SupplyByLandusePerHa

February 17, 2016

In [17]:
```
# Some steps required until these Python modules are properly installed...
import sys
sys.path.append('../Modules')
sys.path.append('../../../../veneer-py')
# Get the Source scripting components (veneer) and GBR specific stuff
import veneer
import gbr
%pylab inline
```

```
Populating the interactive namespace from numpy and matplotlib
```

In [2]:
```
# Point the system at a particular output directory...
gbr.init('D:/Beckers/outputs/Scenario 1/')
gbr.available()
```

Out[2]:
```
['Beta3815',
 'Beta3815_PREC_PARAC_PARAN',
 'Beta3815_test_all_go_fasts',
 'Beta3815_test_parallel_reporting',
 'RUN_FROM_IRONPYTHON_0',
 'RUN_FROM_IRONPYTHON_1',
 'RUN_FROM_IRONPYTHON_2',
 'TEST_ALL_SPEEDUPS',
 'TEST_DEFAULT',
 'TEST_DEFAULT2',
 'TEST_DEFAULT3',
 'TEST_DELETE_TEMP_ARRAYS',
 'TEST_DUMMY',
 'TEST_PARAC',
 'TEST_PRE',
 'TEST_PRE_PARAC',
 'TEST_REARRANGE_PARALLEL',
 'TEST_REPORTING',
 'TEST_REPORTING_SPEED',
 'TEST_SPEEDUP_REGIONAL_REPORTING',
 'TEST_WITHOUT_REPORTING_SPEEDUPS',
 'TIMING_WITHOUT_PARAC_WITHOUT_PARAN_WITHOUT_PRERUN',
 'TIMING_WITHOUT_PARAC_WITHOUT_PARAN_WITH_PRERUN',
 'TIMING_WITHOUT_PARAC_WITH_PARAN_WITHOUT_PRERUN',
 'TIMING_WITHOUT_PARAC_WITH_PARAN_WITH_PRERUN',
 'TIMING_WITH_PARAC_WITHOUT_PARAN_WITHOUT_PRERUN',
 'TIMING_WITH_PARAC_WITHOUT_PARAN_WITH_PRERUN',
 'TIMING_WITH_PARAC_WITH_PARAN_WITHOUT_PRERUN',
 'TIMING_WITH_PARAC_WITH_PARAN_WITH_PRERUN']
```

```
In [3]: # Get a results set
        results = gbr.Results('Beta3815')

In [4]: results.available()

Out[4]: ['climateTable',
         'CrossTabOutputsTable',
         'fuAreasTable',
         'FURatesTable',
         'FUSummaryTable',
         'OutletNodesRatesTable',
         'OverallSummaryTable',
         'ParameterTable',
         'RawResults',
         'RegionalSourceSinkSummaryTable',
         'RegionalSummaryTable',
         'SourceSinkPerFuSummaryTable',
         'SourceSinkSummaryTable',
         'TimeSeriesTable']

In [5]: fuData = results.get('FUSummaryTable')
        fuData
```

Out[5]:

Constituent	FU	Total_Load_in_Kg
P_Particulate	Cropping	0.000000e+00
P_Particulate	Grazing	2.094983e+09
P_Particulate	Grazing Closed	2.361782e+09
P_Particulate	Other	1.441621e+08
P_Particulate	Water	3.609331e+06
Ametryn	Cropping	0.000000e+00
Ametryn	Grazing	0.000000e+00
Ametryn	Grazing Closed	0.000000e+00
Ametryn	Other	0.000000e+00
Ametryn	Water	0.000000e+00
Atrazine	Cropping	0.000000e+00
Atrazine	Grazing	0.000000e+00
Atrazine	Grazing Closed	0.000000e+00
Atrazine	Other	0.000000e+00
Atrazine	Water	0.000000e+00
Tebuthiuron	Cropping	0.000000e+00
Tebuthiuron	Grazing	0.000000e+00
Tebuthiuron	Grazing Closed	0.000000e+00
Tebuthiuron	Other	0.000000e+00
Tebuthiuron	Water	0.000000e+00
Sediment - Fine	Cropping	5.007476e+08
Sediment - Fine	Grazing	1.132774e+10
Sediment - Fine	Grazing Closed	2.359009e+10
Sediment - Fine	Other	8.937387e+08
Sediment - Fine	Water	2.199010e+07
Sediment - Coarse	Cropping	5.696785e+07
Sediment - Coarse	Grazing	1.416679e+09
Sediment - Coarse	Grazing Closed	3.761698e+09
Sediment - Coarse	Other	1.153735e+08
Sediment - Coarse	Water	2.617297e+06

```
N_Particulate            Cropping      8.034205e+07
N_Particulate             Grazing      1.146588e+09
N_Particulate      Grazing Closed      2.866852e+09
N_Particulate               Other      9.028642e+07
N_Particulate               Water      3.585566e+06
N_DIN                     Cropping      4.836041e+07
N_DIN                      Grazing      4.652394e+08
N_DIN              Grazing Closed      1.720243e+08
N_DIN                       Other      0.000000e+00
N_DIN                       Water      6.058283e+05
N_DON                     Cropping      4.836041e+07
N_DON                      Grazing      4.652394e+08
N_DON              Grazing Closed      1.720243e+08
N_DON                       Other      0.000000e+00
N_DON                       Water      6.058283e+05
P_DOP                     Cropping      0.000000e+00
P_DOP                      Grazing      4.652394e+08
P_DOP              Grazing Closed      1.720243e+08
P_DOP                       Other      1.078517e+04
P_DOP                       Water      6.058283e+05
P_FRP                     Cropping      0.000000e+00
P_FRP                      Grazing      4.652394e+08
P_FRP              Grazing Closed      1.720243e+08
P_FRP                       Other      1.078517e+04
P_FRP                       Water      6.058283e+05
```

