

Application of Remote Sensing in Law Enforcement

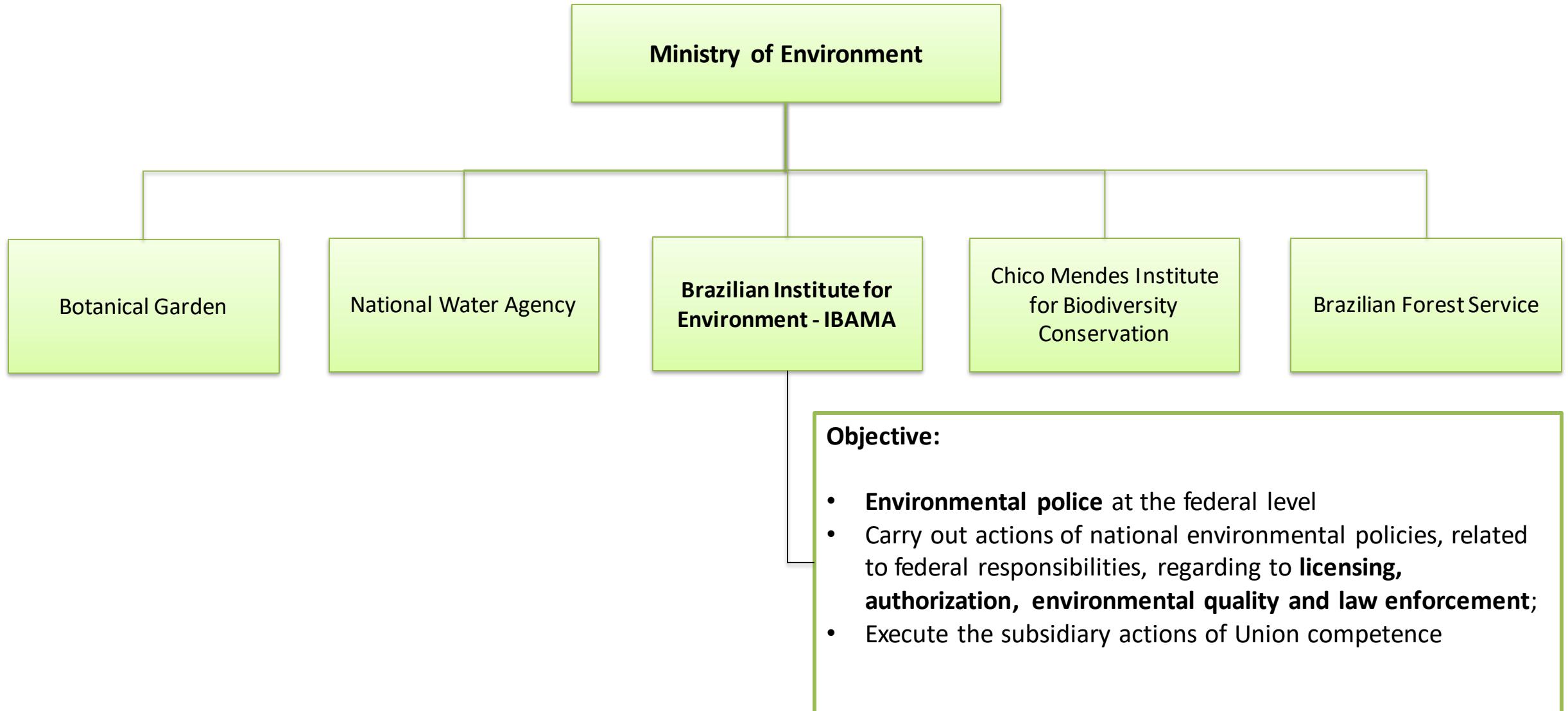
George Porto Ferreira

Environmental Analyst

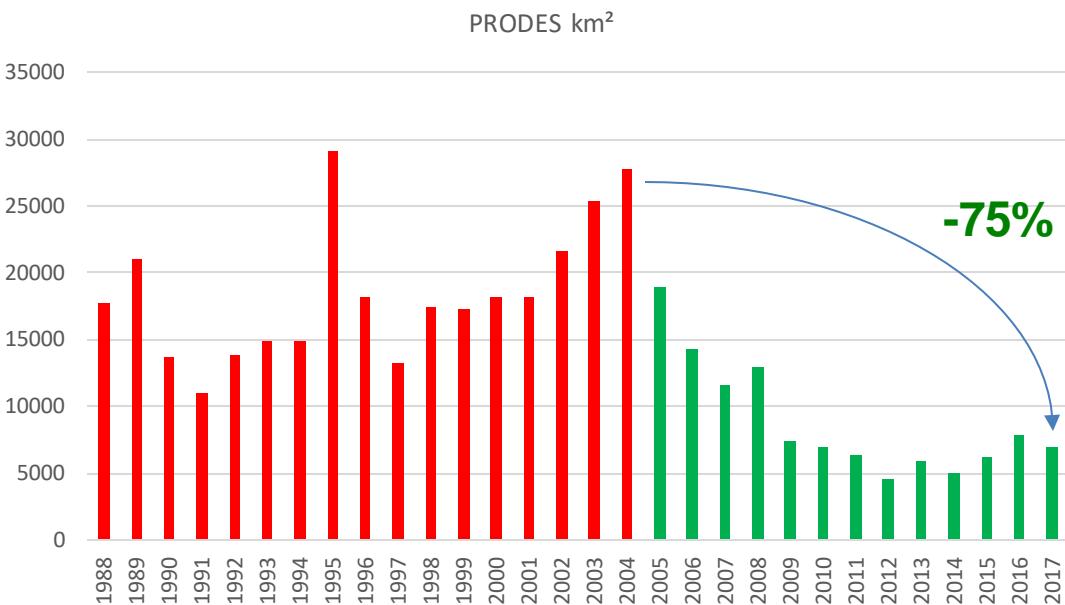
General-Coordinator for Environmental Monitoring and Information

