Restoration of Native Plant Communities
From Theory to Practice

Why restore coastal dunes?

George D. Gann
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Acknowledgements

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- Pine Rockland Initiative, Restoring the Gold Coast, and Natives For Your Neighborhood program staff, sponsors, and collaborators.
Outline

- Background on me, IRC and our mission.
- Native plant conservation context.
- Restoration theory and policy.
- Restoration practice, some examples.
- Conversation!
My Neighborhood
Global and Local Policy

World Conference on Ecological Restoration
Cape Town, South Africa 2019

International Policy Lead

Restoration site, No Name Key
National Key Deer Refuge, FL, USA

Chief Conservation Strategist
40-years of experience in ecological restoration practice, policy, and science

- **1970s** – invasive plant removal in Gann Hammock; nursery production of native plants at Gann’s Native Tropical Greenery.

- **Early 1980s** – *Casuarina* removal on Cape Sable, ENP; prescribe fire on Long Pine Key.

- **Late 1980s** – 7.5 miles of beach dune and coastal strand restoration on Miami Beach; 5 miles of beach dune restoration on Captiva island.

- **1990s** – Post Hurricane Andrew restoration at Cape Florida, tropical hammocks in Miami-Dade County.

- **Mid-2000s to present** – Pine Rockland Initiative in Miami-Dade and Monroe counties.

- **Mid-2010s to present** – Coastal biodiversity restoration and launch of Restoring the Gold Coast.

- **Since 1989** – Engagement with Society for Ecological Restoration including global policy initiatives. Board of Directors 17 years.

- **Since mid-1990s** - Rare plants, floristics, management plans, restoration through IRC.
Everglades Restoration and Rare Plants - Including a Critical Element of Biodiversity

John C. Gifford Arboretum, University of Miami
October 12, 2016

George D. Gann
Chief Conservation Strategist
The Institute for Regional Conservation
www.regionalconservation.org
IRC aims to protect, restore and manage all biodiversity on a regional basis, and to prevent local extinctions of native plants, animals and ecosystems. All conservation is ultimately local. 2019 was our 35th Anniversary Year. Staff of 7, 12 Associates and 7 Board Members.

- Floristic and faunistic inventories
- Rare species research
- Ecological restoration design and implementation
- Educational training and workshops
- Online tools and resources
- International policy
Some IRC Resources

Natives For Your Neighborhood
Conservation of rare plants, animals, and ecosystems

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Rare Plants of South Florida:
The Institute for Regional Conservation

South Florida

The Floristic Inventory of South Florida
Conservation of rare plants, animals, and ecosystems

Plantas de la Isla de Puerto Rico
Un servicio para la conservación de flora / A conservation service for the flora

The Institute for Regional Conservation

A Gardening Guide for Living on the Barrier Island

The Institute for Regional Conservation
Ecological Restoration and Community Outreach
International Policy Work on Ecological Restoration, Conservation, and Sustainability

www.ser.org/Standards
Native Plant Conservation Context
North American Coastal Plain Global Hotspot
Noss et al. 2014
South & North Range Limits in South Florida

Gordonia lasianthus (BONAP.org)

Oncidium ensatum (GBIF.org)

Example from Orange/Seminole area: Ulmus alata; Eulophia alta
Asplenium serratum L.
Bird's-nest fern, wild birdnest fern

Iguassu Falls, Brazil

Fakahatchee Strand, Florida
South Florida Endemics (probably >50)

Jacquemontia reclinata
Beach clustervine
Globally Widespread Species

Schoenus nigricans
Black bogrush
Local Biodiversity Matters!
Plant Biodiversity is Key to Animal Biodiversity

Cicada
Images by Mary Trulio Fesmire

Ceraunus Blue
>50% of South Florida in conservation; United Nations Convention on Biological Diversity (CBD) 2020 Protected Areas Target = 17%. So, everything should be great. But it is not.
Central Florida Conservation Areas
Wilcove 1986

Fragmentation leads to local extinction

no species are lost from either pool. As fragmentation proceeds we eventually reach some critical level of reduction and fragmentation where species begin to die out. The susceptible pool loses species earlier and loses more species in total than does the resistant pool. When the resistant pool begins to lose species, it loses them very rapidly, because by this time the fragments are small and there is little habitat left.

