Farmers’ perception of the ecosystem services provided by diurnal raptors in arid Rajasthan (#75431)

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Farmers' perception of the ecosystem services provided by diurnal raptors in arid Rajasthan

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Understanding the farmer's perceptions, attitude, behaviour, and knowledge toward conservation is critical in developing an effective conservation programme in human-dominated landscapes. Farmers are the most important stakeholders in wildlife conservation in the agricultural landscape. We conducted semi-structured face-to-face interviews with 373 farmers to understand the farmer's perception of ecosystem services provided by diurnal raptors in the arid region of Rajasthanfrom July 2020 to February 2021 and from August 2021 to January 2022. We grouped ecosystem services and disservices into larger categories and estimated the correlation between them, finding that disservices are negatively correlated with benefits. Raptors were perceived as beneficial for their role in controlling rodents and pests, but negatively for poultry predation. In addition, we built a binomial generalised linear model with a logit function to better understand the factors that influence farmers' perceptions of raptors (positive or negative). We observed that males and females have different attitudes toward the ecosystem services provided by raptors. It is critical to understand social perceptions in order to conserve species that are rare on a global scale but may face negative perceptions on a local scale. Our study connects ecological information with socio-demographic factors, which can be useful in developing policy measures for raptor conservation.

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Submission of the manuscript Farmers' Perception of the Ecosystem Services Provided by Diurnal Raptors in Arid Rajasthan″. We are submitting our manuscript as per Peer J celebrating 10-year completion and publishing paper related to conservation biology without any cost. Our manuscript belongs to conservation biology category and we are not unable to pay the APC charges.

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Understanding the farmer's perceptions, attitude, behaviour, and knowledge toward conservation is critical in developing an effective conservation programme in human-dominated landscapes. Farmers are the most important stakeholders in wildlife conservation in the agricultural landscape. We conducted semi-structured face-to-face interviews with 373 farmers to understand the farmer's perception of ecosystem services provided by diurnal raptors in the arid region of Rajasthan from July 2020 to February 2021 and from August 2021 to January 2022. Our study connects ecological information with socio-demographic factors, which can be useful in developing policy measures for raptor conservation. We have uploaded the minimal data of collected during survey as a supporting information_S1. We have provided survey GPS location in raw data.

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Randeep Singh

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Farmers' Perception of the Ecosystem Services Provided by Diurnal Raptors in Arid Rajasthan

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Running Title: Perception of Farmers towards Raptors

Abstract

Understanding the farmer's perceptions, attitude, behaviour, and knowledge toward conservation is critical in developing an effective conservation programme in human-dominated landscapes. Farmers are the most important stakeholders in wildlife conservation in the agricultural landscape. We conducted semi-structured face-to-face interviews with 373 farmers to understand the farmer's perception of ecosystem services provided by diurnal raptors in the arid region of Rajasthan from July 2020 to February 2021 and from August 2021 to January 2022. We grouped ecosystem services and disservices into larger categories and estimated the correlation between them, finding that disservices are negatively correlated with benefits. Raptors were perceived as beneficial for their role in controlling rodents and pests, but negatively for poultry predation. In addition, we built a binomial generalised linear model with a logit function to better understand the factors that influence farmers' perceptions of raptors (positive or negative). We observed that males and females have different attitudes toward the ecosystem services provided by raptors. It is critical to understand social perceptions in order to conserve species that are rare on a global scale but may face negative perceptions on a local scale. Our study connects ecological information with socio-demographic factors, which can be useful in developing policy measures for raptor conservation.

Keywords: Arid region, community perception, ecosystem services, farmers, generalised linear model, raptors, India

Introduction

The importance of the social-ecological perspective or social dimensions (i.e., attitudes, beliefs, perceptions, or values) in human-dominated agricultural landscapes around the world is now recognised for biodiversity conservation and informing policymakers and land-use managers (Bennet et al. 2016, Pooley et al. 2017, Morales-Reyes et al. 2018). Agriculture is a dominant land use in many countries (Cai and Pettenella 2013), and agricultural landscapes provide refuge and habitat for a variety of wildlife species (Perrings et al. 2006). As a result, policymakers are constantly encouraging farmers to protect the habitat of many threatened species on their farms (Kross et al. 2018). The loss of biodiversity in agricultural landscapes is linked to the loss of benefits obtained from ecosystems (Perrings et al. 2006, Morandin et al. 2016). As a result, it is critical to comprehend the relationship between benefits obtained or ecosystem services and biodiversity conservation in agricultural areas (Gorosábel et al. 2022).

