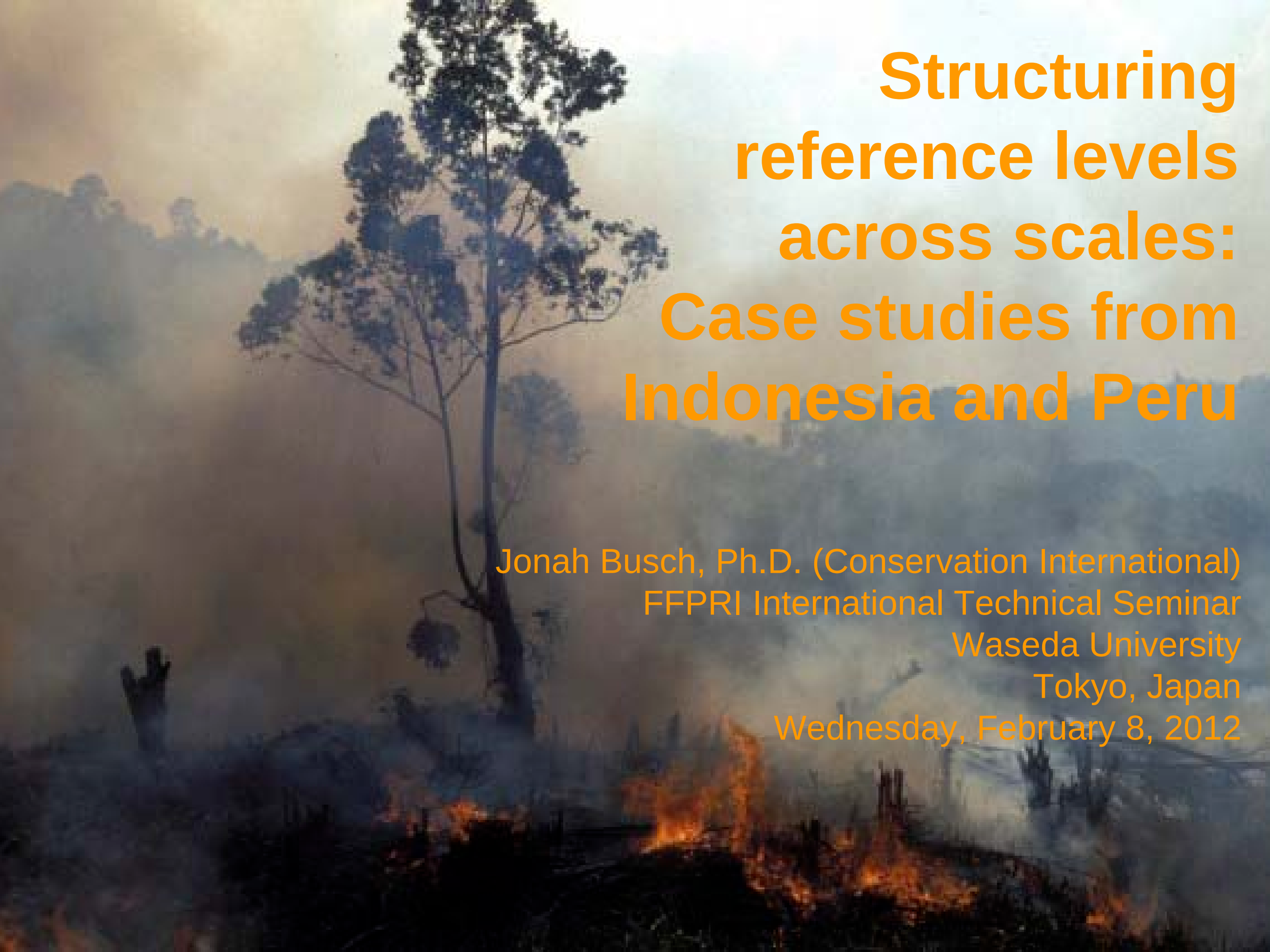


A photograph of a forest fire. In the foreground, a large, dark tree stands on the left side. The ground is covered in flames and smoke. In the background, more trees are visible, and a thick layer of white smoke or mist fills the air. The sky is a pale, hazy blue.

Structuring reference levels across scales: Case studies from Indonesia and Peru

Jonah Busch, Ph.D. (Conservation International)
FFPRI International Technical Seminar
Waseda University
Tokyo, Japan
Wednesday, February 8, 2012

Fundamental challenge of national strategy for REDD+:

Under UNFCCC rules for REDD+, net emissions reductions from forests will ultimately be accounted for at the national scale

However, many decisions that lead to deforestation are made by actors at the regional, local, or household (“sub-national”) scale

How can a country structure economic incentives for REDD+ so that actors across scales are encouraged to reduce emissions, and discouraged from increasing emissions?

National Economic Incentive Structure for REDD+: WHO is paid HOW MUCH for doing WHAT?

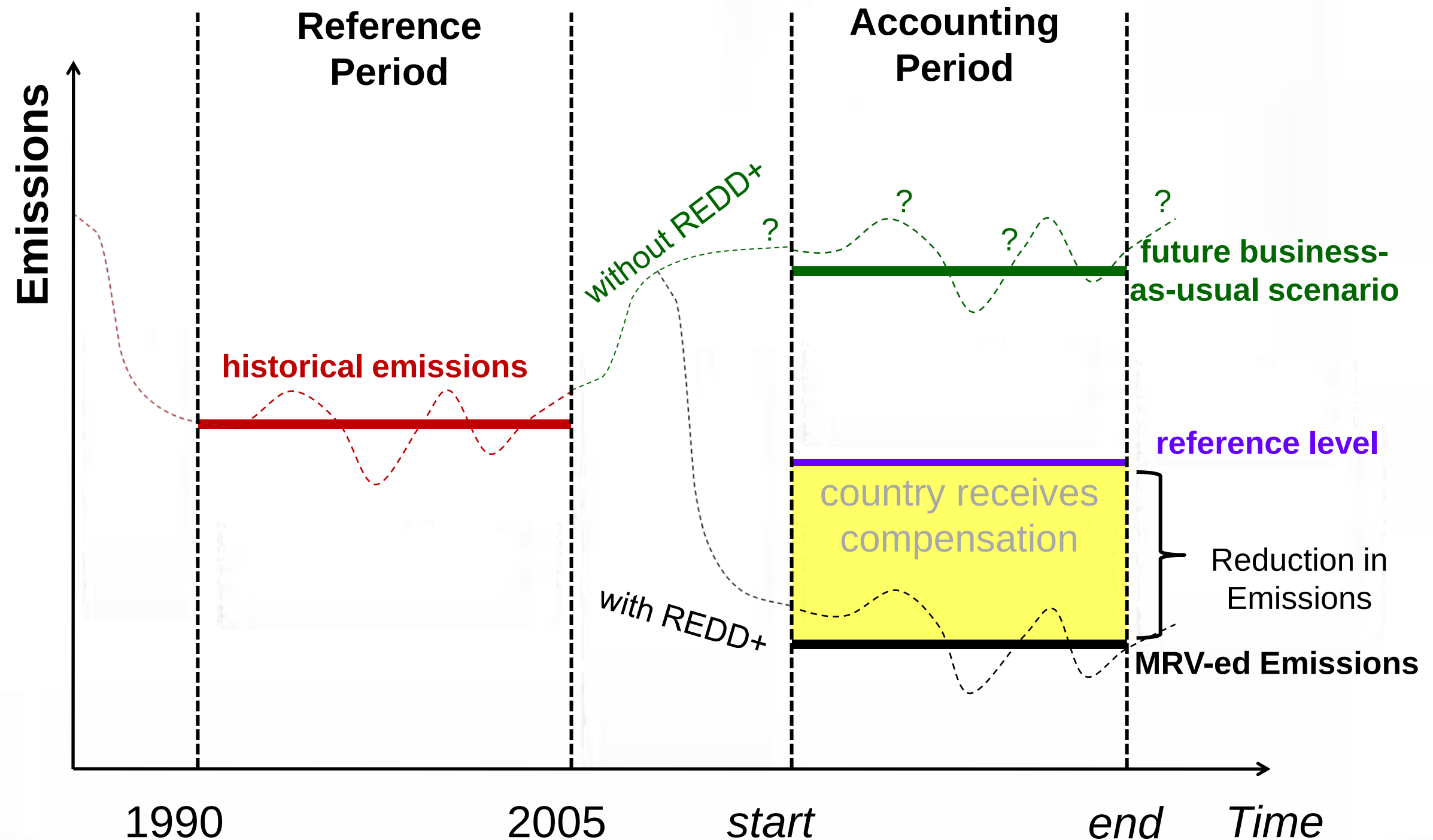
ACCOUNTING SCALE: the administrative level at which net emission reductions are calculated and payments are made

SUB-NATIONAL REFERENCE LEVELS: the level of emissions below which regions could be paid for reductions

