TEXAS WHITE-TAILED DEER INTERNET HARVEST MODEL

A Thesis

by

JENNIFER NICOLE GARRETT

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

December 2006

Major Subject: Wildlife and Fisheries Sciences

TEXAS WHITE-TAILED DEER INTERNET HARVEST MODEL

A Thesis

by

JENNIFER NICOLE GARRETT

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

Approved by:

Co-Chairs of Committee, Roel R. Lopez
Selma N. Glasscock
Committee Members, William E. Grant
Donald S. Davis
Head of Department, Delbert M. Gatlin III

December 2006

Major Subject: Wildlife and Fisheries Sciences

ABSTRACT

Texas White-tailed Deer Internet Harvest Model.

(December 2006)

Jennifer Nicole Garrett, B. S., Texas A&M University-Kingsville

Co-Chairs of Advisory Committee: Dr. Roel R. Lopez
Dr. Selma N. Glasscock

White-tailed deer (*Odocoileus virginianus*) is an intensively managed game species throughout Texas and the United States. Modeling is a tool that has been used to evaluate various management practices and their potential impacts on wildlife populations; however, many existing models are complicated for the average land manager, require a significant amount of demographic data that may not be readily available, or require expensive software. I developed a white-tailed deer (WTD) harvest model, Texas Deer Manager (TDM), using STELLA® (High Performance Systems, Inc., Version 7.0.3) and NetSim Creator® (High Performance Systems, Inc. Version 2.0), that incorporates the field data that are currently collected and/or can be easily collected, and can be used by interested landowners and state biologists. Unlike other population models specific for WTD, my TDM simulation model has an easy-to-use interface and is available on-line via the Internet. Age classes in the model are represented as fawns (<12 months), yearlings (1-2 years), and adults (>2 years) for each sex. Harvest is controlled by the model user. Currently the parameters such as survival and fecundity rates are set for an average year in the Edwards Plateau Ecological Region of Texas; however, model users can adjust survival and fecundity

based on the specifics of their land management area. The website also provides general information about WTD biology and management.

I conducted an on-line survey (*n* = 29) to evaluate the perceived usefulness and satisfaction of the TDM and website. I found that overall participants found the TDM and website were useful with 59% responding they would “probably” or “definitely” use it as a tool to help them determine their harvest plans. There seems to be a strong interest and need for a tool like the TDM and website. It would be beneficial to continue to develop the website and make it applicable for all the regions in Texas. Also, since the TDM model is easily accessible via the Internet and simple to use, it could be incorporated as a tool to teach population dynamics in the classroom.

DEDICATION

I dedicate this to my mother and father. Thank you for your never-ending love and support throughout the years.

ACKNOWLEDGEMENTS

There are several people I would like to thank for their help and support over the past 3 years. I would like first to thank the Rob & Bessie Welder Wildlife Foundation for allowing me the great pleasure of being a Welder Fellow and supporting me financially while I worked toward my master's. I would also like to thank the staff of the Welder Foundation for their encouragement and friendship while I lived and worked on the Refuge. I am truly blessed to have met and worked with such wonderful people.

I would also like to thank my committee members, Drs. Roel Lopez, Selma Glasscock, William Grant, and Donald Davis, for their help and patience the last 3 years. A special thanks to Roel for always putting in the extra effort to make sure his students are taken care of and are on the right track. I could not have asked for a better advisor. I would like to thank Selma for the time she took to get to me know me and help me prepare for my future in the wildlife field.

A very special thanks goes to Garrett Anderson for his help in developing the Texas Deer Manager website and setting up the online survey. I would have been lost without him.

Next I would like to thank the Texas A&M Wildlife and Fisheries Sciences graduate students that have made my life so much fuller then it would have been without them. They were wonderful in aiding me in my academic and social endeavors. I will cherish their friendships for many years to come. I would also like to thank Miguel Herrera for his support. I can't imagine and don't want to imagine how the last 3 years would have been if I had never known him.

Last, but definitely not least, I would like to thank my family. Specifically I want to thank my mom for giving me the drive to do well in everything I do, by being the best role model a daughter could ask for and my dad for introducing me to the outdoors when I was young and giving me the appreciation and love I have for it today. I would not be where I am today without their loving support.

TABLE OF CONTENTS

Page

ABSTRACT iii

DEDICATION v

ACKNOWLEDGEMENTS vi

TABLE OF CONTENTS viii

LIST OF FIGURES x

LIST OF TABLES xi

INTRODUCTION 1

- Background 1
- Problem Statement 3
- Objectives 6

METHODS 8

- Study Area 8
- Model Overview 10
- Model Parameters 12
- Model Use 16
- Evaluation 17

RESULTS 19

- Model 19
- Website 19
- Evaluation 25

DISCUSSION 34

- Model 34
- Website 35

SUMMARY 37

LITERATURE CITED 38

Page

APPENDIX A 43

APPENDIX B 52

VITA 56

LIST OF FIGURES

FIGURE		Page
1	Percent change in the number of rural landowners from 1987 - 1997 for each county in Texas……………………………………………………...	4
2	Counties within the Edwards Plateau Ecological Region of Texas, Armstrong and Young 2000…………………………………………………	9
3	Conceptual diagram of the general structure of the Texas Deer Manager (TDM), 2006……………………………………………………………....	11
4	Recruitment fraction estimates used in the Texas Deer Manager (TDM) to adjust fecundity rates as a function of deer density (acres/deer), based on Kie et al. (1979)…………………………………………..…………….	14
5	The home page of the Texas Deer Manager (TDM) website, 2006……….…...	20
6	Input section of the simulation page of the Texas Deer Manager (TDM) website, 2006……………………………………………………………....	22
7	Example of graphical output given to users on the simulation page of the Texas Deer Manager (TDM) website, 2006………………………………...	23
8	Example of table output given to users on the simulation page of the Texas Deer Manager (TDM) website, 2006………………………………………..	24

LIST OF TABLES

TABLE		Page
1	Survival and fecundity rates used in the Texas Deer Manager (TDM) for white-tailed deer in the Edwards Plateau Ecological Region of Texas, 2006……………………………………………………………………….	13
2	Demographic information of the the participants (n=29) of the Texas Deer Manager (TDM) evaluation survey, 2006…………………………………...	26
3	Demographic information of the the landowner participants (n=19) of the Texas Deer Manager (TDM) evaluation survey, 2006……………………...	28
4	Response frequencies (*n*=29) to general questions about satisfaction with the Texas Deer Manager (TDM) website, 2006.…………………………….	30
5	Response frequencies (*n*=29) to general questions about perceived usefulness of the Texas Deer Manager (TDM) website, 2006………………	31
6	Response frequencies (*n*=29) to general questions about the probability of survey participants doing certain things regarding the Texas Deer Manager (TDM) website, 2006. ……………………………………………………...	32

INTRODUCTION

Background

White-tailed deer (*Odocoileus virginianus*) is one of the most recognizable and sought after wildlife game species in North America (Xie et al. 1999). In Texas, there are an estimated 4 million white-tailed deer (WTD) (Armstrong and Young 2000), which provides intrinsic and economic opportunities for landowners via hunting and wildlife-viewing. Due to their great numbers and importance, WTD are intensively managed throughout most of the state. Monitoring population sizes and trends, herd composition, and deer health are important in managing wildlife populations (Lancia et al. 1994). Often wildlife managers use population trend data to evaluate different harvest options and to "predict" how populations will respond to given harvest strategies. Population modeling is a tool that allows wildlife managers to incorporate trend data and make informed decisions in the management of wildlife populations (Walters and Gross 1972, Jensen 2000, White 2000, Grund and Woolf 2004). There are many types of harvest models that have been developed and are available to aid wildlife biologists.

Models based on harvest trend data are widely used by management agencies because hunter harvest information is readily available annually. Roseberry and Woolf (1991) evaluated several harvest-based models (e.g., index-removal, change-in-ratio, life table, population reconstruction, harvest sex ratio, age structure, and catch per unit effort). However, most harvest-based models are retrospective and do not typically include demographic data ideal in managing wildlife populations (Lubow et al. 1996,

---

This thesis follows the style and format of the *Journal of Wildlife Management.*

White 2000, Collier 2004). ONEPOP was developed as a deterministic computer program used to model the population dynamics of big game for applied management situations (Euler and Morris 1984). ONEPOP was eventually replaced with a more user-friendly POP-II (Bartholow 1986). POP-II is an accounting model that follows each sex- and age-class individually and is used to contrast different harvest regimes through simulation (Bender and Roloff 1996). Another example of a simulation model is the deer management options model (DeerMOM) designed by Xie et al. (1999) using STELLA® (High Performance Systems 1997). It was developed to assess the effects of different harvest strategies on WTD population size, sex, and age structure. A knowledge-based system for WTD management (DeerKBS) was created to incorporate the expertise and knowledge of wildlife managers into a standardized decision-making software (Xie et al. 2001). Risenhoover et al. (1997) created the Deer Management Simulator (DMS) that provided the National Park Service a tool to help them make decisions regarding overabundant WTD. Users of DMS incorporate local Geographic Information Systems (GIS) databases, which allow managers to assess how the WTD population is changing in size but also spatially within an area. Finally, several models (e.g., Weisberg et al. 2002, Sage Jr. et al. 2003) also have been developed that rely on a ecosystem approach, allowing managers to model complex systems and anticipate how different management decisions may influence not only the species in question, but other parts of the system as well . For example, Weisberg et al. (2002) modeled an elk (*Cervus elaphus*) herd in Colorado but also included sub-models that represent other parts of the system (e.g., weather, soil, carbon, nitrogen, water, fire, and plant production) that could be influencing the elk herd or be influenced by the elk herd. This allows managers to better understand how management practices regarding the elk herd are affecting the entire system and how the system is affecting the elk herd.

In sum, the aforementioned models are examples of population harvest models that have been used in the past in managing WTD populations. Collectively, these models allow managers to make better management decisions.

Problem Statement

I designed the Texas Deer Manager (TDM), a WTD harvest model, to address 2 major issues: (1) 97% of the land in Texas is privately owned where owners ultimately make wildlife management decisions and (2) simulation modeling can assist landowners and wildlife managers in managing WTD, but current models are not readily available or easy to use by the general public.

Landowners.–Texas Parks and Wildlife Department (TPWD) has been charged with protecting and managing Texas' natural resources; however, since most lands in Texas are privately owned, landowners play an important role in making decisions regarding wildlife management within the state. Since in most cases TPWD are legally limited to simply setting bag limits on private land, TPWD and other agencies (e.g. Texas Cooperative Extension) work with landowners to provide information, land management assistance, and even financial incentives for wise management. Agency efforts to work with local landowners will likely increase with private land ownership changes in the Texas. Wilkins et al. (2000) reports the overall number of landowners is increasing in Texas while property size is decreasing (Fig. 1). The trend is towards

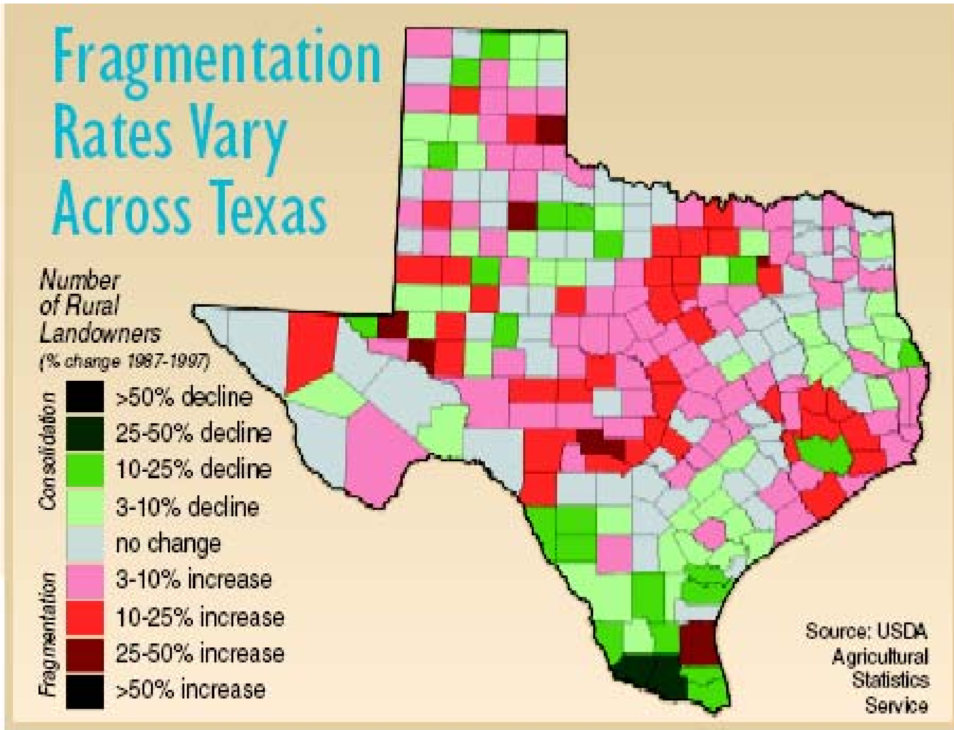


Fig. 1. Percent change in the number of rural landowners from 1987 - 1997 for each county in Texas.

fewer traditional (i.e., agricultural) landowners and more absentee and recreational landowners (Wilkins et al. 2000, American Farmland Trust 2003, Sanders 2005). Sanders (2005) refers to this new landowner group as “Re-Born to the Land”. She defines this group as being more likely to have owned their land between 3 and 25 years, and owning smaller acreages of land (averaging 622.21 acres) when compared to other landowners. These new landowners are said to be younger, more educated, and financially better-off than traditional landowners. TPWD is finding itself serving a new user group with new ideas, perspectives, and knowledge of the land. Many of the Re-born to the Land group have good intentions when it comes to wildlife management, but often lack the training or experience to be successful (American Farmland Trust 2003). Wildlife management tools that can be used by landowners for managing native wildlife populations can assist this emerging landowner group with making sound management decisions. A harvest model is one such tool.

