

Enabling, Constraining, Preventing, and Leaving Open Existing Schemes of Human–Nature and Cosmic Governance under a Generative Relational Description

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Abstract

Governance of the relations between human activity and the wider natural and cosmic field is conducted through a large number of schemes whose vocabularies have developed separately. Precaution, adaptive governance, resilience management, environmental law, earth-system governance and the emerging arrangements for orbital sustainability each describe what they do in terms proper to themselves, and the separation obstructs the comparison of what any two of them accomplish. This paper offers a common description under which the schemes may be compared, and it offers that description for the sake of a result the comparison yields. The description takes relational change as its primitive and represents every governance scheme as a distribution of effort across four operations: enabling a change, constraining its extent, preventing its occurrence, and leaving a possibility unrealised without preventing its later realisation. The schemes are then placed against the four. The result is that the first three operations are densely occupied and the fourth is nearly empty: every tradition surveyed holds developed doctrine for permitting, limiting and forbidding, while deliberate non-occupation is everywhere recorded under a description belonging to another operation, as provisional prevention, as an instrument of learning, as prohibition within a boundary, or as an absence of demand. The paper argues that the emptiness is structural, deriving it from the accounting by which governance schemes are assessed, within which a scheme reports by exhibiting what it produced and an unrealised possibility leaves the field looking the same whether it was withheld or merely unaddressed, and it exhibits the four settings in which the missing operation is presently performed without a doctrine to support it: protected areas, dark-sky designation, unoccupied orbital regions, and deferred industrial transition. The paper closes by stating the five requirements a doctrine of the fourth operation would have to satisfy, each derived from a stated result and each assessable against an existing arrangement.

Keywords: environmental governance; orbital sustainability; precaution; resilience; protected areas; dark skies; generative relational governance.

Draft. This is a working draft. It is circulated for comment, and its arguments, formulations, and open questions are subject to revision. Correction and criticism are welcome at huangwanhong@serendip.ngo.

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Use of generative artificial intelligence. Generative AI assistants (Anthropic’s Claude, OpenAI’s ChatGPT, and Google’s Gemini) were used extensively in preparing this manuscript: for literature survey, for drafting prose from the author’s specifications, for adversarial review of the argument, and for consistency and citation auditing and typesetting. No simulation or empirical figure is used in this paper, and its arguments are discursive throughout; the two tables summarise material argued in the text. Formulations and objections arose in the course of that exchange as well as from the author. Every claim, argument, and citation was reviewed and decided by the author, who is responsible for the content and for any errors. Bibliographic details are to be verified against the primary sources before reliance.

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1 Introduction

This section states the difficulty that a common description addresses, states the objection to which any such description is exposed, states the result by which this paper answers that objection, and sets out the order of the argument. The method is comparative for the placement and the exhibited settings, in Sections 4 to 9, and analytical for the derivation, in Sections 10 and 11.

The relations between human activity and the wider natural and cosmic field are governed through many schemes, and the schemes describe themselves in terms proper to each.

A precautionary regime describes what it does in terms of harm, uncertainty and the burden of proof; a resilience programme in terms of disturbance, absorption and reorganisation; an adaptive management arrangement in terms of learning, feedback and revision; environmental law in terms of permission, prohibition, standard and liability; and the arrangements developing for orbital sustainability in terms of mitigation, disposal and due regard.

The separation obstructs a question that arises whenever two schemes govern the same field. Where a protected area, a discharge permit and a debris guideline all operate on one relational system, a party asking what the three accomplish together has no description under which their accomplishments are comparable. Each scheme reports its own performance in its own terms, and the terms do not translate.

Before the common description is offered, the objection any such description invites is stated, since the objection determines whether the description was worth building. Every scheme admits redescription in some further vocabulary, redescription is cheap, and a redescription that leaves every judgement where it stood has produced a synonym in place of a result.

The objection has force and this paper accepts it. A common description earns its construction where it makes visible something that the separated vocabularies conceal, and where the concealment is a consequence of the separation in place of an accident of attention.

The description offered against that standard takes relational change as its primitive and represents a governance scheme by the operations it performs on such change. Four operations are distinguished.

The first, enabling, makes a change possible that was previously unavailable, by conferring a permission, supplying a capacity, or removing an obstacle; the second, constraining, limits the extent, rate or manner of a change that proceeds; the third, preventing, bars a change from occurring; and the fourth, leaving open, withholds the realisation of a possibility while preserving its availability for later realisation.

The four are jointly exhaustive of what a scheme may do to a possible relational change, and the fourth is distinguished from the third in a respect that the argument turns on. Prevention closes a possibility. Leaving open declines to realise it and closes nothing.

Result 1.1 (Occupation of the operations). Every scheme surveyed in Sections 4 to 8 holds developed doctrine for enabling, constraining and preventing. No scheme surveyed holds

a positive doctrine of leaving open, under which an unrealised possibility is a product of governance in place of an absence of governance.

The result is the paper's justification for the description that produces it. The emptiness of the fourth cell is invisible within any single vocabulary, since a scheme reports what it does and reports no cell it does not occupy. It becomes visible when the schemes are placed against a common set, and the placing is what the description performs.

Result 1.1 invites the question of why the fourth cell stands empty, and Sections 10 and 11 argue that the emptiness is structural. The argument runs through the accounting by which governance schemes are assessed.

A scheme's performance is reported by exhibiting what it produced. An enabling operation produces a permitted activity, a constraining operation produces a measurable reduction, and a preventing operation produces a prohibited activity and a record of enforcement. A leaving-open operation produces an unoccupied possibility, and an unoccupied possibility is indistinguishable in the accounts from a possibility no one wished to occupy.

The consequence is that the fourth operation is performed and is recorded as something else. Section 9 exhibits four settings in which it is presently performed without a doctrine to support it, and in each the operation is described in the vocabulary of one of the other three: a protected area is recorded as prevention, an unoccupied orbital region as an absence of demand, a deferred transition as delay.

The order of the argument is as follows. Sections 2 and 3 fix the object: Section 2 states the scope and the positions declined. Section 3 states the four operations, argues their exhaustiveness, and states the distinction between the third and the fourth.

Sections 4 to 8 perform the placement. Section 4 treats the precautionary and risk-regulatory family. Section 5 treats adaptive governance and resilience management. Section 6 treats environmental law and the international instruments. Section 7 treats the arrangements for orbital sustainability. Section 8 assembles the placement and states Result 1.1.

Section 9 exhibits the settings, treating protected areas, dark-sky designation, unoccupied orbital regions and deferred industrial transition, and identifies in each the vocabulary under which the fourth operation is presently recorded.

Sections 10 and 11 derive the emptiness. Section 10 states the argument from accounting. Section 11 states what a doctrine of the fourth operation would have to supply.

Sections 12 and 13 close, the former arguing the positions declined and the latter stating the limits of what has been established.

2 Scope of the Account and the Restrictions It Accepts

This section fixes what the account describes, states the restrictions confining it, states its relation to the companion papers, and states the positions the paper declines. Its role in the paper is boundary-fixing: every later section argues within the scope stated in this section, and the division of labour with the companion papers stated at §2.3 determines what the present argument may claim. The section is arranged as follows: §2.1 fixes the object, §2.2

states the restrictions, §2.3 states the relation to the companion papers, and §2.4 announces the four positions declined, whose arguments Section 12 supplies.

2.1 The Object of the Account

The object is a governance scheme, understood as an arrangement operating on the relational changes available within a field. A scheme in this sense includes a treaty regime, a statutory permitting system, a management programme, a set of technical guidelines, and a designation of territory.

Two features of this specification carry weight, concerning respectively what the account describes and the primitive on which it rests.

The first is that the account describes what a scheme does to possible changes and describes neither its institutional form nor its effectiveness. Two schemes of wholly different institutional character may perform the same operations, and the description registers the sameness.

The second is that it takes relational change as the primitive on which the operations act. The commitment is inherited from the framework within which the paper is written, its defence lies elsewhere, and the present paper uses it as a descriptive convenience whose value is settled by the result of the introduction.