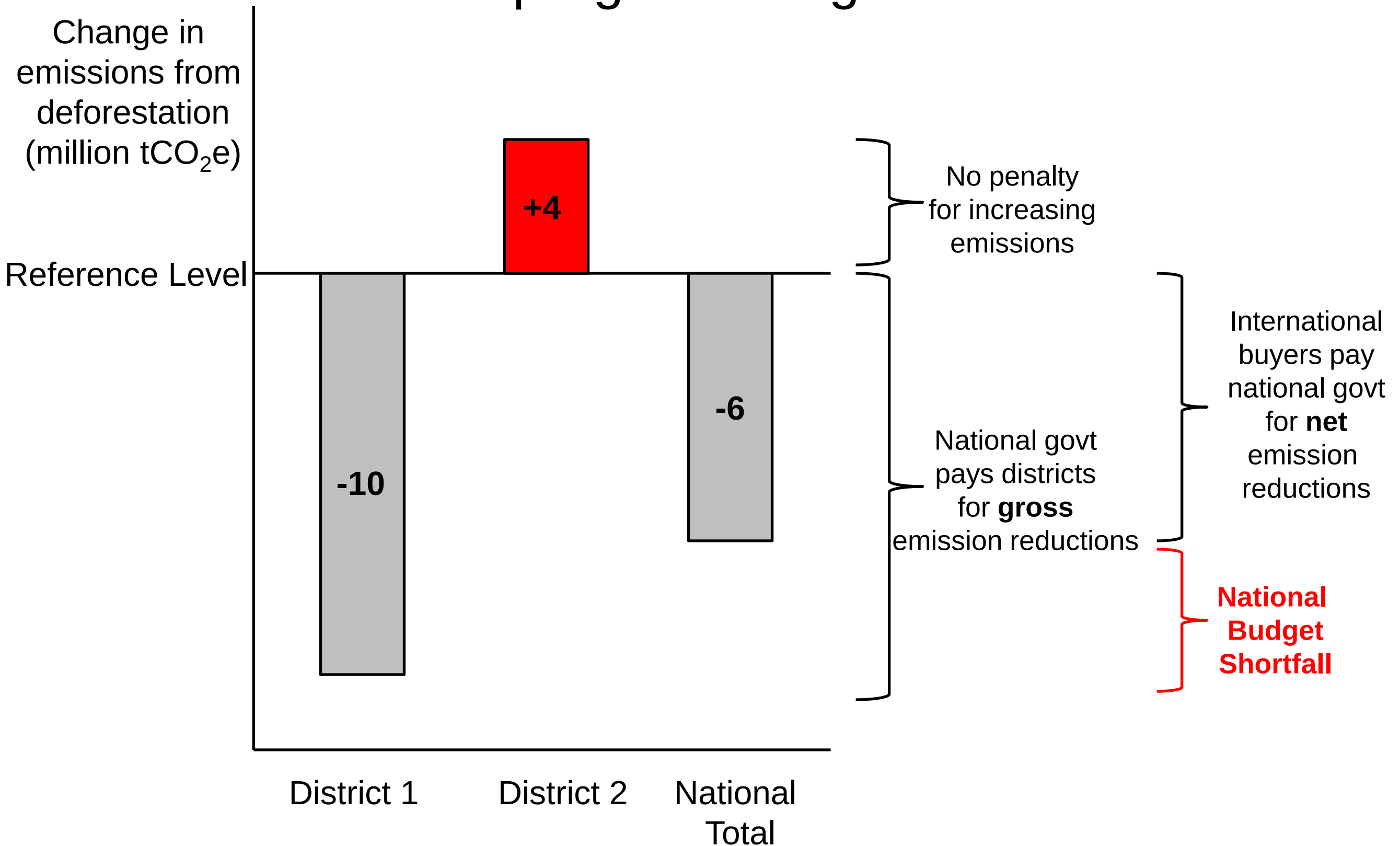
REVENUE SHARING: the portion of international income from carbon payments that would accrue to regions that reduce emissions, and the portion that would remain with the national government

RESPONSIBILITY SHARING: the extent to which actors would be penalized for increasing emissions, and the extent to which the national government would bear the cost of these increases through reduced international payments

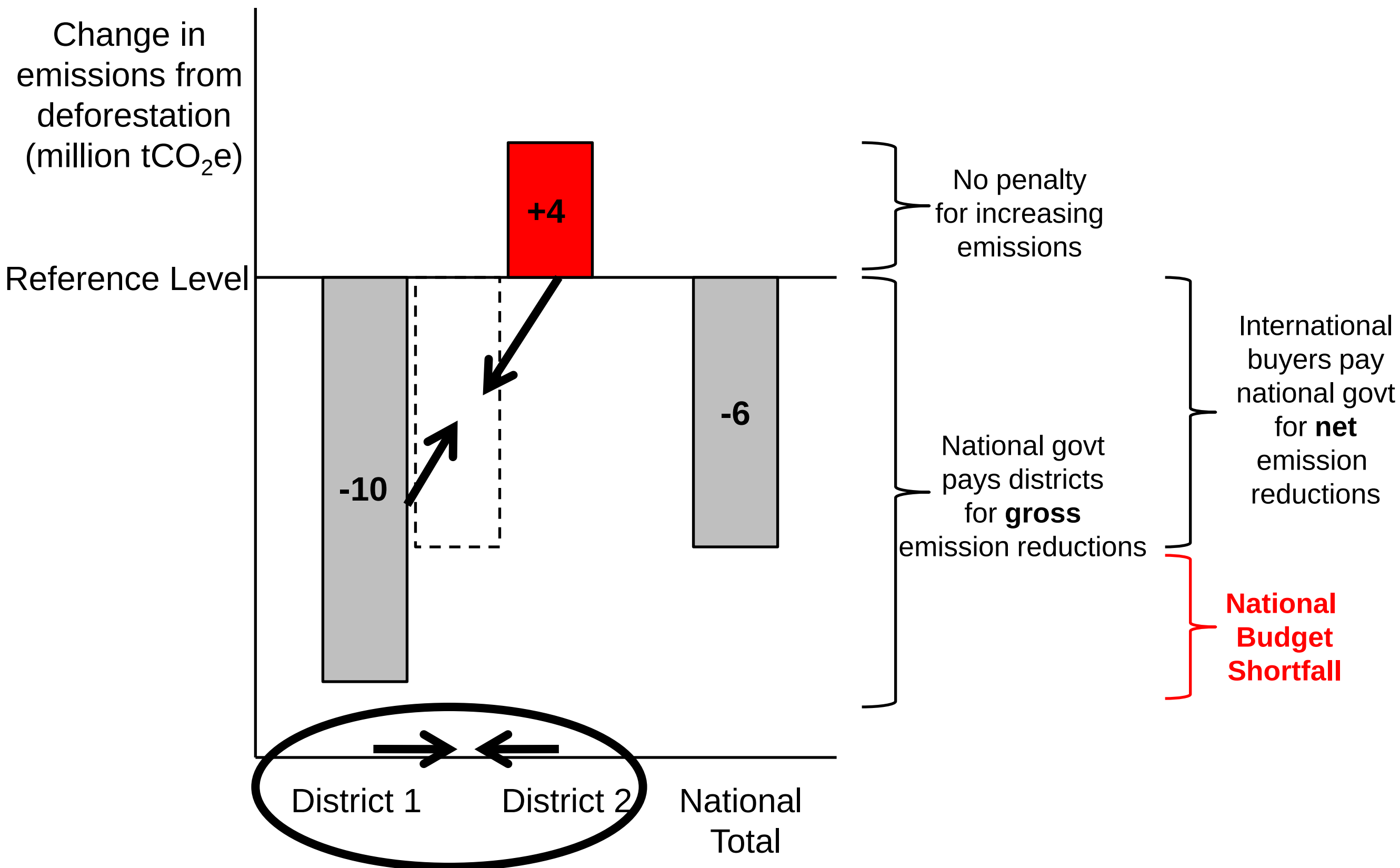
Reference levels are the benchmark for payment:
 $\text{Payment} = (\text{reference level} - \text{emissions}) * \text{carbon price}$



