

Drought Management Plans of States in the Southeastern United States: A Comprehensive Evaluation

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Abstract

While the Southeast is often considered to be a region of abundant rainfall and humidity, severe droughts over the last two decades have raised awareness of the importance of proper management strategies at the state level. Both population growth and regional warming in the coming decades is expected to both intensify and prolong the duration of droughts in the area. Without effective state planning, this will increase both the economic and human cost of this natural hazard. This study presents a systematic means of critically analyzing the comprehensiveness of a state's drought plan, for each state in the Southeast (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia). The state drought plans were evaluated utilizing a three-tiered system, according to the comprehensiveness and the level of detail of specific guidelines presented in the Colorado Drought Mitigation and Response Plan. There were 4 sections included in the analysis (Elements of Drought Management Plan, Emergency Response, Public Education and Relations, and Water Supply Augmentation) that represent strategies during the pre-drought, during-drought, and post-drought periods. The results of the study were highly varied, as some states in the Southeast had comprehensive plans, while others did not have an official state drought plan. However, the areas for improvement for each state can be seen through the quantity and quality of subcategories included in each section. This methodology is a significant first step in communicating the need for organized and comprehensive state drought planning across the Southeast in order to mitigate both modern and future drought impacts.

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Chapter 1: Introduction

The Southeastern United States (hereafter, “the Southeast”) is a region with high annual rainfall, classified predominantly within the humid-subtropical zone of the Köppen Climate Classification Scale (Beck et al. 2018). This frequent rainfall primarily comes from convective flows of warm, humid air from the Gulf of Mexico with cool, dry air from the northern United States and the Rocky Mountains (Earth at Home 2022; Allmon et al 2010). Despite this exchange, the Southeast has nonetheless experienced intense drought in recent decades that have tested the preparation and mitigation abilities of each state (Luo and Wood 2007). Recent heat waves and drier-than-average dry seasons have brought more public attention to the many challenges that result from drought, as well as the degree to which states and communities are prepared to overcome them (Wang et al. 2010). Drought is not a new phenomenon to the Southeast however, as indicated through several proxy indicators such as tree-ring data (Wilhite and Hayes 1998)

Tree-ring data is often used to provide additional historical context of the climate variability and drought sensitivity of a region (Herweijer et al. 2007). Tree-ring studies conducted in the Apalachicola-Chattahoochee-Flint (ACF) River Basin reports that extended drought was a reoccurring phenomenon from 1665-1900 throughout much of the Southeast (Pederson et al. 2012). This study additionally reveals that the 20th century, the period that is typically used as a standard in policy making, was wetter in comparison to previous ones, being unrepresentative of the true potential that droughts can have in the area. The early 21st century (2000-2020) has seen a resurgence of intense droughts that have affected the Southeast, with a total of 10 droughts that have caused over a billion dollars in damage occurring throughout the region during this time range (Table 1).

Table 1. “Billion-Dollar Droughts” that have affected the states of the Southeast from 2000-2020 (Smith 2020). Data obtained by isolating the billion-dollar droughts for all 11 states in the Southeast and including each distinct billion-dollar drought events across the time range.

Name of Drought	Begin Date	End Date	Total CPI-Adjusted Cost (Billions of Dollars)
Western/Central/Southeast Drought/Heat Wave (Spring-Fall 2000)	3/1/2000	11/30/2000	8.895
U.S. Drought (Spring-Fall 2002)	3/1/2002	11/30/2002	15.3108
Midwest Drought (Spring-Summer 2005)	3/1/2005	8/31/2005	2.3303
Midwest/Plains/Southeast Drought (Spring-Summer 2006)	3/1/2006	8/31/2006	9.1166
Western/Eastern Drought/Heat Wave (Summer-Fall 2007)	6/1/2007	11/30/2007	5.272
U.S. Drought (2008)	1/1/2008	12/31/2008	10.024
Southwest/Great Plains Drought (2009)	1/1/2009	12/31/2009	4.9585
Southern Plains/Southwest Drought and Heat Wave (Spring-Summer 2011)	3/1/2011	8/31/2011	16.392
U.S. Drought/Heat Wave (2012)	1/1/2012	12/31/2012	39.905
West/Northeast/Southeast Drought (2016)	1/1/2016	12/31/2016	4.3734

According to the Fourth National Climate Assessment, the Southeastern region of the United States includes the states: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia, as shown in Figure 1 (Carter et al. 2018). This designation is also recognized and supported by the U. S. Department of Agriculture Southeast Climate Hub boundaries (Lackstrom 2022).

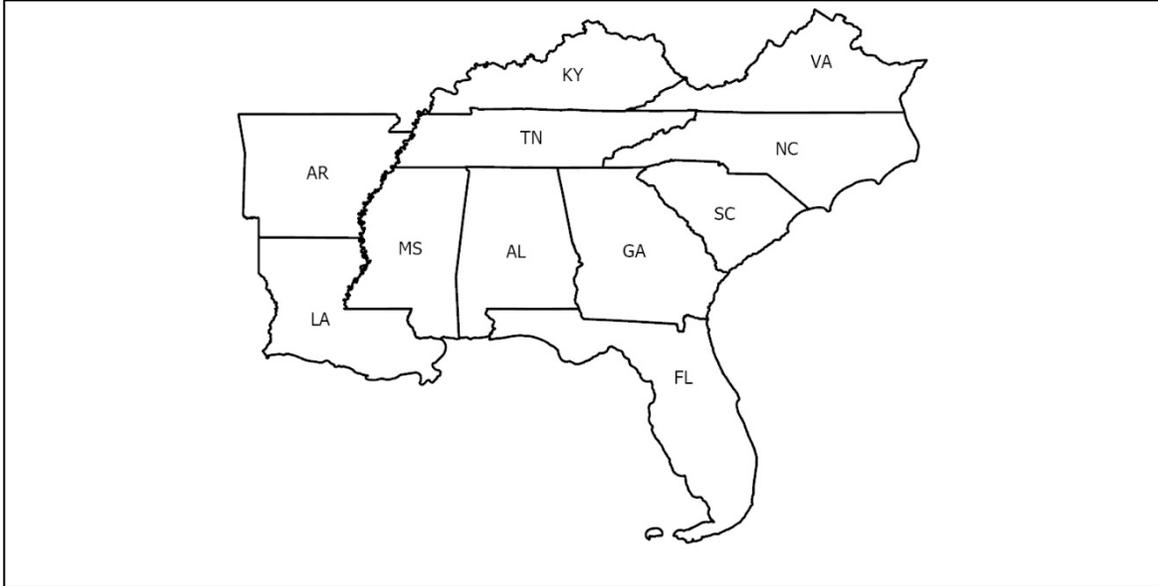


Figure 1: The Study Area, which includes Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia (Carter et al. 2018). State data obtained and modified from United States Census Bureau (USCB) TIGER.

This study will analyze and compare the drought management policies of the Southeastern states and score them according to established standards. Despite being a relatively water-rich region, the Southeast is becoming increasingly vulnerable to drought intensification, due to factors such as increased human water consumption associated with a growing population and climate change (Wada et al. 2013). Persistent, unsustainable water withdrawal practices as well as significant interstate conflict over water supplies also serve to undermine regional water supply and effective drought policy (Engström et al. 2021). To adequately mitigate these magnifying factors and other drought impacts, state drought plans must be both comprehensive and detailed in their approach. The primary research objectives to be addressed in this study are:

- 1) Does the state have an official drought management plan?
- 2) Does the state drought management plan contain the four sections of evaluation (elements of a drought management plan, emergency response, public education and relations, and water supply augmentation)? What sections are sources of strength or weakness?
- 3) How do the state drought management plans compare in terms of comprehensiveness and level of detail across the Southeast?
- 4) Is the state drought management plan a mitigation plan that focuses on reducing the impacts of a drought before onset, or a response plan that focuses on the during-drought period or post-drought period? Is there balance between the approaches?
- 5) How does the score for each state drought management plan compare to their state water management policies?

As each state has different physical and demographic characteristics, the results of each state drought plan analysis will be unique but comparable to one another when standardized. This can help in determining recommendations for drought plan improvement, and productive comparison and cooperation between states.

Chapter 2: Literature Review of Drought

To understand drought and its effect on the Southeast, the background must be split into four categories: drought as a concept, impacts of drought, drought planning, and state water use.

Drought as a Concept

Droughts are a natural climatic process that are loosely defined as a temporary terrestrial dry spell with below average precipitation for a given locality, over a period of months to years (Dai 2011). Droughts have been a constant factor in societal evolution through shaping and collapsing ancient civilizations, influencing war, intensifying famine, and more (Peterson and Haug 2005). The unique characteristics of drought categorize it as a *chronic* natural hazard. Chronic natural hazards are defined by being events of lengthy, complex durations, with unpredictable intensity and onsets (Tobin et al. 2011). The other designation of natural hazards are *acute* natural hazards, that occur suddenly and do not persist for as long as chronic hazards. Examples of acute natural hazards include hurricanes, tornadoes, and earthquakes.

With such a broad definition and rich historical prominence, a drought can be described based on its categorical impact, outlined with the establishment of the National Drought Mitigation Center (NDMC) in 1995. The NDMC organized drought into four distinct categories based on Wilhite and Glantz (1985), with an individual drought able to be defined into one or more categories depending on the drought's overall influence.

The four categories of drought suggested by the authors were meteorological, agricultural, hydrological, and socioeconomic. As drought is a varied phenomenon, the ability to specify areas that a drought impacts enables more effective management and mitigation. Wilhite

and Glantz (1985) defined meteorologic drought from a precipitation perspective, comparing rainfall (or lack thereof) with local averages over an extended period. Agricultural drought considers these factors as well as evapotranspiration levels, soil moisture, and crop failure. Hydrological drought focuses on groundwater and surface water supply levels, while socioeconomic drought focuses mainly on the human and financial effects that droughts have, connecting water demand with community vulnerability.

While these categories are still used, Crausbay et al. (2017) proposed an additional drought category: ecological drought, that has since been adopted by the NDMC (NDMC 2023). Proposed due to society's increasing struggle with the damaging droughts of the 21st century, this designation focuses on how drought affects the local ecosystem. This category of drought is particularly important to the Southeast, as it is an area of extreme biodiversity and host to various endangered species and drought-prone, insular-habitats (Cartwright and Wolfe 2016). One of the more costly forms of drought is "flash drought," which has a more sudden onset followed by rapid intensification. These typically occur when standard characteristics of drought develop (such as lower than average rainfall over an extended period) in addition to external exacerbating forces such as above-normal evaporative demands (Otkin et al. 2018).

Dai (2011) demonstrated how drought would be affected by global warming and served as a basis for research by Crausbay et al. (2017). Dai (2011) builds upon the categories of drought laid out by Wilhite and Glantz (1985), taking note of many indices that can be used to quantify the severity of each of the categories. The research objective proposed in Dai (2011) was to determine how warming climate changes would exacerbate drought, and the findings reflected that global aridity would increase accordingly with the rise in temperature. An important point raised by Dai (2011) was the connection between drought and the La Niña

phenomenon. La Niña is the cooling phase of El Niño Southern Oscillation (ENSO) and is represented by a pattern of cooling surface water in the eastern Pacific (Philander 1985; McPhaden 2002). La Niña influences the weather and climate in the tropical Atlantic and Pacific around the Americas, and typically causes the Southeast to experience increased atmospheric dryness and a decrease in precipitation. (McPhaden 2002). In addition to La Niña, Dai (2011) suggests that the Atlantic Multidecadal Oscillation (AMO) is responsible for causing prolonged droughts over the Southeast. The AMO is a multidecadal variation in Sea Surface Temperature (SST) that is associated with lower rainfall over the United States (Knight et al. 2006).

There are over a hundred indices that have been proposed or developed worldwide for the purpose of quantifying and categorizing drought intensity (Zargar et al. 2011). The variety in indices reflects the variety in impact that a drought can have. Examples of widely used indices include the Palmer Drought Severity Index (PDSI), Drought Area Index (DAI), Crop Moisture Index (CMI), Standard Precipitation Index (SPI) and the Standard Precipitation Evapotranspiration Index (SPEI) (Ndayiragije and Li 2022; Vicente-Serrano et al. 2010; Palmer 1968; Alley 1984; Bhalme and Mooley 1980).

Dai (2013) detailed the connections between global warming and drought using a combination of the self-calibrated Palmer Drought Severity Index (sc_PDSI) and the Penman-Monteith equation. The PDSI is a regional drought-monitoring method that calculates the intensity, onset, and end of a drought and has been used widely for the past 50 years, displacing qualitative historical records with measurements and data (Alley 1984). The Penman-Monteith equation uses a multitude of different, relevant climatic variables to measure evapotranspiration rates (Zotarelli et al. 2010). Using these methods Dai (2013) validated and reproduced models of both ENSO on drought over land and the observed global mean aridity trend from 1923 to 2010.

This supported the earlier conclusions of Dai (2011) that climate change will intensify and prolong drought in several vulnerable areas, including the Southeast.

There are many factors of drought that have amplified in the Southeast. For example, the Southeast has experienced significant regional warming in recent decades. The Third National Climate Assessment determined that temperature in the Southeast has increased by an average of 2°F in total from 1970 to the present, with further increases being likely (Carter et al. 2014). Furthermore, McNulty et al. (2015) demonstrates that temperature models show annual mean temperature increases across the Southeast for all future time periods and emission scenarios, with additional increases in hot days and a decrease in extremely cold days, a result shared by the Fourth National Climate Assessment (Hayhoe et al. 2018). With rising temperatures, both the prevalence and severity of droughts is forecasted to increase accordingly (Ingram and Malamud-Roam 2013). This assertion is supported by the recently published Keellings and Engström (2019) that involved the spatial analysis of Southeastern CMIP5 models to conclude that much of the Southeast will face prolonged drought in the coming century, specifically during the cooler seasons.

Impacts of Drought

Fu et al. (2013) described drought as the most complex, frequent, and economically costly natural hazard in North America, and the one that affects the most people. Despite the various categorical designations and potential future impacts, droughts are often not the focal point of natural hazard management policy. This is likely because as a chronic hazard, droughts do not typically cause as much direct, immediate human loss as acute natural hazards, and it is

difficult to determine their exact onset and conclusion. Tannehill (1947) wrote extensively on the gradual, deceptive beginnings of droughts over half a century ago in which drought was described as a “creeping phenomenon.” Despite this historical attention, the Southeast as a region has only begun to proactively prepare for these disasters at the state level recently, with the first state drought plan in the region (Virginia Drought Assessment and Response Plan) being developed in 2003 (NDMC 2023).

The severity of a drought’s impact results from the interchange between a natural event (temporal precipitation deficiencies stemming from natural climatic variability) and the societal demand placed on water and other natural resources by human-use systems (Wilhite et al. 2007). Impacts of drought can directly reduce cropland, rangeland, and forest productivity, increase wildfire occurrence, diminish water availability, kill livestock and wildlife, deteriorate wildlife and fish habitats, and cause other negative effects (Fu et al. 2013). The indirect impacts of drought are substantial as well, as drought can cause reduction in crop productivity that can bring significant economic impacts in terms of reduced income and government tax revenues, increased prices of food and food businesses, and increased budgets for disaster relief programs (Fu et al. 2013; Wilhite et al. 2007). Table 2 displays several additional drought impacts across a variety of sectors identified by Tsakiris (2016).

The Centers for Disease Control and Prevention (CDC) recognizes many immediate and long-term health impacts associated with drought, including shortages of drinking water, poor quality drinking water, impacts on air quality, sanitation, hygiene, food and nutrition, as well as increases in infectious, chronic, and animal-transmitted diseases that are symptoms of the physical effects that drought has on an affected region (CDC 2020).

Table 2. Examples of Impacts across three sectors: Economic, Social, and Environmental.
Data obtained from Tsakiris (2016).

Economic Impacts
1. Economic damage to agricultural production (crop reduction, damage in cultivations, epidemic, plants diseases)
2. Economic damage to forest production (decrease of forest growth, woods fires, trees diseases)
3. Economic damage to foremilk products and beef (reduction of pasture productivity, forced reduction of stock-farm, closing or reduction of public farm for pasture, increase of thefts, pasture fires)
4. Economic damage to fishing (damage to river habitat and fishes caused by reduced flows)
5. Economic loss to industries connected with agricultural production (food industries, industries producing fertilizing, etc.)
6. Economic damage to industries struck by hydroelectric energy reduction
7. Unemployment caused by production decrease
8. Economic damage to reduced navigability of streams, rivers and canals
9. Damage to tourism sector due to the reduced water availability in water supply and/or water bodies
10. Economic loss to entertaining
11. Economic damage to producers and tradesmen of amusing equipments
12. Pressure on financial institutions (more risks in lending, capitals decrease etc.)
13. Loss in public and local management revenue (because of reduction of taxes and taxes for hunting or fishing license, etc.)
14. Income reduction for water firms due to reduced water delivery
15. Additional costs deriving from integrative water resources use
16. Costs in emergency measures to improve resources and decrease demands (additional costs for water transport and removal, costs of advertising to reduce water use, etc.)
Environmental Impacts
1. Lack of feed and drinking water
2. Increase of salt concentration (in streams, underground layers, irrigated areas)
3. Loss in natural and artificial (fish, landscapes, etc.)
4. Damages to river life (flora, fauna)
5. Damage to air quality (for example polluting dust)
6. Damage to landscape quality (soil erosion, dust, reduced vegetation coverage etc.)
Social Impacts
1. Inconveniences due to water system rationing
2. Risks for health connected with increase of pollution concentration and discontinuous water system
3. Impacts on way of living (unemployment, reduced saving capability, difficulty in personal care, reuse of water at home, street and cars washing prohibition, doubt on future, decrease of fest and amusing, loss of property)
4. Inequity in drought impacts and mitigation measures distribution
5. Risks on public security due to more frequent fires (forests, pasture)
6. Abandonment of activities and emigration (in extreme cases)

To further compound the threat of drought, the Southeast has experienced population growth in the past two decades, with several states recording growth of over 10% between 2010 and 2020 (Table 3). This increases the demand for water, as a growing population requires an increasing supply of potable, usable water for personal use, agriculture, and manufacturing (Arsiso et al. 2017). This increase in consumptive water use is particularly risky in the Southeast, as much of the water that is available is obtained from small, rainfed reservoirs with storage capacities that can no longer adequately provide for modern populations (Gavrilles 2010). Consumptive use is water that has been diminishingly withdrawn from supplies for public, agricultural, or industrial use (Falkenmark and Lannerstad 2005; Schaffer 2008).

This dynamic affects an area's water security. Water security occurs when a region's population has access to safe and affordable water that can be utilized for all biologic, domestic, or professional uses, while water scarcity occurs when these conditions are not met (Rijsberman 2006). Drought can increase water scarcity throughout the during-drought and post-drought period and is one of its most direct impacts. (Pedro-Monzonís et al. 2015). Despite frequent rainfall in the Southeast, severe droughts readily facilitate water scarcity even in regions with abundant water resources (Ahopelto et al. 2019).

In the Southeast, access to drinking water can become impeded during times of drought, as the overreliance of acquiring drinking water from a store potentially serves as a vulnerability, if products become unavailable (D'Odorico et al. 2010). In areas of high population growth such as the Southeast, this issue increases in severity as drought forces increased competition for water resources among consumers, agriculture, and industry (Postel 2005; Veetil and Mishra 2020; Devineni et al. 2015).