Insularization causes extinctions over and above those expected through reduction in the total area of habitat. More species persist at equilibrium if the remaining habitat is concentrated into a single large patch rather than distributed over many small fragments (Figure 4). We stress that the results in Figure 4 are equilibrium patterns; depending on the relative time scales of habitat destruction and species'
Some species and groups go faster.
Some go slower.
Documenting extinctions and rarity since 1996
The Floristic Inventory of South Florida

80 Species To Be Added to Florida’s Endangered Species List

SOME QUESTIONS
- Are very small, fragmented conservation areas important?
- How well does the current conservation system protect rare vascular plants?
- Have there been regional extirpations/extinctions?
1 in 4 native plant species were critically imperiled or extirpated. 
About 8% were reported as presumed or possibly extirpated or extinct (now 6%). 
Four South Florida endemic taxa reported as extinct in Knapp et al. (2020) were documented by IRC in 2002.
**Amaranthus floridanus**

Last Collected in South Florida in 1985, in Florida in 1989

Treated as G3, N3, S3 in NatureServe (1993)
Not tracked by Florida Natural Areas Inventory
Not listed by State of Florida or FWS
Not on CPC National list
Restoration Theory and Policy
United National Decade on Ecosystem Restoration 2021-2030

“There has never been a more urgent need to restore damaged ecosystems than now”
Launched at SER2019 in South Africa, simultaneously in *Restoration Ecology* and by SER.
George D. Gann, Tein McDonald, Bethanie Walder, James Aronson, Cara R. Nelson, Justin Jonson, James G. Hallett, Cristina Eisenberg, Manuel R. Guariguata, Junguo Liu, Fangyuan Hua, Cristian Echeverría, Emily Gonzales, Nancy Shaw, Kris Decler, and Kingsley W. Dixon
Decades of discussion regarding:

- **Which** target?
- **What degree** of recovery?
- **Direct** or **indirect** activity?

**Camp 1:**
‘Inclusive at all costs’
Concerned the movement will lose relevance if all related efforts are not encouraged

**Camp 2:**
‘Raise the bar at all costs’
Concerned full inclusion will devalue the term “ecological restoration”
Section 2: Eight Principles that Underpin Ecological Restoration

1. Engages Stakeholders
2. Draws on Many Types of Knowledge
3. Is Informed by Native Reference Ecosystems, While Considering Environmental Change
4. Supports Ecosystem Recovery Processes
5. Is Assessed Against Clear Goals and Objectives Using Measurable Indicators
6. Seeks the Highest Level of Recovery Possible
7. Gains Cumulative Value When Applied at Large Scales
8. Is Part of a Continuum of Restorative Activities

Eight Principles Underpinning Ecological Restoration
Climate Change and Insurmountable Environmental Change

Are the current site conditions still broadly suitable for the ecosystem that has been degraded? YES USE THAT ECOSYSTEM (full or partial recovery)

NO

Is this due to an ambient change which is feasible and desirable to amend? YES AMEND AND USE THAT ECOSYSTEM

NO

Could the conditions suit an alternative native ecosystem that is feasible and desirable to restore? YES USE THAT ALTERNATIVE ECOSYSTEM

NO

Can the site be managed in some other restorative manner? YES SELECT THE MOST RESTORATIVE OPTION

Figure 3. Decision tree to assist the selection of appropriate native reference ecosystems for restoration projects.
Wastewater Treatment Area at Green Cay Wetland,
Palm Beach County, Florida
## Key Ecosystem Attributes

Table 2. Description of the key ecosystem attributes used to characterize the reference ecosystem, as well as to evaluate baseline condition, set project goals, and monitor degree of recovery at a restoration site. These attributes are suited to monitoring in Principle 5 and the Five-star System discussed in Principle 6.

<table>
<thead>
<tr>
<th>ATTRIBUTE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absence of threats</td>
<td>Direct threats to the ecosystem such as overutilization, contamination, or invasive species are absent.</td>
</tr>
<tr>
<td>Physical conditions</td>
<td>Environmental conditions (including the physical and chemical conditions of soil and water, and topography) required to sustain the target ecosystem are present.</td>
</tr>
<tr>
<td>Species composition</td>
<td>Native species characteristic of the appropriate reference ecosystem are present, whereas undesirable species are absent.</td>
</tr>
<tr>
<td>Structural diversity</td>
<td>Appropriate diversity of key structural components, including demographic stages, trophic levels, vegetation strata and spatial habitat diversity are present.</td>
</tr>
<tr>
<td>Ecosystem function</td>
<td>Appropriate levels of growth and productivity, nutrient cycling, decomposition, species interactions, and rates of disturbance.</td>
</tr>
<tr>
<td>External exchanges</td>
<td>The ecosystem is appropriately integrated into its larger landscape or aquatic context through abiotic and biotic flows and exchanges.</td>
</tr>
</tbody>
</table>
Principle 6