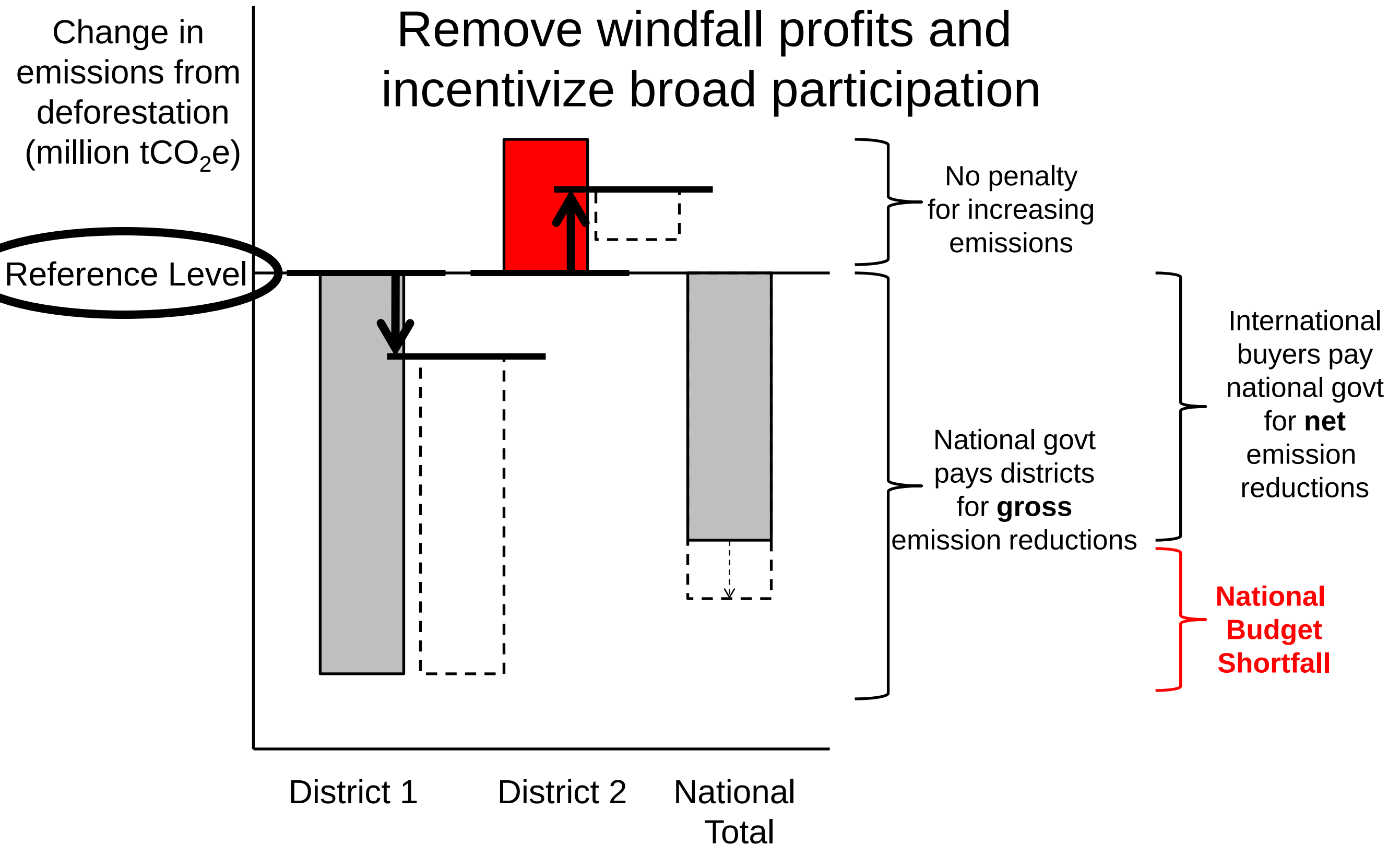
Poorly structured incentives can lead to REDD+ program budget shortfall



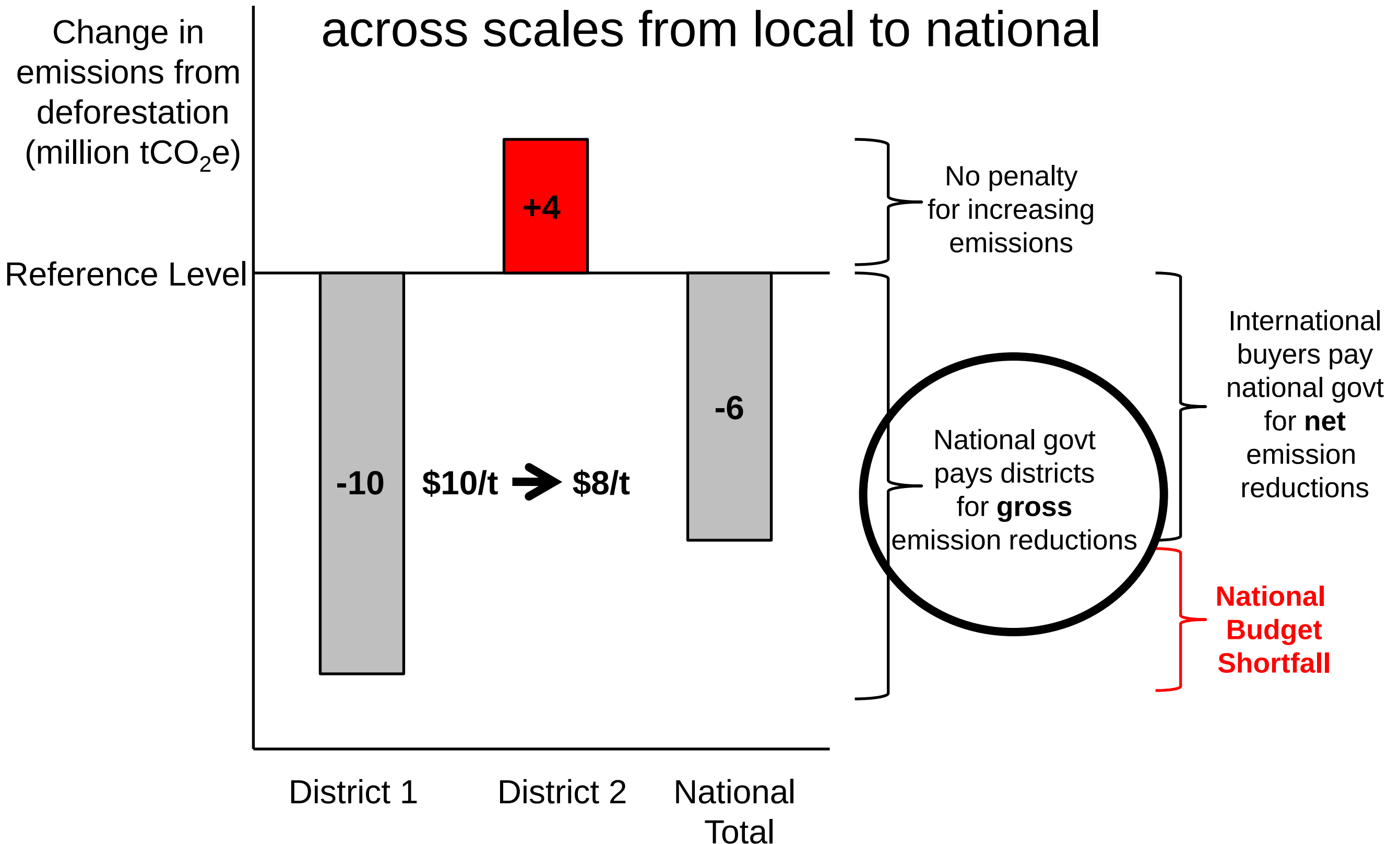
Incentive policy #1: Raise ACCOUNTING SCALE to reward aggregate performance



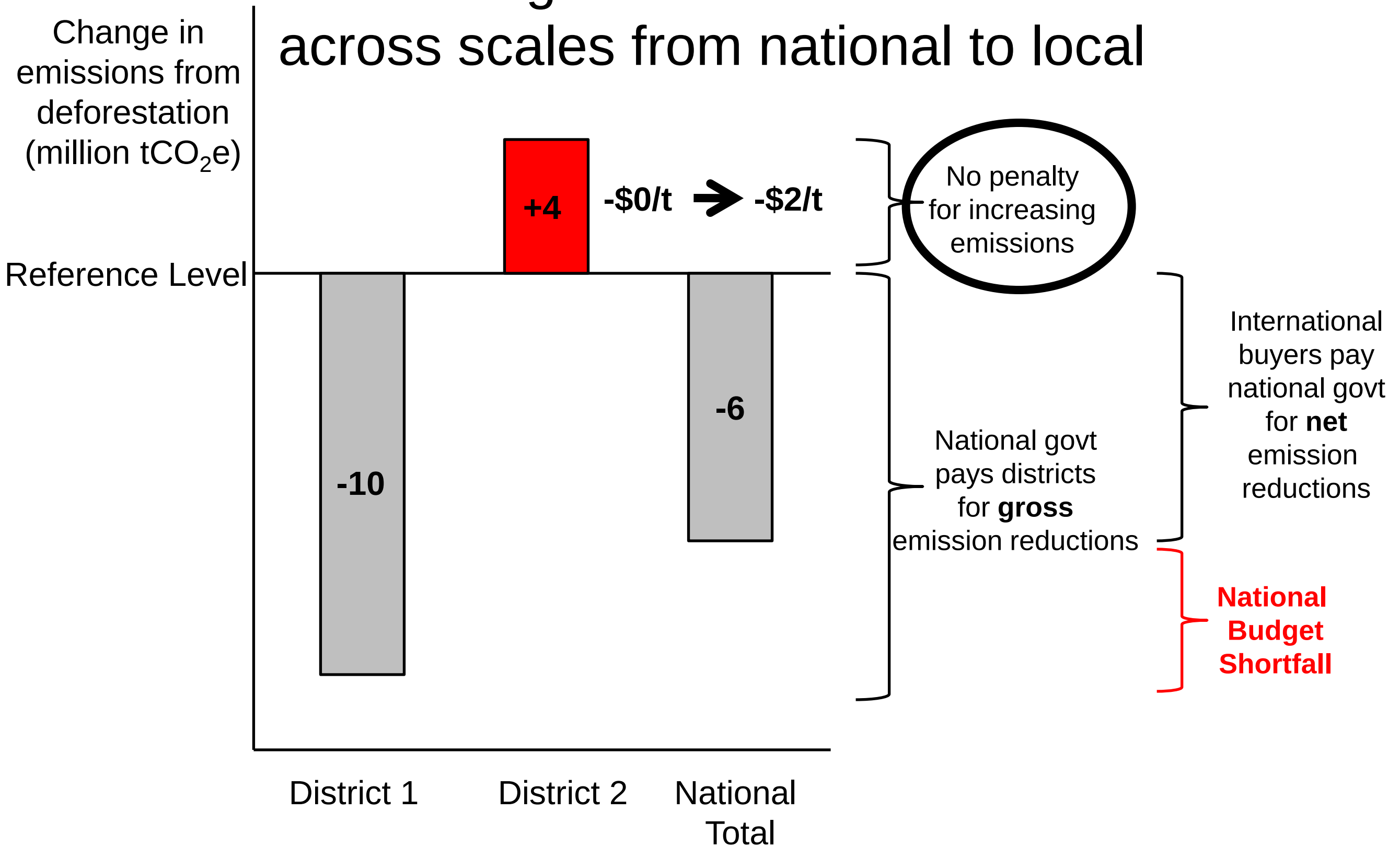
Incentive policy #2: Set SUBNATIONAL REFERENCE LEVELS to accurately approximate future business-as-usual emissions:



Incentive policy #3: SHARE REVENUE resulting from local emission reductions across scales from local to national



Incentive policy #4: SHARE RESPONSIBILITY for costs resulting from local emission increases across scales from national to local



Comparing alternative economic incentive structures for REDD+ using OSIRIS-Indonesia

Click-of-a-button decision support tool to estimate and map the impacts of alternative REDD+ policy decisions on:

- deforestation (ha/yr)
- emission reductions (tCO₂e/yr)
- national and local revenue (\$/yr)

Benefits:

- free
- MS Excel interface
- transparent
- open-source
- peer-reviewed, published, scientific
- online: <http://www.conservation.org/osiris>

Structuring economic incentives to reduce emissions from deforestation within Indonesia

Jonah Busch^{a,1}, Ruben N. Lubowski^b, Fabiano Godoy^a, Marc Steininger^a, Arief A. Yusuf^c, Kemen Austin^d, Jenny Hewson^a, Daniel Juhn^a, Muhammad Farid^e, and Frederick Boltz^f

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Edited by Stephen Polasky, University of Minnesota, St. Paul, MN, and approved December 13, 2011 (received for review June 7, 2011)

We estimate and map the impacts that alternative national and subnational economic incentive structures for reducing emissions from deforestation (REDD+) in Indonesia would have had on greenhouse gas emissions and national and local revenue if they had been in place from 2000 to 2005. The impact of carbon payments on deforestation is calibrated econometrically from the pattern of observed deforestation and spatial variation in the benefits and costs of converting land to agriculture over that time period. We estimate that at an international carbon price of \$10/tCO₂e, a "mandatory incentive structure," such as a cap-and-trade or symmetric tax-and-subsidy program, would have reduced emissions by 163–247 MtCO₂e/y (20–31% below the without-REDD+ reference scenario), while generating a programmatic budget surplus. In contrast, a "basic voluntary incentive structure" modeled after a standard payment-for-environmental-services program would have reduced emissions nationally by only 45–76 MtCO₂e/y (6–9%), while generating a programmatic budget shortfall. By making four policy improvements—paying for net emission reductions at the scale of an entire district rather than site-by-site; paying for reductions relative to reference levels that match business-as-usual levels; sharing a portion of district-level revenues with the national government; and sharing a portion of the national government's responsibility for costs with districts—an "improved voluntary incentive structure" would have been nearly as effective as a mandatory incentive structure, reducing emissions by 136–207 MtCO₂e/y (17–26%) and generating a programmatic budget surplus.

climate change | climate policy | land-use change | reducing emissions from deforestation and forest degradation

An emerging international climate policy mechanism called REDD+ would offer payments to developing countries that voluntarily reduce greenhouse gas emissions from deforestation below internationally agreed reference levels (1). Individual forested countries would decide upon the specific set of policies and measures to implement to achieve nationwide emission reductions. Accounting for these net emission reductions would ultimately take place at the national level, making national governments responsible for any internal geographical shifts of emissions (leakage), and providing incentives for systemic policy actions. However, although governments would receive payments under REDD+, it is actors at the regional, provincial, local, or household (subnational) scales who are directly responsible for many land-use change decisions. Thus, the effectiveness of REDD+ in reducing emissions and generating revenue will depend upon how national governments structure economic incentives so that subnational actors will be encouraged to reduce emissions and discouraged from increasing emissions.

Emission-reduction policy in the energy and industrial sectors of developed countries has commonly been approached through mandatory, market-based incentive structures, such as cap-and-trade or tax-and-subsidy programs. Such "mandatory" structures can be considered economically ideal in that all regulated actors at any emission level have an economic incentive to reduce an

additional unit of emissions. However, in the land-use sectors of developing countries with decentralized land-use decision rights, national governments may instead prefer to structure incentives for emission reduction in such a way that subnational actors might voluntarily choose to maintain forests rather than convert land to agriculture or other uses. A voluntary incentive structure for REDD+ would be characterized by four policy decisions. (i) An "accounting scale" would determine the administrative level at which net emission reductions are calculated and payments made, thereby determining the de facto local decision makers for REDD+. (ii) A subnational "reference level" would be the level of emissions below which an actor could be rewarded for reductions. (iii) A "revenue sharing" arrangement would determine the portion of international income from carbon payments that would accrue to actors that reduce emissions, and the portion that would remain with the national government. (iv) A "responsibility-sharing" arrangement would determine the extent to which actors would be penalized for increasing emissions, and the extent to which the national government would bear the cost of these increases through reduced international payments.

A voluntary incentive structure for REDD+ would face design challenges that a mandatory incentive structure would not. In a voluntary system, the assignment of reference levels not only affects equity in the distribution of payments, as is the case with the distribution of allowances in a cap-and-trade system, but also affects the system's effectiveness in reducing emissions (2). Discrepancies between reference levels and counterfactual business-as-usual emission rates (3) can aggravate an adverse selection problem caused by information asymmetry between private actors and regulators in a voluntary system (4). Actors with reference levels above their business-as-usual emission rates could claim windfall payments beyond their actual emission reductions. Meanwhile, actors with reference levels below their business-as-usual rates could have insufficient incentive to participate in reducing emissions, and could even increase emissions above what they would have been in the absence of the REDD+ incentive system. As a result, a country's choice of economic incentive structure for REDD+ will critically impact the level of greenhouse gas emission reductions it can achieve, the cost-effectiveness of these reductions, and the distribution of costs and benefits within the country.

This article presents a spatially explicit land-use change model for Indonesia that allows us to estimate and map the expected

Author contributions: J.B., R.N.L., and M.S. designed research; J.B., R.N.L., and F.G. performed research; J.B., R.N.L., F.G., M.S., A.A.Y., K.A., J.H., D.J., M.F., and F.B. analyzed data; and J.B. and R.N.L. wrote the paper.

The authors declare no conflict of interest.

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Freely available online through the PNAS open access option.

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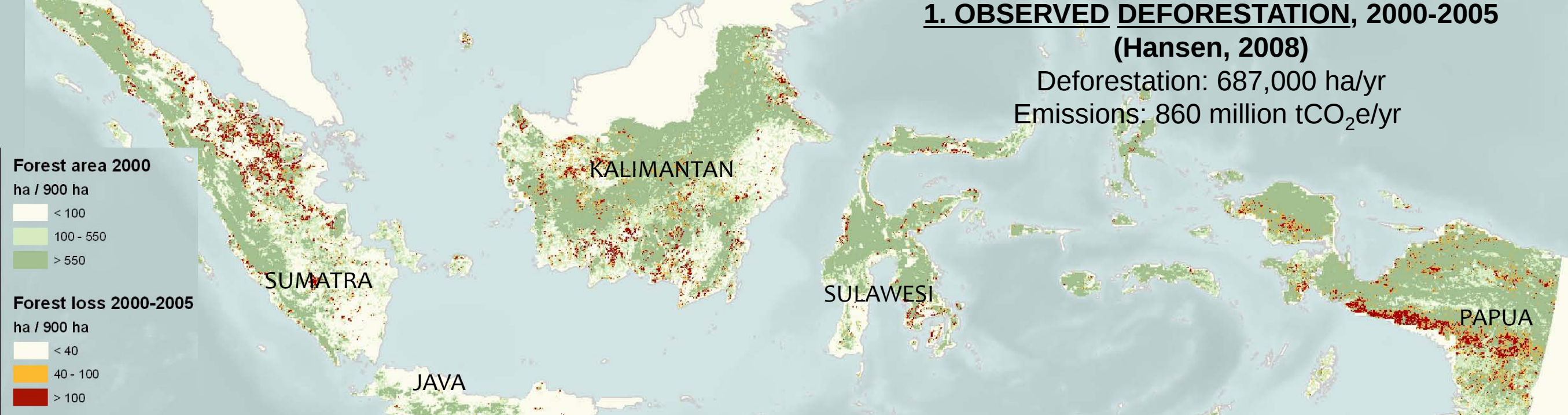
This article contains supporting information online at www.pnas.org/lookup/suppl/doi:10.1073/pnas.1109034109/-DCSupplemental.