Table 3. Population changes from 2010-2020 in the southeast (United States Census Bureau, 2020)

State	Total Population (2010)	Total Population (2020)	Percent Change (%)
Alabama	4,779,736	5,024,279	+5.1
Arkansas	2,915,918	3,011,524	+3.3
Florida	18,801,310	21,538,187	+14.6
Georgia	9,687,653	10,711,908	+10.6
Kentucky	4,339,367	4,505,836	+3.8
Louisiana	4,533,372	4,657,757	+2.7
Mississippi	2,967,297	2,961,279	-0.2
North Carolina	9,535,483	10,439,388	+9.5
South Carolina	4,625,364	5,118,425	+10.7
Tennessee	6,346,105	6,910,840	+8.9
Virginia	8,001,024	8,631,393	+7.9

Manuel (2008) chronicled the 2006-2008 Southeastern drought, and the strain imposed on both urban and rural populations. Manuel (2008) gives several examples of how states in the Southeast had difficulty in lowering water use while impacted by drought. For example, the Birmingham Water Works issued fines to tens of thousands of Birmingham, Alabama, residents who went over a drought-influenced monthly allocated water limit in June 2007. Additionally, significantly lowered water levels forced regional power companies such as the Tennessee Valley Authority (TVA) and Duke Energy in North Carolina to reorganize their energy infrastructure by reducing electricity generation from hydropower and substituting with fossil fuels (Manuel 2008). On October 20 of 2007, Georgia declared a state of emergency as the water supplies of many cities throughout the state had decreased to less than 70 days (Campana et al. 2012).

Agricultural drought also has a significant impact in the Southeast, as agriculture is the region's primary industry. Corn in particular, is a major crop across the Southeast, that struggles during times of drought as it is a water intensive crop (Konrad and Knox 2017). The impacts of drought upon the agriculture industry cannot be understated, with many states recording industry losses in the hundreds of millions of bushels and dollars during years afflicted by drought. For example, during the flash drought of 2016, Gordon County, Georgia harvested only 129,000 bushels of corn, which was a reduction of 71% from the five-year average yield of 434,000 from 2011-2015. The total bushels harvested in 2016 was valued at \$501,000, which was 19% of 2011-2015's yearly average value of \$2,525,000 (Konrad and Knox 2017). During another severe drought in 2007, the agricultural industry for the state of Georgia as a whole experienced crop losses valued at \$339 million (Earth at Home 2022; Allmon et al 2010).

Craig et al. (2019) shows the effect that factors like the severity of drought and the mismanagement of drought response have on public perception in the Southeast. This was the first study that focused exclusively on the Southeast to evaluate the impact of actual drought conditions on individual perceptions about water security. Craig et al. (2019) found that Southeastern populations that had been subjected to the droughts of the early 21st Century were more wary of the phenomenon when compared to residents of areas that had not faced severe drought. Additionally, while natural hazards are often destructive to entire communities or regions, their impact is not always homogenous. Certain demographics and populations of people are at a greater risk from natural hazards than others due to a wide swath of factors that form social vulnerabilities (Cutter et al. 2009). To reflect the diverse impacts of drought, variables that can be used to determine the social vulnerability of a population in drought can be organized in categories. Iglesias et al. (2009) identifies these categories as natural components,

economic capacity, human and civic resources, and agricultural innovation. Specific proxy variables across these categories include agricultural water use (%), area salinized by irrigation (ha), GDP, population below poverty line, population density, and more (Iglesias et al. 2009).

The present and future implications of drought risk in the Southeast is described well by Apurv and Cai (2021). In this paper, the researchers recognize recent advancements in drought mitigation of the Southeast but warn of the escalating intensity of drought in the coming decades. Some of the magnifying factors raised by Apurv and Cai (2021) are vulnerabilities in both soil moisture and streamflow, which typically have a severe deficit during times of drought. These issues were compounded with the impact on water supply and agriculture in the Southeast United States brought upon by increasing water demand due to the growing population, limited storage capacity (such as reservoirs), and the fact that agriculture in the region is primarily rainfed (Apurv and Cai 2021). This overreliance on rainfall is what causes initial meteorological drought to be particularly devastating, and directly influences the onset of different categories of drought and various impacts.

Drought Planning

State drought planning is a relatively recent method in reducing drought impacts, with the earliest state drought plan on record with the NDMC being the Delaware Drought Index, implemented in 1982 (NDMC 2023). With the costs associated with natural hazards increasing in recent decades (due in part to population growth, regional warming, and other factors), Congress launched the Disaster Mitigation Act (DMA) in 2000, that sought to distribute mitigation funds more effectively to states that had proactive hazard mitigation plans (Berke et al. 2012). While

not focused exclusively on drought, the establishment of the DMA represents an evolution in natural hazard policy that was a departure from the general practices of exclusive emergency response towards more multifaceted risk management (Wilhite et al. 2000)

As a natural hazard, it is not possible to wholly prevent drought, especially in areas prone to atmospheric dryness or climate change. However, steps can be taken to prepare for drought onset, and mitigate the impacts that it has on a community. A first step is to develop or adopt comprehensive drought plans for use at the state level. Of the 50 United States, 45 of them have at least one official drought plan (Wickham et al. 2019; NDMC 2023). Alaska, Arkansas, Louisiana, Mississippi, and Wisconsin do not currently have state drought plans (NDMC 2023). As there is no standard or federally mandated quality control to manage the efficacy of a state's official drought plans, the strength of the state's drought plans are subject to vary (Wilhite et al. 2000). This variance in monitoring and planning has contributed to some states being disproportionately damaged by drought (Ford and Labosier 2017). With the threat of more frequent and severe drought continually increasing in the Southeast, it is imperative to verify whether the plans of southeastern states are comprehensive and sufficiently detailed to effectively reduce the impacts of drought.

A drought plan is a singular product, while drought planning is an ongoing, multifaceted process of research and improvement that involves coordinating and involving stakeholders; defining goals and objectives; assessing water supply and demand conditions; generating alternatives; defining evaluation criteria and alternatives; implementing, testing, evaluating, and redefining the drought plan. (Shepherd 1998; Wilhite 1991). Some of the roadblocks in proper state drought planning involve differences in perspective and cooperation between scientists and policymakers, barriers for effective communication between these parties and the public,

financial challenges, and more (Wilhite 1991). This is compounded by drought being a chronic natural hazard, that divides proper impact mitigation methods into three stages: pre-drought, during drought, and post-drought (Rossi et al. 2007). Even in cases where states formulate a drought plan, they may not fully address the many different types and stages of the hazard or take local and demographic characteristics into account. This situation is visualized well by “The Hydro-Illogical Cycle” that reveals the breakdown in the organization and efficiency in management throughout the progression of a drought crisis (Figure 2).

In several cases of drought planning, the approach to drought does not consider the “pre-” and “post-” drought stages of the emergency, instead focusing only on the “during-drought” phase (Wilhite 2012). This method may be effective in the short term, but long-term mitigation of impacts can only be significant if all aspects of a drought are considered. A mitigation plan focuses on the pre-drought phase, proactively incorporating policy and strategy to minimize drought impacts before the onset of the hazard (Wickham et al. 2019). A response plan focuses on the during-drought and post-drought phases, reactively implementing policy and methods for controlling drought impacts throughout and following the event (Wickham et al. 2019). Many state drought management plans are titled as “mitigation and response plans” but have not properly achieved this comprehensive design (Finnessey et al. 2016; Wilhite 2020).

To better facilitate the development of multifaceted “mitigation and response” planning at the state level, Wilhite (1991) defined a “Ten Step Drought Planning Process”. This led to the development of dozens of state plans in the years that followed, but many were still primarily reactive instead of proactive (Wilhite et al. 2000). Wilhite et al. (2000) recognized this issue and developed a revised “Ten Step Drought Planning Process” that incorporates strategies in designing plans to accommodate meteorological, hydrological, agricultural, socioeconomic, and

ecological factors both during and in-between emergency drought events, while avoiding social and political pitfalls (Figure 3). Many of the steps involve increasing public awareness of the threat of drought through educational programs and promoting dialogue between stakeholders and policymakers on developments and decisions.

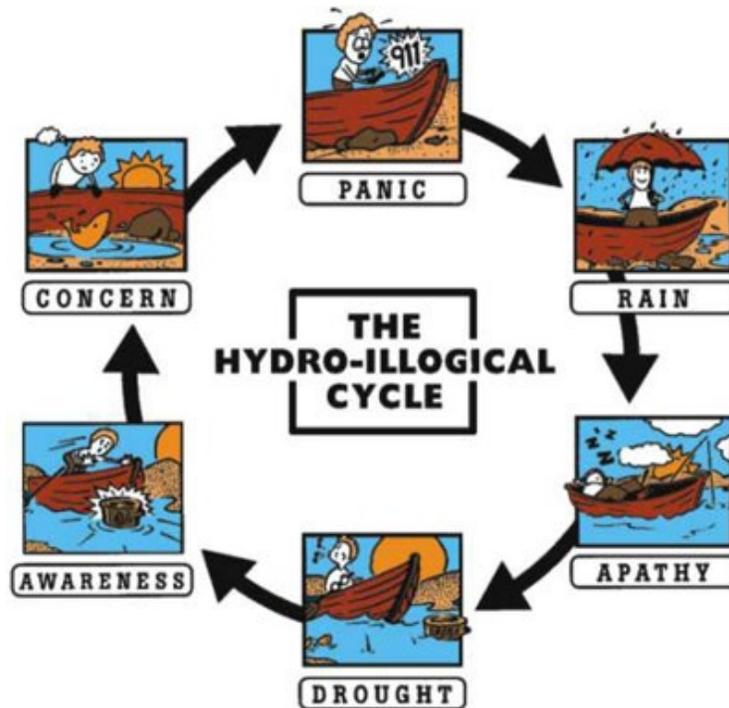


Figure 2: The Hydro-Illogical Cycle system of drought reaction and management (Wilhite, 2012).

Step 1	Appoint a drought task force
Step 2	State the purpose and objectives of the drought preparedness plan
Step 3	Seek stakeholder participation and resolve conflict
Step 4	Inventory resources and identify groups at risk
Step 5	Prepare/write the drought preparedness plan
Step 6	Identify research needs and fill institutional gaps
Step 7	Integrate science and policy
Step 8	Publicize the drought preparedness plan and build public awareness
Step 9	Develop education programs
Step 10	Evaluate and revise drought preparedness plan

Figure 3: Ten Step Drought Planning Process to streamline drought management planning at the state level (Wilhite et al. 2005).

Another issue with drought planning for most states is not that they do not have a drought plan, but that the plan is not comprehensive enough to properly mitigate the impacts of a drought, especially in accordance with regional warming. Berke et al. (2012) found that most hazard mitigation plans that incorporate drought are low-to-moderate in terms of their plan quality. With no federal standard, evaluating current state drought plans to determine how the quality of a plan compares against contemporary standards is a primary step in assessing improvement in risk management, and reducing the impacts of drought on the economy, natural world, and human lives (Fu et al. 2013).

State Water Use

Water policy has developed and evolved over the course of American history, compensating for rapid population growth, economic expansion, and urban development (Deason et al 2001). However, climate change is a phenomenon that state water policies have struggled to account for in recent decades (Cayan et al 2010). With the risk of continued regional warming in many areas of the country such as the Southeast, drought can begin to noticeably impact water supply systems (Hess et al. 2016).

Each state in the Southeast utilizes their water supply for different reasons and have separate priorities in terms of asset distribution (Table 4). In many cases, this leads to conflict when interstate water sources are impacted by drought. Alabama, Florida, and Georgia have often come into conflict over the shared water supply sources of the Alabama-Coosa-Tallapoosa (ACT) and Apalachicola-Chattahoochee-Flint (ACF) River Basins, resulting in frequent state level lawsuits (Jordan 2001). In years of drought, the balance between the interests of the three states have become increasingly strained, as consequences are heightened while drought impact mitigation is not always efficient. Matt Kales, a program manager of the Upper Chattahoochee River Keeper, claimed: “The drought caught us with our pants down” in response to an intense drought that affected the three states in 2000 (Libaw 2000). Mississippi and Tennessee have also been brought into conflict with one another over shared water resources. In 2021, Mississippi unsuccessfully sued Tennessee over presumed excessive groundwater withdrawal of the Middle Claiborne Aquifer, with the case having to be decided by the Supreme Court (Schweitzer 2021).

Table 4. The Primary Water Use of each state in the Southeast. Obtained from Dieter et al. 2015).

State	Primary Water Use
Alabama	Thermoelectric Power
Arkansas	Irrigation
Florida	Thermoelectric Power
Georgia	Public Supply
Kentucky	Thermoelectric Power
Louisiana	Thermoelectric Power
Mississippi	Irrigation
North Carolina	Thermoelectric Power
South Carolina	Thermoelectric Power
Tennessee	Thermoelectric Power
Virginia	Thermoelectric Power

All forms of drought have a significant effect on a state’s water use, with both direct and indirect effects on both surface and groundwater supplies (Campos and de Carvalho Studart 2008; Jinno 1995). Surface water supplies are impacted initially through meteorological drought, with a reduction in average rainfall. As a drought continues, meteorological drought develops into hydrological drought and surface water supply is reduced through lower streamflow and inflow rates to storages (NDMC 2023). Additional drought-related stressors for surface water

supply include elevated withdrawal due to increased demand, as well as unsustainable land management practices (Bhaga et al. 2020).

Groundwater supplies also suffer from initial meteorological drought, where reduced rainfall results in decreased infiltration and groundwater recharge (NDMC, 2023). When this recharge rate is lower than a region's average rate over an extended period, a subcategory of drought known as groundwater drought forms (Van Lanen and Peters 2000). As surface water supply decreases as a drought persists in an area, groundwater supplies also typically decrease. This is due to water being withdrawn from wells at a heightened rate to account for reduced availability of surface water, forming a damaging positive feedback loop over the duration of a drought (Konikow 2013).

Every state in the Southeast uses both consumptive surface and groundwater at the state level (Dieter et al. 2015). While surface water is the predominant consumptive water source across the region, groundwater plays a critical role in supplementing this supply, stabilizing the regional economy and social infrastructure, and supporting ecological vitality (Karki et al. 2021). This variation in water supply and use represents the necessity of integrated risk management, with the comparison of official drought plans to water policy being a crucial step in achieving this (Buurman et al. 2016; Wilhite et al. 2000).

Chapter 3: Data and Research Methods

The official drought management plans for the Southeastern states can be found online at the National Drought Mitigation Center (Table 5). This study analyzes, interprets, and compares official state drought plans similar to methods used by Moore et al. (2021) study of individual city plans for drought management. The benchmark standards for analysis were identified from the Colorado Drought Mitigation and Response Plan (2013). The Colorado Drought Mitigation and Response Plan (2013) was selected as it serves as a well-respected and influential model plan that has since been utilized by the American Planning Association, with over a dozen federal agencies listed as contributors or interest groups (CWCB 2013; Schwab et al. 2013).

The categories and subcategories adopted from the Colorado Drought Mitigation and Response Plan come from its “Adaptive Capacity - Mitigation and Response Actions” section and consist of the major categories utilized by Schwab et al. (2013): I: Elements of a Drought Management Plan, II: Emergency Response, III: Public Education and Response, and IV: Water Supply Augmentation. Certain subcategories were adjusted to ensure fair evaluation across the study area. Within Section IV: Water Supply Augmentation, the subcategories “Deepen wells” and “Reactivate abandoned wells” were merged as well as “Build emergency dams” and “Reactivate abandoned dams” due to significant interstate variation in both water supply access and usage practices in the Southeast (Maupin and Barber 2000; Sanchez et al. 2018). “Employ desalination of brackish groundwater” and “Cloud seeding” were not included in the study as well, due to inequalities in the presence and capabilities of these practices across the Southeast (Ahdab et al. 2018; Khatri et al. 2021)

Table 5. Official State Drought Plans, including official title and year of publication.

State	Title of Plan	Year
Alabama	Alabama Drought Management Plan	2018
Arkansas	No Plan on Record	N/A
Florida	Florida Drought Action Plan	2007
Georgia	The Drought Management Rules	2015
Kentucky	Kentucky Drought Mitigation and Response Plan	2008
Louisiana	No Plan on Record	N/A
Mississippi	No Plan on Record	N/A
North Carolina	North Carolina Drought Assessment and Response Plan	2020
South Carolina	South Carolina Drought Response Plan	2017
Tennessee	Tennessee Drought Management Plan	2010
Virginia	Virginia Drought Assessment and Response Plan	2003

Introduction to Southeastern Drought Policy at the State Level

Of the 11 states that make up the Southeast, 8 of them have official state drought policies (Table 5). Most of the state drought plans in the Southeast appear to take inspiration from the “Ten Step Drought Planning Process” (Figure 3). The three most common characteristics of a state drought plan across the Southeast are: 1) dividing a state into smaller management regions, typically based on counties or hydrologic characteristics, 2) assigning authority over drought preparation and response strategies (through the creation of a designated drought management task force) and 3) developing a drought severity classification system based off several relevant indices. The presence of these components are outlined in Table 6. An expanded discussion of each state’s drought plan is provided in Appendix A.

Table 6. Common characteristics of state drought plans in the Southeast. Most plans contain at least 2 of the 3 categories listed.

State	Drought Management Regions	Task Force	Indices Based Drought Classification
AL	X	X	X
FL	X	X	
GA	X	X	
KY	X	X	X
NC		X	X
SC	X	X	X
TN		X	
VA	X	X	X

Scorecard Methods

The Southeastern states will be evaluated based on the components of drought plan comprehensiveness and detail outlined in the Colorado Drought Mitigation and Response Plan. Similar to Moore et al. (2021), a scorecard system was utilized to evaluate the contents of the state drought plans into quantitative scores. Sections and subcategories that were used for the evaluation can be found in Table 7.

The first step in evaluation was determining if the state has an official drought plan. Next, the plan was analyzed based on a three-step approach, with different tiers evaluating different aspects of a drought plan. The Tier 1 evaluation tested for the presence of the major categories (Sections I-IV) or equivalents in a binary scoring format, where the presence of the category grants a score of 1, while the absence garners a score of 0. With 4 major categories, this means that the maximum score that a state drought plan can receive for Tier 1 is 4 points (Table 7). This tier identifies the broad areas of focus within a drought plan, as well as the degree of organization and accessibility to the general population.

Table 7: List of all major categories and subcategories used to evaluate the comprehensiveness of each state drought plan. Sections I-IV are adopted and modified from the Colorado Drought Mitigation and Response Plan (2013).

I: Elements of a Drought Management Plan
Establish drought response principles, objectives, and priorities
Establish authority & process for declaring a drought emergency
Develop drought stages, trigger points, and response targets X
Prepare ordinances on drought measures
Evaluate historical drought impacts
Monitor drought indicators (e.g., snow pack, stream flow, etc.)
Monitor water quality
Track public perception and effectiveness of drought measures
Improve accuracy of runoff and water supply forecasts
II: Emergency Response
Declare a drought emergency
Establish water hauling programs
Restrict/prohibit new taps
Identify state and federal assistance
Provide emergency water to domestic well users
Import water by truck/train
Establish clear municipal water restrictions during times of drought
Enforce water restrictions
III: Public Education and Relations
Establish a public advisory committee during drought planning and/or drought response efforts
Develop Drought Public Education Campaign with long-term and short-term strategies
Educate provider/municipal staff on how to save water
Provide instructional resources to business on developing an office/business specific drought mitigation and response plan
Provide acoustical meters to assist customers in identifying leaks
IV: Water Supply Augmentation
Establish drought reserves
Draw from drought reserves
Increase groundwater pumping
Deepen or rehabilitate existing wells and/or reactivate abandoned wells
Develop supplemental groundwater/conjunctive use
Flush existing wells to develop maximum flow rates
Blend primary supply with water of lesser quality to increase supplies
Increase use of recycled water
Utilize ditch water or treated effluent for irrigating landscaping/parks
Build new facilities to enhance diversion or divert new supplies
Lower reservoir intake structures
Use reservoir dead storage
Acquire additional storage
Build emergency dams or reactivate abandoned dams

The Tier 2 evaluation analyzes the specific subcategories within each major category and also utilizes a binary scoring system (if subcategory is present, score = 1, if absent, score = 0) to analyze the more specific areas of focus for each plan and the depth of their comprehensiveness. With a total of 36 subcategories spread across the 4 major categories, this means that a state can score a maximum of 36 points for the Tier 2 evaluation.

The Tier 3 evaluation was used to assess the degree of detail for each subcategory identified in the Tier 2 evaluation. Analyzing the content and format of components in a plan characterizes this methodology as an internal plan quality evaluation (Berke and Godschalk 2009). Each subcategory can receive a Tier 3 evaluation Quality Score between 0-3. If a subcategory is not identified within the plan, then the subcategory earns a Tier 3 score of 0 or “Absent.” The degree of detail for each level of Quality Score is determined through the presence of three criteria for each subcategory. The more criteria that a subcategory meets, the more detailed the incorporation of the subcategory is to the plan, and the higher its resultant Quality Score will be. The three criteria used to evaluate the subcategory quality were Inclusion, Implementation, and Applications/Examples. These three criteria were developed based on the Berke and Godschalk (2009) “Internal Characteristics of Plan Quality That Serve as Evaluation Criteria” benchmarks “Implementation” and “Internal consistency” that were relevant to internal plan quality evaluations at the state level.

The Inclusion criterion is scored based on if a Tier 2 identified subcategory is present in the plan. If present, then the subcategory gets credit for the Inclusion criterion, and can be further analyzed to see if the subcategory contains ample detail to qualify for the Implementation and Applications/Examples criteria. If a subcategory does not have enough detail to get credit for either of these criteria, then the subcategory is given a Tier 3 score of 1.

The Implementation criterion is scored based on how well a subcategory is described and equipped to carry out the purpose of a drought plan. A subcategory earns credit in this section by including supporting detail beyond a simple description. If a plan implements a subcategory and provides additional information on attributes such as timelines, relevant organizations, specific restrictions/allowances, or public impact, then the subcategory is given credit for the Implementation criterion. For example, if gauging the quality of the subcategory “Monitor water quality” (a subcategory within Section I: Elements of a Drought Management Plan) a plan would receive credit for this criterion by including information on details such as specific strategies stages of the selected monitoring method or what organizations would be responsible in facilitating this.

The Applications/Example criterion is scored based on if a subcategory identifies specific applications or examples within its description. This is used to determine if a subcategory is realistic in its purpose and potential, streamlines mitigation and response actions, and increases awareness of the extent of a subcategory. If a state plan contained the subcategory “Establish drought reserves” (a subcategory within Section IV: Water Supply Augmentation) and described it by identifying specific drought reserves within the state, or characteristics such as their capacity or what their primary use (e.g., emergency public supply, industrial use, etc.) during drought would be, then the subcategory would get credit for this criterion.

If a subcategory is included within the state drought plan, it earns a minimum Quality Score of 1, “Poor” (as it is credited solely for the Inclusion criterion). If a subcategory contains credit for only one of either the Implementation or Applications/Examples criteria, it earns a Quality Score of 2, “Intermediate.” If the subcategory earns credit for all criteria, it earns a Quality Score of 3, or “Detailed.” This matrix is represented in Table 8.

In summary, the standards for the evaluation included 4 major sections and 36 subcategories that were analyzed with explanations. The maximum possible score a state could achieve is as follows: Tier 1 = 4, Tier 2 = 36, and Tier 3 = 108.

Table 8. Standards for the Tier 3 Quality Evaluation. Explanation of scoring method described in text.

Quality Score	Score Description	Score Title	Inclusion	Implementation	Applications/Examples
0	Component is not present in the plan	Absent			
1	Component is present in the plan. No additional details are provided on proper implementation or examples	Poor	X		
2	Component is present in the plan. Additional description is provided in the form of either detailed implementation methods or specific applications/examples, but not both	Intermediate	X		X
3	Component is present in the plan. Additional description is provided in the form of both detailed implementation methods and applications/examples	Detailed	X	X	X

A hypothetical example of a completed state scorecard can be seen in Table 9. The model in question represents “State X” and received a score of 1 for the Tier 1 evaluation, as it contained at least one subcategory within the section. “State X” received a Tier 2 comprehensiveness score of 6 out of a possible 9, as it contained 6 of the subcategories of

analysis, but missed “Establish authority and process for declaring a drought emergency,” “Develop drought stages, trigger points, and response targets X,” and “Evaluate historical drought impacts.” The hypothetical plan was given a 13 out of a possible 27 for the Tier 3 quality score due to the variety in Inclusion, Implementation, and Applications/Examples for each subcategory, in adherence to the standards in Table 8. The state had 3 subcategories that received a Quality Score of 0 (Absent), 2 subcategories that received a score of 1 (Poor), 1 subcategory that received a quality score of 2 (Intermediate), and 3 subcategories that received the maximum Quality Score of 3 (Detailed).

Table 9: Hypothetical example of how Section I: Elements of a Drought Management Plan would be evaluated for Example State X through the Tier-based scorecard system.

Example State X	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
I: Elements of a Drought Management Plan	1		
Establish drought response principles, objectives, and priorities		1	2
Establish authority & process for declaring a drought emergency		0	0
Develop drought stages, trigger points, and response targets X		0	0
Prepare ordinances on drought measures		1	3
Evaluate historical drought impacts		0	0
Monitor drought indicators (e.g., snow pack, stream flow, etc.)		1	1
Monitor water quality		1	1
Track public perception and effectiveness of drought measures		1	3
Improve accuracy of runoff and water supply forecasts		1	3
Total	1	6	13

Drought Plan Strategic Focus Methods

In order to determine whether the plans are primarily a mitigation plan or a response plan, the four sections must be divided into two categories: “pre-drought mitigation” and “post/during-drought emergency response.” As the post-drought phase encompasses recovery only after the impacts of a drought have lessened, it is categorized as a response rather than preemptive preparation (EPA 2018). To classify a plan’s status as either a pre-drought focused plan or a post/during-drought focused plan, the sections must be analyzed at the section level. Wilhite et al. 2000 identified public education and outreach procedures and preparatory drought planning to be elements of proactive mitigation. This defined Section I and Section III as the mitigation variables. Section II and Section IV were classified as response variables as emergency response and overcoming loss of water supply occur within and following the drought duration (Wilhite et al. 2000).

The Tier 2 score is utilized as the comprehensiveness of the subcategories indicates the direction of the strategy. The sum of a state’s Tier 2 Section I and III scores, out of their total possible score defines the mitigation variable. The sum of a state’s Tier 2 Section II and Section IV values out of their total possible score defines the response variable. The quotient of the mitigation variable divided by the response variable results in a Focus of Strategy ratio (hereafter referred to as FoS ratio). This process is represented through the equation below.

$$\left(\frac{\text{Section I Score}}{\text{Section I Total Possible}} + \frac{\text{Section III Score}}{\text{Section III Total Possible}} \right) = \frac{\text{mitigation variable}}{\left(\frac{\text{Section II Score}}{\text{Section II Total Possible}} + \frac{\text{Section IV Score}}{\text{Section IV Total Possible}} \right)} = \text{FoS score}$$

A plan with an FoS ratio greater than 1 is a plan that focuses on pre-drought strategies, while a plan with an FoS ratio less than 1 is a plan that is focused on post/during drought

strategies. The closer the FoS ratio's value is to 1, the more balanced the drought plan is between strategies. The results of the FoS ratio enable quick reference between different state drought impact reduction methods and assist in determining how balanced of an approach a state drought plan has, with a score of 1 representing a true "mitigation and response" plan.

Comparison to State Water Policy Methods

Effective water-use policy can complement drought management planning well, as both can reduce the impacts associated with drought. As water security is such an important feature for a growing society, all states in the Southeast have some degree of water planning, but there is not always accommodation for features such as population growth, climate change or drought (Musgrave 2022). To represent vulnerabilities in state water-use policy, the Alliance for Water Efficiency (AWE) published an updated "The Water Efficiency and Conservation State Scorecard: An Assessment of Laws and Policies" in 2017, following their 2012 report of the same name. This scorecard can be used to get an initial overview of the comprehensiveness and detail of state water policy and can be compared to results of the scorecards created from this study to better portray how prepared states in the Southeast are for future drought (AWE 2017). Grading for this scorecard is similar to the Tier 3 evaluation for this study, where a component of water sustainability is graded based on its inclusion in a plan and the degree of detail (AWE 2017). Due to this similarity in framework, grades received for the Water Efficiency and Conservation (WEC) scores can be compared to the Tier 3 evaluation for state drought planning to show how the state water policy may compare to the quality of the state drought plans.

The grading scale of the Water Efficiency and Conservation State Scorecard is structured where a state was given a letter grading depending on what range its score fell into. Though the Alliance for Water Efficiency sought to differentiate its grading format from a typical classroom scale, the score ranges can still be quantified through the relationship between a score range and the maximum possible points. This was calculated by determining what the percentage of the given grade ranges are, compared to the maximum possible points. (Table 10). These percentage ranges can be applied to the maximum possible Tier 3 score of 108 and rounded to the nearest whole percent to yield grade ranges reported in Table 10. The overall Tier 3 quality evaluation score for each state drought plan will be organized and scored according to this framework, for ease of comparison to the corresponding state water policy. Each section was also given a comparative score based on the same range calculations, to represent what sections may be areas of particular strength or weakness for the plans (Table 11). It must be noted that there are clear gaps in between grade ranges, and this is recognized by the Water Efficiency and Conservation State Scorecard, which instructs to round up or down depending on the proximity to the range cutoffs (AWE 2017).

Table 10. Scorecard for comparing the grades of state water use plans to state drought plans. Methods of calculating the grade percentage ranges are described in text. All water policy grade data obtained from the Alliance for Water Efficiency (2017).

Grade Range for State Water Policy	Letter Grade	Calculated Grade Percentage Range (%)	Calculated Grade Range for Tier 3 Drought Scores
67-75	A+	89.33-100.00	96-108
58-66	A	77.33-88.00	84-95
49-57	A-	65.33-76.00	71-82
40-48	B+	53.33-64.00	58-69
31-39	B	41.33-52.00	45-56
26-30	B-	34.67-40.00	37-43
21-25	C+	28.00-33.33	30-36
16-20	C	21.33-26.67	23-29
11-15	C-	14.67-20.00	16-22
6-10	D+	8.00-13.33	9-14
1-5	D	1.33-6.67	1-7

Table 11. Calculated letter grade ranges for each section of drought management. Grade ranges were calculated using the same multiplicative scale used in Table 10.

Letter Grade	Section I Grade Range	Section II Grade Range	Section III Grade Range	Section IV Grade Range
A+	24.12-27.00	21.44-24.00	13.40-15.00	37.52-42.00
A	20.88-23.76	18.56-21.12	11.60-13.20	32.48-36.96
A-	17.64-20.52	15.68-18.24	9.80-11.40	27.44-31.92
B+	14.4-17.28	12.80-15.36	8.00-9.60	22.40-26.88
B	11.16-14.04	9.92-12.48	6.20-7.80	17.36-21.84
B-	9.36-10.80	8.32-9.60	5.20-6.00	14.56-16.80
C+	7.56-9.00	6.72-8.00	4.20-5.00	11.76-14.00
C	5.76-7.20	5.12-6.40	3.20-4.00	8.96-11.20
C-	3.96-5.40	3.52-4.80	2.20-3.00	6.16-8.40
D+	2.16-3.60	1.92-3.20	1.20-2.00	3.36-5.60
D	0.36-1.8	0.32-1.60	0.20-1.00	0.56-2.80

Chapter 4: Results and Discussion

Alabama, Florida, Georgia, Kentucky, North Carolina, South Carolina, Tennessee, and Virginia have official state drought management plans on file with the NDMC (NDMC, 2023). Arkansas, Louisiana, and Mississippi received scores of 0 for each tier of evaluation, as they lacked official state drought plans. All scores for each tier, as well as overall scores are reported in Table 12. An expanded report of scores that includes breakdowns for sections I-IV is reported in Table 13.

The Tier 1 evaluation analyzed the main sections of a drought plan to determine its overall organization and framework. All states except for Alabama scored the maximum possible score of 4. Alabama did not earn credit for the Tier 1 evaluation for Section IV: Water Supply Augmentation. This is primarily due to the Alabama Drought Management Plan (2018) taking a “hands-off” approach in dictating exact terms and conditions for water supply management at the state level. Instead, the plan assigns responsibility of water supply augmentation to the Monitoring and Impact Group (MIG) as well as local level drought conservation plans (DCP), without detailing what steps these parties can take (ADECA 2018). The high Tier 1 scores for the states with a plan, except Alabama, indicate that these states are starting with a strong general framework for developing the rest of the plan (Table 12, Figure 4). State drought plans that scored on the Tier 1 evaluation for a section are eligible for further analysis through the Tier 2 and Tier 3 evaluations.

Tier 2 Evaluation Overview

The Tier 2 evaluation focused on what subcategories were included in each section, to gauge the specific focuses of each state drought plan and the depth of their comprehensiveness. For the overall Tier 2 evaluation, Kentucky, South Carolina, and Florida each scored above 50% (>18 out of 36), indicating that the broader, overarching framework of their plans (Tier 1), are supported with a comprehensive structure at the subcategory level (Tier 2) (Table 12, Figure 5). The remainder of the states with a plan scored below 50% (<18 out of 36) at the Tier 2 level, indicating that their plans provide less comprehensive structure and support at the subcategory level.

Both Kentucky and South Carolina had the most comprehensive plans and received the highest Tier 2 scores, each with a total of 25 subcategories. However, the distribution of these subcategories through each section is not uniform. The Kentucky Drought Mitigation and Response Plan (2008) contained every subcategory for Section I (9 out of 9), While the South Carolina Drought Response Plan (2017) was credited for 7 out of 9, as it did not include the subcategories “monitor water quality” or “track public perception and effectiveness of drought measures”.

For the Tier 2 Section II evaluation, both state plans included 6 of the 8 subcategories (Table 9). Neither state received credit for the “restrict/prohibit new taps” subcategory but differed in the remaining missing subcategory. For Kentucky, the missing subcategory was “import water by truck/train”, while South Carolina did not receive credit for the “establish clear municipal water restrictions during times of drought subcategory.”

Similar to the Section I results for these two states, The Kentucky Drought Mitigation and Response Plan (2008) contained every subcategory for Section III (5 out of 5), while the South Carolina Drought Response Plan (2017) missed two subcategories, earning a score of 3 out of 5 (Table 9). South Carolina did not include the subcategories “educate provider/municipal staff on how to save water” or “provide acoustical meters to assist customers in identifying leaks”.

South Carolina scored on 9 out of 14 of the subcategories for the Tier 2 Section IV evaluation, while Kentucky scored on 5 out of 14 (Table 9). Of these distributions, the two states shared many subcategories that were both credited and missed. Both states received credit on “establish drought reserves, draw from drought reserves, develop supplemental groundwater/conjunctive use, and acquire additional storage.” Shared subcategories that were missed between the two drought plans were “Blend primary supply with water of lesser quality to increase supplies, utilize ditch water or treated effluent for irrigating landscaping/parks, use reservoir dead storage, and build emergency dams or reactivate abandoned dams.” Subcategories that South Carolina exclusively included among the two states were “increase groundwater pumping, deepen or rehabilitate existing wells and/or reactivate abandoned wells, flush existing wells to develop maximum flow rates, build new facilities to enhance diversion or divert new supplies, and lower reservoir intake structures,” while Kentucky scored exclusively on “increase use of recycled water.”

Both Georgia and Virginia received the lowest Tier 2 evaluation, by only getting credit for 14 subcategories. For Section I, Georgia received credit for 5 out of 9 subcategories, while Virginia received credit for 6 of the 9 subcategories (Table 9). Both states received credit for the subcategories “Establish drought response principles, objectives, and priorities, establish

authority & process for declaring a drought emergency, develop drought stages, trigger points, and response targets X, prepare ordinances on drought measures, and monitor drought indicators (e.g., snow pack, stream flow, etc.).” Both states shared many missed subcategories as well, including “monitor water quality, track public perception and effectiveness of drought measures, and improve accuracy of runoff and water supply forecasts,” while Virginia exclusively included the subcategory “evaluate historical drought impacts.”

Georgia and Virginia both received credit for the same 4 out of 8 subcategories for the Tier 2 Section II evaluation (Table 9). These subcategories were “declare a drought emergency, identify state and federal assistance, establish clear municipal water restrictions during times of drought, and enforce water restrictions.” Subcategories that both states did not score on for Section II included “establish water hauling programs, restrict/prohibit new taps, provide emergency water to domestic well users, and import water by truck/train.”

Georgia received credit for 3 out of 5 subcategories for the Tier II Section III evaluation, while Virginia received credit for 2 out of 5 subcategories (Table 9). Among these scores, there was one subcategory that both states received credit for, “establish a public advisory committee during drought planning and/or drought response efforts” and one subcategory that both states missed “educate provider/municipal staff on how to save water.” Georgia scored exclusively on both “develop Drought Public Education Campaign with long-term and short-term strategies” and “provide acoustical meters to assist customers in identifying leaks.” Kentucky scored exclusively on a single subcategory “provide instructional resources to business on developing an office/business specific drought mitigation and response plan” (Table 9).

Georgia and Virginia both scored a 2 out of 14 for the Tier 2 Section IV evaluation (Table 9). However, they did not share any credited subcategories. Georgia exclusively

contained the subcategory “establish drought reserves” and “draw from drought reserves,” while Virginia exclusively contained “blend primary supply with water of lesser quality to increase supplies” and “increase use of recycled water.” Subcategories that were commonly missed between Georgia and Virginia in Section IV were “increase groundwater pumping, deepen or rehabilitate existing wells and/or reactivate abandoned wells, develop supplemental groundwater/conjunctive use, flush existing wells to develop maximum flow rates, utilize ditch water or treated effluent for irrigating landscaping/parks, build new facilities to enhance diversion or divert new supplies, lower reservoir intake structures, use reservoir dead storage, acquire additional storage, and build emergency dams or reactivate abandoned dams.”

Tier 3 Evaluation Overview

The Tier 3 evaluation used the standards outlined in Table 8 to inspect the detail of the subcategories of each plan's sections. South Carolina scored the highest for the Tier 3 evaluation, with a score of 58, with Kentucky scoring the second highest with a score of 56. These scores result in overall grades of B+ and B respectively, based on ranges in Table 10. For the Tier 3 Section 1 evaluation, South Carolina received a score of 20 out of 27, a section grade of A- based on the ranges in Table 12. This was a product of 6 of the 7 included subcategories receiving a Quality Score of 3 (Detailed) due to including adequate details on Inclusion, Implementation, and Applications/Examples. These subcategories included “establish authority & process for declaring a drought emergency, develop drought stages, trigger points, and response targets X, prepare ordinances on drought measures, evaluate historical drought impacts, and monitor drought indicators (e.g., snow pack, stream flow, etc.).” 1 of the 7 subcategories included in the plan, “establish drought response principles, objectives, and priorities,” was given a Quality

Score of 2 (Intermediate), as the section did not get credit for the Implementation criterion due to much of the plan assigning drought response principles to the South Carolina Drought Response Committee without detailing timelines or public impact.

