

Permanent Forest Bonds: A pioneering environmental impact bond for Aotearoa New Zealand

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Executive Summary

Section 1: The challenge is **to establish permanent forest on vulnerable land throughout New Zealand**, especially erosion-prone land and waterway margins (see Boxes 1 & 2). Leaving this land unforested hinders the nation's long-term prosperity by degrading national environmental assets and increasing future carbon liabilities, which together, undermine New Zealand's highly valued green reputation.

Section 2: The proposed solution is **a world-pioneering Permanent Forest Bond** which belongs to the wider classes of green and climate-aligned bonds. The innovation is not only to fill a funding gap for budget-constrained government entities, it is to shift the environmental spending paradigm so that the New Zealand Government pays for positive environmental results rather than services. This shifts the risk of a successful intervention from taxpayers to private investors, who are compensated in return for taking the risk.

Section 3: The foundations for the Permanent Forest Bond are based upon the idea of an Environmental Impact Bond, built upon pay-for-performance contracts. First conceived by David Nicola in a 2013 report, there have not yet been any bonds issued in New Zealand under this instrument. However, there are examples emerging in the United States, including **a Forest Resilience Bond currently under development** (see Box 3).

Section 4: The Environmental Impact Bond is an extension of a Social Impact Bond, of which there are now over 60 issued worldwide. However, **the impact bond model is better suited for environmental impacts than social impacts**, particularly because measurement is less controversial and better established (see Box 4).

Section 5: Although there is not yet any empirical track record for Environmental Impact Bonds, there is now an emerging empirical and evaluative literature on Social Impact Bonds. This literature is surveyed to anticipate the various advantages and risks of adapting this structure for establishing permanent forest.

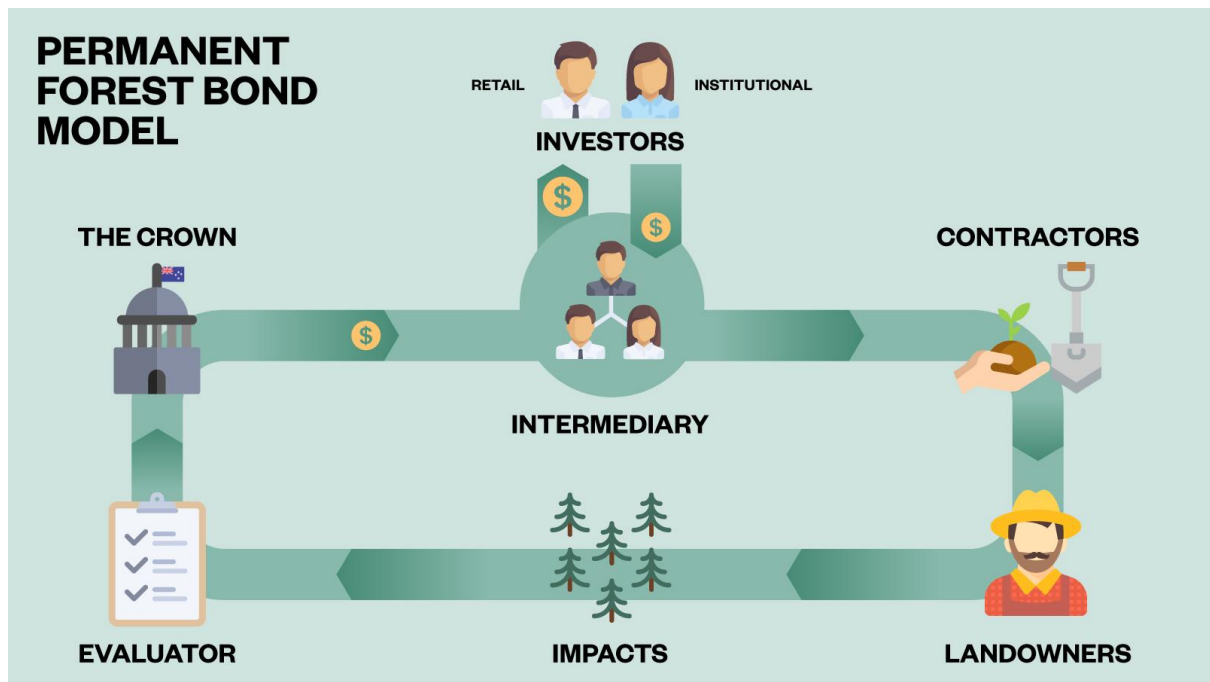
Section 6: **A major advantage of Environmental Impact Bonds over Social Impact Bonds is the pre-existing science and economics of monitoring and valuing environmental assets.** This section draws upon existing literature on ecosystem services to identify the potential expenses, revenue streams and avoided costs that can be negotiated as part of a Permanent Forest Bond.

Sections 7 & 8: **A Permanent Forest Bond is an eminently feasible proposition.** The impact bond structure is well suited to aligning the long-run costs and benefits of establishing forest (or not) on vulnerable land.

Appendix 1: **This innovative and world-leading Permanent Forest Bond is aligned to international trends**, including divestment from fossil fuels, the growing green bonds market, and the international transition to a low-carbon economy through the Paris Agreement.

Appendix 2: The Permanent Forest Bond is **complementary** to other schemes, filling funding gaps left by the Afforestation Grant Scheme and Permanent Forest Sink Initiative.

Permanent Forest Bond Model



For a detailed discussion of this model, turn directly to Section 7 (p. 26–30).

The Stars are Aligning...

International Markets

- Growing demand for green investment options.
- Growing awareness of the scale and risks of stranded fossil fuel assets.
- US\$2.2 trillion capex in stranded fossil fuel assets to fit 2°C carbon budget
- Growing public pressure to divest from fossil fuel investments.
- Growing markets for green bonds and climate-aligned bonds.
- US\$694 billion of outstanding “climate-aligned bonds”.
- Paris Green Bonds Statement to upscale green investment from investors worth US\$11.2 trillion of assets.

Climate Change

- The signing of the Paris Agreement for global net zero emissions by the second half of this century.
- Growing awareness of future carbon liabilities if New Zealand meets emissions targets by purchasing foreign offsets.
- Projected 2030 carbon price of between \$56 and \$152 per tonne (MBIE 2016; IEA World Energy Outlook 2015).
- Growing recognition by the New Zealand Government of the role of afforestation for national climate strategy.
- Reduced carbon sequestration from New Zealand’s plantation forests due to projected deforestation increases into the 2020s.

Environmental Benefits for New Zealand

- Renewed appreciation of the environment’s economic value through the ecosystem services framework.
- Growing public concern about deteriorating water quality and the role of forest to mitigate this.
- Growing need to build resilience to climate change.
- Trees stabilise erosion prone land.
- Trees mediate peak flood flows.
- Trees absorb pollution that affect water and air quality.
- Trees enrich indigenous biodiversity.

(For a more detailed discussion, see Appendix 1.)

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1: The Challenge

The challenge is to increase the area of permanent forest in New Zealand. The priority is highly erosion-prone land and waterway margins, where permanent forest planting is environmentally beneficial (see Box 1 below for detail). This is the *target land* for afforestation.

The environmental benefits of undertaking large-scale afforestation are uncontroversial. These benefits include land stabilisation, reduced soil loss, reduced nutrient runoff, management of water catchments, restoration of indigenous biodiversity, and sequestration of atmospheric carbon.¹

Afforestation of 1.1 million hectares or more of highly erosion prone land in pasture would prevent annual costs to New Zealand worth hundreds of millions of dollars due to erosion damage, reduced water quality, flooding, carbon offsetting and the degradation of New Zealand's green brand (see Section 6).

Also, because much of this target land is (1) marginal for pastoral agriculture and (2) too remote or steep to be profitable for commercial forest, the trade-offs against economic productivity are minimal. Indeed, in some places, permanent forest will be *the most* productive land use by creating opportunities for carbon offsetting, honey production, selective timber felling, recreation, and so forth (see Box 1 below).

The long-term economic case for afforestation is compelling. The major obstacles are present land values and the immediate expense of forest establishment. These costs appear to outweigh the economic benefits, especially for permanent forest, which foregoes predictable timber revenue from rotation cycles. However, while the costs of establishing permanent forest are *internalised* by landowners, the benefits of mature forest—as well as the costs of no forest—are *externalised*. In economic terminology, they are *externalities* that go unaccounted for by decision-makers, yet that impose accountable costs on local communities, on the national economy, and on future generations.

From this wider perspective, the establishment of permanent forest is economically rational, even if it isn't for individual landowners. The immediate costs of action—in this case, the planting of permanent forest on erosion prone land and waterway margins—are outweighed by the aggregate costs of inaction. The challenge is to find a financial instrument that captures these long-run costs and benefits.

¹ For review, see David Hall, "Our Forest Future", Report Prepared for Pure Advantage (Auckland: Pure Advantage, 2016): <http://pureadvantage.org/news/2016/04/22/our-forest-future/>

Box 1: What kind of land is appropriate for a Permanent Forest Bond?

The Permanent Forest Bond is not designed to compete for land that is economically profitable for agriculture, horticulture or forestry. The aim of the Bond is to broaden the land use options available to landowners by making permanent forest more attainable, especially where:

- (1) Land is marginal or minimally productive for agriculture and forestry.
- (2) Land is not marginal but landowners nevertheless plan to convert to permanent forest anyway because of personal choice or regulation.

(1) Marginal land: There are a variety of reasons that land could be marginal or minimally productive for agriculture and forestry. In these instances, the revenue streams from permanent forest (carbon credits, mānuka honey, selective timber felling, etc.) might be more economically productive for landowners. This applies to:

- pastoral land that is prone to erosion and therefore costly in terms of damage to property and fencing;
- land that is too steep or rugged for safe, simple and cost-effective extraction of timber;
- land that is very remote or distant from processing centres, thereby increasing transport costs and reducing profitability.

(2) Planned conversion: There will also be instances where landowners plan to convert or retire land to permanent forest, even when this land is at least minimally productive for agriculture or forestry. In such cases, landowners are motivated to forego more economically optimal land uses because:

- landowners are principally motivated by non-market values of permanent forest such as cultural, aesthetic or environmental reasons;
- landowners are subject to regulation that encourages afforestation, either by central government, local authorities, or industry commitments.

Note that permanent forest will not *always* be preferable, such as instances where riparian planting will reduce river catchment yields.

2: The Solution

The solution explored in this working paper is creating a financial instrument that internalises these very long-run costs and benefits. This instrument will be called a *Permanent Forest Bond*.

The underlying structure is analogous to a Social Impact Bond, insofar as it is built on pay-for-performance contracts. This means that payment will be triggered only once pre-established impact performance targets are achieved. The Permanent Forest Bond is, therefore, potentially an example of an *Environmental Impact Bond*.

In the case of permanent forest planting, this means that investors will only receive a return-on-investment once the bond issuer is assured by third-party evaluators that a newly established forest has met agreed-upon environmental impacts. For example, these impacts could include x-number of trees per hectare after five years, y-tonnes of carbon per hectare, or a z-percentage decrease in phosphorous concentrations in freshwater samples.

The issuer of the Permanent Forest Bond is Government, acting on behalf of the Crown. This is because the Crown (the state) is representative of the interests of all New Zealanders—past, present and future. It is therefore the most appropriate entity to take responsibility for very long-run costs and benefits, because it can justify these costs and benefits in its intergenerational accounts. As long as public spending reliably creates environmental assets and avoids predictable costs, present expenditure can be justified against long-run gains in value.

