

Program for the Payment of Hydrological Environmental Services of Forests:

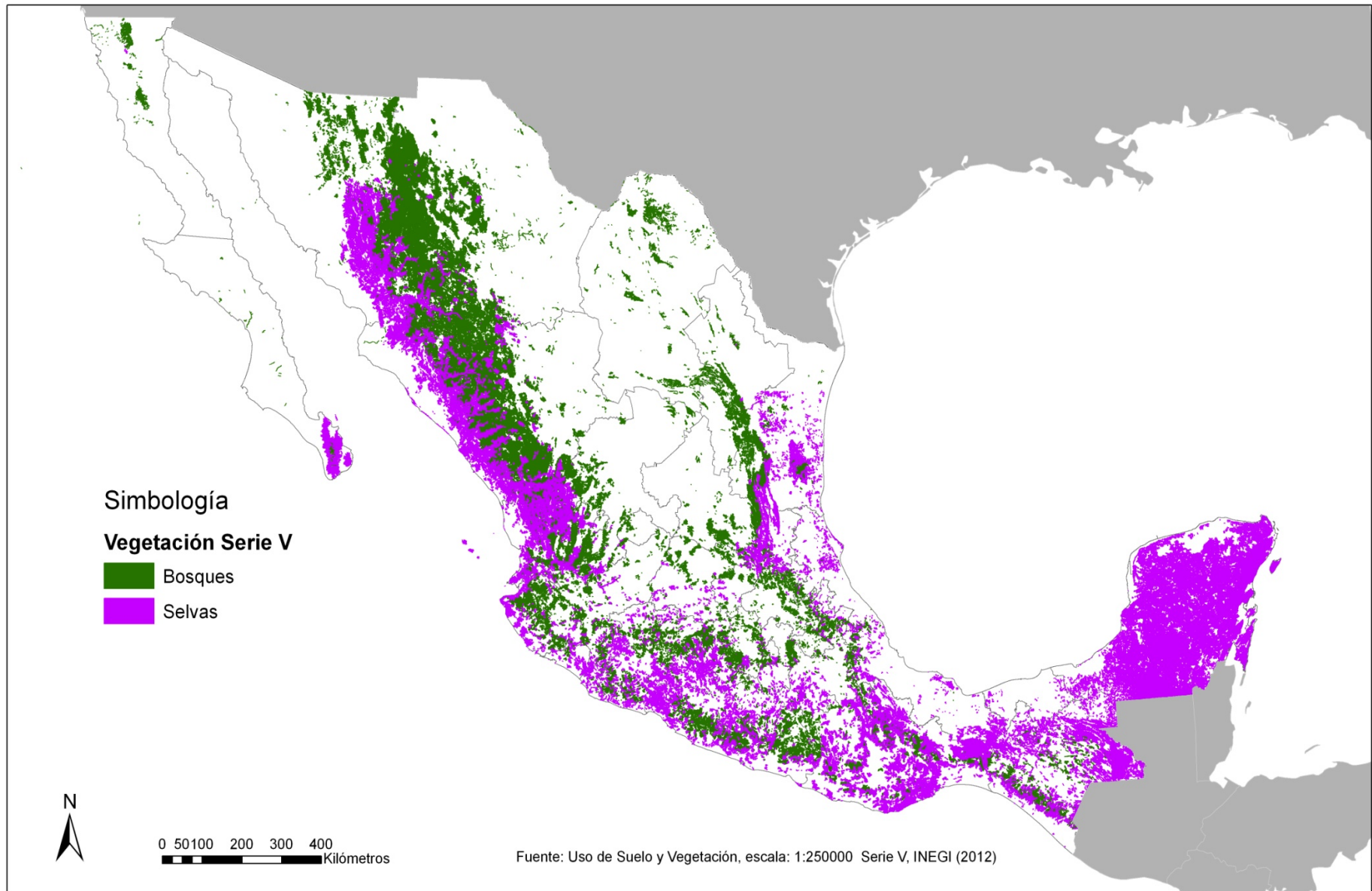
Carlos Muñoz. ITAM
CBD- Technical experts workshop, 2015

Marisol Rivera, INECC.
Alfredo Cisneros, INECC.

Case study with CBD issues highlights.

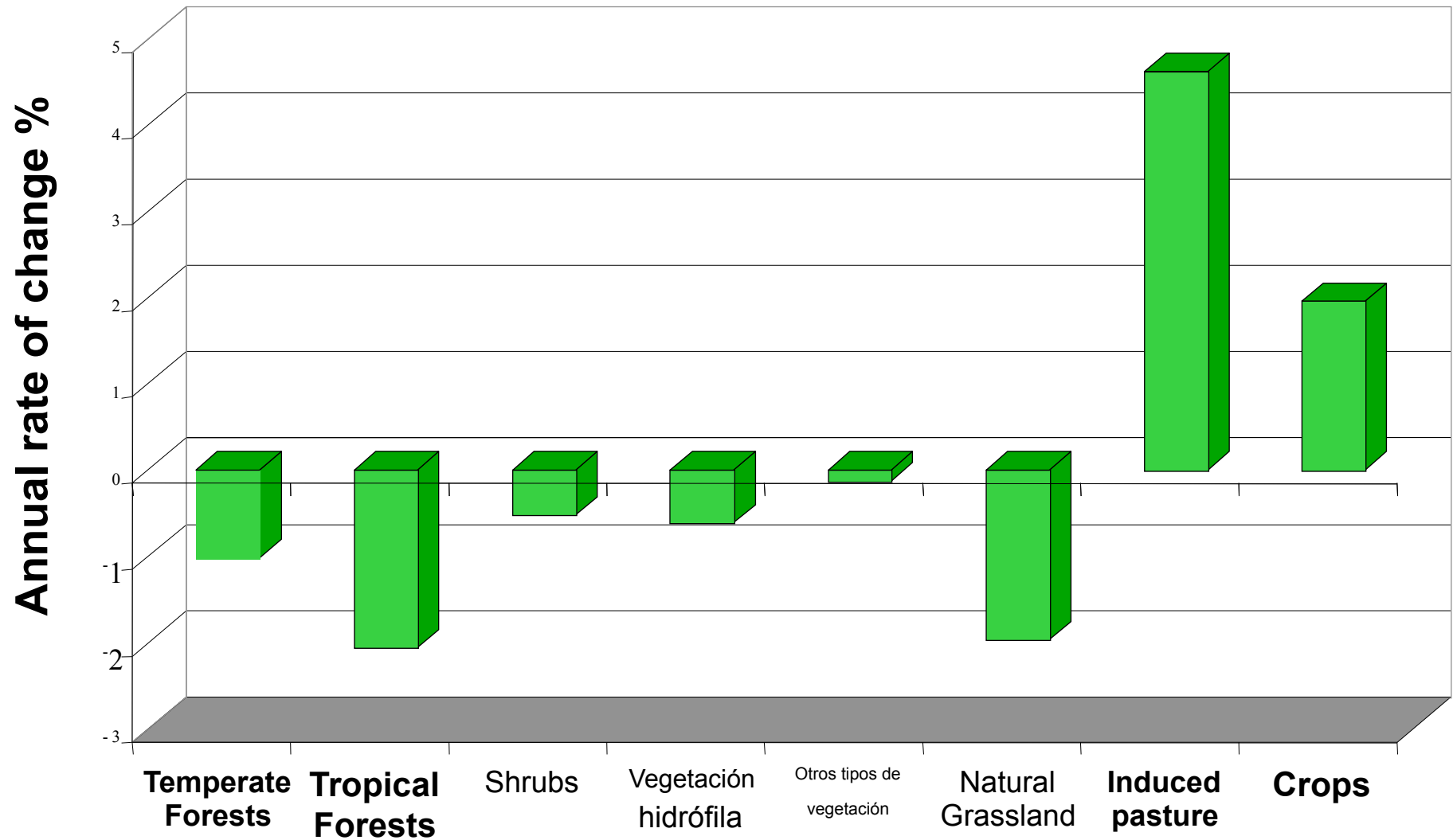
1. Increase **expenditures**, new sources.
2. Measure (and increase) **effectiveness**.
 - Necessary for accurate costing.
3. Address **harmful** expenditures.
 - And how to convert them to neutral or green.

66 million hectares of temperate and tropical forests in Mexico

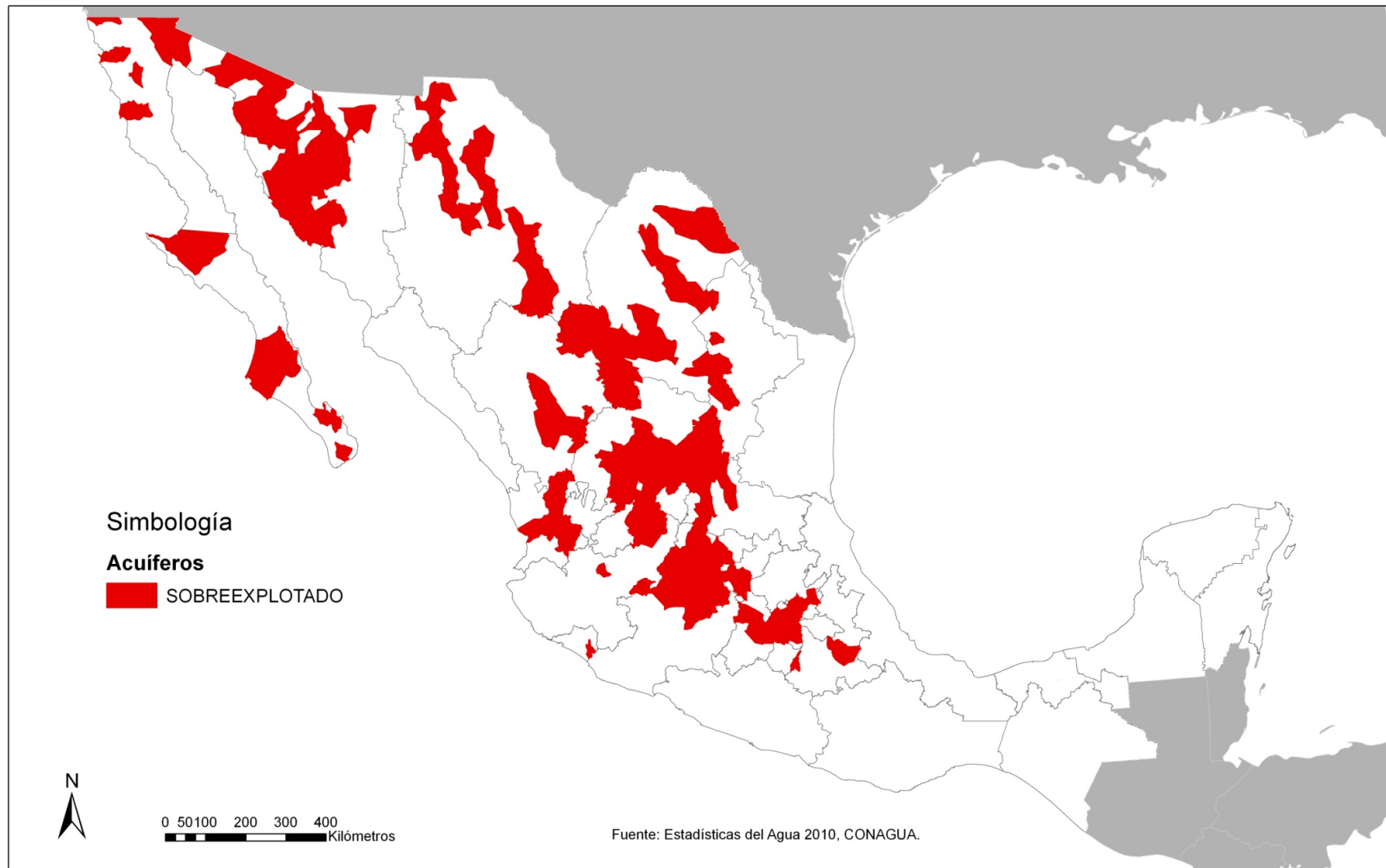


Mexico experienced very fast deforestation

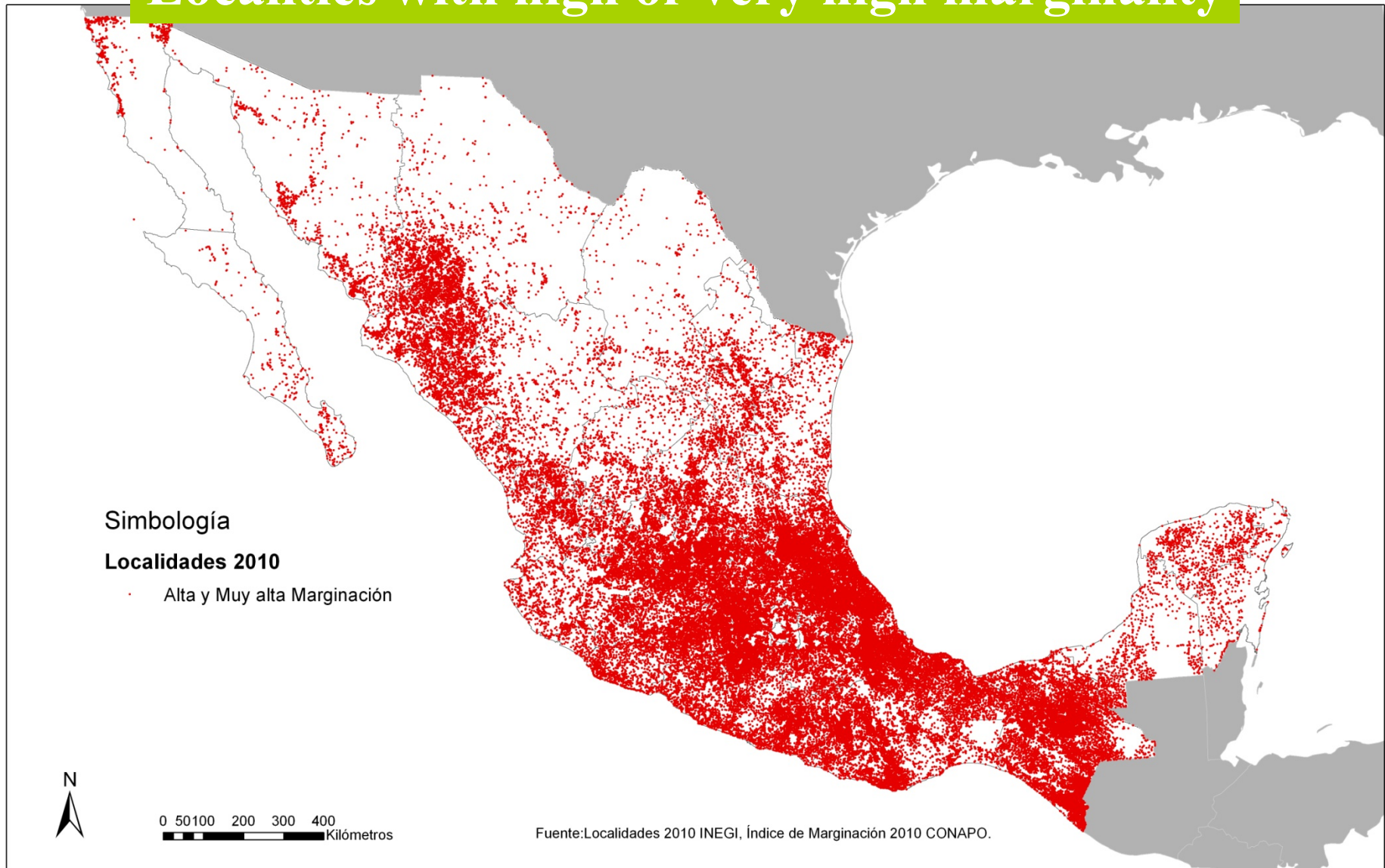
Land use change in Mexico 1993-2000



Overexploited acuífers



Localities with high or very high marginality



Program's Objective

- Stop the deforestation that threatens those forests critical for watershed-related environmental services in Mexico

By

Paying land owners to preserve forest land and avoid its transformation for other uses, such as: agriculture and cattle raising.

Hydrological services



The loss of the forest cover:

- Diminishes the possibility of water recharge of the aquifers and reduces water availability.
- Increases the poor quality surface water
- Extreme precipitation in absence of forest cover exacerbates the probability of a disaster

Land use changes

Control vs. Incentives

- In Mexico, government's control of land use changes is costly, not effective and potentially poverty increasing.
- So, necessarily
conservation = profitable forests
for communal owners taking land use decisions

Otherwise: regulatory taking on the poor

1 out of every 4 Mexicans is extremely poor

% of all households or individuals

Households 46%
Individuals 54%

Households 25%
Individuals 32%

Households 19%
Individuals 24%

Type of Poverty

Assets

Share of households whose income is less than the one needed to cover the basic basket of food, clothing, housing, health, transport and education.