The use of a harvest model does not have to be limited to only new landowners and land managers. It can also be used as an effective learning tool for traditional landowners and wildlife managers. Wildlife agencies such as TPWD and Texas Cooperative Extension could use the model to demonstrate how different harvest regimes affect WTD populations on their property. Such a model could also assist landowners trying to qualify for Proposition 11 (Texas House Bill 1358, Article VIII, Section 1-d-1), which offers Texas landowners the opportunity to remain under agricultural valuation by making wildlife management activities a qualifying agricultural practice (Window on State Government 2002). In order for landowners to qualify they must have an active, written wildlife management plan that includes at least 3 of the following 7 practices: (1) habitat control, (2) erosion control, (3) predator control, (4) providing supplemental supplies of water, (5) providing supplemental supplies of food, (6) providing shelter, and/or (7) making census counts to determine population. A tool that could assist them in accomplishing some of these management activities would be helpful.

Limitations in Existing Models.–Simulation modeling can assist land and wildlife managers in managing WTD populations, but existing population models have limited use among the general public, mainly because they were designed for wildlife biologists. Many population models require complex mathematical equations that are not easily utilized or interpreted by the non-scientist (Roseberry and Woolf 1991). Furthermore, most of the harvest models reviewed by Roseberry and Woolf (1991) are limited to use of harvest data for 1 year and do not allow for evaluation of future population predictions (Walters and Gross 1972). Other harvest models also require a significant amount of demographic data that may not be readily available to the public (Jensen 2002). For example, POP-II model requires sex-specific initial population age structure, age-, sex-, and season specific mortality rates, and age specific natality rates; and the DMS model requires GIS software and maps that usually are not available for privately-managed deer populations. Extensive data requirements are also a draw back to ecosystem-based models. Another limitation in existing models is that most computer-based models (e.g., POP-II, DeerMOM) require a user to be able to download and utilize specific computer software packages that may be somewhat complicated for the average person. Finally, in some cases, population modeling software may be cost-prohibitive for the average landowner. Efforts to overcome current model limitations and provide a reliable, easy to use management tool to Texas landowners can improve the management of WTD populations in the state.

Objectives

To assist with meeting the needs of landowners and wildlife managers, I created the Texas Deer Manager, a deterministic simulation harvest model, and its corresponding website. My population model incorporates baseline data that are easily obtained and uses default parameter estimates based on WTD in Texas and southeastern United States. My specific study objectives were to: (1) develop a WTD simulation model for Texas landowners and land managers that requires easily obtainable data, (2) develop a website where the simulation model can be accessed without additional software except for web browser, (3) provide general information about WTD biology and management via the website, and (4) evaluate the perceived usefulness and satisfaction of the simulation model and website by TDM model users.

METHODS

Study Area

Due to the differences in WTD herd composition and dynamics throughout Texas, my modeling efforts focused on WTD within the Edwards Plateau Ecological Region of Texas (Fig. 2, Armstrong and Young 2000). This region was selected due the importance of WTD hunting in the region and high landownership percent change (Fig. 1). Though the population model was parameterized for the Edwards Plateau, the model offers flexibility for use in other regions of the state.

The Edwards Plateau Ecological Region is approximately 25.5 million acres characterized by hilly terrain and stony plains (Hatch and Pluhar 1993). Soils are usually shallow with a variety of surface textures and are underlain by limestone. Annual precipitation ranges from 30-81 cm with high rainfall in May and September. Overstory trees representative of the area include ashe juniper (*Juniperus ahsei*), live oak (*Quercus virginiana*), and mesquite (*Prosopis glandulosa*). Combinations of cattle, sheep, and goats graze on most rangelands in the area, in addition to free-roaming exotics (e.g., blackbuck antelope [*Antelope cervicapra*], axis deer [*Axis axis*], sika deer [*Cervus nippon*], and fallow deer [*Dama dama*]) (Armstrong and Young 2000).

Deer densities in the Edwards Plateau range from 1 deer/15 acres to 1 deer/3 acres (Armstrong and Young 2000). Teer et al. (1965) reported deer densities in the Llano Basin area of the Edwards Plateau were related to the mean annual precipitation from the previous year, particularly following drought years. Teer et al. (1965) also reported that precipitation was the major factor regulating carrying capacity for

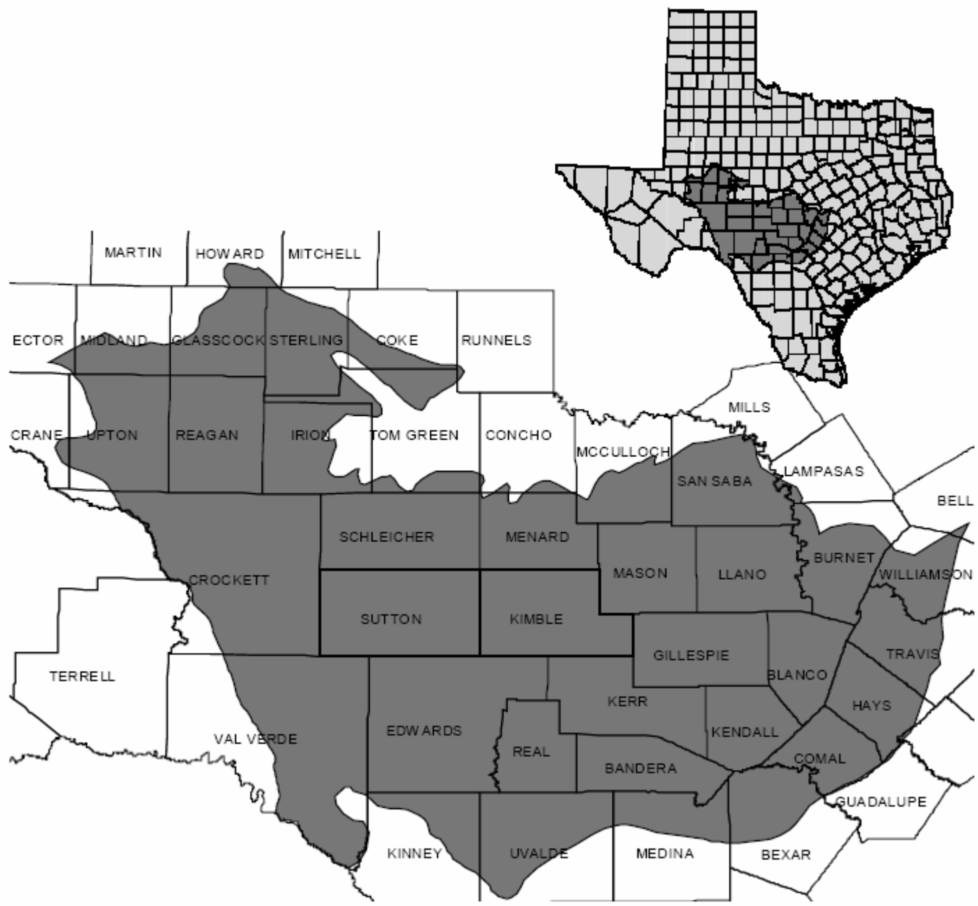


Fig. 2. Counties within the Edwards Plateau Ecological Region of Texas, Armstrong and Young 2000.

WTD populations in the Edwards Plateau.

Model Overview

I designed a WTD harvest model (TDM) using STELLA® Research, Version 7.0.3, computer program (High Performance Systems, Inc., 2002). The TDM is a sex- and stage-structured deterministic model available for use via the Internet. My model was parameterized for the Edwards Plateau Ecological Region of Texas; however, model users have the ability to adjust survival and fecundity based on herd demographic data specific to their management area, making the model easily applicable outside this region. Stage classes for the TDM are represented as fawns (<12 months), yearlings (1-2 years), and adults (>2 years) for each sex (Xie et al. 1999). Sex- and stage-specific survival and fecundity were determined from an extensive literature review. Harvest rates by sex and age classes are controlled by the user (Fig. 3). The TDM has a time step of 1 year (i.e., 1 October-September 30) to correspond with the time of year when deer surveys are typically conducted and necessary data collected. Furthermore, survey data also includes fawn:doe estimates following the first few months of life. Previous modeling efforts caution the use of population models that project beyond 4 years (Grund and Woolf 2004). Thus, the model was restricted in simulation time period within a 3-year window. The TDM has 5 basic assumptions throughout the simulation period: (1) harvest numbers, survival, and fecundity rates are constant once set, (2) high density deer herds have lower fecundity, (3) deer longevity is <10 years, (4) the distribution of age classes reported from surveys is exactly proportional to the entire

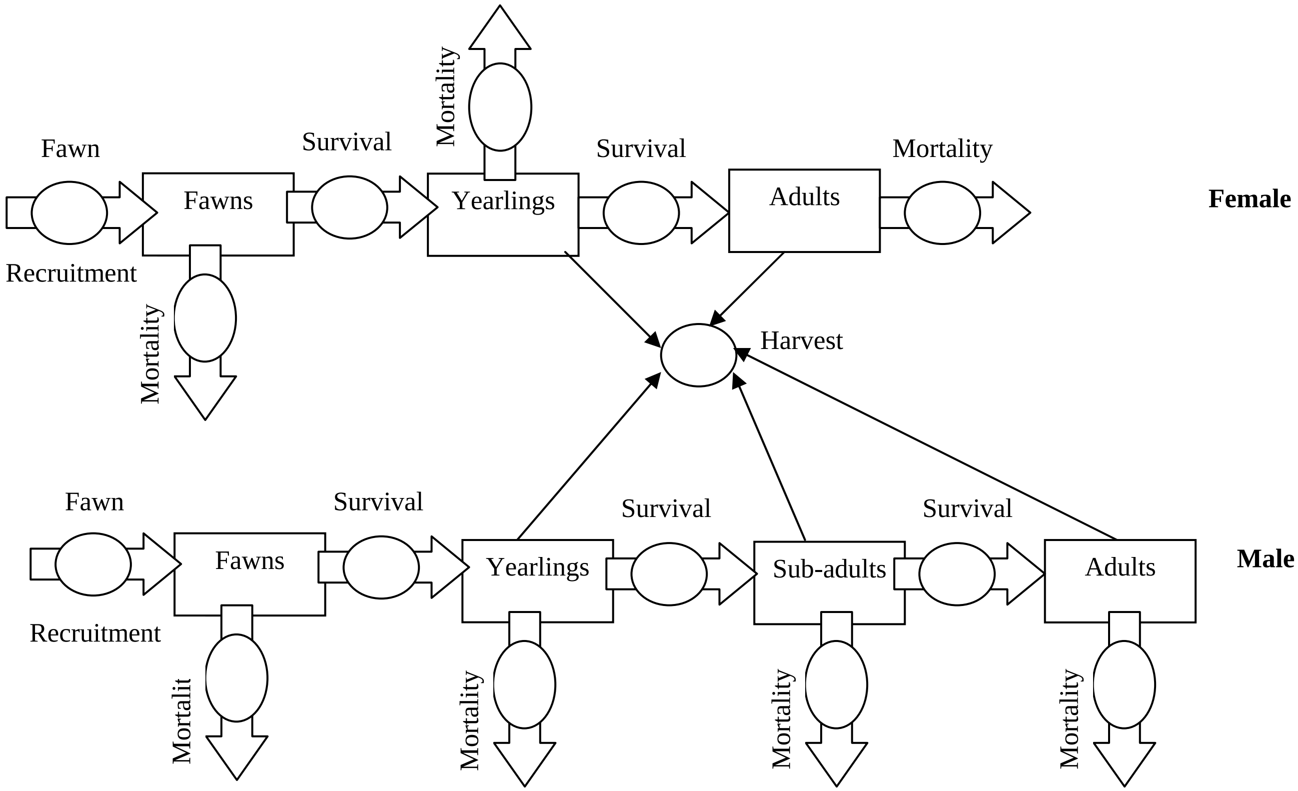


Fig. 3. Conceptual diagram of the general structure of the Texas Deer Manager (TDM), 2006.

standing population, and (5) the deer being managed are a closed population (i.e., immigration and emigration result in zero population change in the herd being managed). Appendix A provides the code for the model.

