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49             "I\\\\\\\\Lab2\\\\\\\\Lab2\\\\\\\\Lab2.gdb'"
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923     "execution_count": 105,
924     "metadata": {},
925     "outputs": [],
926     "source": [
927       "arcpy.env.workspace = Working_Directory"
928     ]
929   },
930   {
931     "cell_type": "code",
932     "execution_count": 106,
933     "metadata": {},
934     "outputs": [],
935     "source": [
936       "arcpy.env.workspace = Working_Directory"
937     ]
938   },
939   {
940     "cell_type": "code",
941     "execution_count": 107,
942     "metadata": {},
943     "outputs": [],
944     "source": [
945       "arcpy.env.workspace = Working_Directory"
946     ]
947   },
948   {
949     "cell_type": "code",
950     "execution_count": 108,
951     "metadata": {},
952     "outputs": [],
953     "source": [
954       "arcpy.env.workspace = Working_Directory"
955     ]
956   },
957   {
958     "cell_type": "code",
959     "execution_count": 109,
960     "metadata": {},
961     "outputs": [],
962     "source": [
963       "arcpy.env.workspace = Working_Directory"
964     ]
965   },
966   {
967     "cell_type": "code",
968     "execution_count": 110,
969     "metadata": {},
970     "outputs": [],
971     "source": [
972       "arcpy.env.workspace = Working_Directory"
973     ]
974   },
975   {
976     "cell_type": "code",
977     "execution_count": 111,
978     "metadata": {},
979     "outputs": [],
980     "source": [
981       "arcpy.env.workspace = Working_Directory"
982     ]
983   },
984   {
985     "cell_type": "code",
986     "execution_count": 112,
987     "metadata": {},
988     "outputs": [],
989     "source": [
990       "arcpy.env.workspace = Working_Directory"
991     ]
992   },
993   {
994     "cell_type": "code",
995     "execution_count": 113,
996     "metadata": {},
997     "outputs": [],
998     "source": [
999       "arcpy.env.workspace = Working_Directory"
1000     ]
1001   },
1002   {
1003     "cell_type": "code",
1004     "execution_count": 114,
1005     "metadata": {},
1006     "outputs": [],
1007     "source": [
1008       "arcpy.env.workspace = Working_Directory"
1009     ]
1010   },
1011   {
1012     "cell_type": "code",
1013     "execution_count": 115,
1014     "metadata": {},
1015     "outputs": [],
1016     "source": [
1017       "arcpy.env.workspace = Working_Directory"
1018     ]
1019   },
1020   {
1021     "cell_type": "code",
1022     "execution_count": 116,
1023     "metadata": {},
1024     "outputs": [],
1025     "source": [
1026       "arcpy.env.workspace = Working_Directory"
1027     ]
1028   },
1029   {
1030     "cell_type": "code",
1031     "execution_count": 117,
1032     "metadata": {},
1033     "outputs": [],
1034     "source": [
1035       "arcpy.env.workspace = Working_Directory"
1036     ]
1037   },
1038   {
1039     "cell_type": "code",
1040     "execution_count": 118,
1041     "metadata": {},
1042     "outputs": [],
1043     "source": [
1044       "arcpy.env.workspace = Working_Directory"
1045     ]
1046   },
1047   {
1048     "cell_type": "code",
1049     "execution_count": 119,
1050     "metadata": {},
1051     "outputs": [],
1052     "source": [
1053       "arcpy.env.workspace = Working_Directory"
1054     ]
1055   },
1056   {
1057     "cell_type": "code",
1058     "execution_count": 120,
1059     "metadata": {},
1060     "outputs": [],
1061     "source": [
1062       "arcpy.env.workspace = Working_Directory"
1063     ]
1064   },
1065   {
1066     "cell_type": "code",
1067     "execution_count": 121,
1068     "metadata": {},
1069     "outputs": [],
1070     "source": [
1071       "arcpy.env.workspace = Working_Directory"
1072     ]
1073   },
1074   {
1075     "cell_type": "code",
1076     "execution_count": 122,
1077     "metadata": {},
1078     "outputs": [],
1079     "source": [
1080       "arcpy.env.workspace = Working_Directory"
1081     ]
1082   },
1083   {
1084     "cell_type": "code",
1085     "execution_count": 123,
1086     "metadata": {},
1087     "outputs": [],
1088     "source": [
1089       "arcpy.env.workspace = Working_Directory"
1090     ]
1091   },
1092   {
1093     "cell_type": "code",
1094     "execution_count": 124,
1095     "metadata": {},
1096     "outputs": [],
1097     "source": [
1098       "arcpy.env.workspace = Working_Directory"
1099     ]
1100   },
1101   {
1102     "cell_type": "code",
1103     "execution_count": 125,
1104     "metadata": {},
1105     "outputs": [],
1106     "source": [
1107       "arcpy.env.workspace = Working_Directory"
1108     ]
1109   },
1110   {
1111     "cell_type": "code",
1112     "execution_count": 126,
1113     "metadata": {},
1114     "outputs": [],
1115     "source": [
1116       "arcpy.env.workspace = Working_Directory"
1117     ]
1118   },
1119   {
1120     "cell_type": "code",
1121     "execution_count": 127,
1122     "metadata": {},
1123     "outputs": [],
1124     "source": [
1125       "arcpy.env.workspace = Working_Directory"
1126     ]
1127   },
1128   {
1129     "cell_type": "code",
1130     "execution_count": 128,
1131     "metadata": {},
1132     "outputs": [],
1133     "source": [
1134       "arcpy.env.workspace = Working_Directory"
1135     ]
1136   },
1137   {
1138     "cell_type": "code",
1139     "execution_count": 129,
1140     "metadata": {},
1141     "outputs": [],
1142     "source": [
1143       "arcpy.env.workspace = Working_Directory"
1144     ]
1145   },
1146   {
1147     "cell_type": "code",
1148     "execution_count": 130,
1149     "metadata": {},
1150     "outputs": [],
1151     "source": [
1152       "arcpy.env.workspace = Working_Directory"
1153     ]
1154   },
1155   {
1156     "cell_type": "code",
1157     "execution_count": 131,
1158     "metadata": {},
1159     "outputs": [],
1160     "source": [
1161       "arcpy.env.workspace = Working_Directory"
1162     ]
1163   },
1164   {
1165     "cell_type": "code",
1166     "execution_count": 132,
1167     "metadata": {},
1168     "outputs": [],
1169     "source": [
1170       "arcpy.env.workspace = Working_Directory"
1171     ]
1172   },
1173   {
1174     "cell_type": "code",
1175     "execution_count": 133,
1176     "metadata": {},
1177     "outputs": [],
1178     "source": [
1179       "arcpy.env.workspace = Working_Directory"
1180     ]
1181   },
1182   {
1183     "cell_type": "code",
1184     "execution_count": 134,
1185     "metadata": {},
1186     "outputs": [],
1187     "source": [
1188       "arcpy.env.workspace = Working_Directory"
1189     ]
1190   },
1191   {
1192     "cell_type": "code",
1193     "execution_count": 135,
1194     "metadata": {},
1195     "outputs": [],
1196     "source": [
1197       "arcpy.env.workspace = Working_Directory"
1198     ]
1199   },
1200   {
1201     "cell_type": "code",
1202     "execution_count": 136,
1203     "metadata": {},
1204     "outputs": [],
1205     "source": [
1206       "arcpy.env.workspace = Working_Directory"
1207     ]
1208   },
1209   {
1210     "cell_type": "code",
1211     "execution_count": 137,
1212     "metadata": {},
1213     "outputs": [],
1214     "source": [
1215       "arcpy.env.workspace = Working_Directory"
1216     ]
1217   },
1218   {
1219     "cell_type": "code",
1220     "execution_count": 138,
1221     "metadata": {},
1222     "outputs": [],
1223     "source": [
1224       "arcpy.env.workspace = Working_Directory"
1225     ]
1226   },
1227   {
1228     "cell_type": "code",
1229     "execution_count": 139,
1230     "metadata": {},
1231     "outputs": [],
1232     "source": [
1233       "arcpy.env.workspace = Working_Directory"
1234     ]
1235   },
1236   {
1237     "cell_type": "code",
1238     "execution_count": 140,
1239     "metadata": {},
1240     "outputs": [],
1241     "source": [
1242       "arcpy.env.workspace = Working_Directory"
1243     ]
1244   },
1245   {
1246     "cell_type": "code",
1247     "execution_count": 141,
1248     "metadata": {},
1249     "outputs": [],
1250     "source": [
1251       "arcpy.env.workspace = Working_Directory"
1252     ]
1253   },
1254   {
1255     "cell_type": "code",
1256     "execution_count": 142,
1257     "metadata": {},
1258     "outputs": [],
1259     "source": [
1260       "arcpy.env.workspace = Working_Directory"
1261     ]
1262   },
1263   {
1264     "cell_type": "code",
1265     "execution_count": 143,
1266     "metadata": {},
1267     "outputs": [],
1268     "source": [
1269       "arcpy.env.workspace = Working_Directory"
1270     ]
1271   },
1272   {
1273     "cell_type": "code",
1274     "execution_count": 144,
1275     "metadata": {},
1276     "outputs": [],
1277     "source": [
1278       "arcpy.env.workspace = Working_Directory"
1279     ]
1280   },
1281   {
1282     "cell_type": "code",
1283     "execution_count": 145,
1284     "metadata": {},
1285     "outputs": [],
```

