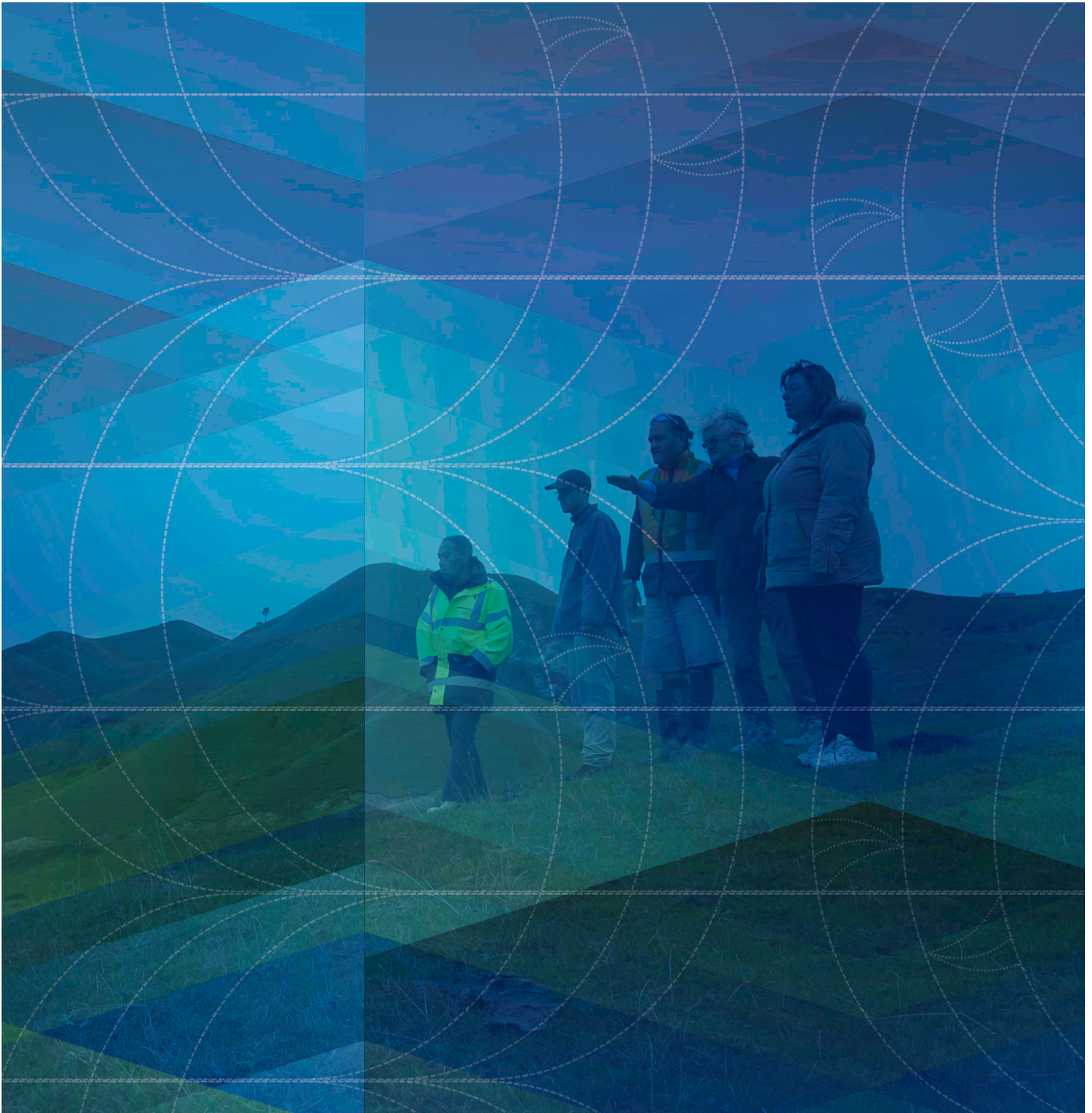


Kaitiaki Intelligence Platforms



Robin Mitchell
Madison Seymour

Meeting the Needs of the Sustainable Finance Sector:
Informing the Kaitiaki Intelligence Platform Design

The Kaitiaki Intelligence Platforms (KIPs) project aims to position Māori at the forefront of cutting-edge remote environmental sensing in Aotearoa.

Leveraging the latest and emerging technologies, this project is designing a robust tech platform that will empower iwi to access real-time and precise information about the environmental condition of their rohe (territories). Furthermore, it will equip Māori farming collectives with the essential data to confidently manage their farms in alignment with their kaitiaki principles. Additionally, the platform will facilitate Māori farms in verifying their sustainable production to markets, regulators, and assurance bodies. Simultaneously, it will provide invaluable data to iwi for informed decision-making regarding their environmental management plans and policies.

Research Team:

Jon Manhire – Managing Director, Agribusiness Group Limited
Prof Pavel Castka – Director, Cognitia International
Kevan Cote – Director, Moose Design
Prof Matthew Wilson – Director, Geospatial Research Institute, UC
Dr Robin Mitchell – Director, Nature Positive
Madison Seymour – Nature Positive
Dr Matthew Rout – Director, Applied Research Collective
Dr Jay Whitehead – Director, Matatihi Ltd
Dr John Reid – Managing Director, Earth Quotient

Creative: Desna Whaanga-Schollum

Photography: Whānau-owned, ahikā farm. Taipōrutu, Te Māhia-mai-Tawhiti. *Indigenous Agro-ecology*, 2014

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Contributors

Dr Robin Mitchell Researcher

Robin is an international biodiversity management expert and restoration ecologist with over 25 years' experience. Robin specialises in advising corporates, governments and the finance sector on nature-climate strategy and reporting; he enjoys learning to be effective in different cultural and organizational settings and solving 'wicked' problems. Robin is based in Otago.

Madison Seymour Researcher

Madison is a systems thinker with a mind for climate justice and healthy ecosystems. As a sustainability consultant and social scientist, she has worked with a variety of industries, particularly agriculture and sustainable finance, to provide research and consultancy services for creating sustainable futures. She has expertise and interest in regenerative agri-food systems, biodiversity restoration, nature-based solutions, international development, emerging nature financing mechanisms and urban sustainability.

Introduction and context

The Kaitiaki Intelligence Platforms (KIPs) project is a Māori-led initiative aimed at designing the Kaitiaki Intelligence Platform (KIP), an environmental sensing network that provides near real-time environmental intelligence to Māori governors and land managers. This network's data could meet the finance sector's increasing demand for detailed environmental information, which is crucial as firms face stricter environmental standards and regulations. These regulations not only affect firms' profitability but also pose financial and reputational risks to investors, who are now more insistent on transparent disclosure of environmental footprints. The KIP has the potential not only to supply environmental data to the financial sector, to generate income, but also to support Māori post-settlement governance entities (PSGEs) and Māori Land Incorporations and Trusts (MALITs) in demonstrating the sustainability of their enterprises, thereby attracting investments and loans under favourable conditions.

The report outlines the history and current state of the sustainable finance sector both globally and in Aotearoa New Zealand (NZ), focusing specifically on the financing mechanisms and evaluation frameworks most pertinent to the primary sector. This includes an examination of environmental, social, and governance (ESG) frameworks, currently in use or under development, which are critical for screening investment decisions and for post-investment protocols such as performance evaluation,

active engagement, and auditing by investors. In-depth analysis of the themes, indicators, and metrics utilized within the ESG frameworks is also undertaken. The literature review synthesizes this information to offer general insights for the KIP design, particularly regarding data generation for the finance sector and understanding the disclosure requirements that PSGEs/MALITs need to meet to secure sustainable finance.

This report also incorporates the analysis of interviews with 19 finance sector actors including asset and fund managers, impact investors, NZ bank lenders, software platform providers, and regulators. It evaluates the future value of KIP data to these different users and scopes the current barriers that limit the adoption of automated environmental sensing data being within the sector. The report concludes with an outline of the design process and next steps for the KIPs project to meet finance sector needs.

History of 'ESG and the Sustainable Finance Sector

Sustainable finance is defined as financing that considers environmental, social and governance (ESG) considerations when making investment decisions.¹ The application of 'ESG' in investment decisions took off in the mid-2000s but was built on a history of rising concerns about the potentially negative relationship between business activities and society or the environment.

The practice of incorporating wider considerations in the definition of financial 'materiality' to manage risk began in the 1960s. Investors started excluding business activities that were considered risky investments because of social considerations such as association with South African apartheid regime.² This practice became known as socially responsible investment (SRI), which over the decades expanded to incorporate a broader sustainability focus and included environmental and governance considerations.

A milestone was the launch of the first global stock exchange profiling of corporate ESG practices – the Dow Jones Sustainability Indices (DJSI) – in 1999. The DJSI are a family of indices that annually rank the largest companies in the world according to their sustainability performance. These indices set a benchmark for responsible investors. Today high-ESG rated companies have been proven to have better risk management

which has been linked to less volatility in stock price and lower 'tail risk' (the chance of a financial loss occurring during a rare event).³ Empirical evidence shows 'ESG investing' (choosing to invest in highly rated companies, bonds or funds) provides downside protection, especially during a social or economic crisis.⁴ High-ESG rated companies are also generally more profitable and pay higher dividends than low-ESG rated companies and this difference in financial performance for both companies and investors has become more marked over longer time horizons.⁵

Apart from attracting investment, consideration of ESG performance provides companies with the opportunity to meet customer demands as societal expectations of business shift toward demonstrating less harm and, in some cases, creating positive social and environmental impacts. Corporate sustainability initiatives are linked to better financial performance due to their implementation requiring improved risk management and governance processes in general as well as stimulating innovation (such as circular economy initiatives).⁶ This has made an ESG lens popular from both the corporate strategy and investment risk/performance perspective as issues such as climate resilience or environmental impacts, and the effects of these on employee or wider community wellbeing are increasingly understood as financially material.

1. GSIA. (2021). *Global Sustainable Investment Review 2020*. Global Sustainable Investment Alliance. <http://www.gsi-alliance.org/>

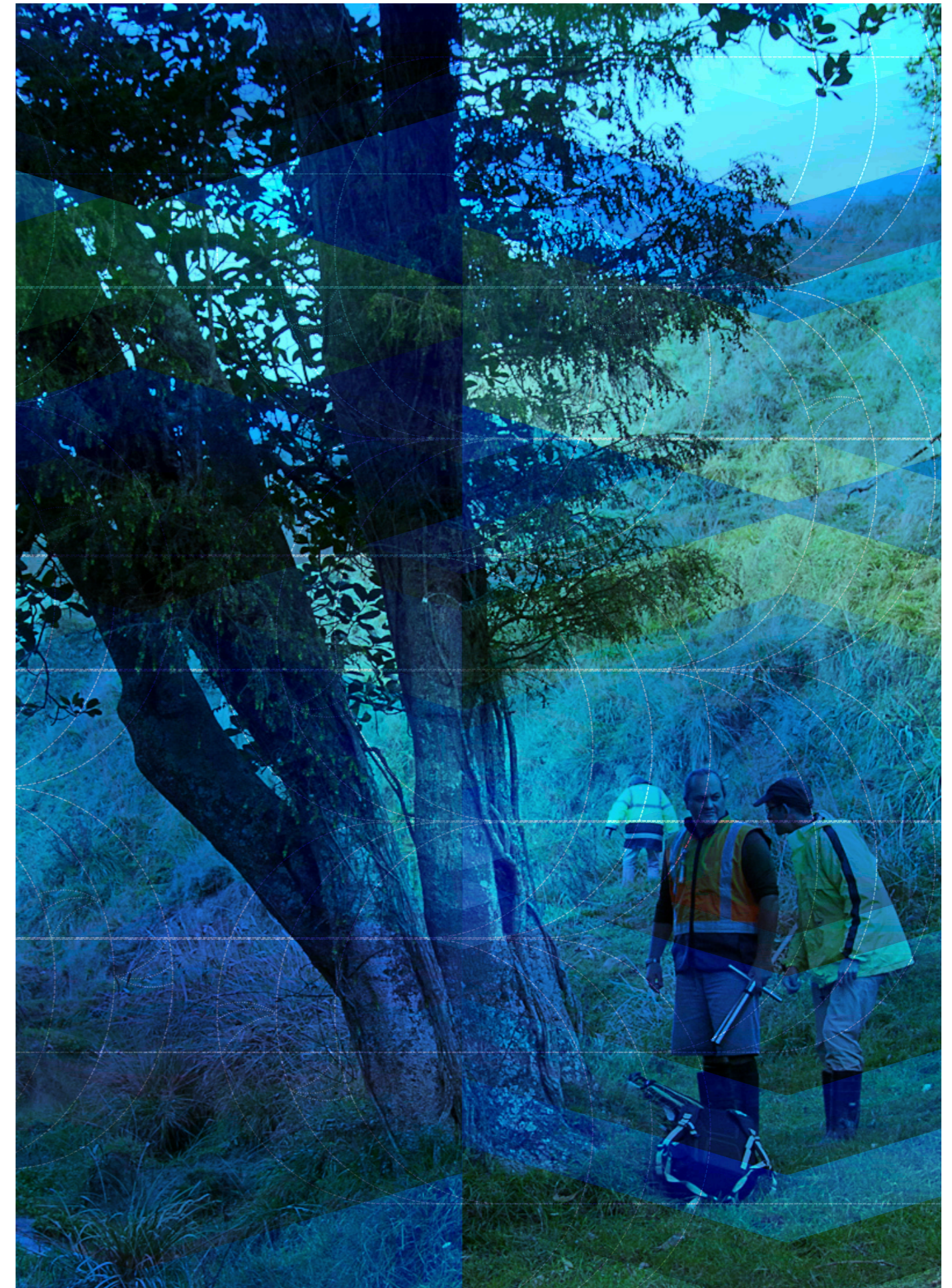
2. MSCI. (n.d.). *The Evolution of ESG Investing*. MSCI. Retrieved February 14, 2023 from <https://www.msci.com/esg-101-what-is-esg/evolution-of-esg-investing>

