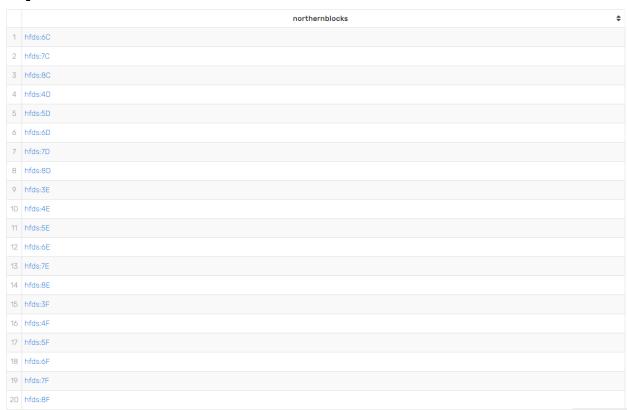
Competency Questions Expressed in SPARQL

1. Which blocks are in the northern section?

Query:

Output:

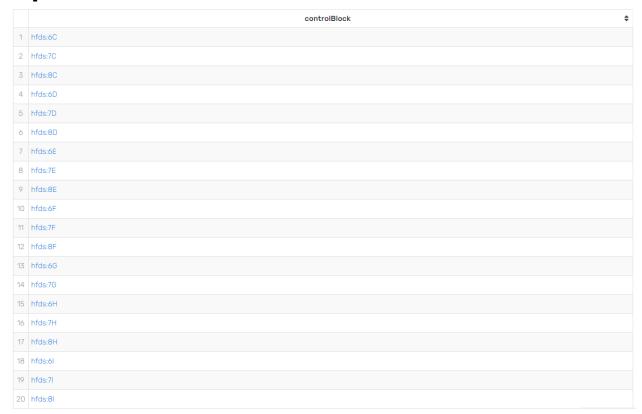


2. Which blocks are in the control block?

```
PREFIX hf: <http://spatialai.org/holtforest/core/v1/>
PREFIX hfds: <http://spatialai.org/holtforest/dataset/>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
```

```
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

SELECT ?b WHERE {
     ?b rdf:type hf:ControlBlock
}
```



3. Which species have been inventoried in Holt Research Forest?

Query:

```
PREFIX hf: <a href="http://spatialai.org/holtforest/core/v1/">http://spatialai.org/holtforest/dataset/</a>
PREFIX hfds: <a href="http://www.w3.org/1999/02/22-rdf-syntax-ns#">http://www.w3.org/1999/02/22-rdf-syntax-ns#</a>
PREFIX rdfs: <a href="http://www.w3.org/2000/01/rdf-schema#">http://www.w3.org/2000/01/rdf-schema#</a>
PREFIX xsd: <a href="http://www.w3.org/2001/XMLSchema#">http://www.w3.org/2001/XMLSchema#</a>
SELECT ?sp WHERE {
    FILTER (?c > 0)
    ?tc hf:ofTreeType ?sp.
    ?tc hf:hasNumericValue ?c.
} GROUP BY ?sp
```



4. How many northern red oaks were in Quadrat 8H_2 in 1988?

```
c $\dagger$

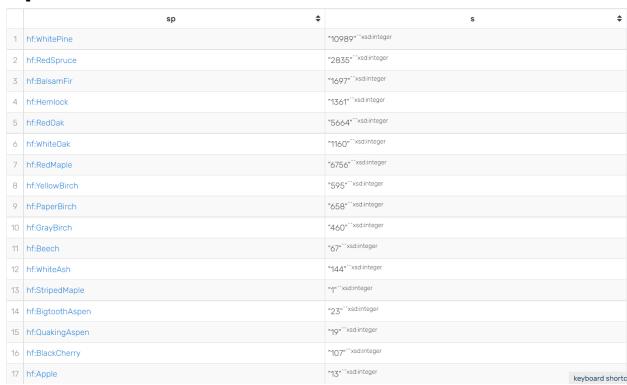
1 "92" *xschnonNegativeInteger
```

