The effect of sea level rise on freshwater flooding, the human population, and natural forest communities of Miami-Dade County

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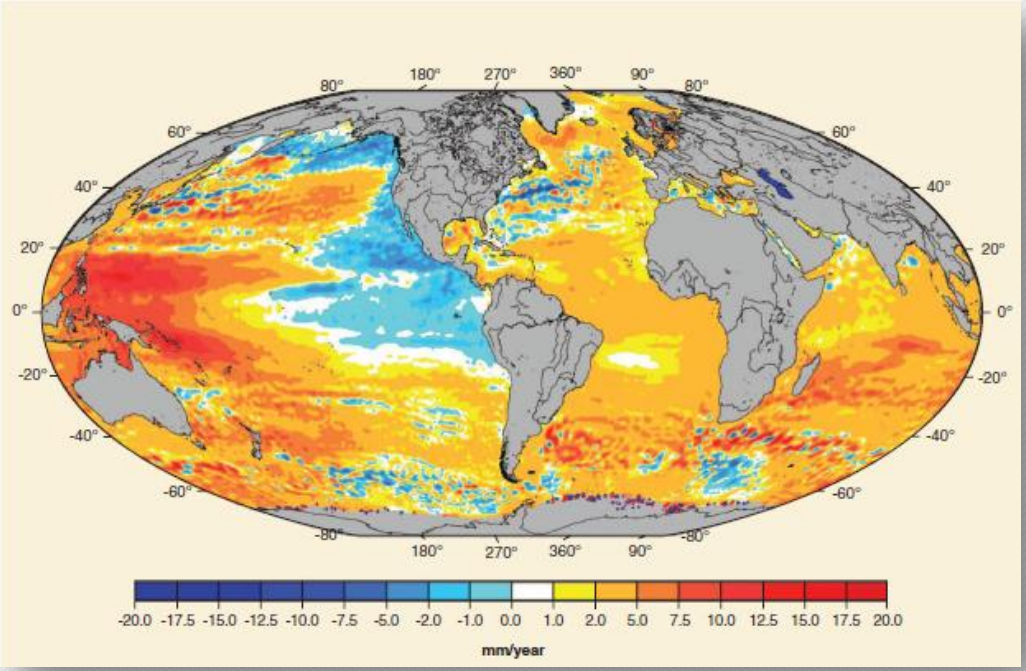
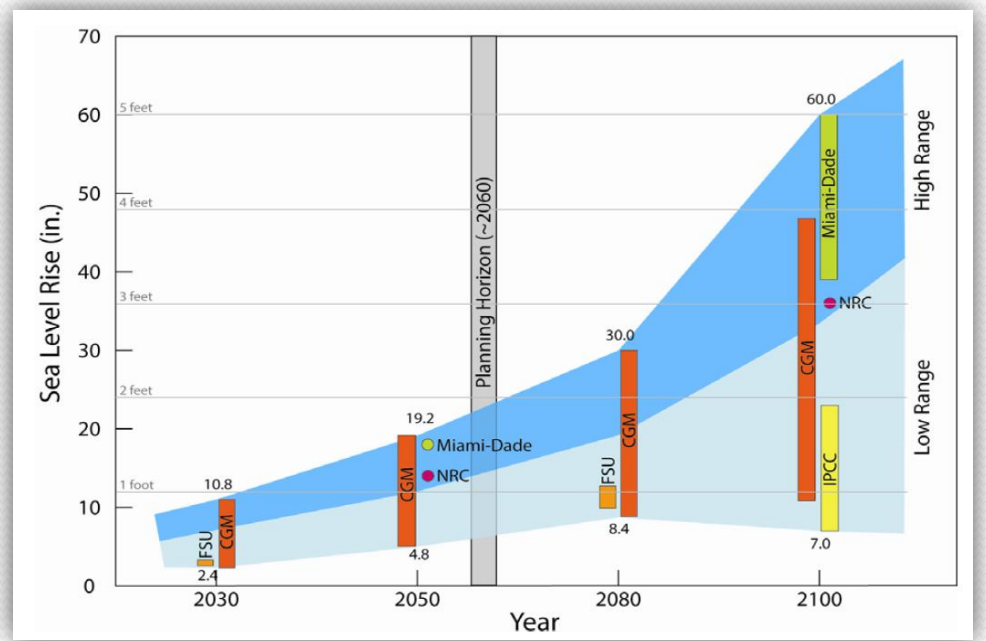
Background

- Reasons for SLR:
  - Thermal expansion due to global climate change.
  - Possible acceleration due to glacial melting.



Background (cont.)

- Local SLR:
  - SLR has regional variation.
  - Florida SLR trends match global projections.
- Impacts on Miami-Dade
  - Lowest continental aquifer in the US.
  - Some inland elevations at or below sea level.
  - Freshwater flooding, a result of the shallow water table.