Ecological Recovery Wheel
Principle 8

THE RESTORATIVE CONTINUUM
Improving biodiversity, ecological health, and ecosystem services

REDUCING SOCIOECONOMIC IMPACTS
IMPROVING ECOSYSTEM MANAGEMENT
REPAIRING ECOSYSTEM FUNCTION
INITIATING NATIVE RECOVERY
PARTIALLY RECOVERING NATIVE ECOSYSTEMS
FULLY RECOVERING NATIVE ECOSYSTEMS

REduced impacts
Remediation
Rehabilitation
Ecological Restoration

SER Society for Ecological Restoration
Provenancing strategies for revegetation (reprinted from Prober et al. 2015). The star indicates the site to be revegetated and the circles represent native populations used as germplasm sources. The circle size indicates the relative quantities of germplasm included from each population at the revegetation site.

These strategies can also be applied to animals and soil biota.
Pine Rockland Initiative
Initiated in 2005, to provide management support for private owners of pine rocklands, specifically invasive species control.

Expanded over the years to include restoration and management of any pine rockland, as well as supporting activities, such as rare species surveys, mapping, ecological restoration design, and outreach.

Primary funding has come from US Fish and Wildlife Service, Coastal and Partners Programs.

Collaborators include Miami-Dade County, Fairchild Tropical Botanic Garden and others.
Extent of Pine Rocklands outside of Everglades National Park
From Loope et al. (1979; NPS) and subsequent

<2% remaining

Gann 2018, unpublished
Miami Rock Ridge Pinelands
(Gann 2018 unpublished)

Vascular Plants
Estimated native taxa – 420

Unique Taxa
Long Pine Key – 4
Redland and Biscayne - 119
Redland – 5
Biscayne – 52

S FL Endemics*
In Pine Rocklands – 28
On MRR only – 11
Outside LPK only - 7
Redland only – 2
Biscayne only – 2
Drivers of Degradation
Losses on Big Pine Key

We Must Aspire to More!
1) Re-Think what is a Pine Rockland
2) Protect All Intact and Restorable Pine Rocklands

Miami-Dade Commission should not betray our environmental legacy by destroying pine rocklands
From a policy perspective, we cannot assume it’s ‘already gone’,” said Botanist George Gann, who has worked on projects to restore pine rockland habitats and serves as president and chair of the Board of The Institute for Regional Conservation. “I look at it as pine rockland with asphalt over it.” Miami Herald, 2020
4) Burn Wherever and Whenever Possible
5) Support both Public and Private Conservation Efforts

IRC’s Pine Rockland Initiative
Private Pine Rockland Owners’ Summit, October 2018
6) Document Potential for Natural Recovery

Long Pine Key, Everglades National Park

Former Scraped Site, SOCSOUTH
7) Identify All Restoration Opportunities

Restoration Opportunities

refers to the restoration of both the extent (e.g. expanding the footprint) and the quality (e.g., integrity) of pine rocklands, including degraded or “transitional” pinelands not currently measured.

What do we really have?

What do we really want?

CHANGING THE CONVERSATION
Is this Destroyed or a Restoration Opportunity?

Florida City, 2018
8) Support Restoration in the Urban Zone
Why plant a pine rockland? Pine rockland is a critically imperiled ecosystem that has been heavily impacted by urban development and agriculture. Found only in South Florida and the Bahama Archipelago, less than 2% of the original pine rocklands remain in Miami-Dade County outside of Everglades National Park. Pine rocklands of the lower Florida Keys have also been heavily impacted by development, sea level rise, and flooding from hurricanes and tropical storms. Creating a pine rockland is not easy or simple, but it can be extremely rewarding. Pine rocklands provide wonderful habitats for native plants and wildlife, including many species of very rare plants, butterflies, bees and other pollinators, and songbirds. If well-planned and managed they can also be aesthetically pleasing.
9) Don’t be Afraid to Trial New Tools and Techniques

Skid Steer with Forestry Mulcher

Billy Goat Brush Cutter
Galactia smallii, Linum arenicola, Croton linearis ~6 weeks after conservation mowing
Saw palmetto reduction at Pine Shore Pineland Preserve
Direct Seeding Trials + Modified Applied Nucleation Concepts
SOC SOUTH

Spring 2019

Spring 2020
10) Develop Measurable Targets and Document Success!
Restoring the Gold Coast
Where Did the Native Biodiversity Go?

