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Georgia Piedmont Soils – Characteristics for Forest Management Decisions Part II – The Alluvial Soil Series

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There are two main types of soils in the Georgia Piedmont (Figure 1); alluvial and residual soils. Part I of this series of papers goes into some detail about the differences between the two types of soils. This paper, Part II, addresses alluvial soils. Part III (in production) of this series will address residual soils. Definitions of soil terms used in this three-part series are found in the Definitions section of this and the other two papers. For more information and a background on forest soils, refer to https://www.bugwood.org/productivity/topic.cfm?id=14.

There are 18 soil series with alluvial parent material. Three are identified as Inceptisols (that is the great group ends in "ept"); Chewacla, Wehadkee, and Riverview. Three more are classified as Entisols (end in "ent" meaning "young"); Cartecay, Toccoa, and Buncombe. All these soils are in the active river floodplain with Chewacla, Cartecay, and Wehadkee being poorly or somewhat poorly drained, likely to be under water at times, and difficult to operate (management consideration: wet conditions can restrict operations on these soils). These soil series are usually best managed as streamside management zones. Riverview, Toccoa, and Buncombe are typically a bit farther from the river and are found on sandier deposits so are well drained to excessively drained. As such, they are generally operable but given their sandy condition may leach fertilizer and other chemical inputs quickly and thus be less responsive (Management consideration: sandy surface, in some cases may less responsive due to leaching).

The remaining 12 of the 18 soils in the alluvial substrate are farther from the floodplain and are Ultisols (end in "ult") with 11 series and Alfisols (end in "alf") with one series. Ultisols and Alfisols both have clay in the subsurface (i.e., an argillic or Bt horizon) so can be similar relative to horizons and texture but different in the composition of the parent material (i.e., the material from which the soil is formed). Alfisols typically have some mafic or base-rich bedrock (i.e., gabbro or limestone) compared to Ultisols that are derived from felsic or acidic bedrock (e.g., granite). Given this mafic influence, Alfisols will tend to have slightly higher pH and base cation (i.e., Ca, Mg, and K) contents. A good example of this chemical difference is the Augusta (an Ultisol) and Fork (an Alfisol) series that are found on similar landscape positions (first river terrace), have a similar sandy surface over a clay rich horizon, but differ in base cation content due to different parent material. If sufficiently deep (> 60 inches) and well-drained or less well drained and bedded, Alfisols can be productive. The Ultisols within this same group have formed beyond the floodplain on different age river terraces. The Augusta series mentioned above may be on the first terrace and is still somewhat poorly drained with a seasonal water table at 12 to 18 inches depth. Altavista on the same landscape position is a bit deeper being

moderately well-drained with the water table at 18 to 30 inches. Whistlestop also shares a similar location but has a finer textural class and has a kandic horizon, a clay horizon comprised of low chemical reactivity. These series do not have management constraints. The State, Wichkam and Molena series are on slightly higher (and possibly older) terraces. The first two are well-drained and productive. Molena with its psammentic subgroup modifier is excessively well-drained so may provide a management challenge (Management constraint: Sandy surface, in some cases may be less responsive due to leaching). The series with the deepest solum, Masada, Hiawasse, and Rome are on old alluvial terraces with few management constraints and start to grade to the residual soil series that is addressed in Part III of this paper series.

Table 1 lists soil series common name, taxonomic name (subgroup modifier and great group names), soil order, topsoil (A or Ap) depth with thin being less than 6 inches and thick being 6 or more inches, state(s) in which the soil series are found, argillic (increase in clay content to slow down water and nutrient movement; Bt) horizon (none or depths), drainage class (important for pine versus hardwood species or dry versus wet site woody species), subsoil texture, and typical soil or solum depth (depth to parent material for solum). Table 2 lists the same soil series and has our current estimated productivity rating (subject to change as we investigate these soils more with pine and hardwood studies) for each of the listed soil series, the taxonomic name, soil order, percent slope range, and management considerations.

