Gopher Tortoise Minimum Viable Population and Minimum Reserve Size
Working Group Report II

Report prepared by:
The Gopher Tortoise Council
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The second Gopher Tortoise Minimum Viable Population and Minimum Reserve Size Workshop was held 4-5 March 2014 at the Solon Dixon Forestry Education Center in Andalusia, Alabama as a follow-up to the first workshop (Gopher Tortoise Council 2013). The consensus from the first workshop was that a minimum viable population (MVP) for the gopher tortoise is 250 adults with a density of no less than 0.4 tortoises/ha and that the minimum reserve size for a MVP to persist is 100 ha of superb habitat.

The objectives for the second workshop were to:

1) Establish consensus on the number and distribution of viable gopher tortoise (*Gopherus polyphemus*) populations necessary to ensure the long-term viability of the species;
2) Discuss desired population structure based on existing data from long-term monitoring, tortoise surveys, and translocation events, and;
3) Address stakeholder concerns regarding the role of small gopher tortoise populations (those fewer than 250 adults) and small tracts of intact habitat.

Attendees included biologists, land managers, and experts in demographic modeling (Table 1). The goal of this report is to further guide gopher tortoise conservation efforts towards species recovery and away from "threatened" status.

Background
The U.S. Fish and Wildlife Service's 12-month finding that the eastern population of the gopher tortoise warranted listing as Threatened under the Endangered Species Act (Department of the Interior, Fish and Wildlife Service 2011) has accelerated interest in conservation of the species. A Candidate Conservation Agreement and Range-Wide Conservation Strategy for the Gopher Tortoise have been developed and outline steps toward assessing the status, conservation, and recovery of the species. To more effectively manage the species and conserve it in perpetuity, clarification of MVP size, the desired number of viable populations, and the ideal geographic distribution of these populations are needed.

An ad hoc meeting of a Gopher Tortoise Minimum Viable Population and Minimum Reserve Size working group was held at the 2012 Annual Meeting of the Gopher Tortoise Council in Bainbridge, Georgia. The meeting spawned interest in future discussions on whether additional population viability modelling would benefit gopher tortoise conservation efforts. Participants at the ad hoc meeting, and others, were invited to a Minimum Viable Population Workshop held on 13-15 March 2013 at the Charlie Elliott Wildlife Center in Mansfield, Georgia. The primary objective of that workshop was to define what represents an MVP for the gopher tortoise based

on previous model results (Abercrombie 1981, Cox et al. 1987, Miller 2001, Tuberville et al. 2009) and the knowledge and experience of the group. Additional objectives were to identify the minimum reserve size needed to support a viable gopher tortoise population and to determine the number and distribution of populations needed to ensure the long-term viability of the species. Results of that workshop were presented in a report that included measureable parameters to define a minimum viable population, a baseline reserve size to support a viable population, as well as information on the importance of smaller populations for the conservation of the gopher tortoise (Gopher Tortoise Council 2013).

The third objective at the 2013 workshop, which was to identify the number and distribution of viable gopher tortoise populations necessary to ensure the long-term viability of the species, was not addressed. Thus, a second workshop was planned for 2014. Based on feedback from Gopher Tortoise Council members at the 2013 annual meeting in Ponte Vedra Beach, Florida, further discussion on the role of small populations was added to the agenda of the second workshop. The following is a summary of the workshop results.

2014 Workshop Summary
The two-day workshop was funded by a USFWS Section 6 grant for candidate species status assessments. Facilitation was provided by Group Solutions, Inc. The meeting opened with general introductions, a review of the 2013 workshop, a summary of feedback on the report, and a review of the progress of population surveys by state. A summary of outcomes, for each of the objectives is provided below.

Objective 1. *Establish consensus on the number and distribution of viable gopher tortoise populations necessary to ensure the long-term viability of the species.*

Individuals from six states (Alabama, Florida, Georgia, Louisiana, Mississippi, and South Carolina) summarized existing information on the size, viability, and number of populations. Alabama estimated the total historical extent of gopher tortoise habitat and reported potentially viable populations on three protected areas with 10-15 sites as potential focal areas for conservation. Information on tortoise populations on private lands in Alabama is lacking. Georgia reported at least 117 MVPs (2/3 of which occur on private lands). Line transect distance sampling surveys have been completed on approximately 60 sites in Georgia. Using element occurrence data and burrow surveys, Florida reported that there are likely at least 130 public conservation lands with MVPs and more sites that approach MVP status or where data are lacking. Mississippi reported that 16-18 counties have gopher tortoise populations; DeSoto National Forest is the primary recovery area. Camp Shelby within the Desoto National Forest likely has several good populations including a tortoise reserve. There are probably good populations on private lands in Mississippi, but data are lacking. Louisiana reported that most tortoises within the state are located in Washington Parish and statewide there are three populations that fit the definition of a support population. South Carolina has three large populations that occur on lands managed by either SCDNR or the Savannah River Site (SRS). The most current estimates of the population at Tillman Sand Ridge Heritage Preserve indicated approximately 163 adult tortoises (Tuberville and Dorcas 2001), but additional tortoises occur throughout adjacent properties, and taken as a whole this population may meet the MVP criteria. The size and status of these populations are unknown. Two hundred and thirty tortoises of mixed

age classes have been introduced via soft-release to the Aiken Gopher Tortoise Heritage Preserve, and an additional 106 tortoises were released on the SRS (Tuberville et. al. 2005). Additional very small groups of tortoises are known to occur in SC.

