ATLSS SESI Documentation Sheet.

Draft v1.0 May 5, 2003

ATLSS SESI Model Number and Name
AT.SKI.v0. Snail Kite Spatially-Explicit Species Index Model

Justification

The snail kite (*Rostrhamus sociabilis*) is an endangered raptor whose distribution in the United States is restricted to the South Florida Ecosystem, including watersheds of the Everglades, Lake Okeechobee, Kissimmee River, and Upper St. Johns River. Because snail kites feed almost exclusively on one species of aquatic snail (the apple snail, *Pomacea paludosa*), their survival depends directly on the hydrologic functioning of these watersheds. Each of these watersheds has experienced, and continues to experience, substantial degradation, resulting in the current planning for what probably will become the largest ecosystem restoration ever undertaken. Although other endangered species occur within the ecosystem, snail kites are probably the only species restricted to the watersheds within the South Florida Ecosystem and dependent on the entire network of wetlands within this ecosystem. Loss, fragmentation, and degradation of over half of the wetlands within central and southern Florida during the past century has prompted planning for ambitious restoration efforts. Because of the snail kite's restricted range and because their population is highly dependent on the success of restoration efforts, the snail kite is a key species to monitor throughout the restoration process.

The ATLSS Snail Kite Index (SKI) Model was developed as a crude indicator of potential habitat quality during the breeding season for snail kites in the Florida Everglades. All evidence suggests that the population dynamics for this species are influenced by environmental conditions occurring throughout its entire range in Florida. This model addresses only relative habitat quality within a limited area, ignoring larger spatial extent population dynamics that may have a much greater effect on this species than habitat quality in part of its range. Consequently, this model should not be interpreted to represent population dynamics or viability. The time scales at which evaluation of alternative scenarios are evaluated also are likely to be too short to encompass some long-term changes in habitat quality. Particularly, stabilized hydrologic regimes may result in a slow degradation of habitat that may be overlooked at the time scales evaluated with this model.

CERP Target

Rather than specifying a single “performance measure” for each model, it is the objective of ATLSS to provide a rational basis for different stakeholders to determine their own criteria for comparing different hydrologic plans based upon their own choices of trade-offs between species, spatial regions and time horizons.

Evaluation Protocol

Several types of habitat have been identified as suitable habitat for snail kite reproduction. These are, with their FGAP numbers: Freshwater marsh (29,30), Typha (34), Spartina (35), Muhlenbergia (33, 39), Eleocharis (31), Open water (0).

- In the BPI, other habitat types are excluded (index for habitat types not listed is set to zero).

Time since the last drydown of the cell affects the quality of habitat by affecting the availability of the snail kite's primary prey, the apple snail. Since apple snails are aquatic and have a limited capacity to survive dry conditions, drying events result in periodic reductions in the availability of snail kite food resources. It takes more than two years for the population of apple snails to recover following a drydown of the cell. Prolonged inundation can also have an adverse effect, as an area that has not dried down for too long a period may deteriorate as suitable habitat.

- In the BPI, a drydown factor (dryfactor) is defined. The dryfactor is related to the time since the last drying down of a cell. Relative habitat quality on average is about 50% of pre-drying conditions the year following the drying event, 85% two years following and fully recovered by three years. A "wetfactor" is also defined. It measures possible habitat deterioration due prolonged periods of inundation. For this index model, cells inundated less than 80% or greater than 98% of the time over a ten-year period are considered unsuitable as snail kite habitat; cells with inundation periods of 80-85% and 95-98% are considered marginal; and cells with 85-95% inundation periods are considered suitable.

The snail kite may have more than one breeding cycle between January 1 and July 31. The continuity of a breeding cycle depends on the depth of water remaining continuously within a certain range, such that apple snails in the water will be available to the snail kites. The time to complete one breeding cycle is estimated to be 110 days, based on the time required for nest building (10 days), egg laying (2-day intervals with incubation beginning with the 2nd egg), incubation (27 days), the nestling period (30 days), and a post-fledgling period (45 days).

- In the BPI, the index is partially determined by the number of uninterrupted breeding cycles through the breeding season, starting on January 1 through July 31. A minimum water depth of 20-cm at the time of initiation is required for suitable breeding conditions. The continuation of a cycle depends on water depths staying within a certain range. Water depths < 10-cm are considered too shallow, so depth must remain above 10-cm for at least the time required to successfully raise a brood (110 days). Water that is too deep may also be unsuitable for breeding snail kites. We defined an upper limit of suitable depths to be 115-cm.

Details of the SESI are available at: http://www.atlss.org/d_kite.html .
We express the effects of proposed scenarios as changes in the spatial pattern of breeding potential over the model area. Our subarea reporting units are shown in http//:www.atlss.org/repunits.pdf).

Model output includes summary tables and three-panel maps displaying landscape results for (a) proposed hydrologic modification scenario on the left, (b) base scenario on the right, and (c) a cell-by-cell difference between index values for the two compared scenarios in the center panel, enabling the reader to make comparisons between alternatives.

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Source and History of Evaluation Protocol

The ATLSS modeling group has worked with field biologists to explore conceptual models and develop spatially-explicit species index models that reflect relationships between hydrologic factors and breeding/foraging potentials for key Everglades species. This SESI was one of 8 identified for development and was developed by Jane Comiskey and Louis Gross, with input and advice from Rob Bennetts.

Selected References:

Darby, P.C., PL. Valentine Darby, R.F. Bennetts, J.D. Croop, H.F. Percival, and W.M. Kitchens. 1997. Ecological studies of apple snails (*Pomacea paludosa*, Say). Final Report prepared for South Florida Water Management District and St. Johns River Water Management District. Contract # E-6609, Florida Cooperative Fish and Wildlife Research Unit, Gainesville, Florida.

Hanning, G.W. 1978. Aspects of reproduction in *Pomacea paludosa* (Mesogastropoda: Pilidae). M.S. Thesis. Florida State Univ., Tallahassee 119 pp.

Little, C. 1968. Aestivation and ionic regulation of two species of *Pomacea* (Gastropoda, Prociobranchia). Journal of Experimental Biology. 48: 569-585.

http://www.atlss.org/d_overview.html

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