers and birdwatchers can find that they are no longer able to use natural areas to the same degree, or with expected outcomes, when they are choked with invasive species.

Health

Some invasive species may cause significant target species health problems. As example, the widespread death of the entire *Fraxinus* (Ash) genus with the invasion of the Emerald Ash Borer.

Inherent Value

The ecosystems that invasive species disrupt offer irreplaceable natural habitat and unique genetic signatures that we may someday need beyond our current needs for crucial ecosystem functions.

Which invasive species should you know?

There is an ever-expanding list of invasive species. Regularly updated lists, along with detailed control methods recommended can typically be found by region e.g.

Midwest Invasive Plant Network: MIPN.org They have also developed apps for smart phones that facilitate early reporting of invasive species and for locating landscape alternatives

If you own land, become familiar with what native species should be there and what invasives have started to displace them. Assess the control strategies that best suit your situation.

If you are interested in helping other land owning organizations, many have invasive species control work days and could use your help!

Designing with Native Plant Communities

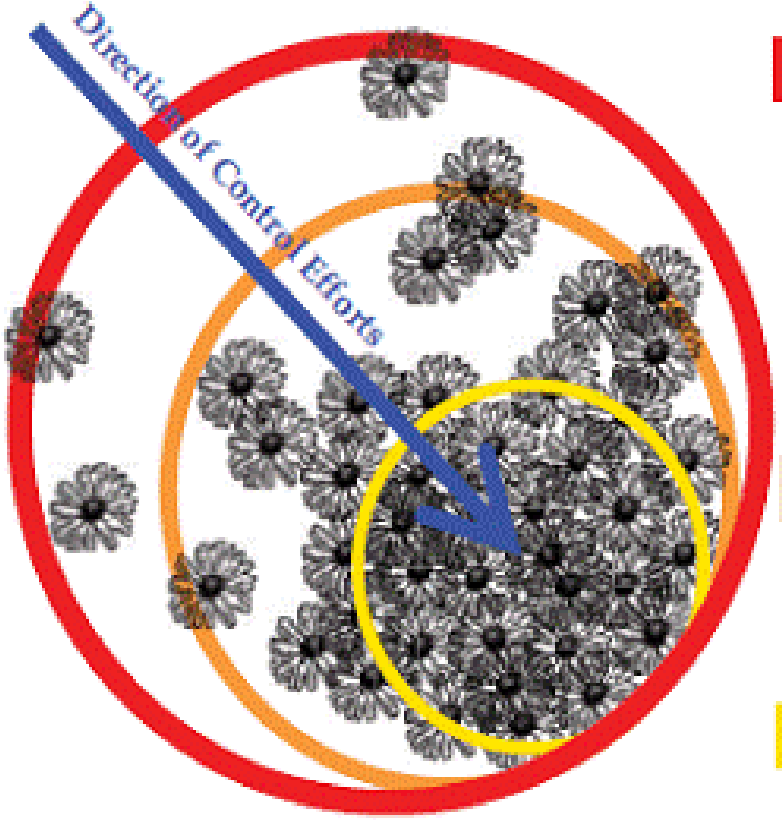
4. DEFEND - Importance of stewarding and maintaining our existing and newly created native plantings

Often Overlooked

- Best to have an understanding prior to project implementation as to the ongoing stewardship commitment and tailor designs accordingly. The invasive species problem will not go away and will likely get worse. To preserve diversity, invasive species must be addressed in perpetuity via site stewardship and adaptive management, ideally guided by project designers. Cultivate a long term client relationships that allows for regular site review and communication with the land stewards.

- Protect the bright spots when managing for invasive species to maximize effectiveness of efforts and contain long term problems.

Prioritizing Control Efforts for a Single Species by Density of Infestation



Note: Effective control may require the use of multiple control methods. Control efforts must be followed up by monitoring for new plants, regrowth, and flowering, generally within the same growing season. Monitoring should be done annually.