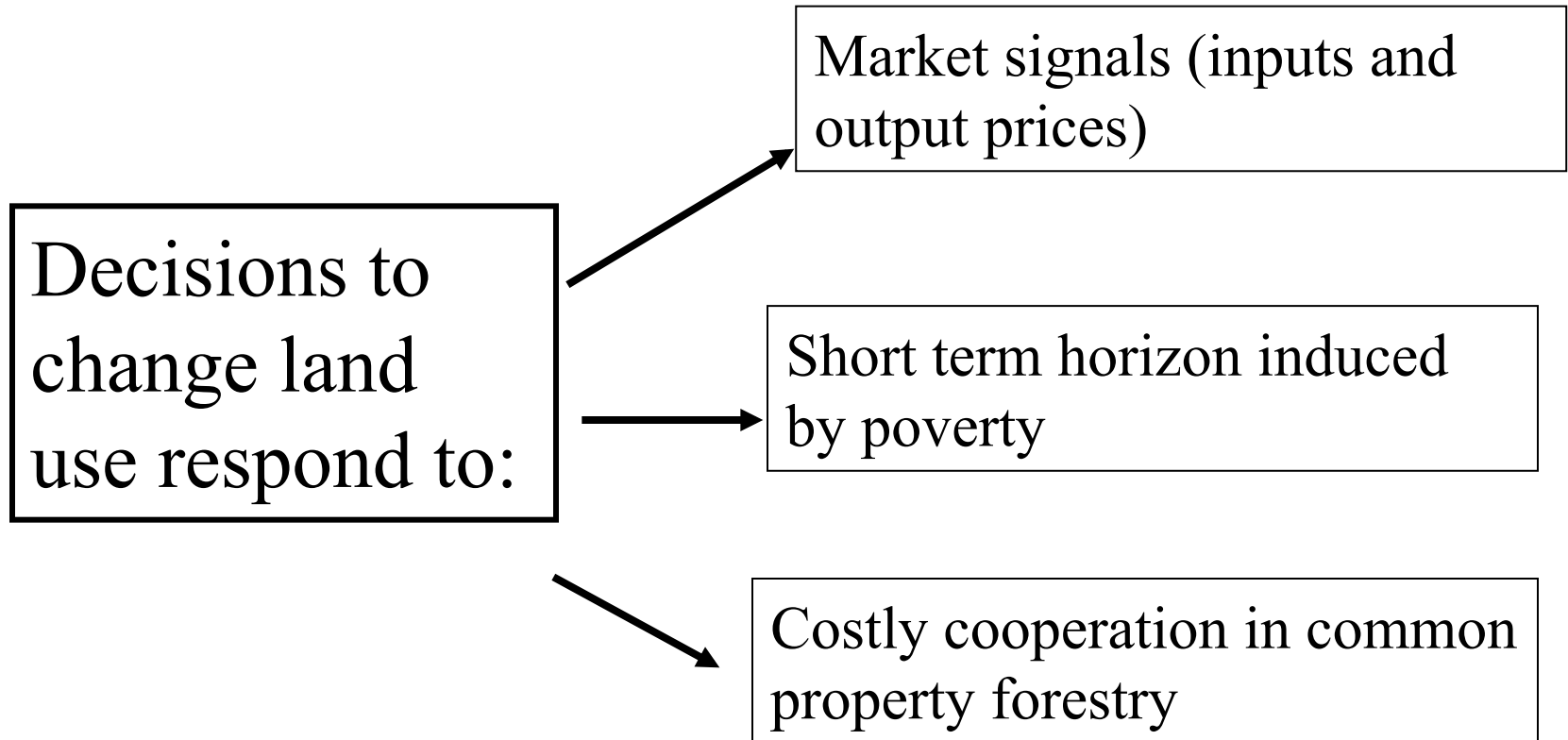
Capacities

Share of households whose income is less than the one needed to cover the basic basket of food, health and education

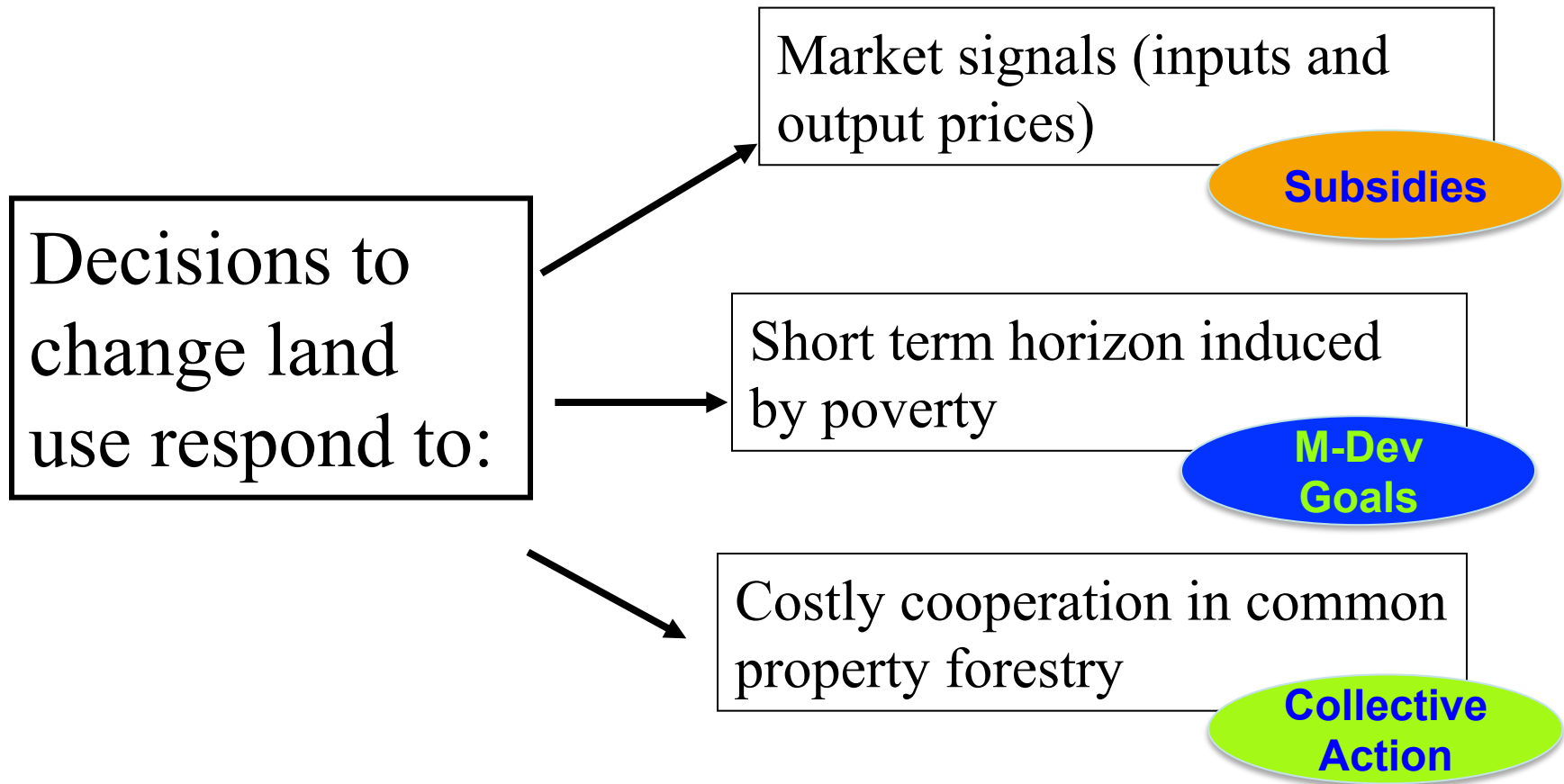
Nutrition

Share of households whose income is less than the one needed to cover the basic basket of food according to INEGI-CEPAL

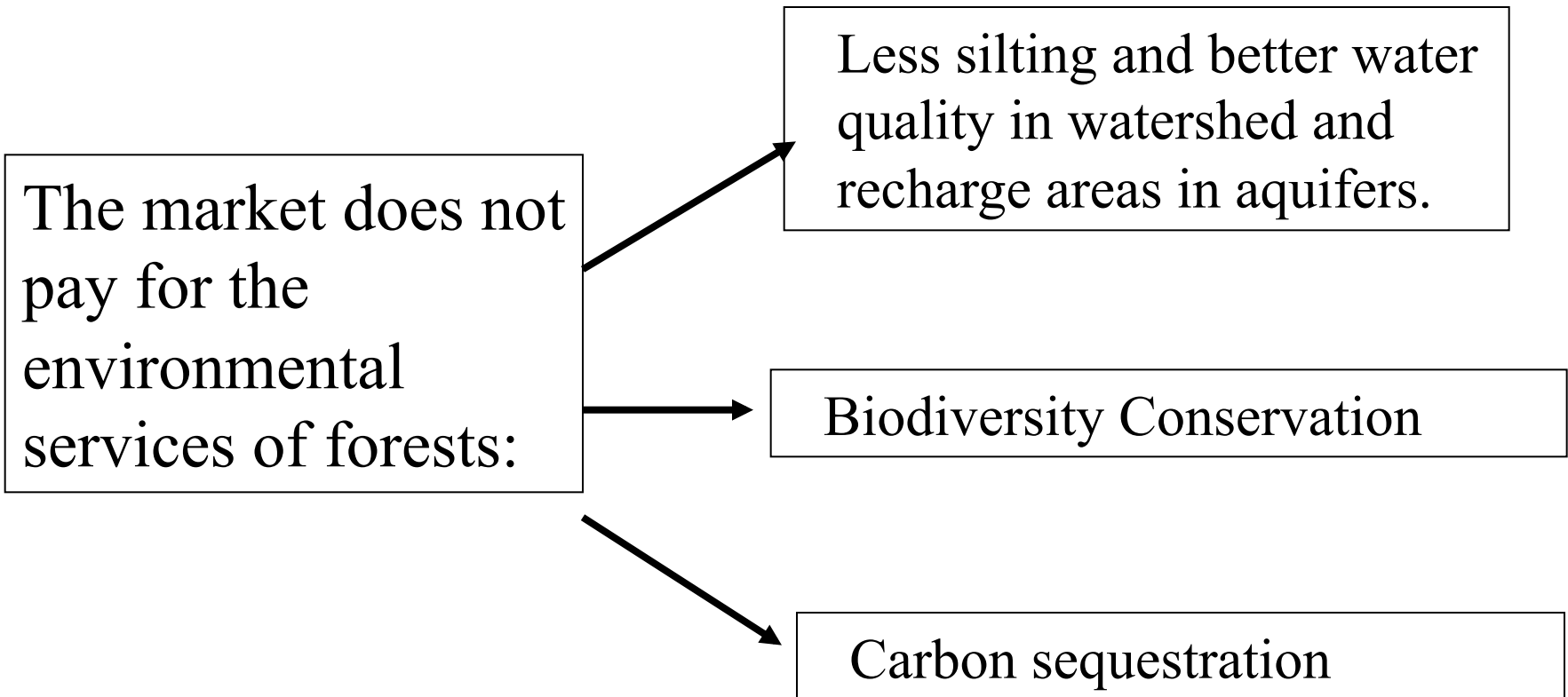
Deforestation in Mexico driven by land use changes



Deforestation in Mexico driven by land use changes



Market failures



Leveling the playing field

Elements of the strategy:

1. Decouple subsidies (agrochemicals, water, “commercialization support”)  Subsidies
2. Keep supporting development of community forestry firms (Prodefor, Procymaf)
3. **Pay for environmental services**

A public policy niche

Forests with (potential) commercial use	➡	PRODEFOR, PROCYMAF, Cadenas Productivas
Plantations	➡	PRODEPLAN
Degraded Forests	➡	PRONARE
Not degraded, not commercial forests, important for watersheds and aquifers	➡	PSAH



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Q1: Choosing how much to pay

Choosing how much to pay

Between two limits:

1. **Value** of the environmental service (measurement?)
2. **Opportunity cost.** How much would they earn in alternative activity?
 - Given a budget and an area, a price that would clear the market...



A close-up look at maize

Opportunity cost

$$\text{Profit per hectare} = \left(\frac{\text{production}}{\text{surface}} * \text{Price} \right) - \text{Average production cost per hectare}$$

ALL MEXICO

Production	9.97 million tons
/ Surface harvested	4.82 million hectares
= Average product	2.07 tons/hectare
* Average price	US\$ 334 dollars/ton
= Average income	US\$ 692 dollars/hectare
- Average cost	US\$ 555 dollars/hectare
= Net Profit	US\$ 136 dollars/hectare

¹ Source: precios, volumen toneladas, Servicio de Información Agropecuario y Pesquero (2011)

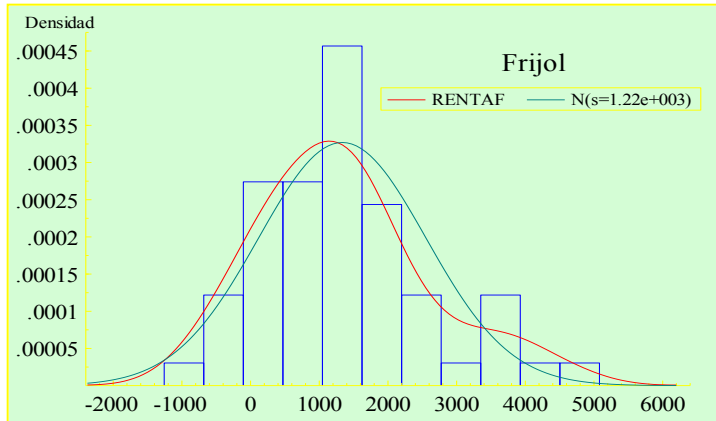
² Source: FIRA, Costos de producción (2011)

**However... averages
hide important issues.**

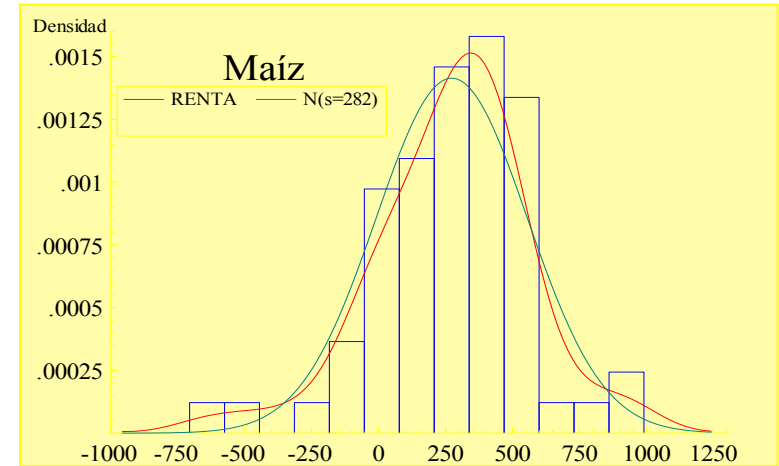


OPORTUNITY COSTS

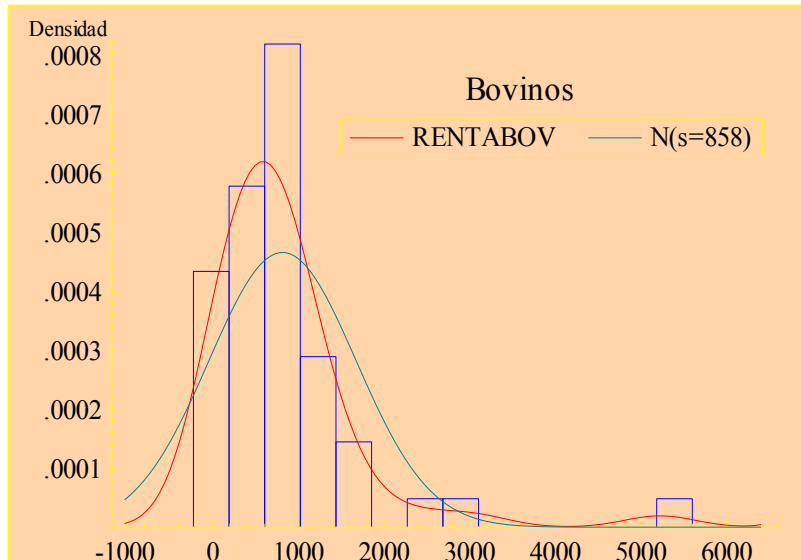
Beans



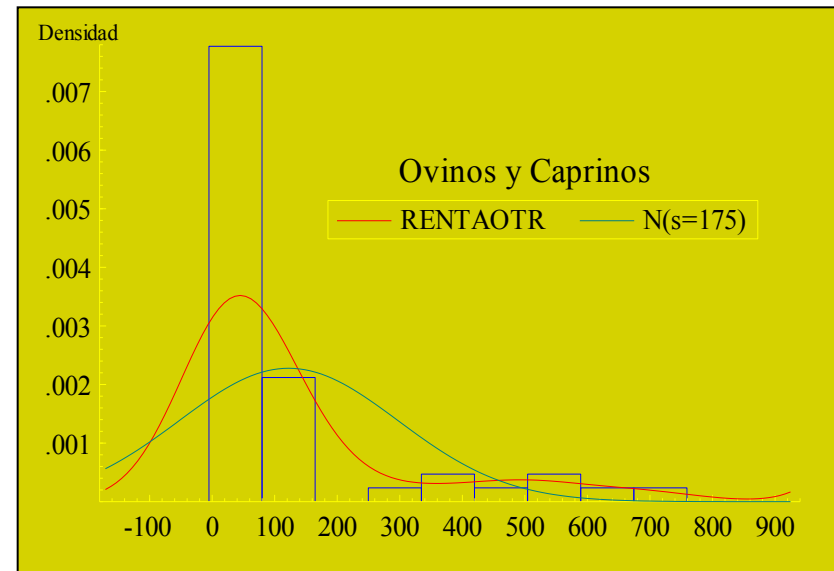
Corn



Cattle



Sheep & Goats



Payments **PSAH**



Literature* suggests additional value from:

1. **Cloudforests** (fog-water)
2. **Dry Tropical Forests** (flood prevention)

* J.Carrillo (2003), I. García-Coll (2002), Bruijnzeel (2002)

If uncertainty: precautionary principle

In 2002 payments started at:

- US\$ 40 per hectare to cloudforests
- US\$ 30 per hectare to all other.



