Sustainability & satellites

New frontiers in sovereign debt investing

⊕ **Investec**
Asset Management

WWF

Advances in geo-spatial research and its applications are giving investors new tools to measure environmental risk in sovereign debt portfolios.

The investment community should embrace them.

Foreword

The decline of nature at an unprecedented rate threatens the stability of the natural and human-made systems that underpin our health, livelihoods, food security and economies. Drivers of this decline include deforestation, unsustainable farming practices, overfishing, climate change, poaching and pollution.

The degradation of nature must be halted and reversed. As indicated in WWF's 2018 Living Planet Report, there is still a window of opportunity, albeit limited, to initiate policies and actions that can achieve change at scale. All stakeholders, including financial institutions, must play their part in the urgent effort needed to secure humankind's sustainable future.

Sovereign debt investors are very well placed to contribute, through a robust and comprehensive integration of environmental considerations into their investment and government-engagement strategies. At the end of 2018, an estimated US$66 trillion of sovereign debt was outstanding, constituting as much as two-thirds of the assets in the global bond market, by some estimates.[1] Given the size of this asset class and the positive influence bondholders can exert on governments, the engagement of sovereign debt investors will be critical in moving towards sustainable management of our planet's natural resources.
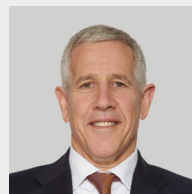
Current models to assess the risks associated with sovereign debt investments typically do not comprehensively integrate environmental issues, often relying on broad proxy indicators that may mask the complex nature of the environmental threats facing countries.

This report, developed jointly by WWF and Investec Asset Management, points sovereign debt investors to the use of geospatial data to identify trends in natural-resource use and countries' commitment to conserving biodiversity. Spatial tools and data may help them form an independent and credible assessment of the systemic environmental risks countries face.

This is an exciting collaboration and we hope it will catalyse action by investors globally. They have a key part to play in protecting and restoring our natural world, and safeguarding the natural assets on which we all depend. Integrating environmental considerations more fully into sovereign debt investing will enable the finance community to play a meaningful role, assisting countries to forge a path towards sustainable development.

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1 https://www.cnbc.com/2019/01/23/government-debt-tab-hits-66-trillion-80percent-of-global-gdp-fitch-says.html
https://www.bis.org/ifc/events/ifc_armenia_2018/Tissot.pdf

The *fast* view

1 The degradation of nature threatens national economies and the systems that underpin human society globally.

2 Understanding environmental risks is therefore key to profiling a country's economic prospects and its ability to repay debt.

3 Analysis of geo-spatial data and satellite imagery will increasingly allow sovereign debt investors to obtain more accurate and timely assessments of environmental change.

4 This will enhance investors' ability to evaluate and monitor environmental risks. It will also facilitate their engagements with sovereign issuers and encourage the adoption of long-term fiscal agendas that serve people and the planet.

Introduction

With the world facing a looming climate and biodiversity crisis, new research techniques could transform investors' ability to evaluate environmental risks. For sovereign debt investors, they provide valuable opportunities to assess such risks at the country level.

These analytical methodologies give deeper insight into sustainability-related risk and return dynamics in government bond portfolios. They also offer the investment community a must-seize opportunity to extend and enhance their engagement with national policymakers, with the aim of encouraging a long-term fiscal agenda that serves people and the planet.

Urgent action needed

Mounting evidence suggests time is running out to address the world's environmental challenges. The Global Footprint Network estimates that we are using nature 1.7 times faster than our planet's ecosystems can regenerate.[2] The pace of environmental degradation and climate change is unprecedented. This unsustainable state of affairs calls for the transformation of core global systems, including energy, infrastructure, transport, land, industry and finance.[3]

The relevance of this to national economies, in terms of both risks and opportunities, is clear. Individually and collectively, asset managers must act to safeguard the interests of sovereign bond investors, and to contribute to the global effort to safeguard the future of our planet.

In this paper, we explore advances in the science of sustainable investing, particularly those based on analysis of satellite imaging and geo-spatial data. We also examine their potential to augment current sustainability research techniques and provide sovereign bond investors with a more robust picture of environmental risks. We offer several case studies to demonstrate how integrating environmental issues more fully into sovereign debt portfolios could enhance investment analysis and facilitate constructive engagement with sovereign issuers.

Mounting evidence suggests time is running out to address the world's environmental challenges.

2 https://www.footprintnetwork.org/2018/07/23/earth-overshoot-day-2018-is-august-1-the-earliest-date-since-ecological-overshoot-started-in-the-early-1970s-2/
3 https://www.stockholmresilience.org/research/research-news/2017-07-02-three-years-to-safeguard-our-climate.html

The decline of nature

A growing concern for sovereign debt investors

Gauging how a country is using (or abusing) its natural capital — its stock of natural assets including land, air, water and all living things — is becoming increasingly critical for sovereign debt investors. There is abundant evidence that the degradation of nature poses risks for national economies, and therefore may impact the performance of sovereign bonds.

Every country's prosperity ultimately derives from the natural world. Minerals, soil, energy, water and biological resources underpin the growth of most economic sectors. Without resilient natural ecosystems, economic activity cannot be sustained. Recognising this, countries are beginning to include natural capital in their national accounting frameworks.

Recent research suggests the consequences of continued environmental degradation are becoming more severe and immediate. In October 2018, the UN Intergovernmental Panel on Climate Change warned that the planet has less than 12 years to avoid catastrophic levels of global warming.[4] In May 2019, following the most comprehensive investigation ever into the planet's health, another UN body concluded that one million species face extinction due to human activity and that "we are eroding the very foundations of economies, livelihoods, food security, health and quality of life worldwide".[5] In the pursuit of social development, every nation is exceeding sustainable environmental boundaries (Figure 1).[6]

Gauging how a country is using (or abusing) its natural capital is becoming increasingly critical for sovereign debt investors.

4 https://www.ipcc.ch/2018/10/08/summary-for-policymakers-of-ipcc-special-report-on-global-warming-of-1-5c-approved-by-governments/
5 https://www.ipbes.net/news/Media-Release-Global-Assessment
6 https://www.nature.com/articles/s41893-018-0021-4

Figure 1: No country has yet made significant social progress without transgressing environmental boundaries (bubbles scaled by population)
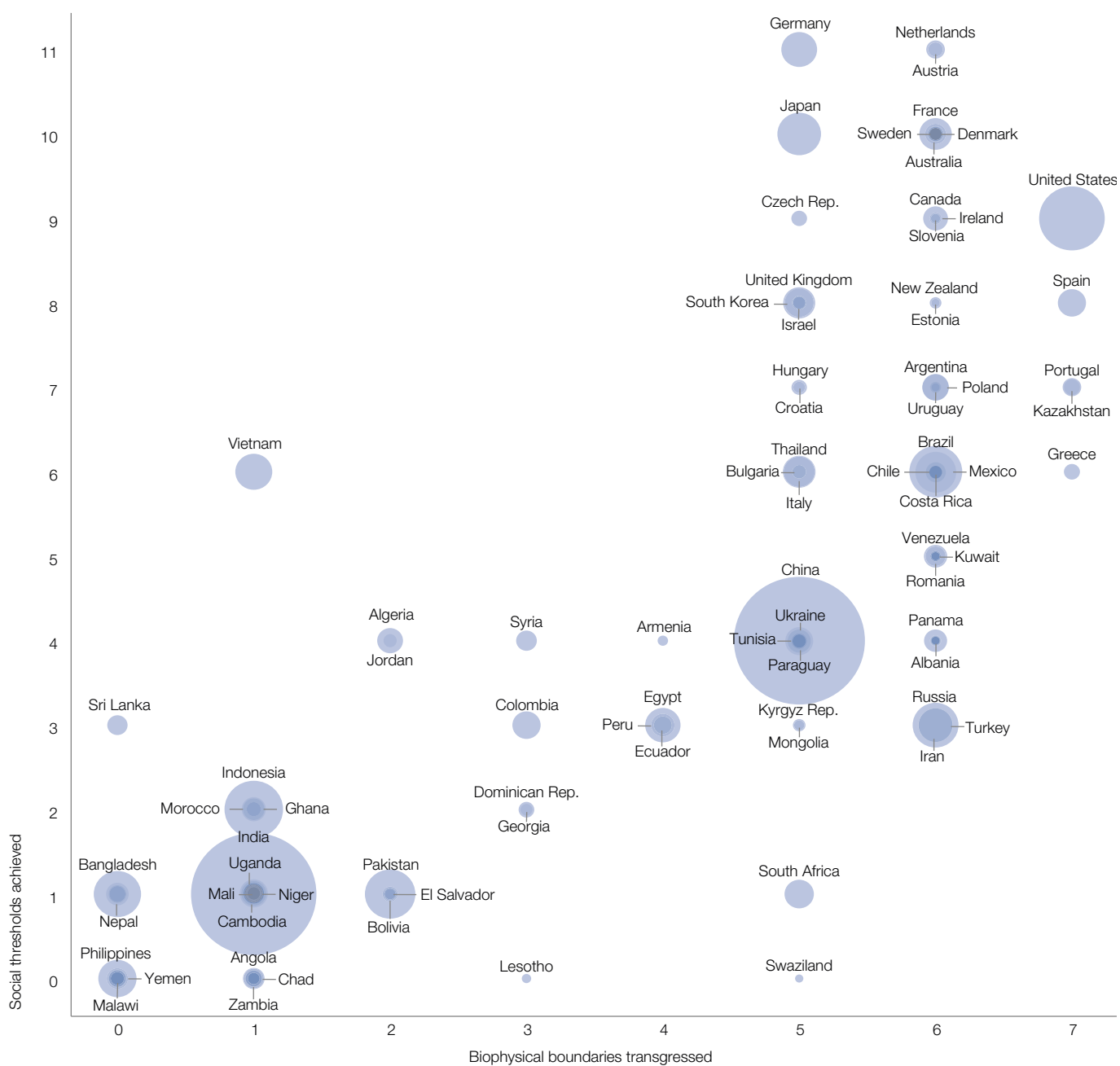
# The decline of nature continued

The latest studies suggest we are reaching a tipping point. A combination of global warming, soil infertility, pollinator loss, chemical leaching and ocean acidification is creating a 'new domain of risk' (Figure 2). The natural world may become increasingly unable to sustain healthy national economies.[7]

Only three of the nine natural systems identified as regulating the stability and resilience of the Earth are currently within a safe operating space (i.e. within limits that will allow humanity to continue to thrive). As we explore in the next section, it is becoming increasingly urgent for sovereign debt investors to address environmental risks.