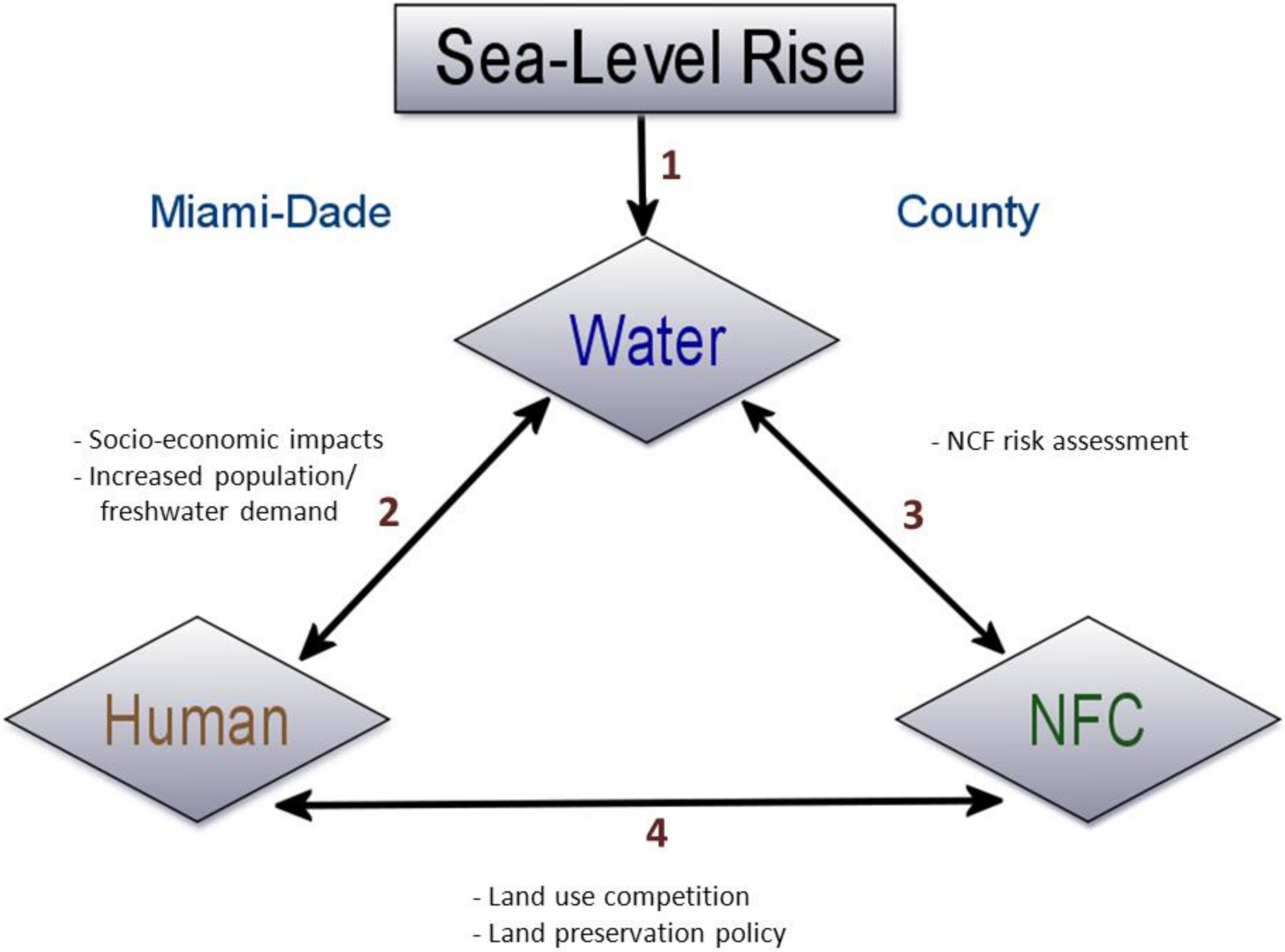


Sustainability Concepts for Miami-Dade

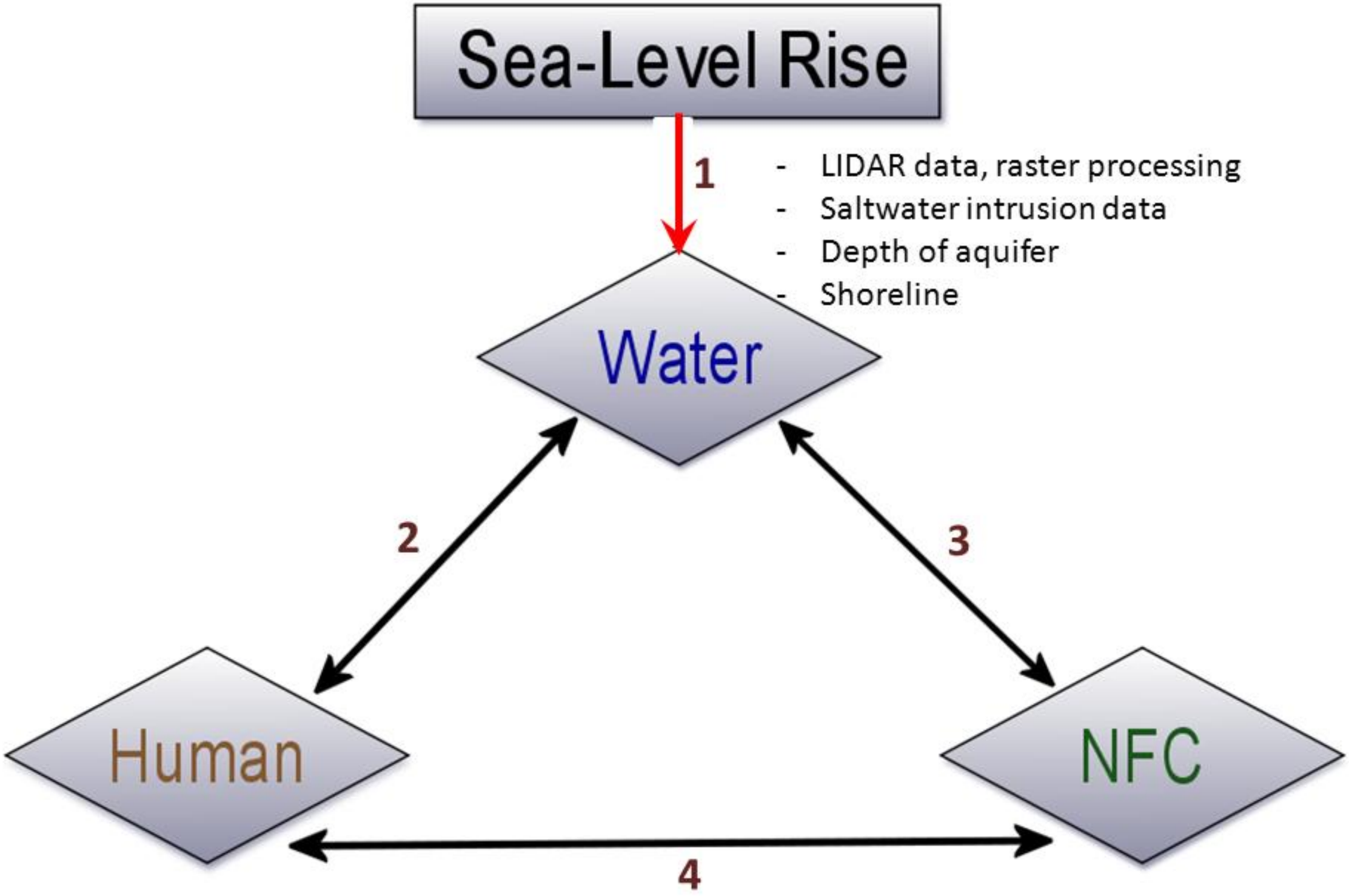
- Potential for resilience?
  - Project evaluates SLR impacts on a CHES, providing background for future sustainability initiatives.
- Displacement
  - Flooding displaces human population groups and natural forest communities.
- Inclusive Wealth
  - Project can be used as a parameter for an inclusive wealth model of Miami-Dade.

Project Question and Hypothesis

- How will projected sea level rise scenarios affect the interactions between sea water and freshwater flooding, natural forest communities, and the human population of Miami-Dade County?
- Based on SLR scenarios of 0.5 m, 1 m and 2 m, we predict:
  - Saltwater intrusion will threaten freshwater supply.
  - Flooding may impact population groups based on socioeconomic status and location of residence.
  - Flooding will impact the number and percent of remaining NFCs.

