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A contribution to the macrofungi of Cloudland Canyon State Park

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A Contribution to the Macrofungi of Cloudland Canyon State Park

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Abstract

I conducted a survey of the macroscopic fungi within Cloudland Canyon State Park, Dade County, GA that consisted of twenty-three forays from May through December of 2019, and one foray in March 2020. The results of my survey add baseline data to our knowledge of the mushrooms present within the park, allow for the future construction of an All Taxa Biodiversity Index, and allow comparisons to other surveys of fungal diversity in similar areas of the Cumberland Plateau: the Tennessee River Gorge Trust (Starrett 2005), and the Lula Lake Land Trust (De Guzman 2000). My survey resulted in an overall collection of 198 specimens of which 116 were identified. Of the 116 specimens identified, 55 genera and 70 species were recorded. Specimens collected for this survey will be accessioned in the UTC Museum of Natural History - Fungi, and images and metadata will be uploaded to MycoPortal. My research objective was to contribute to the knowledge of the macrofungi of the southern Cumberland Uplands. The aim of the present study was to add species to the lists of those macrofungi known to occur within the bounds of the large, nearly contiguous public and private conservation lands of The Tennessee River Gorge, the Lula Lake Land Trust, and Cloudland Canyon State Park. These three areas are similar geologically, geographically, floristically, and have a rich, shared cultural history. The Jaccard's Index of Similarity was utilized in comparing the similarities of macrofungi within Cloudland Canyon State Park, the Tennessee River Gorge Trust, and Lula Lake Land Trust.

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Introduction

Objective of the Study

To date, there has been no systematic survey on the macrofungal diversity found within Cloudland Canyon State Park. Documentation of macrofungal biodiversity can facilitate and inform conservation and management of the Cloudland Canyon State Park ecosystem and contribute to our understanding of biodiversity of forests of the Southern Cumberland Uplands. This information could also serve as the foundation of an All Taxa Biodiversity Inventory.

My research objective was to contribute to the knowledge of the macrofungi of the southern Cumberland Uplands. The aim of the present study was to add species to the lists of those macrofungi known to occur within the bounds of the large, nearly contiguous public and private conservation lands of The Tennessee River Gorge, the Lula Lake Land Trust, and Cloudland Canyon State Park. These three areas are similar geologically, geographically, floristically, and have a rich, shared cultural history.

Cloudland Canyon State Park and the Tennessee River Gorge Ecosystems

Cloudland Canyon State Park is located on the western edge of Lookout Mountain in Dade County, Georgia. The park was established in 1938 with an original area of 779 hectares and is now comprised of 1,410 hectares within the Cumberland Plateau that boast great potential for biodiversity. The great potential for biodiversity is due to the widely varied ecosystems within the park. The park varies in elevation from 243-549 meters, with high cliffs and bluffs of sandstone above, and caves, ravines, and creeks with exposed limestone on the slopes and

canyon below. There are dense, rich mixed mesophytic forests in the coves and north-facing slopes, while the plateau surface is characterized by a dryer, more open woodland.

Located in Chattanooga, Tennessee, the Tennessee River Gorge is another area that boasts high biological diversity considering its complexity. The trust was established in 1981 and consists of 10,927 hectares, of which 6,906 are currently protected. There are mature mixed mesophytic and mixed oak forests at the higher elevations of the gorge. The gorge has cliffs of sandstone that transition to limestone and dolomite in the lower layers, along with caves, ravines, and creeks.

Located in Lookout Mountain, Georgia, Lula Lake Land Trust also has the potential for high biological diversity. The trust was established 1994, but the land acquisition began in 1958 by Robert M. Davenport who wished to conserve the property to allow for educational opportunities, such as biological inventories (Lula Lake Land Trust n.d.). It now consists of 3,327 hectares of mostly mixed mesophytic forests, primarily consisting of Allegheny-Cumberland Dry Oak Forests on the slopes, flatlands, and ridges while transitioning to a South-Central Interior Mesophytic Forests in the deeper portions (Prater III 2015). Lula Lake Land Trust is also in a partnership with Cloudland Canyon State Park. The Trust has given land to CCSP and has thus doubled the size of CCSP with the intent of creating a contiguous park system on Lookout Mountain, Tennessee and Georgia (Lula Lake Land Trust n.d.).

Management of an Ecosystem in Relation to Species Richness and Diversity

Ecosystem management is an ambiguous term in the sense that no agreed upon definition is applied by federal or state entities (Grumbine 1994). Considering this, one could use a

working definition of ecosystem management as a process that "integrates scientific knowledge of ecological relationships within a complex sociopolitical and values framework toward the general goal of protecting native ecosystem integrity over the long term" (Grumbine 1994).

