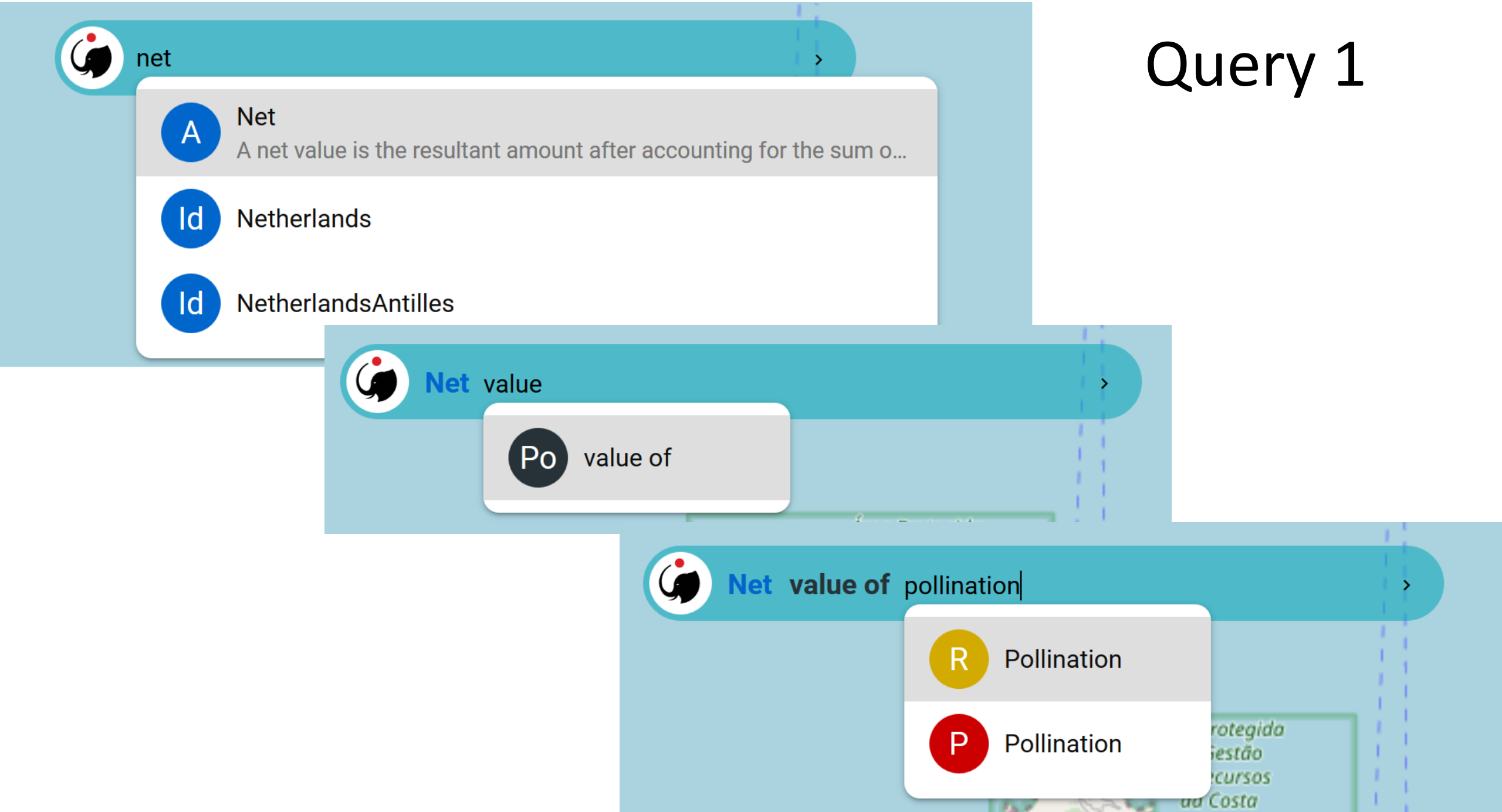
From a semantic query in k.Explorer to a system of observables in k.Modeler

Example: Pollination model

bc3
BASQUE CENTRE
FOR CLIMATE CHANGE
Klima Aldaketa Ikergai

Query 1


net
A
Net
A net value is the resultant amount after accounting for the sum o...
Id
Netherlands
Id
NetherlandsAntilles
Net value
Po
value of
Net value of pollination
R
Pollination
P
Pollination

What can we observe?