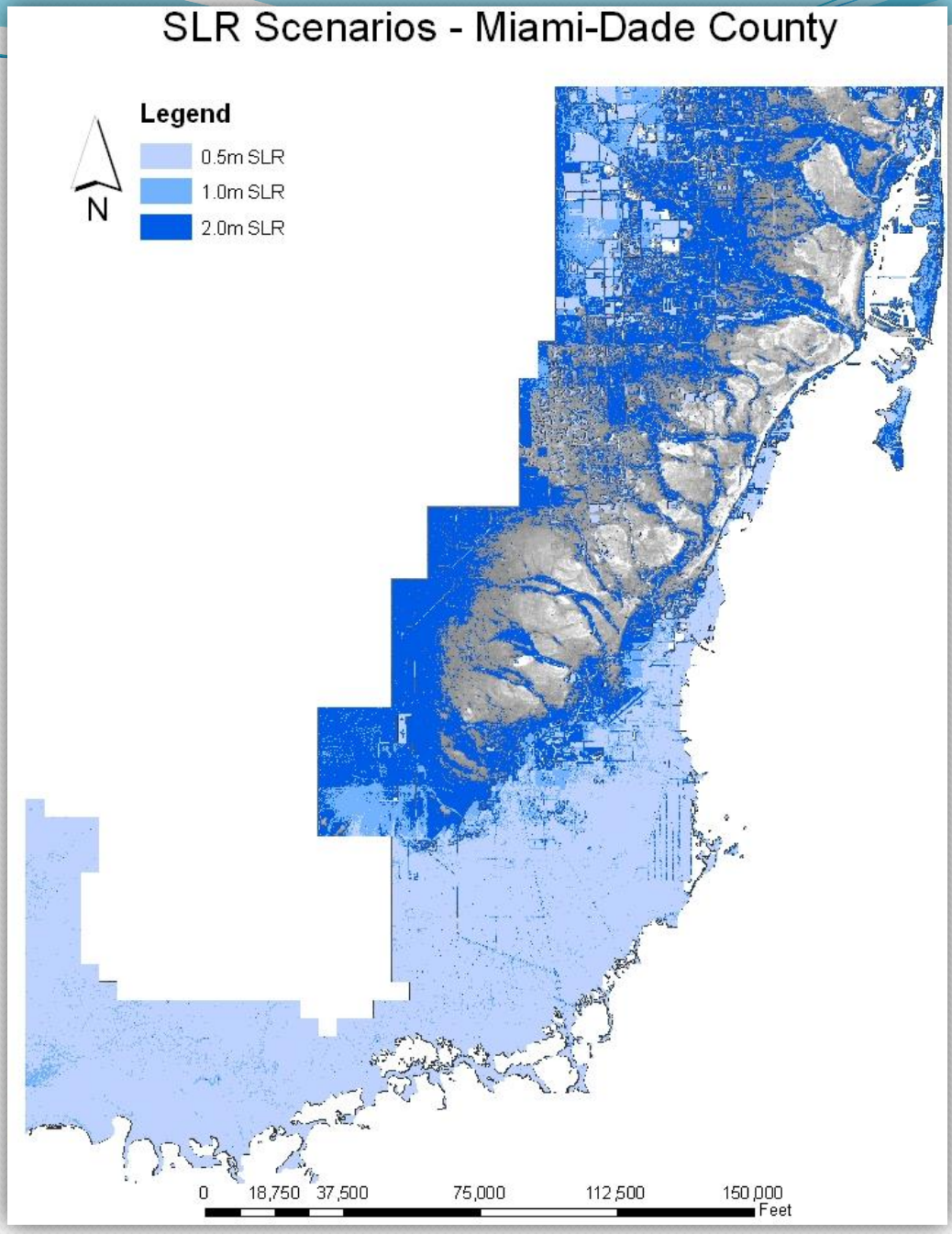

Sea-Level Rise
1
Miami-Dade
County
Water
- Socio-economic impacts
- Increased population/
freshwater demand
2
3
- NCF risk assessment
Human
NFC
4
- Land use competition
- Land preservation policy

Results and Discussions


Sea-Level Rise
1
- LIDAR data, raster processing
- Saltwater intrusion data
- Depth of aquifer
- Shoreline
Water
2
3
Human
NFC
4

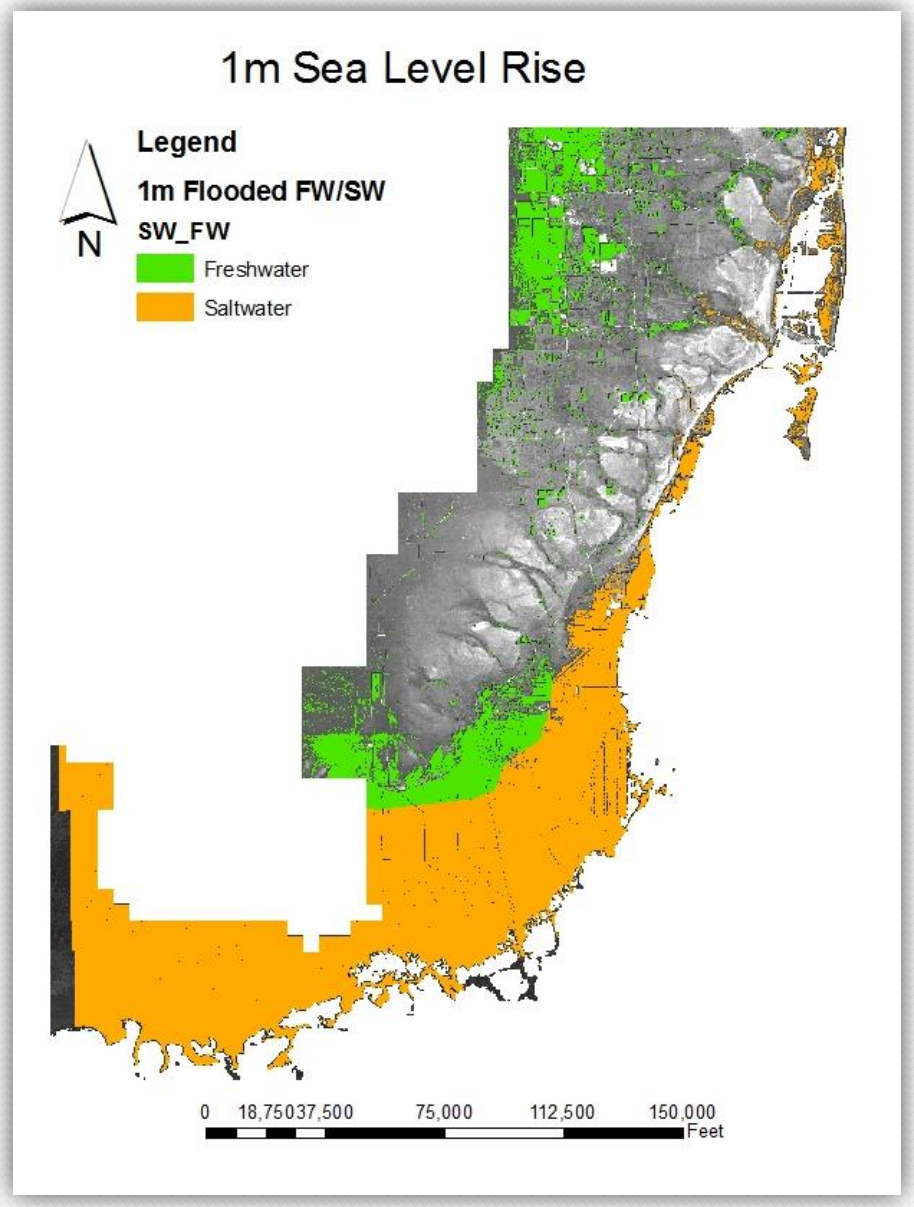
Link 1:
SLR to Water

- Flooding
  - Flooding mostly in the wetlands.
  - The coastal ridge remains mostly unaffected until the 2.0 m SLR scenario.



Link 1 (cont.)

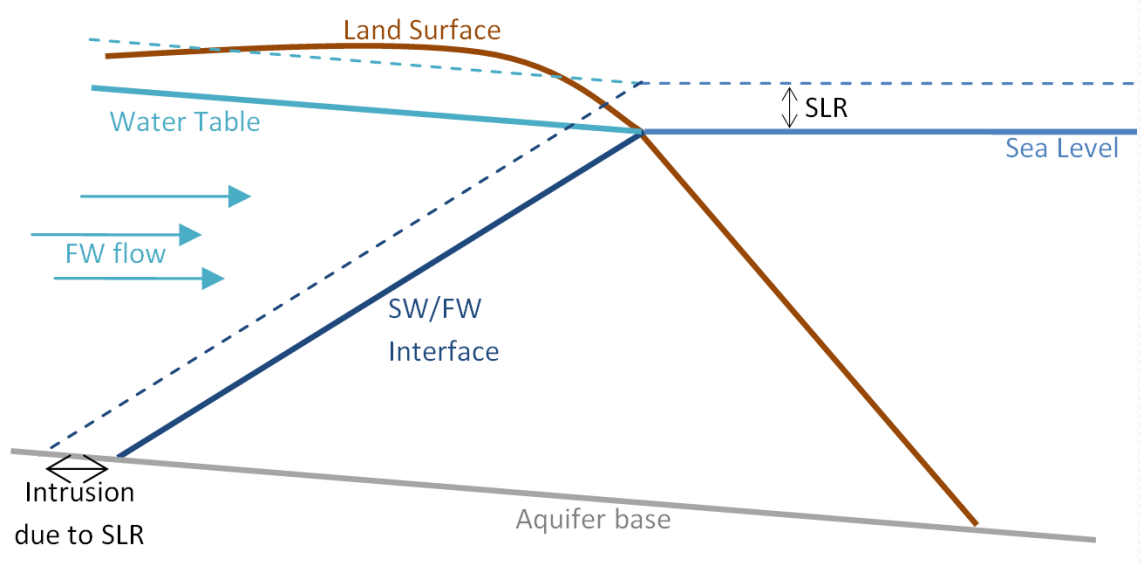
- Saltwater vs Freshwater flooding
  - Inland flooding is freshwater.
  - Saltwater flooding along the coast and in the wetlands.
    - Some areas of SW flooding in the “Finger Glades”.