replace with often

Many species (i.e., insects, birds, and rodents) are known crop pests in agricultural landscapes; they directly cause harm to farmers by damaging crops, which can result in reduced productivity or increased production costs (Zhang et al. 2007, Sekercioglu et al. 2016, Garcia et al. 2020). Raptors or birds of prey, on the other hand, are highly valued in some agroecosystems because they significantly control pest abundance or activity and act as intraguild predators. They offer biological crop pest control (Belaire et al. 2015, Kross et al. 2016, Shave et al. 2018, Garcia et al. 2020), which benefits farmers indirectly (Kross et al. 2016). Raptors are a sustainable pesticide alternative that not only provides economic benefits but also reduces pest outbreaks (Naranjo et al. 2015). It also has a positive socio-ecological impact by lowering human health risks and preserving biodiversity (Gibbs et al. 2009, Sarwar 2015).

can

I don't know if Kross et al. 2016 is correct here (that paper is about songbird control of insect pests). Kross et al. 2012 (bird pests) and Kross et al. 2018 (barn owls eating rodents) may be better.

How do they benefit farmers indirectly? Can you add an e.g. here?

I think here it would be good to either point out that this is relevant to insect pests, or to state that this is for invertebrate pests.

Raptors also have a positive…

However, raptors face significant threats in agricultural landscapes due to a variety of anthropogenic activities such as intensive agriculture practices, the use of pesticides to maintain food production, land use change, widespread deforestation, habitat alterations, hunting, and trade

Use of pesticides is particularly important for raptors- suggest adding a reference from Hindmarch or Elliot here.

(Gibbs et al. 2009). Indeed, anthropogenic threats are cited as one of the major causes of decline in the ecological or ecosystem services provided by raptors around the world (Emmerson et al. 2016, Rusch et al. 2016). Raptor conservation in agricultural landscapes is dependent on farmers'

rephrase- as stockholders could also mean people who hold livestock

knowledge, behaviour, farm practices, and attitudes. Because they are the first stockholders, their direct and indirect involvement in raptor conservation decision-making is critical. Farmers' ecological knowledge can provide important information about raptor distributions, breeding, threats, and ecosystem services in agricultural landscapes (Gaston et al. 2018; Kross et al. 2018). As a result, raptor protection is heavily reliant on farmers' knowledge, attitudes, and perception. Few studies have documented farmers' knowledge and attitudes toward the ecological importance and value of raptors' ecosystem services. The relationships between functional traits of organisms and provisioning and regulating ecosystem services are well established, but the traits that underpin the benefits derived from cultural ecosystem services are not (Zoeller et al. 2020), and the contribution of raptors to cultural ecosystem services such as sense of place or education is unknown (Echeverri et al. 2018).

The current study aims to understand farmers' perceptions of raptors in Rajasthan's arid region, as well as the socioecological factors that influence whether raptors are viewed as a source of benefits or a source of damage by farmers (Fig. 1). Organic agriculture has gained popularity in the arid region of Rajasthan in recent years (Dangour et al. 2010), and its potential as a development strategy for rural communities is recognised (Panwar et al. 2010). Farmers who grow

organic crops have few pests control options, and raptors serve as a natural biological pest control agent in cropland (Costa et al. 2019, Van Bruggen et al. 2016).

Suggest moving these references to before the comma here as they are not about raptors. Could repeat some of the references from above for the raptor part of the sentence.

As a result, we hypothesised that raptors are more beneficial to farmers growing organic crops in the region. Furthermore, rural communities in the study area rely primarily on agriculture for a living, with small poultry operations supplementing household income (Ithika et al. 2013). Male farmers are primarily responsible for livelihood (tourism, agriculture, crop protection, and animal husbandry), whereas female farmers are responsible for the household, livestock grazing, fodder/wood collection, and poultry (Kumar et al. 2021). Female farmers interact with livestock and poultry more directly than male farmers (Mohapatra and George 2021).

