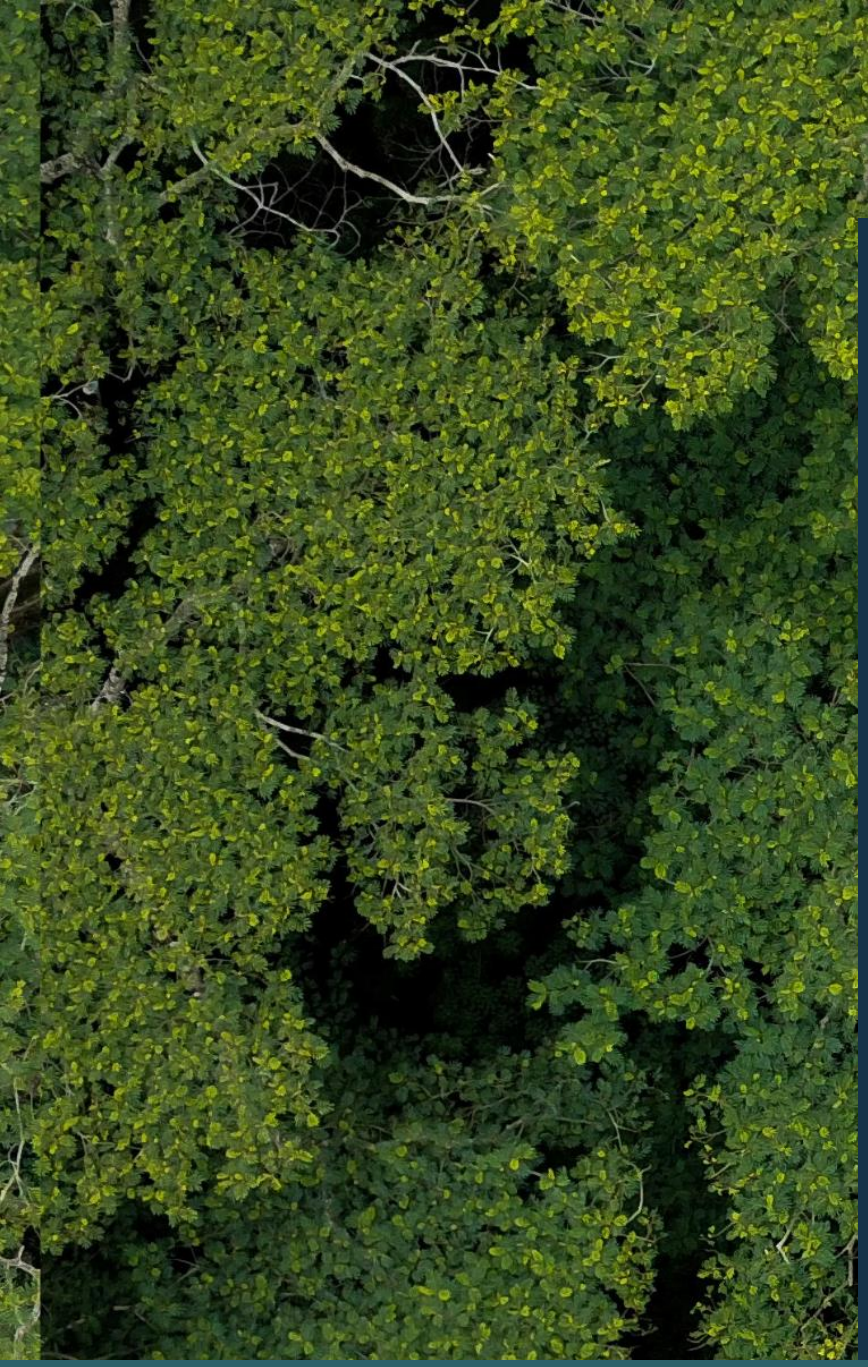


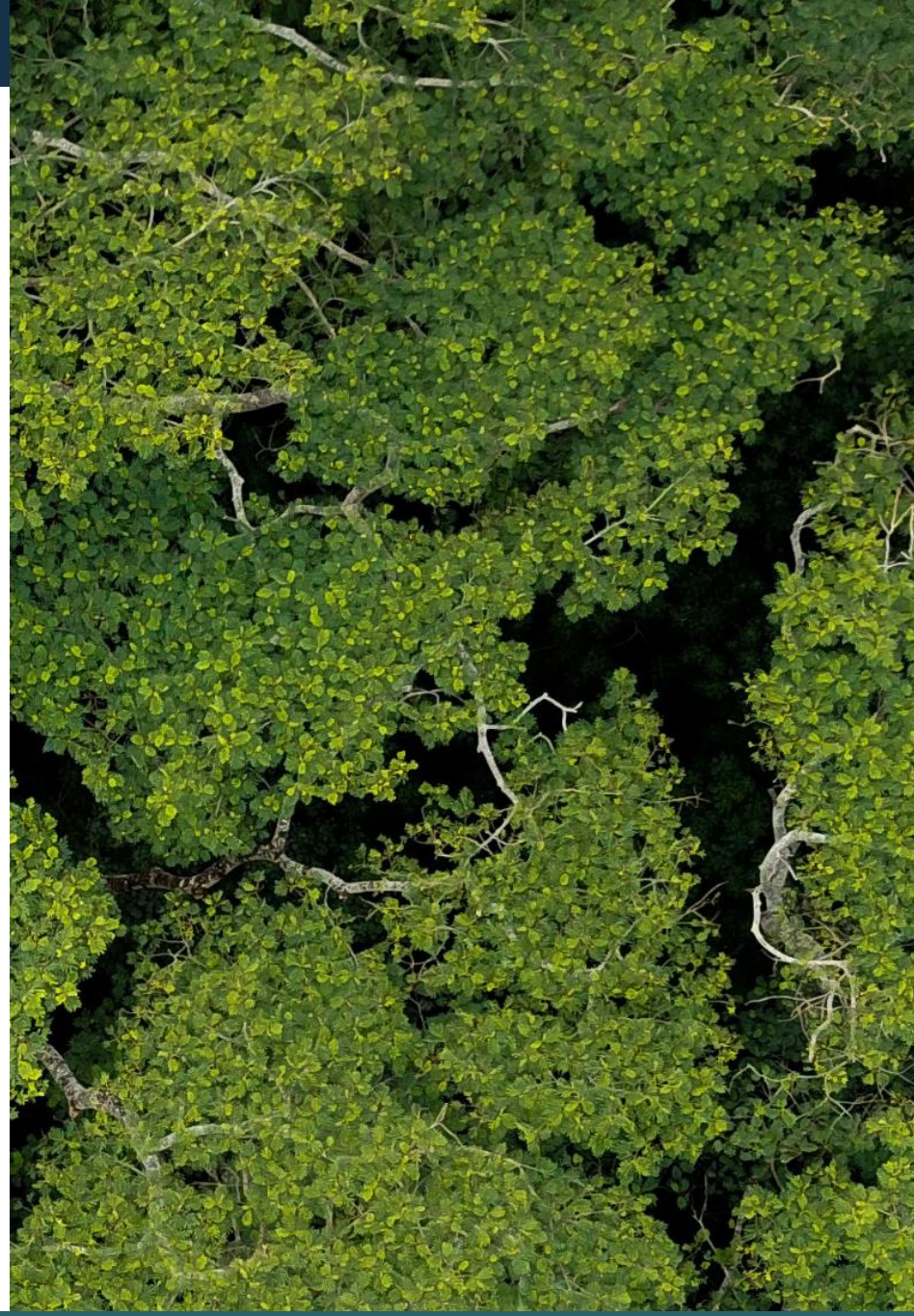
UN environment programme | finance initiative

Principles for Sustainable Insurance

PSI Working Group for Nature

Core Thematic Group – Component 1

Working Group Activity: Integrating Nature in Underwriting



Problem Statement

- Climate risks are increasing insured losses, **but ecosystem condition is not captured in claims or risk models**, leading to a climate-only framing and potential risk mispricing.
- **Nature-related opportunities remain under-recognised**, including the role of healthy ecosystems in reducing losses, maintaining insurability and enabling access to new markets linked to the transition.
- Quantification remains constrained, with **largely qualitative assessments**, limited and non-granular geospatial data, and insufficient forward-looking analysis.
- Nature-related risks and opportunities are not yet systematically integrated into underwriting or product design.
- **Systemic and cascading risks remain insufficiently considered**, including implications for insurability and financial stability.