Although there are many facets to properly maintaining a forest ecosystem, a critical part of that process is the proper collection and identification of species within that ecosystem (Grumbine 1994). The construction of a baseline species assessment allows for a general recognition of species present within the ecosystem that could potentially help guide management efforts. Once a baseline assessment is established, a more thorough and comprehensive listing can take form with the help of continuous survey efforts. It is important to note that these baseline data alone do not allow for specific answers concerning conservation efforts (Starrett 2005); a more systematic approach must be implemented to answer these questions.

Role of Fungi in an Ecosystem

Fungi are essential to forest ecosystems, and to disregard their importance is to "misunderstand the system" (Rayner 1992). The existence of fungi is dependent upon the interactions and associations formed in various ways. Saprobic fungi aid in the decomposition of organic matter that is then also cycled throughout the ecosystem (Pilz and Molina 1996). Through this decomposition, accumulation of the organic matter within the fungi occurs and can "effect temporal changes in the availability of materials in the environment" (Dighton 2016). Parasitic fungi are the disease-causing agents of many plants, animals, and other fungi. Parasitic fungi can also increase biodiversity by infecting, and ultimately killing, tree hosts that can then

be inhabited by various other species that previously could not utilize the tree (Pilz and Molina 1996). The vast majority of forest plants are engaged in a mutualistic symbiotic relationship with fungi called a mycorrhiza (Heijden and Horton 2009). The mycorrhiza is an organ of exchange between plant's root system and a fungus, or multiple fungi. For mycorrhizal fungi, the benefits include sugars and other products manufactured by their plant partners via photosynthesis. For mycorrhizal plants, the underground networks formed with their fungal partners result in increased nutrient uptake, seedling support, disease protection, internal cycling of nutrients, and ability to facilitate bacterial dispersion (Heijden and Horton 2009). It is also important to note that a mycorrhizal fungus cannot live without its host, and, in the absence of the fungus, the host does not compete well in comparison to those with mycorrhizal associations (Arora 1986). These networks are important for any heterogeneous environment considering the resources found within them can be allocated from areas of storage or excess to young, growing areas (Dighton 2016). Also, mycorrhizas serve to aggregate soils, which aids in erosion prevention (Miller and Jastrow 1992). Fungi also provide a wide array of organisms within an ecosystem with nutrients through being consumed. Examples of animals that eat fungi include deer, small mammals, arthropods, mollusks, and other invertebrates. Fungi can also be consumed by humans and some may even be utilized for their medicinal properties, which has led to an increase in foraging of wild mushrooms that have resulted in a commercial market being established (Pilz and Molina 1996).

Edge Effects on Fungi

Edge effects occur as a result of forest fragmentation, which creates an abrupt transition between two habitat types. Although hiking trails are usually narrow, they still have the potential

to create fragmentation and increase the edge area of a forest. Fragmentation can lead to isolation of patches of forest, a reduction in the overall area of forest, and an increase of environmental exposure at forest edges. These edges are considered ecologically distinct in comparison to the interior and thus have differing microclimatic conditions (Crockatt 2012). Edges generally allow for greater species richness and alpha diversity (Van Dyke 2008). However, the species that usually utilize edges are considered "habitat generalists" that are associated with large dispersal distances and wide geographic ranges (Van Dyke 2008). Considering the specificity of many fungal species, this may account for certain species being present or absent along the trail. The conditions of microclimate and their effects on fungi, both at the individual and community level, are still in need of future research considering the complexity and multi-layered effects that a change in microclimate has, but it is known that generally the abundance of fruiting bodies and biomass in the soil is reduced at the edge compared to the interior (Crockatt 2012).

Detection of Fungal Species

Considering there are currently around 100,000 known species of fungi and an estimated 12 million species (Bing et al. 2019) species to be discovered, the present study will focus on only macrofungi. The macrofungi are those fungi that produce macroscopic sporocarps – also known as "mushrooms". Yeasts (unicellular fungi), molds (fungi with microscopic sporocarps), lichens (fungi in obligate symbiosis with an alga and/or cyanobacterium), endophytes (fungi that live entirely within a plant host), and endomycorrhizas (microscopic structures in roots visible only after clearing and staining the host cells) are too difficult to study in natural settings and within my suggested timeframe and resources (Pilz and Molina 1996).

Macrofungal sporocarps typically arise from a mycelium, which is embedded in a host or substratum. A mycelium is composed of a mass of hyphae, which are branching filamentous tubular cells that are a part of the vegetative growth of fungi and that help develop a continuous connectivity between cells (Dighton 2016). Originally, the mycelium is monokaryotic and cannot produce a sporocarp. Once the joining of two compatible monokaryotic mycelia occurs, a dikaryotic mycelium is formed which can lead to the production of a sporocarp. Fruiting of a sporocarp is very much driven by local climatic conditions and varies annually (Lodge et. al 2004). Along with climatic conditions being met, the fruiting of certain species is also dependent upon seasonality considering factors of humidity, temperature, and available nutrition (Pilz and Molina 1996). For this study, it is also important to note that even when observing locations near one another, different habitats have an effect on fruiting phenology (Pilz and Molina 1996).

Considering many mushrooms are ephemeral and have irregularly occurring fruiting phenology, to properly document species richness and diversity, observance of any given site should be repeated routinely, and the frequency of observation should increase when conditions and results are favorable (i.e. after precipitation) (Lodge et. al 2004). However, favorable conditions do not guarantee fruiting and specimens can still be undocumented due to a mistimed forage. To create an ideal species inventory of an area, it is suggested that five years of weekly to monthly visits occur during fruiting seasons (Pilz and Molina 1996).

Methods

Study Parameters

The survey area is within Cloudland Canyon State Park in Dade County, Georgia. Forays were conducted from May to December of 2019, and once in March 2020. Collected specimens were identified, prepared (dried then frozen), and catalogued in the UTC Museum of Natural History – Fungi. In their survey of the Tennessee River Gorge Trust, Starrett (2015) followed a similar protocol for identification, preparation, and cataloguing. Our species records were compared. A comparison between the findings of this survey and the findings of De Guzman (2000) was warranted considering the similarity and proximity of the study areas.

Forays

Currently, there is no universally applicable technique to surveying fungi (Rossman 1998). Thus, I utilized a visual transect sampling method by traversing seven trails within various regions of Cloudland Canyon State Park, which considered different habitat types. The research areas consisted of the Can't Hardly Trail, Cherokee Falls, the West Rim Loop Trail, Sitton's Gulch, the Pathkiller Trail, the Backcountry Trail, and the Cloudland Connector Trail. Each trail was covered in its entirety on an "out and back" basis minus Sitton's Gulch and the Cloudland Connector Trail considering their lengths.

A total of twenty-three forays were conducted from May to December 2019, with one foray in March of 2020, and the respective frequencies of trail visitation are noted in Table 1. Each foray ranged in time from 1-3 hours, depending on the distance hiked and the amount of

time spent off trail. This was ample time to collect an adequate number of specimens and allow for the obtainment of a spore print in some cases.

Collecting

When collecting macrofungal specimens, both fleshy and perennial sporocarps, the entire fruiting body was collected from the substrate using a knife in order to maintain the integrity of the specimen. Excavation of the specimen also served to uncover any potential "volva, rooting base, bulb, or attachment to buried substrata" which would aid in identification (Lodge et. al 2004). In instances of crust (e.g. *Hydnochaete olivacea*) or "jelly" fungi (e.g. *Exidia recisa*), a portion of substrate was removed with the specimen. If various stages of sporocarp development were found within an area, they were collected as well. For a mycological survey of an area, it is imperative that specimens be labeled as they are collected (Lodge et. al 2004; Arora 1986). Collection of meta-data included date, location description, latitude and longitude (in decimal degrees), habitat, surrounding vegetation, substratum, and any notable characteristics of the mushroom itself including color of the pileus and hymenophore (including staining or bruising), type of hymenophore (smooth surface, lamellae, folds, tubes, or teeth), texture, the presence or absence of any veil remnants, the presence or absence of an annulus, and the shape of the fruiting body. Two methods of in-field storage were utilized: wax paper with a 3x5 index card and printer paper folded into an envelope. Both methods served to obtain a spore print both while in the field and upon returning by placing the hymenophore portion of the specimen directly on paper to capture the spores. In situ photos were taken of specimens that were harvested to aid in identification.

Identification

Identification began in the field while constructing notes on the specimen in situ. This is important considering that dried mushroom characteristics often differ significantly from their fresh, in-situ state. Upon returning to the lab, specimens were checked for spore prints (spore deposits en masse) that would aid in the identification process by providing visual evidence for spore color. Aside from the observations of physical characteristics made in the field, microscopic characteristics were determined in the lab. These consisted of spore size, shape, orientation, and morphology. Various other microscopic structures such as spore producing structures (basidia and asci) and cystidia were observed for some specimens. For example, very few species of fungi have horn-like pleurocystidia (sterile cells on gill surfaces), so this was helpful in determining the identification of *Pluteus cervinus* (Figure 1). Melzer's reagent was, in some cases, utilized to determine whether spores were amyloid (blue), dextrinoid (red), or nonamyloid (no change). A 4% solution of Potassium Hydroxide (KOH) was utilized to test color changes, or lack thereof.