Model Parameters

Survival.–Survival rates used in the TDM were calculated by taking averages of reported annual survival rates (Teer et al. 1965, Cook et al. 1971, White 1973, Carroll and Brown 1977, Kie and White 1985, Lopez et al. 2003, Campbell et al. 2005). This method was used to estimate survival for fawns, yearlings, and adults for each sex (Table 1). It was assumed that no WTD survived after 10.5 yrs. The TDM uses a default value (i.e., average survival estimate) for each sex- and stage-class; however, this estimator can be adjusted by the model user if desired.

Fecundity and Fetal Sex Ratio.–Fecundity estimates were based on data collected from Teer et al. (1965). Fecundity was estimated for yearling and adult does only, because fawns rarely reproduce successfully in Texas (Illige 1951, Teer et al. 1965). Like survival, fecundity estimates reported by Teer et al. (1965) are used as a model default; however, these estimates can be adjusted by users (Table 1). Studies done in south Texas by Illige (1951) and Kie and White (1985) estimated the fetal sex ratio of WTD to be male biased 59% and 51%, respectively. I took the average of reported fetal sex ratios (i.e., 55% male-biased).

Table 1. Survival and fecundity rates used in the Texas Deer Manager (TDM) for white-tailed deer in the Edwards Plateau Ecological Region of Texas, 2006.

Model parameter estimates	Average year[a]	Ranges[b]	Sources
Survival			
Fawn buck	0.62	0.10-1.0	Teer et al. 1965, Cook et al. 1971, Carroll and Brown 1977, Lopez et al. 2003, Campbell et al. 2005
Yearling buck	0.77	0.48-1.0	Teer et al. 1965, Kie and White 1985, Lopez et al. 2003, Campbell et al. 2005
Adult buck	0.8	0.48-1.0	Teer et al. 1965, White 1973, Kie and White 1985, Lopez et al. 2003, Campbell et al. 2005
Fawn doe	0.66	0.10-1.0	Teer et al. 1965, Cook et al. 1971, Carroll and Brown 1977, Lopez et al. 2003, Campbell et al. 2005
Yearling doe	0.88	0.48-1.0	Teer et al. 1965, White 1973, Kie and White 1985, Lopez et al. 2003, Campbell et al. 2005
Adult doe	0.82	0.48-1.0	Teer et al. 1965, White 1973, Kie and White 1985, Lopez et al. 2003, Campbell et al. 2005
Fecundity			
Yearling does	0.88	0.63-1.38	Teer et al. 1965
Adult does	1.2	0.93-1.54	Teer et al. 1965

[a]These rates are representative of an average year in the Edwards Plateau and are set as the default estimate in the TDM.

[b]These ranges are given to aid the TDM users in adjusting rates to better fit their situation. (e.g., lower rates would be used during a drought year.)

Density Dependence.–I assumed density dependence by adjusting fecundity (Teer et al. 1965). I used the graphical function in STELLA® Research to generate a "recruitment curve" that adjusted fecundity as a function of deer density (Fig. 4). (The recruitment curve was based on a study done by Kie et al. (1979) that reported that density had little effect on reproduction of WTD until it reached 4 acres/deer to which fetal rates declined as their study population approached 2.38 acres/deer.) A recruitment fraction is selected by the model based on the initial density of the population that is calculated for each TDM user (for information on how initial abundance is determined, see next section), this recruitment index is used to adjust deer fecundity. For example, when WTD densities are low the fraction or multiplier used in the model is 1. However, when WTD densities are high (e.g., 3 acres/deer, where the recruitment fraction would be 0.62 [Fig. 4]), fecundity decreases, when multiplied by the recruitment fraction.

Fig. 4. Recruitment fraction estimates used in the Texas Deer Manager (TDM) to adjust fecundity rates as a function of deer density (acres/deer), based on Kie et al. (1979).

Initial Abundances.–Initial abundance is calculated for the user after they enter data (i.e., visibility, length of transect, deer seen, etc.) collected from 1of the following survey methods: spotlight, Hahn line, mobile line, or helicopter. The equation (1) used to calculate initial abundance (I) is based on the equation reported by Schult and Armstrong (1999) where $_d$ = does, $_f$ = fawns, $_b$ = all bucks, $_y$ = young bucks, and $_a$ = adult bucks. The equation is

$$I = (S_f(R/O)) + (S_d(R/O)) + (S_b(R/O)) \quad (1)$$

where

$$S_b = S_y + S_a \quad (2)$$

and

$$O = (V*T)/4047 \quad (3)$$

and

V = average width of visibility in m

T = transect length in m

O = observed number of acres

I = initial abundance

S = original number seen

R = ranch size in acres

Harvest.–Harvest is determined by the user. Model users can decide how many young bucks (1.5 to 2.5 yrs), adult bucks (3.5-10.5 yrs), or does (1.5-10.5 yrs) they would like to harvest or what they have harvested if the model is being used after the hunting season.

Model Use

Model Conversion.–Once the model was developed using the STELLA® Research software it was converted to an HTML format using the software NetSim Creator®, Version 2.0 (High Performance Systems, Inc. 2002). NetSim Creator® was developed by the makers of STELLA® Research to serve as a user-friendly interface to facilitate the use of population models via the Internet.

Website Development.–A webpage was designed around the simulation model. Visual Web Developer™, Express Edition (Microsoft, 2005) was used in the HTML development. Along with hosting the simulation model, it was designed to provide interested landowners and wildlife mangers with information about WTD management and harvest plans. The website is interactive in that model users are guided through the process of entering population density data (i.e., spotlight, Hahn line, mobile line, or helicopter), determining appropriate fecundity and survival rates to use in model simulations, and finally in determining harvest rates desired in managing their WTD populations. Users are then given projected abundance and composition (e.g., fawn/buck ratio or does/buck ratio) of the deer herd for the initial year as well as for the following 3 years. Links to PDF files containing more information about how to set up a survey, managing habitat, and setting goals (e.g., Shult and Armstrong 1999, Armstrong and Young 2000) were placed throughout the website. The website was initially designed to keep a record of website visitors who were required to create an account including providing a username, password, and e-mail address. E-mail addresses were used in evaluating user feedback about the TDM. Following the evaluation period, the login page was removed.

Evaluation

Survey Procedure.–Following approval to conduct research on human subjects by the Internal Review Board at Texas A&M University (Protocol Number: 2006-0169), Sonny Arnold, Texas Master Naturalist Assistant Program Coordinator, was contacted to help promote the project. He posted information about the project on the Texas Master Naturalist ListServe and asked the leaders of the chapters to promote the TDM website and ask for participants in the evaluation process. This group was chosen because of their interest in learning more about conservation and the outdoors and the likelihood they owned land (Sonny Arnold, Texas Parks and Wildlife, personal communication). As stated above, each person that viewed the website created an account which included providing an e-mail address. The e-mail addresses were used to send each person a request to participate in an online evaluation survey of the TDM and website. A reminder e-mail was sent out about once a week for 11 weeks. Four prizes were given away (i.e., laser rangefinder, Global Positioning System (GPS) unit, compass, and a Boone & Crockett scoring kit) as an incentive for filling out the survey. Winners were chosen randomly.

Survey Content.–The survey was used to evaluate users' perceived satisfaction and usefulness of the TDM and website (Appendix B). Participants had 5 choices ranging from "very satisfied" to "very dissatisfied" on various questions about the overall website and questions about the formatting and organization of the site.

Participants also had 5 choices (ranging from “not at all useful” to “invaluable”) in answering how useful they found the website and TDM simulation model. They also were asked how certain they would be to do specific things regarding the website and model (e.g., they were asked how certain they were that they would use the WTD simulation model as a tool to help determine their harvest plan). They had 5 choices regarding these questions ranging from “definitely” to “definitely not”. I also included demographic and background questions, such as what they considered their knowledge of WTD management, so I could better understand differences in responses. At the end of the survey, I left space for questions or comments.

Survey Data Analysis.–Descriptive statistics were used to describe participant demographics (SPSS Inc. 2002). They also were used to summarize user attitudes on the usefulness of model predictions and ease of model use.

RESULTS

Model

I designed a WTD deterministic sex- and stage-structured harvest model that incorporates baseline data collected from population surveys. The TDM was parameterized for the Edwards Plateau Ecological Region of Texas; however, model users have the ability to adjust survival and fecundity based on herd demographic data specific to their management area. The TDM, like any model, is dependent on quality baseline data and model assumptions. Because of this, it was not recommended to users to base their harvest plan solely on the TDM results. It was suggested that they consider other information such as land history/management practices, good judgment, and recommendations from a local wildlife biologist.

Website

Texas Deer Manager (TDM) was made available on the Internet at the following address: http://deer.tamu.edu/deersim/. At the top of every page is a navigation bar with 5 hyperlinks to pages found in the website (Fig. 5). The names of the hyperlink pages are as follows: home, simulation, help, information, and contact us.

Home Page.–Provided on the home page (Fig. 5) is a brief description of the TDM project and a disclaimer about modeling and modeling assumptions. It also includes a section where users are instructed that they will need to conduct an initial survey (i.e., spotlight, Hahn line, mobile line, or helicopter) and then are given instructions on how to conduct one. At this point, users are asked to decide and click on which Ecological Region of Texas they live in, which takes them to the simulation page. The only Region available for users for my study was the Edwards Plateau.

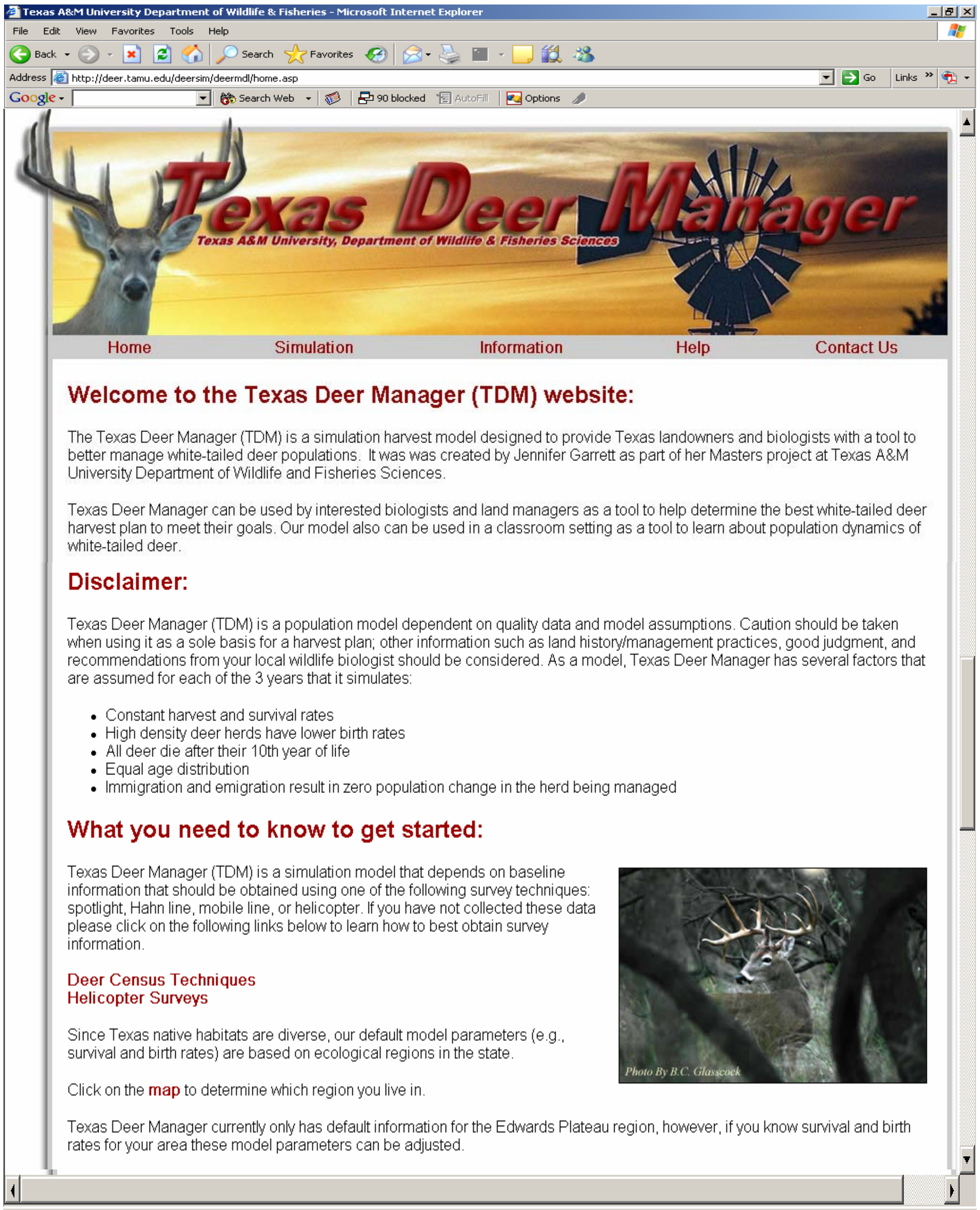


Fig. 5. The home page of the Texas Deer Manager (TDM) website, 2006.