- S — Subject
- Q — Qualilty
- P — Process
- E — Event
- R — Relationship
- A — Attribute
- Id — Identity
- R — Realm

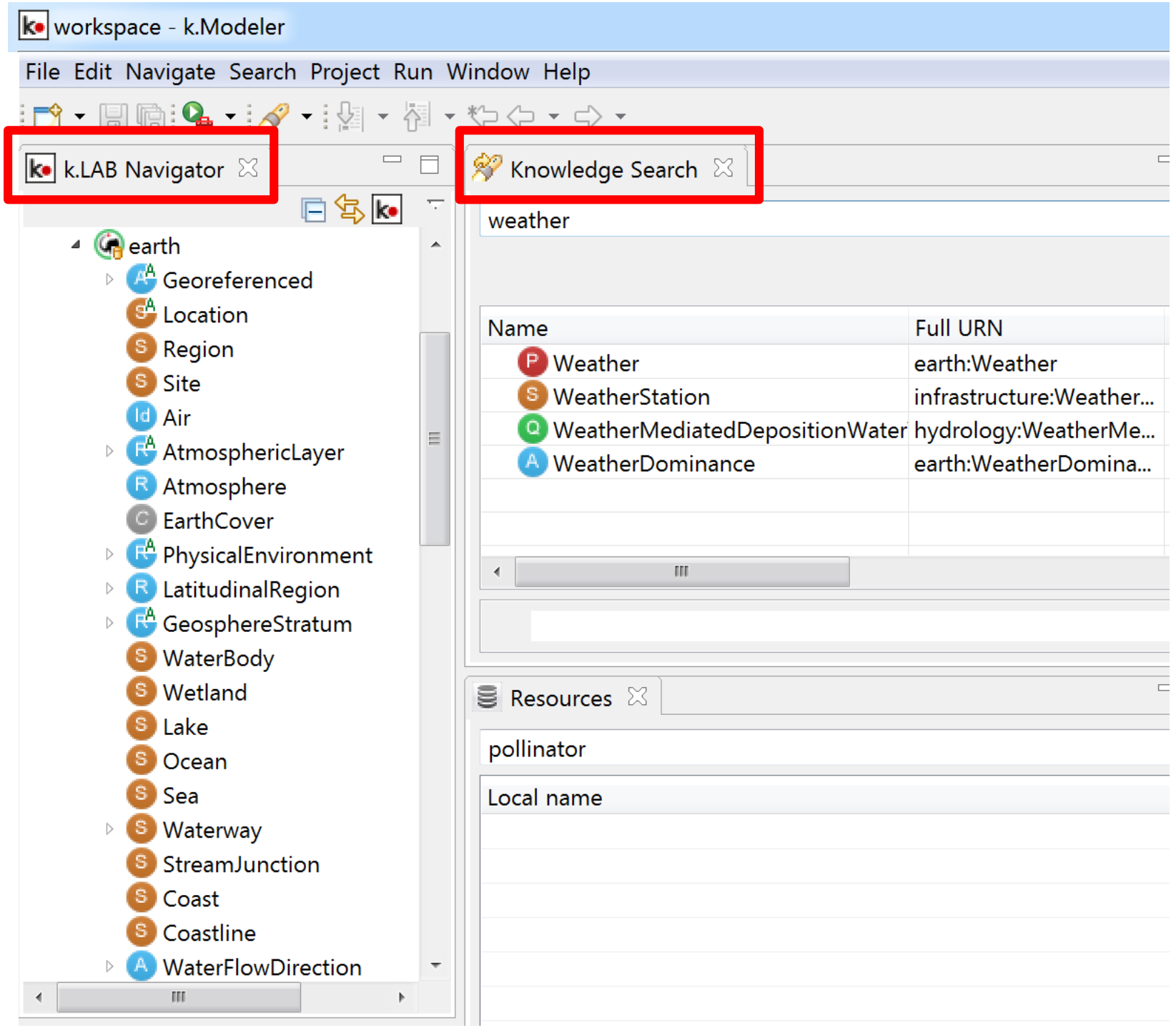
Not possible to observe but existing in k.IM:

- R — Role
- C — Configuration

More details:

Villa, F., S. Balbi, I. N. Athanasiadis, and C. Caracciolo. 2017. Semantics for interoperability of distributed data and models: Foundations for better-connected information. *F1000Research* 6(2):686.

The whole system of observables available in k.Modeler



Connecting observables through semantic operators in k.IM

Po presence of

Po count of

Po distance to

...

Operator prototype	Applies to	Produces
presence of <O>	Subjects, relationships, events and processes	A quality concept describing the presence or absence of O, whose states are true/false values.
count of <O>	Countables (subjects and events)	A quantity concept describing the numerosity of O in a context.
distance to <O>	Subjects and events in a spatial context	A length concept describing the distance to any observation of O in a spatial context.
probability of <O>	Events	A quality concept describing the probability of O happening.
uncertainty of <O>	Qualities	A quantity concept describing the uncertainty associated with an observation of O.
proportion of <O> [**in** <O>]	Identities in quantities of more general identity	A quantity describing the proportion of a particular identity in a medium, e.g. salt vs. water volume.
ratio of <O1> **to** <O2>	Quantities	A quantity describing the ratio between two other quantities.
value of <O> [**over** <O2>]	Any concept, including non-observables, over matching concepts	A quantity describing the value attributed by the observer to a particular concept, possibly in comparison with another.
occurrence of <O>	Subjects, relationships, events and processes	A shorthand for “probability of presence of O”.