2.2 Restrictions Accepted by the Account

The account is restricted in four respects, and each narrows what Result 8.1 may be taken to establish.

The first restriction is that the account describes operations and assesses no scheme. A scheme densely occupying three operations may govern well, and the placement of Sections 4 to 8 is no criticism of any scheme placed.

The second restriction is that the account concerns doctrine, reaching practice only where the two are examined together. Result 1.1 asserts the absence of a positive doctrine, and Section 9 exhibits the practice that proceeds without one.

The third restriction confines the account to the field of human relations with the natural and cosmic environment. The four operations may describe governance schemes in other fields, and the paper asserts nothing about them.

The fourth restriction is that the account states an exhaustiveness claim for the four operations and states no claim that the four are the only useful partition. A finer partition would distinguish operations the present one merges, and §3.4 states what the present partition merges.

2.3 The Relation to the Companion Papers

Two companion papers occupy the cell this paper finds empty, and the division is stated in this subsection so that the present argument is read correctly.

The first establishes a criterion allocating the burden of justification where a course would irreversibly foreclose the generative capacity of a trajectory other than the acting party's own. That criterion supplies a condition under which the fourth operation is required, and the present paper establishes that the operation lacks a doctrine independently of any particular condition for performing it.

The second establishes who is positioned to determine the state of a system when a governing rule depends on that state. Its results bear on the fourth operation where the decision to leave a possibility unrealised turns on the condition of the field.

Neither companion is presupposed in this paper. A reader rejecting both may hold Result 1.1, which concerns the occupation of the operations by existing schemes.

2.4 The Positions Declined

Four positions are declined in the present subsection, and the argument for each declination is given in Section 12, after the results on which it depends have been established.

The first declination is of a charge of error against the schemes surveyed. The emptiness of the fourth cell is derived in Sections 10 and 11 from the accounting under which schemes report, and a scheme reporting under that accounting has done what its situation required.

The second is of a priority for the fourth operation. A field well governed by the first three requires no performance of the fourth, and the paper establishes that where the fourth is performed it proceeds without doctrine.

The third is of a doctrine of the fourth operation. Section 11 states what such a doctrine would have to supply, and the paper's constructive content ends at those requirements.

The fourth is of a measure of the distribution of a scheme's effort across the four operations. The placement of Sections 4 to 8 is qualitative throughout, and §13.1 records the cost.

3 The Operations and Their Exhaustiveness over Acts upon the Realizable Set

This section states the four operations formally, establishes that they exhaust the acts a scheme may perform upon the set of realizable changes, distinguishes the fourth operation from the stance of a scheme that performs no act at all, and states what the partition merges. The distinction of §3.4 is the section's principal result, since it supplies the mechanism by which the fourth operation escapes the record. Its role in the paper is to supply the vocabulary: the four operations defined in this section are the common description under which Sections 4 to 8 place the existing schemes, and the exhaustiveness result is what entitles the placement to completeness over acts. The section is arranged as follows: §3.1 states the primitive and the realizable set, §3.2 defines the operations, §3.3 establishes their exhaustiveness, §3.4 distinguishes the fourth operation from the null stance, §3.5 states the distinctions the partition merges, and §3.6 states the exclusions. The method is analytical, and the operations are displayed in Table 1.

3.1 The Primitive and the Realizable Set

Let a field admit a collection of possible relational changes. Write R_t for the set of changes realizable at time t , in the sense that some party could bring each about by a course available to it, and write A_t for the set of changes available for realisation at some later time, so that $R_t \subseteq A_t$.

The distinction between the two sets carries the argument. A change may stand outside the present realizable set while remaining available later, and a change may stand outside both. The first condition is what an unbuilt road, an unoccupied orbital region and an unlit sky exhibit. The second is what an extinguished population and a severed migration corridor exhibit.

A governance scheme acts upon the pair (R_t, A_t) , and the operations are the acts it may perform.

3.2 The Operations Defined over the Realizable Set

Four operations are defined below, each stated as an effect upon a change c and each distinguished from the others by what it does to the two sets.

Enabling places c within the realizable set where it stood outside: $c \notin R_t \Rightarrow c \in R_t$. A permit granted, a capacity supplied, an obstacle removed and a right conferred all perform it.

Constraining retains c within the realizable set in a restricted form, admitting c within bounds on its extent, rate or manner. An emission limit, a quota, a seasonal restriction and a technical standard all perform it.

Preventing removes c from both sets: $c \in R_t \Rightarrow c \notin R_t$ and $c \notin A_t$. A prohibition performs it where the prohibition is permanent, and an irreversible physical act performs it whether or not any scheme intended the removal.

Leaving open removes c from the realizable set while retaining it in the available set: $c \in R_t \Rightarrow c \notin R_t$ and $c \in A_t$. A designation withholding an area from development while the area remains developable, an orbital region withheld from occupation while it remains occupiable, and a technology withheld from deployment while it remains deployable all perform it.

3.3 The Exhaustiveness of the Four over Acts upon the Set

Claim 3.1 (Exhaustiveness). An act of a governance scheme upon a change c alters the membership of c in R_t , alters the terms on which c belongs to R_t , or alters the membership of c in A_t . The four operations exhaust these alterations.

The argument proceeds by cases. An act altering membership in R_t either admits c or removes it. Admission is enabling. Removal either retains c in A_t or removes it, and the two are leaving open and preventing. An act altering the terms on which c belongs to R_t , while retaining the membership, is constraining. An act altering membership in A_t alone, without altering membership in R_t , is a limiting case: where c is removed from A_t while remaining in R_t , the scheme has permitted a change and foreclosed its repetition, and the operation is

Table 1: The four operations stated as effects upon the set of changes realizable at present and the set available later, with the governance instrument that characteristically performs each.

Operation	Effect on the present realizable set	Effect on later availability	Characteristic instrument
Enabling	Admits the change	Retains the change	Permit, conferral of right, supply of capacity
Constraining	Admits the change within bounds	Retains the change	Emission limit, quota, seasonal restriction, technical standard
Preventing	Removes the change	Removes the change	Permanent prohibition; irreversible physical alteration
Leaving open	Removes the change	Retains the change	Designation withholding an area, a region or a technology while it remains available

prevention performed prospectively.

The claim asserts exhaustiveness over acts; the stance of a scheme performing no act is a separate matter. Subsection §3.4 treats that stance, and the treatment is where the paper's difficulty originates.

3.4 The Null Stance and Its Coincidence with the Fourth Operation

A scheme may perform no act upon a change. The change then stands where it stood, and the scheme is silent about it.

Silence and leaving open are distinguished by the presence of an act. A scheme leaving a change open has withheld it, the withholding is a decision of the scheme, and the change remains available by the same decision. A scheme silent about a change has decided nothing, and the change stands in whatever position the field and other schemes have placed it.

Claim 3.2 (Extensional coincidence). At any moment at which a change c stands outside the realizable set and inside the available set, the field presents the same configuration whether c was left open by an act or was never acted upon. The two are distinguished by the provenance of the configuration and are indistinguishable in the configuration itself.

Three consequences follow from the asymmetry of Claim 3.2, and together they organise the remainder of the paper.

The first is that the fourth operation admits no verification from the state of the field. A party asked to show that a scheme left a possibility open exhibits an unoccupied possibility, and an unoccupied possibility is what silence also exhibits.

The second is that the fourth operation admits no failure that is visible as failure. Where a scheme abandons a designation and the possibility is realised, the realisation is recorded as a development, and the scheme's abandonment of its withholding is recorded nowhere.

The third is that the fourth operation is available to a scheme that performs nothing, its performance available as a description to a scheme that has merely refrained. A difficulty of

the same form arises in the companion papers by other routes, since the product of a course satisfying their criterion is an absence and the record supporting a determination of system state is held by the party the determination favours. The companion paper constituting the problem class states the common form: what a governance act accomplishes cannot be verified from the field by the party that would need to verify it. Section 10 establishes what follows for the doctrine, and Result 1.1 records that no doctrine has developed.

3.5 Distinctions the Partition Merges

The four-operation partition merges distinctions a finer one would separate, and three are recorded.