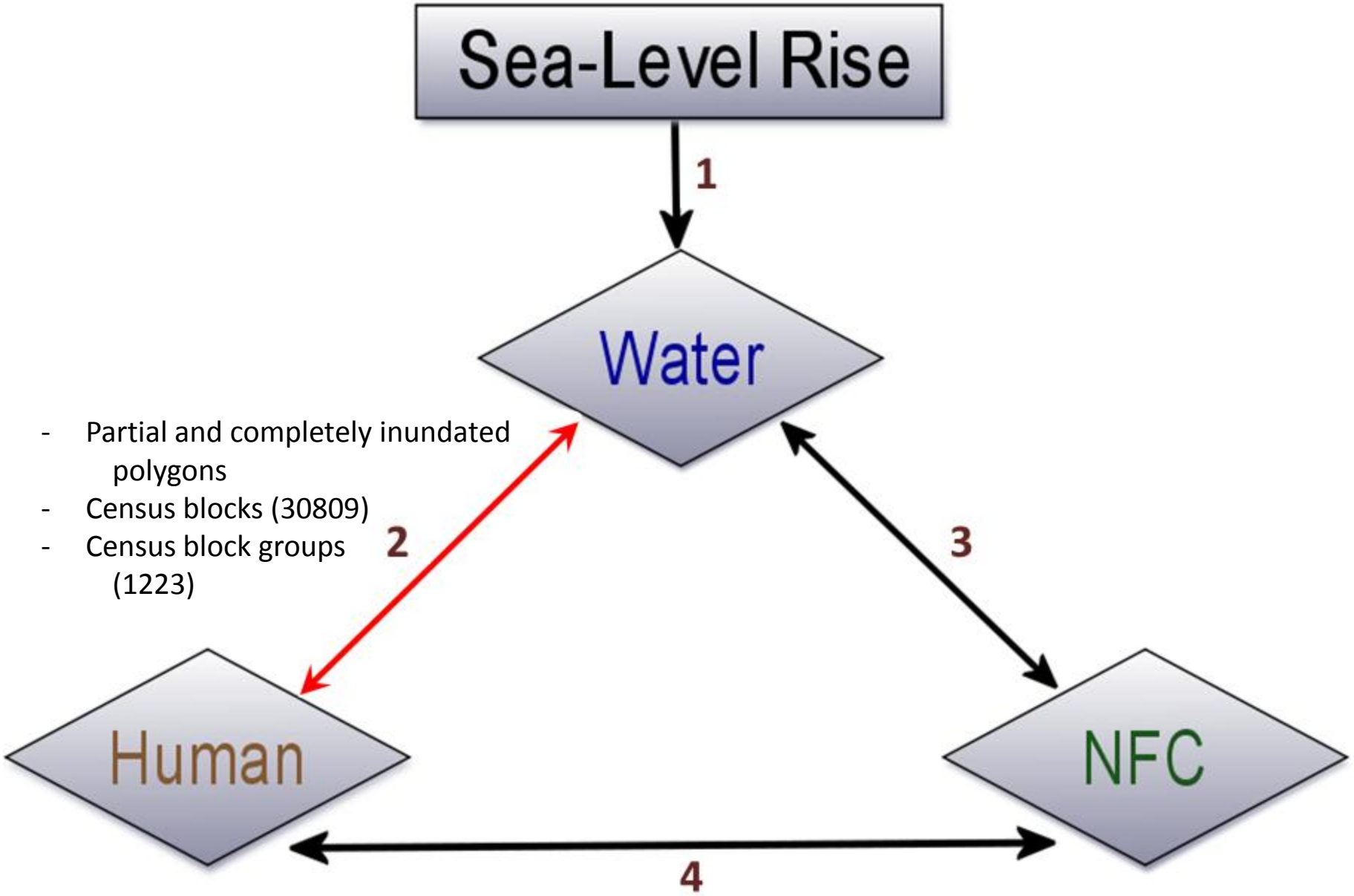


Link 1 (cont.)

	Intrusion (feet)			
SLR	**Max**	**Min**	**Average**	**St. Dev.**
0.5 m	785.98	10.67	117.33	138.47
1.0 m	1567.18	21.33	233.11	273.13
2.0 m	3134.36	42.66	466.23	546.27

- Saltwater Intrusion
  - Distance to the shoreline
  - Aquifer Depth
- Data suggests a maximum intrusion of only 3,000 ft