From the Crown’s perspective, the Permanent Forest Bond provides a cost-efficient route to long-run prosperity and fulfilling transgenerational obligations, as well as an opportunity to involve the private sector in environmental remediation. The Permanent Forest Bond is an example of a public-private partnership, although one that contracts for outcomes rather than outputs. This enables the Crown to redistribute risk away from public funds and onto private investors, because the spending of public money is triggered only by the fulfilment of outcomes. Pay-for-performance contracts also permit innovation and experimentation through service delivery; and can leverage the expertise, talents, and resources of the private sector.

From the perspective of private investors, the Permanent Forest Bond provides an attractive green investment opportunity. It belongs not only to the class of financial instruments known as Environmental Impact Bonds, but also more broadly to “green bonds” and “climate-aligned bonds”. So, rather than merely donate philanthropically, private sector investors are offered an investable opportunity with reasonable returns and an alignment to sustainability goals.

Box 2: Who might participate in a Permanent Forest Bond?

Below are fictional but realistic examples of groups and individuals who might be interested in participating in a Permanent Forest Bond:

—A community conservation group in Northland that wishes to undertake a habitat restoration project on a land section, yet lacks the finances to do so. The group is willing to accept the rigor of measurement and evaluation in order to access private investor capital as contractors for a Permanent Forest Bond.

—A dairy farming family in the Waikato which has developed a riparian management plan as part of Dairy NZ's Sustainable Dairying: Water Accord. They would willingly undertake riparian planting before the Accord's 2030 deadline, but currently lack the capacity to do so. They also support any initiative that creates employment opportunities for local workers. Accordingly, they are persuaded by the offer of a local social enterprise that employs ex-offenders as contractors for tree planting, which uses its proven record of success to access capital through the Permanent Forest Bond.

—A Māori land trust on the East Coast that wants to replace existing exotic plantation forest with permanent native forest, to be managed as a continuous cover forestry regime in line with kaitiakitanga values. However the trust lacks the upfront capital to establish native forest, and also prefers not to enter into a covenant with the Crown, two reasons that weigh against the Permanent Forest Sink Initiative. The trust is also keen to trial out transitional regimes which strike the best balance between timber and carbon revenue with a long-term plan for native conversion.

—A Manawatū sheep farming family who recognise that large blocks of their erosion prone land should be retired, following the damage caused by the 2015 storm. However they want forest conversion to occur more rapidly than by natural regeneration, so to generate carbon credits within their lifetimes. They are time-poor as well as cash-poor, their wealth tied up in the family farm, so they would need upfront capital to activate afforestation. Their applications to other funds, such as local council erosion control funds or QEII covenants, haven't been successful.

—A forest owner who has clear-felled a *Pinus radiata* forest in Golden Bay. The logs were exported overseas for minimal returns, so there is little incentive to restock. Moreover, the forest was on steep land, so inappropriate for dairy conversion. The cleared land is also now prone to slips and sediment loss. The forest owner would like to realise the local community's aspirations for the land to be converted to native bush, to augment the region's "green assets" for tourism and recreation. But the landowner cannot afford to invest in habitat restoration, needing to invest his returns elsewhere.

3: What is an Environmental Impact Bond?

The proposed Permanent Forest Bond is a specific example of a larger class of assets called Environmental Impact Bonds (EIBs). This asset class is new, first articulated in a 2013 working paper by David Nicola.

In his report, Nicola introduces the EIB as follows:²

...an EIB will be defined as a “pay-for-performance” (PFP) contract that addresses an environmental issue. The PFP mechanism inherent in EIBs will be similar to that of SIBs [Social Impact Bonds], whereby the government (or another contracting entity) pays an agreed-upon return if impact performance targets, as specified in the investment contract, are met. EIBs tend to represent a “monetization” of future costs savings, whereby investors are paid a return based on the amount of cost savings generated by a particular project. Monetization of future cost savings is a staple of environmental finance.

In very basic terms, this is how it works: Private investors transfer money to an intermediary. The intermediary uses this money to pay contractors to perform an environmental service (such as planting and protecting a new native forest). Third-party evaluators then monitor the real-world impacts of this environmental service to determine whether pre-established performance impact targets have been met. If, and only if, these targets are met, then government (and perhaps other non-governmental parties) will pay an agreed-upon sum to the intermediary. This money is then used to pay the return and a coupon to investors. See Figure 1 below.

² David J. Nicola, “Environmental Impact Bonds,” Case i3 Working Paper #1 (Duke University, The Fuqua School of Business, 2013), 14.

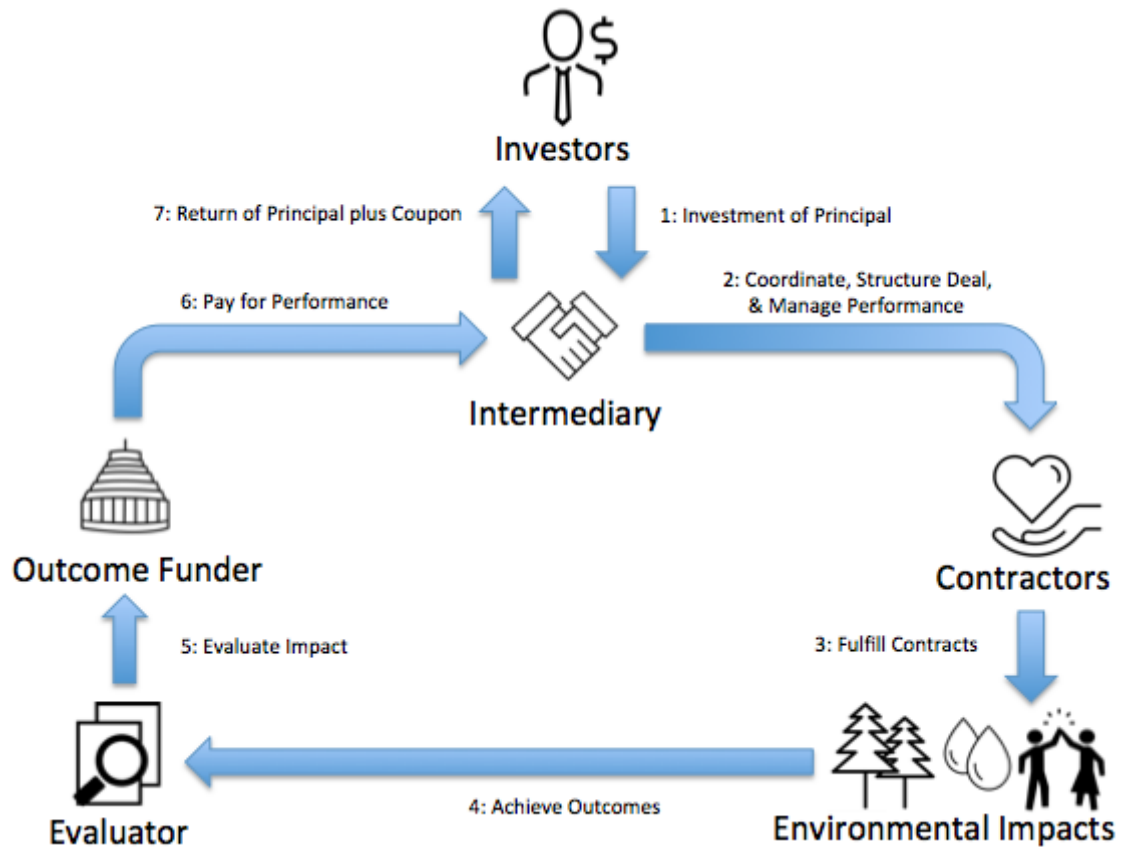


Figure 1: Schema for an Environmental Impact Bond.³

At the time of writing, there has been only one such bond issued in the United States: an Environmental Impact Bond issued by DC Water and Sewer Authority to control stormwater runoff and improve the District’s water quality.⁴ This \$25 million tax-exempt EIB was issued on 29th September 2016 and sold to Goldman Sachs Urban Investment Group and the Calvert Foundation. The proceeds will be used to construct green infrastructure to slow rainwater surges into overflows. There is a mandatory tender set for 1st April 2021, when investors will be paid in line with their performance. They will receive a US\$3.3 million coupon if runoff is reduced by over 41.3%; no coupon if runoff is reduced by 18.6%–41.3%; and investors will pay a “risk share payment” of US\$3.3 million if runoff is reduced by less than 18.6%. The final maturity is set for 1st October 2046.

³ This diagram is adapted from Emily Gustafsson-Wright, Sophie Gardiner, and Vidya Putcha, “The Potential and Limitations of Impact Bonds: Lessons from the First Five Years of Experience Worldwide” (Washington, D.C.: The Brookings Institute, July 9, 2015), 6, <https://www.brookings.edu/research/the-potential-and-limitations-of-impact-bonds-lessons-from-the-first-five-years-of-experience-worldwide/>.

⁴ District of Columbia Water and Sewer Authority, “Fact Sheet: DC Water Environmental Impact Bond,” Public Utility Subordinate Lien Revenue Bonds Series 2016B (Washington, D.C.: District of Columbia Water and Sewer Authority, 2016).

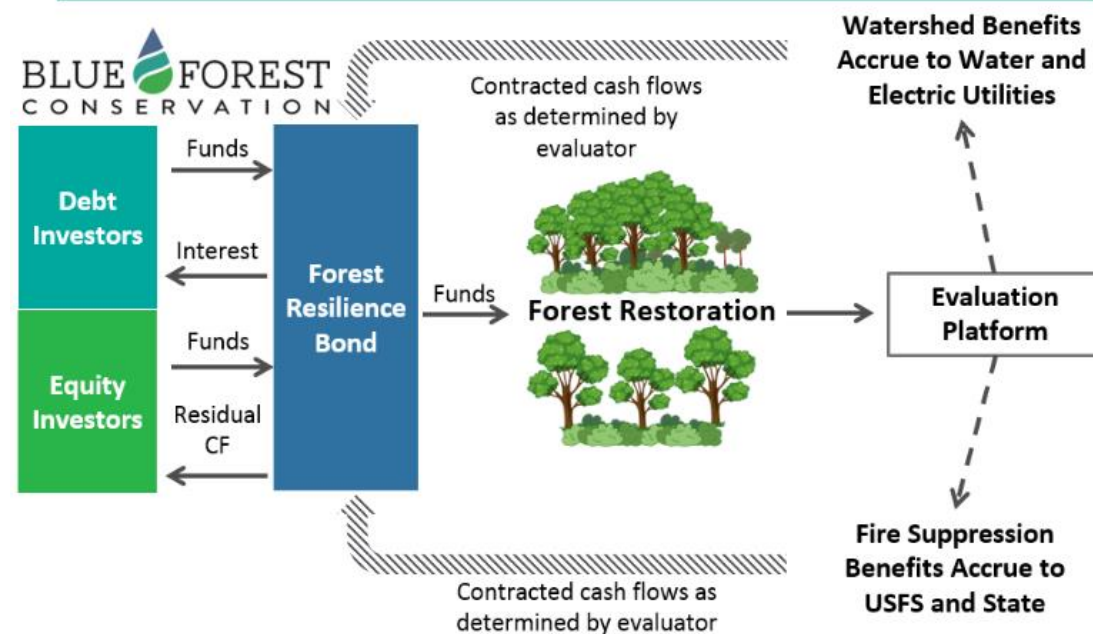
Although this is being heralded as the first EIB in the United States, it is not the only EIB in development. Of special relevance to this working paper is a pilot project for a Forest Resilience Bond that reduces fire risk (see Box 3 below). The feasibility of this bond suggests that the EIB structure might be well-aligned to the challenge of establishing permanent forest. The following section, Section 4, will survey the Social Impact Bond literature to illuminate its prospects.