Figure 2: Beyond planetary boundaries
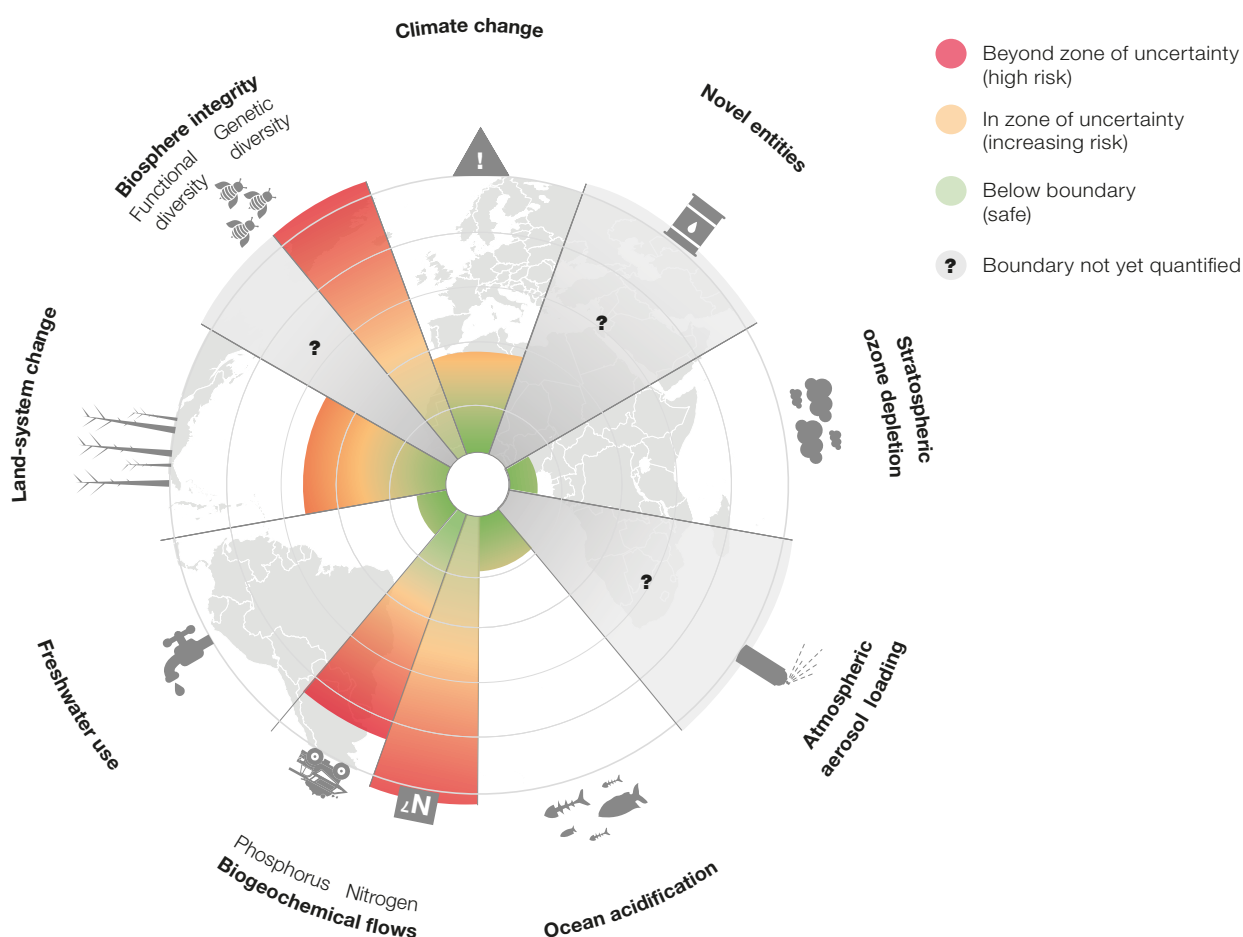
Source: Steffen et al 2015, modified from Rockström et al 2009

7 https://www.nature.com/articles/461472a

Material impact

Why environmental issues matter to sovereign debt investors

It is increasingly clear that a country's management of its natural resources will influence the sustainability and volatility of its growth over the long term. In turn, this will shape a government's ability to generate revenues to repay its debt, and become a key driver of sovereign credit ratings and sovereign bond returns.

The dynamics can be complex. For instance, climatic conditions — specifically droughts, which resulted in community displacement and fuelled unemployment — were a trigger for the Arab Spring, which spread across the Middle East from 2010.[8] But as that example highlights, the economic and social impacts can be enormous. Environmental factors can therefore have a material impact on the financial performance of sovereign bond portfolios.

Arguably, international trade is increasingly being influenced by sustainability concerns. For example, consumer resistance to products containing palm oil threatens an industry that contributes 3.5% of Indonesia's GDP and generates the incomes of 17 million of that country's citizens.[9,10] Sovereign debt investors need to be alert to the impact of such trends, including the possibility of stranded assets in the future.

It is important to emphasise that the relationship between a country's environmental and economic performance can be positive as well as negative. Just as degradation of natural assets can give rise to risks for sovereign debt holders, careful stewardship of natural capital has the potential to yield beneficial outcomes, as the following examples show.

Uruguay: powering up

In 2012, just 40% of Uruguay's electricity was generated from renewables. By January 2018, almost all of its energy was being produced from wind, solar and other sustainable sources.

As well as reducing the country's carbon footprint, this astonishingly swift energy transition bolstered Uruguay's ability to withstand external economic shocks: with no fossil-fuel resources of its own, Uruguay used to rely on imported oil to augment domestic hydro-power.

Uruguay's push for energy independence has also had positive impacts on its trade balance, balance of payments and economy more broadly.

Its energy mix continues to evolve. Ultimately, the country should be able to meet its base energy requirements solely from wind, with hydro-power used only to cover peak demand.

Uruguay's push for energy independence has had positive impacts on its economy.

8   https://af.reuters.com/article/africaTech/idAFL8N1ZN3H1
9   https://www.bloomberg.com/news/articles/2019-03-20/indonesia-threatens-to-ban-european-goods-as-palm-row-escalates
10 https://www.bloomberg.com/news/articles/2019-05-05/palm-oil-titan-warns-eu-controls-on-biofuel-use-will-backfire

Brazil: ecosystems under threat

The Cerrado, which lies primarily in central and north-eastern Brazil, is an area of forest, savanna and grassland that once covered two million square kilometres. It is home to about 5% of the world's biodiversity.[11] Half of Brazil's watersheds originate there, including the Pantanal, the world's largest wetland.

About 50% of the Cerrado has been converted to agricultural use, particularly soy production. The removal of native vegetation has been linked to changes in precipitation patterns and regional climate change, with negative impacts on agriculture and hydropower production capacity. Further conversion of natural vegetation risks creating stranded agricultural and energy assets.[12]

The Cerrado is vital to the sustainability of the Brazilian economy. Some 90% of Brazilians rely on hydroelectric power generated from watersheds originating in the Cerrado, which is also a source of water for millions of people.

There are sustainable solutions, strengthening the case for positive engagement with the Brazilian authorities. For instance, soy production could be tripled without converting any more land to agriculture.[13,14] Efforts in this direction have received backing from investors and food-industry companies, 135 of whom had signed the Cerrado Manifesto's Statement of Support by April 2019, which calls for zero-deforestation soy.

As Daniel Salter, group responsible sourcing manager at supermarket chain Tesco, noted, "Industry, civil society and governments must work together to ensure that soy expansion occurs only on existing agricultural land. Offering incentives as well as effective policies that redirect soy expansion to existing agricultural land can ensure zero-deforestation soy production".[15]

11 https://news.mongabay.com/2019/04/brazil-soy-trade-linked-to-widespread-deforestation-carbon-emissions/
12 https://news.mongabay.com/2019/03/investors-warn-soy-giants-of-backlash-over-deforestation-in-south-america/
13 https://www.researchgate.net/publication/310599766_Cracking_Brazil's_Forest_Code
14 https://core.ac.uk/download/pdf/82713437.pdf
15 https://www.businessgreen.com/bg/news/3036780/cerrado-manifesto-investors-and-corporates-step-up-calls-for-zero-deforestation

Case study: Brazil

Historical indicators of the 'Dutch disease'

What are the signs that natural-capital depletion poses risks to sovereign debt performance? Analysts at Investec Asset Management examined Brazil, where changes in the rate of resource depletion appear to lead returns on sovereign bonds by about seven years (Figure 3). The following reflects Investec Asset Management's analysis and opinions.

A historical examination of Latin America's largest economy suggests prior evidence of the so-called Dutch disease — when a country's addiction to commodities causes its entire economy to become distorted and unsustainable. Brazil's consumption of natural resources began to increase around 1999, reaching a peak in 2008 before slowing.

