



# Birds, Frogs, and Workers

Wildlife in the Coffee Fields of Southern India



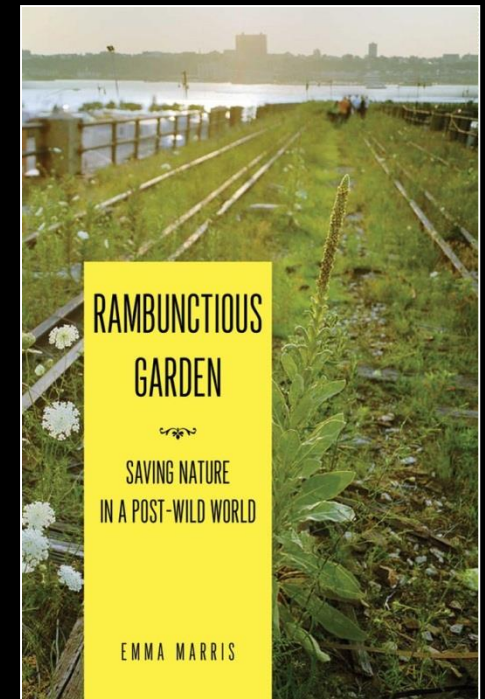
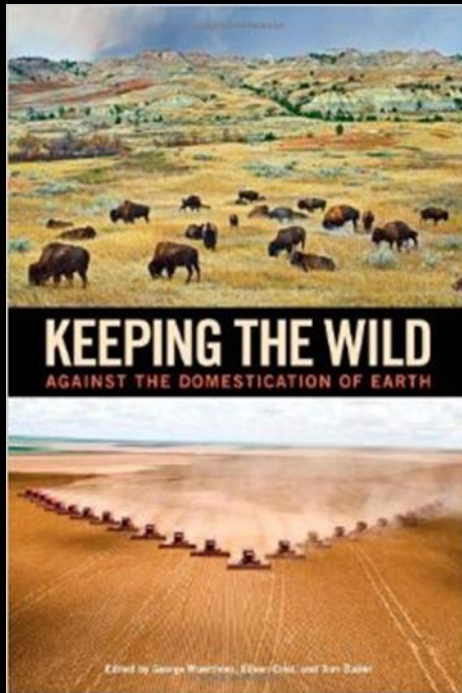


# Anthropocene

Earth systems dominated by anthropogenic forces

Climate change  
Ecological Novelty  
Altered geomorphology  
Altered biogeochemistry

Land Sparing.... Land Sharing...?



# “Producing wildlife: Biodiversity conservation in dynamic commodity landscapes”

- National Science Foundation (NSF #7153185)
  - Dr. Krithi Karanth
  - Centre for Wildlife Studies, WCS
- Collaborative investigation (NSF #1153944)
  - Dr. Ashwini Chhatre
  - Bharti Institute of Public Policy, Indian School of Business, Hyderabad



# Production landscapes

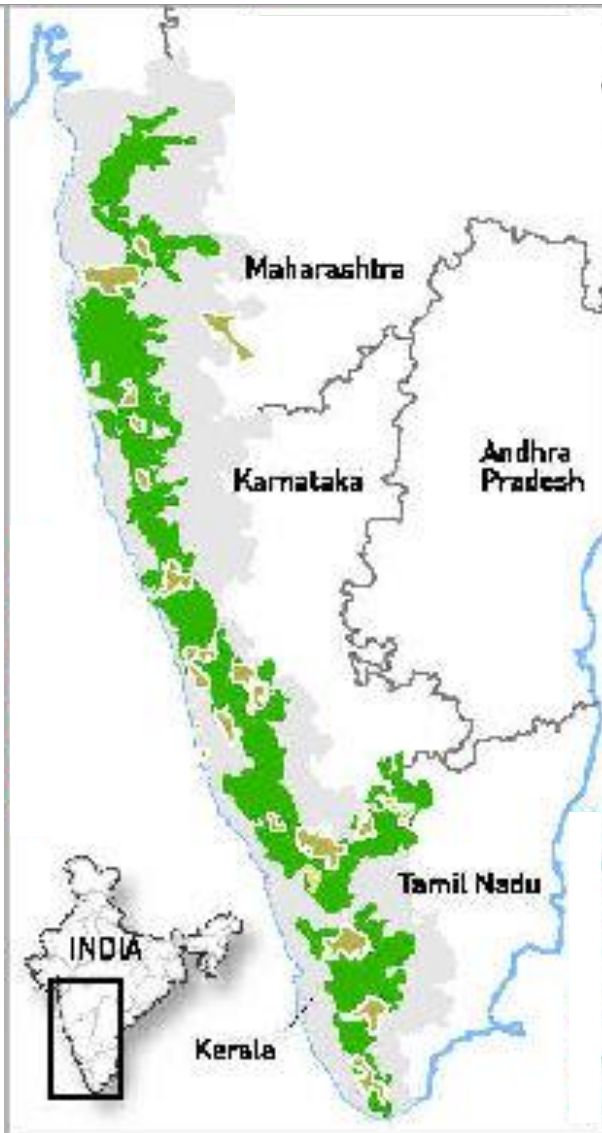


# Production landscapes



- Forest-Plantation  
Landscape mosaic (Faria et al., 2006; Gardner et al., 2006)
- Structural complexity of habitat (Tscharntke et al., 2005)
- Some taxa adapt better than others (Daily et al., 2001)

# Western Ghats perspective



- Small and fragmented PAs
- Insufficient literature
  - Single taxon, land-use type
  - Spatial-scale and sample size

- Natural vegetation
  - evergreen, moist-deciduous and dry deciduous forests, and montane grasslands
- Faunal diversity
  - includes 30% of all Indian plant and vertebrate species.
- Land Uses
  - Compared to formal conservation areas (<12% of the landscape) and
  - traditional conservation systems such as sacred groves (<1%)
  - agro-forestry areas cover a much larger proportion of the landscape





