Teaching Notes for Case Study:
Managing Prairie Dogs for Ferret Reintroduction

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Acknowledgements: This work was supported by the National Socio-Environmental Synthesis Center (SESYNC) under funding received from the National Science Foundation DBI-1052875. Tara Stephens and Sian Wilson at the Centre for Conservation Research - Calgary Zoo provided valuable background information. We would like to thank our home institutions, Colorado State University (Fort Collins, CO) and Mount Royal University (Calgary, Canada) and the staff at SESYNC for their support on this project.

This case study explores the ecological relationship between black-tailed prairie dogs and black-footed ferrets. As black-footed ferrets are listed as an endangered species, students will explore social issues (where and how to reintroduce ferrets), political dynamics of a species that crosses state and national borders, and ecological consequences of a captive breeding and reintroduction program. The student learning outcomes address each of these broad disciplinary topics such that by the end of the case, students will be able to:

- Discuss the predator-prey relationships between ferrets and prairie dogs
- Understand and explain the role of the ecological niche in the ferret-prairie dog system
- Explain relationships among species and be able to differentiate the importance of each species within the community
- Identify the potential negative consequences of introduced species on ecosystems
- Compare and contrast viewpoints of different groups and describe potential conflicts
- Describe the different agencies involved in management at different scales (local to international) and to compare and contrast differences in ESA and SARA
- Identify factors that contribute to population dynamics
- Extrapolate and interpret life history data to evaluate the influence of different factors on survival and population growth
- Construct graphical representations of data

Audience and Variations

This case is intended for biology majors taking a course in ecology but throughout the teaching notes, we provide variations on the case so that it could be used for undergraduate university

students in an introductory class for majors or non-majors, or even an upper-level course in a related topic such as conservation biology. We have tried to incorporate as much flexibility as possible into this case: the entire case could be worked on outside of class, instructors could complete the entire case during class time, or anything in between. After each description of the content, we provide an estimate of the amount of time that it should take for each segment of the case to be completed during class time. We provide these time estimates as a tool to help instructors manage their class time appropriately but the level of the class and student preparation may significantly affect the amount of time required to complete each section. **An answer key to the questions in the Case Study is available through SESYNC.**

Setting the Scene: The Scenario (35-40 mins)

The case begins with a scenario where an undergraduate student has just been offered summer employment to help assist researchers with a black-footed ferret reintroduction program. This scenario provides the needed background information on the ecology and history of ferret populations. This scenario can be given to students to read either in class or as a pre-reading to the case. (10 mins)

If there is time, the Wyoming Fish and Game Department has created a 12-minute video clip that reviews the history of black-footed ferrets and their recovery in Wyoming. This clip includes interviews and videos of wild black-footed ferrets and might be helpful (but not necessary) to set the stage for subsequent activities. The video can be found at: **https://www.youtube.com/watch?v=1U-YCXjf4_I** (12 mins)

Option: For an introductory course, it might be useful to have a discussion with students about the ecology of prairie dogs and ferrets. One option would be to have students research and construct a food web of this ecological community. In constructing a food web, students should consider what other species prey upon prairie dogs, what other species use prairie dog burrows for shelter, what effect prairie dogs have on the vegetation via herbivory, what other species compete with prairie dogs, and what other species prey upon black-footed ferrets. This would enable the instructor to also introduce some key terms such as:

- generalist and specialist,
- obligate and facultative
- density dependent and independence
- producers and consumers, and
- keystone species.

This would likely be a review for students but might provide a good starting point for the discussion (Research and Food web = 20 minutes; Discussion = 15 mins)

Assessment: Research for and construction of the food web could be assigned as homework for summative assessment if desired. Alternatively, students could brainstorm in small groups and construct food webs during class.

A. Captive Breeding of Black-footed Ferrets (40 mins)

This section of the case study is intended for students to think critically about captive breeding and recovery programs and to interrogate many of the social, political and scientific issues with reintroduction programs. Depending on the discipline, course curriculum and level of students, the instructor can add questions or expand on specific topics. For example, a recovery program that is based on such a small number of individuals has many interesting problems based on genetic diversity. In an upper-year ecology course or a conservation genetics course, this idea could be expanded and a new section of the case could be added. We recommend that students work in small groups so they can brainstorm ideas (20 minutes) and then these questions be considered by the whole class (20 minutes with discussion). Following this format, we expect this section would take approximately 40 minutes of class time.