Objective and Intended Outcomes

*This phase **aims to deliver an informed method that makes nature visible and actionable** in underwriting processes and product design, built on the PSI Nature Uncovered for Insurer series and TNFD's Locate, Evaluate, Assess, Prepare (LEAP) Approach.*

Main intended outcomes:

1. A clearer **causal understanding** of how ecosystem condition changes risk
2. **An aligned framework** for quantifying and integrating ecosystem condition into risk models
3. **Improved capability** of underwriting process and decision-making
4. **Enhanced identification and quantification** of nature-related opportunities and informed product design
5. **Insurers are better equipped to engage with their stakeholders** (incl. customers, brokers, external stakeholders)

Scope & Prioritization

In Scope:

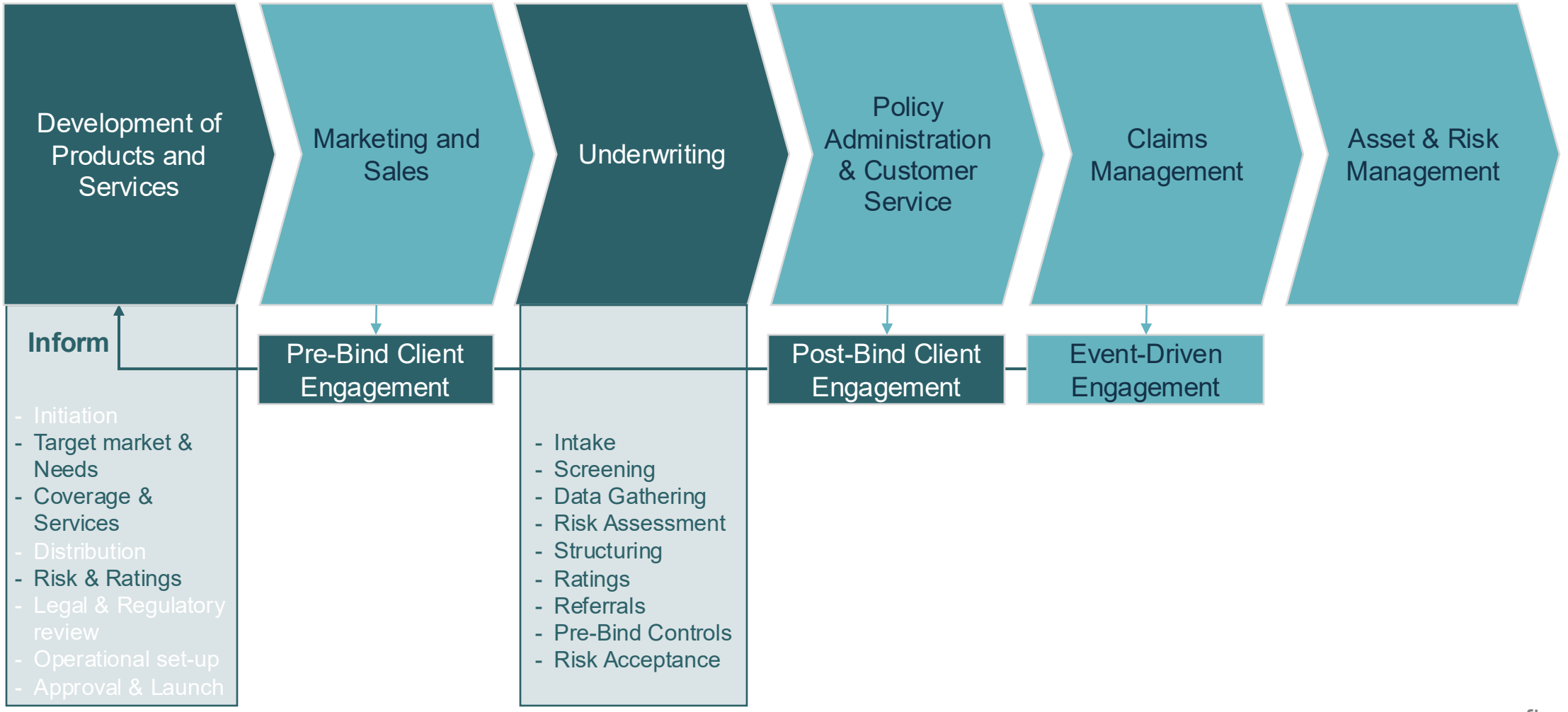
- **P&C (non-life) insurance lines**
- **Physical nature-related risks and opportunities**
- **Light-touch for nature-related transition** risks and opportunities
- Emphasis on **location-based, micro-level risk assessments and quantification**

Out of Scope:

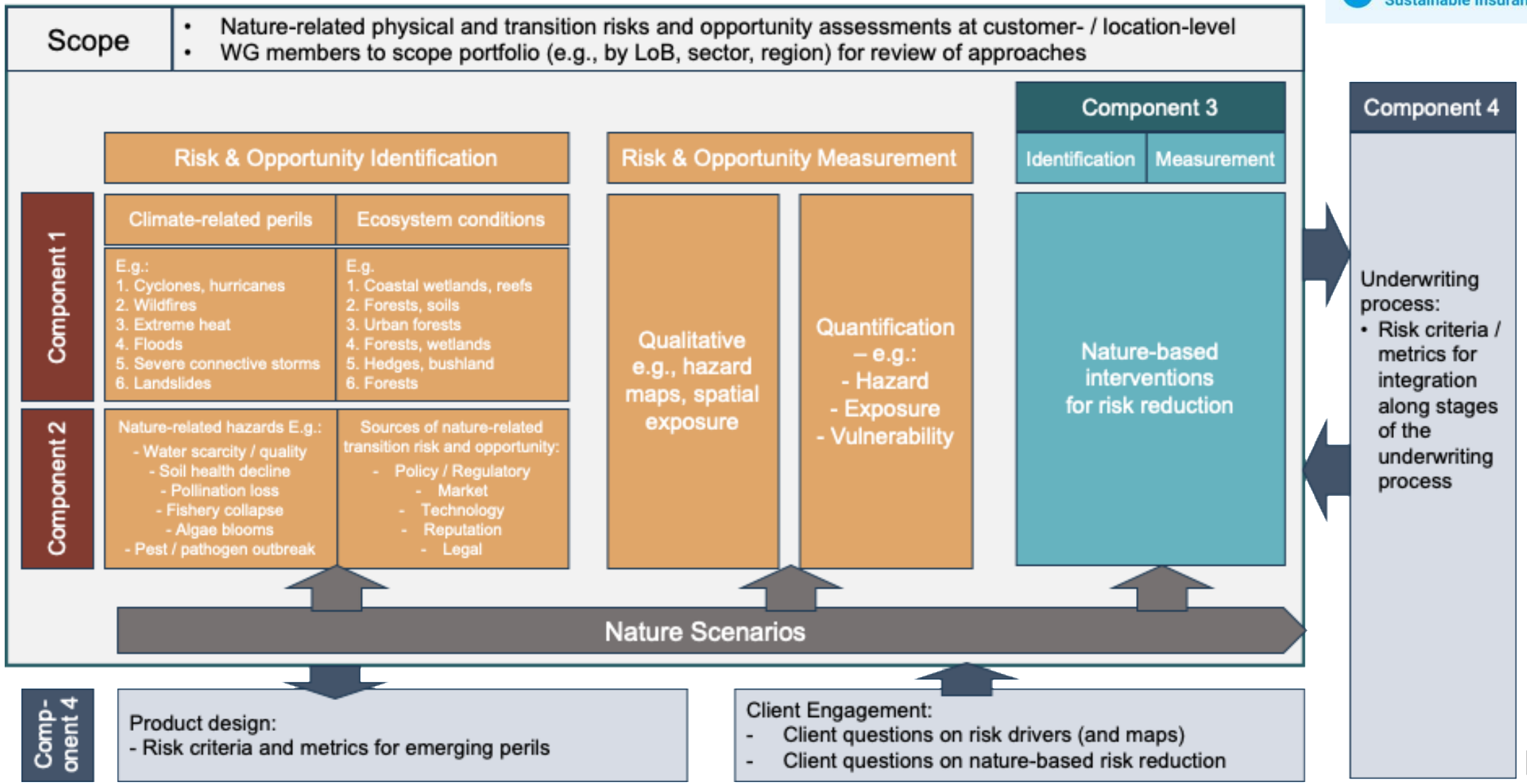
- Portfolio-level ("top-down") **systemic assessments, incl. full ORSA / Pillar 2**
- **Re-designing or recalibrating** catastrophe, pricing or capital models
- Developing or applying global **nature scenarios or macro-economic modelling**