5. How many of each species were inventoried in 1984?

```
Query:
PREFIX hf: <http://spatialai.org/holtforest/core/v1/>
PREFIX hfds: <http://spatialai.org/holtforest/dataset/>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

SELECT ?sp (sum(?c) AS ?s)
WHERE {
    ?ti rdf:type hf:TreeInventory.
    ?ti hf:yearOfInventory "1984"^^xsd:gYear.
    ?ti hf:hasTreeCount ?tc.
    ?tc hf:ofTreeType ?sp.
    ?tc hf:hasNumericValue ?c.
} GROUP BY ?sp
```

Output:



6. How many red maples were in each block in 1996?

```
PREFIX hf: <a href="http://spatialai.org/holtforest/core/v1/">http://spatialai.org/holtforest/core/v1/</a>
PREFIX hfds: <a href="http://spatialai.org/holtforest/dataset/">http://spatialai.org/holtforest/dataset/</a>
PREFIX rdf: <a href="http://www.w3.org/1999/02/22-rdf-syntax-ns#">http://www.w3.org/1999/02/22-rdf-syntax-ns#</a>
PREFIX rdfs: <a href="http://www.w3.org/2000/01/rdf-schema">http://www.w3.org/2000/01/rdf-schema</a>
```

```
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

SELECT ?block (sum(?c) AS ?Tot_RedMaple)

WHERE {
    ?ti rdf:type hf:TreeInventory.
    ?ti hf:yearOfInventory "1996"^^xsd:gYear.
    ?ti hf:hasFeature ?q.
    ?q hf:containedIn ?block.
    ?ti hf:hasTreeCount ?tc.
    ?tc hf:ofTreeType hf:RedMaple.
    ?tc hf:hasNumericValue ?c.
} GROUP BY ?block
```

	block	Tot_RedMaple \$
1	hfds:3E	"87" "xsd:integer
2	hfds:3F	"132" ~xsd:integer
3	hfds:3G	"196" "xsd-integer
4	hfds:3H	"201" "xsd:integer
5	hfds:3I	"124" xsd-integer
6	hfds:3D	"137" xsd:integer
7	hfds:4D	"86" xsd.integer
8	hfds:4E	"117" ^xsd:integer
9	hfds:4F	"88" xsd.integer
10	hfds:4G	"165"^xsd-integer
11	hfds:4H	"104" "xsd:integer
12	hfds:4l	"121" ~xsd:integer
13	hfds:4J	"144" "xsd:integer
14	hfds:5D	"371" xsd:integer
15	hfds:5E	"137" "xsd:integer
16	hfds:5F	"117" *xsd.integer
17	hfds:5G	"271" "xsd.integer keyboard shortcu
		keyboard shorted

7. How many paper birch trees were in block 5E in each inventory?

```
PREFIX hf: <http://spatialai.org/holtforest/core/v1/>
PREFIX hfds: <http://spatialai.org/holtforest/dataset/>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

SELECT ?y (sum(?c) AS ?s)
WHERE {
    ?ti rdf:type hf:TreeInventory.
    ?ti hf:yearOfInventory ?y.
```

```
?ti hf:hasFeature ?q.
    ?q hf:containedIn hfds:5E.
    ?ti hf:hasTreeCount ?tc.
    ?tc hf:ofTreeType hf:PaperBirch.
    ?tc hf:hasNumericValue ?c.
} GROUP BY ?y
```