Enabling merges the conferral of a permission with the supply of a capacity. A party permitted to act and unable to do so stands differently from a party both permitted and able, and a scheme performing one has performed less than a scheme performing both.

Preventing merges prohibition by rule with foreclosure by physical alteration. The first is reversible by the repeal of the rule and the second is reversible by nothing, and the companion papers turn on exactly that difference. The present partition treats them together because both remove a change from the available set, and §13.1 records the cost.

Leaving open merges withholding for a stated period with withholding of indefinite duration. A designation lapsing after ten years and a designation without a term differ in what they preserve, and a doctrine of the fourth operation would have to distinguish them.

3.6 Exclusions from the Taxonomy

Three matters lie outside the taxonomy, concerning respectively effectiveness, the composition of schemes, and the individuation of changes.

The first is that the taxonomy describes acts upon changes and describes no scheme's effectiveness. A scheme performing an operation on paper and failing to perform it in the field has performed the operation on the description and §2.2 restricts the account accordingly.

The second is that it attributes each act to a scheme, treating the composition of several schemes acting on one change only where Section 8 assembles the placement. Where two schemes perform opposite operations, the field carries the resultant, and the taxonomy supplies no account of how the resultant is determined.

The third is that the taxonomy treats a change as a unit, supplying no individuation of changes. A development admitting description as one change or as many is treated as the description supplies, and the partition inherits whatever individuation the scheme under description employs.

4 The Precautionary and Risk-Regulatory Family

This section places the precautionary and risk-regulatory schemes against the four operations. It states the family's self-description, identifies the operations it occupies together with the

doctrine supporting each, examines the instrument that most nearly performs the fourth operation, and records the placement. Its role in the paper is the first of the four placements from which Result 1.1 is assembled in Section 8. The section is arranged as follows: §4.1 states the family's self-description, §4.2 identifies the operations occupied and the doctrine supporting each, §4.3 examines the moratorium as the instrument nearest the fourth operation, and §4.4 records the placement.

4.1 The Self-Description of the Family

The precautionary and risk-regulatory family describes what it does in terms of harm, uncertainty and the allocation of proof. Principle 15 of the Rio Declaration [12] states the weak formulation, under which incomplete certainty affords no ground for postponing measures against serious or irreversible damage, and the stronger formulations place on the proponent of an activity the burden of establishing its safety.

The organising question of the family is what a governing party may require of an activity whose consequences remain unestablished, and the answers range over authorisation, limitation and prohibition.

4.2 The Operations Occupied and the Doctrine Supporting Each

Enabling is occupied through authorisation. A registration regime conditions market access on the submission of data, and a substance satisfying the condition enters the set of realizable changes by an act of the scheme.

Constraining is occupied most densely. Exposure limits, permissible concentrations, application conditions and use restrictions each admit an activity within bounds, and the family holds developed doctrine on how a bound is derived from evidence of harm under uncertainty.

Preventing is occupied through prohibition. A substance whose proponent fails to discharge the burden is barred, and the doctrine treats the bar as the consequence of an evidential failure.

4.3 The Instrument Nearest the Fourth Operation

The instrument nearest the fourth operation within the precautionary family is the moratorium, and the description under which the family records it is the point of interest.

A moratorium withholds an activity while preserving its later availability, and it therefore performs the fourth operation in form. Its doctrinal description locates the withholding in an evidential deficit: the activity is withheld because its consequences are unestablished, and the withholding terminates when the deficit is repaired.

The consequence is that the withholding is instrumental throughout. It is performed for the sake of knowledge, its duration is fixed by the progress of inquiry, and a moratorium continuing after the evidence has been supplied is criticised within the family's own terms. The family accordingly holds no account under which a possibility is withheld for its own

preservation, and Sunstein's [6] objection to the strong formulation bears on the family from the opposite direction, holding that its withholdings are too readily performed and never that they are performed for a reason of the wrong kind.

4.4 The Placement Recorded

The precautionary and risk-regulatory family occupies enabling, constraining and preventing with developed doctrine for each. It performs a withholding that preserves later availability, and it describes that withholding as provisional prevention justified by an evidential deficit. No doctrine within the family treats an unrealised possibility as a product.

5 Adaptive Governance and Resilience Management

This section places the adaptive and resilience families against the four operations, following the order of Section 4. Its role in the paper is the second of the four placements from which Result 1.1 is assembled in Section 8, and it follows the order of Section 4. The section is arranged as follows: §5.1 states the families' self-description, §5.2 identifies the operations occupied and the doctrine supporting each, §5.3 examines the instruments nearest the fourth operation, and §5.4 records the placement.

5.1 The Self-Description of the Families

Adaptive management describes what it does in terms of learning under uncertainty, treating a management action as an experiment whose results revise the next action, and Walters [13] states the programme. Adaptive governance extends the treatment to the institutional arrangements within which such management proceeds [2].

Resilience management describes what it does in terms of disturbance, absorption and reorganisation. Holling [3] established resilience as the persistence of relationships under disturbance, and Walker and colleagues [7] distinguished resilience from adaptability and from transformability.

5.2 The Operations Occupied and the Doctrine Supporting Each

Enabling is occupied through the experimental treatment. An adaptive programme admits an action for the sake of the information its outcome supplies, and the doctrine on experimental design within management is developed.

Constraining is occupied through the harvest control, the safe operating limit and the staged intervention, and the doctrine relates each bound to the state of the resource and to the confidence attaching to the estimate of that state.

Preventing is occupied where a threshold is identified and an action carrying the system across it is barred.

5.3 The Instruments Nearest the Fourth Operation

Two instruments within these families approach the fourth operation, and each is instrumental in the same manner as the moratorium.

The first is the control area. An adaptive programme withholds treatment from a portion of the field in order that the treated portion may be compared against it, and the withheld portion is unoccupied by design. The design is an experimental one throughout, the withholding is performed for the sake of the comparison, and a control area whose comparison has been completed carries no further claim within the doctrine.

The second is the retention of response diversity. The resilience literature holds that a system retaining varied responses to disturbance absorbs disturbance better, and it accordingly counsels against the elimination of functions presently redundant. The counsel preserves options and preserves them for the sake of the system's persistence, so that a redundancy contributing nothing to absorption carries no claim.

Both instruments therefore withhold and justify the withholding by an end the withholding serves. Neither supplies an account under which a possibility unrealised is itself the product.

5.4 The Placement Recorded

The adaptive and resilience families occupy enabling, constraining and preventing with developed doctrine. They perform withholdings whose justification lies in learning or in absorption, and the withholdings terminate when the end is served. No doctrine within the families treats an unrealised possibility as a product.

6 Environmental Law and the International Instruments

This section places environmental law and the principal international instruments against the four operations. The family occupies the fourth operation more nearly than any other surveyed, and the manner in which its doctrine describes that occupation is the section's finding. Its role in the paper is the third of the four placements from which Result 1.1 is assembled in Section 8, and it carries particular weight because the family occupies the fourth operation more nearly than any other surveyed. The section is arranged as follows: §6.1 states the family's self-description, §6.2 identifies the operations occupied and the doctrine supporting each, §6.3 examines territorial designation and its doctrinal description, and §6.4 records the placement.

6.1 The Self-Description of the Family

Environmental law describes what it does in terms of permission, prohibition, standard, assessment and liability. Its instruments are the permit, the prohibition, the technical standard, the impact assessment, the designation of territory and the rule of state responsibility.

6.2 The Operations Occupied and the Doctrine Supporting Each

Enabling is occupied through the permit, the concession and the conferral of a right of use, and the doctrine of authorisation is among the most developed in the field.

Constraining is occupied through the standard, the limit value, the condition attached to a consent and the requirement of assessment before a project proceeds.

Preventing is occupied through prohibition, through the customary obligation to prevent significant transboundary harm, and through the proposals to establish criminal liability for severe and widespread environmental damage.

6.3 The Designation of Territory and Its Doctrinal Description

Territorial designation is the instrument that most nearly performs the fourth operation, and its doctrinal description performs the substitution the paper is concerned with.

