

Adaptive Management & Shorebird Conservation in the Atlantic Flyway



*Applied Shorebird Habitat Management in the Atlantic Flyway:
Managing Habitat With a Flyway Perspective
Avalon, New Jersey
May 13-15, 2003*



Outline

- **What is adaptive management?**
- **Why is it relevant to shorebirds?**
- **What is needed operationally to manage adaptively?**
- **Proposed pilot project**



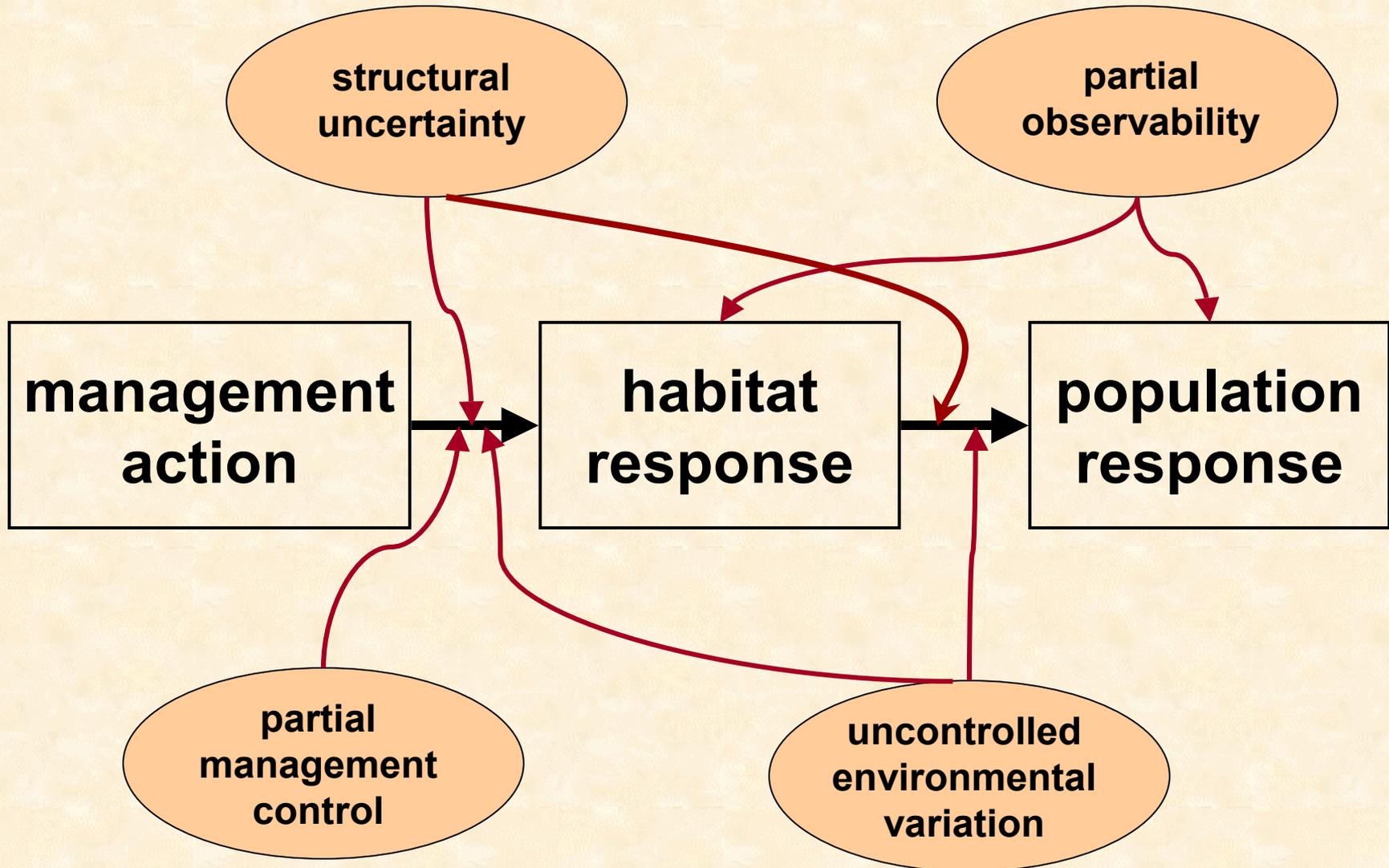
Adaptive management is...

Management in the face of uncertainty, with a focus on its reduction

- uncertainty is an inherent feature of natural resource management
- management is necessary anyway
- but, some management strategies are more robust to uncertainty than others
- and some management strategies are more informative than others



Sources of uncertainty



Defining characteristics of AM

- probabilistic predictions about system response
- best management action in light of those uncertain responses
- observation of system response
- comparison of predictions & observations and adjustment of future management actions