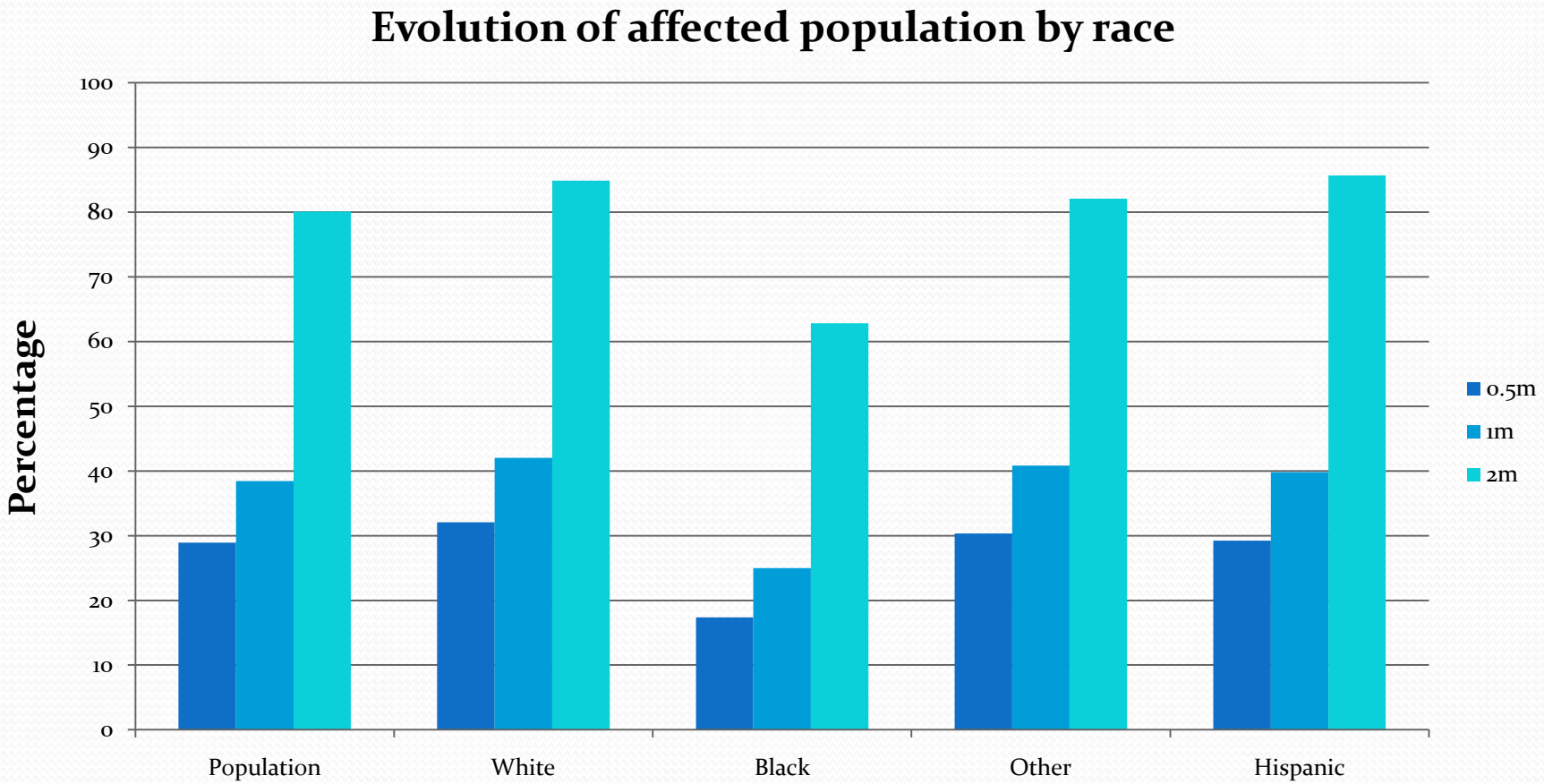

Sea-Level Rise
1
Water
- Partial and completely inundated polygons
- Census blocks (30809)
- Census block groups (1223)
2
3
Human
NFC
4

Link 2: Census blocks, race

- Population distribution by census 2000 and affected by different SLR scenarios.

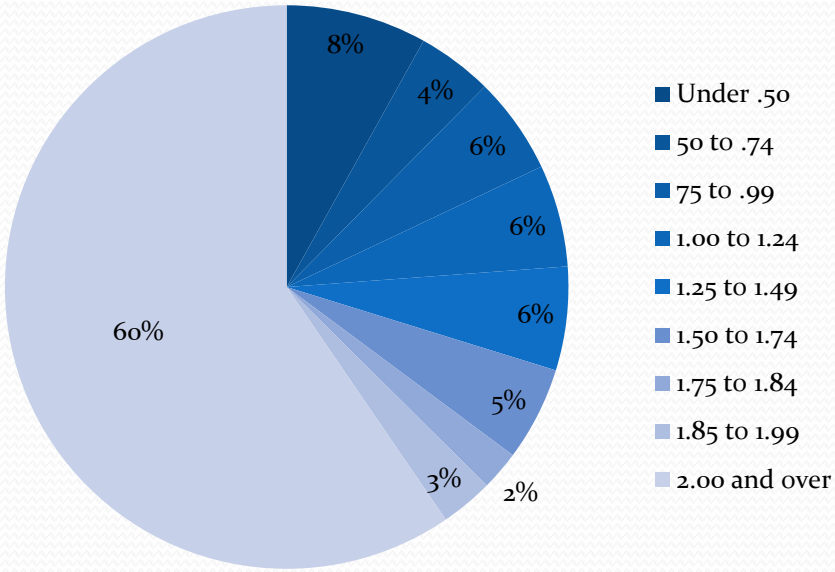
	Census 2000	0.5m	1m	2m
Population	**2,253,362**	**651,872**	**866,635**	**1,805,180**
White	**1,570,558 (12.4)**	**503,941 (19.4)**	**660,297 (16.9)**	**1,332,769 (12.5)**
Hispanic	**1,291,737 (57.3)**	**377,394 (57.9)**	**514,083 (59.3)**	**1,106,788 (61.3)**
Black	**457,214 (20.3)**	**79,441 (12.2)**	**114,217 (13.2)**	**287,196 (15.9)**
Other	**225,590 (10.0)**	**68,490 (10.5)**	**92,121 (10.6)**	**185,215 (10.3)**