```

69     "metadata": {},
70     "source": [
71         "### Assign Working Directory"
72     ]
73 },
74 {
75     "cell_type": "code",
76     "execution_count": 8,
77     "metadata": {},
78     "outputs": [],
79     "source": [
80         "Working_Directory = r'C:\\Users\\Alexander Danielson\\Desktop\\Fall
2022Spring2023\\ArcGIS I\\Lab2\\Lab2'"
81     ]
82 },
83 {
84     "cell_type": "code",
85     "execution_count": 9,
86     "metadata": {},
87     "outputs": [
88         {
89             "data": {
90                 "text/plain": [
91                     "'C:\\\\Users\\\\Alexander Danielson\\\\\\\\Desktop\\\\\\\\Fall 2022Spring2023\\\\\\\\ArcGIS
I\\\\\\\\Lab2\\\\\\\\Lab2'"
92                 ]
93             },
94             "execution_count": 9,
95             "metadata": {},
96             "output_type": "execute_result"
97         }
98     ],
99     "source": [
100         "Working_Directory"
101     ]
102 },
103 {
104     "cell_type": "markdown",
105     "metadata": {},
106     "source": [
107         "### MN Geo Data Server Link Assigned to a Variable"
108     ]
109 },
110 {
111     "cell_type": "code",
112     "execution_count": 11,
113     "metadata": {},
114     "outputs": [
115         {
116             "data": {
117                 "text/plain": [
118                     "'https://resources.gisdata.mn.gov/pub/'"
119                 ]
120             },
121             "execution_count": 11,
122             "metadata": {},
123             "output_type": "execute_result"
124         }
125     ],
126     "source": [
127         "MN_GEO = r'https://resources.gisdata.mn.gov/pub/'\n",
128         "MN_GEO"
129     ]
130 },
131 {
132     "cell_type": "markdown",
133     "metadata": {},
134     "source": [
135         "### LAS File Download Link Assigned to a Variable"

```