One indicator of Dutch disease is excessive reliance on the accumulation of capital to drive growth, rather than on labour and productivity. That Brazil was suffering from the malaise was also flagged by increasing investment of capital into resource-depleting sectors.

Harvard University's Economic Complexity Index offers another perspective (Figure 4).[16] Brazil's declining index score highlights that the Brazilian economy became less diversified as it grew more dependent on capital-intensive commodity production. This deterioration in the quality of the Brazilian economy foreshadowed lower financial returns.

Financial-cycle models, like those used at Investec Asset Management, can also reveal the broader economic symptoms of excessive dependency on commodities. In Brazil, these included a credit and property boom, an overvalued real exchange rate and a large current account deficit. They ultimately led to a deep recession.

Traditionally, investors have looked at excesses in credit growth and property markets as signs of imbalance and potential crisis. In the future, the depletion of natural resources could become a key early warning indicator in its own right.

What are the signs that natural-capital depletion poses risks to sovereign debt performance?

16 http://globe.cid.harvard.edu/

Figure 3: Sovereign returns and resource use

Changes in Brazil's rate of resource depletion appear to lead returns on sovereign bonds by about seven years. The chart plots 3-year annualised returns on sovereign US dollar debt, as reflected in the JPMorgan EMBI Global Diversified Brazil index, vs natural resources rents, a measure of the value being extracted from natural resources.

Brazilian sovereign US dollar debt returns (3-year annualised, %)

Brazil: Natural Resources Rents (% of GDP, RHS inverted, top date axis)
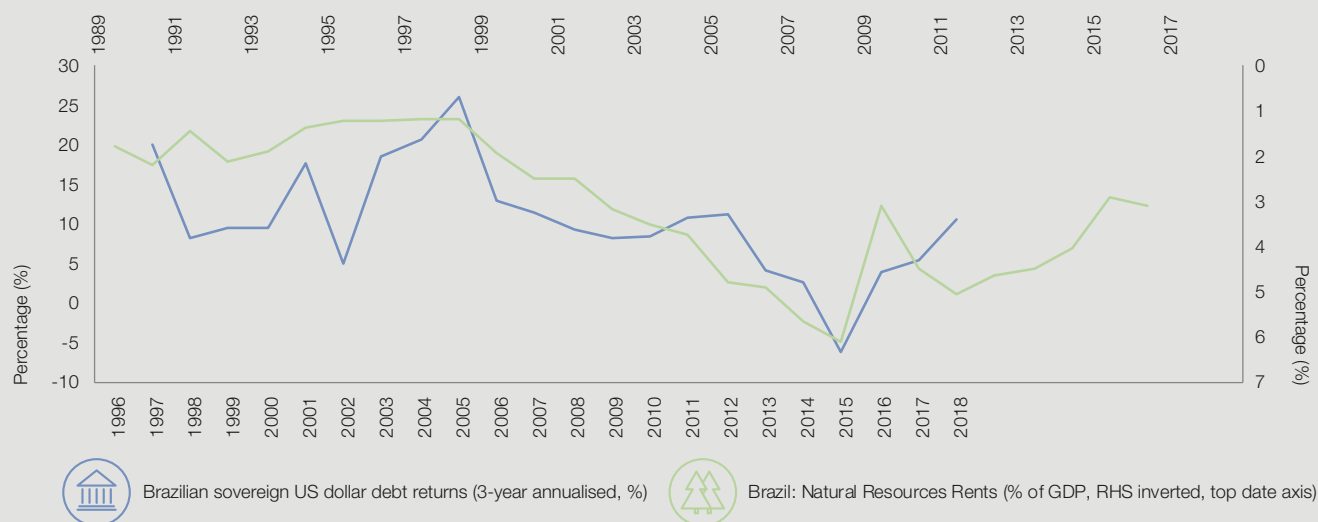
Source: World Bank, Bloomberg, Investec Asset Management

Figure 4: Local currency returns and economic complexity

Excessive focus on commodities was evident in a reduction in the Brazilian economy's 'complexity' score, a measure of economic diversity. The chart plots returns for Brazilian local currency cash instruments, as reflected in the JPMorgan ELMI + Brazil index, vs a Harvard University complexity index.

Brazilian local currency cash instrument returns

Brazil: Economic Complexity Index (Ratio, RHS)
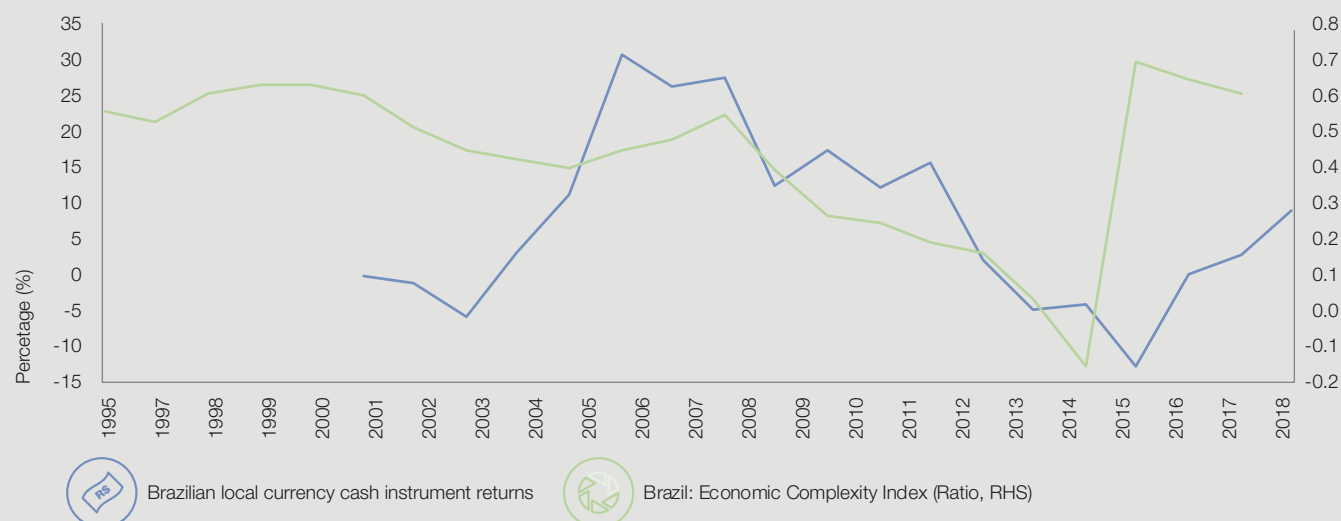
Source: Harvard University, Bloomberg, Investec Asset Management

Putting sustainability

into sovereign ESG analysis

Despite the importance of natural capital to a nation's economic sustainability, until recently investors have generally paid scant attention to the connection between environmental factors and the long-term risk/return profile of debt issued by sovereign entities. In contrast, social and governance factors have been widely considered.

One reason for this is the lack of timely and accurate data on environmental issues, coupled with the fact that it can take longer for them to be reflected in portfolio returns. It has also often been challenging to demonstrate that environmental concerns are material (see 'Recognising materiality: water risks and growth' on page 13).

Another impediment to the consideration of environmental factors is that investors' primary measure of economic performance has historically been gross domestic product (GDP), which measures a nation's income but ignores its total wealth, including its natural capital.

Things began to change in the mid-1980s, as concern grew that rapid GDP growth in resource-rich countries was being driven largely by liquidating natural assets. Though this boosted consumption in the short term, it was not necessarily leading to sustainable improvements in wealth or wellbeing.

Accounting for natural capital

Consensus is growing among investors that a wider measure is needed to evaluate the sustainability of economic progress, one that looks not only at income but at wealth. As the World Bank has noted, GDP and wealth are complementary indicators that provide a fuller picture of a country's economic prospects.[17] As well as natural capital (e.g., forests and water), wealth includes produced capital (e.g., factories and roads), human capital and net foreign assets.[18] Natural capital constitutes almost half of wealth in low-income countries and more than one quarter in lower- to middle-income countries.

The advent of environmental, social and governance (ESG) investing has introduced a plethora of metrics aimed at helping investors integrate what used to be called 'non-financial' factors into their decision-making, including those relating to natural capital. However, current ESG research may provide only a limited picture of a nation's environmental performance. Also, the current design of typical sovereign-debt investment processes may constrain portfolio managers' ability to give enough weight to environmental factors.

This is starting to change. First, fixed income investors are beginning to recognise the materiality of environmental risks. Second, as we explore later in this report, advances in sustainability research are starting to give sovereign debt investors new tools to incorporate country-level changes in natural capital into their risk frameworks.

