Linking Forest Resources Inventory Data to the Ontario Forest Vegetation Simulator

Forestry Futures Trust Ontario
Forest Resources Inventory Knowledge Transfer and Tool Development webinar

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Project Context

- The **FVS-ON** growth and yield model began development about 2006 and has been substantially localized to the Boreal and Great Lakes – St. Lawrence forest zones
- FVS-ON is intended to model the impacts of intensive forest management strategies to support diverse economic, ecological and social objectives
- Carbon sequestration is a recent addition

Project Context

- FVS simulations use stand inventories
  - Stand information such as slope, elevation, sampling methods, down wood, etc.
  - Tree information such as species, diameter, height, increment, crown, etc.
- In the past, inventories have been harder to obtain and organize but are now organized into well-structured and well-maintained databases
- FVS is standardizing around SQLite databases for input
- Long-term goals include integration with LiDAR, VSN sources

Project Context

- FVS simulations create numerous kinds of output from the tree to stand resolution: applications for timber, carbon and habitat
- Output is now standardizing around the open-source SQLite database
- The FVSonline portal is becoming a common platform for many users
- R-language scripting is commonly used for customized analyses and visualization

Project Goals

- This project aims to create working prototype tools for creating FVS stand lists from existing data from corporate inventories (federal and provincial), producing working SQLite databases that can be used directly by FVS-Ontario

Project Steps

1) Obtain snapshots of MS SQL Server databases for federal (NFI) and provincial (PSPPGP) inventories
2) Evaluate alternative data sources – hand-held
3) Evaluate tool and language options – SQL queries, VBA / Excel, R-language
4) Design and develop prototype scripted solution
5) Deliver training session

Project Steps

1) Obtain snapshots of MS SQL Server databases for federal (**NFI**) and provincial (PSPPGP) inventories
   - Running on secure server behind VPN
   - Documentation in hand with good support from staff
   - Work has focused on the simpler import from NFI

2) Evaluate alternative data sources – hand-held
   - Did some evaluation of data acquisition database but concluded effort better spent working with target federal and provincial data repositories

Project Steps

3) Evaluate tool and language options – SQL queries, VBA / Excel, R-language
   - SQL queries are fast, but in our experience can fail if the table data is not completely consistent; debugging can be difficult as query complexity grows
   - VBA / Excel is a very customizable environment but not a natural fit for the SQL Server source and SQLite target and requires a paid MS license. Versioning can also cause issues
   - R-language is very customizable for handling unusual input data that require complex logic, provides a good debugging environment, is open source and integrates well with other scripting solutions (shell, Python)

Project Steps

4) Design and develop prototype scripted solution
   - Different table structures require a variety of queries and R logic; one of the small tree queries shown here

```
#Small Trees can be done with two different queries, one of which is shown here

smquery <- "SELECT  [tblPlot].[PlotNFI] AS 'Stand_ID'
        ,[SmallTreeNum] AS 'Tree_ID'
        ,[tlkpGYSpec].[GYSpecAbbrev] AS 'Species'
        ,[DBH] AS 'DBH'
        ,[Length] AS 'HT'
        , CASE
        WHEN [DBHClass]= 0 THEN .5
        WHEN  [DBHClass]=1 THEN 2
        WHEN  [DBHClass]=2 THEN 4
        WHEN [DBHClass]= 3 THEN 6
        WHEN  [DBHClass]=4 THEN 9
        WHEN [DBHClass]= 5 THEN 11
        WHEN [DBHClass]= 6 THEN 13.5
        WHEN [DBHClass]= 7 THEN 16
        ELSE NULL
        END AS 'DBH2'
        , CASE
        WHEN  [HeightClass]>=1 THEN [HeightClass]+.5
        ELSE NULL
        END AS 'HT2'
        , IIF(LEFT([SmallTreeStatusCode],1) ='L',0, IIF(LEFT([SmallTreeStatusCode],1) ='V',0,8)) AS 'History'
        FROM [gyNFI].[dbo].[tblSmallTree], [tlkpGYSpec], [tblPlot], [tblSmallTreeHeader]
        WHERE [tblSmallTree].[GYSpecCode] = [tlkpGYSpec].[GYSpecCode]
        AND [tblSmallTree].[SmallTreeHeaderKey] = [tblSmallTreeHeader].[SmallTreeHeaderKey]
        AND [tblSmallTreeHeader].[PlotKey] = [tblPlot].[PlotKey]"
```

Project Steps

4) Design and develop prototype scripted solution
   - Example of the resulting FVS input database shown here

Database Structure | Browse Data | Edit Pragmas | Execute SQL

Table: FVS_StandInit

Filter in any column

	Stand_ID	Elevation	Inv_Year	Slope	Aspect	Site_Species	Basal_Area_Factor	Brk_DBH	Latitude	Variant	Region	Forest
	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter
1	1108656	NULL	2005	0	NULL	Sb	-40.501274832171	1.0	49.0	ON	9	15
2	1115341	NULL	2014	1	270	NUL						
3	1115541	NULL	2005	0	NULL	Sb						
4	1122221	217	2010	0	NULL	NUL						
5	1129066	275	2009	3	15	NUL						
6	1129141	210	2017	1	270	La						
7	1129306	308	2005	3	116	NUL						
8	1135991	211	2008	0	360	NUL						
9	1136156	NULL	2006	0	NULL	Sb						
10	1136161	240	2005	0	NULL	NUL						
11	1136166	NULL	2005	0	NULL	Sb						
12	1136191	283	2005	0	NULL	NUL						
13	1142896	NULL	2008	11	95	NUL						
14	1143061	NULL	2004	5	220	NUL						
15	1149706	NULL	2015	0	NULL	Sb						
16	1149746	NULL	2014	15	270	NUL						
17	1149956	NULL	2005	2	55	NUL						
18	1156631	NULL	2014	38	180	NUL						

Table: FVS_TreeInit

Filter in any column

	Stand_ID	Plot_ID	Tree_ID	Species	DBH	CrRatio	HT	History	Tree_Count
	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter
1	1143061	1.0	60004	Sb	12.3	NULL	11.0	0	1.0
2	1143061	1.0	60005	Sb	12.7	NULL	NULL	0	1.0
3	1143061	2.0	60006	Sb	2.9	NULL	2.46	0	1.0
4	1143061	2.0	60007	Sb	10.2	NULL	9.78	0	1.0
5	1143061	2.0	60008	Sb	7.2	NULL	7.4	0	1.0
6	1143061	2.0	60009	Sb	5.0	NULL	5.03	0	1.0
7	1143061	2.0	60010	Sb	6.8	NULL	7.01	0	1.0
8	1143061	2.0	60011	Pb	21.5	NULL	10.1	0	1.0
9	1143061	2.0	60012	Sb	6.2	NULL	6.4	0	1.0
10	1143061	1.0	60013	Sb	3.1	NULL	2.69	0	1.0
11	1143061	1.0	60014	Sb	3.7	NULL	3.42	0	1.0
12	1143061	2.0	60015	Sb	11.4	NULL	10.52	0	1.0
13	1143061	2.0	60016	Sb	9.4	NULL	9.23	0	1.0
14	1143061	1.0	60017	Sb	7.8	NULL	7.95	0	1.0

Project Steps

5) Deliver training session
   - to follow, after NFI import and testing is complete

Thoughts – Comments – Questions?

Leap boldly

Forage deeply

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