South Carolina received a Tier 3 score of 13 out of 24 for Section II, a section grade of B+. Of the 6 subcategories identified by the Tier 2 evaluation, “enforce water restrictions” and “import water by truck/train” received a Quality Score of 1 (as they did not contain enough detail meet the criteria for Implementation and Applications/Examples), “declare a drought emergency” was given a Quality Score of 2, and “establish water hauling programs, identify state and federal assistance, and provide emergency water to domestic well users “ were given Quality Scores of 3.

South Carolina was given a Tier 3 score of 6 out of 15 for Section III, a section grade of B-. “Provide instructional resources to business on developing an office/business specific drought mitigation and response plan” was given a Quality Score of 1, as there were standards included in the plan to address this, but they did not include enough supporting detail to be credited for the Implementation or Applications/Examples criteria. “Develop Drought Public Education Campaign with long-term and short-term strategies” was given a Quality Score of 2. The drought public education campaign would be created by the South Carolina Emergency Management Division (earning credit for the Implementation criteria by assigning authority over this subcategory to a relevant organization organization), but this only occurs after the onset of a drought, and there are no applications or examples of content or purpose identified (subcategory did not get credit for the Applications/Examples criterion) (SCEMD 2019). The subcategory “establish a public advisory committee during drought planning and/or drought response efforts” was given a Quality Score of 3 for identifying the Drought Response Committee and providing

substantial supporting detail to meet both the Implementation and Applications/Examples criteria (SCEMD 2019).

South Carolina was given a Tier 3 score of 19 out of 42 for Section IV, a section grade of B. There was substantial variety in terms of the description of different subcategories. “Develop supplemental groundwater/conjunctive use” and “Flush existing wells to develop maximum flow rates” were given a Quality Score of 1, as they were included as sources of water supply augmentation in the plan, but there was no additional detail provided that could be counted for the Implementation and Applications/Examples criteria. The subcategories “increase groundwater pumping, deepen or rehabilitate existing wells and/or reactivate abandoned wells, build new facilities to enhance diversion or divert new supplies, and lower reservoir intake structures” were given Quality Scores of 2, as they were included in the plan and earned credit towards either the Implementation or Applications/Examples criteria. The subcategories “establish drought reserves, draw from drought reserves, and acquire additional storage” were given Quality Scores of 3. The plan adequately describes these subcategories, as the reservoirs under jurisdiction of the U.S. Army available as drought reserves, and gives examples of practices that can be used to gain additional storage, earning credit for the Implementation and Applications/Examples criteria to receive the maximum Quality Score for these subcategories (SCEMD 2019)

Tennessee scored the lowest for the Tier 3 evaluation, with a score of 32 out of 108, a C+. For the Section I Tier 3 evaluation, Tennessee was given a score of 14 out of 27, a section grade of B. A Quality Score of 1 was received for the subcategories “develop drought stages, trigger points, and response targets X” and “prepare ordinances on drought measures.” These subcategories were included as specific points in the plan but were not developed with adequate

detail to receive credit for the Implementation or Applications/Examples criteria. The subcategories “establish drought response principles, objectives, and priorities, establish authority & process for declaring a drought emergency, monitor water quality, and evaluate historical drought impacts” were given a Quality Score of 3, due to substantial description that received credit for the Implementation and Applications/Examples criteria.

Tennessee received a Tier 3 Section II evaluation score of 9 out of 24, a section grade of B-. The subcategories “establish water hauling programs” and “provide emergency water to domestic well users” were included in the plan and given Quality Scores of 1. A Quality Score of 2 was assigned to the subcategories “establish clear municipal water restrictions during times of drought” and “enforce water restrictions” as both subcategories earned credit for the Applications/Examples criterion due to discussion on examples of water restrictions and past impacts, but there is no qualifying information for the Implementation criterion present, such as specific metrics of trigger-points used for the restrictions (TDEC 2010). The subcategory “identify state and federal assistance” was given a Quality Score of 3, as there was adequate description to be credited for the Implementation and Applications/Examples subcategory.

Tennessee was given a Tier 3 Section III evaluation score of 5 out of 15, a section grade of C. The subcategories that were given a Quality Score of 1 were “develop Drought Public Education Campaign with long-term and short-term strategies” and “provide instructional resources to business on developing an office/business specific drought mitigation and response plan.” A Quality Score of 3 was given to the subcategory “establish a public advisory committee during drought planning and/or drought response efforts” for adequate description that met the criteria for Implementation and Applications/Examples.

The Tier 3 Section IV evaluation for Tennessee was given a score of 4 out of 42, a section grade of D+. The subcategories “Draw from drought reserves” and “develop supplemental groundwater/conjunctive use” received a Quality Score of 1. A quality Score of 2 was given to the subcategory “acquire additional storage,” as the plan outlines that new storage systems can be developed for specific water-use purposes (Implementation), but there are no examples given on any characteristics such as current storage supplies, possible additional storages, or methods on how these alternative or additional storages would be designated (Applications/Examples).

Although South Carolina and Kentucky had the highest Tier 3 scores, with each scoring above 50% (>54 out of 108) (Table 12, Figure 6), these scores indicate that the amount of supporting detail (Implementation and Applications/Examples) included in their plans provide only modest support for the broader framework and structure of the plans that were shown to be relatively comprehensive at the Tier 1 and Tier 2 levels. The remainder of the states with a plan scored below 50% (<54 out of 108) at the Tier 3 level, indicating that the amount of supporting detail provided in their plans may require substantial upgrades.

Average and maximum possible scores provide further evidence for the overall results for each tier and further contextualize the pattern of the Southeast having a strong Tier 1 general framework but weakening when evaluated according to the Tier 2 and Tier 3 standards (As they become less comprehensive and detailed the more specific the focus). Tier 1 had an average score of 2.82 out of 4, which means that the region scored above 50% (>2 out of 4) for Tier 1 and had a solid general framework. The average score for all states for Tier 2 was 13.45 out of 36. This is below 50% (<18 out of 36) and further indicates that the states need to strengthen their comprehensive structure at the subcategory level. The average Tier 3 score across the

Southeast was 29.82 out of 108, which is significantly below 50% (<54 out of 108) and provides further evidence that the Southeastern states require significant improvement in terms of detail.

Average scores are reported in Table 14 and represented graphically on Figures 7-9). The results of the evaluation of the 4 major categories and their subcategories are reported in Appendices B, C, D, E, and F.

Table 12: Comprehensive scorecard including the Tier 1, 2, and 3 scores for all 11 states in the study area. The maximum possible scores for each tier are as follows: Tier 1 = 4, Tier 2 = 36, Tier 3 = 108

State	Tier	Tier Scores	Total Combined Scores
Alabama	Tier 1	3	54
	Tier 2	16	
	Tier 3	35	
Arkansas	Tier 1	0	0
	Tier 2	0	
	Tier 3	0	
Florida	Tier 1	4	64
	Tier 2	20	
	Tier 3	40	
Georgia	Tier 1	4	51
	Tier 2	14	
	Tier 3	33	
Kentucky	Tier 1	4	85
	Tier 2	25	
	Tier 3	56	
Louisiana	Tier 1	0	0
	Tier 2	0	
	Tier 3	0	
Mississippi	Tier 1	0	0
	Tier 2	0	
	Tier 3	0	
North Carolina	Tier 1	4	57
	Tier 2	17	
	Tier 3	36	
South Carolina	Tier 1	4	87
	Tier 2	25	
	Tier 3	58	
Tennessee	Tier 1	4	53
	Tier 2	17	
	Tier 3	32	
Virginia	Tier 1	4	56
	Tier 2	14	
	Tier 3	38	

Table 13: Expanded version of results for Table 8 that shows all scores for sections I, II, III, and IV.

State	Tier	Section I	Section II	Section III	Section IV	Total
AL	Tier 1	1	1	1	0	3
	Tier 2	9	4	3	0	16
	Tier 3	20	8	7	0	35
AR	Tier 1	0	0	0	0	0
	Tier 2	0	0	0	0	0
	Tier 3	0	0	0	0	0
FL	Tier 1	1	1	1	1	4
	Tier 2	5	3	3	9	20
	Tier 3	12	6	7	15	40
GA	Tier 1	1	1	1	1	4
	Tier 2	5	4	3	2	14
	Tier 3	12	10	7	4	33
KY	Tier 1	1	1	1	1	4
	Tier 2	9	6	5	5	25
	Tier 3	26	13	10	7	56
LA	Tier 1	0	0	0	0	0
	Tier 2	0	0	0	0	0
	Tier 3	0	0	0	0	0
MS	Tier 1	0	0	0	0	0
	Tier 2	0	0	0	0	0
	Tier 3	0	0	0	0	0
NC	Tier 1	1	1	1	1	4
	Tier 2	8	3	3	3	17
	Tier 3	20	7	6	3	36
SC	Tier 1	1	1	1	1	4
	Tier 2	7	6	3	9	25
	Tier 3	20	13	6	19	58
TN	Tier 1	1	1	1	1	4
	Tier 2	6	5	3	3	17
	Tier 3	14	9	5	4	32
VA	Tier 1	1	1	1	1	4
	Tier 2	6	4	2	2	14
	Tier 3	18	12	4	4	38

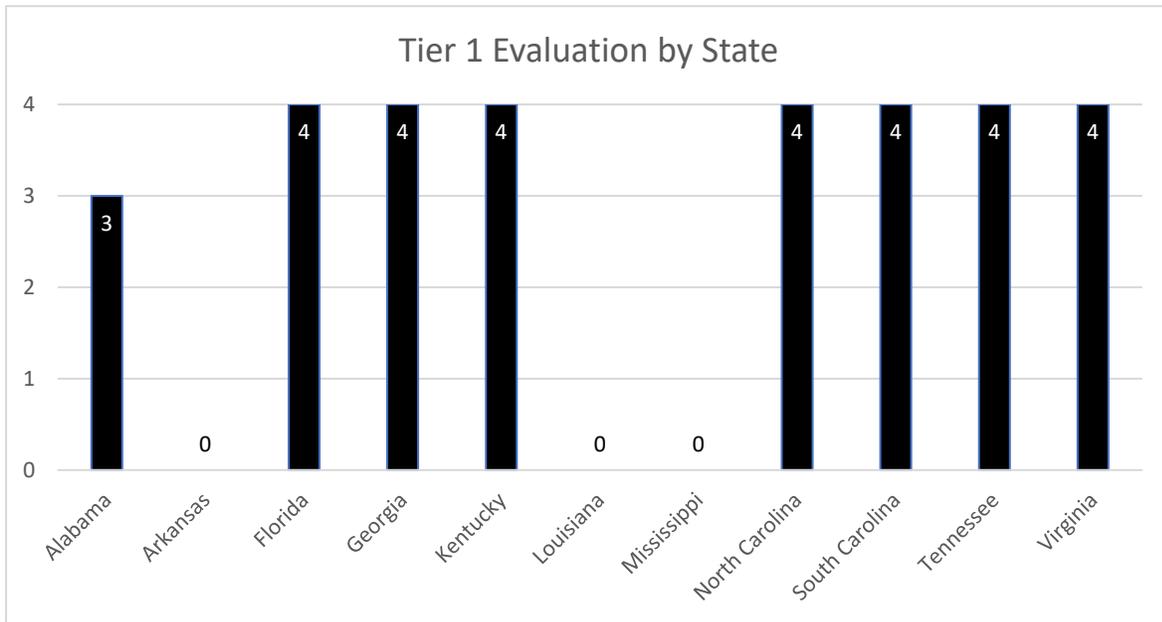


Figure 4: Tier 1 evaluation scores for each state. Tier 1 has a maximum possible score of 4. Data represented from Table 12.

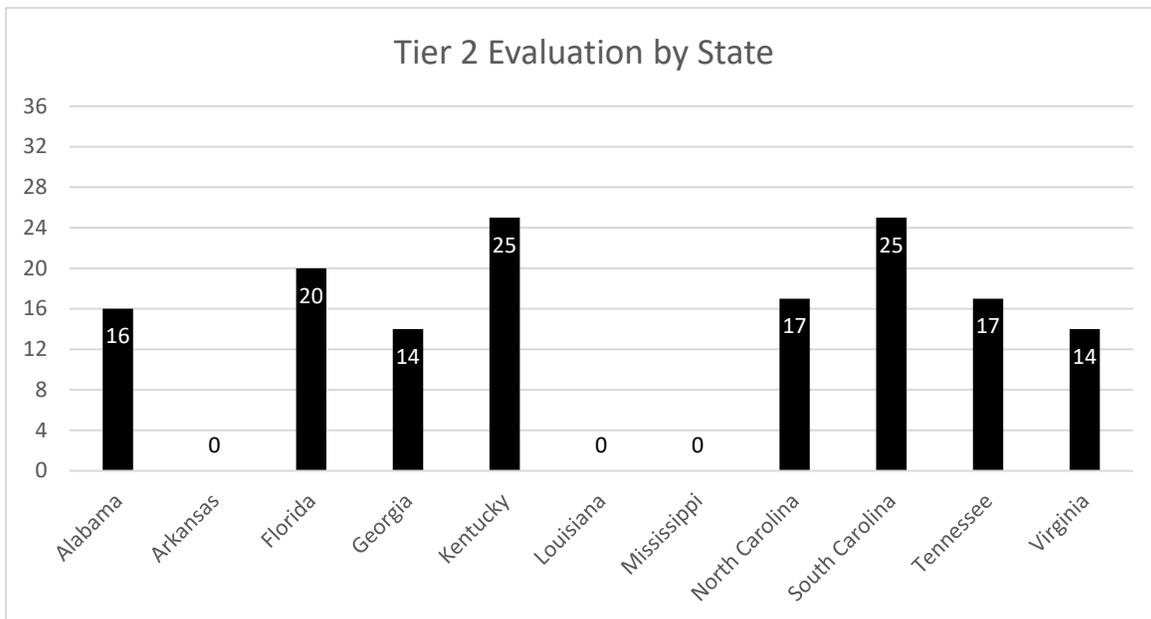


Figure 5: Tier 2 evaluation scores for each state. Tier 2 has a maximum possible score of 36. Data represented from Table 12.

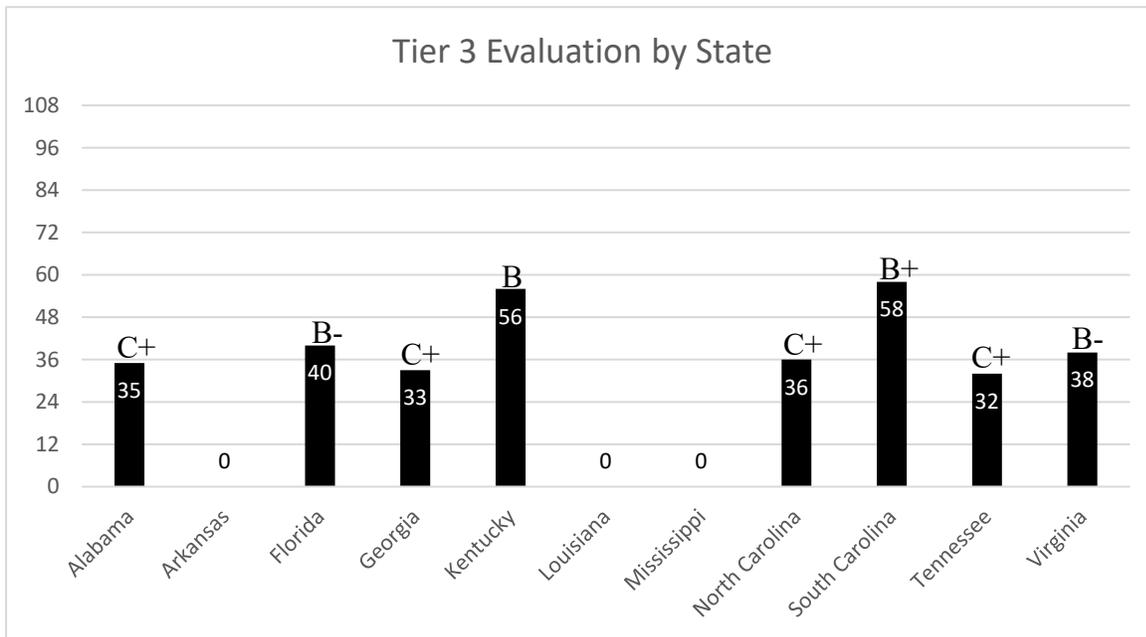


Figure 6: Tier 3 evaluation scores for each state. Tier 3 has a maximum possible score of 108. Data represented from Table 12. Letter grades calculated through methods in Table 10.

Table 14: Maximum possible and average points per tier per section for all 11 states in the study. Average scores were determined by adding up the scores of each relevant section and dividing by the number of states in the Southeast (11).

Section	Tier 1		Tier 2		Tier 3	
	Max Possible	Average	Max Possible	Average	Max Possible	Average
I: Elements of a Drought Management Plan	1	0.73	9	5.00	27	12.91
II: Emergency Response	1	0.73	8	3.18	24	7.09
III: Public Education and Relations	1	0.73	5	2.27	15	4.73
IV: Water Supply Augmentation	1	0.64	14	3.00	42	5.09
Total	4	2.82	36	13.45	108	29.82

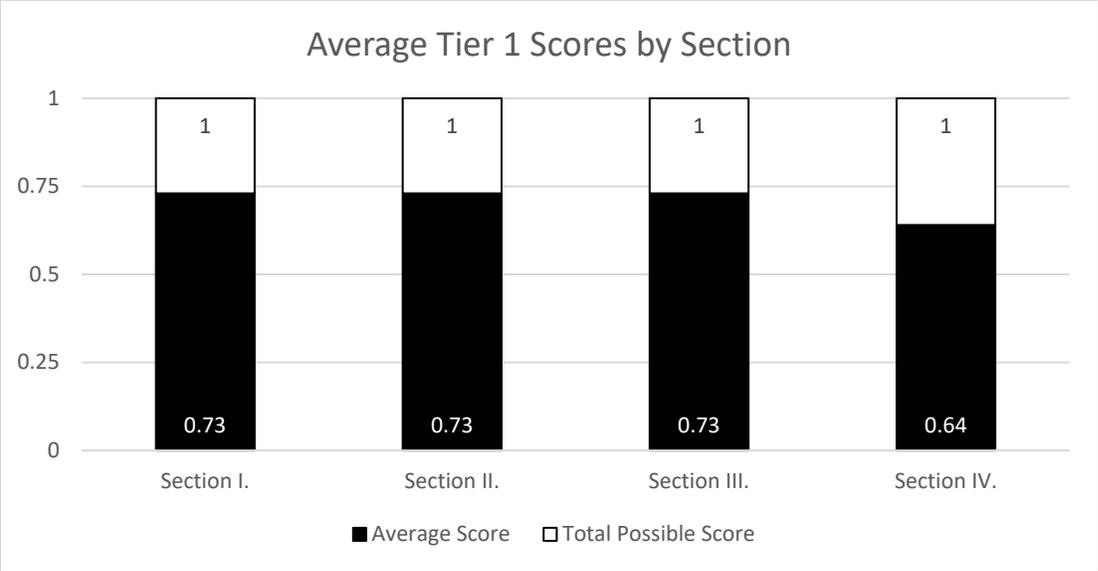


Figure 7: Average Tier 1 evaluation scores for each section. Black portion of the bar representative of the average score for Tier 1 for all 11 states in the study, with the remainder of the bar representing the maximum possible points per section. Data represented from Table 14.