17 Source: https://www.worldbank.org/en/news/infographic/2018/01/30/the-changing-wealth-of-nations
18 Source: Ibid

Recognising materiality: water risks and growth

This map, taken from WWF's Water Risk Filter, highlights how spatial data can illuminate the potential materiality of environmental issues to investments, and to economic growth more broadly. Overlaying physical water risk on a geographically distributed measure of GDP reveals that 19% of global economic output comes from areas of high to very-high water risk.[19] These regions are under threat of severe socio-economic impacts.
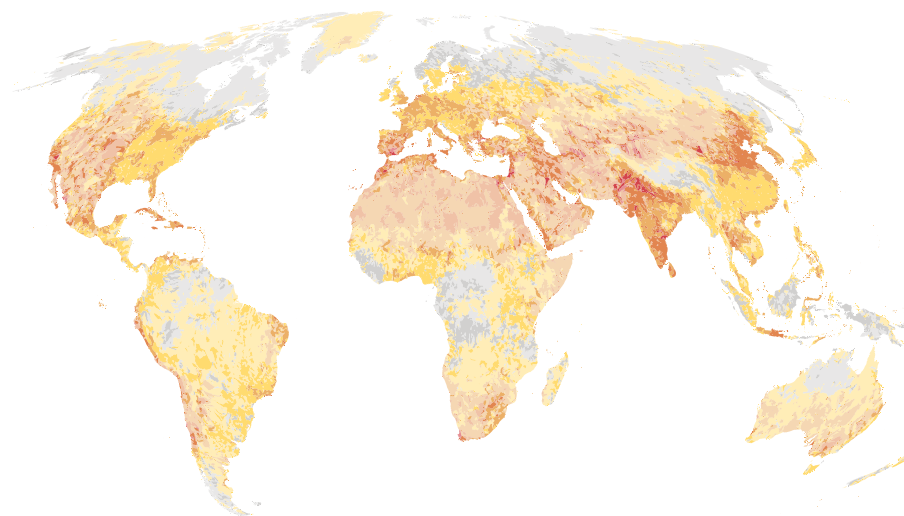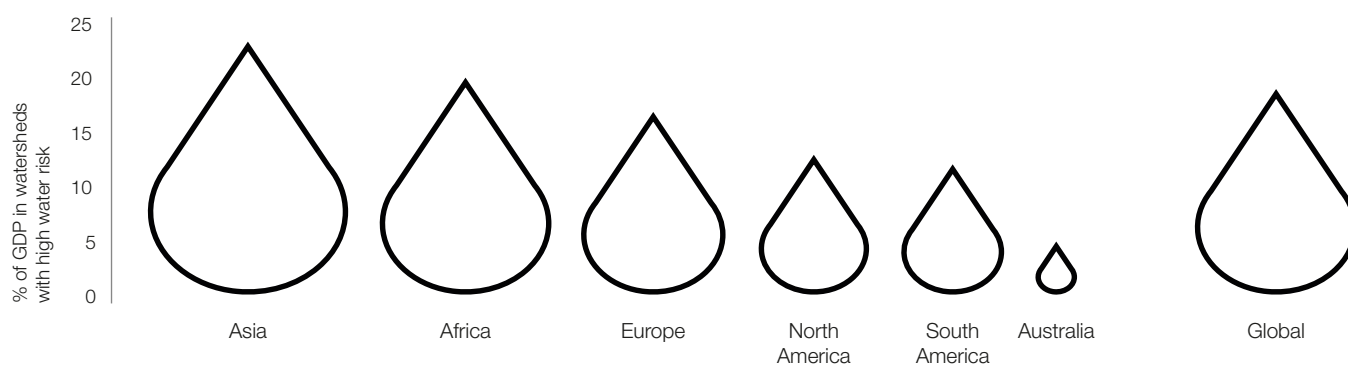
19%
of global GDP comes from areas of high to very high water risk

GDP and water risk

Relative total GDP Purchasing Power Parity per HydroSHED[20]

Physical risk score	Very low	Low	Moderate	High	Very high
Lower three quartiles	⚪	🟡	🟠	🟠	🔴
Upper quartile	⚪	🟡	🟠	🟠	🔴

Figure 5: Physical water risk

% of GDP in watersheds with high water risk

Asia   Africa   Europe   North America   South America   Australia   Global

Source: 'Valuing Rivers' (pp. 42-43), WWF, 2018

19 http://awsassets.panda.org/downloads/wwf_valuing_rivers__final_.pdf
20 https://www.worldwildlife.org/pages/hydrosheds

Putting sustainability into sovereign ESG analysis
continued

The start of a journey

At the end of 2018, an estimated US$66 trillion of government bonds was outstanding, equivalent to about 80% of global GDP and constituting as much as two-thirds of the assets in the global bond market, by some estimates.[21]

In our view, taking a sustainable approach to managing sovereign debt portfolios is in the interests of investors worldwide. As the holders of securities issued by governments to finance growth and development, sovereign debt investors can also play a key role in encouraging nations to address environmental risks.

Their engagement is especially valuable because sovereign-debtholders are often long-term investors. Election cycles and the vagaries of politics mean that governments typically have much shorter horizons, while introducing market mechanisms to tackle environmental issues has sometimes proven deeply unpopular with electorates.

We believe there is an opportunity for investors to develop a collective voice on these issues. But we are at the start of a journey. As we discuss in the final section of this report, owners and managers of sovereign debt may need to adapt their investment policies and approaches to more fully take account of environmental risks. And it will take co-ordinated action by investors and other stakeholders to effect meaningful change in countries' management of their natural capital. But as more sovereign debt investors begin to price in environmental risks, governments will have a further reason to address them.

Investors can play a key role in encouraging nations to address environmental risks.

21 https://www.cnbc.com/2019/01/23/government-debt-tab-hits-66-trillion-80percent-of-global-gdp-fitch-says.html
   https://www.bis.org/ifc/events/ifc_armenia_2018/Tissot.pdf

Sustainable palm oil

The role of sovereign debt investors

Sovereign debt investors can make a positive contribution to a broad range of environmental issues. Palm-oil production offers a prime example.

Palm oil is used in many foodstuffs and other consumables, and its cultivation generates incomes for millions of people worldwide. However, the methods used to grow the crop have fuelled climate change, caused air pollution and harmed biodiversity.

The consequences of unsustainable palm-oil production were brought sharply to the world's attention in 2015. Fires to clear forestland for palm-oil cultivation produced a smog that engulfed vast tracts of Southeast Asia and may have caused over 100,000 premature deaths.[22]

Indonesia is the world's leading producer of palm oil, accounting for 55% of global production in 2016.[23] Since 2000, the area of land in Indonesia under cultivation for oil palms has more than tripled, contributing to deforestation, peatland degradation and greenhouse-gas emissions.[24]

Coordinated, sustained action required

WWF regards palm oil, a highly productive crop, as a critical commodity for global food security.[25] Replacing it with other edible oils would require expanding agricultural land, leading to more deforestation and other habitat loss and exacerbating climate change.

Rather than seeking to phase out palm oil, WWF and other organisations advocate moving the palm-oil industry onto a sustainable footing. This requires continuous engagement at multiple levels, but particularly with the governments of producer countries. Sovereign debt investors are well placed to play a role in this.

Joining the effort

Spurred by the work of various entities since the early 2000s in particular, a broad coalition of stakeholders is already engaged in the campaign. An increasingly strong consumer backlash in the West has encouraged multinationals and governmental organisations – including, notably, the European Union – to try to source only sustainable palm oil.

The financial sector is also getting involved. But while equity and corporate credit investors have become more sensitive to the risk of exposure to palm oil, sovereign debtholders have to date generally been slower to act — despite the fact that the palm-oil industry is a key component of the national economies of producer countries, accounting for 3.5% of Indonesian GDP.[26]

22 https://www.theguardian.com/world/2016/sep/19/haze-indonesia-forest-fires-killed-100000-people-harvard-study
23 Cited in CLSA U Blue Book, 'Keep palm… Edible-oil sustainability in Asia', July 2018
24 Ibid
25 WWF, 'WWF to financial institutions: Don't divest away our forests', April 2019
26 https://www.bloomberg.com/news/articles/2019-03-20/indonesia-threatens-to-ban-european-goods-as-palm-row-escalates

Work to do

There is still a long way to go to make palm-oil production sustainable. Fast growth in demand from Asia, where consumers tend to be less motivated by environmental concerns, could reduce some of the pressure on agribusinesses and government agencies in palm-oil producing countries. Moreover, making palm-oil production sustainable is a highly complex challenge for the governments of the countries that grow the crop, which lack the financial resources of more developed economies. For example, well-intentioned national policies in Indonesia have been undermined by difficulties of enforcement. Between 2000 and 2012, an estimated 80% of forest clearance for palm-oil production in Indonesia was illegal.[27]

Long-term engagement

Various initiatives are underway to ameliorate the situation in the near term. But given the above complexities, achieving and maintaining palm-oil industry sustainability will be a long-term project – one that sovereign debt investors, as holders of government securities typically with long investment horizons, are particularly well placed to contribute to.

Spatial data could be key in helping them do so. Currently, geo-spatial information for Indonesia is limited.[28] As it improves, sovereign debt investors will have useful tools to help them monitor progress, evaluate the investment risks associated with unsustainable palm-oil production, and engage with sovereign issuers on a critical environmental challenge facing the planet.

An important area of discussion for sovereign debt investors is Indonesia's banking sector. Indonesian banks lag their peers in Singapore and some in Malaysia on ESG integration and — in the view of the Financial Stability Board's Task Force on Climate-related Financial Disclosures (TCFD) — are not adequately managing climate risk.

The banking sector is a key component of Indonesia's GDP, which makes the climate risks associated with it an important vulnerability for the economy overall. Also, local banks are the primary lenders to the palm-oil industry, and therefore have the potential to influence the sustainability of the agricultural sector. To date, only two Indonesian banks have recognised biodiversity loss as a risk. None of them requires its clients to commit to zero deforestation as a lending condition.

Through more robust regulation, the government can help Indonesian banks make faster progress on ESG integration, aligning them with their regional peers and science-based best practices.

An important area of discussion for sovereign debt investors is Indonesia's banking sector.

27 Source: CLSA U Blue Book, 'Keep palm… Edible-oil sustainability in Asia', July 2018
28 Ibid

Current ESG metrics

A valuable but incomplete view for sovereign bond investors

For investors in sovereign bonds, recognising the links between a nation's management of its natural capital — its stock of natural assets — and its economic sustainability is the first step. But how can they assess a country's environmental performance?

Various efforts have been made to improve the measurement of environmental risks in sovereign debt portfolios.[29] However, the complexity of environmental and biodiversity data has limited investors' ability to incorporate it systematically into risk frameworks.