8. Which tree species have been inventoried in block 8H?

```
PREFIX hf: <a href="http://spatialai.org/holtforest/core/v1/">http://spatialai.org/holtforest/core/v1/>
PREFIX hfds: <a href="http://spatialai.org/holtforest/dataset/">http://spatialai.org/holtforest/dataset/</a>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <a href="http://www.w3.org/2000/01/rdf-schema">http://www.w3.org/2000/01/rdf-schema">
PREFIX xsd: <a href="http://www.w3.org/2001/XMLSchema#">http://www.w3.org/2001/XMLSchema#>
SELECT ?sp
WHERE {
     ?ti rdf:type hf:TreeInventory.
     ?ti hf:yearOfInventory ?y.
     ?ti hf:hasFeature ?q.
     ?q hf:containedIn hfds:8H.
     ?ti hf:hasTreeCount ?tc.
     ?tc hf:ofTreeType ?sp.
     ?tc hf:hasNumericValue ?c.
     FILTER (?c > 0)
} GROUP BY ?sp
```



9. What was the change in the number of Eastern White Pine trees in quadrat 4E4 from 1984 to 1996?

Query:

```
PREFIX hf: <http://spatialai.org/holtforest/core/v1/>
PREFIX hfds: <a href="http://spatialai.org/holtforest/dataset/">http://spatialai.org/holtforest/dataset/</a>
PREFIX rdf: <a href="http://www.w3.org/1999/02/22-rdf-syntax-ns">http://www.w3.org/1999/02/22-rdf-syntax-ns</a>
PREFIX rdfs: <a href="http://www.w3.org/2000/01/rdf-schema">http://www.w3.org/2000/01/rdf-schema">
PREFIX xsd: <a href="http://www.w3.org/2001/XMLSchema#">http://www.w3.org/2001/XMLSchema#>
SELECT ?count84 ?count96 ?diff
WHERE {
     filter((?quad = hfds:4E_4) && (?spe = hf:WhitePine))
     bind(?count96-?count84 as ?diff)
     ?t1 rdf:type hf:TreeInventory;
       hf:yearOfInventory "1984"^^xsd:qYear;
       hf:hasFeature ?quad;
       hf:hasTreeCount ?tc1.
     ?tc1 hf:ofTreeType ?spe;
       hf:hasNumericValue ?count84.
     ?t2 rdf:type hf:TreeInventory;
       hf:yearOfInventory "1996"^^xsd:gYear;
       hf:hasFeature ?quad;
       hf:hasTreeCount ?tc2.
     ?tc2 hf:ofTreeType ?spe;
       hf:hasNumericValue ?count96.
}
```

Output:



10. What is the most abundant specie in the northern section?

```
?b rdf:type hf:NorthBlock.
?ti hf:hasTreeCount ?tc.
?tc hf:ofTreeType ?specie.
?tc hf:hasNumericValue ?c.
} GROUP BY ?specie
ORDER BY DESC (?quantity)
limit 1
```



11. What is the average Diameter at Breast Height (DBH) of each tree specie for the year 1988?

Query:

```
PREFIX hfds: <http://spatialai.org/holtforest/dataset/>
PREFIX hf: <http://spatialai.org/holtforest/core/v1/>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

SELECT ?CommonName (AVG(?da88) as ?aveDBH88)
WHERE {
    ?tree rdf:type ?sp.
    ?sp hf:hasCommonName ?CommonName.
    ?tree hf:diameterAtBreastHeight ?da88.
    ?tree hf:yearOfObservation "1988"^^xsd:gYear.
} GROUP BY ?CommonName
```