3. Giese, G., Lee, L.-E., Melas, D., Nagy, Z., & Nishikawa, L. (2019). Foundations of ESG Investing: How ESG Affects Equity Valuation, Risk, and Performance. *The Journal of Portfolio Management*, 45(5), 69–83. <https://doi.org/10.3905/jpm.2019.45.5.069>

4. Whelan, T., Atz, U., Van Holt, T., & Clark, C. (2021). *ESG and Financial Performance: Uncovering the Relationship by Aggregating Evidence from 1,000 Plus Studies Published between 2015 – 2020*. NYU Stern Centre for Sustainable Business. <https://www.stern.nyu.edu/experience-stern/about/departments-centers-initiatives/centers-of-research/center-sustainable-business/research/research-initiatives/esg-and-financial-performance>

5. (Whelan et al., 2021); (Giese et al., 2019)

6. (Whelan et al., 2021)



Literature Review

Sustainable finance industry structure

The sustainable finance industry is a networked series of actors operating on a variety of levels. Figure 1 provides a schematic of the ESG assurance process, and how verification data flows amongst actors. Performance information is reported to lenders, shareholders, equity investors, fund or asset managers, government, or is publicly disclosed. Investors, whether through debt or equity, use this information to evaluate the ESG-related risk or opportunity of their investment and where applicable to also meet the requirements of their credit providers. There are a variety of funding mechanisms used in this investment process. Examples of common funding mechanisms

include sustainability linked bank loans (SLL), impact funds, sovereign debt, private equity, and bonds.

Borrowers/Investees are entities that receive capital to use for their business operations. They use ESG indices to measure their real-world impact (positive and negative) or risk and to report to major investors or other interested parties (such as government, shareholders, or the public). Reporting frameworks used by borrowers could be a global standard, or a mechanism that aligns with specific requirements of financiers. Some ESG reporting may also be a regulatory requirement and may be disclosed to relevant parties (i.e., climate

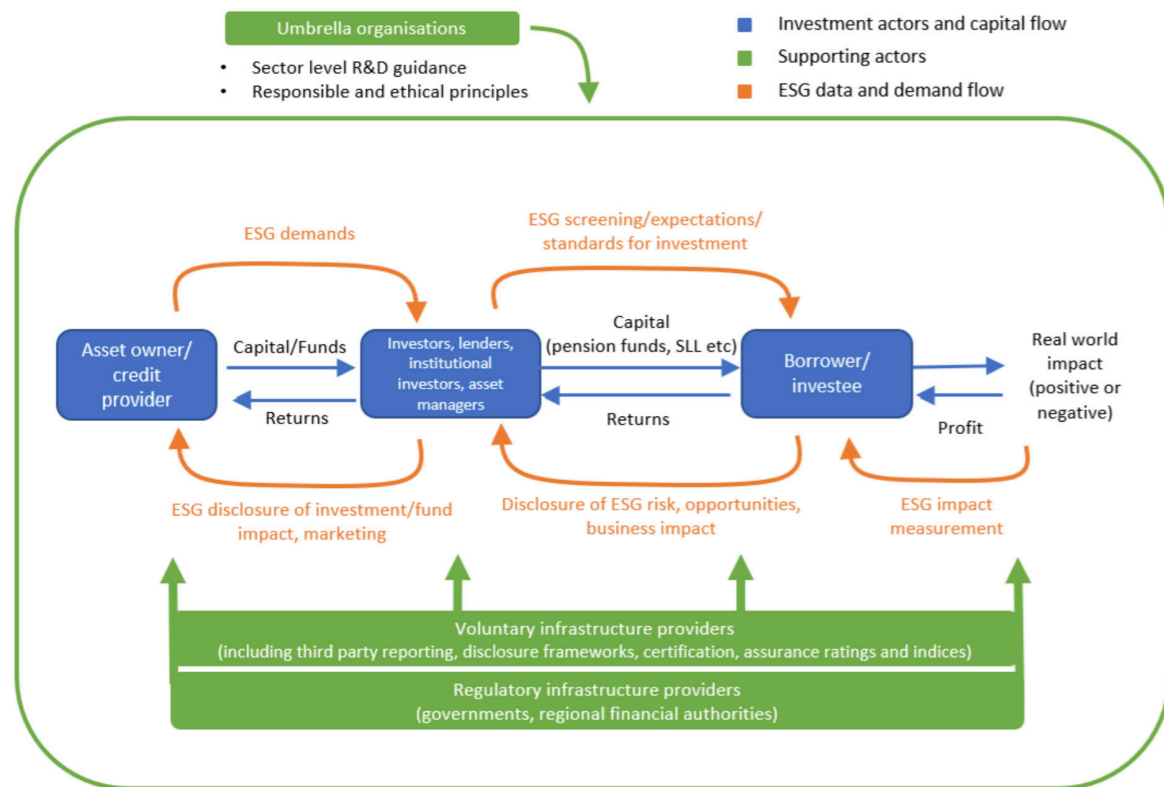


Figure 1: Structure of the sustainable finance industry

Sustainable investment spectrum

APPROACH	TRADITIONAL INVESTMENT	RESPONSIBLE, ETHICAL, SUSTAINABLE INVESTMENT						PHILANTHROPY	
		Exclusionary/negative screening	Norms-based screening	Positive/Best-in-class screening	Sustainability-themed investing	ESG integration	Corporate engagement and shareholder action	Impact investing and community investing	
METHOD	Providing limited or no regard for environmental, social governance and ethical factors in investment decision making.	The exclusion from a fund or portfolio of certain sectors, companies, countries or other issuers based on activities considered not investable. Exclusion criteria (based on norms and values) can refer, for example, to product categories (e.g., weapons, tobacco), company practices (e.g., animal testing, violation of human rights, corruption) or controversies.	Screening of investments against minimum standards of business or issuer practice based on international norms such as those issued by the UN, ILO, OECD and NGOs (e.g. Transparency International).	Investment in sectors, companies or projects selected for positive ESG performance relative to industry peers, and that achieve a rating above a defined threshold.	Investing in themes or assets specifically contributing to sustainable solutions - environmental and social - (e.g., sustainable agriculture, green buildings, lower carbon tilted portfolio, gender equity, diversity).	The systematic and explicit inclusion by investment managers of environmental, social and governance factors into financial analysis.	Employing shareholder power to influence corporate behaviour, including through direct corporate engagement (i.e., communicating with senior management and/or boards of companies), filing or co-filing shareholder proposals, and proxy voting that is guided by comprehensive ESG guidelines.	Investing to achieve positive, social and environmental impacts - requires measuring and reporting against these impacts, demonstrating the intentionality of investor and underlying asset/investee, and demonstrating the investor contribution.	Using grants to target positive social and environmental outcomes with no direct financial return
INTENTION		Avoids harm							
FEATURES AND OUTCOMES		Benefits stakeholders							
		Contributes to solutions							
		Delivers competitive financial returns							
		Manages ESG risks							
		Contributes to better system stability and economic stability							
		Pursues opportunities and creates real-economy outcomes							

Figure 2: Sustainable investment spectrum. Adapted from RIAA, 2022 using definitions from GSIA, 2021

disclosures to government bodies such as the NZ External Reporting Board (XRB)). Reporting may be certified by an external third party for assurance purposes (e.g. BlueMark Assurance Standard).

Notably, the sustainable finance sector has various supporting actors. These include infrastructure developers who create the voluntary and regulatory frameworks for ESG reporting, conduct ESG certifications, assurance ratings or indices. They consist of a variety of global entities such as International Finance Corporation (IFC), International Capital Market Association (ICMA), International Finance Reporting

Standards (IFRS) (which includes the International Sustainability Standards Board (ISSB)), Global Sustainability Standards Board (GSSB), BlueMark, Taskforce for Climate-related Financial Disclosures (TCFD), and Taskforce for Nature-related Financial Disclosures (TNFD), among others. Regional infrastructure developers create regulatory frameworks such as the Europe Union's Corporate Sustainability Reporting Directive (CSRD) and the XRB mandatory climate risks reporting framework. Other supporting actors include 'umbrella organisations': those which are encouraging, connecting, and propelling the development of the sector. Global

	2014	2016	2018	2020	GROWTH PER PERIOD			COMPOUND ANNUAL GROWTH RATE (CARG) 2014-2020
					GROWTH 2014-2016	GROWTH 2016-2018	GROWTH 2018-2020	
Europe* (EUR)	€9,885	€11,045	€12,306	€10,730	12%	11%	-13%	1%
United States (USD)	\$6,572	\$8,723	\$11,995	\$17,081	33%	38%	42%	17%
Canada (CAD)	\$1,011	\$1,505	\$2,132	\$3,166	49%	42%	48%	21%
Australasia* (AUD)	\$203	\$707	\$1,033	\$1,295	248%	46%	25%	36%
Japan (JPY)	¥840	¥5,7056	¥231,952	¥310,039	6,692%	307%	34%	168%

NOTE: Asset values are expressed in billions. New Zealand assets were converted to Australian dollars. In 2020, Europe includes Austria, Belgium, Bulgaria, Denmark, France, Germany, Greece, Italy, Spain, Netherlands, Poland, Portugal, Slovenia, Sweden, the UK, Norway, Switzerland, Liechtenstein. *Europe and Australasia have enacted significant changes in the way sustainable investment is defined in these regions, so direct comparisons between regions and with previous versions of this report are not easily made.

Figure 3: Growth of sustainable investing assets by region in local currency 2014-2020. Source: GSIA, 2021

examples include Global Impact Investment Network (GIIN), Principles of Responsible Investment (PRI), the Climate Bonds Initiative, and the Integrity Council for Voluntary Carbon Markets (ICVCM). These organisations serve to guide the sector, often creating consensus principles and undertaking high-level meta-analysis of sector progress. In NZ, such organisations include Responsible Investment Association Australasia (RIAA), the New Zealand Impact Investing Network, and Toitū Tahua: Centre for Sustainable Finance. These groups oversee the sector and create roadmaps for sector development. These organisations can also be involved in market infrastructure development. For example, Toitū Tahua: Centre for Sustainable Finance developed the NZ Sustainable Agriculture Finance Initiative (SAFI). Internationally, GIIN created and manages the Impact Reporting and Investment Standards (IRIS+) framework and the new GIIN impact lab that is prototyping impact performance benchmarks, indices, and other analytical tools.

The spectrum of ESG investing

There is a broad spectrum of ESG consideration in both investment decision-making and the level of engagement

investors have with investee entities (Figure 2). Each investment actor will have requirements dictating how capital will be deployed driven by both risk management of their investments and expectations around the impact it creates. For example, at minimum, negative/exclusionary screening excludes sectors, companies, countries (based on the concept of 'sovereign risk'). This is often dictated by social norms and may include certain product categories (e.g., weapons, tobacco) or company practices (e.g., animal testing, human rights violations, corruption), or relevant controversies (e.g., Russian Government-owned companies after the Russian invasion of Ukraine). At the opposite end of the spectrum, impact investing involves investment in companies that have an explicit intent to create positive social and environmental benefits alongside financial returns.