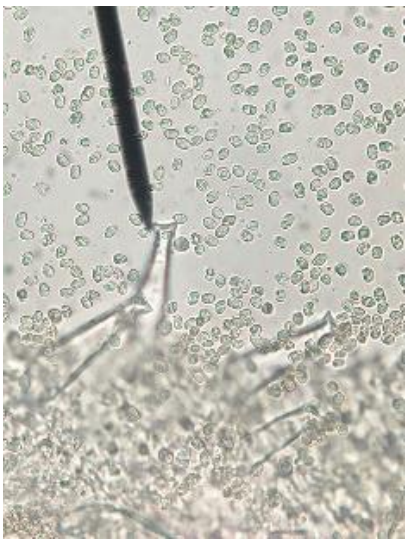

Figure 1 Pleurocystidia of *Pluteus cervinus*

Species diagnoses were made in the lab using mushroom field guides and dichotomous keys (Arora 1986; Bessette et. al 2007; Beug et. al 2014; Christensen 1965; Elliot & Stephenson 2018; Hesler 1975; Lincoff 1981; Miller & Miller 2006) and online resources.

Considering the use of guides of various age, it is imperative to note that taxonomy of fungi is fluctuating constantly based on new findings and is overall loose in structure (Arora 1986; Bing 2019; Dighton 2016). For example, *Xerocomus subtomentosus* (Figure 2), a species within the Boletaceae family, was formerly known as *Boletus subtomentosus* and is still recognized as such by some mycologists. This distinction comes as a result of genetic testing that separates *X. subtomentosus* from other species within the genus *Boletus*. This approach is now being implemented more in taxonomic analysis considering the traditional parameters and previous lack of phylogenetic approaches within fungal identification (Bing 2019).

Figure 2 *Xerocomus subtomentosus;* collected on 26 July 2019 on the Can't Hardly Trail

Preparation of Specimens

To be stored within the UTC Museum of Natural History – Fungi and aid in future identification processes, voucher specimens had to be properly prepared and preserved. The preparation process included both drying and freezing of specimens. Drying is an essential to the preservation of fungi for later study and also maintains the microscopic anatomical features (Arora 1986). The drying process serves to remove excess moisture from the mushrooms to eliminate the potential to rot, while also eliminating some organisms that might be feeding on the specimen. However, it is important to note that dried specimens are still hygroscopic, thus they can absorb moisture from the ambient air, so proper storage once dried is necessary (Lodge et. al 2004). Drying began soon after arrival at the laboratory and ample descriptive notes had been taken on the fresh specimen. The specimens were placed in the UTC Mycology drying cabinet for approximately 48 hours at a temperature of 90F (32C) with some larger specimens requiring more time if not sectioned beforehand. The use of a commercial dryer is not the only way to dry specimens, but it is more efficient than other processes such as air drying or using an in-home dehydrator. After the specimens were removed from the dryer and placed in temporary storage, they were moved to a freezer that maintained a temperature of -20F (-29C) for approximately 48 hours. Placing the specimens in this environment was intended to kill insects and other arthropods in the specimens that may have survived the drying treatment.

Cataloging / Comparison

Field notes from the forays coupled with identifications were input into the collBook desktop application (Powell 2019) which contained sections for: genus, species, substrate, occurrence remarks, identification remarks and references, locality, latitude and longitude coordinates, and primary and associated collectors. Data sheets for the UTC-Fungarium are in the process of being made and will also include accession numbers that will be entered into the existing record.

The results of this survey were measured strictly by the numbers of species represented. These results were compared to the findings of Starrett (2005) and De Guzman (2000) by utilizing the Jaccard's Index of Similarity (Jaccard 1912). This index compares the findings of two sets by identifying the shared and distinct specimens in each. The measure of similarity is represented by a range of zero to one hundred percent, with a higher percentage representing more similarity. The formula for this index is as follows: $J(X,Y) = |X \cap Y| / |X \cup Y|$, where $|X \cap Y|$ (intersection) represents the number of species shared by both sets while $|X \cup Y|$ (union) represents the number of species in either set.

Nomenclature was considered when creating a list of similar species within the park. Considering the fluidity of taxonomy in fungal species, to adequately compare findings, the names of species that have undergone a recent change in nomenclature were synonymized using the fungal database Mycobank.

Results

This macroscopic survey resulted in collection of 198 specimens that represented 55 genera and 70 species from Cloudland Canyon State Park (Table 2). Seventeen specimens of the 198 were identified to genus level. One-hundred two specimens of the 198 were identified to species level. The species richness is thus established at 70 species and is used to calculate species diversity. The Jaccard's Index of Similarity value between Cloudland Canyon State Park and the Tennessee River Gorge was 8.9%, while the value between Cloudland Canyon State Park and Lula Lake Land Trust was 6.05%. Only specimens that were identified to a species level were considered when calculating results (Table 3, 4). As Starrett (2005) did in their study, specimens denoted under a certain genus that could not be identified to the species level were denoted by *"sp.*". These were then grouped under their respective genera and counted as a single species. An example is the listings for *Russula sp.*, which had four unidentified specimens all grouped as one species (Table 2).