Q2: Where to get the money
from?

Linking providers with those who benefit

- Federal Fees Law reformed to introduce an earmarking of a portion of the water fee.

Negotiations

- Initial proposal 2.5%
- Finance Ministry & National Water Commission want to exclude municipalities from payment, so fix amount to ~US\$20 million.

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Where to get the money from?

Sources of funding

Options:

1. General Budget

2. Earmarked fiscal instrument

– Advantage: sends signals to resource users.

- PSAH (Federal Government):

- Federal Fees Law (223-A): US \$20 million, earmarked *Forestry Fund*.

- Natural Protected Areas:

- Federal Fees Law. Earmarked, entry fee of approx US\$2 per visitor.

Where to get the money from?

From National to local level

Additional option:

3. Matching funds

- Mexico-WB agreement: From “local markets” to matching funds.
- 2008, *Fondos Concurrentes* program launched. Participation from:
 - State Governments,
 - Environmental NGOs,
 - Irrigation Districts,
 - Mining companies.

Q4: How to measure effectiveness?

Challenges for PES

1. Unexpected success: Three times as many applications as funds. (Excess demand)
2. Possibility of generating greater value to customers.
3. Who received the payments?
4. Lets look at the actual targeting...

Targetting:

- By type of forests
- By type of environmental service
- By level of poverty
- By risk of deforestation

➤ Important: voluntary program implies *self-selection*.

Lets study the first 4 years...

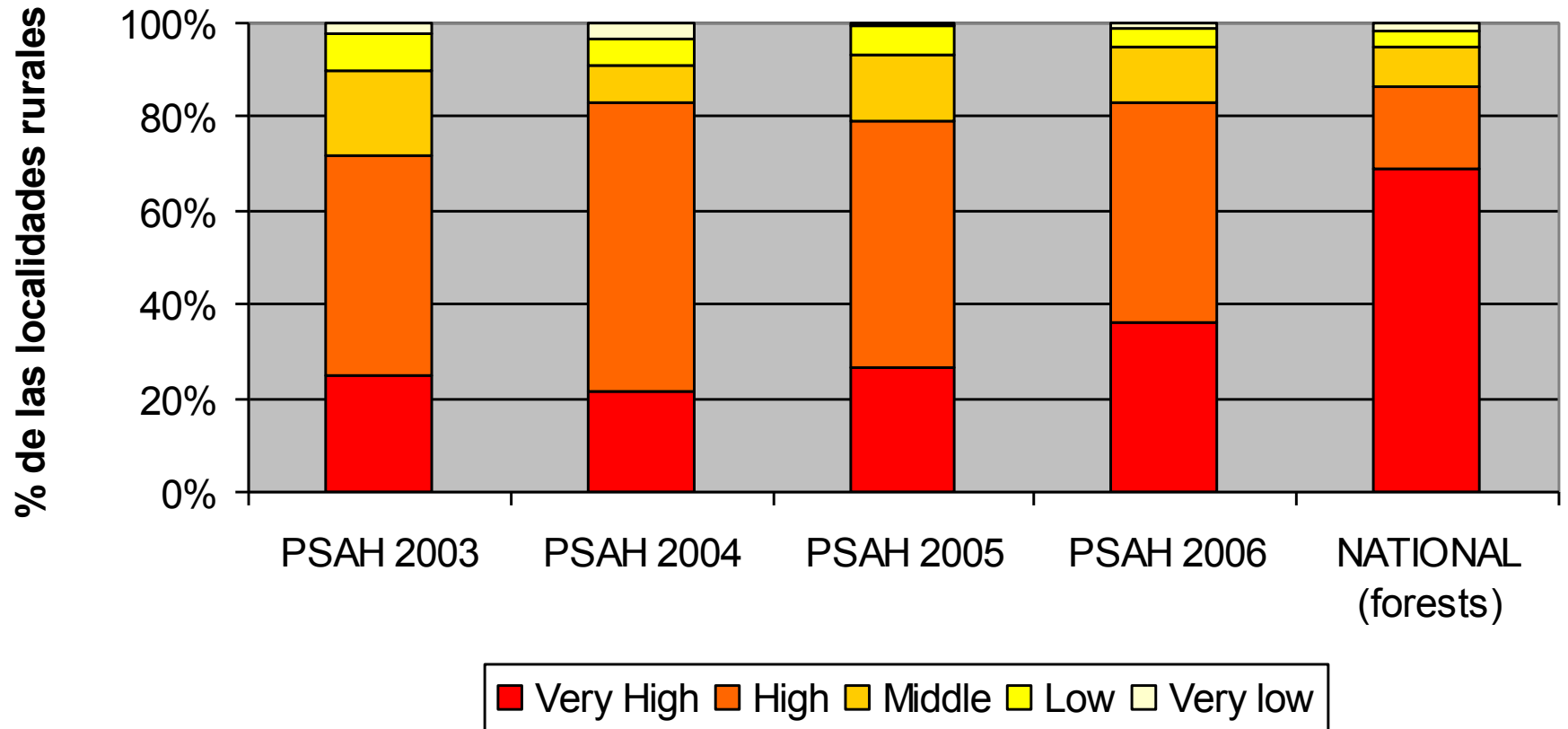
Overexploited aquifers

Type of Aquifer	Nationwide (surface) %	Nationwide (population) %	Eligibility CONAFOR	PSAH 2003 %	PSAH 2004 %	PSAH 2005 %	PSAH 2006 %
Extremely Overexploited (+50% a +800%)	0.1	29	7	0	0	7	13
Moderately Overexploited (+5% a +50%)	19	14	18	13	10	20	34
Expansion margin or Equilibrium (less than +5%)	68	57	73	79	85	72	51
No information	13	0.1	2	8	5	2	2
TOTAL	100	100	100	100	100	100	100

Poverty and PSAH

Marginality	Forest communities national level	Elegibility CONAFOR	PSAH 2003	PSAH 2004	PSAH 2005	PSAH 2006
	Hectares (%)	Hectares (%)	Hectares (%)	Hectares (%)	Hectares (%)	Hectares (%)
Very high	69	35	25	22	26	36
High	17	43	47	61	53	47
Medium	9	6	18	8	14	12
Low	3	14	8	6	6	4
Very Low	2	1	2	3	1	1
Total	100	100	100	100	100	100

Targetting poverty



Q4: How to measure effectiveness, regarding actual behaviour modification?

SEEKING EFFECTIVENESS

SEEKING EFFICIENCY

- **PSAH objective:** Maximize protection of environmental services through **avoiding deforestation**
- **Efficiency:** Maximize value to fee-payers through avoiding **maximum hectares** deforested at **minimum cost**, within budget constraint.

**Measuring the Avoided
Deforestation effect of the
Payment for Hydrological
Environmental Services
Program in Mexico (PSAH)**

What would have happened...

- Measuring how much deforestation was **avoided** requires comparing:
 - **Observed** deforestation, against
 - the deforestation that **would have happened**.

What would have happened...

- Measuring how much deforestation was **avoided** requires comparing:
 - **Observed** deforestation, against
 - the deforestation that **would have happened**.
- But, how to know how much deforestation would have occurred?

What would have happened...

- Measuring how much deforestation was **avoided** requires comparing:
 - **Observed** deforestation, against
 - the deforestation that **would have happened**.
- But, how to know how much deforestation would have occurred?
 - We need to be able to predict deforestation, and then predict it under the alternative scenario where the PES did not occur.

3 ways to predict:

Naive:

1. It would be the same rate as before.
2. It would be the same number of hectares as before.

Sophisticated:

3. It would follow the same pattern as before (same coefficients but with updated variables).

The Reality and the Problem.

- **Reality** always differs from prediction, but it could be a small difference if you have a good model.
- The real **problem** of using naive baselines is that they are only useful for large aggregates (national level, state level).

A 4th way: ex post

- In social policy evaluations (anti-poverty) regression analysis is used to compare a group of participants in a program with a group of non participants.
- Controlling for the rest of the variables that influence the result, and selection bias, the effect of the program on the target behaviour or state is measured.

Expressing it mathematically

- $\text{Result} = A + B1(\text{variable}) + B2(\text{program}) + e$, where
 - A is the base behaviour
 - $B1$ captures the influence of site & owner characteristics
 - $B2$ is the specific influence of the program
 - e represents the effect of random variables
- For those that **did not** participate in the program their behaviour is equal to $A + B1(\text{variable}) + e$
- For those that **did** participate in the program the outcome is $A + B1(\text{variable}) + B2 + e$

*“All models are wrong, but some
are useful.”*

(George Box, quoted by Kennedy 1992: 73;
quoted by Kaimowitz & Angelsen: 1998; and here).

To measure the effect of PSAH

- We use two approaches:
 - **Ex-ante**. Important to target future payments.
 - **Ex-post**. Important to measure the truly avoided deforestation.
- Because they are **pixel**-level analysis a R(E)DD effect can be calculated for **each property, or area or territory, or....**

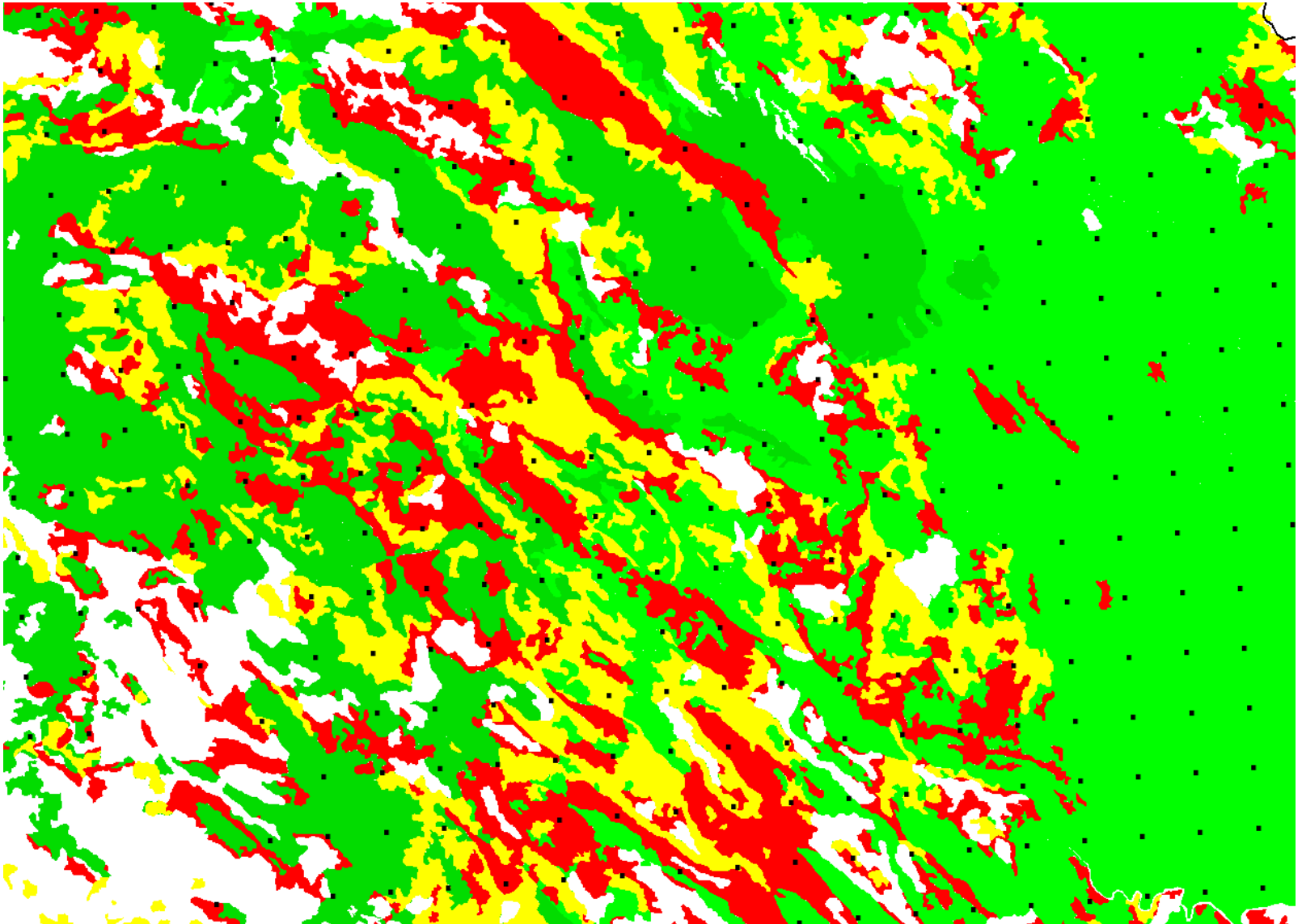
The basic model

- Land use is determined by (communal or individual) forest owners who choose among alternatives the one that represents the higher net present value of **income flows** (Von Thunen) (Chomitz). Preserved or sustainably used forests are two of the options, as are agriculture or pastures..
- So, the observed deforestation in a particular period of time would come from:
 - Plots where the relative profitability of agriculture or cattle ranching was already greater than the forest but change had not happened yet.
 - Plots where circumstances changed in such a way that the relative profitability of agriculture or pastures increased.

Ex-post model for PSAH

- Data base:
 - Random Sample National Forest Inventory 2000: 153,764 pixels with forests, 2 kms away from each other.
 - 4,419 of them with PSAH, 149,345 without PSAH
 - Variation in:
 - Slope
 - Type of Ecosystem
 - Distance to population and markets
 - Level of Marginality
 - NPA, forestry activity, etc...
 - Pixels observed again in the 2007 Forest Inventory.

A set of sample points



Possible Outcomes

Inventory 2000

Inventory 2007

Primary Forest
(well preserved)

Conservation

Primary Forest
(well preserved)

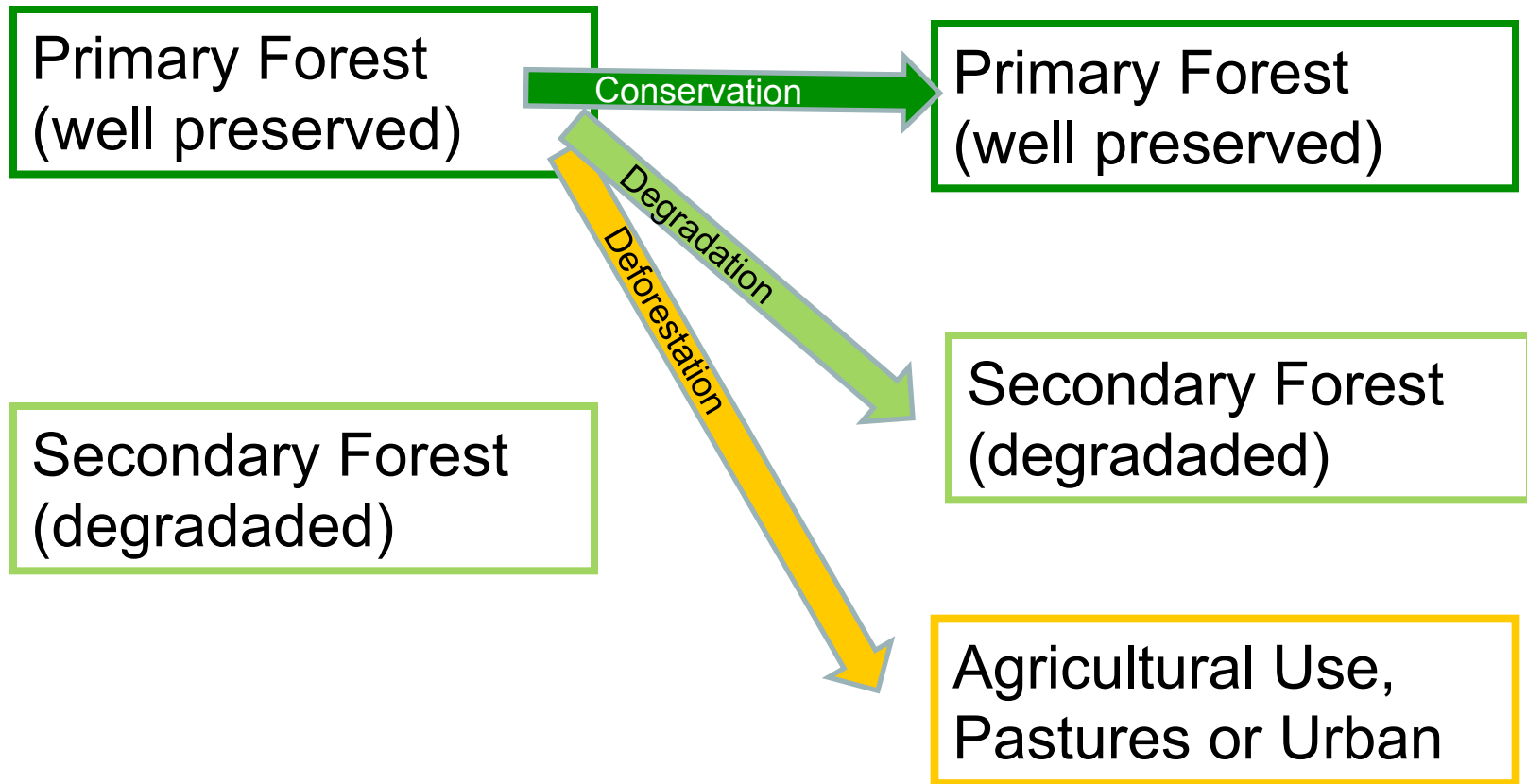
Degradation

Secondary Forest
(degradaded)