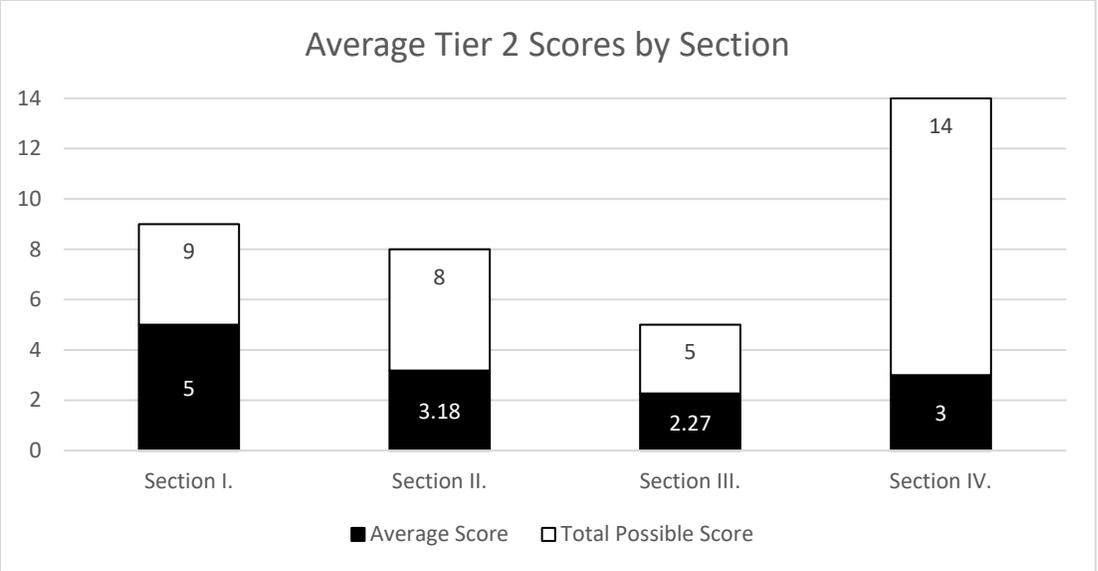


Figure 8: Average Tier 2 evaluation scores for each section. Black portion of the bar representative of the average score for Tier 2 for all 11 states in the study, with the remainder of the bar representing the maximum possible points per section. Data represented from Table 14.

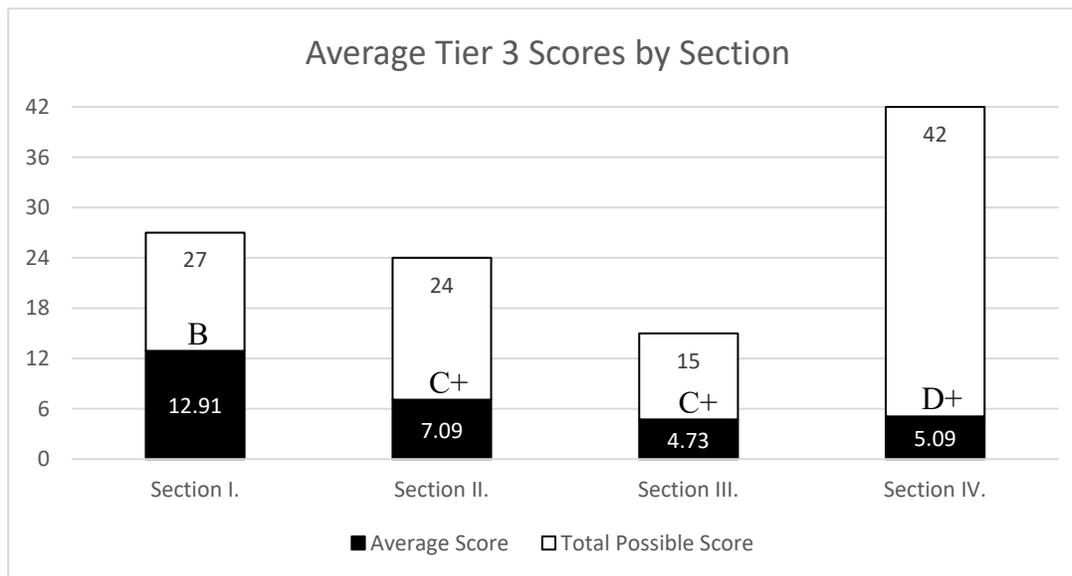


Figure 9: Average Tier 3 evaluation scores for each section. Black portion of the bar representative of the average score for Tier 3 for all 11 states in the study, with the remainder of the bar representing the maximum possible points per section. Data represented from Table 14. Letter grades calculated through methods in Table 10.

Section I: Elements of a Drought Management Plan

Section I scored the highest average overall score, as well as the highest score out of the maximum possible points for both Tier 2 and Tier 3. The Tier 2 and Tier 3 average scores were 5.00 and 12.91 for Tier 2 and Tier 3 respectively (Figures 8-9). Alabama and Kentucky both scored the maximum number of points for the Tier 2 evaluation, as each had 9 subcategories included (Figure 10). However, only Kentucky would score the highest for the Tier 3 evaluation, with a score of 26 (section grade of A+), scoring a 3 across all 9 subcategories except for “monitoring water quality,” which was given a Quality Score of 2 due to no qualifying information for the Applications/Examples criteria (Table 8, Figure 11).

Florida and Georgia scored the lowest on the Section I Tier 2 evaluation, each containing only 5 subcategories (Figure 10). These categories were not fully shared between the states, however. Both states contained the subcategories “establish drought response principles, objectives, and priorities” and “establish authority & process for declaring a drought emergency.” Florida scored exclusively on the subcategories “evaluate historical drought impacts, monitor water quality, and improve accuracy of runoff and water supply forecasts.” Georgia scored exclusively on the subcategories “develop drought stages, trigger points, and response targets X, prepare ordinances on drought measures, and monitor drought indicators (e.g., snow-pack, stream flow, etc.).” Neither state contained the subcategory “track public perception and effectiveness of drought measures.”

Florida and Georgia also tied for the lowest Tier 3 score for this section, both with a score of 12, a section grade of B (Figure 11), as several of the included subcategories were not explained in the plan with a high degree of detail. The subcategory that both states received a Quality Score of 3 for was “establish drought response principles, objectives, and priorities,” while the remainder of the subcategories differed significantly in terms of their associated detail.

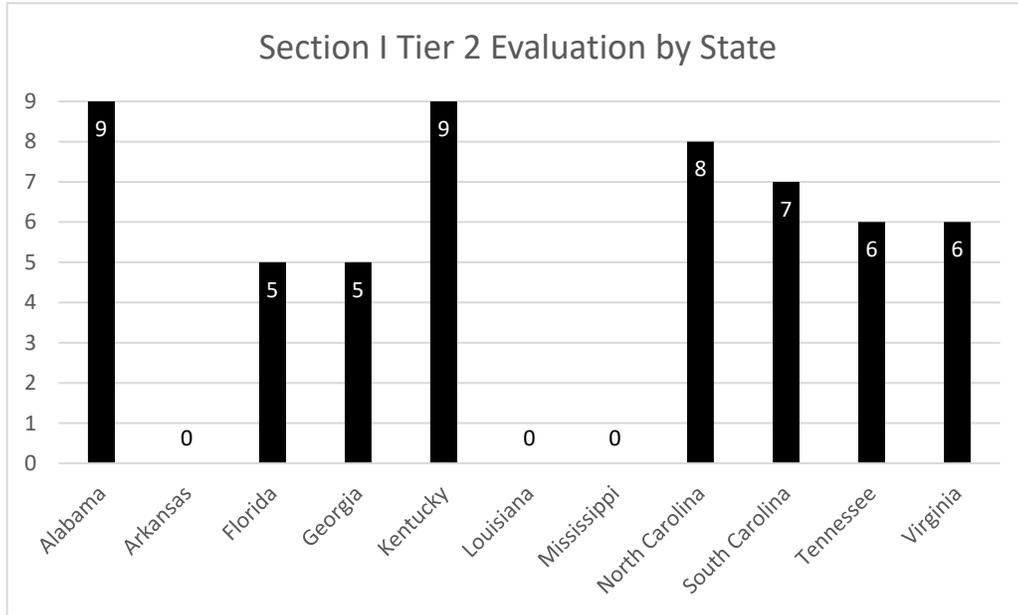


Figure 10: Scores for the Section I Tier 2 Evaluation. Scoring format is binary, with greater scores representing a greater inclusion of subcategories.

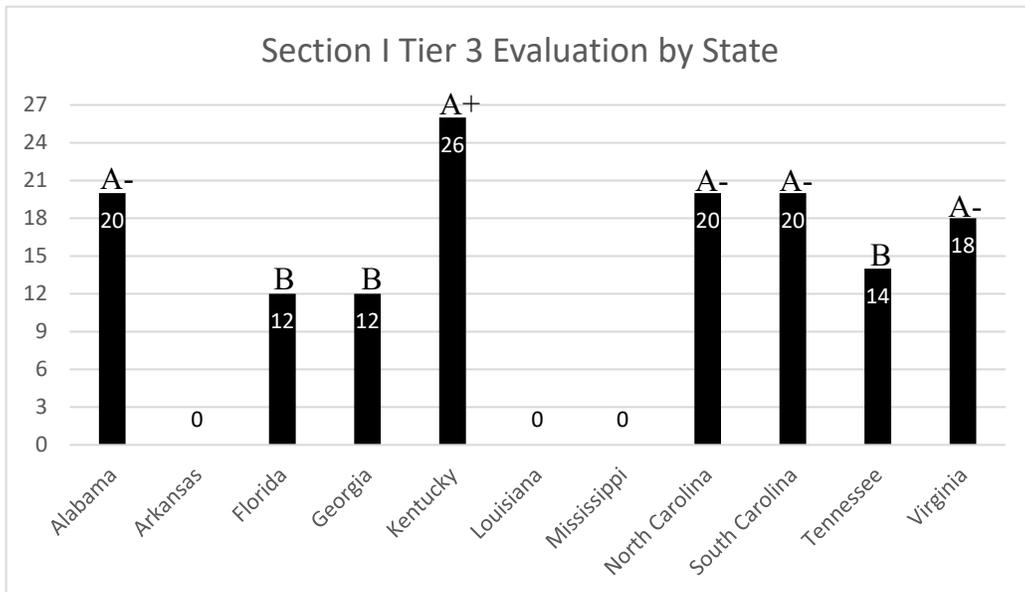


Figure 11: Scores for the Section I Tier 3 Evaluation. Scoring format is qualitative and based on standards outlined in Table 12. Higher scores represent more detailed implementation of subcategories.

Section II: Emergency Response

Kentucky and South Carolina scored the highest for the Tier 2 evaluation, containing 6 out of 8 subcategories. The similarities between the Tier 2 Section II scores for these states were covered in the Tier 2 Evaluation section of this study. One differentiation between the two state's Tier 2 Section II was that Kentucky exclusively contained the “establish clear municipal water restrictions during times of drought” subcategory while South Carolina exclusively contained the “import water by truck/train” subcategory.

Florida and North Carolina scored the lowest for the Section II Tier 2 evaluation, as both contained 3 out of 8 subcategories (Figure 12). For Florida, these subcategories were “identify state and federal assistance, establish clear municipal water restrictions during times of drought, enforce water restrictions.” For North Carolina, these subcategories were “declare a drought emergency, identify state and federal assistance, and enforce water restrictions.” The average score across all states for the Tier 2 evaluation of Section II was 3.18 out of 8 (Figure 8).

Kentucky and North Carolina also received the highest Tier 3 evaluations for this section, with Tier 3 scores of 13 out of 24, a section grade of B+. (Figure 13). Both states received a Quality Score of 3 for the subcategory “identify state and federal assistance” and lacked the subcategory “restriction/prohibition of new taps during a time of drought.” Aside from this, the quality varied for each subcategory. Furthermore, Kentucky received a Quality Score of 3 on the “declare a drought emergency” while South Carolina was given a Quality Score of 2. Kentucky also received a Quality Score of 2 while South Carolina was given a 3 for both “establish water hauling programs” and “provide emergency water to domestic well users.” Despite these differences, the two state's scores would balance out as Kentucky was given a Quality Score of 2 while South Carolina was given a 3 for the “enforce water restrictions” subcategory, while both

were given a Quality Score of 1 for their exclusively included categories, as both plans lacked the respective details to earn credit for the Implementation or Applications/Examples criteria for either subcategory.

Florida scored the lowest for the Tier 3 Section II evaluation, with a score of 6 out of 24, a section grade of C (Figure 13). Florida received a Quality Score of 1 for the subcategory “establish clear municipal water restrictions during times of drought” as it was included in the plan but did not contain enough detail to get credited for the Implementation or Applications/Examples criteria. A Quality Score of 2 was given for the “enforce water restrictions” subcategory, as the plan outlined good historical examples to gain credit for the Applications/Examples criterion but did not provide enough detail to be credited for the implementation criterion. A Quality Plan of 3 was given for the subcategory “identify state and federal assistance,” as adequate detail was given to provide credit for both criteria of quality evaluation. The average score across all states for the Tier 3 evaluation of Section II was 7.09 out of 24 (Figure 9).

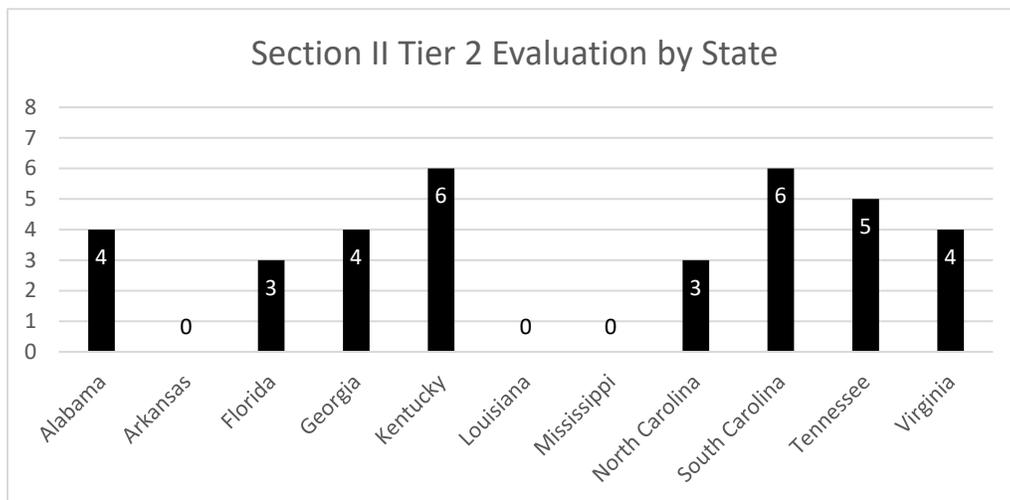


Figure 12: Scores for the Section II Tier 2 Evaluation. Scoring format is binary, with greater scores representing a greater inclusion of subcategories per section.

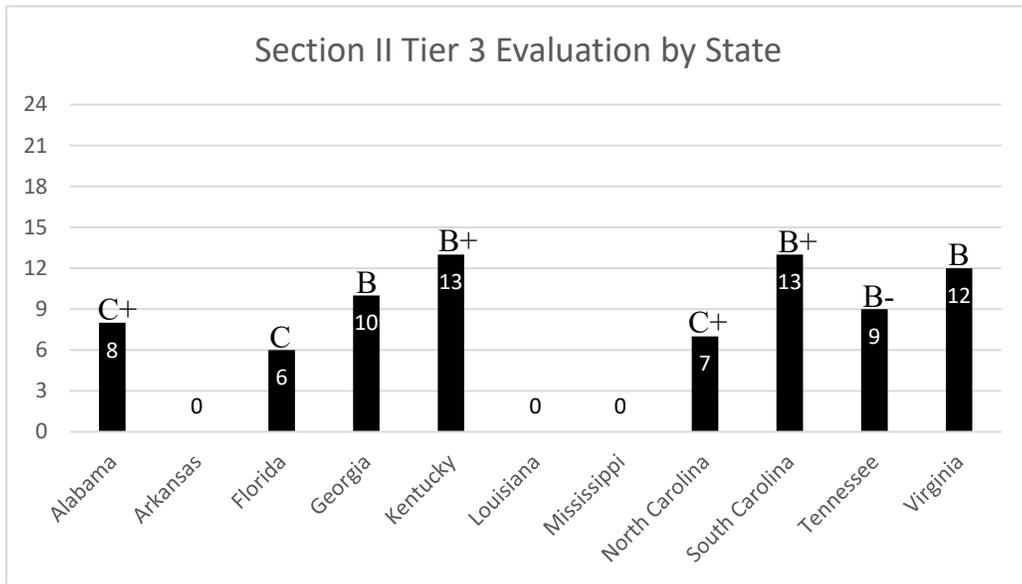


Figure 13: Scores for the Section II Tier 3 Evaluation. Scoring format is qualitative and based on standards outlined in Table 12. Higher scores represent more detailed implementation of subcategories.

Section III: Public Education and Relations

The highest scoring state for the Tier 2 Section III evaluation was Kentucky, with a Tier 2 score of 5, as it contained all 5 subcategories (Figure 14). Virginia received the lowest score for the Tier 2 Section II evaluation, by including 2 out of 5 subcategories. These subcategories were “establish a public advisory committee during drought planning and/or drought response efforts” and “provide instructional resources to business on developing an office/business specific drought mitigation and response plan.” This score could have been improved if Virginia included the subcategories “develop Drought Public Education Campaign with long-term and short-term strategies, educate provider/municipal staff on how to save water, and provide

acoustical meters to assist customers in identifying leaks” as Kentucky had. The average score across all states for the Tier 2 evaluation for Section III was 2.27 out of 5 (Figure 8).

Kentucky was also given the highest Tier 3 score for the section, 10 out of 15, a section grade of A- (Figure 15). The subcategories “educate provider/municipal staff on how to save water” and “provide instructional resources to business on developing an office/business specific drought mitigation and response plan” was given a Quality Score of 1, as neither subcategory contained enough detail to get credited for the Implementation or Applications/Examples criteria. A Quality Score of 2 was given to the subcategory “develop Drought Public Education Campaign with long-term and short-term strategies” as the plan includes many examples of how public education will be implied (Applications/Examples) but does not necessarily identify what long-term/short-term components of drought to educate the public on, with the focus appearing to primarily be response oriented (Implementation). A Quality Score of 3 was given to the subcategories “establish a public advisory committee during drought planning and/or drought response efforts” and “provide acoustical meters to assist customers in identifying leaks” as sufficient supporting detail was included to credit both the Implementation and Applications/Examples criteria.