www.pnas.org/cgi/doi/10.1073/pnas.1109034109

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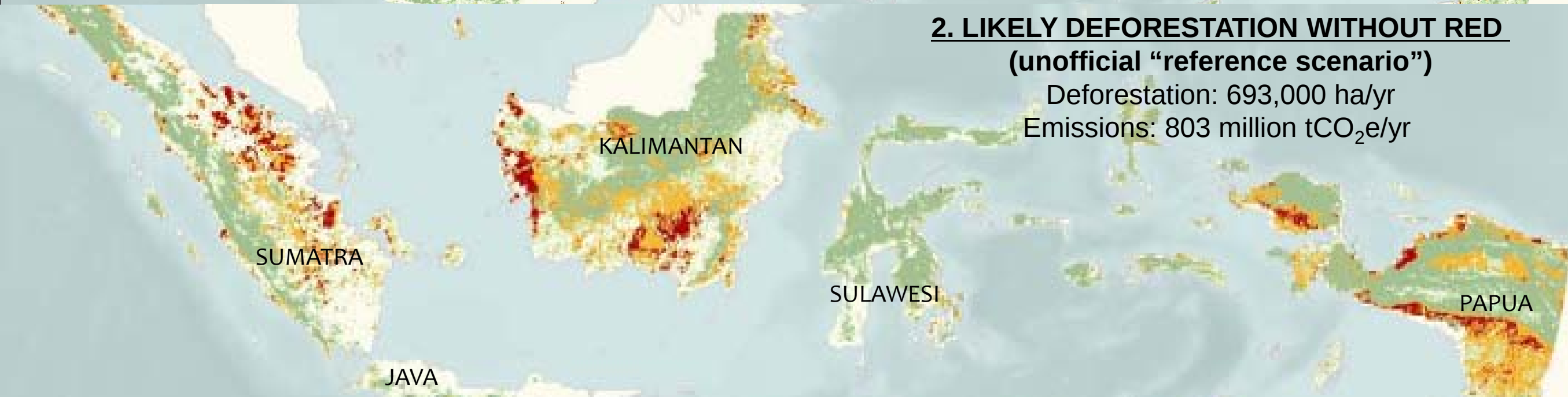
1. OBSERVED DEFORESTATION, 2000-2005 (Hansen, 2008)

Deforestation: 687,000 ha/yr
Emissions: 860 million tCO₂e/yr



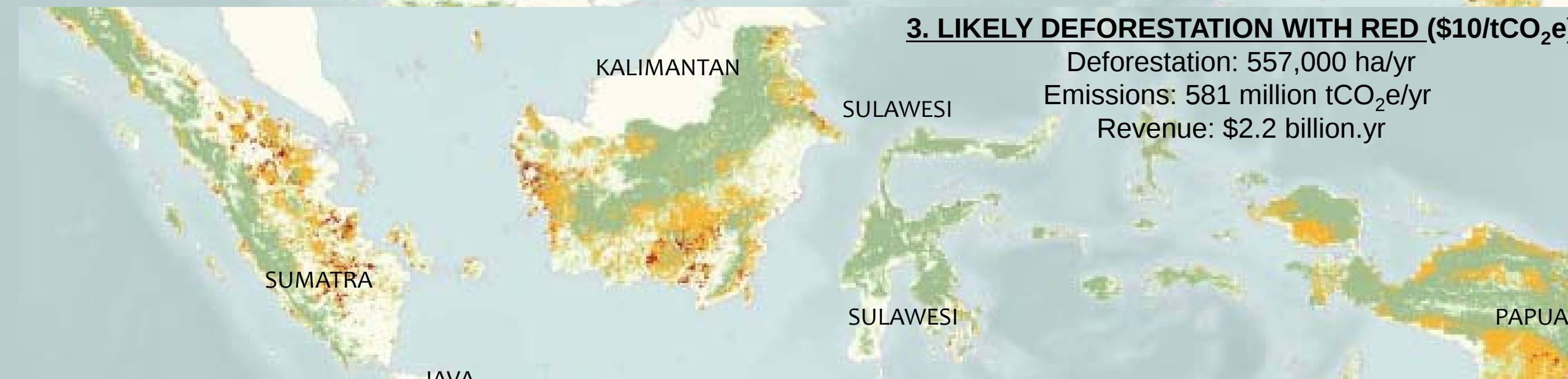
2. LIKELY DEFORESTATION WITHOUT RED (unofficial “reference scenario”)

Deforestation: 693,000 ha/yr
Emissions: 803 million tCO₂e/yr



3. LIKELY DEFORESTATION WITH RED (\$10/tCO₂e)

Deforestation: 557,000 ha/yr
Emissions: 581 million tCO₂e/yr
Revenue: \$2.2 billion.yr



Well-structured voluntary REDD+ nearly as effective as cap-and-trade

(1) Basic PES-style voluntary incentives

Site-scale accounting;
historical reference levels

(2) District-scale accounting;
historical reference levels

(3) District-scale accounting;
projected reference levels

(4) District-scale accounting;
projected reference levels
+20% revenue sharing

(5) Well-structured voluntary incentives

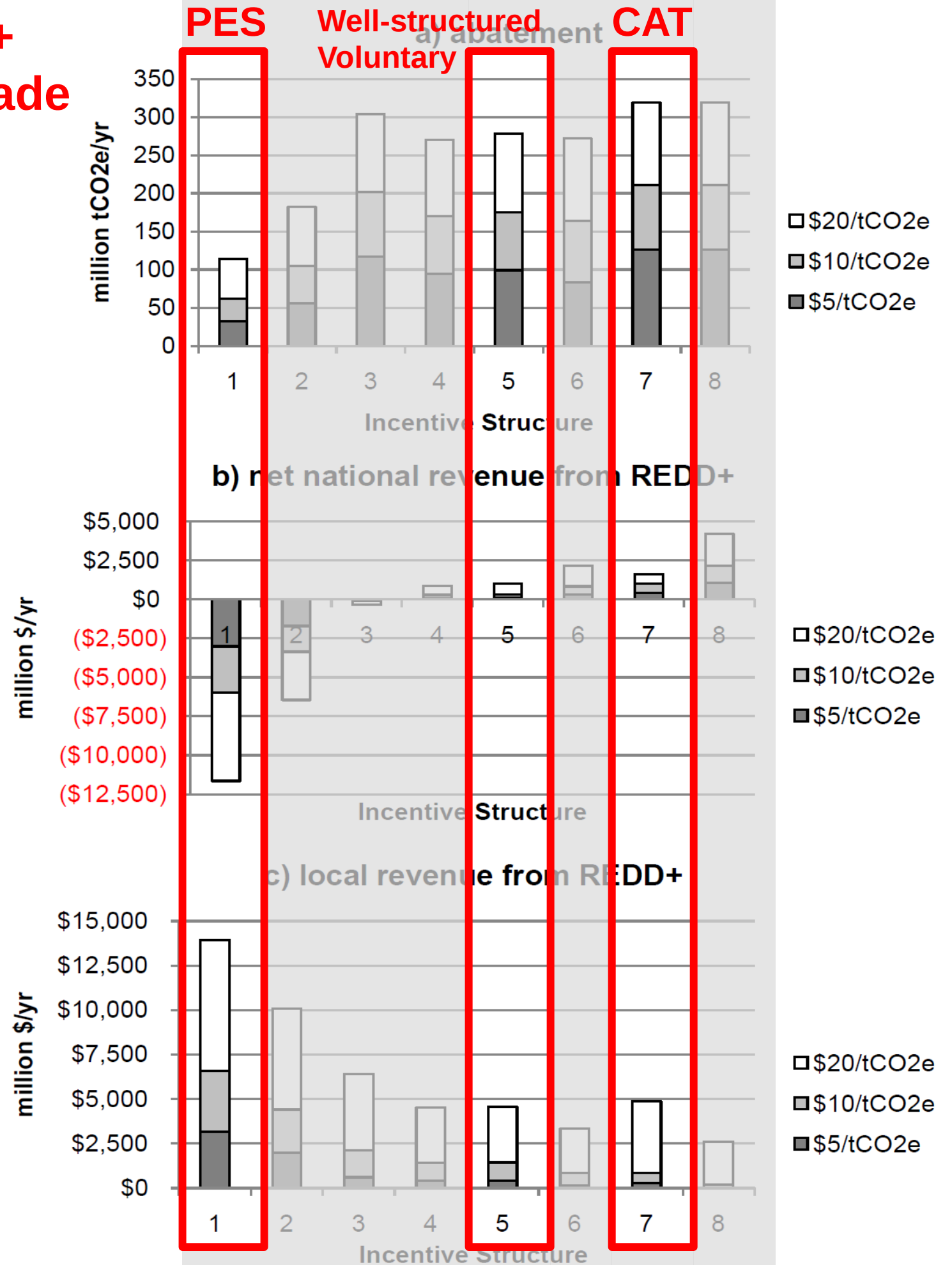
District-scale accounting;
projected reference levels
+20% revenue sharing
+20% responsibility sharing