Outliers – Highest priority

- Lowest density of infestation
- Goal = eliminate small, isolated infestations
- Prevent the reproduction and survival of outliers
- Monitor annually beyond the known infestation for new outliers
- Lowest level of commitment, resources and effort needed

Advancing Front

- Goal = control the advancing front and perimeter of core infestations
- Prevent the expansion of the core infestation

Core – Lower priority

- Highest density of infestation
- Goal = suppress the interior of core infestations
- Highest level of commitment, resources and effort needed

Adapted from work by Fred Clark, Clark Forestry, Inc. and Wisconsin DNR-Urban Forestry

Tools to get an upper hand with invasive species include:

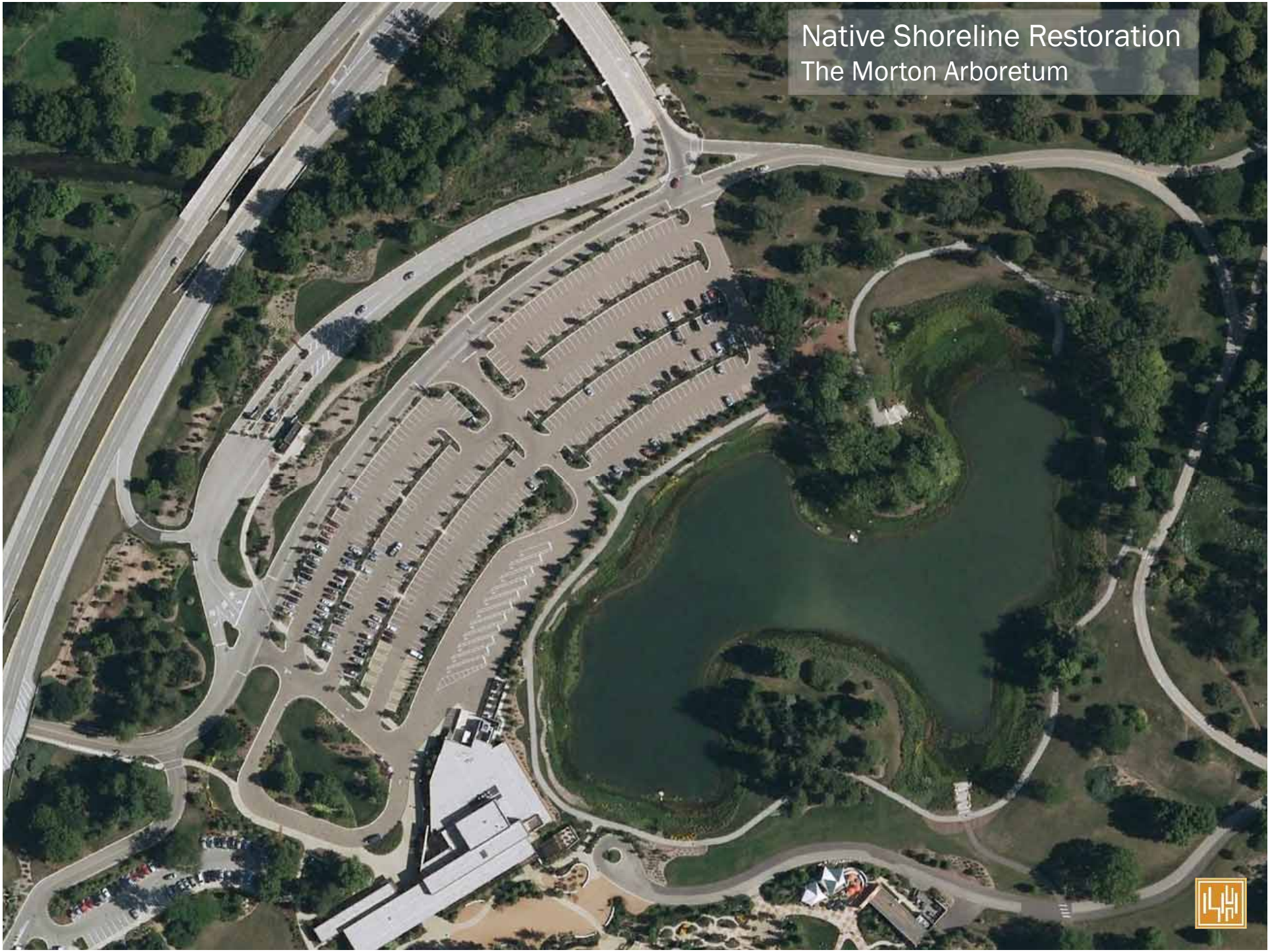
Manual control – hand pulling, digging, flooding, mulching, burning, removal of alternate hosts, and harvesting