A protected area withholds a portion of a field from development while the portion remains developable. The withholding is deliberate, it is performed by an act, and the possibility withheld remains available, since a designation may be altered and the area may be developed thereafter. The instrument accordingly performs the fourth operation in substance.

Its doctrinal description is a prohibition of specified activities within a boundary. The instrument is drafted as a list of what may not be done, its administration consists in enforcement against those activities, and its performance is reported as area under protection. The description therefore places the instrument within prevention, and the property that distinguishes the fourth operation, which is the retention of the possibility in the available set, appears in the doctrine as a vulnerability in place of a feature: the alterability of a designation is treated as a risk to be guarded against and never as the respect in which the instrument differs from a prohibition.

One value category developed within economics bears on the instrument and is recorded in this subsection, since it supplies what the doctrinal description omits. Krutilla [18] established that an environment retained carries value to parties who neither presently use it nor may ever use it, and distinguished the value attaching to the retention of a future possibility from the value attaching to use. The category names what a designation preserves.

The category is a category of value, and an operation is a further thing. Option value states what a retention is worth, and leaves open when a scheme should withhold, about what counts as withholding well, about how a withholding is distinguished from an absence of interest, or about what ends a withholding. Result 8.1 concerns the absence of a doctrine of the operation, and the availability of a value category attaching to its product leaves that absence in place. The point is recorded again at §11.5, where the requirement of a measure is stated together with the difficulty that a measure of this form aggregates.

Two further instruments exhibit the same substitution, the first within biodiversity reporting and the second within the law of outer space.

The reporting of protected-area targets counts extent. An arrangement committing parties to place a stated fraction of land and sea under protection [9] measures its own performance

by area, and area records the reach of the prohibition and records nothing about what has been preserved as possible. Proposals to place half the terrestrial surface under protection [14] extend the same measure, and the critical literature on wilderness [1] contests what such designation presupposes about human presence without contesting the operation it performs.

The prohibition of national appropriation in outer space [11] withholds a legal status while leaving the possibility of use in place. The provision is drafted as a prohibition addressed to states, and its effect is to preserve a field as usable by all while foreclosing the acquisition of exclusive title. The instrument performs the fourth operation with respect to appropriation and is described as prevention.

6.4 The Placement Recorded

Environmental law occupies enabling, constraining and preventing with the most developed doctrine of any family surveyed. It performs the fourth operation through territorial designation and through the withholding of appropriable status, and it describes both as prohibition. Its performance measures record the extent of prohibition and record no preserved possibility.

7 The Arrangements for Orbital Sustainability

This section places the arrangements governing activity in orbit against the four operations. The family is examined last among the four because it is the youngest, because its doctrine is presently forming, and because the fourth operation is performed within it more visibly than elsewhere while receiving less description. Its role in the paper is the last of the four placements from which Result 1.1 is assembled in Section 8, and the family is examined last because its doctrine is presently forming and the fourth operation is performed within it with unusual clarity. The section is arranged as follows: §7.1 states the family's self-description, §7.2 identifies the operations occupied and the doctrine supporting each, §7.3 examines the withholding of orbital regions, §7.4 examines the assignment procedures, and §7.5 records the placement.

7.1 The Self-Description of the Family

The orbital sustainability family describes what it does in terms of mitigation, disposal, due regard and coordination. Its instruments are the debris mitigation guideline, the disposal requirement, the coordination procedure for spectrum and orbital position, the licensing condition imposed by a launching state, and the sustainability guideline adopted through the multilateral committee [10].

The organising problem of the family is the one Kessler and Cour-Palais [4] identified, under which the population of objects in a shell may pass a density above which collision becomes self-sustaining.

7.2 The Operations Occupied and the Doctrine Supporting Each

Enabling is occupied through licensing and through the coordination procedures by which a position and a frequency are assigned. The doctrine is developed, and the assignment procedures are among the oldest instruments in the field.

Constraining is occupied through the disposal requirement, the limit on post-mission lifetime, the passivation requirement and the conditions attached to a licence. The doctrine relates each requirement to the contribution the object makes to the population.

Preventing is occupied thinly. The destructive testing of anti-satellite weapons has attracted declarations of restraint, and the deliberate generation of debris is the principal activity the family seeks to bar.

7.3 The Withholding of Orbital Regions and Its Description

The fourth operation is performed in this family in a form more visible than any examined in Section 6, and it receives less doctrinal description.

An orbital region withheld from occupation remains occupiable. The withholding forecloses nothing physically, the shell persists whether or not it carries traffic, and a region left unoccupied today may be occupied at any later time by any party capable of reaching it. The fourth operation therefore applies to orbit with a clarity the terrestrial cases lack, where a withheld valley may be altered by processes no scheme controls.

The description available within the family places the unoccupied region under two headings and under neither of the four operations.

The first heading is capacity. An unoccupied region is described as available capacity, and the description treats occupation as the realisation of a value that the region holds latently. Under this description a region left unoccupied has produced nothing, and the arrangements that would keep it unoccupied appear as restrictions on the use of an asset.

The second heading is demand. An unoccupied region is described as a region for which no application has been made, and the description treats the vacancy as a fact about the market in place of a fact about governance. Claim 3.2 establishes why this description is available: the configuration presented by a region deliberately withheld is the configuration presented by a region no one wished to occupy.

The consequence is that the family holds no instrument by which a region is designated as withheld. A region may be congested and subject to mitigation requirements, and a region may be uncongested and subject to none. The category of a region kept uncongested by an act has no place in the instruments.

7.4 The Assignment Procedures and Their Presuppositions

One feature of the family bears on the derivation of Sections 10 and 11 and is recorded in this subsection.

Positions and frequencies are assigned on procedures that reward the party first in a

position to use them, and the resulting inequities have been contested for decades within the arguments for equitable access advanced by parties whose capability developed later.

The contest proceeds within the vocabulary of assignment. A party arguing for equitable access argues that a share of the capacity should be reserved to it, and a reservation of that kind is a withholding performed for the benefit of a designated party. The argument therefore reaches the fourth operation and describes it as a species of enabling deferred in time, which is a third description available for an unoccupied region and the only one within the family that treats the vacancy as produced by a decision.

7.5 The Placement Recorded

The orbital sustainability family occupies enabling and constraining with developed doctrine and occupies prevention thinly. It performs no designated withholding of orbital regions, it describes unoccupied regions as available capacity or as absent demand, and the equitable-access argument supplies the single description under which a vacancy is treated as produced by a decision.

8 The Assembled Placement and the Occupation of the Operations

This section assembles the placements of Sections 4 to 7, states Result 1.1, states what the result asserts and what it withholds, and identifies the single description under which the fourth operation is presently treated as produced by a decision. Its role in the paper is central: Result 1.1 is the paper's principal claim, and the description identified at §8.5 supplies the condition on which the settings of Section 9 are chosen. The section is arranged as follows: §8.1 assembles the placement, §8.2 states the result, §8.3 answers the objections to it, §8.4 states its content and limits, and §8.5 identifies the description under which a vacancy is attributed to a decision.

8.1 The Assembled Placement

Table 2 sets out the four families against the four operations, recording for each cell the instrument through which the family performs the operation together with the doctrine supporting it.

Three features of the assembled placement carry the result, concerning respectively the occupied columns, the fourth column, and the family in which its vacancy is starkest.

The first three columns are occupied by every family, and each family holds doctrine relating its instruments in those columns to the evidence and the ends it recognises. A party asking what a scheme does when it permits, limits or forbids receives an answer from within the scheme.

The fourth column is occupied in substance by three families and by no family under a description proper to it. The moratorium, the control area, the protected area and the withheld appropriable status all withhold a possibility while preserving its availability, and each is recorded under a heading belonging to another operation or to another purpose.

Table 2: The surveyed families against the four operations, with the instrument performing each and, for the fourth operation, the description under which the family records the withholding.