```

136     ]
137 },
138 {
139     "cell_type": "code",
140     "execution_count": 12,
141     "metadata": {},
142     "outputs": [
143         {
144             "data": {
145                 "text/plain": [
146
147                     "https://resources.gisdata.mn.gov/pub/data/elevation/lidar/examples/lidar_sample/
148                     las/4342-12-05.las'"
149             ],
150             "execution_count": 12,
151             "metadata": {},
152             "output_type": "execute_result"
153         }
154     ],
155     "source": [
156         "LAS_File =
157         r'https://resources.gisdata.mn.gov/pub/data/elevation/lidar/examples/lidar_sample/las
158         /4342-12-05.las'\n",
159         "LAS_File"
160     ]
161 },
162 {
163     "cell_type": "markdown",
164     "metadata": {},
165     "source": [
166         "### Sending Post Request to LAS Download Link; Saving Output As Variable"
167     ]
168 },
169 {
170     "cell_type": "code",
171     "execution_count": 13,
172     "metadata": {},
173     "outputs": [],
174     "source": [
175         "LAS_File_OBJ = requests.post(LAS_File)"
176     ]
177 },
178 {
179     "cell_type": "code",
180     "execution_count": 14,
181     "metadata": {},
182     "outputs": [
183         {
184             "data": {
185                 "text/plain": [
186                     "<Response [200]>"
187                 ]
188             },
189             "execution_count": 14,
190             "metadata": {},
191             "output_type": "execute_result"
192         }
193     ],
194     "source": [
195         "LAS_File_OBJ"
196     ]
197 },
198 {
199     "cell_type": "markdown",
200     "metadata": {},
201     "source": [
202         "### Create Output File Name (Where File Destination Will Be); Save Output Path As
203         Variable"

```

```

200     ]
201 },
202 {
203     "cell_type": "code",
204     "execution_count": 15,
205     "metadata": {},
206     "outputs": [
207         {
208             "data": {
209                 "text/plain": [
210                     "'C:\\\\Users\\\\Alexander Danielson\\\\\\\\Desktop\\\\\\\\Fall 2022Spring2023\\\\\\\\ArcGIS
I\\\\\\\\Lab2\\\\\\\\Lab2\\\\\\\\LASDataSample.las'"
211                 ]
212             },
213             "execution_count": 15,
214             "metadata": {},
215             "output_type": "execute_result"
216         }
217     ],
218     "source": [
219         "Path_To_LAS = os.path.join(Working_Directory, 'LASDataSample.las')\n",
220         "Path_To_LAS"
221     ]
222 },
223 {
224     "cell_type": "markdown",
225     "metadata": {},
226     "source": [
227         "### Write (.content of) Response From Post Request To Disk"
228     ]
229 },
230 {
231     "cell_type": "code",
232     "execution_count": 16,
233     "metadata": {},
234     "outputs": [],
235     "source": [
236         "with open(Path_To_LAS, 'wb') as f:\n",
237         "    f.write(LAS_File_OBJ.content)"
238     ]
239 },
240 {
241     "cell_type": "markdown",
242     "metadata": {},
243     "source": [
244         "## Convert LAS File to DEM "
245     ]
246 },
247 {
248     "cell_type": "markdown",
249     "metadata": {},
250     "source": [
251         "### Create LAS DataSet to Set Boundary "
252     ]
253 },
254 {
255     "cell_type": "code",
256     "execution_count": 49,
257     "metadata": {},
258     "outputs": [
259         {
260             "data": {
261                 "text/html": [
262                     "<div class='gpresult'><h2>Messages</h2><div id='messages'
data-messages='[\"Start Time: Saturday, October 22, 2022 10:07:51
AM\", \"Succeeded at Saturday, October 22, 2022 10:07:51 AM (Elapsed Time: 0.11
seconds)\"]' data-show='true'><div id = 'default' /></div></div>"
263                 ],
264                 "text/plain": [

```

```

265         "<Result 'C:\\\\Users\\\\Alexander Danielson\\\\Desktop\\\\Fall
266         2022Spring2023\\\\ArcGIS I\\\\Lab2\\\\Lab2\\\\LASDataSample_LasDataset.lasd'>"
267     ],
268     "execution_count": 49,
269     "metadata": {},
270     "output_type": "execute_result"
271 }
272 ],
273 "source": [
274     "arcpy.management.CreateLasDataset(r\"'C:\\Users\\Alexander Danielson\\Desktop\\Fall
275     2022Spring2023\\ArcGIS I\\Lab2\\Lab2\\LASDataSample.las'\", r\"C:\\Users\\Alexander
276     Danielson\\Desktop\\Fall 2022Spring2023\\ArcGIS
277     I\\Lab2\\Lab2\\LASDataSample_LasDataset.lasd\", \"NO_RECURSION\", None,
278     'PROJCS[\"datum_D_North_American_1983_HARN_UTM_Zone_15N\",GEOGCS[\"GCS_datum_D_North_
279     American_1983_HARN\",DATUM[\"D_unknown\",SPHEROID[\"GRS_1980\",6378137.0,298.25722210
280     1]],PRIMEM[\"Greenwich\",0.0],UNIT[\"Degree\",0.0174532925199433]],PROJECTION[\"Trans
281     verse_Mercator\"],PARAMETER[\"false_easting\",500000.0],PARAMETER[\"false_northing\",
282     0.0],PARAMETER[\"central_meridian\",-93.0],PARAMETER[\"scale_factor\",0.9996],PARAMET
283     ER[\"latitude_of_origin\",0.0],UNIT[\"Meter\",1.0]],VERTCS[\"NAVD88 - Geoid03
284     (Meters)\",VDATUM[\"unknown\"],PARAMETER[\"Vertical_Shift\",0.0],PARAMETER[\"Directio
285     n\",1.0],UNIT[\"Meter\",1.0]]', \"COMPUTE_STATS\", \"ABSOLUTE_PATHS\",
286     \"ALL_FILES\", \"DEFAULT\", None, \"INTERSECTED_FILES\")"
287 ]
288 },
289 {
290     "cell_type": "markdown",
291     "metadata": {},
292     "source": [
293         "### Convert LAS File to DEM (Python)"
294     ]
295 },
296 {
297     "cell_type": "code",
298     "execution_count": 50,
299     "metadata": {},
300     "outputs": [
301         {
302             "data": {
303                 "text/html": [
304                     "<div class='gpresult'><h2>Messages</h2><div id='messages'
305                     data-messages='[\"Start Time: Saturday, October 22, 2022 10:18:01
306                     AM\", \"Succeeded at Saturday, October 22, 2022 10:18:03 AM (Elapsed Time: 1.78
307                     seconds)\"]' data-show='true'><div id = 'default' /></div></div>"
308                 ],
309                 "text/plain": [
310                     "<Result 'c:\\\\Users\\\\alexander danielson\\\\Desktop\\\\fall
311                     2022spring2023\\\\ArcGIS I\\\\Lab2\\\\Lab2\\\\Lab2.gdb\\\\LAS_To_DEM'>"
312                 ]
313             },
314             "execution_count": 50,
315             "metadata": {},
316             "output_type": "execute_result"
317         }
318     ],
319     "source": [
320         "arcpy.conversion.LasDatasetToRaster(r\"C:\\Users\\Alexander
321         Danielson\\Desktop\\Fall 2022Spring2023\\ArcGIS I\\Lab2\\Lab2\\LASDataSample.las\",
322         r\"c:\\Users\\alexander danielson\\Desktop\\fall 2022spring2023\\ArcGIS
323         I\\Lab2\\Lab2\\Lab2.gdb\\LAS_To_DEM\", \"ELEVATION\", \"BINNING AVERAGE LINEAR\",
324         \"FLOAT\", \"CELLSIZE\", 10, 1)"
325     ]
326 },
327 {
328     "cell_type": "code",
329     "execution_count": 51,
330     "metadata": {},
331     "outputs": [
332     ]
333 }

```