***AM is not (or at least shouldn't be)
"trial & error" management nor "research."***



Operational elements of AM

assessment

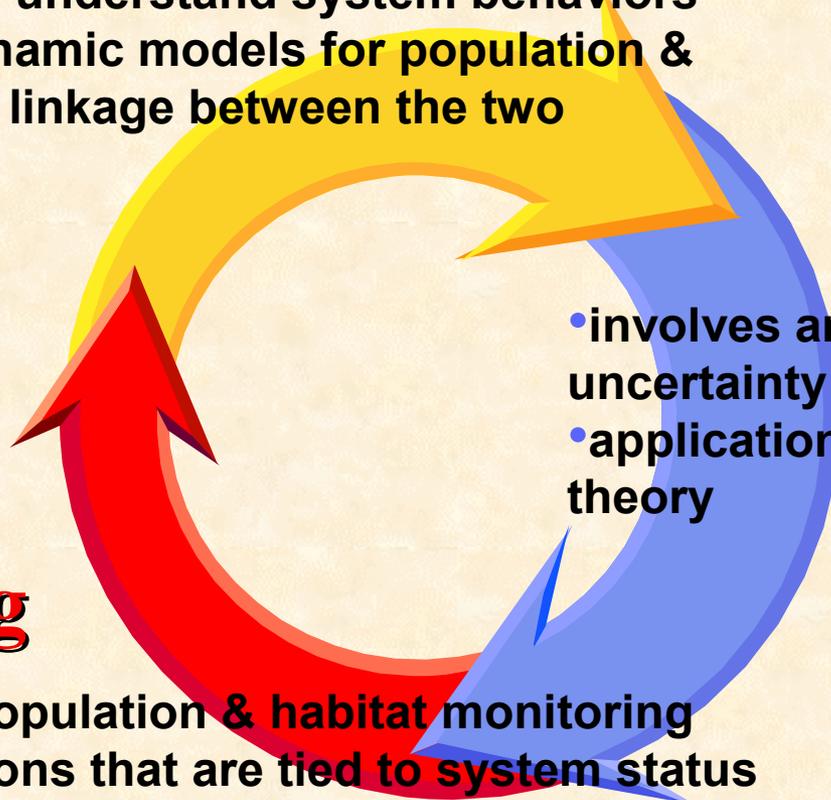
- collective efforts to understand system behaviors
- development of dynamic models for population & habitat processes & linkage between the two

decision making

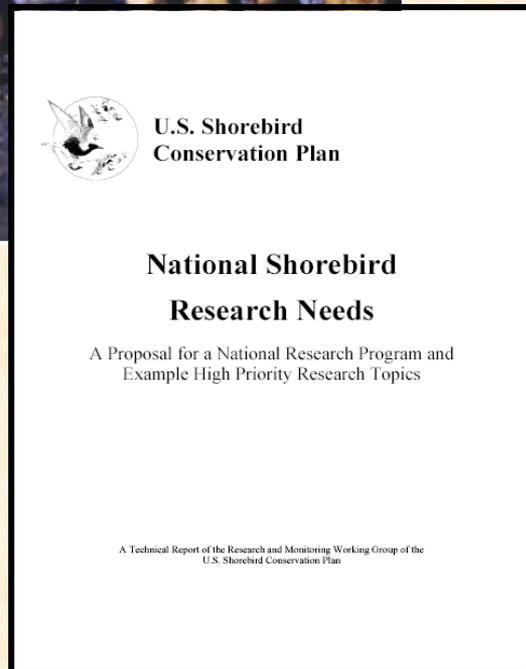
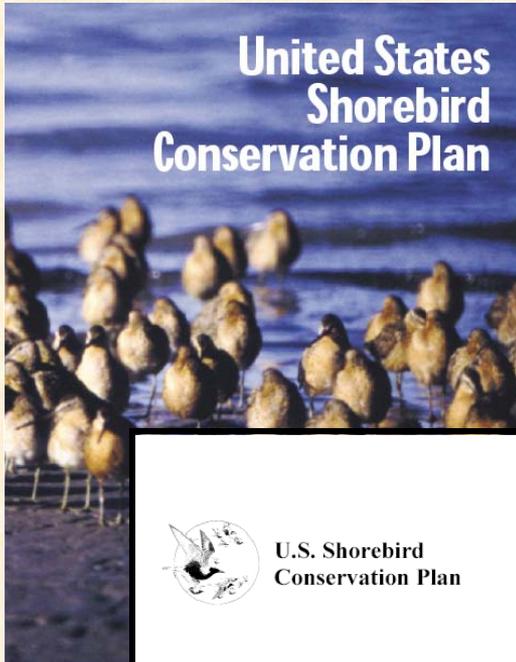
- involves an explicit recognition of uncertainty
- application of statistical decision theory

monitoring

- consists of both population & habitat monitoring
- permits mgmt actions that are tied to system status
- provides data necessary to understand system behaviors and responses to mgmt



Why is AM relevant?



- declining pops & continuing threats
- uncertainty about most effective management actions & responses of populations
- provides a coherent framework for management decision making at multiple scales

Why is AM relevant?



Building the capacity

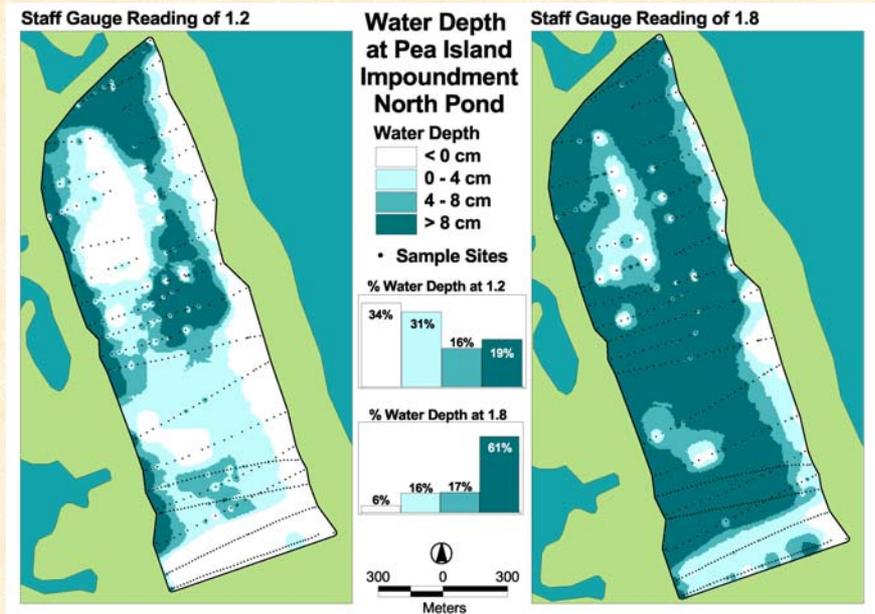
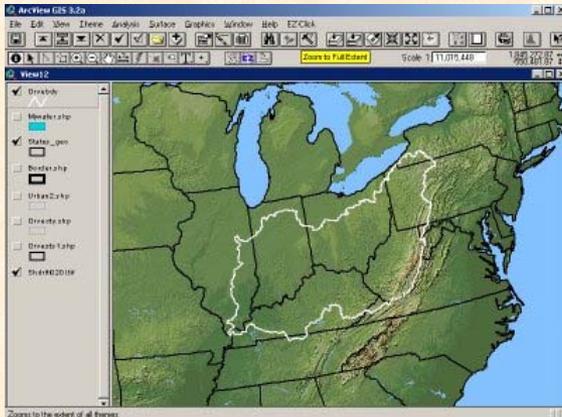
- **Monitoring component**
- **Integrated modeling / analysis component**
- **Decision-support component**
- **Information component**