Family	Enabling	Constraining	Preventing	Leaving open, and its recorded description
Precaution and risk regulation	Authorisation on submitted data	Exposure limits, use conditions	Bar on failure of the burden	Moratorium, recorded as provisional prevention pending evidence
Adaptive governance and resilience	Experimental treatment	Harvest controls, safe operating limits	Bar on crossing an identified threshold	Control area and retained redundancy, recorded as instruments of learning and of absorption
Environmental law and international instruments	Permit, concession, conferred right	Standards, limit values, assessment conditions	Prohibition, no-harm rule, proposed criminal liability	Territorial designation and withheld appropriable status, recorded as prohibition and reported as area
Orbital sustainability arrangements	Licensing, position and frequency assignment	Disposal and life-time requirements, passivation	Restraint on de-liberate debris generation	No designated instrument; vacancy recorded as available capacity or as absent demand

The companion synoptic paper adds a consequence bearing directly on this. Placing the systems of the class on axes of representation and reach, it finds that in the region where both are narrowest the other three operations become unavailable, since a party cannot enable what it cannot reach, cannot constrain what it cannot describe, and cannot prevent what it does not act upon. The operation for which no doctrine exists is accordingly the operation that remains available exactly where the others fail.

The fourth column is unoccupied altogether in the family where the operation applies most cleanly. Orbit affords the clearest case of a possibility withheld without physical foreclosure, and the arrangements governing it hold no instrument by which a region is designated as withheld.

8.2 The Result

Result 8.1 (Occupation of the operations). Each family surveyed holds developed doctrine for enabling, for constraining and for preventing. No family surveyed holds a doctrine of leaving open under which the retention of a possibility in the available set is the end the operation serves. Where the operation is performed, it is recorded as provisional prevention, as an instrument of learning or absorption, as prohibition within a boundary, or as an absence

of demand.

Result 8.1 restates Result 1.1 in the terms of the placement that establishes it, and three features of its content require statement before the objections are answered.

8.3 The Objections to the Result

Three objections bear on Result 8.1, and each is answered from the placement in place of from any further premise.

The first holds that the result is an artefact of the partition. A partition drawn so as to separate leaving open from preventing will find the separation unoccupied, since no family had reason to draw it.

The answer is that the distinguishing property is stated within the doctrines themselves. Sections 4 and 6 establish that a moratorium is described as temporary and that a designation is described as alterable, and both descriptions state the retention of the possibility in the available set. The partition therefore names a distinction the doctrines already draw, and the doctrines treat it as a defect of the instrument in place of as its character.

The second holds that the substitution is harmless. An instrument performing the fourth operation performs it whatever description is recorded, and a protected area recorded as a prohibition preserves what a protected area recorded otherwise would preserve.

The answer is that the description governs the termination. A withholding described as instrumental has its duration fixed by the progress of the end it serves: a moratorium ends when the evidence arrives, a control area when the comparison closes, a designation stands until the prohibition it is drafted as is repealed. An operation whose termination is governed by an end external to it is a different operation from one performed for the preservation it accomplishes, and the two coincide only while the external end persists.

The third holds that the missing doctrine is unnecessary, since the operation proceeds without it.

The answer is that the operation proceeds with no account of when it should be performed, of what counts as performing it well, of how a performance is distinguished from a failure to act, and of what a party abandoning it has done. Claim 3.2 establishes that the last of these admits no answer from the state of the field.

8.4 The Content of the Result and Its Limits

Result 8.1 asserts an absence of doctrine, and the practice stands on its own feet: Section 9 exhibits four settings in which the operation is performed extensively, and the practice is old, substantial and in several cases effective.

It asserts, second, that the recorded descriptions belong to other operations, and the recordings themselves stand correct on their own terms: a scheme recording a protected area as a prohibition of specified activities has recorded what its instrument enforces, and §12.1 declines the position that the families have erred.

And the result concerns the families surveyed, while the survey omits several. Customary

and indigenous governance systems are the omission that bears most heavily, since deliberate non-occupation supported by a positive account of what the non-occupation accomplishes is reported within several such systems, and a doctrine of the fourth operation may exist there. The omission is recorded at §13.2 as a standing threat to Result 8.1 in place of as a gap in coverage.

8.5 The Description under Which a Vacancy Is Attributed to a Decision

One description encountered in the survey treats an unrealised possibility as produced by a decision, and its position is recorded here, since Sections 10 and 11 argue that the absence of such descriptions is structural.

The equitable-access argument advanced within the assignment of orbital positions and frequencies holds that a share of a capacity should be reserved to parties whose capability developed later. A reservation of that kind withholds a possibility from present realisation, retains it in the available set, and is performed for a stated beneficiary.

The description is available because the beneficiary is nameable. A withholding performed for a party that can be identified is recorded as a deferral of that party's enabling, and the record has a subject. Sections 10 and 11 establish that the descriptions available for a withholding fail precisely where no beneficiary can be named, and the four settings of Section 9 are settings of that kind.

9 The Settings in Which the Operation Is Performed without a Doctrine

This section exhibits four settings in which the fourth operation is performed extensively and in which no doctrine describes it as an operation of its own. The settings are chosen to satisfy the condition identified at §8.5, that no beneficiary of the withholding can be named, and the section closes by stating the relation between that condition and the availability of an institutional form. One further setting is examined and excluded, and the exclusion establishes a boundary the paper requires. Its role in the paper is exhibitiv: the four settings establish that the fourth operation is performed extensively without a doctrine, which is the pattern that Section 10 derives from the structure of reporting. The section is arranged as follows: §9.1 states the condition the settings share, §9.2 to §9.5 treat areas withheld from development, skies withheld from illumination, orbital regions withheld from occupation, and reserves withheld from extraction, §9.6 states the setting excluded and the reason, and §9.7 states the relation between nameability and institutional form.

9.1 The Condition the Settings Share

Each of the four settings exhibits a possibility withheld from realisation while remaining available for realisation later, and in each the withholding is deliberate.

Each setting also exhibits the condition of §8.5. The parties who would gain by the withholding are unenumerable, they include parties not yet existing, and in some cases they include trajectories that render no account of any gain. A withholding performed for such

parties admits no record with a subject, and the descriptions available to the schemes therefore attach the withholding to something else.

9.2 Areas Withheld from Development

The withholding of areas from development was placed at §6.3 and is restated in this section in the vocabulary of the four operations.

An area withheld from development remains developable. The withholding is performed by a designation, the designation is alterable, and the alterability is what distinguishes the instrument from a prohibition and what the doctrine treats as its weakness.

The description records the prohibition of specified activities within a boundary, and the performance measure records extent. A party asked what a designation has produced answers with an area, and an area is the reach of a prohibition. What the withholding preserved, which is the availability of a range of futures within that area, appears in no measure the family employs.

9.3 Skies Withheld from Illumination

The withholding of skies from illumination is the clearest instance of the operation in a terrestrial field, and the clarity follows from the physical reversibility of the withholding.

Illumination withheld from a sky forecloses nothing. A sky unlit today is illuminable tomorrow at the cost of the fixtures, and the withholding is accordingly a pure instance of removal from the realizable set with retention in the available set. Designation programmes [15] withhold illumination across defined areas by conditions on fixtures, on shielding and on hours.

The descriptions available divide according to whether a beneficiary can be named, and the division bears directly on Claim 9.1.

Where an observatory lies within the designated area, the withholding is recorded as the protection of a research function. The beneficiary is nameable, its interest is statable, and the instrument attaching to it is correspondingly firm. The arrangements developed for the protection of astronomical observation from satellite constellations [17] exhibit the same structure at a different scale.

Where no observatory lies within the area, the beneficiaries are nocturnal populations, future observers and a general amenity, and none is nameable in the sense the record requires. The instruments available in such areas are correspondingly weaker: voluntary designation, advisory standards, and ordinances whose enforcement is occasional.

The pattern across the two cases is the section's first evidence for Claim 9.1, and the three settings that follow reproduce it.

9.4 Orbital Regions Withheld from Occupation

The withholding of orbital regions from occupation was placed at §7.3 and satisfies the condition of §9.1 completely.

A region withheld from occupation remains occupiable, and the withholding forecloses nothing physically. The parties who would gain are the operators of a later generation, the astronomers whose observations the region would obstruct, and the parties whose access depends on the shell remaining traversable. The first are unenumerable, the second are nameable and are protected under the description of §9.3, and the third include every party that has yet to develop a launch capability.