Species diversity for Cloudland Canyon State Park was found to be lower than that of the Tennessee River Gorge Trust based upon the species recorded from these surveys. In comparison to Lula Lake Land Trust, Cloudland Canyon State Park was found to have more diversity.

Discussion

The results from this survey provided a good baseline species assessment of macrofungi within Cloudland Canyon State Park. The twenty-four forays, which ran through a total of 8 months, conducted in CCSP added to a previously non-existent list that now boasts 70 total species within the park. This similar time frame and frequency conducted by Starrett (2005) in

the TRGT resulted in higher diversity findings which added 138 new species resulting in a list of 176 total species. De Guzman (2000) conducted a yearlong study within a one-acre plot in the Lula Lake Land Trust area, which added 63 species. When it comes to accurate comparisons, the results from this survey can be most accurately compared to those of Starrett (2005) considering more shared variables. The Jaccard's Index of Similarity values calculated were interesting. Considering that the three areas are similar geologically, geographically, floristically, and are also nearly contiguous, one would expect primarily similar species to be found in surveys. This was not the case in the comparison of Cloudland Canyon State Park to the Tennessee River Gorge Trust and Lula Lake Land Trust, which had similarity values of 8.94% and 6.05% respectively. These low values suggest that these areas may be quite distinct concerning their fungal diversity. However, a better explanation may be that actual fungal diversity is very high and that considering the limited scopes of the three studies, only a very small portion of fungal diversity was sampled. It is likely that the similarities of the sites would begin to converge after many seasons of repeated sampling and many years of systematic surveys in each of the areas, ideally over a five-year span (Pilz & Molina 1996). I suggest future surveys in all the areas to record more species. When species are added to the existing lists of macrofungi, I expect that the Jaccard's Index of Similarity values between the three locations will be higher.

This survey operated under the model of a visual transect, considering that "no universally applicable technique to assess fungal diversity" exists (Rossman 1998). This form of sampling was highly successful in both my survey and Starrett's survey (2005). For my survey, the trail was considered the line that was followed. While staying on the path, one could presumably see both sides at a distance of 3 to 4 meters. These transects can be established within various habitats within the area of study as well. If transects are established in these study

areas, they could potentially be revisited in future surveys in order to provide long term data about species richness and abundance, even showing where certain species are most present along each transect. Another way to have a more systematic approach is to supply latitude and longitude coordinates for each specimen collected. For this survey, only the coordinates of trailheads were denoted. Lastly, a mycoblitz event could be organized. A mycoblitz, as organized in Starrett's (2005) survey, involves the recruitment of a group of expert mycologists to aid in collection and identification. This multiple day-spanning, "many eyeballs" method allowed for the discovery and identification of many species in comparison to this survey's mostly solo foraging effort. Lodge et al (2004) hints at the value of such methods by saying, "Unless a large, efficient workforce is available, specimens may decay before they can be adequately documented, resulting in significant loss of data." With the implementation of these recommendations, species richness counts at CCSP could potentially rise to numbers similar to the TRGT with future surveys.

Results concerning biodiversity must be represented mathematically, but this often negates the significance of various species within an ecosystem (Van Dyke 2008). Considering this, it is important to note that the specimens found in this survey are not limited in their role or conservation value within CCSP based upon the number of their occurrences in this survey. The results were influenced by what was sampled and the area sampled, thus the Fungarium specimens do not reflect the overall diversity of macrofungi of the park.

The purpose of this survey was to add to our knowledge and understanding of macrofungal diversity within Cloudland Canyon State Park, an area in the Southern Cumberland Uplands that has potential for high biodiversity considering the variety of ecosystems within the

park. This survey and the baseline data recorded provide a foundation for future surveys in the park.

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Tables

Table 1: Survey site positions and dates traversed

SURVEY SITE	LATITUDE	LONGITUDE	DAYS HIKED
Backcountry Trail	34.824443	-85.480328	07 August 2019 28 August 2019 20 October 2019
Can't Hardly Trail	34.838036	-85.438643	14 June 2019 27 June 2019 26 July 2019 7 September 2019 27 October 2019
Cherokee Falls Trail	34.8337	-85.4840	21 April
Cloudland Connector Trail	34.83741217	-85.43925176	15 November 2019 16 November 2019
Pathkiller Trail	34.83741217	-85.43925176	24 May 2019 02 July 2019 22 September 2019 09 November 2019
Sitton's Gulch	34.8599	-85.4847	07 May 2019 29 September 2019 06 October 2019 02 December 2019 12 March 2020
West Rim Loop Trail	34.834667	-85.480517	30 April 2019 19 July 2019 07 September 2019 27 October 2019

