Research Method

Math & Stats Tutorial

Day 9

Prabesh Dhakal

17 June 2019

CLASS ACTIVITY (LAST WEEK)

Go through the paper (MyStudy) and discuss with your neighbors:

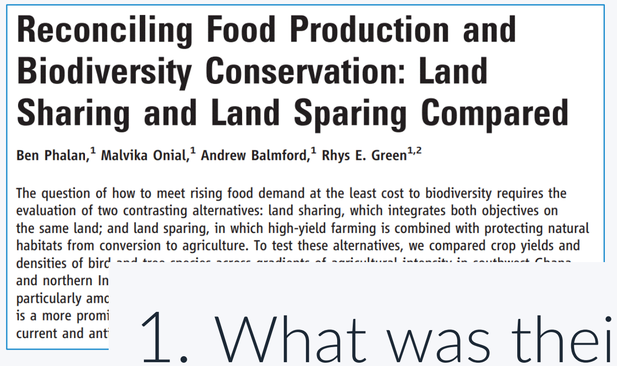
1. What was their research question?
2. What was their study design?
3. What statistical methods were used?
4. What was their result?

PHALAN ET AL., 2011

Reconciling Food Production and Biodiversity Conservation: Land Sharing and Land Sparing Compared

Ben Phalan,[1] Malvika Onial,[1] Andrew Balmford,[1] Rhys E. Green[1,2]

The question of how to meet rising food demand at the least cost to biodiversity requires the evaluation of two contrasting alternatives: land sharing, which integrates both objectives on the same land; and land sparing, in which high-yield farming is combined with protecting natural habitats from conversion to agriculture. To test these alternatives, we compared crop yields and densities of bird and tree species across gradients of agricultural intensity in southwest Ghana and northern India. More species were negatively affected by agriculture than benefited from it, particularly among species with small global ranges. For both taxa in both countries, land sparing is a more promising strategy for minimizing negative impacts of food production, at both current and anticipated future levels of production.



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PHALAN ET AL. : (LAST WEEEK)

1. What was their research question?

- **How does the use of the land impact biodiversity?**

2. What was their study design?

Sampling	**Explanatory variable** *(predictor)*	**Response variable**
No random assignment Land in SW Ghana & Northern India → 3 types of land	3 types of land (yield) 1. Land with “land sharing” 2. Land with “land sparing” 3. Land with conventional agriculture	Biodiversity (density) For each type of land: 1. Density of birds 2. Density of trees

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PHALAN ET AL. : IMRaD

3. Methods?

- Sampling method → handheld GIS system
- Statistical method:
  - “maximum-likelihood univariate parametric **regression models** for each species”
    - Dependent variable**: population density**
    - Independent variables: either **food energy production per unit area** or **annual profit per unit area**


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PHALAN ET AL. : IMRaD

Statistical method:

"maximum-likelihood univariate parametric **regression models** for each species"

- *Dependent variable:* **population density**
- *Independent variables:*
  either **food energy production** per unit area
  or **annual profit** per unit area

Model 1: $$\boldsymbol{density} = \boldsymbol{e}^{(b_0 + b_1 \cdot x^{\alpha})}$$

Model 2: $$\boldsymbol{density} = \boldsymbol{e}^{(b_0 + b_1 \cdot x^{\alpha} + b_2 \cdot x^{2\alpha})}$$

Where $\boldsymbol{b_0}$, $\boldsymbol{b_1}$, $\boldsymbol{b_2}$, and $\boldsymbol{\alpha}$ are values estimated from the data and $\boldsymbol{e} = \mathbf{2.71828}$ (approx.) is the Euler's constant.