Perceived to be

Related to with discussion above, I'm interested in why you'd expect male farmers to interact with raptors more? (I think it's okay to have the hypothesis, just not clear on why) You might also cite Kross et al. 2018 which found differences between male and female farmer attitudes toward wildlife.

As a result, we hypothesised that male farmers interact with raptors more than female farmers, and thus have different perceptions of raptors. In addition, we assess farmers' attitudes toward other species (bats and perching birds) using the same criteria. The current study aimed to collect baseline data for the forest department and policymakers to use in developing conservation and management plans for raptors in the agriculture ecosystem. Through community outreach programmes, the forest department and conservation organisations can initiate education awareness programmes to improve farmers' knowledge of ecology and ecosystem services provided by raptors in agriculture ecosystems for future conservation initiatives in the region. Females perceive raptors differently than males.

Figure 1. Flowchart explaining connection between ecosystem services and human perception (Zoeller et al. 2020).

Material and methods

Study area

In the hot arid region of Rajasthan, India, we studied a community of diurnal raptors (Fig. 2). The study area covered 0.198 million square kilometres and was located between 24°31′ and 30°12′ north latitudes and 69°15′ to 76°42′ east longitudes. The region is characterised by low and erratic rainfall, with an average annual rainfall of 500 mm, 90 percent of which falls during the monsoon season (Mohranna et al. 2012). Temperatures can range from 0°C in the winter to 50°C in the summer. The terrain is slightly undulating within the venue of sand deposited by inland drainage and streams, with salt lakes and limited water resources and arable lands (Sharma and Sharma 2004). Man's reliance on animal rearing, combined with a sparse and nomadic population (Singh and Kumar 2015). Northern tropical thorn forests (Champion and Seth Classification 6B), which include *Calligonum polygonoidis, Prosopis cineraria, Prosopis juliflora, Acacia capparis, Acacia Senegal, Acacia catechu, Anogeissus pendula, Butea monosperma*, and *Azadirachta indica*, cover the rolling arid landscape. Anthropogenic activities have an impact on the landscape because 22.5 million people live there, making it the world's most populous desert at a density of about 84 people per square kilometre (Singh and Kumar 2015). The majority of residents' occupations (70%) are farming, raising livestock, and mining. This area is home to numerous residents and migratory raptors despite its harsh climate and man-made limitations. The existence of so many raptor species in the arid region can be attributed to both socioeconomic and climatic factors (Chhangani 2007).

rephrase

Figure 2: Location map of (a) study area and (b) sampling location in arid region Rajasthan during July 2020 to February 2022

Methods

Data Collection

From July 2020 to January 2022, we conducted face-to-face interviews with 373 respondents (Supporting information S2) using semi-structured questionnaires (Supplementary file 1). There were three main sections to the questionnaire: (A) sociodemographic profile of the respondents, (B) details on how farmers feel about raptors and the ecosystem services they provide, and (C) details on how they feel about other species in the area. On a five-point Likert scale (1-Strongly disagree to agree 5-Strongly) (Likert 1932), respondents were asked to rank raptors according to their subjective agreement with nine different statements. These items discussed the ecosystem benefits and harms that raptors provide (Martinez et al., 2020) and disservices that raptors provide (Echeverri et al. 2018, Zoeller et al. 2020).

Note that there are 2 Martinez references, both with hyphenations

To measure the attitudes of male and female respondents for ecosystem services offered by other avian species the data was gathered on a Likert scale (Likert 1932, Kross et al. 2018) and then compared with the ecosystem services offered by the raptors. The following questions and details were used to elicit responses regarding respondents' opinions on the trend of the raptor population: of the species that you see in your area, did you see them more, less, or about the same as you did in previous years: 0 (no change), 1 (increasing), and 1 (decreasing) (Morales Reyes et al. 2018). The survey was carried out utilising convenience sampling (Som 2020). People were informed of the purpose of the study before they participated in interviews, and only then did they give their informed consent.

