Anthropogenic influences on the fate of sediment

in East Fork Creek, Tennessee.

By

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Introduction:

Located in Williamson County, Tennessee, roughly 16 km West of the City of Franklin, Tennessee is East Fork Creek (EFC), a network of valley-hillslope systems. EFC is a rural environment comprising a small artificially dammed lake (Stephens Lake) at the headwater stream and numerous subwatersheds that collectively contribute to the primary watershed for this valley. Most of the land adjacent to the East Fork Creek channel within EFC are fallow fields, pastures to grow fodder, and locally raised livestock, such as horses and cattle. The main EFC watershed encompasses ~11.2 km^2, and this study analyzes 4 representative subwatersheds of EFC. The drainage pattern of EFC can be classified as dendritic (having an elongate, trellised channel network), suggesting a relatively uniform distribution of bedrock, and a hypothesized uniform contribution of sediment to the valley and mainstream channel of East Fork Creek.

Previous studies in the middle Tennessee region have shown human habitancy in this area since ~15-10 kya, presenting possible anthropogenic influences, such as plant resource utilization and land use from Holocene to present (Delcourt et al., 2017). Periods of sediment stability and soil development in the region can vary depending on environmental factors such as flooding, and anthropogenic influences like the introduction of forest cutting and crop agriculture (Brakenridge 1984). Sediment can accumulate or erode rapidly in fluvial systems due to stream and channel morphology (Brakenridge 1984). Studies observing numerous alluvial plains throughout the Southeastern region of North America provide evidence, such as "alluviation records and soil-forming profiles," showing that many climate-driven changes have occurred during the middle to late Holocene (Little 2003). Changes in land-use and climate over this time are expected to have influenced sediment mobility and landscape development.

This study will explore these potential effects by estimating the amount of sediment being produced within each subbasin in the EFC watershed. Creating a sediment mass balance of the EFC watershed will supply the data needed to estimate the rate, timing, and history of mass production, transport, and storage over time, and the governing processes. This mass balance should supply insight on the influences that soil, landscape evolution, and climate change have projected onto the watershed and possible downstream impacts on the mainstem Harpeth River. Spatial and quantitative sediment data from EFC are compiled into a Geographic Information System (GIS) to reconstruct recent landscape history of the EFC watershed. This research will supply insights on climate and anthropogenic effects on local watershed landscapes through the last century and Holocene.

Study Sites:

Four subwatersheds (systems) within EFC valley are investigated. System 1 and 4 are located on the western side of EFC, and systems 2 and 3 are on the eastern side (figure 1). The systems rank in area from largest to smallest: system 4 (3.2 km^2), system 3 (1.3 km^2), and systems 1 and 2 (both 1.1 km^2).

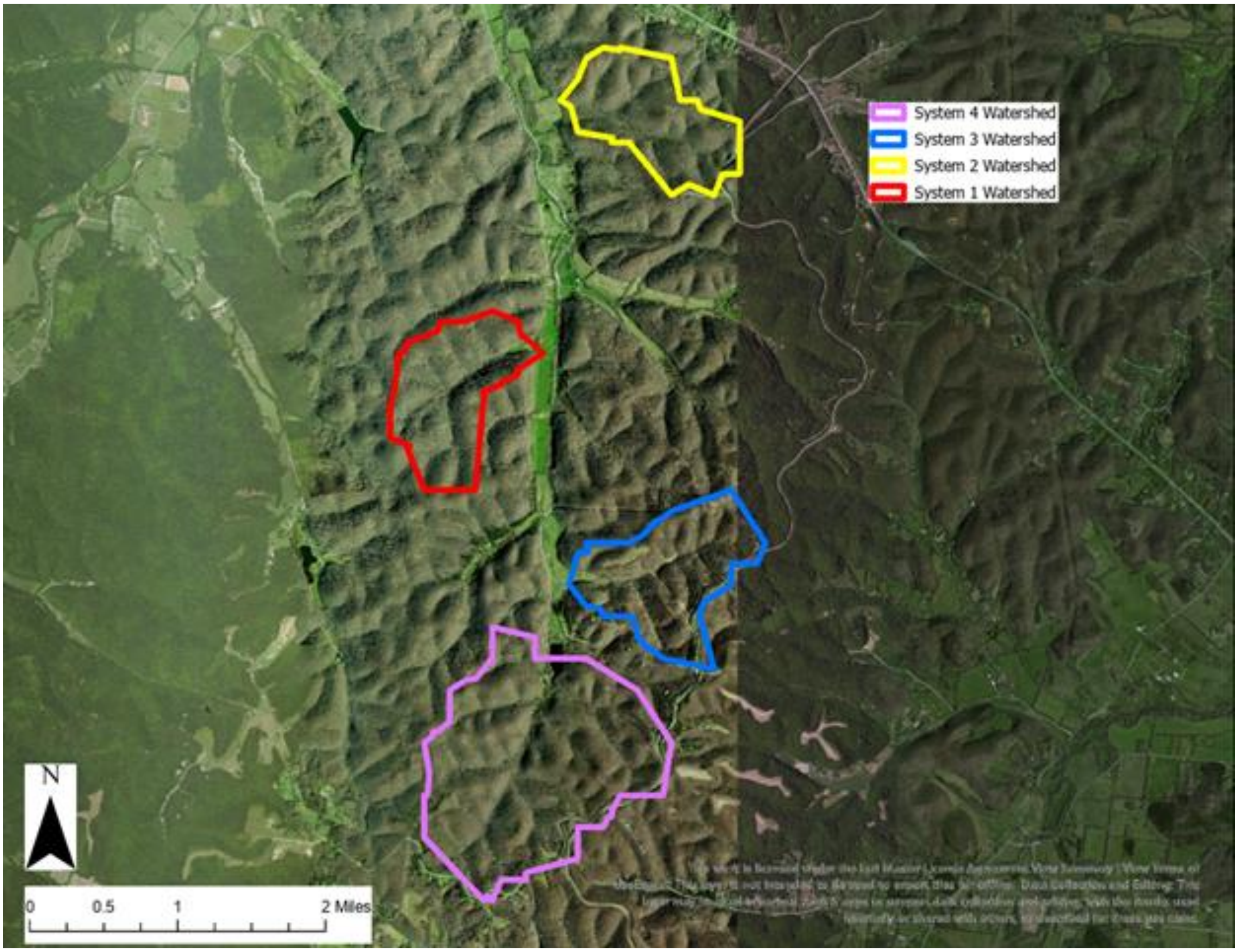
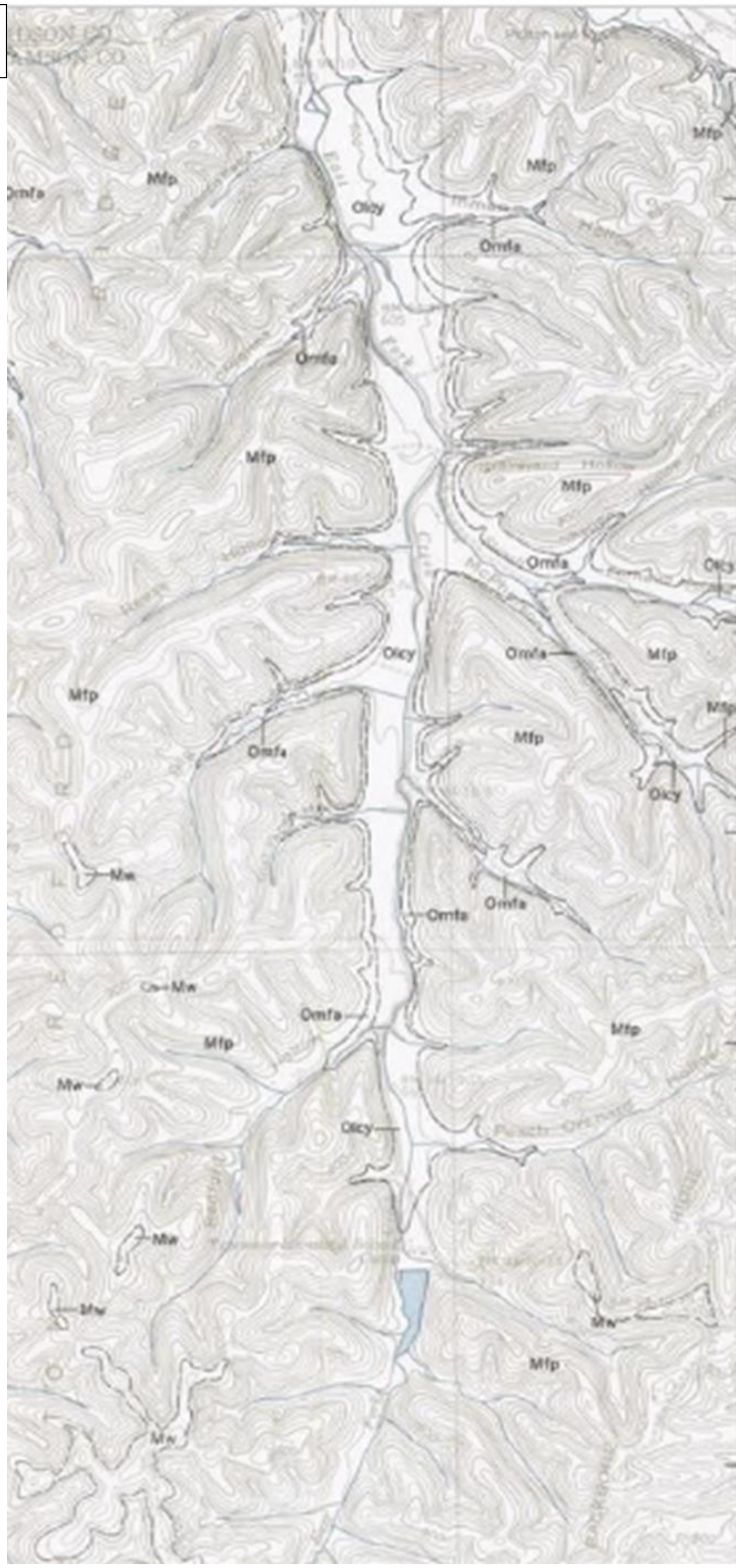