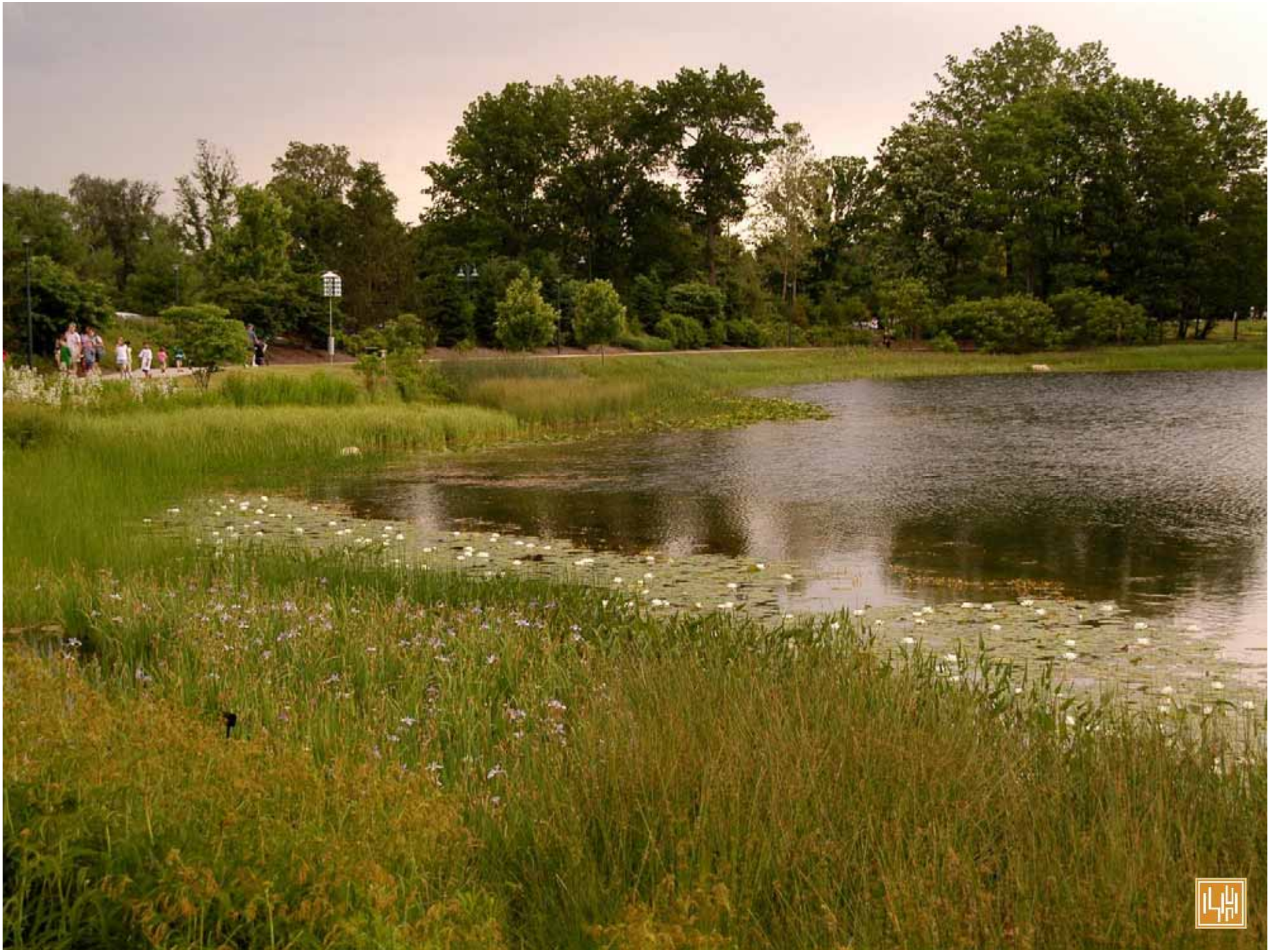
Prescribed fire – careful use of controlled burning to favor native plant health and damage certain invasive species

Mechanical control – hoeing, cutting, girdling, tilling, mowing, chopping and barricading

Chemical control – use of pesticides for basal bark, cut-stump and foliar applications

Biologic control – targeted use of animals, insects, fungi or diseases


Native Shoreline Restoration
The Morton Arboretum



LIVING HABITATS