Simulation Page.–On the simulation page (Fig. 6) users are prompted to input data they collected (e.g., ranch size, transect length, does seen, etc.) from one of the previously mentioned surveys. They then are prompted to input survival and fecundity rates along with harvest numbers for young bucks (1.5-2.5 yrs), adult bucks (3.5-10.5 yrs), and does (1.5-10.5 yrs) (On the website the word “birth rate” is used instead of fecundity to avoid scientific jargon). Default survival and fecundity rates (i.e., parameter estimates during an average year) are provided; however, these can be adjusted. Users are then asked to click on the “run” button to begin the simulation. Once this is done, model users are given projected abundance and composition (e.g., fawn/buck ratio or does/buck ratio) of the deer herd for the initial year as well as for the following 3 years (Figs. 7 and 8). Users then have the option of running other iterations by adjusting harvest and seeing how harvest affects abundance and composition. Each section of the simulation page provides a hyperlink to the help page where users can get more information about input definitions and result interpretation.

Help Page.–A help page was provided that includes definitons of all the input questions. In this section, I also provide ranges that have occurred in the past, during a drought versus an exceptional year (i.e., high rainfall), to aid users in adjusting survival and fecundity (Table 1). There also is a section on the help page that provides users with information to interpret their results.

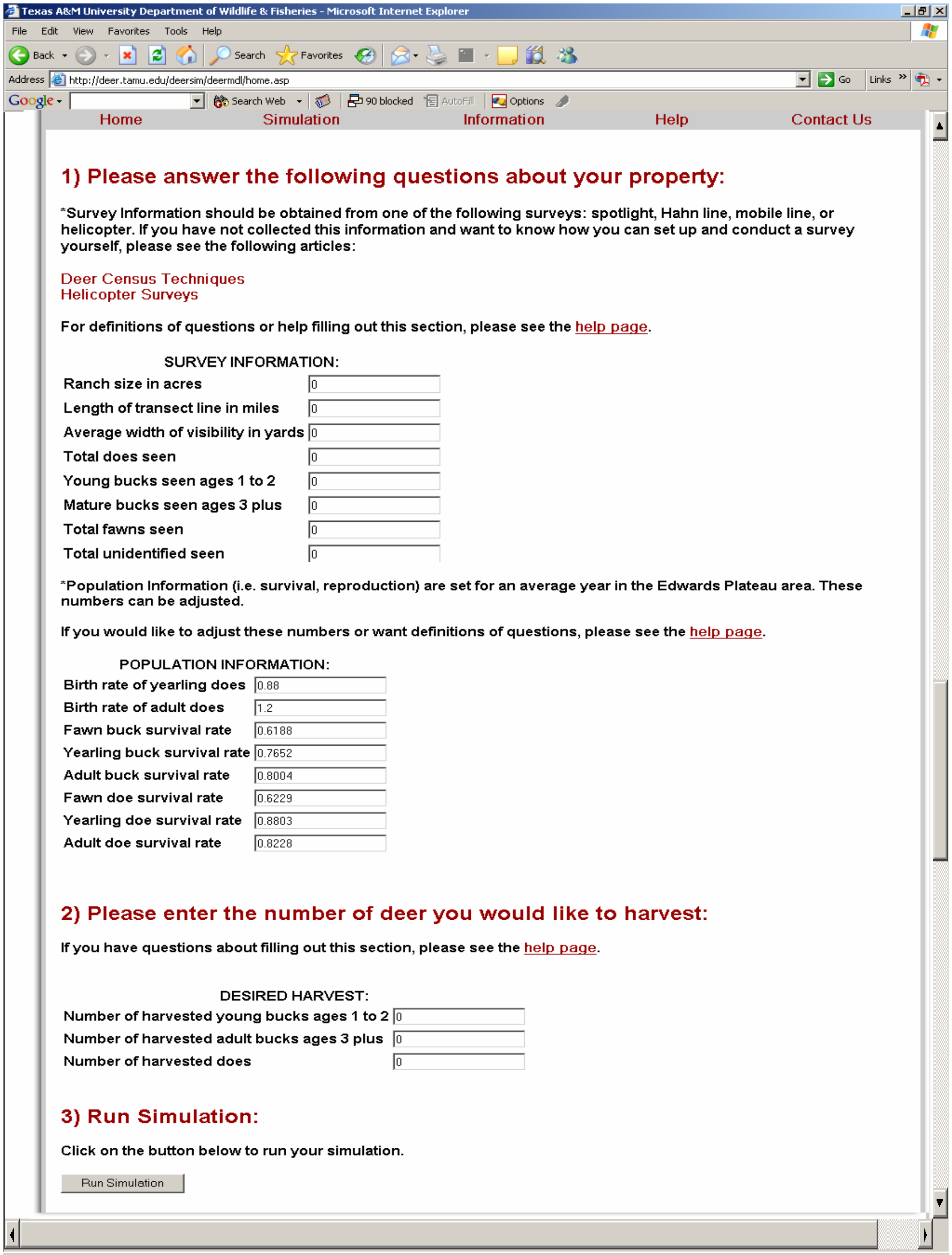


Fig. 6. Input section of the simulation page of the Texas Deer Manager (TDM) website, 2006.

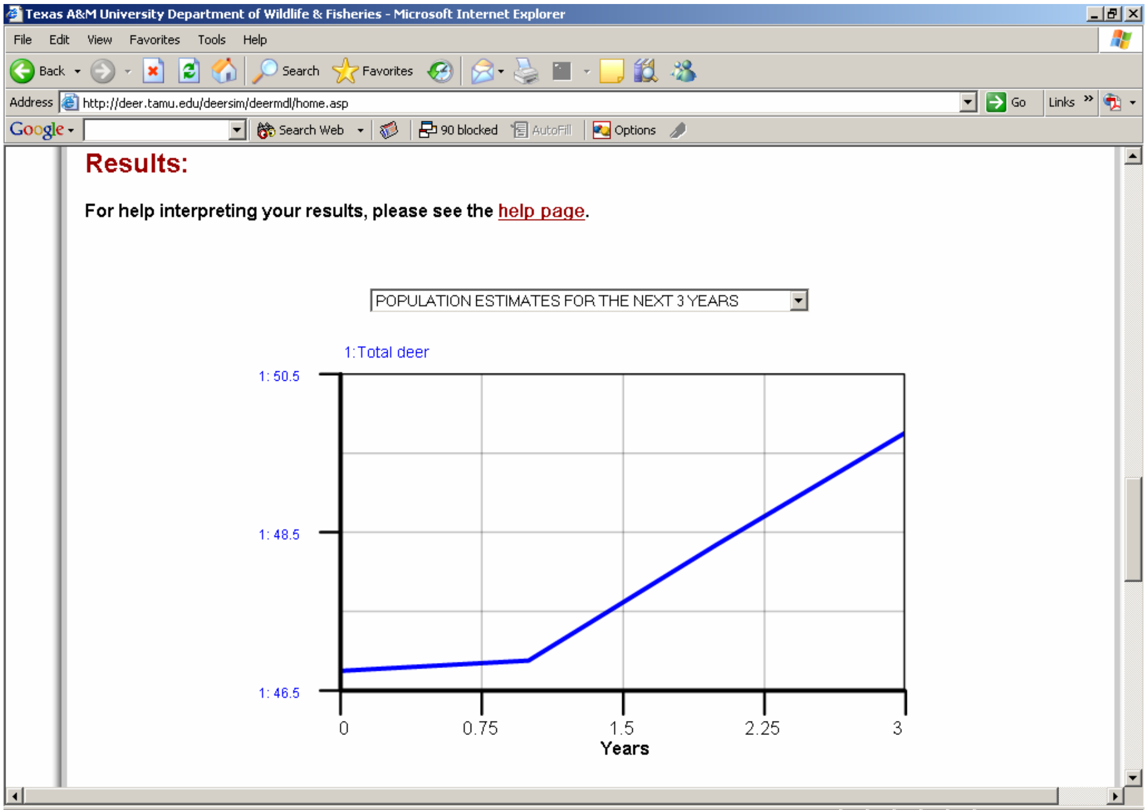
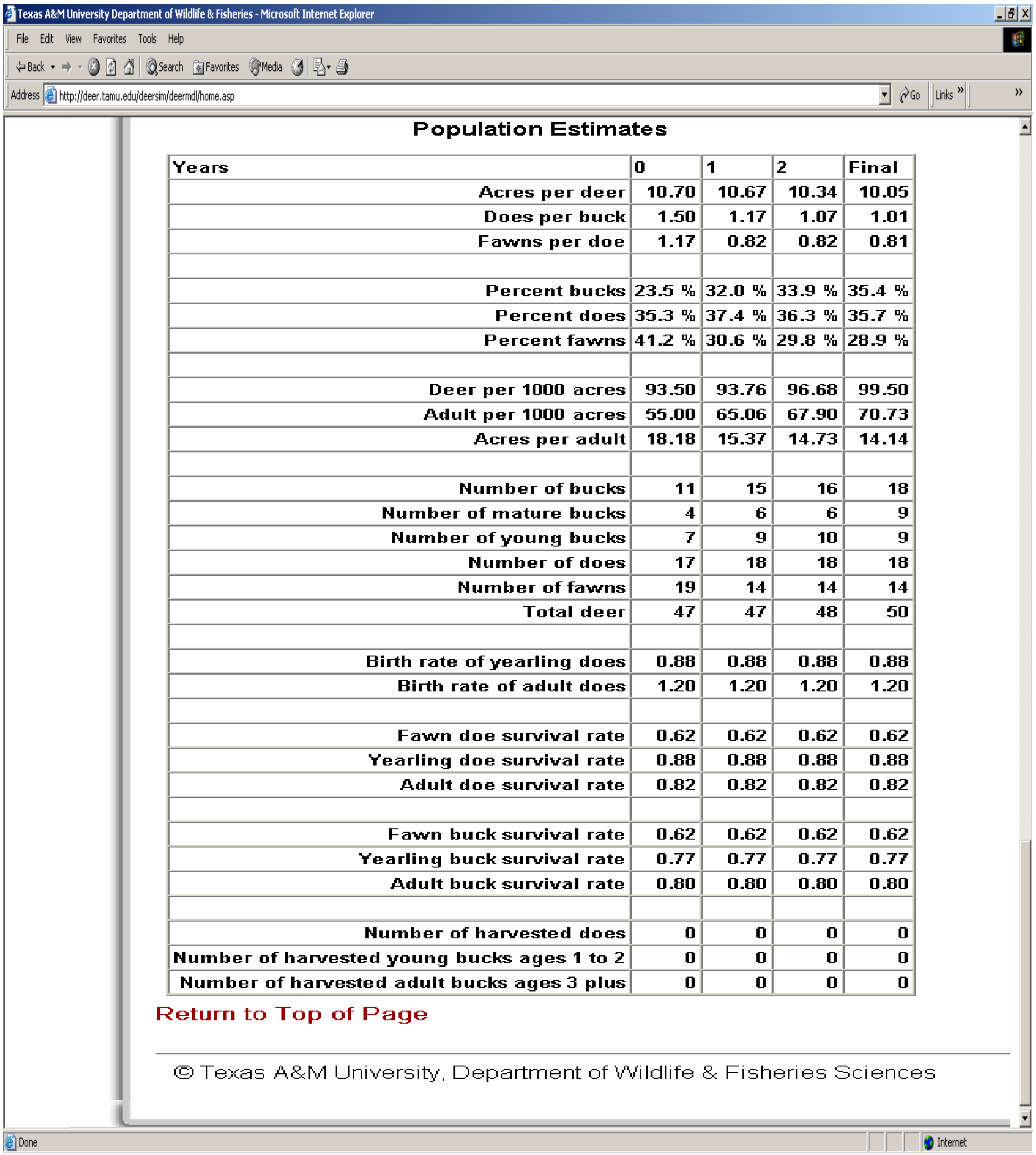


Fig. 7. Example of graphical output given to users on the simulation page of the Texas Deer Manager (TDM) website, 2006.