Insurance Functions in Scope for Nature Integration

Insurance Value Chain – Process View



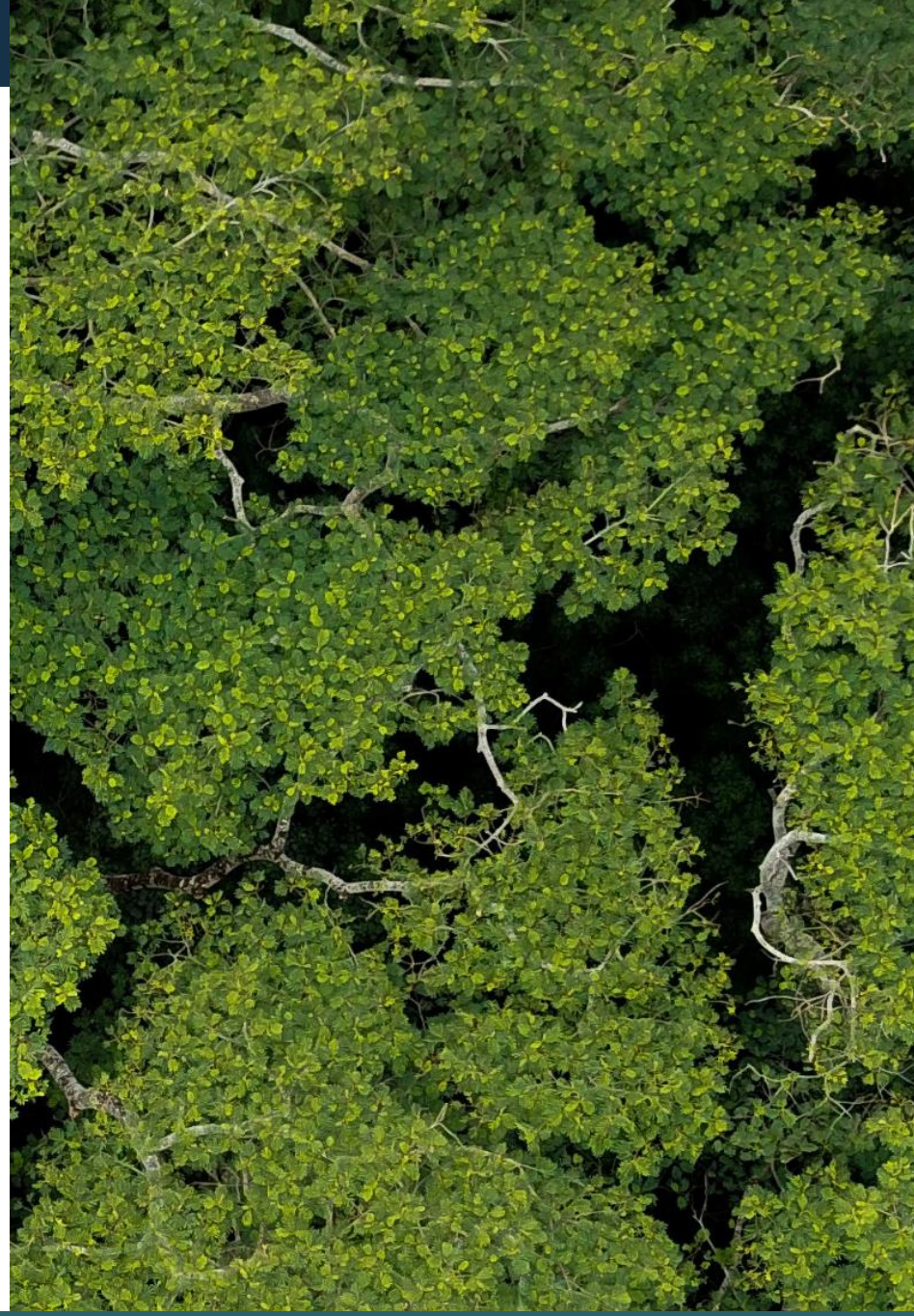
High-Level Approach



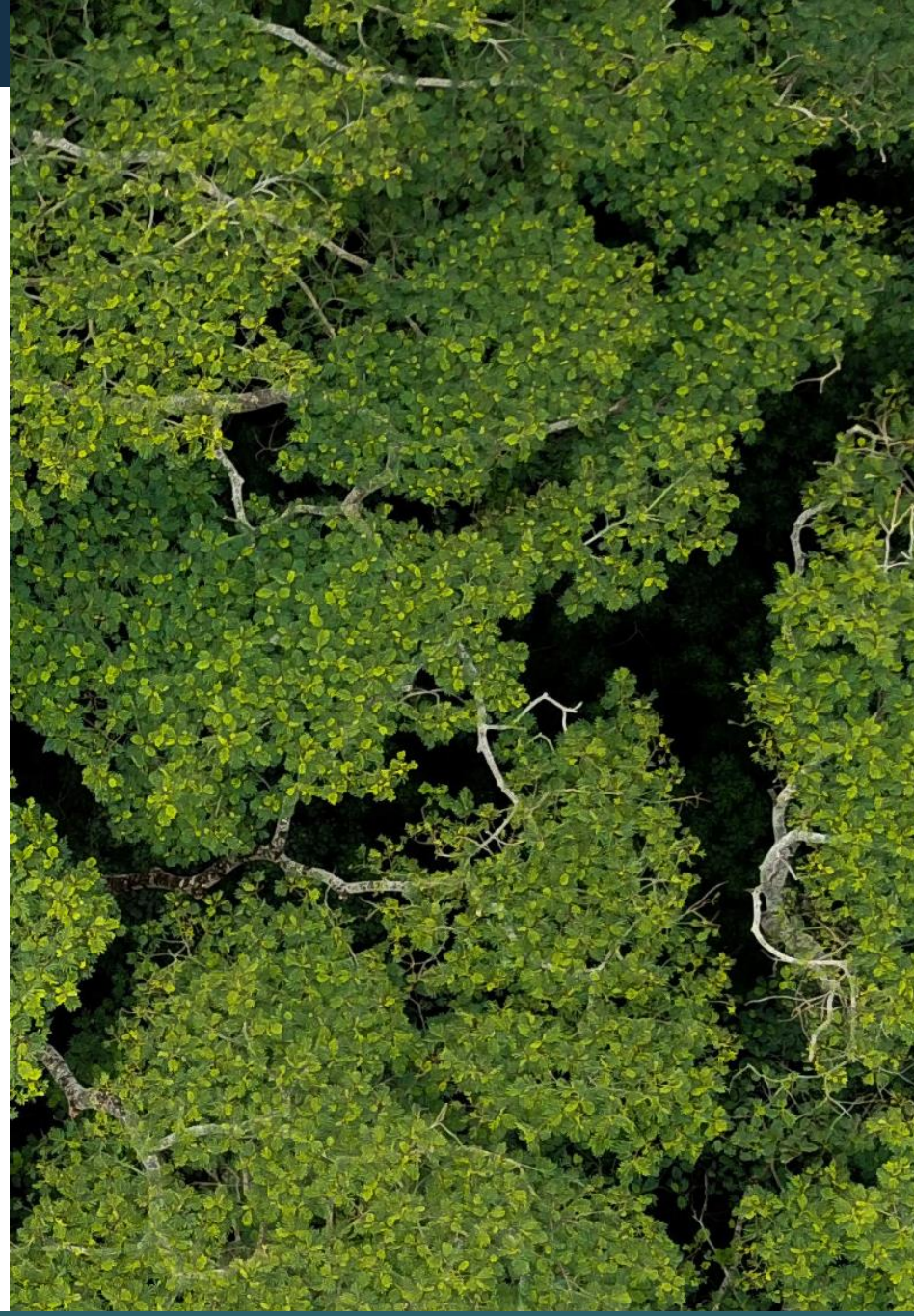
Intended Outputs and Timelines

Intended Outputs	Timelines
Component 1 – Climate-Nature Nexus Atlas	January – July 2026
Component 2 – Nature-Related Risks & Opportunities Register	August – December 2026
Component 3 – NbS Integration Playbook	January – March 2027
Component 4 – Underwriting Toolkit	January 2026 – March 2027

Component 1: Climate-Nature Nexus Atlas



Objectives and Key Steps



Component 1 – Context and Objective

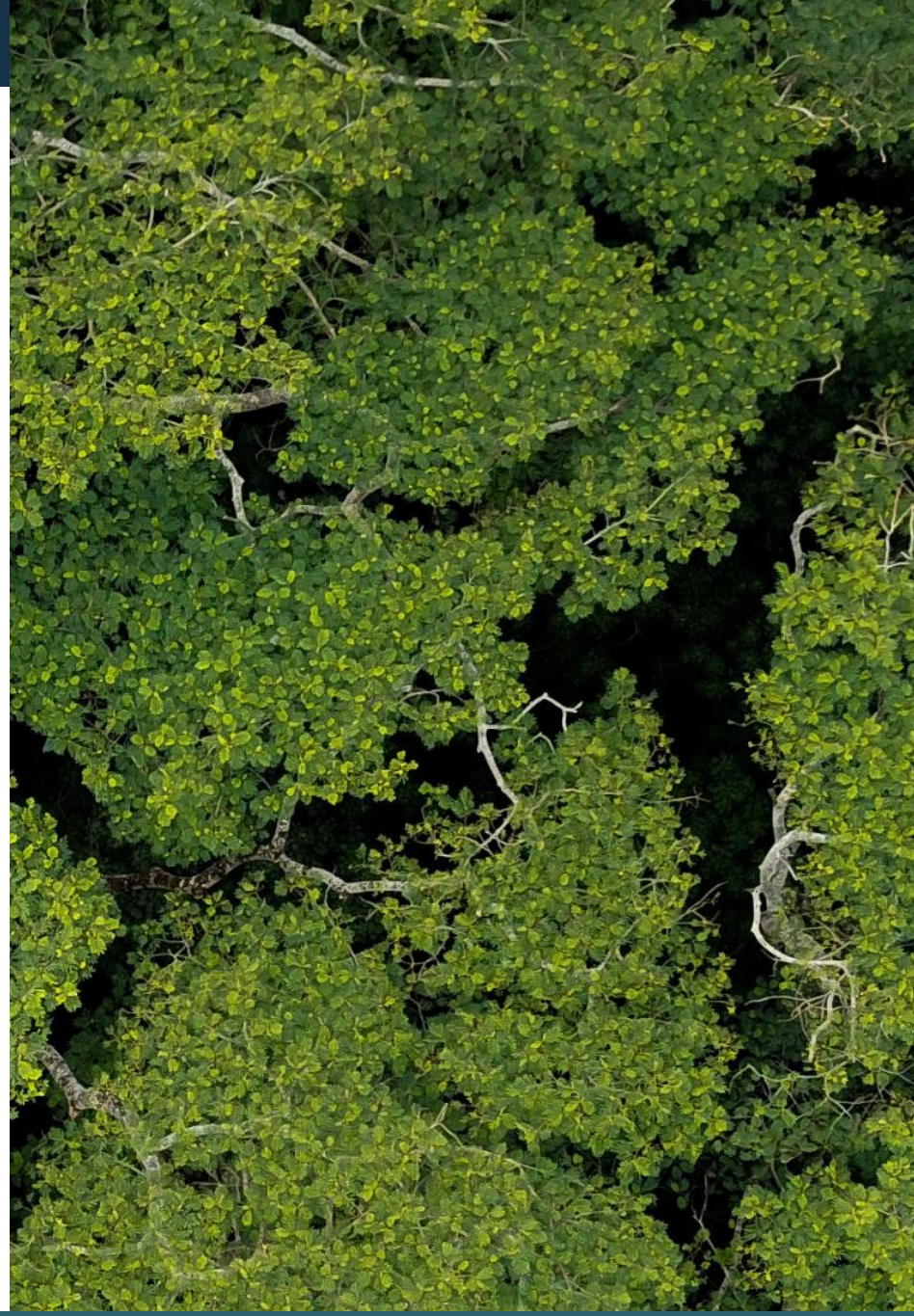
Problem Statement	The state of **nature is not yet systematically integrated into underwriting processes** for climate-related perils, beyond partial or implicit use (e.g., hazard maps), across screening, risk assessment, models, and pricing.
Objective	Identify risk-relevant **ecosystems that are present** and assess how their **extent and condition and species** (where feasible, considering future scenarios) **attenuate or amplify climate-related perils**, and how this information can be integrated into **underwriting processes**.
Intended Output	Climate-Nature Nexus Atlas including: • **mapping** of climate-related perils and risk-relevant ecosystem factors • **framework** to integrate ecosystem (and species) metrics into risk models (≥ 3 peril–ecosystem pairs with agreed metrics and data sources) • **practical underwriting guidance** (≥ 2 lines of business where nature signals inform specific underwriting decisions)

Component 1 – Key Steps

1	Identify climate-related perils in scope where ecosystem factors have an evidence base for influencing risk of climate-related perils
2	Identify relevant ecosystem determinants and metrics (ecosystem extent, condition, and species) for the selected climate-related perils
3	Guidance to integrate ecosystem factors into underwriting processes, including screening, risk models, and decision-making