(6) District-scale accounting
projected reference levels minus 10%
+20% revenue sharing
+20% responsibility sharing

(7) Mandatory incentives, e.g. Cap & Trade

District-scale accounting;
projected reference levels minus 10%
0% revenue sharing
100% responsibility sharing

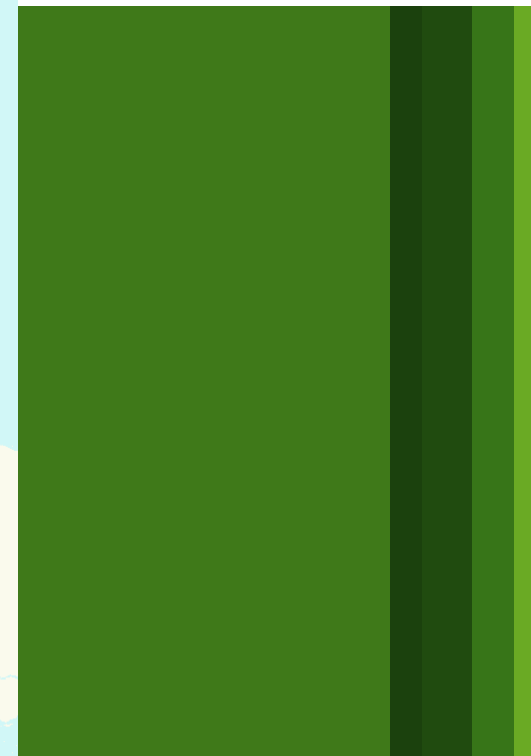
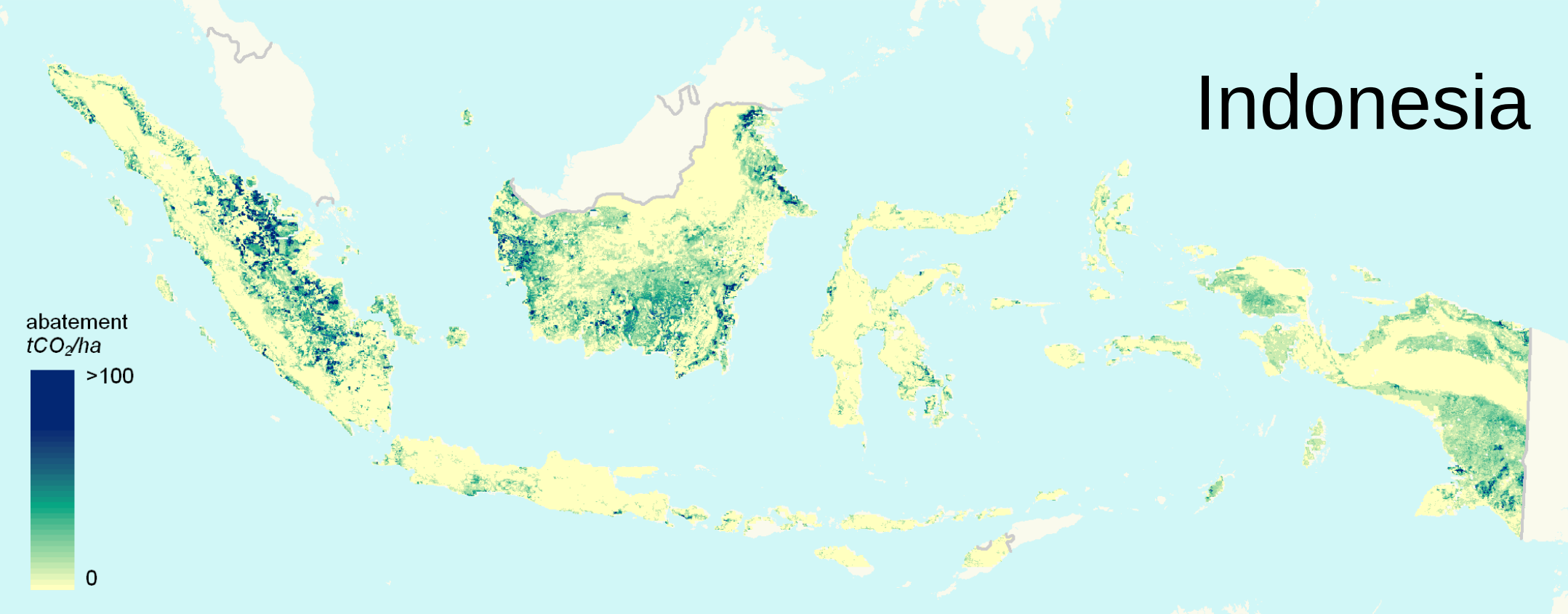
(8) District-scale accounting;
projected reference levels minus 26%
0% revenue sharing
100% responsibility sharing



Key messages

- International REDD+ payments would be earned based on net emission reductions at the national level. But since many land use decisions are made locally, a structure of economic incentives for REDD+ is needed
- Cap-and-trade for REDD+ at \$10/tCO₂e would provide greatest emission reductions (**211 MtCO₂e/yr**) and budget surplus (**\$1 billion/yr**), and effectiveness would not rely on accurately predicting future deforestation
- Basic PES-style voluntary sub-national incentives for REDD+ (**62 MtCO₂e/yr**) can leave the national government with a severe budget shortfall (**-\$6.2 billion/yr**), due to error in setting reference levels
- Well-structured voluntary incentives can be nearly as effective (**175 MtCO₂e/yr**) as mandatory incentives, while producing a budget surplus (**\$331 million/yr**), by:
 - **Aggregating accounting** to higher jurisdictional scale (e.g. province or department)
 - **Projecting reference levels** to approximate future business-as-usual emissions
 - **Sharing revenues** that accrue from emission reductions with national government
 - **Sharing responsibility** for costs that accrue from emission increases with local actors

Indonesia

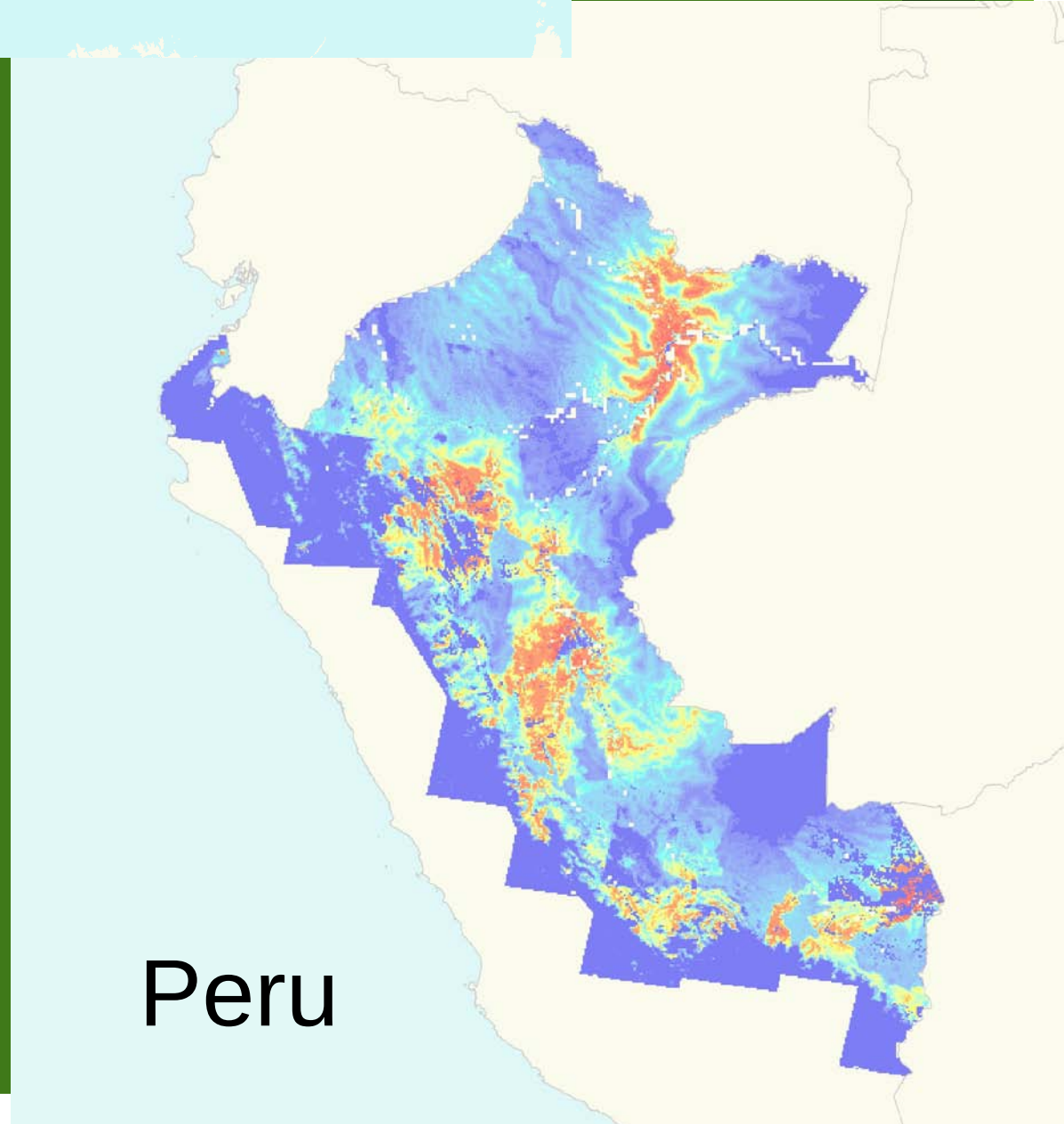


Spatially prioritizing REDD+ pilots:
Mapping expected distribution of
abatement under REDD+ at \$10/tCO₂e