There is only one question mentioned here

Data analyses

We used regression analysis to examine the relationship between farmers' perceptions of species population trends and their perceptions of the services (Supporting information S2) offered by vultures and raptors (Morales reyes et al. 2018). The flow chart of analysis is described in Fig. 3. The responses to various ecosystem services were then divided into groups according to gender

This is really only the first mention of vultures- were farmers able to answer differently for these two groups?

193 and broad categories (Table 1). To verify the data's internal consistency, Cronbach's alpha for the
194 variables was estimated (Cronbach 1951). To reduce the dimensionality of the
195 variables, explanatory factor analysis was performed on Likert scale, which produced three
196 different items that represented nine different services. Scree plots were used to estimate the
197 number of factors (Supporting information S3, S4). Factanal function was used to divide the likert
198 scale items into three major categories (Table 1) of ecosystem services provided by raptors
199 (Echeverri et al. 2019, Zoeller et al. 2020). For both male and female respondents, we also
200 calculated pairwise correlation across ecosystem services. We created a logit-based binomial
201 generalised linear model (GLM) (Luoto and Hjort 2004, MacKenzie 2018). The sociodemographic
202 data of respondent's was kept as a predictive variable, and their perception of raptors, whether they
203 were helpful or harmful, was kept as an explanatory variable. ANOVA with a post-hoc-Tukey
204 Honest Significant Difference (HSD) test was employed to determine whether there was a
205 statistically significant difference between the perceptions of the male and female respondents
206 about the ecosystem services that raptors provide. Tukey's HSD tests are conservative because
207 they lessen the chance of a Type I error in addition to allowing comparisons between groups with
208 multiple categories (Abdi and Williams 2010, Nanda et al. 2021). To compare respondents'
209 perceptions with those of the other species present in the area (bats and perching birds), perceptions
210 of the respondents were also collected for those species (Supporting information S5 - S10). The
211 "CAR" (Fox and Weisberg 2019), "ggplot2 (Wickham 2016), "Psych" (Revelle 2022), and
212 "Corrplot" (Wei and Simko 2021) packages were used to analyse all the data in R (R Core Team
213 2020). The open-source, free QGIS software was used to prepare the location map (QGIS 2021).
214

215 **Results**

Perception of Indirect Benefits: There was a significant difference between male and female respondents' perceptions of how raptors affect crop quality and production (p =.0007 and p =.0001, respectively). Regarding the impact of raptors on overall yield, there was no discernible difference between the opinions of the two categories of respondents (p =.852).

Please report effect sizes here as well as Z-values or whatever the test statistic was. Are these based on the GLM?
The relevant figure is really not showing a clear difference between male and female farmers.
Also, add a 0 before the decimal for any values less than 0.

Perception of Services: There was no discernible difference between male and female respondents' perceptions of raptors' detrimental effects on pollinators (p=.021), poultry (p=.013), and livestock (p=.002) (Fig. 4).

Does this mean that everyone thought they were detrimental to pollinators?

Perception of Direct Benefits: There was no significant difference in male and female respondents' perceptions of the role of raptors in controlling rodents (p=.013) or insects (p=.002), but there was a significant difference in their perceptions of whether raptors can serve as an alternative to pesticides (p=.002) (Supporting information S11). Compared to conventional farmers, organic farmers were more tolerant of raptors (Fig. 5).

This is unclear. Were they more positive or more negative?

For both vultures and raptors, the regression plot (Fig. 6) shows that farmers frequently view species as advantageous if they believe their population is declining. The results of the factor analysis show that there are three factors among the items on the Likert scale (Table 1). These variables were interpreted as various categories that stood in for various ecosystem benefits and drawbacks. Disservices were found to be negatively correlated with ecosystem services and other categories for both male and female respondents, according to pairwise correlations across both categories. All the ecosystem services' advantages were adversely correlated with their disadvantages. The "Dr. Jekyll and Mr. Hyde paradox" is demonstrated by the respondents'

This is an interesting finding!

I don't understand this sentence.

Add a citation here- has this been used in the ecosystem services/disservices literature before? Also, I suggest moving this to the dis

perceptions of the same species as both harmful and advantageous. For male respondents, the strength of the correlations was greater. According to GLM analysis (Table 2), growing fruit crops and seed crops were the main factors influencing people's favourable attitudes toward raptors (p=0.02 and p0.001, respectively). There is no mention of the bat or songbird data in the results.