b

Current State: Insurance Feedback

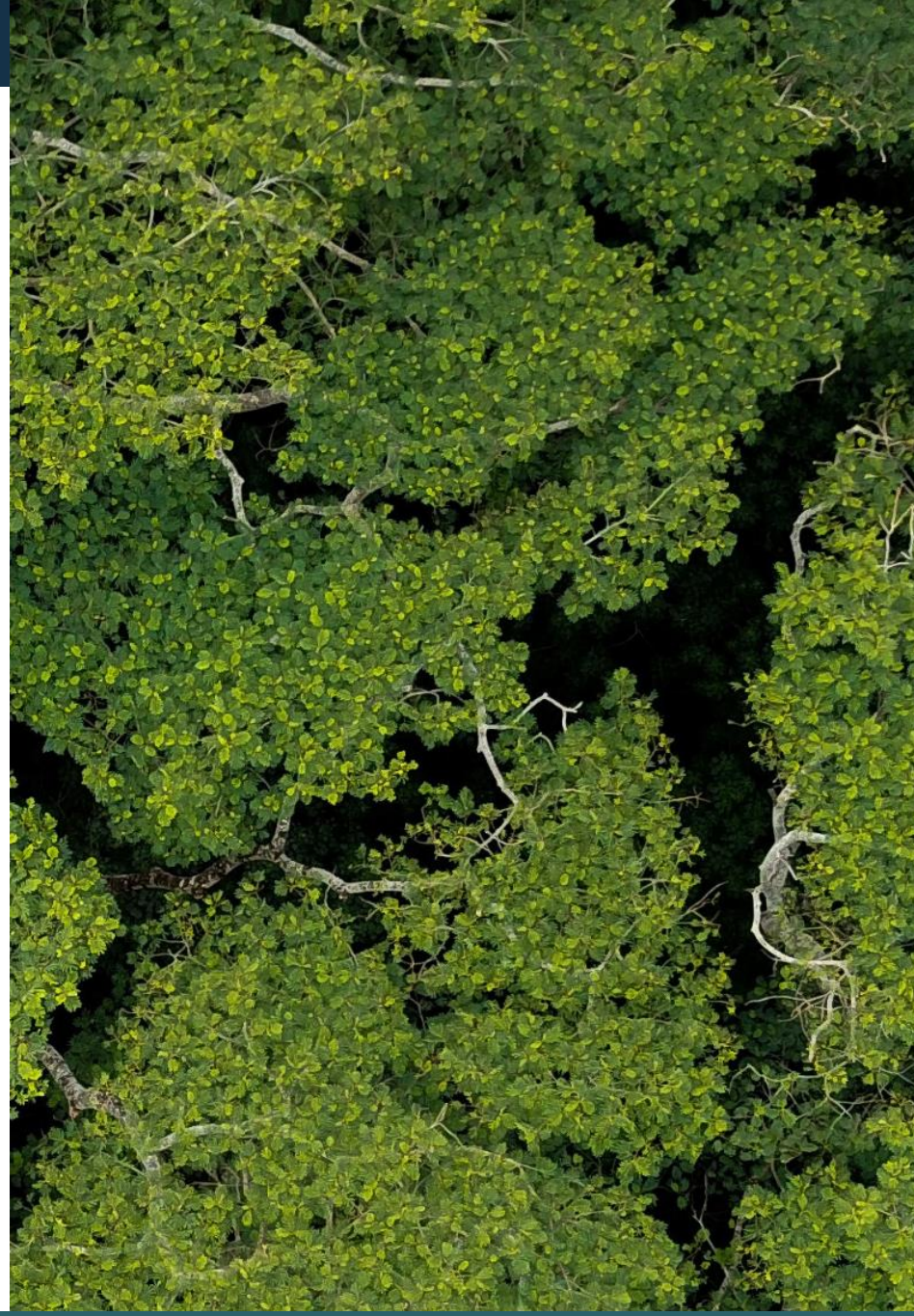


Step 1 - Current State Review: Early Feedback

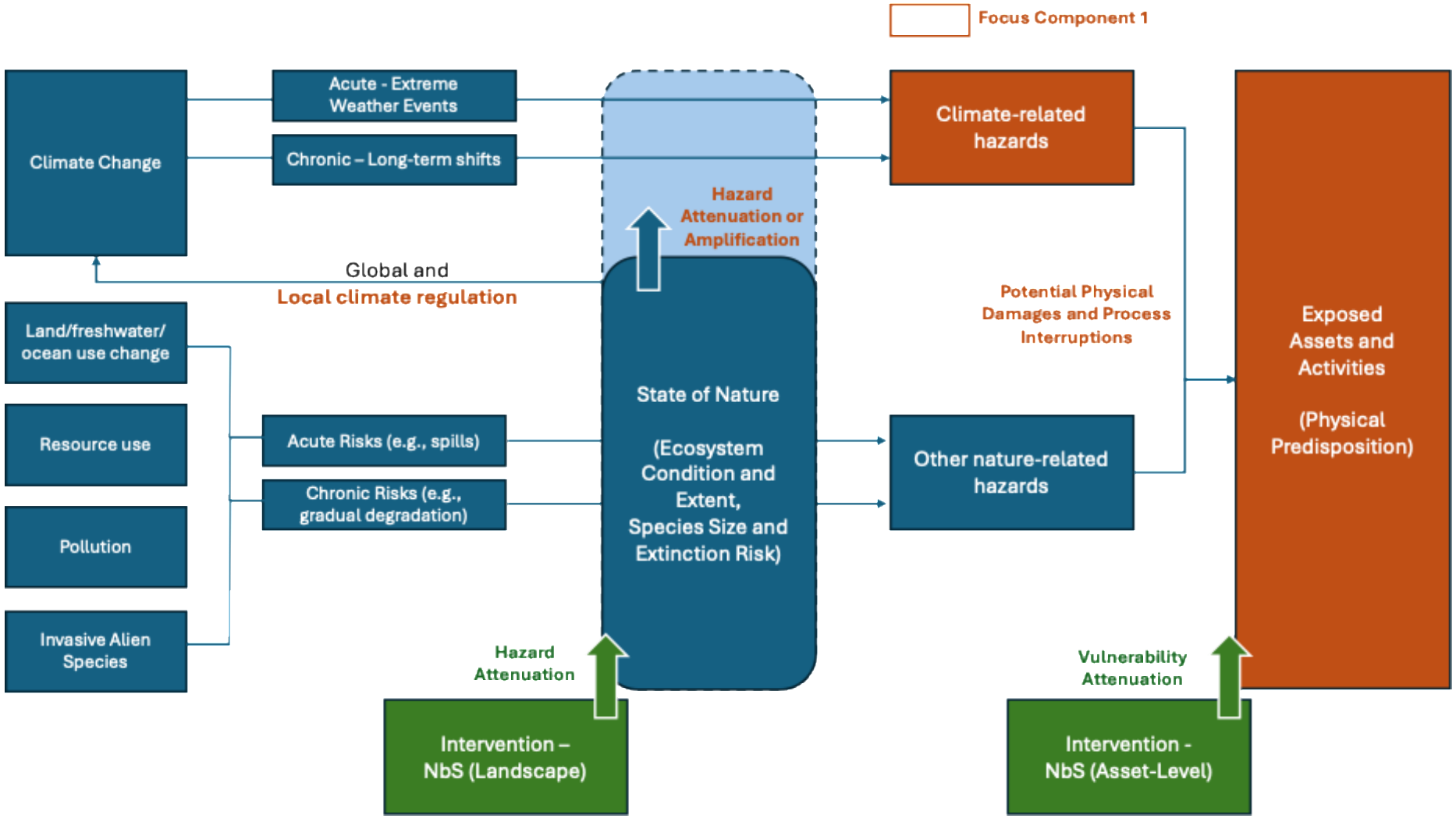
- **Based on member feedback**; this does not represent full market practice. Early progress: more regular, granular ecosystem data in risk profiling, and integration of ecosystem condition into catastrophe models and risk rating.

LEAP Phase	Current State Overview – Based on Feedback Received	Status
LOCATE Location of insured assets	• **Location data collected** for mostly for all exposed assets across perils • **Granularity varies** – postcode to asset level (lat/long, COPE, parcel IDs); geocoding applied for the majority • **Asset attributes do not capture ecosystem condition** in the surrounding area • **Sources:** onboarding, broker schedules, public/private & cadastral registries, geolocation and remote-sensed tools	**Partially in place**
EVALUATE Ecosystem condition at asset locations	• **Ecosystems & condition not routinely identified** – landscape classification favoured over condition • **Updated condition data not used in screening** – relies on zone / flood-plain classifications • **Vendor models use ecosystem proxies** (fire-weather zones; distance-to-watercourse, slope, soil, vegetation) at limited granularity, without regular updates • **Sources:** external vendor models plus public/government registries; ecosystem state generally excluded	**Early / Not yet in place**
ASSESS Integration into underwriting	• **Ecosystem condition not integrated** into risk assessment beyond the above • **Internal (public-data) and vendor tools** used separately for exposure management and pricing • **Targeted mitigation applied/proposed** (e.g. riparian setbacks, event stop-sells) but not through NbS • **Not yet systematically integrated into underwriting processes or decisioning, nor reflected in pricing; claim data does not capture ecosystem condition.**	**Not yet in place**

Draft Methodology – Ecosystems in the Risk Function of Climate-Related Perils



Climate–Nature Nexus: Risk Pathways



In scope for Component 1:

- pathways where ecosystem condition **directly modifies climate-related hazards** and asset vulnerability and,
- where evidence exists, indirectly modifies events via **local climate regulation**.