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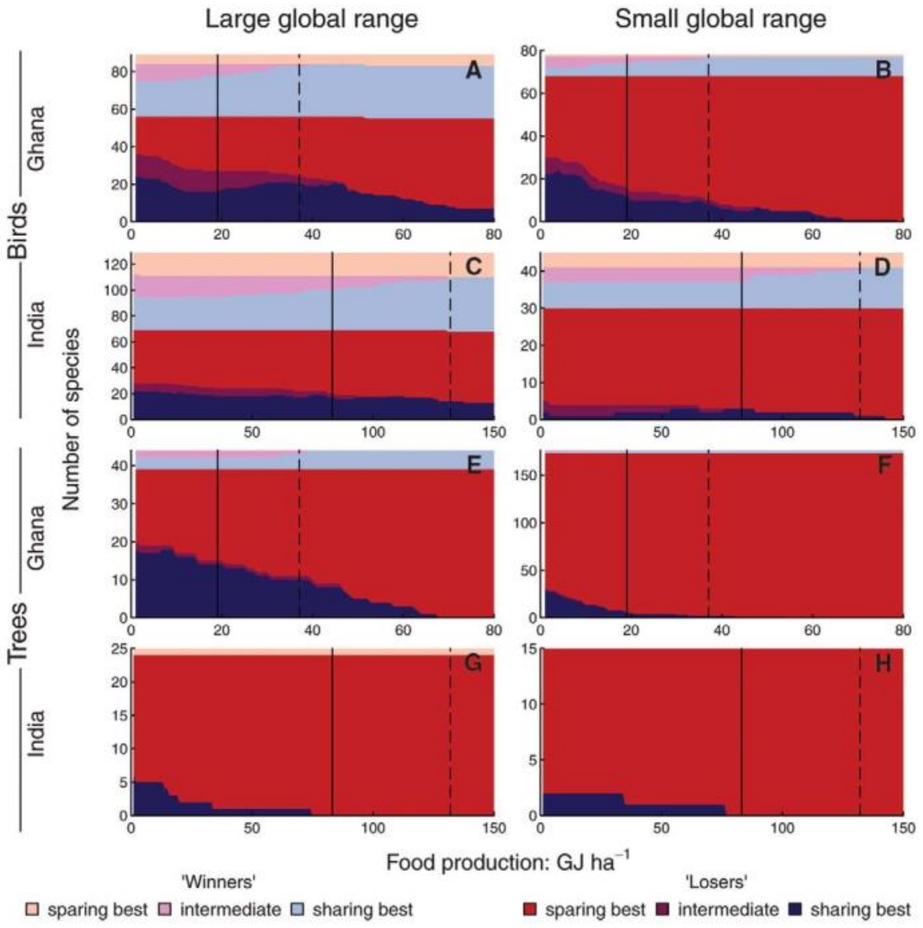
Results? (there were many)

At all production targets, there were fewer winners (Fig. 2, pale colors) than losers (Fig. 2, dark colors), particularly for trees (Fig. 2, E to H) and species with small global ranges (Fig. 2, B, D, F, and H). Among losers, land sparing (dark red) resulted in the highest total population for the majority of species in each taxon, country, and range-size group, at almost all production targets. Only at production targets well below the current level for wide-ranging Ghana birds did the number of losers with highest populations from land sharing equal that of losers with highest populations from land sparing. The ratio of losers for which land sparing results in the highest population (dark red) to those for which land sharing is best (dark blue) was greater for species with smaller global ranges and higher for trees than for birds. There were few losers for which the highest total population occurred at an intermediate yield (dark purple).