Figure 1: Satellite imagery of the EFC watershed and the four highlighted systems. System 1 is red, system 2 is yellow, system 3 is blue, and system 4 is purple.

Using ArcGIS Pro v3.0, with a data source of the North American Datum of 1983 Tennessee State Plane, the average elevation for system 1 is 209 m with a relief of 27 m. System 2 has an average elevation of 201 m and relief of 25 m. System 3 has an average elevation of 219 m and relief of 12 m. System 4 has an average elevation of 226 m and relief of 27 m. The United States Geological Survey (USGS) maps the bedrock geology of EFC valley floor as Leipers and Catheys Formation limestones (*Olcy*) and Mannie, Fernvale, and Arnheim Formations shales and limestones (*Omfa*), whereas the hillslopes are recorded as Fort Payne and Chattanooga Formations siltstones, shales, and mudstones (*Mfp*) (figure 2).

A



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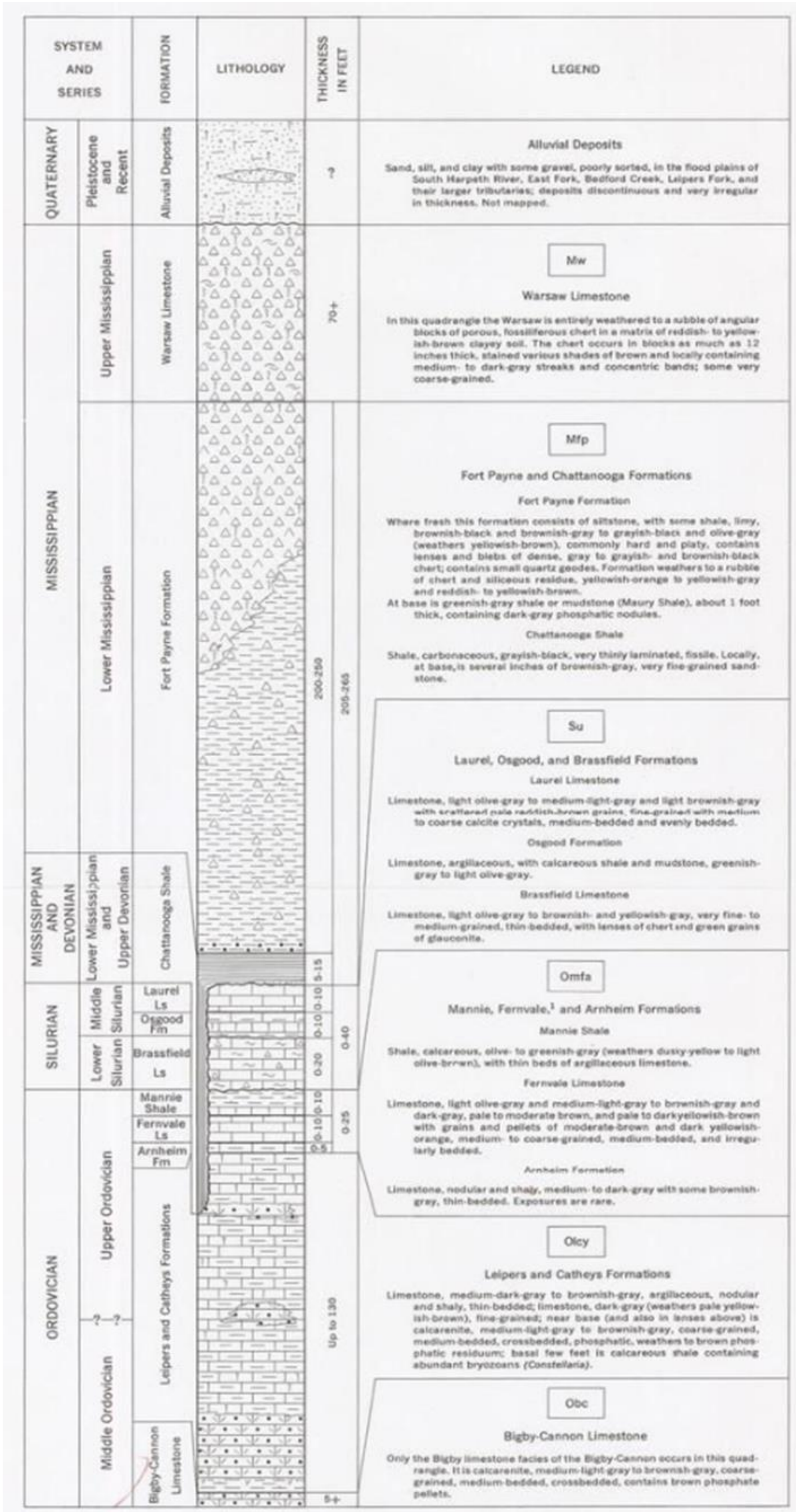

SYSTEM AND SERIES
FORMATION
LITHOLOGY
THICKNESS IN FEET
LEGEND
QUATERNARY
Pleistocene and Recent
Alluvial Deposits
?
Alluvial Deposits
Sand, silt, and clay with some gravel, poorly sorted, in the flood plains of South Harpeth River, East Fork, Bedford Creek, Leipers Fork, and their larger tributaries; deposits discontinuous and very irregular in thickness. Not mapped.
MISSISSIPPIAN
Upper Mississippian
Warsaw Limestone
70+
Mw
Warsaw Limestone
In this quadrangle the Warsaw is entirely weathered to a rubble of angular blocks of porous, fossiliferous chert in a matrix of reddish- to yellowish-brown clayey soil. The chert occurs in blocks as much as 12 inches thick, stained various shades of brown and locally containing medium- to dark-gray streaks and concentric bands; some very coarse-grained.
Lower Mississippian
Fort Payne Formation
200-250
205-265
Mfp
Fort Payne and Chattanooga Formations
Fort Payne Formation
Where fresh this formation consists of siltstone, with some shale, limy, brownish-black and brownish-gray to grayish-black and olive-gray (weathers yellowish-brown), commonly hard and platy, contains lenses and blebs of dense, gray to grayish- and brownish-black chert; contains small quartz geodes. Formation weathers to a rubble of chert and siliceous residue, yellowish-orange to yellowish-gray and reddish- to yellowish-brown.
At base is greenish-gray shale or mudstone (Maury Shale), about 1 foot thick, containing dark-gray phosphatic nodules.
Chattanooga Shale
Shale, carbonaceous, grayish-black, very thinly laminated, fissile. Locally, at base, is several inches of brownish-gray, very fine-grained sandstone.
MISSISSIPPIAN AND DEVONIAN
Lower Mississippian and Upper Devonian
Chattanooga Shale
5-15
SILURIAN
Middle Silurian
Laurel Ls
0-10
Osgood Fm
0-10
Lower Silurian
Brassfield Ls
0-20
0-40
Su
Laurel, Osgood, and Brassfield Formatons
Laurel Limestone
Limestone, light olive-gray to medium-light-gray and light brownish-gray with scattered pale reddish-brown grains, fine-grained with medium to coarse calcite crystals, medium-bedded and evenly bedded.
Osgood Formation
Limestone, argillaceous, with calcareous shale and mudstone, greenish-gray to light olive-gray.
Brassfield Limestone
Limestone, light olive-gray to brownish- and yellowish-gay, very fine- to medium-grained, thin-bedded, with lenses of chert and green grains of glauconite.
ORDOVICIAN
Upper Ordovician
Mannie Shale
0-10
Fernvale Ls
0-10
Arnheim Fm
0-5
0-25
Omfa
Mannie, Fernvale,1 and Arnheim Formations
Mannie Shale
Shale, calcareous, olive- to greenish-gray (weathers dusky-yellow to light olive-brown), with thin beds of argillaceous limestone.
Fernvale Limestone
Limestone, light olive-gray and medium-light-gray to brownish-gray and dark-gray, pale to moderate brown, and pale to darkyellowish-brown with grains and pellets of moderate-brown and dark yellowish-orange, medium- to coarse-grained, medium-bedded, and irregularly bedded.
Arnheim Formation
Limestone, nodular and shaly, medium- to dark-gray with some brownish-gray, thin-bedded. Exposures are rare.
?—?
Middle Ordovician
Leipers and Catheys Formations
Up to 130
Olcy
Leipers and Catheys Formations
Limestone, medium-dark-gray to brownish-gray, argillaceous, nodular and shaly, thin-bedded; limestone, dark-gray (weathers pale yellowish-brown), fine-grained; near base (and also in lenses above) is calcarenite, medium-light-gray to brownish-gray, coarse-grained, medium-bedded, crossbedded, phosphatic, weathers to brown phosphatic residuum; basal few feet is calcareous shale containing abundant bryozoans (Constellaria).
Bigby-Cannon Limestone
5+
Obc
Bigby-Cannon Limestone
Only the Bigby limestone facies of the Bigby-Cannon occurs in this quadrangle. It is calcarenite, medium-light-gray to brownish-gray, coarse-grained, medium-bedded, crossbedded, contains brown phosphate pellets.