Broad proxies — such as energy intensity[30] or water stress[31] — are often used to gauge a country's exposure to environmental threats. Though useful to investors, these indicators may provide an incomplete picture of environmental risks. In addition, they are typically factored in at an early contextualisation phase of an investment process and are often disconnected from mainstream financial analysis.[32]

Another challenge is that sustainability information tends to be outdated. It may therefore be of limited use in helping investors assess whether governments are delivering on their environmental commitments. Although more environmental data has become available, key information required to measure natural capital is still missing, difficult to access or unreliable. This includes data on water, minerals, pollination, natural hazards and the condition of natural capital generally.
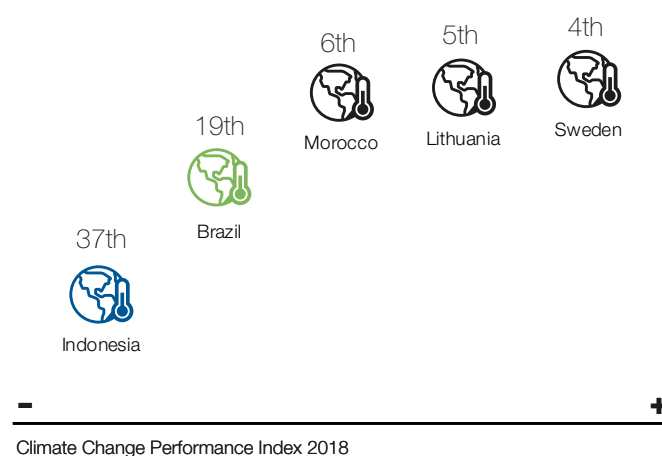
Here, we profile three of the established metrics available to sovereign debt investors to gain insights into country-level environmental risks. We highlight the performance of Brazil and Indonesia, which feature in case studies elsewhere in this report.

Though these measures can be useful to investors, they may mask potentially important indicators of the depletion of nature and natural capital. As we explore later, spatial data can help to provide a more complete picture.

Climate change

The Climate Change Performance Index (CCPI) is one of several measures that seek to gauge countries' progress towards meeting international climate agreements.[33]

Indonesia's low rank (37th/57) reflects the destruction and degradation of its forestlands. Brazil scores highly, its ranking boosted in part by its adoption of various international declarations on climate change and forest conservation, among other commitments.

Climate Change Performance Index 2018

29 For example, see https://www.unepfi.org/ecosystems/erisc/
30 https://www.nb.com/web/japan/news/N0273_ESG_Factors_in_Sovereign_Debt_Investing.pdf
31 https://www.unpri.org/fixed-income/integrating-esg-factors-into-sovereign-issuer-analysis/31.article
32 https://www.tandfonline.com/doi/abs/10.1080/20430795.2013.837810
33 https://www.climate-change-performance-index.org/

Resource management

The Resource Governance Index (RGI)[34] assesses policies and practices that countries employ to govern their oil, gas and mining industries. Both Brazil and Indonesia rank as 'Satisfactory'.

Land and water management

The Ecosystem Vitality subset of the Environmental Performance Index (EPI)[35] provides a proxy for land-management trends. It assesses forest loss, protection of biodiversity, fisheries, water resources, agriculture, climate trends, energy use and air pollution. Brazil (68th out of 180 countries) significantly outscores Indonesia (116th). As with the other metrics discussed here, to some extent the gap reflects the different stages of development of the Brazilian and Indonesian economies.

Resource Governance Index 2017
(Oil and Gas or Mining - Highest Value reported)

Environmental Performance Index (EPI), 'Ecosystem Vitality' 2018

34 https://resourcegovernanceindex.org/country-profiles
35 https://epi.envirocenter.yale.edu/epi-topline

Spatial finance

Towards more sustainable sovereign debt investing

Spatial finance has the potential to significantly augment current ESG metrics, particularly for sovereign debt investors seeking to gain national and global perspectives on environmental risks. This emerging field brings together geospatial data (essentially, any information with a geographic component), Earth observation (e.g. satellite imagery) and financial analysis.

To explore spatial data's potential application to investing, Investec Asset Management and WWF launched a joint project to examine how it could be used in a sovereign debt context. We hope this will kick-start industry engagement to develop this important area.

Spatial data's potential impact on sovereign debt investing has a parallel in advances in the availability of financial data over the past decades. Where once fixed income investors waited weeks between inflation readings, they can now monitor a vast range of economic data on a continual basis. The application of spatial data to finance could bring about a similar evolution in investors' ability to understand and respond to environmental issues.

By monitoring natural assets via satellite images and interpreting other information derived from remote-sensing sources — and combining these insights with geo-located information on assets such as mining concessions or dams — spatial finance could help investors monitor a broad range of sustainability concerns. It could also allow them to cross-check other ESG analysis and to verify a country's adherence to its environmental policies and commitments.

Unlike much ESG analysis, the data used in spatial finance is often quantitative and so less open to interpretation. It can also be sourced regularly, sometimes almost in real time.

This is a fast-developing area, but the primary initial uses of spatial finance can be summarised as follows:

- **Check compliance**: Spatial datasets can offer new or better ways of cross-checking the ESG performance of a state or company, provided its assets can be geographically defined. For example, they can be used to monitor a nation's adherence to its climate-change policies or its commitment to restore a specific area of forestland.

- **Enable timely analysis**: At present, some spatial datasets (and most sovereign ESG indicators) are only updated annually, though others are refreshed more frequently. Commercial providers are now imaging the entire planet every day. As a result, metrics based on this data can be generated more frequently than some established ESG indicators.

- **Provide new insights**: In some developing countries, the broad proxies used to measure ESG performance and other issues of relevance to investors can be difficult to produce. Spatial data may be able to fill the gaps. For example, it could be used to track shipping activity in real time, providing insights into economic activity.

Spatial data offers the means to monitor pressures on nature.
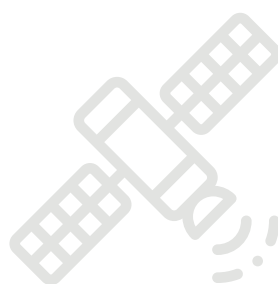
Spatial data in investment research

What is it? | Who owns it? | How can investors access it?

Spatial data and satellite imagery have been available since the mid-1980s, though they have improved significantly in recent years. Today, they offer one of the primary means of monitoring pressures on nature. They are used to generate a range of ESG-relevant metrics, like the OECD's Green Growth Indicator.[36]

Such metrics track, for example, land-cover change over time (e.g., loss of natural and semi-natural vegetated land to farming or artificial surfaces) and land fragmentation (the extent to which an area of land is divided into patches, which may affect its ability to sustain certain plants or animals).

Spatial data is owned and released by public agencies and private companies. The intellectual property of the primary products is held by these institutions, but licensing terms vary. Open data-licensing is common with the spatial satellite programmes of public agencies (e.g. the European Space Agency's Copernicus, and NASA's Earth Observing System), while commercial restrictions usually apply to the data generated by private companies.

Open licensing has led to the generation of various products based on the data. The companies behind such initiatives tend to supply basic, or less up-to-date, versions of their products freely. They also typically offer premium services based on current data or more sophisticated analysis. For example, Global Forest Watch provides annual global maps of forest loss; for payment, users can access weekly alerts. Depending on their needs and capabilities, end-users may process and analyse spatial data themselves, or purchase research based on the data from a third party.

WWF-UK and WWF-Switzerland are engaging financial institutions and commercial data providers — as well as a key conservation data provider, IBAT[37] (Integrated Biodiversity Assessment Tool) — to support the integration of spatial data into traditional ESG methodologies. As a first step, they are supporting the development of a commercial spatial-finance product that systematically screens for risks to World Heritage sites and protected areas from extractive-industry companies.

36 Source: http://www.oecd.org/greengrowth/green-growth-indicators/
37 IBAT is a joint initiative by BirdLife International, Conservation International, IUCN and UNEP-WCMC (www.ibat-alliance.org)

Coverage & complexity

## Getting to grips with spatial data

As with any information source, it is important that investors understand the characteristics of spatial data. As we highlight below using two examples of spatial datasets, collating and interpreting the data can be complex. For an overview of the emerging ecosystem of ESG-relevant spatial data platforms and providers, please see the appendix.

Forest-loss spatial data

Several data sources enable investors to track forest loss (Figure 8). The spatial data available to do so in Brazil is excellent. The MapBiomas[38] initiative provides annual land cover and land use maps from 1985 to the present. In addition, the Brazilian government has collected remote-sensing data on annual deforestation within the Brazilian Amazon since 2000, via its Amazon Deforestation Monitoring Project (PRODES). PRODES data for the Cerrado has been available since 2016, and the programme intends to cover the entire country by 2020.[39]

Spatial-data coverage of some other regions is patchier. Researchers therefore need to rely on global forest-monitoring datasets, such as that provided by Global Forest Watch (GFW), which tracks forest loss since 2000. However, different methodologies underlie the various datasets. For instance, GFW and PRODES estimates of forest loss vary, partly because PRODES only detects forest loss greater than 6.5 hectares. There are also differences in the frequency of updates and public accessibility.

