Case Study: Planting at Scale — China's National Forest Protection Programme and the Limits of Sovereign Nature-Based Finance

Relevant disciplines: in Public Enterprise Economics, Infrastructure Finance, or Environmental Economics

Level: Postgraduate

Time allotment: 90–120 minutes session

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1. Introduction

In 1998, catastrophic flooding along the Yangtze River killed 4,150 people and caused an estimated US$26 billion in economic losses. The disaster triggered a fundamental reappraisal of China's state forestry sector: decades of logging in natural forests had stripped watersheds of the vegetation that once moderated rainfall into river flows, turning a severe monsoon season into a national emergency. The government's response was the National Forest Protection Programme (NFPP) — a commercial logging ban across natural state-owned forests, paired with large-scale afforestation and reforestation, launched the same year.

The NFPP is now the single most-studied example of a nature-based solution (NbS) in the academic literature: twelve of the 37 studies in a recent systematic review of NbS adoption by public enterprises worldwide focus on China's forestry sector. That concentration makes it an unusually rich case for examining a question facing public enterprises everywhere: when a state actor deploys nature-based infrastructure at national scale, what trade-offs does it make between ecological ambition, financing sustainability, and social equity — and what can other public enterprises and policymakers learn from how those trade-offs played out?

This case places you inside that evidence base, asking you to evaluate the financing model behind the NFPP, diagnose the design choices that produced its mixed outcomes, and translate those lessons into a policy package for another public enterprise contemplating a nature-based solution of its own.

> "If immediate investments are made into nature-based solutions, the rate of species loss projected by 2100 could be reduced from 37 per cent to 25 per cent — a difference measured in the irreversible."
>
> *— Isbell et al. (2022), as synthesised in the systematic review*

1.1. Learning Objectives

Upon completion of this case study, you will be able to:

1. **Evaluate alternative financing instruments for nature-based infrastructure** against the specific market failures they are designed to correct, and assess their viability under different institutional and governance conditions.
2. **Diagnose the design flaws in a large-scale, state-directed NbS programme** and propose targeted policy instruments that would mitigate each without abandoning the programme's ecological objectives.
3. **Design an integrated policy package**, spanning legal, financial, and institutional dimensions, that draws on evidence from a sovereign-scale NbS programme to accelerate adoption by public enterprises elsewhere, while anticipating political economy resistance.

2. Background

2.1. What Are Nature-Based Solutions?

Nature-based solutions (NbS) are interventions that work with, rather than against, natural processes to deliver infrastructure services. They encompass reforestation and afforestation, constructed and restored wetlands, blue-green urban drainage, agroforestry systems, coastal mangrove restoration, and similar approaches. They differ from conventional ("grey") infrastructure in two respects that matter for how they are financed. First, many of their outputs — clean air, biodiversity, flood protection — are public goods or positive externalities not captured by market prices. Second, their benefit streams are long-dated, often materialising over decades rather than the 3–5-year payback horizons preferred by private capital. Together, these characteristics create a structural funding gap that private capital has little incentive to fill on its own — making public enterprise both a natural protagonist in NbS adoption, and, as this case explores, sometimes a financially constrained one.

Table 1. Taxonomy of Ecosystem Services Delivered by NbS

Service Category	Examples Documented in the Review
Regulating	Flood attenuation, drought mitigation, carbon sequestration, water purification, storm protection
Provisioning	Clean drinking water, timber (sustainable yield), food crops, bioenergy feedstock
Supporting	Nutrient cycling, soil formation, pollination, nitrogen fixation, hydrological regulation
Cultural	Recreation, tourism, landscape amenity, indigenous cultural heritage, human health benefits

A systematic review of 37 peer-reviewed studies (2004–2024) examining NbS adoption by public enterprises found that forest management interventions dominate the evidence base (46 per cent of studies), and that China represents the largest single-country concentration of research — driven substantially by the scale and academic interest in the NFPP.