Population Estimates

Years	0	1	2	Final
Acres per deer	10.70	10.67	10.34	10.05
Does per buck	1.50	1.17	1.07	1.01
Fawns per doe	1.17	0.82	0.82	0.81
Percent bucks	23.5 %	32.0 %	33.9 %	35.4 %
Percent does	35.3 %	37.4 %	36.3 %	35.7 %
Percent fawns	41.2 %	30.6 %	29.8 %	28.9 %
Deer per 1000 acres	93.50	93.76	96.68	99.50
Adult per 1000 acres	55.00	65.06	67.90	70.73
Acres per adult	18.18	15.37	14.73	14.14
Number of bucks	11	15	16	18
Number of mature bucks	4	6	6	9
Number of young bucks	7	9	10	9
Number of does	17	18	18	18
Number of fawns	19	14	14	14
Total deer	47	47	48	50
Birth rate of yearling does	0.88	0.88	0.88	0.88
Birth rate of adult does	1.20	1.20	1.20	1.20
Fawn doe survival rate	0.62	0.62	0.62	0.62
Yearling doe survival rate	0.88	0.88	0.88	0.88
Adult doe survival rate	0.82	0.82	0.82	0.82
Fawn buck survival rate	0.62	0.62	0.62	0.62
Yearling buck survival rate	0.77	0.77	0.77	0.77
Adult buck survival rate	0.80	0.80	0.80	0.80
Number of harvested does	0	0	0	0
Number of harvested young bucks ages 1 to 2	0	0	0	0
Number of harvested adult bucks ages 3 plus	0	0	0	0

Return to Top of Page

Fig. 8. Example of table output given to users on the simulation page of the Texas Deer Manager (TDM) website, 2006.

Information Page.–The information page includes a list of hyperlinks to PDF files (e.g., Shult and Armstrong 1999, Armstrong and Young 2000) containing more detailed information about how to set up a survey, managing habitat, and setting goals. These hyperlinks also were placed throughout the website to aid model users in interpreting model parameters and output data. A hyperlink to help users find their local Texas Parks and Wildlife biologist also is found on this page. Finally, at the bottom of the page is a list of common words and their definitions found throughout the website.

Contact Us Page.–The contact us page provides contact information for the model designers.

Evaluation

Participant Demographics.–There were 49 people that visited the TDM website. I sent an e-mail to each person asking them to participate in an on-line survey about the TDM and website. I had a response rate of 59.2%, however, some participants did not answer every question, so response rates varied for some questions. Sixty-eight percent of the participants were male (Table 2). Participant ages ranged from 26-70 years with the largest group being 30-40 years old (36%). The participants were educated, with 100% graduating with a college degree. Seven percent graduated with an Associates degree, 28% with a Bachelors degree, and 65% with a post graduate degree. All but 1 participant resided in Texas.

Table 2. Demographic information of the the participants (n=29) of the Texas Deer Manager (TDM) evaluation survey, 2006.

Demographic variable	Frequency	%
Gender		
Male	19	68
Female	9	32
Age (yrs)		
<30	1	4
30-40	10	36
41-50	8	29
51-60	6	21
61-70	3	10
Highest level of education		
Associates degree	2	7
Bachelors degree	8	28
Post college graduate	19	65
Live in Texas		
Yes	28	97
No	1	3
Own land		
Yes	19	66
No	10	34
Participant self descriptions		
Wildlife manager/biologist	11	38
Rancher	8	28
Lease land for hunting	8	28
Teacher/Professor	8	28
Other	7	24
Farmer	0	0.0
Student	0	0.0
Knowledge of white-tailed deer management		
<Basic knowledge	8	28
≥Basic knowledge	21	72
Frequency of internet usage		
Every day	18	62
Several times a week	8	28
About once a month	2	7
Several times a month	1	3
Time spent at the TDM website (min)		
5 to 9	6	21
10-19	10	35
20-29	2	7
30-39	5	17
≥40	6	20

Participants were given several profession descriptors and asked to choose the ones that best described them. Thirty-eight percent described themselves as wildlife managers/biologists. The next most chosen descriptions were rancher, lease land for hunting, and teacher/professor, with 28% of the participants choosing these descriptors. Other choices offered were student and farmer which were not chosen by anyone. Twenty-four percent of the participants felt that none of the above descriptions described them. Twenty-eight percent of the particpants admitted to having less than basic knowledge of WTD management. They used the Internet on a regular basis, with 90% reporting they “surfed” the Internet several times a week or more. In regards to my website, 44% reported they viewed the TDM and website for more than 20 minutes.

Landowner Demographics.–Sixty-six percent of the participants reported that they owned land, with 75% of the landowners owning relatively small acreages of land of 350 acres or less (Table 3). Half of the them lived on their property while the other half were absentee landowners. Seventy-five percent owned their land for less than 25 years. Seventy-eight percent hunted WTD on their property, while 58% actively managed for WTD. Of the landowners that actively managed, 55% reported management intensity of WTD to be low to very low.

Table 3. Demographic information of the the landowner participants (n=19) of the Texas Deer Manager (TDM) evaluation survey, 2006.

Demographic variable	Frequency	%
Residency status		
Resident	9	50
Absentee	9	50
Area managed (acres)		
≤50	5	27
51-200	4	21
201-350	5	27
351-500	2	10
501-650	1	5
>1000	2	10
Tenure (yrs)		
<3	4	21
3-10	5	26
11-25	5	26
>25	2	11
>Generation	3	16
Hunt white-tailed deer on property		
Yes	14	78
No	4	22
Actively manage white-tailed deer		
Yes	11	58
No	8	42
Management intensity of white-tailed deer		
High - very high	4	36
Not sure	1	9
Low - very low	6	55

Response Frequencies.–The overall view of the TDM website had a high median rank (M=4) of satisfaction for both landowners (n=19) and non-landowners (n=10) (Table 4). Both groups also ranked the overall layout and organization of the TDM website high (M=5). However, when looking at individual responses none of the non-landowners ranked their satisfication for these 2 questions below a 4 out of 5, while there were 6 individual landowners that did. When looking at the perceived usefulness of the website as a whole, median rank was high (M=4) again for both landowners and non-landowners (Table 5). Landowners as a whole saw the simulation model as "very useful" (M=4), while the non-landowners as a whole found it to be "somewhat useful" (M=3). When asked if they would visit the TDM website again the median ranks were 4 and 4.5 for landowners and non-landowners, respectively. When asked if they would use TDM as a tool to help set their harvest plans 57% of the landowners answered "probably" or "definitely" (M=4) (Table 6). The non-landowner group had no person respond with "definitely" but 60% responded with "probably" (M=4).

Table 4. Response frequencies (*n*=29) to general questions about satisfaction with the Texas Deer Manager (TDM) website, 2006. Rank levels are from 1 (very dissatisfied) to 5 (very satisfied).

	Rank levels [n (%)]					Summary statistics	
	Very dissatisfied				Very satisfied		
Satisfaction questions	1	2	3	4	5	Mean rank (SE)	M
Landowners							
Overall view of the TDM website	0 (0.0)	2 (10.5)	1(5.3)	7 (36.8)	9 (47.4)	4.21 (0.224)	4
Overall layout and organization of the TDM website	0 (0.0)	2 (10.5)	1 (5.3)	6 (31.6)	10 (52.6)	4.26 (0.227)	5
Non-landowners							
Overall view of the TDM website	0 (0.0)	0 (0.0)	0 (0.0)	7 (70.0)	3 (30.0)	4.3 (0.15)	4
Overall layout and organization of the TDM website	0(0.0)	0 (0.0)	0 (0.0)	4 (40.0)	6 (60.0)	4.6 (0.16)	5

Table 5. Response frequencies (*n*=29) to general questions about perceived usefulness of the Texas Deer Manager (TDM) website, 2006. Rank levels are from 1 (not at all useful) to 5 (invaluable).

	Rank levels [n (%)]					Summary statistics	
	Not at all useful				Invaluable		
Perceived usefulness questions	1	2	3	4	5	Mean rank (SE)	M
Landowners							
The website as a whole	0 (0.0)	0 (0.0)	6 (31.6)	13 (68.4)	0 (0.0)	3.68 (0.110)	4
The simulation model	1 (5.6)	0 (0.0)	6 (33.3)	11 (61.1)	0 (0.0)	3.5 (0.185)	4
Non-landowners							
The website as a whole	0 (0.0)	1 (10.0)	2 (20.0)	7 (70.0)	0 (0.0)	3.6 (0.22)	4
The simulation model	0 (0.0)	1 (10.0)	5 (50.0)	4 (40.0)	0 (0.0)	3.3 (0.21)	3

Table 6. Response frequencies (*n*=29) to general questions about the probability of survey participants doing certain things regarding the Texas Deer Manager (TDM) website, 2006. Rank levels are from 1 (definitely not) to 5 (definitely).

	Rank levels [n (%)]					Summary statistics	
	Definitely not				Definitely		
Probability questions	1	2	3	4	5	Mean rank (SE)	M
Landowners							
Visit the TDM website again	0 (0.0)	0 (0.0)	3 (15.8)	9 (47.4)	7 (36.8)	4.21 (0.164)	4
Recommend the TDM website to someone else	0 (0.0)	1 (5.3)	2 (10.5)	9 (47.4)	7 (36.8)	4.16 (0.191)	4
Use TDM as a tool to help set harvest plan	2 (10.5)	1 (5.3)	5 (26.3)	5 (26.3)	6 (31.6)	3.63 (0.298)	4
Non-landowners							
Visit the TDM website again	0 (0.0)	2 (20.0)	0 (0.0)	3 (30.0)	5 (50.0)	4.1 (0.38)	4.5
Recommend the TDM website to someone else	0 (0.0)	0 (0.0)	1 (10.0)	3 (30.0)	6 (60.0)	4.5 (0.22)	5
Use TDM as a tool to help set harvest plan	1 (10.0)	0 (0.0)	3 (30.0)	6 (60.0)	0 (0.0)	3.4 (0.31)	4

Response Comments.–Seventeen of the 29 participants (59%) left comments or questions. The majority of the comments were positive in nature. One participant wrote "I thought this was a very well developed site…It will be a great tool, especially for those that have not have the benefit of formal WT deer management techniques. Very well done." Another participant wrote, "The website was very useful and contained very good information about deer surveys and determining harvest quotas. I especially appreciated the population data graphs generated by each run of the model." Three people wrote they would recommend the site to other people. "Nice website. User friendly game management tool. I have and will notify others in my wildlife co-op, NWTF and TOWMA, organizations." There were, however, 2 participants that did not believe the simulation model really worked. One of them wrote "I applaud your efforts to bring something as complex as deer management to computer screen. I just don't think it will work."

There were several recommendations that were advised. Four individuals recommended that data not have to be re-entered every time to run an iteration that way they could "…tinker with individual fields without having to re-enter all the info each time." Two individuals stated that they would like to see the model work for more than just the Edwards Plateau Region of Texas. One person even wrote "I would have probably given the website higher ratings, however, I could not get the simulator to work for areas outside the Hill Country." One particiapnt suggested that "Many guidance biologists may find this tool helpful to help generate recommendations for private or public landowners."

DISCUSSION

Many variations of WTD population harvest models exist in the scientific community. The TDM however was designed for landowners and wildlife managers. Starfield (1997) suggests that a simple model that is easy to understand can be more beneficial than a complex model that is hard to comprehend especially when the model is being used as a communication tool with the general public. This is why simplicity, flexibility, and easily acquired baseline information were priorities in the TDM development. Many of existing population models are based on harvest data collected over many years (e.g., Xie et al. 1999, Roseberry and Woolf 1991); however, these kinds of extensive data are not readily available to many landowners, particularly new landowners. The TDM is based on population trend surveys that are relatively easy for a landowner to conduct. The TDM also differs from previous models because on the webpage provides guidelines in the selection of plausible survival and fecundity ranges to help guide users. Moreover, the TDM also differs from other models in that the model is available via the Internet (free) with a user-friendly interface designed for landowners and wildlife managers. Finally, the TDM website provides additional information about WTD ecology useful in the management of deer populations and in the interpretation of model results.