```

313     "data": {
314         "text/html": [
315             "<div class='gpresult'><h2>Messages</h2><div id='messages'
              data-messages='[\"Start Time: Saturday, October 22, 2022 10:23:28
              AM\", \"Succeeded at Saturday, October 22, 2022 10:23:30 AM (Elapsed Time: 2.27
              seconds)\"]' data-show='true'><div id = 'default' /></div></div>"
316         ],
317         "text/plain": [
318             "<Result 'c:\\\\Users\\\\alexander danielson\\\\Desktop\\\\fall
              2022spring2023\\\\ArcGIS I\\\\Lab2\\\\Lab2\\\\Lab2.gdb\\\\LAS_To_DEMTri'>"
319         ]
320     },
321     "execution_count": 51,
322     "metadata": {},
323     "output_type": "execute_result"
324 }
325 ],
326 "source": [
327     "arcpy.conversion.LasDatasetToRaster(\"LASDataSample_LasDataset.lasd\",
              r\"c:\\\\Users\\\\alexander danielson\\\\Desktop\\\\fall 2022spring2023\\\\ArcGIS
              I\\\\Lab2\\\\Lab2\\\\Lab2.gdb\\\\LAS_To_DEMTri\", \"ELEVATION\", None, \"FLOAT\",
              \"CELLSIZE\", 10, 1)"
328 ]
329 },
330 {
331     "cell_type": "markdown",
332     "metadata": {},
333     "source": [
334         "## Convert LAS File to TIN"
335     ]
336 },
337 {
338     "cell_type": "code",
339     "execution_count": 53,
340     "metadata": {},
341     "outputs": [
342         {
343             "data": {
344                 "text/html": [
345                     "<div class='gpresult'><h2>Messages</h2><div id='messages'
                      data-messages='[\"Start Time: Saturday, October 22, 2022 10:27:25
                      AM\", \"Succeeded at Saturday, October 22, 2022 10:28:01 AM (Elapsed Time: 35.65
                      seconds)\"]' data-show='true'><div id = 'default' /></div></div>"
346                 ],
347                 "text/plain": [
348                     "<Result 'C:\\\\Users\\\\Alexander Danielson\\\\Desktop\\\\Fall
                      2022Spring2023\\\\ArcGIS I\\\\Lab2\\\\Lab2\\\\LASDataSample_LasDataset.lasd'>"
349                 ]
350             },
351             "execution_count": 53,
352             "metadata": {},
353             "output_type": "execute_result"
354         }
355     ],
356     "source": [
357         "arcpy.ddd.LasDatasetToTin(r\"C:\\\\Users\\\\Alexander Danielson\\\\Desktop\\\\Fall
              2022Spring2023\\\\ArcGIS I\\\\Lab2\\\\Lab2\\\\LASDataSample_LasDataset.lasd\",
              r\"C:\\\\Users\\\\Alexander Danielson\\\\Desktop\\\\Fall 2022Spring2023\\\\ArcGIS
              I\\\\Lab2\\\\Lab2\\\\LAS_To_TINDataset\", \"NONE\", '', None, 50000000, 1, \"CLIP\")"
358     ]
359 },
360 {
361     "cell_type": "code",
362     "execution_count": 17,
363     "metadata": {},
364     "outputs": [
365         {
366             "data": {
367                 "text/html": [

```

```

368     "<div class='gprresult'><h2>Messages</h2><div id='messages'
      data-messages='[\"Start Time: Saturday, October 22, 2022 11:07:01
      AM\", \"Succeeded at Saturday, October 22, 2022 11:07:36 AM (Elapsed Time: 34.76
369     ],
370     \"text/plain\": [
371     \"<Result 'C:\\\\Users\\\\Alexander Danielson\\\\Desktop\\\\Fall
      2022Spring2023\\\\ArcGIS I\\\\Lab2\\\\Lab2\\\\LAS_To_TINSample'>\"
372     ]
373     },
374     \"execution_count\": 17,
375     \"metadata\": {},
376     \"output_type\": \"execute_result\"
377     }
378 ],
379 \"source\": [
380     \"arcpy.ddd.LasDatasetToTin(r\"C:\\Users\\Alexander Danielson\\Desktop\\Fall
      2022Spring2023\\ArcGIS I\\Lab2\\Lab2\\LASDataSample.las\", r\"C:\\Users\\Alexander
      Danielson\\Desktop\\Fall 2022Spring2023\\ArcGIS I\\Lab2\\Lab2\\LAS_To_TINSample\\\",
      \\\"NONE\\\", '', None, 50000000, 1, \\\"CLIP\\\")\"
381 ]
382 },
383 {
384     \"cell_type\": \"markdown\",
385     \"metadata\": {},
386     \"source\": [
387     \"## Transfer DEM and TIN Files to Disk via Write Path Variable\"
388     ]
389 },
390 {
391     \"cell_type\": \"markdown\",
392     \"metadata\": {},
393     \"source\": [
394     \"### LAS to DEM Sample\"
395     ]
396 },
397 {
398     \"cell_type\": \"code\",
399     \"execution_count\": 22,
400     \"metadata\": {},
401     \"outputs\": [],
402     \"source\": [
403     \"Path_LASDEMSample = r'C:\\LAS_To_DEM'\"
404     ]
405 },
406 {
407     \"cell_type\": \"code\",
408     \"execution_count\": 23,
409     \"metadata\": {},
410     \"outputs\": [],
411     \"source\": [
412     \"filehandle = open(Path_LASDEMSample, 'w')\\n\",
413     \"filehandle.write('LAS_To_DEM')\\n\",
414     \"filehandle.close()\"
415     ]
416 },
417 {
418     \"cell_type\": \"markdown\",
419     \"metadata\": {},
420     \"source\": [
421     \"### LAS to DEM (with LAS Dataset Triangulation)\"
422     ]
423 },
424 {
425     \"cell_type\": \"code\",
426     \"execution_count\": 24,
427     \"metadata\": {},
428     \"outputs\": [],
429     \"source\": [

```