Deforestation

Secondary Forest
(degradaded)

Agricultural Use,
Pastures or Urban



Possible Outcomes

Inventario 2000

Inventario 2007

Primary Forest
(well preserved)

Primary Forest
(well preserved)

Secondary Forest
(degradaded)

Secondary Forest
(degradaded)

Uso Agropecuario o
Urbano

Regeneration

No Change

Deforestation

The econometric model

- The explanatory variables are qualitative:
 - Was it deforested? Yes/No
 - Was it degraded, deforested or preserved?
- Use qualitative dependent variable models: **Probit**, Ordered Probit, Multinomial Logit
- Explained with economic variables regarding **plot** and **owners**

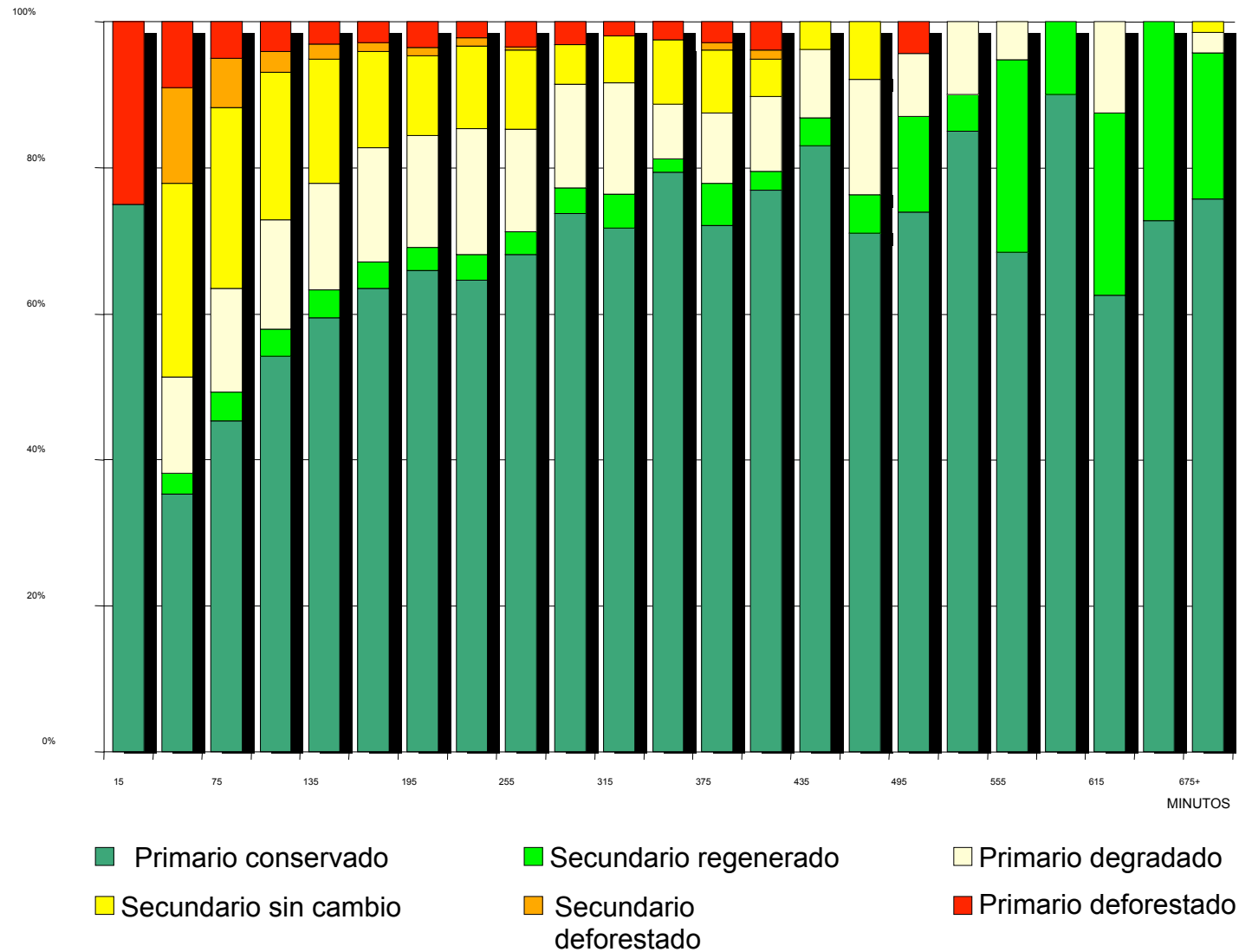
Probit Model:

What explains deforestation?

Proxies for the explanatory variables:

1. Access to Local Markets
2. Access to Regional Markets
3. Poverty/Marginality of forest owners and neighbours
4. Natural Protected Area System
5. Slope, Potential Ag Yields
6. PSAH or not PSAH

Land use changes and distance to the nearest town



Probability of Deforestation depends on:

Variable	Unit	Estimated Coefficient	Marginal Change in Probability	Signif> 90%
Constant		-2.91		Sí
Distance to nearest town	Minutes	-0.0038	-0.0001	Sí
Distance to nearest city	Minutes	-0.00011	-0.000004	Sí
Marginación de población local	Level [0 , 5.5]	0.13	0.005	Sí
Average Yield of Corn in AGEB	Tons/ha	0.18	0.007	Sí
Slope	%	-0.0048	-0.0002	Sí
Agricultural Frontier	% of pixels around with Ag	0.74	0.0278	Sí
Natural Protected Area	within one	-0.27	-0.008	Sí
PSAH	Does participate	-0.25	-0.007	Sí

A similar regression done using data from the 1990s was used for targeting

Using the 1990s data, a Deforestation Risk Index was calculated and used for the targeting criteria introduced in the 2007 version of PSAH rules onward

Risk of Deforestation Index (*Economic Pressure on Deforestation*) Mexico
Quintiles (Versión 1.01)

	Very Low	Low	Medium	High	Very High
<u>Observed</u> rate of deforestation (2000-2007)	0.3%	0.9%	1.8%	3.4%	7.8%

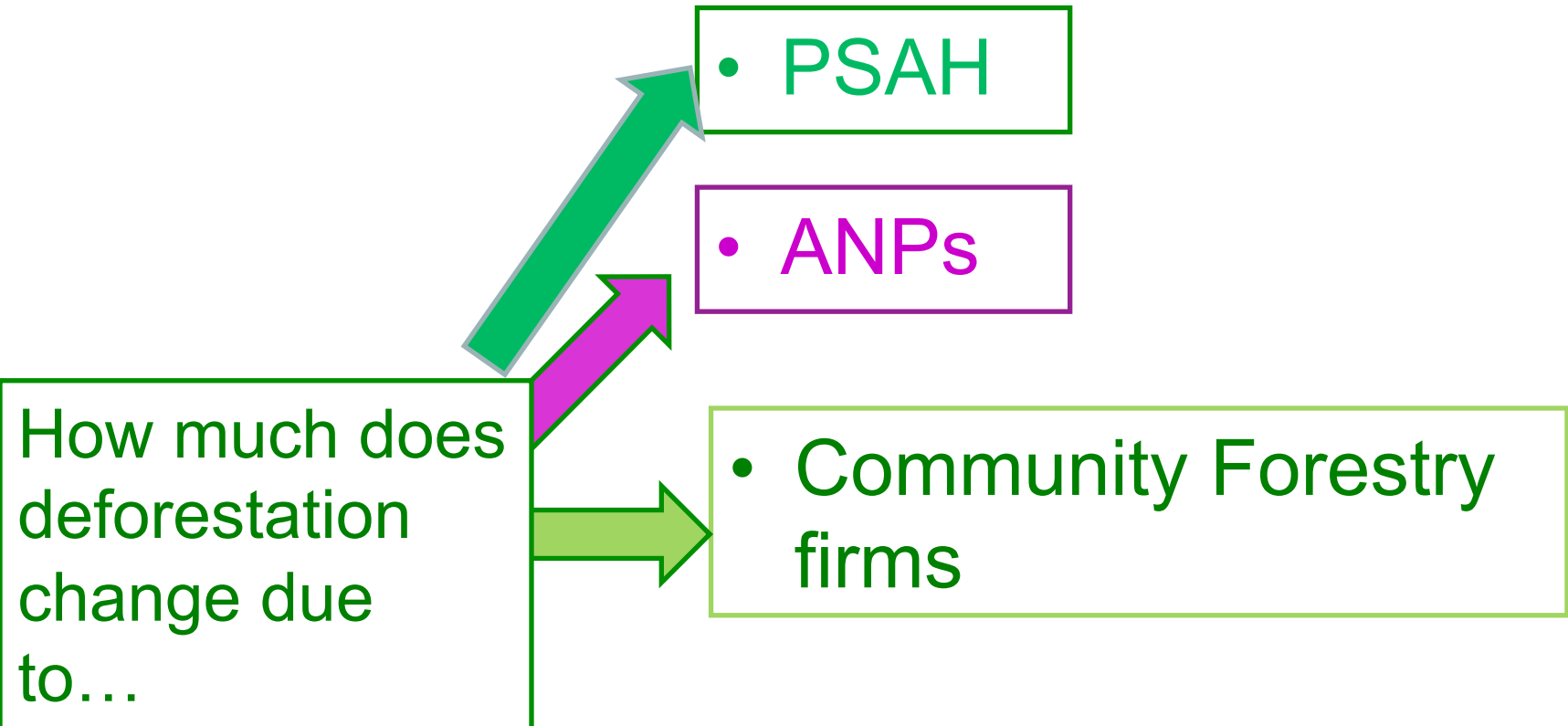
Basic interpretation of results :

- *How does the probability that a determined **pixel** of 9 hectares was deforested between 2000 y 2007 change when one of the explanatory variables change?*
 - *Distance*
 - *Marginality*
 - *Fertility*
 - *Slope*
 - *Declared as Natural Protected Areas*
 - *PSAH*

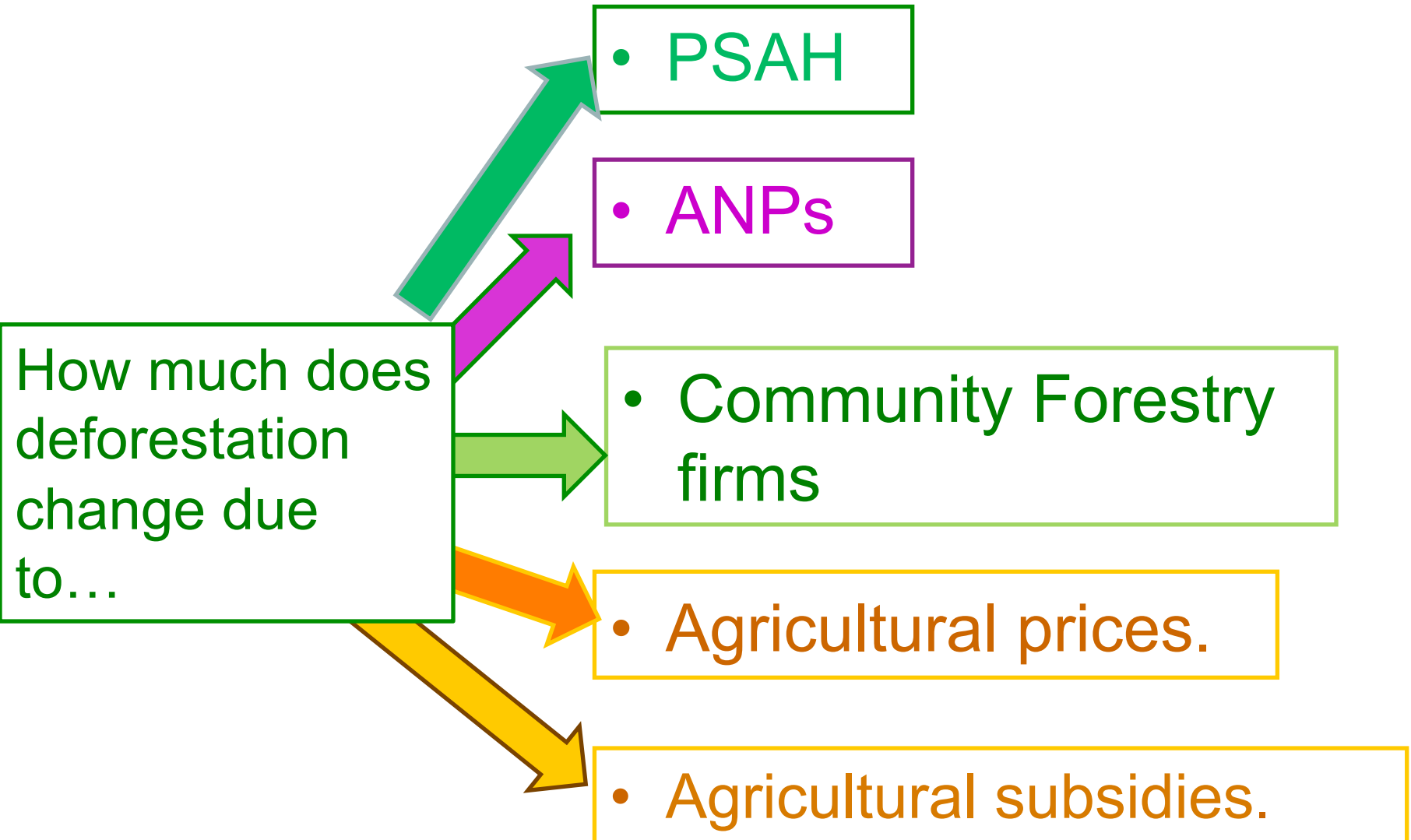
Basic interpretation of results ::

- *How does the probability that a determined **pixel** of 9 hectares was deforested between 2000 y 2007 change when one of the explanatory variables change?*
- By aggregating the probability of all pixels that share characteristics one obtains a percentage, a **rate of deforestation**.

What can be tested?



What can be tested?



Modelling to answer:

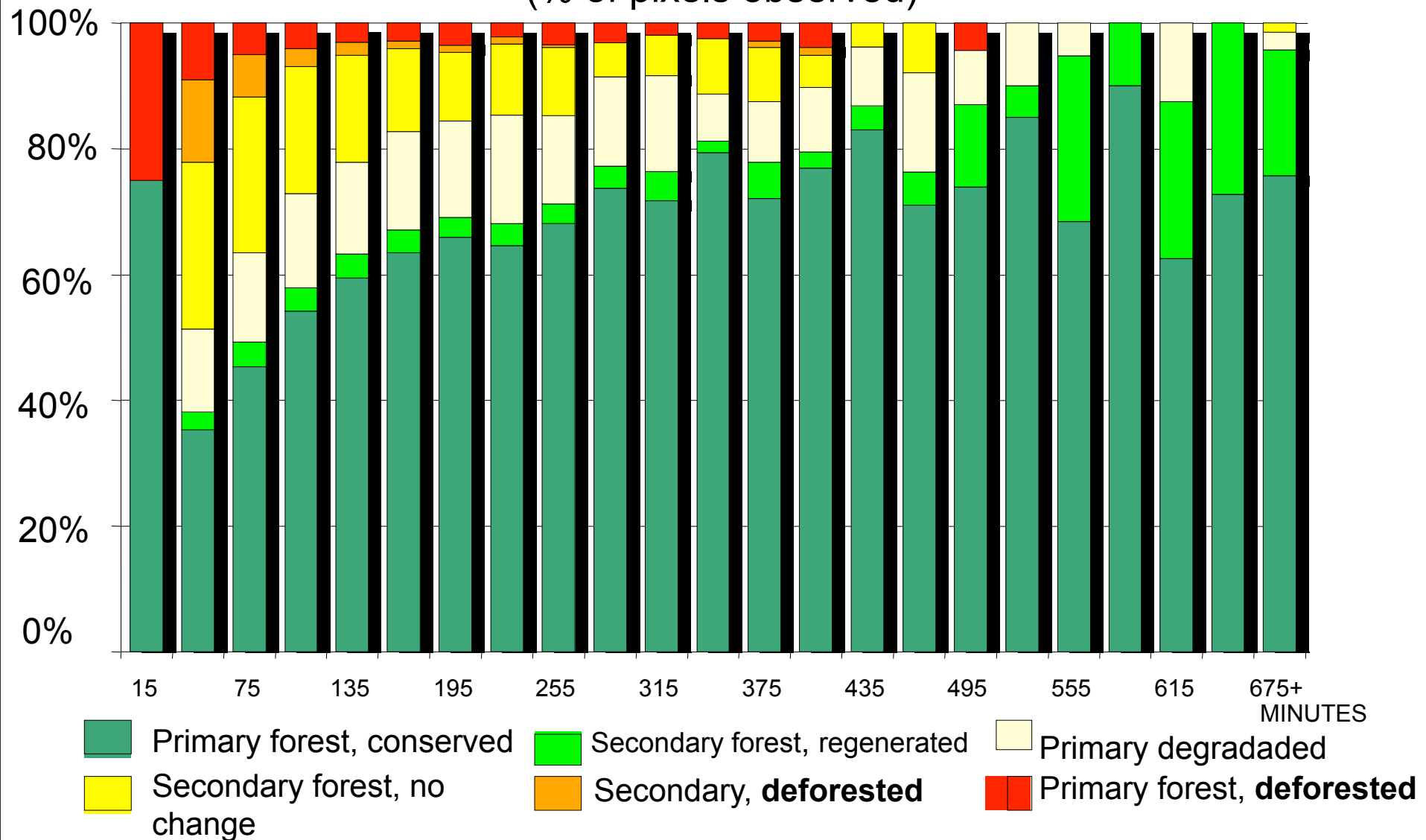
What explains deforestation?