Link 2: Census blocks, race

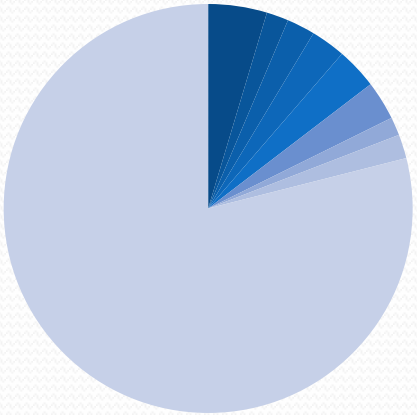


Link 2: Block Census Group, income

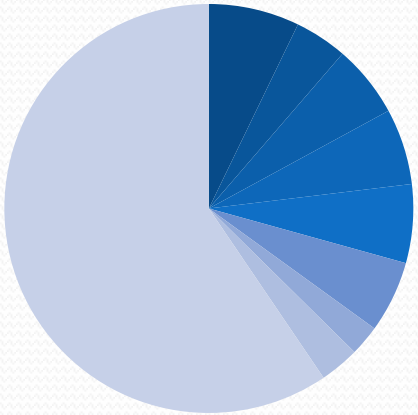
Ratio of income to poverty level



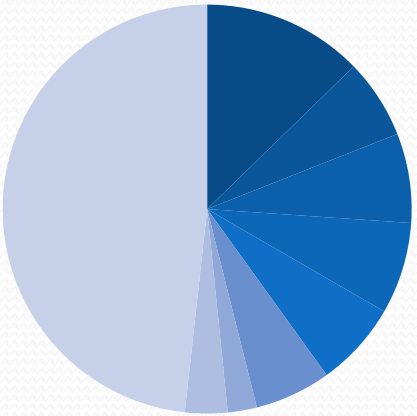
White

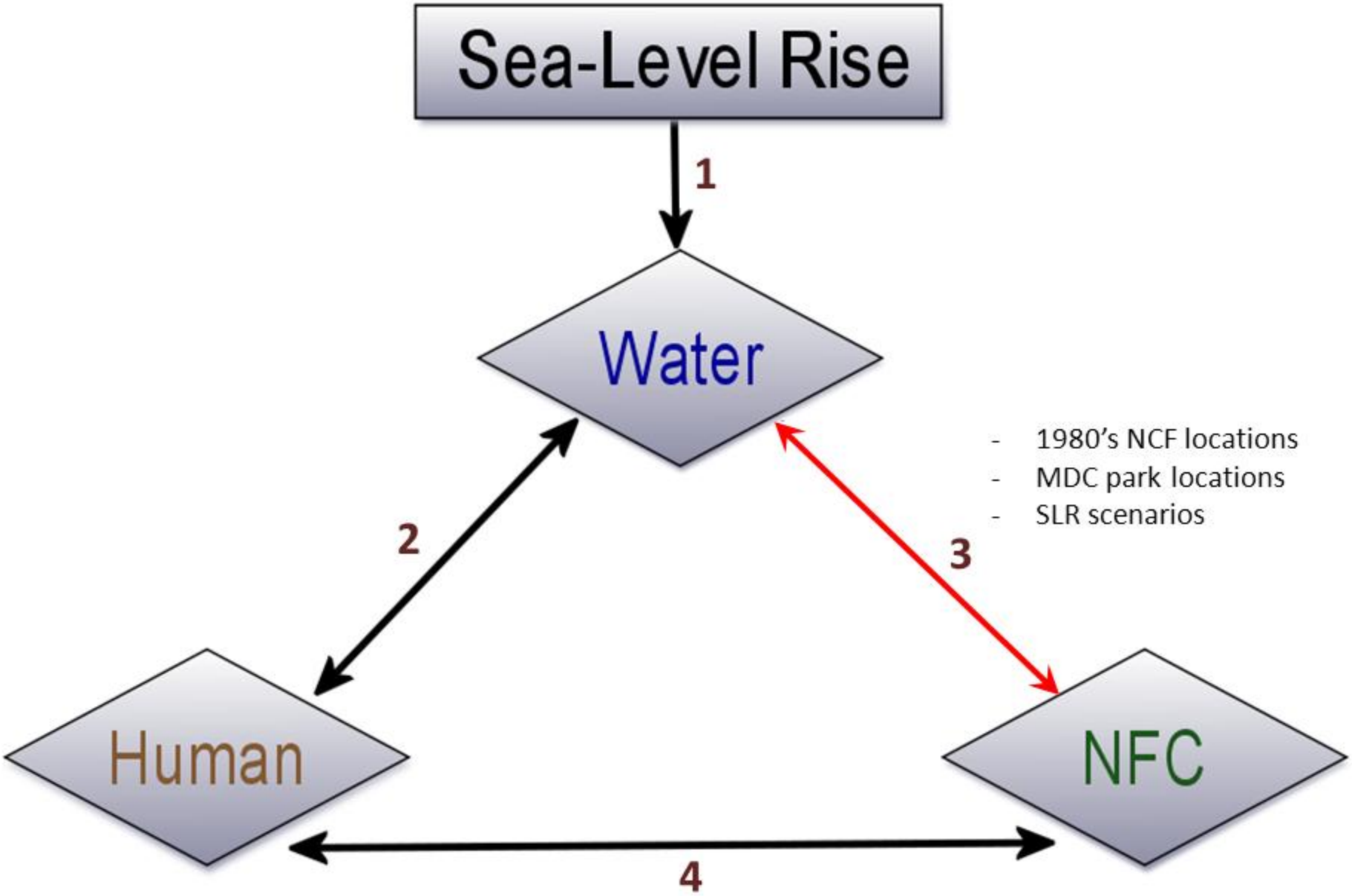


Hispanic



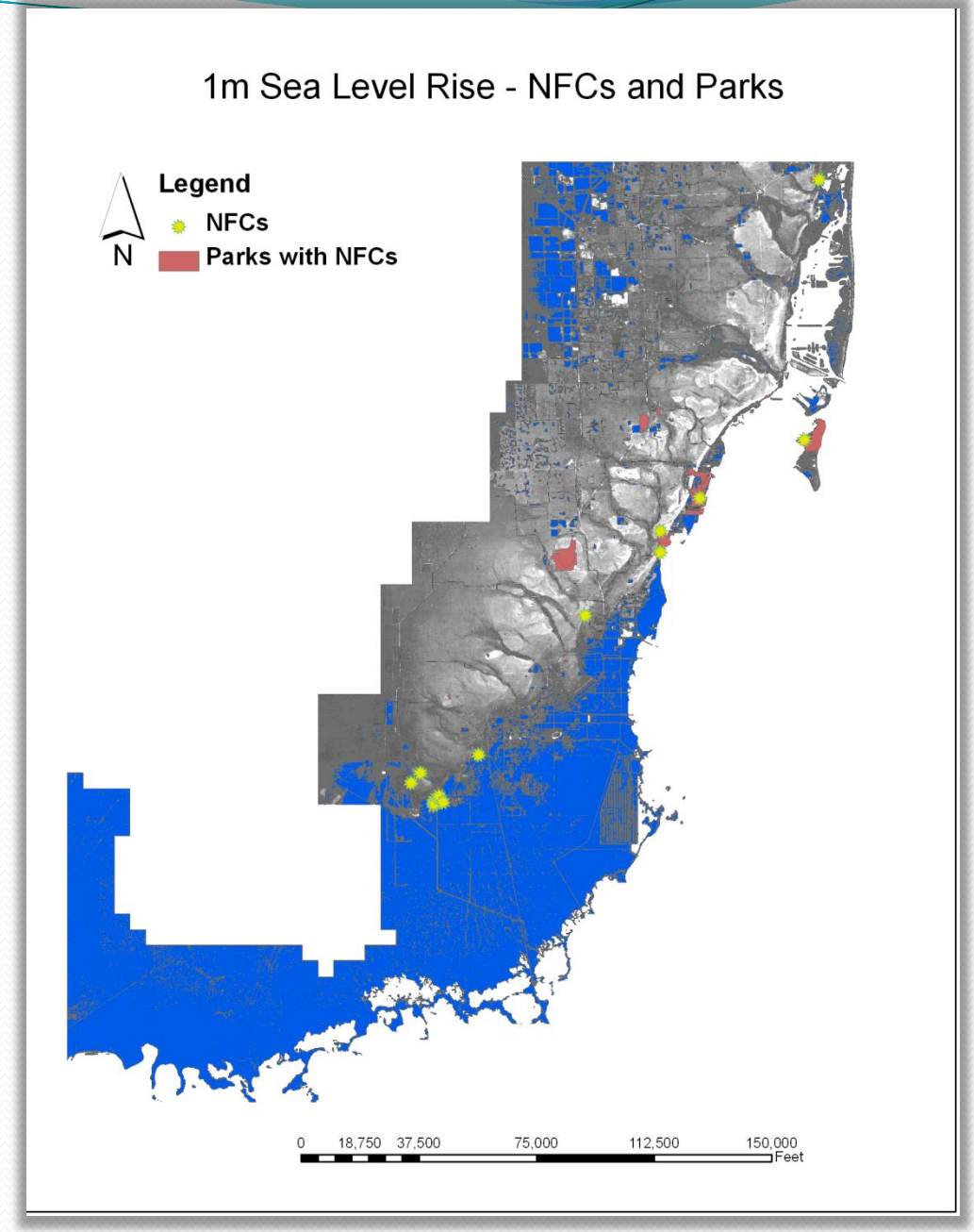
Black



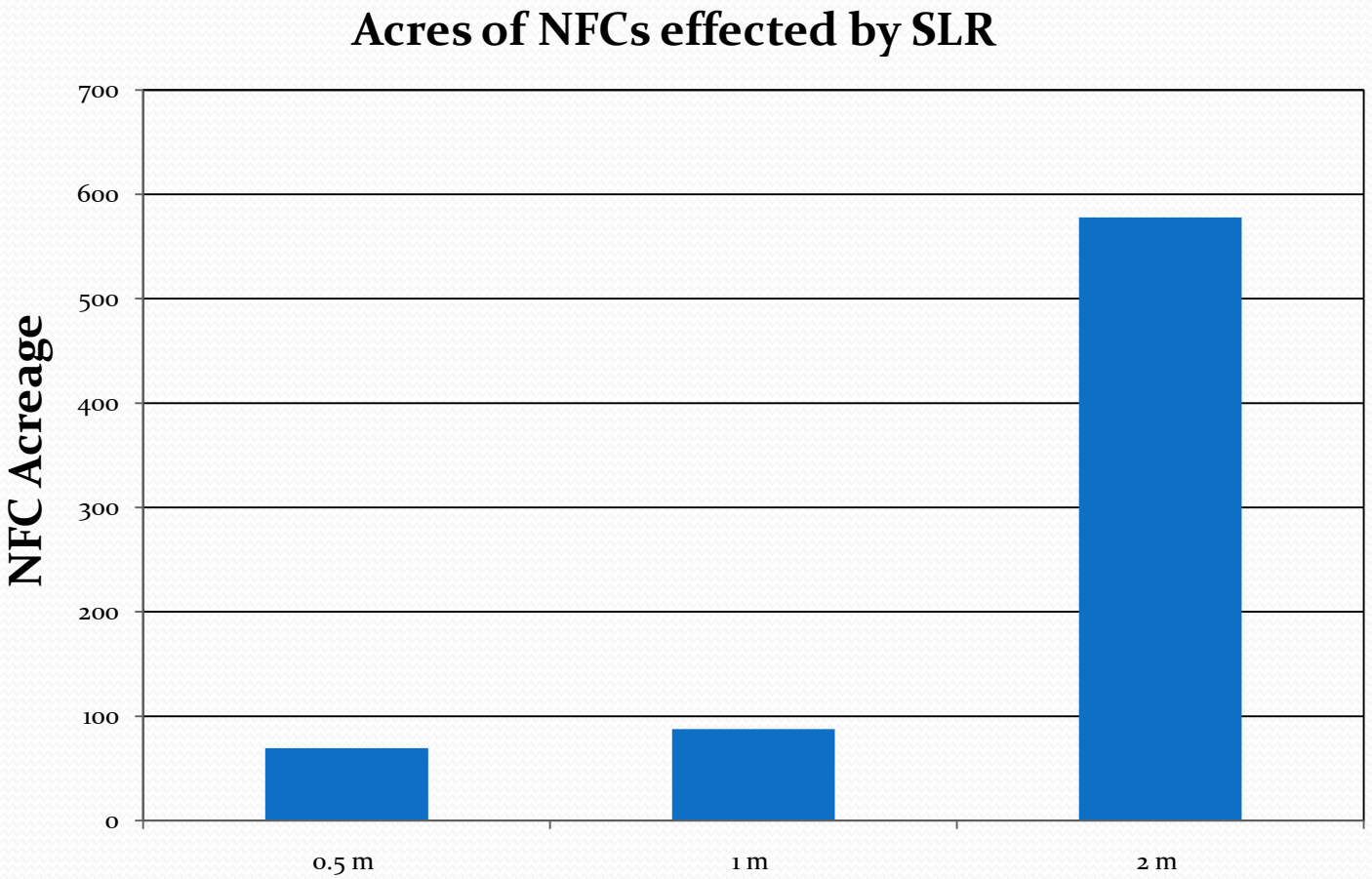