Building the capacity

Monitoring component

- population monitoring designs and protocols
- environmental monitoring & assessment
- database management



Building the capacity

Integrated modeling/analysis component

- demographic research
- assessment of biophysical processes
- models linking population & environmental processes

N = population size
 S = survival probability
 P = recruitment rate
 Ψ = movement probability
(S^{Ψ}) = transition probability

$$N^A = N^F (S^{FA} + P)$$

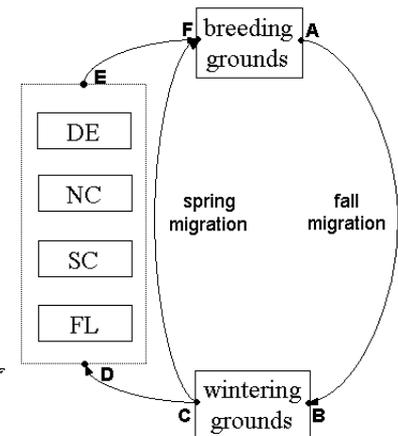
$$N^B = N^A S^{AB}$$

$$N^C = N^B S^{BC}$$

$$N^D = N^C (\Psi^{CD} S^{CD})$$

$$N^E = N^D S^{DE}$$

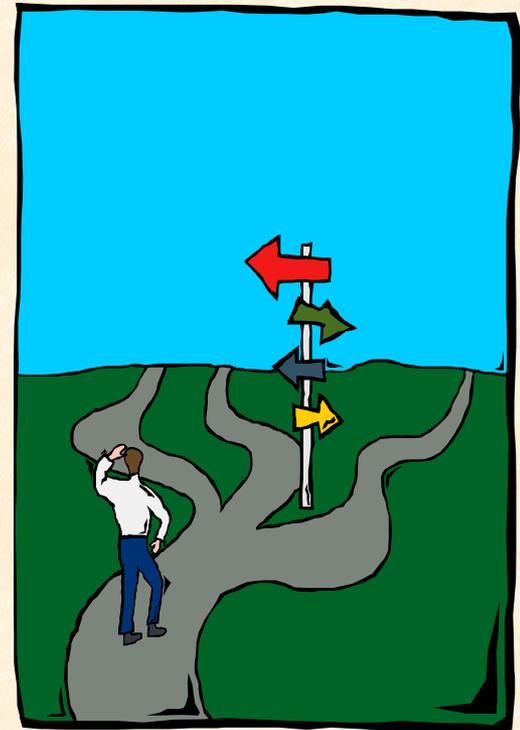
$$N^F = N^E S^{EF} + N^C (1 - \Psi^{CD}) S^{CF}$$



Building the capacity

Decision-support component

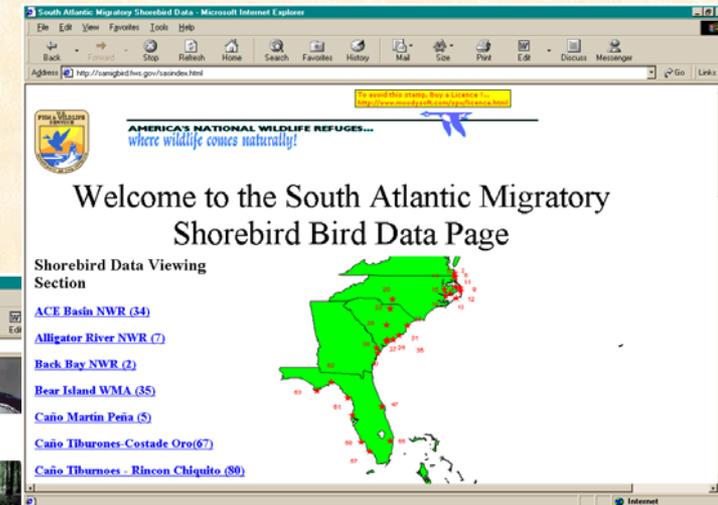
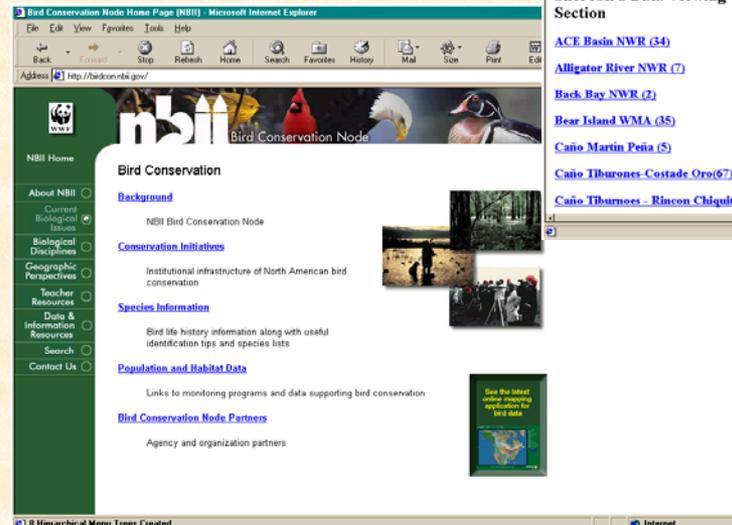
- computer-based, decision support tools
- statistical decision analyses
- design of adaptive management strategies