Assessment: Questions 1 and 2 in the student handout for this section are best suited to formative assessment and in-class discussion, rather than summative assessment. If desired, Question 3 (transboundary issues when ferrets cross state and national borders) lends itself as a homework research assignment regarding variation in the federal and state legislation protecting black-footed ferrets and their prairie dog prey. For example, students would find that the black-tailed prairie dog is a protected species in Canada, whereas in many states it is actively exterminated. Student groups could be assigned to research the legislation for different jurisdictions, and then present to each other. The Ferret Bootcamp video can be presented in class or assigned as homework with Question 4.

A useful website on the legislation in Canada:

Species at Risk Public Registry (Government of Canada). This website explains Canada's Species at Risk Act and includes species recovery plans and species status reports for both black-footed ferrets and black-tailed prairie dogs. https://www.registrelep-sararegistry.gc.ca/default.asp?lang=en&n=24F7211B-1

B. Where to Reintroduce Ferrets? (30 mins)

The questions in this section are specifically related to the interactive ESRI story map that can be found at https://tinyurl.com/ESRI-ferrets. This map will help students explore the spatial relationships between historical and present ranges of black-footed ferrets and black-tailed prairie dogs. Depending on technological infrastructure in the classroom, students may work in small groups to complete this section, or instructors might find it valuable to explore this map as a whole class activity. One benefit of using an entire class discussion is that instructors have the ability to pose additional questions to the class to generate more discussion. Exploring the map and answering the following five questions should take about 30 minutes of class time.

Assessment: The story map and accompanying five questions can readily be used as a summative assignment, either completed in-class or as homework.

C. Ferret Energetics (60 mins)

It is important for students to be able to quantify the ecological dynamics that occur between ferrets and prairie dogs to better understand the intimate relationship of these two species. These calculations, although fairly straightforward, may be challenging for students to work on independently. Depending on the student's prior experience with calculating energetics will likely dictate the pedagogical approach by instructors. We have tried to include multiple variations within each question so that instructors can model the approach to answering the question with the first step (such as M_g in question 2a) and then students can use this example as a template for subsequent variations. For students with no experience, it will take at least one hour of class time for this section of the case.

Assessment: Assessment will depend on students' prior experience and instructor pedagogy. Although these worksheets and calculations lend themselves as a summative assessment, it is important that students have prior experience and confidence in performing these calculations before such assessment. For students with little experience, these worksheets and calculations may be more effective as an in-class activity that they can work on with a partner.

D. Prairie Dog Demographics (40-60 mins)

This section of the case study introduces the student to life tables to examine population demographics of black-tailed prairie dogs. The time to complete this section will depend on an instructor's pedagogical approach. Some instructors might use an approach similar to problem-based learning (PBL) where students are provided with only minimal information such as the life table and are expected to discover the strategy to complete their task. In this approach, we recommend that students work on the problem in small groups so they can discuss and debate the meaning of each variable; we also suggest that the descriptions for each variable be stripped from the instructions. Using a PBL approach will take more class time (~60 minutes) than working through the example in class (40 min with the discussion of terms) but the learning can

be profound. Alternatively, if instructors have already introduced the concept and use of life tables and survivorship curves in a prior class, this section might be used to reinforce these skills (20 min) or they might assign this section to be completed as homework.

Assessment: If a PBL approach is taken, formative assessment is more appropriate for this exercise. Alternatively, the instructor could work through the life table example for the male prairie dogs in-class and assign the example for the female prairie dogs as homework.

E. Social-Environmental Issues with Prairie Dogs and Ferrets (30+ mins)

This section focuses on the broader social-environmental issues regarding prairie dogs and ferrets. You may want to tailor this section to your class, as this synthesis could be done in many ways. For example, you could assign it as a homework assignment, have students do it as group work (as written), or have students participate in a debate about the issues involved. You may also want to assign specific social-environmental issues to different students or groups. If this is done entirely in class, students will need about 30 minutes to read articles and work in their groups, and then each group will need about 5 minutes to informally present.

Other Suggested References:

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