Figure 8: Shrinking forest: satellite images of the Amazon

1980

2016
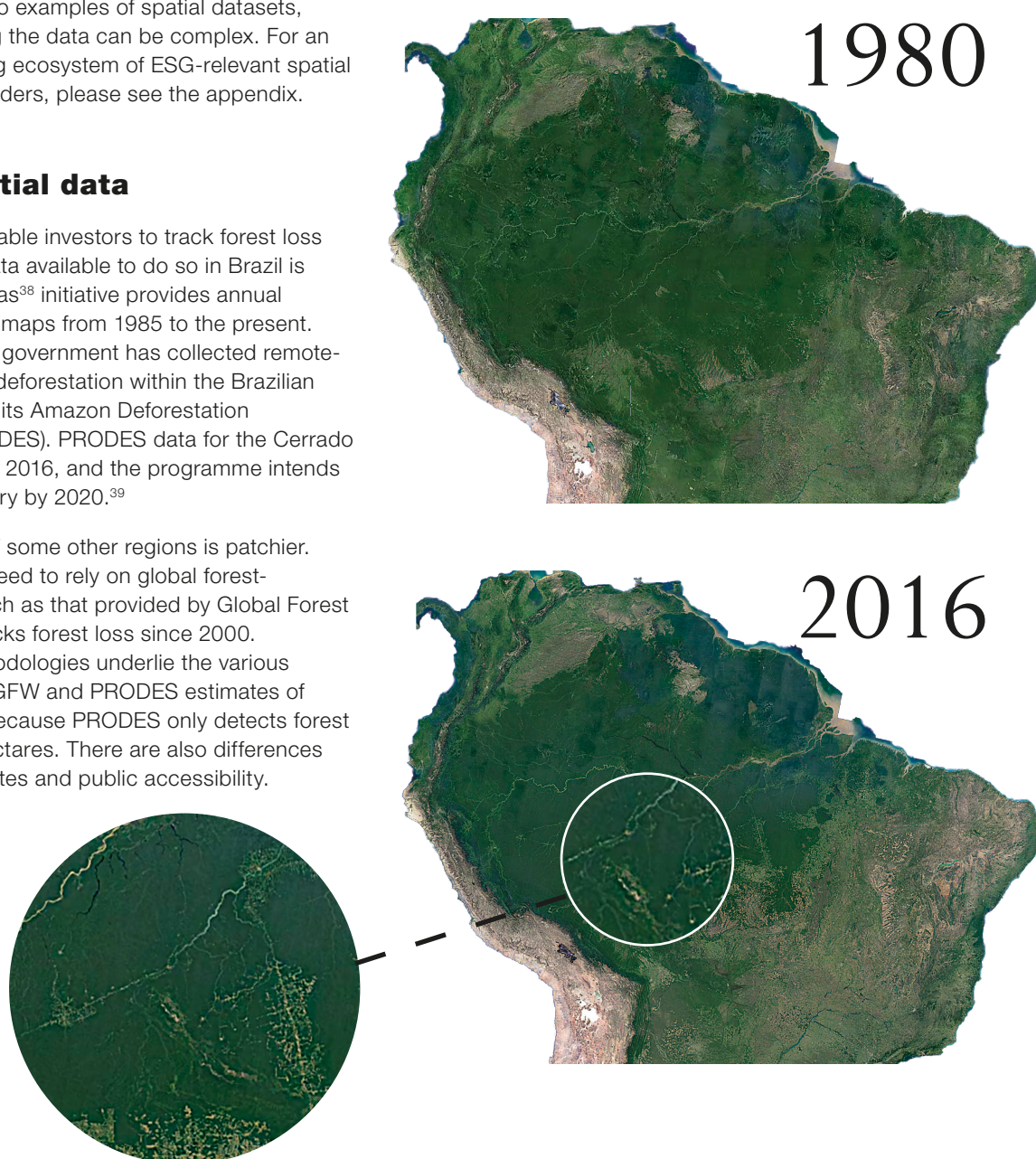
38 http://mapbiomas.org/
39 http://wwf.panda.org/wwf_news/?340110/Cerrado-sees-a-reduction-in-deforestation-rates-in-2018

Source: EarthTime - Google Earth Timelapse
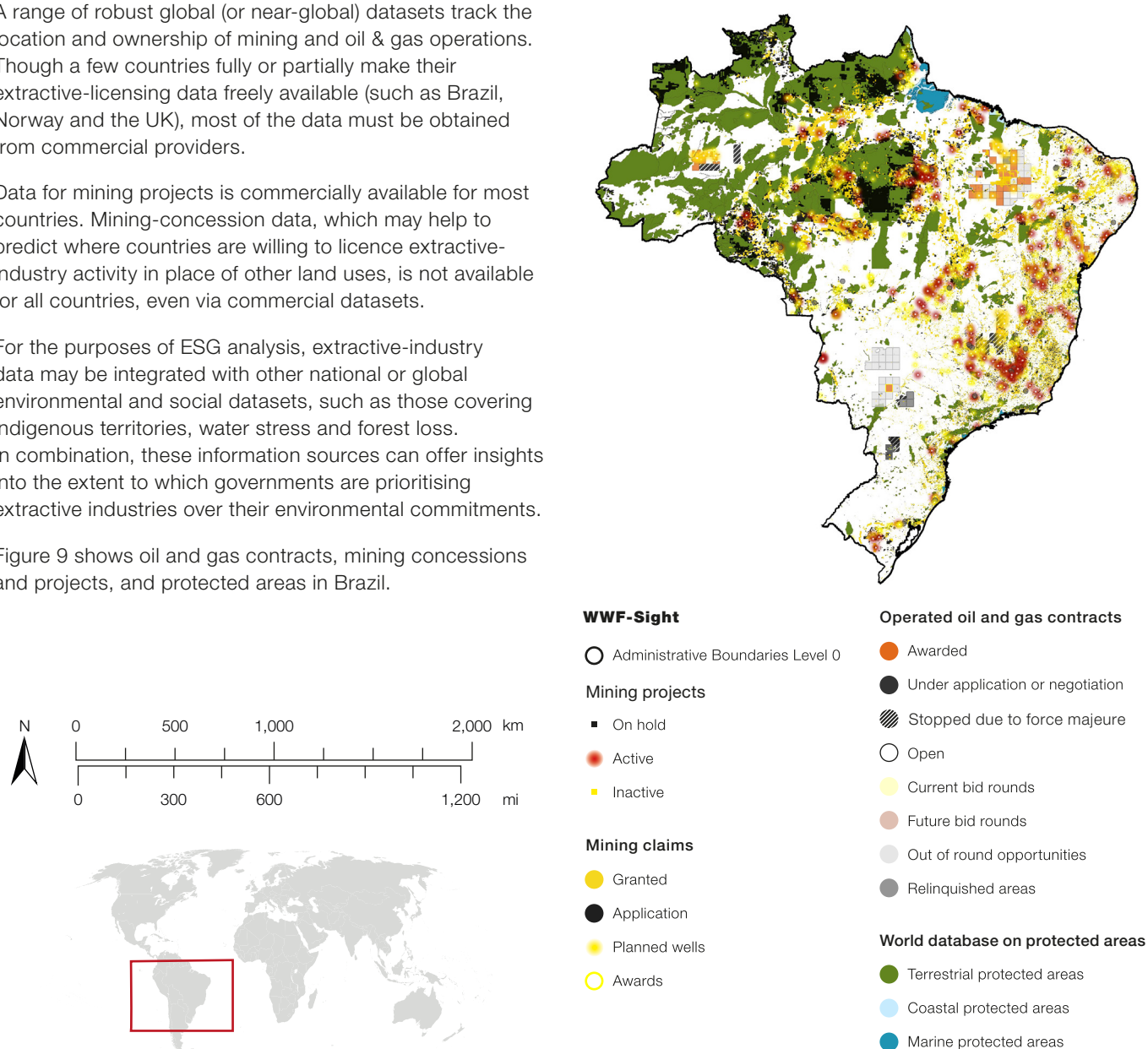
Extractive-industry spatial data

A range of robust global (or near-global) datasets track the location and ownership of mining and oil & gas operations. Though a few countries fully or partially make their extractive-licensing data freely available (such as Brazil, Norway and the UK), most of the data must be obtained from commercial providers.

Data for mining projects is commercially available for most countries. Mining-concession data, which may help to predict where countries are willing to licence extractive-industry activity in place of other land uses, is not available for all countries, even via commercial datasets.

For the purposes of ESG analysis, extractive-industry data may be integrated with other national or global environmental and social datasets, such as those covering indigenous territories, water stress and forest loss. In combination, these information sources can offer insights into the extent to which governments are prioritising extractive industries over their environmental commitments.

Figure 9 shows oil and gas contracts, mining concessions and projects, and protected areas in Brazil.

Figure 9: Spatial data tracking mining and oil and gas in Brazil

WWF-Sight

○ Administrative Boundaries Level 0

Mining projects

■ On hold

● Active

■ Inactive

Mining claims

● Granted

● Application

● Planned wells

○ Awards

Operated oil and gas contracts

● Awarded

● Under application or negotiation

▨ Stopped due to force majeure

○ Open

Current bid rounds

Future bid rounds

Out of round opportunities

● Relinquished areas

World database on protected areas

● Terrestrial protected areas

● Coastal protected areas

● Marine protected areas

N
0   500   1,000   2,000 km

0   300   600   1,200 mi

Use & interpretation

Applying spatial insights

The application of spatial data to investing is a nascent field, but WWF and Investec Asset Management believe it has significant potential to shed light on a diverse range of risks. Below, we offer examples of how sovereign debt investors could use spatial data to assess environmental risks.

Forest-loss spatial analysis

ESG metrics, such as the CCPI and EPI indices discussed earlier, offer useful insights into a country's management of its natural resources. But could high rankings in these measures mask more negative trends? Among other uses, spatial data can help investors evaluate the expansion of farming into forest areas.

ESG metrics offer useful insights. But could high rankings mask negative trends?

Figure 10 depicts forest-loss in Brazil since 2000, while Figure 11 plots forest-loss data (2001 to 2017) from Global Forest Watch for the Brazilian Legal Amazon against farming and land cover data from MapBiomas. It reveals a tendency for the trend in farmland coverage tracked by MapBiomas to follow GFW estimates of forest loss, but with a lag of four years.