Box 3: Case study: The Forest Resilience Bond pilot project.

A pilot project for a Forest Resilience Bond (FRB) is currently being undertaken by Blue Forest Conservation in the United States. It is being developed in partnership with Encourage Capital and the World Resources Institute, supported by philanthropic funding from the Rockefeller and Packard Foundations.

The purpose of the FRB is to make national forests in the United States more resilient to climate change, specifically by removing forest litter to reduce the risk of severe wildfire and drought. This creates value for a diverse set of stakeholders, foremost the US Forest Service, which can reduce planned expenditure on future fire-fighting if it is confident that there is a reduced likelihood of future fire. Other beneficiaries include water and electric utilities and private water-dependent companies, which benefit from the prevention of drought- and fire-related erosion that results in worsening water quality and sedimentation. These contracting entities pay for these environmental benefits once agreed-upon impact performance targets are met.

The Forest Resilience Bond Structure



As the diagram above shows, contracted cash flows are determined by third-party evaluators. The relevant mechanism is pay-for-performance contracts, whereby payment is triggered by outcomes that meet impact performance targets, supported by pre-established environmental indicators and measures. This evaluation framework is currently under development for the Blue Forest Conservation bond—but the intention is to develop a scalable verification method which identifies additional water quantity and quality benefits that result from forest restoration. This method will involve the integration of survey and satellite technology with model-based measuring techniques to identify actual-versus-projected differences in evapotranspiration, snowpack accumulation, and delivery of additional water through existing reservoirs and conveyance infrastructure.

The pay-outs for meeting performance impact targets create the capital that investors receive as returns on investment. There are multiple ways that these returns can be structured, potentially as tranches that reflect an investor's appetite for risk.

Blue Forest Conservation advocates for the impact bond structure on the following grounds:

- sharing of costs (and benefits) reduces aggregate costs to each individual stakeholder;
- tapping private capital allows for amortization of costs over time, maximizing immediate restoration scale without stressing budgets;
- and accelerating restoration treatments prevents further overgrowth and future costs to stakeholders.⁵

⁵ "Forest Resilience Bond," *Blue Forest Conservation*, accessed October 14, 2016, <http://blueforestconservation.com/#frb>.

4: The Precursor: the Social Impact Bond.

In his report, Nicola treats the EIB as homologous to the better known Social Impact Bond (or SIB). So, even though there is no empirical track record for EIBs to draw upon, we can turn to the literature on SIBs to identify the potential advantages and risks.

Social Finance, an economic think tank that pioneered work on SIBs, describes these financial instruments as follows:⁶

At its core, a Social Impact Bond is a public-private partnership which funds effective social services through a performance-based contract. Social Impact Bonds enable federal, state, and local governments to partner with high-performing service providers by using private investment to develop, coordinate, or expand effective programs. If, following measurement and evaluation, the program achieves predetermined outcomes and performance metrics, then the outcomes payor repays the original investment. However, if the program does not achieve its expected results, the payor does not pay for unmet metrics and outcomes.

As of June 2016, there were 60 projects launched globally within the SIB category, including in the United Kingdom, United States, Australia, Germany, the Netherlands, Belgium, Canada, Portugal, India, Switzerland, Austria, Israel, Finland and Sweden. These have raised over US\$200 million of capital and involved over 90,000 people in their service delivery.⁷

Conventional histories trace the origins of SIBs to the Peterborough Prison Bond, issued by Social Finance in the United Kingdom (2010–2015). This was designed to reduce prisoner recidivism. It raised £5 million for providers to reduce reoffending among 2,000 former prisoners. In 2014, it was reported that the bond succeeded in reducing recidivism by 8.4%, not enough to trigger immediate repayment (this target was 10%), but on track to trigger repayment in 2016 (over 7.5%). However the Bond was disestablished in 2015, due to nation-wide policy reforms under the Transforming Rehabilitation programme, which made the Peterborough Prison Bond not only redundant but also contrary to incoming legislation.⁸

In New Zealand, there is an active interest in social investment, whereby SIBs are being investigated as one mechanism for delivery. Former Finance Minister Bill English has argued that “social investment is a more rigorous and evidence-based feedback loop linking service delivery to a better understanding of people’s needs and indicators of the effectiveness of social services.”⁹ In 2013, the Ministry of Health commenced work on a “social bond” for the rehabilitation of people living with mental health

⁶ Annie Dear et al., “Social Impact Bonds: The Early Years” (Social Finance, July 2016), 12.

⁷ Dear et al., “Social Impact Bonds: The Early Years.”

⁸ Social Finance, “Peterborough Social Impact Bond Reduces Reoffending by 8.4%; Investors on Course for Payment in 2016,” *Social Finance*, July 8, 2014, <http://www.socialfinance.org.uk/peterborough-social-impact-bond-reduces-reoffending-by-8-4-investors-on-course-for-payment-in-2016/>.

⁹ Bill English, “Speech to the Treasury Guest Lecture Series on Social Investment,” *The Beehive*, September 17, 2015, <http://www.beehive.govt.nz/speech/speech-treasury-guest-lecture-series-social-investment>.

issues. This pilot project has since stalled because the service provider withdrew from the project.¹⁰ Work on a second social bond commenced in early 2016, with \$29 million set aside for the rollout of four bonds in total. The Government remains committed to exploring this approach further.

Around the world, however, many SIBs have gone beyond pilot phase. A recent report by Social Finance paints a cautiously optimistic picture. Of the 60 SIBs launched internationally between 2010 and June 2016, 22 have reported performance data, 21 indicated positive social outcomes, 12 have made outcome payments, and 4 have fully repaid investor capital.¹¹ The report authors argue that this first generation of SIBs offer “a promising, if early, record of success”, while acknowledging that this is informed by interim, not final, results.¹² This is reinforced by an earlier Brookings Institute survey of 38 SIBs which concluded that “it is very likely that the impact bond model development process, structure, and application will continue to be adapted in the future”.¹³

However, it must be clearly stated that, because SIBs are a novel category of financial instrument, there is not yet an uncontroversial empirical record to evaluate their success. Moreover, current debates over the merits of SIBs are often infused with ethical or political objections, which complicates the conclusions drawn from empirical data. For example, the cessation of the Peterborough Prison Bond is occasionally used by critics as evidence that the impact bond model is intrinsically flawed, even though the SIB was discontinued because of wider policy reform.¹⁴ This *does* highlight the regulatory risks that SIBs are vulnerable to – perhaps even uniquely vulnerable to – but it does *not* serve as general proof that the SIB model is essentially flawed.

Another frequent criticism is that SIBs are being rolled out as a replacement for existing programmes, perhaps even a substitute for core funding. However, the literature on SIBs does *not* endorse these structures as a substitute for conventional forms of social funding, nor as appropriate for all situations.¹⁵ Rather, SIBs are recommended as a potential funding route in situations:

- where the intervention focus is preventative;
- where there is a lack of upfront funding or political will for intervening;
- where long-time horizons are acceptable to contracting parties;
- where the most effective form of intervention is undetermined;
- where government seeks innovation and private sector rigour in service provision;
- where existing public spending has poor or undetermined outcomes; and
- where the future financial and political cost-savings from intervening are substantial.

¹⁰ Kate Gudsell, “Government’s First Social Bond Collapses,” *Radio New Zealand*, July 6, 2016, <http://www.radionz.co.nz/news/political/308026/government’s-first-social-bond-collapses>.

¹¹ Dear et al., “Social Impact Bonds: The Early Years,” 6.

¹² *Ibid.*, 26.

¹³ Gustafsson-Wright, Gardiner, and Putcha, “The Potential and Limitations of Impact Bonds,” 50.

¹⁴ Emma Tomkinson, “The Peterborough Social Impact Bond (SIB) Conspiracy,” *Emma Tomkinson*, October 27, 2014, <https://emmatomkinson.com/2014/10/27/the-peterborough-social-impact-bond-sib-conspiracy/>.

¹⁵ This is a common claim in the literature, but for specific examples, see Jenesa Jeram and Bryce Wilkinson, “Investing for Success: Social Impact Bonds and the Future of Public Services” (Wellington, NZ: New Zealand Initiative, 2015), 5–6; Dear et al., “Social Impact Bonds: The Early Years,” 21; and Emily Gustafsson-Wright and Sophie Gardiner, “Policy Recommendations for the Applications of Impact Bonds: A Summary of Lessons from the First Five Years of Experience Worldwide” (Washington, D.C.: The Brookings Institute, November 2015), 3–4, <https://www.brookings.edu/research/the-potential-and-limitations-of-impact-bonds-lessons-from-the-first-five-years-of-experience-worldwide/>.

By contrast, SIBs are seen as unlikely to succeed in situations where:

- where outcomes are diffuse;
- where measurement is difficult or highly contestable;
- where attribution of outcomes is complex due to confounding variables;
- where knowledge and empirical evidence of intervention impacts is too scant to convince investors to risk their capital;
- where the use of targets or metrics creates perverse incentives;
- where there is uncertainty over whether the outcome funder (such as a government with a poor credit rating) can repay investors;
- where there is a possibility for corruption at any stage;
- where programmes are politically controversial over the SIB's long lifespan; and
- where government is already willing to fund conventional outcomes-based interventions that have proven effectiveness.

This working paper follows the lead of such research by treating Environmental Impact Bonds as one instrument in the toolbox, not a panacea. In other words, this working paper will not advocate the impact bond model as adequate for all investments into environmental infrastructure, nor as an alternative to core funding for environmental management; rather, it explores the adequacy of this financial instrument for *the particular challenge* of planting permanent forest in New Zealand. Whether impact bonds can be successfully adapted for other environmental challenges—such as the DC Water and Sewer Authority bond for green infrastructure—is beyond the scope of this paper.

The next section (Section 5) will adapt the SIB literature to the possibility of EIBs. For a direct discussion of why the obstacles for *environmental* bonds might not be faced by *social* bonds, see Box 4 below.

Box 4: Why Social Impact Bonds Are Not Like Environmental Impact Bonds.

The key difference between SIBs and EIBs is the object of impact: SIBs target sectors of society, such as offenders or underprivileged children, whereas EIBs target attributes of the natural environment, such as water quality or biodiversity.

This basic difference has three important implications: (1) measuring impact for EIBs is less controversial than for SIBs; (2) EIBs can piggyback on established models and frameworks for monitoring and evaluation; and (3) EIBs can look to more diverse revenue streams than government.

(1) Physical measurement is far less controversial than social measurement. Measuring improvements in mental health, for example, necessarily involves normative criteria such as “what is healthy?”, “what is socially acceptable?”, and “what is well-being?” Answering these questions involves not only methodological disputes, but also ethical and political disputes over what we consider “good” or “normal”. By contrast, measuring physical properties in an environment—say, the presence of particulates in air, or the volume of phosphorous in water—is relatively less controversial. Although we cannot avoid ethical and political disputes entirely—for instance, we still need to decide what are “safe” levels of particulates or phosphorous—we can at least more easily distinguish these issues from issues of measurement.