Nature-related hazards are in scope for **Component 2**.

Component 3 examines potential NbS that could reduce risk and approaches to quantify avoided losses - whereas **Component 1 focuses on condition of existing ecosystems**.

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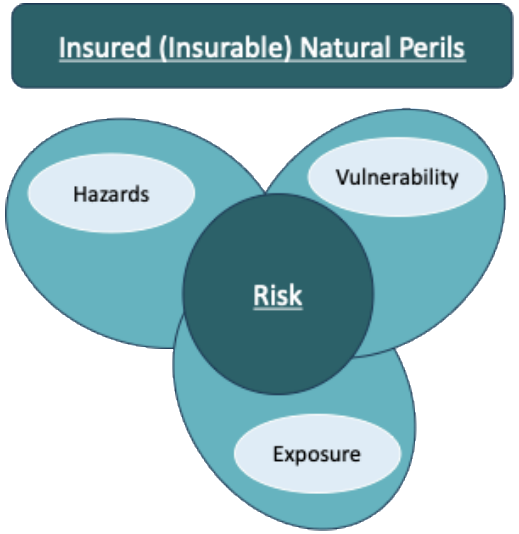
Baseline: Risk Definition and Risk Function

Risk Definition for Underwriting acc. to Rooted in Risk[1]	Nature-related risks are understood as **sources of risk**, such as **chronic** ecosystem degradation or **acute** events (e.g., pollution incidents), that affect the **state of nature**. These changes can **modify underlying physical conditions,** influencing the frequency and severity of insured natural perils **(Component 1),** or give **rise to new or emerging nature-related hazards**, potentially resulting in new insurable perils **(Component 2).** In **Rooted in Risk**, risk is understood as a **function of hazard, exposure, and vulnerability,** resulting **in potential financial loss** associated with a **specific peril.**

Risk Function acc. to IPCC[2]	Hazard	Exposure	Vulnerability	Risk
Description	Potential occurrence of a physical event or trend that may cause harm to people, assets, ecosystems, or services.	People, assets, ecosystems, or activities located in areas that could be affected by a hazard.	Propensity to be adversely affected, reflecting sensitivity to harm and limited capacity to cope or adapt.	Potential adverse outcomes arising from the interaction of hazard, exposure, and vulnerability.



1 UNEP FI (2025). Rooted in Risk. Nature Uncovered for Insurer Series. Geneva: unepfi.com/ based on TNFD (2023) and NGFS (2023).
2 IPCC AR6 Working Group II – Glossary – ipcc.ch/

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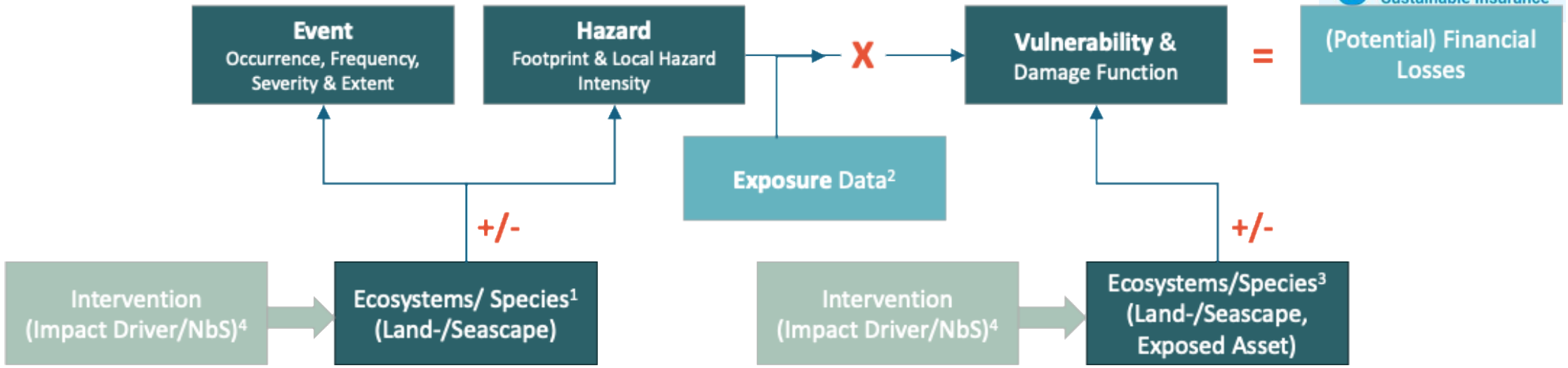
Ecosystems in the Risk Function



1	Ecosystems include (semi-)natural and intensive land-use systems. Through ecosystem extent and condition (and species), at the land(sea-)scape scale, ecosystems can influence **event frequency and severity** (for some perils - through influencing local climate regulation) and can **modify hazard behaviour and local hazard intensity** before hazards reach exposed assets.
2	Exposed assets may include (semi-)natural ecosystems (and species) themselves (e.g. mangroves, cropland) and physical assets located within ecosystems. Longer-term **exposure changes** linked to ecosystem degradation (e.g. relocation, production shifts) are **out of scope for component 1**.
3	Where **ecosystems** are themselves insured, extent and condition influence **vulnerability** through damage severity and recovery capacity. Where **physical assets** are insured, ecosystem condition is **hazard-modifying** where it modifies intensity before reaching the asset and **vulnerability-modifying** where the asset owner can influence ecosystem state directly (e.g. on-site vegetation, defensible space). Cat models apply this distinction inconsistently.
4	The primary focus is on **current state indicators** of existing ecosystem condition. For underwriting integration, **temporal dimension** matters: (a) **dynamic indicators** - active processes changing ecosystem condition (e.g. deforestation rate, pest infestation, restoration programmes) - signal where ecosystem condition is heading over the policy period, informing risk selection; and (b) for **scenario analysis**, the full risk pathway from impact drivers through ecosystem condition to hazard and loss can be considered.

Step 1: Climate-Related Perils and Ecosystems in Scope

- **Insured natural perils** (meteorological, hydrological, climatological) affected by climate change and nature loss.
- Focus on **acute extreme events c**overed by insurers (e.g., storms, floods, hail, wildfire), with **insured slow-onset perils** (e.g., drought) also included.
- **Non-insured slow-onset trends** (e.g., sea-level rise) are recognized indirectly as **drivers increasing event occurrence and intensity** (e.g., coastal flooding).

Ecosystems are the functional units of nature, interacting **living and non-living components** (plants, animals, microorganisms, soil, water, air, nutrients, climate) functioning together as a system. **Species** are the living organisms that **underpin ecosystem functioning** (IPBES).

This results in consideration of the following perils:

1. **Tropical cyclones** (wind, surge, flooding)
2. **Extratropical cyclones** (wind, surge, flooding)
3. **Severe convective storms** (SCS; tornado, wind, hail, flooding)
4. **Fluvial floods**
5. **Pluvial floods** (surface water, flash)
6. **Coastal floods** (surge / wave action)
7. **Landslides** (slope failure, mudflows)
8. **Wildfires**
9. **Droughts** (agricultural, hydrological)
10. **Extreme snowfall / freezing rain / ice**

Ecosystems are grouped using typologies based on shared biophysical and functional characteristics (IUCN typology, applied in TNFD).

Levels of aggregation relevant for Component 1:

- **Level 1 – Realms**: Broad domains (terrestrial, freshwater, marine) used for high-level framing.
- **Level 2 – Biomes**: Used to structure the high-level review of the evidence base.
- **Level 3 – Ecosystem Functional Groups (EFGs):** Used for **detailed evidence review**, as hazard-regulation functions and ecosystem condition metrics vary across EFGs.