The group recognized that additional data on population size are needed to meet this objective. Surveys are currently underway in Georgia, Florida, Alabama, and Louisiana and planned for Mississippi and South Carolina. After the state reports, the group discussed the issue of vulnerability of individual populations on lands in different ownership and created a ranking system based on the relative degree of threat. A high vulnerability ranking means a site has high potential for land use change and the population is at risk and includes private lands that are not under easement. Medium vulnerability lands are generally private and under an easement, but either their easements do not provide specific conservation of tortoise habitat and/or are not permanent. Finally, low vulnerability populations occur on public conservation lands and private lands under perpetual conservation easements with language that restricts land use. The group determined that this ranking concept was worth revisiting in the future.

Objective 2. *Discuss desired population structure based on existing data from long- term monitoring, tortoise surveys, and translocation events.*

The group was in agreement that a MVP implies a population is demographically stable. However, the age class structure of a stable gopher tortoise population is difficult to measure. Long-term mark-recapture studies (Tuberville et al. 2014) provide the best information on the relationship between population size, age class structure and population trends. However, assessments of age class structure based on size of occupied burrows from survey data can be informative, particularly with regard to subadult and adult age classes which are crucial to population stability. Survey data may be our best source of information at a large scale. The following topics were discussed as warranting further research:

- Methods to reliably census juvenile tortoises
- Survival to adulthood

States will continue to collect baseline demographic data on tortoise populations and management history, such as prescribed fire. Additionally, monitoring programs will be established. A commitment to management and protection of populations is crucial to the conservation of the gopher tortoise.

Objective 3. *Address concerns expressed regarding the role of small gopher tortoise populations (those fewer than 250 adults) and small tracts of intact habitat.*

In defining a MVP and support populations for the gopher tortoise, the group considered three critical aspects of their ecology: population size, area of suitable habitat, and management commitments. MVP has been defined in the literature as "a species-specific abundance threshold below which stochastic threats pose an unacceptable risk to an isolated population" (Shaffer 1981 in Shoemaker et al. 2014). Results from existing gopher tortoise population viability models vary from 25 to 250 tortoises under ideal habitat conditions (Abercrombie 1981, Cox et

al. 1987, Miller 2001, Tuberville et al. 2009). Consensus of this working group is that a MVP for the gopher tortoise is 250 adults with a density of no less than 0.4 tortoises/ha on a site that is at least 100 ha in size and of superb quality (Gopher Tortoise Council 2013). Populations with fewer than 250 adults were defined as "Support Populations". Support Populations may persist for long periods of time and, although are likely more vulnerable to stochastic events, they play an important role in supporting the overall recovery of the species. Given their importance in supporting overall recovery of the species we refined our definition of Support Populations as follows:

Primary Support Populations: Populations with between 50-250 adults which are candidates for population restoration by improving habitat to increase natural recruitment, or through population augmentation to attain MVP status. By definition, Primary Support Populations must occur on sites large enough to sustain a MVP.

Secondary Support Populations: Populations of <50 adults, some of which are constrained from reaching primary support status because of limited habitat or management options. Secondary Support Populations are important for education, community interest, or can be used for augmentation purposes. If sufficient potential habitat is present and managed, Secondary Support Populations are candidates for habitat restoration and/or population augmentation to attain Primary Support Population or MVP status.

Future Directions
It is clear that we need additional information and discussion to determine the approximate number and distribution of viable gopher tortoise populations necessary to ensure the long-term viability of the species (Objective 1). The following topics also warrant further review and discussion:

- Determine the barriers to tortoise movement. What are they? Where are they?
- Improve methods for juvenile tortoise detection.
- Determine how long it takes for populations to respond following habitat restoration efforts. Implement post-restoration monitoring.
- Pursue landowner assistance programs, incentives, and easements.

Table 1. Participants at the Gopher Tortoise Minimum Viable Population and Minimum Reserve Size Workshop at the Solon Dixon Forestry Education Center in Andalusia, Alabama on 4-5 March 2014.

PARTICIPANTS	AFFILIATION
Joan Berish	Florida Fish and Wildlife Conservation Commission
Rachel Bormann	University of Georgia
Doug Bruggerman	Ecological Services and Markets, Inc
Deborah Burr	Florida Fish and Wildlife Conservation Commission
Kyla Cheynet	Plum Creek Timber
Will Dillman	South Carolina Department of Natural Resources
Matt Elliott	Georgia Department of Natural Resources
Steve Godley	Cardno Entrix
Jeff Goessling	Auburn University
Craig Guyer	Auburn University
Sharon Hermann	Auburn University
Matt Hinderliter	U.S. Fish and Wildlife Service
Jen Howze	Joseph W. Jones Ecological Research Center
John Jensen	Georgia Department of Natural Resources
Keri Landry	Louisiana Natural Heritage Program
Jessica McGuire	Georgia Department of Natural Resources
Clint Moore	USGS; University of Georgia
Brett Moule	South Carolina Department of Natural Resources
Bryan Nuse	University of Georgia
Lora Smith	Joseph W. Jones Ecological Research Center
Rachael Sulkers	Environmental Services, Inc.
Mark Thornton	Fort Benning - Conservation Branch
Ben Wigley	National Council for Air and Stream Improvement, Inc.
Facilitators	
Vern Herr	Group Solutions
Adam R. Saslow	Group Solutions

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