(2) Unlike SIB metrics, which must be created from scratch and trialled over time, standardised EIB metrics generally already exist, or can be readily adapted, from existing technologies and frameworks for environmental monitoring and evaluation. This avoids a major disincentive for SIBs: that they are very costly and laborious to set up because of debates of measures of well-being. In regards to measuring the value and effects of permanent forest, however, New Zealand already has government systems in place that could be co-opted or adapted for the purposes of impact measurement, evaluation, baseline setting, the pricing of costs and benefits, and so on. Crown research institutes such as Landcare, Scion and NIWA are already involved in relevant science, including measurements of water quality, air quality, and land use surveys. The National Environmental Standards currently under development for the Ministry for the Environment, especially the framework being developed for plantation forests in collaboration with the Ministry for Primary Industries, could also be adapted to create impact performance targets for permanent forest planting.

(3) The final strength of EIBs is that revenue streams are a regular occurrence for natural resources, whereas for SIBs the primary source of revenue is government. Specifically, the prime justification for public spending on SIBs is avoided costs to government, typically through the prevention of social harms that require public investment. However, when the object of impact is natural resources, the value could also accrue to private companies, such as the water and electricity utilities in the forest resilience bond. For permanent forest, revenue could potentially come from selective timber felling, honey production, carbon offsetting, recreation, and so on (although the trade-off for more diverse revenue is the overall complexity and risk of the instrument).

5: Environmental Impact Bonds: Advantages and Risks.

This next section draws upon the existing literature on SIBs to survey the advantages and risks of this financial structure, adapting this analysis to the hypothetical case of a Permanent Forest Bond.¹⁶

The advantages are as follows:

- Risk is displaced from the public sector to private investors (§5.1.1).
- Auditing and monitoring are built into the funding structure (§5.1.2).
- Emphasis on measurement, cause and effect (§5.1.3).
- Emphasis on long-term outcomes (§5.1.4).
- Potential for long-term fiscal savings from future avoided costs (§5.1.5).
- The provision of upfront capital is part of the instrument (§5.1.6).
- Potential for greater innovation and more cost-effective service provision (§5.1.7).
- Potential to harness expertise and reputation of private investors and intermediaries (§5.1.8).
- Potential for scalability (§5.1.9).
- Potential for more successful achievement of outcomes (§5.1.10).
- Potential to harness philanthropic and prosocial motivations among investors (§5.1.11).
- Potential for flexibility (§5.1.12).

The risks are as follows:

- The complexity of impact bonds creates novel dimensions of risk (§5.2.1).
- Measurement of outcomes can be unreliable and controversial (§5.2.2).
- Costs of establishment are high (§5.2.3).
- The drive to cost-effectiveness could incentivise poor quality services (§5.2.4).
- Vulnerable to policy reform and shifting government priorities (§5.2.5).

¹⁶ The following section draws on the following reports: Laura Callanan, Jonathan Law, and Lenny Mendonca, "From Potential to Action: Bringing Social Impact Bonds to the U.S." (McKinsey & Company, May 2012), <http://mckinseysociety.com/social-impact-bonds/>; Jenesa Jeram and Bryce Wilkinson, "Investing for Success: Social Impact Bonds and the Future of Public Services" (Wellington, NZ: New Zealand Initiative, 2015); Gustafsson-Wright, Gardiner, and Putcha, "The Potential and Limitations of Impact Bonds"; Emily Gustafsson-Wright and Sophie Gardiner, "Policy Recommendations for the Applications of Impact Bonds: A Summary of Lessons from the First Five Years of Experience Worldwide" (Washington, D.C.: The Brookings Institute, November 2015), <https://www.brookings.edu/research/the-potential-and-limitations-of-impact-bonds-lessons-from-the-first-five-years-of-experience-worldwide/>; Annie Dear et al., "Social Impact Bonds: The Early Years" (Social Finance, July 2016); Lindsay Beck, Catarina Schwab, and Anna Pinedo, "Social Impact Bonds: What's in a Name?," *Stanford Social Innovation Review*, October 12, 2016, https://ssir.org/articles/entry/social_impact_bonds_whats_in_a_name.

5.1: Advantages

§5.1.1: Risk is displaced from the public sector to private investors.

By issuing bonds based on pay-for-performance contracts, the government reallocates a variable degree of financial risk onto private sector investors. Specifically, governments (or other issuers) pay for outcomes, not services, so the risk of not achieving outcomes falls upon private sector investors. By contrast, with conventional output-based contracts, the risk that service providers will fail to achieve outcomes is carried by the public money that is paid for the service. (Note that this displacement of risk must be weighed against the novel risks that the SIB structure incurs, especially the risks of failed implementation; see §5.2.1)

In regards to permanent forest planting, this is a potential advantage over the Afforestation Grant Scheme (AGS). Under the AGS, grants are awarded if forest is planted according to certain specifications—but this in itself is no guarantee of success. There are grounds to recoup public subsidies if the grantee has demonstrably failed to “[t]ake all reasonable steps to protect the Forest... from loss, damage or destruction” (Afforestation Grant Scheme Agreement [5.1a]). But recouping carries uncertainties and efforts that the pay-for-performance mechanism circumvents.

§5.1.2: Auditing and monitoring are built into the funding structure.

There is a growing demand within government to demonstrate links between policy and outcomes, justified on the grounds that the public expects greater efficacy and efficiency from tax-funded programmes. This pursuit for fiscal accountability has resulted in the growth of agencies and mechanisms that monitor, audit and evaluate the outcomes of public service provision.

A strength of EIBs is that the pay-for-performance contracts ensure that monitoring and evaluation is built into service delivery. The methods for doing this are pre-arranged as part of the contract agreement, then monitored continually when service provision starts, with strong incentives to closely monitor outcomes given the direct connection between measurement and payment. By contrast, conventional monitoring and evaluation programmes are often retrospectively imposed on existing policies, often by external agencies. This means that appropriate methodologies will be developed post hoc, relevant feedback will be delayed, and independent budgets will be required.

§5.1.3: Emphasis on measurement, cause and effect.

Impact bonds are informationally rich, because the process of determining, measuring and achieving impact targets will produce unique data about what works and what is most effective. This knowledge could be transferrable to other programmes, including conventional public funding of services or outputs. In regards to an EIB for permanent forest planting, the monitoring of conventional and innovative planting regimes will generate information about what trees work on what sites, which planting regimes succeed, where costs can be cut, and so on. This can inform planting projects undertaken by Department of Conservation and Ministry for the Environment.

The flipside of this informational richness is that EIBs require a lot of information upfront to inform the decisions and risk assessments of investors, service providers, and bond issuers. Fortunately, as noted earlier in Box 4, EIBs can draw upon a large existing repository of data and technologies from environmental monitoring and evaluation to support conventional policies and obligations at the central and local government levels.

§5.1.4: Emphasis on long-term outcomes.

Impact bonds take several years to mature. More broadly, Climate Bonds Initiative notes that 70% of climate-aligned bonds have tenors (time-to-maturity) of 10 years or more.¹⁷ This lack of liquidity will be unattractive to some investors. It also invites political risks because governments and government priorities could change before the bond matures (see §5.2.5).

However, from a policy perspective, it is advantageous that impact bonds are designed to demonstrate continued effectiveness over long-term timescales, not just short-term effects. For permanent forest, this is valuable, because saplings generally take several years to successfully establish themselves. Only after a period of, say, five years could young trees be said to be mature enough to survive without continued weed and pest control. Also, the longer lasting the bond, the more diverse the possibilities for additional revenue to feed into its capital returns, such as carbon offsetting and selective timber extraction. Relevantly, in the Afforestation Grant Scheme, the government claims ownership of resultant carbon credits for the first ten years, which indicates the kinds of timeframes that are relevant for carbon sequestration (see Appendix 2).

§5.1.5: Potential for long-term fiscal savings from future avoided costs.

It is noted that impact bonds are well-suited to preventative activities. Common themes for SIBs are reducing rates of recidivism, reducing homelessness, or preventing truancy. Accordingly, a key economic justification for bonds is the avoidance of future costs. Present expenditure is justified if the sum cost of intervening is less than the sum cost of not intervening. Because target problems can persevere for years or decades, these future costs will aggregate to significant sums (discount rates notwithstanding).

This is well-suited to environmental problems, because it is a feature of many environmental problems (such as climate change) that costs are cumulative and time-delayed. As discussed in Section 1, an obstacle to dealing rationally with environmental problems is that costs are *externalised*, unaccounted for by the decision makers whose economic activities are causing the environmental harms. Instead the costs are borne elsewhere, such as through the depreciation of natural assets, or lost revenue by other users of a natural resource, or as harms inflicted upon future peoples. The nature of environmental problems, therefore, is well-suited to justifications of impact.

§5.1.6: The provision of upfront capital is part of the instrument.

¹⁷ Climate Bonds Initiative, “Bonds and Climate Change: The State of the Market in 2016” (Climate Bonds Initiative & HSBC Climate Change Centre of Excellence, July 2016), 5.

What makes an impact bond not merely a pay-for-performance contract is that it delivers capital upfront to service providers. This is particularly useful where service providers lack the necessary resources and where opportunities for revenue are delayed.

This is advantageous for permanent forest planting, because the costs for establishing and protecting forest can be significant, while reliable revenue opportunities will take years or decades to mature. It is also preferable to the Afforestation Grant Scheme, where payment from Government is only triggered after forest has been established (see Appendix 2).

§5.1.7: Potential for greater innovation and more cost-effective service provision.

Pay-for-performance contracts proscribe only outcomes, *not* how service providers are to deliver those outcomes. This creates the freedom to innovate, to find new and effective ways to deliver services. Although innovation might not occur, because private investors bear the risk of unsuccessful innovation, it is nevertheless an option because service providers are not constrained by output-based contracts. A Brookings Institute survey of 38 SIBs found that although none deployed an unprecedented method of service delivery, many applied methods in new and different settings, or in unique combinations.¹⁸

Governments and government departments, by contrast, are constrained from innovation because of their vulnerability to political risk. In the case of a failed impact bond, however, the costs are borne by private investors, thereby shielding government from public scrutiny. With this freedom to experiment, it is anticipated that services can be delivered at a lower cost than government departments could deliver it.

§5.1.8: Potential to harness expertise and reputation of private investors and intermediaries.

A distinguishing feature between conventional government contracts and impact bonds is the relationship that service providers establish with private sector investors, actuaries, and other intermediaries. These relationships are not only an opportunity for capital investment, but also for expertise in fiscal and institutional management, business and entrepreneurial acumen, skills in communications and marketing, contacts and networks, reputational integrity, and more. This could also be advantageous if the relationship between government and the target community is fractious, because intervention might be more readily welcomed when delivered by private sector organisations with name recognition among target populations. This could be an asset for permanent forest planting, if landowners are wary of interventions and land use allocations by government.

§5.1.9: Potential for scalability.

The establishment of impact bonds can be costly, time-consuming and labour intensive (see §5.2.3). However, these high initial establishment costs can be justified if the delivery model is successful and can be scaled up or replicated.

¹⁸ Gustafsson-Wright and Gardiner, "The Potential and Limitations of Impact Bonds," 43.