C

Figure 2: (A) Geologic map of the Fairview Quadrangle located in Middle Tennessee at East Fork Creek. (B) The geologic units for the bedrock within the EFC valley are Leipers and Catheys formations (Olcy) and Mannie, Fernvale, and Arnheim formations (Omfa). Whereas the hillslopes are recognized as Fort Payne and Chattanooga Shale formations (Mfp).; these units each differ in lithology. (C) Colorized geologic units map of the East Fork Creek valley showing the extent of each rock type, yellow and pink indicate the Mfp formations (Fort Payne Formation and Chattanooga Shale) with yellow having more limestone content than the pink shaded regions, and blue indicates Mfp units with Silurian Formations (limestones and shales) (USGS).

Methods:

Multiple streambeds within the EFC watershed were analyzed for qualitative and quantitative data. Point samples were collected every 50 m along the stream until arriving at the headwaters of each stream. Each point had the following data recorded: geospatial coordinates, sediment depth to bedrock, streambed composition (bedrock or sediment laden), gravel to mud ratio, number of floodplain terraces, width of floodplain terraces, valley width (toe to toe), channel width, channel depth, total stream volume, and if the stream is meandering or straight. This approach was adopted to determine the volume of sediment stored within each sub watershed, ultimately describing the entirety of the EFC hillslope/valley system. The initial approach to this mass balance method was to take multiple soil cores along a defined transect across the entire EFC watershed to account for hillslope sediment in addition to that stored in the valley. The problem with this approach is that upon further investigation it was discovered that some bedrock units weathered as alternating beds of clay and hard bedrock, making it very difficult to accurately determine the depth to bedrock and total available sediment. A decision was then made to quantify only sediment stored in the valley and only qualitatively assess the hillslope bedrock and soil cover.

Once the field data was collected for each of the four systems, a table of results was created and uploaded into an ArcGIS Pro map. This map served as the geospatial network for analysis in which the volume of sediment per unit area of each system was derived. Once the data was uploaded into ArcGIS Pro, a hydrology toolset (spatial analysis) function (watershed) was executed to determine the area upstream of each point that contributed water and sediment. The watershed function uses a combination of HydroSHEDS and spatial data to determine the contributing amount for each cell in the raster by summing the areas defined by the pixels (within the watershed) that have higher elevations (ESRI). The output from this function was a raster file detailing each point and the area of land that was drained to that point.

Results:

The United States Geological Survey (USGS) maps the bedrock of EFC as uniformly comprising the Mississippian Fort Payne Formation and Chattanooga Shale (figure 2C). Though most of the bedrock observed in the EFC systems appears to be a type of shale or limestone, the depth to bedrock is not consistent across the systems. In system 1 the bedrock can be observed in exposed outcrops lining the main stream and its tributaries. The bedrock in system 1 is light grey in color, easily weathered, and intertwined with units of a more massive, harder rock. This system also appeared to have a large sediment accumulation downstream towards the primary valley of EFC. The channel in system 1 was primarily mantled with gravel sediment but locally was locally scoured to a bedrock stream (figure 3).

Figure 3: Example A (left) shows the amount of sediment accumulation at an outcrop located at the mouth of system 1 The top half (light brown color) of the outcrop is a result of sediment transport from the adjacent hillslope. The bottom half of the outcrop (darker brown color) is a result of stream deposition. Example B (right) shows the typical bedrock formation found in system 1.

The outcrop of valley sediment in figure 3A is roughly 4.2 m in height, with varying sediment composition. The upper most layer (top 0-210 cm) of sediment is uniform and fine grained with a sloped surface suggesting transport from the adjacent hillslope.Below this hillslope unit, the outcrop sediment (210-350 cm) is a mix of large gravel and fine-grained material that is horizontally bedded and typical of the floodplain terrace deposits in the valley, suggesting that they are deposited by the stream channel. The lowermost unit of the outcrop (350-420 cm) is very fine-grained sediment, mostly clay with some gravel present, which is a result of stream deposition of sediment. This layer also has plastic, bedded clay (Fig. 3A, red arrow) and appears to represent in-situ weathering of bedrock into erodible fine-grained sediment. The exposed bedrock in figure 4B is deformable and susceptible to erosion, as seen in the photo by undercutting the stream. The fine, clay/silt-like sediment that is produced by weathering the bedrock can be found in different areas within the channels of each sub watershed. The stream bed appears to be floored by more resistant bedrock.

System 2 follows a similar regime of bedrock as system 1, having more sediment within the streambeds and a light grey mix of softer and harder bedrock units. Figure 4 shows two examples of the exposed bedrock and the typical streambed composition for system 2. Figure 4A is a hillslope that stems directly from the streambed of system 2. The exposed bedrock in this hillslope is like the bedrock of that in system 1 but has units that are less easily eroded as indicated by the red arrow in figure 4.

Figure 4: Example A (left) shows the exposed bedrock found in system 2, and example B (right) shows the streambed composition.

The streambed in system 2 is like system 1 but appears less active due to the presence of trees within the streambed. As seen in figure 4B, a moderate sized tree, growing in the middle of the stream that drains systems 2, suggesting that very little sediment is being eroded from the streambed and the force of the stream typically is very low. Also, the streambed in figure 4B was incised by erosion before the tree in the middle of the stream began growing. The trees atop that same terrace are all roughly the same age as the tree in the middle of the stream channel (figure 4B), suggesting that formation of the terrace and incision occurred at about the same time and have since been largely abandoned.

Unlike systems 1 and 2, system 3 primarily flows atop bedrock with few instances of sediment accumulation in the streambed. Most of the hillslope bedrock in system 3 is a mix of shale and limestone. Figure 5A shows the hillslope bedrock, with the uppermost layers being sheet-like, and the bottommost layers being very angular and blocky, with little erosion. Figure 4B shows the typically streambed composition that can be found throughout system 3. The streambed continuously flows atop bedrock except for a few places where there are instances of sediment input (via tributary, damming, or etc.).

Figure 5: Example A shows the bedrock structure on the hillslope in system 3, and example B shows the general streambed composition for system 3.

The block-like rock that underlies the stream in system 3 presents in a stair-like fashion near the headwaters. Like system 2, undercutting is also present throughout system 3 where the hillslopes are being eroded bottom-up due to the change in lithology from hard to soft bedrock. The final system, 4, doubles as the East Fork Creek headwaters. System 4 is similar to system 3 in that it is a bedrock stream containing little sediment in the streambeds. The block-like rock formations found in system 3 are prevalent throughout system 4, also presenting many joint fractures as indicated by the red arrows in figure 6B.

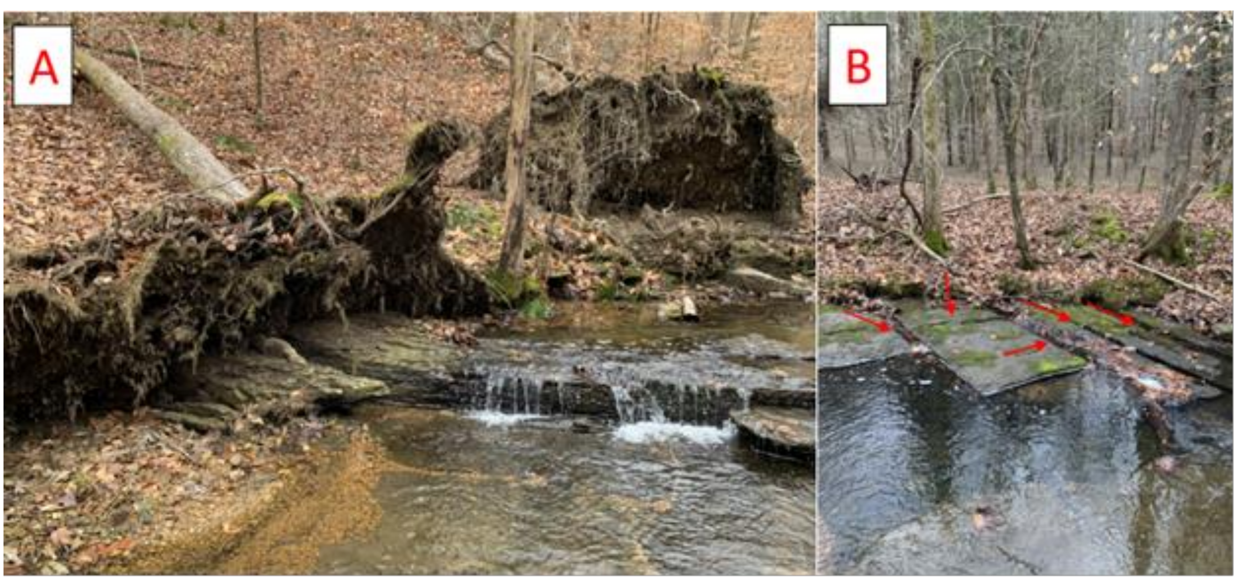


Figure 6: Example A shows the general streambed composition and hillslope pattern within

system 4, and example B shows the bedrock stream with many joints (indicated by the red arrows).

System 4 has many areas that have the potential to input sediment as seen in system 3. Figure 5B shows the typical block-like bedrock found in most of EFC, but in system 4 harder units of bedrock are interbedded with weaker layers that have weathered into erodible muds. Beneath the hard bedrock are void areas that were once home to very fine sediments, such as clays and silts. The presence of clay is known due to the layering of clay seen in the stream beds along the stream channels. The clay is often very light grey in color, and very fine, but can also be dark brown depending on the location, such as in system 1 (figure 3A).

Much of the bedrock observed in system 4, and some in system 3, contain numerous fractures that are parallel in direction. These fractures are joint fractures because they exhibit no shear displacement (Van Der Pluijm and Marshak 2004). The joints seen in system 4 can either be backfilled with clastic sediment (figure 7A) or be eroded by water (figure 7B), smoothing the angular edges.

Figure 7: Example A (left) shows joints filled with sediment, and example B (right) shows the erosion of joints overtime.

The fractures on the bedrock are a product of stress produced by tectonic plate motions (Molnar 2004). There are three principal stress directions that (σ_1, σ_2, and σ_3) that define the orientation of the applied stress field. Each principal stress direction asserts a specific percentage, or amount, of stress onto a material. The maximum stress is referred to as σ_1, the intermediate stress is σ_2, and the minimum stress is σ_3 (Shan et al. 2006). For joints, like those observed in systems 3 and 4, we can see the directions of principle stress in figure 8.

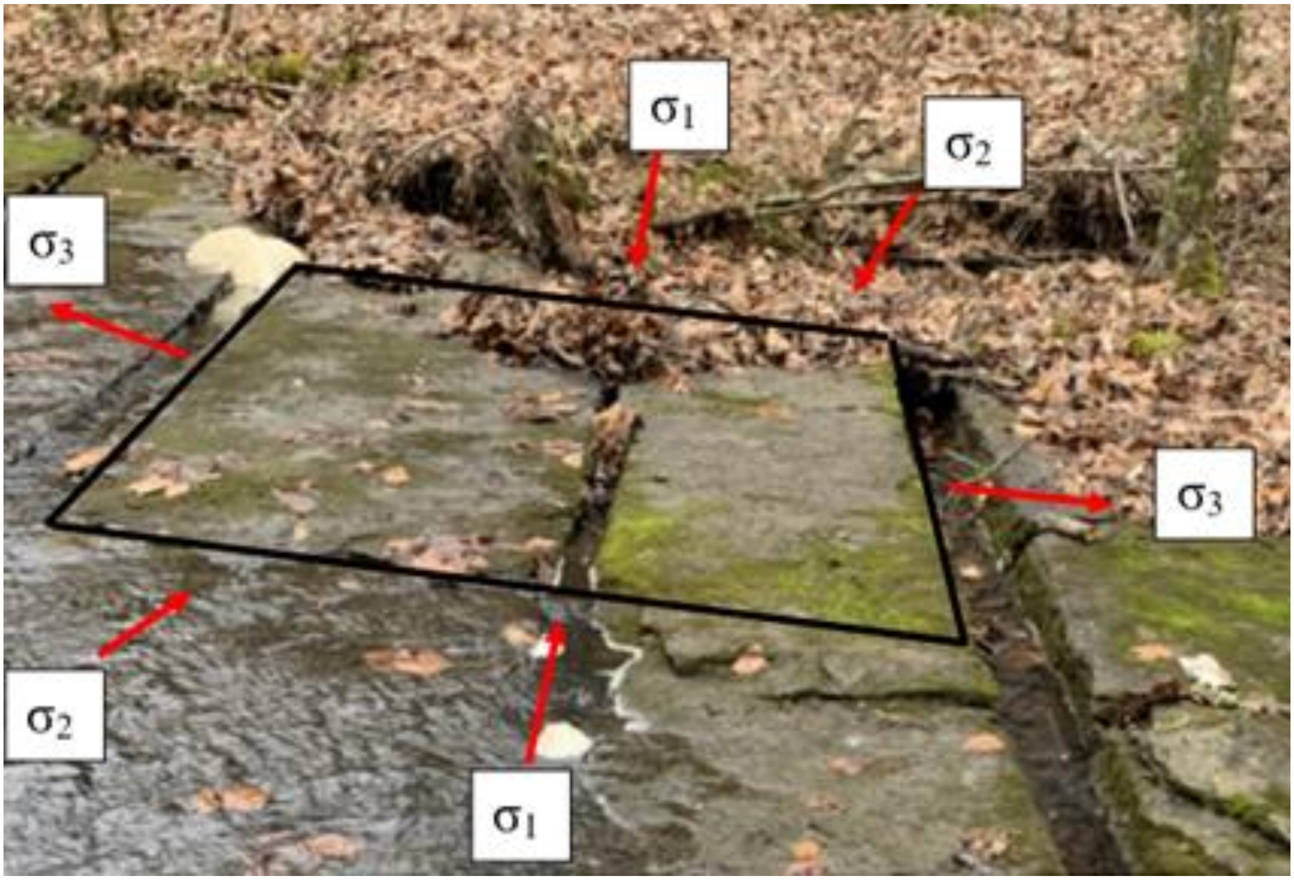


Figure 8: The three principal geologic stress directions, σ_1 (maximum stress), σ_2 (intermediate stress), and σ_3 (minimum stress) each acting simultaneously on the bedrock to create these joints.

Each system observed in this study had at least one tributary input into the sub watershed stream, which can store and/or transport sediment (Meade 1996). Figure 9 shows a couple of examples of tributary inputs from the systems studied.

Figure 9: Red arrows indicating the incoming tributary into the mainstream for the sub watersheds.

The tributaries noted throughout each system drain various parts of the sub watersheds. At the confluence of the tributary and the mainstream there is observable accumulation of sediment, most likely meaning that the tributaries are acting as a source of sediment for the systems. The total sediment storage for each subbasin was calculated by taking the cumulative distance along the basin from the mouth to the headwaters and plotting it against the cumulative total sediment storage. Streambed data was also collected for each of the four subwatersheds in this study. Qualitative data such as streambed composition was recorded at each point within each system. The streambed compositions were recorded as either sediment laden (having a value of 1), or exposed bedrock (value of zero). This data is represented by pink and white dots in figure 10, with the pink dots representing a sediment laden streambed and white dots representing a bedrock streambed.