WASHINGTON, OCTOBER 25, 2018

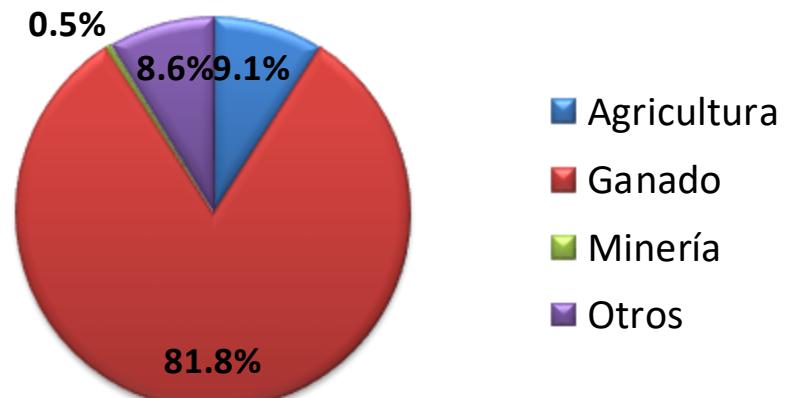
Federal Environmental Agencies



Deforestation in the Amazon

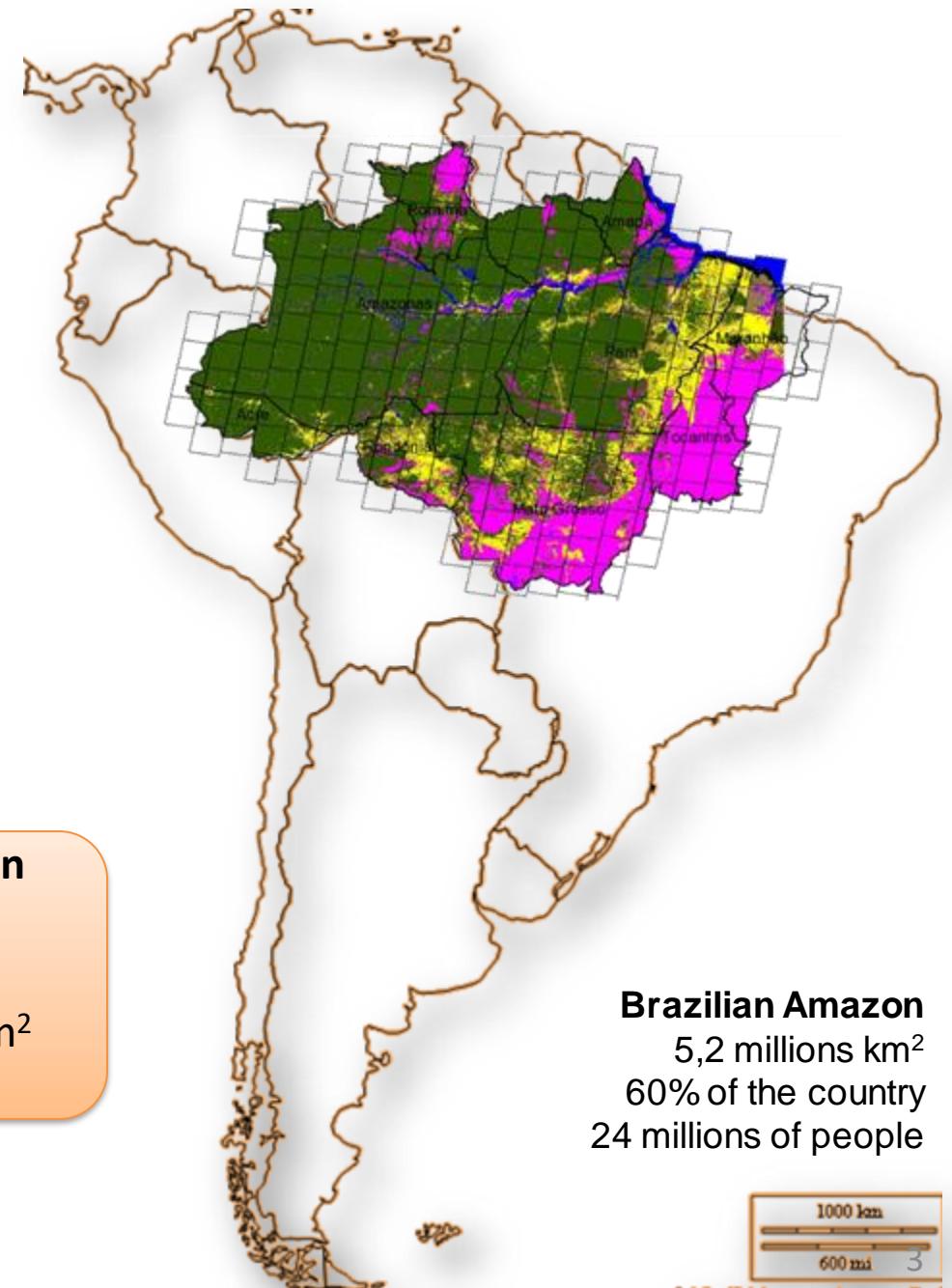


Deforestation Motivation



Illegal deforestation reduction targets

2020 → 3.925 km²
2030 → 0 km²



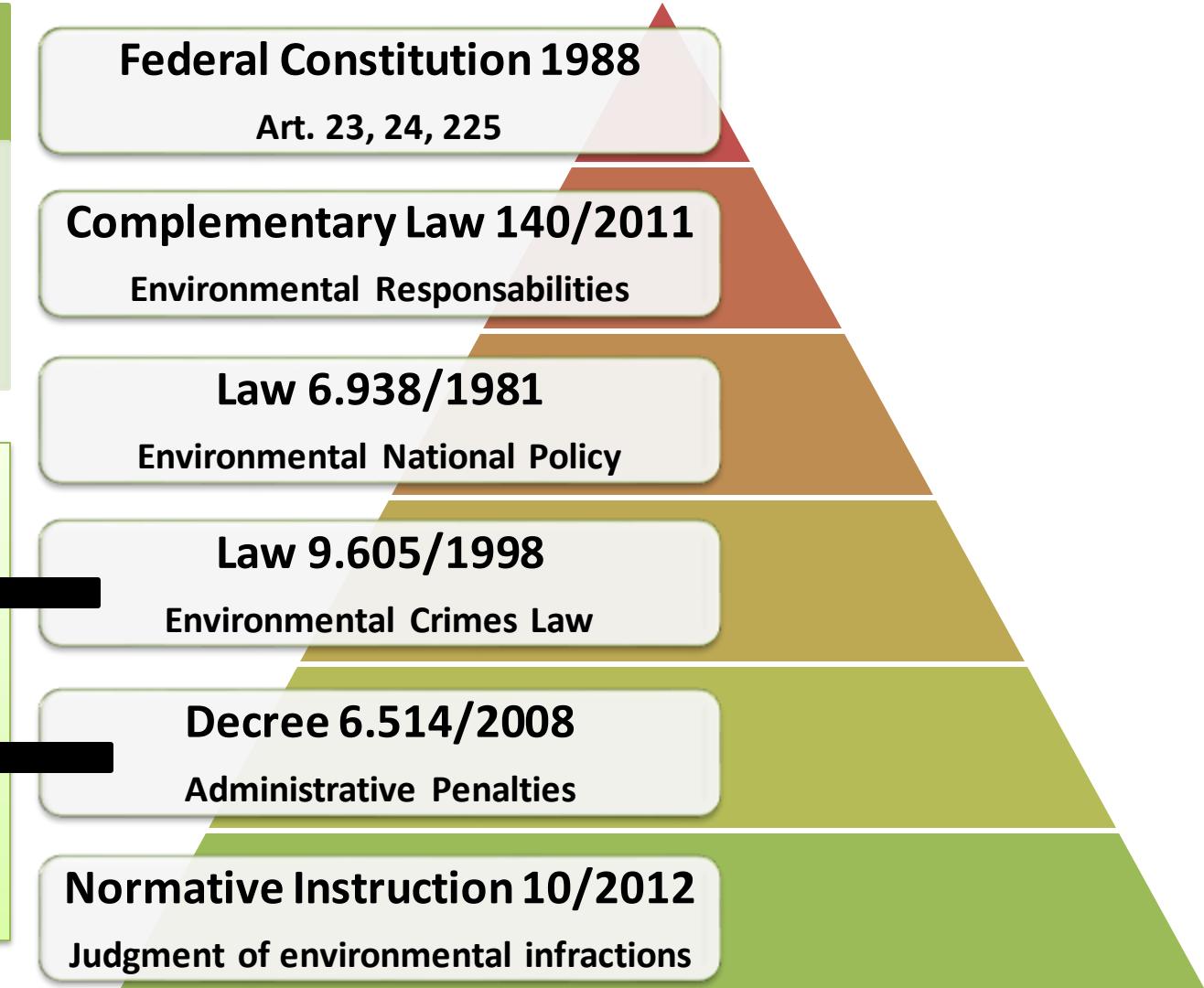
Brazilian Amazon
5.2 millions km²
60% of the country
24 millions of people



Punitive legislation

Administrative	Criminal	Civil
<ul style="list-style-type: none">• IBAMA• State Agencies• Municipal Agencies	<ul style="list-style-type: none">• Federal Police• State Police• Public ministry	<ul style="list-style-type: none">• IBAMA• Public ministry• Others

Administrative Penalties
<ul style="list-style-type: none">• Formal Warning• Simple or diary fine (R\$ 50 a R\$ 50.000.000 / U\$ 15 a U\$ 15.000.000)• Apprehension of goods and products• Destruction of goods and products• Demolition• Interdiction• Sales and manufacturing suspension• Rights restriction

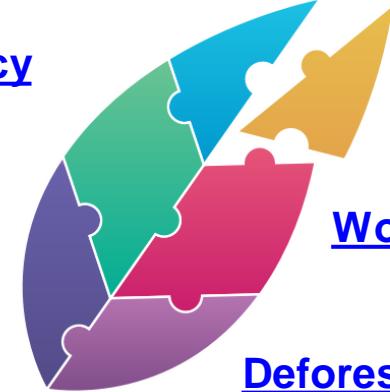


Rules and regulation

Forest Control National System- Sinaflor



Transparency



Forestry exploitation

Wood transportation control

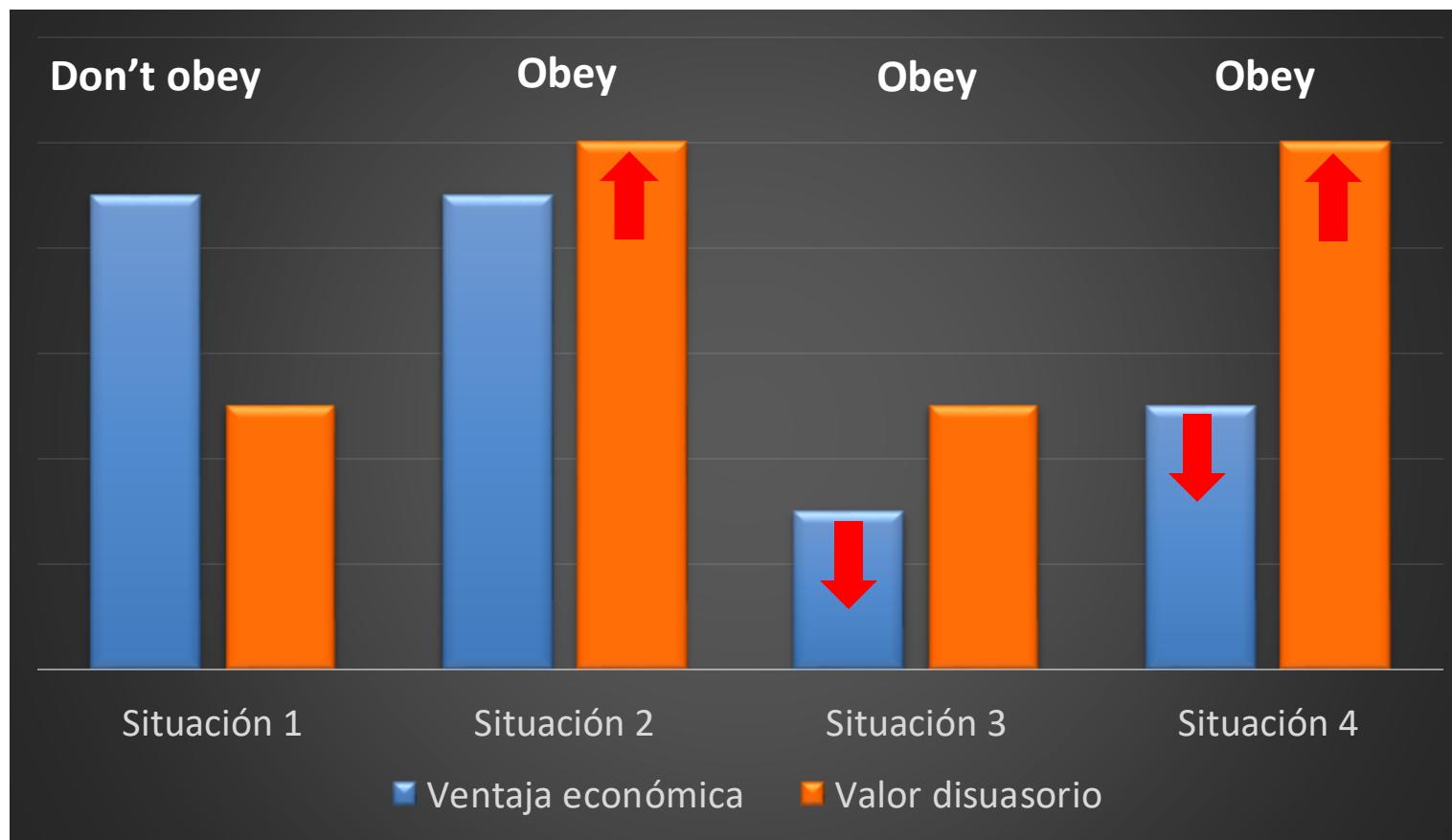
Deforestation authorization

Catastro Ambiental Rural - CAR



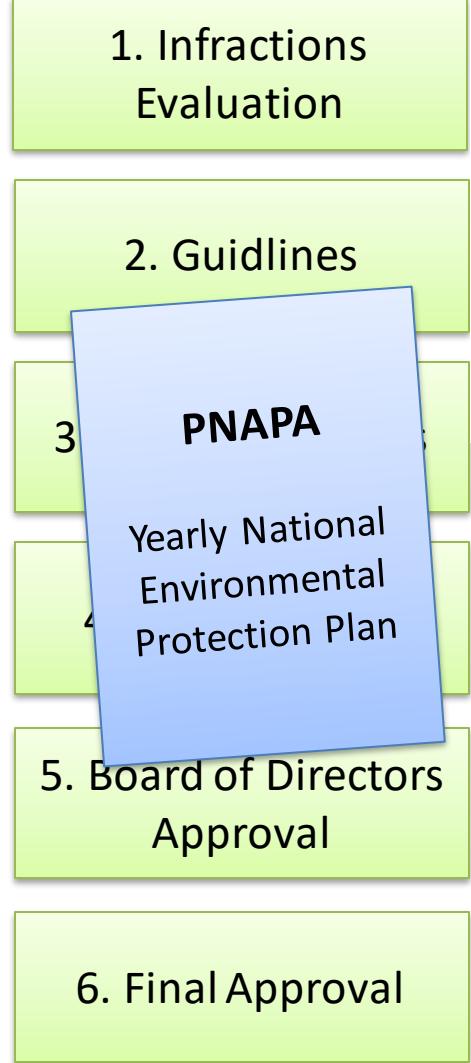
General Strategy for Law Enforcement

Dissuasion Theory x Economic theory of crime (Becker, 1968)