The explanation for this relationship is that farmers often graze livestock on freshly deforested land, while the landowner raises capital and prepares the infrastructure to plant soy (see 'Brazil: ecosystems under threat'). GFW data indicates a re-emergence of forest loss in Brazil in 2016, a potential indicator of a future surge in farmland coverage. For a discussion on the links between the preservation of natural assets and the Brazilian economy, please see page 9.
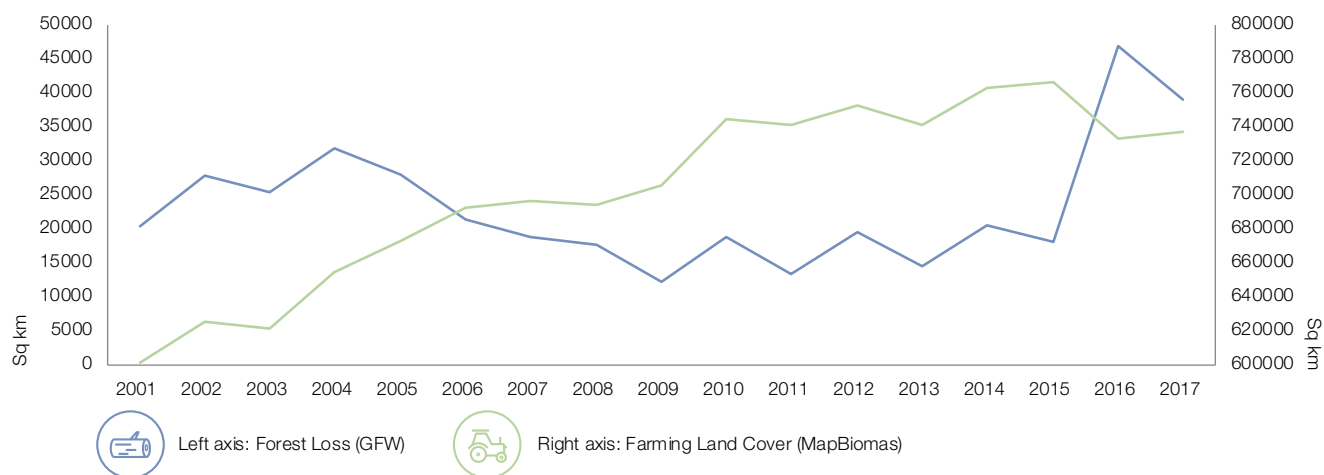
Figure 10: Amazon forest loss since 2000 (orange areas show more recent forest loss)
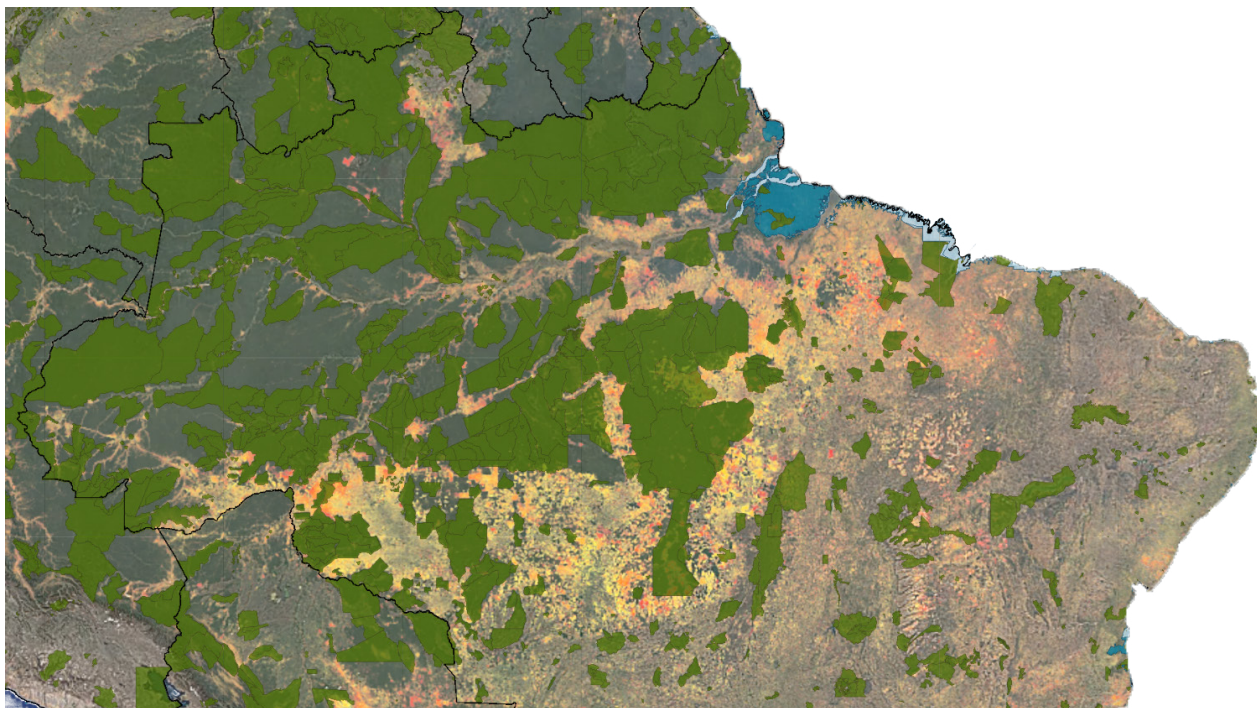
Source: EarthTime - Google Earth Timelapse, UNEP-WCMC World Database on Protected Areas (accessed May 2019); Hansen et al

Figure 11: Forest loss and farmland cover in the Brazilian Legal Amazon

Sources: Global Forest Watch, MapBiomas

Use & interpretation continued

Extractive-industry spatial analysis

For the purposes of ESG analysis, extractive-industry spatial datasets can be particularly valuable when combined with other environmental and social metrics, such as those covering indigenous territories, water stress and forest loss.

To illustrate the insights that might be gained from spatial data, we examined the relationship between mining concessions and protected areas in Brazil. Of the 2,299 Brazilian protected areas identified in the UNEP WCMC

World Database on Protected Areas, 655 (28%) contain mining concessions (Figure 12). Tracked over time, this metric could provide a useful perspective on Brazil's commitment to conserving its legally protected areas.
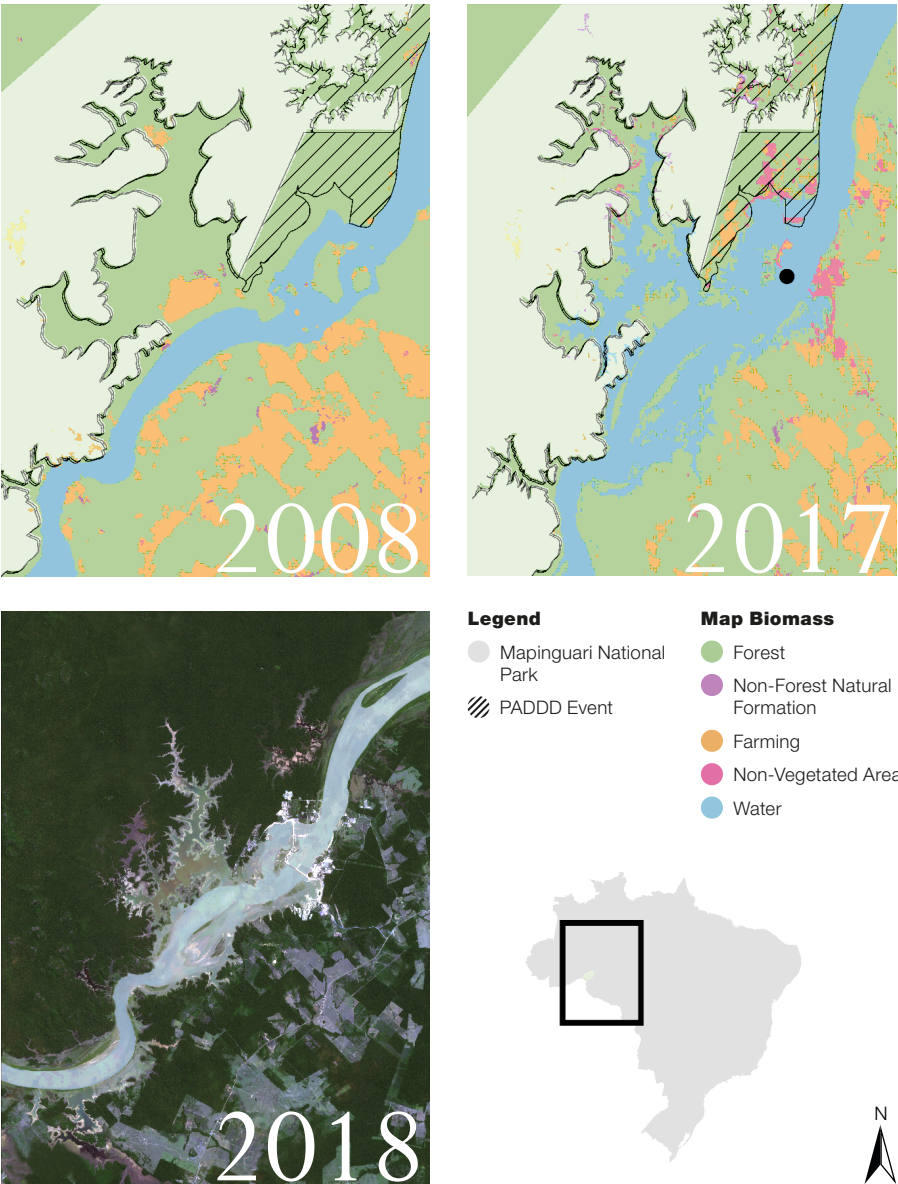
The maps below show the extent to which Brazilian states comprise protected areas (%) and the proportion of the protected areas that are overlapped by mining concessions.