The descriptions available are the two recorded at §7.3. An unoccupied region is available capacity, or it is a region for which no application has been made. Neither description has a subject, and §8.5 establishes that the single description with a subject is the reservation argued for on grounds of equitable access, whose beneficiary is a party that can be named.

9.5 Reserves Withheld from Extraction

The withholding of reserves from extraction supplies the paper's clearest exhibit, since a party attempted to construct a record for the withholding and the attempt is documented in its failure and in its later revival by another route.

A mineral reserve withheld from extraction remains extractable, and the withholding is a pure instance of the operation.

In 2007 the government of Ecuador proposed to leave the reserves of the Ishpingo, Tambococha and Tiputini fields unextracted, on the condition that the international community contribute a sum reported at some three and a half billion dollars against the revenue thereby foregone. The proposal is best understood as an attempt to supply the withholding with a record. A price was attached, a payer was solicited, and the withholding would thereby have become a transaction with two subjects. The attempt failed on the second element: contributions reported at some thirteen million dollars had been collected by 2013, the initiative was abandoned, and extraction proceeded.

In August 2023 a national referendum returned a majority for keeping the crude underground indefinitely, and the withholding was thereby constituted as a decision with a subject of another kind. The subject supplied was the electorate in place of a beneficiary, and the constitution succeeded where the transaction had failed. Reported implementation has been partial, decommissioning is estimated in years and in sums exceeding a billion dollars, and the majority in the provinces containing the park ran the other way.

Three features of the case bear on the argument. The withholding required a subject before it could be recorded, and two candidate subjects were tried. The subject that succeeded was constituted politically in place of being found among the beneficiaries. And the administration of the withholding has proved to consist in the undoing of infrastructure, which the accounts record as decommissioning cost, so that the operation appears in the record as an expense and appears nowhere as a product.

9.6 The Setting Excluded and the Reason for Excluding It

Deferred industrial transition resembles the four settings and belongs to none of them, and the reason fixes a boundary the paper requires.

A party deferring the replacement of an energy system withholds the replacement, and the withholding appears to instance the operation. It fails to instance it because the field drifts during the deferral. The possibility whose realisation the party defers is a possibility whose value depends on the state the field is in when it is realised, and the state changes while the party defers. What is withheld is accordingly removed from the available set by the passage of time, and the operation performed is prevention effected by delay.

The companion paper establishes the general form of this case and establishes that a criterion stated over intervention alone releases the deferring party. The present paper records the consequence for the taxonomy: the fourth operation requires that the availability of the possibility be genuinely retained, and a withholding performed in a drifting field retains nothing.

9.7 The Relation between Nameability and Institutional Form

Claim 9.1 (Nameability and the strength of the instrument). Across the settings exhibited, the firmness of the instrument available for performing the fourth operation varies with whether a beneficiary of the withholding can be named. Where a beneficiary is nameable, the withholding is recorded as a deferred enabling of that party or as the protection of its function, and the instruments are firm. Where no beneficiary is nameable, the instruments are voluntary, advisory or absent, and the withholding is recorded as a prohibition, as an expense, or as an absence of demand.

The claim is offered as a pattern across four settings and no more. Section 10 argues that the pattern follows from the structure of governance accounting, and §13.1 records that the claim is untested against any setting the survey omits.

10 The Derivation of the Pattern from the Structure of Performance Reporting

This section derives Claim 9.1 from the structure by which a governance scheme reports what it has done. The derivation proceeds from three premises, two of which are established in Sections 3 and 9, and it yields the pattern exhibited in Section 9 as a consequence in place of an observation. The section then states a second and independent source of the same pattern, and states what the derivation withholds. Its role in the paper is explanatory: the derivation converts the pattern of Section 9 from an observation into a consequence, which is what entitles the paper to call the emptiness of the fourth cell structural. The section is arranged as follows: §10.1 states the structure of a performance report, §10.2 establishes the evidential unavailability of the field, §10.3 states the sources remaining to a report, §10.4 states the derivation, §10.5 states the counterfactual requirement and its asymmetry, and §10.6 states the exclusions.

10.1 The Structure of a Performance Report

A governance scheme answers for what it has done. The answering is performed to a party, it concerns a period, and it consists in the exhibition of items attributable to the scheme's acts.

Two features of this structure carry the derivation, concerning respectively what a report must exhibit and to whom the item must be attributable.

The first is that a report requires an item that can be exhibited. An assertion that a scheme acted, unaccompanied by anything the scheme can produce, is a claim about the scheme's intentions and is assessed as such.

The second is that a report requires the item to be attributable to the scheme. An item present in the field for reasons unconnected with the scheme's acts supports no claim about the scheme's performance, and a scheme reporting such an item has overstated.

10.2 The Evidential Unavailability of the Field

Claim 3.2 establishes that at any moment at which a possibility stands outside the realizable set and inside the available set, the field presents the same configuration whether the possibility was withheld by an act or was never acted upon.

The consequence for reporting follows immediately. The field withholds the item the second feature of §10.1 requires. An unoccupied possibility is present in the field, and its presence is consistent with the scheme having withheld it and with no scheme having addressed it. A report exhibiting the unoccupied possibility as its item has exhibited something whose attribution to the scheme the field does not support.

The first three operations are unaffected. An enabled activity, a measured reduction and an enforcement action are each present in the field and each attributable, since none of them would be present had the scheme not acted.

10.3 The Sources Remaining to a Report

Two sources remain to a scheme reporting performance of the fourth operation, and each records something other than the preservation.

The first is the act. A scheme may exhibit the instrument by which it withheld: the designation made, the rule adopted, the condition imposed, the enforcement conducted against parties who acted contrary to it. Each item is attributable and each is exhibitable. What each records is the operation of a prohibition, since an instrument drafted to withhold is enforced by barring the activities that would realise the possibility. A report drawing on this source therefore describes the operation as prevention, and §6.3 exhibits the description in the doctrine of territorial designation.

The second is the beneficiary. A scheme may exhibit a party whose position the withholding improved: an observatory whose observations continue, a later-entering operator whose access is preserved, a party for whom a share was reserved. The item is the party's improved position, it is attributable to the withholding, and it is exhibitable because the party can be asked. A report drawing on this source describes the operation as an enabling of that party

deferred in time, and §8.5 exhibits the description in the equitable-access argument.

10.4 The Derivation

Claim 10.1 (Derivation of the pattern). A scheme reporting performance of the fourth operation draws on the act or on the beneficiary, since Claim 3.2 removes the field as a source. Where a beneficiary can be named, the second source is available, the report has a subject whose position may be examined, and the instrument may be firm because its performance may be assessed. Where no beneficiary can be named, the first source alone remains, the report records the operation of a prohibition, and the preservation the operation accomplished appears in no item the report contains.

Claim 9.1 follows. The firmness of the instrument varies with the nameability of a beneficiary because the assessability of the performance varies with it, and an instrument whose performance admits no assessment is not made firm by any degree of commitment to it.

Two features of the derivation bear on how it should be read, concerning respectively the conduct of the schemes and the source of the difficulty.

The first is that the derivation requires no defect in any scheme. A scheme reporting under this structure has reported what it could attribute, and §12.1 declines the position that the schemes have erred.

The second is that the derivation identifies the demand for a subject as a feature of accountability in place of a feature of measurement. A scheme answers to a party for what it has done, and a report addressed to that party is assessed by whether an item can be produced and attributed. The requirement is relational throughout, and a scheme reporting to no one would face the difficulty in a weaker form.

10.5 The Counterfactual Requirement and Its Asymmetry

A second source of the same pattern operates independently of the first and is recorded in this subsection.

A claim that a withholding preserved a possibility asserts that the possibility would have been foreclosed had the withholding not been performed. The assertion is counterfactual, its warrant requires a claim about what parties would have done, and the claim is contested precisely where the withholding is contested, since a party opposing the withholding asserts that it would have acted with care.

The first three operations require no comparable assertion. A permit issued, a limit met and a prosecution brought are each actual, and a report exhibiting them asserts nothing about a world in which the scheme acted otherwise.