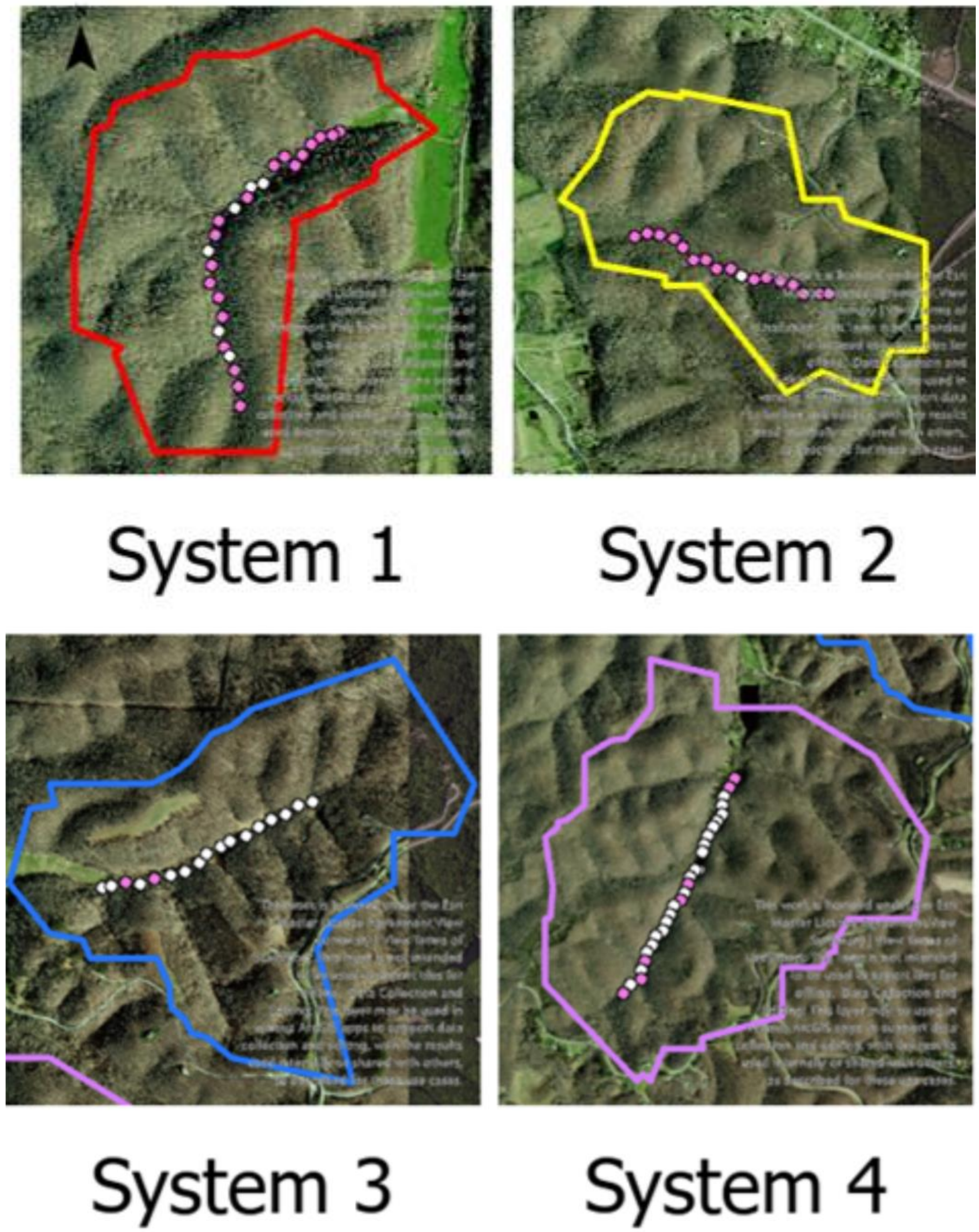
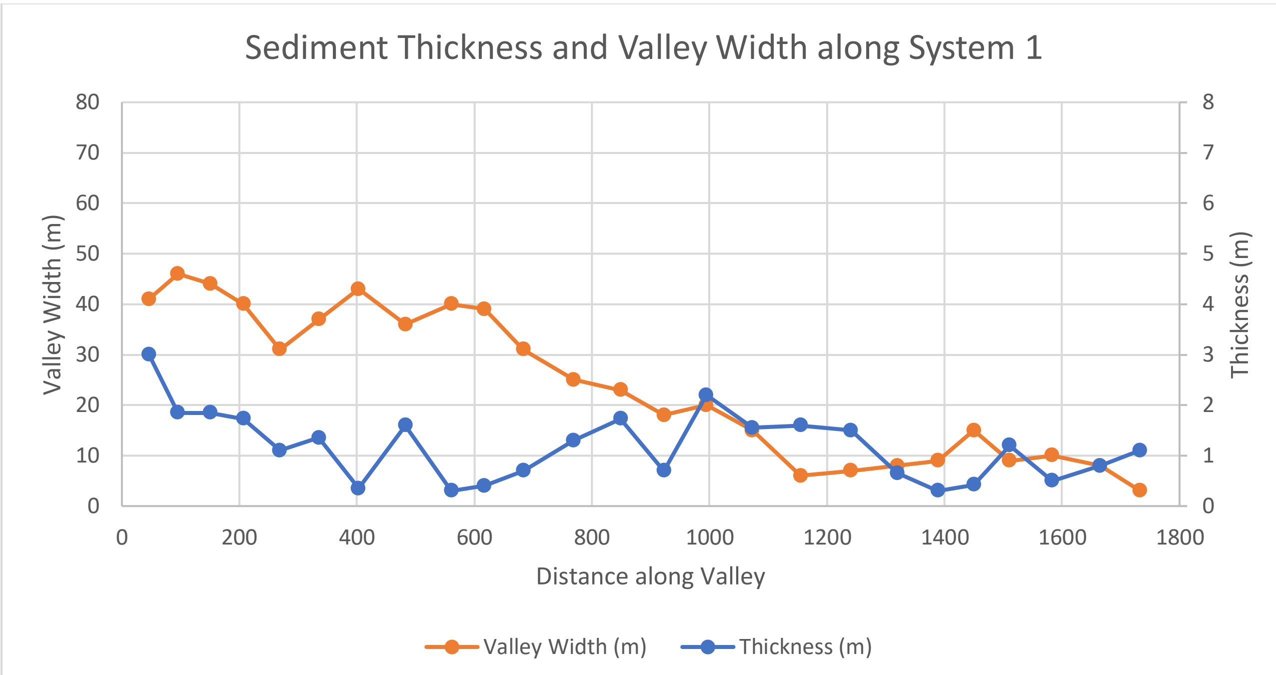
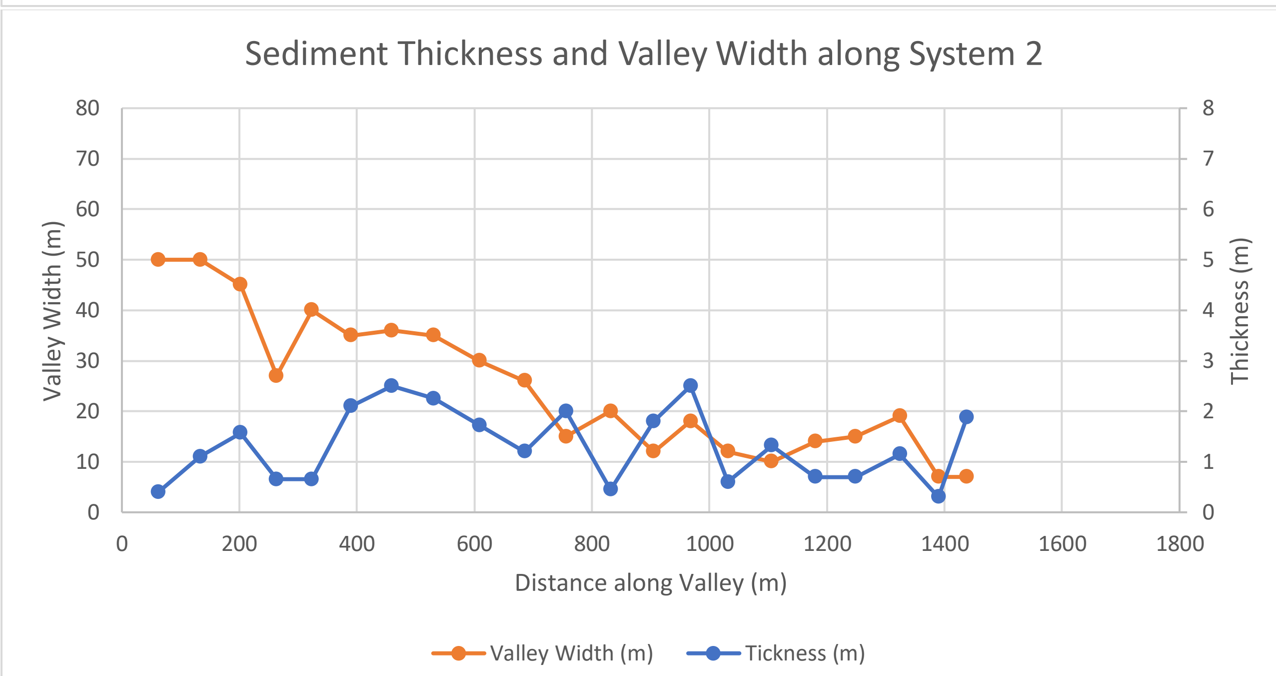
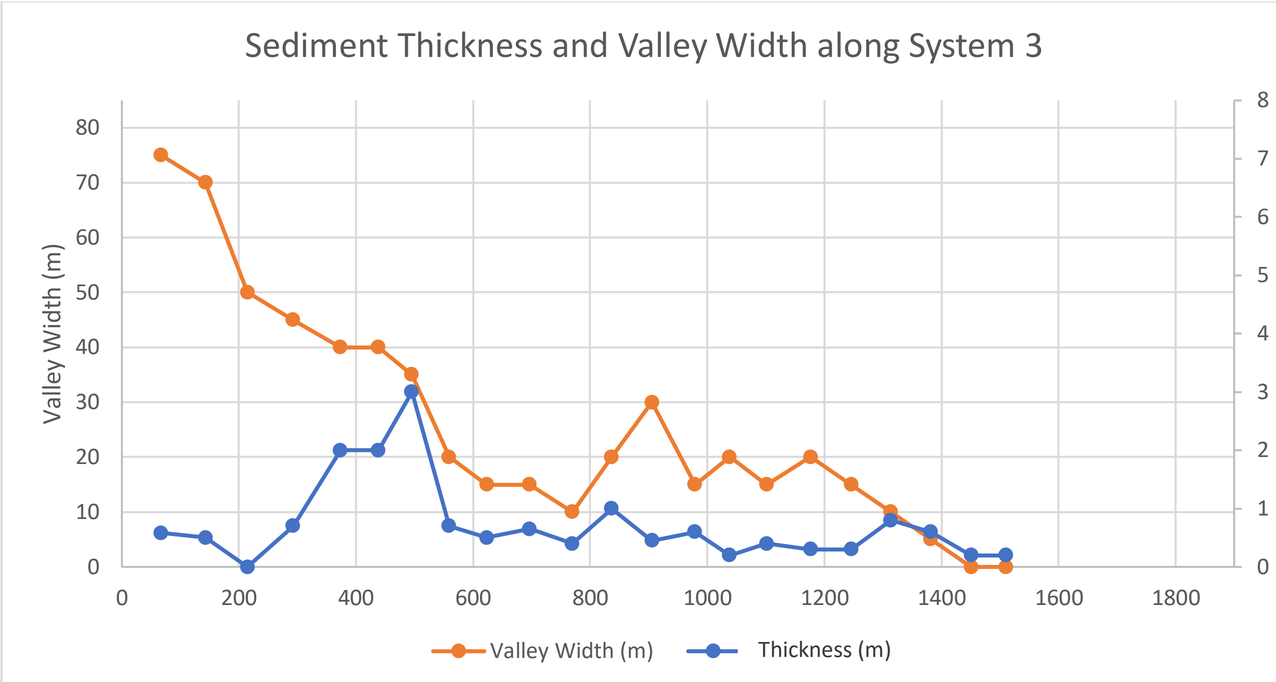