Explanatory Variables (and its proxies):

1. Costs of access to local markets, labour
2. Costs of access to regional markets
3. Poverty and credit constraints of owners
4. Natural Protected Areas
5. Land productivity and slope (Agriculture vs Forestry)
6. PSAH or not PSAH
7. Prices of corn, cattle.
8. Forestry activity, forestry firms

Land use changes and distance to nearest local population center.

(% of pixels observed)



Econometric model to predict future deforestation

$$\text{PDEF} = \sum \begin{bmatrix} 0.36 * \text{BP} \\ 0.49 * \text{BPE} \\ 0.52 * \text{BEO} \\ 0.703 * \text{SB} \\ 0.49 * \text{SM} \\ 0.60 * \text{SA} \\ 0.34 * \text{VS} \\ 0.02 * \text{ALT} \\ -0.01 * \text{ALT}^2 \\ -0.07 * \text{PEND} \\ -0.04 * \text{ACC20} \\ -0.01 * \text{ACC250} \\ 0.76 * \text{DAGR} \\ 0.15 * \text{RMAIZ} \\ 0.13 * \text{MARG} \\ -0.24 * \text{ANP} \\ 0.06 * \text{PGAN} \\ 0.17 * \text{PMAIZ} \\ -4.28 \end{bmatrix}$$

PDEF: Probability of deforestation

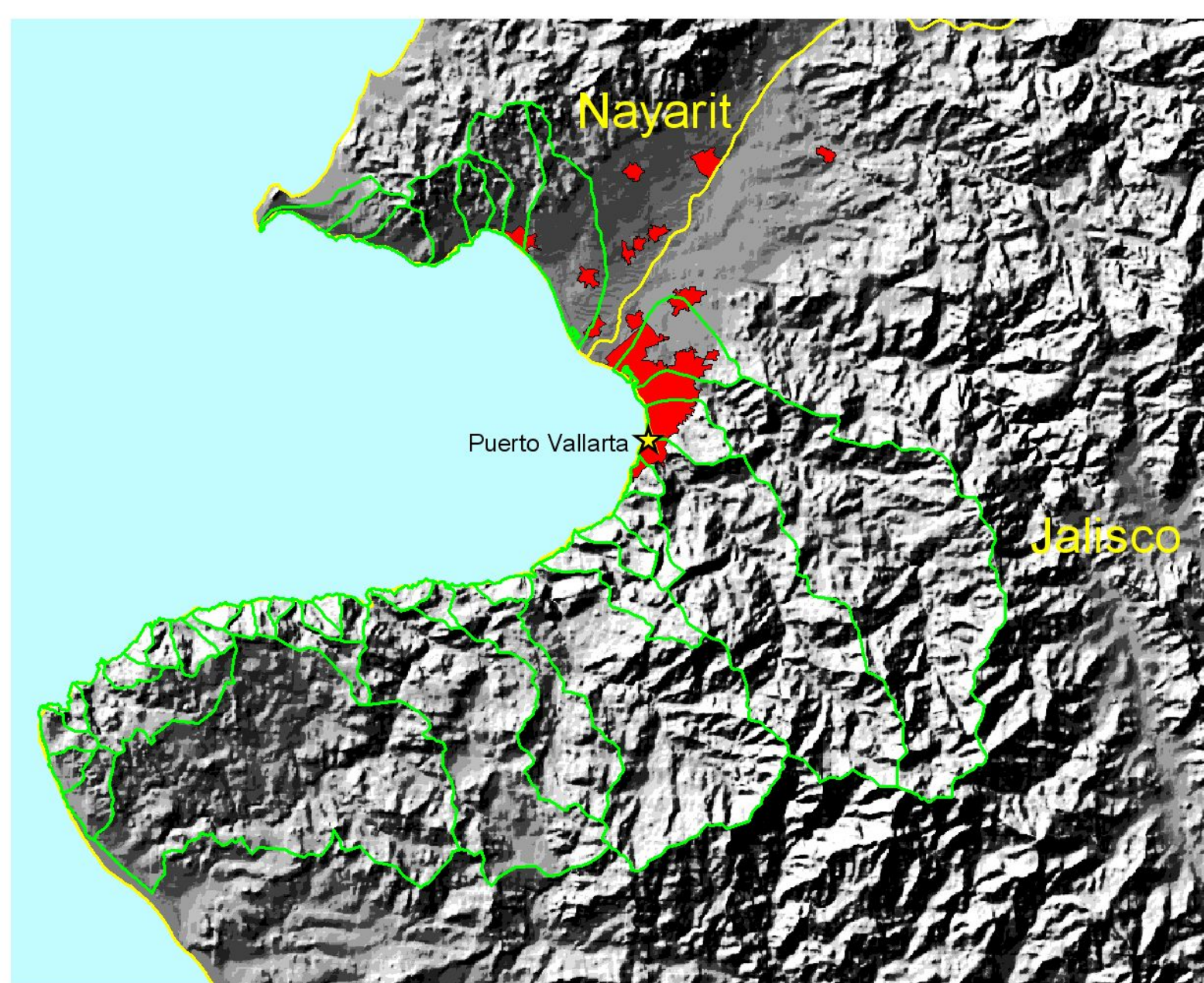
Donde:

- BMM: Cloudforest
- BP: Pine Forest
- BPE: Pine-Oak Forest
- BEO: Oak forests and others
- SB: Dry Tropical Forest**
- SM: Tropical Forest**
- SA: Rainforests**
- VS: Secondary vegetation
- ALT: Altitude
- ALT2: Altitude(squared).
- PEND: Slope
- ACC20: Travel distance to localities > 20,000 inhabitants
- ACC250: Travel distance to localities > 250,000 inhabitants
- DAGR: Agricultural density (plots around pixel)
- RMAIZ: Corn yield
- MARG: Average social marginality (poverty) in census tract**
- ANP: Natural Protected Area**
- PMAIZ: Regional white corn average price
- PGAN: Regional price for cattle

Deforestation risk index (Economic pressure index)

PUERTO VALLARTA

- ★ Localidad
- Cuencas
- División Estatal
- Zona Urbana



Puerto Vallarta

Jalisco



0 20 40 60 80 100 Kilometers

Econometric model to predict future deforestation

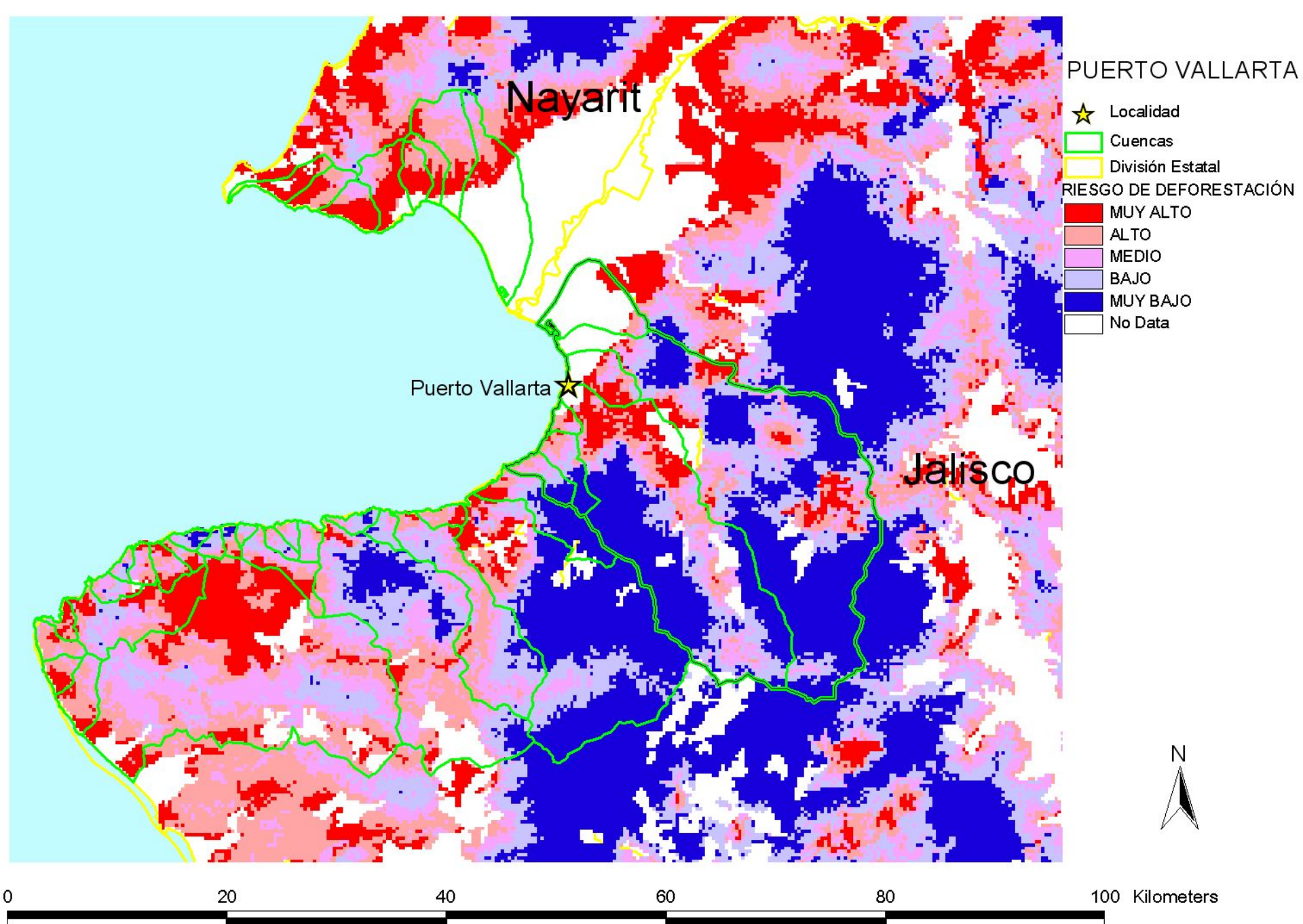
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Deforestation risk index (Economic pressure index)



How accurate is the prediction ?

Índice de Riesgo de Deforestación (Presión económica a la Deforestación) en Mexico **Quintiles (Versión 1.01)**

	Muy Bajo	Bajo	Medio	Alto	Muy Alto
<u>Observed</u> rate of deforestation (2000-2007)	0.3%	0.9%	1.8%	3.4%	7.8%

To evaluate PSAH:

- How does the rate of deforestation change, for equivalent plots, whenever these receive a payment for environmental services ?
- This can be answered to all combination of forests, according to ecosystem, location, marginality, environmental regulation, etc...

Example:

“Those cloudforests located half an hour away from the closest town, three hours away from the nearest city, with a slope of 15%, relatively fertile soil (2 tons/ha of corn yield), with a high level of marginality in the area, not declared a Natural Protected Area, were deforested at a rate of $x\%$ if they were not part of PSAH. However, those that did participate the full 4 years in PSAH had a deforestation rate of only $x\%$.”

Measuring the effect of PSAH: step 1

PSAH	Hectáreas Totales (miles)	Índice de <i>Riesgo</i> (Presión Eco) de Deforestación	Deforestación observada 2000-2007	
			k-has	%
Participantes	1,886	0.009	12	0.6%
No participantes	63,868	0.034	2,372	3.7%

- Por la realidad de costos de oportunidad más altos, y errores de focalización del programa se incorporaron superficies de medio y bajo riesgo de deforestación.
- Esta prueba es para los ejidos y comunidades que participaron entre 2003 y 2007, contratos de 5 años que en la ventana observada llevaban 2.4 años de operación

First step: compare deforestation rate observed in forests with/without PSAH.

PSAH	Observed Deforestation 2000-2007	
	k-has	%
Participantes	12	0.6%
No participantes	2,372	3.7%

Difference is due to the initial difference in deforestation risk index AND the effect of PSAH

How can these two effects be separated?

Expressing it mathematically

- $\text{Result} = A + B1(\text{variable}) + B2(\text{program}) + e$, where
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Building a counterfactual: *what would have happened*

PSAH	Deforestación observada 2000-2007		<u>Sin</u> PSAH se hubieran deforestado:	
	k-has	%	k-has	%
Participantes	12	0.6%	29	1.6%
No participantes	2,372	3.7%	2,372	3.7%

(Open Parenthesis...)

How good are our predictions?

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(...Close Parenthesis)

Building a counterfactual: *what would have happened*

PSAH	Deforestación observada 2000-2007		<u>Sin</u> PSAH se hubieran deforestado:		Deforestación Evitada por el PSAH (con respecto a la observada)	
	k-has	%	k-has	%	k-has	%
Participantes	12	0.6%	29	1.6%	17	1.0%
No participantes	2,372	3.7%	2,372	3.7%		

En términos de Reducir Emisiones de CO₂e por Deforestación Evitada (REDD)

Tipo de Bosque	Deforestación evitada por el PSAH	Tons/ha de CO2 liberadas por encima del suelo (descomposición de biomasa, quema de biomasa en el lugar y en otro lugar)		Tons/ha de CO2 (en el <u>suelo</u>)		Emisiones de CO2e evitadas gracias al PSAH (tons)
		Bosque Primario	Bosque Secundario	Bosque Primario	Bosque Secundario	
Pino y otras coníferas	2,277	113	20	63	63	339,378
Pino-Encino y Encino-Pino	4,501	83	28	89	87	691,661
Mesófilo	435	58	11	69	87	49,158
Encino y otros	2,510	58	11	69	87	290,521
Selva baja	1,546	24	18	70	160	215,774
Selva mediana	4,476	125	34	177	176	979,180
Selva alta	1,644	125	34	177	176	392,837
Total	17,389					2,958,509

Not bad, but small. Could have done better?

Fact:

Those selected for PSAH in 2003-2006 were not among the ones at higher risk (due to aforementioned targeting failure)

PSAH	Totales Hectares (thousands)	Deforestation Risk Index (1990s based)
Participants	1,886	0.009
Non participants	63,868	0.034

Second Step: Use econometric model to predict what would have happened in both type of forests...