Step 1: Approach for Peril-Ecosystem-LoB Mapping

Climate-Related Peril and Hazards ->	TC Wind	TC Coastal Flood	Wildfires	[…]
Biome A				
Ecosystem Group 1	**	-	**	[…]
Ecosystem Group 2	*	-	**	[…]
Biome B				
[…]	-	***	-	[…]
Line of Business -> - Property - […]	Yes	Yes	No	[…]

Key

***	**Strong, well-established connection;** substantial body of research demonstrating effects on hazard regulation and/or vulnerability, with defined methods and/or indicators available.
**	**Established connection;** emerging or partial research on hazard regulation and/or vulnerability, but methods and indicators are not yet clearly specified or standardised.
*	**Mechanism recognised/plausible,** but not yet empirically demonstrated for this pairing
-	**No documented connection identified** in the literature or research on hazard regulation or vulnerability to date.

*Note: The **symbols (*/–)** indicate the strength of the evidence base only. They **do <u>not</u> imply a decrease or increase in risk**, but rather the degree to which ecosystem state (including species) has been shown to influence hazards and/or vulnerability in the literature.*

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Step 2 – Derive relevant Ecosystem Determinants (1/2)

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Approach for Mapping Ecosystems to the **Generic Risk Function: [By Peril]**

- Additional determinants and metrics for the **respective ecosystem functional group(s) (EFG)**

Peril-Ecosystem Pair				Event Generation						Local Hazard Intensity					
Peril	Hazard	Status of Determinants	EFG	Primary Physical Determinants	Input data and metrics	Modifier Event Determinants	Quantitative Parameters	Determinant–Event Causal Pathway	Output	Primary Physical Determinants	Input data and metrics	Modifiers Local Hazard Intensity Determinants	Quantitative Parameters	Determinant–Hazard Intensity Causal Pathway	Hazard Intensity Output
Tropical Cyclone	Coastal Flooding	Baseline Assumptions	N/A	*Governing determinants of event occurrence, probability, severity, and spatial footprint*	*Observational datasets and derived indices*	*Ecosystem state variables modulating event occurrence, probability, severity, and spatial footprint*	*Measurable ecosystem condition indicators relevant to event occurrence, probability, severity, and spatial footprint*	*Mechanistic description of how physical and ecosystem determinants propagate to event outputs*	*Characterisation of event occurrence probability, and spatial footprint*	*Governing physical determinants of local hazard intensity*	*Observational datasets and derived metrics*	*Ecosystem state variables modulating local hazard intensity determinants*	*Measurable ecosystem condition indicators relevant to local hazard intensity*	*Description of how physical and ecosystem determinants translate into local hazard intensity and propagation*	*Spatially explicit representation of hazard intensity across the event footprint*
		New	M1.1	*Ecosystem-mediated event determinants* *(incl. current state of nature and dynamic indicators)*	*EFG-specific metrics and indices* *Core metrics vs. in-depth metrics*	*EFG-specific modulation of event occurrence, probability, severity, and spatial footprint* *Core indicators vs. in-depth determinants*	*Quantified effect magnitudes of ecosystem condition on event parameters* *Core metrics vs. in-depth metrics*	*Ecosystem-mediated modification pathways and their effect on event outputs* *Core metrics vs. in-depth metrics*	*How ecosystem condition modifies event outputs*	*Additional physical determinants introduced by this ecosystem* *(incl. current state of nature and dynamic indicators)*	*EFG-specific observational metrics and derived indices* *Core metrics vs. in-depth metrics*	*EFG-specific modulation of local hazard intensity and rate of hazard propagation* *Core indicators vs. in-depth determinants*	*EFG-specific modulation of local hazard intensity and rate of hazard propagation* *Core metrics vs. in-depth metrics*	*Ecosystem-mediated modifications to hazard intensity relationships* *Core metrics vs. in-depth metrics*	*Ecosystem-adjusted hazard intensity outputs*
		New	T2.1 T2.2	[xxx]	[xxx]	[xxx]	[xxx]	[xxx]	[xxx]	[xxx]	[xxx]	[xxx]	[xxx]	[xxx]	[xxx]
		New	[xxx]	[xxx]	[xxx]	[xxx]	[xxx]	[xxx]	[xxx]	[xxx]	[xxx]	[xxx]	[xxx]	[xxx]	[xxx]

Draft

Step 2 – Derive relevant Ecosystem Determinants (2/2)

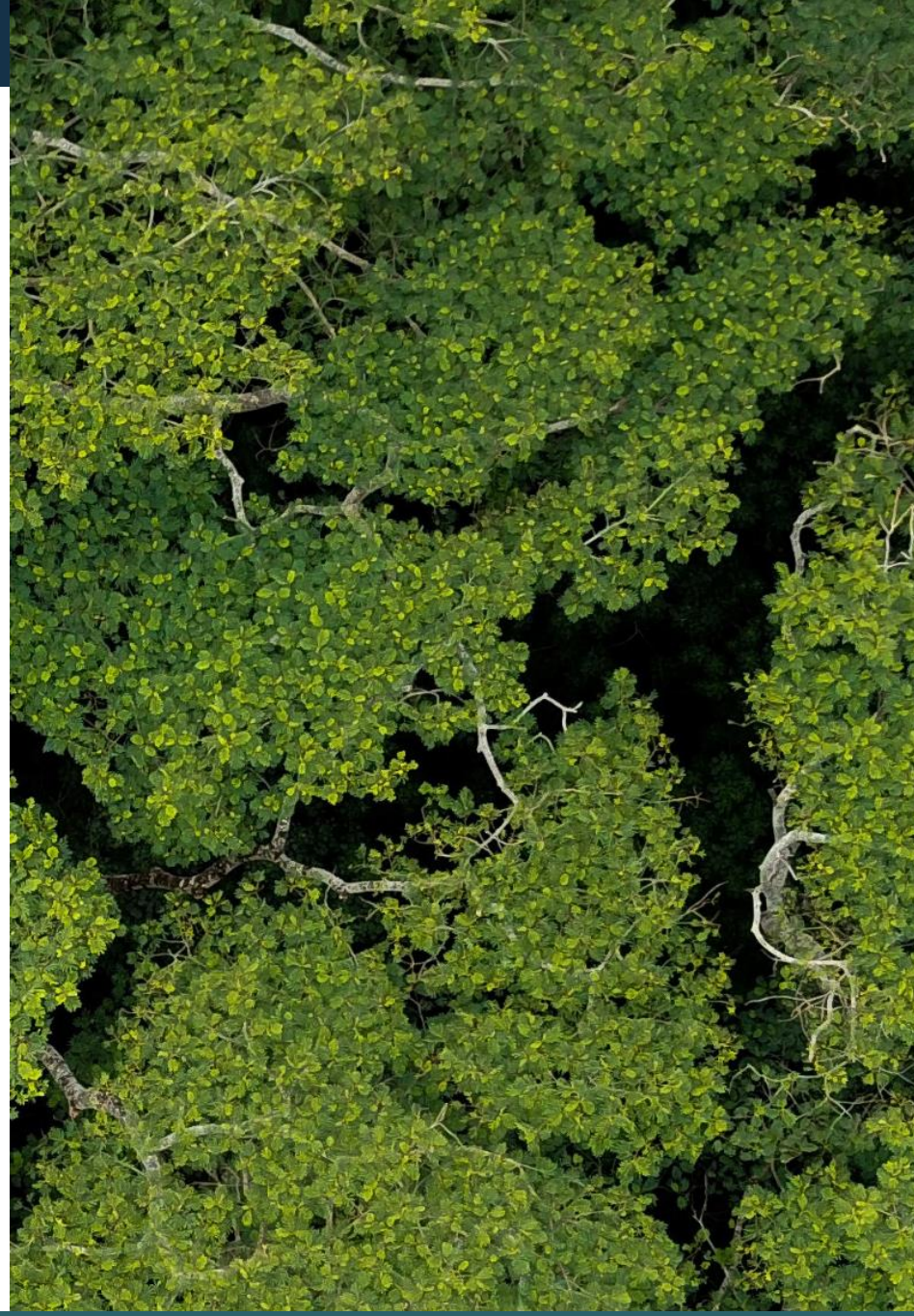
Principles for Sustainable Insurance

Approach for Mapping Ecosystems to the **Generic Risk Function: [By Peril]**

➢ Additional determinants and metrics for the **respective ecosystem functional group(s) (EFG)**