Southern Palm Beach County, circa 1970
What We Have Done Well

move sand

plant sea-oats and a few other species

recover sea turtles
A diverse dune is a healthy dune, and our first line of defense against sea level rise
The Delray dune is loaded with rare plants.
2015 Survey and Assessment of Delray Beach

101 native dune species were recorded, but 7 previously recorded are possibly missing.

An additional 75 species within native range were identified as missing and could be restored in area.

Our current list includes 235 native dune species in southern Palm Beach County.
Focal Gold Coast Species

Beach ragweed
_Ambrosia hispida_
- Florida Keys north to Brevard County, but nearly extinct along Florida east coast.
- Introduced at Atlantic Dunes Park (2016) and Delray Municipal Beach (1993; still present).

Beach Clustervine
_Jacquemontia rectinata_
- Federally endangered, Miami-Dade to Martin County ( endemic).
- Reintroduced to Atlantic Dune Park (2016) and introduced to Delray Municipal Beach (2002-2006; still present).

Beach-tea
_Croton punctatus_
- Scattered and rare in southeastern Florida. Not common on renourished beaches.
- Present at Atlantic Dunes Park and Delray Municipal Beach. Plants added in 1995.

Pineland Croton
_Croton linearis_
- Florida Keys to St. Lucie County. Nearly extinct north of Miami-Dade County. Sole larval host for two federally endangered and endemic butterflies.
- Planted at Delray Municipal Beach (1993) but introduction failed.

Bartram's Scrub-hairstreak
_Stenoox eugaster bartramii_
- Federally endangered. Monroe and Miami-Dade counties; extinct in Broward and Palm Beach counties.
- Larvae feed only on Pineland croton.

Florida prairieclover
_Dalea arborescens var. floridana_
- Federally endangered. Southern mainland north to Palm Beach and Collier counties. Extinct in Palm Beach County.
- Collected in the Palm Beach area only in 1895 and 1918.
June 2019 Rapid Assessment
Town of Ocean Ridge

George Gann, Kimberlee Duke Pompeo, Commissioner Phil Besler, Lieutenant Scott McClure
Some Key Areas Coastal Forests Protected
And Some Grassy Areas Intersect Those Forests
But Coastal Strand (Shrub Zone) Heavily Impacted

Lighthouse Point Park, Volusia County

Ocean Ridge, Palm Beach County
Coastal strand is being overwhelmed or destroyed
Perception Weighted Toward Forests

https://www.jstor.org/stable/24320068
Seagrapes and Biodiversity

A workshop contributing to understanding the issues behind seagrape trimming, ecological restoration, and coastal conservation
Seagrapes are native to this ecosystem, but not dominant, or event abundant.
Building a Coalition Since 2018
Opportunities
Areas of Outside of Scope

Areas with Poor Engineering

Areas of Active Erosion
RGC Events
Professional Restoration Crew

In collaboration with Fairchild Tropical Botanic Garden, we are restoring beach clustervine habitat at South Beach Park and Red Reef Park in Boca Raton.

2014

Before

Afte

50 species planted

Seeds and plants collected
Resources for Private Dune Owners

Biodiversity Starter Kits

As part of our Restoring the Gold Coast Program, IRC is offering native biodiversity starter kits for gardens on barrier islands in southern Palm Beach County.

Each kit comes with hand-selected native plants perfect for enhancing your native beach dune system or coastal garden. This service helps make the restoration of native habitats on barrier islands cost effective and time efficient.

What Each Starter Kit Contains

A single kit contains five native plants in 4" to 5-gal. containers, including at least one rare species not readily available on the open market. A double contains 10 native plants. Prices start at $60 for DIY kits.