Model

Participants in the evaluation ranked the simulation model fairly high, where landowners as a whole saw the simulation model as “very useful” (M=4), while the non-landowners as a whole found it to be “somewhat useful” (M=3). The non-landowner group may have ranked it lower because they do not own land so they would have no need for a simulation model to help manage deer populations. Scores might have been higher for both landowners and non-landowners for the usefulness questions if "invaluable" was not the choice for the highest possible rank (i.e., 5). Participants may not have felt comfortable describing the simulation model as "invaluable". Most written comments about the simulation model were positive. Even though there were 2 skeptics that believed the model would not work, most people had an interest in using it as a tool to determine harvest plans. One participant wrote "Look forward to taking a survey on the lease (probably in early Sept) and then plugging in the numbers in your model."

Website

The TDM website was created to host the model and provide information to landowners and managers about WTD management. Both landowners and non-landowners ranked the overall layout and organization of the TDM website high (M=5). One person wrote, "As a webmaster, I do feel that the site is well done." When participants were asked if they would visit the TDM website again the median ranks were 4 and 4.5 for landowners and non-landowners, respectively (4=probably; 5=definitely). When looking at the survey results and comments it seems that overall the participants liked the website and how it was set-up; however, there were some recommendations that were suggested.

Two people specifically wrote that they want the model to be available for the other Ecological Regions in Texas. This information will help to justify expanding the scope of the model and website to accommodate more users in different areas. Another major recommendation was to set up the interface so the user did not have to re-enter inputs for each iteration. This was unfortunately a limitation of the NetSim Creator®, Version 2.0 (High Performance Systems, Inc. 2002). Model improvements with regards to this limitation is recommended.

SUMMARY

There seems to be an interest and need for a tool like the TDM and website. It would be beneficial to continue to develop the website and make it applicable for all the regions in Texas. Model parameters for TDM are set for the Edwards Plateau Ecological Region of Texas; however, the model and webpage can be easily updated to include the other 9 regions of the state. Because of the flexibility and simplicity of the model, in the future the simulation model and webpage also could be adjusted so it could be used as a tool by landowners throughout the United States. Changes in land ownership trends in Texas are similiar to other areas in the United States. All but 9 of the lower 48 states have had an increase of landowners from 1992-2002 (National Agricultural Statistics Service 2005). The TDM and website are an excellent tool to help landowners reach their goals in a responsible way. Also, since the model is easily accessible via the Internet and simple to use, it can be incorporated as a tool to teach population dynamics in the classroom. It is also a good choice as a learning tool because of its interdisciplinary approach, which is of high priority in most school systems today. The TDM and website incorporates language arts, math, technology, and science.

LITERATURE CITED

American Farmland Trust. 2003. Going, going, gone: impacts of land fragmentation on Texas agriculture and wildlife. American Farmland Trust, Texas Regional Office, San Marcos, Texas, USA.

Armstrong, W. E., and E. L. Young. 2000. White-tailed deer management in the Texas Hill Country. Texas Parks and Wildlife Department, Austin, Texas, USA.

Bartholow, J. 1986. POP-II system documentation. Fossil Creek Software, Ft. Collins, Colorado, USA.

Bender, L. C., and G. J. Roloff. 1996. Modelling deer harvest alternatives in Indiana. Transactions of the Illinois State Academy of Science 89: 63–71.

Campbell, T. A., B. R. Laseter, W. M. Ford, and K. V. Miller. 2005. Population characteristics of a central Appalachian white-tailed deer herd. Wildlife Society Bulletin 33: 212–221.

Carroll, B. K. and D. L. Brown. 1977. Factors affecting neonatal fawn survival in southern-central Texas. Journal of Wildlife Management 41: 63–69.

Collier, B. A. 2004. Evaluation of selective harvest management on age structure and sex ratio of white-tailed deer (*Odocoileus virginianus*) in Arkansas. Dissertation. University of Arkansas, Fayetteville, Arkansas, USA.

Cook, R. S., M. White, D. O. Trainer, and W. C. Glazener. 1971. Mortality of young white-tailed deer fawns in south Texas. Journal of Wildlife Management 35: 47–56.

Euler, D., and M. M. J. Morris. 1984. Simulated population dynamics of white-tailed deer in an any-deer hunting system. Ecological Modelling 24: 281–292.

Grund, M. D., and A. Woolf. 2004. Development and evaluation of an accounting model for estimating deer population sizes. Ecological Modelling 180: 345–357.

Hatch, S. L., and J. Pluhar. 1993. Texas range plants. Texas A&M University Press, College Station, Texas, USA.

Illige, D. 1951. An analysis of the reproductive pattern of whitetail deer in South Texas. Journal of Mammalogy 32: 411–421.

Jensen, A. L. 2000. Sex and age structured matrix model applied to harvesting a white tailed deer population. Ecological Modelling 128: 245–249.

Jensen, A. L. 2002. Analysis of harvest and effort data for wild populations in fluctuating environments. Ecological Modelling 157: 43–49.

Kie, J. G., M. White, and F. F. Knowlton. 1979. Effects of coyote predation on population dynamics of white-tailed deer. Pages 65–82 *in* D. L. Drawe, editor. Proceedings Welder Wildlife Foundation symposium. Welder Wildlife Foundation Contribution B-7.

Kie, J. G., and M. White. 1985. Population dynamics of white-tailed deer (*Odocoileus virginianus*) on the Welder Wildlife Refuge, Texas. Southwestern Naturalist 30: 105–118.

Lancia, R. A., J. D. Nichols, and K. H. Pollock. 1994. Estimating the number of animals in wildlife populations. Pages 215–253 *in* T. A. Bookout, editor. Research and management techniques for wildlife and habitats. Wildlife Society, Bethesda, Maryland, USA.

Lopez, R. L., M. E. P. Vieira, N. J. Silvy, P. A. Frank, S. W. Whisenant, and D. A. Jones. 2003. Survival, mortality, and life expectancy of Florida Key deer. Journal of Wildlife Management 67: 34–45.

Lubow, B. C., G. C. White and D. R. Anderson. 1996. Evaluation of a linked sex harvest strategy for cervid populations. Journal of Wildlife Management 60 787–796.

National Agricultural Statistics Service. 2005. 2002 Census of Agriculture - Volume 1 Geographic Area Series Census, US - State Data. <http://www.nass.usda.gov:8080/Census/Create_Census_US.jsp> Accessed 1 Aug 2006.

Netsim® Creator 2002. Version 2.0. High Performance Systems, Inc., Hanover, New Hampshire, USA.

Risenhoover, K. L., H. B. Underwood, W. Yan, and J. L. Cooke. 1997. A spatially explicit modeling environment for evaluating deer management strategies. Pages 367–379 *in* W. J. McShea, H. B. Underwood, and J. H. Rappole, editors. The science of overabundance: deer ecology and population management. Smithsonian Institution Press, Washington, D.C., USA.

Roseberry, J. L., and A. Woolf. 1991. A comparative evaluation of techniques for analyzing white-tailed deer harvest data. Wildlife Monographs 117.

Sage, R. W., Jr., B. C. Pattern, and P. A. Salmon. 2003. Institutionalized model-making and ecosystem-based management of exploited resource populations: a comparison with instrument flight. Ecological Modelling 170: 107–128.

Sanders, J. C. 2005. Relationships among landowner and land ownership characteristics and participation in conservation programs in central Texas. Thesis, Texas A&M University, College Station, Texas, USA.

Shult, M. J., and B. Armstrong. 1999. Deer census techniques. Texas Parks and Wildlife Department, Austin, Texas, USA.

SPSS. 2002. SPSS 11.5.1 for Windows. Version 11.5.1. SPSS Inc., Chicago, Illinois, USA.

Starfield, A. M. 1997. A pragmatic approach to modeling for wildlife management. Journal of Wildlife Management 61: 261–270.

STELLA® Research. 2002. Version 7.0.3. High Performance Systems, Inc., Hanover, New Hampshire, USA.

Teer, J. G., J. W. Thomas, and E. A. Walker. 1965. Ecology and management of white-tailed deer in the Llano Basin of Texas. Wildlife Monographs 15.

Walters, C. J., and J E. Gross. 1972. Development of big game management plans through simulation modeling. Journal of Wildlife Management 36: 119–128.

Weisberg, P. J., N. T. Hobbs, J. E. Ellis, and M. B. Coughenour. 2002. An ecosystem approach to population management of ungulates. Journal of Environmental Management 65: 181–197.

White, G. C. 2000. Modeling population dynamics. Pages 84-107 *in* S. Demarais, and P. R. Krausman, editors. Ecology and management of large mammals in North America. Prentice-Hall, Upper Saddle River, New Jersey, USA.

White, M. 1973. The whitetail deer of the Aransas National Wildlife Refuge. Texas Journal of Science 24: 457–489.

Wilkins, N., R. D. Brown, R. J. Conner, J. Engle, C. Gilliland, A. Hays, R. D. Slack, and D. W. Steinbach. 2000. Fragmented lands: changing land ownership in Texas. Texas A&M University System, College Station, Texas, USA.

Window on State Government. 2002. Guidelines for Qualification of Agricultural Land in Wildlife Management Use. <http://www.window.state.tx.us/taxinfo/proptax/agrland/> Accessed 11 Oct 2006.

Xie, J., H. R. Hill, S. R. Winterstein, H. Campa, III, R. V. Doepker, T. R. Van Dellen, and J. Liu. 1999. White-tailed deer management options model (DeerMOM): design, quantification, and application. Ecological Modelling 124: 121–130.

Xie, J., J. Liu, and R. Doepker. 2001. DeerKBS: a knowledge-based system for white-tailed deer management. Ecological Modelling 140: 177–192.

APPENDIX A

SIMULATION CODE FOR THE TEXAS DEER MANAGER (TDM), 2006

```
Buck_Fawns(t) = Buck_Fawns(t - dt) + (male_fawn_recruitment - m_fawn_survival -
mal_fawn_mort) * dt
INIT Buck_Fawns = .565*original_number__of_fawns

INFLOWS:
male_fawn_recruitment = ROUND(.55*total_recuitment)
OUTFLOWS:
m_fawn_survival = Buck_Fawns*Fawn_buck_survival_rate
mal_fawn_mort = Buck_Fawns*(1-Fawn_buck_survival_rate)
Doe_fawns(t) = Doe_fawns(t - dt) + (female_fawn_recruitment - f_fawn_surv -
fem_fawn_mort) * dt
INIT Doe_fawns = original_number__of_fawns-Buck_Fawns

INFLOWS:
female_fawn_recruitment = total_recuitment-male_fawn_recruitment
OUTFLOWS:
f_fawn_surv = Doe_fawns*Fawn_doe_survival_rate
fem_fawn_mort = Doe_fawns*(1-Fawn_doe_survival_rate)
Feamale_6_yr(t) = Feamale_6_yr(t - dt) + (fsurv_5yr - fsurv_6_yr - Female_Harv_6 -
Female_mort_6) * dt
INIT Feamale_6_yr = (1/10)*original_number__of_does

INFLOWS:
fsurv_5yr = (Female_5_yr*Fem_5_yr_surv_rate)-Female_Harv_5
OUTFLOWS:
fsurv_6_yr = (Feamale_6_yr*Fem_6_yr_surv_rate)-Female_Harv_6
Female_Harv_6 = Feamale_6_yr*Doe_Harvest_Rate
Female_mort_6 = Feamale_6_yr*(1-Fem_6_yr_surv_rate)
Female_10_yr(t) = Female_10_yr(t - dt) + (fsurv_9_yr - fsurv_10_yr - Female_Harv_10
- Female_mort_10) * dt
INIT Female_10_yr = (1/10)*original_number__of_does

INFLOWS:
fsurv_9_yr = (Female_9_yr*Fem_9_yr_surv_rate)-Female_Harv_9
OUTFLOWS:
fsurv_10_yr = (Female_10_yr*Fem_10_yr_surv_rate)-Female_Harv_10
Female_Harv_10 = Female_10_yr*Doe_Harvest_Rate
Female_mort_10 = Female_10_yr*(1-Fem_10_yr_surv_rate)
Female_1_yr(t) = Female_1_yr(t - dt) + (f_fawn_surv - fsurv_1_yr - Female_mort_1 -
Female_Harv_1) * dt
```

INIT Female_1_yr = (1/10)*original_number__of_does

INFLOWS:
f_fawn_surv = Doe_fawns*Fawn_doe_survival_rate
OUTFLOWS:
fsurv_1_yr = (Female_1_yr*Yearling_doe_survival_rate)-Female_Harv_1
Female_mort_1 = Female_1_yr*(1-Yearling_doe_survival_rate)
Female_Harv_1 = Female_1_yr*Doe_Harvest_Rate
Female_2_yr(t) = Female_2_yr(t - dt) + (fsurv_1_yr - fsurv_2_yr - Female_Harv_2 - Female_mort_2) * dt
INIT Female_2_yr = (1/10)*original_number__of_does

