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# Robust Property Rights Institutions to Manage Local and Global Commons

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# The Challenges we Face in Understanding Property Rights

- Overcoming the “Panacea Trap”
  - Accepting -- rather than rejecting complexity
  - Recognizing the benefits of institutional diversity as well as biodiversity
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# Challenge 1: The Panacea Trap

- Panaceas – policy advice for “the” best way to govern and manage CPRs – assuming that there is one simple cure-all for multiple ecological problems
  - Scholars & policy makers fall into panacea traps even when they assume an uncertain world
  - Derived from basic failures to recognize the differences among CPRs in diverse sectors, at multiple spatial scales and over time
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# “Tragedy of the Commons” Debate – One Source of Panaceas

- Hardin (1968) envisioned helpless resource users
  - To prevent resource destruction must *impose* government ownership or private ownership
  - Community control now proposed by some as a solution to resource destruction
  - All 3 panaceas – government, private, or community control -- work in some settings and fail in others -- depend on the *match* of the specific institutional arrangement and problem specifics as well as how implemented
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# Challenge 2: Accepting Rather than Rejecting Complexity

- Scientific progress involves understanding complex, decomposable, multi-tier systems
  - Interactions are rarely linear additive
  - Cannot assume away complexity and be successful in remedying problems
  - Must dig into complex systems that are partially decomposable
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## Challenge 3: Recognize Value of Institutional Diversity

- Panacea thinking focuses on simplified policy solutions: private, governmental, communal ownership
  - Research finds vast numbers of specific rules used in sustainable systems tied to specific variables of a resource system & its units
  - Scientists recognize and want to protect biological diversity
  - To achieve sustainability we must recognize and understand institutional diversity rather than trying to eliminate it as “too confusing”
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# Diversity is Important for Sustainability

- Two general types:
  - *Biological* diversity – extensive scientific findings – well accepted
  - *Institutional* diversity – importance not yet accepted
- Simple institutional blueprints are frequently recommended
  - Government ownership
  - Privatize land
  - Co-management
- Imposing blueprints reduces institutional diversity
- Our research finds variations of all 3 succeed & fail
- Lets review findings from our multi-country, multi-disciplinary forestry research network using remote sensing & field studies.
- First to Maya Biosphere Reserve in Guatemala

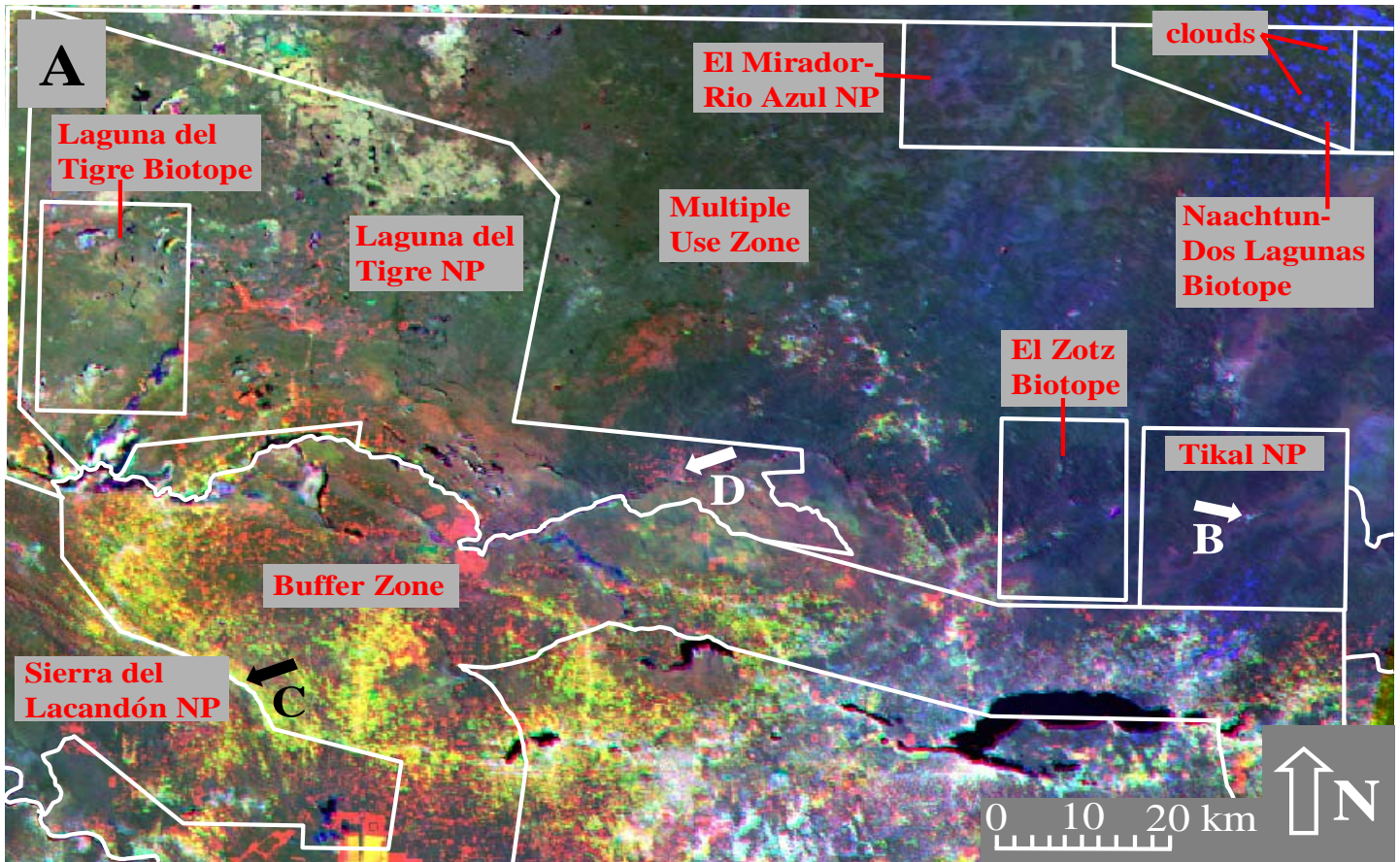
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# Maya Biosphere Reserve

- Four National Parks (NPs) in close proximity
  - Tikal NP has large budget to pay for extensive fences and guards
  - El Mirador protected by nature
  - Laguna del Tigre severely overharvested
  - Sierra del Lacandón severely overharvested
  - Same formal institution:
    - Two are sustainable, but different causal process
    - Two are vulnerable to massive illegal harvesting
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# Maya Biosphere Reserve

Multitemporal Color Composite (Dietz, Ostrom, Stern, 2003, *Science* SOM)



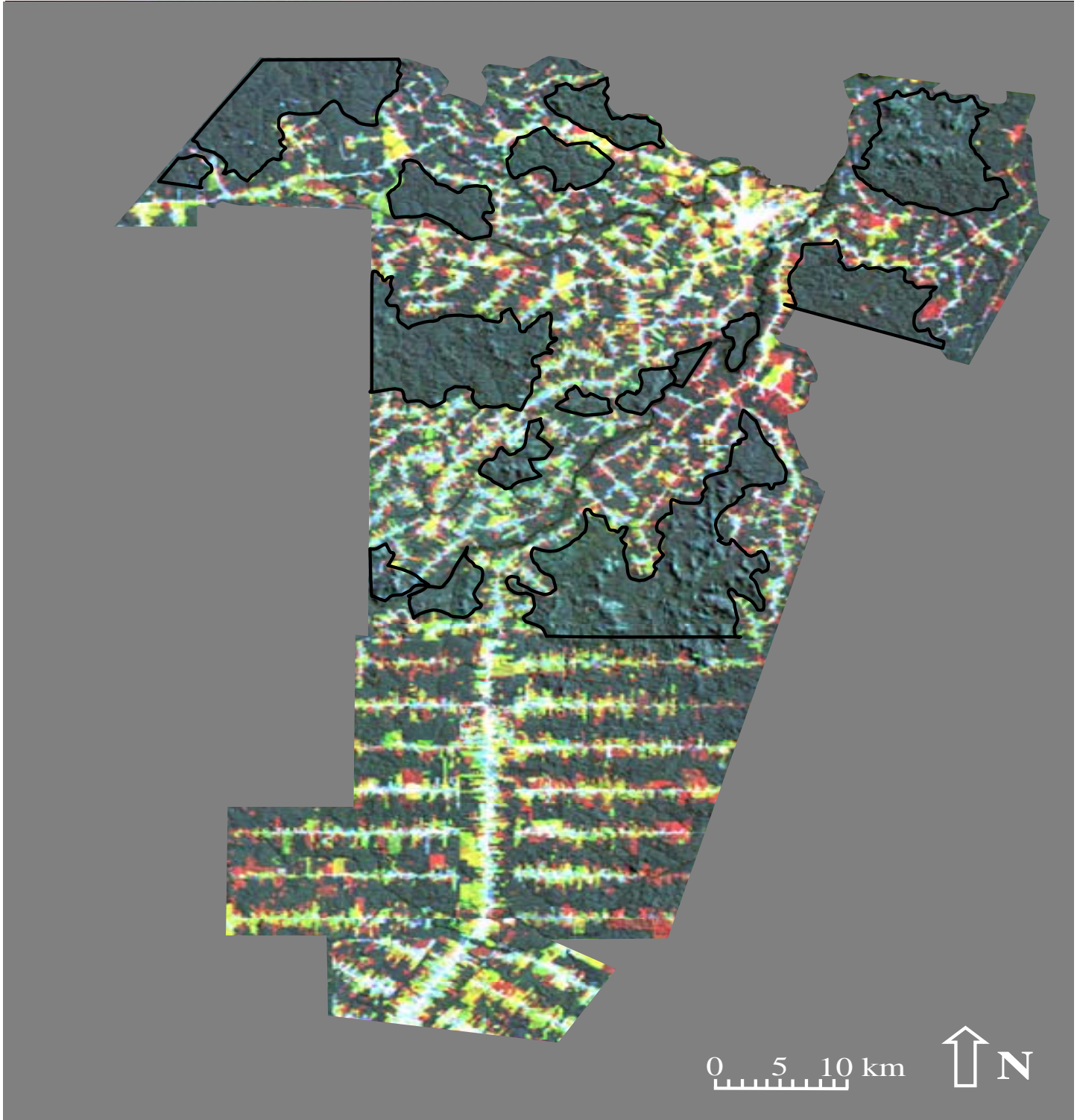
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# To Rondônia, Brazil

- Two colonization projects assigned private property & obligation to preserve half of the forested land
  - Established side by side in 1980s
  - Southern project laid out “typical” rectangular plots. Farmers obliged to preserve 50% of land assigned to them
  - Northern project involved users in the plan
    - Topographically sensitive layout
    - Established separate forest reserves
    - Private owners had full control of smaller plots
    - Rubber tappers assigned to monitor the forest reserves (not government officials)
  - Northern project is more sustainable than most Brazilian colonization projects that assign farmers responsibility to preserve 50% of forest on their own land
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# Contrasting Colonization Projects

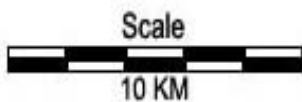
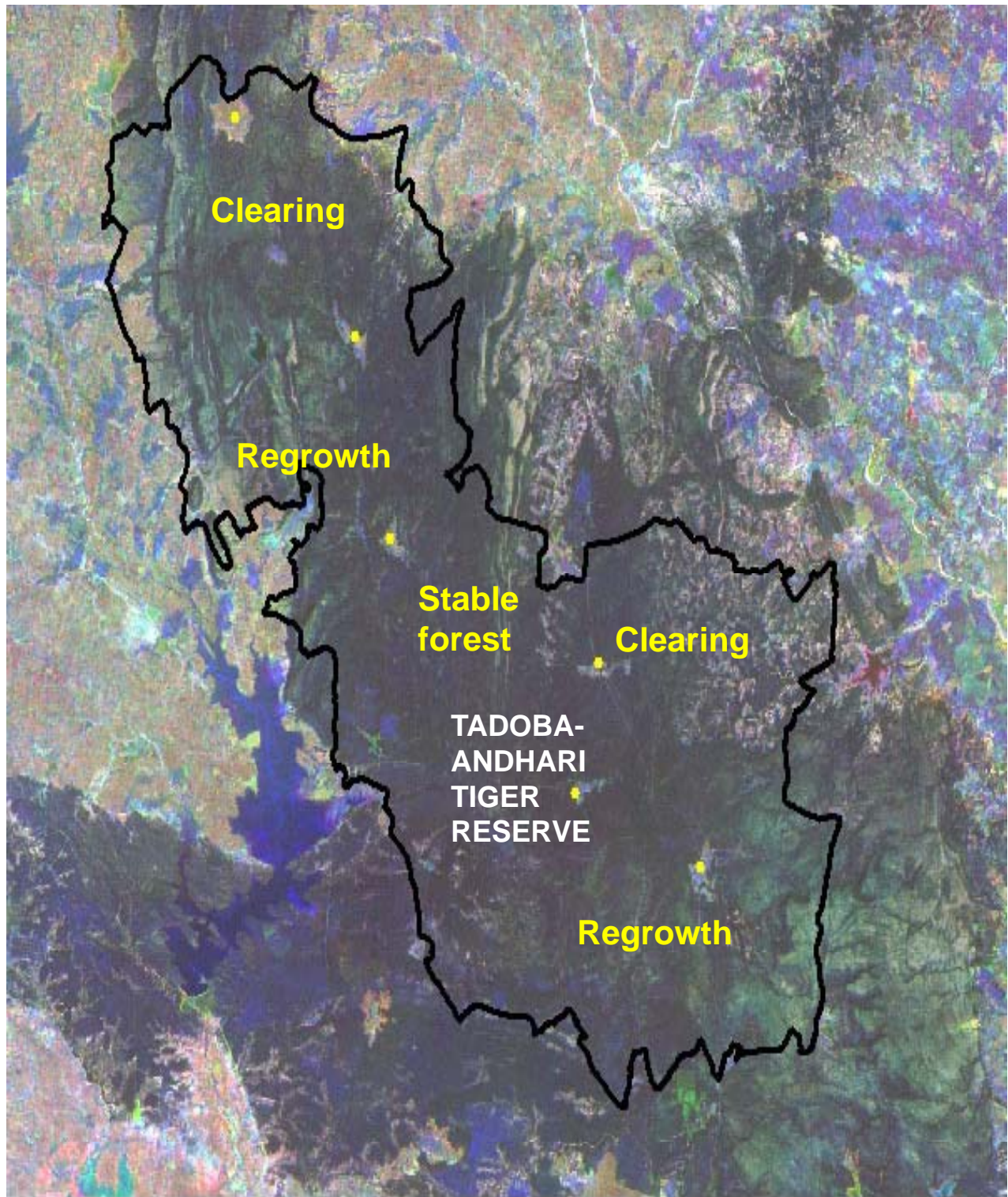
(Batistella, 2003)



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# Now to India

- Todoba-Andhari Tiger Reserve
  - An under-funded national wildlife reserve with multiple outcomes
  - Stable forests in the core
  - Park guards are not able to control harvesting along sections of the borders
  - Complementary field studies find
    - Consistent harvesting of non-timber forest products
    - Existence of considerable conflict between guards and local people
      - Nagendra & Ostrom, *PNAS*, 2006
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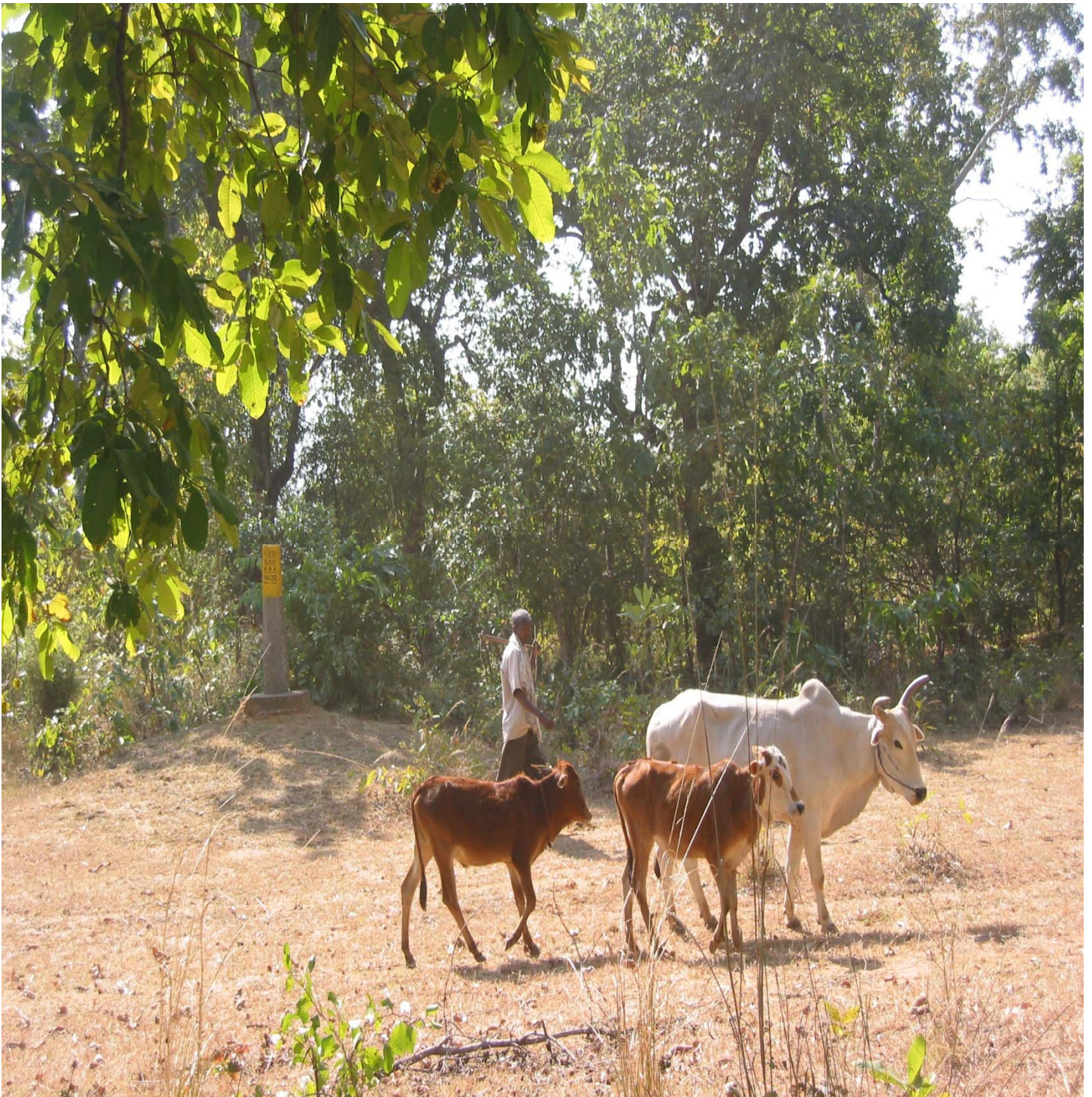
● Interior villages



Multi-temporal Landsat color composite, 1972-1989-2001, landscape surrounding Tadoba-Andhari Tiger Reserve, India.



Women harvesting thatch grass from within the TATR - while the forest ranger accompanying our research team looks on helplessly.



Cattle entering the TATR boundary (marked by the yellow topped pillar in the background) on their daily foraging beat.



Bicycles and trucks confiscated from timber poachers stealing large logs

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## Diversity of Institutions, Ecological Systems, and Results

- While some Protected Parks are successful in protecting forests, others are not.
  - Depends on many factors re how established and relationships with local people.
  - In a large cross-sectional IFRI study of 163 forests in 12 countries, no difference in forest density (scale assigned by forester on team after doing forest plots) is measured for Protected Parks compared to *all* other institutional arrangements (Non-Parks)
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# Comparison of Forester's Field Evaluation of Vegetation Densities in 163 Parks and Non-Parks

	Vegetation density				
	Very sparse	Sparse	About average	Somewhat abundant	Very abundant
Officially designated parks (N = 76)	13%	21%	36%	26%	4%
Non-parks (N = 87)	6%	22%	43%	26%	3%

**Kolmogorov-Smirnov Z score = 0.472, p = .979.**

**No significant difference.**

*Source: Hayes, Tanya, & Elinor Ostrom, "Conserving the World's Forests: Are Protected Areas the Only Way?" Indiana Law Review 38(3) (2005): 607.*

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# Findings from Repeat Visits to IFRI Forests

- 2<sup>nd</sup> time research visit in 42 IFRI forests
    - India – 5 forests
    - Kenya – 3 forests
    - Nepal – 10 forests
    - Uganda – 18 forests
    - USA – 6 forests
  - Not a random sample of forests but based on a random sample of plots inside each forest and first study of this type
  - Can assess:
    - Relative strength of formal institution on changes in DBH, basal area, and stem count
    - Strength of regular involvement of user groups in monitoring forests on same forest measures
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# Impact of Formally Designated Tenure and Forest Monitoring on Changes in Forest Condition: Assessment using ANOVA

Independent variables	Change in DBH	Change in basal area	Change in stem count
Ownership <sup>a</sup>	F = 0.89	F = 2.52	F = 1.00
Involvement of user groups in monitoring rules <sup>b</sup>	F = 0.28	<b>F = 10.55**</b>	<b>F = 4.66*</b>

<sup>a</sup> Government, community, private

<sup>b</sup> At least one user group is involved in regular monitoring of rules of forest use

\* Significant at .05

\*\* Significant at .01

*Source:* Ostrom, Elinor, & Harini Nagendra, "Insights on Linking Forests, Trees, and People from the Air, on the Ground, and in the Laboratory." *PNAS* 103(51) (2006): 19230.

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# Importance of Local Monitoring

- An initially surprising finding but now supported by several studies
    - Monitoring by local forest users of the harvesting practices by other users is strongly associated with improved forest conditions
    - Four recent studies find local monitoring to be very important –
      - Coleman in *JPAM* (2009),
      - Coleman & Steed in *Ecol. Econ* (2009);
      - Chhatre & Agrawal *PNAS* (2008) & (2009)
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## Study 100 forests in 14 countries

- IFRI over-time data
  - Coleman & Steed found when local user groups have right to harvest from the forest, they are more likely to engage in M&S
  - Considered counterintuitive to some policy makers that giving the right to harvest products from a forest may actually improve forest conditions
  - But those who have long-term rights to a flow of future benefits do monitor to see that rules are followed
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# Chhatre and Agrawal

- Recent analyses focusing on forests in 10 tropical countries examines tradeoffs and synergies between level of carbon storage in forests and their contributions to livelihoods.
  - Larger forests more effective in enhancing carbon *and* livelihoods
  - Even stronger when local communities have strong rule-making autonomy and incentives to monitor
  - Keeping local users out of forests is NOT a panacea!!!!
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# A Puzzle from Field

## Research: Why Do Users Monitor Others?

- Voluntary effort to produce a “public good” of rule conformance
- Game theoretic predictions – no one will voluntarily contribute to provide a public good
- Earlier findings from field studies led to a series of laboratory experiments at IU and now replicated by others

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# Harvesting Common-Pool Resources in the Lab

- Baseline experiment of complete anonymity and finitely repeated game
    - Game theoretical prediction is substantial over-harvesting
    - Prediction supported in the lab
  - Adding the capacity to communicate – does not change prediction – in a social dilemma communication is only CHEAP TALK
  - Subjects make good use of opportunity for cheap talk – especially when repeated
  - They use it to agree on joint harvesting strategy & for verbal sanctions of unknown over-harvesters
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# In the Lab

- Sanctioning design
    - External rule established by experimenters: participants may pay a “fee” to “fine” others
    - Game theory prediction: no one will sanction
    - Results: relatively high levels of sanctioning – increases contributions but costly due to payment of fees & fines
  - Self-determined sanctioning system
    - Achieve 90% of optimal outcomes!
    - Demonstrated capacity to self-organize without external enforcers
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## In the Field – Users Make Their Own Rules

- Design enabled subjects who had experience with imposed sanctions to decide whether or not to make agreement about harvesting levels AND about whether & how large sanctions they would use
  - Groups who decided against crafting their own sanctioning system – started with low harvesting rates but cooperation collapsed over time
  - Groups who made their own rules – achieved 90% of optimal with very high levels of conformance .
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# Replications

- Findings related to effect of communication repeatedly replicated in other labs and in field experiments
  - New paper in *Science* in about a week will report on finding from a more complex experimental design where communication is again shown to be effective (and just having punishment capability is not effective)
    - Janssen, Lee, Holahan, and Ostrom, “Lab Experiments for the Study of Social-Ecological Systems..”
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# Initial Effort to Develop Design Principles of Robust CPR Institutions

- Result of my struggle to examine multiple cases in our CPR database for specific rules that appeared strongly related to long-term sustainable systems.
- Based on a close reading of a large number of existing case studies and checking with case authors re the accuracy of my speculations
- Thought I should share my struggle with others in *Governing the Commons* as a step toward ~~developing theory re what enhances~~ robustness

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# New Findings re Design Principles

- Cox, Arnold & Villamayor “A Review and Reassessment of Design Principles for Community-based Natural Resource Management” R&R for *Ecology & Society*.
  - Reviewed 96 studies from around the world (by other scholars of applicability of design principles across sites as well as case studies)
  - Found substantial support for principles and have proposed a better framing of the principles so that one does not combine ecological factors (such as physical boundaries) with social factors (such as group membership)
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# Clarified Design Principles

- *Boundaries* – now distinguish clear boundaries between users & non-users and for the resource itself.
  - *Congruence* – now distinguish rules congruent with local social & ecological conditions from distribution of benefits and costs
  - *Monitoring* – included monitoring resource conditions as well as user actions
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# Reframed Principles

- 1A. *Clearly defined boundaries:*  
Individuals or households who have rights to withdraw resource units from the CPR must be clearly defined.
  - 1B. The boundaries of the CPR itself must be well defined.
  - 2A. *Congruence between appropriation and provision rules and local conditions:*  
Appropriation rules restricting time, place, technology, and/or quantity of resource units are related to local conditions.
  - 2B. Appropriation rules are related to provision rules requiring labor, material, and/or money.
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- 3. *Collective-choice arrangements:* Most individuals affected by the operational rules can participate in modifying the operational rules.
  - 4A. *Monitoring:* Monitors are present and actively audit CPR conditions and appropriator behavior.
  - 4B. Monitors are accountable to the appropriators or are the appropriators.
  - 5. *Graduated sanctions:* Appropriators who violate operational rules are likely to be assessed graduated sanctions (depending on the seriousness and the context of the offense) by other appropriators, by officials accountable to these appropriators, or both.

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6. *Conflict-resolution mechanisms:* Appropriators and their officials have rapid access to low-cost local arenas to resolve conflicts among appropriators or between appropriators and officials.

7. *Minimal recognition of rights to organize:* The rights of appropriators to devise their own institutions are not challenged by external governmental authorities.

8. *Nested enterprises:* Appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities are organized in multiple layers of nested enterprises.

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# Results by design principle

(1 = Principle present, 0 = Principle not present)

		Evidence				
Principle		1	0	n	Fisher's p	Effect size
1A	Success	42	5	80	0.000	0.61
	Failure	10	23			
1B	Success	35	5	59	0.007	0.383
	Failure	10	9			
2A	Success	29	1	49	0.000	0.914
	Failure	1	18			
2B	Success	25	2	45	0.000	0.863
	Failure	1	17			
3	Success	30	2	56	0.000	0.675
	Failure	7	17			
4A	Success	34	2	57	0.000	0.695
	Failure	6	15			
4B	Success	31	0	45	0.000	0.846
	Failure	3	11			
5	Success	21	2	41	0.000	0.853
	Failure	1	17			
6	Success	26	1	46	0.000	0.778
	Failure	4	15			
7	Success	30	4	56	0.021	0.337
	Failure	13	9			
8	Success	22	4	45	0.011	0.397
	Failure	9	10			

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# Why Design Principles Enhance Robustness

- Assures participants that operational rules are being followed by others
  - Those most knowledgeable about effects of rules are involved in making rules
  - Resolves conflicts before they escalate
  - Diversity of governance units stimulates learning and increased performance
  - Large and small units backup each other
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# Threats to Robust CPR Institutions

- **Mismatch of boundaries**
    - ❑ Only national or local authorities – or only general purpose jurisdictions – need polycentric institutions at multiple domains
  - **Poor information about resource attributes especially when:**
    - ❑ Highly variable
    - ❑ Complex interactions
    - ❑ Very slow regeneration rate
  - **Imposed blueprint by outside authorities**
    - ❑ REDD+ could become such a threat
    - ❑ Treating design *principles* as blue prints
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## Threats *(continued)*

- **Corruption**
  - **Overdependence on external aid**
  - **Intergenerational transmission failures of general principles used to guide design and change of institutions**
  - **Rules that increase inequities over time**
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# To Study Robustness, Need to Change Social Sciences

- **Dynamic to complement static models**
  - **Multiple tiers of analysis – Polycentricity**
  - **Heterogeneous types of individuals**
  - **Confront complexity rather than denying it (keeping theories as general as possible)**
  - **Triangulate methods (theory, case studies, large N studies, lab experiments, ABMs)**
  - **(Poteete, Janssen, and Ostrom. 2010. *Working Together: Collective Action, the Commons, & Multiple Methods in Practice*. Princeton University Press)**
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# Application of Lessons to Global Commons

- In my 2009 report to the World Bank, “A Polycentric Approach for Coping with Climate Change,” I stressed that global agreements are needed but that waiting for them is wasting time.
  - Meaningful actions can be taken at a local, regional, and national level that can contribute benefits at each of these levels are generated
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## Basic Lessons

- No single idealized type of governance structures is successful in all ecological and social settings
  - Institutional monocultures are not robust
  - Dangerous tendencies to impose uniform rules
    - People living in or around a project frequently not involved in design
    - Few opportunities for experimentation and learning
  - Rules-on-paper confused for rules-in-use – don't really know what rules are being used in field
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# Thank You For Listening

- Thanks to many colleagues and co-authors, our International Forestry Resources and Institutions (IFRI) colleagues, and to the many resource users in the field who have helped us greatly
  - Thanks to the National Science Foundation, MacArthur Foundation, and Ford Foundation for supporting our research
  - Questions?
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