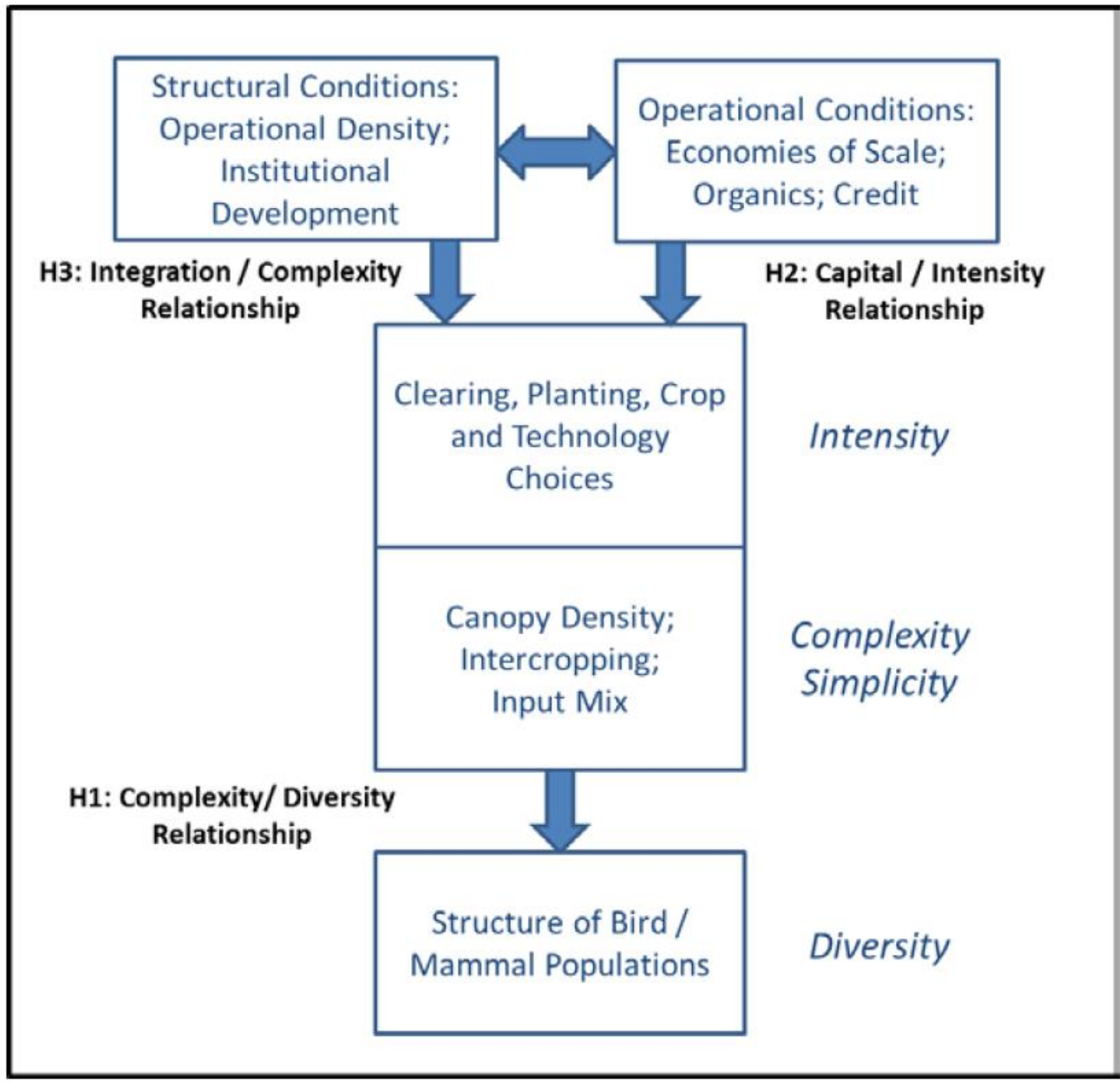


Areca

Coffee

Rubber





Structural Conditions:  
Operational Density;  
Institutional  
Development

Operational Conditions:  
Economies of Scale;  
Organics; Credit

**H3: Integration / Complexity  
Relationship**

**H2: Capital / Intensity  
Relationship**

Clearing, Planting, Crop  
and Technology  
Choices

*Intensity*

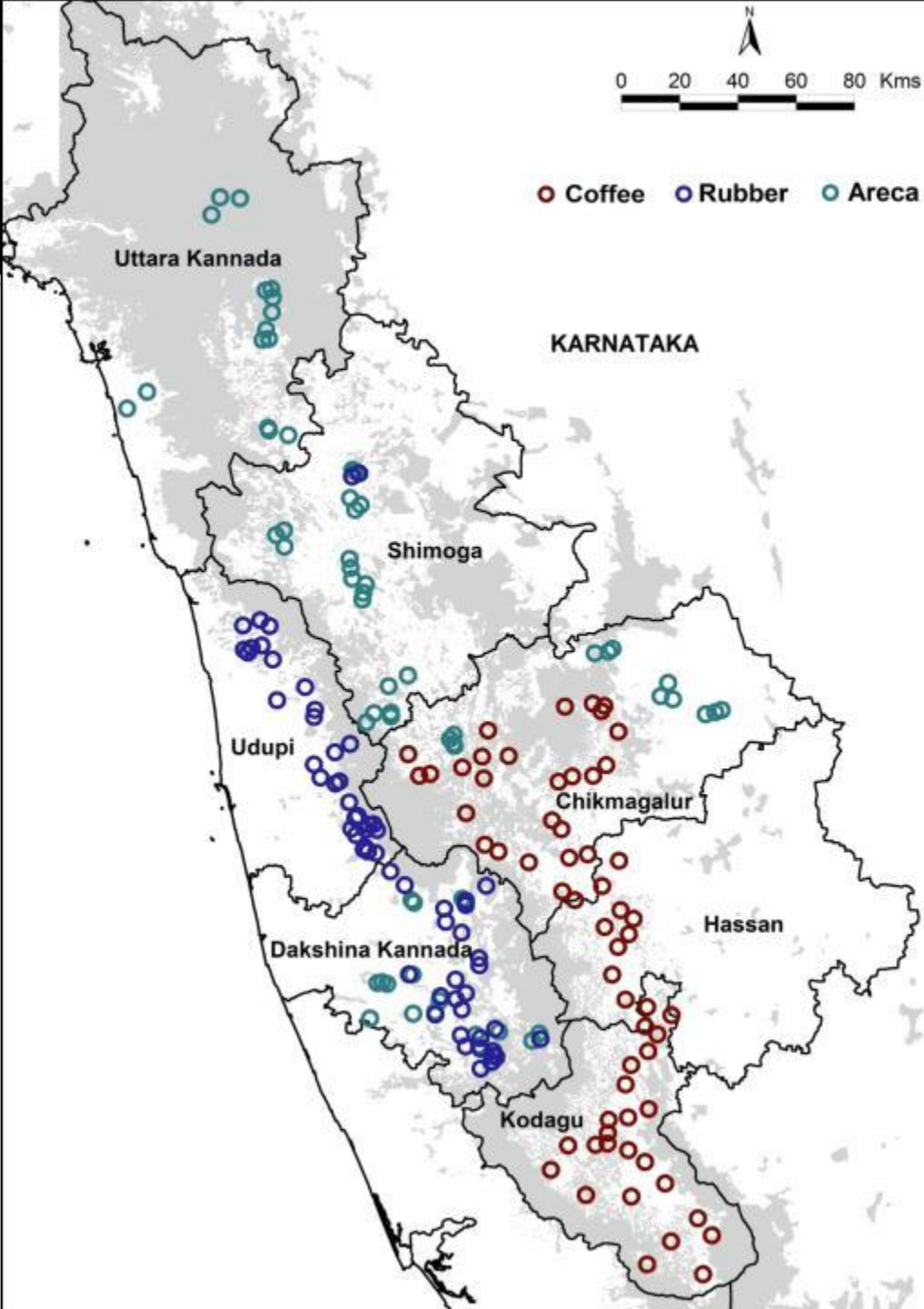
Canopy Density;  
Intercropping;  
Input Mix

*Complexity  
Simplicity*

**H1: Complexity/ Diversity  
Relationship**

Structure of Bird /  
Mammal Populations

*Diversity*



# Study area

- 65 areca
- 61 coffee
- 61 rubber

29634 km<sup>2</sup> area

# BIRD RESULTS

# Sampling design



- 187 plantations
- Dry season sampling
- 7 minute point-counts (386 sampling hours)
- 200 meters distance
- 551 point-counts
- 6 temporal replicates



©SD/KKK/NSF

**6 INTERNS**

**11 VOLUNTEERS**



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Malabar Trogon



©Ramki S

Red Spurfowl



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White-bellied Woodpecker



©Ramki S

Greater Racket-tailed Drongo



©Ramki S

Orange-headed Thrush



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Banded Bay Cuckoo



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Malabar Woodshrike



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Malabar Barbet



©Ramki S

Grey-headed Bulbul



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Malabar Parakeet



©Ramki S

Flame-throated Bulbul



©Ramki S

Hill Myna



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Brown-breasted Flycatcher



©Ramki S

Asian Paradise Flycatcher



©Ramki S

Tickell's Leaf Wabler



©Ramki S

Kashmir Flycatcher



©Ramki S

Blue-tailed Bee-eater



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# Bird Species Richness



	Areca	Coffee	Rubber
No. of resident species (160)	105	137	106
No. of endemics (14)	6	14	11
Mean Species Richness	34.06 (1.76)	58.21 (2.13)	45.41 (2.10)

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# Factors associated with richness



	Tree Cover	Tree Richness	Tree Density	Rainfall	Elevation	Distance to PA
Areca	+					
Coffee		+	+		-	
Rubber				+		

# AMPHIBIAN RESULTS

# Sampling design



- 118 plantations
- Monsoon sampling
- 187 sampling hours
- Time-bound random walks
- Sampling in all microhabitats

# Amphibian Sampling



- Method 1  
5m\*5m quadrat  
across all available  
micro-habitats
- Method 2  
Time bound Visual  
encounter survey





*Rhacophorus malabaricus*.

Photo by: Shashank Dalvi/Krithi Karanth/CWS.

The gliding abilities of *Rhacophorus malabaricus* aided by long skin between their fingers allow these frogs to cover distances of 10 feet in one leap.

*Polypedates maculatus*.  
Photo by: Shashank  
Dalvi/Krithi Karanth/CWS.

*Polypedates maculatus* can  
adopt lighter skin colors  
and secrete mucus to  
regulate moisture loss.



*Rarchestes luteolus*.  
Photo by: Shashank Dalvi/Krithi  
Karanth/CWS.

The blue-eyed bush frog



*Nyctibatrachus minimus*.

Photo by: Shashank Dalvi/Krithi Karanth/CWS.

*Nyctibatrachus minimus* is the smallest known frog in India.



*Rhacophorus lateralis*.

Photo by: Shashank Dalvi/Krithi Karanth/CWS.

*Rhacophorus lateralis* was rediscovered in 2000 and is thought to be extremely localized. We observed more than 200 individuals of this species in a pond.



*Nyctibatrachus dattatreyaensis*.

Photo by: Shashank Dalvi/Krithi Karanth/CWS

New to science 2008

Critically Endangered



# Factors associated with occupancy



Guild	Pond	Stream	Road	Effort	Elevation	Rain	Soil pH
Tree	+				-	+	
Bush					-		
Small-ground			+	+			
Large-ground	+		+	+			-
Small-stream		+		+			
Large-stream		+		+	+	-	+
Pond	+	+					

# Inferences



- Canopy cover and structure (de Lima et al., 2013)
- Bird endemism -high canopy species
- Ecosystem function – Frugivores & Salliers
- Tree density, **richness/diversity**, and % tree cover



- Microhabitat presence – breeding sites
- Body size and ecology

# Inferences



- Importance of agro-plantation landscapes
- Biodiversity of smaller fauna
- Management decisions of individuals





# Explaining Diversity in Coffee

avian diversity

↔ *Significant correlation*

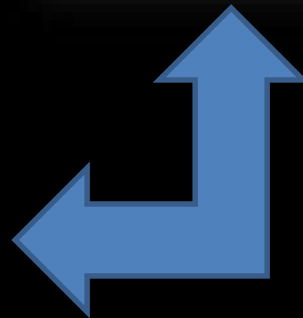
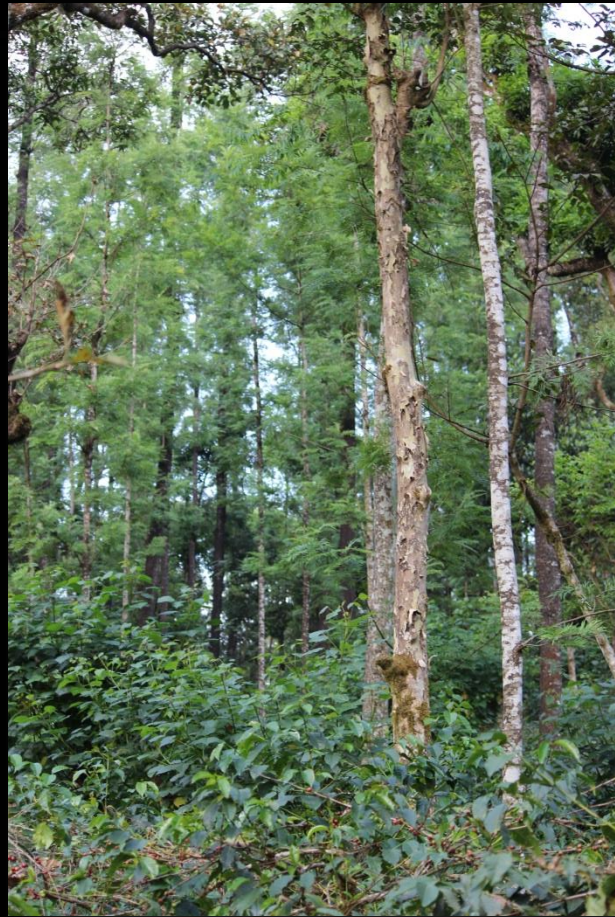
tree species diversity



Also:

percentage tree cover  
tree density

To a lesser degree:  
elevation



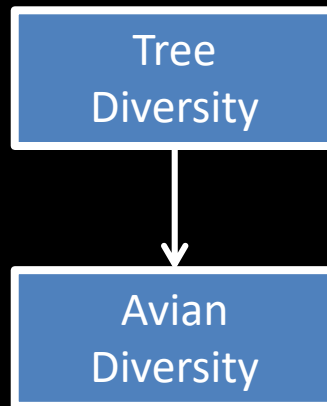
Canopy

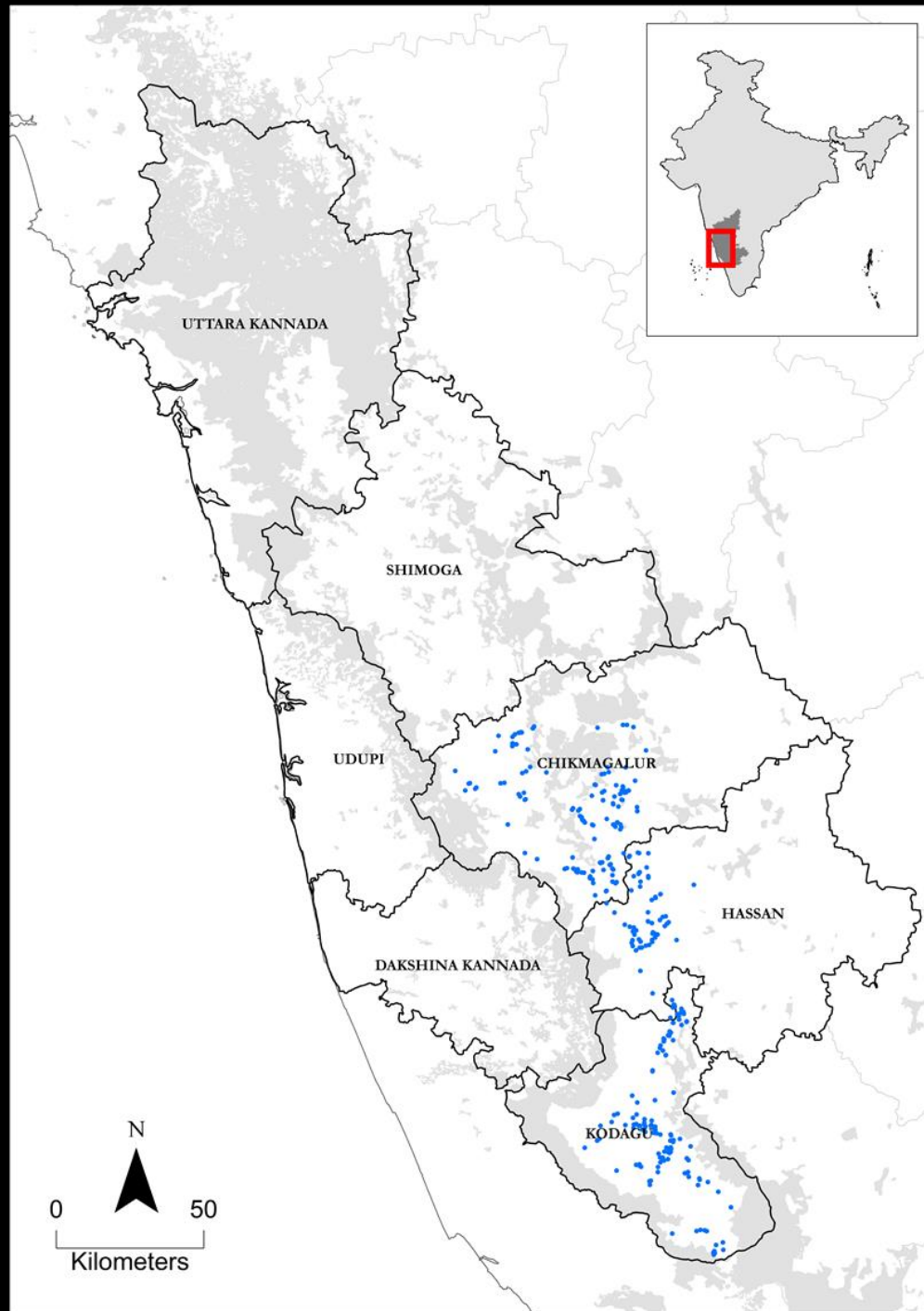
## Species Diversity



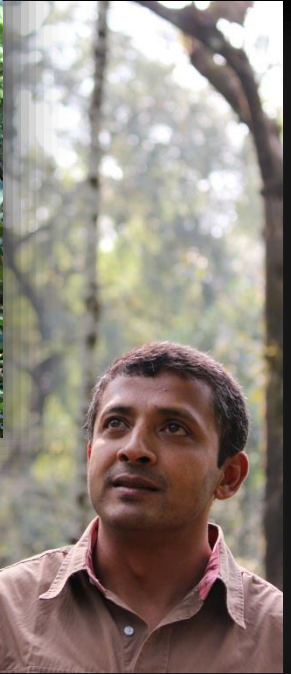
Mean 7 tree species on coffee plantations; maximum 31.

# Explaining Avian Diversity in Coffee





344 Plantations  
Surveyed



## Tree species found on at least 5 percent of surveyed plantations

Local Name	Species	% of plantations (344)
Silver oak	<i>Grevillea robusta</i>	93
Jackfruit/Halasu	<i>Artocarpus heterophyllus</i>	85
Nandi	<i>Lagerstroemia microcarpa</i>	55
Jamoon/Nerle	<i>Syzygium cumini</i>	41*
Basri	<i>Ficus Religiosa</i>	39
Teak/Sagwani/Tega	<i>Tectona grandis</i>	37
Mathhi	<i>Terminalia crenulata</i>	36
Rosewood	<i>Dalbergia latifolia</i>	33*
Hone/ Banje (Honne)	<i>Pterocarpus marsupium</i>	30
Halvana/Dadup/Parivala	<i>Erythrina subumbrans</i>	30
Atthi	<i>Ficus racemosa</i>	28
Havalige	<i>Acrocarpus fraxinifolius</i>	26*
Garge	<i>Garuga pinnata</i>	26
Mango/ Hulimavu/kukku	<i>Mangifera Indica</i>	25*
Ballangi	<i>Poeciloneuron indicum</i>	12
Soapnut/ Antwala	<i>Sapindus emarginatus</i>	12
Sampige	<i>Magnolia champaca</i>	11
Goni	<i>Ficus drupacea</i>	8*
Hebbahalasu/ peja	<i>Artocarpus hirsutus</i>	8
Thaari	<i>Terminalia bellirica</i>	7
Beetel (arecanut)	<i>Areca catechu</i>	6*

Note: \* Significantly present on plantations growing Arabica (either Arabica-only or mix of Arabica and Robusta), using a Linear Probability Model

# Explaining Habitat Diversity in Coffee

tree species diversity



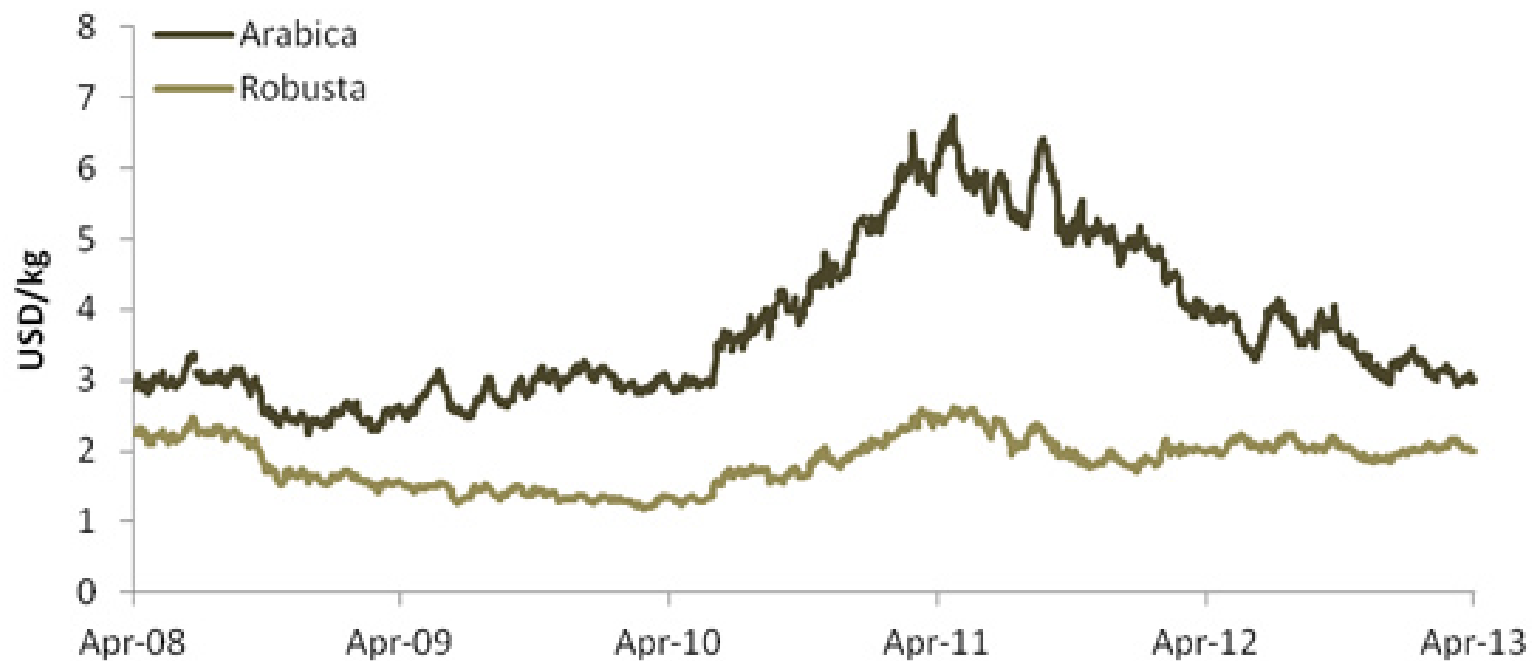
plantation size

arabica varieties



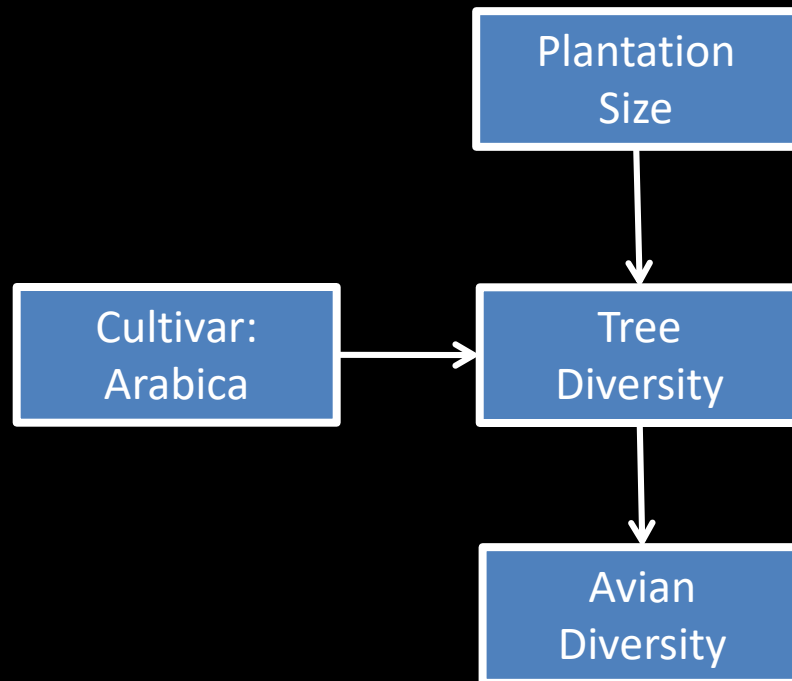


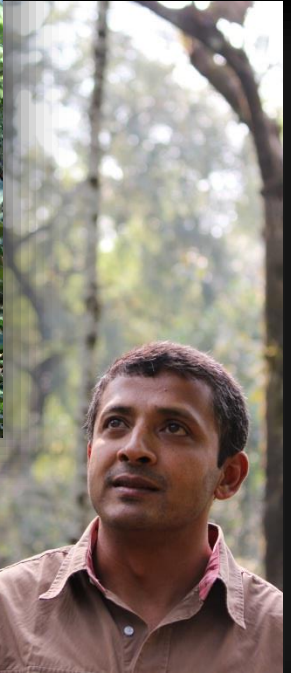
## Narrowing spread between Arabica and Robusta Coffee



Source: Bloomberg Data - ICE, NYSE Liffe

# Explaining Habitat Diversity in Coffee





## Effect of coffee plantation structural and socioeconomic conditions on tree species diversity; Multiple Regression Results

Variable	Model1	Model2	Model3	Model4
Permanent labor	1.157***	0.037	1.094***	
Herbicide/ pesticide use	0.763**	0.476	0.023	
Total area		1.021***		1.032***
Arabica cultivation			1.176**	.592*
Increase in tree canopy				1.028**
North Karnataka				1.486***
Education (12th grade)				0.058
Household size				-0.083
Constant	6.11***	4.936***	5.862***	3.888***
N	331	331	331	328
f	5.87	15.35	5.64	10.81
R-squared	0.0371	0.1371	0.0528	0.1942
*p<.10, **p<.05, ***p<.01, two-tailed test				

# The Catch...

plantation size + arabica + tree diversity



labor

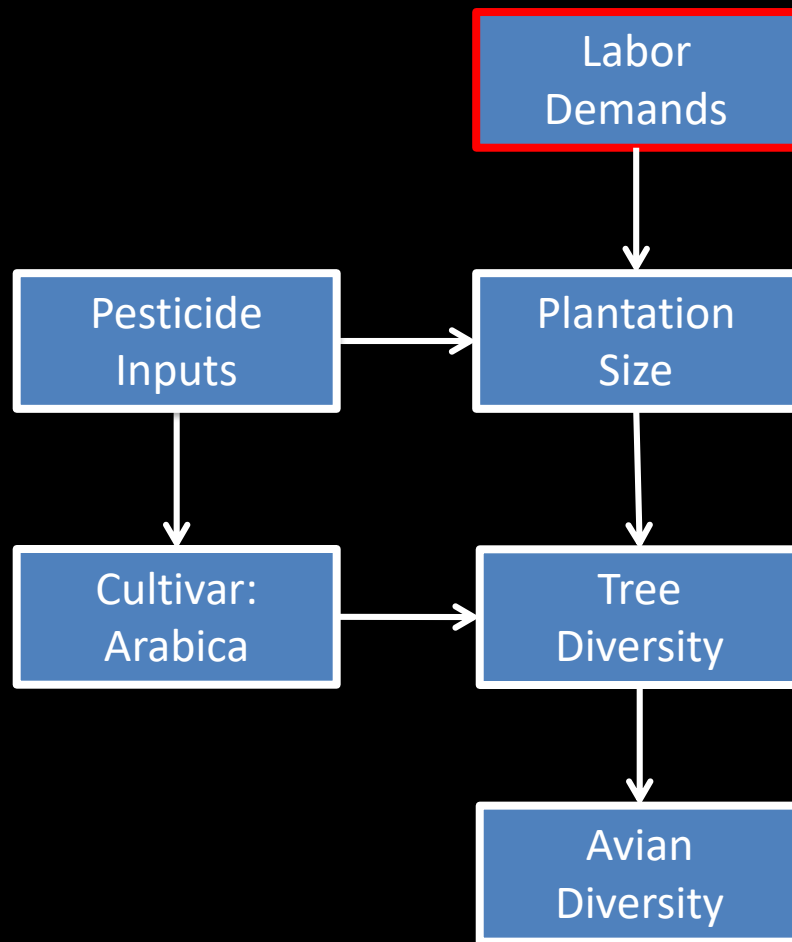
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arabica



pesticide inputs

# Labor in the Ecological Chain of Explanation

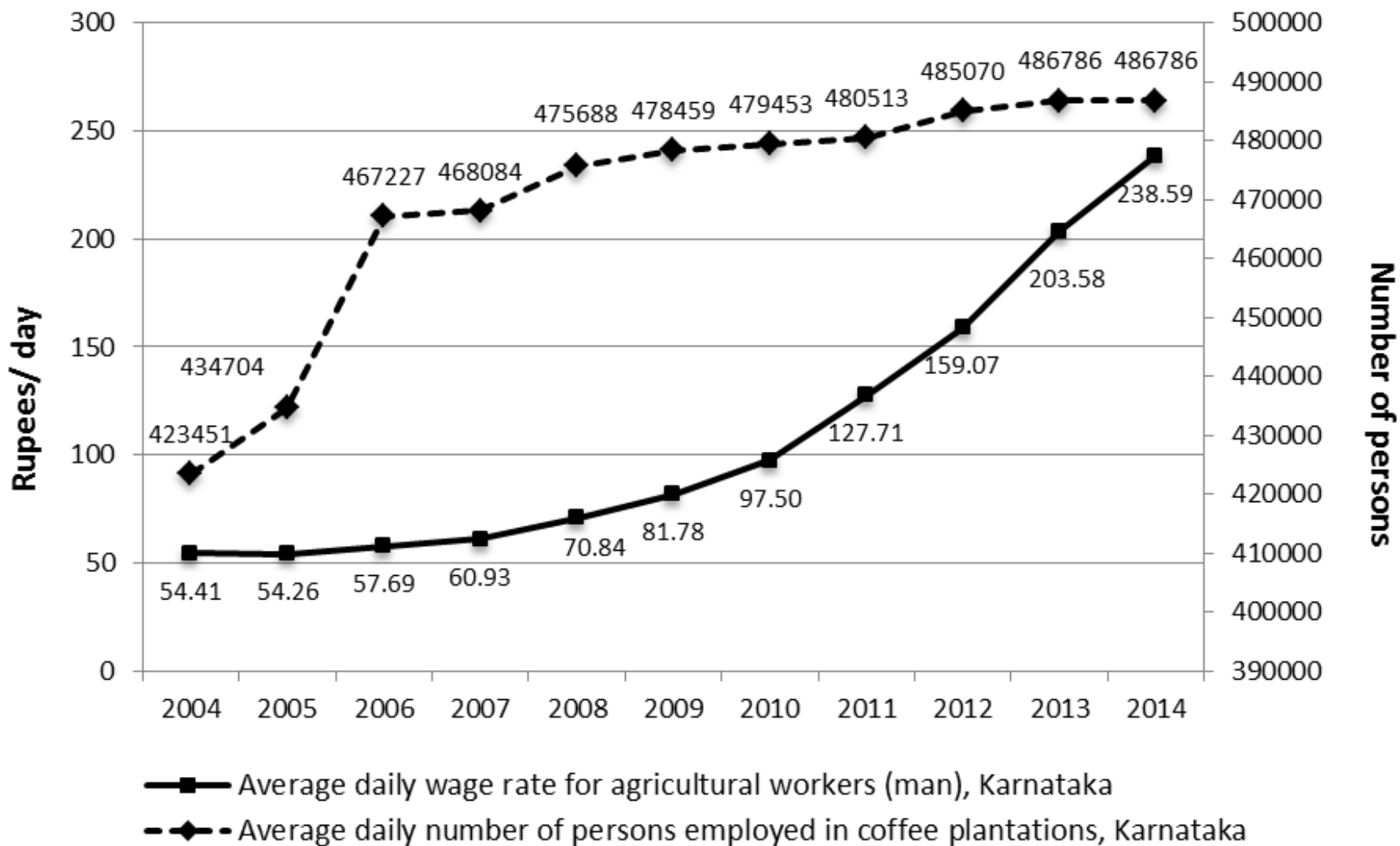




**Coffee:**  
**Permanent labor: 63.3%**

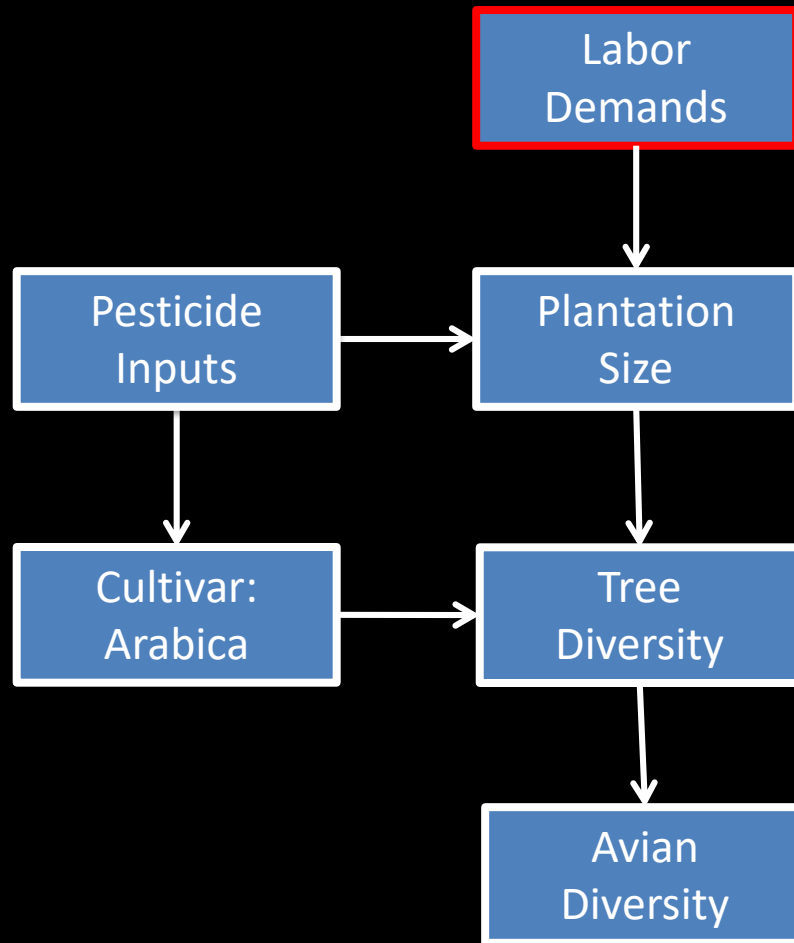






Source: Ministry of Agriculture, Govt. of India; accessed from: [indiastat.com](http://indiastat.com)

# Labor in the Ecological Chain of Explanation



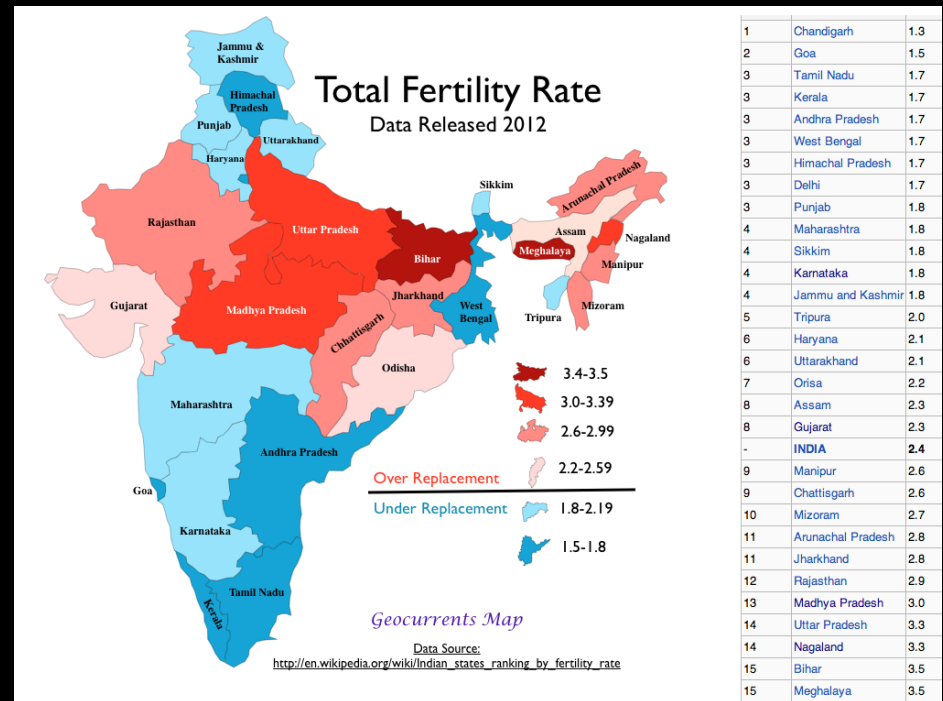
What happens if there is not enough?

Where did agrarian labor go?

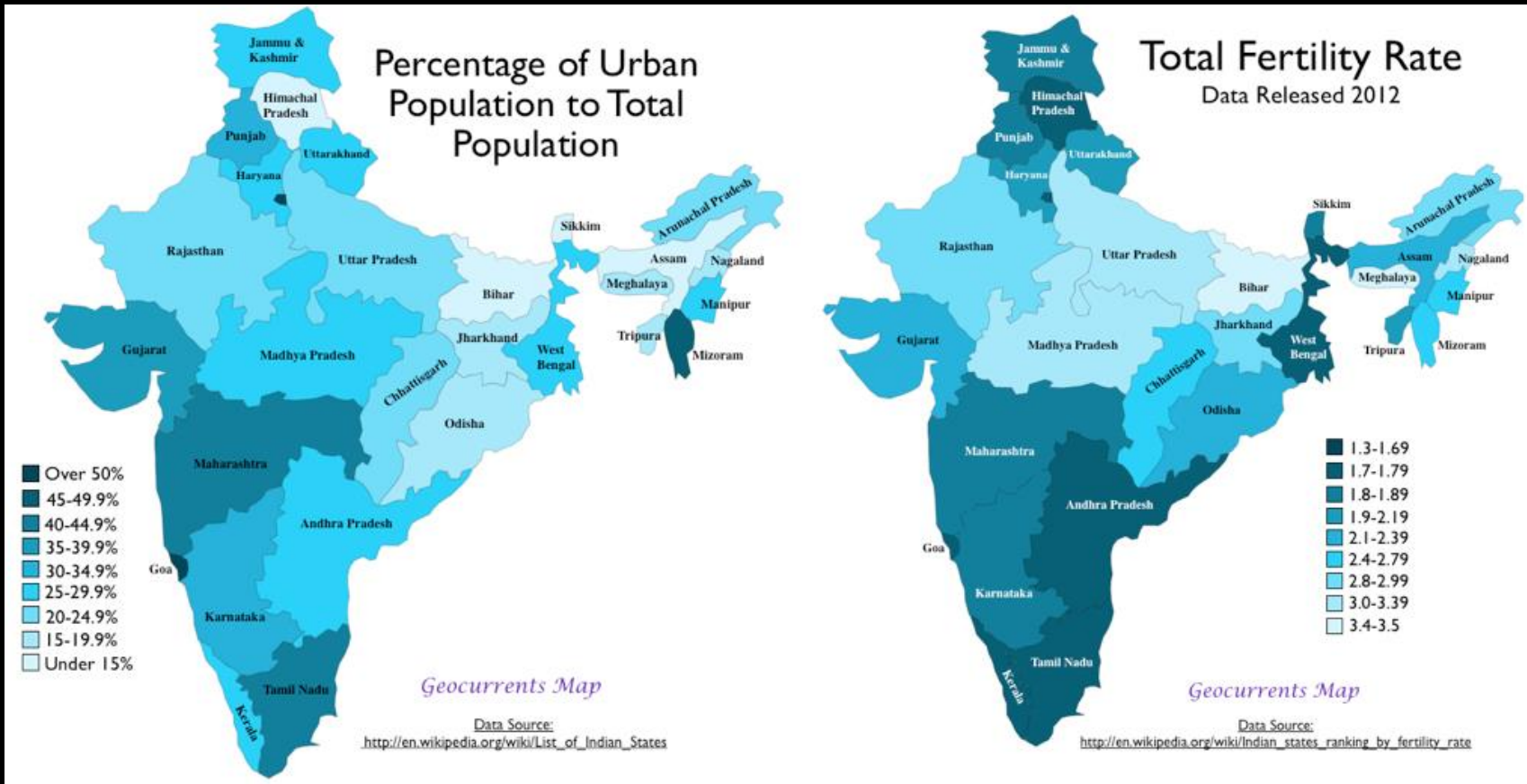
Does a shift to robusta mean fewer birds but fewer pesticides applications?

# Some Key Indicators

- Karnataka fertility rate: 1.79
- Between 2005-06 and 2010-11, average growth rate of Karnataka GSDP: 8.6 %
- Karnataka is now among the more urbanized States in India
  - 38 per cent of its population living in urban areas (Census of India 2011)
  - 33.99 per cent in 2001



# The Great Transition



- Robbins, P., K. Karanth, A. Chhatre, and V. (under review) Tripuraneni, Coffee, trees, and workers: Political economy of biodiversity in commodity agroforests, *Annals of the Association of American Geographers*.
- Karanth, K.K., Sankararaman, V., Dalvi, S., Srivathsa, A., Chhatre, A., Robbins, P. (under review). Amphibians calling: Richness, diversity and abundance in Western Ghats plantations. *Diversity and Distributions*.
- Chang, C. H., Karanth, K., **Robbins, P.** 2018. (forthcoming) “Birds and beans: Comparing avian richness and endemism in arabica and robusta plantations in India’s Western Ghats” *Nature: Scientific Reports*.
- Karanth, K. K., V. Sankararaman, S. Dalvi, A. Srivathsa, R. Parameshwaran, S. Sharma, **P. Robbins**, and A. Chhatre. 2016. Producing diversity: Agroforests Sustain Avian Richness and Abundance in India's Western Ghats. *Frontiers in Ecology and Evolution*. 4: 111.
- **Robbins, P.**, A. Chhatre and K. Karanth. 2015. “Political ecology of commodity agroforests and tropical biodiversity” *Conservation Letters*. 8(2): 77–85.



## OUR STORY



Wild Kaapi emerged out of a scientific project measuring biodiversity on 187 coffee, areca and rubber farms while also studying market dynamics, labour inputs and management actions of more than 1100 growers in India's Western Ghats. Management practices, particularly on coffee farms are WILDLIFE FRIENDLY™ and the farms teeming with wildlife!

Our coffee is sourced from coffee farms that are [CERTIFIED WILDLIFE FRIENDLY™](#) through rigorous scientific audits for birds, butterflies, mammals, amphibians and trees. Our goal is to build sustainable livelihoods and create a network of coffee growers who foster wildlife on their lands while delivering the highest quality, freshly roasted coffee to your homes.

[LEARN MORE](#)

## @WILD KAAPi ON INSTAGRAM



## Scientific Audits

A research project led by Dr. Paul Robbins (University of Wisconsin-Madison), Dr. Krithi Karanth (Wildlife Conservation Society, Duke and Centre for Wildlife Studies) and Dr. Ashwini Chhatre (University of Illinois, Indian School of Business) measured biodiversity on 187 coffee, areca and rubber plantations in India's Western Ghats. Their collaborative interdisciplinary efforts have produced multiple scientific publications and established monitoring protocols for wildlife found in these farms. This research identified specific elements of coffee management that produces direct and ancillary wildlife conservation benefits.

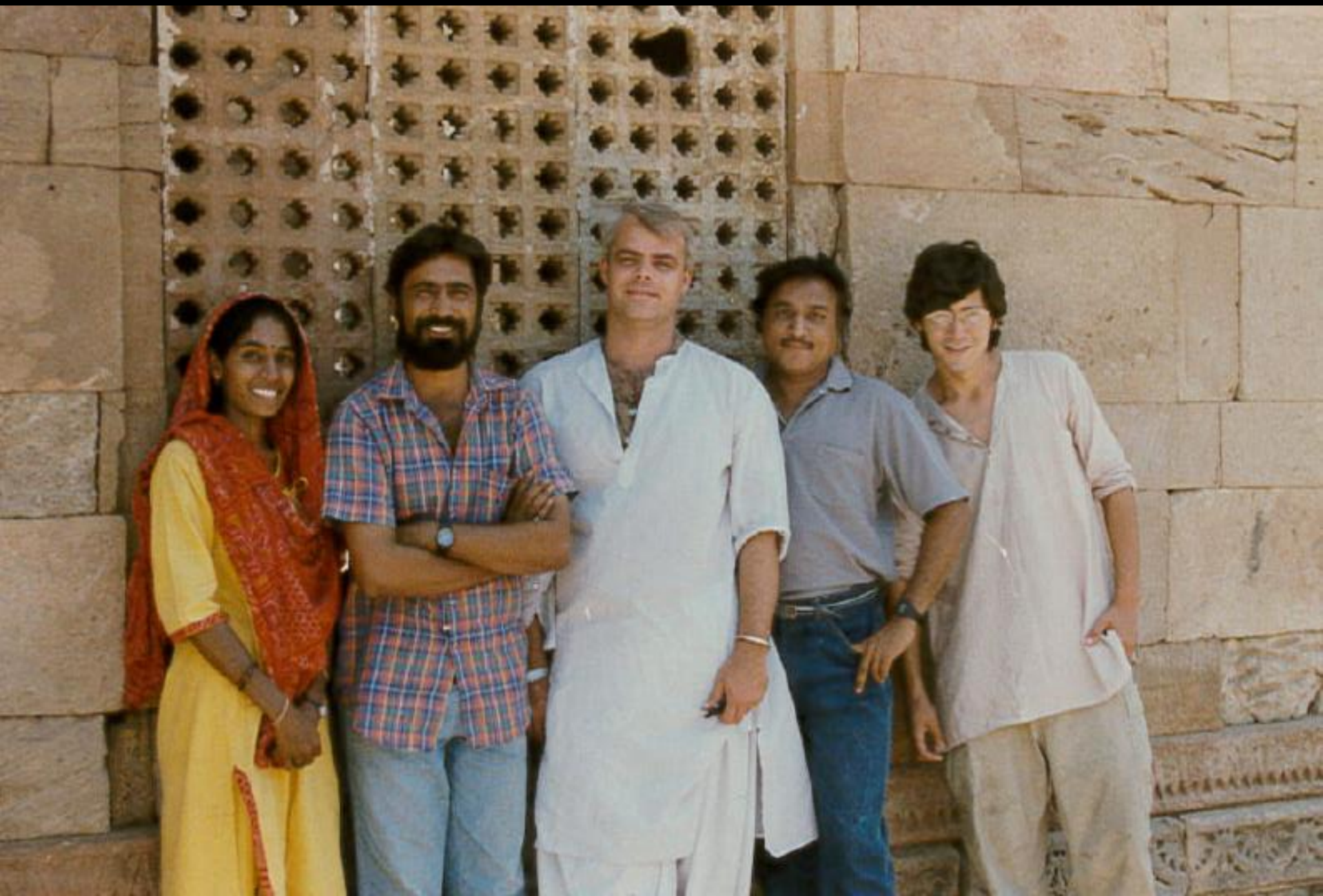
Wild Kaapi conducts comprehensive and rigorous ecological audits that measure species richness and diversity across multiple taxonomic groups using advanced scientific methods.

## Publications

1. Robbins, PR, Chhatre, A, Karanth, KK. 2015. Political ecology of commodity agroforests and tropical biodiversity. Conservation Letters. 8: 77–85. 10.1111/conl.12169
2. Karanth, KK, Sankaraman, V,\* Dalvi, S\*, Srivathsa, A\*, Parameshwaran, RP, Sushma, S., Robbins, PR, Chhatre, A. 2016. Producing Diversity: Agroforests Sustain Avian Richness and Abundance in India's Western Ghats. Frontiers in Ecology and Evolution. Front. 4:111. doi: 10.3389/fevo.2016.00111

# Lessons

- Avian and amphibian habitat are extremely sensitive to producer decision-making
- What's good for birds isn't always good for workers and vice versa
- Political/economic changes are driving cropping choices with significant biodiversity implications
- Perhaps the largest untold story of the next 25 years is the global "baby bust"





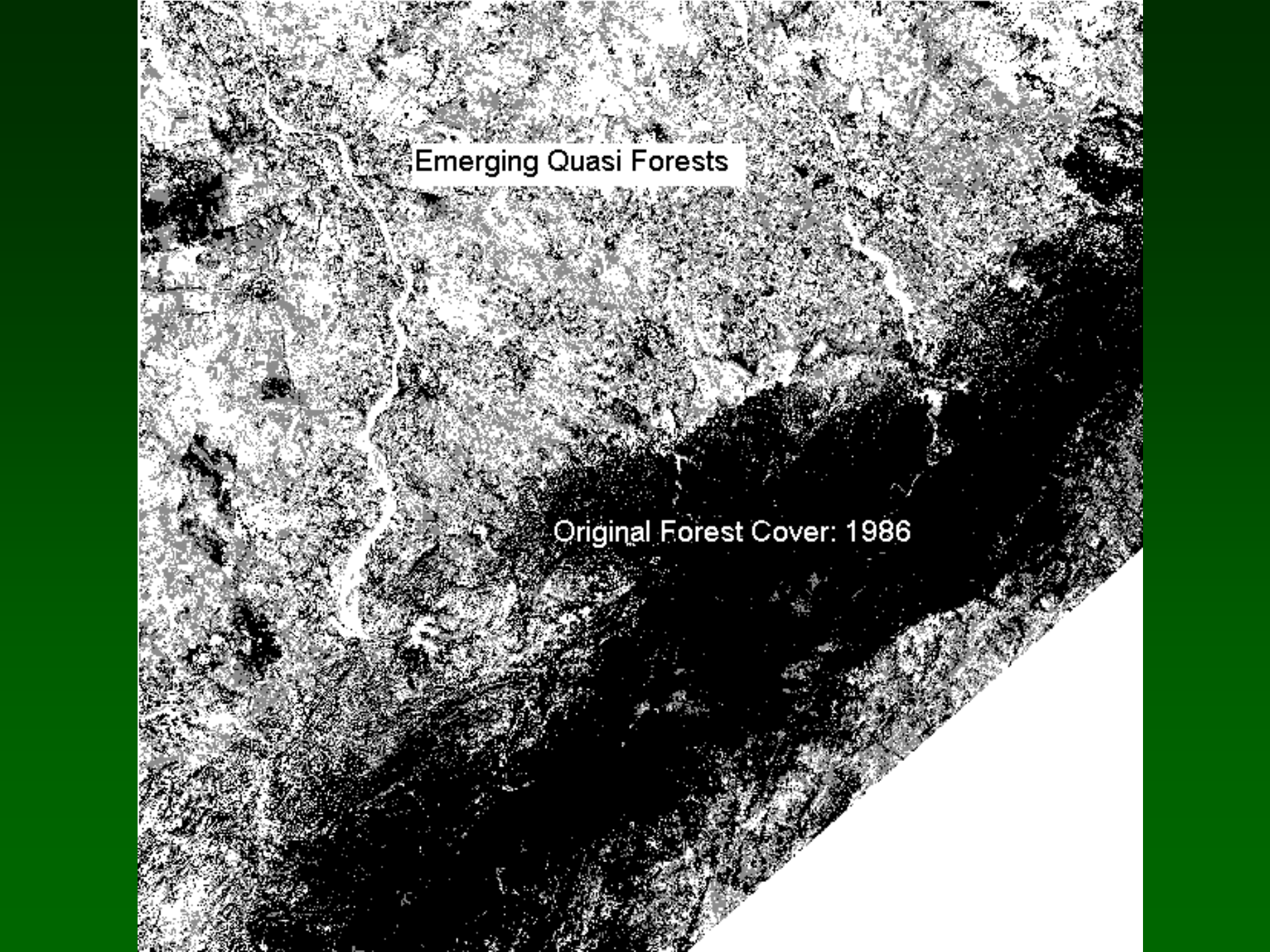






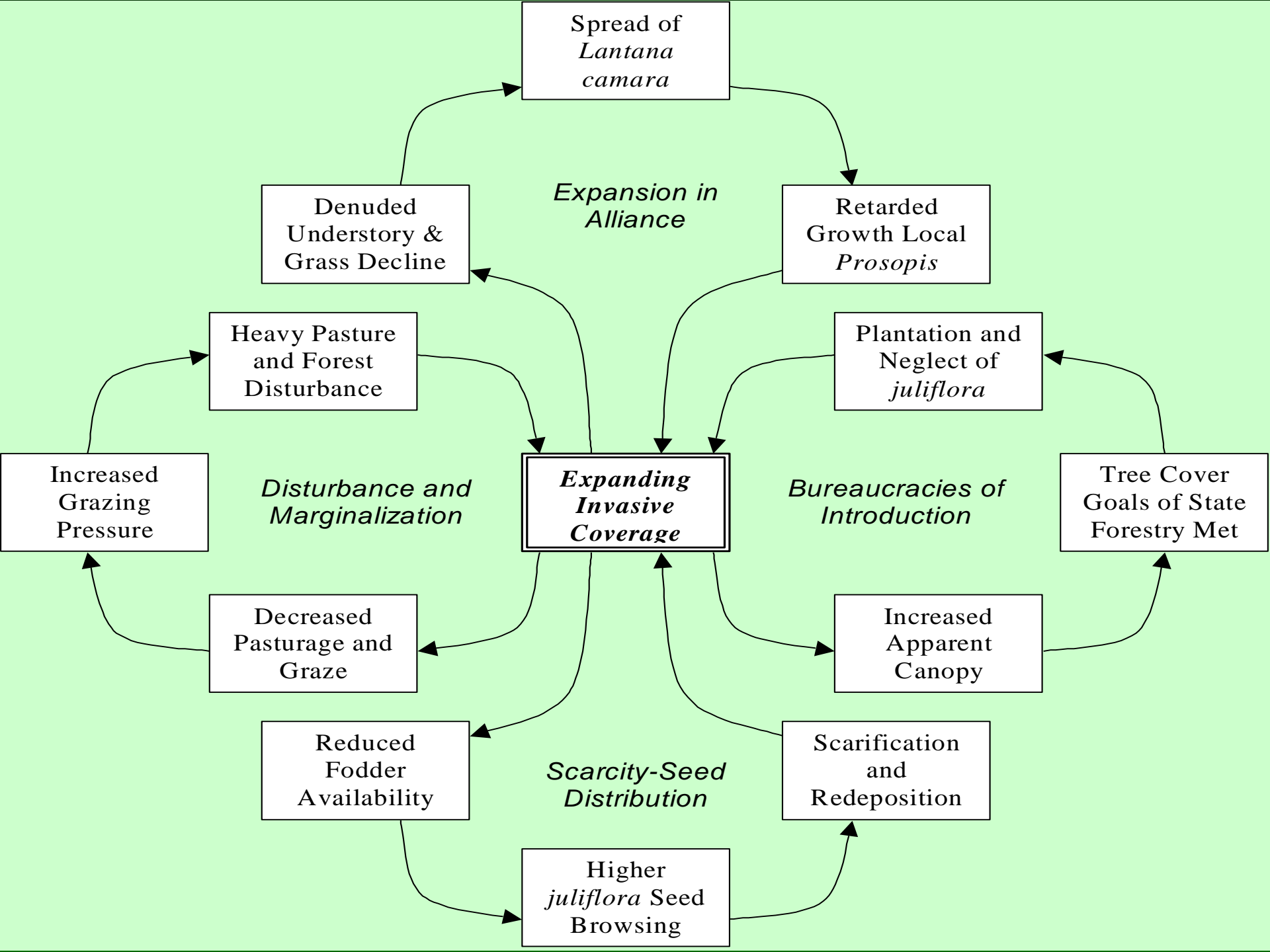
# Mesquite (*Prosopis juliflora*)



A satellite image showing a forest landscape. The image is divided into two main regions. The upper region is labeled 'Emerging Quasi Forests' and shows a lighter, more fragmented texture. The lower region is labeled 'Original Forest Cover: 1986' and shows a darker, more uniform texture. A white diagonal line separates the two regions. The image is set against a green background.

Emerging Quasi Forests

Original Forest Cover: 1986



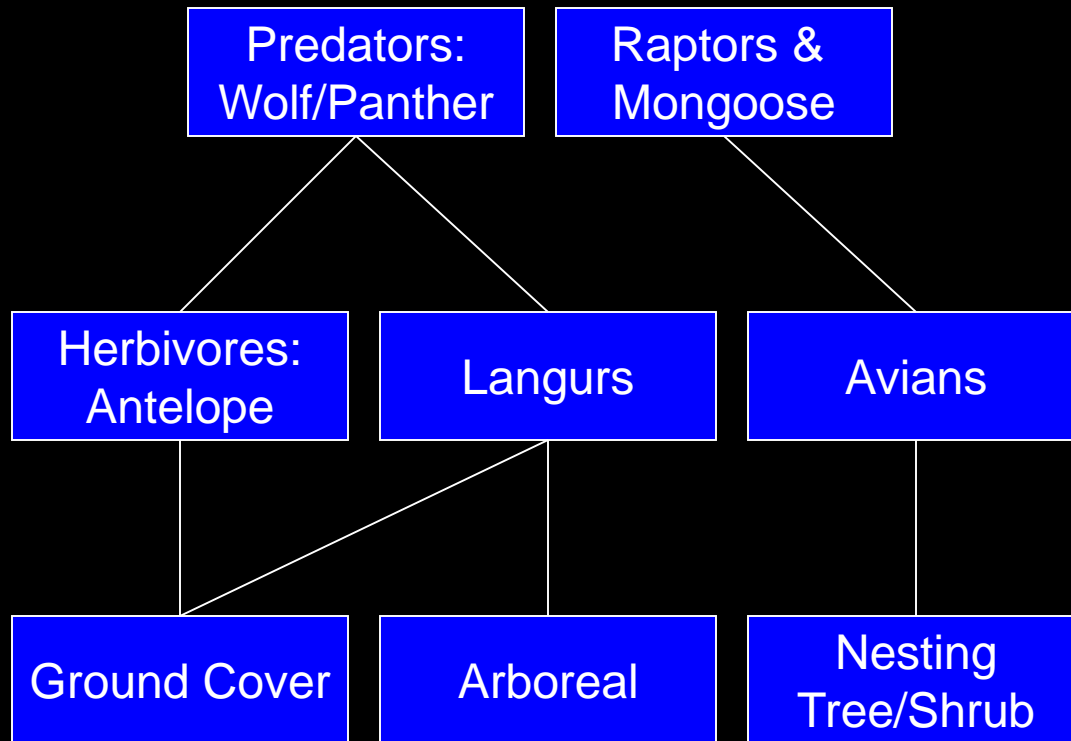








# System State I



# System State II