Recent trends of the ESG investment sector

In recent years the sustainable investment sector has grown rapidly. Between 2016 and 2020 there was a 55% increase in total global sustainable investment volume (reaching US\$35.5 trillion).⁷ In 2020, sustainable investment assets

FIGURE 7 Global growth of sustainable investing strategies 2016-2020

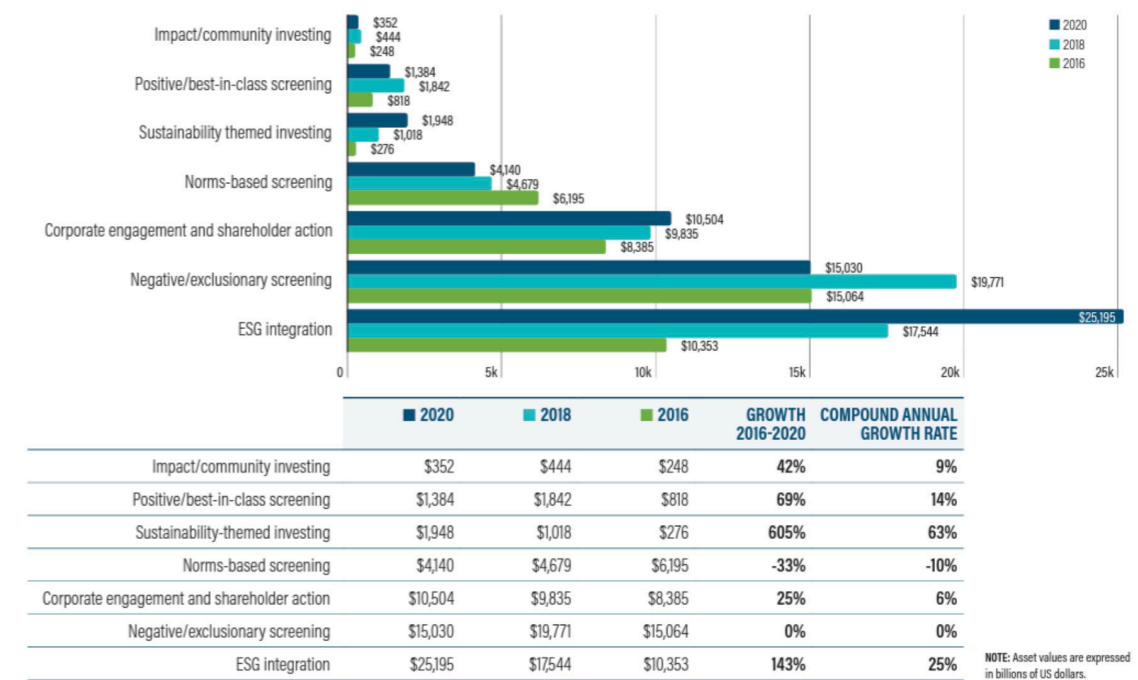


Figure 4: Source GSIA, 2021

Note: Community investing refers to where capital is specifically directed to traditionally underserved individuals or communities, as well as financing that is provided to businesses with a clear social or environmental purpose. Some community investing is classed as impact investing, but community investing is broader and considers other forms of investing and targeted lending activities.

under management made up a total of 35.9% of total assets under management.⁸ Australasia's growth of sustainably invested assets^a is relatively high compared to global averages (Figure 3). There is a drop in the growth rate for the 2018-2020 reporting period for Australasia and Europe, but this is due to a slight change in reporting methods; both regions strengthened their standards for sustainable investment or sustainable finance products, indicating the ongoing evolution of the industry. The rapid growth in ESG investment is being driven by a mix of social and financial considerations such as direct

client demand^b for sustainable outcomes, and better risk management approaches. Investor entity reputation and financial performance have consistently ranked highly as the leading drivers for investors incorporating ESG into their investment decision making.⁹ The topics of greatest ESG concern to investors mirror those which are gaining traction in wider society. Transitional risks (i.e. legal, reputational or financial risk associated with the global transition to a low carbon economy) and physical risks posed by climate change, the biodiversity crisis and other current ESG issues are making the disclosure of

7. (GSIA, 2021)
8. (GSIA, 2021)

9. BNP Paribas. (2019). *The ESG Global Survey 2019*. BNP Paribas. <https://securities.cib.bnpparibas/the-esg-global-survey-2019/>; BNP Paribas. (2021). *The ESG Global Survey 2021*. BNP Paribas. <https://securities.cib.bnpparibas/esg-global-survey-2021/>; PWC. (2022). *PWC's Global Investor Survey 2022*. PWC. <https://www.pwc.com/gx/en/issues/esg/global-investor-survey-2022.html>

a. Sustainable invested assets are defined as those in sustainable investment strategies listed in GSIA, 2021
b. PWC, 2022 refers to 'client' as the actor to whom investors have the fiduciary duty to maximise returns for.

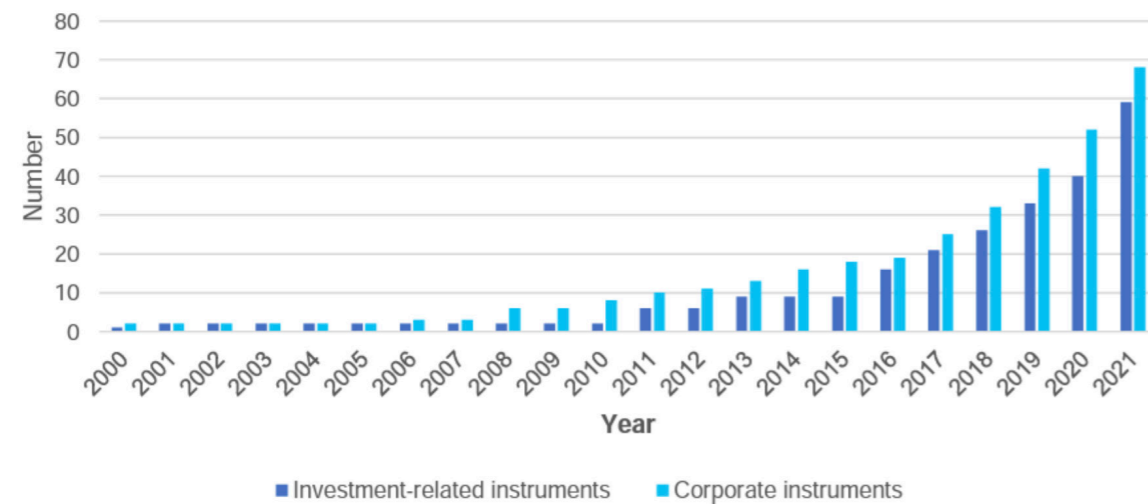


Figure 5: Growth in ESG Reporting instruments overtime (to October 2021). Source: PRI Association, 2022.

financial and non-financial ESG materiality as valuable to investors as traditional financial statistics. Companies involved with environmentally harmful activities such as fossil fuels and industrial animal agricultural are increasingly being included in 'exclusion' lists for funds and portfolios and, recently, sustainability-themed investment strategies (as defined in the investing spectrum, Figure 2) have skyrocketed with a growth of 605% between 2016 and 2020 (Figure 4). This shows evidence of a swift increase in the application of the more targeted ESGs that contributes to solutions-focused investing (such as those on the right-hand side of the spectrum) in recent years.

Complementing the growth of the sustainable finance sector is the development of increasingly detailed and

stringent standards and benchmarks for ESG screening to give structure to and standardise how companies or investors are reporting on ESG issues. Figure 5 shows the rapid growth over the last 10 years of corporate or investor ESG screening and reporting instruments available.^c

Drivers of this growth in ESG reporting instruments are the increase in:

- Materiality of ESG issues for companies (and therefore their relevance to investors);
- Regulatory reporting requirements for investors in different jurisdictions around the world;
- Voluntary reporting schemes that contain reporting requirements on issues such as climate or biodiversity;
- Demand for investor accountability around their financing.¹⁰

10. PRI Association. (2022). *Review of trends in ESG reporting requirements for investors*. Principles for Responsible Investment. <https://www.unpri.org/driving-meaningful-data/review-of-trends-in-esg-reporting-requirements-for-investors/10296.article>

c. PRI, 2022 defines corporate instruments as financial or non-financial reporting instruments that apply to

business as an entity, rather than any investments they hold. This includes reporting on material ESG issues and in some cases also the impact of products or operations on people and the environment. Investment-related instruments are those used by investors to report on ESG characteristics of their investments or investment processes.

This has contributed toward the shift from 'tell me', to 'show me' reporting where investors, clients, shareholders, and the public are asking for companies and fund managers to report not just their policies, objectives and strategy related to ESG issues (i.e., the 'tell me'), but also on the impact that entities and fund holdings' value chains are having on the environment and communities (i.e., the 'show me').¹¹ ESG disclosure on its own does not drive financial performance, entities must be acting on ESG-related issues and are increasingly expected to show proof of impact (neutral or positive) using reliable and credible data.¹² The increasing demand for information on performance illustrates that the information platforms which KIPs proposes could fulfil an investor need. High resolution environmental monitoring would provide critical veracity to 'show me' reporting of environmental performance.

In September 2022 NZ's first Stewardship Code for Responsible Investors was released which aligns with RIAA's Product Certification Standard and the UN PRI.¹³ The code defines stewardship as "the responsible allocation and management of capital by investors – including asset owners and fund managers – to create and preserve long-term value for current and future generations" while promoting "sound investor and issuer governance, and business practices that lead to sustainable

outcomes for our environment, society, and economy."¹⁴ The Code, housed by a secretariat jointly managed by Toitū Tahua: Centre for Sustainable Finance and the Responsible Investment Association Australasia (RIAA), directly recognises the importance of incorporating material ESG matters, and considering a te ao Māori stewardship lens (mainly through principle 3: *incorporating material ESG matters*). This includes supporting signatories to ask how their policies and practices embed Te Tiriti O Waitangi and te ao Māori values into their investment beliefs and goals for stewardship as well as how their actions are ensuring equitable and sustainable outcomes for tangata whenua. Signatories are expected to adopt the code initially on a 'comply or explain' basis, and as the code and industry develops, an 'apply or explain' basis, followed by 'apply and explain' basis. The difference between comply and apply in these contexts refers to signatories moving beyond a 'tick box' approach to the principles, and being able to more comprehensively describe how their practices are achieving effective stewardship. These trends indicate that demonstrating on-the-ground impacts will become increasingly valuable to NZ entities accessing domestic and international finance. As ESG is woven more deeply into both voluntary and regulatory elements of the sustainable finance sector it reinforces the shift from 'tell me', to 'show me'.

11. (PRI Association, 2022)

12. (Whelan et al., 2021); Arvidsson, S., & Dumay, J. (2022). Corporate ESG reporting quantity, quality and performance: Where to now for environmental policy and practice? *Business Strategy and the Environment*, 31(3), 1091–1110. <https://doi.org/10.1002/bse.2937>

13. RIAA & Toitū Tahua. (2022). *Stewardship Code Aotearoa New Zealand*. <https://stewardshipcode.nz/>

14. (RIAA & Toitū Tahua, 2022) 15. RIAA & Toitū Tahua. (2022). *Stewardship Code Aotearoa New Zealand*. <https://stewardshipcode.nz/>

Future formalisation of ESG and growing influence of nature-related considerations

As the finance industry trends toward integrating more stewardship into investment decisions, equity investment and lending will also lean toward more sophisticated ESG considerations. Many current voluntary frameworks are being adapted into regulatory frameworks. For example, TCFD was a key structural basis for the NZ XRB's mandatory climate-related disclosures which from 2023 are required of the country's largest companies, banks, credit unions, insurers, and investment managers. Now, TNFD is influencing the creation of Ngā pou o te kawa ora - XRB's non-financial sustainability disclosure framework. Although currently voluntary, Ngā pou o te kawa ora is likely to form the base of a mandatory framework that the NZ government will require by 2030 to meet its commitments to the Kunming-Montreal Global Biodiversity Framework. Similarly, the TCFD, Global Reporting Initiative (GRI) and Sustainable Accounting Standards Board (SASB) frameworks are being used to inform the structure of the EU's regulatory European Sustainability Reporting Standards (ESRS) reporting (to start 2024).

As sustainability reporting becomes increasingly mandatory, investor demands for evidence that companies have the policies and human/financial resources

necessary to meet or even keep ahead of regulatory changes grow. 78% of investors ranked regulatory risk management as a driver for investor interest in ESG investing.¹⁵ This demand for evidence of regulatory risk management is highly relevant for NZ agriculture and forestry, which is currently in a high flux of regulatory change for on-farm practices. Regulatory change is primarily occurring in response to social expectations in NZ and international markets' demands for less polluting agricultural production models. Regulations typically lag behind these larger societal shifts, so periods of high regulatory change are indicative that broader systemic change is occurring. As such, the industry looks to face more regulatory ESG reporting requirements in the future as regulations and consumer demand evolves.

As the sustainable finance sector and responses to ESG issues evolve, notable sub sectors have emerged such as 'green finance', 'climate finance', and 'nature finance' (see Glossary). These sub-sectors drive finance flows to manage climate and nature-related risk and capture commercial opportunities provided by initiatives aiming to achieve desired societal transitions (such as decarbonisation or zero-deforestation supply chains). Sub sectors such as restoration or nature-based solutions finance are emerging but are yet to be defined in taxonomies or by principles¹⁶ (see Figure 6).