```

430     "Path_LASDEMTri = r'C:\\LAS_To_DEMTri'"
431 ]
432 },
433 {
434     "cell_type": "code",
435     "execution_count": 25,
436     "metadata": {},
437     "outputs": [],
438     "source": [
439         "filehandle = open(Path_LASDEMTri, 'w')\n",
440         "filehandle.write('LAS_To_DEMTri')\n",
441         "filehandle.close()"
442     ]
443 },
444 {
445     "cell_type": "markdown",
446     "metadata": {},
447     "source": [
448         "### LAS to TIN Sample"
449     ]
450 },
451 {
452     "cell_type": "code",
453     "execution_count": 26,
454     "metadata": {},
455     "outputs": [],
456     "source": [
457         "Path_LAS_To_TINSample = r'C:\\LAS_To_TINSample'"
458     ]
459 },
460 {
461     "cell_type": "code",
462     "execution_count": 27,
463     "metadata": {},
464     "outputs": [],
465     "source": [
466         "filehandle = open(Path_LAS_To_TINSample, 'w')\n",
467         "filehandle.write('LAS_To_TINSample')\n",
468         "filehandle.close()"
469     ]
470 },
471 {
472     "cell_type": "markdown",
473     "metadata": {},
474     "source": [
475         "### LAS to TIN (With LAS DataSet)"
476     ]
477 },
478 {
479     "cell_type": "code",
480     "execution_count": 28,
481     "metadata": {},
482     "outputs": [],
483     "source": [
484         "Path_LAS_To_TINDataset = r'C:\\LAS_To_TINDataset'"
485     ]
486 },
487 {
488     "cell_type": "code",
489     "execution_count": 29,
490     "metadata": {},
491     "outputs": [],
492     "source": [
493         "filehandle = open(Path_LAS_To_TINDataset, 'w')\n",
494         "filehandle.write('LAS_To_TINDataset')\n",
495         "filehandle.close()"
496     ]
497 },
498 {

```



```

499     "cell_type": "markdown",
500     "metadata": {},
501     "source": [
502         "## Export DEMs and TINs to PDF Visualizations using arcpy.mp"
503     ]
504 },
505 {
506     "cell_type": "code",
507     "execution_count": 3,
508     "metadata": {},
509     "outputs": [
510         {
511             "data": {
512                 "text/plain": [
513                     "'C:\\\\Users\\\\Alexander Danielson\\\\Desktop\\\\Fall 2022Spring2023\\\\ArcGIS
514                     I\\\\Lab2\\\\Lab2\\\\DEMTIF.pdf'"
515                 ],
516             },
517             "execution_count": 3,
518             "metadata": {},
519             "output_type": "execute_result"
520         ],
521         "source": [
522             "aprx = arcpy.mp.ArcGISProject(r\"C:\\Users\\Alexander Danielson\\Desktop\\Fall
523             2022Spring2023\\ArcGIS I\\Lab2\\Lab2\\Lab2.aprx\")\n",
524             "lyt = aprx.listLayouts(\"Visualizations*\")[0]\n",
525             "lyt.exportToPDF(r\"C:\\Users\\Alexander Danielson\\Desktop\\Fall
526             2022Spring2023\\ArcGIS I\\Lab2\\Lab2\\DEMTIF.pdf\", resolution = 300)"
527         ]
528     },
529     {
530         "cell_type": "code",
531         "execution_count": 2,
532         "metadata": {},
533         "outputs": [
534             {
535                 "ename": "NameError",
536                 "evalue": "name 'lyt' is not defined",
537                 "output_type": "error",
538                 "traceback": [
539                     "\u001b[0;31m-----\n-----\u001b[0m\n\u001b[0;31mNameError\u001b[0m\nTraceback (most recent call last)",
540                     "In \u001b[0;34m[2]\u001b[0m: \u001b[0m\nLine \u001b[0;34m1\u001b[0m\n\u001b[0m\n\u001b[0;36mlen\u001b[0m[39;49;00m(lyt)\u001b[0m",
541                     "\u001b[0;31mNameError\u001b[0m: name 'lyt' is not\ndefined\n\u001b[0;31m-----\n-----\u001b[0m"
542                 ]
543             }
544         ],
545         "source": [
546             "len(lyt)"
547         ]
548     },
549     {
550         "cell_type": "markdown",
551         "metadata": {},
552         "source": [
553             "# PRISM Data Download and Spacetime Cube Operations"
554         ]
555     },
556     {
557         "cell_type": "markdown",
558         "metadata": {},
559         "source": [
560             "### Save \"Base\" of PRISM Data Request using URL and to A Variable (Using Web

```