Sea-Level Rise
1
Water
2
3
- 1980's NCF locations
- MDC park locations
- SLR scenarios
Human
NFC
4

Link 3: NFCs to Water

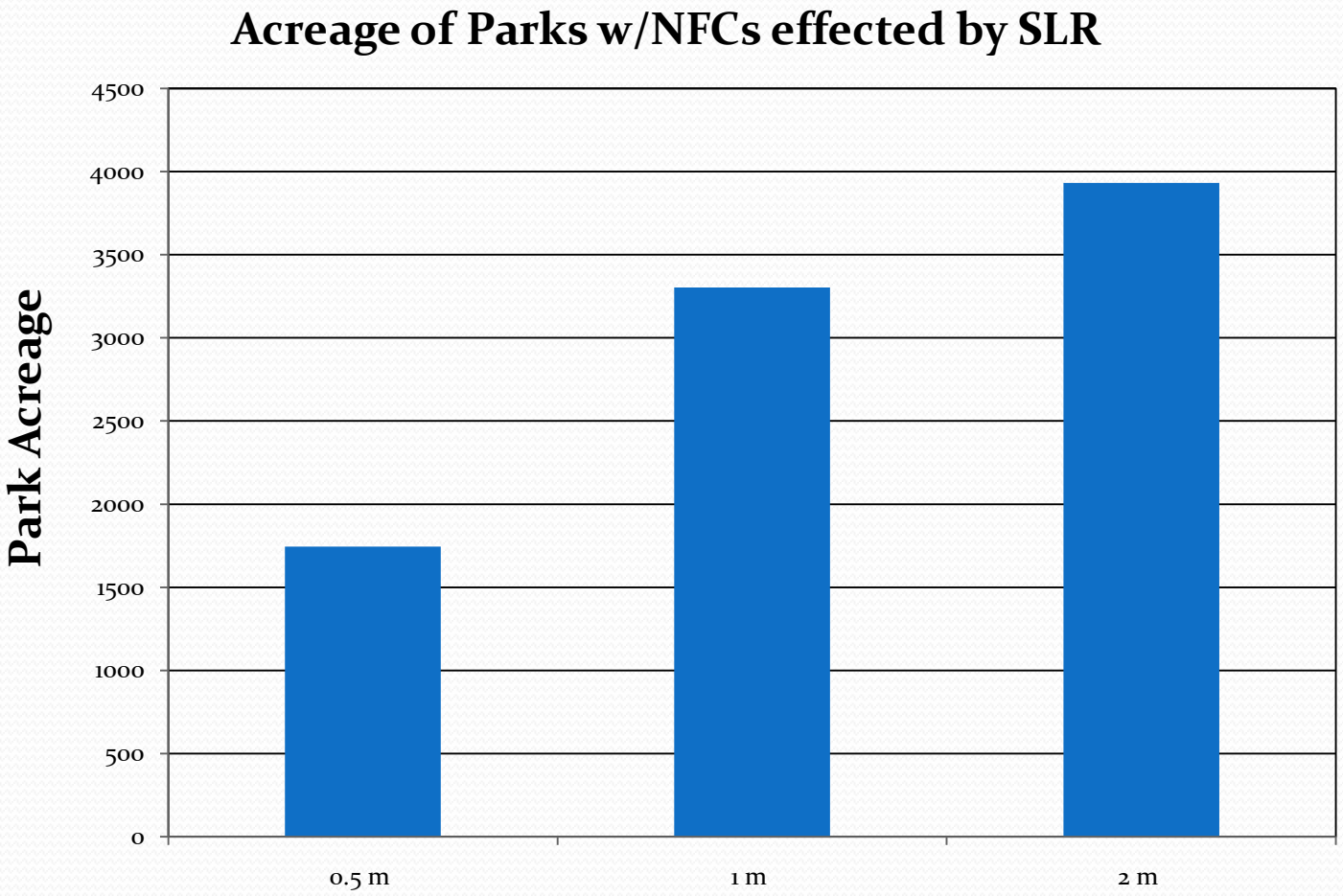
- 698 NFCs in MDC.
  - 120 effected at 2m.
- 741 County and Municipal Parks in MDC.
  - 27 with NFCs.
    - 20% affected by 0.5m SLR.
    - 30% affected by 1.0m SLR.
    - 74% affected by 2.0m SLR.
- 172 rare species in MDC.