Figure 10: Streambed composition of each system in the EFC watershed. Pink dots represent points where the stream is sediment laden, and white dots represent points where the stream flows atop bedrock. The streambed continuously flows atop bedrock in Systems 3 and 4 except for a few places where there are instances of sediment input (via tributaries, damming, etc.).

The streambed cover was analyzed at various points along each streambed in each of the four systems. The streambeds were analyzed as either having sediment on the streambed, or if the stream flowed atop bedrock. Each system has different streambed covers, or no common pattern present in the amount of sediment, etc. The method for quantifying the valley sediment storage involved calculating the product of the width of the stream valleys and the sediment thickness at each point and the distance between observations to produce of volume of sediment in the valley. Once this value for sediment volume along each reach of the valley was produced, the total cumulative amount of sediment in the valley was calculated by summing the volume at each observation. The total sediment storage for each system is found to differ not only in storage but also in the distance along each valley.







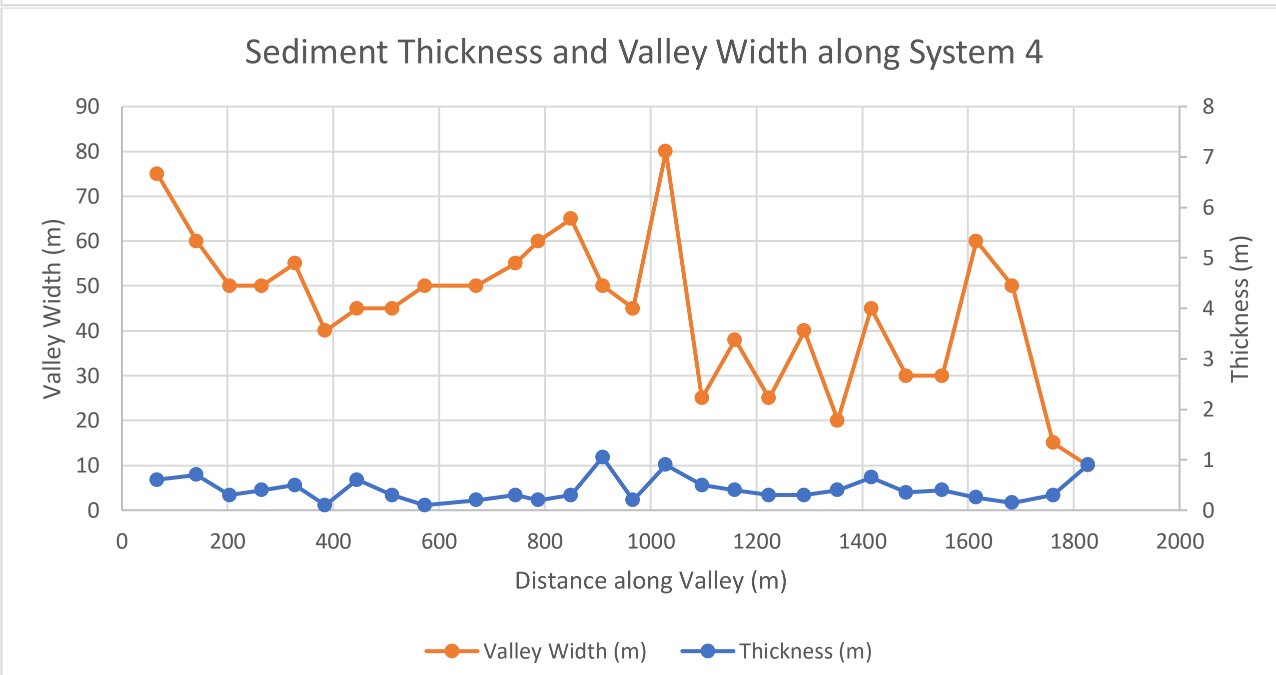


Figure 11: The sediment thickness (m) correlated with the valley width (m) along the valley for each subbasin. For these figures the mouth of the systems is at x=0m, and the headwaters of each system lie at values x>1400m

The sediment thickness and valley width along systems 1 and 2 followed trends of upstream decreasing valley width and slight variations in sediment thickness at various points along the valley. At ~1000 m the sediment thickness for systems 1 and 2 both spiked and then fell to a lower value due to tributary confluences. The sediment thickness and valley width along system 3 differed near the valley mouth (0-200 m), but soon after followed a similar pattern of decrease. System 4 differed from the others in having a relatively consistent valley width through the entirety of the system. The sediment thickness in system 4 also varied relatively little along the stream path.

The total sediment storage for each subwatershed was calculated. To find the total sediment storage, the product of the distance along the valley for each system and the unit sediment volume was computed. The unit sediment volume was a measure of volume involving the total valley sediment, valley width for each system, and the length of each system. The depth profiles for each system are shown in conjunction with the valley width for each system in figure 11, which show that the sediment thickness varied only in areas where there was additional sediment input from margining tributaries. By taking depth to bedrock measurements every ~50m along each streambed, the amount of sediment stored in the main EFC valley could then be estimated. Figure 12 shows a comparison of each of the total cumulative sediment storage for the four systems in this study. The total sediment storage for each point within all four systems in located in the appendix as Table 1A.