In [ ]:

In [6]:
```
SupplyByLanduse_kg = fuData.reset_index().pivot('Constituent','FU','Total_Load_in_Kg')
SupplyByLanduse_kg
```

Out[6]:

FU	Cropping	Grazing	Grazing Closed	Other	\
Constituent					
Ametryn	0.000000e+00	0.000000e+00	0.000000e+00	0.000000e+00	
Atrazine	0.000000e+00	0.000000e+00	0.000000e+00	0.000000e+00	
N_DIN	4.836041e+07	4.652394e+08	1.720243e+08	0.000000e+00	
N_DON	4.836041e+07	4.652394e+08	1.720243e+08	0.000000e+00	
N_Particulate	8.034205e+07	1.146588e+09	2.866852e+09	9.028642e+07	
P_DOP	0.000000e+00	4.652394e+08	1.720243e+08	1.078517e+04	
P_FRP	0.000000e+00	4.652394e+08	1.720243e+08	1.078517e+04	
P_Particulate	0.000000e+00	2.094983e+09	2.361782e+09	1.441621e+08	
Sediment - Coarse	5.696785e+07	1.416679e+09	3.761698e+09	1.153735e+08	
Sediment - Fine	5.007476e+08	1.132774e+10	2.359009e+10	8.937387e+08	
Tebuthiuron	0.000000e+00	0.000000e+00	0.000000e+00	0.000000e+00	

FU	Water
Constituent	
Ametryn	0.000000
Atrazine	0.000000
N_DIN	605828.327441
N_DON	605828.327441
N_Particulate	3585565.990618
P_DOP	605828.327441
P_FRP	605828.327441
P_Particulate	3609331.438365

```
Sediment - Coarse   2617297.375432
Sediment - Fine    21990101.995216
Tebuthiuron              0.000000
```

In [7]:
```
SupplyByLanduse_t = SupplyByLanduse_kg/1000.0
SupplyByLanduse_t
```

Out[7]:

FU	Cropping	Grazing	Grazing Closed	\
Constituent				
Ametryn	0.000000	0.000000	0.000000	
Atrazine	0.000000	0.000000	0.000000	
N_DIN	48360.407997	465239.444921	172024.277874	
N_DON	48360.407997	465239.444921	172024.277874	
N_Particulate	80342.048058	1146588.357639	2866852.150093	
P_DOP	0.000000	465239.444921	172024.277874	
P_FRP	0.000000	465239.444921	172024.277874	
P_Particulate	0.000000	2094982.558569	2361781.828970	
Sediment - Coarse	56967.845023	1416679.289583	3761697.769276	
Sediment - Fine	500747.624140	11327743.982034	23590091.061379	
Tebuthiuron	0.000000	0.000000	0.000000	

FU	Other	Water
Constituent		
Ametryn	0.000000	0.000000
Atrazine	0.000000	0.000000
N_DIN	0.000000	605.828327
N_DON	0.000000	605.828327
N_Particulate	90286.421464	3585.565991
P_DOP	10.785170	605.828327
P_FRP	10.785170	605.828327
P_Particulate	144162.127855	3609.331438
Sediment - Coarse	115373.537116	2617.297375
Sediment - Fine	893738.700494	21990.101995
Tebuthiuron	0.000000	0.000000