INFLOWS:
fsurv_1_yr = (Female_1_yr*Yearling_doe_survival_rate)-Female_Harv_1
OUTFLOWS:
fsurv_2_yr = (Female_2_yr*Fem_2_yr_surv_rate)-Female_Harv_2
Female_Harv_2 = Female_2_yr*Doe_Harvest_Rate
Female_mort_2 = Female_2_yr*(1-Fem_2_yr_surv_rate)
Female_3_yr(t) = Female_3_yr(t - dt) + (fsurv_2_yr - fsurv_3_yr - Female_Harv_3 - Female_mort_3) * dt
INIT Female_3_yr = (1/10)*original_number__of_does

INFLOWS:
fsurv_2_yr = (Female_2_yr*Fem_2_yr_surv_rate)-Female_Harv_2
OUTFLOWS:
fsurv_3_yr = (Female_3_yr*Fem_3_yr_surv_rate)-Female_Harv_3
Female_Harv_3 = Female_3_yr*Doe_Harvest_Rate
Female_mort_3 = Female_3_yr*(1-Fem_3_yr_surv_rate)
Female_4_yr(t) = Female_4_yr(t - dt) + (fsurv_3_yr - fsurv_4_yr - Female_Harv_4 - Female_mort_4) * dt
INIT Female_4_yr = (1/10)*original_number__of_does

INFLOWS:
fsurv_3_yr = (Female_3_yr*Fem_3_yr_surv_rate)-Female_Harv_3
OUTFLOWS:
fsurv_4_yr = (Female_4_yr*Fem_4_yr_surv_rate)-Female_Harv_4
Female_Harv_4 = Female_4_yr*Doe_Harvest_Rate
Female_mort_4 = Female_4_yr*(1-Fem_4_yr_surv_rate)
Female_5_yr(t) = Female_5_yr(t - dt) + (fsurv_4_yr - fsurv_5yr - Female_Harv_5 - Female_mort_5) * dt
INIT Female_5_yr = (1/10)*original_number__of_does

INFLOWS:
fsurv_4_yr = (Female_4_yr*Fem_4_yr_surv_rate)-Female_Harv_4

OUTFLOWS:
fsurv_5yr = (Female_5_yr*Fem_5_yr_surv_rate)-Female_Harv_5
Female_Harv_5 = Female_5_yr*Doe_Harvest_Rate
Female_mort_5 = Female_5_yr*(1-Fem_5_yr_surv_rate)
Female_7_yr(t) = Female_7_yr(t - dt) + (fsurv_6_yr - fsurv_7_yr - Female_Harv_7 - Female_mort_7) * dt
INIT Female_7_yr = (1/10)*original_number__of_does

INFLOWS:
fsurv_6_yr = (Feamale_6_yr*Fem_6_yr_surv_rate)-Female_Harv_6
OUTFLOWS:
fsurv_7_yr = (Female_7_yr*Fem_7_yr_surv_rate)-Female_Harv_7
Female_Harv_7 = Female_7_yr*Doe_Harvest_Rate
Female_mort_7 = Female_7_yr*(1-Fem_7_yr_surv_rate)
Female_8_yr(t) = Female_8_yr(t - dt) + (fsurv_7_yr - fsurv_8_yr - Female_Harv_8 - Female_mort_8) * dt
INIT Female_8_yr = (1/10)*original_number__of_does

INFLOWS:
fsurv_7_yr = (Female_7_yr*Fem_7_yr_surv_rate)-Female_Harv_7
OUTFLOWS:
fsurv_8_yr = (Female_8_yr*Fem_8_yr_surv_rate)-Female_Harv_8
Female_Harv_8 = Female_8_yr*Doe_Harvest_Rate
Female_mort_8 = Female_8_yr*(1-Fem_8_yr_surv_rate)
Female_9_yr(t) = Female_9_yr(t - dt) + (fsurv_8_yr - fsurv_9_yr - Female_Harv_9 - Female_mort_9) * dt
INIT Female_9_yr = (1/10)*original_number__of_does

INFLOWS:
fsurv_8_yr = (Female_8_yr*Fem_8_yr_surv_rate)-Female_Harv_8
OUTFLOWS:
fsurv_9_yr = (Female_9_yr*Fem_9_yr_surv_rate)-Female_Harv_9
Female_Harv_9 = Female_9_yr*Doe_Harvest_Rate
Female_mort_9 = Female_9_yr*(1-Fem_9_yr_surv_rate)
Male_10_yr(t) = Male_10_yr(t - dt) + (msurv_9_yr - msurv_10_yr - Male_mort_10 - Male_Harv_10) * dt
INIT Male_10_yr = IF(original_number__of_young_bucks=0)Then((1/10)*original_number__of_mature_bucks)Else((1/8)*original_number__of_mature_bucks)

INFLOWS:
msurv_9_yr = (Male_9_yr*Mal_9_yr_surv_rate)-Male_Harv_9
OUTFLOWS:
msurv_10_yr = (Male_10_yr*Mal_10_yr_surv_rate)-Male_Harv_10

Male_mort_10 = Male_10_yr*(1-Mal_10_yr_surv_rate)
Male_Harv_10 = Male_10_yr*Adult_buck_harvest_rate_
Male_1_yr(t) = Male_1_yr(t - dt) + (m_fawn_survival - msurv_1_yr - Male_Harv_1 - Male_mort_1) * dt
INIT Male_1_yr = If(original_number__of_young_bucks=0)Then((1/10)*original_number__of_mature_bucks)Else((1/2)*original_number__of_young_bucks)

INFLOWS:
m_fawn_survival = Buck_Fawns*Fawn_buck_survival_rate
OUTFLOWS:
msurv_1_yr = (Male_1_yr*Yearling_buck_survival_rate)-Male_Harv_1
Male_Harv_1 = Male_1_yr*Young_buck_harvest_rate
Male_mort_1 = Male_1_yr*(1-Yearling_buck_survival_rate)
Male_2_yr(t) = Male_2_yr(t - dt) + (msurv_1_yr - msurv_2_yr - Male_Harv_2 - Male_mort_2) * dt
INIT Male_2_yr = If(original_number__of_young_bucks=0)Then((1/10)*original_number__of_mature_bucks)Else((1/2)*original_number__of_young_bucks)

INFLOWS:
msurv_1_yr = (Male_1_yr*Yearling_buck_survival_rate)-Male_Harv_1
OUTFLOWS:
msurv_2_yr = (Male_2_yr*Mal_2_yr_surv_rate)-Male_Harv_2
Male_Harv_2 = Male_2_yr*Young_buck_harvest_rate
Male_mort_2 = Male_2_yr*(1-Mal_2_yr_surv_rate)
Male_3_yr(t) = Male_3_yr(t - dt) + (msurv_2_yr - msurv_3_yr - Male_Harv_3 - Male_mort_3) * dt
INIT Male_3_yr = IF(original_number__of_young_bucks=0)Then((1/10)*original_number__of_mature_bucks)Else((1/8)*original_number__of_mature_bucks)

INFLOWS:
msurv_2_yr = (Male_2_yr*Mal_2_yr_surv_rate)-Male_Harv_2
OUTFLOWS:
msurv_3_yr = (Male_3_yr*Mal_3_yr_surv_rate)-Male_Harv_3
Male_Harv_3 = Male_3_yr*Adult_buck_harvest_rate_
Male_mort_3 = Male_3_yr*(1-Mal_3_yr_surv_rate)
Male_4_yr(t) = Male_4_yr(t - dt) + (msurv_3_yr - msurv_4_yr - Male_mort_4 - Male_Harv_4) * dt
INIT Male_4_yr = IF(original_number__of_young_bucks=0)Then((1/10)*original_number__of_mature_bucks)Else((1/8)*original_number__of_mature_bucks)

INFLOWS:
msurv_3_yr = (Male_3_yr*Mal_3_yr_surv_rate)-Male_Harv_3
OUTFLOWS:
msurv_4_yr = (Male_4_yr*Mal_4_yr_surv_rate)-Male_Harv_4
Male_mort_4 = Male_4_yr*(1-Mal_4_yr_surv_rate)
Male_Harv_4 = Male_4_yr*Adult_buck_harvest_rate_
Male_5_yr(t) = Male_5_yr(t - dt) + (msurv_4_yr - msurv_5_yr - Male_mort_5 - Male_Harv_5) * dt
INIT Male_5_yr = IF(original_number__of_young_bucks=0)Then((1/10)*original_number__of_mature_bucks)Else((1/8)*original_number__of_mature_bucks)

INFLOWS:
msurv_4_yr = (Male_4_yr*Mal_4_yr_surv_rate)-Male_Harv_4
OUTFLOWS:
msurv_5_yr = (Male_5_yr*Mal_5_yr_surv_rate)-Male_Harv_5
Male_mort_5 = Male_5_yr*(1-Mal_5_yr_surv_rate)
Male_Harv_5 = Male_5_yr*Adult_buck_harvest_rate_
Male_6_yr(t) = Male_6_yr(t - dt) + (msurv_5_yr - msurv_6_yr - Male_mort_6 - Male_Harv_6) * dt
INIT Male_6_yr = IF(original_number__of_young_bucks=0)Then((1/10)*original_number__of_mature_bucks)Else((1/8)*original_number__of_mature_bucks)

INFLOWS:
msurv_5_yr = (Male_5_yr*Mal_5_yr_surv_rate)-Male_Harv_5
OUTFLOWS:
msurv_6_yr = (Male_6_yr*Mal_6_yr_surv_rate)-Male_Harv_6
Male_mort_6 = Male_6_yr*(1-Mal_6_yr_surv_rate)
Male_Harv_6 = Male_6_yr*Adult_buck_harvest_rate_
Male_7_yr(t) = Male_7_yr(t - dt) + (msurv_6_yr - msurv_7_yr - Male_mort_7 - Male_Harv_7) * dt
INIT Male_7_yr = IF(original_number__of_young_bucks=0)Then((1/10)*original_number__of_mature_bucks)Else((1/8)*original_number__of_mature_bucks)

INFLOWS:
msurv_6_yr = (Male_6_yr*Mal_6_yr_surv_rate)-Male_Harv_6
OUTFLOWS:
msurv_7_yr = (Male_7_yr*Mal_7_yr_surv_rate)-Male_Harv_7
Male_mort_7 = Male_7_yr*(1-Mal_7_yr_surv_rate)
Male_Harv_7 = Male_7_yr*Adult_buck_harvest_rate_
Male_8_yr(t) = Male_8_yr(t - dt) + (msurv_7_yr - msurv_8_yr - Male_mort_8 - Male_Harv_8) * dt

INIT Male_8_yr =
IF(original_number__of_young_bucks=0)Then((1/10)*original_number__of_mature_bucks)Else((1/8)*original_number__of_mature_bucks)

INFLOWS:
msurv_7_yr = (Male_7_yr*Mal_7_yr_surv_rate)-Male_Harv_7
OUTFLOWS:
msurv_8_yr = (Male_8_yr*Mal_8_yr_surv_rate)-Male_Harv_8
Male_mort_8 = Male_8_yr*(1-Mal_8_yr_surv_rate)
Male_Harv_8 = Male_8_yr*Adult_buck_harvest_rate_
Male_9_yr(t) = Male_9_yr(t - dt) + (msurv_8_yr - msurv_9_yr - Male_mort_9 - Male_Harv_9) * dt
INIT Male_9_yr =
IF(original_number__of_young_bucks=0)Then((1/10)*original_number__of_mature_bucks)Else((1/8)*original_number__of_mature_bucks)