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PHALAN ET AL. : **IMRaD**

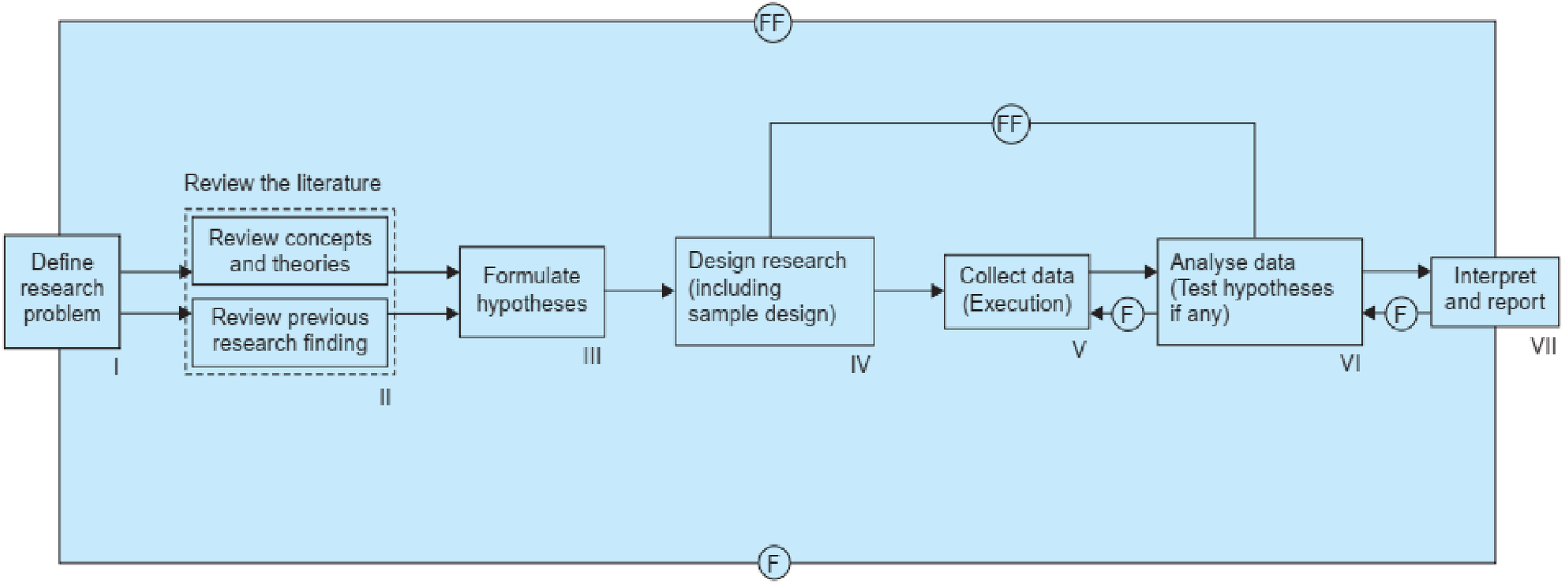
Interpretations?

For all strategies, we expect that the total populations of more than half of all bird and tree species will be lower in 2050 than in 2007. Because densities of most forest species were much higher in the forest than outside, we predict that populations of most forest species will decline in proportion to forest area.

…

These results suggest that both countries could produce more food with minimal further negative impacts on forest species if they were to implement ambitious programs of forest protection and restoration alongside sustainable increases in agricultural yield, but they could not if they adopted land sharing.

RESEARCH PROCESS



Source: Kothari, C.R. (2004), *Research Methodology*

RESEARCH PROCESS (ALTERNATIVE VIEW)