Table 2: CCSP macrofungi specimen list

Genus	**Species**	**Family**	**Order**	**Date Collected**
Amanita	*sp.*	Amanitaceae	Agaricales	9/14/2019
Annulohypoxylon	*cohaerens*	Xylariaceae	Xylariales	9/22/2019
Annulohypoxylon	*cohaerens*	Xylariaceae	Xylariales	11/9/2019
Annulohypoxylon	*cohaerens*	Xylariaceae	Xylariales	11/16/2019
Annulohypoxylon	*sp.*	Xylariaceae	Xylariales	11/9/2019
Auricularia	*fuscosuccinea*	Auriculariaceae	Auriculariales	10/27/2019
Auricularia	*fuscosuccinea*	Auriculariaceae	Auriculariales	3/12/2020
Boletus	*auripes*	Boletaceae	Boletales	6/14/2019
Byssomerulius	*incarnatus*	Meruliaceae	Polyporales	3/12/2020
Calocera	*cornea*	Daacrymycetaceae	Dacrymycetes	10/6/2019
Calocera	*cornea*	Daacrymycetaceae	Dacrymycetes	10/20/2019
Calocera	*viscosa*	Daacrymycetaceae	Dacrymycetes	10/27/2019
Calvatia	*cyathiformis*	Agaricaceae	Agaricales	11/1/2019
Cantherellus	*lateritius*	Cantharellaceae	Cantharellales	6/14/2019
Cantherellus	*lateritius*	Cantharellaceae	Cantharellales	6/27/2019
Cantherellus	*lateritius*	Cantharellaceae	Cantharellales	7/19/2019

Cerioporus	*leptocephalus*	Polyporaceae	Polyporales	8/28/2019
Cerioporus	*leptocephalus*	Polyporaceae	Polyporales	9/7/2019
Cerioporus	*leptocephalus*	Polyporaceae	Polyporales	9/29/2019
Cerioporus	*leptocephalus*	Polyporaceae	Polyporales	6/14/2019
Cerioporus	*leptocephalus*	Polyporaceae	Polyporales	9/22/2019
Clavulinopsis	*sp.*	Clavariaceae	Agaricales	6/27/2019
Clitocybe	*ectypoides*	Tricholomataceae	Agaricales	7/26/2019
Coprinopsis	*sp.*	Psathyrellaceae	Agaricales	6/14/2019
Craterellus	*fallax*	Cantharellaceae	Cantharellales	6/14/2019
Crepidotus	*sp.*	Crepidotaceae	Agaricales	8/7/2019
Diatrype	*stigma*	Diatrypaceae	Xylariales	7/19/2019
Diatrype	*stigma*	Diatrypaceae	Xylariales	9/14/2019
Diatrype	*stigma*	Diatrypaceae	Xylariales	9/22/2019
Exidia	*recisa*	Auriculariaceae	Auriculariales	10/27/2019
Exidia	*recisa*	Auriculariaceae	Auriculariales	11/9/2019
Exidia	*recisa*	Auriculariaceae	Auriculariales	11/16/2019
Fomitopsis	*cajanderi*	Fomitopsidaceae	Polyporales	6/14/2019
Fomitopsis	*cajanderi*	Fomitopsidaceae	Polyporales	10/6/2019

Fomitopsis	*rosea*	Fomitopsidaceae	Polyporales	6/14/2019
Galerina	*marginata*	Hymenogastraceae	Agaricales	3/12/2020
Galiella	*rufa*	Sarcosomataceae	Pezizales	6/14/2019
Galiella	*rufa*	Sarcosomataceae	Pezizales	6/27/2019
Galiella	*rufa*	Sarcosomataceae	Pezizales	7/26/2019
Gerronema	*strombodes*	Marasmiaceae	Agaricales	7/19/2019
Hericium	*coralloides*	Hericiaceae	Russulales	11/1/2019
Hydnochaete	*olivaceum*	Hymenochaetaceae	Hymenochaetales	8/28/2019
Hydnochaete	*olivaceum*	Hymenochaetaceae	Hymenochaetales	9/14/2019
Hymenochaete	*badio-ferruginea*	Hymenochaetaceae	Hymenochaetales	6/14/2019
Kretzschmaria	*deusta*	Xylariaceae	Xylariales	3/12/2020
Lactarius	*sp.*	Russulaceae	Russulales	6/27/2019
Lactarius	*volemus*	Russulaceae	Russulales	6/27/2019
Lenzites	*betulina*	Polyporaceae	Polyporales	6/14/2019
Lenzites	*betulina*	Polyporaceae	Polyporales	10/6/2019
Lenzites	*betulina*	Polyporaceae	Polyporales	10/27/2019
Lycoperdon	*pyriform*	Agaricaceae	Agaricales	11/9/2019
Lycoperdon	*pyriform*	Agaricaceae	Agaricales	11/16/2019

