BAIN ID
Technical Specification

Bio-Asset Identification Number
Schema, Format, and Protocol Rules

1. Purpose and Scope

This document defines the formal specification for the Bio-Asset Identification Number (BAIN ID) - the canonical identifier system for biological assets within the BCCS protocol. BAIN ID serves the same structural function for biological capital that ISIN serves for securities, SWIFT/BIC for bank routing, and ISO 6346 for shipping containers.

BAIN ID is not a token, a certificate, or a financial instrument. It is a reference key - a structured, machine-readable string that uniquely links a physical biological asset to its digital state record, verification history, policy permissions, and economic identity within any system that implements the BCCS protocol.

This specification covers the identifier format, encoding rules, asset classification taxonomy, 8-state lifecycle encoding, validation logic, and API query schema.

2. BAIN ID Format

A BAIN ID is a fixed-structure alphanumeric string of 21 characters (excluding hyphens). Format: JJ-CCCC-YYYYMMDD-SSSSSSS. A BAIN ID is fully immutable once assigned. Identity is permanent; state is dynamic.

2.1 Structure

Segment	Length	Name	Description	Example
JJ	2	Jurisdiction	ISO 3166-1 alpha-2 country code	RU
CCCC	4	Asset Class	BCCS asset classification code	PFRS
YYYYMMDD	8	Registration	Date of BAIN ID assignment (ISO 8601)	20260915
SSSSSSS	7	Sequence	Unique sequential number within combination	0000142

2.2 Example BAIN IDs

BAIN ID	Reading
RU-PFRS-20260915-0000142	Russian Federation, Permafrost Reserve, registered September 15 2026, sequence 142
BR-FRCS-20261201-0003891	Brazil, Forest Carbon System, registered December 1 2026, sequence 3891
NO-MARE-20270301-0000017	Norway, Marine Ecosystem, registered March 1 2027, sequence 17
ID-SOIL-20260801-0000503	Indonesia, Soil Microbiome System, registered August 1 2026, sequence 503

2.3 Encoding Rules

All characters are uppercase ASCII alphanumeric (A-Z, 0-9). Hyphens are formatting separators only and must be stripped before machine processing. The canonical machine form is a 21-character string: JJCCCCYYYYMMDDSSSSSSS. Systems must accept both hyphenated (human-readable) and compact (machine) forms. Sequence numbers are zero-padded to 7 digits, allowing 9,999,999 assets per jurisdiction-class-date combination.

2.4 Immutability Guarantee

BAIN IDs are strictly immutable. Once assigned, no segment ever changes for the lifetime of the asset. Identity is permanent; state is dynamic. An asset's current lifecycle state, confidence score, decay deadline, and policy permissions are properties of the asset record, queried through the BCCS API, not encoded in the identifier itself.

3. Asset Classification Taxonomy

The BCCS asset classification uses a 4-character code identifying the biological asset class.

Code	Asset Class	Description
FRCS	Forest Carbon System	Standing forest assessed for carbon sequestration, biodiversity, and ecosystem services
PFRS	Permafrost Reserve	Permafrost formations assessed for methane and carbon storage stability
SOIL	Soil Microbiome System	Agricultural and natural soil systems assessed for organic carbon and microbial health
MARE	Marine Ecosystem	Coastal and open-water ecosystems including mangroves, seagrass, coral reefs, and kelp forests
AGRI	Agricultural Production	Managed agricultural land assessed for sustainable yield, soil health, and input efficiency
GENE	Genetic/Biodiversity Resource	Genetic material, seed banks, microbial libraries, and biodiversity repositories
BIOM	Biomass Energy Flow	Biomass production systems assessed for energy yield and lifecycle emissions

New asset classes may be added through BCCS protocol governance. Each new class requires a unique 4-character code, formal definition, measurement parameters, and verification requirements for each lifecycle state.

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4. The 8-State Lifecycle Model

The BCCS protocol tracks every biological asset through an 8-state lifecycle that captures the full thermodynamic journey from registration to terminal exit. This replaces linear verification tiers with a dynamic, non-linear system that reflects biological reality.

4.1 State Definitions

Code	State	Description
01	Registered	Asset identified and BAIN ID minted on-chain. Class and stewardship documented.
02	Active	Node is live and producing attestation data through PoPS consensus. Verification cycle running.
03	Suspended	Temporary halt pending investigation, sensor recalibration, or anomaly resolution.
04	Migrating	Asset in physical transition between jurisdictions or biomes. Spatial Split/Merge in progress.
05	Dormant	Asset enters natural low-activity period (e.g. winter permafrost, dry-season agriculture). Monitoring continues at reduced cadence.
06	Degraded	Biological capital below minimum viability threshold. Recovery protocol initiated. Restricted transactions.
07	Depleted	Asset has crossed the point of no return. Irrecoverable biological destruction confirmed. Terminal state.
08	Archived	Clean exit from the network. Full historical data preserved immutably. BAIN ID remains as permanent record.