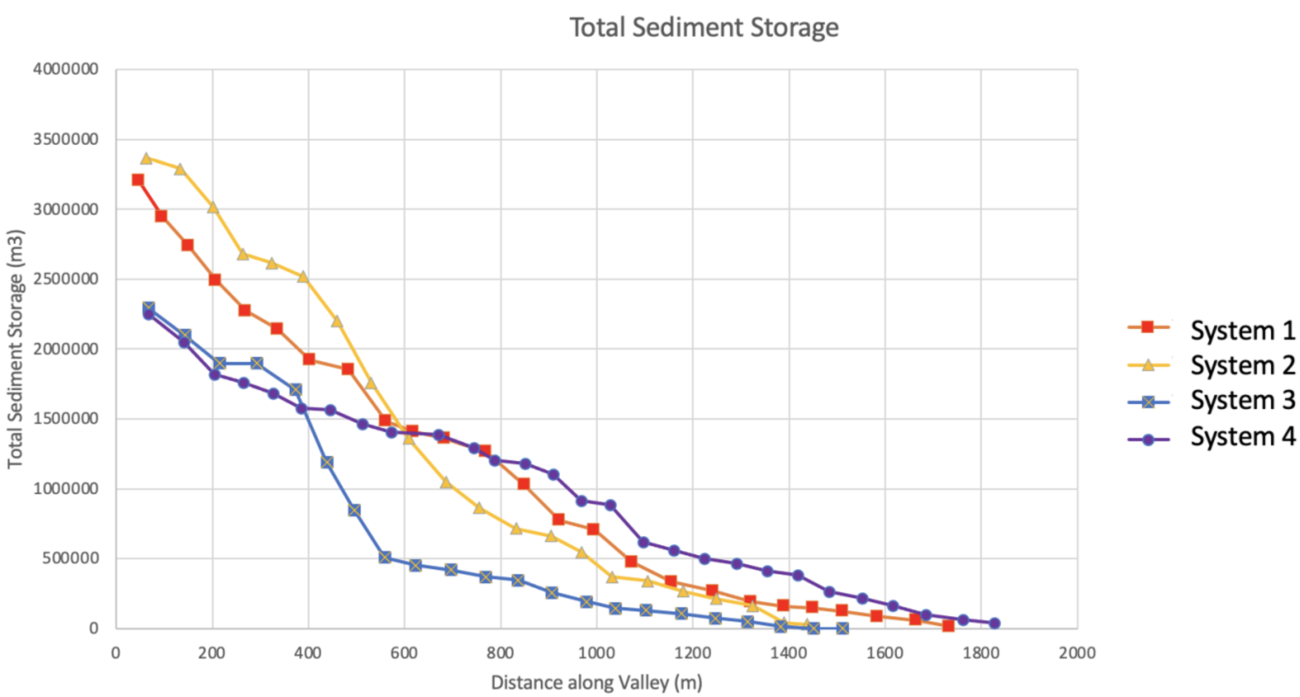


Figure 12: The total cumulative sediment storage (m^3) along the valley (m) for each respective subwatershed in the EFC valley. Red indicates system 1, yellow is system 2, blue is system 3, and purple is system 4.

Discussion:

Of the four systems studied in this project, system 2 had the most sediment being stored, followed by system 1. Systems 3 and 4 both stored the least amount of sediment in the EFC watershed. There was a 28% difference in the amount of sediment stored at the mouth of the EFC watershed in systems 1 and 2, compared to that of systems 3 and 4 located at the headwaters of EFC. This substantial difference in sediment can be attributed to several factors, but in the scope of this project the difference is most likely due to the response of each system to logging and/or other anthropogenic activities that may have occurred in EFC over the last century. When comparing the soils and bedrock of the EFC valley, there appear to be little to no differences in influencing factors (differences in the amounts of clay, silt, and/or sand) on the amount of sediment being stored and/or distributed within EFC. Based on soil and geologic maps there should be little/no notable difference among the geology and soils throughout each subbasin. When observing the soil and bedrock in the field there were numerous changes and differences that conflicted with that of referenced mapping from the USGS and NRCS. Figure 13 shows the NRCS soils map for each of the four subbasins in the EFC watershed.

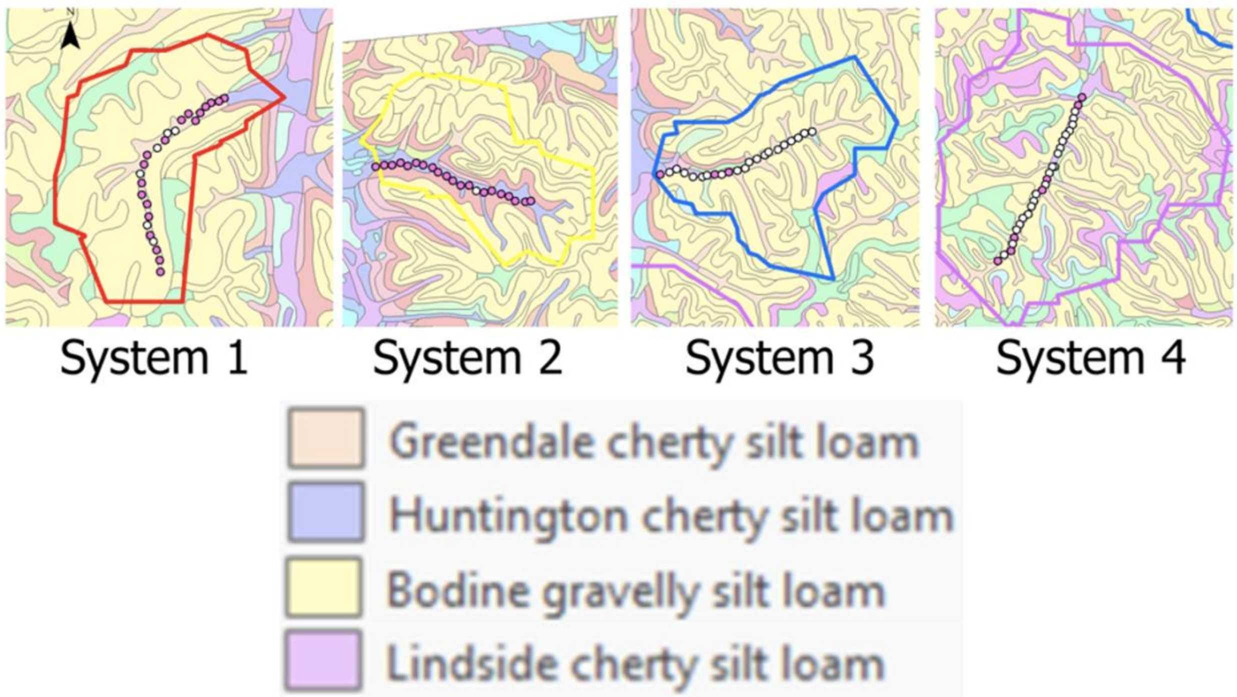


Figure 13: Soil maps of each system in EFC. The pink dots represent points in the stream that are sediment laden, and white dots represent points where the stream flows atop bedrock. In system 1 the data collected was all in the Greendale cherty silt loam series. The points in system 2 were all in the Huntington cherty silt loam series. The points in system 3 were in the Huntington cherty silt loam, Bodine gravely silt loam, Lindside cherty silt loam, and the Greendale cherty silt loam series. The points in system 4 were in the Lindside cherty silt loam and Greendale cherty silt loam series.

The National Resource Conservation Service defines the use/vegetation and parent material for each soil series. The Greendale series are mostly cleared for utilized for pastures and/or hay, and they have parent materials of limestone, shale, and sandstone. The Huntington series are very well drained soils used mostly for crops or parure (corn or soybeans), and are formed from shale, sandstone, and limestone. The Huntington soils are also mostly located on level flood plains of river valleys. The Bodine series are commonly associated with forests, being suitable for the growth of many tree types. The Bodine soils are also primarily formed in residuum weathered from cherty limestone. Finally, the Lindside series are mostly utilized as cropland, pastures, and haylands, and are formed via alluvium composed of limestone. The hillslopes in systems 1-4 are all composed of the Bodine soil series, which are all significantly influenced by colluvium from soil creep. The bedrock (parent material) information provided by the NRCS is more spatially correlated to the bedrock observed in the field, whereas the bedrock data mapped by the USGS is very generic, having one umbrella classification for many other more defined classifications that are present in the NRCS map.

From the time of deforestation to present day, which is estimated to be a few decades, there has most likely been the same amount of rainfall, but depending on the bedrock there may have been more/less erosion in some subbasins than others. Bedrock can weather at different rates depending on composition and environmental factors. Figure 5 shows two common bedrock types in EFC, a large, blocky type, and a flat, shale type. The amount of erosion is dependent on the structural geology of the bedrock. For example, in system 4 there are apparent locations of soft clay layers, sections of bulky limestone, or clay layers appear in bands on the hillslopes (figure 14). The looser clay that is present in between bedrock layers leaves the rock susceptible to erosion.