Lycoperdon	*sp.*	Agaricaceae	Agaricales	8/7/2019
Megacollybia	*platyphylla*	Tricholomataceae	Agaricales	5/17/2019
Panellus	*stipticus*	Mycenaceae	Agaricales	10/27/2019
Phaeolus	*alboluteus*	Fomitopsidaceae	Polyporales	7/19/2019
Phellinus	*everhartii*	Hymenochaetaceae	Polyporales	10/6/2019
Phellinus	*gilvus*	Hymenochaetaceae	Polyporales	5/17/2019
Phellinus	*gilvus*	Hymenochaetaceae	Polyporales	5/24/2019
Phellinus	*gilvus*	Hymenochaetaceae	Polyporales	6/14/2019
Phellinus	*gilvus*	Hymenochaetaceae	Polyporales	11/16/2019
Phellinus	*gilvus*	Hymenochaetaceae	Polyporales	11/1/2019
Phellinus	*robiniae*	Hymenochaetaceae	Polyporales	3/12/2020
Phellinus	*sp.*	Hymenochaetaceae	Polyporales	6/14/2019
Phellinus	*sp.*	Hymenochaetaceae	Polyporales	9/7/2019
Phellinus	*sp.*	Hymenochaetaceae	Polyporales	9/14/2019
Phlebia	*radiata*	Meruliaceae	Polyporales	10/27/2019
Phlebia	*tremullosa*	Meruliaceae	Polyporales	11/9/2019
Pleurotus	*ostreatus*	Pleurotaceae	Agaricales	11/16/2019
Pleurotus	*ostreatus*	Pleurotaceae	Agaricales	12/2/2019

Pleurotus	*ostreatus*	Pleurotaceae	Agaricales	3/12/2020
Pluteus	*cervinus*	Pluteaceae	Agaricales	10/27/2019
Polyporus	*sp.*	Polyporaceae	Polyporales	8/28/2019
Poria	*sp.*	Polyporaceae	Polyporales	9/22/2019
Poronidulus	*conchifer*	Polyporaceae	Polyporales	3/12/2020
Retiboletus	*ornatipes*	Boletaceae	Boletales	7/2/2019
Russala	*sp.*	Russulaceae	Russulales	6/14/2019
Russala	*sp.*	Russulaceae	Russulales	6/27/2019
Russala	*sp.*	Russulaceae	Russulales	6/27/2019
Russala	*sp.*	Russulaceae	Russulales	6/27/2019
Sarcoscypha	*coccinea*	Sarcoscyphaceae	Pezizales	3/12/2020
Schizophyllum	*commune*	Schizophyllaceae	Agaricales	9/29/2019
Schizophyllum	*commune*	Schizophyllaceae	Agaricales	3/12/2020
Schizopora	*paradoxa*	Schizoporaceae	Hymenochaetales	8/28/2019
Schizopora	*paradoxa*	Schizoporaceae	Hymenochaetales	9/14/2019
Scleroderma	*sp.*	Sclerodermataceae	Boletales	8/7/2019
Sparassis	*crispa*	Sparassidaceae	Polyporales	11/1/2019
Spongipellis	*pachydon*	Cerrenaceae	Polyporales	11/1/2019

Spongipellis	*pachyodon*	Cerrenaceae	Polyporales	12/2/2019
Stereum	*complicatum*	Stereaceae	Russulales	5/24/2019
Stereum	*complicatum*	Stereaceae	Russulales	8/7/2019
Stereum	*complicatum*	Stereaceae	Russulales	9/7/2019
Stereum	*hirsutum*	Stereaceae	Russulales	10/27/2019
Stereum	*ostrea*	Stereaceae	Russulales	4/30/2019
Stereum	*ostrea*	Stereaceae	Russulales	5/17/2019
Stereum	*ostrea*	Stereaceae	Russulales	5/24/2019
Stereum	*ostrea*	Stereaceae	Russulales	6/14/2019
Stereum	*ostrea*	Stereaceae	Russulales	8/7/2019
Stereum	*ostrea*	Stereaceae	Russulales	11/16/2019
Strobilomyces	*floccopus*	Boletaceae	Boletales	6/27/2019
Trametes	*elegans*	Polyporaceae	Polyporales	9/7/2019
Trametes	*gibbosa*	Polyporaceae	Polyporales	9/29/2019
Trametes	*hirsuta*	Polyporaceae	Polyporales	4/30/2019
Trametes	*hirsuta*	Polyporaceae	Polyporales	5/24/2019
Trametes	*versicolor*	Polyporaceae	Polyporales	8/28/2019
Trametes	*versicolor*	Polyporaceae	Polyporales	9/14/2019