This is a virtue in the context of afforestation in New Zealand, because the land available for future forest is large. The Ministry for Primary Industries identifies an afforestation target of at least 1.1 million hectares of highly erosion prone marginal land. Yet existing projects do not have the requisite scale. The Afforestation Grant Scheme, for example, targets only 15,000 hectares of new forest by 2020, which is only 1.36 per cent of the 1.1-million-hectare problem identified by Ministry for the Environment. Another scheme, the Erosion Control Funding Programme (formerly the East Coast Forestry Project), will deal to only 6.45 per cent of this national problem once complete. But expanding the EIB would require merely issuing new bonds with the same proven structure. Also, because an EIB for permanent forest planting would be world-pioneering, there is potential that this model could be exported elsewhere to countries facing similar problems, particularly those countries in South America and Southeast Asia that have experienced dramatic deforestation in recent decades.

§5.1.10: Potential for more successful achievement of outcomes.

A common hypothesis for impact bonds is that pay-for-performance contracts are more likely than output-based contracts to achieve outcomes. In light of the novelty of these instruments and the thin empirical record, this is offered only as a hypothesis here.¹⁹ A New Zealand Initiative report claims that “better outcomes are more likely to be achieved”—yet this appears to be grounded in a presumption that financial incentives work.²⁰ In light of general research on human motivation, there is reason to doubt that this presumption is generally true, even though it could be true in specific situations.²¹ The major virtue of impact bonds is not that success is more likely, but that failure doesn’t need to be paid for. A strict focus on financial incentives, moreover, could neglect the influence of other motivations, which are especially relevant for permanent forests given the various non-economic reasons for planting—such as reasons of health and community cited by conservation groups, or the duty of *kaitiakitanga* among Māori.

§5.1.11: Potential to harness philanthropic and prosocial motivations among investors.

Not all investors will find the EIB structure attractive, given the allocation of risk, the delayed returns, and lack of liquidity. However the explicit focus on environmental outcomes—and the reputational value that comes with the class of “green bonds” and “climate-aligned bonds”—will be highly attractive to impact investors and other socially responsible retail investors. For philanthropic investors, it could be attractive that investors receive even a modest return on investments, rather than simply provide donations with no expectation of return. It could also be attractive to pioneer a new asset class that delivers environmental outcomes. These attractions could outweigh the necessary compromises in other areas, such as risk, returns and secondary liquidity. Indeed, this has been the case for Social Impact Bonds: “Most investors in the early transactions are foundations and impact investors who have a higher tolerance for the risk associated with engaging early in this market, alongside a desire to see complex social problems addressed effectively.”²²

¹⁹ For some analysis, see *ibid.*, 44.

²⁰ Jeram and Wilkinson, “Investing for Success: Social Impact Bonds and the Future of Public Services,” 7.

²¹ Dan Ariely et al., “Large Stakes and Big Mistakes,” *Review of Economic Studies* 76 (2009): 451–69.

²² Dear et al., “Social Impact Bonds: The Early Years,” 27.

Large-scale institutional investors, such as pension funds, are initially unlikely to accept such compromises because of their fiduciary duties to shareholders. However, a stakeholder workshop on forest finance notes: “Forest bonds should target impact and socially responsible investors initially, while the market develops, then begin to target institutional investors as the forest bond market deepens. A tranche structure with different risk/return profiles could also be used to simultaneously appeal to both groups.”²³ By emphasising the environmental value of the bond, this could also alleviate the need for interest rates or coupons that are competitive with conventional kinds of investment.

§5.1.12: Potential for flexibility.

A major asset for impact bonds is the potential for tailoring targets to meet the expectations and demands of specific stakeholders. In the case of permanent forest, this is important because the bond can be adapted to different localities and geographic regions, where the likelihood of meeting targets are different. Carbon sequestration, for example, occurs more slowly in the southern regions of New Zealand than the northern regions; so targets will need to be geographically sensitive (as for the Emissions Trading Scheme look-up tables). Similarly, if contractors and investors wish to experiment with mixed native/exotic transitional regimes, this could be accommodated within the contract.

5.2: Risks

§5.2.1: The complexity of impact bonds creates novel dimensions of risk.

Impact bonds involve multiple contracts that connect together multiple parties. Although impact bonds purport to shift risk onto the private sector and away from public funds, their complexity introduces a further risk that the lengthy and laborious establishment process will be prematurely aborted because relevant parties cannot agree on the various attributes of the bond. These attributes include acceptable levels of risks and returns, what outcomes should be contracted for, how outcomes will be measured, and the establishment of mutual confidence among the multiple contracting parties. These risks can be mitigated however by ensuring a simple structure, by ensuring trust and transparency between contracting parties, and striving for wide political endorsement.

§5.2.2: Measurement of outcomes can be unreliable and controversial.

Due to the complexity of the problems that impact bonds tend to address, it can be difficult to isolate confounding variables and their causal effects on outcomes. The problem of separating out causal influences is certainly less intractable for environmental bonds than for social bonds, because natural processes are more amenable to description in terms of general laws than social phenomena. However, explanation of environmental outcomes is still complex. Measuring sediment levels in a

²³ Cranford et al., “Unlocking Forest Bonds: A High-Level Workshop on Innovative Finance for Tropical Forests,” 7.

river, for example, could be affected by unpredicted and unobserved events along the river that are unrelated to the intervention being monitored.

The best response is to strive for simplicity in design, especially in identifying outcomes and impact targets. A 2015 survey of existing impact bonds noted that “choosing the simplest set of outcomes and metrics possible makes the resulting SIB program significantly easier to operate. Simple metrics provide a clear focus for the service provider and reduce resources needed for evaluation. Although a simple metric may not capture every outcome that matters to all actors, a measure that is a proxy for other meaningful outcomes could be sufficient.”²⁴

§5.2.3: Costs of establishment are high.

Given the complexity of impact bonds, they are relatively resource intensive to establish. At least initially, these establishment costs could outweigh any cost-savings from the application. In regards to SIBs, the New Zealand Initiative notes: “It is more likely that at least in the short term, the main benefit from SIBs will come from achieving better social outcomes, rather than fiscal savings. The transaction costs of SIBs could be high relative to the amount of capital raised, particularly in the early stages of their development.”²⁵ In regards to EIBs specifically, there is reason to believe that transaction costs can be reduced somewhat if the EIB can free-ride on existing systems for environmental monitoring, rather than invent new systems from scratch. Moreover, as discussed above in §5.1.9, the vast scale of potential permanent forest planting, as well as the scale of costs avoided, could justify these high initial establishment costs.

§5.2.4: The drive to cost-effectiveness could incentivise poor quality services.

A long-standing critique of outcome-oriented contracting is that it incentivises contractors to game, cheat or otherwise manipulate the achievement of outcomes. Service providers are suspected of ticking boxes, of doing the bare minimum to achieve targets, instead of delivering substantive impacts. This is a risk that cannot be ruled out for permanent forest planting—but it can be mitigated through a judicious selection of indicators. For example, if service providers cut corners in regards to planting methods, or using low-quality stock, or failing to provide sufficient aftercare, then the forest is likely to suffer higher mortality rates. But mortality rates, or at least minimal levels of tree density after five years, can be among the performance impact targets used to trigger repayments. In other words, as long as sensible targets are selected, then cutting corners only increases risks to investors, so there is an intrinsic incentive not to do so and to deliver outcomes with integrity.

§5.2.5: Vulnerable to policy reform and shifting government priorities.

The involvement of government in impact bonds, as well as the long repayment cycle, makes impact bonds vulnerable to political risks. The Peterborough Prison Bond is a prominent example (see Section 4): it was cancelled because of nationwide reforms to ex-offender rehabilitation policy. Another source of risk is partisanship: if an opposition party has an ideological or principled objection to impact

²⁴ Gustafsson-Wright, Gardiner, and Putcha, “The Potential and Limitations of Impact Bonds,” 29.

²⁵ Jeram and Wilkinson, “Investing for Success: Social Impact Bonds and the Future of Public Services,” 7.

funding, then there is a risk that the impact bond will be abandoned or undermined if that party subsequently comes to power. Assuring cross-party support for impact bonds will do much to provide confidence for investors.

While impact bonds can potentially be held hostage to the competing demands of parliamentary sovereignty and policy longevity, it should also be recognised that these risks are not unique to impact bonds. These risks are relevant to other kinds of government contract also, although these risks are conventionally borne by service providers rather than investors.

6: A Preliminary Indication of Expenses, Revenue and Avoided Costs.

Please note: The following section is not written to establish the economic case for planting permanent forest. Such a case would require a more comprehensive analysis of the opportunity costs for alternative land uses, particularly dairy farming. This section is written simply to demonstrate that an economic case can be made, by indicating the kinds of expenses, revenue streams and avoided costs that might be invoked in negotiations.

The Permanent Forest Bond will bridge the gap between untapped private capital and the unrealised environmental benefits of permanent forest.

The benefits of permanent forest are predicted by scientists on the basis of empirical observation and general knowledge about natural systems.²⁶ An ecosystem services approach can then be employed to value environmental interventions, or to put a price on the costs of not intervening.²⁷ For example, Barry et al. estimate that the total value of avoided erosion into perpetuity from future forest on 2.47 million hectares of erosion-prone land is NZ\$3.6 billion.²⁸ On average, this works out to \$1578.95 per hectare. Avoided costs of this kind can then be integrated into the long-term decision making of the Crown, because it is a trans-generational institution that bears *both* the immediate and long-term costs. To put the same point differently, the Crown that eventually bears the cost of lost productivity from future environmental degradation is the same Crown that could choose to invest today in obviating that degradation and subsequently benefit from long-term prosperity. It can therefore justify so-called Payments for Ecosystem Services (PES).²⁹

The challenge for the Permanent Forest Bond is to secure enough revenue and ecosystem services to outweigh the expected costs of initial forest establishment. It is not plausible here to provide a comprehensive survey of expenditure and revenue, partly because this will be determined by negotiating the Bond itself, the results of which cannot be anticipated in advance. However, it is

²⁶ For review, see Kate G. McAlpine and Debra M. Wotton, "Conservation and the Delivery of Ecosystem Services: A Literature Review," Science for Conservation (Wellington, NZ: Department of Conservation, 2009); Robert B. Allen et al., "New Zealand's Indigenous Forests and Shrublands," in *Ecosystem Services in New Zealand—condition and Trends*. (Lincoln, NZ: Manaaki Whenua Press, 2013), 34–48; Lin Roberts et al., "The Nature of Wellbeing: How Nature's Ecosystem Services Contribute to the Wellbeing of New Zealand and New Zealanders" (Wellington, NZ: Department of Conservation, 2015), <http://www.doc.govt.nz/upload/documents/science-and-technical/sap258entire.pdf>.

²⁷ Gretchen C. Daily et al., "Ecosystem Services: Benefits Supplied to Human Societies by Natural Ecosystems," *Issues in Ecology*, no. 2 (1997): 1–18; Robert Costanza et al., "The Value of the World's Ecosystem Services and Natural Capital," *Ecological Economics* 25, no. 1 (April 1998): 3–15; Natural Capital Declaration, "Towards Including Natural Resource Risks in Cost of Capital: State of Play and the Way Forward" (Natural Capital Declaration, November 2015).

²⁸ Luke E. Barry et al., "Enhancing Ecosystem Services through Afforestation: How Policy Can Help," *Land Use Policy* 39 (July 2014): 139.