	cn \$	aveDBH88 \$
1	"white pine" - xsd:literal	"25.632866780787433289698923" - xsd:decimal
2	"red spruce" - xsd:literal	"19.312018489984591679506934" ** xsd:decimal
3	"balsam fir" - xsd:literal	"13.322645290581162324649299" - xsd:decimal
4	"hemlock" - xsd:literal	"22.488390092879256965944272" ** xsd:decimal
5	"red oak" - xsd:literal	"19.957013155456735223272188" - xsd:decimal
6	"white oak" ^ xsd:literal	"18.091165413533834586466165" ** xsd:decimal
7	"red maple" - xsd:literal	"17.674059471003778544438968" - xsd:decimal
8	"yellow birch" - xsd:literal	"17.533944954128440366972477" ** xsd:decimal
9	"paper birch" - xsd:literal	"19.324829931972789115646259" xsd:decimal
10	"gray birch" - xsd:literal	"14.795454545454545454545455" - xsd:decimal
11	"beech" - xsd:literal	"17.6" xsd:decimal
12	"white ash" - xsd:literal	"16.074766355140186915887850" ** xsd:decimal
13	"striped maple" - xsd:literal	"13" xsd:decimal
14	"bigtooth aspen" - xsd:literal	"21.77777777777777777778" xsd:decimal
15	"quaking aspen" - xsd:literal	"17" - xsd:decimal
16	"black cherry" - xsd:literal	"14.287234042553191489361702" - xsd:decimal
17	"apple" ^xsd:literal	"13.6363636363636363636364" ^{-^} xsd:decimal
18	"red pine" - xsd:literal	"29.25" xsd:decimal
19	"pitch pine" - xsd:literal	"21.552447552447552448" ^{-*-xsd:decimal}
20	"witch hazel" xsd:literal	"10.75" xsd:decimal

12. What is the total number of life (or dead) plants of each specie in the control section of the Holt Forest during the 1996 inventory?

```
PREFIX rdf: <a href="http://www.w3.org/1999/02/22-rdf-syntax-ns#">http://spatialai.org/holtforest/core/v1/>
PREFIX xsd: <a href="http://www.w3.org/2001/XMLSchema#">http://www.w3.org/2001/XMLSchema#</a>>
SELECT ?specie (count(?tree) as ?total)
```

```
WHERE {
    ?tree rdf:type hf:LiveTree.
    ?tree rdf:type ?sp.
    ?tree hf:yearOfObservation "1996"^^xsd:gYear.
    ?sp hf:hasCommonName ?specie.
    ?tree hf:hasFeature ?quad.
    ?quad hf:containedIn ?blk.
    ?blk a hf:ControlBlock
} GROUPBY ?specie
```

	specie \$	total \$
1	"white pine" - xsd:literal	"4289" - xsd:integer
2	"red spruce" ^xsd:literal	"1033" [^] xsd:integer
3	"balsam fir" ^{^xsd:literal}	"482" [^] xsd:integer
4	"hemlock" - xsd:literal	"774" - xsd:integer
5	"red oak" ^xsd:literal	"2241" xsd:integer
6	"white oak" - xsd:literal	"515" xsd:integer
7	"red maple" - xsd:literal	"2944" - xsd:integer
8	"yellow birch" - xsd:literal	"222" xsd:integer
9	"paper birch" "xsd:literal	"272" xsd:integer
10	"gray birch" - xsd:literal	"41" - xsd:integer
11	"beech" - xsd:literal	"63" xsd:integer
12	"white ash" xsd:literal	"11" - xsd:integer
13	"bigtooth aspen" - xsd:literal	"6" xsd:integer
14	"black cherry" - xsd:literal	"23" ^{-^} xsd:integer
15	"apple" ^xsd:literal	"2" xsd:integer
16	"hop hornbeam" - xsd:literal	"1" ^xsd:integer
17	"red pine" Txsd:literal	"4" ^xsd:integer
18	"pitch pine" - xsd:literal	"10" ^{-^} xsd:integer
19	"witch hazel" - xsd:literal	"1" xsd:integer

13. What is the common name of the tree with the scientific name "Pinus strobus"?

Query:

```
PREFIX hf: <http://spatialai.org/holtforest/core/v1/>
PREFIX hfds: <http://spatialai.org/holtforest/dataset/>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

SELECT ?cn WHERE {
    ?sp hf:hasScientificName "Pinus strobus"^^xsd:literal.
    ?sp hf:hasCommonName ?cn.
}
```