Building the capacity

Information component

- design of an information commons
- distributed network
- data synthesis

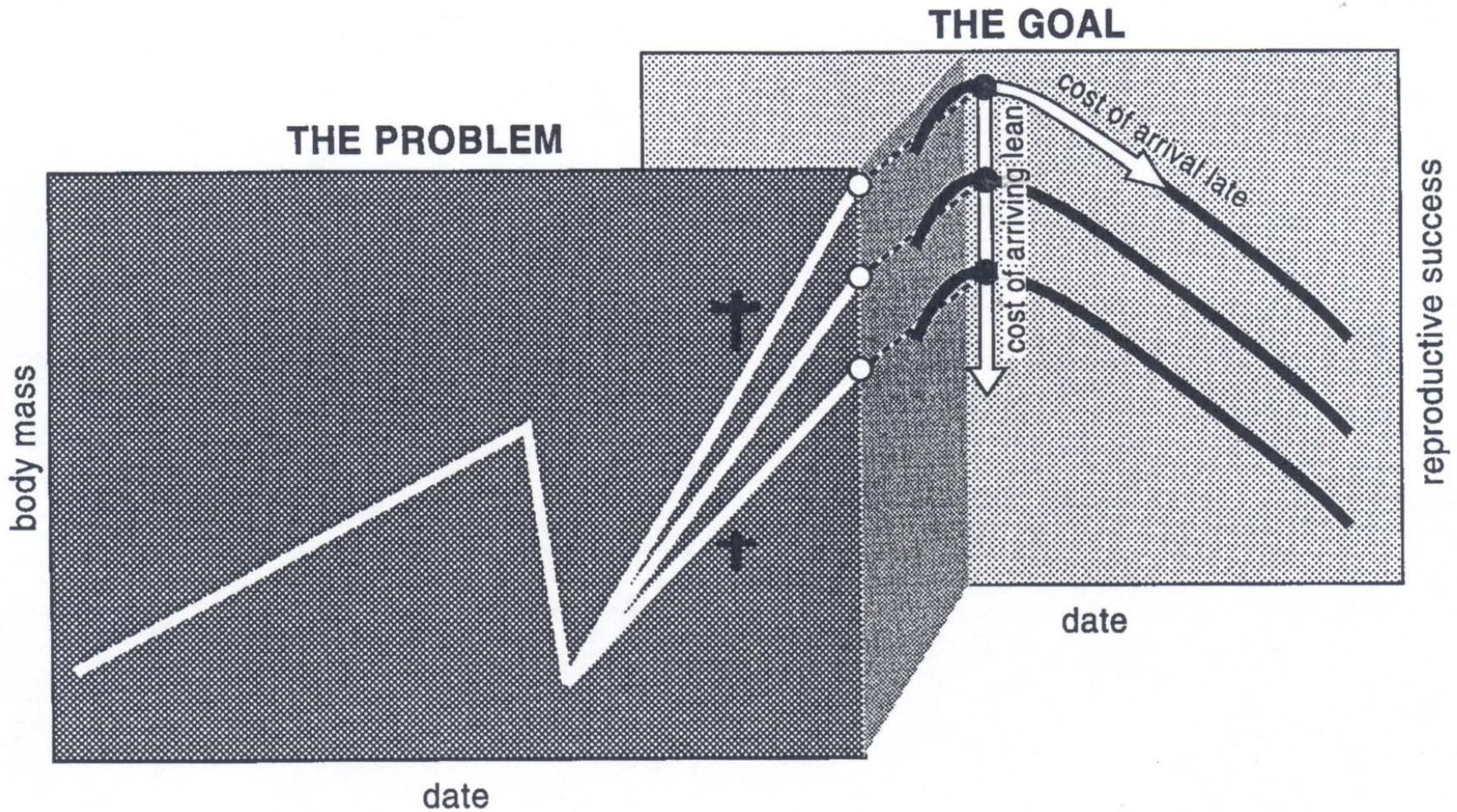


Proposed pilot project

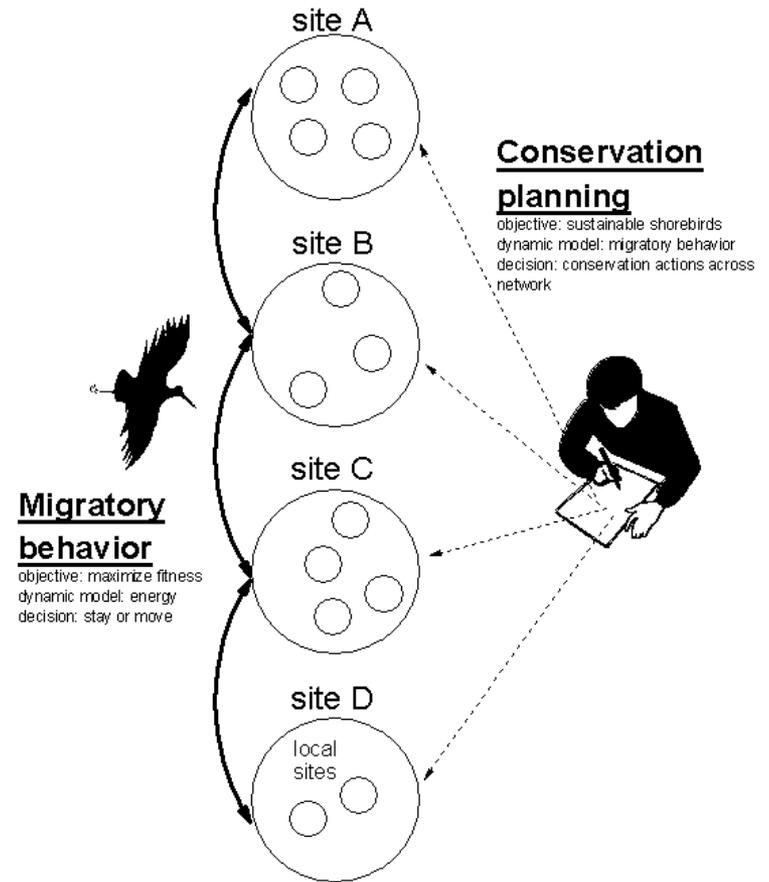
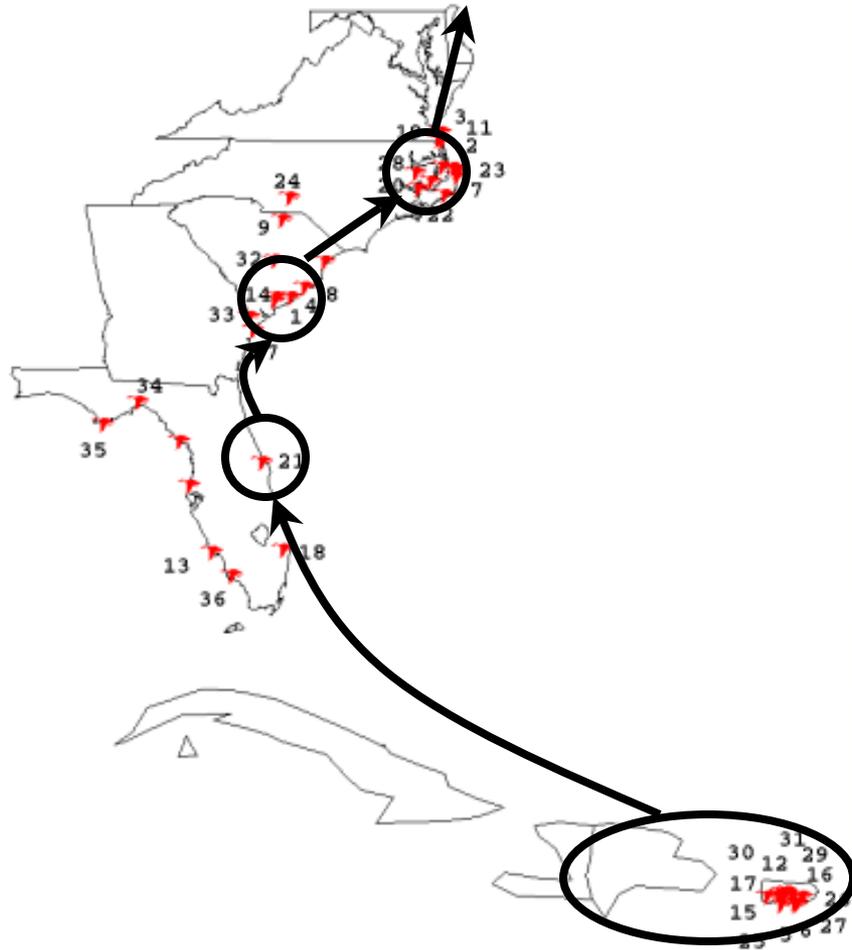
- predict (model) movements (and fitness consequences) of spring-migrating shorebirds through the SE, as a function of controlled and uncontrolled environmental conditions
- use those predictions to support decision-making *and* evaluation by managers at various spatial, temporal, and organizational scales