Figure 12: Mining and protected areas

% of Protected Area
Overlapped by Mining
Concessions

% Overlap in PA
0.1
24.6

% of Protected Area
Coverage by State

% Overlap in PA
1
93.03
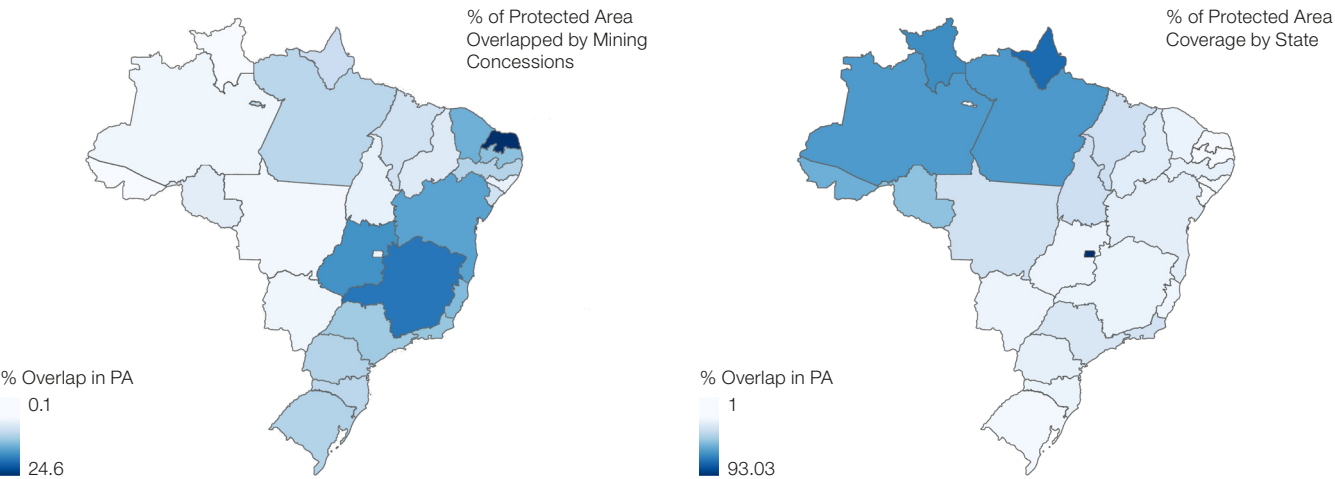
Sources: UNEP-WCMC World Database on Protected Areas
(accessed May 2019); S&P SNL Metals and Mining; accessed April 2019

Figure 13: Tracking the impact of PADDD events

2008

2017

2018

Legend

⬤ Mapinguari National Park

▨ PADDD Event

Map Biomass

⬤ Forest

⬤ Non-Forest Natural Formation

⬤ Farming

⬤ Non-Vegetated Area

⬤ Water

N

We also ran the mining-concession information against a database that monitors changes in the legal status of protected areas, like national parks. Such occurrences are known as PADDD (protected area downgrading, downsizing and degazettement) events. Of the 127 PADDD events identified in 106 protected areas of Brazil, about 60% occurred in protected areas that include current or old (expired or inactive) mining concessions.

Brazil's Mapinguari National Park experienced a PADDD event in 2008 to allow for construction of a hydro dam (black dot). The maps and satellite images (Figure 13) show the subsequent flooding and the increase in farming and non-forested lands in the area where the PADDD event occurred (hatched).

While more work is needed to interpret this data, the broad point is that ongoing monitoring of the spatial distribution of a nation's extractive and infrastructure assets relative to its key social and environmental assets could provide valuable insights beyond those provided by traditional ESG metrics.

Use & interpretation continued

An evolving field: advances in spatial finance

Even for nations with excellent spatial information, significant challenges remain in unravelling the stories behind the data. But this is a fast-developing field. We expect spatial finance to become an increasingly valuable tool for sovereign debt investors:

- A new constellation of satellites is providing higher quality, more extensive data to facilitate environmental and climate monitoring. This is generating deeper insights into areas such as land coverage, rainfall patterns, soil moisture, air quality and ocean microplastics.

- Artificial intelligence techniques are enhancing raw spatial data, for example by making it possible to differentiate between specific materials in the urban infrastructure. The universe of ESG-relevant data is further expanding as spatial data is combined with existing information sources to generate new perspectives on environmental and social trends.

- Advances in systems used to track land coverage are overcoming the atmospheric challenges that can hamper existing monitoring. For example, the increasing availability of radar data has the potential to improve the accuracy of forest-loss tracking as it is not impeded by cloud cover.

Conclusions

Robust, credible and comprehensive risk assessments

There is abundant evidence that the destruction of natural ecosystems has potential consequences for the economic and social systems that underpin human society. In turn, these may impact the macroeconomic factors that influence risks and returns in sovereign debt portfolios.

To date, sovereign debt investors have paid relatively little attention to environmental risks. Partly due to the availability of better data, we now have a much clearer understanding of the materiality of environmental factors.

A range of ESG-related metrics exist to help sovereign debt investors monitor environmental risks in their portfolios. Though at an early stage, investment analysis based on spatial data has the potential to significantly expand and enhance these insights. In our view, it will help investors conduct more robust, comprehensive and credible assessments of the systemic environmental risks facing sovereign issuers.

As the case studies in this report show, use of spatial data can help sovereign debt investors look beyond broad country-level sustainability indicators, which may mask the complexity and true nature of the threats to a country. Moreover, the quality of spatial data is improving rapidly, in terms of both granularity and geographic coverage. It therefore offers an increasingly reliable means of verifying governments' environmental commitments and actions.

This report does not prescribe specific research approaches or spatial datasets. Rather, it points investors to possible applications of spatial data to assess environmental risks at the country level. We urge sovereign debt investors to explore them. A collaborative approach involving multiple stakeholders will accelerate the development of better tools and frameworks, based on a continually expanding universe of spatial data.

It is important to emphasise that, while spatial data can be a valuable tool, the onus remains on asset managers to develop a robust view on the future direction of environmental policies and, crucially, their implementation by governments. But these insights can facilitate constructive engagement between investors, governments and NGOs to advance the sustainable management of natural assets. As a first step, we hope this report encourages sovereign debt investors to ask government representatives during their engagements about these issues.

Environmental factors must also become a core part of the investment process within the sovereign debt asset class, with the aim of serving the parallel objectives of targeting financial returns and creating strong incentives for countries to remain on sustainable trajectories.

Encouraging countries toward responsible stewardship of their natural capital will serve the interests of investors. We believe it will also contribute to the effort to protect the environment and help to avert dire consequences for human society.

Investments carry a risk of capital loss.

Key points

1. Spatial data can help investors conduct more robust, comprehensive and credible analysis of the systemic environmental risks facing sovereign bond issuers.

2. The quality of spatial data is improving rapidly, offering investors new research possibilities and enabling them to have greater confidence in their analysis.

3. A collaborative approach may strengthen the case that environmental risks are material within the sovereign debt asset class, and accelerate the development of better tools and frameworks.

4. By addressing environmental risks more fully and engaging constructively with issuers, sovereign debt investors can play a meaningful role in encouraging more responsible stewardship of the Earth's natural capital.

Appendix
Selected 'spatial' ESG-relevant platforms

There is an emerging ecosystem of 'spatial' ESG-relevant platforms. Building on advancements in satellite imagery and analysis, they provide insights into environmental issues at national, regional or (increasingly) parent-company levels. Platforms currently available to the commercial sector include the following:

FLINTpro: Aims to enable organisations to manage land-sector greenhouse gas emissions data.

GFW Pro: Provides spatial information on deforestation.

Integrated Biodiversity Assessment Tool (IBAT): Provides geographic information about global biodiversity and protected areas.

Ecometrica: Offers insights based on a range of satellite-derived products, covering areas from forest protection to disaster response.

Verisk Maplecroft: Offers ESG, climate and political risk analytics and research.

Water Risk Filter: Helps users explore and assess basin-risk exposure, understand whether assets and companies are pursuing optimal water-stewardship responses, and calculate potential value impacts on assets of water risk.

Trase: Maps the links from consumer countries via trading companies to the places of production, including for commodity exports.

Aqueduct: Helps investors understand indicators of water-related risk and geographic water issues.

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Vivienne Taberer, Portfolio Manager
André Roux, Portfolio Manager
Peter Eerdmans, Head of Fixed Income
Therese Niklasson, Global Head of ESG
Naasir Roomanay, ESG Analyst

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About WWF

WWF is one of the world's largest independent conservation organisations, active in nearly 100 countries. Our supporters – more than five million of them – are helping us to restore nature and to tackle the main causes of nature's decline, particularly the food system and climate change. We're fighting to ensure a world with thriving habitats and species, and to change hearts and minds so it becomes unacceptable to overuse our planet's resources.

WWF. For your world.
For wildlife, for people, for nature.

Find out more about our work, past and present at
wwf.org.uk

About Investec Asset Management

It all began in South Africa in 1991, where we were a small start-up asset manager offering domestic strategies in an emerging market. Over twenty seven years of growth later we're an international business managing approximately US$145.2 billion (31.03.19) for clients based all over the world.

Investec Asset Management provides investment products and services to institutions, advisory clients and individuals. Our clients include pension funds, central banks, sovereign wealth funds, insurers, foundations, financial advisers and individual investors.

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