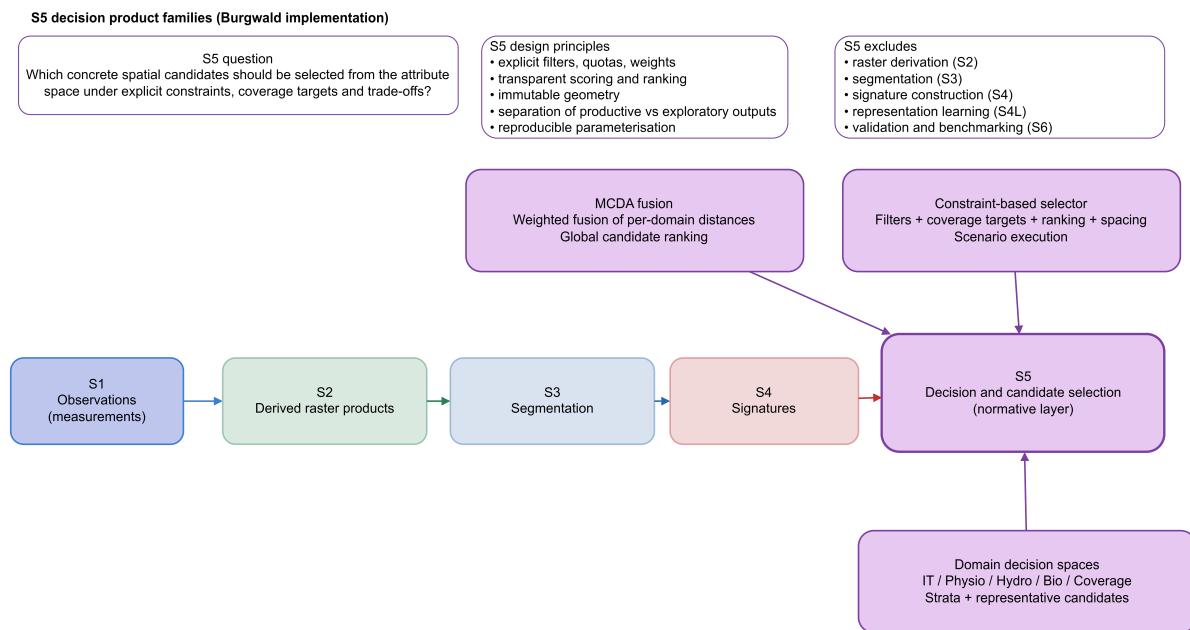


S5 — Validation and Selection Space

1 S5: Decision and candidate selection space

Burgwald decision stack: meta-level description



1.0.1 Role of S5 in the Pipeline

S5 is the terminal decision space of the Burgwald pipeline. It does not generate spatial structure, nor does it reinterpret or refine it. All spatial meaning—segmentation, stratification, domain restriction, and candidate generation—is fixed before S5 is entered. By the time S5 operates, space is already discretised into segments, each segment is assigned to one or more strata, and each stratum provides an internally consistent distance metric.

This strict separation is intentional. S5 is not a modelling layer and not a discovery layer. Its sole function is to **transform a set of already valid alternatives into a defensible choice**. Any operation that would alter the spatial hypothesis space—re-clustering, redefining domains, or reweighting geometry—would violate the contract of S5 and must occur upstream.

S5 therefore answers a narrowly defined question: *Given this set of candidates and these explicit decision rules, which candidates are selected, and why?*

1.0.2 Preconditions Entering S5

S5 presupposes that all candidate-generating logic has been completed in S4. This includes IT-, physio-, hydro-, biostructure-, and coverage-based stratifications. Each of these produces two artefacts: a **complete segment layer** annotated with stratum membership and distance-to-centre measures, and a **candidate subset** derived from those strata according to S4-specific rules.

All spatial constraints—AOI restriction, watershed hulls, station-based envelopes—must already be applied at this stage. S5 does not test spatial validity. It assumes it. Any candidate passed to S5 is treated as spatially admissible by construction.

As a consequence, S5 treats all incoming decision spaces symmetrically. IT strata are not privileged over physio strata, nor are hydro distances inherently more informative than biostructure distances. Differences in importance are not implicit; they are introduced only through explicit decision logic.

1.0.3 Decision Architecture Inside S5

The internal logic of S5 is intentionally layered. Each layer has a distinct responsibility, and none of them are interchangeable.

The first layer is **metric harmonisation**. Distances originating from different S4 spaces are not comparable by default. Harmonisation transforms these distances into a common numerical frame—typically through normalisation—so that they can be evaluated jointly. This step is purely technical. It does not assert that the underlying processes are comparable; it merely ensures that the decision problem is mathematically well-posed.

The second layer is **evaluation**, which may be implemented either as a formal multi-criteria decision analysis (MCDA) or as a reduced rule-based scoring scheme. MCDA is used when trade-offs between competing criteria are intentional and must be made explicit. Weights in MCDA are not optimisation parameters; they are **statements of preference**. Changing them must change the outcome. If it does not, the decision logic is ill-defined.

The third layer is **selection**, implemented through selector rules. Selectors do not evaluate candidates in an abstract sense; they **enforce constraints on the evaluated set**. Typical

selector logic includes per-stratum quotas, minimal spatial separation, or limits on redundancy. Selectors are not softer versions of MCDA. They operate at a different epistemic level: MCDA orders candidates, selectors restrict admissible solutions.

Crucially, S5 does not collapse these layers. Evaluation without selection produces rankings but no decisions. Selection without evaluation produces arbitrary filtering. Only their explicit combination produces a controlled and interpretable outcome.

1.0.4 Interpretation of Strata in S5

In S5, strata are treated strictly as **operational typifications**. A stratum is a label indicating membership in a cluster defined in a specific representation space. It is not an ecological class, not a hydrological unit, and not a process regime.

S5 does not interpret strata. It respects them. This means that selection logic may enforce representation across strata, but it never assigns meaning to what a stratum “is”. Any semantic interpretation belongs upstream or outside the pipeline altogether.

1.0.5 Normativity and Responsibility

S5 is the point in the pipeline where normativity becomes unavoidable. Every weight, every threshold, and every selector rule encodes a value judgement: centrality versus diversity, redundancy versus coverage, representativeness versus extremity. The pipeline does not attempt to hide these judgements behind optimisation rhetoric.

Responsibility in S5 therefore lies not in the correctness of the code alone, but in the justifiability of the decision logic with respect to the problem definition in S0. S5 makes these choices explicit, inspectable, and reversible. This is a design goal, not a limitation.

1.0.6 What S5 Explicitly Does Not Do

S5 does not optimise networks in a formal sense. It does not guarantee maximal information gain, hydrological closure, or spatial representativeness. If such properties emerge, they do so as consequences of explicit rules, not as automatic outcomes.

S5 also does not resolve uncertainty. It exposes it. By making evaluation and selection logic explicit, S5 allows alternative assumptions to be tested and compared without changing the upstream spatial model.

1.0.7 Outcome

A successful S5 implementation does not yield a single authoritative solution. It yields a **traceable decision path** from spatial abstractions to concrete selections. Its value lies in making disagreement, sensitivity, and alternative choices structurally visible rather than implicit.

S5 closes the pipeline not by producing certainty, but by making the limits and consequences of decision-making explicit.