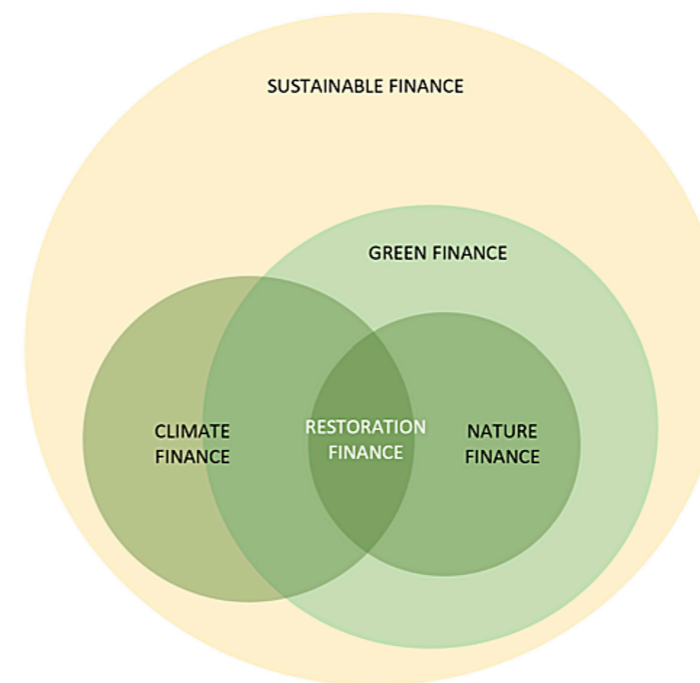


Figure 6: Major sub sectors of sustainable finance sector. Circle size roughly indicates relative size of sectors. Not to scale. Adapted from United Nations and World Bank, 2022.¹⁸

Global investment in these spheres remains slow to scale-up; nature-based solutions (NbS) had an investment growth rate of only 2.6% between 2021-2022.¹⁷ At a total of US\$154 billion invested in nature; this is well under the required investment growth rate to align with what is required to meet Rio Convention Targets.¹⁹ In 2022, the Coalition of Finance Ministers for Climate Action released a report that encouraged the world's Ministries of Finance (MoFs) to support nature recovery, including creating targeted policy, regulation, and guidance that aligns financial flows with global biodiversity targets such as that of the Post-2020 Global Biodiversity Framework.²⁰ To respond to sovereign risk created by nature loss, MoFs are encouraged to reform economic policy, integrate nature-smart planning and nature-based solutions into all sectors (from construction to agriculture for example),

support the development and integration of more detailed natural capital accounting, and mobilise more public and private finance for nature. This is likely to expand investment in nature markets which can provide financial opportunities for MACs and other land-based primary industries with good stewardship approaches. A nature market is "a trade where there is a specific price on nature that generates nature-specific revenues", i.e., where the direct or indirect valuing of nature is an integral part of trading goods or services.²¹

There are four types of nature markets:

- *Asset markets*: markets which the right to use ecosystem assets with long-lived value are traded e.g., agricultural land, timber land, water rights;
- *Intrinsic nature markets*: markets in which provisioning, regulating or cultural ecosystem services are traded

15. (PWC, 2022)

16. (RIAA & Toitū Tahua, 2022)

17. UNEP. (2022). *State of Finance for Nature. Time to act: Doubling investment by 2025 and eliminating*

nature-negative finance flows. <https://wedocs.unep.org/20.500.11822/41333>

18. (United Nations & World Bank, 2022)

19. (UNEP, 2022)

20. Power, S., Dunz, N., & Gavryliuk, O. (2022). *An overview of nature-related risks and potential policy actions for ministries of finance: Bending the curve of nature loss.* Coalition of Finance Ministers for Climate Action.

21. Taskforce on Nature Markets. (2022). *Global nature markets landscaping study.* NatureFinance. <https://www.naturemarkets.net/publications/global-nature-markets-landscaping-study>

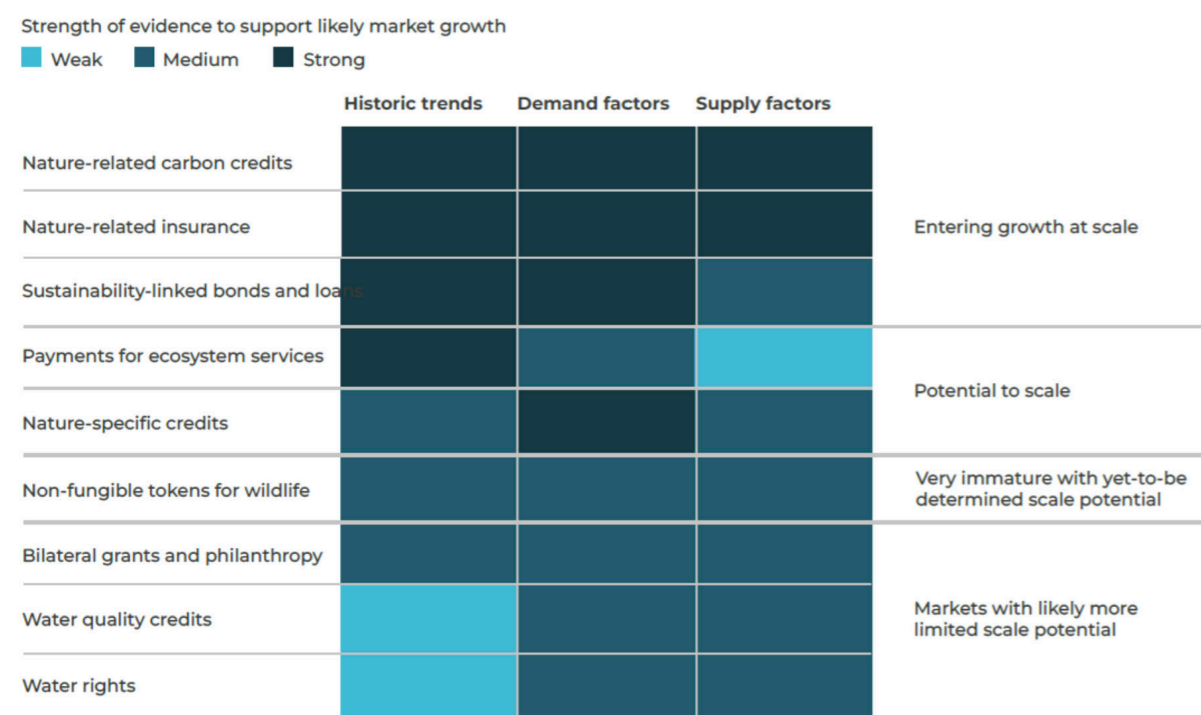


Figure 7: Qualitative review of trends in less mature international nature markets. Source: Taskforce on Nature Markets, 2022

e.g., products such as food, wood, sand, and minerals; conservation of nature through payment for ecosystem services; or access/use of cultural tourism e.g., wildlife tourism;

- **Credit markets:** markets where credits that reflect efforts to enhance or conserve ecosystems assets or services are traded. This includes nature-specific credits (e.g., biodiversity or water credits) and nature-related carbon credits (e.g., carbon credits that reflect the value of carbon sequestration or storage);
- **Derivative markets:** markets for financial products which directly

reflect ecosystem values or ecosystem risks (e.g., commodity derivatives, nature-related insurance).²²

The intrinsic nature markets of agricultural and forest commodities make up some of the largest nature markets in the world. Food commodities are valued at US\$4.3 trillion per year in global production, only second to extractive commodities.²³ Forest products are the smallest soft commodity market by value but are still worth US\$150 billion per year in global production. Yet, despite their economic value, the role of nature within these markets has long been undervalued.²⁴ As intrinsic nature markets, both are highly dependent on ecological

integrity. The environmental and social risks of poorly managed production systems, exacerbated by climate change, are now creating a strong case for the application of ESG in these markets. ESG frameworks are applied to monitor and report on outcomes of financial products used to fund large scale sustainable agriculture and forestry projects internationally. The Green Bond Standards and Climate Bond Standards, for example, list sustainable agriculture and forestry as eligible categories for investment. Small scale pilot bond mechanisms are also developing such as the Forest Resilience Bond (by Blue Forest), which channels private investment into forest and watershed health in the United States.

Other forms of nature markets such as nature offset markets, are also being integrated with agricultural and forestry commodity markets. Nature-related carbon credits (voluntary and compliance) are valued at US\$1.46 billion per year but demand is expected to increase 10 times this by 2030 due to the climate targets institutions and corporations have set themselves.²⁵ In NZ, this could be a valuable source of investment for land-based entities and a growing market that could be validated through KIPs data. Voluntary carbon markets use certification frameworks such as Verra's Climate, Community and Biodiversity Standard which allocates certified carbon credits based on the projects positive ESG impact in addition to the GHG mitigation outcomes.

There are limited agricultural and forestry funds and credit markets in NZ currently, but some smaller ones exist indicating NZ is in an early growth stage of nature markets development.

For example:

- AgRegen – An NZ equity fund purchasing land assets to apply regenerative agriculture techniques.
- New Ground Impact Enterprise Fund (\$30-60M) – Domestic-focused impact investment fund; investing equity into sustainable food production and agricultural technology enterprises (among others).
- Both NZ Ministry for Environment (MfE) and Toha NZ are looking to develop biodiversity credit schemes. In each case, KIPs data could facilitate this kind of investment mechanism.

However, new nature markets such as nature-related carbon credits, insurance, and sustainability linked loans and bonds are rapidly maturing (see Figure 7). It is these nature markets that MACs could prime themselves to meet. The markets could develop to be an important source of financing beyond the income MACs receive from the soft commodities they produce.

22. (Taskforce on Nature Markets, 2022)
23. (Taskforce on Nature Markets, 2022)
24. (Taskforce on Nature Markets, 2022)

25. (Taskforce on Nature Markets, 2022); McKinsey & Company. (2021). *A blueprint for scaling voluntary carbon markets to meet the climate challenge*. <https://www.mckinsey.com/business-functions/sustainability/our-insights/a-blueprint-for-scaling-voluntary-carbon-markets-to-meet-the-climate-challenge>

www.mckinsey.com/business-functions/sustainability/our-insights/a-blueprint-for-scaling-voluntary-carbon-markets-to-meet-the-climate-challenge

Potential Indicators and Frameworks

ESG instruments vary based on the type of entity that is reporting, the intended audience for the reporting, and whether

the disclosure required is voluntary or mandatory.²⁶ Table 1 shows a variety of the most common ESG-related frameworks.

Table 1: Major types of ESG frameworks used in sustainable finance sector

Type of ESG Framework	Description/ purpose	Examples					
		Framework	Jurisdiction	Voluntary / regulatory	Manager of framework	ESG coverage	Market application / purposes (what it is used for)
Taxonomies	Classifications of economic activities that are considered to meet a certain sustainability threshold. Details criteria for sector activities to be eligible. Acts as a high-level guide	EU taxonomy	EU	Dependent on application	The European Commission	Comprehensive; Industry specific guidelines	Used as parameters for EU Green Bonds, EU Ecolabel; forthcoming ESRS
		Climate Bond taxonomy (Global)	Global	Voluntary	Climate Bonds Initiative	Comprehensive; Industry specific guidelines	Basis of Climate Bonds Standard and Certification
High level investor principles	Details what responsible/ethical investment should include. Usually involves voluntary signatories who commit to embodying the principles.	UN Principles for Responsible Investment	Global	Voluntary	PRI Foundation	N/A	Used to guide investment decision-making but not designed to directly measure or monitor ESG issues.
		NZ Stewardship Code	NZ	Voluntary	Toitū Tahua & RIAA		
ESG Reporting and standards	Frameworks that are designed to help entities to screen, report, and disclose non-financial performance information.	IRIS+	Global	Voluntary	GIIN	Comprehensive	Universal disclosure/ impact reporting
		SDGs	Global	Voluntary	UN	Comprehensive (structured into goal themes)	Thematic framework that can be aligned to impact reporting/ disclosure
		GRI	Global	Voluntary	GSSB	Comprehensive (industry and theme specific)	Universal disclosure/ impact reporting
		SASB Standards	Global	Voluntary	ISSB	Comprehensive (industry specific)	Universal disclosure/ reporting
		Harmonised Framework for Impact Reporting	Global	Voluntary	IMCA	Comprehensive (sector specific)	Reporting guidance for issues of IMCA Green Bonds

26. (PRI Association, 2022)

Type of ESG Framework	Description/ purpose	Examples					
		Framework	Jurisdiction	Voluntary / regulatory	Manager of framework	ESG coverage	Market application / purposes (what it is used for)
ESG reporting and standards	Frameworks that are designed to help entities to screen, report, and disclose non-financial performance information.	SAFI	NZ	Voluntary	Toitū Tahua: Centre for Sustainable Finance	Environment, Social (agriculture specific)	Informs sustainability-linked lending for NZ lenders e.g. banks
		TCFD	Global	Voluntary	TCFD	Environment (climate)	Universal risk disclosure
		XRB climate-related disclosures	NZ	Regulatory	XRB	Environment (climate)	NZ large entity disclosures
		SFDR	EU	Regulatory	The European Commission	Comprehensive	Reporting and disclosure for financial products and entities
		ESRS (forthcoming)	EU	Regulatory	The European Commission	Comprehensive (theme and sector specific)	Sustainability reporting and disclosure standards for large entities required to report under CSRD and NFRD.
		IFRS Sustainability Disclosure Standards: Climate and Sustainability (forthcoming)	Global	Voluntary	ISSB	Comprehensive	Universal risk disclosures
		IFC Social and Environmental Standards	Global	Voluntary	IFC	Comprehensive	Used as parameters for commercial banks and finance when investing for developing country projects. Takes primarily a 'less-harm' approach.
		Equator Principles	Global	Voluntary	Equator Principles Association	Comprehensive	Financial industry benchmark for managing environmental and social risk in large infrastructure and industrial projects. Includes most of the commercial banks that would either invest directly in NZ companies or provide capital to NZ banks.
		NZ Climate Innovation Market	NZ	Voluntary	Toha	Environment (agriculture specific)	Niche market for impact investment
Secondary verification frameworks and ratings	Frameworks that aim to verify or serve as assurance for the quality and consistency of ESG reporting	BlueMark Assurance Standard	Global	Voluntary	BlueMark	Comprehensive	Assesses quality of external impact reporting
		Sustainable Fitch Finance ESG Ratings for Bonds	Global	Voluntary	Sustainable Fitch	Comprehensive	Evaluates ESG impact of different financial instruments
		MSCI ESG Ratings (Global)	Global	Voluntary	MSCI	Comprehensive	Measures companies' resilience to material ESG risks
		DJSI	Global	Voluntary	S&P DJ	Comprehensive	Share market ratings for sustainability performance of global top companies