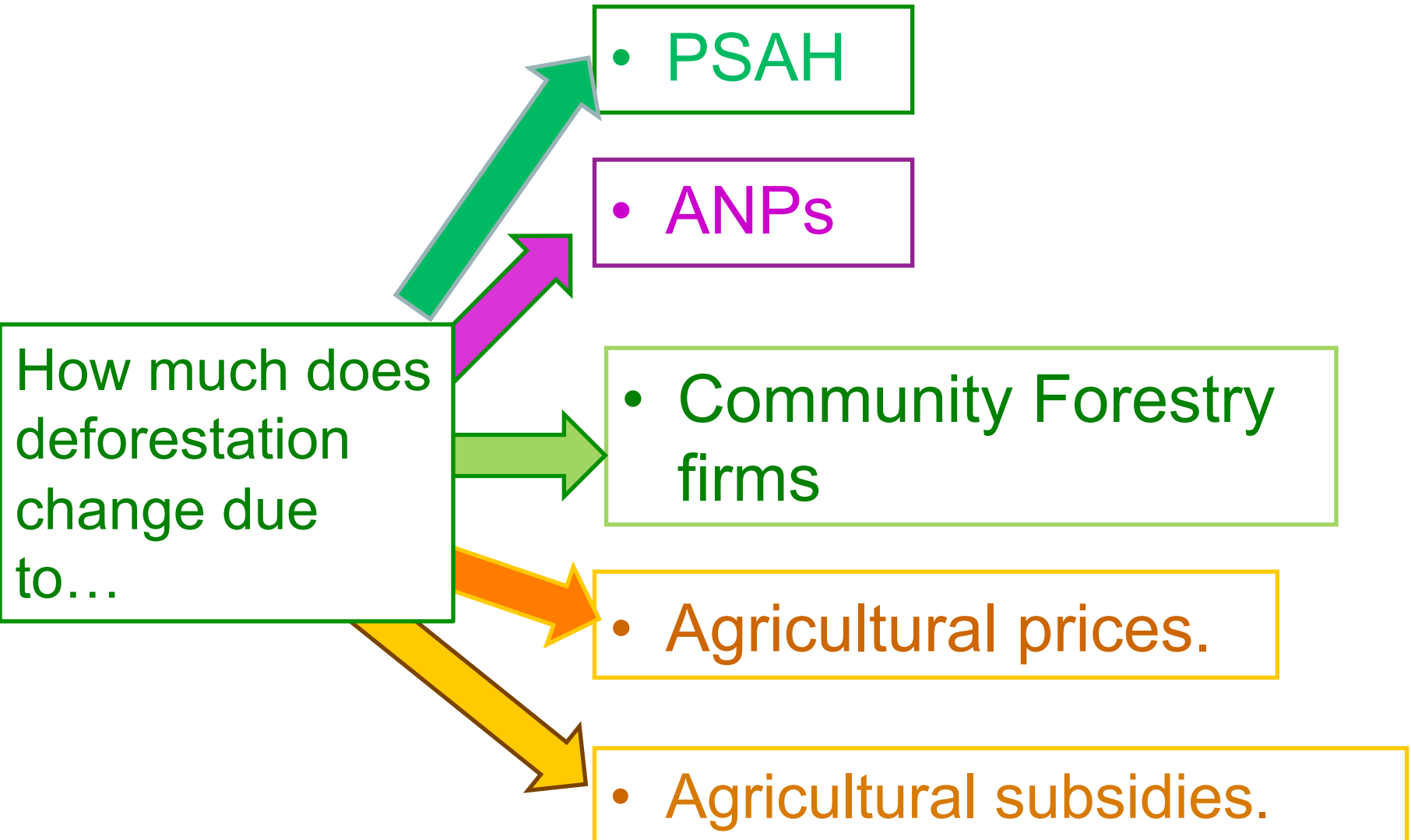
PSAH	Observed Deforestation 2000-2007		Without PSAH they would have deforested in ...		Deforestation Avoided by PSAH (with respect to the observed one)	
	k-has	%	k-has	%	k-has	%
Participantss	12	0.6%	30	1.6%	18	1.0%
No participantss	2,372	3.7%	2,372	3.7%		

New question:

Q6:

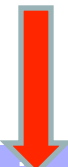
**Can other programs be
evaluated also?**

What can be tested?



The same approach to evaluate other programs:

Case: Natural Protected Area System



Hectáreas declaradas como ANPS	Total Area	Observed Deforestation 2000-2007		Predicted Deforestation 2000-2007		Without NPA deforestation would have been...		Avoided Deforestation thanks to NPA status	
	k-has	k-has	%	k-has	%	k-has	%	k-has	puntos%
Natural Protected Areas (federal)	6,099	75	1.2%	77	1.3%	114	1.9%	37	0.6%
Naturales Areas not protected	59,654	2,308	3.9%	2,086	3.5%	2,086	3.5%	0	0%
Total	65,753	2,384	3.6%	2,163	3.3%	2,200	3.3%		

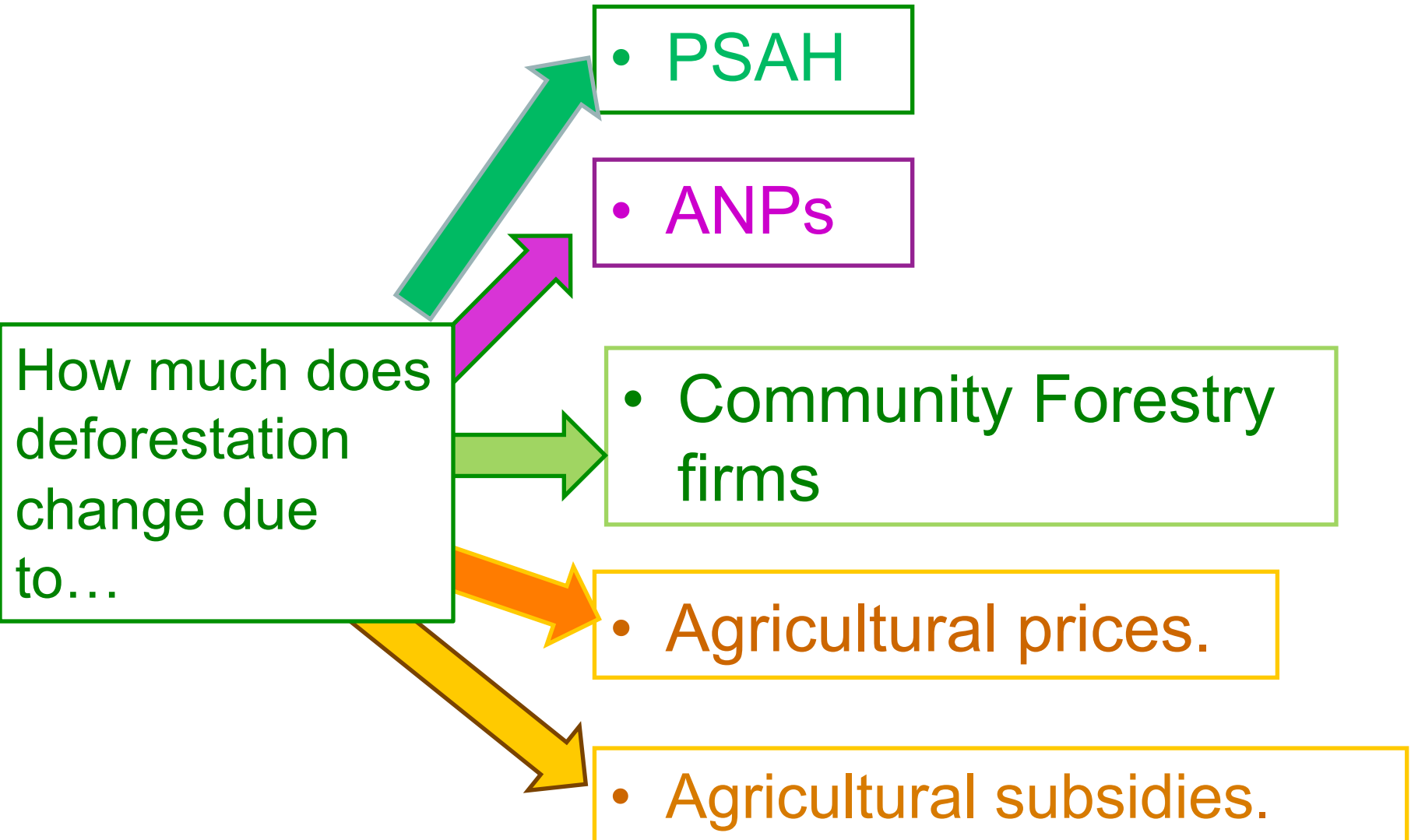
In terms of **REDD**, the effects of each program are summed...

Pine Forest	Emisiones de CO2e evitadas gracias al PSAH 2000-2007(tons)	Emisiones de CO2e evitadas gracias al SINANP 2000-2007 (tons)
Pine –Forest	268,607	328,358
Oak-Pine Forest	539,251	1,267,053
Oak Forest	217,074	1,163,208
Cloudforest	29,635	40,782
Dry Tropical Forest	154,572	1,992,598
Medium Tropical Forest	599,930	1,749,648
Rainforest	516,327	1,586,506
Total	2,325,396	8,128,154

Type of programs that could be evaluated according to their **Avoided** or **Induced Deforestation**

1. Payment for Environmental Services: **PSAH**
2. Strategic Support for development of Community Forestry Firms:
 - Timber (Procymaf, Prodefor)
 - Ecotourism, Hunting
3. Regulation: Ej: **ANPs**, **Enforcement**.
4. Support for activities that expand the agricultural frontier:
 - Cattle ranching (PROGAN: direct payments)
 - Agriculture (irrigation, fuel, other inputs)

What can be tested?



Probability of Deforestation depends on:

Variable	Unidad	Coeficiente estimado	Cambio mrg en probabilidad	Signif> 90%
Constant		-2.12		Sí
Distance to nearest town	Minutos	-0.0038	-0.0001	Sí
Distance to nearest city	Minutos	-0.0005	-0.000012	Sí
Marginación de población local	Nivel [0 , 5.5]	0.09	0.003	Sí
Average Yield of Corn in AGEB	Tons/ha	-0.02	-0.0007	NO
Slope	%	-0.013	-0.0003	Sí
Agricultural Frontier	Proporción de píxeles alrededor	0.64	0.02	Sí
Natural Protected Area	Está en una	-0.30	-0.006	Sí
Sustainable Forestry Management Plan	Ejido tiene o no	-0.42	-0.007	Si
PSAH	Participa Si/ No	-0.47	-0.008	Sí

Estados: D.F., Estado de México, Morelos, Oaxaca, Puebla, Querétaro, Veracruz.

Support for Cattle Ranching: PROGAN

- Subsidies during a 4 year period: A total of US\$145 per animal.
- Conditioned to improving ranching practices. Efficiency.
- A budget of US\$800 million per year

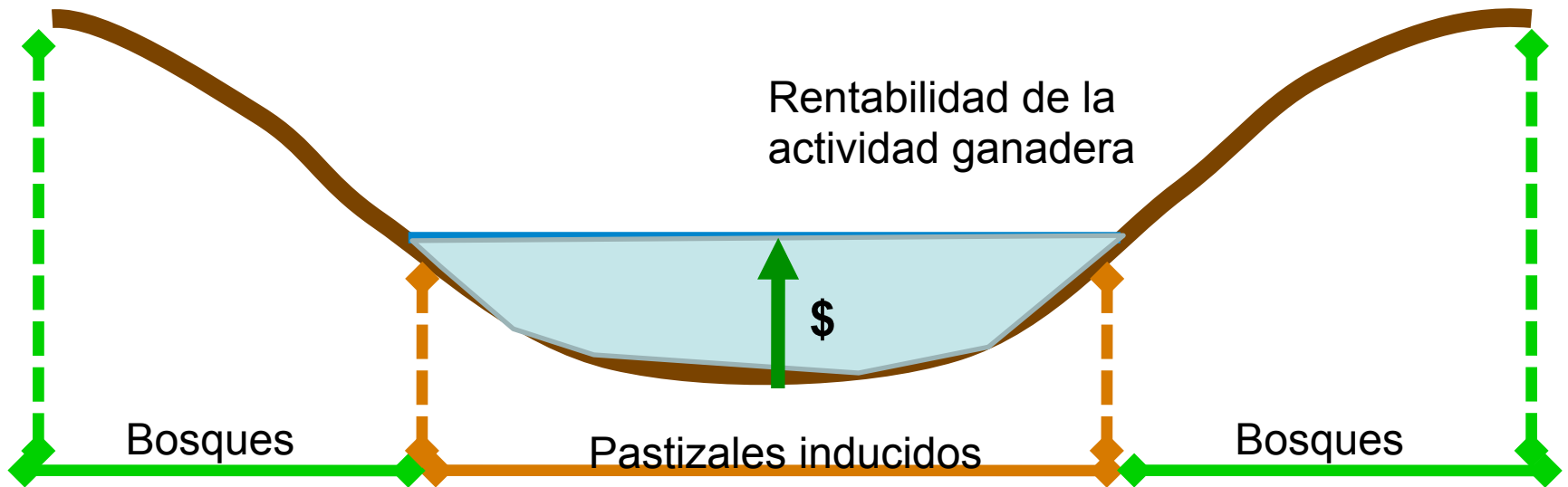
PROGAN (2003-2007)

- Los participantes recibieron **4 pagos** durante el período 2003-2007.
-

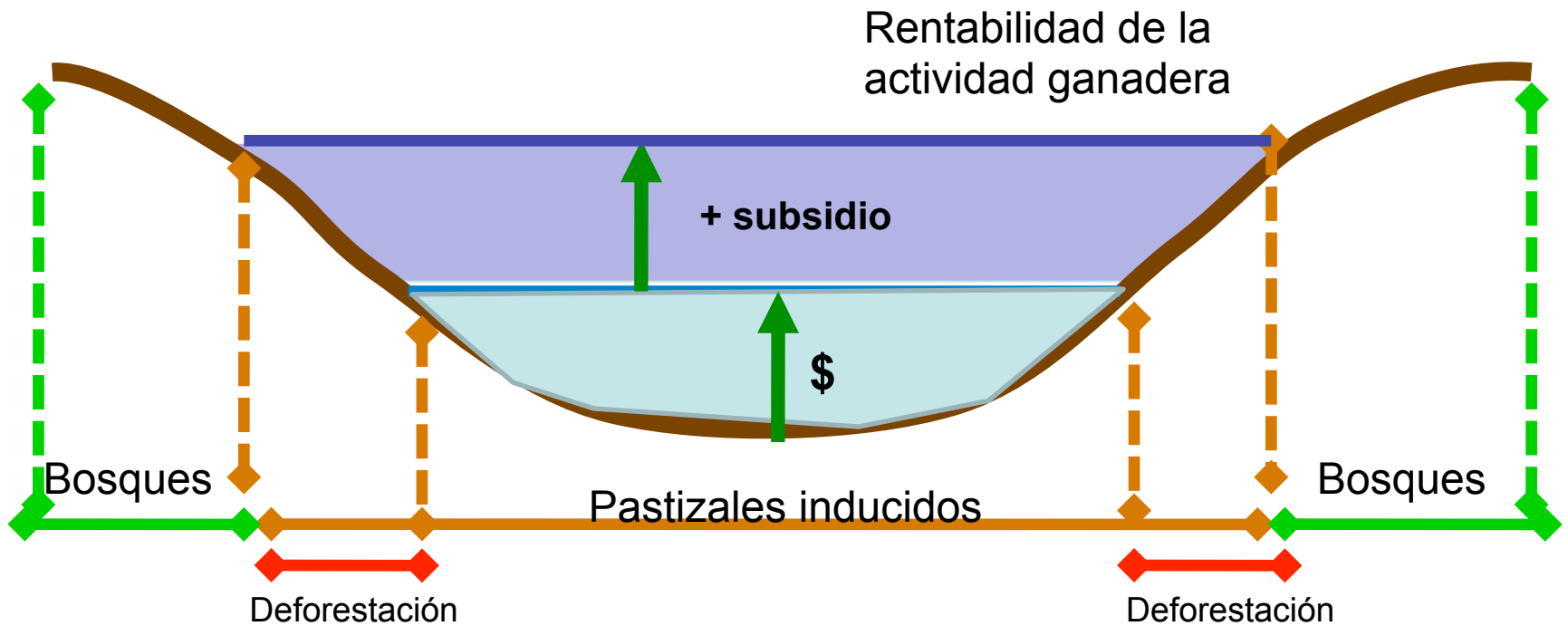
- El primer año recibieron \$300 por vientre (vaca), el segundo \$400, el tercero \$500 y el cuarto \$600. En total, **\$1,800** por vientre durante todo el período.
 - Se exigía la realización de una serie de prácticas pecuarias previamente acordadas.
 - Si incumplían algún compromiso del contrato se suspendía su pago hasta que cumplieran.
-

- Los subsidios del programa fueron cerca de \$8.8 mil millones de pesos.

Antes del subsidio



Después del subsidio



Pero las EFC no surgen en cualquier bosque

- Planes de Manejo en ejidos y comunidades, por ecosistema y superficie forestal (muestra ENNAF 2010).

Tamaño (has de bosque)	Ecosistema Forestal		
	Pino	Encino o Mesófilo	Selvas varias
< 100	0%	0%	0%
100-500	44%	0%	17%
500-1,000	77%	25%	0%
1,000-2,000	46%	50%	8%
>2,000	74%	25%	31%
TOTAL	65%	24%	16%

Fuente: ENNAF 2010.