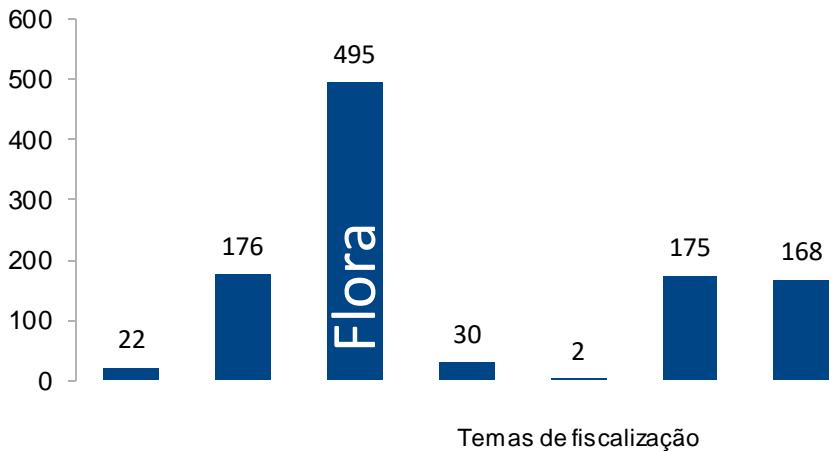


- Action Guidelines:
 1. Presence in critical areas of deforestation
 2. Remote Control of deforestation
 3. Control of forest harvesting and transportation
 4. Identification of Cattle and agriculture products from deforestation
 5. Cut Financing for deforestation