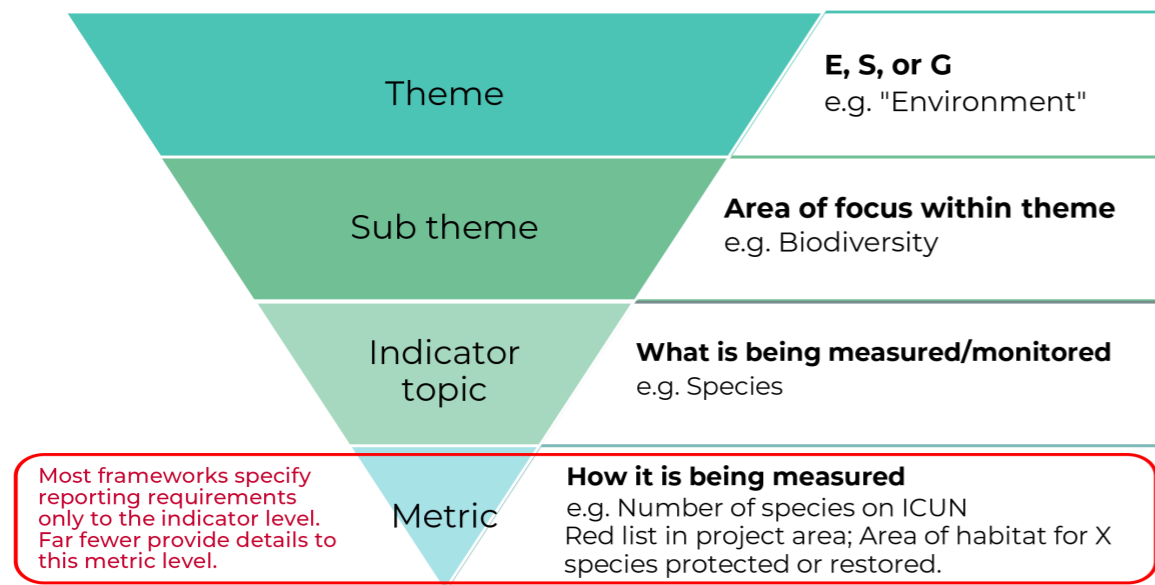


Figure 8: Example of levels of theme, sub-theme, indicators, and metrics used in ESG reporting.

ESG reporting frameworks and standards

ESG reporting frameworks and standards are designed to guide businesses (generally the larger listed ones), including those in the primary industries, on what and how to disclose their ESG-related information to relevant stakeholders. Frameworks can range from high level guidelines for disclosure to specific reporting standards for companies measuring and monitoring impact and risk. Some are specific to a single ESG theme (e.g., TCFD focuses on climate), whereas others are significantly broader or have multiple standards designed to cover different ESG themes (e.g. SASB has a meat/poultry/dairy standard and an agriculture standard, among others).

Each framework specifies a differing level of detail users need to report on to comply with the standard. Some frameworks specify indicator topics that businesses must report on (such as impact on

biodiversity), and a sub-set of these would provide details that specify how this impact should be measured (i.e. using the metric: amount of habitat restored). These different levels are given as an example in Figure 8.

The data demands of different finance sector actors are dependent on their position in the value chain (Figure 1). While companies measuring on the ground impact may collect quantitative detail about the impact of their operations (e.g., for regulators or their own governance purposes), their investors may only ask for qualitative data such as whether they have systems in place to monitor their impact. How the company measures impact (i.e., what metric they use) may be an internal governance decision. Therefore, indicators are often specified in frameworks, but few provide details on recommended metrics for measurement as the audience for the reporting may not require that level of detail.

Climate reporting (emissions data and evaluation of climate related dependencies) is now widespread and while only 40% of 4,581 NI00^d companies around the world currently report on biodiversity loss, this number is growing rapidly.²⁷ For example, TCFD is one of the most used climate disclosure frameworks globally, and the follow up framework for nature-related disclosures, TNFD is now being rapidly trialled.^e Along with TCFD, GRI and the Sustainable Development Goals (SDG's) were the most used frameworks for sustainability reporting in 2022.²⁸

It is useful to note that the SDGs, despite being commonly used reporting framework, individual entities mostly use the themes of the SDG goals as a framework to structure and present their reporting, rather than using the targets as a tool for performance measurement. To help entities align their reporting with the SDGs, SDG Compass^f includes an inventory that collates existing business indicators (e.g., GRI indicators) that contribute to each SDG target into a searchable database.

Links with voluntary assurance programmes and regulatory planning

There can be overlap between monitoring done for investment related ESG frameworks and commodity market assurance programmes. For example, in NZ agriculture, SAFI focuses on climate mitigation and adaptation and NZ Farm

Assurance Programme Plus (NZFAP+) (the highest of the two NZFAP standards) focuses on ethical and responsible production and product traceability. But both SAFI and NZFAP+ cover themes such as animal welfare, freshwater health, biodiversity, emissions monitoring, sustainable practices, and resource management planning. Many of these aspects then also align with mandatory management planning and monitoring (e.g., Freshwater Farm Plans and He Waka Eke Noa recommendations). Therefore, while ESG frameworks are designed for reporting that informs investment decision-making, the data they require overlaps with that used in commodity markets and to meet regulatory requirements.

Secondary verification frameworks and ratings

As the number and types of companies undertaking sustainability reporting rapidly expands the quality of sustainability reporting is also being put under scrutiny. 87% of investors surveyed in PWC 2022 global investor survey say they think that corporate reporting contains unsupported sustainability claims i.e., greenwashing.²⁹ The survey found that a company assuring its sustainability reporting to the same level as its financial statements would increase investor confidence. As a result, there are many secondary verification frameworks that are being developed to verify or certify the sustainability reporting of investors or businesses. An example of such a framework is the BlueMark framework

27. KPMG. (2022). Big shifts, small steps: Survey of Sustainability Reporting 2022. KPMG International. <https://home.kpmg/xx/en/home/insights/2022/09/survey-of-sustainability-reporting-2022.html>

28. (KPMG, 2022)

29. (PWC, 2022)

d. NI00 refers the largest 100 companies by revenue in each of 58 countries, territories and jurisdictions researched in KPMG's 2022 Survey of Sustainability Reporting study.

e. Filipe Arango, TNFD Director of Industry Piloting, Personal communications, 2022

f. <https://sdgcompass.org/business-indicators/>

piloted in 2022. This framework was built to assess the quality of impact reporting by judging the completeness, and reliability of impact reports released by companies and asset managers. There are also frameworks that act to verify certain financial mechanisms such as the Sustainable Fitch Finance ESG Ratings for Bonds. Wider ESG ratings and rankings for companies have also become popular. For example, in the context of the share market, DJSI is utilised as a credible and well-regarded indicator of a company's sustainability in comparison to its peers.

Potential indicators for automation

In the future, what data land-based primary industries can supply will become a limiting factor of what financial markets or products

they are able to access. Data coverage will determine the spatial boundaries of sustainable finance opportunities. Aligning remote sensing data with emerging climate, nature, and restoration finance opportunities will be immensely valuable to primary production businesses.

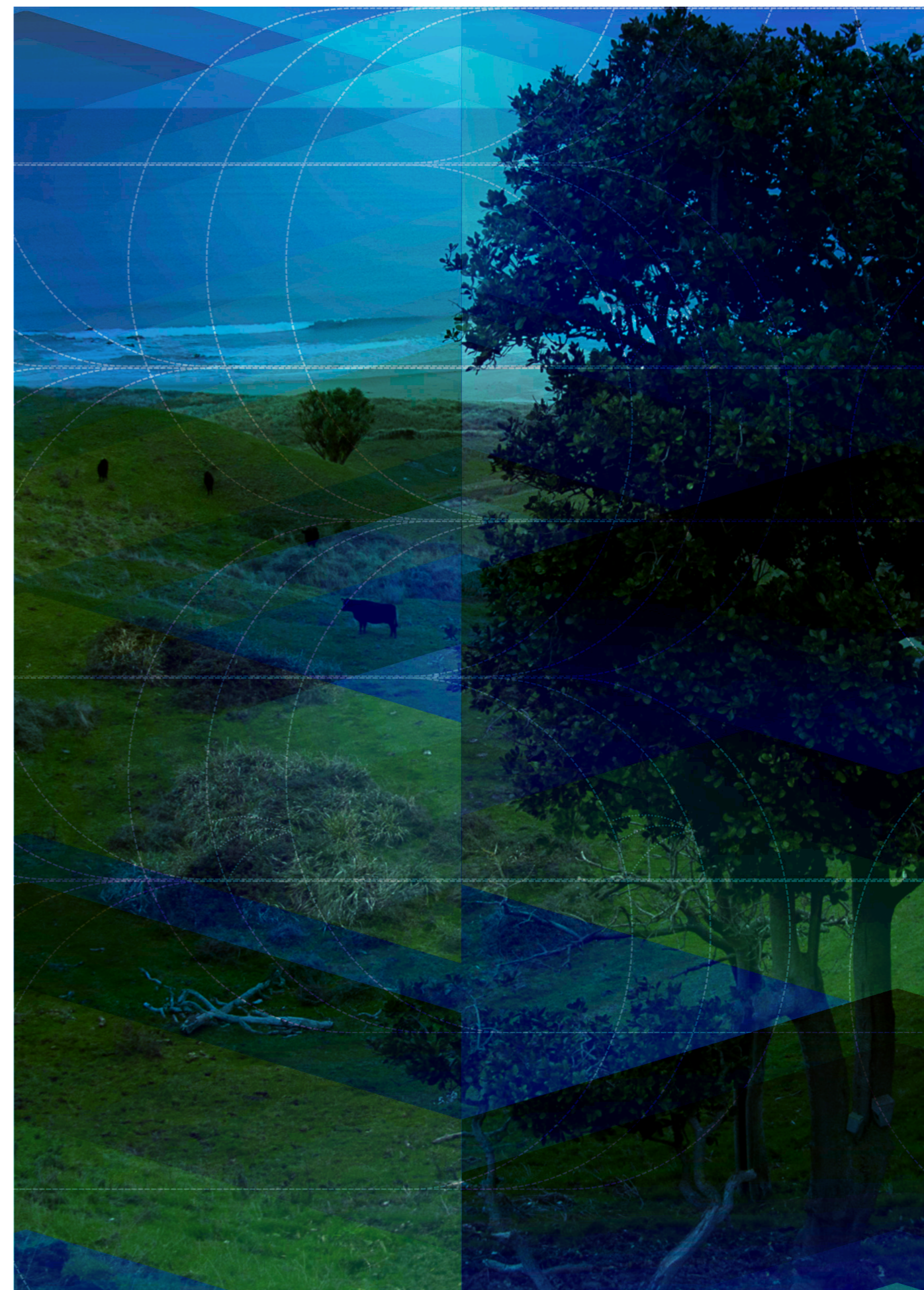
The ESG metrics already in use by various ESG frameworks that align with the five proposed KIPs data domains are covered in Table 2. This list is by no means exhaustive but provides an indication of the kinds of data required by key ESG frameworks that have potential to be fulfilled by automated, high resolution environmental data.