3. Case: China's National Forest Protection Programme

3.1. Policy Context

The NFPP imposed a commercial logging ban across natural state-owned forests, paired with large-scale afforestation and reforestation, with the explicit aims of curbing deforestation and soil erosion to reduce flood risk. It represents one of the largest state-directed nature-based interventions ever undertaken — a scale of coordinated action available only to a government with centralised policy authority.

3.2. Outcomes and Unintended Consequences

The ecological results were substantial. China's forests contributed to approximately 25 per cent of global net forest growth between 2000 and 2017, and carbon storage in state-owned natural forests increased measurably. Economically, independent assessments found that the programme generated net present value benefits exceeding three times its fiscal cost, with fruit plantation systems delivering some of the highest per-hectare returns — evidence that commercial and non-commercial objectives can be combined within a single NbS programme.

However, the programme also generated significant unintended consequences:

Table 2. NFPP Outcomes

Dimension	Outcome
Forest coverage change (2000–2017)	~25% of global net forest growth attributable to China
Benefit-to-cost ratio (independent assessment)	>3:1 on a net present value basis
Species and biodiversity outcomes	Mixed: afforestation gains offset by monoculture biodiversity deficits
Equity impact	Low government subsidies and insufficient farmer compensation caused economic hardship and intermittent long-term engagement
Financing model	Almost entirely state budget; difficulty securing diversified finance
Monitoring standard	Below scientific recommendation; surveying gaps reduced credibility
Key design flaw	Rigid, one-size-fits-all logging ban; no regional differentiation

A rigid, nationally uniform logging ban caused the collapse of traditional timber enterprises and substantial worker displacement in state-forest communities. Afforestation targets incentivised the planting of monoculture species, which delivered inferior biodiversity outcomes and greater long-run climate vulnerability than mixed-native plantings. Low government compensation payments created persistent equity grievances among communities whose livelihoods depended on forest access.

3.3. The Financing Constraint

Beyond its ecological and equity trade-offs, the review identifies the NFPP's financing model as a structural weakness in its own right: the programme has relied almost entirely on general state budget allocations, with limited success in mobilising diversified or private sources of capital. The review's own policy recommendations — drawn from studying the programme — call for projects of this kind to diversify their financing sources, strengthen monitoring, and deepen collaboration with local government and regional stakeholders.

This is not a problem unique to China. Across the broader systematic review, four structural barriers consistently limit NbS financing:

- **Public goods problem:** many NbS outputs (flood protection, biodiversity, carbon sequestration) are non-excludable and non-rival, generating benefits that accrue broadly but cannot be monetised by the investing enterprise.
- **Long payback horizons:** natural forest conservation may require 20–50 years to yield measurable benefits, conflicting with the shorter time preferences of private capital.
- **Non-standard business models:** NbS do not conform to the discounted cash flow or IRR templates private capital markets use to evaluate infrastructure, limiting the pool of eligible investors.
- **Metric inadequacy:** without standardised, auditable metrics linking ecological inputs to financial outputs, it is difficult to price NbS risk or structure performance-linked instruments.

The review catalogues a menu of financing instruments piloted internationally to address these barriers:

Table 3. NbS financing instruments

Instrument	Mechanism	Key Precedent
Ecosystem Service Tariff (MRSE)	Ring-fenced user tariff dedicated to upstream watershed management; mandated by law	Peru (2014 Ecosystem Services Law)
Environmental Impact Bond (EIB)	Private investors fund NbS; repayment contingent on verified ecological outcomes	Washington D.C. (stormwater)
Forest Resilience Bond	Bond backed by projected avoided costs of wildfire suppression and watershed degradation	Blue Forest Conservation, California, USA
Payment for Ecosystem Services (PES)	Direct compensation to landowners/managers for delivering specified ecosystem services	RUPES Programme, Indonesia; Kenya Shamba System
Green Bond (NbS-tagged)	Standard bond with use-of-proceeds restricted to eligible NbS projects	Multiple sovereign and utility issuers globally
Blended Finance Facility	Concessional public capital absorbs first-loss risk, crowding in private capital at below-market risk levels	World Bank / GEF NbS facilities