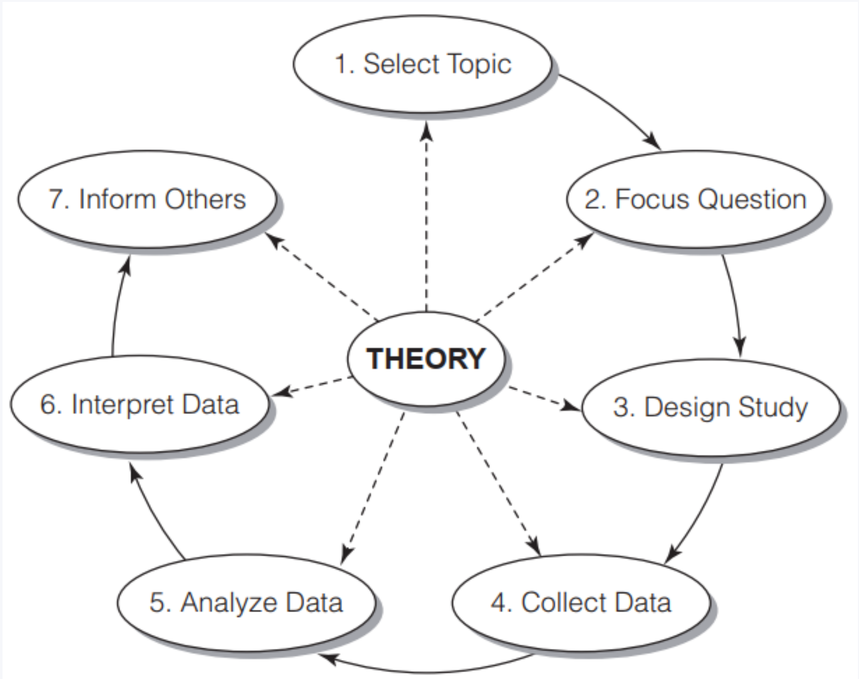


FIGURE 1 Steps in the Quantitative Research Process

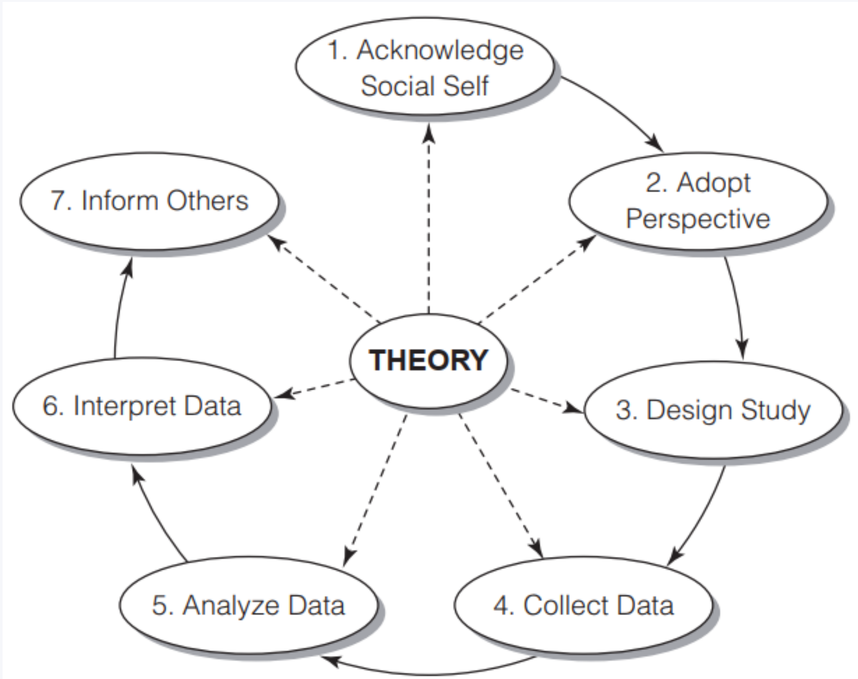


FIGURE 2 Steps in the Qualitative Research Process

Source: Neuman, W. L. (2014), *Social Research Methods: Qualitative and Quantitative Approaches*

GROUP TASK

Today: (5 minutes)
Form yourselves into groups of 4-5 individuals, and give your group a (creative) name.

This session (or over this week)**:**
Work on the **Klein et al. (2003)** paper and identify the following:

1. Research question
2. Research Design and Methodology
3. Results
4. Interpretation
5. Discussions

Next session:
I will ask one of the groups to present their findings next week.

PLAN FOR NEXT WEEK

That’s it for today! :-)

Next week’s topics will be based on your choice:

https://tinyurl.com/LastSession19

If you want to reach me, mail me at:

`prabesh.dhakal@stud.leuphana.de`