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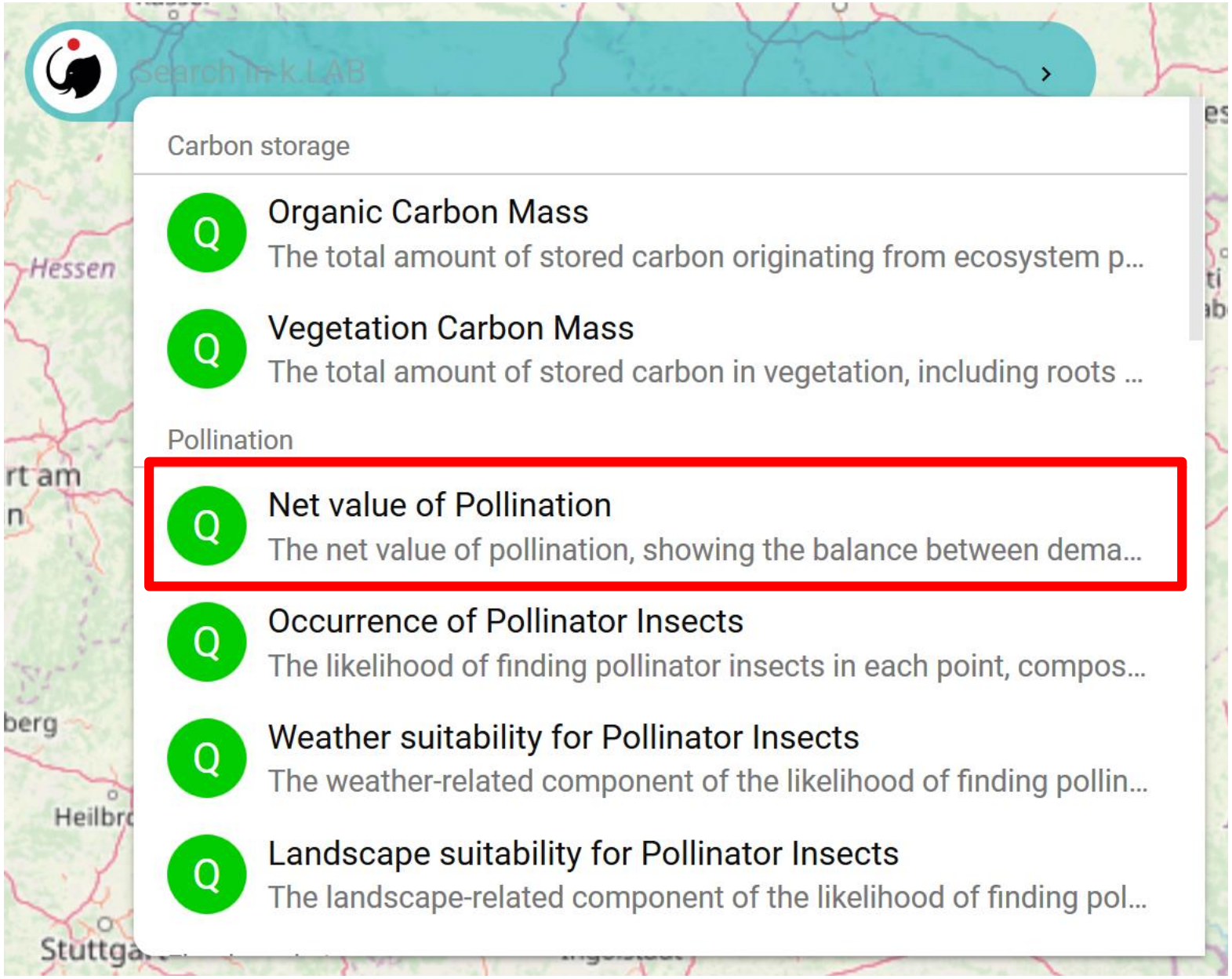
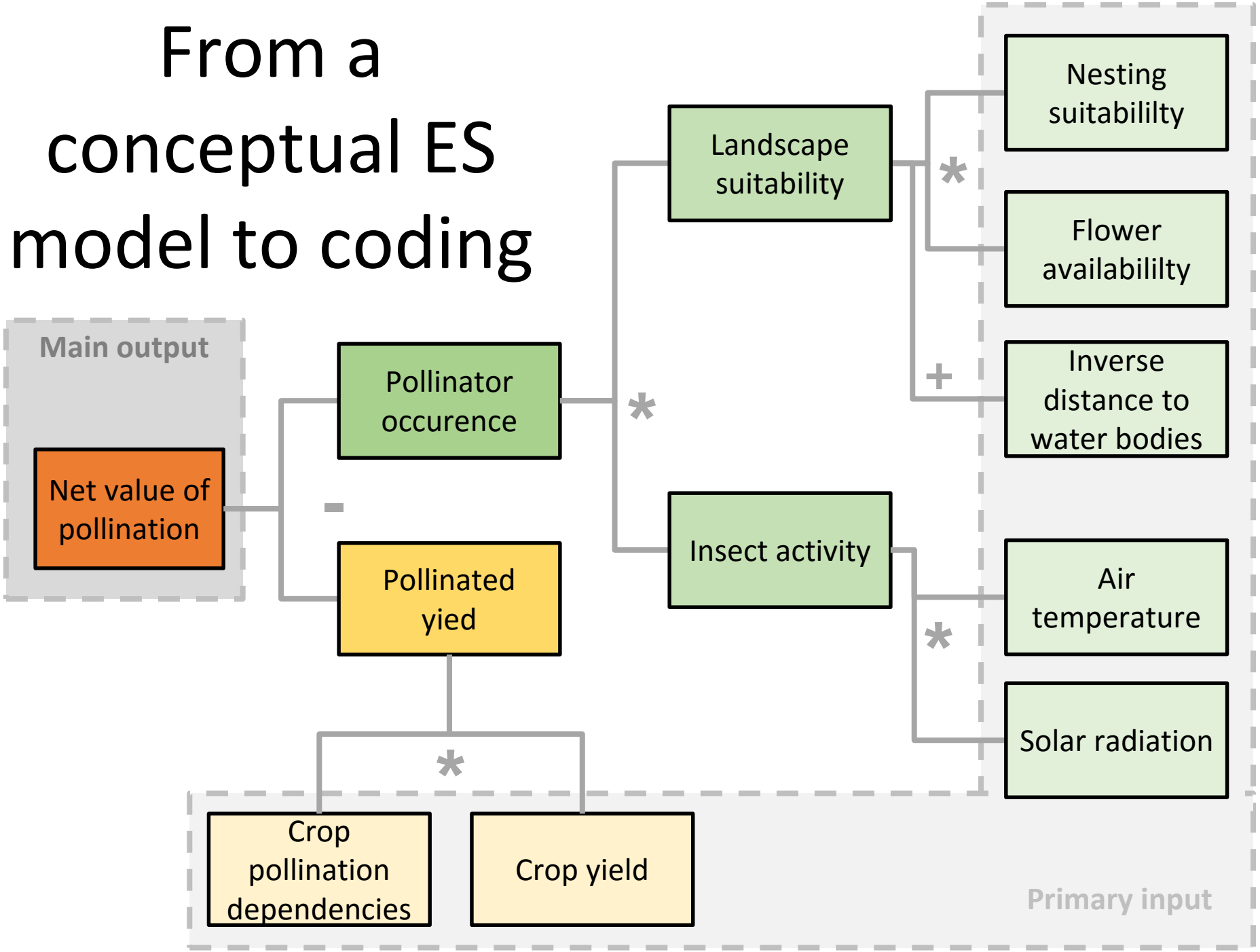