A motivating hypothesis

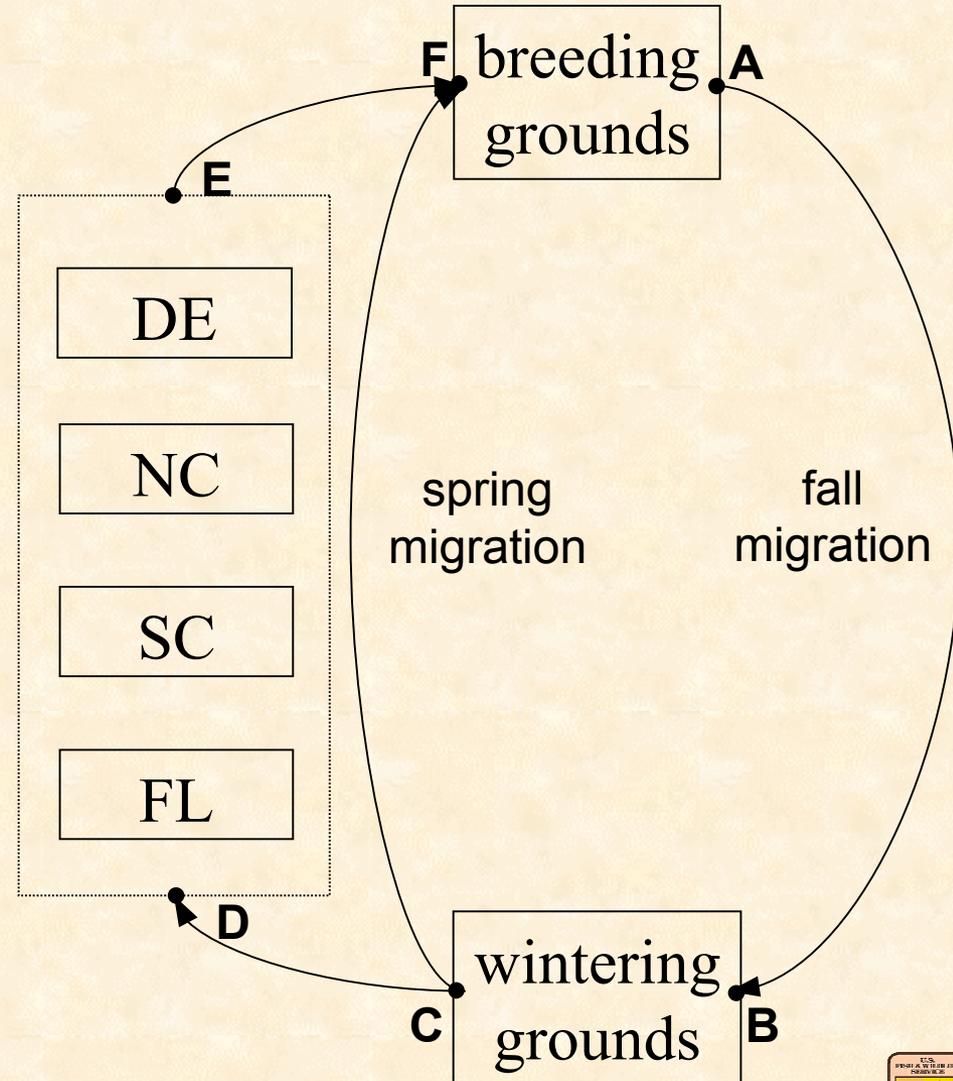
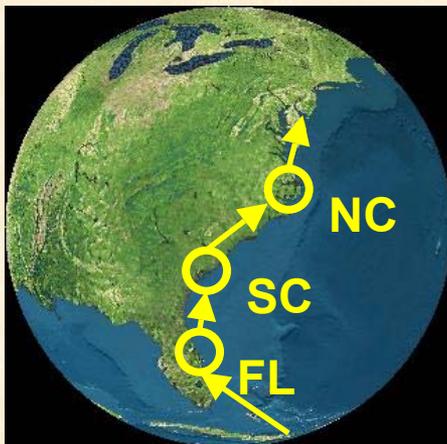


Connecting stop-over sites



Analytical framework

- multiple scales of system dynamics & decision making and coherent scaling
- focus on local mgmt, but with large-scale context
- explicitly includes shorebird vital rates
- used to guide decision making and monitoring & research design



Analytical framework

N = population size
 S = survival probability
 P = recruitment rate
 Ψ = movement probability
 $(S\Psi)$ = transition probability

