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Developing Habitat Suitability Indices for Mammalian Herbivores at Augrabies Falls NP, South Africa

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EXECUTIVE SUMMARY

Commonly used in evaluating wildlife habitat are Habitat Suitability Indices (HSI). However, HSI models often fail. We propose that they can be improved by applying foraging theory. Our new metric is based on optimal habitat selection theory and optimal patch use theory. We are applying the index to hyraxes (*Procavia capensis*), klipspringers (*Oreotragus oreotragus*), and springbok (*Antidorcas marsupialis*) in Augrabies Falls National Park (NP), South Africa. In order to compare our new index with more traditional ones, we are collecting appropriate measurements to allow us to construct both kinds. We will compare population densities in subsequent years to both new and traditional HSI models and experimentally test for the effect of various inputs. The new indices based on foraging theory will improve our ability to manage wildlife in parks and game farms, allowing for more holistic, community-level wildlife management. Activities for the year included planning, recruiting students, making arrangements for working in the field, and working out details for handling the budget. Collaboration during the past year included a planning meeting between all of the principal investigators that took place in August, 2001 in Port Elizabeth, South Africa and a trip to the field site in July, 2002 that involved the American PI, the South African PIs, and the students. The recent meeting allowed for the project personnel to meet the National Park staff, choose field sites, check out field facilities, and to apply field techniques and collect preliminary data.

SECTION I

A) Research Objectives:

1. We propose to apply foraging theory to conservation biology by developing habitat suitability indices (HSI) based on optimal habitat selection and optimal patch use. Unlike measurements of habitat quality from traditional HSI models, measurements based on foraging theory are leading indicators of habitat suitability. The development of such an index will improve our ability to manage wildlife in parks and game farms, allowing for a more holistic, community-level approach to wildlife management.

2. We propose to measure habitat selection and patch use behavior of large herbivorous mammals (hyraxes, klipspringers, springbok) at Augrabies Falls National Park, South Africa. We will use activity data calculated in adjacent habitats to calculate the isodars. Isodars will determine how habitats vary quantitatively in terms of productivity and qualitatively in terms of water and/or safety from predators. We will use artificial feeding trays to calculate giving-up densities (GUDs) in order to quantify patch use. The combined measures of GUDs, isodars, and activity patterns will classify habitats into categories of "unsuitable", "core", "refuge", and "valuable but costly". HSIs based on foraging theory will then be compared to actual population performance and to HSIs based on traditional approaches in order to test the efficacy of the new method. We will also include the experimental examination of patch use by foraging animals in which we will manipulate food type, water, and distance to cover to better understand how these factors may contribute to habitat quality.

3. We propose to examine the role of predation and competition in determining habitat suitability of hyraxes, klipspringers, and springbok through the examination of mechanisms of species coexistence. This will allow the inclusion of the effects of competition and predation in HSI models for the first time.

4. The proposed research has significance for conservation biology and sustainable development in that it will improve our ability to assess habitat suitability, a necessary input for conservation, ecotourism, and game farming. Such information is vital in species reintroductions, restoring degraded habitat, and managing wildlife. The proposed research will also allow us to search for general patterns in foraging behavior and mechanisms of species coexistence for large mammalian herbivores by allowing comparisons to similar systems in other parts of the world.

5. The specific goal for the past year were to launch the project and establish field sites in the following habitats:

Substrates	Habitats
Broken Rocky	Riverlines
	Gravel plains
	Kopjes

Rocky Catina	Dry river
	Pebble plains
Savanna	Dry river
	Sandy plains

Within each habitat we planned to establish 3 feeding stations (> 200m apart) with two food patches. One food patch will be placed near cover and the other away from cover (food patches should be c. 3-4 m apart).

Data will be collected four times per year within the different habitats and substrates. Field sessions would last upwards of two weeks and include censusing hyraxes, springbok, and klipspringers using visual counts and pellet counts, collecting vigilance data, collecting GUDs in feeding patches, conducting vegetation surveys to determine the vegetation composition, percent cover, and forage availability (clip plots) for constructing traditional habitat suitability indices, and measuring bite diameters and bite numbers for measuring natural GUDs.

B) Research Accomplishments:

Research accomplishments to date are limited to developing field techniques. For example, we have tried out various methods for observing animals in the field for measuring vigilance and apprehension. See Table 1 for an example.

Table 1. Time budget data for springbok, klipspringers, and hyraxes.