Query 2

(... for selected combinations of observables)

From a conceptual ES model to coding



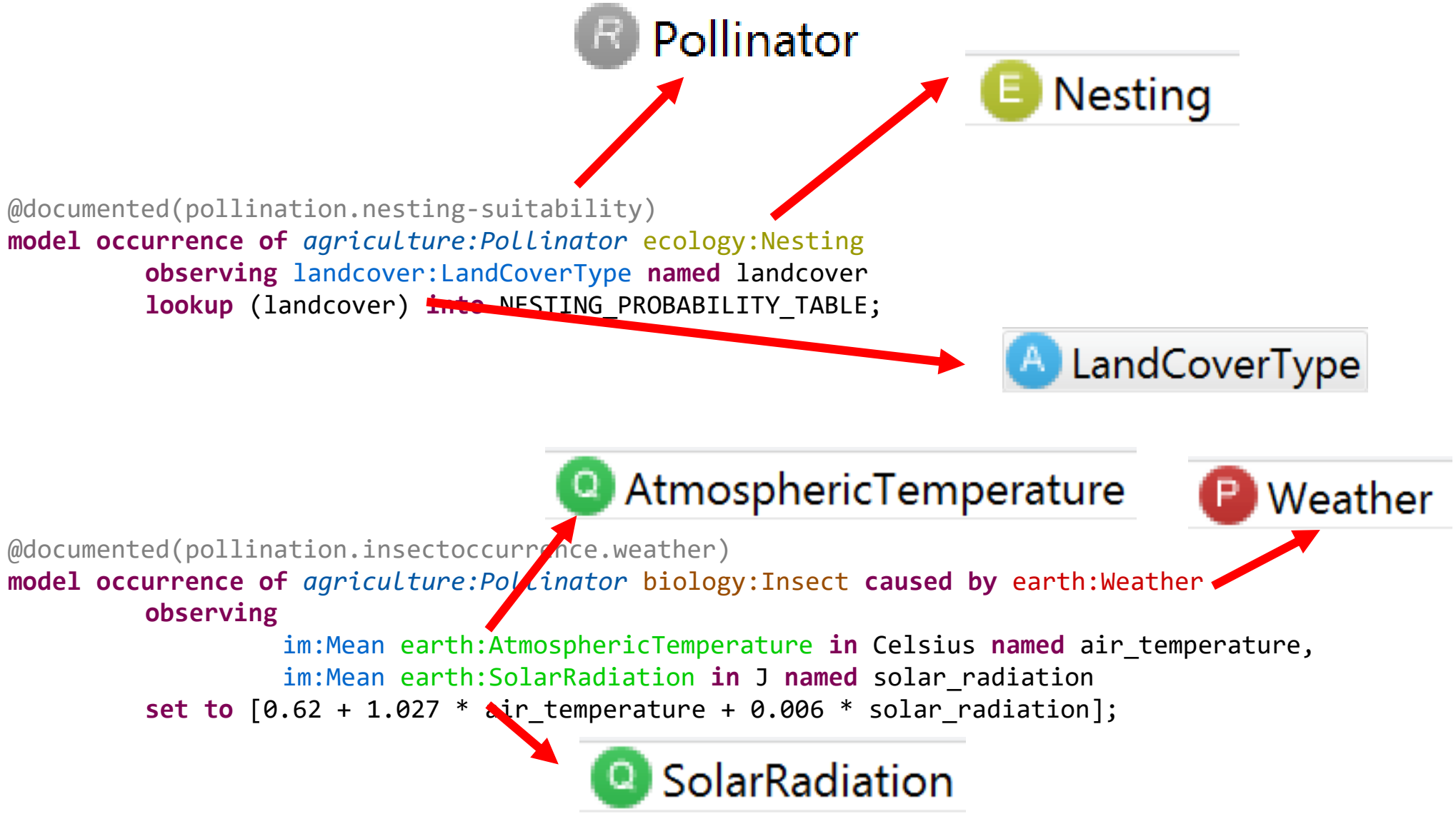

```
@documented(pollination)
namespace aries.global.pollination
        using (FLOWERING_PROBABILITY_TABLE, NESTING_PROB
                from aries.global.pollination.tables;

@documented(pollination.nesting-suitability)
model occurrence of agriculture:Pollinator ecology:Nest
        observing landcover:LandCoverType named landcove
        lookup (landcover) into NESTING_PROBABILITY_TABL

@documented(pollination.flower-availability)
model probability of ecology:Flowering
        observing landcover:LandCoverType named landcove
        lookup (landcover) into FLOWERING_PROBABILITY_TA

@documented(pollination.insectoccurrence.landscape)
model occurrence of agriculture:Pollinator biology:Inse
        observing
                distance to earth:Waterway in m  named d
                distance to earth:WaterBody in m named d
                probability of ecology:Flowering named f
                occurrence of agriculture:Pollinator eco
        set to [
                def lake_effect   = nodata(distance_to_l
                def stream_effect = nodata(distance_to_s
                return stream_effect + lake_effect + (ne
        ];
```

Examples: modelled phenomena, coding and observables

Nesting suitabililty

Air temperature

Solar radiation



Examples: modelled phenomena, coding and observables

Inverse distance to water bodies

```
@documented(pollination.insectoccurrence.landscape)
model occurrence of agriculture:Pollinator biology:Insect caused by ecology:Landscape named
landscape_suitability
        observing
            presence of earth:WaterBody named water_body_presence,
                probability of ecology:Flowering named flowering_suitability,
                occurrence of agriculture:Pollinator ecology:Nesting named nesting_suitability
        set to [(water_body_presence)? unknown : (
                    nesting_suitability * flowering_suitability)];
```