The asymmetry compounds the derivation of §10.4. Where a beneficiary is nameable, the counterfactual concerns a party that can be asked what it would have done. Where none is nameable, the counterfactual concerns unenumerable parties and the assertion has no examinable content.

10.6 Exclusions from the Derivation

Three matters lie outside the derivation, concerning respectively effectiveness, the theory of accountability, and the constructibility of a doctrine.

The first is that the derivation concerns the reporting of performance and concerns the effectiveness of any instrument in no respect. An instrument reported poorly may operate well, and Section 9 records that the practice in several settings is substantial.

The second is that it treats accountability as the relation within which reporting occurs, supplying no theory of accountability. Where a scheme answers to a party by a route other than the exhibition of items, the derivation applies weakly, and §13.1 records the qualification.

The third is that the derivation establishes why the descriptions available substitute other operations for the fourth, while establishing nothing about whether a doctrine could be constructed. Section 11 states what such a doctrine would have to supply.

11 The Requirements on a Doctrine of the Fourth Operation

This section states what a doctrine of the fourth operation would have to supply. Each requirement is derived from a result established in Sections 3 to 10, and the section stops at the requirements, for the reason recorded at §2.4. The requirements are stated so that an existing arrangement may be assessed against them. Its role in the paper is constructive: the requirements stated in this section are what the paper offers in place of a doctrine, and each is assessable against an existing arrangement. The section is arranged as follows: §11.1 states the criterion of occasion, §11.2 the criterion of adequate performance, §11.3 the record distinguishing the operation from silence, §11.4 the termination condition, §11.5 the measure of preservation, and §11.6 states the standing of the requirements.

11.1 A Criterion of Occasion

The first requirement is that a doctrine state the occasion on which the operation is to be performed.

The requirement follows from §8.3, where the third objection holds that the operation proceeds without a doctrine and the answer records what proceeding without one consists in. A scheme performing the operation on some occasions and omitting it on others, with no criterion distinguishing them, has performed no operation that admits assessment.

The companion papers supply one candidate criterion, under which the operation is required where realisation would irreversibly foreclose the generative capacity of a trajectory other than the acting party's own. The present paper records the candidate and adopts none, since Result 8.1 concerns the absence of a doctrine and stands whatever criterion a doctrine adopts.

11.2 A Criterion of Adequate Performance

The second requirement is that a doctrine state what performing the operation well consists in.

The requirement follows from §3.5, which records that the partition merges withholding for a stated period with withholding of indefinite duration. A designation lapsing in ten years and a designation without term both remove a possibility from the realizable set, and they retain it in the available set to different degrees and for different periods. A doctrine would have to state which is required on a given occasion.

11.3 A Record Distinguishing the Operation from Silence

The third requirement is that a doctrine supply a means by which a performance of the operation is distinguished from an absence of action.

The requirement follows from Claim 3.2 and is the most demanding of the five. The field affords no such means, since the configurations coincide. The distinction is available only from the provenance of the configuration, and the provenance is established by a record of the act.

A doctrine would accordingly have to constitute the withholding as a recorded act with a stated object, a stated period and a stated author. Section 9 exhibits two attempts to constitute a withholding in this manner, one through a transaction with a solicited payer and one through a referendum, and §9.5 records that the second succeeded where the first failed.

11.4 A Termination Condition Proper to the Operation

The fourth requirement is that a doctrine state what ends a withholding.

The requirement follows from the second answer at §8.3. A withholding described as instrumental has its termination fixed by the progress of the end it serves, and a withholding performed for the preservation it accomplishes has no such external end. A doctrine would therefore have to state a condition of relaxation belonging to the operation itself, and the condition would have to distinguish a withholding correctly relaxed from a withholding abandoned.

The requirement is exacting for the reason §3.4 gives. Where a withholding is abandoned and the possibility is realised, the realisation is recorded as a development and the abandonment is recorded nowhere.

11.5 A Measure of the Preservation Accomplished

The fifth requirement is that a doctrine supply a measure of what a performance preserved.

The requirement follows from §6.3, where the reporting of designation counts extent, and from §9.5, where the administration of a withholding appears in the accounts as decommissioning cost. Both measures record something other than the preservation, and a doctrine supplying no measure of its own leaves the operation reported by measures

belonging to other operations.

The requirement is stated with a caution the paper takes seriously, and the caution has two parts. A measure of preserved possibility ranges over the possibilities preserved, and a measure ranging over them aggregates. A measure of that form is also a common measure over the participants of the field, and the series describes such fields as heterogeneous precisely where no such measure is available to the party governing them, so the requirement of §11.5 asks for what the description of the field denies. The companion paper establishes that aggregation over trajectories licenses the substitution of one foreclosure for two preservations, and a doctrine adopting an aggregate measure would import that consequence. A measure satisfying the present requirement without incurring it is a problem the paper leaves open.

11.6 The Standing of the Requirements

The five requirements are stated as conditions on a doctrine, and the construction of a doctrine satisfying them is the work the paper leaves.

Each is derived from a result established in Sections 4 to 9, and each is assessable against an existing arrangement. An arrangement performing the fourth operation may be examined for whether it states an occasion, a standard of adequate performance, a record of the act, a termination condition of its own, and a measure of what was preserved. Section 9 establishes that the arrangements surveyed supply the third in one case, through a constituted decision, and supply none of the others.

12 Positions Declined and the Arguments for Declining Them

This section argues the four declinations announced at §2.4. Each position is stated at the strength its proponents would give it, the ground for declining it is derived from a result established in Sections 3 to 11, and the cost of the declination is stated. Its role in the paper is to discharge the four announcements of §2.4 with arguments, so that each declination stands on a stated result in place of on preference. The section is arranged as follows: §12.1 declines a charge of error against the schemes, §12.2 declines a priority for the fourth operation, §12.3 declines a proposed doctrine, and §12.4 declines a measure of the distribution of effort.

12.1 The Declination of a Charge of Error

The position declined holds that the families surveyed have made a mistake, and that a family recording a withholding as a prohibition has misdescribed its own instrument.

The ground for declining it is Claim 10.1. A scheme reports what it can exhibit and attribute, Claim 3.2 removes the field from among the sources available, and a scheme drawing on the act has drawn on the only source remaining where no beneficiary can be named. The recorded description is accordingly the description the reporting structure admits, and a family adopting it has done what its situation permitted.

The cost is that a party to whom a remedy might be addressed must be identified by other means. A structural account identifies a condition and identifies no agent whose conduct

produces it, and §13.3 records the consequence for the prospect of repair.

12.2 The Declination of a Priority for the Fourth Operation

The position declined holds that the fourth operation should be performed more often than it is, and that the absence of a doctrine has produced an absence of performance.

The ground for declining it is derived from Section 9, which exhibits four settings in which the operation is performed extensively. The absence established by Result 8.1 concerns doctrine, the practice is old and in several cases substantial, and an inference from the absence of doctrine to the absence of performance is unavailable.

A second ground is derived from §3.5. The partition merges withholdings of different duration, and a doctrine distinguishing them might require the operation less often than it is presently performed, in settings where an indefinite withholding is performed where a bounded one would serve.

The cost is that the reason for adopting a doctrine of the operation rests on the assessability of what is presently performed, and on that alone.

12.3 The Declination of a Proposed Doctrine

The position declined holds that a paper establishing the absence of a doctrine should supply one.

The ground for declining it is derived from §11.5 and §11.3. A doctrine requires a measure of what a performance preserved, a measure ranging over preserved possibilities aggregates, and the companion paper establishes that aggregation licenses the substitution the operation exists to withhold. A doctrine proposed without a resolution of that difficulty would carry the difficulty into every arrangement adopting it. And a doctrine requires a record constituting the withholding as an act, the constitution of such records is an institutional matter, and §9.5 exhibits two attempts of which one failed and one succeeded for reasons proper to the polity that made it.

The cost of the four declinations taken together is the following. The paper establishes that an operation is performed without a doctrine, states five requirements a doctrine would satisfy, and leaves the construction to parties better placed to attempt it.