Trametes	*versicolor*	Polyporaceae	Polyporales	9/14/2019
Tremella	*aurantia*	Tremellaceae	Tremellales	8/28/2019
Tremella	*aurantia*	Tremellaceae	Tremellales	3/12/2020
Tremella	*globispora*	Tremellaceae	Tremellales	8/28/2019
Tremella	*mesenterica*	Tremellaceae	Tremellales	10/20/2019
Tremella	*messentarica*	Tremellaceae	Tremellales	3/12/2020
Trichaptum	*biforme*	Polyporaceae	Polyporales	5/24/2019
Trichaptum	*biforme*	Polyporaceae	Polyporales	6/14/2019
Trichaptum	*biforme*	Polyporaceae	Polyporales	8/28/2019
Tyromyces	*sp.*	Polyporaceae	Polyporales	3/12/2020
Xerocomus	*subtomentosus*	Boletaceae	Boletales	7/26/2019
Xylaria	*cubensis*	Xylariaceae	Xylariales	3/12/2020
Xylobolus	*frustulatus*	Stereaceae	Russulales	9/22/2019

Table 3: Cloudland Canyon State Park & Tennessee River Gorge Trust Jaccard's Similarity Index values

TRGT Shared Species Findings	**CCSP Species not in TRGT**
Calocera cornea	*Annulohypoxylon cohaerens*
Boletus retipes = Retiboletus ornatipes	*Auricularia fuscosuccinea*
Calvatia cyathiformis	*Byssomerulius incarnatus*
Fomitopsis cajanderi	*Calocera viscosa*
Galiella rufa	*Cantharellus lateritius*
Hydnochaete olivaceum	*Clitcocybe ectypoides*
Lactarius volemus	*Craterellus fallax*
Lenzites betulina	*Diatrype stigma*
Lycoperdon pyriforme	*Exidia recisa*
Panellus stipticus	*Fomitopsis rosea*
Polyporus varius = Cerioporus leptocephalus	*Galerina marginata*
Phellinus gilvus	*Gerronema strombodes*
Pleurotis ostreatus	*Hericium coralloides*
Pluteus cervinus	*Hymenochaete badio-ferruginea*
Sarcoscypha coccinea	*Megacollybia platyphylla*
Spongipellis pachydon	*Phaeolus albolutens*
Stereum complicatum	*Phellinus everhartii*
Stereum hirsutum	*Phellinus robiniae*
Stereum ostrea	*Phlebia radiata*
Strobilomyces floccopus	*Phlebia tremullosa*
Trichaptum biformis = Trichaptum biforme	*Poronidulus conchifer*
Ustulina deusta = Kretzschmaria deusta	*Schizophyllum commune*
	Schizopora paradoxa
	Sparassis crispa
	Tremella aurantia
	Tremella mesentarica
	Trametes elegans
	Trametes gibossa
TRGT Species Total = 176	*Xerocomus subtomentosus*
CCSP Species Total = 70	*Xylaria cubensis*
Total Species Count = 246	*Xylobolus frustulatus*
Shared Species = 22	
Jaccard's Index Value = 8.94%	**Total Species Not Found in TRGT = 31**

Table 4: Cloudland Canyon State Park & Lula Lake Land Trust Jaccard's Similarity Index values

De Guzman's (2000) Shared Species Findings	CCSP Species not in LLLT
Boletus retipes = Retiboletus ornatipes	*Annulohypoxylon cohaerens*
Lactarius volemus	*Auricularia fuscosuccinea*
Pleurotus ostreatus	*Boletus auripes*
Tricholomopsis platyphylla = Megacollybia platyphylla	*Byssomerulius incarnatus*
Trametes hirsutum = Trametes hirsuta	*Calocera cornea*
Trichaptum biformis = Trichaptum biforme	*Calocera viscosa*
Auricularia auricula = Auricularia fuscosuccinea	*Calvatia cyathiformis*
Bulgaria rufa = Galiella rufa	*Cantharellus lateritius*
	Cerioporus leptochephalus
	Clitocybe ectypoides
	Craterellus fallax
	Diatrype stigma
	Exidia recisa
	Fomitopsis cajanderi
	Fomitopsis rosea
	Galerina marginata
	Hericium coralloides
	Hydnochaete olivaceum
	Hymenochaete badio-ferruginea
	Kretzschmaria deusta
	Lenzites betulina
	Lycoperdon pyriform
	Panellus stipticus
	Phaeolus alboluteus
	Phellinus gilvus
	Phellinus robiniae
	Phlebia radiata
	Phlebia tremullosa
	Pluteus cervinus
	Poronidulus conchifer
	Sarcoscypha coccinea
	Schizophyllum commune
	Schizopora paradoxa
	Spongipellis pachydon
	Stereum complicatum

LLLT Species Total = 63
CCSP Species Total = 70
Total Species Count = 133
Shared Species = 8
Jaccard's Index Value = 6.05%

Stereum hirsutum
Strobilomyces floccopus
Trametes elegans
Trametes gibbosa
Trametes versicolor
Tremella aurantia
Tremella mesentarica
Xerocomus submentosus
Xylaria cubensis
Xylobolus frustrulatus

Total Species Not Found in LLLT =45