```

Inspector)"
559 ]
560 },
561 {
562   "cell_type": "code",
563   "execution_count": 2,
564   "metadata": {},
565   "outputs": [
566     {
567       "data": {
568         "text/plain": [
569           "'https://prism.oregonstate.edu/fetchData.php'"
570         ]
571       },
572       "execution_count": 2,
573       "metadata": {},
574       "output_type": "execute_result"
575     }
576   ],
577   "source": [
578     "PRISM_Request_URL = r'https://prism.oregonstate.edu/fetchData.php'\n",
579     "PRISM_Request_URL"
580   ]
581 },
582 {
583   "cell_type": "markdown",
584   "metadata": {},
585   "source": [
586     "### Save Request Parameters To A Variable"
587   ]
588 },
589 {
590   "cell_type": "code",
591   "execution_count": 3,
592   "metadata": {},
593   "outputs": [
594     {
595       "data": {
596         "text/plain": [
597           "'type=all_bil&kind=normals&spatial=4km&elem=ppt&temporal=annual'"
598         ]
599       },
600       "execution_count": 3,
601       "metadata": {},
602       "output_type": "execute_result"
603     }
604   ],
605   "source": [
606     "PRISM_Parameters =
607     r'type=all_bil&kind=normals&spatial=4km&elem=ppt&temporal=annual'\n",
608     "PRISM_Parameters"
609   ],
610   {
611     "cell_type": "markdown",
612     "metadata": {},
613     "source": [
614       "### Combine the Parameters To the Base of the URL, Using '+', By Separating the two
615       items using A '?' \n"
616     ]
617   },
618   {
619     "cell_type": "code",
620     "execution_count": 4,
621     "metadata": {},
622     "outputs": [],
623     "source": [
624       "Final_PRISM_Path = PRISM_Request_URL + '?' + PRISM_Parameters"
625     ]

```

```

625 },
626 {
627     "cell_type": "code",
628     "execution_count": 5,
629     "metadata": {},
630     "outputs": [
631         {
632             "name": "stdout",
633             "output_type": "stream",
634             "text": [
635
636                 "https://prism.oregonstate.edu/fetchData.php?type=all_bil&kind=normals&spatial=4km&
637                 elem=ppt&temporal=annual\n"
638             ],
639         },
640     ],
641     "source": [
642         "print(Final_PRISM_Path)"
643     ],
644     "cell_type": "code",
645     "execution_count": 12,
646     "metadata": {},
647     "source": [
648         "### Saving The Data Captured By Posting The URL String To A Variable"
649     ],
650     "cell_type": "code",
651     "execution_count": 12,
652     "metadata": {},
653     "outputs": [],
654     "source": [
655         "PRISM_Post_Request = requests.post(Final_PRISM_Path)"
656     ],
657     "cell_type": "code",
658     "execution_count": 13,
659     "metadata": {},
660     "outputs": [
661         {
662             "data": {
663                 "text/plain": [
664                     "<Response [200]>"
665                 ]
666             },
667             "execution_count": 13,
668             "metadata": {},
669             "output_type": "execute_result"
670         }
671     ],
672     "source": [
673         "PRISM_Post_Request"
674     ],
675     "cell_type": "code",
676     "execution_count": 14,
677     "metadata": {},
678     "outputs": [],
679     "source": [
680         "### Saving The Raw Data Of The Zipfile To A Variable"
681     ],
682     "cell_type": "code",
683     "execution_count": 14,
684     "metadata": {},
685     "outputs": [],
686     "source": [
687

```

```

692     "ourzipfile = zipfile.ZipFile(\n",
693     "         io.BytesIO(\n",
694     "             PRISM_Post_Request.content)\n",
695     "        )"
696 ]
697 },
698 {
699     "cell_type": "code",
700     "execution_count": 15,
701     "metadata": {},
702     "outputs": [
703     {
704         "data": {
705             "text/plain": [
706                 "<zipfile.ZipFile file=<_io.BytesIO object at 0x0000022F4E534D60> mode='r'>"
707             ]
708         },
709         "execution_count": 15,
710         "metadata": {},
711         "output_type": "execute_result"
712     }
713 ],
714     "source": [
715         "ourzipfile"
716     ]
717 },
718 {
719     "cell_type": "markdown",
720     "metadata": {},
721     "source": [
722         "### Creating New Folder (path) For PRISM .BIL Files"
723     ]
724 },
725 {
726     "cell_type": "code",
727     "execution_count": 19,
728     "metadata": {},
729     "outputs": [
730     {
731         "data": {
732             "text/plain": [
733                 "'C:\\\\Users\\\\Alexander Danielson\\\\Desktop\\\\Fall 2022Spring2023\\\\ArcGIS"
734                 "I\\\\Lab2\\\\Lab2\\\\PRISM_BILS'"
735             ]
736         },
737         "execution_count": 19,
738         "metadata": {},
739         "output_type": "execute_result"
740     }
741 ],
742     "source": [
743         "bilsfolder = os.path.join(Working_Directory, 'PRISM_BILS')\n",
744         "bilsfolder"
745     ]
746 },
747 {
748     "cell_type": "markdown",
749     "metadata": {},
750     "source": [
751         "### Extracting Data To Newly Created Folder"
752     ]
753 },
754 {
755     "cell_type": "code",
756     "execution_count": 20,
757     "metadata": {},
758     "outputs": [],
759     "source": [
760         "ourzipfile.extractall(bilsfolder)"

```