²⁹ B. Kelsey Jack, Carolyn Kousky, and Katharine R. E. Sims, "Designing Payments for Ecosystem Services: Lessons from Previous Experience with Incentive-Based Mechanisms," *Proceedings of the National Academy of Sciences* 105, no. 28 (July 15, 2008): 9465–70.

possible to indicate the sorts of costs and benefits that negotiations could involve, which is done in Table 1 below.

It is also worth noting that spatial economic tools are currently being developed to assess the net value of forests inclusive of ecosystem services. For example, the Forest Investment Framework (FIF) will account not only for standard costs and revenues from planted forests, but also water quality (avoided nitrate leaching), water supply, recreation, and biodiversity conservation.³⁰ Similarly, an online land use tool, dNITRO, is being developed by Toitu te Waonui Limited which provides a cost-benefit analysis of land use change to mānuka forest and/or *Pinus radiata* in the Lake Rotorua area, and factors in carbon credits, nitrogen allowances and afforestation grants. Such technologies could, in time, be adapted for land use decisions on permanent forest.

But an important point needs to be made: when considering potential revenue streams, there is a trade-off to be made with complexity. As identified in §5.2.1 and §5.2.2, the potential complexity of impact bonds is a major source of structural risk. As layered capital structures, impact bonds involve contracts with multiple parties across public and private sectors, mediated through sophisticated systems for monitoring and evaluation. From this perspective, it is prudent to favour simplicity in designing impact bonds, by favouring a streamlined set of uncontroversial targets and measures, and involving as few contracting parties as possible. From the perspective of generating revenue, however, there is an incentive to include multiple impacts, because this widens the field of outcome funders who might pay for outcomes. But this requires further sets of contracts and measurement frameworks, each inviting new dimensions of risk.

In short, the demands of risk mitigation and revenue generation pull in two different directions. So a major design challenge for the Permanent Forest Bond is to strike the right balance: on the one hand, to establish enough reliable contracts that investors will see attractive rates of interest on repayment, while on the other hand not inviting so much complexity that it renders the financial instrument vulnerable to contingency and controversy.

³⁰ Richard T. Yao et al., “Validation and Enhancement of a Spatial Economic Tool for Assessing Ecosystem Services Provided by Planted Forests,” *Forest Policy and Economics*, New Frontiers of Forest Economics: Forest Economics beyond the Perfectly Competitive Commodity Markets, 72 (November 2016): 122–31.

Table 1: Indicative expenditure, revenue and avoided costs from permanent forest establishment in New Zealand.

	Item	Notes	Cost (all prices in \$NZ)
Expenditure	Trees	<ul style="list-style-type: none"> —Saplings —Cuttings —Seeds 	<ul style="list-style-type: none"> —Variable due to location, economies of scale, and stems per hectare. —\$4–10 per sapling (including labour).
	Fencing	—Fencing to manage farm stock and pests	—Variable costs due to site location, existing fencing, stock types & likely pests.
	Labour	<ul style="list-style-type: none"> —Planning & organisation —Site preparation (weeding, fencing, etc.) —Planting —Aftercare (weed & pest control, fence repair, etc.) 	— Variable costs due to site access, remoteness, steepness, & presence of weeds & herbivorous pests.
	Transport	—Transport for saplings and labour	— Variables include site access, remoteness, & existing roading.
	Annual fixed costs	—Rates and insurance for forest loss (fire, wind event, disease, etc.)	—Variable depending on region.
Revenue	Carbon credits	<ul style="list-style-type: none"> —Provision of NZUs through Permanent Forest Sink Initiative or Emissions Trading Scheme. —Provision of alternative carbon credits for voluntary carbon market. 	<ul style="list-style-type: none"> —Current price of NZU of \$17–19 per tonne. —Projected carbon price at 2030 of \$152 per tonne assuming a global low-carbon transition, or \$104 per tonne assuming domestic transition to renewable energy and EV uptake, or \$56 per tonne assuming Tiwai Point shutdown (MBIE 2016; IEA World Energy Outlook 2015). —Carbon stock in non-soil pools from planted forests (2008): \$148–\$22,749 per hectare, assuming a carbon price of \$0.19–29.24 per tonne (Barry et al. 2013).
	Honey production	—Use of transitional mānuka forest for honey production.	—Bulk honey price for mānuka honey: \$9.50–\$116.50 per kg in 2015, up from \$7–\$37.50 in 2010 (MPI 2015).
	Timber revenue	<ul style="list-style-type: none"> —Selective felling of forest under permanent canopy cover rules. —Felling of transitional/nursery crops as interim income. 	—For emerging work on the economic viability of native forestry, see Quinlan (2011).

	Recreation	<ul style="list-style-type: none"> —Paid access to forest for walking, biking, etc. 	Willingness to pay for recreational opportunities in planted/native forests: \$34–67 per visit (Dhakal et al 2012).
Avoided costs	Soil erosion	<ul style="list-style-type: none"> —Agricultural production loss —Farm infrastructure loss —Direct private property damage —Road/rail infrastructure damage —Utility network damage —Recreational facility damage —Loss of visual amenity —Other soil erosion effects (damage to wāhi tapu, loss of farmer confidence, etc.) 	<ul style="list-style-type: none"> —Total value of avoided erosion into perpetuity from future forest on 2.47 million hectares of erosion-prone land: \$3.6 billion (Barry et al 2014). —Avoided erosion value from 2.9 million hectares of erosion prone land: \$250 million per year (Barry et al 2013). —Average annual cost of soil erosion and sedimentation combined: \$127 million although true value likely to be higher. Lost agricultural production alone is estimated at \$37 million annually (Krausse et al 2001). —Net present value of soil conservation (for erosion and sedimentation): at least \$2.7 million at internal rate of return of 11.3% (Weber et al 1992). —One-off costs of June 2015 storm in Taranaki/Horizons: total cost of \$68.9 million with up to 800 properties impacted. Majority of impact on sheep and beef farms (\$57.6 million) with \$37 million in infrastructure damage and \$20.6 million in production losses (MPI 2015).
	Sedimentation and water quality	<ul style="list-style-type: none"> —Cost of filtering drinking water —Increased cost of processing from machine wear and efficiency losses —Loss of recreation (fishing, boating, swimming, etc.) —Water storage loss (reservoirs and dams) —Navigation (cost of dredging ports and channels) —Reticulation (irrigation/hydro canals, drainage ditches) —Biodiversity loss (degradation of freshwater and estuarine ecosystems) —Other sediment effects (dust nuisance, loss of community confidence, etc.) 	<ul style="list-style-type: none"> —Sedimentation costs are difficult to generalise beyond specific events or catchments (see Blaschke et al 2008) —The commercial asset value for snapper stocks, whose spawning is threatened by sedimentation in estuaries like the Kaipara Harbour: \$262 million in 2009 (Statistics NZ 2010) —Annual value of water quality improvement from existing planted forests in the Hawkes Bay: \$29 million per year (Barry et al 2013). —Total cost of Ministry for the Environment’s nine clean-up projects of polluted lakes and rivers (includes Lake Taupō, Rotorua Te Arawa Lakes, and Manawatu River): \$272.6 million; Crown contribution is \$122.2 million.

Water volume	<ul style="list-style-type: none"> —Insured loss (flood costs for public or private insurance) —Production loss 	<ul style="list-style-type: none"> —Cost to insurers from flood damages from 1995–2004: NZ\$247 million excluding government compensation payments (Bicknell et al. 2004). —Cost to insurers from weather-related events, largely flooding, in 2015: \$115 million including \$50 million for June 2015 storm in Manawatu/Horizons (Insurance Council of New Zealand 2016).
Air quality	<ul style="list-style-type: none"> —Filtration of particulates. —Reduced respiratory disease and associated public health expenditure. 	<ul style="list-style-type: none"> —Health benefits from reduced exposure to PM10 particulates in Christchurch air: \$19.2 million (Cavanagh 2008). — Value of improved air quality from planting for Project Twin Streams in Waitakere: \$1.8–4 million (Vesely 2009).
Biodiversity	<ul style="list-style-type: none"> —Loss of unique indigenous species and habitats. 	<ul style="list-style-type: none"> —Willingness to pay for improved provision of habitat for native species in public forests: NZ\$95 per year per household (Yao and Kaval 2010).
Loss of “clean green” market reputation	<ul style="list-style-type: none"> —General degradation of 100% Pure brand due to damage of environmental reputation. 	<ul style="list-style-type: none"> —Added value to dairy exports from perceptions of environmental non- degradation in Asian, African, Indian, and Middle Eastern export markets: \$241–569 million (Ministry for the Environment 2001). —Added value to tourism from perceptions of environmental non-degradation: \$530–780 million (Ministry for the Environment 2001).

7: What Would a Permanent Forest Bond in New Zealand Look Like?

The proposed Permanent Forest Bond is an alignment of interests between three stakeholders: investors, contractors and the Crown. Two other parties are required to facilitate this contractual arrangement: an intermediary and an evaluator. (See Figure 2 below.)

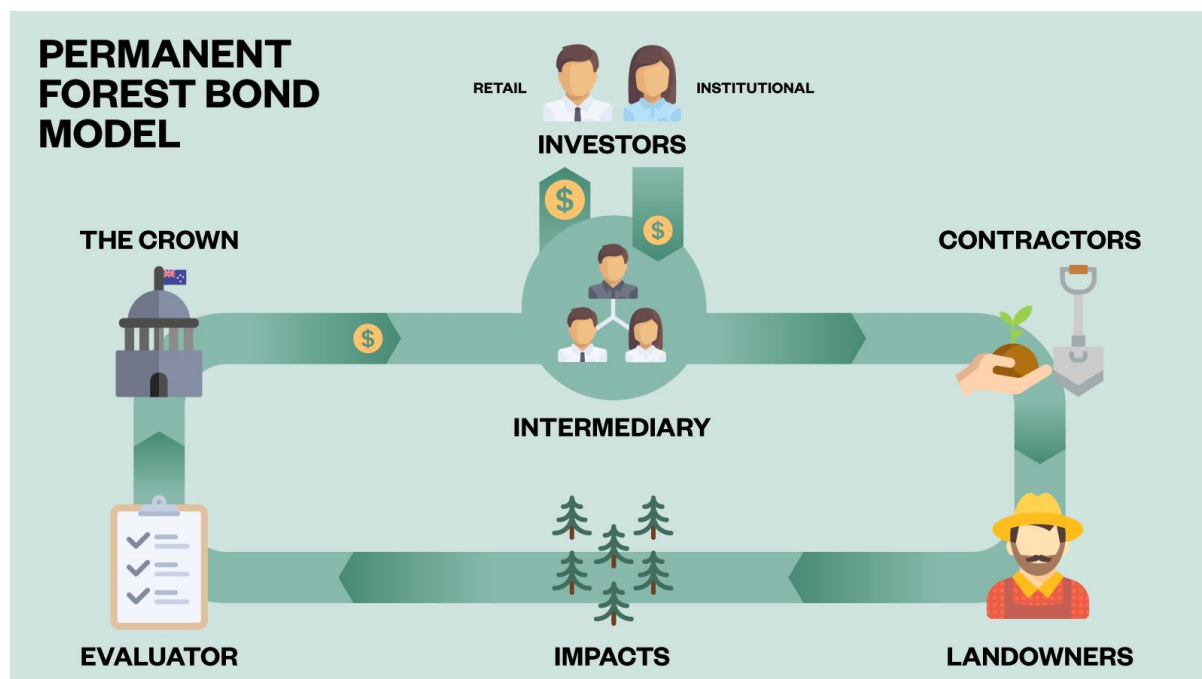


Figure 2: Schema for a Permanent Forest Bond

The first group of stakeholders is *investors* who want to invest in positive environmental outcomes. This can include both *institutional investors* like banks and pension funds, and smaller-scale *retail investors* who .