Virginia also received the lowest Tier 3 score for Section III, with a score of 4 out of 15, a section grade of C (Figure 15). The breakdown of subcategory scoring involved “establish a public advisory committee during drought planning and/or drought response efforts” to receive a Quality Score of 3, and “provide instructional resources to business on developing an office/business specific drought mitigation and response plan” to receive a Quality Score of 1. These scores were earned based on whether they contained ample supporting detail on proper

implementation or applications/examples, or not. The average score across all states for the Tier 3 evaluation for Section III was an overall detail score of 4.73 out of 15 (Figure 9).

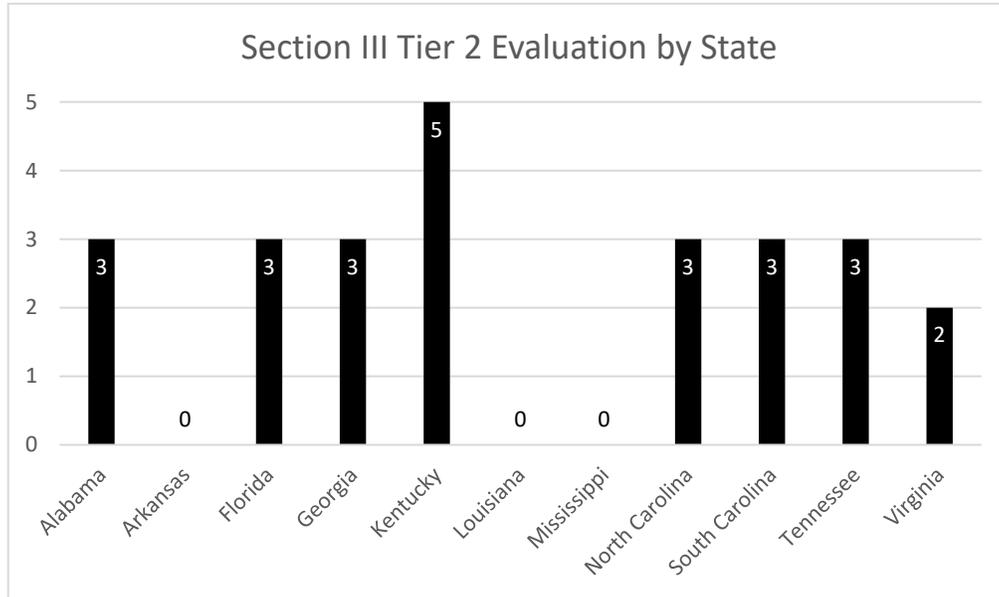


Figure 14: Scores for the Section III Tier 2 Evaluation. Scoring format is binary, with greater scores representing a greater inclusion of subcategories per section.

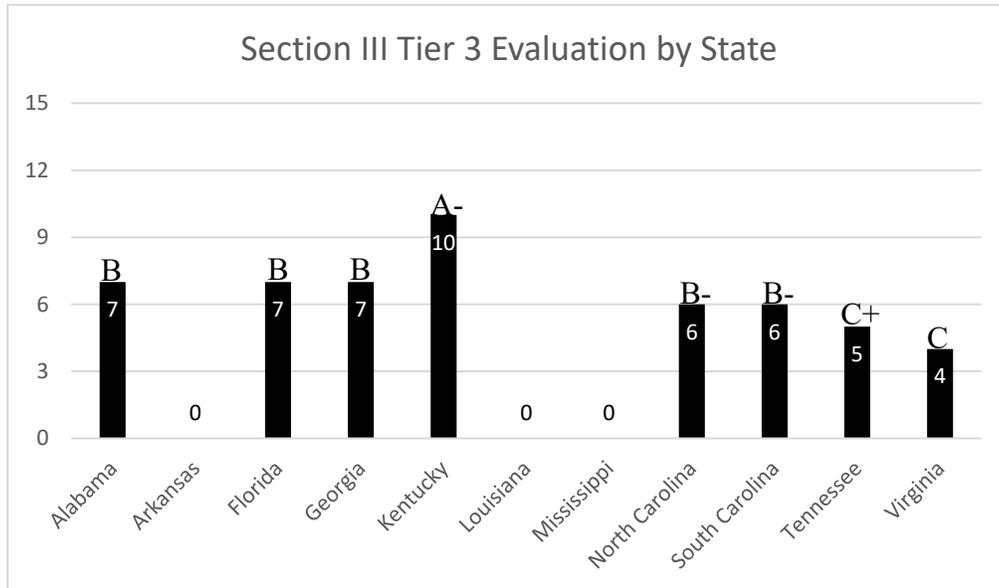


Figure 15: Scores for the Section III Tier 3 Evaluation. Scoring format is qualitative and based on standards outlined in Table 12. Higher scores represent more detailed implementation of subcategories.

Section IV: Water Supply Augmentation

Florida and South Carolina scored the highest for the Section IV Tier 2 evaluation, as both contained 9 subcategories out of 14 (Figure 16). Subcategories that were included in common between these two plans were: “establish drought reserves, draw from drought reserves, build new facilities to enhance diversion or divert new supplies, and lower reservoir intake structures.” Both plans also failed to include the subcategory “build emergency dams or reactivate abandoned dams.” Aside from these similarities, both states had 4 subcategories that they exclusively included. For Florida, these were “blend primary supply with water of lesser quality to increase supplies, use reservoir dead storage, increase use of recycled water, and utilize ditch water or treated effluent for irrigating landscaping/parks.” For South Carolina, these were “increase groundwater pumping, deepen or rehabilitate existing wells and/or reactivate abandoned wells, flush existing wells to develop maximum flow rates, and acquire additional storage.”

Georgia and Virginia were given the lowest Tier 2 score for Section IV, as each only contained 2 out of the 14 subcategories. The subcategories that Georgia included were “blend primary supply with water of lesser quality to increase supplies” and “increase use of recycled water.” The subcategories that Virginia included were “establish drought reserves” and “draw from drought reserves.” The average Tier 2 evaluation score for Section IV was 3.00 out of 14 across all states in the Southeast (Figure 8).

South Carolina received the highest Tier 3 score for Section III, given 19 out of 42 (section grade of B), its categories and quality evaluation being reported in the previous Tier 3 Evaluation section of the analysis. North Carolina scored the lowest for the Section IV Tier 3 quality evaluation score of 3 out of 42, a section grade of D (Figure 17). Subcategories that the

North Carolina Drought Assessment and Response Plan included were “develop supplemental groundwater/conjunctive use, blend primary supply with water of lesser quality to increase supplies, and acquire additional storage.” Each of these subcategories were given a Quality Score of 1, as all were implemented in the plan, but included no supporting detail on implementation, or applications/examples. The Section IV Tier 3 average score across all states was 5.09 out of 42 (Figure 9).

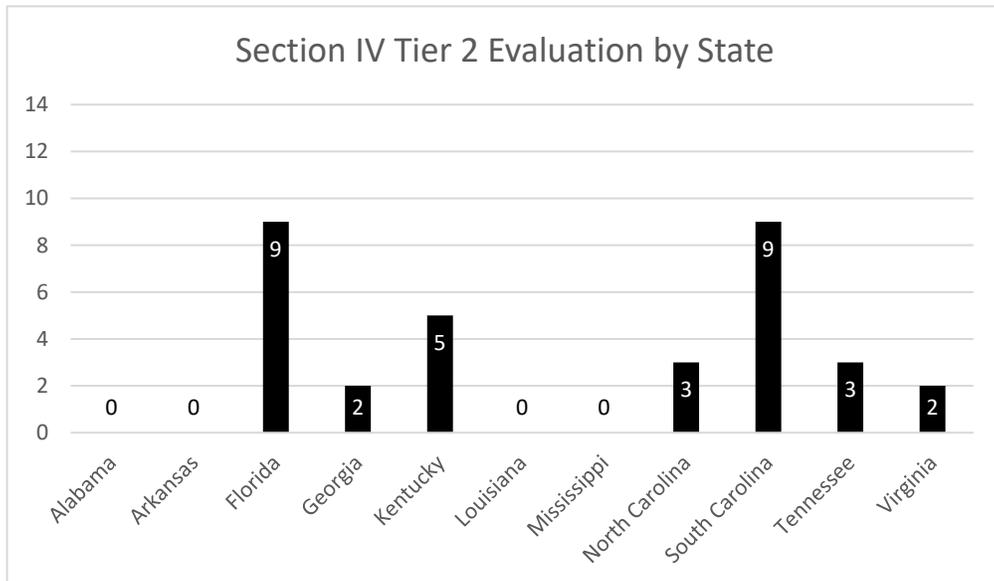


Figure 16: Scores for the Section IV Tier 2 Evaluation. Scoring format is binary, with greater scores representing a greater inclusion of subcategories per section.

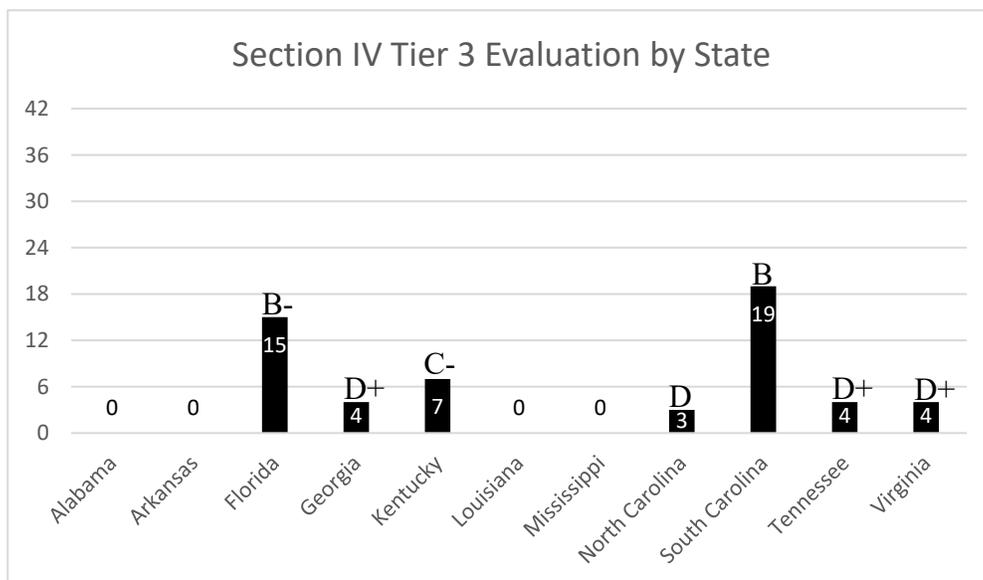


Figure 17: Scores for the Section IV Tier 3 Evaluation. Scoring format is qualitative and based on standards outlined in Table 12. Higher scores represent more detailed implementation of subcategories.

Drought Plan Strategic Focus Results

Alabama, Florida, Georgia, Kentucky, North Carolina, Tennessee, and Virginia could be classified as pre-drought focused (mitigation plan), while South Carolina could be classified as post/during-drought focused (response plan) based on the Focus of Strategy Ratio. (Table 15). Alabama had the highest FoS ratio, with a score of 3.20, implying that mitigation strategies are heavily present in the plan, an observation supported by Lackstrom (2022). South Carolina scored both the lowest FoS score, as well as the score that is closest to an FoS score of 1. This means that South Carolina has a comparatively balanced plan compared to others in the Southeast and can be classified as a “mitigation and response” plan.

Table 15: Categorization of states into pre-drought focused plans or post/during drought focused plans. Explanation for the process of determining the categorization is represented in the text. The score of each state’s ratio is in parenthesis.

Pre-Drought Focused Plans FoS Ratio > 1	Post/During-Drought Focused Plans FoS Ratio < 1
Alabama (3.20)	South Carolina (0.99)
Florida (1.14)	
Georgia (1.80)	
Kentucky (1.81)	
North Carolina (2.53)	
Tennessee (1.51)	
Virginia (1.66)	

Comparison to Southeast Water Policy Results

According to The Water Efficiency and Conservation State Scorecard, Georgia had the highest scoring state water laws and policies in the Southeast, with a grade of B+ (AWE 2017). The lowest scoring state was Mississippi, with a score of WEC score of 4 (AWE 2017). These results differ in terms of the state drought plan quality evaluation, in which South Carolina scored the highest with a Tier 3 grade of B+ (score of 58) based on the modified grade range framework in Table 10. Of the states with a plan, the lowest scoring state was Tennessee with a Tier 3 grade of C+ and a score of 32 (Table 16). The average Water Efficiency and Conservation score for all states in the Southeast was 7, earning a grade of C- (AWE 2017). This is slightly below the overall United States average of 9.85, which also warranted a grade of C (AWE 2017).

The calculated average Tier 3 Drought Plan Grade across the entire Southeast was a C, with a score of 29.91 out of 108 (Table 14).

Table 16: Scorecard of state water policy grades and calculated state drought policy grades. Method for determining grading scheme is explained in text. WEC = water efficiency and conservation. All water policy grading data (WEC Score, WEC Grade) obtained from the Alliance for Water Efficiency (2017).

State	WEC Score	WEC Grade	Tier 3 Drought Plan Score	Tier 3 Drought Plan Grade
AL	10.5	C-	35	C+
AR	12.5	C-	0	
FL	24.5	C+	40	B-
GA	40.5	B+	33	C+
KY	30	B-	56	B
LA	9	D+	0	
MS	4	D	0	
NC	26	B-	36	C+
SC	12.5	C-	58	B+
TN	13	C-	32	C
VA	33.5	B	38	B-

Chapter 5: Summary and Conclusions

Proactive state drought management is a topic of increasing importance in the Southeast to best mitigate the impacts of intensifying drought in the face of population growth and regional warming. Among the eleven states, there is great diversity both in the presence of state drought management, as well as the effectiveness of it. In order to better standardize the organization of drought planning in the region, an analytical framework must be developed. This evaluation was handled through a three-part, tier-based analysis meant to highlight the strengths and weaknesses of certain areas of a plan and resulted in the creation of scorecards used to represent a state drought plan's overall comprehensiveness.

The presence of Elements of a Drought Management Plan, Emergency Response, Public Education and Relations, and Water Supply Augmentation within a state drought plan would affect its Tier 1 score, which outlined the general framework of a drought plan. The Southeast as a group scored relatively highly on this Tier, with an average overall score of 2.82 out of 4, placing the region above 50% (>2 out of 4) despite Arkansas, Louisiana, and Mississippi greatly decreasing the average by not having plans. The Tier 2 evaluation was based on the inclusion of specific subcategories and analyzed the depth of the comprehensiveness of the plan. Overall, the Southeast performed moderately poorly in this tier, with an average score of 13.45, less than 50% (<18 out of 36). The Tier 3 evaluation was an analysis of the overall level of detail of each subcategory in a plan. Tier 3 scored the lowest compared to its maximum possible points, with an average score well below 50% (<54 out of 108) at 29.91 out of 108. This indicates that the states across the Southeast need to substantially increase the amount of detail present in their plans.

Of all sections, states scored the highest on Section I compared to the maximum possible points with average scores of 0.73 out of 1, 5.00 out of 9, and 12.91 out of 27 for Tiers 1, 2, and 3 respectively. States scored the lowest on Section IV compared to the maximum possible points with average scores of 0.64 out of 1, 3.00 out of 14, and 5.09 out of 42 for Tiers 1, 2, and 3 respectively.

These results imply that while states in the Southeast can recognize important parameters to include in a drought plan, the region as a whole can benefit from further improving the comprehensiveness and detail of their plans, as the average Tier 2 and Tier 3 scores for the Southeast were less than 50%. From a section perspective, the Southeastern states could benefit from including greater focus on expanding water supply to accommodate drought. The Southeast has a lack of reservoir storage, and this combination can prove to be problematic in the future if more consistent ways to enhance and distribute water in the case of significant drought is not included in revisions of the state drought plans (Gavrilles 2010). The Southeastern states incorporate many mitigation components in their drought plans. This was evident through the Focus of Study ratio calculating all states with a plan to be primarily pre-drought-oriented plans, with the exception of South Carolina. Most states in the Southeast had Tier 3 evaluation scores that were graded very similarly to their state water policy grades, as determined through the original Water Efficiency and Conservation State Scorecard, and relation-preserving modifications to its grade ranges to relate to drought plans (AWE 2017). Overall, the results of the study serve to answer the initial research objectives featured in the introduction.

1) Does the state have an official drought management plan?

Alabama, Florida, Georgia, Kentucky, North Carolina, South Carolina, Tennessee, and Virginia all have official state drought management plans. Arkansas, Louisiana, and

Mississippi are the only states within the region that do not have official state drought plans.

Due to continued regional population growth as well as the potential for more intense, prolonged drought in the decades to come, these states could benefit greatly from the creation of state drought plans.

- 2) Does the state drought management plan contain the four sections of evaluation (elements of a drought management plan, emergency response, public education and relations, and water supply augmentation)? What sections are sources of strength or weakness?

The state drought plans of Florida, Georgia, Kentucky, North Carolina, South Carolina, Tennessee, and Virginia contained all four sections of the evaluation. The Alabama Drought Management Plan (2018) was not able to score on Section IV Water Supply Augmentation. For the Tier 2 and Tier 3 evaluations, Section I: Elements of a Drought Management Plan is a consistent strength across the Southeast. Despite three of the states not having state drought plans, the average value for Section I was still above 50%, at 5.00 out of 9 for Tier 2, and a score of 12.91 out of 27 for Tier 3 (Figure 8 and Figure 9). This statistic represents that the states across the Southeast have a solid grasp on how to set up core aspects of a drought management plan. This may be partly due to their somewhat recent creations, as all were formed after (and show influences from) Wilhite et al. (2000). Section IV: Water Supply Augmentation was scored consistently low throughout the Southeast, with overall average Tier 2 and Tier 3 scores well below 50% with scores of 3.00 out of 14 and 5.09 out of 42 respectively (Figure 8 and Figure 9). This is a particular problem in the Southeast, as drought has a substantial effect on the region's limited reservoir storage. Planning to enhance water supply can greatly strengthen a state's drought plan and overall likelihood to resist increased drought impacts in the years to come.

- 3) How do different drought management plans compare in terms of comprehensiveness and level of detail across the Southeast?

When comparing between states, it is important to recognize differences in their comprehensiveness (Tier 2) and degree of detail (Tier 3). The Kentucky Drought Mitigation and Response Plan and South Carolina Drought Response Plan were the most comprehensive, with overall Tier 2 comprehensiveness scores of 25 across all sections. The South Carolina Drought Response Plan was the most detailed plan, with an overall Tier 3 quality evaluation score of 58 across all sections.

- 4) Is the state drought management plan a mitigation plan that focuses on reducing the impacts of a drought before onset, or a response plan that focuses on the during-drought period or post-drought period? Is there balance between the approaches?

The Focus of Strategy ratio identified seven states that focus on pre-drought management (Alabama, Florida, Georgia, Kentucky, North Carolina, Tennessee, and Virginia) and one state that focuses on post/during drought management (South Carolina). South Carolina had an FoS score closest to 1, with 0.99 (Table 15). This represents that South Carolina has a close balance between the approaches of drought management. These results were relatively unexpected, but likely due to underperformance across Section IV: Water Supply Augmentation (a drought response-oriented category) for much of the Southeast.

- 5) How does the score for each state drought management plan compare to their state water management policies?