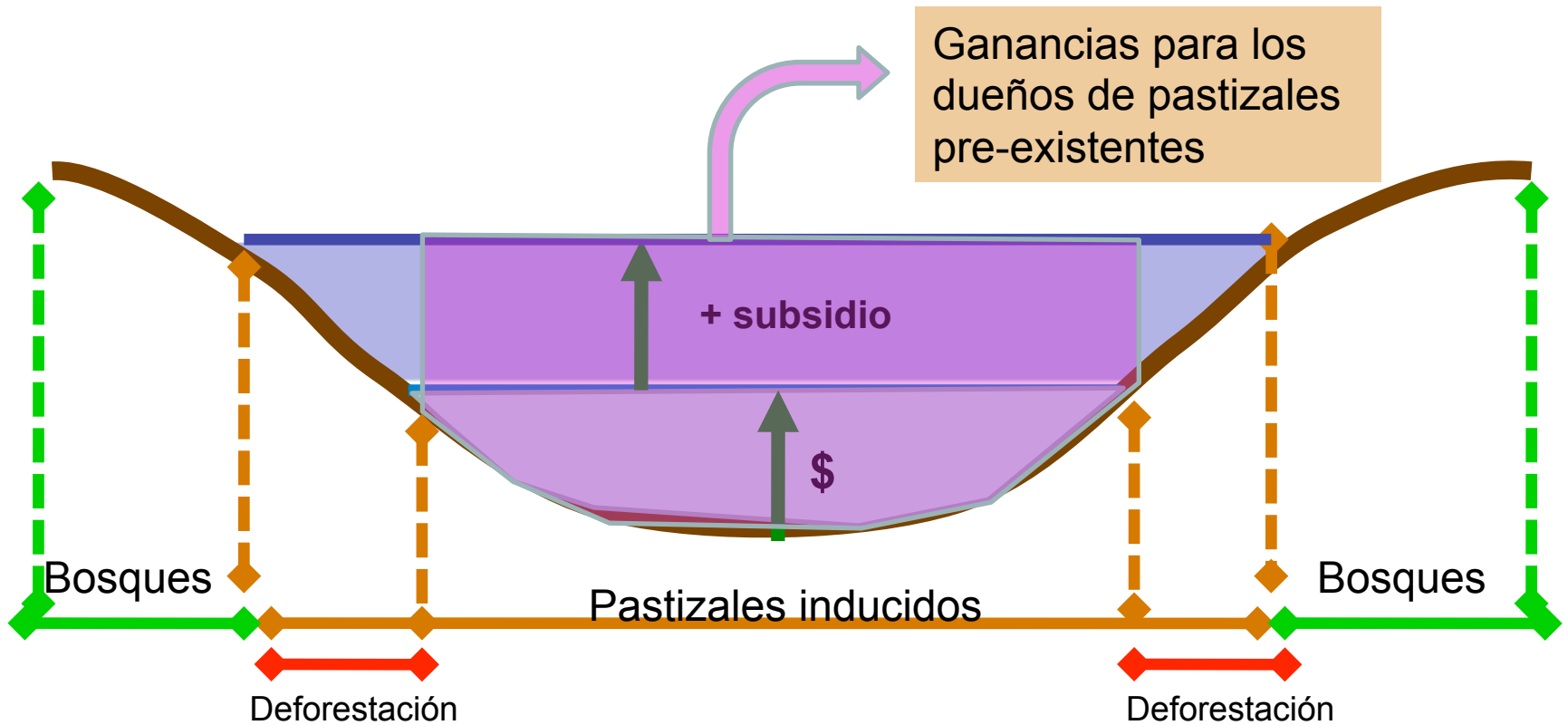
Por lo tanto apoyo estratégico focalizado

❖ Patrón: *La deforestación va a ocurrir principalmente en los predios sin negocio forestal. En algunos sitios será difícil que surjan estos negocios.* Reorganizar la estrategia de políticas públicas alrededor de esto.

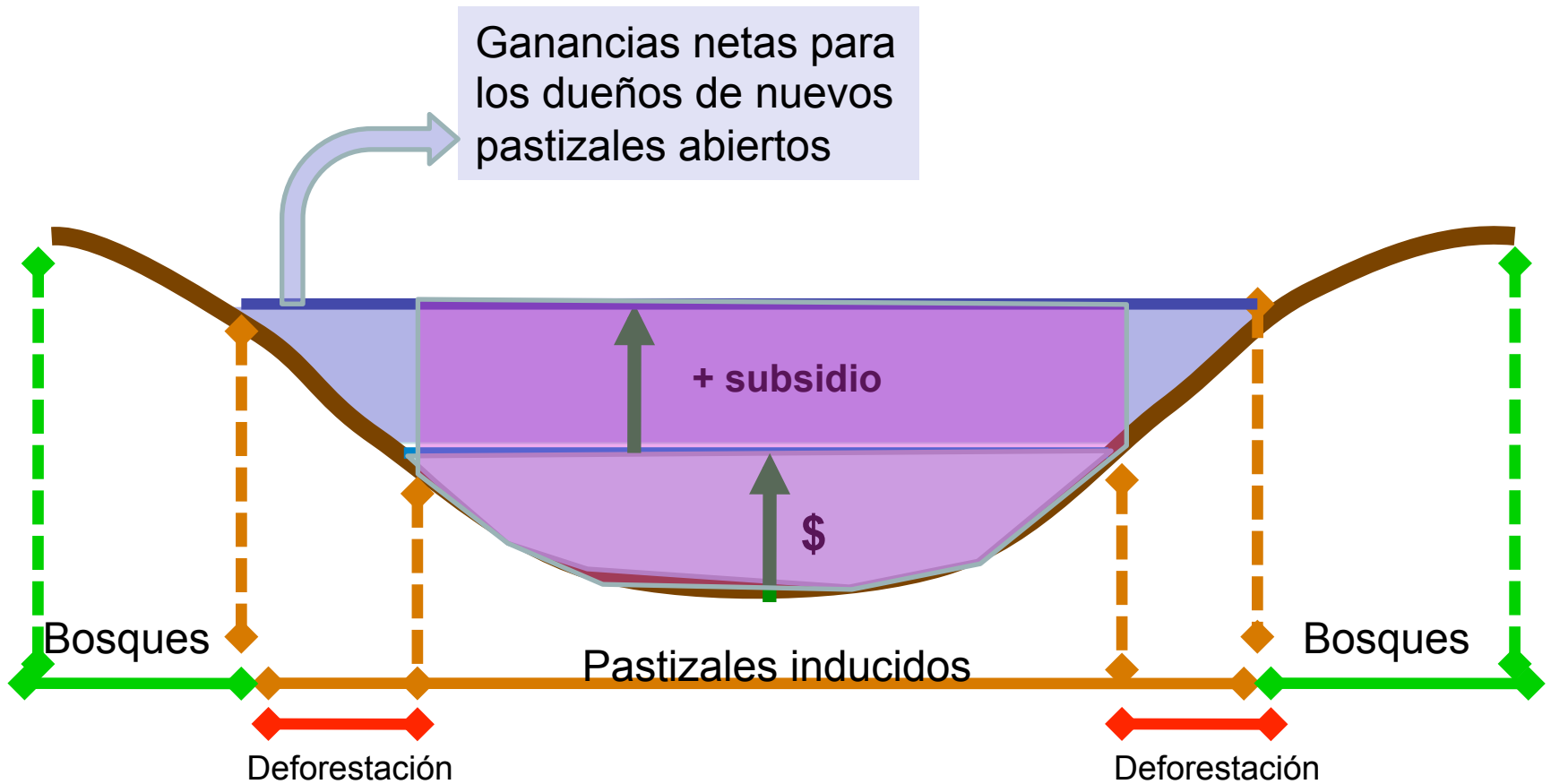
Estrategia actual:

1. En **Prodefor** se apoya a los que ya tienen negocio forestal o muy cerca.
2. En **Procymaf** se impulsa aquellos que se esperaba que tuvieran, pero no tienen, EFC, por restricciones de Kh.
3. En el **PSAH** se acota su participación, debido a que éstos ya generan ingresos.

Después del subsidio



Después del subsidio



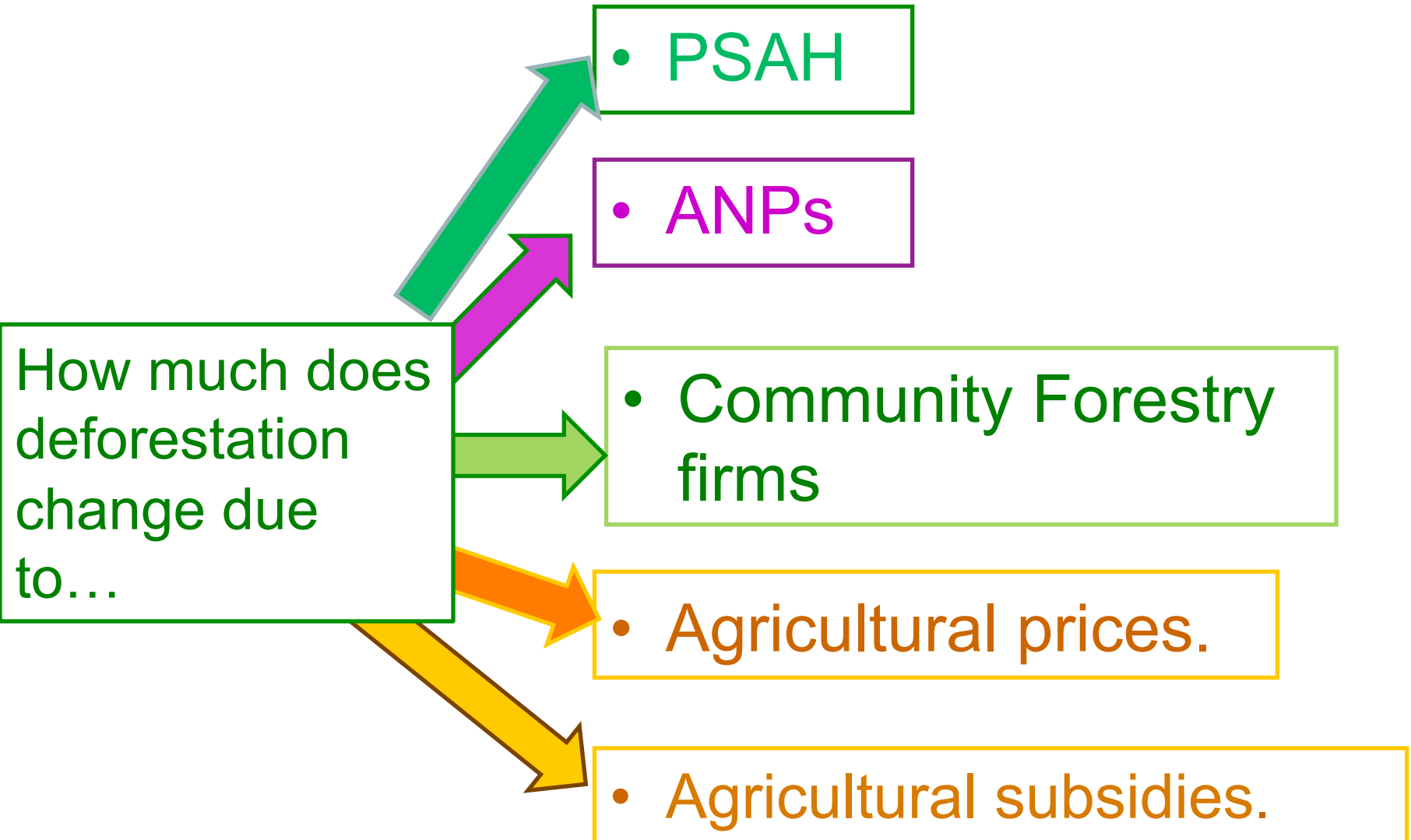
Probabilidad de Deforestar depende de:

Variable	Unidad	Coeficiente estimado	Cambio mrg en probabilidad	Signif> 90%
Constante		-3.60		Sí
LN Distancia a poblado más cercano	Minutos	-0.201	-0.008	Sí
LN Distancia a ciudad más cercana	Minutos	-0.079	-0.003	Sí*
Marginación de población local	Nivel [0 , 5.5]	0.13	0.006	Sí
Productividad media del maíz en AGEb	Tons/ha	0.142	0.006	Sí
LN Pendiente del terreno	%	-0.073	-0.003	Sí
Frontera Agrícola	Proporción de píxeles alrededor	0.669	0.028	Sí
ÁNP	Está en una	-0.226	-0.008	Sí
PROGAN	Monto promedio por hectárea	0.001	0.00004	Si
PSAH	Participa Si/ No	-0.246	-0.008	Sí

En términos de **REDD**, los efectos de cada programa se van sumando (o restando)...

Tipo de Bosque	Emisiones de CO2e evitadas gracias al PSAH 2000-2007(tons)	Emisiones de CO2e evitadas gracias al SINANP 2000-2007 (tons)	Emisiones de CO2e inducidas debido a PROGAN 2003-2006 (tons)
Pino y otras coníferas	339,378	235,710	1,178,449
Pino-Encino y Encino-Pino	691,661	1,028,499	2,859,441
Mesófilo	49,158	34,570	246,184
Encino y otros	290,521	939,009	3,064,754
Selva baja	215,774	1,783,331	15,879,039
Selva mediana	979,180	746,579	15,044,954
Selva alta	392,837	846,723	9,263,739
Total	2,958,509	5,614,422	47,536,560

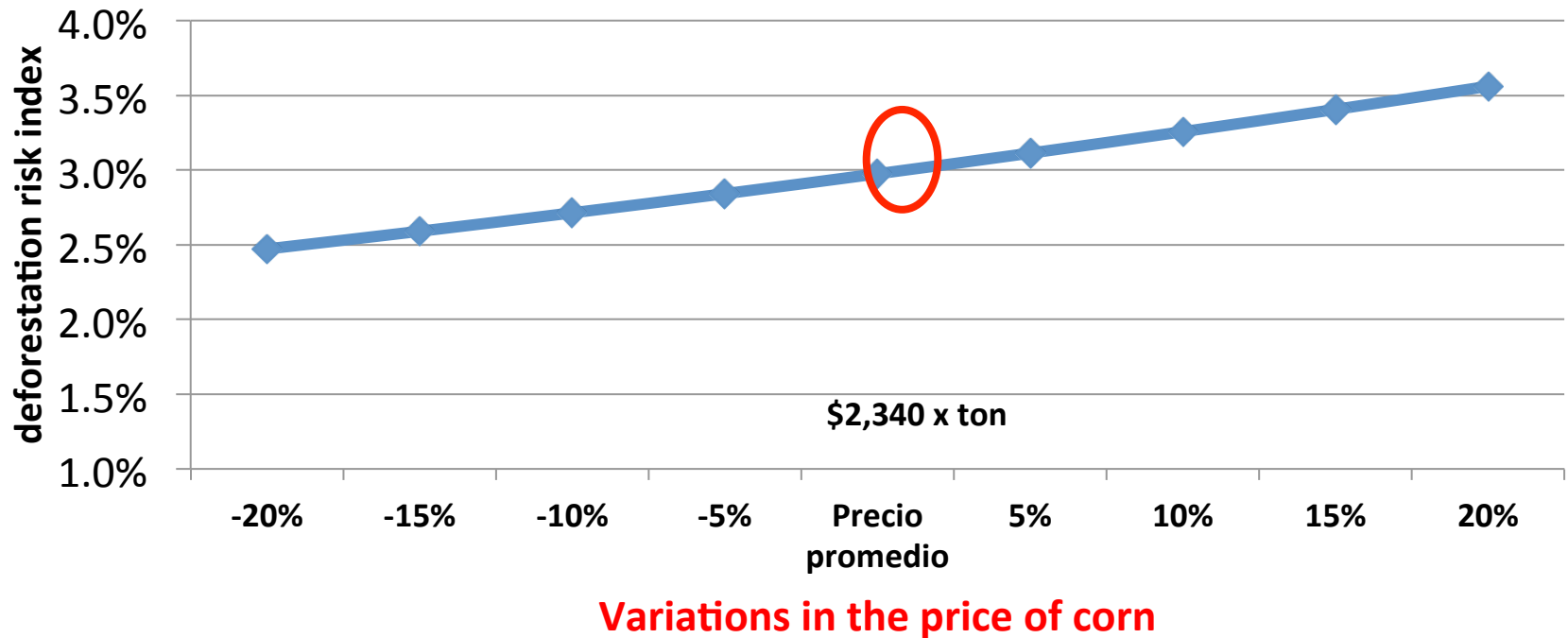
What can be tested?