```

760     ]
761 },
762 {
763     "cell_type": "markdown",
764     "metadata": {},
765     "source": [
766         "## Spacetime Cube Parameters"
767     ]
768 },
769 {
770     "cell_type": "markdown",
771     "metadata": {},
772     "source": [
773         "### Create Mosaic Dataset"
774     ]
775 },
776 {
777     "cell_type": "code",
778     "execution_count": 17,
779     "metadata": {},
780     "outputs": [
781         {
782             "data": {
783                 "text/html": [
784                     "<div class='gppresult'><h2>Messages</h2><div id='messages'
785                     data-messages='[\"Start Time: Sunday, October 30, 2022 2:45:36 PM\", \"Succeeded
786                     at Sunday, October 30, 2022 2:45:38 PM (Elapsed Time: 2.30 seconds)\"]'
787                     data-show='true'><div id = 'default' /></div></div>"
788                 ],
789                 "text/plain": [
790                     "<Result 'C:\\\\Users\\\\Alexander Danielson\\\\\\\\Desktop\\\\\\\\Fall
791                     2022Spring2023\\\\\\\\ArcGIS I\\\\\\\\Lab2\\\\\\\\Lab2\\\\\\\\Lab2.gdb\\\\\\\\PRISMDData'>"
792                 ]
793             },
794             "execution_count": 17,
795             "metadata": {},
796             "output_type": "execute_result"
797         }
798     ],
799     "source": [
800         "arcpy.management.CreateMosaicDataset(r\"C:\\Users\\Alexander
801         Danielson\\Desktop\\Fall 2022Spring2023\\ArcGIS I\\Lab2\\Lab2\\Lab2.gdb\",
802         \"PRISMDData\",
803         'PROJCS[\"datum_D_North_American_1983_HARN_UTM_Zone_15N\",GEOGCS[\"GCS_datum_D_North_
804         American_1983_HARN\",DATUM[\"D_unknown\",SPHEROID[\"GRS_1980\",6378137.0,298.25722210
805         1]],PRIMEM[\"Greenwich\",0.0],UNIT[\"Degree\",0.0174532925199433]],PROJECTION[\"Trans
806         verse_Mercator\",PARAMETER[\"false_easting\",500000.0],PARAMETER[\"false_northing\",
807         0.0],PARAMETER[\"central_meridian\",-93.0],PARAMETER[\"scale_factor\",0.9996],PARAMET
808         ER[\"latitude_of_origin\",0.0],UNIT[\"Meter\",1.0]],VERTCS[\"NAVD88 - Geoid03
809         (Meters)\",VDATUM[\"unknown\"],PARAMETER[\"Vertical_Shift\",0.0],PARAMETER[\"Directio
810         n\",1.0],UNIT[\"Meter\",1.0]]', None, '', \"NONE\", None)"
811     ]
812 },
813 {
814     "cell_type": "markdown",
815     "metadata": {},
816     "source": [
817         "### Add .BIL Rasters To Mosaic Dataset"
818     ]
819 },
820 {
821     "cell_type": "code",
822     "execution_count": 18,
823     "metadata": {},
824     "outputs": [
825         {
826             "data": {
827                 "text/html": [
828                     "<div class='gppresult'><h2>Messages</h2><div id='messages'

```

```

data-messages='["Start Time: Sunday, October 30, 2022 2:46:29
PM","\2022-10-30T14:46:31.326: Loading raster
datasets","\2022-10-30T14:46:31.357: Completed crawling 13 data source items.
Added 13 mosaic dataset items","\2022-10-30T14:46:31.358: Synchronizing crawled
data source items","\2022-10-30T14:46:31.364: Synchronizing items associated
with raster type instance &#39;Raster Dataset&#39; [ID:
1].","\2022-10-30T14:46:31.468: Completed synchronization: 13 items selected, 13
items synchronized","\2022-10-30T14:46:31.541: Computing cell size
levels","\2022-10-30T14:46:31.541: Computing unique cell size
values","\2022-10-30T14:46:31.575: Computing maximum cell size
values","\2022-10-30T14:46:31.582: Computing minimum cell size
values","\2022-10-30T14:46:31.589: Updating visibility values of selected
items","\2022-10-30T14:46:31.601: Computing maximum cell size for mosaic
dataset","\2022-10-30T14:46:31.608: Completed computing cell size
ranges","\2022-10-30T14:46:31.645: Completed building boundary","\Succeeded
at Sunday, October 30, 2022 2:46:31 PM (Elapsed Time: 2.09 seconds)\"]'
data-show='true'><div id = 'default' /></div></div>"
815 ],
816 "text/plain": [
817 "<Result 'PRISMDData'>"
818 ]
819 },
820 "execution_count": 18,
821 "metadata": {},
822 "output_type": "execute_result"
823 }
824 ],
825 "source": [
826 "arcpy.management.AddRastersToMosaicDataset("\PRISMDData","\Raster Dataset",
r"\C:\\Users\\Alexander Danielson\\Desktop\\Fall 2022Spring2023\\ArcGIS
I\\Lab2\\Lab2\\PRISM_BILS","\UPDATE_CELL_SIZES","\UPDATE_BOUNDARY",
"\NO_OVERVIEWS", None, 0, 1500, None, '', "\SUBFOLDERS","\ALLOW_DUPLICATES",
"\NO_PYRAMIDS","\NO_STATISTICS","\NO_THUMBNAILS','',
"\NO_FORCE_SPATIAL_REFERENCE","\NO_STATISTICS", None, "\NO_PIXEL_CACHE",
r"\C:\\Users\\Alexander Danielson\\AppData\\Local\\ESRI\\rasterproxies\\PRISMDData")"
827 ]
828 },
829 {
830 "cell_type": "markdown",
831 "metadata": {},
832 "source": [
833 "### Calculate Field for a Variable to Assign Timestamps in Next Field(s)"
834 ]
835 },
836 {
837 "cell_type": "code",
838 "execution_count": 28,
839 "metadata": {
840 "scrolled": true
841 },
842 "outputs": [
843 {
844 "data": {
845 "text/html": [
846 "<div class='gpresult'><h2>Messages</h2><div id='messages'
data-messages='["Start Time: Sunday, October 30, 2022 3:02:01 PM","\Succeeded
at Sunday, October 30, 2022 3:02:01 PM (Elapsed Time: 0.07 seconds)\"]'
data-show='true'><div id = 'default' /></div></div>"
847 ],
848 "text/plain": [
849 "<Result 'PRISMDData\\\\\\\\Footprint'>"
850 ]
851 },
852 "execution_count": 28,
853 "metadata": {},
854 "output_type": "execute_result"
855 }
856 ],
857 "source": [

```