The Alliance for Water Efficiency's 2017 "The Water Efficiency and Conservation State Scorecard: An Assessment of Laws and Policies" report was used as a benchmark for state water policy review. Modifying but maintaining the relational bounds of the grading

framework allowed the Tier 3 quality evaluation score of each drought management plan to be compared to the water policy (WEC) grades. State drought plan's Tier 3 values scored grades that were higher than their state water policy grades, with the exception of Georgia, North Carolina, and Virginia. Georgia had the greatest drop in grade from water policy to drought plan, with a WEC grade of B+ and a Tier 3 drought quality grade of C+ (Table 16). This reduction in grade from water policy to drought management is likely because Georgia has replaced its previous drought management plan with law code, which reduces the degree of detail that can be incorporated for each component. South Carolina had the greatest increase from water policy to drought plan, with a WEC grade of C- and a Tier 3 drought quality grade of B+ (Table 16). Louisiana and Mississippi should prioritize greater water and drought planning as they received WEC scores of D+ and D respectively, and do not currently have state drought plans.

Recommendations for Future Research

The presence and quality of state drought plans are a good indicator of how prepared a state will be in the face of drought. However, the Southeastern states all scored low for the Tier 3 evaluation in comparison to the maximum possible points attainable in the entire analysis (Highest Tier 3 score was 58 out of 108). Further research into this trend can determine what the cause is for low level of detail, as there are multiple factors that can affect this, such as an overreliance on local, smaller scale drought plans, an overall weakness of state drought plans in the region, or improper standards established through the study (or a combination of these and others). One path of study that may prove insightful is comparing a state drought plan's overall comprehensiveness to other official state plans that may relate to the topic, such as water plans or

emergency response plans. There may be a greater focus on managing water scarcity and taking appropriate responses in these other plans, at the detriment of the state drought plan. This may explain why states such as Georgia scored comparatively low in this evaluation, despite having a very competent water-use plan (Kundell 2007).

Several adjacent state's drought plans had similarities to one another, indicating that these states have similar vulnerabilities or have comparable strategies in reducing drought impacts. As drought is a natural hazard that does not distinguish between state boundaries, it may be worth researching the potential pros and cons of establishing multi-state, regional drought management committees to best allocate resources and response efforts. This can involve the uses of several drought indices across a larger, diverse landscape and designate percentile thresholds as recommended by Steinemann and Cavalcanti (2006). This interstate cooperation can help alleviate one of the most significant weak points of all plans, water supply augmentation. While there has been an increase in severe drought in the Southeast in the past 20 years compared to much of the 20th Century, the region has still not faced the degree of water scarcity issues that areas such as the Southwest have faced (Moore et al. 2021).

The scorecard products of this study, outlined in Appendix F, can be effective tools for shareholder, governmental, and public communication and planning efforts. Further research can determine how the weaknesses of these plans can best be addressed, and how the methodology of this study can be applied to other regions of the United States, to better prepare a wider array of states for potentially devastating drought.

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Appendix A: Introduction for States in the Southeast

Outlines of all states with drought plans within the study. Introductions serve to provide additional background information for drought management plans in the Southeast, without disrupting the overall flow of the paper.

A1. Alabama

A2. Florida

A3. Georgia

A4. Kentucky

A5. North Carolina

A6. South Carolina

A7. Tennessee

A8. Virginia

A1. Alabama

The Alabama Drought Management Plan (2018) follows the guidelines of the Alabama Drought Planning and Response Act (Code of Alabama, 1975, §9-10C-1, et seq.) closely in establishing a statewide governmental structure and fundamental requirements for statewide drought planning and response (ADECA 2018). Much of the Alabama Drought Management Plan focuses on the delegation of specific responsibilities to several parties. These include: The Alabama Office of Water Resources (AOWR), The Alabama Water Resources Commission (AWRC), The Alabama Drought Assessment and Planning Team (ADAPT), and The Monitoring and Impact Group (MIG)

Each of these parties are given unique responsibilities and areas of influence in regard to drought planning and response, diversifying Alabama's overall resistance to drought impacts from a leadership perspective. Another major area of focus for the Alabama Drought Management Plan is the county-based breakdown of the state into 9 specific Drought Management Areas, which can help organize and streamline drought-related planning and response. In addition, Alabama's Reservoir Systems are broken down into 5 categories that are the responsibility of different groups, which monitor, report, and respond to drought in different ways, and are as follows: Alabama-Coosa-Tallapoosa (ACT) River Basin System Management (U.S. Army Corps of Engineers (USACE) Mobile District), Alabama Power Company Reservoir Management (Alabama Power Company), Apalachicola-Chattahoochee-Flint (ACF) River Basin System Management (USACE Mobile District and the South Atlantic Division), TVA System Management and Drought Response Activities (Tennessee Valley Authority (TVA), and PowerSouth System Management (PowerSouth Energy Cooperative)

The Alabama Drought Management Plan bases much of its response to drought through organized drought declarations. There are 4 drought declarations, ranging in ascending order of severity from Drought Advisory to Drought Watch to Drought Warning to Drought Emergency, and are based on a number of indices that help to represent the 5 different types of drought (Lawn and Garden Index, Crop Moisture Index, Palmer Drought Severity Index, USGS, below normal 28-day average streamflow compared to historical streamflow for the day of year, Keetch-Bryam Drought Index, AOWR Drought Streamflow Portal for regulated and unregulated streamgages, and Precipitation: 180-day rainfall and 60-day rainfall). Based on the level of drought severity, the responsible drought management parties can provide the associated guidance to each region (ADECA 2018). The Alabama Drought Management Plan contains 39 pages in its main body text, and 10 pages in the appendix.

A2. Florida

The Florida Drought Action Plan (2007) focuses on “improving coordination and communication among key participating agencies, facilitating outreach to concerned parties, and expressing the basic short and mid-term action steps now thought necessary to address the drought.” There are no official indices-based drought declarations identified in the Florida Drought Action Plan, but management of the plan is primarily carried out by a combination of relevant agencies, rather than a combined drought task force (FDEP 2018). The key agencies outlined in the plan are: The Florida Division of Emergency Management (DEM), The Florida Department of Environmental Protection (DEP), The Florida Department of Agriculture and Consumer Services (DACS), The South Florida Water Management District (SFWMD)

Communication and outreach are areas of strict focus for these agencies, and additional management and reporting are given by the five Florida Water Management Districts, which all utilize distinct strategies to compensate for regional differences in water and precipitation abundances (FDEP 2018). These districts are: The South Florida Water Management District (SFWMD), the Southwest Florida Water Management District (SWFWMD), the St. Johns River Water Management District (SJRWMD), the Suwannee River Water Management District (SRWMD), the Northwest Florida Water Management District (NFWMD). The Florida Drought Action Plan contains 21 pages in its main body text, and 9 pages in the appendix.

A3. Georgia

Georgia Drought Management Plan (2003) was replaced by The Drought Management Rules, Chapter 391-3-30 of The Rules and Regulations of the State of Georgia in 2015. This enables the purpose of drought management to more permanently establish “rules and regulations relating to drought management, including provisions for a drought response committee; drought indicators and triggers; a drought declaration process; and state and local predrought mitigation strategies and drought response strategies” (DNR 2015). As part of the Rules and Regulations of the State of Georgia, the Drought Management Rules can seamlessly reference other rules within the law code and diversify both the mitigation and response strategies. Unlike many other Southeastern State Plans, Georgia does not designate a static drought management task force, instead relying on a Drought Response Committee, who’s members and activation depend on the discretion of the Director of the Environmental Protection Division of the Department of Natural Resources. However, Georgia still declares drought in a similar way to other Southeastern states, using an indices-based level system, that ascends in severity from Level 1 Drought to Level 2 Drought, and ultimately Level 3 Drought. These categorizations are based on the following indices: precipitation, streamflow, groundwater, reservoir levels, soil moisture, short term climate predictions, U.S. Drought Monitor, and water supply conditions. Georgia does not separate its state into separate drought management regions within The Drought Management Rules (DNR 2015). The Drought Management Rules constitutes 11 pages in total, with no appendix.

A4. Kentucky

The purpose of the Kentucky Drought Mitigation and Response Plan (2008) “is to provide statewide guidance to assess and minimize the impacts of a drought in Kentucky.” (EEC 2018). To accomplish these objectives, the Kentucky Drought Mitigation and Response Plan assigned several state agencies to be a part of the Kentucky Drought Management Team (KDMT) and collaborate and respond accordingly. A select few of the many agencies in the KDMT include: The Energy and Environment Cabinet (Chair), Department of Fish and Wildlife Resources, and the Department for Public Health

The Kentucky Drought Mitigation and Response Plan (2008) organizes drought into 4 categories based on ascending severity and depended on a number of indices. These go from the minor Drought Advisory to Level I Drought, Level II Drought, and Level III Drought and are based on precipitation deficits, streamflows, The Drought Monitor, soil moisture, and reservoir storage. The Kentucky Drought Mitigation and Response Plan (2008) additionally separates the state into 15 county-oriented drought management regions to streamline response efforts (EEC 2018). The Kentucky Drought Mitigation and Response Plan contains 50 pages in its main body and 19 pages in the appendix.

A5. North Carolina

North Carolina Drought Assessment and Response Plan (2020) has been developed to “provide a system for assessing a drought cycle’s progress and for determining when to institute a formal drought response.” (SERT 2020). Much of the plan focuses on the identification of relevant agencies and their responsibilities during time of drought, as well as how to best distribute limited resources to maximize the efficacy of the hazard response. One of the most significant supporting agencies identified in the North Carolina Drought Assessment and Response Plan (2020) is the North Carolina Drought Management Advisory Council (DMAC). This interagency task force consists of several departments, with some examples being: The NC Division of Environmental Quality (chair), NC Cooperative Extension Service, State Climate Office of North Carolina State University, and the NC Public Staff of the Utilities Commission o NC Wildlife Resources Commission.

During times of drought, several additional task forces oversee their respective areas, to account for how the many types of drought can affect a state. From here, strategies for both immediate and continuing response efforts are identified in order to best prepare the state for emergency response and long-term impact mitigation. Like many other Southeastern states, drought classification is based on measured indices (in this case, primarily the U.S. Drought Monitor and Palmer Drought Severity Index) and is delineated by phases. Normal Conditions are the standard atmospheric and precipitation characteristics of North Carolina, while drought severity increases with each phase. Phase 1-Moderate Drought, Phase 2-Severe Drought, Phase 3-Extreme Drought, and Phase 4-Exceptional Drought (SERT 2020). The North Carolina Assessment and Response Plan contains 17 pages in its main body text, and 5 pages in the appendix.

A6. South Carolina

The South Carolina Drought Response Plan (2017) utilizes a multifaceted approach to combat drought at the state and county level, represented by Purpose C. of the plan stating that one of the main purposes of the plan is to “Provide statewide planning and response strategies that allow State and County Emergency Management officials to effectively and efficiently plan and coordinate the application of local, State, and Federal resources in response to a severe or extreme drought event to prevent loss of life, minimize damage, lessen the economic impact, and protect the environment.” (SCDRC 2017). Much of the planning stems from how a drought is classified, based on the South Carolina Drought Response Act (2000). This system specifies drought into four categories which are used to develop the appropriate response strategies, based on a number of relevant indices. These levels of severity are incipient drought, moderate drought, severe drought, and extreme drought. The defining indices include the Palmer Drought Severity Index, Crop Moisture Index, Standard Precipitation Index, Keetch-Byram Drought Index, U.S. Drought Monitor, average daily streamflow, and the ground and static water level in an aquifer.

South Carolina Drought Response Plan (2017) empowers the South Carolina Drought Response Committee as the task force in charge of drought management and consists of representatives from the following agencies: The SC Department of Natural Resources (SCDNR), SC Department of Environmental Control (DHEC), SC Forestry Commission (SCFC), SC Department of Agriculture (SCDA), and the South Carolina Emergency Management (SCEMD).

To facilitate appropriate resource management and planning organization, the South Carolina Drought Response Plan (2017) divides the state into four county-oriented Drought

Management Areas, to allow a more equivalent response and implementation across the state (SCDRC 2017). The South Carolina Drought Response Plan contains 24 pages in its main body text, and 9 pages in the appendix.

A7. Tennessee

The Tennessee Drought Management Plan (2010) readily acknowledges the history and variety in type of drought within the state, with the stated purpose being “to outline the Tennessee Department of Environment and Conservation’s role during a drought, to facilitate planning, and to provide a framework for action and cooperation in water resources management among the many local, state, and federal agencies with drought-related responsibilities “(TDEC 2010). The plan goes on to outline the many conditions, strategies of mitigation and response, and relevant agencies and their roles in drought management. In the conclusion of the plan, there is an emphasis on updating and expanding on the plan in the years to come, to account for shifting environmental and societal conditions.

Outlining the drought management task force and each agency’s responsibilities makes up the bulk of the plan, with the task force comprising of several departments, some of which include: The Tennessee Department of Environment and Conservation, Water Resources Technical Advisory Committee, Community Water Systems, and Local Governments. The Tennessee Drought Management Plan contains 36 pages in its main body text, and 10 pages in the appendix.

A8. Virginia

The Virginia Drought Assessment and Response Plan (2003) identifies regions, agencies and both mandatory and non-mandatory tactics of drought management, and how to adequately recognize, prepare for and respond to drought. Responses are flexible and tailored to an indices-based drought categorization scheme, in which the presence of certain conditions qualify an event in increasing order of severity from one classified as normal conditions, to drought watch, drought warning, and ultimately, drought emergency (DRTAC 2003) Another focus of the plan is the expressed restrictions of several non-essential water usages that vary from personal irrigation, to water reductions in businesses and industry, and even water rationing. In terms of drought monitoring, the Virginia Drought Assessment and Response Plan attributes the responsibility to the Virginia Drought Monitoring Task Force, with examples of a handful of the included agencies represented being: The Virginia Department of Emergency Management, Virginia Department of Health, Virginia Department of Agriculture and Consumer Services, and the Virginia State Climatology Office. The Virginia Drought Assessment and Response Plan (2003) divides the state into 13 county-oriented Drought Evaluation Regions based on “a consideration of river basins, climatic divisions, physiographic provinces, major geomorphologic features, and service areas of major water supplies.

The main drought indicators that the Virginia Drought Assessment and Response Plan uses to monitor, evaluate and classify drought are precipitation deficits, streamflows, ground water levels, and reservoir storage. These drought indicators are used to determine the severity of a drought through “comparing current conditions to long term average conditions,” revealing if current conditions are within a typical range or the conditions instead indicate that there is

drought (DRTAC 2003). The Virginia Drought Assessment and Response Plan contains 22 pages in its main body text, and 3 pages in the appendix.

Appendix B: Elements of a Drought Management Plan scores for each state

Display of scores for Section I for all three tiers of each state plan. Section had a total of 9 subcategories that were evaluated. Maximum possible scores for this Tier are as follows: Tier 1 = 1, Tier 2 =9, and Tier 3 = 27 (See Table 12).

B1. Alabama Drought Management Plan

B2. Florida Drought Action Plan

B3. Georgia Drought Management Plan

B4. Kentucky Drought Mitigation and Response Plan

B5. North Carolina Drought Assessment and Response Plan

B6. South Carolina Drought Response Plan

B7. Tennessee Drought Management Plan

B8. Virginia Drought Assessment and Response Plan

B1. Alabama Drought Management Plan

Alabama Drought Management Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
I: Elements of a Drought Management Plan	1		
Establish drought response principles, objectives, and priorities		1	3
Establish authority & process for declaring a drought emergency		1	3
Develop drought stages, trigger points, and response targets X		1	3
Prepare ordinances on drought measures		1	3
Evaluate historical drought impacts		1	1
Monitor drought indicators (e.g., snow pack, stream flow, etc.)		1	2
Monitor water quality		1	2
Track public perception and effectiveness of drought measures		1	1
Improve accuracy of runoff and water supply forecasts		1	2
Total	1	9	20

B2. Florida Drought Action Plan

Florida Drought Action Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
I: Elements of a Drought Management Plan	1		
Establish drought response principles, objectives, and priorities		1	3
Establish authority & process for declaring a drought emergency		1	3
Develop drought stages, trigger points, and response targets X		0	0
Prepare ordinances on drought measures		0	0
Evaluate historical drought impacts		1	3
Monitor drought indicators (e.g., snow pack, stream flow, etc.)		0	0
Monitor water quality		1	2
Track public perception and effectiveness of drought measures		0	0
Improve accuracy of runoff and water supply forecasts		1	1
Total	1	5	12

B3. Georgia Drought Management Plan

Georgia Drought Management Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
I: Elements of a Drought Management Plan	1		
Establish drought response principles, objectives, and priorities		1	3
Establish authority & process for declaring a drought emergency		1	2
Develop drought stages, trigger points, and response targets X		1	3
Prepare ordinances on drought measures		1	3
Evaluate historical drought impacts		0	0
Monitor drought indicators (e.g., snow pack, stream flow, etc.)		1	1
Monitor water quality		0	0
Track public perception and effectiveness of drought measures		0	0
Improve accuracy of runoff and water supply forecasts		0	0
Total	1	5	12

B4. Kentucky Drought Mitigation and Response Plan

Kentucky Drought Mitigation and Response Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
I: Elements of a Drought Management Plan	1		
Establish drought response principles, objectives, and priorities		1	3
Establish authority & process for declaring a drought emergency		1	3
Develop drought stages, trigger points, and response targets X		1	3
Prepare ordinances on drought measures		1	3
Evaluate historical drought impacts		1	3
Monitor drought indicators (e.g., snow pack, stream flow, etc.)		1	3
Monitor water quality		1	2
Track public perception and effectiveness of drought measures		1	3
Improve accuracy of runoff and water supply forecasts		1	3
Total	1	9	26

B5. North Carolina Drought Assessment and Response Plan

North Carolina Drought Assessment and Response Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
I: Elements of a Drought Management Plan	1		
Establish drought response principles, objectives, and priorities		1	2
Establish authority & process for declaring a drought emergency		1	3
Develop drought stages, trigger points, and response targets X		1	3
Prepare ordinances on drought measures		1	2
Evaluate historical drought impacts		1	1
Monitor drought indicators (e.g., snow pack, stream flow, etc.)		1	3
Monitor water quality		1	3
Track public perception and effectiveness of drought measures		0	0
Improve accuracy of runoff and water supply forecasts		1	3
Total	1	8	20

B6. South Carolina Drought Response Plan

South Carolina Drought Response Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
I: Elements of a Drought Management Plan	1		
Establish drought response principles, objectives, and priorities		1	2
Establish authority & process for declaring a drought emergency		1	3
Develop drought stages, trigger points, and response targets X		1	3
Prepare ordinances on drought measures		1	3
Evaluate historical drought impacts		1	3
Monitor drought indicators (e.g., snow pack, stream flow, etc.)		1	3
Monitor water quality		0	0
Track public perception and effectiveness of drought measures		0	0
Improve accuracy of runoff and water supply forecasts		1	3
Total	1	7	20

B7. Tennessee Drought Management Plan

Tennessee Drought Management Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
I: Elements of a Drought Management Plan	1		
Establish drought response principles, objectives, and priorities		1	3
Establish authority & process for declaring a drought emergency		1	3
Develop drought stages, trigger points, and response targets X		1	1
Prepare ordinances on drought measures		1	1
Evaluate historical drought impacts		1	3
Monitor drought indicators (e.g., snow pack, stream flow, etc.)		0	0
Monitor water quality		1	3
Track public perception and effectiveness of drought measures		0	0
Improve accuracy of runoff and water supply forecasts		0	0
Total	1	6	14

B8. Virginia Drought Assessment and Response Plan

Virginia Drought Assessment and Response Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
I: Elements of a Drought Management Plan	1		
Establish drought response principles, objectives, and priorities		1	3
Establish authority & process for declaring a drought emergency		1	3
Develop drought stages, trigger points, and response targets X		1	3
Prepare ordinances on drought measures		1	3
Evaluate historical drought impacts		1	3
Monitor drought indicators (e.g., snow pack, stream flow, etc.)		1	3
Monitor water quality		0	0
Track public perception and effectiveness of drought measures		0	0
Improve accuracy of runoff and water supply forecasts		0	0
Total	1	6	18

Appendix C: Emergency Response scores for each state

Display of scores for Section II for all three tiers of each state plan. Section had a total of 8 subcategories that were evaluated. Maximum possible scores for this Tier are as follows: Tier 1 = 1, Tier 2 = 8, and Tier 3 = 25 (See Table 12).