INFLOWS:
msurv_8_yr = (Male_8_yr*Mal_8_yr_surv_rate)-Male_Harv_8
OUTFLOWS:
msurv_9_yr = (Male_9_yr*Mal_9_yr_surv_rate)-Male_Harv_9
Male_mort_9 = Male_9_yr*(1-Mal_9_yr_surv_rate)
Male_Harv_9 = Male_9_yr*Adult_buck_harvest_rate_
Acres_per_adult =
IF(Adult_per_1000_acres=0)THEN(0)ELSE(1000/Adult_per_1000_acres)
Acres_per_deer =
IF(Number_of_total_deer=0)THEN(0)ELSE(Ranch_size_in_acres/Number_of_total_deer)
Adult_buck_harvest_rate_ = If(Number_of_harvested_adult_bucks_ages_3_plus=0)Or(Number_of_mature__bucks=0)Then(0)Else(Number_of_harvested_adult_bucks_ages_3_plus/Number_of_mature__bucks)
Adult_buck_survival_rate = .8004
Adult_does = Feamale_6_yr + Female_10_yr + Female_2_yr + Female_3_yr + Female_4_yr + Female_5_yr + Female_7_yr + Female_8_yr + Female_9_yr
Adult_doe_survival_rate = .8228
adult_females = Feamale_6_yr + Female_10_yr + Female_2_yr + Female_3_yr + Female_4_yr + Female_5_yr + Female_7_yr + Female_8_yr + Female_9_yr
Adult_per_1000_acres =
IF(Number_of_bucks+Number_of_does+Number_of_fawns=0)THEN(0)ELSE(Deer_per_1000_acres*((Number_of_bucks+Number_of_does)/(Number_of_bucks+Number_of_does+Number_of_fawns)))
Average_width_of_visibility_in_yards = 0
Birth_rate_of_adult_does = 1.20
Birth_rate_of_yearling_does = .88
conversion_to_yds_for_strip_length = Length_of_transect__line_in_miles*1760

converstion_to__squared_yds_observed =
conversion_to_yds_for_strip_length*Average_width_of_visibility_in_yards
Deer_per_1000_acres = IF(Acres_per_deer=0)THEN(0)ELSE(1000/Acres_per_deer)
Does_per_buck =
IF(Number_of_bucks=0)THEN(0)ELSE(Number_of_does/Number_of_bucks)
Doe_Harvest_Rate =
If(Number_of_harvested_does=0)Or(Number_of_does=0)Then(0)Else(Number_of_harvested_does/Number_of_does)
Fawns_per_doe =
IF(Number_of_does=0)THEN(0)ELSE(Number_of_fawns/Number_of_does)
Fawn_buck_survival_rate = .6188
Fawn_doe_survival_rate = .6229
Fem_10_yr_surv_rate = 0
Fem_2_yr_surv_rate = Adult_doe_survival_rate
Fem_3_yr_surv_rate = Adult_doe_survival_rate
Fem_4_yr_surv_rate = Adult_doe_survival_rate
Fem_5_yr_surv_rate = Adult_doe_survival_rate
Fem_6_yr_surv_rate = Adult_doe_survival_rate
Fem_7_yr_surv_rate = Adult_doe_survival_rate
Fem_8_yr_surv_rate = Adult_doe_survival_rate
Fem_9_yr_surv_rate = Adult_doe_survival_rate
Length_of_transect__line_in_miles = 0
Mal_10_yr_surv_rate = 0
Mal_2_yr_surv_rate = Adult_buck_survival_rate
Mal_3_yr_surv_rate = Adult_buck_survival_rate
Mal_4_yr_surv_rate = Adult_buck_survival_rate
Mal_5_yr_surv_rate = Adult_buck_survival_rate
Mal_6_yr_surv_rate = Adult_buck_survival_rate
Mal_7_yr_surv_rate = Adult_buck_survival_rate
Mal_8_yr_surv_rate = Adult_buck_survival_rate
Mal_9_yr_surv_rate = Adult_buck_survival_rate
Mature_bucks_seen_ages_3_plus = 0
Number_of_acres_observed = converstion_to__squared_yds_observed/4840
Number_of_bucks = Number_of_mature__bucks+Number_of__young_bucks
Number_of_does = Female_1_yr + Female_2_yr + Female_10_yr + Feamale_6_yr + Female_3_yr + Female_4_yr + Female_5_yr + Female_7_yr + Female_8_yr + Female_9_yr
Number_of_fawns = Doe_fawns+ Buck_Fawns
Number_of_harvested_adult_bucks_ages_3_plus = 0
Number_of_harvested_does = 0
Number_of_harvested_young_bucks__ages_1_to_2 = 0
Number_of_mature__bucks = Male_10_yr + Male_3_yr + Male_4_yr + Male_5_yr + Male_6_yr + Male_7_yr + Male_8_yr + Male_9_yr

Number_of_total_deer =
Number_of_bucks+Number_of_does+Number_of_fawns+Total_unidentified
number_of_young_bucks = Male_1_yr + Male_2_yr
Number_of__young_bucks = Male_1_yr + Male_2_yr
original_number__of_bucks =
IF(Total_bucks_seen=0)THEN(0)ELSE(Total_bucks_seen*(Ranch_size_in_acres/Number_of_acres_observed))
original_number__of_does =
IF(Total_does_seen=0)THEN(0)ELSE(Total_does_seen*(Ranch_size_in_acres/Number_of_acres_observed))
original_number__of_fawns =
IF(Total_fawns_seen=0)THEN(0)ELSE(Total_fawns_seen*(Ranch_size_in_acres/Number_of_acres_observed))
original_number__of_mature_bucks =
IF(Mature_bucks_seen_ages_3_plus=0)THEN(0)ELSE(Mature_bucks_seen_ages_3_plus*(Ranch_size_in_acres/Number_of_acres_observed))
original_number__of_young_bucks =
IF(Young_bucks_seen__ages_1_to_2=0)THEN(0)ELSE(Young_bucks_seen__ages_1_to_2*(Ranch_size_in_acres/Number_of_acres_observed))
Percent_bucks =
IF(Number_of_bucks+Number_of_does+Number_of_fawns=0)THEN(0)ELSE(PCT(Number_of_bucks/(Number_of_bucks+Number_of_does+Number_of_fawns)))
Percent_does =
IF(Number_of_bucks+Number_of_does+Number_of_fawns=0)THEN(0)ELSE(PCT(Number_of_does/(Number_of_bucks+Number_of_does+Number_of_fawns)))
Percent_fawns =
IF(Number_of_bucks+Number_of_does+Number_of_fawns=0)THEN(0)ELSE(PCT(Number_of_fawns/(Number_of_bucks+Number_of_does+Number_of_fawns)))
Ranch_size_in_acres = 0
Total_bucks_seen =
Mature_bucks_seen_ages_3_plus+Young_bucks_seen__ages_1_to_2
Total_deer = Number_of_bucks + Number_of_does + Number_of_fawns
Total_does_seen = 0
Total_fawns_seen = 0
total_recuitment =
((Birth_rate_of_adult_does*adult_females)+(Birth_rate_of_yearling_does*yearling_females))*recruitment_fraction
Total_unidentified =
IF(Total_unidentified__seen=0)THEN(0)ELSE(Total_unidentified__seen*(Ranch_size_in_acres/Number_of_acres_observed))
Total_unidentified__seen = 0
Yearling_buck_survival_rate = .7652
Yearling_does = Female_1_yr
Yearling_doe_survival_rate = .8803

yearling_females = Female_1_yr
Young_bucks_seen__ages_1_to_2 = 0
Young_buck_harvest_rate = IF
(Number_of_harvested_young_bucks__ages_1_to_2=0)Or(number_of_young_bucks=0)
THEN (0)
ELSE (Number_of_harvested_young_bucks__ages_1_to_2/number_of_young_bucks)
recruitment_fraction = GRAPH(Acres_per_deer)
(1.00, 0.005), (2.00, 0.29), (3.00, 0.62), (4.00, 0.85), (5.00, 1.00), (6.00, 1.00), (7.00, 1.00), (8.00, 1.00), (9.00, 1.00), (10.0, 1.00), (11.0, 1.00), (12.0, 1.00), (13.0, 1.00), (14.0, 1.00), (15.0, 1.00), (16.0, 1.00), (17.0, 1.00), (18.0, 1.00), (19.0, 1.00), (20.0, 1.00), (21.0, 1.00), (22.0, 1.00), (23.0, 1.00), (24.0, 1.00), (25.0, 1.00), (26.0, 1.00), (27.0, 1.00), (28.0, 1.00), (29.0, 1.00), (30.0, 1.00), (31.0, 1.00), (32.0, 1.00), (33.0, 1.00), (34.0, 1.00), (35.0, 1.00), (36.0, 1.00), (37.0, 1.00), (38.0, 1.00), (39.0, 1.00), (40.0, 1.00), (41.0, 1.00), (42.0, 1.00), (43.0, 1.00), (44.0, 1.00), (45.0, 1.00), (46.0, 1.00), (47.0, 1.00), (48.0, 1.00), (49.0, 1.00), (50.0, 1.00)

APPENDIX B

ONLINE SURVEY GIVEN TO USERS OF THE TEXAS DEER MANAGER (TDM) WEBSITE, 2006

Evaluation of the Texas Deer Manager (TDM) website

Please answer the following questions to the best of you knowledge. Thank you for you input.

Question 1) Please rate your satisfaction of the following:

	Very Dissatisfied	Somewhat Dissatisfied	Undecided	Somewhat Satisfied	Very Satisfied
Overall visit to our website.					
Overall layout and organization of the website.					
Text size on the website.					
Time it took for pages to load.					
Time it took for the simulation to run and provide results.					

Question 2) What were your reasons for visiting our website? Choose all that apply.

__ Information about a particular topic
__ Technical support information
__ Interest in the subject matter
__ Entertainment
__ For work/school
__ Other (specify) ________________________________

Question 3) Please rate how useful you found the following:

	Invaluable	Very useful	Somewhat useful	Not very useful	Not at all useful
The website as a whole.					
The white-tailed deer simulation model					

Question 4) All together, how long have you spent at our website?

__ Under 5 minutes
__ 5 to 9 minutes
__ 10 to 19 minutes
__20 to 29 minutes
__ 30 to 39 minutes
__ 40 minutes or longer

Question 5) If you were talking to someone you did not know, what number on the following scale (1 to 5) would say described your understanding and knowledge of white-tailed deer management. _____________

l --------------------------------l--------------------------------------l
1 3 5
No knowledge basic knowledge Comprehensive knowledge

Question 6) Please rate how certain you are you would do the following:

	Definitely	Probably	Not sure	Probably not	Definitely not
Visit our website again?					
Recommend our website to someone else?					
Use our white-tailed deer simulation model as a tool to help determine your harvest plan?					

Please provide the following demographic information. It will only be used to make statistical comparisons between different groups of respondents; it will not be used to profile individual respondents.

Question 7) Do you live in Texas?

__ Yes
__ No

Question 8) What is your gender?

__ Male
__ Female

Question 9) How old are you?

____

Question 10) Which of the following best represents the highest level of education that you have completed?

__ Some high school or less
__ High school graduate
__ Attended some college
__ Associates degree
__ Bachelors degree
__ Post-college graduate

Question 11) Which of these best describe you? Choose all that apply.

__ Rancher
__ Wildlife biologist/manager
__ Farmer
__ Lease land for hunting
__ Teacher/Professor
__ Student
__ None of these descriptions describes me

Question 12) Do you own land?

__ Yes
__ No →(Skip to Q. 19)

Question 13) How many acres of land do you own?

____

Question 14) How long have you owned your land?

____

Question 15) Do you live on the land that you own?

__ Yes
__ No

Question 16) Do you currently hunt white-tailed deer on your property?

__ Yes
__ No

Question 17) Do you actively manage white-tailed deer on your property?

__ Yes
__ No →(Skip to Q. 19)

Question 18) How would you rate the intensity of your management program?

__ Very high
__ High
__ Not sure
__ Low
__Very low

Question 19) What kind of internet connection do you use?

__ Dial up
__ Cable
__ DSL
__ Satellite
__ Do not know
__ Other (specify) ______________________

Question 20) How frequently do you surf the web?

__ Every day
__ Several times a week
__ About once a week
__ Several times a month
__ About once a month
__ Less than once a month
__ Not sure (don't keep track)

Any questions or comments?

____
____
____
____
____

Thank you for filling out this survey. Your time and effort are greatly appreciated.

VITA

Jennifer Nicole Garrett

ADDRESS

Department of Wildlife and Fisheries Sciences
Texas A&M University
2258 TAMU
006 Nagle Hall
College Station, TX 77843-2258
jennifer_n_garrett@yahoo.com

EDUCATION

Master of Science, Wildlife and Fisheries Sciences, Texas A&M University, 2006

Bachelor of Science, Range and Wildlife Management, Texas A&M University-Kingsville, 2003

WORK EXPERIENCE

Rob & Bessie Welder Wildlife Foundation Fellow, (2003-2006)

Conservation Educator, Welder Wildlife Foundation, Sinton, Texas, 2004-2006

Office Manager, Martin Hall at Texas A&M University-Kingsville, Texas, 2002-2003

Nature Tourism Program Assistant, Texas Cooperative Extension, Corpus Christi, Texas, 2002

Wildlife Research Assistant, Caesar Kleberg Research Institute, Texas A&M University-Kingsville, Texas, 2001-2002

Park Ranger GS-0025-04, US Army Corp of Engineers, Canyon Lake, Texas, Summer 2001, 2002, and 2003

Undergraduate Research, Caesar Kleberg Research Institute, Texas A&M University-Kingsville, Texas, 2001-2002