$$N^A = N^F (S^{FA} + P)$$

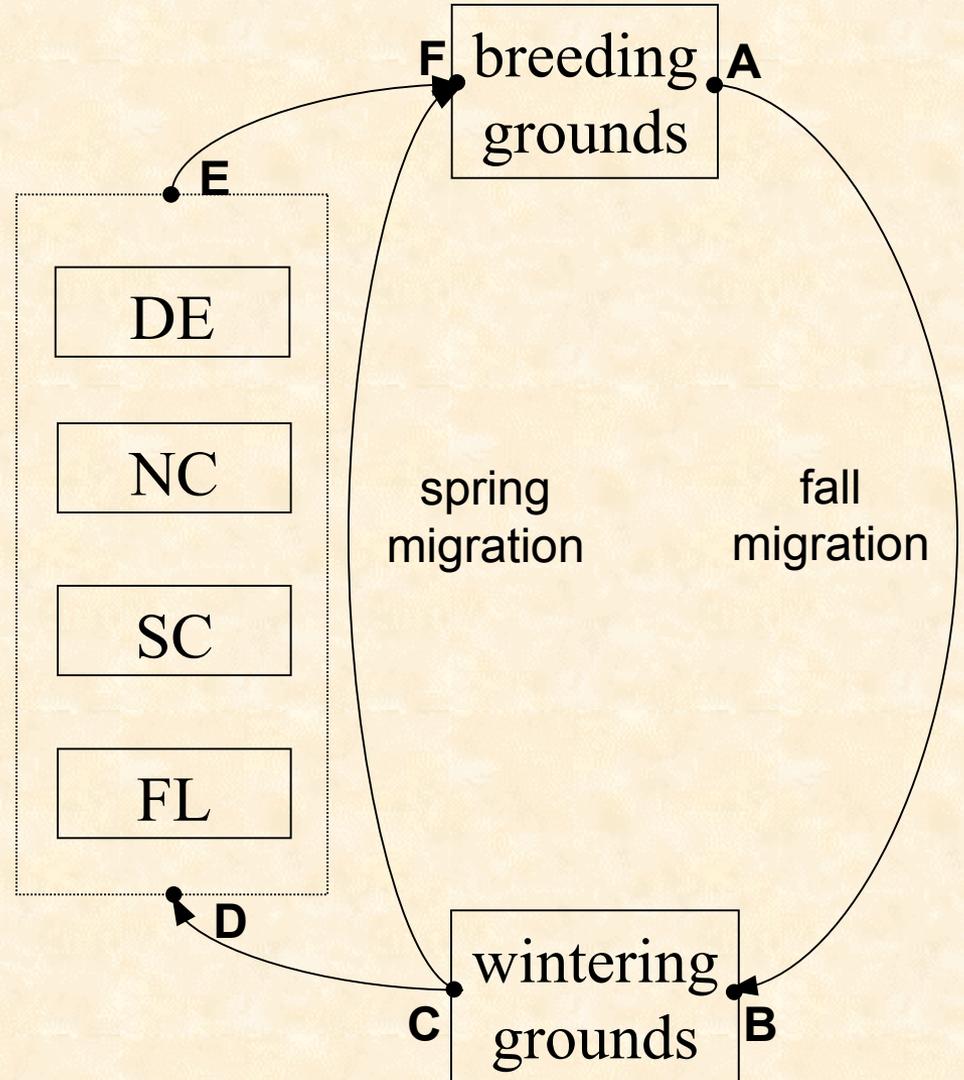
$$N^B = N^A S^{AB}$$

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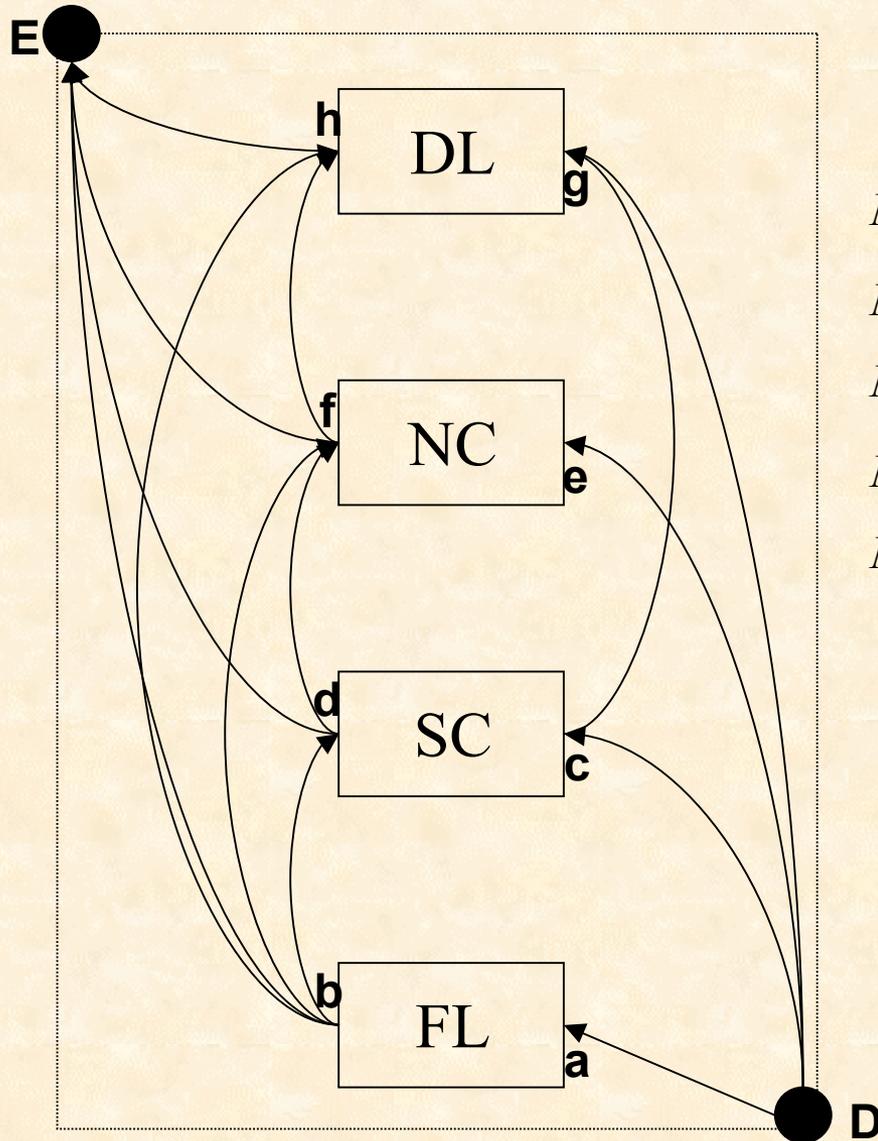
$$N^D = N^C (\Psi^{CD} S^{CD})$$