Species	No. of focals	Total time (min.)	Feeding (min.)	Vigilant (min.)	Moving (min.)	Other (min.)
Springbok	15	93.883	36.483	31.083	10.233	16.083
Klipspringer	9	55.233	7.75	45.067	1.617	3.0
Hyrax	1	8.0	0.417	0.167	1.067	6.35

Here, it can be seen that springbok spend approximately equal time feeding and being vigilant and 33.53% of their total time in vigilance; klipspringer overall spend 14.03% of their time feeding and 81.74% vigilant. Klipspringers devote a much higher percent of their time to vigilance. Male and female klipspringers differ from each other as well. Males devote much more time to vigilance than do females. Male klipspringers feed only 6.01 % of their time and are vigilant for 91.02 % of the time; female klipspringers feed 24.15 % of the time and are vigilant 69.71% of the time. Differences in feeding time and vigilance reflect differences in habitat and in ecology, including differences in heard size.

C) SCIENTIFIC Impact of Collaboration

Scientific collaboration during the past year has been satisfactory. The project is still early in its development and execution, so little scientific activity has taken place up until now. Two meetings have taken plane among the principal investigators and other scientific personnel of

the project. The first meeting took place in August, 2001 and was devoted to planning and logistics with the South African PI, his assistant (Dr. Guy Castley), the U.S. PI, and the Israeli PI in attendance. Plans for the first year of field activities were jointly produced and agreed upon. The second meeting took place for a week in July, 2002 at the field site and was attended by the U.S. PI, the graduate students associated with the project, the students' academic advisors, and Dr. Castley. During this time, research areas were located and field techniques developed. Finally, during the past year, the South African PI recruited two students to work on the project and to receive training.

D) Description of Project Impact:

The project is still in its early stages, so the results from the project are not being used yet. We anticipate that the results will be used for proactive management of wildlife populations and for game ranching.

E) Strengthening of Developing Country Institutions:

Graduate students working on the project have learned field techniques, including how to take focal animal observations for obtaining vigilance and time budget data.

Transferring research funds to South Africa was a long process that involved getting accounts opened, moving funds from one country to another, etc. But that has now been satisfactorily attended to.

F) Future Work:

Because of the long lead time between when the proposal was recommended for funding, when it was actually funded, when money was transferred to research accounts in South Africa, and the amount of time it took to recruit students for the project, we found it necessary to invest some time in additional planning and arranging of logistics before we could begin field activities. We have now completed those activities, and have begin the project as planned. This has caused a delay of approximately 12 months in all items of the original time table. Otherwise, the time table is unchanged. That leaves most of the proposed research remaining to be done. This includes experiments to (1) quantify relationships between habitat variables, activity densities, population densities, isodars, and GUDS, (2) evaluate foraging efficiencies among habitats, microhabitats, and species, (3) quantify how characteristics of food and habitat affect patch use and therefore habitat suitability, (4) test for the effects of competition and predation on habitat suitability and the coexistence of klipspringers, springbok, and hyrax, and (5) test whether measurements of habitat suitability based on GUDs and isodars can be used to determine unsuitable, refuge, core, and valuable but costly habitats, and to predict future changes in population sizes. These experiments will allow use to test the efficacy of a foraging theory based HIS, examine how specific environmental inputs affect habitat quality, examine the roles of water, food and toxins in determining patch use and habitat suitability, examine the various mechanisms of species coexistence for this system of springbok, klipspringers, and hyraxes.

SECTION II

A) Managerial Issues:

The major management issue has been the recruitment of personnel. During the last 6 months, we have completed our recruitment by adding Ms. Caroline Reid to the project. Ms. Reid is a M.Sc. student and will gather data to further the goals of the project as part of her studies. She will be fully trained in the theory and application of foraging theory to conservation biology.

B) Budget: Describe and justify major changes (10% or more in budget items) to budget.

None

C) Special Concerns:

None

D) Collaboration, Travel, Training and Publications:.

1. Completed travel.

    a. November, 2001. Visit by Drs. Michael Knight and Guy Castley to Augrabies Falls National Park. This visit to the field site involved establishing liaisons with National Park personnel, scouting out potential study plots, and arranging other logistics.
    b. July, 2002. Visit by Drs. Joel Brown, Guy Castley, Graham Kerley, Rob Slotow, and the two graduate students to Augrabies Falls National Park. This visit served the purpose of introducing the students to the Park and to Park personnel, gathering most of the project personnel at the field site fort he first time, training the graduate students in techniques for gathering vigilance data on klipspringers, springbok, and hyrax, and gathering the first data.

2. Anticipated activities in next 6 months

    a. November 2002. Visit of the graduate students to Augrabies Falls National Park for the purposes of gathering a complete set of data for the two-week field protocol described above.
    b. January 2003. Arrival of Dr. Joel Brown to Augrabies Falls National Park for 3 month visit. During this time, Dr. Brown and the graduate students will work intensively in the field, and all of the project personnel will participate at various times.
    c. February 2003. Arrival of Dr. Burt Kotler to Augrabies Falls National Park for two weeks

for field work, consulting, and training purposes.

D) Request for American Embassy Tel Aviv or A.I.D. Actions

None.