Managing pine rocklands: a conundrum and paradox

Conundrum:

- *an intricate and difficult problem*
- *questions or problems having only conjectural answers*
- **Paradox:** *an argument that apparently derives self-contradictory conclusions by valid deduction from acceptable premises*

Paradoxical statements

- Because fire is necessary to maintain pine rockland communities, all prescribed fires are inherently “beneficial” (Sugarloaf Key)
- Only natural fires produce “desired” or beneficial results (exemplary Unit 4 Rx burn)
- All fires increase plant species diversity (Boss Tract, large open areas persist but where is the herbaceous layer 13-years post burn?)

NKDR Burn Program

Wilmers (2004):

- “Currently, goals for NKDR prescribed burns are fragmentary and lack ecological rigor; the overarching emphasis is fuel reduction. While the latter is of great importance, it fails to address the fundamental question of the ecological end-product over time. In essence, once fuel has been reduced, what then? At what successional stages are the pine rocklands to be maintained and what are the biological reasons for doing so? What are the specific goals and recommended measures for maintaining faunal and floral heterogeneity and biodiversity?”

Conundrum

Global warming:

- Hurricane frequency and severity projected to increase
- Increased tidal flooding and/or wind damage: widespread pine mortality after Georges and Wilma (only Cat. 2 storms)
- Hurricanes increase fuel loads and risk of a catastrophic fire (*Liu and Chen, 2003: used sediment cores to derive fire history and paleotempestogical records)*
- Pine mortality ongoing nearly 2 years post Wilma indicative of stress: Rx burning in near future would only exacerbate loss of seed trees in areas where few remain
- Al Gore: We can solve the problems of global warming because "political will is a renewable resource.“
- But sea level rise already a known impact (Ross et al. 1994)

North Big Pine Key: Is this good management?

Adaptive Management: Too often a buzzword that rationalizes repetitively making the same mistakes

Table 19. Percent slash pine mortality for trees ≥ 2.5 inches dbh. Percent mortality is the total number of pines (N) divided by the number of pines with ≥ 90% dead needles.

Area	N	N trees ≥ 90% dead needles	% mortality
NBPK	65	42	**65**
Koehn	82	15	**18**
Cudjoe	55	29	**53**
ESUGAR	49	39	**80**
WSUGAR	21	17	**81**

June 2005 photo: Upper Sugarloaf (burned 2004): 100% mortality pines < 2.4 dbh

30+ years after a fire

Chamaecrista keyensis: pineland not burned for 30+ years

Frequent burns: a panacea for diversity?

Reinhart and Menges (2004): 3 Rx burns in a 7-year period in a <u>fire suppressed</u> [63 years] slash pine (*var densa*) stand at Lake Wales:

- "Fire changed species abundance and vegetation structure but caused only minimal changes in species turnover and diversity."
- "…general trend for an increase in the cover of herbs following fire but this was a statistically significant effect for only one species…"

Garber's Spurge (USFWS 1999)

- "…requires open sunny areas and needs periodic fires to maintain habitat suitability, although this has not yet been verified by studies." [my underline here and below]
- "…found in a variety of open to moderately shaded habitat types."
- "In the Florida Keys, it grows on semi-exposed limestone shores, open calcareous salt flats, pine rocklands, calcareous sands of beach ridges, and along disturbed roadsides."

Parameter	Pinelands NKDR	Pinelands ENP
Inches (cm) annual rainfall	39 (99 cm)	60 (152 cm)
Growth rates	~Lower (less rain)	~Higher (more rain)
Salt-laden air	Omnipresent	Negligible
Slash pine size	Smaller	Larger
Hurricane impacts	Wind and tidal flooding	Wind -- no tidal flooding
Thrinax palms	Abundant	Absent
Hardwood community	Primarily West Indian	Some West Indian
Hydroperiod	Negligible	20-60 days/year
Fragmentation	High	Low
WUI issues	Yes	Negligible
Herbaceous layer (Snyder 1990)	Low diversity	High diversity

More than just plants and Key deer:

Need a holistic view of burning, including the life history needs of all native <u>wildlife</u> species:

- Area and habitat requirements of a species
- Dispersal capabilities of a species
- Ability of a species to traverse intervening habitats: connectivity and fragmentation (e.g., Big Pine Key ring-necked snake)
- Concept of post-burn mosaics: Patch size is critical
- Post-burn community responses over time – short-term studies valuable but long-term studies needed

Each site is different: 31 years. Notice the pine regeneration

Deer, fire and herbaceous communities

McCullough (1969): fire can have positive effects on herbaceous species, but heavy deer browsing pressure can be detrimental for herb species in burned areas

Barrett (2004): “complex interaction of fire and Key deer herbivory determine herbaceous community composition.”

Fire and Key deer overabundance

- **Wilmers (1997)** *"… dangerously high deer densities on No Name Key and five areas on Big Pine Key."*
  "…*carrying capacity had been grossly exceeded in some of these areas, as evidenced by over-browsed, degraded habitat*."
- ***Carlson et al. (1993):*** *Key deer numbers likely augmented by burning*
- **McCullough (1997):** *"Sudden creation of habitat for subclimax species of ungulates often leads to irruptive behavior." [i.e. explosive population increases].*

Deer Overabundance

McCullough (1997):

- "Feeding by ungulates often heavily affects vegetation near the ground and indirectly affects a number of animal species dependent upon this vegetation. Commonly, these effects result in local extinction of some species of plants and animals and cause shifts in the species composition of the community..."

Barrett (2004): Key deer browsing negatively impacts:

Bursera simaruba, Erithalis fruticosa, Bumelia celastrina, Jacquinia keyensis, and *Guapira discolor*

Burning and high deer density

- Wilmers (1997):"…burning smaller tracts (about 10 acres or less) in widely scattered areas would seemingly minimize undesirable population increases in areas where deer carrying capacity has been exceeded.
- Barrett (2004) "Pinelands should be burned in small tracts (< 20 acres) allowing for unburned areas to act as a refuge from heavy deer herbivory on islands with high Key deer densities."

Conundrum: Where we are now

- Snyder et al. (2005) conclusion:

“ Most of all, the results suggest that we need to become more analytical about the relationships between fire, weather, fuel amounts, forest structure, and fuel conditions, and go beyond simplifications that have been depended on till now.”

[And that’s just for plant communities]

Post-hurricane pine survival

- Platt et al. 2002 "…anthropogenic dry-season fires result in increased mortality during and especially after hurricanes. [Note: Hong and Menges (2004): winter fires better for *Chamaecrista keyensis*]
- Platt et al. (2000): "Total hurricane related mortality was 30–60% higher in second- than old-growth stands."

Recommendations

- Prioritize research and management efforts. Formulate specific, holistic, measurable objectives
- Multi-disciplinary research approach needed
- Sea level rise/hurricane considerations
- No burns this year, minimally– pines still dying
- Use WUI burns as research sites and think outside the box
- Heuristically burn smaller plots (10-20 acres) where practicable to increase sample size (fire effects) and reduce deer population increases
- Over time, generate predictive burn models and evaluate model robustness
- Hire an on-site fire ecologist with “burn boss” authority

A parting thought

- The three hardest words to say in the English language: I DON’T KNOW