Agricultural Prices

- Profitability of agriculture (P-C)

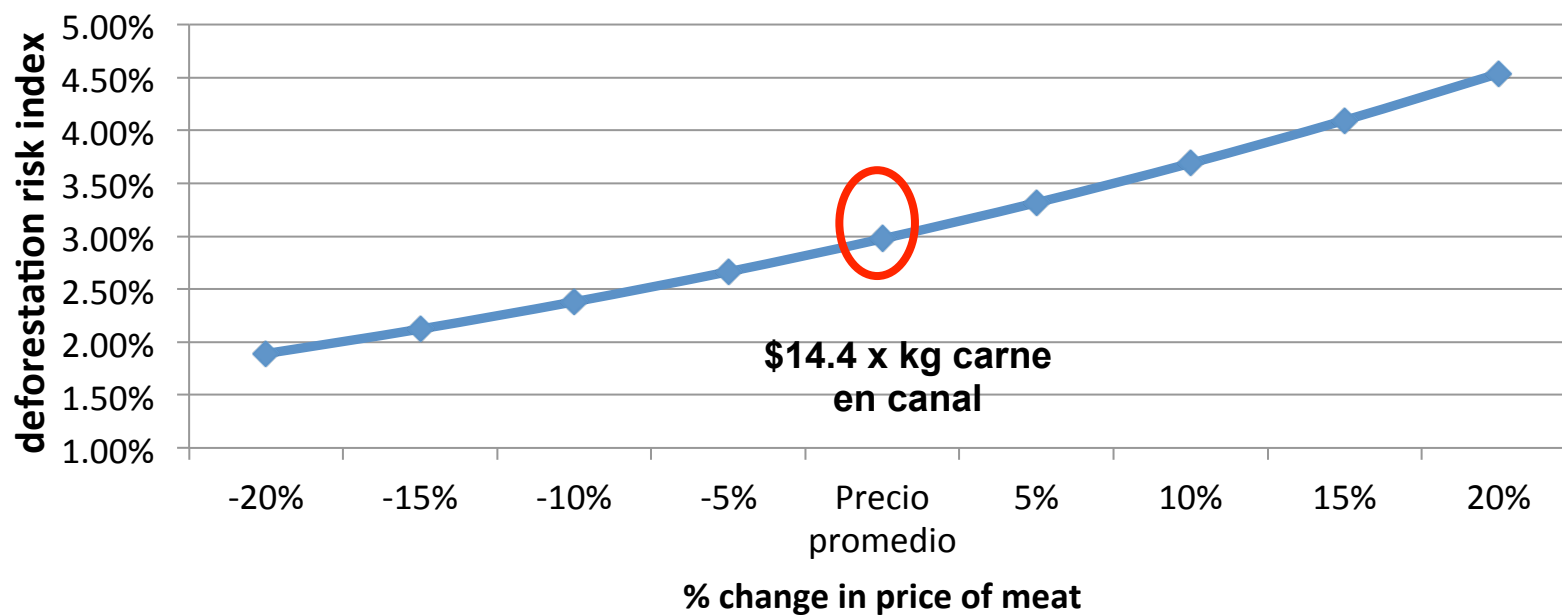
Deforestation



Cattle prices

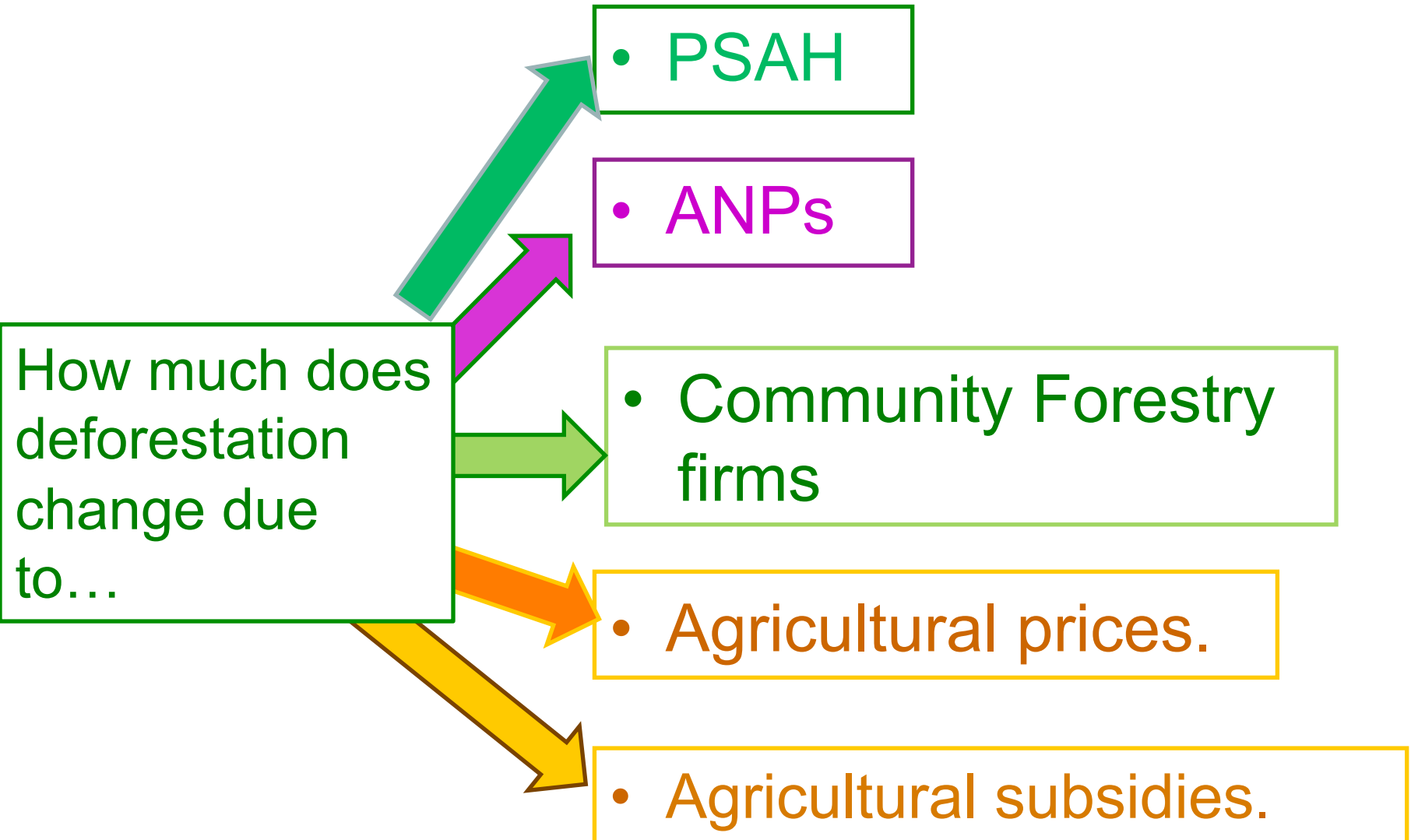
- Cattle ranch profitability (P-C)

Deforestation



Precio de ganado en pie (\$/kg)

What can be tested?



Evidencia de **cuánto** la silvicultura comunitaria reduce los incentivos a la deforestación

H_1 : Planes de Manejo y Empresas Forestales comunitarias hacen rentable al bosque y plt reducen la tasa de deforestación.

Modelo INE-IRDf (info sólo para 9 Estados)

Coefficiente estimado: -0.22

- Estos predios con Plan de Manejo hubieran tenido deforestación de 2.2% en el periodo, pero sólo tuvieron una tasa de 1.4%

Probabilidad de Deforestar depende de:

Variable	Unit	Coeficiente estimado	Cambio mrg en probabilidad	Signif> 90%
Constante		-2.65		Sí
Distancia a poblado más cercano	Minutos	-0.0039	-0.0001	Sí
Distancia a ciudad más cercana	Minutos	-0.00005	-0.000002	No
Marginación de población local	Nivel [0 , 5.5]	0.11	0.004	Sí
Productividad media del maíz en AGEb	Tons/ha	0.16	0.006	Sí
Pendiente del terreno	%	-0.0048	-0.0002	Sí
Frontera Agrícola	Proporción de píxeles alrededor	0.73	0.0277	Sí
Área Natural Protegida	Está en una	-0.17	-0.006	Sí
PROGAN	Monto promedio por hectárea	0.00097	0.00004	Si
PSAH	Participa Si/ No	-0.25	-0.007	Sí

In terms of **REDD**, the effects of each program are summed and subtracted

Tipo de Bosque	Emisiones de CO2e evitadas gracias al PSAH 2000-2007(tons)	Emisiones de CO2e evitadas gracias al SINANP 2000-2007 (tons)	Emisiones de CO2e inducidas debido a PROGAN 2003-2006 (tons)
Pino y otras coníferas	268,607	328,358	897,605
Pino-Encino y Encino-Pino	539,251	1,267,053	2,204,709
Mesófilo	29,635	40,782	195,302
Encino y otros	217,074	1,163,208	2,303,659
Selva baja	154,572	1,992,598	13,452,319
Selva mediana	599,930	1,749,648	11,828,834
Selva alta	516,327	1,586,506	7,400,677
Total	2,325,396	8,128,154	38,283,105

thank you...

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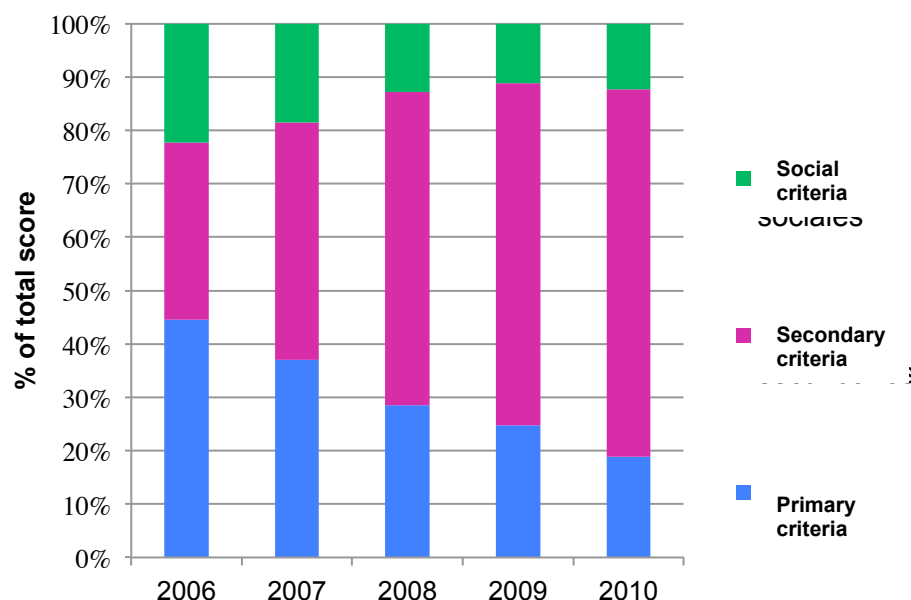
Papers at: <https://goo.gl/bUVN2U>

The targeting challenge

Existing criteria

Primary criteria have lost relevance and compete with other that are no so relevant

- To generate sinergies with other programs and make easy the administration of the program it has been included new secondary criteria reducing the importance of the primary criteria

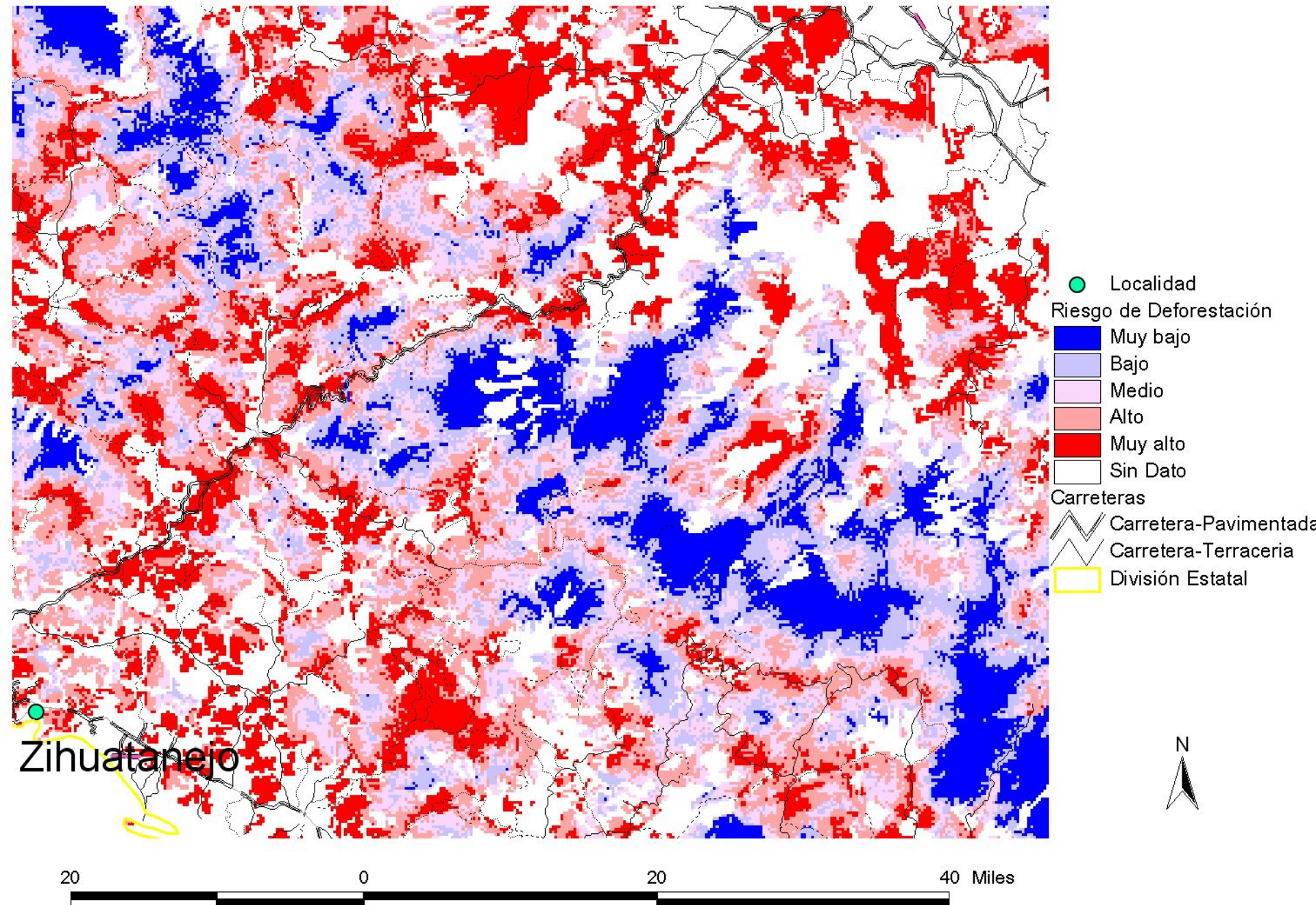


- The increase of the selection criteria and the total score possible make the targetting process losses efectiveness to comply the primary objectives of the program

	2006	2010
Criteria	9	26
Total score	45	106

Fuente: Reglas de Operación ProÁrbol

Guerrero



Q7:

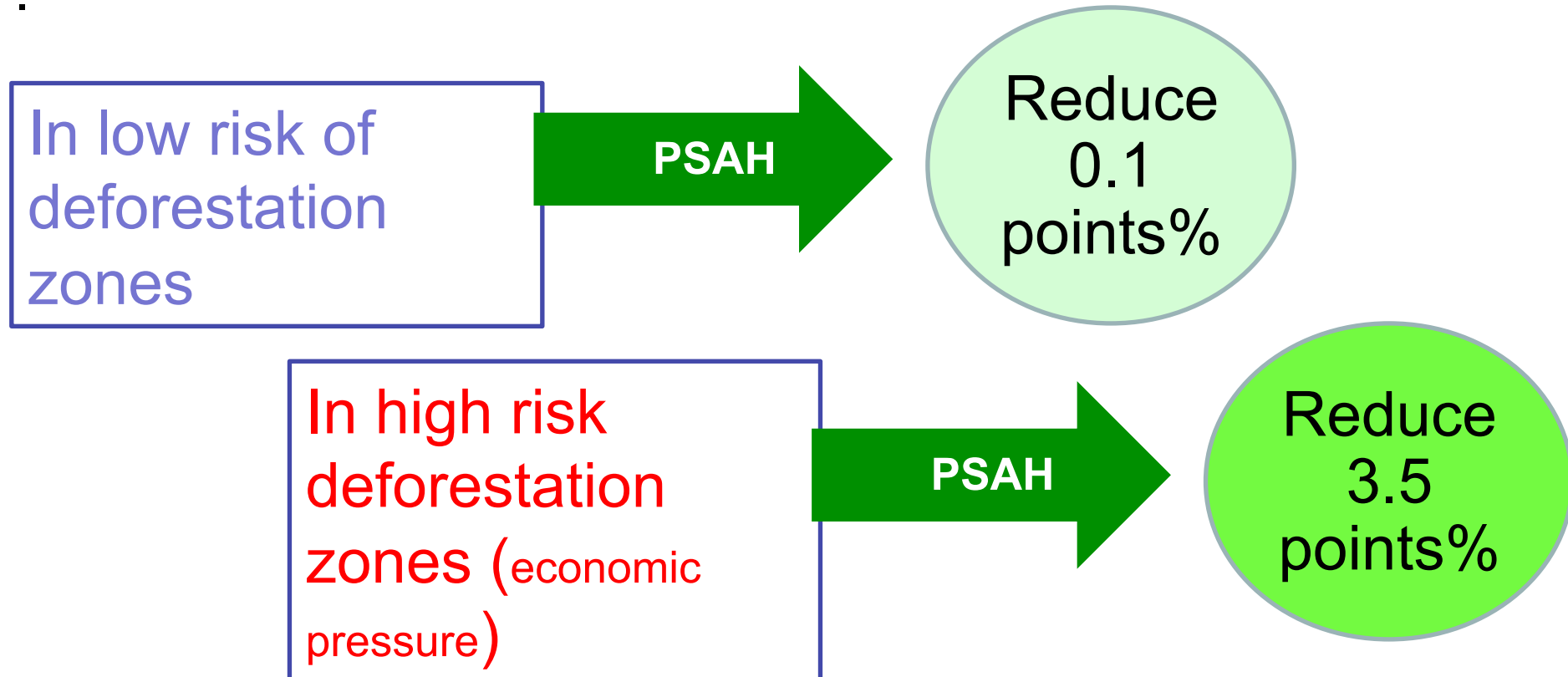
If there are different opportunity costs,
should the program differentiate
payments?

Higher opportunity cost, higher payment receive



Targetting makes a great difference

- If the program have accepted all those applicants of high and very high rate of deforestation, in the important hydrological zones the avoided deforestation would be double of the observed deforestation.



thank you...

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