4. The Case Task

4.1. Discussion Questions

1. **Innovative Financing Structures.** The NFPP has relied almost entirely on state budget allocations, and the systematic review specifically identifies "difficulty in securing finance" as one of the programme's structural weaknesses. Evaluate two financing instruments from the exhibit above that China's forestry administration could deploy to diversify its funding base. For each instrument: (a) identify the market failure it is designed to correct; (b) assess the conditions under which it would be viable given China's centralised governance model and state land ownership structure; and (c) identify the key risk to the programme if the instrument's assumptions do not hold.

2. **Lessons from China's NFPP.** The NFPP achieved a benefit-to-cost ratio exceeding 3:1, yet also generated significant equity and biodiversity failures. Identify three specific design flaws in the NFPP and, for each, propose a policy instrument that would have mitigated the failure without abandoning the programme's ecological objectives.

3. **Policy Design: From Evidence to Action.** You are advising a minister of finance in a middle-income country who wishes to accelerate NbS adoption by public utilities and municipal corporations. Drawing on the NFPP case and the broader systematic review evidence, design a policy package that: (a) creates the enabling legal and regulatory framework; (b) mobilises both public and private finance; and (c) addresses institutional inertia within existing public enterprises. Identify the two most significant political economy constraints your package would face and explain how you would address them.

4.2. Submission Requirements

Questions 1 and 2 will be discussed in class. Question 3 shall be answered in the report. Students are expected to refine and deepen their analysis using points raised during the in-class discussion and synthesis

- **Format:** Individual or group report (instructor's choice, depending on class size and format).
- **Length:** 1,200–1,500 words (excluding references).

4.3. Supplementary Exhibit: Key Concepts and Definitions

Table 4. Glossary of Core Terms

Term	Definition
Nature-Based Solutions (NbS)	Interventions that protect, sustainably manage, or restore natural or modified ecosystems to address societal challenges while simultaneously providing human well-being and biodiversity benefits.
Ecosystem Services	Benefits that people obtain from ecosystems, classified as provisioning (e.g. clean water), regulating (e.g. flood control), cultural (e.g. recreation), and supporting (e.g. nutrient cycling).
Grey Infrastructure	Conventional engineered infrastructure (pipelines, reservoirs, concrete channels) designed to deliver a single service, typically without co-benefits.
Environmental Impact Bond (EIB)	An outcome-based finance instrument in which investor returns are contingent on verified environmental performance metrics.
MRSE Tariff	Mecanismo de Retribución por Servicios Ecosistémicos: a Peruvian ring-fenced water tariff surcharge dedicated to upstream ecosystem conservation.
Payment for Ecosystem Services (PES)	A market-based instrument in which beneficiaries of ecosystem services compensate providers (landowners, communities) for managing land in ways that sustain those services.
Path Dependency	The tendency of organisations to continue along an established trajectory of practice due to sunk costs, institutional norms, and cognitive inertia, even when superior alternatives exist.
Blended Finance	The strategic use of concessional public or philanthropic finance to mobilise additional private investment into projects with positive development or environmental outcomes.

4.4. Selected References

The following sources inform the case.

- Isbell, F. et al. (2022). Expert perspectives on global biodiversity loss and its drivers. Science.
- Jin, Y. & Jiang, Z. (2023). Scientization versus parametrization in Chinese state forest conservation. Forest Policy and Economics.
- OECD (2024). State-Owned Enterprises in the Global Economy. OECD Publishing.
- Seddon, N. et al. (2020). Understanding the value and limits of nature-based solutions to climate change. Philosophical Transactions of the Royal Society B.

5. Instructor's Guide & Debriefing Points

5.1. Purpose and Background:

This case is designed for a postgraduate course in Public Enterprise Economics, Infrastructure Finance, or Environmental Economics. It draws on a systematic review of 37 peer-reviewed studies examining nature-based solutions adopted by state-owned enterprises and municipal corporations worldwide, with particular focus on China's National Forest Protection Programme. Students are expected to have prior exposure to discounted cash flow analysis, public goods theory, and principal–agent problems.