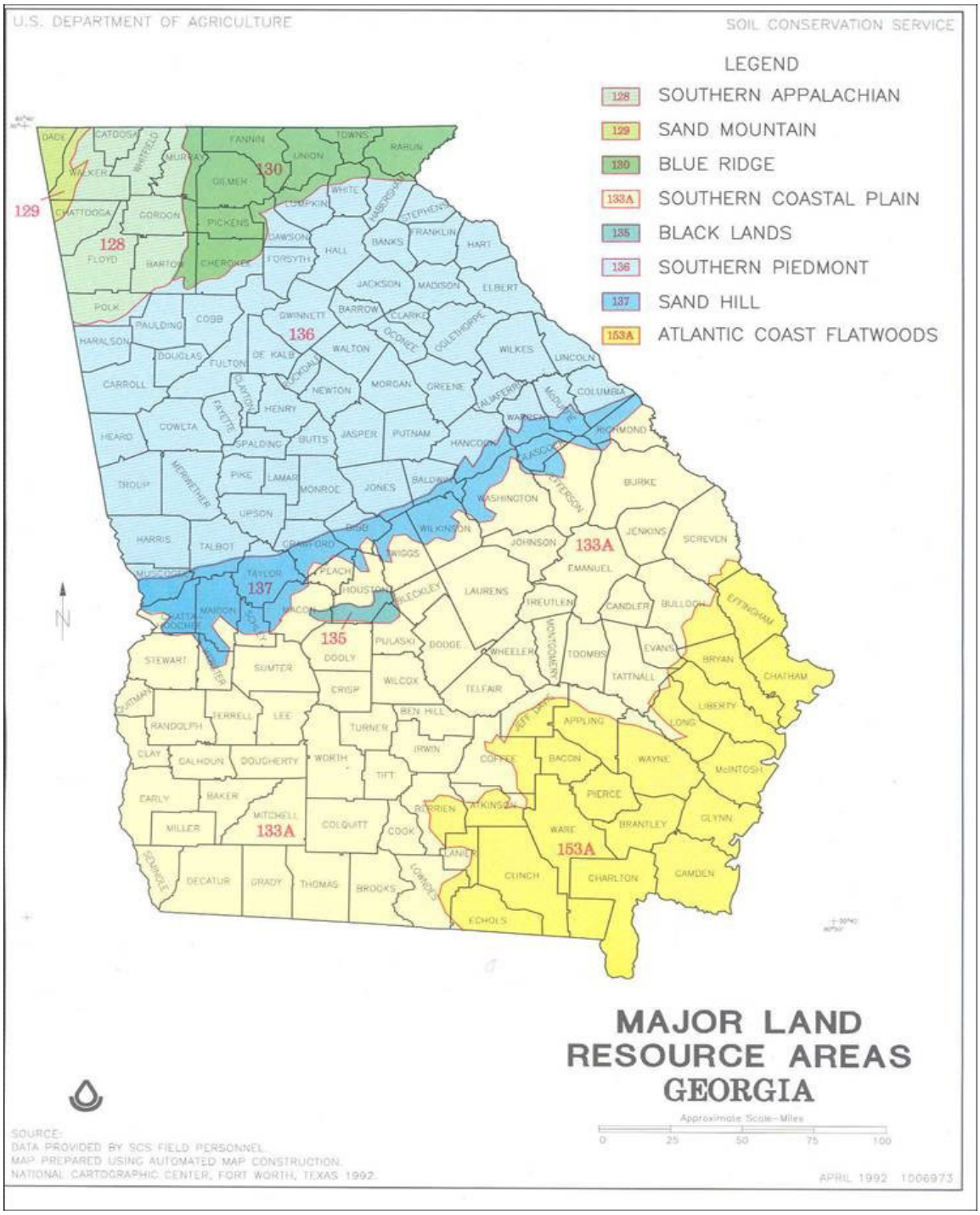

Figure 1: *Georgia map illustrating the major land resources including the Piedmont.*

Table 1. Alluvial soil series of the Georgia Piedmont – Characteristics for forest management decisions