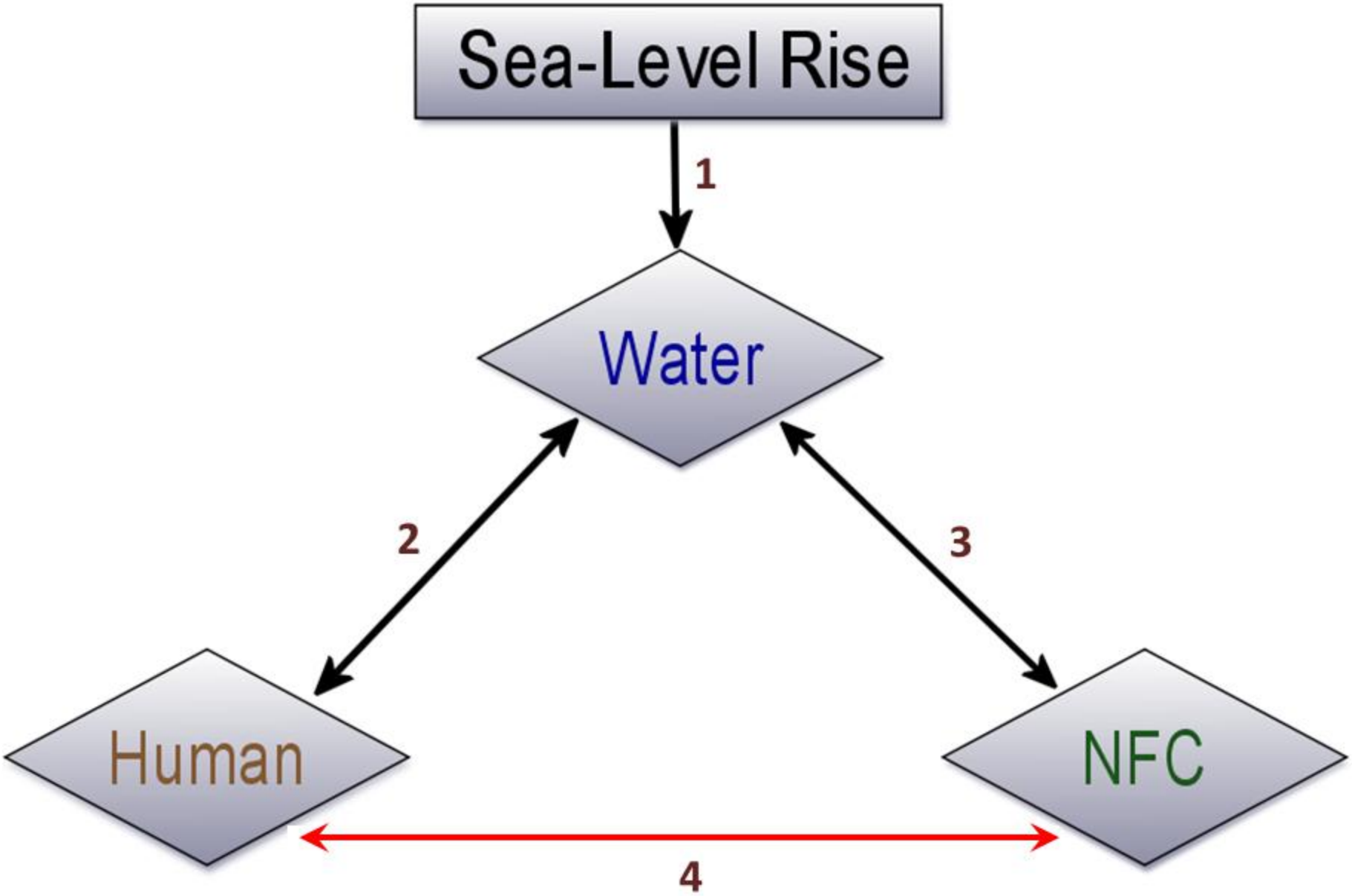


Link 3 (cont.)


Acres of NFCs effected by SLR
NFC Acreage
700
600
500
400
300
200
100
0
0.5 m
1 m
2 m

Link 3 (cont.)

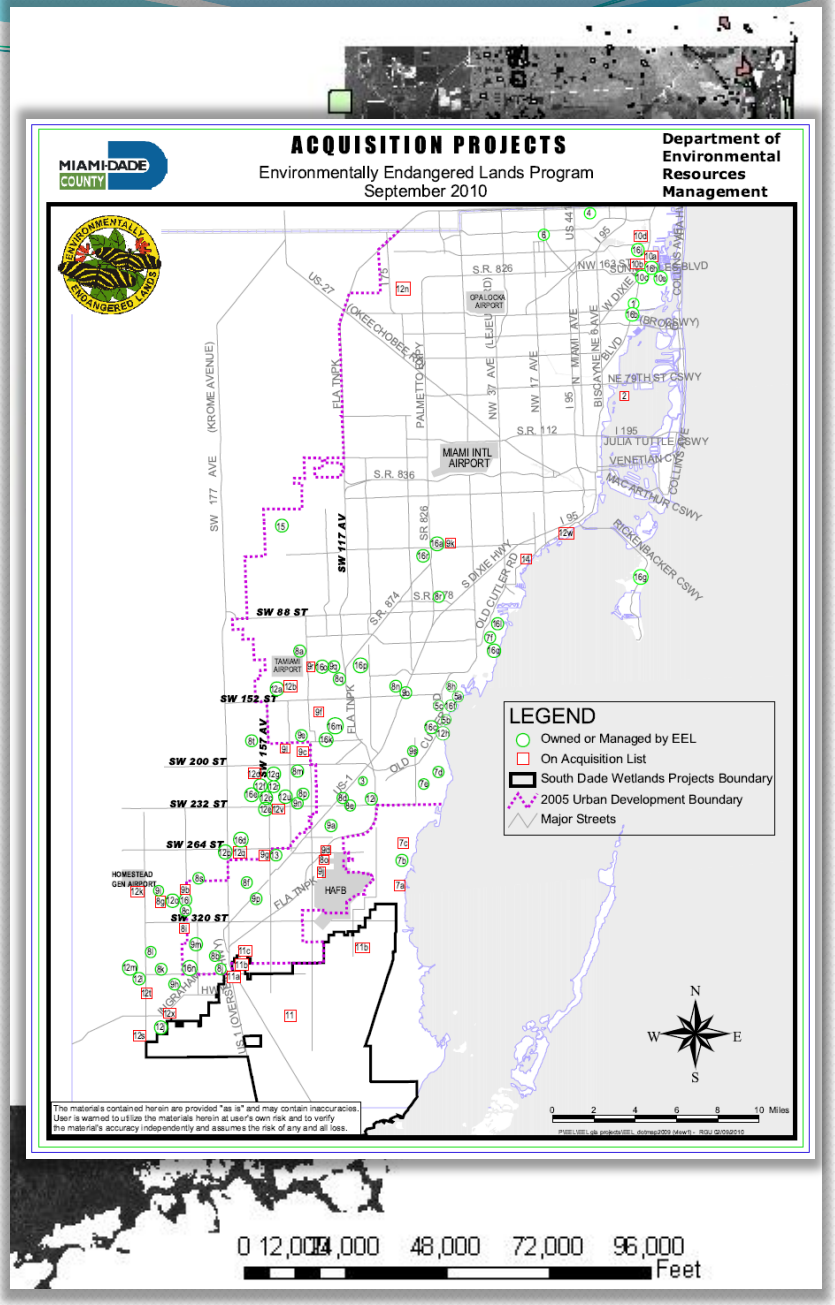

Acreage of Parks w/NFCs effected by SLR
Park Acreage
4500
4000
3500
3000
2500
2000
1500
1000
500
0
0.5 m
1 m
2 m



- MDC ordinances
- MDC, EEL properties

Link 4: Humans to NFCs

- Good news: 74% of parks with NFCs acquired or managed by EEL program.
  - 23,000+ acres as of Sept. 2010.
- 714 other parks.



Link 4: Humans to NFCs (cont.)

- Environmentally Endangered Lands (EEL) - 1990
  - Run by Board of County Commissioners.
  - Vulnerable, low-lying lands with special natural features.
  - Tax breaks for owners (based on acreage).
  - Must follow 10 year management plan, updated at least every 5 years, inspection every year.
  - Development highly unlikely.
- Climate Change Advisory Task Force – 2006
  - Advises Mayor and Board of County Commissioners.
- GreenPrint – MDC chosen as pilot community in 2009
  - Assessment and Goals made as Milestones 1 and 2.
  - Currently on Milestone 3: Planning.
  - Milestone 4: Implement.
  - Milestone 5: Monitor/Evaluate.

greenPrint
Our Design for a Sustainable Future

Link 4: Humans to NFCs (cont.)

- Value of recreational parks and green space in urban areas.
- 16% affected by 0.5m SLR.
- 25% affected by 1.0m SLR.
- 40% affected by 2.0m SLR.
- Types of management
  - City, County.
- 15% undeveloped.
- Potential for development?

Conclusions

Conclusions

1) Extensive flooding in low-lying wetlands and coastal areas.

2) Influence of SLR scenarios on socio-economic groups.

3) SLR will impact NFCs and, in turn, rare plant populations.

4) MDC has positive initiatives for protecting NFCs.