Table 2: Examples of existing environmental data that is viable for automation

KIPs domain	Existing quantitative metric requirements
Nutrient emissions	<ul style="list-style-type: none"> - Water quality of discharge effluents: NO3, pH level (GBP) - Water turbidity (IRIS+)
Biomass Sequestration	<ul style="list-style-type: none"> - Increase in above and below ground carbon stocks. (GBP) - Evidence of soil carbon sequestration longevity (>20yrs) (CBS) - Area of trees planted: native; total. (IRIS+) - Woody vegetation planting records (CBS)
Biodiversity	<ul style="list-style-type: none"> - Ecosystem type, size, condition, change over time (GRI) - Species abundance, habitat, conservation status (IRIS+) - Species extinction risk, change over time (GRI) - Biodiversity footprint (IRIS+) - Protected area connectivity (IRIS+) - Area of trees planted: native; total. (IRIS+) - Amount of habitat restored. (IRIS+) - Number of indigenous species restored (GBP) - Conversion of land to more diverse cropping systems (GBP) - Net positive biodiversity impact (native species) (Verra CCB Standard) - Area of peatlands/wetlands under conservation practices/restored. (GBP, CBS) - Increase in land area set aside for biodiversity conservation. (GBP) - Increase in area under integrated pest management (GBP) - Invasive Alien species monitoring (GRI)
Carbon Emissions	<ul style="list-style-type: none"> - GHG emissions avoided, mitigated, reduced. (IRIS+ ; SASB, GBP, GRI) - Reduction of GHG emissions as a result of soil conservation measure and land use change (tCo2e/ha) (GBP) - GHG emissions scope 1/2/3 (SASB)
Hydrological flow	<ul style="list-style-type: none"> - Water quantity (withdrawn, discharged, efficiency) (IRIS+) - Lengths of streams present, restored. (IRIS+) - Water stress/scarcity (IRIS+)

Notes for Table 3:

- IRIS+ - International Reporting and Investment Standards
- GBP – Green Bond Principles (sourced from Harmonised Framework for Impact Reporting (IMCA))
- CBS – Climate Bond Standard (agriculture criteria)
- GRI – Global reporting Index - Biodiversity (304) standard exposure draft
- Verra CCB Standard – Verra Climate Community and Biodiversity Standard
- SASB – Sustainability Accounting Standards Board – Meat Poultry, Dairy industry standard, Agriculture Standard



KIPS Data and its Value to the Finance Sector

MACs have two basic options to derive value from provision of remotely sensed environmental intelligence – a) use it to attract investment in their own land-based enterprises or b) sell data covering a larger area of production lands (irrespective of Māori ownership) to a variety of regulatory or investor users. There is potential current value for the former option, at least for equity investors with a keen focus on risk and even more for those seeking positive impact, particularly if they have interest in the unique social and governance characteristics of MACs. The value proposition for the latter is theoretically present but demand for such high-resolution data is limited and provision of the data to users covering the specific land area associated with their investment proposition is complex.

There is a general sense of need to increase accuracy, resolution and availability of good quality ESG data across the finance industry as data constraints are well known as a limitation for effective ESG reporting.³⁰ Tackling poor disclosure and availability of environmental and social information about the impact and effect of production systems and supply chains of soft commodities is a critical part of designing more sustainable markets.³¹ Transparency, management and governance of data and information is also an area needing improvement. KIPs could contribute to

fixing these challenges in the NZ context as it can support the provision of high resolution, traceable data to feed into relevant environmental reporting, strongly positioning itself in the emerging 'show me' era of ESG reporting.

All domains of KIPs are considered highly valuable across actors in the finance industry (as seen in Table 2 and evidenced from interviews). Currently reporting on GHG emissions is the most advanced, but it is still often based on estimates and models at regional scales rather than real-time actual emissions at local scales. Data on nutrient emissions and hydrological flows have been monitored for some time by actors such as regional councils, but through manual, labour intensive data collection methods. Similarly, calculating carbon sequestration for statutory⁹ and voluntary carbon markets often utilises either regional estimates or labour intensive on-the-ground measurements. Through automation, KIPs has the appeal of improving both the accuracy and resolution of data for these environmental domains while lowering costs and covering a much wider spatial scale. Biodiversity monitoring is can still be considered an emerging so while the appeal of having high resolution biodiversity data is high, readiness to receive it may be low (discussed in limitations section).

Value of KIPs data to different finance users

The value of high resolution remotely sensed environmental data (referred to from here on as RS data) varies according to the user and is often determined by the kind of data they are seeking.

Bank lenders

NZ banks that lend to farmers see value in KIPs data because it helps them determine the transitional or physical risk³² of the business they are investing in and/or track business operations improvement conditions of their 'sustainability linked loan' (SLL) products. However, the current criteria NZ banks use for assessing farm lending mostly remains qualitative (e.g. questions around traceability of farm inputs, quality of animal welfare or methods used to manage GHG emissions etc.) so the value of RS data would take time to be realised.

Similarly, KIP data could be used to support green or climate bond issuances aimed at financing sustainable land use (e.g., provision of capital for regenerative agriculture conversion costs). However, while bonds have been used for this purpose overseas³³, the use of green and climate bonds for sustainable agriculture transitions is a financial mechanism that is yet to be well developed in New Zealand. Under New Zealand Government's Sovereign Green Bond Programme (2022),

the green category of "living and natural resources and land use" which directly targets sustainable land use as an eligible use of bond proceeds³⁴ only makes up 1.3% share of total eligible expenditure pool as of March 2023³⁵. Also, in the case of New Zealand's Green Investment Finance bank (NZGIF) investment in land transition is limited by availability of projects of bankable scale.

Direct equity investors

Investors considering investing in land-based primary industries could use RS data to understand the transition or physical risks of the business's impact on land, water, and climate. This information could be used to support investment decision-making or to support direct investor engagement with the business's governance to reduce long-term financial risks. Accordingly, MACs and other land-based primary industries seeking equity investment could use RS data to increase financing opportunities by communicating their impact with investors, shareholders, lenders, and customers.

Impact investors

Impact investors – those focused on investing for a particular environmental or social outcome, rather than solely on risk-reduction that is the due diligence focus of most investors – could use RS data to quantify the impact their investment is creating. Because impact investors are

30. Eccles, R. G., Kastropeli, M. D., & Potter, S. J. (2017). How to Integrate ESG into Investment Decision-Making: Results of a Global Survey of Institutional Investors. *Journal of Applied Corporate Finance*, 29(4), 125–133. <https://doi.org/10.1111/jacf.12267>

31. Taskforce on Nature Markets. (2023). Soft commodities scoping paper. NatureFinance. <https://www.naturemarkets.net/publications/soft-commodities-scoping-paper>

naturemarkets.net/publications/soft-commodities-scoping-paper

9. Under the NZ Emissions Trading Scheme, for land parcels under 100ha regional average look up tables are used to estimate carbon sequestration, and for land parcels over 100ha ground measurement is conducted.

32. TCFD. (2017). Recommendations of the Task Force on Climate-related Financial Disclosures. <https://assets.bbhub.io/company/sites/60/2021/10/FINAL-2017-TCFD-Report.pdf>

33. PepsiCo Inc. (2022). PepsiCo Green Bond Framework—2022. https://www.pepsico.com/docs/default-source/sustainability-and-esg-topics/pepsico-green-bond-framework-2022.pdf?sfvrsn=a04db793_11

34. New Zealand Treasury. (2022). New Zealand Sovereign Green Bond Framework. https://debtmanagement.treasury.govt.nz/sites/default/files/media/media_attachment/nz-sovereign-green-bond-framework.pdf

35. New Zealand Treasury (2023). New Zealand Sovereign Green Bond Programme. <https://debtmanagement.treasury.govt.nz/investor-resources/green-bonds>

purpose driven, they are also more likely to spend more time seeking out this data for their investment (whether it be a direct equity investment or a through an aggregated fund). Therefore, at least in the short to medium term, KIPs data may be of significantly more value to impact investors than traditional investors.

Fund and asset managers

NZ-scale RS data does not currently have value for most fund and asset managers because they typically invest in scores of listed companies from a variety of sectors, of which a limited number have NZ land-based value chains. MACs are also not currently listed companies and therefore likelihood of investment in MACs by fund and asset managers is low.

The level of detail RS data provides is simply not required by fund and asset managers; they rely on qualitative ESG scores measuring a company's policies, practices, and governance systems rather than the on-the ground impact of its products or services.³⁶ For example, typical questions screened by fund managers in the environmental domain may be yes/no questions about if the company has:

- Risk management procedures for climate
- Carbon certifications
- Green/social bonds or committed to an SLL
- Monitoring for indicators such as water consumption intensity
- Set a target for water efficiency (or other related monitored indicators).

At a company level, some of these questions may require detailed quantitative data to answer how KIPs data is of use. But this data is not required further up the value chain where high level qualitative metrics are instead considered best practice.

Regulators

Monitoring of actual emissions across a NZ-based value chain would support companies to fulfil the requirements of New Zealand Climate Disclosure Standards with increased accuracy. XRB's disclosures of climate-related risks with financial materiality came into effect in January 2023 as a regulatory requirement for large, listed companies and financial institutions in NZ. For first year reporting, only Scope 1 and 2 are mandatory, but Scope 3 will be introduced from 2024 reporting period. This disclosure framework was strongly based on the international framework TCFD. XRB is also currently drafting Ngā pou o te kawa ora (a voluntary non-financial sustainability disclosure framework) for which the other KIPs domains (biodiversity and water related) are very likely to be of value. Ngā pou o te kawa ora is currently in its first phase of development and is using advanced Māori reporting entities as a baseline for the framework.

Additionally, regional councils could be a paying user of KIPs data to support them to meet freshwater regulation. The provision of automated data for hydrological flows and nutrient emissions could be a cost-effective method for councils to monitor and manage freshwater bodies within their jurisdiction.



Nature market developers

RS data has value for developers of new nature markets such as carbon credits that account for social or biodiversity co-benefits, biodiversity credit markets and other payments for ecosystem services. In NZ, a key example is the upcoming NZ Climate Innovation Market (NZCIM) managed by Toha (a data infrastructure developer). NZCIM will be a marketplace to channel finance from large scale investors to individual projects on the ground such as those undertaken by farmers or businesses. Such marketplaces rely on third party data to verify and monitor claims toward positive environmental outcomes on the ground.

KIPs would be well positioned to become a data supplier for such NZCIM. Similarly, MfE also have an ongoing workstream focused on biodiversity credits, for which KIPs data could be of use to in the future. In conclusion, as the demand for quantitative data on the actual impact of a company's products and services increases and broadens across the investor spectrum from impact investors, the value of RS data will accrue. RS data can contribute toward the increasing detail that will be fed into next generation versions of ESG frameworks (such as new GRI304 or IRIS+ biodiversity metrics) as it can support metrics being verified more accurately.

36. Beith, K. (2022), Forsyth Barr's Carbon and ESG ratings: Methodology. Forsyth Barr. <https://www.forsythbarr.co.nz/assets/public/Uploads/Research-Public/R081222-CESG-Ratings-Methodology-Documents-f.pdf>

[co.nz/assets/public/Uploads/Research-Public/R081222-CESG-Ratings-Methodology-Documents-f.pdf](https://www.forsythbarr.co.nz/assets/public/Uploads/Research-Public/R081222-CESG-Ratings-Methodology-Documents-f.pdf)

Possible Constraints or Limitations

There are several constraints and limitations to realising the full functionality of KIPs RS data in the finance sector. These are covered in detail below:

Finance sector user readiness for remote sensed data

Remote sensing data offered by KIP provides the ability to supply high resolution data to verify some key environmental elements of ESG. Remote sensing data has become well established for monitoring, developing and managing natural resources³⁷. Some of its earliest applications included monitoring land-use change³⁸ which became useful to hold companies accountable for environmental damage such as deforestation³⁹. Now, the application of digital technologies to revolutionise the finance sector has become known as 'FinTech'⁴⁰. Industry 4.0 technologies such as Internet of Things, artificial intelligence, block chain and big data are investigated for application to ESG reporting and integration into international climate finance. FinTech could enable analysis of large quantities of detailed and robust data at speed to support advanced ESG reporting and verification⁴³.

One notable example of automation in the NZ nature market context is using artificial

intelligence to improve identification of ETS-eligible native forests. Carbon Crop is a newly established NZ issuer of voluntary native carbon credits called Native Carbon Crop Units (Native CCU). They use machine learning, aerial imagery, and remote sensing technology to determine the to distinguish between trees and pasture, and recognise heights, ages and species of trees with more accuracy.⁴⁴

However, as far as this research can tell, few investors in NZ land-based primary industry companies are currently integrating automated data into their verification, or decision-making processes. Most investors are aware of the rapid pace of technological development and demand for increasing ESG claims verification based on performance data, but they lack the time or expertise to integrate it into their existing frameworks for decision making. This has limited their readiness for high resolution quantitative data.

To enable investor utilisation of automated data, new infrastructure and changes to existing standards are required. For example, a NZ bank SLL issuance relies on a manual approval process and independent client progress audit. This is per the requirement of the Asia Pacific

Loan Market Association who issue the SLL best practice standards. A data platform would have to be verified by these global standards as a credible data source to streamline the process and result in use of automated high-quality data. But to date, global standards are not set up to provide verification to data platforms, and bank lenders view this as a medium to long term development.

Similarly, bank lenders' current process for farm loans includes collation of financial metrics and qualitative non-financial metrics. Interviewees predicted quantitative non-financial metrics becoming more integrated overtime, but currently, their decision-making criteria is not supportive of this integration.

The likelihood for investors (of any type) to realise the value of high-resolution spatial data will be based on their internal technical capacity and how much time they are able to invest in individual investment decisions. Large asset managers with a global reach are hiring data scientists to prepare for this new wave of big data. Comparatively, small fund managers are likely to rely on listings prepared by others. The role of data infrastructure providers therefore becomes critical. These providers may be companies providing ESG listings and ratings like MSCI or DJSI, or those facilitating capital and/or data flow between scales of investment such as Toha. As ESG

demands align with the provision of RS data, the sector will require interfaces that can support the transmission of high-resolution data for multiple scales (e.g., farm-level to whole supply chain land footprint of a listed company) and into formats that meet different actor's needs. This infrastructure is evolving but still premature which hinders the ability for KIP to be designed now for maximum value and uptake in the future.