OSIRIS tools available for:

- Indonesia
- Peru
- Madagascar
- Bolivia
- Mexico*

Peru



Case study from Peru

- Patchwork of REDD+ projects aiming to sell credits on voluntary markets (VCS with CCBS)
- Some projects have overlapping leakage-accounting boundaries under VCS methodologies
- Different regions moving ahead on REDD+ at different speeds, led by San Martin and Madre Dios (REDD+ Social and Environmental Standards)
- Need for nesting— harmonization of reference levels across scales, based on projections of future deforestation and bottom-up approach
(see Peru R-PP, March 2011)



Case study from Peru

Phase 1

- patchwork of individual projects, each with own projected reference level

Phase 2

- regions develop projected reference levels when they are capable
- within regions, existing projects can maintain validated reference levels for an interim time period

Phase 3

- within regions, projects' reference levels have been reconciled with regional reference levels
- national reference level is constructed by bottom-up summation of regional reference levels





Thank you!

ありがとうございました

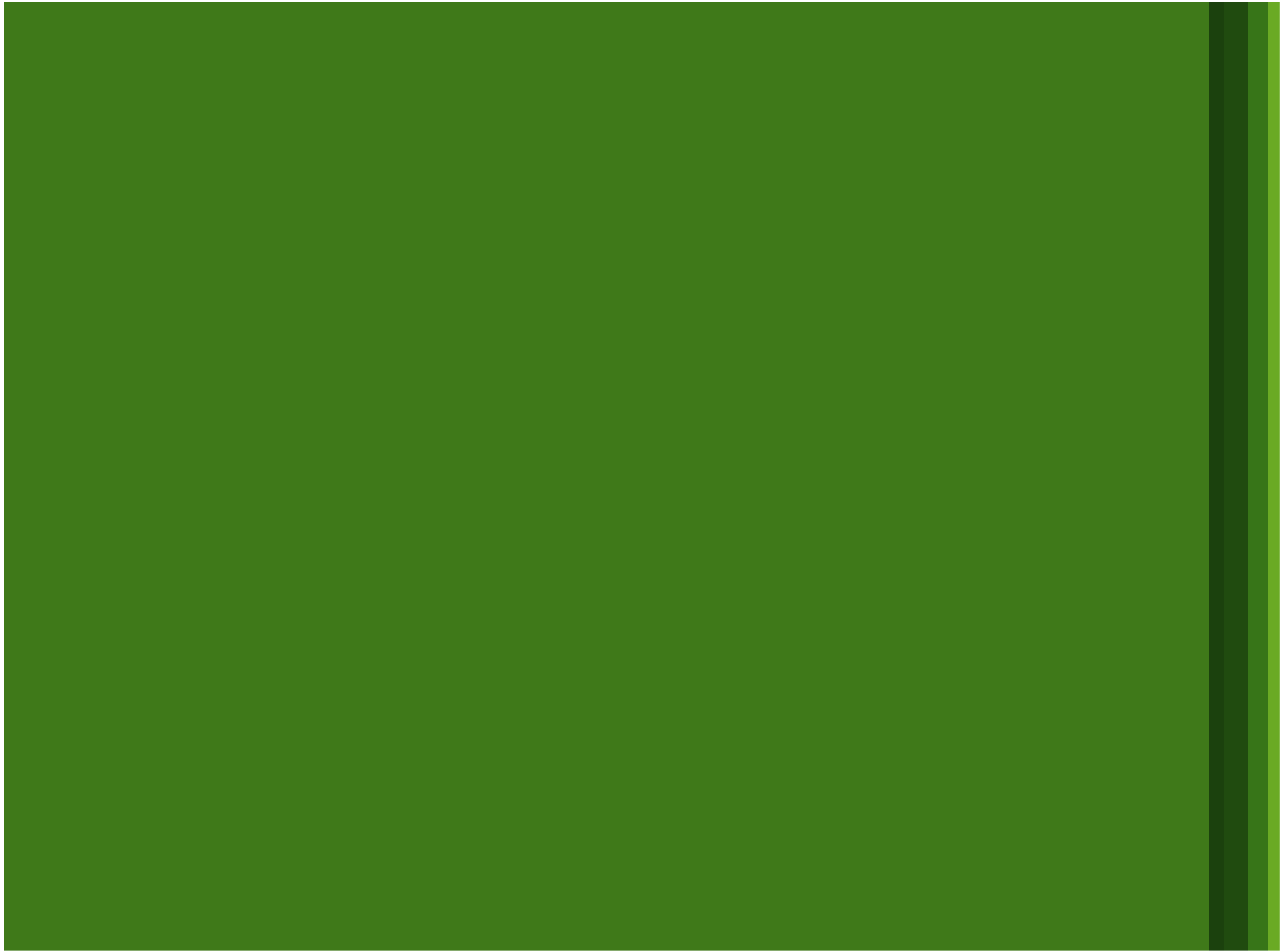
Thanks to:

**Forestry and Forest Products Research Institute
Norwegian Agency for Development Cooperation**

Comments and feedback welcome:

<http://www.conservation.org/osiris>

jbusch@conservation.org



Case study from Indonesia

4th greatest greenhouse gas emission reduction potential (WRI CAIT, 2010)

3rd most tropical forest (FAO, 2010)

1st most endemic forest birds (Birdlife International, 2010);

1st most endemic forest mammals (Schipper et al, 2008);

6th most endemic forest amphibians (Stuart et al, 2004)

A global market for RED could provide Indonesia with revenue of \$1.9-5.1 billion annually (authors' calculations based on Piris-Cabezas, 2010; Busch et al, 2010)

26-41% emission reduction commitment by 2020

May, 2010: \$1 billion Norway-Indonesia Letter of Intent



OSIRIS-Indonesia model

Data on forest cover, forest cover change, emission factors, terrain, access, protected status, concession boundaries, potential agricultural revenue compiled for ~200,000 3km x 3km grid cells across all of Indonesia

Relationship between potential carbon revenue and deforestation determined econometrically using observed forest cover loss (2000-2005)

National government sets REDD+ economic incentive structure (accounting scale; reference levels; revenue sharing; responsibility sharing)

401 forested districts respond to incentives by choosing whether or not to participate in REDD+, and choosing where and how much to deforest

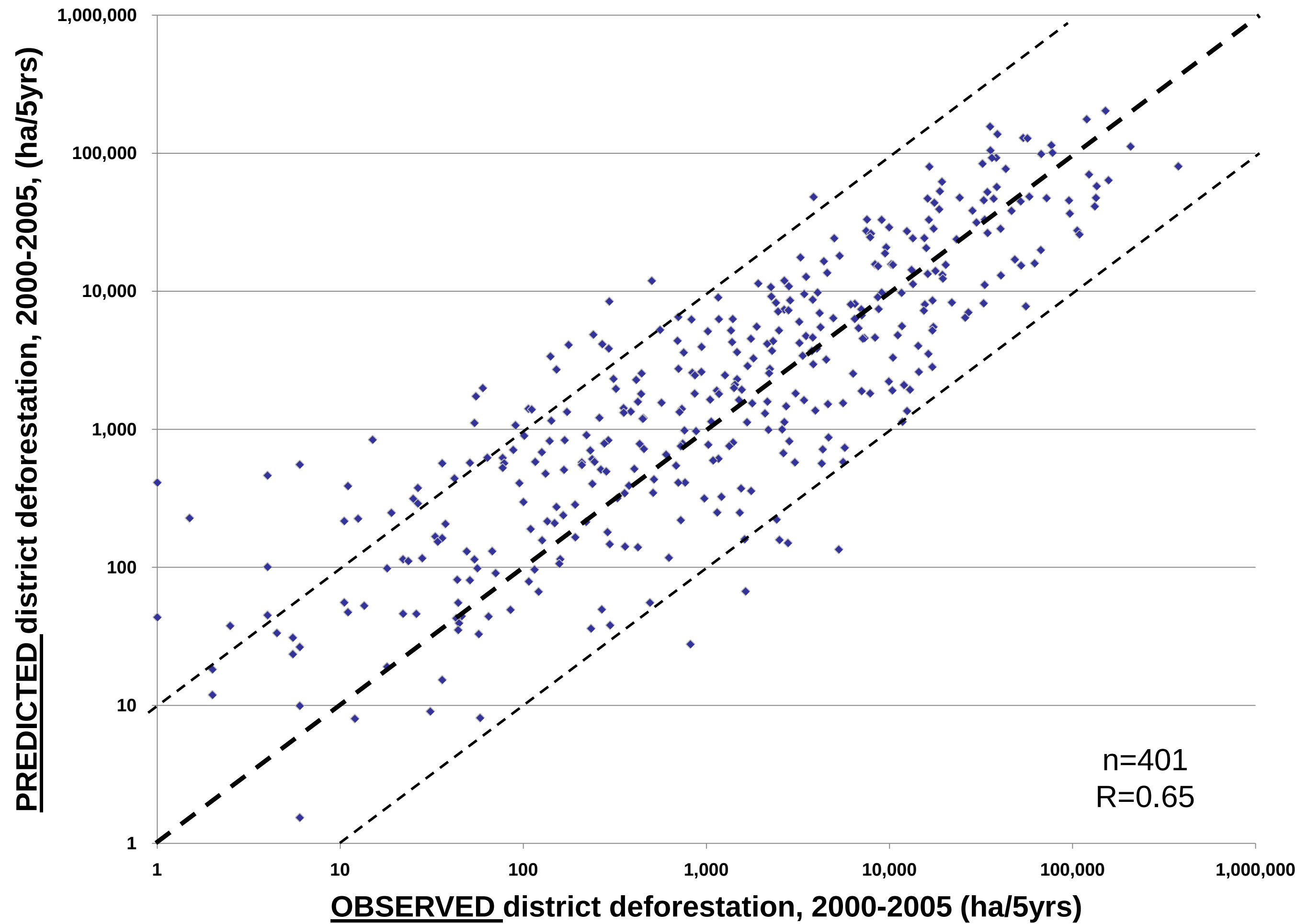
Market feedbacks produce “leakage” of deforestation