Kits Are Available For:
- Beach dunes and coastal grasslands
- Coastal strand and shrublands (back dune)
- Tropical hammock forests and coastal gardens
- Butterfly attracting kits for a wide variety of coastal habitats

How You Can Get Your Kit

We will be offering a monthly pickup service of these kits. Delivery and planting can be arranged for an additional fee. If you're interested in purchasing an IRC Biodiversity Kit, please visit our website at: regionalconservation.org/3onationrgc.html
Four Larval Hosts – 10 Coastal Butterflies

- Cassius Blue
- Large Orange Sulphur
- Martial Scrub-Hairstreak
- Common Buckeye
- Gray Hairstreak
- Phaon Crescent
- White Peacock
- Gulf Fritillary
- Julia Heliconian
- Zebra Heliconian
Restoration design. Bringing coastal strand east by using cues from natural recruitment.
Discoveries and Recovery

Monthly Conservation Notes

Biodiversity Explosion in Delray Beach

Since 2016 we have been working with dozens of volunteers and collaborators to reduce invasive species and restore native biodiversity at Atlantic Dunes Park (ADP) in Delray Beach. Starting as part of our Green Delray program, Atlantic Dunes Park is now one of the biodiversity hot spots in our Restoring the Gold Coast program. See a list of plant species at the park here.

Work has been slow but steady, but over the last two years native plants have been showing up that have not been recorded there before, or which have not been seen at the park in decades, or which are recruiting and spreading into new areas. It is a remarkable example of the power of natural recovery in response to sound ecological restoration practice - in this case the restoration of coastal strand, the most impacted upland ecosystem in coastal Palm Beach County.

Commelina erecta, or whitemouth dayflower, has recruited en masse in the back dune just east of the seagrass line.

Salvias bahamensis, or Bahama nightshade, had been buried under seagrapes, vines, and invasive species. It emerged in 2020.

On Friday, I was able to go back to ADP with four ecological restoration practitioners and co-workers from the city of Delray Beach. Once again we found native plants that had not been recorded before, emerging from under what had been a smothering canopy of Brazilian pepper and seagrass. In celebration of getting back outside and enjoying springtime, I am posting pictures of some of the cool native plants celebrating the restoration at Atlantic Dunes Park. Enjoy!

George Gann
Founder & Executive Director

This is one of the very few native historical populations of Juniperus capsularis, or tropical juniper, in southern Palm Beach County. We first recorded this at Atlantic Dunes Park on Friday.

We recorded Pinus caroliniana subsp. caroliniana, or potted striped pine, for the first time on coastal dunes in Palm Beach County in 2019. This species is normally found growing in pine forests.
Natives For Your Neighborhood
We Must Restore Degraded Ecosystems, Small and Large, Fragmented and Connected

Comprehensive Everglades Restoration Plan (CERP)

The CERP was authorized by Congress in 2000 as a plan to "restore, preserve, and protect the south Florida ecosystem while providing for other water-related needs of the region, including water supply and flood protection." At a cost of more than $10.5 billion and with a 35+ year time-line, this is the largest hydrologic restoration project ever undertaken in the United States.
Native Plant and Wildlife Data
How can we better link national and local resources for native landscaping and restoration?

National Wildlife Federation

National Audubon Society

Plant Agents
Precise Data Encouraging the Use of Native Species Within Their Native Ranges
(2020: >76,000 users, >750,000 page views)
Mapping Zip Codes to North

Original Scope

Laurel Oak – Quercus laurifolia

Coming Soon – Floristic Inventory of Central Florida?
General Landscape Uses: Accent shrub.
Availability: Grown by one or two native plant nurseries in central Florida.
Description: Medium erect shrub. Leaves about 1-2 inches long, covered with brown hairs when young.
Dimensions: About 4-6 feet in height. Usually taller than broad.
Growth Rate: Moderate.
Range: South Carolina and Georgia south to Miami-Dade and Collier counties.
Habitats: Pinelands and hammocks.
Soil: Moist to dry, well-drained sandy or limestone soils, with or without humusy top layer, acid pH.
Nutritional Requirements: Low to moderate; it can grow in nutrient poor soils or soils with some organic content.
Salt Water Tolerance: Low; does not tolerate flooding by salt or brackish water.
Salt Wind Tolerance: Low; salt wind may burn the leaves.
Drought Tolerance: Moderate to high; plants growing in extremely dry soils may die during extended periods of drought.
Light Requirements: Full sun.
Flower Color: White or pink.
Flower Characteristics: Showy.
Flowering Season: Spring-summer.
Fruit: Inconspicuous capsule.
Wildlife and Ecology: Provides some food and moderate amounts of cover for wildlife. Attracts bee pollinators.
Play the Long Game
We Need Your Support!

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