$$N^E = N^D S^{DE}$$

$$N^F = N^E S^{EF} + N^C (1 - \Psi^{CD}) S^{CF}$$



Analytical framework



$$N^a = N^d (\Psi^{Da} S^{Da})$$

$$N^b = N^a S^{ab}$$

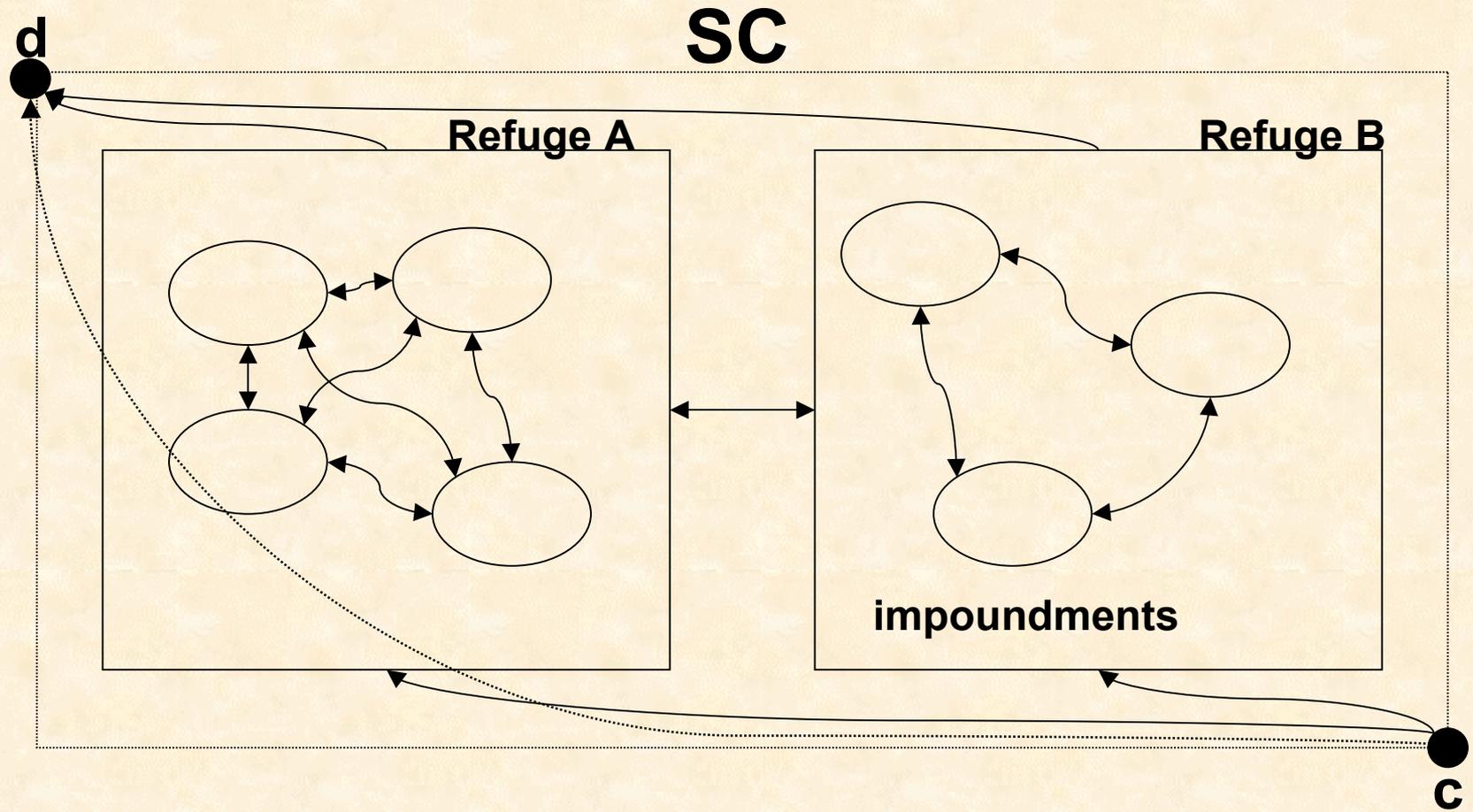
$$N^c = N^b (\Psi^{bc} S^{bc}) + N^D (\Psi^{Dc} S^{Dc})$$

$$N^d = N^c S^{cd}$$

$$N^e = N^d (\Psi^{de} S^{de}) + N^b (\Psi^{be} S^{be}) + N^D (\Psi^{De} S^{De})$$

and so on...

Analytical framework



Building partnerships



Monitoring component

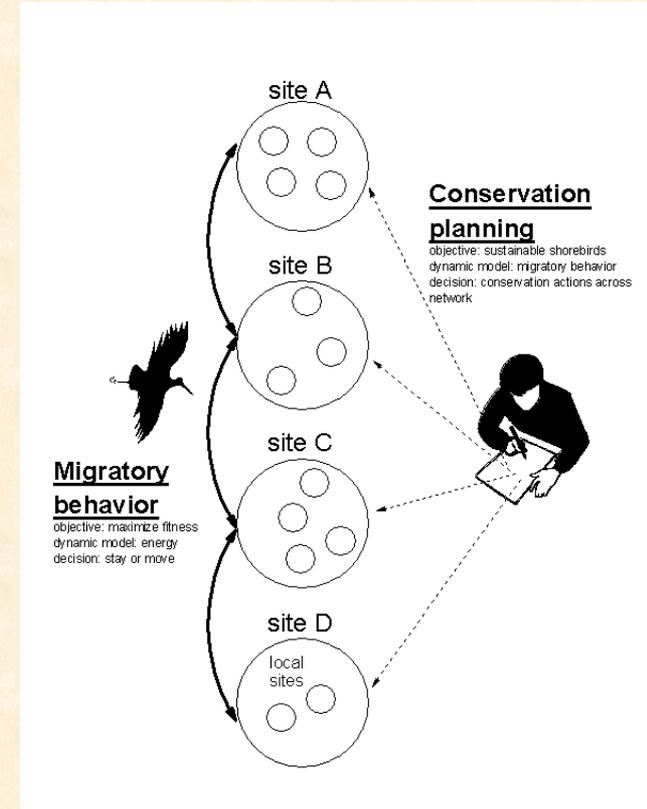
- USFWS Reg 4
- NC State University
- USGS NC Coop Unit
- USGS Patuxent WRC

Modeling/analysis component

- USFWS Reg 9
- NC State University
- USGS NC Coop Unit
- USGS FL Coop Unit
- USGS Patuxent WRC

Decision-support component

- USFWS Reg 9
- USGS Cntr. Aquatic Res. Studies



Information component

- USFWS Reg 4
- USGS NBII



Summary



- **Adaptive management is an iterative process of monitoring, assessment, and decision making; it is about making good decisions in the face of uncertainty and then learning from those decisions.**
- **Has relevance to shorebirds given their status, uncertainty as to the effectiveness of management activities, and the need for a coherent decision making at multiple scales.**
- **Necessary operations components include monitoring, integrated modeling and analyses, decision support, and information commons.**
- **Proposed pilot project - predicting spring migration as a function of environmental factors, and then using those predictions to support decision making and evaluation at multiple scales.**
- **Need analytical framework that can focus on local management within a large-scale context, explicitly incorporate vital rates, and guide design of research and monitoring programs.**
- **Project will require extensive partnerships among USFWS, USGS, et al. SEAMG can help facilitate those partnerships.**