Spatial distribution of deforestation in equilibrium used to calculate emissions and national and local revenue, under alternative national REDD+ incentive structures

Central revenue can fund national policies and measures for REDD+

1. Removal of subsidies for deforestation and forest degradation
2. Tax land clearance
3. Strategic road planning
4. Improve forest law enforcement
5. Improve tenure security
6. Devolve forest management to local communities
7. Forest certification
8. Conservation concessions
9. Strengthen the protected area network
10. Payments for environmental services
11. Funding fire prevention programmes
12. Sustainable forest management/ improved forest planning
13. Support for reduced impact logging (RIL)
14. Reforest degraded land
15. Alternative livelihood programmes
16. Agricultural intensification
17. Support community forestry
18. Improve off-farm employment

Source: Peskett et al, "Making REDD Work for the Poor," 2008.



Sensitivities

- Functional form
- Included variables
- Policy decisions
- Model parameters
 - Carbon price
 - Price elasticity of demand for frontier agriculture (intranational leakage)
 - Exogenous agricultural price increase (international leakage)
 - Peat emission factor
 - Social preference for agricultural revenue
 - National reference level
 - District level start-up costs
 - Site-level transaction costs

		Basic Voluntary Incentive Structure			Sophisticated Voluntary Incentive Structure			Regulatory Incentive Structure		
		A	N	D	A	N	D	A	N	D
Model Parameters										
Carbon Price (tCO2e/yr)	\$5	32	-\$3,003	\$3,162	99	\$95	\$403	126	\$404	\$276
	\$10*	62	-\$5,970	\$6,590	175	\$331	\$1,431	211	\$808	\$1,349
	\$15	89	-\$8,857	\$10,196	234	\$659	\$2,868	272	\$1,213	\$2,945
	\$20	114	-11,656	\$13,929	278	\$1,030	\$4,564	319	\$1,617	\$4,875
Effective elasticity	0	71	-\$5,894	\$6,606	206	\$413	\$1,652	242	\$808	\$1,618
	1.9	66	-\$5,935	\$6,598	192	\$379	\$1,541	227	\$808	\$1,486
	3.8*	62	-\$5,970	\$6,590	175	\$331	\$1,431	211	\$808	\$1,349
	5.7	58	-\$6,002	\$6,582	161	\$281	\$1,343	195	\$808	\$1,235
Exogenous agricultural price increase	0%*	62	-\$5,970	\$6,590	175	\$331	\$1,431	211	\$808	\$1,349
	20%	54	-\$6,039	\$6,575	170	\$312	\$1,395	206	\$808	\$1,313
	50%	41	-\$6,143	\$6,555	158	\$270	\$1,326	199	\$808	\$1,259
Peat emission factor (tCO2e/ha) ¹	947.5	40	-\$5,004	\$5,401	120	\$224	\$984	147	\$686	\$836
	1474.2*	62	-\$5,970	\$6,590	175	\$331	\$1,431	211	\$808	\$1,349
	2099.8	95	-\$7,098	\$8,044	256	\$490	\$2,076	298	\$954	\$2,092
Social preference for agricultural revenue	1.0*	62	-\$5,970	\$6,590	175	\$331	\$1,431	211	\$808	\$1,349
	2.0	58	-\$5,989	\$6,571	167	\$316	\$1,358	211	\$808	\$1,349
	3.0	56	-\$5,999	\$6,554	162	\$310	\$1,318	211	\$808	\$1,349
National reference level as % of BAU emissions	80%	62	-\$7,587	\$6,590	175	-\$1,286	\$1,431	211	-\$808	\$1,349
	100%	62	-\$5,970	\$6,590	175	\$331	\$1,431	211	\$808	\$1,349
	120%	62	-\$4,353	\$6,590	175	\$1,948	\$1,431	211	\$2,425	\$1,349
District-level start-up and transaction costs (\$/district/5yr)	\$0*				175	\$331	\$1,431	211	\$808	\$1,349
	\$1 million				174	\$329	\$1,420	211	\$808	\$1,349
	\$5 million				171	\$325	\$1,396	211	\$808	\$1,349
	\$10 million				170	\$322	\$1,382	211	\$808	\$1,349
Per-hectare start-up and transaction costs (\$/ha/5yr)	\$0*	62	-\$5,970	\$6,590	175	\$331	\$1,431	211	\$808	\$1,349
	\$1,000	59	-\$5,974	\$6,563	169	\$323	\$1,370	202	\$808	\$1,268
	\$5,000	46	-\$5,985	\$6,449	127	\$247	\$1,025	173	\$808	\$996
	\$10,000	32	-\$5,994	\$6,318	82	\$161	\$658	143	\$808	\$709

Expected spatial distribution of abatement under REDD+ at \$10/tCO₂e (tCO₂e/ha)



Where is the carbon, AND where can money change behavior?

Lesson 1: Partnership lessons from the FCPF: A partnership among often-contentious stakeholders in tropical land use can find ways to communicate and explore highly policy-sensitive topics, if it first builds trust and willingness to share new ideas.

Lesson 2: Lessons in sectoral coordination: The cross-cutting nature of REDD-plus presents new challenges in sectoral coordination that may be solved by embedding the REDD-plus strategy in overarching policy frameworks (e.g., a low-carbon development strategy) and by mobilizing decisive political will.

Lesson 3: Stakeholder participation: Countries are now grappling with how to operationalize the inclusion of stakeholders in REDD-plus policy and implementation, raising new issues of control over resource management and the respective decision-making processes.

Lesson 4: Lessons from country R-PP formulation process: Political will is required to create highly qualified, teams capable of resolving competing interests into a coherent national Plan for REDD-plus.

Lesson 5: New techniques and tools: Promising results are emerging where countries are combining traditional evaluation of potential REDD-plus strategy options with newer analytic tools that facilitate making choices among competing options.

Lesson 6: Implementation of REDD-plus on the ground: A REDD-plus bridge has not yet been built between the wealth of experiences at the local level in managing forest resources and land use change, and ideas on REDD-plus policy frameworks and incentive programs at the national level.

Lesson 7: Governance aspects of REDD-plus: Early cooperative development of a first set of rules of the game for REDD-plus transactions and benefit sharing is an essential prerequisite for the broad legitimacy and support of REDD-plus programs.

Lesson 8: REDD-plus methodological issues Addressing methodological issues such as reference level and measurement, reporting and verification (MRV) is a key entry requirement for REDD-plus programs. In the absence of clear policy guidance from the international level and price signals for REDD-plus, countries could embark on a no-regrets stepwise approach to begin building capacity.

Lesson 9: REDD-plus financing: Early initiatives to finance REDD-plus have illuminated a paradox: In spite of the high level of international commitments to REDD-plus funding, the mechanics of multilateral programs to move resources to REDD-plus partner countries require due diligence and safeguards that have slowed the flow of funds to countries.

Lesson 10: REDD cannot be cast as a potential solution to every problem: If REDD-plus is to evolve and achieve its promise to mitigate global climate change, these lessons suggest it needs some time, some space, and some flexibility to be fairly experimented with over the next few years.



Harvesting Knowledge on REDD-plus:
Early Lessons from the FCPF Initiative and Beyond

The road ahead

- Zoning and agricultural policy
- Degradation and reforestation
- Safeguards for REDD+ (DEFRA)
- Long-term incentives for REDD+
- Risk management mechanisms
- Complementary agricultural policies
- Matching payments for biodiversity, water and other ecosystem services
- Green economic development
- Open for discussion!...