Lack of metric standardisation – an evolving industry

Globally, there is a lack of consistency on ESG measurements as frameworks prioritise different indicator topics or provide only high-level themes as indicators. While GHG emissions data has a standard reporting unit (tonnes of CO2 equivalent), large scale collation and standardisation of other environmental data such as biodiversity, hydrology, nutrient emissions, and biomass sequestration for the purpose of reporting within finance sector is in its infancy. This inconsistency of metrics for environmental parameters is a major barrier to automating data flows for finance sector decision making as inconsistency in reporting prevents utility across investors and funds. It also limits potential to aggregate projects together to attain a 'bankable' scale attractive to larger investors.

37. Avtar, R., Komolafe, A. A., Kouser, A., Singh, D., Yunus, A. P., Dou, J., Kumar, P., Gupta, R. D., Johnson, B. A., Thu Minh, H. V., Aggarwal, A. K., & Kurniawan, T. A. (2020). Assessing sustainable development prospects through remote sensing: A review. *Remote Sensing Applications: Society and Environment*, 20, 100402. <https://doi.org/10.1016/j.rsase.2020.100402>

38. Bhatt, G. (1992). Remote Sensing in Economic Development. *Finance & Development*, 29(002). <https://doi.org/10.5089/9781451952513.022.A017>

39. Global Forest Watch. (n.d.). Forest Monitoring, Land Use & Deforestation Trends. Retrieved June 2, 2023, from <https://www.globalforestwatch.org/>

40. Schulz, K., & Feist, M. (2021). Leveraging blockchain technology for innovative climate finance under the Green Climate Fund. *Earth System Governance*, 7, 100084. <https://doi.org/10.1016/j.esg.2020.100084>

41. Saxena, A., Singh, R., Gehlot, A., Akram, S. V., Twala, B., Singh, A., Montero, E. C., & Priyadarshi, N. (2023). Technologies Empowered Environmental, Social, and Governance (ESG): An Industry 4.0 Landscape. *Sustainability*, 15(1), Article 1. <https://doi.org/10.3390/su15010309>

42. (Schulz & Feist, 2021)

43. Macpherson, M., Gasperini, A., & Bosco, M. (2021). Artificial Intelligence and FinTech Technologies for ESG Data and Analysis (SSRN Scholarly Paper No. 3790774). <https://doi.org/10.2139/ssrn.3790774>

Werner, J., & Szegda, L. (2021, November 17). Fintech and ESG: A desirable crossover. International Bar Association. <https://www.ibanet.org/fintech-and-esg-crossover>

44. CarbonCrop. (2023, April 19). AI Gives Native Forest Owners A Larger Slice Of A \$90 Million Annual Carbon Credit Pie. CarbonCrop. <https://www.carboncrop.nz/post/ai-gives-native-forest-owners-a-larger-slice-of-a-90-million-annual-carbon-credit-pie>

While multiple interviewees from across the finance sector find RS data appealing, some feared a 'data overload'. Traceable, high-resolution data is perceived as valuable, but only the 'right kind of data' that enables insights for decision-making as per the user lens. Bank lenders through to asset managers were clear that the industry is still determining what valuable insights look like, and what data needs to be prioritised for collection to achieve them. In other words, there is still indecisiveness within the finance sector on what 'good' data and acceptable performance levels are for many environmental parameters. This means the demand for provision of such data lags behind the availability of technology to collect it.

Given how rapidly environmental data and the ESG sector is currently evolving it is highly uncertain what future finance-related decision frameworks will look like. It is expected that demand for transparency of supply chain impacts validated with high resolution data will increase. Trends and emerging frameworks can be used to predict what might be the next indicator topics to be more heavily developed, for example, the push for nature-related impacts, dependencies, and risks reporting (e.g., TNFD) has led to the development of more biodiversity and ecosystem services monitoring within ESG frameworks (e.g., IRIS+ and GRI304).

Need for integration of ESG dimensions

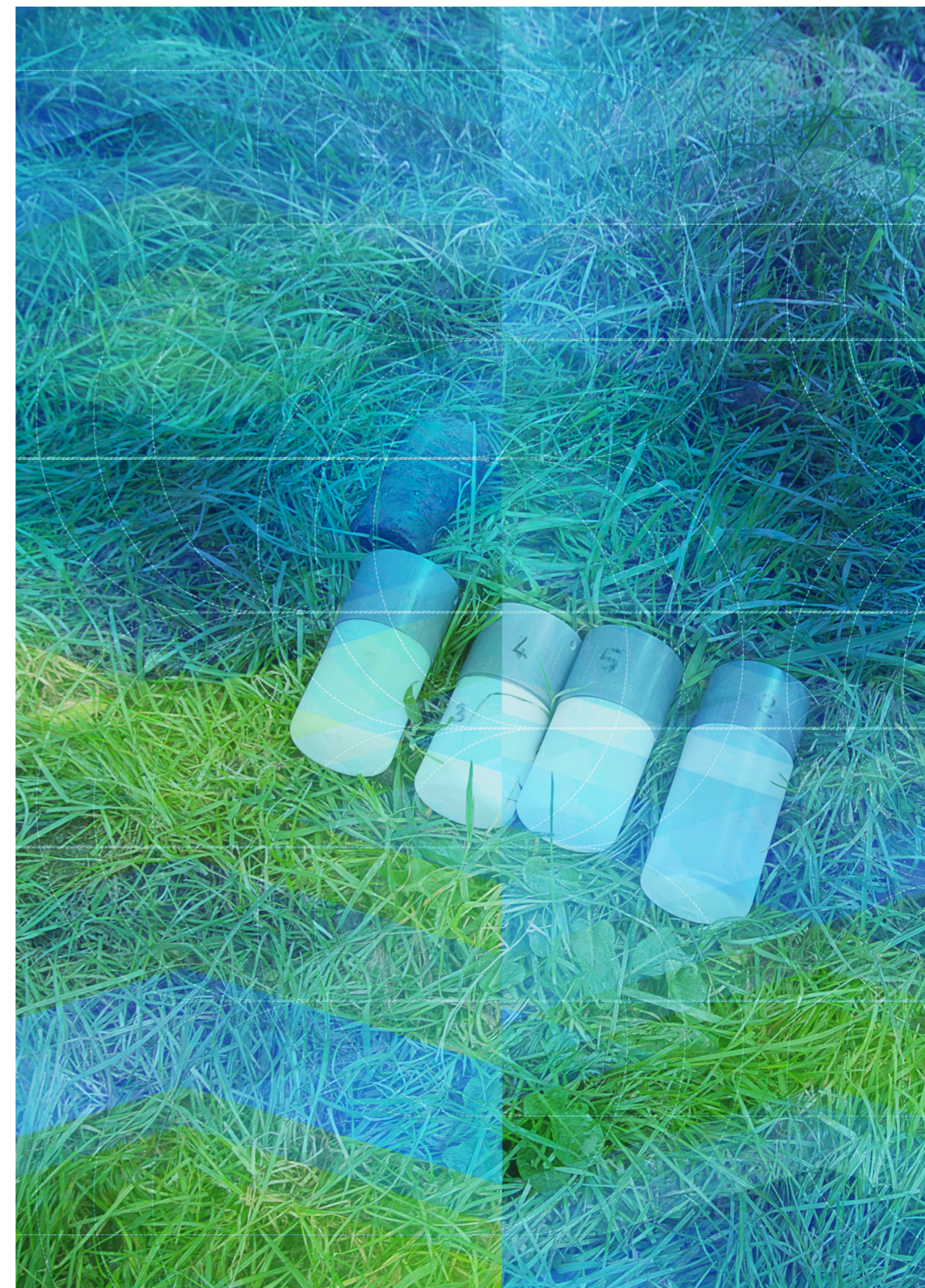
While the environmental data which KIPs proposes to collate would primarily contribute towards satisfying the environmental performance reporting demands for investors, it is worth noting that entities using KIP data would still be required to fulfil social and governance

reporting to access financing opportunities sensitive to ESG performance.

In sustainable finance, the environmental, social and governance aspects are often aggregated (e.g., for company scoring on sustainability listings, and for asset manager decision making). Some investors may use frameworks that prioritise one of these themes, for example, frameworks such as SAFI and Toha are land-based frameworks skewed toward environmental reporting within agriculture and/or native forestry. However, the importance of social and governance risk disclosure is rapidly increasing in value. For example, KPMG's *Survey of Sustainability Reporting* reported on rates of social and governance risk disclosure, the use of materiality assessments, and rates of executive leadership-level representation for sustainability for the first time in 2022.⁴⁵ This shows the expansion of 'sustainability' reporting to integrate and expand beyond the environmental focus more thoroughly. Table 3 shows how several key environmentally focused frameworks that this research considers to be most applicable to primary production businesses require coverage of social and governance components (and some environmental indicators outside of the scope that KIP proposed to provide – e.g., waste management).

Investors across the value chain (as seen in figure 1) were particularly interested in evidence of good governance from a climate change risk reduction perspective. Some NZ bank lenders, particularly those engaged with the Māori business sector saw the potential of developing social metrics as high priority and questioned if KIP would provide access to data on such metrics.

45. (KPMG, 2022)



Potential ESG indicators and frameworks most applicable to Māori agri-business

ESG Indicators most applicable to Māori agri-business

This section identifies the major subthemes and indicator topics most covered by ESG frameworks. Table 3 shows the theme and topic coverage of 5 the most relevant frameworks for Māori agribusiness that had publicly available data on their ESG

framework. GRI and TCFD are two of the most used global frameworks, SAFI and Toha are the most applicable NZ agricultural frameworks, and Gold Standard is a highly regarded international carbon standard used by the NZ certification and consulting services organisation Toitū Envirocare.

Table 3: Breakdown of ESG themes into common sub-themes and indicator topics for the most common frameworks likely applicable to Māori agri-businesses

Note: The themes and sub-themes featured in this table are those most applicable to Māori agribusiness entities applying Māori ethics. Some of the frameworks listed here that are not agriculture/forestry industry specific may include other themes which are not listed due to them being outside of this scope.

**GRI304: Biodiversity (2017) is in the process of being reformed. The version used here is the 2022 exposure draft.*

ESG Theme	Sub-Theme	Indicator Topics	Framework	GRI 304: Biodiversity*	GRI 13: Agriculture, Aquaculture Fisheries	TCFD	SAFI	Toha	Gold Standard Safeguarding Principles & Requirements	
										Legend
<p>Legend:</p> <ul style="list-style-type: none"> ● Framework directly includes indicator topic ● Framework references this indicator topic, but this may be either indirectly or at a high level <p>For example, an agriculture/food/forestry organisation reporting with TCFD would cover all areas where they are producing or reducing emissions or have climate-related risks/opportunities. TCFD recommends that this cover aspects such as supply chain, land use, grazing regimes, food and by-product waste, and production efficiency (among others), however does not directly reference these as indicators.</p>										
Environment	Land use	Land surface		●	●	●			●	
		Pesticides/chemical use		●			●		●	
		Agricultural production				●			●	
		Pest management		●				●		
		Sustainable practices		●		●	●		●	
	Waste Management	Waste production			●	●				●
		Hazardous waste				●	●			●
		Recyclable/compostable/reusable materials			●	●	●			
	Energy	Usage				●				●
		Renewables				●				
	Supply chain	Animal feed		●	●	●				
		Other materials		●	●	●				
	Animal welfare	Animal health and welfare			●		●	●		●
Ecosystem services / systems approach	Ecosystem services (quant or qual)		●							
Social	Diversity, equity & inclusion	Diversity and equity in workforce			●					
		Labour rights	Working conditions		●		●		●	
	Wages		●		●			●		
	Employee satisfaction									
	Worker/stakeholder feedback and recourse		●		●					
	Community	Community/stakeholder engagement		●						
		Community impact/benefit		●					●	
Resilience		●						●		
Culture	Cultural heritage							●		
Governance	Management team and actions	Leadership demographics								
		Commitment								
		Futureproofing/risk management					●			
		Property/land rights respected		●					●	
		Transparency		●	●				●	
	Commitment	Strategies/commitment to ESG (e.g., climate, water, biodiversity)		●		●	●		●	
		Show alignment with /contribution to SDGs				●			●	
	Futureproofing / risk management	Disclosure/risk management (including transition plans)		●	●	●	●	●		
		Financial health of organisation/project								

ESG Theme	Sub-Theme	Indicator Topics	Framework	GRI 304: Biodiversity*	GRI 13: Agriculture, Aquaculture Fisheries	TCFD	SAFI	Toha	Gold Standard Safeguarding Principles & Requirements	
Environment	Land use	Land surface		●	●	●			●	
		Pesticides/chemical use		●			●		●	
		Agricultural production				●			●	
		Pest management		●				●		
		Sustainable practices		●		●	●		●	
	Waste Management	Waste production			●	●				●
		Hazardous waste				●	●			●
		Recyclable/compostable/reusable materials			●	●	●			
	Energy	Usage				●				●
		Renewables				●				
	Supply chain	Animal feed		●	●	●				
		Other materials		●	●	●				
	Animal welfare	Animal health and welfare			●		●	●		●
Ecosystem services / systems approach	Ecosystem services (quant or qual)		●							
Social	Diversity, equity & inclusion	Diversity and equity in workforce			●					
		Labour rights	Working conditions		●		●		●	
	Wages		●		●			●		
	Employee satisfaction									
	Worker/stakeholder feedback and recourse		●		●					
	Community	Community/stakeholder engagement		●						
		Community impact/benefit		●					●	
Resilience		●						●		
Culture	Cultural heritage							●		
Governance	Management team and actions	Leadership demographics								
		Commitment								
		Futureproofing/risk management					●			
		Property/land rights respected		●					●	
		Transparency		●	●				●	
	Commitment	Strategies/commitment to ESG (e.g., climate, water, biodiversity)		●		●	●		●	
		Show alignment with /contribution to SDGs				●			●	
	Futureproofing / risk management	Disclosure/risk management (including transition plans)		●	●	●	●	●		
		Financial health of organisation/project								

Next Stages

in their Te Tai o Rehua Fund (managed by Clarity Funds Management Limited, in partnership with Tahito as the investment consultant). In this example, Tahito is taking an indigenous worldview to market by using Māori values to select the ESG criteria they use for investment decisions. However, as a fund, the source of data for this analysis primarily remains that supplied from listed companies and therefore is bound by data flows through intermediaries which sit strongly in the western ESG sphere. Despite this, the fund has outperformed the benchmark fund (NZX50) since 2020⁴⁶.