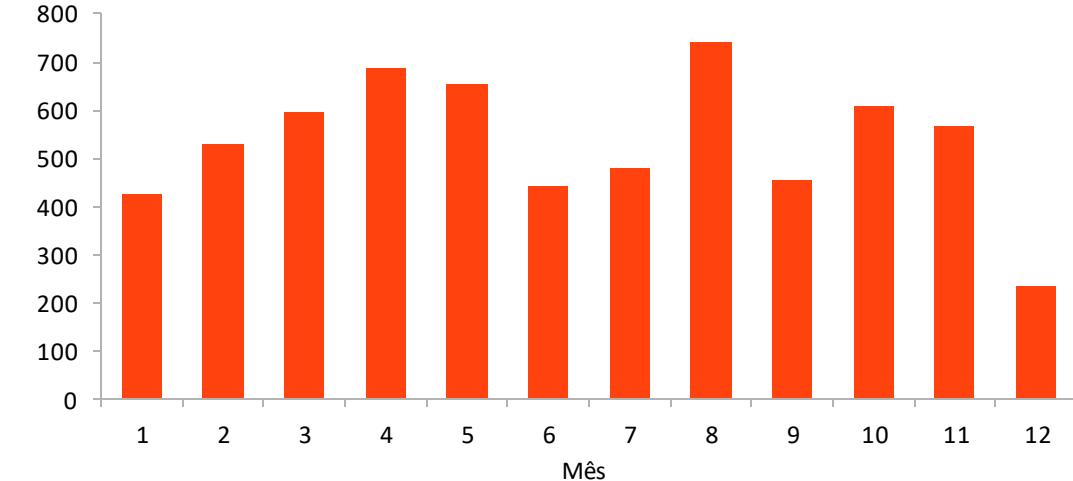
Law Enforcement actions planification



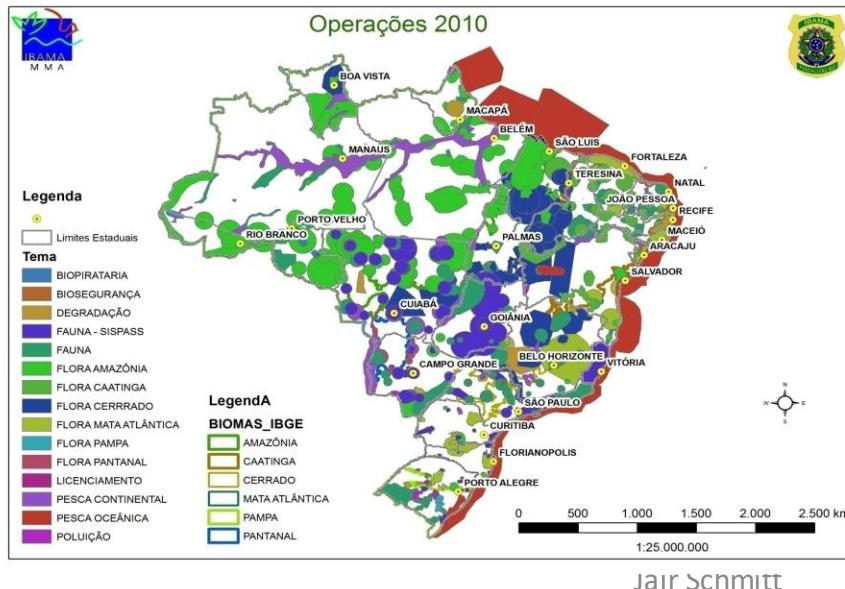
Actions



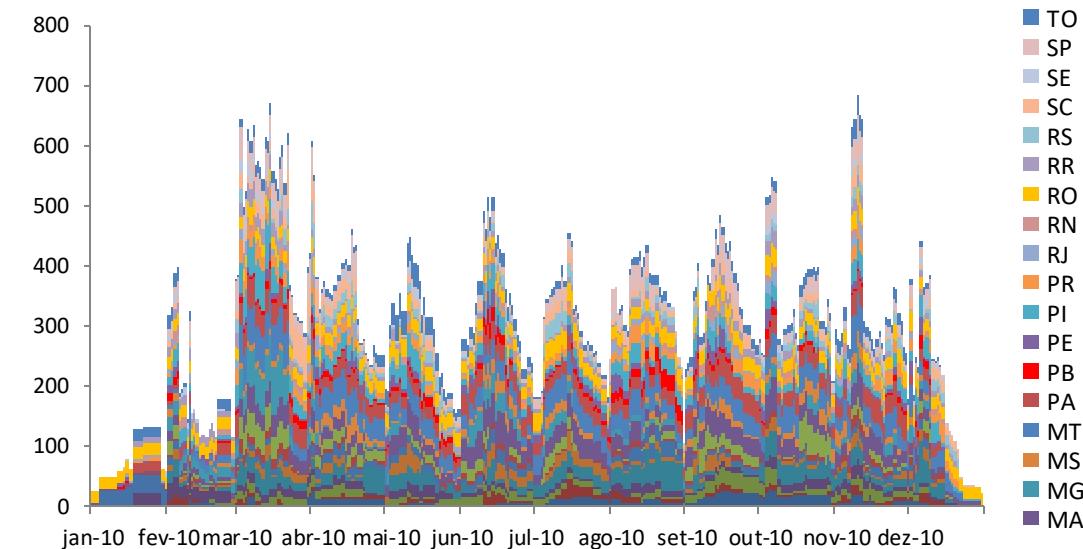
Agents

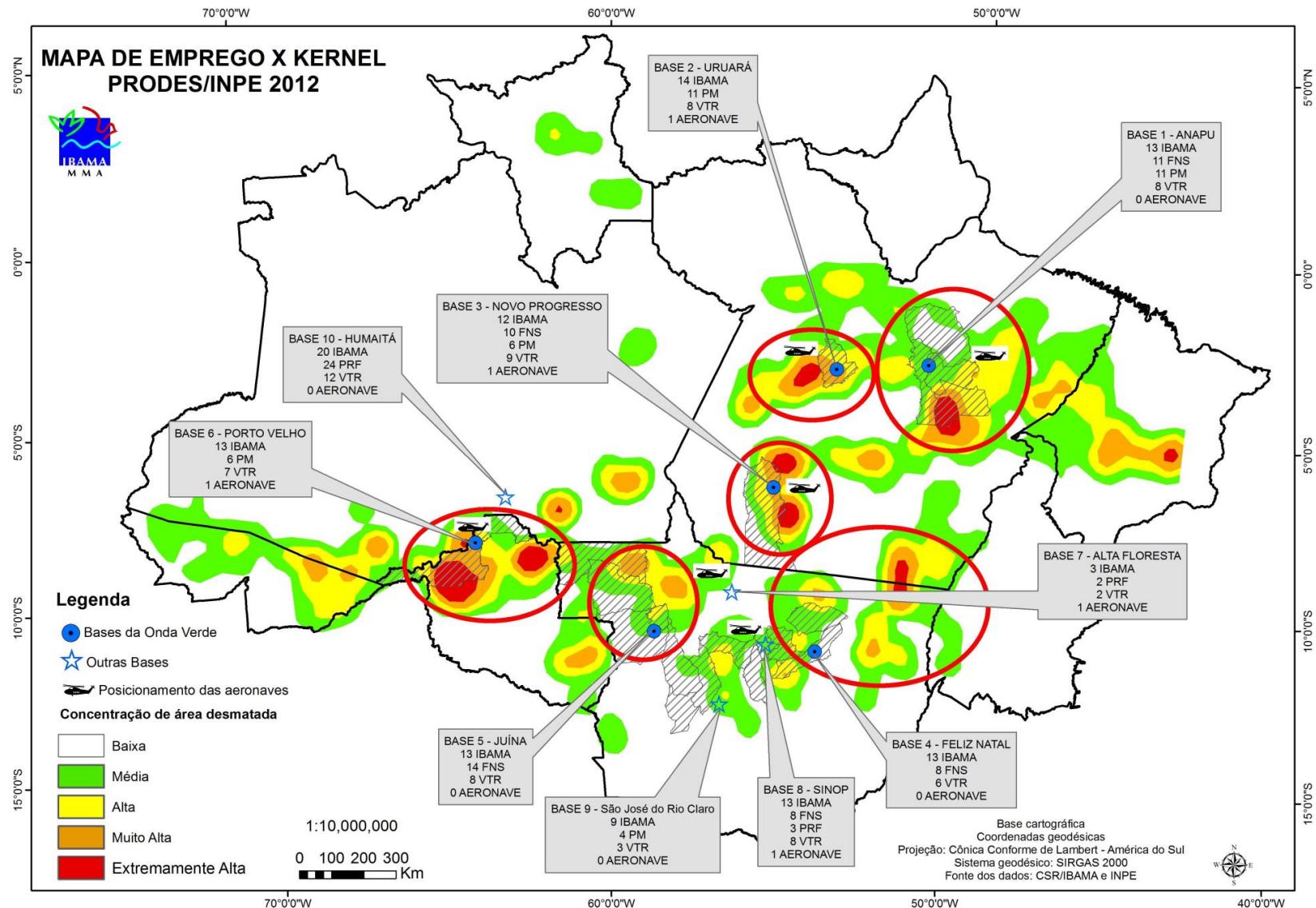


Area



Recruitment





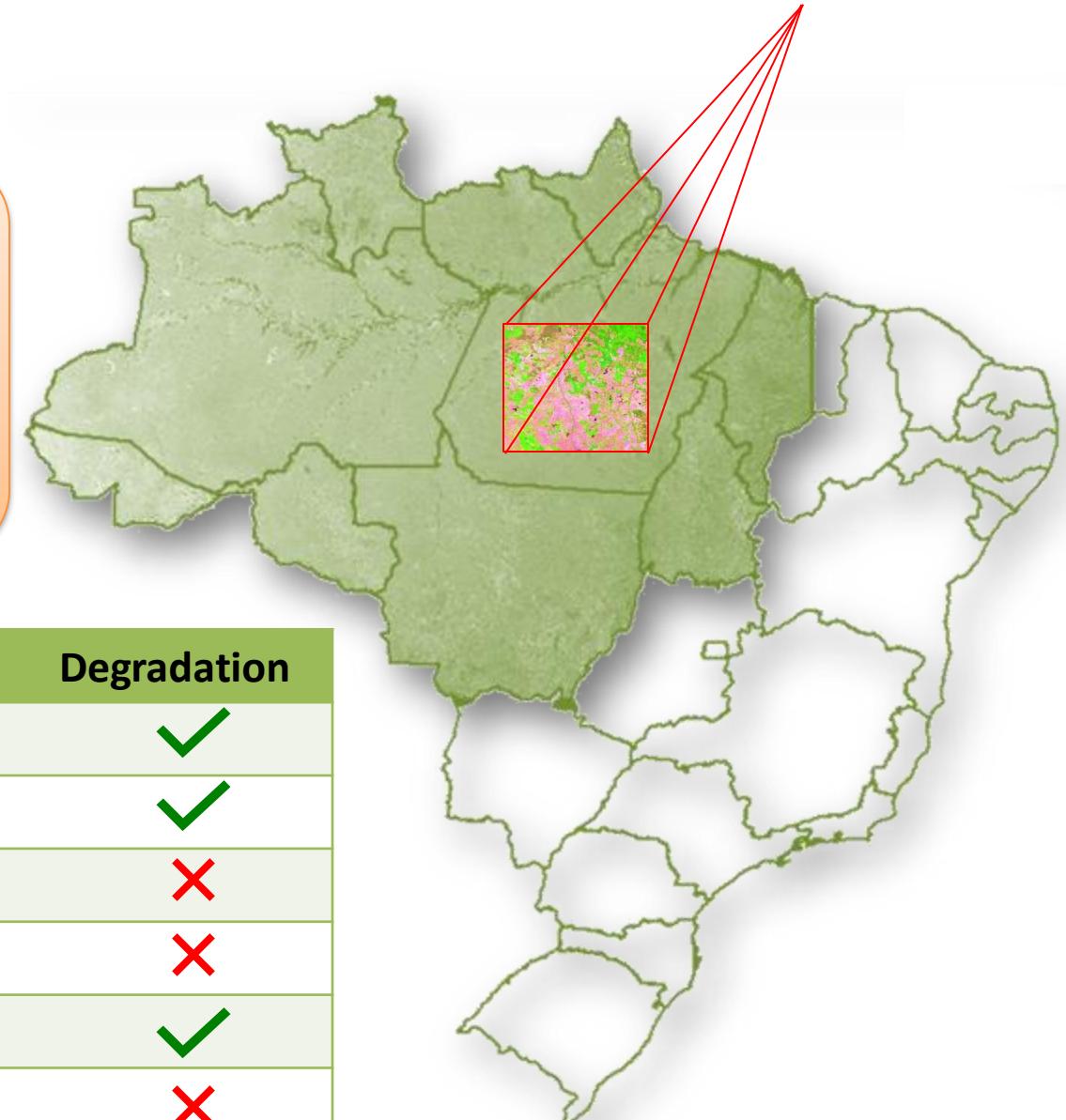


Remote Sensing Monitoring

Early Warning Remote Sensing Systems

Self Monitoring

- Soya moratorium
- Governmental, non Governmental and productive sector agreement
- Commitment to don't buy soybean from deforested area



System	Started	Spatial R	Temporal R	Sensor	Degradation
DETER/INPE	2004	250-60-56m	1-5 days	WFI+Awifs	✓
SAD/IMAZON	2008	250-30-10m	30 days	Modis+OLI+S	✓
GLAD/UMD	2016	30m	8 days	OLI	✗
JJ-FAST/JAXA	2016	50m	45 days	Alos 2	✗
SAR/SIPAM	2016	3-6m	15 days	CosmoSkymed	✓
SIRAD-X/ISA	2018	10m	30 days	Sentinel 1	✗

Active Deforestation

Stop damage!

X

Consolidated Deforestation

5 years to apply a fine

(Remote Control)

Alerts aggregation

T0

2015-11-11

2015-11-11

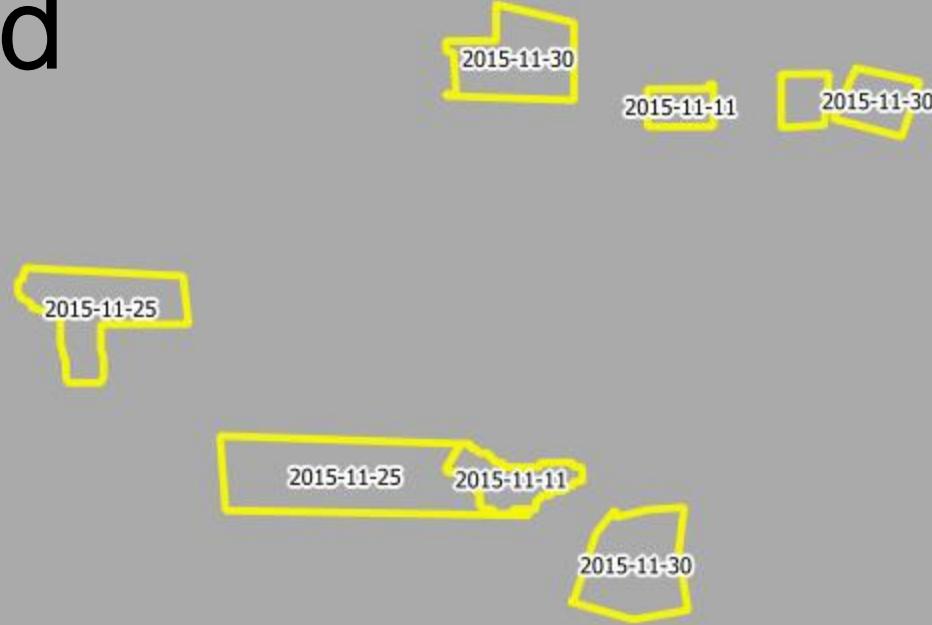
Alerts aggregation

T0+14d



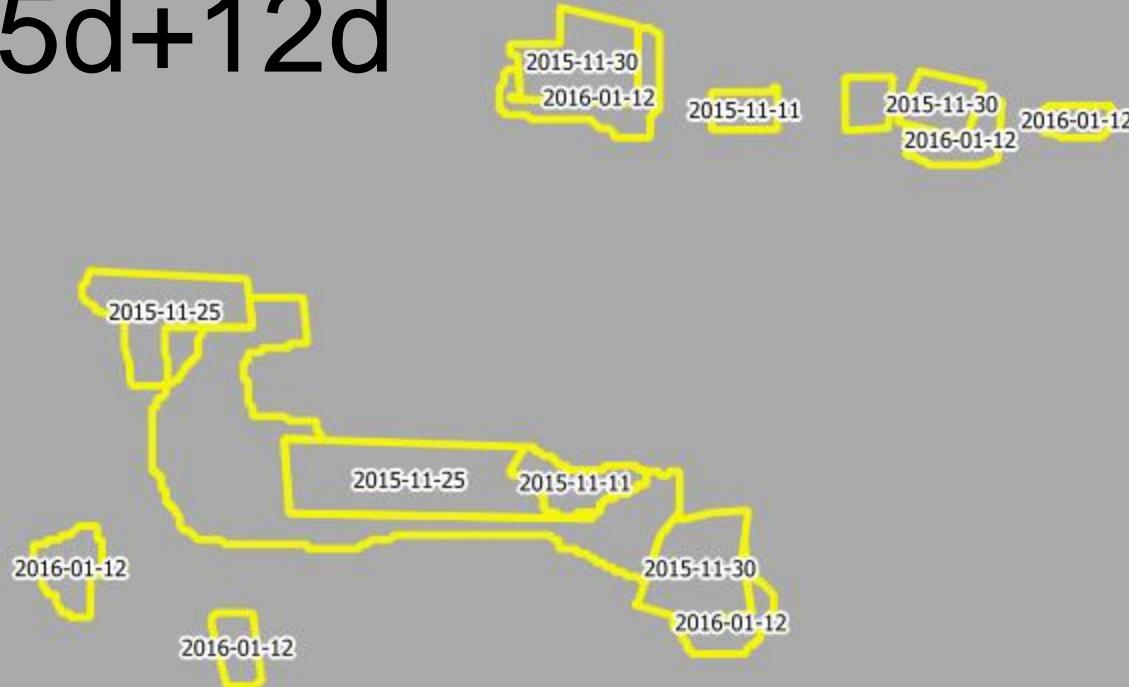
Alerts aggregation

T0+14d+5d



Alerts aggregation

T0+14d+5d+12d



Alerts aggregation

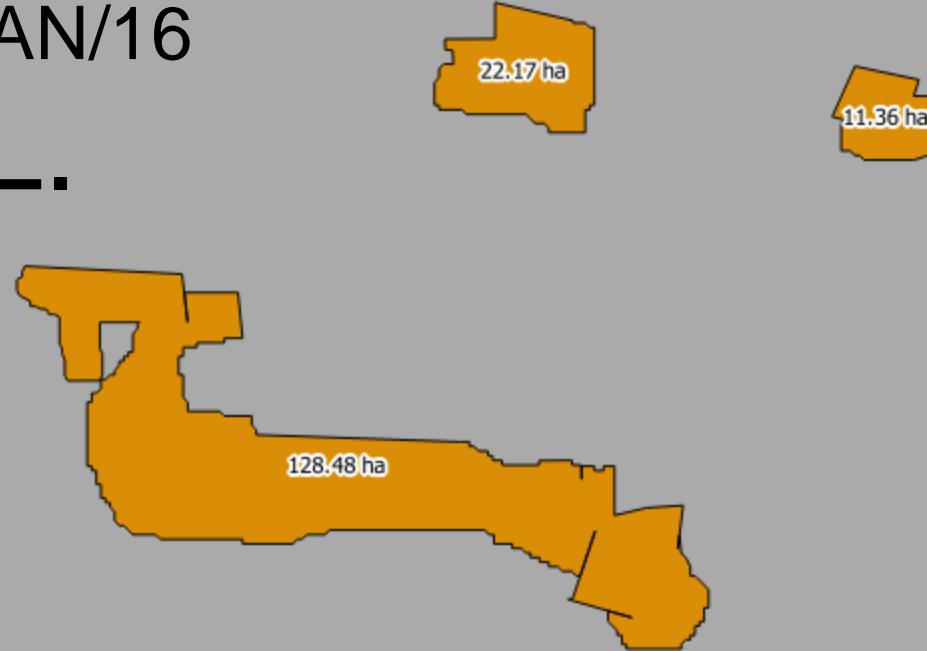
31 dias



DETER AWIFS

NOV, DEZ/15 e JAN/16

12.343 POL.

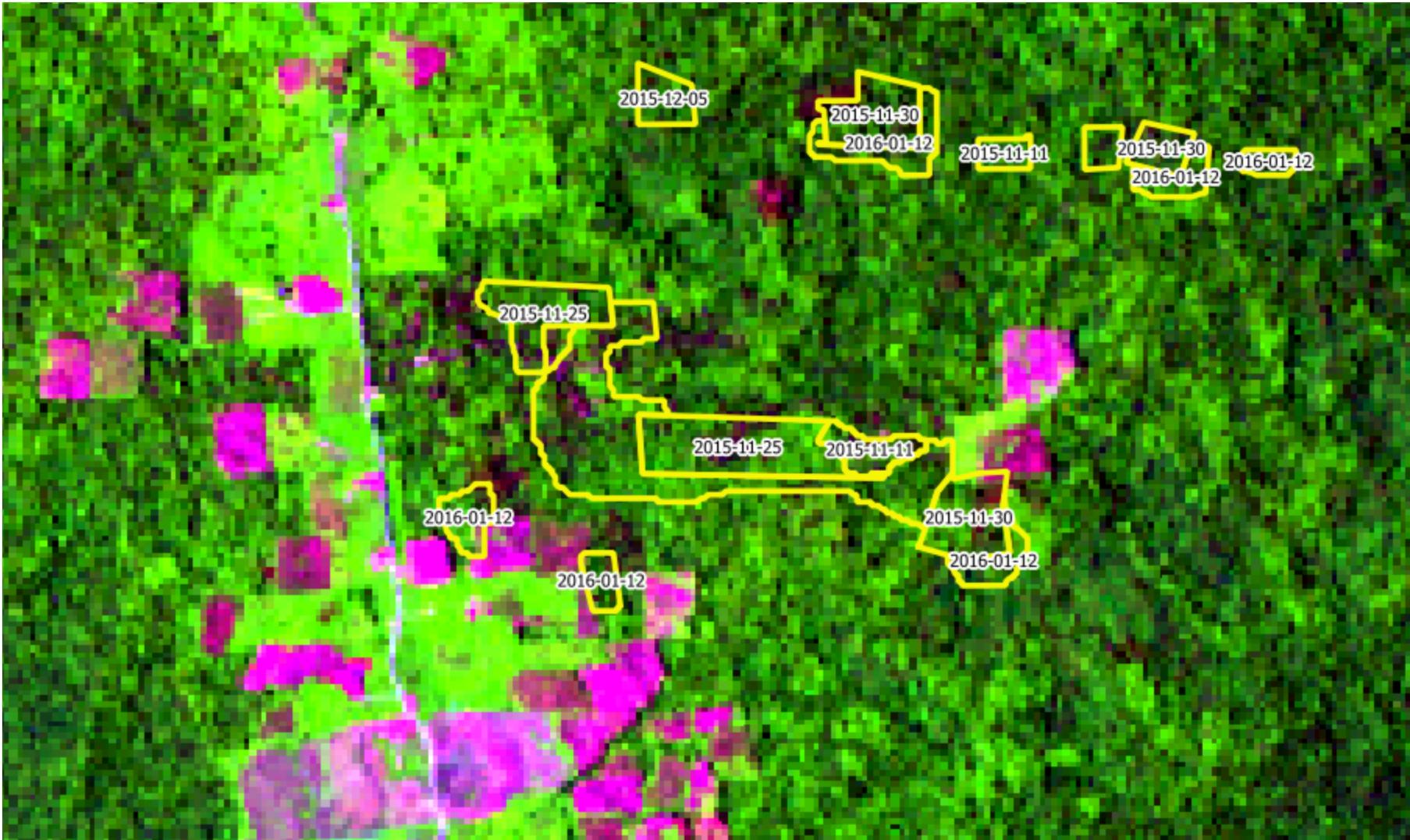


602 polígonos agregados (5%)

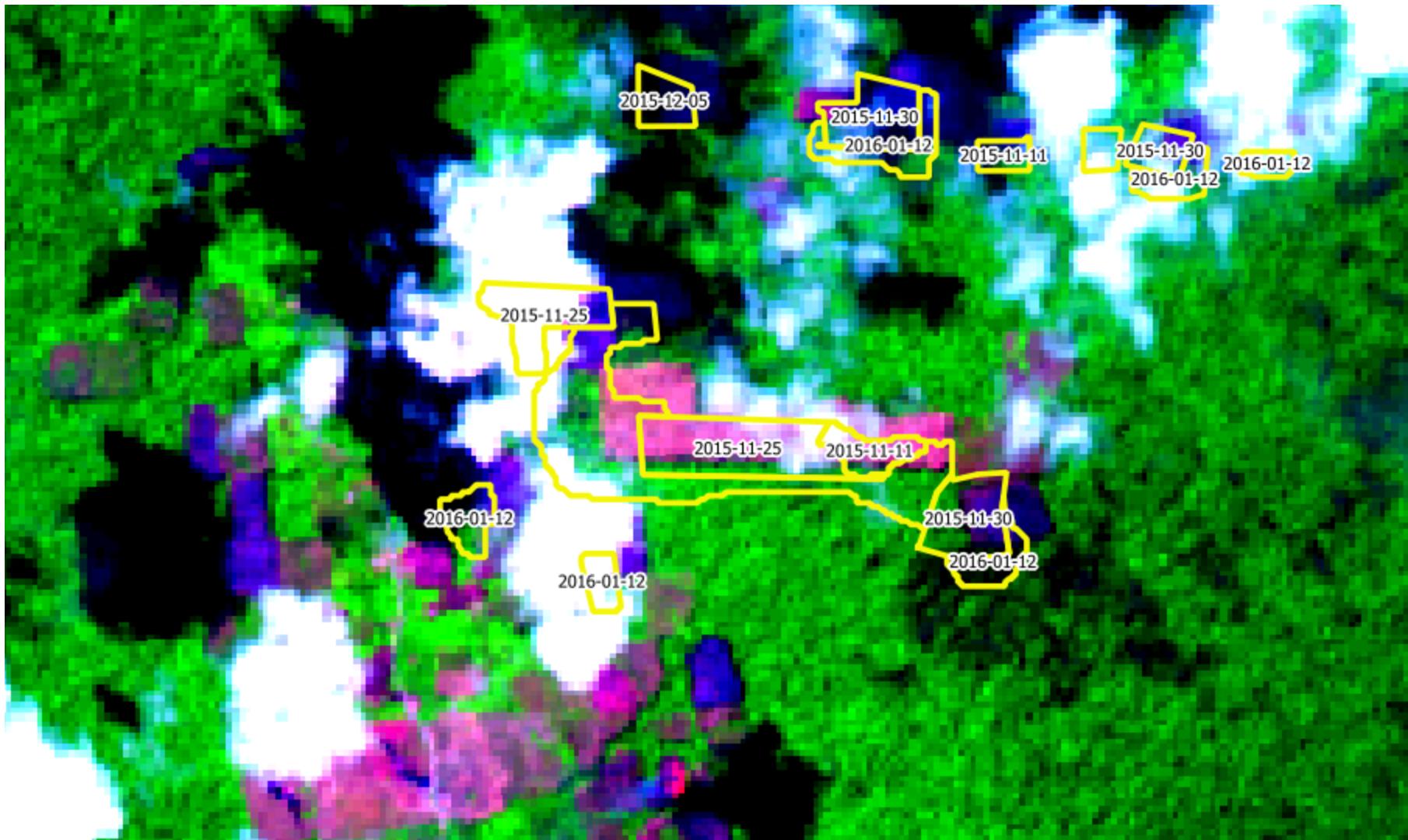
11-set-2015



11-set-2015



16-dez-2015



09-jun-2016



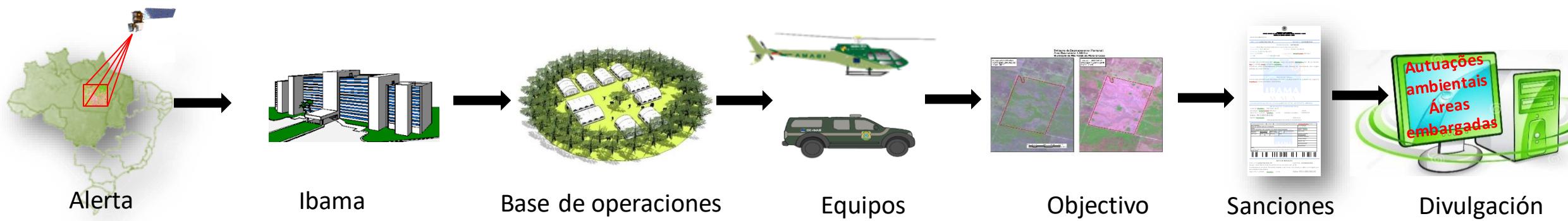
 DETER_20151101_20160131_neighbour :: Feições de totais: 602, filtrado: 602, selecionado: 1



 Expressão

	120	<input type="text" value="120"/>
	55	<input type="text" value="5"/>
	93	<input type="text" value="2015/11/12"/>
	156	<input type="text" value="2015/12/26"/>
	159	<input type="text" value="3.80840973120443"/>
	189	<input type="text" value="906.013441423636"/>
	232	<input type="text" value="6"/>
	237	<input type="text" value="935;9320;11519;6553;6557;9107"/>
	7	<input type="text" value="2015/11/12;2015/12/01;2015/12/11;2015/12/16;2015/12/26"/>
	22	<input type="text" value="3.808410;8.304196;481.405943;247.467375;165.027517"/>
	28	<input type="text" value="20.5912145778"/>
	53	
	54	
	56	

1. Presence in critical areas of deforestation







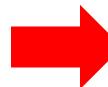
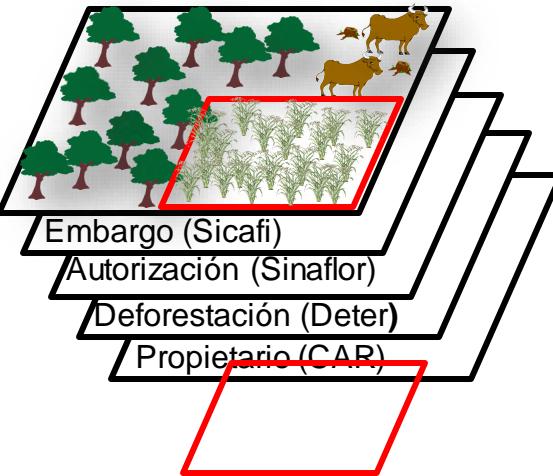
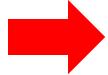
Jair Schmitt



Jean Schmitt

2. Remote Control of deforestation

Análisis de la información



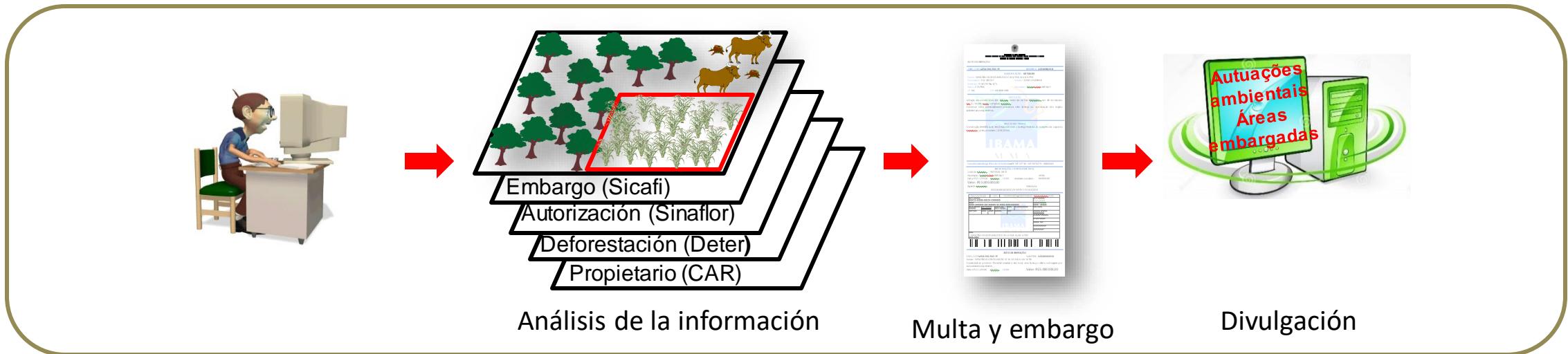
Multa y embargo



Divulgación



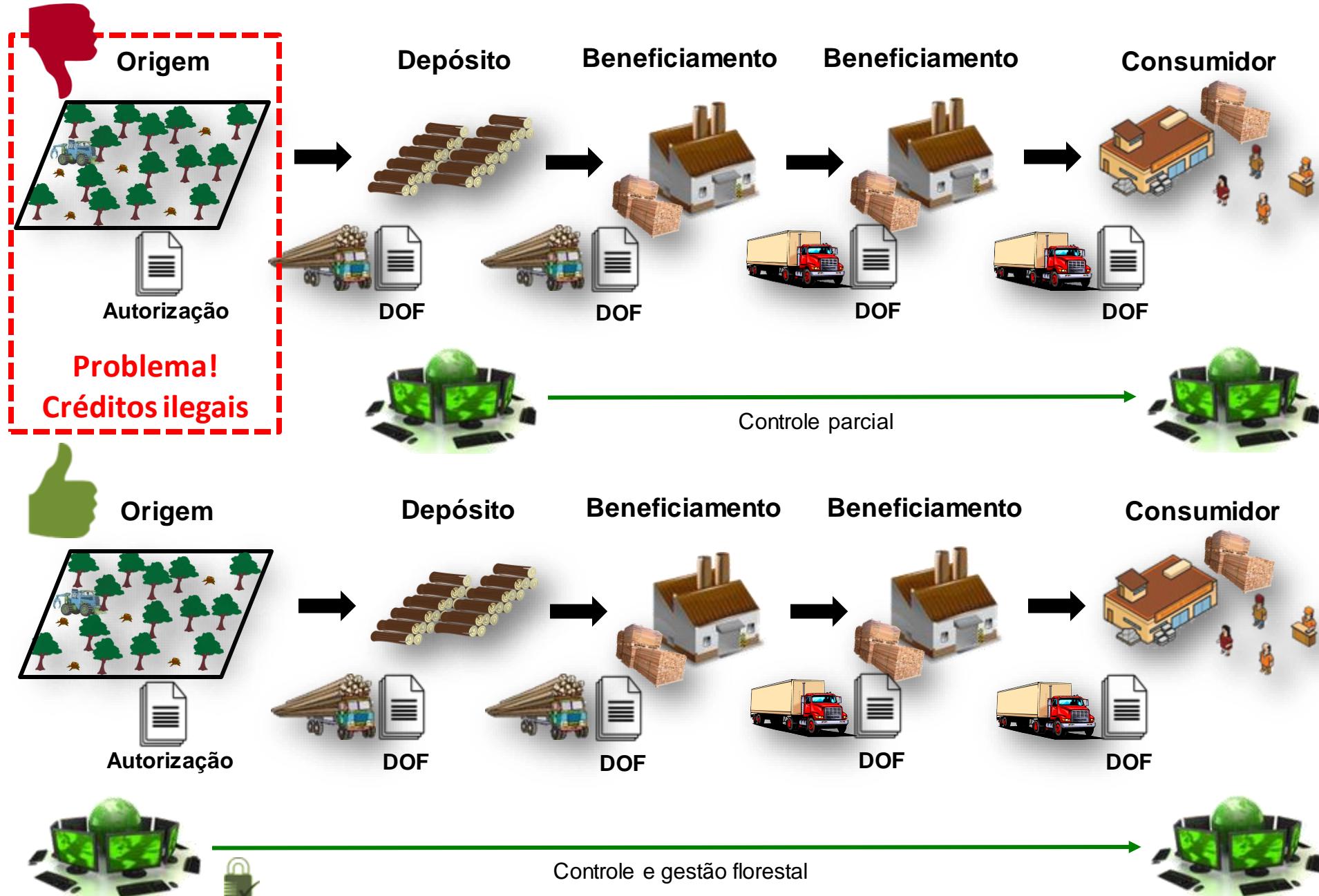
2. Remote Control of deforestation



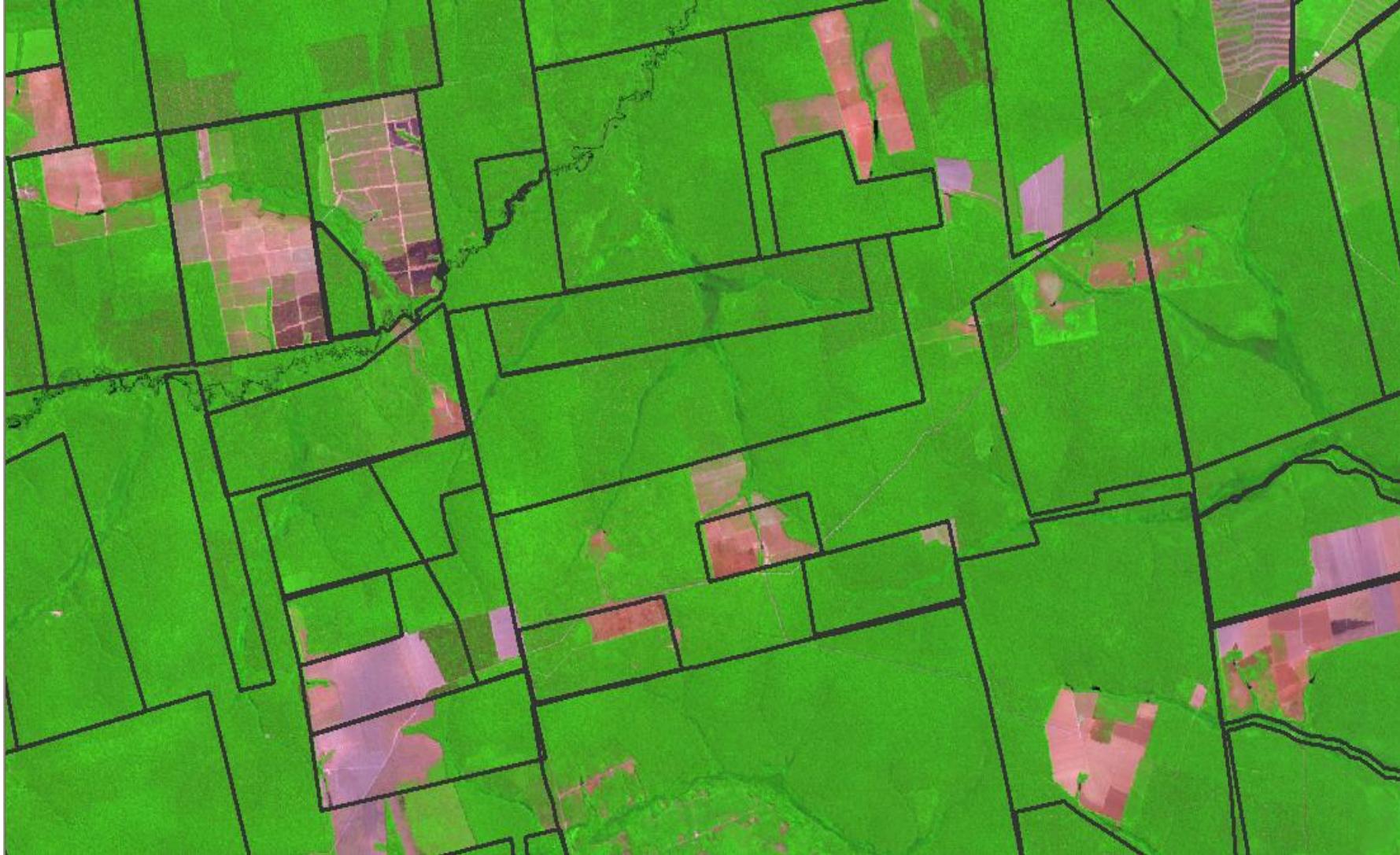
Comparación	Fiscalización remota	Fiscalización convencional
Producción	+++++	+
Coste por proceso	++++++	+
Calidad técnica	++++	++
Fuerza de trabajo	++++++	+
Oportunidad	+	+++++

Infracción	Proceso	Área (km2)
Incumplimiento de suspensión	54	368,9
Deforestación	168	310,1
Actividad sin licencia	129	1.109,3
Evitar la regeneración	50	377,0
Total	401	2.165,3
Área suspendida		1.419,4

3. Transport and harvesting monitoring



Regular RGB Composition



Linear mixture model processed image



4. Cattle and agriculture products from deforestation

Dissemination of deforestation alerts and environmental criminals

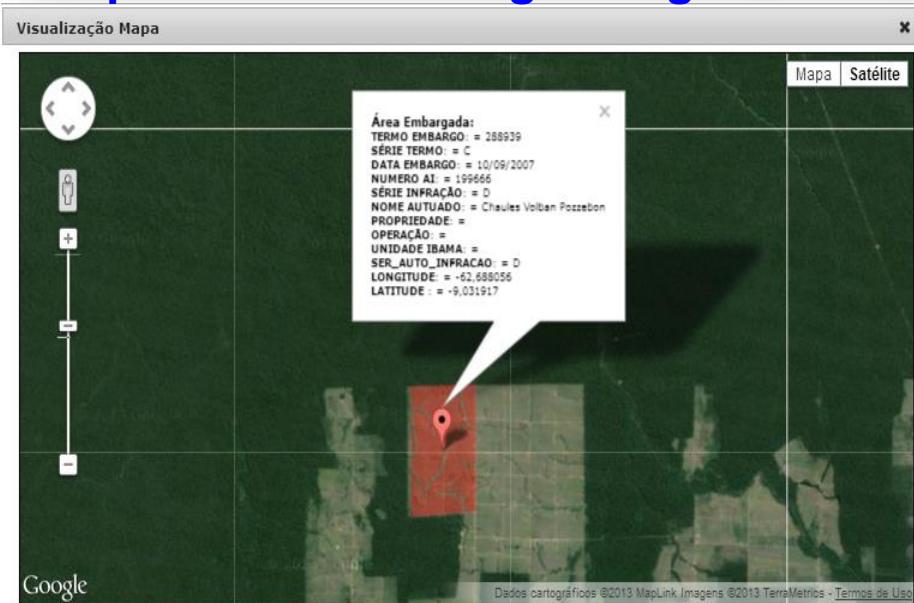
- Social control
- Differentiate legal and illegal deforestation
- Information to the market

<http://terrabrasilis.info/composer/DETER-B>

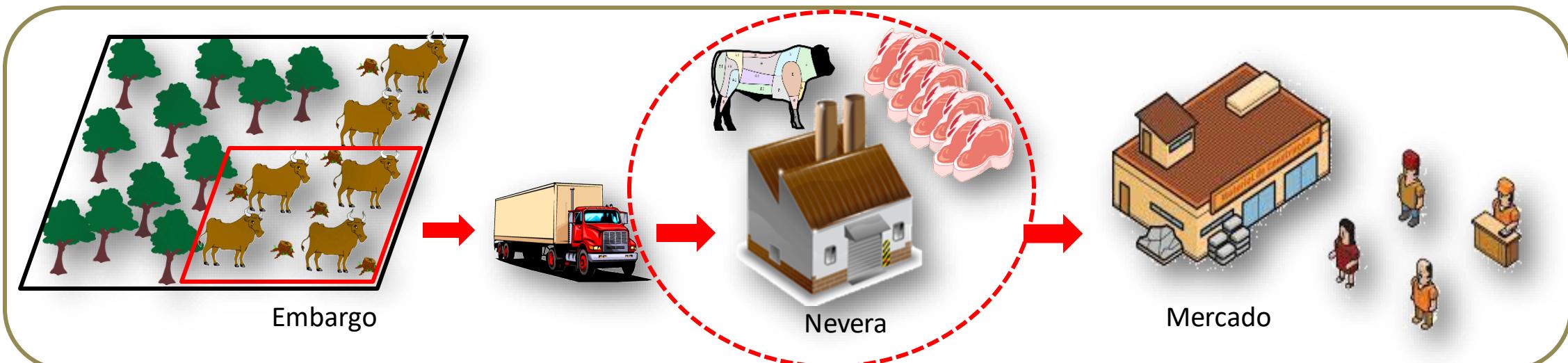
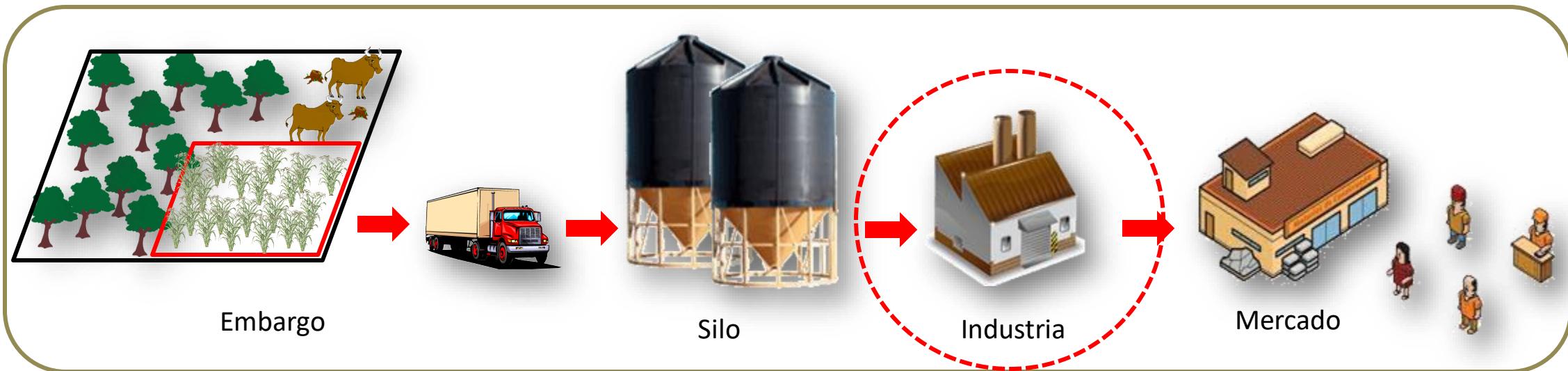
The screenshot shows the DETER (Sistema de Detecção de Desmatamentos em Tempo Real) interface. At the top, there's a navigation bar with links like 'www.obt.inpe.br/deter/indexdeter.php?id=10344', 'Gmail', 'Google', 'Correio', 'Entrada', 'Ibama', 'Ibamanet', 'Sicafi', 'DocIBAMA', 'Aéreo', 'Siscom', 'Clipping', and 'Redmine'. Below the bar, there's a header with 'DETER' and 'Detecção de Desmatamento em Tempo Real'. The main area features a map of Brazil with various yellow and red polygons indicating deforestation alerts. A legend on the left side provides details about the alert types. On the right, there are several tabs: 'Mosaico LandSat', 'Mosaico Modis', 'Mapas Temáticos', and 'Cartografia'. At the bottom, there are links for 'Download das imagens MODIS e dados vetoriais', 'Metodologia (pdf)', 'Relatórios de Avaliação', and 'Banco de Fotos do campo'. A note at the very bottom states: 'Dávulas, comentários e sugestões: ptobr@inpe.br'.

Consulta Pública de Autuações Ambientais e Embargos																																																																																																																																			
Consulta Pública de Autuações Ambientais e Embargos																																																																																																																																			
Consulta Pública de Autuações Ambientais e Embargos																																																																																																																																			
Consulta Pública de Autuações Ambientais e Embargos																																																																																																																																			
Consulta Pública de Autuações Ambientais e Embargos																																																																																																																																			
<input checked="" type="radio"/> Embargos <input type="radio"/> Autuações Ambientais																																																																																																																																			
Embargos																																																																																																																																			
pesquisa por Estado ou município:																																																																																																																																			
Estado: MATO GROSSO Municipio: -selecionar-																																																																																																																																			
pesquisa por Nome ou CPF/CNPJ:																																																																																																																																			
Nome ou Razão Social:																																																																																																																																			
Nome do Imóvel:																																																																																																																																			
CPF ou CNPJ:																																																																																																																																			
<input type="button" value="Consultar"/> <input type="button" value="Nova Consulta"/> <input type="button" value="Gerar PDF"/>																																																																																																																																			
<table border="1"><thead><tr><th>Nº TAD</th><th>Área (ha)</th><th>Nº A.I.</th><th>Nome ou Razão Social</th><th>CPF ou CNPJ</th><th>Localização do Imóvel</th><th>UF</th><th>Município</th><th>Julgamento</th><th>Infração</th><th>Data de Inteigração</th><th>Ação</th></tr></thead><tbody><tr><td>199108</td><td>520594</td><td></td><td>JOAQUIM BATISTA DA SILVEIRA NETO</td><td>152.379.078-49</td><td>09°19'35"S 56°55'27"W</td><td>MT</td><td>ALTA FLORESTA</td><td></td><td>Infração da Flora/Não Classificada-Móvel</td><td>22/08/2006</td><td><input type="radio"/></td></tr><tr><td>199110</td><td>520592</td><td></td><td>APARECIO PARACAL PECINATO</td><td>327.917.129-88</td><td>10°04'04"S 57°28'01"W</td><td>MT</td><td>NOVA MONTE VERDE</td><td></td><td>Infração da Flora/Não Classificada-Móvel</td><td>18/08/2006</td><td><input type="radio"/></td></tr><tr><td>199118</td><td>557442</td><td></td><td>JAIRO JOÃO TAVARES</td><td>142.265.101-00</td><td>NAS COORDENADAS 10°21'S 59°54'50"W</td><td>MT</td><td>TERRA NOVA DO NORTE</td><td>14/10/2008</td><td>Infração da Flora/Não Classificada-Móvel</td><td>19/12/2006</td><td>Ver Mapa</td></tr><tr><td>199119</td><td>557444</td><td></td><td>MOISES PRADO DOS SANTOS</td><td>604.602.109-04</td><td></td><td>MT</td><td>ALTA FLORESTA</td><td>30/04/2012</td><td>Infração da Flora/Não Classificada-Móvel</td><td>29/09/2006</td><td>Ver Mapa</td></tr><tr><td>199121</td><td>557445</td><td></td><td>MANOEL RODRIGUES DE FREITAS NETO</td><td>554.752.769-87</td><td>COORDENADAS 10°29'34"S E 54°45'40"W - ZONA RURAL - MUNICÍPIO DE TERRA NOVA DO NORTE/MT</td><td>MT</td><td>TERRA NOVA DO NORTE</td><td>28/12/2007</td><td>Infração da Flora/Não Classificada-Móvel</td><td>24/07/2012</td><td>Ver Mapa</td></tr><tr><td>199123</td><td>557448</td><td></td><td>WALTER EVERTON DA SILVA</td><td>098.090.188-00</td><td>FAZENDA SÃO PAULO</td><td>MT</td><td>COLIDER</td><td></td><td>Infração da Flora/Não Classificada-Móvel</td><td>28/09/2006</td><td><input type="radio"/></td></tr><tr><td>199124</td><td>557449</td><td></td><td>REINALDO REMI PASSARINI</td><td>476.081.379-91</td><td>APIACAS-MT</td><td>MT</td><td>APIACAS</td><td>03/03/2008</td><td>Infração da Flora/Não Classificada-Móvel</td><td>27/09/2006</td><td>Ver Mapa</td></tr><tr><td>199126</td><td>557450</td><td></td><td>NILTON DE ALMEIDA</td><td>141.641.098-82</td><td></td><td>MT</td><td>APIACAS</td><td>31/12/2007</td><td>Infração da Flora/Não Classificada-Móvel</td><td>07/11/2006</td><td>Ver Mapa</td></tr><tr><td colspan="12">Endereço</td></tr></tbody></table>												Nº TAD	Área (ha)	Nº A.I.	Nome ou Razão Social	CPF ou CNPJ	Localização do Imóvel	UF	Município	Julgamento	Infração	Data de Inteigração	Ação	199108	520594		JOAQUIM BATISTA DA SILVEIRA NETO	152.379.078-49	09°19'35"S 56°55'27"W	MT	ALTA FLORESTA		Infração da Flora/Não Classificada-Móvel	22/08/2006	<input type="radio"/>	199110	520592		APARECIO PARACAL PECINATO	327.917.129-88	10°04'04"S 57°28'01"W	MT	NOVA MONTE VERDE		Infração da Flora/Não Classificada-Móvel	18/08/2006	<input type="radio"/>	199118	557442		JAIRO JOÃO TAVARES	142.265.101-00	NAS COORDENADAS 10°21'S 59°54'50"W	MT	TERRA NOVA DO NORTE	14/10/2008	Infração da Flora/Não Classificada-Móvel	19/12/2006	Ver Mapa	199119	557444		MOISES PRADO DOS SANTOS	604.602.109-04		MT	ALTA FLORESTA	30/04/2012	Infração da Flora/Não Classificada-Móvel	29/09/2006	Ver Mapa	199121	557445		MANOEL RODRIGUES DE FREITAS NETO	554.752.769-87	COORDENADAS 10°29'34"S E 54°45'40"W - ZONA RURAL - MUNICÍPIO DE TERRA NOVA DO NORTE/MT	MT	TERRA NOVA DO NORTE	28/12/2007	Infração da Flora/Não Classificada-Móvel	24/07/2012	Ver Mapa	199123	557448		WALTER EVERTON DA SILVA	098.090.188-00	FAZENDA SÃO PAULO	MT	COLIDER		Infração da Flora/Não Classificada-Móvel	28/09/2006	<input type="radio"/>	199124	557449		REINALDO REMI PASSARINI	476.081.379-91	APIACAS-MT	MT	APIACAS	03/03/2008	Infração da Flora/Não Classificada-Móvel	27/09/2006	Ver Mapa	199126	557450		NILTON DE ALMEIDA	141.641.098-82		MT	APIACAS	31/12/2007	Infração da Flora/Não Classificada-Móvel	07/11/2006	Ver Mapa	Endereço											
Nº TAD	Área (ha)	Nº A.I.	Nome ou Razão Social	CPF ou CNPJ	Localização do Imóvel	UF	Município	Julgamento	Infração	Data de Inteigração	Ação																																																																																																																								
199108	520594		JOAQUIM BATISTA DA SILVEIRA NETO	152.379.078-49	09°19'35"S 56°55'27"W	MT	ALTA FLORESTA		Infração da Flora/Não Classificada-Móvel	22/08/2006	<input type="radio"/>																																																																																																																								
199110	520592		APARECIO PARACAL PECINATO	327.917.129-88	10°04'04"S 57°28'01"W	MT	NOVA MONTE VERDE		Infração da Flora/Não Classificada-Móvel	18/08/2006	<input type="radio"/>																																																																																																																								
199118	557442		JAIRO JOÃO TAVARES	142.265.101-00	NAS COORDENADAS 10°21'S 59°54'50"W	MT	TERRA NOVA DO NORTE	14/10/2008	Infração da Flora/Não Classificada-Móvel	19/12/2006	Ver Mapa																																																																																																																								
199119	557444		MOISES PRADO DOS SANTOS	604.602.109-04		MT	ALTA FLORESTA	30/04/2012	Infração da Flora/Não Classificada-Móvel	29/09/2006	Ver Mapa																																																																																																																								
199121	557445		MANOEL RODRIGUES DE FREITAS NETO	554.752.769-87	COORDENADAS 10°29'34"S E 54°45'40"W - ZONA RURAL - MUNICÍPIO DE TERRA NOVA DO NORTE/MT	MT	TERRA NOVA DO NORTE	28/12/2007	Infração da Flora/Não Classificada-Móvel	24/07/2012	Ver Mapa																																																																																																																								
199123	557448		WALTER EVERTON DA SILVA	098.090.188-00	FAZENDA SÃO PAULO	MT	COLIDER		Infração da Flora/Não Classificada-Móvel	28/09/2006	<input type="radio"/>																																																																																																																								
199124	557449		REINALDO REMI PASSARINI	476.081.379-91	APIACAS-MT	MT	APIACAS	03/03/2008	Infração da Flora/Não Classificada-Móvel	27/09/2006	Ver Mapa																																																																																																																								
199126	557450		NILTON DE ALMEIDA	141.641.098-82		MT	APIACAS	31/12/2007	Infração da Flora/Não Classificada-Móvel	07/11/2006	Ver Mapa																																																																																																																								
Endereço																																																																																																																																			

http://siscom.ibama.gov.br/geo_sicafi



4. Cattle and agriculture products from deforestation



5. Cut Financing for deforestation

Resolución
3.545/2008
del Banco
Central



“The election of Jair **Bolsonaro** as president of Brazil now seems overwhelmingly likely, and he is committed, like Donald Trump, to **withdrawing his country from the Paris accords**. His policies in the Amazon basin will greatly accelerate deforestation”

The Guardian, October 8, 2018

<https://www.theguardian.com/commentisfree/2018/oct/08/the-guardian-view-on-climate-change-a-global-emergency>





George Porto Ferreira

Environmental Analyst

General Coordinator for Environmental Monitoring and Information

george.ferreira@ibama.gov.br

cenima.sede@ibama.gov.br

<http://www.ibama.gov.br>



References:

- <http://www.obt.inpe.br/OBT/assuntos/programas/amazonia/prodes>
- <http://www.obt.inpe.br/OBT/assuntos/programas/amazonia/deter>
- <https://www.theguardian.com/commentisfree/2018/oct/08/the-guardian-view-on-climate-change-a-global-emergency>
- <http://terrabrasilis.info/composer/DETER-B>
- <http://terrabrasilis.info/dashboard/DETER-B>
- <http://marte.sid.inpe.br/col/dpi.inpe.br/sbsr@80/2008/11.17.18.35.53/doc/5625-5632.pdf>
- <http://repositorio.unb.br/handle/10482/19914>
- <http://dadosabertos.ibama.gov.br/organization/instituto-brasileiro-do-meio-ambiente-e-dos-recursos-naturais-renovaveis>