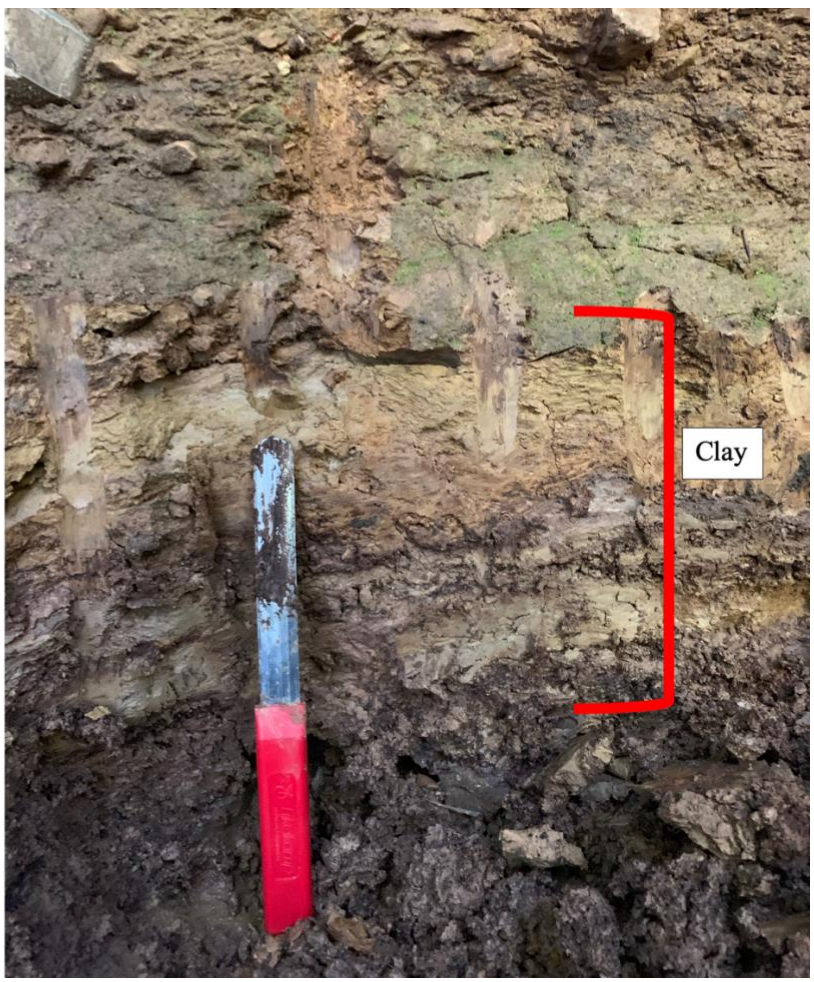


Figure 14: Banding of soil with high percentage of clay on a hillslope.

A direct comparison among the four systems studied in EFC are presented in figure 15 below.

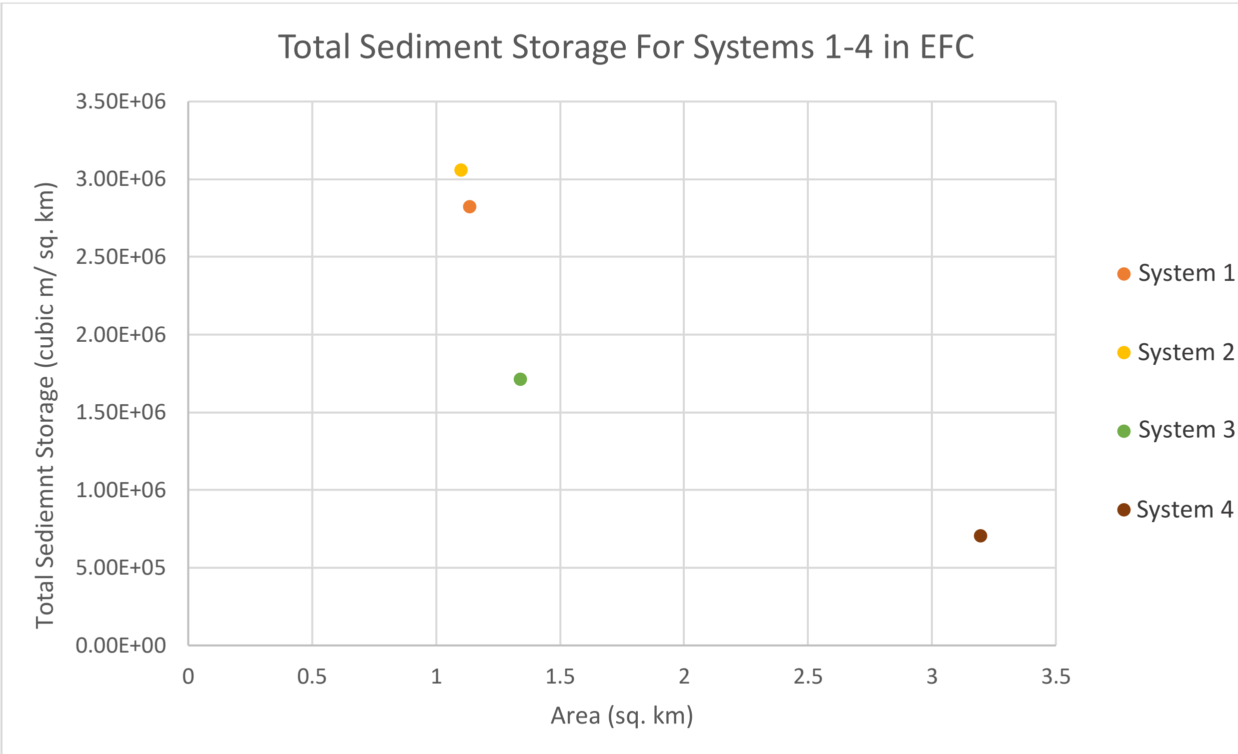


Figure 15: Total sediment storage per basin area (m^3/km^2) for all four systems studied in this experiment. Orange indicates system 1, yellow indicates system 2, green indicates system 3, and brown indicates system 4.

Conclusion:

The EFC watershed is a forested conservation land that is mapped and often described as a relatively uniform bedrock valley system. Upon further investigation the EFC valley was comprised of numerous subwatersheds that differed in bedrock type, stream bed cover, and total sediment storage. The goal of this study was to describe the mass (sediment) storage and transport regimes presented in EFC; to understand how sediment is routed from the hillslopes to the valley where the soils support agricultural activity. Unexpectedly, the EFC valley had considerable heterogeneity across the subbasins regarding the production and storage of sediment. The two smallest subbasins, systems 1 and 2, had the most sediment being stored, whereas the two larger subbasins, systems 3 and 4, had significantly less sediment stored.

The valley hillslope systems within the EFC watershed each contributed independently to the amount of sediment being washed out into the main EFC valley. Each of the four systems have uniform distribution of bedrock type, each supplying some amount of sediment to the main valley, assuming a quasi-steady state. There was an overall 28% difference in the amount of sediment stored in subwatersheds along the middle reaches of the main EFC watershed compared with the amount of sediment stored subwatersheds near the headwaters of EFC valley. Anthropogenic activity (logging) in the EFC watershed and the influence of bedrock composition both contribute to the amount of sediment being produced and transported within each system. Due to the increase in bare land cover from logging operations the hillslopes were more suspectable to erosion, thus increasing the amount of sediment being distributed throughout EFC. Also, as the bedrock changes from easily erodible material (shales) to nearly unerodable (limestones), and vice versa, over distance, there will varying amounts of sediment produced and transported throughout EFC.

APPENDIX

Point	Total Sediment Storage (m^3)
1.01	3208005
1.02	2946604
1.03	2738929
1.04	2493589
1.05	2272685
1.06	2142449
1.07	1920893
1.08	1852118
1.09	1483478
1.10	1410470
1.11	1361023
1.12	1265636
1.13	1028608
1.14	773952
1.15	705513
1.16	476783
1.17	334967
1.18	269310
1.19	192732
1.20	160279
1.21	147535
1.22	123552
1.23	84282
1.24	57637
1.25	15439
2.01	3368083
2.02	3289708
2.03	3016266
2.04	2680487
2.05	2615119
2.06	2519984
2.07	2199527
2.08	1757770
2.09	1360903
2.10	1048737
2.11	863416
2.12	714942
2.13	662794
2.14	547656

2.15	369618
2.16	340640
2.17	266746
2.18	212704
2.19	163593
2.20	39932
2.21	30854
3.01	2294961
3.02	2098814
3.03	1898670
3.04	1898670
3.05	1707417
3.06	1188224
3.07	849496
3.08	507632
3.09	451500
3.10	420037
3.11	368050
3.12	346670
3.13	256810
3.14	192592
3.15	144263
3.16	130197
3.17	106079
3.18	72437
3.19	50682
3.20	14081
3.21	0
3.22	0
4.01	2250552
4.02	2050532
4.03	1818422
4.04	1759151
4.05	1684609
4.06	1578729
4.07	1565595
4.08	1465950
4.09	1407073
4.10	1388162
4.11	1292024
4.12	1202547
4.13	1180048
4.14	1104678

4.15	916936
4.16	887325
4.17	617653
4.18	558691
4.19	499297
4.20	468385
4.21	414292
4.22	382620
4.23	263634
4.24	217633
4.25	162063
4.26	100431
4.27	65454
4.28	38600

Table 1A: The cumulative total sediment storage (m^3) for each point along each subbasin in the EFC watershed.

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