The second is the *contractors* – typically called *service providers* in the context of SIBs – in this case the prospective forest planters who lack the upfront capital to plant permanent native forest.

The third party is the *outcome funder*, which in this case is *the Crown* (although the Crown could partner with other beneficiaries of permanent forest outcomes as discussed below). The ultimate interest of the Crown is to avoid the future costs of environmental degradation, as well as future carbon liabilities for purchasing foreign carbon credits to meet international emissions reduction targets. Although this is economically rational for the Crown over the very long run, the Crown also has more proximate interests in functioning as cost effectively as possible. This is the appeal of the Permanent Forest Bond, which promises to provide the service of forest planting more time- and cost-effectively by involving the private sector rather than direct intervention from the Crown itself.

These stakeholders are coordinated by two other actors: the *intermediary* and the *evaluator*. Typically, the intermediary determines the feasibility of outcomes, structures the deal, identifies contractors, and raises and distributes capital by working with investors and outcomes funders. Meanwhile, the evaluator monitors and assesses whether contractors succeed in meeting the relevant performance impact targets (see §7.1 below). If these targets are met, then payment to investors is triggered in accordance with the pay-for-performance contracts. According to measured impacts, investors will experience either a loss of principal, a return of principal, or a return of principal plus coupon. The bond maturity can be set for a timeframe when tree mortality is low (say, 5–8 years). Additionally, there might be a system of interim payments at key milestones.

The schema above leaves a lot undetermined. For the purposes of this working paper, this is proper, because the detail of the Permanent Forest Bond can only be specified through the process of negotiation. However, for the purposes of shedding light on what the bond might look like, the following subsections discuss some of the options that negotiators must settle on:

§7.1: The selection of impact targets.

Ultimately, the most critical task is to identify impact targets that will trigger payment from the pay-for-performance contracts. These targets need to be unambiguous enough to forestall disputes and contestation among parties, yet also open enough to invite innovation and cost-effective delivery of outcomes. They also need to be supported by evidence, or investors won't have the confidence to purchase the bonds.

There is no *a priori* solution to the question of targets, because their final selection must emerge from negotiations among stakeholders. However, targets such as these below could form the basis of negotiations:

- x-number of native tree stems per hectare (or part thereof) after five or ten years;³¹
- volume of carbon per hectare (or part thereof) after five or ten years;
- improvements to the Fish Spawning Indicator being developed for the National Environmental Standard for Plantation Forestry;
- improvements to erosion susceptibility, perhaps using existing models such as NZeem® (New Zealand Empirical Erosion Model);
- reduced sedimentation in associated waterways, either by empirical measures or numerical models;
- reduced presence of nutrients (phosphorous, nitrates) in associated waterways.

³¹ Depending on stakeholder ambitions, stems per hectare could be specified as native or endemic species, or left open to include exotics. Alternatively, a Permanent Forest Bond could allow split targets for native/exotic species that can accommodate transitional regimes, where a nursery crop of fast-growing exotics (such as eucalyptus or paulownia) is interplanted with an understorey of natives (such as various podocarps). So although standard conservation planting might recommend 2,500 stems per hectare for forest planting, the Permanent Forest Bond could set a low target of 1,000 native stems per hectare alongside a total target of 2,500 stems per hectare (natives or exotics), allowing investors and contractors to choose what is the most effective regime.

The key virtue here, as discussed earlier, is simplicity. Simple targets that are easy and uncontroversial to measure will reduce evaluation costs, as well as reduce the risk of dispute among contracting parties.

§7.2: Choosing an evaluator.

Another issue to be determined is who should play the role of evaluator. To build confidence and trust among contracting parties, it is preferable to secure a third-party evaluator who can determine measurements impartially and arbitrate disputes. This is the inference in the simplified schema above (Figure 2).

However, as a Brookings Institute report notes, there is substantial variation among existing impact bonds over who occupies roles and how the roles are structured.³² Occasionally, contracting parties are involved in more than one role. Notably, it is not unusual for outcome funders to have at least a secondary role in evaluation by verifying the initial assessments of evaluators. In regards to the Permanent Forest Bond, it is also likely that the Crown's role as outcome funder will blur with the role of evaluation because the Bond will very likely piggyback on existing programmes of environmental monitoring which are undertaken by local authorities; or state-funded Crown Research Institutes such as NIWA, Scion, Landcare Research, and AgResearch; or by government departments themselves. Relevantly for the Permanent Forest Bond, the Ministry for the Environment and Ministry for Primary Industries are currently involved in creating a National Environmental Standard for Plantation Forestry (NES-PF), which will identify a series of assessment standards which could be adapted for measuring the impact of permanent forest planting also. These crossovers will need to be navigated by the intermediary when defining the evaluation role, in order to ensure impartiality and transparency.

§7.3: Additional outcome funders.

For simplicity's sake, this working paper has focused on the Crown as the appropriate entity for issuing a Permanent Forest Bond, because it represents the interests of present and future citizens. However, there are other stakeholders who could be contracted into the Permanent Forest Bond alongside the Crown. Of course, the involvement of additional outcome funders increases the complexity of the bond and the risks associated with complexity (see §5.2.1), but it is for negotiators to strike the right balance between complexity and funding opportunities.

- *Local authorities:* Regional, district and city councils are substantially involved in environmental issues. They are the authorities usually responsible for Resource Management Act decisions; they are involved in local environmental monitoring; they own environmental assets; and they invest in clean-up and environmental remediation projects. Accordingly, local authorities could be called upon to contribute to a Permanent Forest Bond given that subsequent forest will increase the value of green assets and reduce expenditure on clean-ups.
- *Hydropower generators:* Sedimentation is a major issue for hydropower generators—for example, damage to turbines—particularly in Waikato and Clutha Rivers. Forest planting around

³² Gustafsson-Wright, Gardiner, and Putcha, "The Potential and Limitations of Impact Bonds," 23–27.

erosion-prone areas and waterway margins could reduce the costs of damage to infrastructure, so hydropower generators could contribute ecosystem service payments.

- *Private companies:* There are other private companies that could benefit directly from permanent forest planting, such as fishing companies that rely on fish stocks unaffected by estuarine sedimentation, or tourism ventures that benefit from clean rivers without sediment, or recreation companies that wish to invest in future forest. The Permanent Forest Bond could serve as a vessel for contributing financially to positive outcomes.
- *Landowners or agriculture businesses:* In instances where the Permanent Forest Bond creates outcomes that mitigate environmental damage caused by intensive agriculture, there is a case to be made that those profiting from agriculture—that is, landowners or agricultural businesses—should be contributing to payment for such outcomes. Otherwise the bond is subsidising polluters, because it removes remedial expenses that the polluters would otherwise have carried under regulatory restriction.
- *Insurers and reinsurers:* Given the risks to infrastructure and property from vulnerability to erosion and land subsidence, insurers and reinsurers have an interest in increasing the resilience of land to existing climate risks, as well as heightened risk of extreme weather events under conditions of climate change.

§7.4: Ownership.

Given the long time-horizons of forestry, the issue of forest ownership is always challenging. It is not unusual for land ownership titles to be many decades old, and therefore to straddle very different legal contexts. The Permanent Forest Bond introduces additional ownership issues in regards to intellectual property and carbon credits. How to allocate ownership among stakeholders in the Permanent Forest Bond will be critical to the distribution of benefits and, therefore, critical to the Bond's attractiveness to prospective participants.

Ownership of forest: It is not unusual in plantation forestry for ownership of land and forest to be split between different owners, whereby forest operators lease land for establishing forest. A fundamental choice is whether the Bond should be designed to align forest ownership with land ownership, or whether the Crown should claim ownership of forest in the public interest as the principal outcome funder. Given that the public interest referred to here is the carbon and environmental benefits of permanent forest to New Zealand, there are also pathways for restricted ownership to be considered. For example, although the ownership of the forest could be granted to landowners, this could come with clear restrictions against cutting anymore trees than consistent with continuous cover forestry. Alternatively, forest ownership by landowners could be paired with mandatory registration with a covenant, such as the Permanent Forest Sink Initiative or QEII covenant, to best guarantee forest longevity.

Intellectual property: The Permanent Forest Bond is information rich, generating evidence about effective forest practices. Its targeted structure is also designed to promote innovation, to encourage investors and contractors to discover the most cost-effective strategies for establishing forest. This will provide a competitive edge to contractors in securing future bonds, but it could be detrimental to the wider aims of afforestation, insofar as new knowledge about best practice isn't shared among other contractors or the wider community. A requirement for open-access or commons licensing

would provide the greatest transparency and knowledge dispersion, which could be delayed by a period of years in order to reward innovation.

Carbon credits: An important potential source of revenue for permanent forest is the generation of carbon credits to be sold on voluntary carbon markets, or compliance markets like the Emissions Trading Scheme (ETS). Within the context of the Paris Agreement, stakeholders have various interests in carbon credits (see Appendix 1 for a discussion of this context). The Crown has an interest in acquiring carbon credits to meet its international emissions targets. Private investors have an interest in acquiring credits for offsetting their internal emissions, either voluntarily to meet corporate sustainability goals or compulsorily as participants in the ETS. Landowners have an interest in acquiring carbon credits as a revenue stream for their land.

The distribution of carbon credits could be carved up in various ways. The following examples are provided only to shed light on these possibilities:

- The Crown wholly acquires the first 10 years of carbon credits (as it does under the Afforestation Grant Scheme; see Appendix 2). Thereafter, landowners must compulsorily enter the forest into Permanent Forest Sink Initiative and acquire all subsequent credits.
- The Crown and landowner receive a 50/50 split of carbon credits; then after 10 years the landowner acquires an increasing proportion of these credits until s/he acquires all credits from 50 years after the forest was established.
- Investors receive the first 10 years of carbon credits, possibly as a coupon paid on bond maturity. This structure would incentivise maximal carbon production. Thereafter, the carbon credits are acquired wholly by the Crown, or by the landowner, or split 50/50 between the Crown and the landowner.

8: Conclusion

This working paper concludes that an Environmental Impact Bond model could plausibly be adapted to address the challenge of afforestation in New Zealand. A Permanent Forest Bond is technically feasible, in certain ways more feasible than the Social Impact Bonds that are currently under development in New Zealand. These advantages include the pre-existence of established conventions for environmental measurement and monitoring; the creation of “hard assets” that can generate revenue streams that are well-understood; and the potential avoidance of costs to the nation’s long-term prosperity that are large and often quantifiable.

There is, however, no guarantee that a Permanent Forest Bond would succeed. The reasons for this need not be because the model itself is essentially flawed, but because successful implementation depend on the contingencies of the actual negotiation process, including the conduct of the parties involved and the strength of their commitment to the shared goal of expanding permanent forest.