12.4 The Declination of a Measure of the Distribution of Effort

The position declined holds that the placement of Sections 4 to 8 should be quantitative, assigning to each family a distribution of its effort across the four operations.

The ground for declining it is derived from Result 8.1 itself. A quantitative placement would count instruments, provisions or expenditures, and each of these is recorded under the descriptions the families employ. A count of provisions performing the fourth operation would therefore count the provisions recorded as performing it, and Result 8.1 establishes that the operation is recorded under other headings throughout. The measure would return

an occupancy of nearly zero for the fourth column and would return it as an artefact of the recording in place of a finding about the practice.

The cost is that the placement of Table 2 is qualitative and admits dispute at every cell.

13 The Limits of the Account and the Questions It Leaves Open

This section states the limits of the account in three classes, records the objection that bears most heavily against Result 8.1, and fixes the relation to the companion papers and to the remaining paper of the series. Its role in the paper is closing: it states what the account has not established, so that Result 8.1 is carried forward at its warranted strength and no further. The section is arranged as follows: §13.1 states the limits internal to the account, §13.2 records the objection bearing most heavily against the result, §13.3 states the prospect of repair, and §13.4 fixes the relation to the companion papers and the series.

13.1 Limits Internal to the Account

Four limits attach to the account itself, running from the partition on which it rests to the unit to which it attributes an operation.

The first is that the partition merges distinctions the argument elsewhere relies upon, and §3.5 records three. The merge of prohibition by rule with foreclosure by physical alteration is the consequential one, since the companion papers turn on the difference between a removal reversible by repeal and a removal reversible by nothing.

The second is that Claim 9.1 is a pattern across four settings and is untested elsewhere. The settings were chosen to satisfy the condition of §9.1, the selection was purposive, and a survey selecting settings on other grounds might find the pattern weaker.

The third is that the derivation of §10.4 treats accountability as a relation within which items are exhibited and attributed. Where a scheme answers to a party by another route, through deliberation, through the standing of the party that adopted it, or through a tradition in which the answering takes another form, the derivation applies weakly.

The fourth is that the account treats a scheme as the unit performing an operation. Where several schemes act on one possibility, the field carries the resultant, and §3.6 records that the taxonomy supplies no account of how a resultant is determined.

13.2 The Objection Bearing Most Heavily against the Result

The survey of Sections 4 to 8 covers four families and omits several, and one omission bears on Result 8.1 directly.

Customary and indigenous governance systems are reported to perform deliberate non-occupation with an account of what the non-occupation accomplishes. Where such an account states an occasion, a standard of adequate performance, a means by which the withholding is distinguished from mere absence, a condition of relaxation, and a sense in which what is preserved may be spoken of, the system holds a doctrine of the fourth operation and Result

8.1 is qualified accordingly.

The qualification would be substantial and the paper does not resist it. Result 8.1 would then assert that the families constituting contemporary environmental and orbital governance hold no such doctrine while doctrines exist elsewhere, and the finding would become a finding about which traditions the contemporary families have drawn on.

A related literature bears on the examination. Wynne [19] established that observation sustained locally over long periods may carry standing that institutional assessment fails to receive, which is a difficulty of reception in place of a difficulty of doctrine, and the two must be kept apart: a system holding a doctrine of withholding that no institution receives stands differently from a system holding none.

Two cautions attach to the examination such a qualification requires. An account rendered in terms proper to a tradition is not assessed by whether it satisfies requirements drawn from another, and §11 states its five requirements as conditions on a doctrine of the kind the surveyed families would recognise. And the assimilation of such accounts into a framework built elsewhere is itself contested, on grounds the present paper is not positioned to adjudicate.

13.3 The Prospect of Repair

Section 10 derives the absence from the structure of performance reporting, and the derivation bears on what a repair would require.

A repair operating on the doctrine alone leaves the reporting structure in place. A family adopting a doctrine of the fourth operation would report its performance under that doctrine, the report would require an exhibitable and attributable item, and Claim 3.2 establishes that the field withholds any such item.

The repair the derivation indicates operates on the constitution of the act. Where a withholding is constituted as a recorded decision with an author, a period and an object, the record supplies the item, and §9.5 exhibits a case in which such a constitution was achieved through a referendum and a case in which it was attempted through a transaction and failed.

The paper accordingly identifies the point at which a repair would operate, the repair itself remains for other work, and §12.3 states why.

13.4 The Relation to the Companion Papers and to the Series

The first companion paper establishes a criterion under which the fourth operation is required, and the present paper establishes that the operation lacks a doctrine independently of any criterion for performing it. The two results are separable and §2.3 records that a reader rejecting the criterion may hold Result 8.1.

The second companion paper establishes who is positioned to determine the state of a system where a governing rule depends on it, and its results bear on the fourth operation wherever the occasion for withholding turns on the condition of a field.

Two matters raised in this paper belong to the remaining paper of the series. The first is

the constitution of the problem class within which these results sit, and the finding of §9.6 fixes one of its boundaries: a withholding performed in a drifting field retains nothing, so the operation requires a field whose availability persists absent action. The second is the question recorded at §13.2, which concerns which traditions the contemporary families have drawn on and which they have left aside.

References

- [1] Cronon, William. "The Trouble with Wilderness; or, Getting Back to the Wrong Nature." In *Uncommon Ground: Rethinking the Human Place in Nature*, edited by William Cronon, 69–90. New York: W. W. Norton, 1995.
- [2] Folke, Carl, Thomas Hahn, Per Olsson, and Jon Norberg. "Adaptive Governance of Social–Ecological Systems." *Annual Review of Environment and Resources* 30 (2005): 441–473.
- [3] Holling, C. S. "Resilience and Stability of Ecological Systems." *Annual Review of Ecology and Systematics* 4 (1973): 1–23.
- [4] Kessler, Donald J., and Burton G. Cour-Palais. "Collision Frequency of Artificial Satellites: The Creation of a Debris Belt." *Journal of Geophysical Research* 83, no. A6 (1978): 2637–2646.
- [5] Ostrom, Elinor. *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge: Cambridge University Press, 1990.
- [6] Sunstein, Cass R. *Laws of Fear: Beyond the Precautionary Principle*. Cambridge: Cambridge University Press, 2005.
- [7] Walker, Brian, C. S. Holling, Stephen R. Carpenter, and Ann Kinzig. "Resilience, Adaptability and Transformability in Social–Ecological Systems." *Ecology and Society* 9, no. 2 (2004): art. 5.
- [8] Young, Oran R. *The Institutional Dimensions of Environmental Change: Fit, Interplay, and Scale*. Cambridge, MA: MIT Press, 2002.
- [9] Convention on Biological Diversity, 1760 UNTS 79, opened for signature 5 June 1992; Kunming–Montreal Global Biodiversity Framework, adopted 19 December 2022.
- [10] United Nations Committee on the Peaceful Uses of Outer Space. *Guidelines for the Long-term Sustainability of Outer Space Activities*. Adopted 2019.
- [11] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, 610 UNTS 205, opened for signature 27 January 1967.
- [12] Rio Declaration on Environment and Development, UN Doc. A/CONF.151/26 (Vol. I), 1992, Principle 15.

- [13] Walters, Carl J. *Adaptive Management of Renewable Resources*. New York: Macmillan, 1986.
- [14] Wilson, Edward O. *Half-Earth: Our Planet's Fight for Life*. New York: Liveright, 2016.
- [15] DarkSky International. *International Dark Sky Places Program*. Programme documentation and designation criteria, accessed August 2026.
- [16] Prime, Lillian. "Blocking Oil Development in Yasuní National Park: Ecuador's Unprecedented Strides Towards Environmental Justice." *Consilience* no. 27 (2025), doi:10.52214/consilience.vi27.12100.
- [17] International Astronomical Union. *Centre for the Protection of the Dark and Quiet Sky from Satellite Constellation Interference*. Established 2022.
- [18] Krutilla, John V. "Conservation Reconsidered." *American Economic Review* 57, no. 4 (September 1967): 777–786.
- [19] Wynne, Brian. "Misunderstood Misunderstanding: Social Identities and Public Uptake of Science." *Public Understanding of Science* 1, no. 3 (1992): 281–304.