```

858     "arcpy.management.CalculateField(r\"PRISMDData\\Footprint\", \"Variable\",
859     '\\"Precip\\"', \"PYTHON3\", '', \"TEXT\", \"NO_ENFORCE_DOMAINS\")"
860 },
861 {
862     "cell_type": "markdown",
863     "metadata": {},
864     "source": [
865         "### Calculate Field for Timestamps of .Bil Rasters"
866     ]
867 },
868 {
869     "cell_type": "code",
870     "execution_count": 31,
871     "metadata": {
872         "scrolled": true
873     },
874     "outputs": [
875         {
876             "data": {
877                 "text/html": [
878                     "<div class='gpresult'><h2>Messages</h2><div id='messages'
879                     data-messages='[\"Start Time: Sunday, October 30, 2022 3:09:45 PM\", \"Succeeded
880                     at Sunday, October 30, 2022 3:09:45 PM (Elapsed Time: 0.10 seconds)\"]'
881                     data-show='true'><div id = 'default' /></div></div>"
882                 ],
883                 "text/plain": [
884                     "<Result 'PRISMDData\\\\\\\\Footprint'>"
885                 ]
886             },
887             "execution_count": 31,
888             "metadata": {},
889             "output_type": "execute_result"
890         }
891     ],
892     "source": [
893         "arcpy.management.CalculateField(r\"PRISMDData\\Footprint\", \"Timestamp\",
894         'DateAdd(Date(2022, 0, 1), $feature.OBJECTID-1, \"month\")', \"ARCADE\", '',
895         \"DATE\", \"NO_ENFORCE_DOMAINS\")"
896     ]
897 },
898 {
899     "cell_type": "markdown",
900     "metadata": {},
901     "source": [
902         "### Build Multidimensional Raster Information "
903     ]
904 },
905 {
906     "cell_type": "code",
907     "execution_count": 33,
908     "metadata": {},
909     "outputs": [
910         {
911             "data": {
912                 "text/html": [
913                     "<div class='gpresult'><h2>Messages</h2><div id='messages'
914                     data-messages='[\"Start Time: Sunday, October 30, 2022 3:11:34 PM\", \"Succeeded
915                     at Sunday, October 30, 2022 3:11:35 PM (Elapsed Time: 1.15 seconds)\"]'
916                     data-show='true'><div id = 'default' /></div></div>"
917                 ],
918                 "text/plain": [
919                     "<Result 'PRISMDData'>"
920                 ]
921             },
922             "execution_count": 33,
923             "metadata": {},
924             "output_type": "execute_result"
925         }
926     ]
927 }

```

```

918 ],
919 "source": [
920     "arcpy.md.BuildMultidimensionalInfo(\"PRISMDData\", \"Variable\", \"Timestamp # #\",
None, \"NO_DELETE_MULTIDIMENSIONAL_INFO\")"
921 ]
922 },
923 {
924     "cell_type": "markdown",
925     "metadata": {},
926     "source": [
927         "### Make Multidimensional Raster Layer"
928     ]
929 },
930 {
931     "cell_type": "code",
932     "execution_count": 34,
933     "metadata": {},
934     "outputs": [
935         {
936             "data": {
937                 "text/html": [
938                     "<div class='gpresult'><h2>Messages</h2><div id='messages'
data-messages='[\"Start Time: Sunday, October 30, 2022 3:12:19 PM\", \"Succeeded
at Sunday, October 30, 2022 3:12:20 PM (Elapsed Time: 1.82 seconds)\"]'
data-show='true'><div id = 'default' /></div></div>"
939                 ],
940                 "text/plain": [
941                     "<Result 'PRISMDData_MultidimLayer'>"
942                 ]
943             },
944             "execution_count": 34,
945             "metadata": {},
946             "output_type": "execute_result"
947         }
948     ],
949     "source": [
950         "arcpy.md.MakeMultidimensionalRasterLayer(\"PRISMDData\",
\"PRISMDData_MultidimLayer\", \"Precip\", \"ALL\", None, None, '', '', '', None, '',
'-2871587.5494 2660354.42202726 3264899.3806283 6041683.9549
PROJCS[\"datum_D_North_American_1983_HARN_UTM_Zone_15N\",GEOGCS[\"GCS_datum_D_North_A
merican_1983_HARN\",DATUM[\"D_unknown\",SPHEROID[\"GRS_1980\",6378137.0,298.257222101
]],PRIMEM[\"Greenwich\",0.0],UNIT[\"Degree\",0.0174532925199433]],PROJECTION[\"Transv
erse_Mercator\"],PARAMETER[\"false_easting\",500000.0],PARAMETER[\"false_northing\",0
.0],PARAMETER[\"central_meridian\",-93.0],PARAMETER[\"scale_factor\",0.9996],PARAMETE
R[\"latitude_of_origin\",0.0],UNIT[\"Meter\",1.0]],VERTCS[\"NAVD88 - Geoid03
(Meters)\",VDATUM[\"unknown\"],PARAMETER[\"Vertical_Shift\",0.0],PARAMETER[\"Directio
n\",1.0],UNIT[\"Meter\",1.0]]', \"DIMENSIONS\", None)"
951     ]
952 },
953 {
954     "cell_type": "markdown",
955     "metadata": {},
956     "source": [
957         "### Create Space Time Cube From Multidimensional Raster Layer"
958     ]
959 },
960 {
961     "cell_type": "code",
962     "execution_count": 35,
963     "metadata": {},
964     "outputs": [
965         {
966             "data": {
967                 "text/html": [
968                     "<div class='gpresult'><h2>Messages</h2><div id='messages'
data-messages='[\"Start Time: Sunday, October 30, 2022 3:15:08 PM\", \"WARNING
110442: The Input Multidimensional Raster Layer contains irregular or missing
time intervals.\", \"WARNING 110013: The default Time Step Interval is 28
days.\", {\"element\": \"content\", \"data\": \"The space time cube has aggregated

```





```
986     "source": [  
987         "### Export Space Time Cube to GIF"  
988     ]  
989 },  
990 {  
991     "cell_type": "markdown",  
992     "metadata": {},  
993     "source": [  
994         "### Use Export Raster Tools"  
995     ]  
996 },  
997 {  
998     "cell_type": "code",  
999     "execution_count": null,  
1000     "metadata": {},  
1001     "outputs": [],  
1002     "source": []  
1003 }  
1004 ],  
1005 "metadata": {  
1006     "kernelspec": {  
1007         "display_name": "ArcGISPro",  
1008         "language": "Python",  
1009         "name": "python3"  
1010     },  
1011     "language_info": {  
1012         "file_extension": ".py",  
1013         "name": "python",  
1014         "version": "3"  
1015     }  
1016 },  
1017 "nbformat": 4,  
1018 "nbformat_minor": 2  
1019 }  
1020
```