Appetite for integrating Māori ethics in finance

The environmental performance data alone that KIPs aims to provide does not express indigeneity. Instead, indigeneity can be expressed through interconnection of E, S and G or the framing of the metrics used within them. For example, financial wellbeing from an indigenous perspective may be the absence of poverty in local communities, compared to a western perspective which may be based on the accumulation of wealth.

There generally seemed to be low demand for indigenous ethics within ESG frameworks. Views were mixed on supporting a system within sustainable finance that cultivated more space for indigenous ethics to thrive. Some lenders and investors saw value in building frameworks to represent indigenous ethics and were actively working in this space. For example, Tahito, and the upcoming

XRB's Ngā pou o te kawa ora. Others are more cynical and felt the finance industry in general had no (financial) incentive to branch beyond western ESG investment or loan criteria because of the limited size of MACs and higher transaction costs associated with smaller entities. As such, there were a low number of lenders or equity investors with any appetite to represent indigenous values in funds.

However, multiple interviewees did discuss that they expected the demand for including indigenous values in ESG to likely increase overtime. The inherently interconnected and intergenerational thinking that indigenous worldviews provide set up good risk management and positive outcome-orientated business strategies which will increasingly be in demand. Further, inclusion of indigenous ethics is made more likely by the strong alignment between them and alternative economic models such as wellbeing economies and circular economies, which a number of countries including NZ are focused on implementing in the near future.

From the interview process, it has become clear that the role of data infrastructure providers is critical to realising the value of KIPs data throughout the finance sector.

Questions around platform operability and privacy were raised by a variety of finance sector users. For large scale investors to make use of KIPs data, they would require a platform that can associate land blocks with the supply chains of listed land-based primary industries. Privacy issues could be problematic where high-resolution data is attributed down to farm level, however users interested in value-chain level data may not need to identify farm level performance.

Once KIPs understands the cost of bringing RS technology to scale, the potential to integrate data with Toha could be explored. Toha provides data infrastructure and platform operability and is currently fine tuning how to support the flow of data from on-the-ground projects to landscape-scale investors.

Indigeneity indicators generally aim to measure whether indigenous people are respected and engaged. This is most frequently framed around ensuing indigenous property rights are recognised, or the indigenous people are involved in decision-making. This framing reflects a general premise that indigenous entities are not the business owners but are rather 'affected parties' or 'stakeholders' which does not represent the situation in Aotearoa where indigenous ethics are being used to guide indigenous owned businesses operating on indigenous land.

⁴⁶ Tahito. (2023) Ngā Toho Whakahirā o Tahito (Highlights and Key Points of Tahito) <https://tahito.co.nz/sites/default/files/documents/TAHITO%20Fact%20Sheet%20-%20March%202023.pdf>



Future Developments

There are multiple ongoing work programmes and ESG framework developments that will likely increase the value of RS environmental data. These include:

In December 2022, NZ was among the almost 200 signatories of the **Global Biodiversity Framework**. Target 15 of the Framework asks governments to make reporting on nature impacts, dependencies and risk mandatory for large businesses and financial institutions by 2030. This will increase demand for nature sensitive or positive production systems which could be verified by KIPs monitoring.

XRB's mandatory climate disclosure standards are now signed into law. 2023 is the first reporting year for which large, listed companies (> \$60 million market capitalisation), large registered banks, licences insurers, credit union, building societies, and managers of investment schemes (> \$1 billion in assets) are required to report their climate disclosures to government. The standards require mandatory assurance for climate risks (including scope 3) by 2024. The standards do not require companies to use a particular method to calculate their GHG emissions, only to disclose what method they use. However, KIPs could provide companies with a more accurate method of calculation and help reporters meet assurance requirements specified under the standard.

XRB are developing a voluntary non-financial **Sustainability reporting framework: Ngā pou o te kawa ora**. This is to be a conceptual framework to report non-financial value and impacts to increase trust, transparency, and information for decision making, sustainable investment and maintain social licence to operate. The framework's draft principles are drawing on insight from reporting done by Māori entities as its baseline. The initial draft is expected to be available mid-2023. While the framework is voluntary, the NZ government has committed to make nature reporting mandatory by 2030 so Ngā pou o te kawa ora is likely a precursor for the mandatory framework. This evolution of business reporting requirements will continue to drive demand for non-climate domains of KIPs information.

New Zealand Climate Innovation Market (managed by Toha) is yet to launch but could be a major player in getting investment into sustainable agriculture in NZ. As mentioned in Next Stages section, KIPs has potential to become a trusted data supplier to feed into this marketplace.

Revision of the **GRI304 disclosure standard (Biodiversity)** is currently a priority task for the Global Sustainability Standards Board due to the developments in the global sustainability development agenda in recent years. An exposure draft of was released in 2022 and the release of the revised standard is expected to be in Q4 of 2023. This standard may provide new metrics for measuring biodiversity.

Glossary

ISSB has committed to improving the biodiversity and nature sections of its SASB standards. In 2022 ISSB noted that they are creating a work programme to research “incremental enhancements that complement the Climate-related Disclosures Standard (S2), including relating to natural ecosystems and the human capital aspects of the climate resilience transition (just transition)”⁴⁷. ISSB will consider work of TNFD and other nature-related standards and disclosures to inform these enhancements. This aligns with the increase in focus on biodiversity and natural capital in other frameworks, such as with GRI. Companies will have to meet more stringent biodiversity and nature related standards as frameworks such as SASB and GRI step up requirements which increases demand for high resolution monitoring of impact across their supply chains. The **TNFD** beta version 0.4 was released early 2023 and it is expected to release Version 1 by the end of this year. This framework will provide essential guidance for nature-related financial disclosures. KIPs data will be directly relevant to some of the recommended disclosures, and it supports companies in their more general assessment of impacts and dependencies in preparation for disclosure.

From January 2023, membership to the **World Business Council for Sustainable Development (WBCSD)** requires companies to have set targets to reach net-zero GHG emissions by 2050. WBCSD requires companies to have science-informed plans that include natural climate solutions and other carbon removal solutions to achieve this target. Membership also demands that companies set ambitious science-informed goals that contribute to biodiversity recovery by 2050. As leading businesses begin to adopt and report on climate and nature it will drive transformation along value chains to their suppliers, including those providing agricultural products. To meet their own climate and biodiversity goals and expectations of their customers, many WBCSD companies will begin to optimise their supply chain by removing suppliers that have harmful environmental impacts. This largescale shift in supply chains will spike demand for automated, high resolution environmental performance data that KIPs can offer.

Asset Manager: A person or company that takes care of someone else’s investments.

Bond: A bond acts like a loan or an IOU that is issued by a corporation, municipality, or the government. The issuer promises to repay the full amount of the loan on a specific date and pay a specified rate of return for the use of the money to the investor at specific time intervals.

Capital: The funds invested in a company on a long-term basis and obtained by issuing preferred or common stock, by retaining a portion of the company’s earnings from date of incorporation and by long-term borrowing.

Climate finance: Any financial activity that supports climate change related mitigation and adaptation.

Entity: Refers to a corporation, bank, or trust

Environmental (part of ‘ESG’): Factors that relate to the quality and functioning of the natural environment, and natural systems, e.g., carbon emissions, environmental regulations, water stress and waste.

ESG: Acronym refers to the use and consideration by investors, shareholders (and intermediaries) or governance entities of information on the environmental, social or governance performance of an entity.

Equity: Ownership of assets that may have debts or other liabilities attached to them.

Fund: A pool of money from a group of investors in order to buy securities. The two major ways funds may be offered are (1) by companies in the securities business (these funds are called mutual funds); and (2) by bank trust departments (these are called collective funds).

Governance (part of ‘ESG’): Factors that relate to the management and oversight of companies and investee entities, e.g., board structure, pay.

Green finance: Any structured financial activity that has been created to ensure a better environmental outcome.

Indicator: The ESG topic being reported on to show status, health or impact of an investment or company operations.

Investor: An entity that makes investment decisions (distinct from entities that provide capital to those entities).

Māori Agribusiness Collectives (MACs): In this report, Māori agribusiness collectives refers to the commercial agribusiness and forestry operations owned by MALITs and PSGEs on behalf of their collective shareholders.

Metric: What is measured to show status or progress on any given indicator.

Nature-based Solutions: Actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human wellbeing and biodiversity benefits.

Nature finance: Financial flows that contribute towards nature-based solutions.

Restoration finance: Finance which is used specifically to restore biodiversity or ecosystem services. Can be a sub-set of nature and/or climate finance. Is a sub-set of biodiversity finance, which aims to conserve, restore, or avoid a negative footprint on biodiversity or ecosystem services.

Securities: Another name for investments such as stocks or bonds. The name ‘securities’ comes from the documents that certify an investor’s ownership of stocks or bonds.

Social (part of ‘ESG’): Factors that relate to the rights, well-being, and interests of people and communities affected by an investee entity, e.g., labour management, health & safety.

Sustainable finance: Finance that considers environmental, social and governance (‘ESG’) factors alongside conventional financial analysis.

47. IFRS. (2022, December 14). *ISSB describes the concept of sustainability and its articulation with financial value creation, and announces plans to advance work on natural ecosystems and just transition.* <https://www.ifrs.org/news-and-events/news/2022/12/issb-describes-the-concept-of-sustainability/>

[org/news-and-events/news/2022/12/issb-describes-the-concept-of-sustainability/](https://www.ifrs.org/news-and-events/news/2022/12/issb-describes-the-concept-of-sustainability/)

Acronyms

APLMA Asia Pacific Loan Market Association	MfE Ministry for Environment (New Zealand)
CCU Carbon Crop Unit (NZ)	MoF Ministries of Finance
CSRD Corporate Sustainability Reporting Directive	MSCI Morgan Stanley Capital International
DJSI Dow Jones Sustainability Indices (benchmark index family)	NbS Nature-based Solutions
ESG Environment, Social, Governance	NFRD Non-Financial Reporting Directive
ESRS European Sustainability Reporting Standards	NZ New Zealand
GRI Global Reporting Initiative	NZFAP .. New Zealand Farm Assurance Programme
GSSB Global Sustainability Standards Board	PKW Parininihi ki Waitotara
ICMA International Capital Market Association	PRI (UN) Principles for Responsible Investment
ICVC Integrity Council for Voluntary Carbon Markets	PSGE Post-Settlement Governance Entities
IEA International Energy Agency	RIAA Responsible Investment Association Australasia
IFC International Finance Corporation (part of the World Bank Group)	SAFI Sustainable Agriculture Financial Initiative (NZ)
IFRS International Finance Reporting Standards	SASB Sustainability Accounting Standards Board
IPCC Intergovernmental Panel on Climate Change	SDG's Sustainable Development Goals
IRIS+ International Reporting and Investment Standards	SFDR Sustainability Finance Disclosure Regulation
ISSB International Sustainability Standards Board	SLL Sustainability-Linked Loan
KIPs Kaitiaki Intelligence Platform	TCFD Taskforce for Climate-related Financial Disclosures
LMA Loan Market Association	TNFD Taskforce for Nature-related Financial Disclosures
LSTA Loan Syndications and Trading Association	UNEPFI .. United Nations Environment Programme Finance Initiative
MACs Māori Agribusiness Collectives	WBCSD .. World Business Council for Sustainable Development
MALIT Māori Land Incorporations and Trusts	XRB External Reporting Board (NZ government)

National
SCIENCE
Challenges

OUR LAND
AND WATER

Toitū te Whenua,
Toiora te Wai