Soil Series	Subgroup modifier	Great group	Order	A or Ap depth <6 vs>=6 (in)	State(s)	Argillic (in)	Drainage	Subsoil texture	Typical Pedon, Soil or Solum Depth (in)
Fork	Aeric	Endoaqualfs	Alfisol	<6 (1)	VA, GA, NC	Btg1=18-30, Btg2=30-38	somewhat poorly drained	silty clay loam to clay loam	thin (38)
Cartecay	Aquic	Udifluvents	Entisol	>=6 (9)	AL, GA, NC, SC, VA	none	somewhat poorly drained	loam to loamy sand	Ap to 9, C4 @ 40 to 60 (loamy sand)
Toccoa	Typic	Udifluvents	Entisol	>=6 (12)	NC, AL, GA, SC, VA	None	well drained and moderately well drained	loam to loamy sand	Ap to 12, C4 @ 50 to 62 (loamy sand)
Buncombe	Typic	Udipsamments	Entisol	>=6 (10)	NC, AL, GA, SC, TN, VA	None	excessively drained	sand to sandy loam	thick (55)
Chewacla	Fluvaquentic	Dystrudepts	Inceptisol	<6 (4)	NC, AL, GA, SC, TN, VA	None	somewhat poorly drained	loam to clay loam	thick (60)
Riverview	Fluventic	Dystrudepts	Inceptisol	>=6 (6)	AL, FL, GA, NC, SC, VA	None	well drained	sandy loam to loam	thin to thick (39)
Wehadkee	Fluvaquentic	Endoaquepts	Inceptisol	>=6 (8)	NC, AL, GA, SC, TN, VA	None	poorly drained and very poorly drained	loam to sandy clay loam	thin to thick (40)
Augusta	Aeric	Endoaquults	Ultisol	>=6 (9)	GA, AL, NC, VA	Bt=9-19 - Btg3=52-60	somewhat poorly drained	sandy clay loam to clay loam	thick (60)
Roanoke	Typic	Endoaquults	Ultisol	>=6 (7)	VA, AL, GA, NC, SC	Btg1=7-12 - Btg3=20-40	poorly drained	silty clay loam to clay	thin to thick (40)
Worsham	Typic	Endoaquults	Ultisol	<6 (5)	VA, AL, GA, NC, SC	Btg1=10-22, Btg2=22-35	poorly drained	clay	thin to thick (40)
Altavista	Aquic	Hapludults	Ultisol	>=6 (8)	NC, AL, GA, SC, VA	Bt1=15-20, Bt2=20-35	moderately well drained	sandy loam to clay loam	thick (42)
Molena	Psammentic	Hapludults	Ultisol	>=6 (7)	GA, NC, SC, VA	Bt=18-51	somewhat excessively drained	loamy sand to sand	thick (51)
Masada	Typic	Hapludults	Ultisol	<6 (2)	VA, AL, GA, NC, SC, TN	Bt1=15-25 - BCt=50-55	well drained	sandy loam to clay loam to clay	thick (50)
Rome	Typic	Hapludults	Ultisol	>=6 (9)	GA	Bt1=9-20 - Bt3=34-53	well drained	loam to sandy clay loam	thick (53)
State	Typic	Hapludults	Ultisol	>=6 (10)	VA, AL, GA, NC, SC	Bt=15-35	well drained	loam	thin (35)
Wickham	Typic	Hapludults	Ultisol	>=6 (6)	NC, AL, GA, SC, VA	Bt1=6-11 - Bt3=20-36	well drained	sandy clay loam to sandy loam	thick (50)
Whistlestop	Oxyaquic	Kanhapludults	Ultisol	>=6 (7)	GA, AL, NC	Bt1=7-26- Bt3=37-55	moderately well drained	clay to clay loam	thick (55)
Hiawassee	Rhodic	Kanhapludults	Ultisol	<6 (5)	SC, AL, GA, NC, VA	Bt1=13-38 - Bt4=63-80	well drained	sandy clay loam to clay	very thick (80)

Footnotes:
Solum or soil depths (using the smallest number, depth to top of C or BC horizon or largest Bt number): <20" very thin, 20-40" thin, 40-60" thick, >60" very thick, except for Cartecay & Toccoa
18 Alluvial soil series; 1 Alfisol, 3 Entisols, 3 Incepticols and 11 Ultisols

Table 2. Alluvial soil series of the Georgia Piedmont – estimated productivity rating and management considerations

Productivity Rank	Soil Series	Subgroup modifier	Great Group	Order	Slope (%)	Management Considerations
3	Fork	Aeric	Endoaqualfs	Alfisol	0-7	With Bt1 @ 18-30" may be a good candidate for treatments, wet conditions can restrict operations on this soil
1	Cartecay	Aquic	Udifluvents	Entisol	0-2	Wet conditions can restrict ground operations on this soil
2	Toccoa	Typic	Udifluvents	Entisol	0-4	Loam to loamy sand 60", may be less responsive to treatments due to potential leaching
2	Buncombe	Typic	Udipsamments	Entisol	0-6	Sand to sandy loam soil profile to 50", may be less responsive to treatments due to potential leaching
4	Chewacla*	Fluvaquentic	Dystrudepts	Inceptisol	0-2	Wet conditions can restrict ground operations on this soil
2	Riverview	Fluventic	Dystrudepts	Inceptisol	0-2	Sandy loam to loam profile to 39", may be less responsive to treatments due to potential leaching
4	Wehadkee*	Fluvaquentic	Endoaquepts	Inceptisol	0-2	Wet conditions can restrict ground operations on this soil
3	Augusta	Aeric	Endoaquults	Ultisol	0-2	Wet conditions can restrict ground operations on this soil
2	Roanoke	Typic	Endoaquults	Ultisol	0-2	Wet conditions can restrict ground operations on this soil
2	Worsham	Typic	Endoaquults	Ultisol	0-8	Poorly drained soils that occur in depressions where local alluvium has collected
4	Altavista	Aquic	Hapludults	Ultisol	0-10	With Bt1 @ 15-20" may be a good candidate for treatments**
3	Molena	Psammentic	Hapludults	Ultisol	0-35	With Bt1 @ 18-51" may be a good candidate for treatments
4	Masada	Typic	Hapludults	Ultisol	0-25	With Bt1 @ 15-25" may be a good candidate for treatments
4	Rome	Typic	Hapludults	Ultisol	0-6	With Bt1 @ 9-20" may be a good candidate for treatments
4	State	Typic	Hapludults	Ultisol	0-10	With Bt1 @ 15-35" may be a good candidate for treatments
4	Wickham	Typic	Hapludults	Ultisol	0-25	With Bt1 @ 6-11" may be a good candidate for treatments
4	Whistlestop	Oxyaquic	Kanhapludults	Ultisol	0-10	With Bt1 @ 7-26" may be a good candidate for treatments
4	Hiawassee	Rhodic	Kanhapludults	Ultisol	0-25	With Bt1 @ 13-38" may be a good candidate for treatments