5.2. Structuring the Session

- **Format:** Two in-class discussion rounds (Questions 1 and 2 only), each moving from small-group discussion to full-class report-back to instructor synthesis. Question 3 (Policy Design) is addressed afterward, in the written report, building on the in-class discussion.

- **Opening (15 minutes):** Introduce the case in depth: the 1998 Yangtze flooding and its human and economic toll, the NFPP's logging ban and afforestation response, and its headline outcomes — a benefit-to-cost ratio exceeding 3:1 alongside significant equity, biodiversity, and financing shortcomings. This is a good point to walk through the four structural financing barriers (public goods, long payback horizons, non-standard business models, metric inadequacy) and the financing instruments exhibit, since both rounds draw directly on this material.

- **Round 1, Financing (35 minutes):**

    - **Small groups (20 min):** Groups of 3–4 discuss Question 1, selecting one or two financing instruments from the exhibit and working through all three sub-parts (market failure addressed, viability given China's governance and land-ownership model, key risk if assumptions fail)

    - **Report-back (10 min):** 2–3 groups share their instrument choice(s) and reasoning.

    - **Synthesis (5 min):** Instructor connects the groups' choices back to the structural financing barriers, drawing out why some instruments transplant well to China's centralised, state-land-ownership context and others don't.

- **Round 2, Design Flaws (35 minutes):**

    - **Small groups (20 min):** Groups identify one or two design flaws in the NFPP and work through a mitigating policy instrument for each in depth.

    - **Report-back (10 min):** Groups share their flaw/fix pairing(s); the educator tracks flaws under rough categories (equity, biodiversity, monitoring, financing).

- **Synthesis (5 min):** Instructor to highlight the patterns between the flaws, setting up the framing students will carry into the policy design question in their written report.

- **Closing (10 minutes):** Brief wrap-up of what the NFPP demonstrates about the possibilities and limits of state-directed NbS at scale, and why "what worked for China" doesn't automatically transfer to a different institutional context. Introduces Question 3 as the bridge into the written report: students are asked to take the financing and design lessons surfaced in class and turn them into a policy package for a different country context.

5.3. Debriefing Points

To encourage critical thinking and reflection, the educator may wish to raise the following points:

- **If groups gravitate toward Green Bonds or Blended Finance (the "easy" answers),** push them on why China hasn't already done this at scale. State-owned enterprises and sovereign issuers already have strong bond market access — so why has NFPP financing remained almost entirely budget-based? Worth surfacing: this may be less about instrument availability and more about *metric inadequacy* (no standardised way to link ecological outcomes to a bond's use-of-proceeds reporting) and the *long payback horizon* problem (20–50 years doesn't fit typical green bond tenors).

- **If groups pick PES or Ecosystem Service Tariffs,** ask whether these are politically feasible in China's institutional context. PES and MRSE both depend on either (a) willing landowners entering compensation agreements, or (b) a legal basis for ring-fenced tariffs — both of which sit awkwardly with a top-down logging ban imposed on state-owned land. This is a good moment to contrast with Peru's MRSE, which worked *because* it was purpose-built through new legislation, not retrofitted onto an existing mandate.

- **Steer away from flaws that only have one obvious fix.** "Low compensation caused hardship → pay farmers more" is true but shallow. Push for why compensation was low — was it a fiscal constraint, a design choice, or a monitoring failure (i.e., no reliable way to verify who was owed what)? The richer discussion is in the mechanism, not just the symptom.

- **A tension to leave unresolved (good for provoking debate):** Some of the "flaws" may be the price of achieving scale and speed at a moment of national crisis. A more differentiated, consultative programme might have avoided the equity and biodiversity failures — but possibly at the cost of the rapid, coordinated rollout that produced the 25%-of-global-forest-growth outcome. Ask groups directly: was that trade-off worth it, and would they make the same call under similar time pressure?

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