

Competency Questions Expressed in SPARQL

1. Which blocks are in the northern section?

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 ?northernblocks WHERE {
    ?northernblocks rdf:type hf:NorthBlock
}
```

Output:

	northernblocks
1	hfds:6C
2	hfds:7C
3	hfds:8C
4	hfds:4D
5	hfds:5D
6	hfds:6D
7	hfds:7D
8	hfds:8D
9	hfds:3E
10	hfds:4E
11	hfds:5E
12	hfds:6E
13	hfds:7E
14	hfds:8E
15	hfds:3F
16	hfds:4F
17	hfds:5F
18	hfds:6F
19	hfds:7F
20	hfds:8F

2. Which blocks are in the control block?

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

Output:

	controlBlock
1	hfds:6C
2	hfds:7C
3	hfds:8C
4	hfds:6D
5	hfds:7D
6	hfds:8D
7	hfds:6E
8	hfds:7E
9	hfds:8E
10	hfds:6F
11	hfds:7F
12	hfds:8F
13	hfds:6G
14	hfds:7G
15	hfds:6H
16	hfds:7H
17	hfds:8H
18	hfds:6I
19	hfds:7I
20	hfds:8I

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

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 WHERE {
    FILTER (?c > 0)
    ?tc hf:ofTreeType ?sp.
    ?tc hf:hasNumericValue ?c.
} GROUP BY ?sp
```

Output:

	sp
1	hf:WhitePine
2	hf:BalsamFir
3	hf:RedOak
4	hf:GrayBirch
5	hf:WhiteAsh
6	hf:QuakingAspen
7	hf:BlackCherry
8	hf:Apple
9	hf:RedSpruce
10	hf:Hemlock
11	hf:WhiteOak
12	hf:RedMaple
13	hf:YellowBirch
14	hf:PaperBirch
15	hf:BigtoothAspen
16	hf:PitchPine
17	hf:StripedMaple
18	hf:Beech
19	hf:WitchHazel
20	hf:RedPine
21	hf:Alder

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

```
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 ?c
WHERE {
    ?ti rdf:type hf:TreeInventory.
    ?ti hf:yearOfInventory "1988"^^xsd:gYear.
    ?ti hf:hasFeature hfds:8H_2.
    ?ti hf:hasTreeCount ?tc.
    ?tc hf:ofTreeType hf:RedOak.
    ?tc hf:hasNumericValue ?c.
} GROUP BY ?c
```

	c
1	"92"^^xsd:nonNegativeInteger

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:

	sp	s
1	hf:WhitePine	"10989"^^xsd:integer
2	hf:RedSpruce	"2835"^^xsd:integer
3	hf:BalsamFir	"1697"^^xsd:integer
4	hf:Hemlock	"1361"^^xsd:integer
5	hf:RedOak	"5664"^^xsd:integer
6	hf:WhiteOak	"1160"^^xsd:integer
7	hf:RedMaple	"6756"^^xsd:integer
8	hf:YellowBirch	"595"^^xsd:integer
9	hf:PaperBirch	"658"^^xsd:integer
10	hf:GrayBirch	"460"^^xsd:integer
11	hf:Beech	"67"^^xsd:integer
12	hf:WhiteAsh	"144"^^xsd:integer
13	hf:StripedMaple	"1"^^xsd:integer
14	hf:BigtoothAspen	"23"^^xsd:integer
15	hf:QuakingAspen	"19"^^xsd:integer
16	hf:BlackCherry	"107"^^xsd:integer
17	hf:Apple	"13"^^xsd:integer

keyboard shortcuts

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

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 ?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
```

Output:

	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:3J	"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:4I	"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

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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

```

Output:

	y	s
1	"1984"^^xsd:gYear	"0"^^xsd:integer
2	"1988"^^xsd:gYear	"3"^^xsd:integer
3	"1996"^^xsd:gYear	"5"^^xsd:integer

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

```

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
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

```

Output:

	sp
1	hf:GrayBirch
2	hf:BigtoothAspen
3	hf:YellowBirch
4	hf:Beech
5	hf:PaperBirch
6	hf:BalsamFir
7	hf:WhiteOak
8	hf:Hemlock
9	hf:RedSpruce
10	hf:RedMaple
11	hf:WhitePine
12	hf:RedOak

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: <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 ?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:gYear;
        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:

	count84	count96	diff
1	"58"^^xsd:nonNegativeInteger	"101"^^xsd:nonNegativeInteger	"43"^^xsd:integer

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

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 ?specie (SUM(?c) as ?quantity)
WHERE {
    ?ti rdf:type hf:TreeInventory.
    ?ti hf:yearOfInventory "1996"^^xsd:gYear.
    ?ti hf:hasFeature ?q.
    ?q hf:containedIn ?b.
```

```

    ?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

```

Output:

	specie	quantity
1	hf:WhitePine	"6504"^^xsd:integer

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

Query:

```

PREFIX hfd: <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

```

Output:

	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	"21.777777777777777777777778"^^xsd:decimal
15	"quaking aspen"^^xsd:literal	"17"^^xsd:decimal
16	"black cherry"^^xsd:literal	"14.287234042553191489361702"^^xsd:decimal
17	"apple"^^xsd:literal	"13.636363636363636363636364"^^xsd:decimal
18	"red pine"^^xsd:literal	"29.25"^^xsd:decimal
19	"pitch pine"^^xsd:literal	"21.552447552447552447552448"^^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?

Query:

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

```

Output:

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

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.
}
```

Output:

	cn
1	"white pine"^^xsd:literal