In [8]:
```
FUAreas_m2 = results.get('fuAreasTable')
FUAreas_m2
```

Out[8]:

Catchment	FU	Area
SC #3	Cropping	8.074063e+08
SC #3	Grazing	0.000000e+00
SC #3	Grazing Closed	1.330350e+10
SC #3	Other	3.993125e+08
SC #3	Water	6.187500e+06
SC #2	Cropping	5.402813e+08
SC #2	Grazing	5.937374e+09
SC #2	Grazing Closed	1.178470e+09
SC #2	Other	2.325625e+08
SC #2	Water	5.062500e+06
SC #5	Cropping	5.587969e+08
SC #5	Grazing	7.641781e+09
SC #5	Grazing Closed	0.000000e+00
SC #5	Other	3.971406e+08
SC #5	Water	6.968750e+06

```
SC #4            Cropping  5.762500e+07
SC #4             Grazing  3.347191e+09
SC #4      Grazing Closed  1.399668e+09
SC #4               Other  4.936094e+08
SC #4               Water  8.156250e+06
SC #1            Cropping  3.929375e+08
SC #1             Grazing  2.130250e+09
SC #1      Grazing Closed  0.000000e+00
SC #1               Other  1.207812e+07
SC #1               Water  2.625000e+06
```

In [9]:
```
TotalFuAreas_m2 = FUAreas_m2.groupby('FU').sum()
TotalFuAreas_m2
```

Out[9]:
```
                        Area
FU
Cropping        2.357047e+09
Grazing         1.905660e+10
Grazing Closed  1.588164e+10
Other           1.534703e+09
Water           2.900000e+07
```

In [10]:
```
TotalFuAreas_ha = TotalFuAreas_m2.Area/10000.0
TotalFuAreas_ha
```

Out[10]:
```
FU
Cropping           235704.687480
Grazing           1905659.607422
Grazing Closed    1588163.830106
Other              153470.312491
Water                2899.999998
Name: Area, dtype: float64
```

In [ ]:

In [11]:
```
SupplyLandUse_per_ha = SupplyByLanduse_t/TotalFuAreas_ha
SupplyLandUse_per_ha
```

Out[11]:

FU	Cropping	Grazing	Grazing Closed	Other	Water
Constituent					
Ametryn	0.000000	0.000000	0.000000	0.000000	0.000000
Atrazine	0.000000	0.000000	0.000000	0.000000	0.000000
N_DIN	0.205174	0.244136	0.108316	0.000000	0.208906
N_DON	0.205174	0.244136	0.108316	0.000000	0.208906
N_Particulate	0.340859	0.601675	1.805136	0.588299	1.236402
P_DOP	0.000000	0.244136	0.108316	0.000070	0.208906
P_FRP	0.000000	0.244136	0.108316	0.000070	0.208906
P_Particulate	0.000000	1.099348	1.487115	0.939349	1.244597
Sediment - Coarse	0.241692	0.743406	2.368583	0.751765	0.902516
Sediment - Fine	2.124470	5.944264	14.853689	5.823528	7.582794
Tebuthiuron	0.000000	0.000000	0.000000	0.000000	0.000000

In [ ]:

In [12]:
```
# Translating it to a reusable function
def exportPerLandusePerHa(results):
```

```
    FUAreas_ha = results.get('fuAreasTable').groupby('FU').sum() / 10000.0

    fuData_kg = results.get('FUSummaryTable')
    SupplyByFU_t = fuData_kg.reset_index().pivot('Constituent','FU','Total_Load_in_Kg') / 1000

    return SupplyByFU_t / FUAreas_ha.Area
```

In [13]:
```
# Call the new function
exportPerLandusePerHa(results)
```

Out[13]:

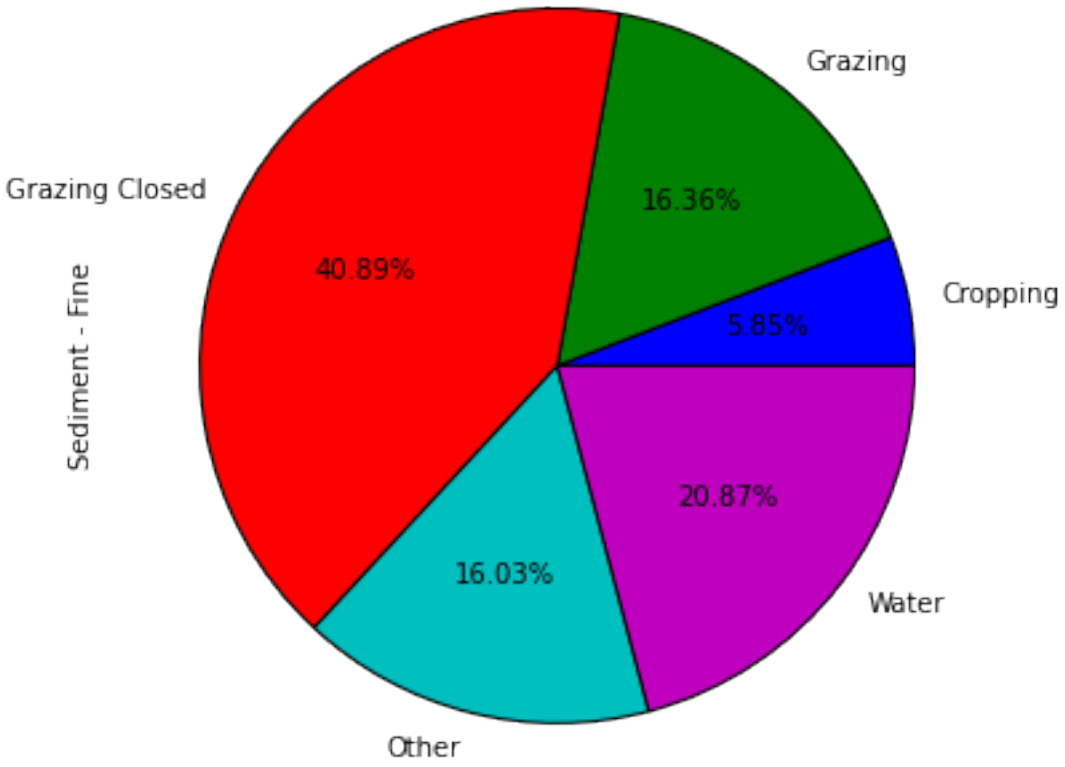
FU	Cropping	Grazing	Grazing Closed	Other	Water
Constituent					
Ametryn	0.000000	0.000000	0.000000	0.000000	0.000000
Atrazine	0.000000	0.000000	0.000000	0.000000	0.000000
N_DIN	0.205174	0.244136	0.108316	0.000000	0.208906
N_DON	0.205174	0.244136	0.108316	0.000000	0.208906
N_Particulate	0.340859	0.601675	1.805136	0.588299	1.236402
P_DOP	0.000000	0.244136	0.108316	0.000070	0.208906
P_FRP	0.000000	0.244136	0.108316	0.000070	0.208906
P_Particulate	0.000000	1.099348	1.487115	0.939349	1.244597
Sediment - Coarse	0.241692	0.743406	2.368583	0.751765	0.902516
Sediment - Fine	2.124470	5.944264	14.853689	5.823528	7.582794
Tebuthiuron	0.000000	0.000000	0.000000	0.000000	0.000000

In [15]:
```
# Or, once folded back into the shared module...
lu_t_y = results.queries.exportPerLandusePerHa('t/y') # To get it in tons/ha/yr
lu_t_y
```

Out[15]:

FU	Cropping	Grazing	Grazing Closed	Other	Water
Constituent					
Ametryn	0.000000	0.000000	0.000000	0.000000	0.000000
Atrazine	0.000000	0.000000	0.000000	0.000000	0.000000
N_DIN	0.033726	0.040131	0.017805	0.000000	0.034340
N_DON	0.033726	0.040131	0.017805	0.000000	0.034340
N_Particulate	0.056030	0.098903	0.296726	0.096704	0.203238
P_DOP	0.000000	0.040131	0.017805	0.000012	0.034340
P_FRP	0.000000	0.040131	0.017805	0.000012	0.034340
P_Particulate	0.000000	0.180710	0.244450	0.154409	0.204586
Sediment - Coarse	0.039729	0.122200	0.389345	0.123574	0.148355
Sediment - Fine	0.349218	0.977112	2.441634	0.957265	1.246452
Tebuthiuron	0.000000	0.000000	0.000000	0.000000	0.000000

In [26]:
```
# We can also make some plots of the data here...
# Heaps of options...
lu_t_y.transpose().plot(kind='pie',y='Sediment - Fine',legend=False,figsize=(6,6),autopct='%.2
```


Grazing
16.36%
Grazing Closed
40.89%
Sediment - Fine
Cropping
5.85%
20.87%
16.03%
Water
Other

In [ ]: