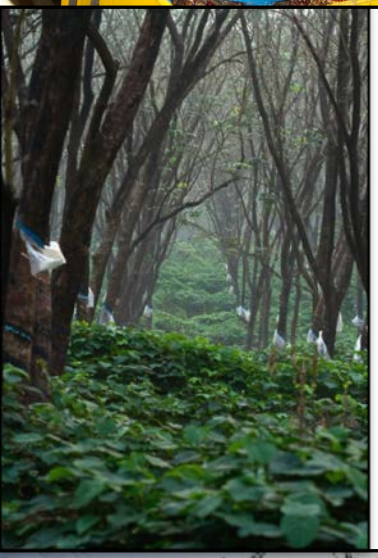
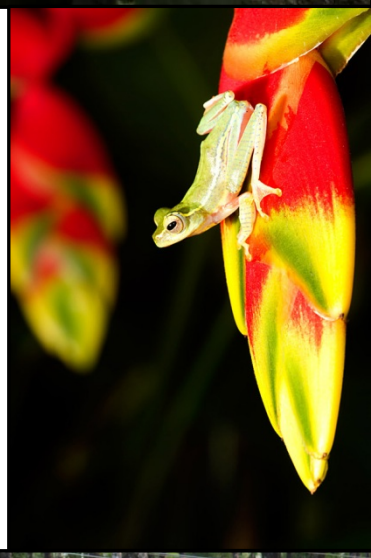


Sustainability

People and Environment in the Anthropocene

NELSON INSTITUTE FOR Environmental Studies



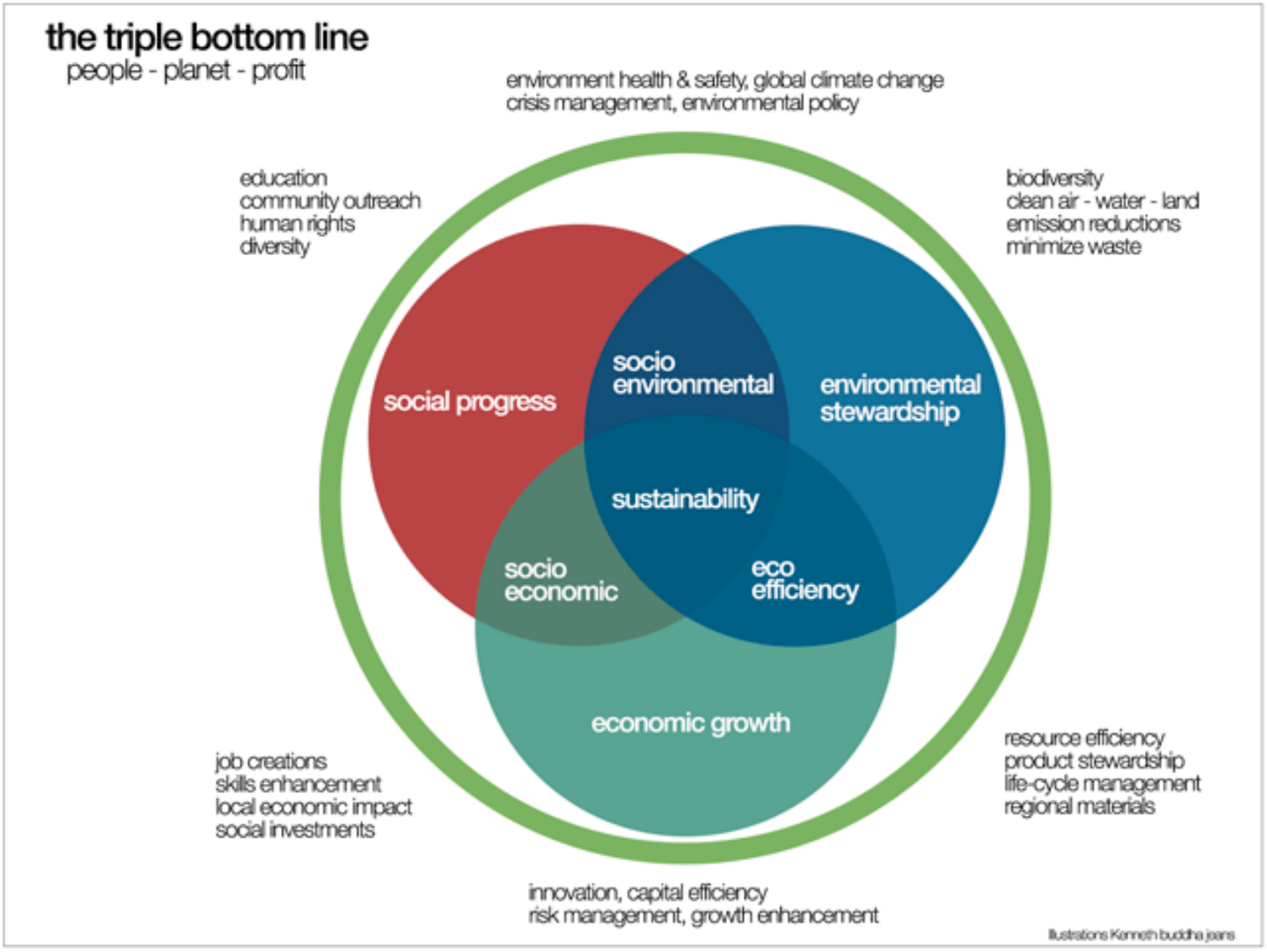

Sustainability Science

- The cultivation, ***integration***, and application of knowledge about Earth systems gained especially from the holistic and historical sciences (such as geology, ecology, climatology, oceanography) coordinated with knowledge about human interrelationships gained from the social sciences and humanities, in order to evaluate, ***mitigate***, and minimize the consequences, regionally and worldwide, of human impacts on planetary systems and on societies across the globe and into the ***future*** – that is, in order that humans can be knowledgeable Earth stewards

  – Kieffer, S.W., Barton, P., Palmer, A.R., Reitan, P.H., & Zen, E. 2003. "Megascale events: Natural disasters and human behavior." Geol. Soc. America Abstracts: 432.

the triple bottom line

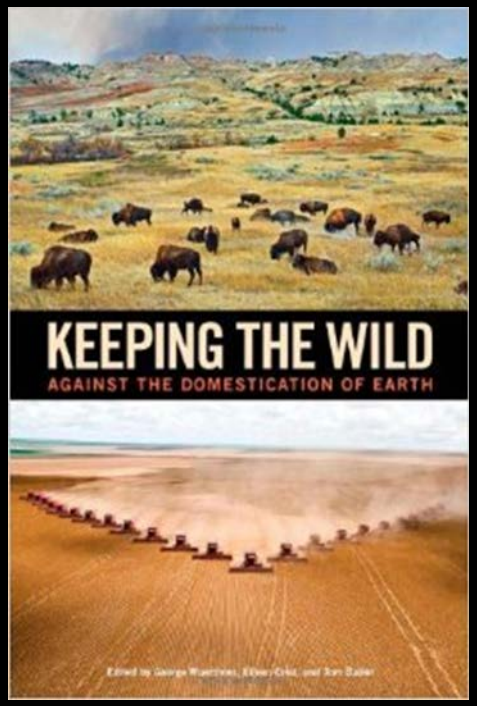
people - planet - profit

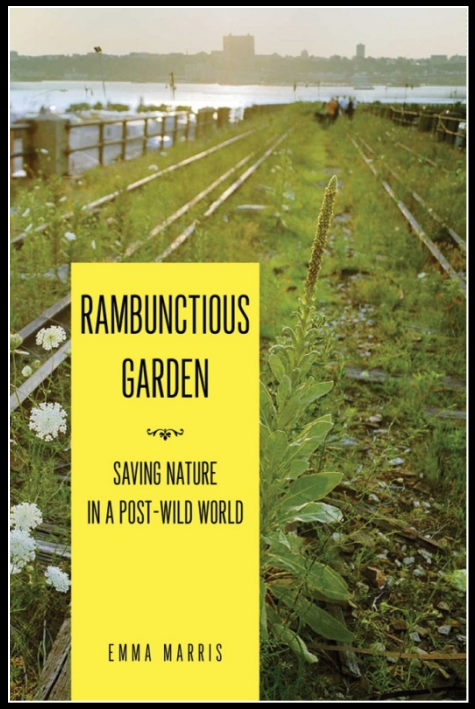


Anthropocene

Earth systems dominated by anthropogenic forces

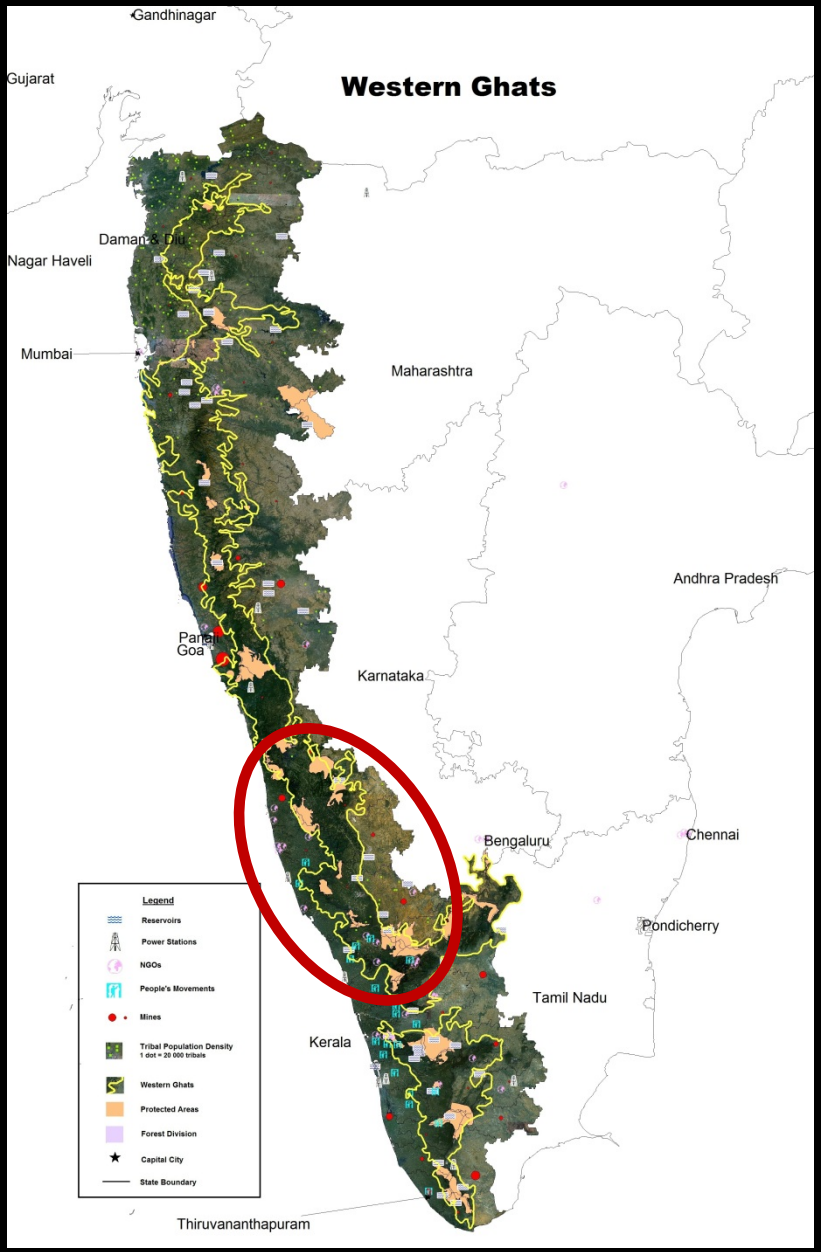
Climate change
Ecological Novelty
Altered geomorphology
Altered biogeochemistry





“Producing wildlife: Biodiversity conservation in dynamic commodity landscapes”

- National Science Foundation (#7153185): Dr. Krithi Karanth (Centre for Wildlife Studies, India)
- Collaborative research investigation with University of Illinois project (NSF #1153944), Ashwini Chhatre

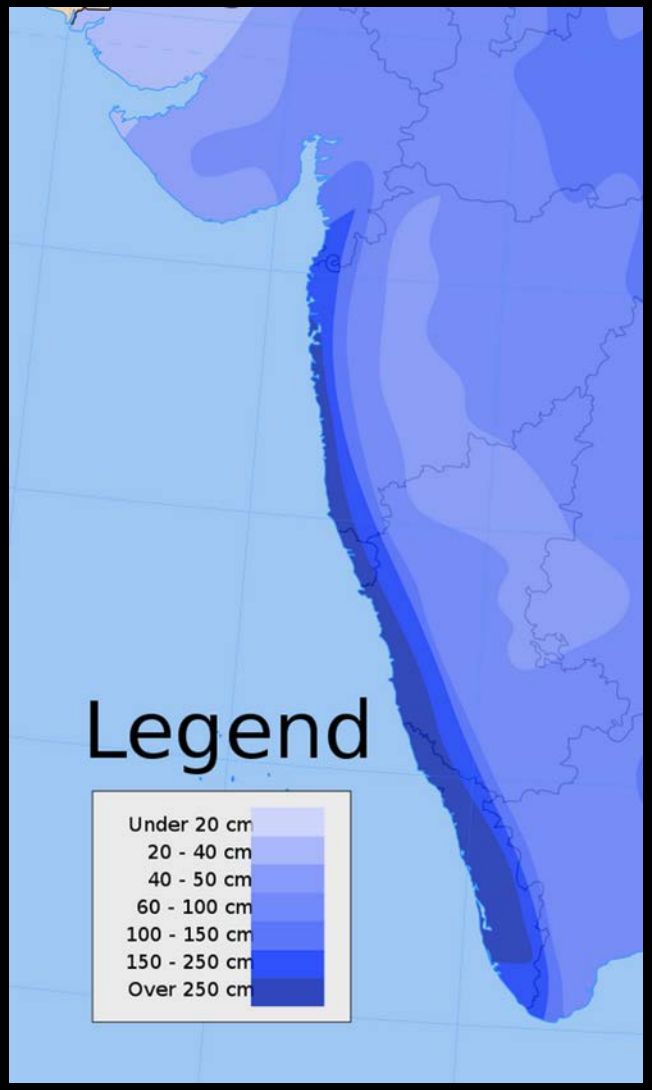


http://keystone-foundation.org

WILDLIFE CONSERVATION SOCIETY

CENTRE FOR WILDLIFE STUDIES

- 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

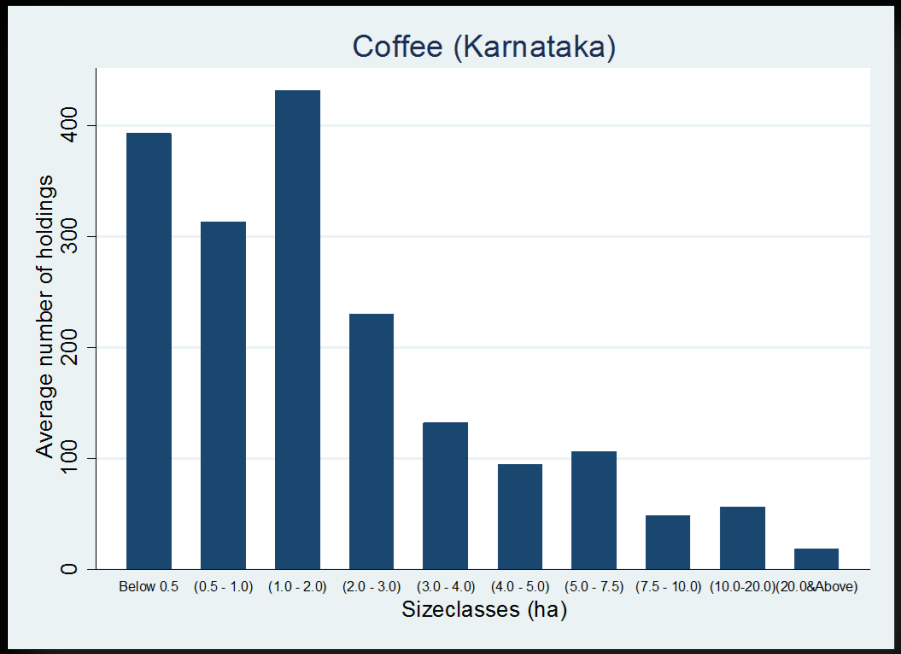


Key Commodities / Land Uses

- coffee (3,200 sq.km.)
- rubber (5,000 sq.km.)
- areca (2,700 sq.km.)

range of holding sizes

from large highly-capitalized plantations (> 100ha) to smallholder systems (<5ha)


Coffee (Karnataka)
Average number of holdings
0
100
200
300
400
Below 0.5
(0.5 - 1.0)
(1.0 - 2.0)
(2.0 - 3.0)
(3.0 - 4.0)
(4.0 - 5.0)
(5.0 - 7.5)
(7.5 - 10.0)
(10.0-20.0)
(20.0&Above)
Sizeclasses (ha)


©SD/KKK/NSF


©SD/KKK/NSF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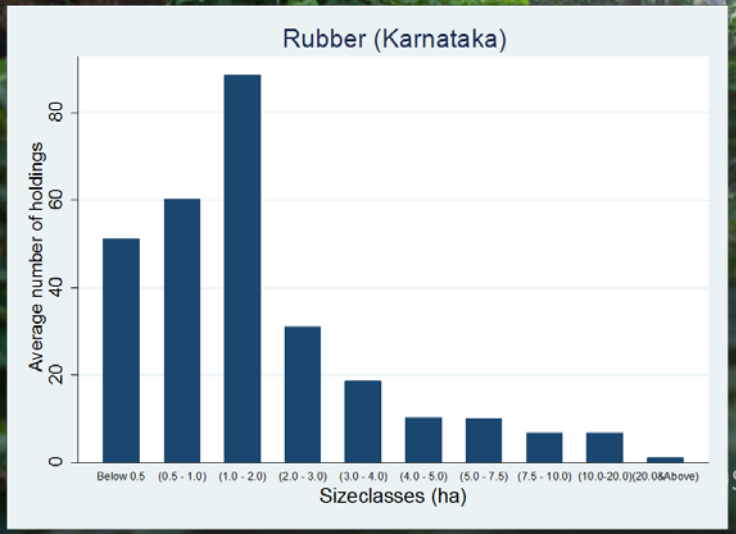
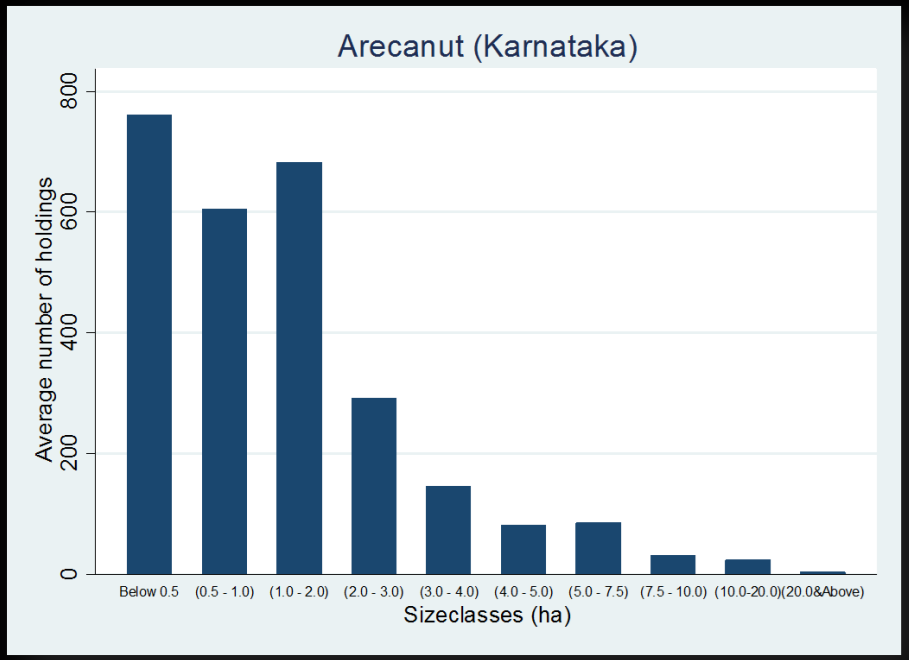
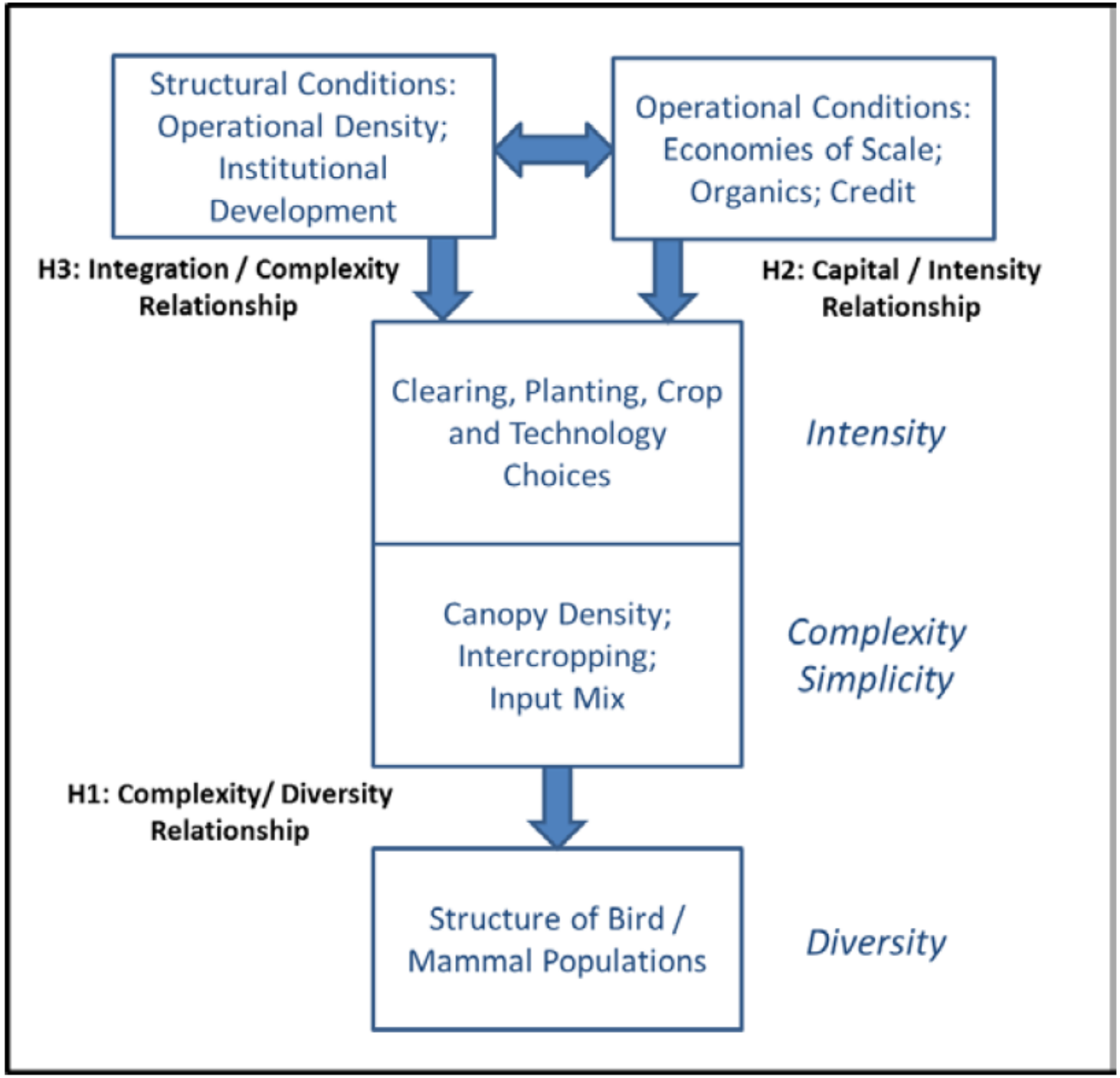
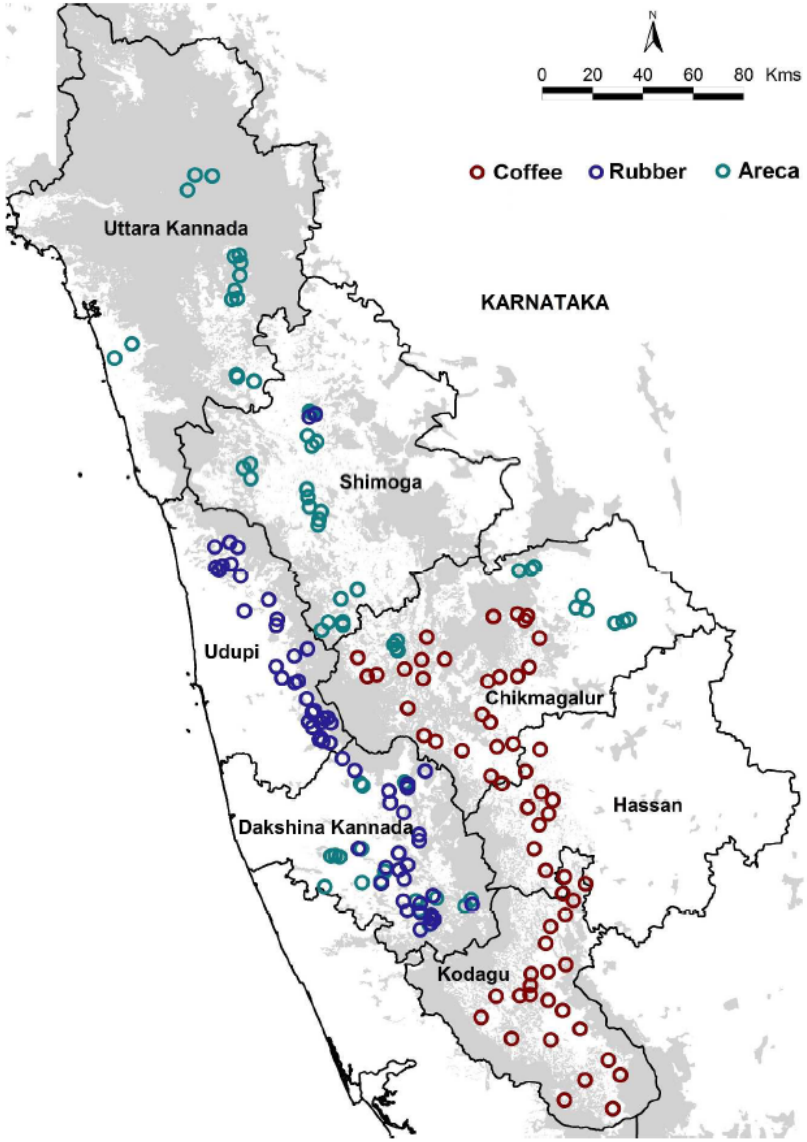

Rubber (Karnataka)
Average number of holdings
0
20
40
60
80
Below 0.5
(0.5 - 1.0)
(1.0 - 2.0)
(2.0 - 3.0)
(3.0 - 4.0)
(4.0 - 5.0)
(5.0 - 7.5)
(7.5 - 10.0)
(10.0-20.0)
(20.0&Above)
Sizeclasses (ha)

SD/KKK/NSF


Arecanut (Karnataka)
Average number of holdings
0
200
400
600
800
Below 0.5
(0.5 - 1.0)
(1.0 - 2.0)
(2.0 - 3.0)
(3.0 - 4.0)
(4.0 - 5.0)
(5.0 - 7.5)
(7.5 - 10.0)
(10.0-20.0)
(20.0&Above)
Sizeclasses (ha)

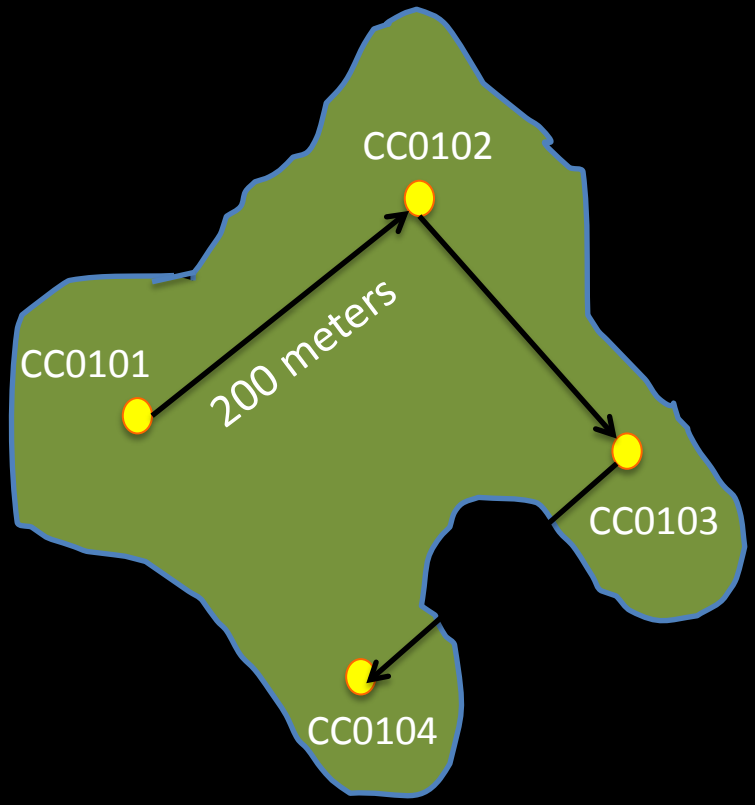

©Prasenjit Yadav


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



Locations of all sampled areca, coffee and rubber agro-plantations in India's Western Ghats
994x1386mm (120 x 120 DPI)

Bird Point Count Sampling



- Each point re-sampled 6 times
- Sampling time per point is 7 minutes

6 INTERNS

11 VOLUNTEERS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Malabar Trogon
©Ramki S


Red Spurfowl
©Ramki S


White-bellied Woodpecker
©Ramki S


Greater Racket-tailed Drongo
©Ramki S


Orange-headed Thrush
©Ramki S


Banded Bay Cuckoo
©Ramki S


Malabar Woodshrike
©Ramki S


Malabar Barbet
©Ramki S


Grey-headed Bulbul
©Ramki S


Malabar Parakeet
©Ramki S


Flame-throated Bulbul
©Ramki S


Hill Myna
©Ramki S


Brown-breasted Flycatcher
©Ramki S


Asian Paradise Flycatcher
©Ramki S

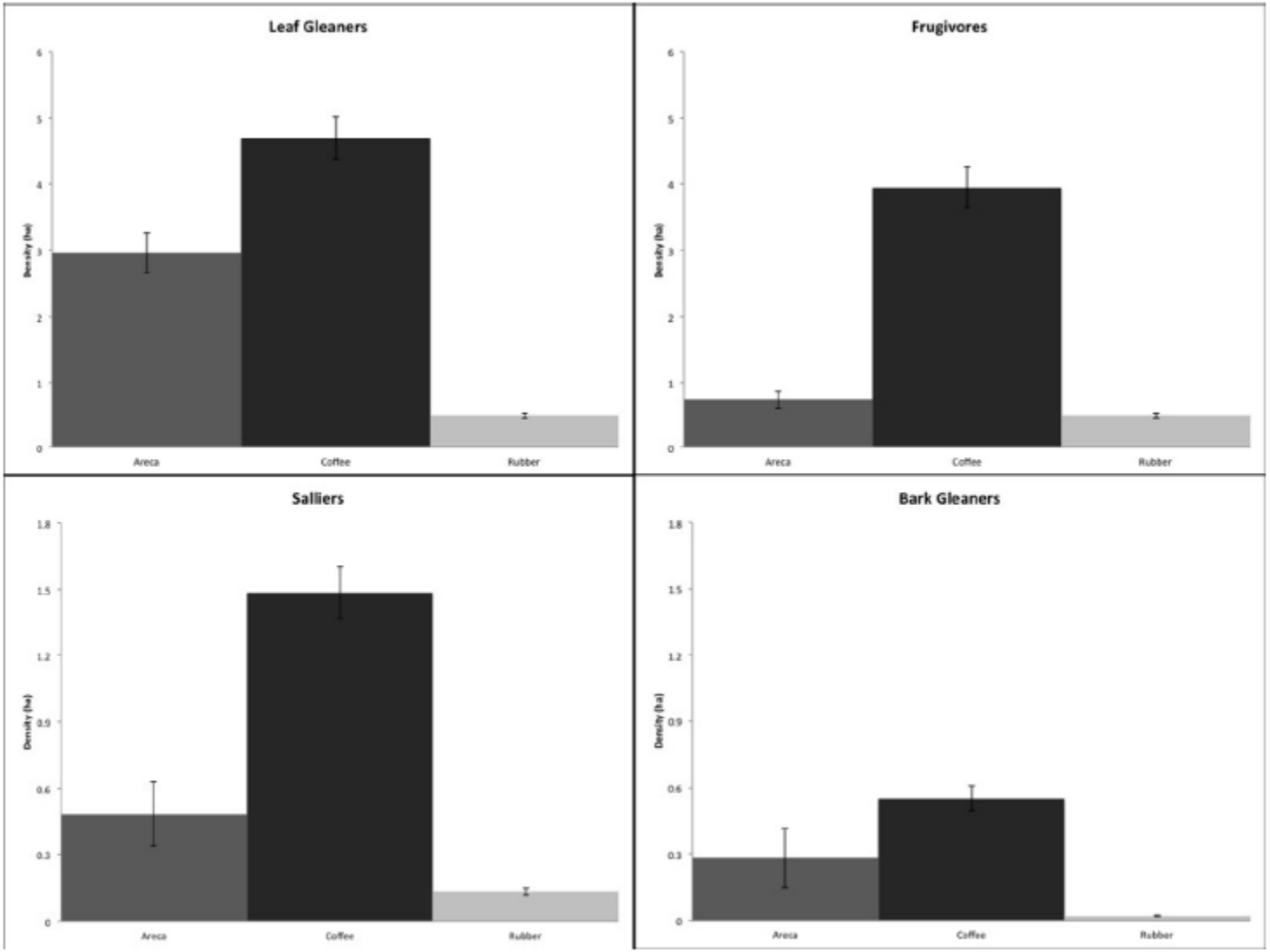

Tickell's Leaf Wabler
©Ramki S


Kashmir Flycatcher
©Ramki S


Blue-tailed Bee-eater
©Ramki S

Table 1: Bird species and species richness across the three agro-plantations

	Areca	Coffee	Rubber
Total number of species	122	127	169
Total number of Migrant species	105	106	137
Species Richness (SE)	34.06 (1.76)	58.21 (1.85)	45.41 (2.1)



Bird density (per hectare) across the three agro-plantations for four feeding guilds: Leaf Gleaners, Frugivores, Salliers, Bark Gleaners
407x305mm (72 x 72 DPI)

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

19.5% of the coffee planters reported an increase in canopy cover over the last 10 years

5% reported a decrease

Canopy

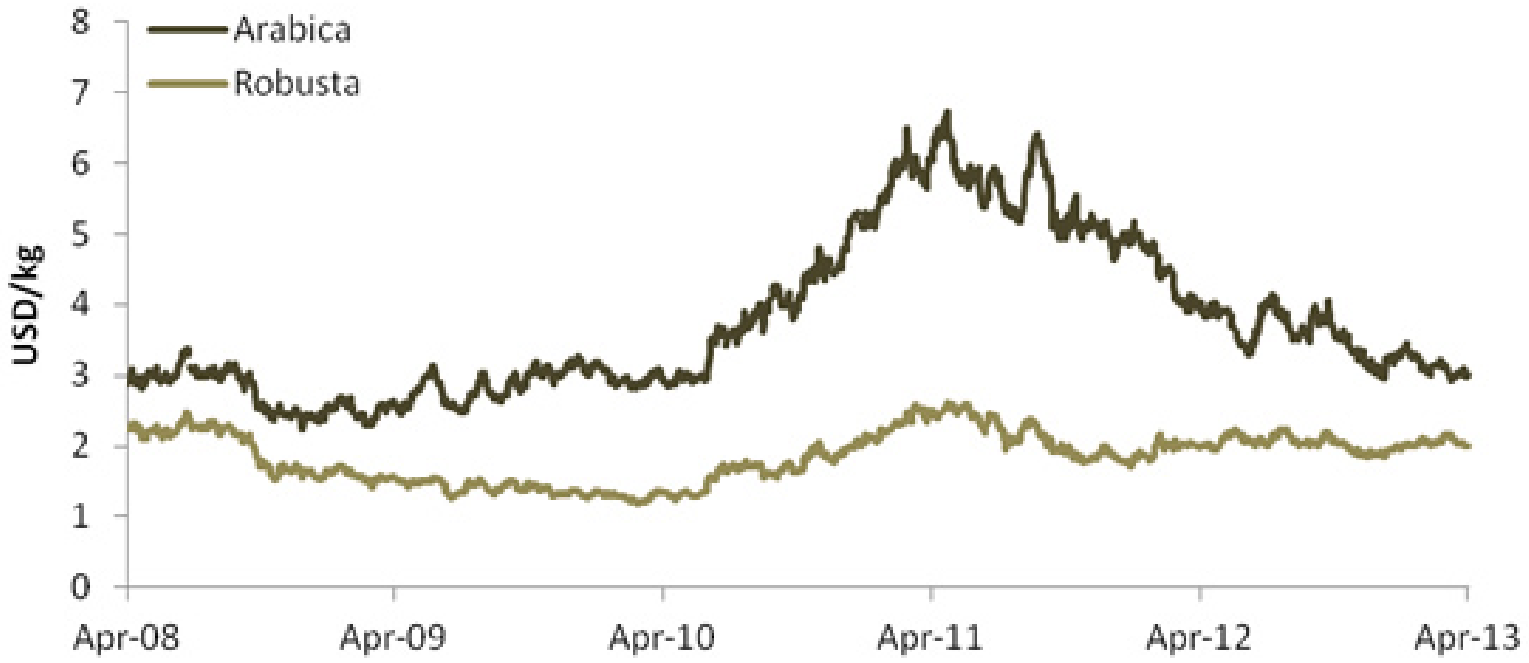
Species Diversity

Mean 7 tree species on coffee plantations (reported)

One Arabica planter identified the maximum of 31 tree species.

Ground Cover and Intercropping

Narrowing spread between Arabica and Robusta Coffee



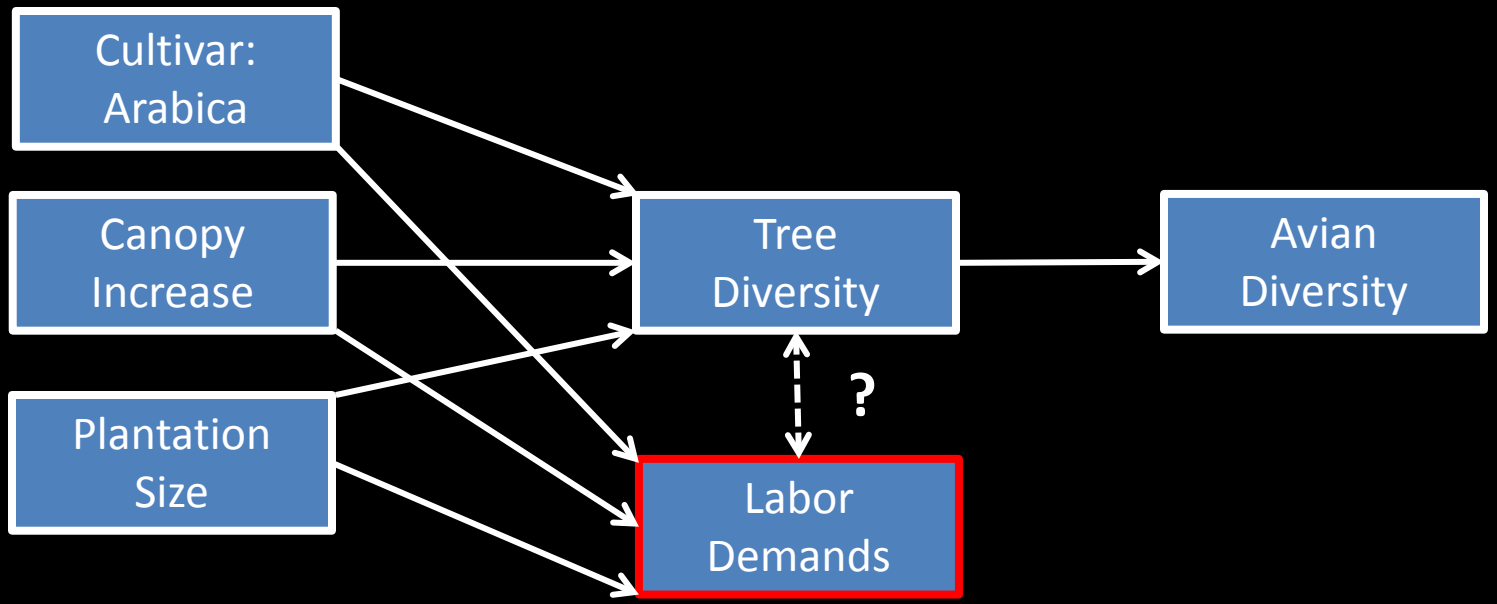
Source: Bloomberg Data - ICE, NYSE Liffe


Coffee:
Seasonal labor 93.7%
Permanent labor: 63.3%

Initial Findings in Coffee

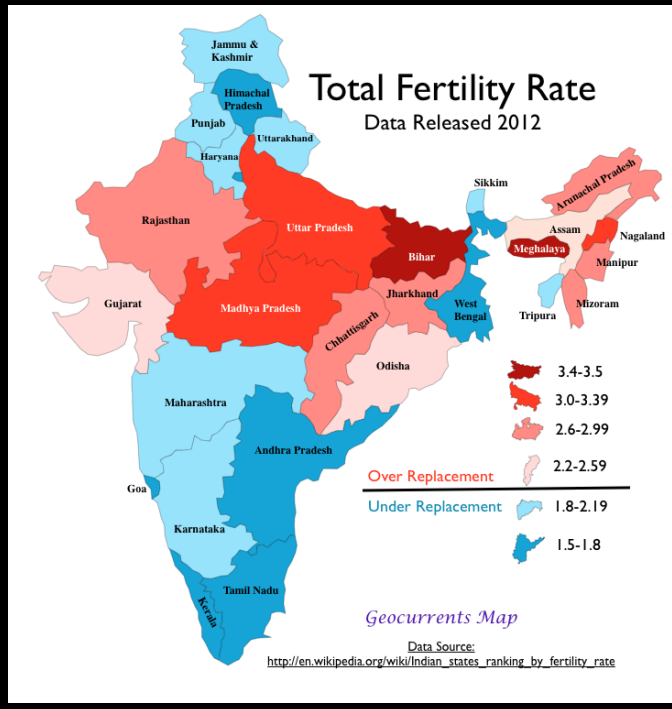
- Significant relationships
  - avian diversity ↔ tree species diversity
  - tree diversity ↔ reported increase in canopy
  - tree diversity ↔ plantation size
  - tree diversity ↔ Arabica
  - tree diversity ↔ permanent and seasonal labor

Labor in the Ecological Chain of Explanation



Some Key Indicators

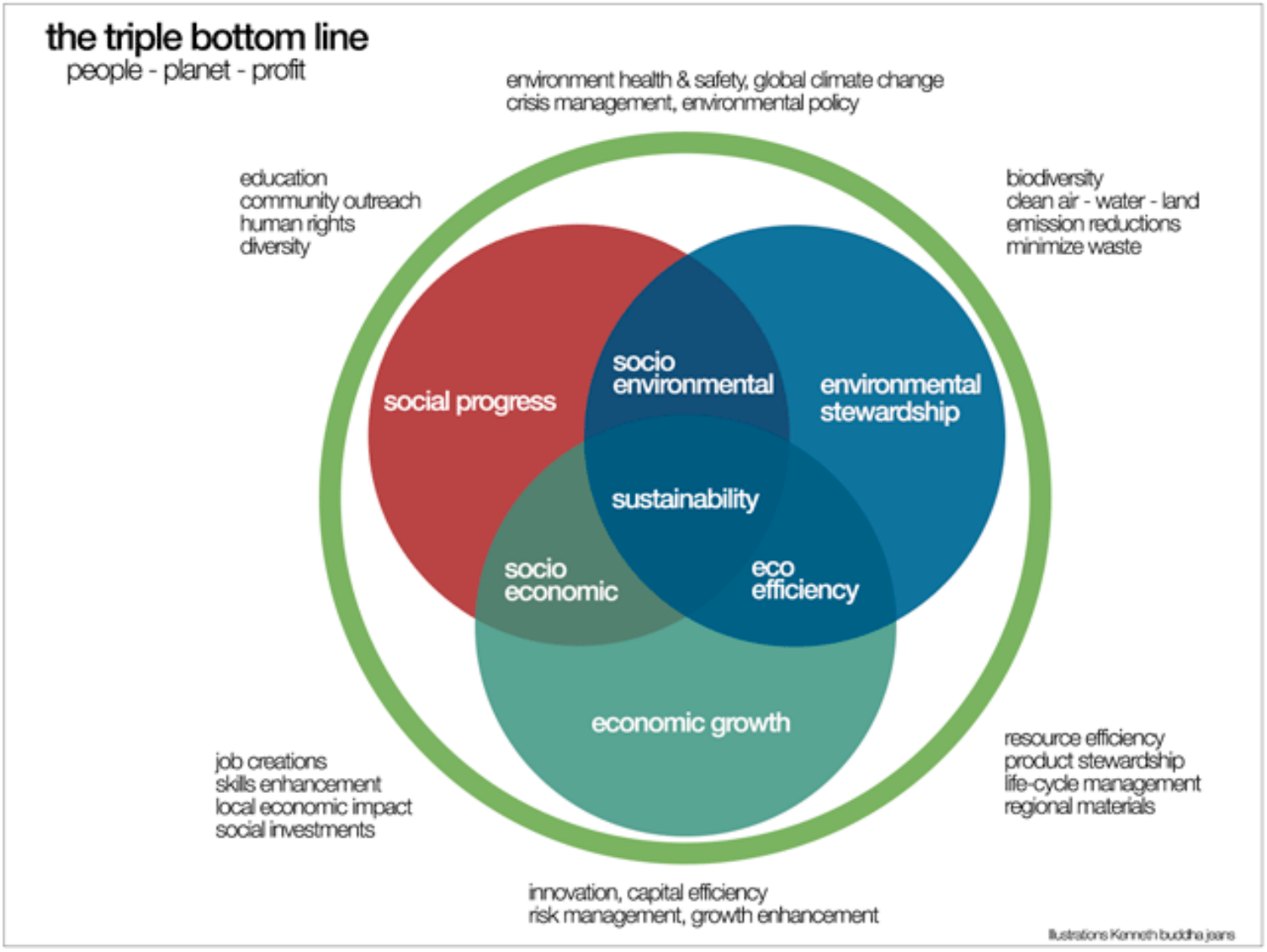
- Karnataka fertility rate: 1.79
- Between 2005-06 and 2010-11, average growth rate of Karnataka GSDP: 8.6 %
- Karnataka is now among the more urbanized States in India
  - 38 per cent of its population living in urban areas (Census of India 2011)
  - 33.99 per cent in 2001



1	Chandigarh	1.3
2	Goa	1.5
3	Tamil Nadu	1.7
3	Kerala	1.7
3	Andhra Pradesh	1.7
3	West Bengal	1.7
3	Himachal Pradesh	1.7
3	Delhi	1.7
3	Punjab	1.8
4	Maharashtra	1.8
4	Sikkim	1.8
4	Karnataka	1.8
4	Jammu and Kashmir	1.8
5	Tripura	2.0
6	Haryana	2.1
6	Uttarakhand	2.1
7	Orisa	2.2
8	Assam	2.3
8	Gujarat	2.3
-	**INDIA**	**2.4**
9	Manipur	2.6
9	Chattisgarh	2.6
10	Mizoram	2.7
11	Arunachal Pradesh	2.8
11	Jharkhand	2.8
12	Rajasthan	2.9
13	Madhya Pradesh	3.0
14	Uttar Pradesh	3.3
14	Nagaland	3.3
15	Bihar	3.5
15	Meghalaya	3.5

the triple bottom line

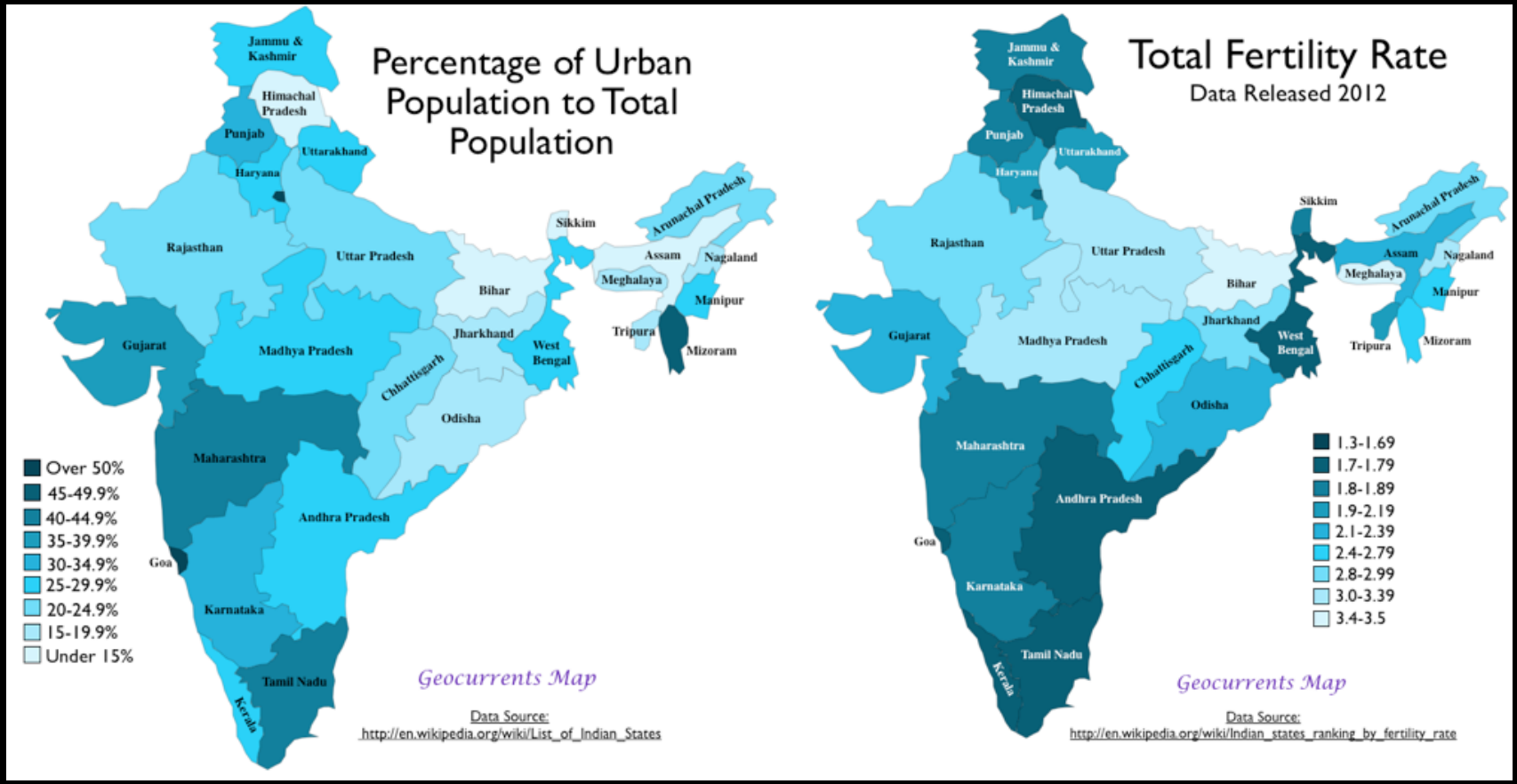
people - planet - profit



- 2015 (Under Review) Karanth, Robbins et al. “Birds in our farmyards: Richness and diversity in Agro-plantations of India’s Western Ghats” *Conservation Biology*.

- 2015. Robbins, Chhatre, and Karanth. “Political Ecology of Commodity Agroforests and Tropical Biodiversity” *Conservation Letters*. 8(2): 77–85

The Great Transition



Via Martin Lewis