Therefore, any practical progress that develops from this working paper must pay careful attention to the actual relations between contracting parties. There should be no assumption that the plausibility of the Permanent Forest Bond “on paper” will result in its seamless implementation in the real world; rather, there should be a careful attendance to the inter-organisational and inter-personal dynamics at play in this public/private partnership. These dynamics cannot be solved in advance, but they can be anticipated. Ultimately, success will depend on the sound leadership and good judgment of the intermediary in coordinating and structuring the deal, as well as the shared commitment to success among the contracting parties. Given the long life span of impact bonds, it will also be important to secure cross-party political support to reduce the risk of wavering government interest.

Given the environmental assets at stake, including New Zealand’s freshwater, soil and forest assets, the Permanent Forest Bond deserves to be seriously explored as an instrument for improving New Zealand’s long-term prosperity. If, however, this instrument is seen as excessively risky, then stakeholders—the Crown in particular—owes New Zealand citizens an account of how the problem will be solved, if not through public/private partnerships like impact bonds, then through conventional output-based interventions on behalf of the public. If nothing else, the EIB model makes clear that environmental investments are economically rational from a national and intergenerational perspective. These problems ought to be addressed *somehow*, if not by impact bonds then by some other funding model.

Appendix 1: The International Context

An important part of the international context for the Permanent Forest Bond is the growing global call for fossil fuel divestment.

Carbon Tracker Initiative estimates that, to have an 80% probability of staying within 2°C warming, 60–80% of existing fossil fuel investments must be written off as stranded assets.³³ This means forfeiting capital expenditure in fossil fuels worth US\$2.2 trillion as the fossil fuel market shrinks to fit a 2°C carbon budget.³⁴ These estimates have been publicly influential, most prominently through transnational environmental activists such as 350.org or localised campaigns that focus on the capital investments of universities and other institutions. However, acknowledgement of the problem has also come from the mainstream financial establishment, most notably the Bank of England’s governor Mark Carney. In a speech to Lloyd’s of London in September 2015, he warned that “a wholesale reassessment of prospects, especially if it were to occur suddenly, could potentially destabilise markets”. If investors wait to respond to events rather than shift their investments pre-emptively, he argued it “may already be too late”.³⁵ These concerns were more recently reiterated by the European Systemic Risk Board (ESRB), which oversees the European Union’s financial system.³⁶

But where will these investments be shifted to? The call to divest depends upon there being alternative investment opportunities with equivalent levels of risk. These need not be green investments—but if public pressure over climate change is strong enough, financial markets might seek not only to divest from the principal cause of the problem (fossil fuels), but also to re-invest some proportion of that capital into solutions to the problem—that is, into renewable energy, low-carbon technologies, carbon sinks and so on. Consequently, there is a need for low-risk long-term investment alternatives to fossil fuels, especially those that could complement a “green” investment portfolio by being low- or negative-emissions.

At the same time, there is an emerging supply of new financial instruments that meet some of these criteria. Climate Bonds Initiative’s *State of the Market 2016* report has identified US\$694 billion of “climate-aligned bonds” currently outstanding, used to finance low carbon and climate-resilient infrastructure. Of these climate-aligned bonds, only about 17% are labelled explicitly as “green bonds”; the remainder include municipal, and other bonds that finance low-carbon infrastructure development, particularly in transport (67% of all climate-aligned bonds) and energy (19%).³⁷

³³ Carbon Tracker Initiative and Grantham Research Institute on Climate Change and the Environment, “Unburnable Carbon 2013: Wasted Capital and Stranded Assets” (London, 2013), <http://www.carbontracker.org/wp-content/uploads/2014/09/Unburnable-Carbon-2-Web-Version.pdf>.

³⁴ Carbon Tracker Initiative, “The \$2 Trillion Stranded Assets Danger Zone: How Fossil Fuel Firms Risk Destroying Investor Returns” (London: Carbon Tracker Initiative, November 2015), <http://www.carbontracker.org/report/stranded-assets-danger-zone/>.

³⁵ Pilita Clark, ‘Mark Carney Warns Investors Face “Huge” Climate Change Losses’, *Financial Times*, 29 September 2015, <http://www.ft.com/cms/s/0/622de3da-66e6-11e5-97d0-1456a776a4f5.html>.

³⁶ European Systemic Risk Board (ESRB), “Too Late, Too Sudden: Transition to a Low-Carbon Economy and Systemic Risk,” Reports of the Advisory Scientific Committee (Frankfurt, DE: European System of Financial Supervision, February 2016).

³⁷ Climate Bonds Initiative, “Bonds and Climate Change: The State of the Market in 2016” (Climate Bonds Initiative & HSBC Climate Change Centre of Excellence, July 2016).

There are also public pledges to support this growing asset class. During COP21 in Paris, a group of asset owners and investment managers overseeing a combined US\$11.2 trillion of assets released the Paris Green Bonds Statement which pledged to “scale up investment in green bonds, climate bonds and other bonds financing mitigation of and adaptation to climate change that meet out risk and return requirements as institutional investors.”³⁸ Climate Bonds Initiative, which co-organised this Statement, is currently in the process of developing standards for green bonds, which consists of a certification process, pre-issuance requirements, post-issuance requirements and a suite of sector-specific eligibility and guidance documents. Sector specific standards for solar, wind, low carbon buildings, geothermal and low carbon transport are already fully functioning. Standards for water, marine, hydropower, bioenergy and land use are currently awaiting board approval after undergoing public consultation.

When it comes to land use, bonds related to agriculture and forestry currently account for only 0.9% of outstanding climate-aligned bonds.³⁹ However there is substantial interest in financing forest, not only because of its relevance to climate change, but also sustainable development in underdeveloped nations. In regards to forest, bonds are regarded as uniquely appropriate instruments, given the large scale and long timeframes involved. A high-level stakeholder workshop noted in the subsequent report, *Unlocking Forest Bonds*, that: “The issuance of bonds directly addresses the concerns of time and scale, enabling issuers to raise large-scale finance now that will be repaid by existing and anticipated future income.”⁴⁰

Presently, most attention is paid to the protection of existing older forests, especially for capitalising REDD+ mechanisms—that is, Reducing Emissions from Deforestation and forest Degradation. In essence, private sector capital is provided to communities in order to finance the transition to sustainable development pathways, where revenue streams are created to conserve and sustainably manage existing forest, rather than removing the forest for unsustainable timber, energy, or land-clearing for agriculture. Some are designed as *payments for ecosystem services* (PES), whereby a framework of incentives is developed that finances and pays for the environmental value of existing forests.

There is a lesser focus on afforestation/reforestation (or A/R). Afforestation is defined as establishing forest on land that was non-forested for the preceding 50 years, whereas reforestation is establishing forest on land that was forested within 50 years. A/R are both recognised as potential sources of carbon units under the Kyoto Protocol, most relevantly Articles 3.3 and 3.4, which enable countries to generate credits through A/R and through Improved Forest Management (or IFM) which increases carbon stocks within existing forest. These rules look likely to remain a feature of future international climate frameworks; indeed, New Zealand relies on the existence of these rules to purchase carbon credits in future decades to offset national emissions. But there are no guarantees.

There is a tension, however, between New Zealand’s willingness to bind itself to emissions reductions targets under the Paris Agreement, yet its reluctance to produce domestic carbon sinks

³⁸ See the Paris Green Bonds Statement at the Climate Bonds Initiative website (last accessed 28/1/2016): <http://www.climatebonds.net/resources/press-releases/Paris-Green-Bonds-Statement>

³⁹ Climate Bonds Initiative, “Bonds and Climate Change: The State of the Market in 2016,” 4.

⁴⁰ M. Cranford et al., “Unlocking Forest Bonds: A High-Level Workshop on Innovative Finance for Tropical Forests,” Workshop Report (WWF Forest & Climate Initiative, Global Canopy Programme and Climate Bonds Initiative, 2011), 6.

that can offset national emissions. Why resign future generations to purchasing offsets at an unknown price when we could create our own domestic offsets by establishing permanent forest on marginal land? Surely it is cheaper and less risky to long-term national prosperity to create as many carbon sinks as possible with whatever land is available. The projected carbon prices used for official planning should provide fair warning: a recent MBIE report used 2030 carbon price projections of \$56–\$152 per tonne⁴¹ while the BusinessNZ Energy Council assumes a 2050 carbon price of \$60–\$115 by 2050 for its projections.⁴²

If New Zealand succeeds in establishing a Permanent Forest Bond, it would be world-pioneering. Potentially, it could attract international investors seeking credible green investments or proof of the viability of such instruments. Also, the Permanent Forest Bond could be not only scalable within New Zealand, but also internationally scalable, replicated in other countries with marginal land that is suitable for permanent forest. In particular, it could be deployed by those South American and South East Asian countries which have seen mass deforestation in recent decades, yet for economic, environmental and climate reasons want to embark on reforestation programmes.

⁴¹ These projections are derived from the International Energy Agency's *World Energy Outlook 2015*. The 2030 carbon price of \$152 per tonne assumes a global low-carbon transition, \$104 per tonne assumes domestic transition to renewable energy and EV uptake, and \$56 per tonne assumes Tiwai Point shutdown. See Ministry of Business, Innovation & Employment, "Electricity Demand and Generation Scenarios: Scenario and Results Summary" (Wellington, NZ: Ministry of Business, Innovation & Employment, August 2016), 6.

⁴² BusinessNZ Energy Council, Paul Scherrer Institute, PricewaterhouseCoopers NZ, & Sapere Research Group, 'New Zealand Energy Scenarios: Navigating Energy Futures to 2050' (Wellington, NZ: BusinessNZ Energy Council, 2015), 37.

Appendix 2: Comparison of Afforestation Schemes

	<i>Environmental Impact Bond (EIB)</i>	<i>Afforestation Grant Scheme (AGS)</i>	<i>Permanent Forest Sink Initiative (PFSI)</i>
<i>Upfront capital for planting</i>	Yes: upfront transfer of capital from investors to contractors (via intermediary) prior to planting.	No: payment only made after site inspection to ensure that forest meets Minimum Established Standard.	No: delayed revenue through selling carbon credits generated by forest growth.
<i>Principal distribution of risk</i>	Private investors bear principal risk of failed forest establishment as purchasers of targeted EIBs.	Landowners bear principal risk of failed forest establishment until AGS payment is made. Government bears principal risk after AGS payment is made.	Landowners bear substantial risk for failed forest establishment, not only from lost carbon revenue, but also for reimbursing carbon credits from forest loss.
<i>Flexibility of outcomes</i>	Highly flexible: outcomes are specified through the setting of impact targets through negotiation, either general or tailored to specific locality.	Moderately flexible: planting is constrained by Minimum Established Standard (750 stems per hectare, native or exotic, free of weed competition).	Moderately flexible: planting of natives or exotics is constrained by PFSI eligibility criteria (forest of >1ha, >30m wide, >30% tree crown cover, trees >5m high).
<i>Protection of forest</i>	Variable: the date of maturity and requirements for covenanting (or some other agreement) will be determined by negotiation.	10 years: landowners must maintain forest for ten years, after which there are no obligations.	50 year covenant: covenant limits exit for 50 years and only then on surrender of equivalent carbon credits. Also prohibits forest loss for 99 years (except for continuous cover forestry).
<i>Relationship between landowners and government</i>	Indirect: landowners deal with the EIB's intermediary and non-governmental contractors.	Direct: landowners make grant agreement with the Crown.	Direct: landowners enter into covenant with the Crown.

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