Peril-Ecosystem Pair				Exposed Assets	Vulnerability & Damage Function						Integrated Risk Assessment Output	Cascading / Secondary Hazards
Peril	Hazard	Status of Determinants	EFG	Insured Assets	Physical Damage Mechanism	Vulnerability - Key Parameters	Input Data and Metrics	Vulnerability & Damage Mechanism Modifier	Quantitative Parameters	Output – Damage Ratio Estimation		
Tropical Cyclones	Coastal Flooding	Baseline Assumptions	N/A	*Typology of insured assets exposed within the hazard event footprint*	*Proximate pathway by which hazard contacts and damages the exposed asset*	*Asset properties determining susceptibility to each damage mechanism*	*Datasets used to characterise and assess asset vulnerability*	*Asset-proximate ecosystem condition modifying the operative damage mechanism and asset response*	*Measurable ecosystem condition indicators relevant to vulnerability and damage estimation*	*Damage ratio by asset class as a function of hazard intensity, expressed as mean and distribution*	*Output combining occurrence probability, hazard intensity, exposure, and vulnerability*	*Secondary hazards triggered by or associated with this hazard*
		New	T1.1 T1.2	*EFG-specific insured asset exposure considerations*	*Ecosystem-mediated modification of damage mechanism*	*EFG-specific modifications to asset vulnerability parameters* *(incl. current state of nature and dynamic indicators)*	*EFG-specific vulnerability input data and metrics* *Core metrics vs. in-depth metrics*	*How EFG-specific ecosystem condition modifies the operative damage mechanism and asset susceptibility* *Core indicators vs. in-depth determinants*	*Quantified ecosystem condition metrics and their evidenced effects on damage mechanism and vulnerability* *Core metrics vs. in-depth metrics*	*How ecosystem condition modifies damage ratio estimates*	*How ecosystem condition modifies the integrated risk output*	*Secondary hazards specific to this ecosystem*
		New	M1.3	[xxx]	[xxx]	[xxx]	[xxx]	[xxx]	[xxx]	[xxx]	[xxx]	[xxx]
		New	[xxx]	[xxx]	[xxx]	[xxx]	[xxx]	[xxx]	[xxx]	[xxx]	[xxx]	[xxx]

Ecosystems in Underwriting Process: Early Draft and different Maturity Levels



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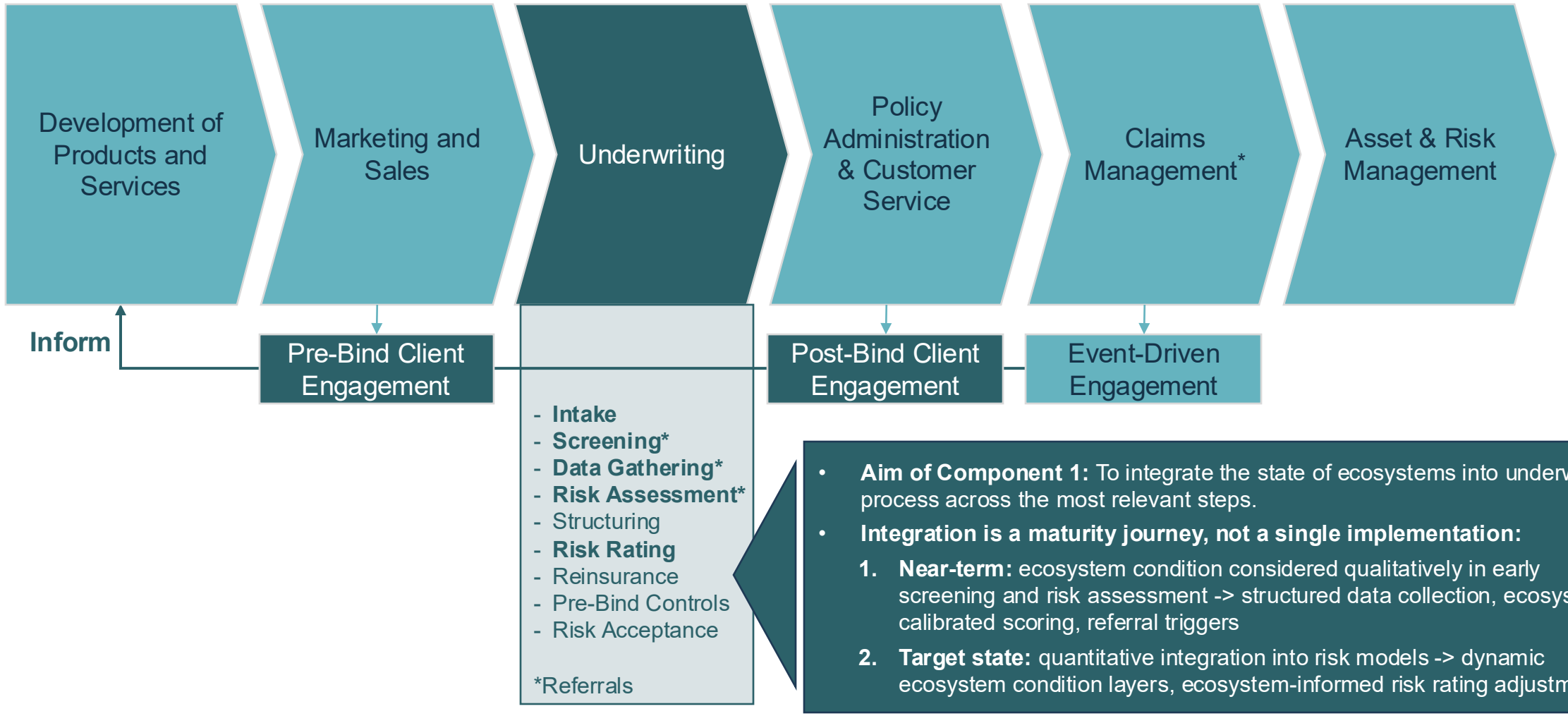
Step 3 - Component 1 in the Insurance Value Chain

Principles for Sustainable Insurance

Insurance Value Chain – Process View



- **Aim of Component 1:** To integrate the state of ecosystems into underwriting process across the most relevant steps.
- **Integration is a maturity journey, not a single implementation:**
  1. **Near-term:** ecosystem condition considered qualitatively in early screening and risk assessment -> structured data collection, ecosystem-calibrated scoring, referral triggers
  2. **Target state:** quantitative integration into risk models -> dynamic ecosystem condition layers, ecosystem-informed risk rating adjustments

Integration of Nature in Scope Not in Scope

* Claims data as enabler for calibrating damage functions

Step 3 – Underwriting Toolkit

Draft

Selected Climate-Related Peril	Extratropical Cyclone	Ecosystem Functional Group (EFG)	MFT1.3 Coastal saltmarshes and reedbeds
Selected Line of Business (LoB)	Commercial Insurance	Maturity Level	Level 1 (Early Integration)

TNFD LEAP	Underwriting Process					
		Baseline	Maturity Level 1: Discretionary Overlay of Ecosystems	Maturity Level 2: Quantitative Ecosystem Scoring and Scenario Analysis	Maturity Level 3: Recalibration and Implementation in Risk Models	UW Outcome
Potential Gaps						
Locate Location of Asset Specifics of Asset	Data Gathering	*[Details]*	*[Details]*	*[Details]*	*[Details]*	'No decision – insufficient data may return to broker'
Evaluate Ecosystem Interface Ecosystem Condition	Screening	*[Details]*	*[Details]*	*[Details]*	*[Details]*	Based on Eligibility/Appetite Filter -> Proceed or Early Decline
Assess Risk Assessment Risk Management	Risk Assessment	*[Details]*	*[Details]*	*[Details]*	*[Details]*	Based on Risk Quality -> Decline, Refer or Proceed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