Productivity ratings (assumes site prepared and planted loblolly pine and active management (4=highest, 3=second highest, 2=third highest, 1=lowest rating. *Chewacla and Wehadkee can be very productive, but may be best suited as streamside management zones (smz). **Treatments include fertilization, herbicide application and other management activities to improve growth.

DEFINITIONS

A horizon – Mineral horizons that formed at the surface or below an O (organic matter; the forest floor consisting of the litter; Oi layer, fermentation; Oe layer, and the Oa, humus layer) horizon that exhibit obliteration of all or much of the original rock structure and (a) are characterized by an accumulation of humified organic matter mixed with the mineral fraction and not dominated by the properties characteristic of E or B horizons; or (b) have properties resulting from cultivation, pasturing, or similar kinds of disturbances. Source: Glossary of Soil Science Terms 1996 Soil Science Society of America.

B horizon – The B Horizon is also known as the subsoil. B Horizons are often greatly composed of material illuviated (washed in from) layers above it, mostly clay, iron, aluminum oxides (deposited by eluviated water), and minerals that formed in the layer. Source: Soil Horizons - Soil Ecology Wiki (buffalo.edu)

Bt horizon – The t in the Bt horizon is an accumulation of silicate clay that either has formed in the horizon or has been moved into it by illuviation (material displaced across a soil profile, from one layer to another one, in this case clay movement into the B horizon) by the action of rainwater. Source: Glossary of Soil Science Terms 1996 Soil Science Society of America. The Bt horizon is called the argillic layer.

BC horizon – A horizon comprised of individual parts of the B and C horizon in which the B horizon component is dominant and surrounds the C component. Source: Glossary of Soil Science Terms 1996 Soil Science Society of America.

C horizon - The C Horizon, also known as the substratum is unconsolidated material above bedrock. It is insufficiently weathered to be considered soil, but still considered a layer of a soil profile. Subterranean life is far scarcer in this layer, and plant roots do not usually extend here, although it is usually soft enough for root penetration. It is essentially a transitional layer from bedrock to the soil. Source: Soil Horizons - Soil Ecology Wiki (buffalo.edu)

E horizon - The E in "E Horizon" stands for eluviation, another word for leaching. This name is appropriate because, in this layer clay, iron, and aluminum oxides leach into the lower layers (mostly the B Horizon). [1] Like the O Horizon, this layer is not always present, but when it is, it's usually in forested areas and rarely in grasslands. Because of the loss of material through eluviation, it tends to be noticeably lighter than the layers above and below it. Source: Soil Horizons - Soil Ecology Wiki (buffalo.edu)

felsic - Felsic is a modifier describing igneous rocks that are relatively rich in elements that form feldspar and quartz. It is contrasted with mafic rocks, which are relatively richer in magnesium and iron. Felsic refers to silicate minerals, magma, and rocks which are enriched in the lighter elements such as silicon, oxygen, aluminium, sodium, and potassium. Felsic rocks are usually light in color. The most common felsic rock is granite. Common felsic minerals include quartz, muscovite, orthoclase, and the sodium-rich plagioclase feldspars (albite-rich). Source: Felsic - Wikipedia

friable – A soil consistency term pertaining to the ease of crumbling of soils. Source: Glossary of Soil Science Terms 1996 Soil Science Society of America.

mafic - A mafic mineral or rock is a silicate mineral or igneous rock rich in magnesium and iron. Most mafic minerals are dark in color, and common rock-forming mafic minerals include olivine, pyroxene, amphibole, and biotite. Common mafic rocks include basalt, diabase and gabbro. Mafic rocks often also contain calcium-rich varieties of plagioclase feldspar. Mafic materials can also be described as ferromagnesian (silicate minerals relatively high in iron and magnesium). Source: Wikipedia

solum – A set of soil horizons that are related through the same cycle of pedogenic (processes occurring in soil or leading to the formation of soil) processes; the A, E and B horizons. Source: Glossary of Soil Science Terms 1996 Soil Science Society of America.