C1. Alabama Drought Management Plan

C2. Florida Drought Action Plan

C3. Georgia Drought Management Plan

C4. Kentucky Drought Mitigation and Response Plan

C5. North Carolina Drought Assessment and Response Plan

C6. South Carolina Drought Response Plan

C7. Tennessee Drought Management Plan

C8. Virginia Drought Assessment and Response Plan

C1: Alabama Drought Management Plan

Alabama Drought Management Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
II: Emergency Response	1		
Declare a drought emergency		1	3
Establish water hauling programs		0	0
Restrict/prohibit new taps		0	0
Identify state and federal assistance		1	3
Provide emergency water to domestic well users		0	0
Import water by truck/train		0	0
Establish clear municipal water restrictions during times of drought		1	1
Enforce water restrictions		1	1
Total	1	4	8

C2. Florida Drought Action Plan

Florida Drought Action Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
II: Emergency Response	1		
Declare a drought emergency		0	0
Establish water hauling programs		0	0
Restrict/prohibit new taps		0	0
Identify state and federal assistance		1	3
Provide emergency water to domestic well users		0	0
Import water by truck/train		0	0
Establish clear municipal water restrictions during times of drought		1	1
Enforce water restrictions		1	2
Total	1	3	6

C3. Georgia Drought Management Plan

Georgia Drought Management Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
II: Emergency Response	1		
Declare a drought emergency		1	2
Establish water hauling programs		0	0
Restrict/prohibit new taps		0	0
Identify state and federal assistance		1	2
Provide emergency water to domestic well users		0	0
Import water by truck/train		0	0
Establish clear municipal water restrictions during times of drought		1	3
Enforce water restrictions		1	3
Total	1	4	10

C4. Kentucky Drought Mitigation and Response Plan

Kentucky Drought Mitigation and Response Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
II: Emergency Response	1		
Declare a drought emergency		1	3
Establish water hauling programs		1	2
Restrict/prohibit new taps		0	0
Identify state and federal assistance		1	3
Provide emergency water to domestic well users		1	2
Import water by truck/train		0	0
Establish clear municipal water restrictions during times of drought		1	1
Enforce water restrictions		1	2
Total	1	6	13

C5. North Carolina Drought Assessment and Response Plan

North Carolina Drought Assessment and Response Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
II: Emergency Response	1		
Declare a drought emergency		1	3
Establish water hauling programs		0	0
Restrict/prohibit new taps		0	0
Identify state and federal assistance		1	3
Provide emergency water to domestic well users		0	0
Import water by truck/train		0	0
Establish clear municipal water restrictions during times of drought		0	0
Enforce water restrictions		1	1
Total	1	3	7

C6. South Carolina Drought Response Plan

South Carolina Drought Response Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
II: Emergency Response	1		
Declare a drought emergency		1	2
Establish water hauling programs		1	3
Restrict/prohibit new taps		0	0
Identify state and federal assistance		1	3
Provide emergency water to domestic well users		1	3
Import water by truck/train		1	1
Establish clear municipal water restrictions during times of drought		0	0
Enforce water restrictions		1	1
Total	1	6	13

C7. Tennessee Drought Management Plan

Tennessee Drought Management Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
II: Emergency Response	1		
Declare a drought emergency		0	0
Establish water hauling programs		1	1
Restrict/prohibit new taps		0	0
Identify state and federal assistance		1	3
Provide emergency water to domestic well users		1	1
Import water by truck/train		0	0
Establish clear municipal water restrictions during times of drought		1	2
Enforce water restrictions		1	2
Total	1	5	9

C8. Virginia Drought Assessment and Response Plan

Virginia Drought Assessment and Response Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
II: Emergency Response	1		
Declare a drought emergency		1	3
Establish water hauling programs		0	0
Restrict/prohibit new taps		0	0
Identify state and federal assistance		1	3
Provide emergency water to domestic well users		0	0
Import water by truck/train		0	0
Establish clear municipal water restrictions during times of drought		1	3
Enforce water restrictions		1	3
Total	1	4	12

Appendix D: Public Education and Relations for each state

Display of scores for Section III for all three tiers of each state plan. Section had a total of 5 subcategories that were evaluated. Maximum possible scores for this Tier are as follows: Tier 1 = 1, Tier 2 = 5, and Tier 3 = 15 (See Table 12).

D1. Alabama Drought Management Plan

D2. Florida Drought Action Plan

D3. Georgia Drought Management Plan

D4. Kentucky Drought Mitigation and Response Plan

D5. North Carolina Drought Assessment and Response Plan

D6. South Carolina Drought Response Plan

D7. Tennessee Drought Management Plan

D8. Virginia Drought Assessment and Response Plan

D1. Alabama Drought Management Plan

Alabama Drought Management Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
III: Public Education and Relations	1		
Establish a public advisory committee during drought planning and/or drought response efforts		1	3
Develop Drought Public Education Campaign with long-term and short-term strategies		0	0
Educate provider/municipal staff on how to save water		1	2
Provide instructional resources to business on developing an office/business specific drought mitigation and response plan		1	2
Provide acoustical meters to assist customers in identifying leaks		0	0
Total	1	3	7

D2. Florida Drought Action Plan

Virginia Drought Assessment and Response Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
III: Public Education and Relations	1		
Establish a public advisory committee during drought planning and/or drought response efforts		1	3
Develop Drought Public Education Campaign with long-term and short-term strategies		1	3
Educate provider/municipal staff on how to save water		1	1
Provide instructional resources to business on developing an office/business specific drought mitigation and response plan		0	0
Provide acoustical meters to assist customers in identifying leaks		0	0
Total	1	3	7

D3. Georgia Drought Management Plan

Georgia Drought Management Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
III: Public Education and Relations	1		
Establish a public advisory committee during drought planning and/or drought response efforts		1	2
Develop Drought Public Education Campaign with long-term and short-term strategies		1	2
Educate provider/municipal staff on how to save water		0	0
Provide instructional resources to business on developing an office/business specific drought mitigation and response plan		0	0
Provide acoustical meters to assist customers in identifying leaks		1	3
Total	1	3	7

D4. Kentucky Drought Mitigation and Response Plan

Kentucky Drought Mitigation and Response Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
III: Public Education and Relations	1		
Establish a public advisory committee during drought planning and/or drought response efforts		1	3
Develop Drought Public Education Campaign with long-term and short-term strategies		1	2
Educate provider/municipal staff on how to save water		1	1
Provide instructional resources to business on developing an office/business specific drought mitigation and response plan		1	1
Provide acoustical meters to assist customers in identifying leaks		1	3
Total	1	5	10

D5. North Carolina Drought Assessment and Response Plan

North Carolina Drought Assessment and Response Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
III: Public Education and Relations	1		
Establish a public advisory committee during drought planning and/or drought response efforts		1	2
Develop Drought Public Education Campaign with long-term and short-term strategies		0	0
Educate provider/municipal staff on how to save water		1	2
Provide instructional resources to business on developing an office/business specific drought mitigation and response plan		1	2
Provide acoustical meters to assist customers in identifying leaks		0	0
Total	1	3	6

D6. South Carolina Drought Response Plan

South Carolina Drought Response Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
III: Public Education and Relations	1		
Establish a public advisory committee during drought planning and/or drought response efforts		1	3
Develop Drought Public Education Campaign with long-term and short-term strategies		1	2
Educate provider/municipal staff on how to save water		0	0
Provide instructional resources to business on developing an office/business specific drought mitigation and response plan		1	1
Provide acoustical meters to assist customers in identifying leaks		0	0
Total	1	3	6

D7. Tennessee Drought Management Plan

Tennessee Drought Management Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
III: Public Education and Relations	1		
Establish a public advisory committee during drought planning and/or drought response efforts		1	3
Develop Drought Public Education Campaign with long-term and short-term strategies		1	1
Educate provider/municipal staff on how to save water		0	0
Provide instructional resources to business on developing an office/business specific drought mitigation and response plan		1	1
Provide acoustical meters to assist customers in identifying leaks		0	0
Total	1	3	5

D8. Virginia Drought Assessment and Response Plan

Virginia Drought Assessment and Response Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
III: Public Education and Relations	1		
Establish a public advisory committee during drought planning and/or drought response efforts		1	3
Develop Drought Public Education Campaign with long-term and short-term strategies		0	0
Educate provider/municipal staff on how to save water		0	0
Provide instructional resources to business on developing an office/business specific drought mitigation and response plan		1	1
Provide acoustical meters to assist customers in identifying leaks		0	0
Total	1	2	4

Appendix E: Water Supply Augmentation scores for each state

Display of scores for Section IV for all three tiers of each state plan. Section had a total of 14 subcategories that were evaluated. Maximum possible scores for this Tier are as follows: Tier 1 = 1, Tier 2 = 14, and Tier 3 = 42 (See Table 12).

E1. Alabama Drought Management Plan

E2. Florida Drought Action Plan

E3. Georgia Drought Management Plan

E4. Kentucky Drought Mitigation and Response Plan

E5. North Carolina Drought Assessment and Response Plan

E6. South Carolina Drought Response Plan

E7. Tennessee Drought Management Plan

E8. Virginia Drought Assessment and Response Plan

E1. Alabama Drought Management Plan

Alabama Drought Management Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
IV: Water Supply Augmentation	1		
Establish drought reserves		0	0
Draw from drought reserves		0	0
Increase groundwater pumping		0	0
Deepen or rehabilitate existing wells and/or reactivate abandoned wells		0	0
Develop supplemental groundwater/conjunctive use		0	0
Flush existing wells to develop maximum flow rates		0	0
Blend primary supply with water of lesser quality to increase supplies		0	0
Increase use of recycled water		0	0
Utilize ditch water or treated effluent for irrigating landscaping/parks		0	0
Build new facilities to enhance diversion or divert new supplies		0	0
Lower reservoir intake structures		0	0
Use reservoir dead storage		0	0
Acquire additional storage		0	0
Build emergency dams or reactivate abandoned dams		0	0
Total	1	0	0

E2. Florida Drought Action Plan

Florida Drought Action Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
IV: Water Supply Augmentation	1		
Establish drought reserves		1	1
Draw from drought reserves		1	1
Increase groundwater pumping		0	0
Deepen or rehabilitate existing wells and/or reactivate abandoned wells		0	0
Develop supplemental groundwater/conjunctive use		1	2
Flush existing wells to develop maximum flow rates		0	0
Blend primary supply with water of lesser quality to increase supplies		1	2
Increase use of recycled water		1	2
Utilize ditch water or treated effluent for irrigating landscaping/parks		1	2
Build new facilities to enhance diversion or divert new supplies		1	2
Lower reservoir intake structures		1	2
Use reservoir dead storage		1	1
Acquire additional storage		0	0
Build emergency dams or reactivate abandoned dams		0	0
Total	1	9	15

E3. Georgia Drought Management Plan

Georgia Drought Management Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
IV: Water Supply Augmentation	1		
Establish drought reserves		0	0
Draw from drought reserves		0	0
Increase groundwater pumping		0	0
Deepen or rehabilitate existing wells and/or reactivate abandoned wells		0	0
Develop supplemental groundwater/conjunctive use		0	0
Flush existing wells to develop maximum flow rates		0	0
Blend primary supply with water of lesser quality to increase supplies		1	1
Increase use of recycled water		1	1
Utilize ditch water or treated effluent for irrigating landscaping/parks		0	0
Build new facilities to enhance diversion or divert new supplies		0	0
Lower reservoir intake structures		0	0
Use reservoir dead storage		0	0
Acquire additional storage		0	0
Build emergency dams or reactivate abandoned dams		0	0
Total	1	2	2

E4. Kentucky Drought Mitigation and Response Plan

Kentucky Drought Mitigation and Response Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
IV: Water Supply Augmentation	1		
Establish drought reserves		1	3
Draw from drought reserves		1	1
Increase groundwater pumping		0	0
Deepen or rehabilitate existing wells and/or reactivate abandoned wells		0	0
Develop supplemental groundwater/conjunctive use		1	1
Flush existing wells to develop maximum flow rates		0	0
Blend primary supply with water of lesser quality to increase supplies		0	0
Increase use of recycled water		1	1
Utilize ditch water or treated effluent for irrigating landscaping/parks		0	0
Build new facilities to enhance diversion or divert new supplies		0	0
Lower reservoir intake structures		0	0
Use reservoir dead storage		0	0
Acquire additional storage		1	1
Build emergency dams or reactivate abandoned dams		0	0
Total	1	5	7

E5. North Carolina Drought Assessment and Response Plan

North Carolina Drought Assessment and Response Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
IV: Water Supply Augmentation	1		
Establish drought reserves		0	0
Draw from drought reserves		0	0
Increase groundwater pumping		0	0
Deepen or rehabilitate existing wells and/or reactivate abandoned wells		0	0
Develop supplemental groundwater/conjunctive use		1	1
Flush existing wells to develop maximum flow rates		0	0
Blend primary supply with water of lesser quality to increase supplies		1	1
Increase use of recycled water		0	0
Utilize ditch water or treated effluent for irrigating landscaping/parks		0	0
Build new facilities to enhance diversion or divert new supplies		0	0
Lower reservoir intake structures		0	0
Use reservoir dead storage		0	0
Acquire additional storage		1	1
Build emergency dams or reactivate abandoned dams		0	0
Total	1	3	3

E6. South Carolina Drought Response Plan

South Carolina Drought Response Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
IV: Water Supply Augmentation	1		
Establish drought reserves		1	3
Draw from drought reserves		1	3
Increase groundwater pumping		1	2
Deepen or rehabilitate existing wells and/or reactivate abandoned wells		1	2
Develop supplemental groundwater/conjunctive use		1	1
Flush existing wells to develop maximum flow rates		1	1
Blend primary supply with water of lesser quality to increase supplies		0	0
Increase use of recycled water		0	0
Utilize ditch water or treated effluent for irrigating landscaping/parks		0	0
Build new facilities to enhance diversion or divert new supplies		1	2
Lower reservoir intake structures		1	2
Use reservoir dead storage		0	0
Acquire additional storage		1	3
Build emergency dams or reactivate abandoned dams		0	0
Total	1	9	19

E7. Tennessee Drought Management Plan

Tennessee Drought Management Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
IV: Water Supply Augmentation	1		
Establish drought reserves		0	0
Draw from drought reserves		1	1
Increase groundwater pumping		0	0
Deepen or rehabilitate existing wells and/or reactivate abandoned wells		0	0
Develop supplemental groundwater/conjunctive use		1	1
Flush existing wells to develop maximum flow rates		0	0
Blend primary supply with water of lesser quality to increase supplies		0	0
Increase use of recycled water		0	0
Utilize ditch water or treated effluent for irrigating landscaping/parks		0	0
Build new facilities to enhance diversion or divert new supplies		0	0
Lower reservoir intake structures		0	0
Use reservoir dead storage		0	0
Acquire additional storage		1	2
Build emergency dams or reactivate abandoned dams		0	0
Total	1	3	4

E8. Virginia Drought Assessment and Response Plan

Virginia Drought Assessment and Response Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
IV: Water Supply Augmentation	1		
Establish drought reserves		1	3
Draw from drought reserves		1	1
Increase groundwater pumping		0	0
Deepen or rehabilitate existing wells and/or reactivate abandoned wells		0	0
Develop supplemental groundwater/conjunctive use		0	0
Flush existing wells to develop maximum flow rates		0	0
Blend primary supply with water of lesser quality to increase supplies		0	0
Increase use of recycled water		0	0
Utilize ditch water or treated effluent for irrigating landscaping/parks		0	0
Build new facilities to enhance diversion or divert new supplies		0	0
Lower reservoir intake structures		0	0
Use reservoir dead storage		0	0
Acquire additional storage		0	0
Build emergency dams or reactivate abandoned dams		0	0
Total	1	2	4

Appendix F: Comprehensive Scorecard of all Sections for each State

Display of all Tier scores by section and total. These comprehensive scorecards are the main product of this study. Maximum possible scores for each Tier are as follows: Tier 1 = 4, Tier 2 = 36, and Tier 3 = 108 (See Table 12).

F1. Alabama Drought Management Plan

F2. Florida Drought Action Plan

F3. Georgia Drought Management Plan

F4. Kentucky Drought Mitigation and Response Plan

F5. North Carolina Drought Assessment and Response Plan

F6. South Carolina Drought Response Plan

F7. Tennessee Drought Management Plan

F8. Virginia Drought Assessment and Response Plan

F1. Alabama Drought Management Plan

Alabama Drought Management Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
I: Elements of a Drought Management Plan	1	9	20
II: Emergency Response	1	4	8
III: Public Education and Relations	1	3	7
IV: Water Supply Augmentation	0	0	0
Final Composite Score	3	16	35

F2. Florida Drought Action Plan

Florida Drought Action Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
I: Elements of a Drought Management Plan	1	5	12
II: Emergency Response	1	3	6
III: Public Education and Relations	1	3	7
IV: Water Supply Augmentation	1	9	15
Final Composite Score	4	20	40

F3. Georgia Drought Management Plan

Georgia Drought Management Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
I: Elements of a Drought Management Plan	1	5	12
II: Emergency Response	1	4	10
III: Public Education and Relations	1	3	7
IV: Water Supply Augmentation	1	2	4
Final Composite Score	4	14	33

F4. Kentucky Drought Mitigation and Response Plan

Kentucky Drought Mitigation and Response Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
I: Elements of a Drought Management Plan	1	9	26
II: Emergency Response	1	6	13
III: Public Education and Relations	1	5	10
IV: Water Supply Augmentation	1	5	7
Final Composite Score	4	25	56

F5. North Carolina Drought Assessment and Response Plan

North Carolina Drought Assessment and Response Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
I: Elements of a Drought Management Plan	1	8	20
II: Emergency Response	1	3	7
III: Public Education and Relations	1	3	6
IV: Water Supply Augmentation	1	3	3
Final Composite Score	4	17	36

F6. South Carolina Drought Response Plan

South Carolina Drought Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
I: Elements of a Drought Management Plan	1	7	20
II: Emergency Response	1	6	13
III: Public Education and Relations	1	3	6
IV: Water Supply Augmentation	1	9	19
Final Composite Score	4	25	58

F7. Tennessee Drought Management Plan

Tennessee Drought Management Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
I: Elements of a Drought Management Plan	1	6	14
II: Emergency Response	1	5	9
III: Public Education and Relations	1	3	5
IV: Water Supply Augmentation	1	3	4
Final Composite Score	4	17	32

F8. Virginia Drought Assessment and Response Plan

Virginia Drought Assessment and Response Plan	Tier 1 (0,1)	Tier 2 (0,1)	Tier 3 (0-3)
I: Elements of a Drought Management Plan	1	6	18
II: Emergency Response	1	4	12
III: Public Education and Relations	1	2	4
IV: Water Supply Augmentation	1	2	4
Final Composite Score	4	14	38