4.2 Permitted State Transitions

From	Permitted To	Trigger
Registered (01)	Active (02)	First successful verification by accredited oracle
Active (02)	Suspended (03)	Anomaly detected by Validator Network or oracle self-report
Active (02)	Dormant (05)	Seasonal cycle detected; monitoring confirms low-activity
Active (02)	Degraded (06)	Threshold breach; biological metrics below minimum viability
Active (02)	Migrating (04)	Spatial operation initiated (Split or Merge)
Suspended (03)	Active (02)	Investigation resolved; sensors recalibrated; oracle re-verified
Migrating (04)	Active (02)	Spatial operation completed; child BAIN IDs active
Dormant (05)	Active (02)	Seasonal reactivation; monitoring confirms activity resumed
Degraded (06)	Active (02)	Recovery confirmed; metrics back above viability threshold
Degraded (06)	Depleted (07)	Independent assessment confirms irrecoverable destruction
Any (01-06)	Depleted (07)	Catastrophic event confirmed by multi-source evidence
Depleted (07)	Archived (08)	Protocol exit; data preservation complete
Active (02)	Archived (08)	Voluntary clean exit from active network

4.3 State Decay Rule

Biological assets are entropic. Active assets must be re-verified within a defined validity window. If not re-verified, the asset transitions to Suspended automatically.

Asset Class	Re-verification Window	Decay Target

FRCS (Forest)	12 months	Active -> Suspended
PFRS (Permafrost)	24 months	Active -> Suspended
SOIL (Soil)	6 months	Active -> Suspended
MARE (Marine)	12 months	Active -> Suspended
AGRI (Agricultural)	6 months	Active -> Suspended
GENE (Genetic)	36 months	Active -> Suspended
BIOM (Biomass)	6 months	Active -> Suspended

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5. API Query Schema

Endpoint	Method	Description
/asset/{bain_id}/state	GET	Current lifecycle state, last verification timestamp, decay deadline, active verifier
/asset/{bain_id}/policy	GET	Policy envelope: permitted actions, constraints, escalation triggers, liability allocation
/asset/{bain_id}/history	GET	Full state-transition history with timestamps, verifier IDs, evidence hashes
/asset/{bain_id}/lineage	GET	Spatial lineage: parent, children, split/merge events with timestamps
/asset/{bain_id}/verify	POST	Submit verification claim from accredited oracle. Requires credentials and evidence
/asset/register	POST	Register new biological asset and assign BAIN ID
/asset/{bain_id}/split	POST	Execute spatial split. Retire parent, create child BAIN IDs with inherited lineage
/asset/merge	POST	Execute spatial merge. Retire sources, create new parent with inherited lineage
/asset/query	POST	Batch query: state and policy for multiple BAIN IDs in single request
/asset/{bain_id}/permission	GET	Agent-specific: yes/no for a specific action given agent credentials

6. Spatial Operations

6.1 Split Operation

When a biological asset physically divides - through partial destruction, land subdivision, or administrative redistribution - the parent BAIN ID transitions to Migrating (04), child BAIN IDs are issued for each resulting portion, and the parent moves to Archived (08). Each child inherits the parent's verification history up to the split date but enters the lifecycle independently at Registered (01).

6.2 Merge Operation

When adjacent biological assets are consolidated - through restoration, administrative merger, or ecosystem reconnection - source BAIN IDs transition to Migrating (04), a new parent BAIN ID is issued, and sources move to Archived (08). The merged asset enters at Registered (01) until independent assessment establishes its state.

6.3 Lineage Tracking

All spatial operations create an immutable lineage chain. Every BAIN ID record includes parent_bain_id and child_bain_ids fields, enabling any system to trace the complete genealogy of a biological asset through any number of splits and merges.

7. Validation Rules

Rule	Check	Failure Action
Format	Matches pattern: 2 alpha + 4 alphanum + 8 digit + 7 digit (21 chars)	Reject as malformed
Jurisdiction	JJ is valid ISO 3166-1 alpha-2 code	Reject as invalid jurisdiction
Asset Class	CCCC is registered BCCS asset class code	Reject as unrecognized class
Date	YYYYMMDD is valid calendar date, not in the future	Reject as invalid date
Sequence	SSSSSSS is 7-digit zero-padded integer, 0000001-9999999	Reject as invalid sequence

| Lineage | If parent_bain_id is set, verify parent exists and references this ID | Flag as orphaned |
| Terminal | Query API to verify asset is not Depleted (07) or Archived (08) | Block transaction |

8. Interoperability

System	Integration Pattern
ISIN / CUSIP / SEDOL	Cross-referenced when bio-assets are securitized or tokenized. Mapping table links BAIN IDs to financial identifiers.
ISO 14064 / GHG Protocol	Carbon accounting systems reference BAIN IDs for forest and permafrost assets, linking verified state to offset claims.
Chainlink / Oracle Networks	Data oracle providers feed environmental readings into BCCS state evaluation by referencing BAIN IDs as canonical key.
Agent Wallets (Coinbase)	Transaction authorization checks reference BAIN ID + current state + policy envelope before clearing.
Sovereign Registries	National cadastral, forestry, and environmental registries adopt BAIN ID with namespace delegation.
Insurance / Reinsurance	Parametric insurance policies reference BAIN IDs. State transitions trigger automatic premium adjustments or claims.

9. Governance and Ownership

The BAIN ID specification, encoding rules, asset classification taxonomy, 8-state lifecycle model, and API schema are proprietary intellectual property of KRYONIS Sovereign Systems Limited, Hong Kong. Taxonomy governance, registrar authorization, namespace control, and version control are managed by KRYONIS. Backward compatibility is mandatory for all versions.