Discussion

The concept of ecosystem services has gained widespread acceptance as a way for people to express the values they attach to different ecosystem functions (Ferreira et al 2018). Studies of locals' perceptions can offer crucial information for observing, comprehending, and interpreting the social impacts and ecological results of conservation. Our findings, which demonstrate how farmers view raptors, highlight the need for ongoing research, focused outreach efforts, and legislative measures that give farmers the information they need to choose wildlife-friendly agricultural practices (Kross et al. 2016). According to the impact they are having, raptors are seen by the respondents as both beneficial and harmful. According to our findings, they can improve pest control (Raimilla and Rau 2017), but they can also cause negative perceptions due to poultry predation. This specific reason wasn't mentioned in the results. Additionally, raptors were viewed as being extremely beneficial for fruit growers' produce because they keep rodents and other pests off the farm. Was that what respondents said? Putting up nest boxes to draw raptors can help reduce rodent populations on farms (Coles et al. 2019, Paz Luna et al. 2020). None of the respondents confirmed that any of the raptor species in the study area engaged in frugivory (Fitzsimons and Leighton, 2021). Also see Shave et al, Wendt and Johnson, Kross Bourbour & Matinico, Charter et al.

Both male and female organic farmers perceived positive attitude towards raptors and were willing to spend for their conservation. Among respondents, most of the organic farmers believed that their cropping method can also be helpful in conservation of raptors, this point is also reflected in Suggest- had positive perceptions of raptors… -or- had positive attitudes towards raptors… Not mentioned in results section

the study completed by Kirk et al. (2020). Integrated pest management (IPM) is a decision-based process involving coordinated use of multiple tactics for optimizing the control of all classes of pests (insects, pathogens, weeds, vertebrates) in an ecologically and economically sound manner. It involves regular monitoring of pests, and their natural enemies (Ehler 2006). Raptors play a

You might also point to some of the other papers in the introduction here.

effective role in controlling damage to crops by feeding on pests (Peisley et al. 2017, Gorosabel 2022) and are important part of IPM (Zagorski 2019). The rodent population can be controlled by

There are very few papers that have actually demonstrated rodent population control by raptors- Kay et al. 1994 did,

providing raptors with adequate conservation as suggested by Antkowiak (2004), which will also lower the cost of farming inputs (Machar et al. 2017). They can serve as an alternative to pesticides and reduce the impact of these harmful chemicals have on food chain (Maria et al. 1996, Hughes et al. 2013). As conventional farming is more common than organic farming, further research is needed to understand role of the raptors for controlling insect pests. Views of female respondents on the effect of raptors on livestock varied quite significantly from that of males as most of the female respondents spend more time with their livestock and were out with them in grazing areas for hours in search of fodder. Also, it was observed that perception of raptors and vultures as beneficial depends on level of rareness of species in terms of perceived population. Positive relationship between rareness of species and perception was firstly reported by (Courchamp et al. 2015, Hall et al. 2015). There is an opposite relationship between species rareness and perception

I think that some of this background information would be good in the introduction to explain to the reader why you were testing for this relationship.

of species as providers of ecosystem services (Morales Reyes et al. 2018). General pubic gives more value to rare species relative to common ones (Angulo and Courchamp 2009). It is a common belief that attitudes and perceptions towards a species are influenced by the degree of its rarity. Although, it was reported that rareness in terms of distribution cannot be a criterion in the decision for investing on conservation of the species (Martin-Lopez et al. 2007). Elusive species which are globally considered as endangered and are least known are rarely perceived as emblematic (Cortés-

You didn't ask about individual species, but about broad groups of species

Avizanda et al. 2022). Our results on rarity and perception towards a species are in accordance with study done by (Otsuka et al. 2016), which indicates that farmers have species specific view that incorporate cultural and aesthetic value of rare species and they prefer usefulness of these species over other.

Were there questions about cultural and aesthetic values?

Negative correlations between disservices and other cultural ecosystem services suggest that the categories are dependent on each other. People are influenced by general positive or negative effects when judging disservices and benefits. It suggests that likeability of respondents towards raptors was positively correlated with direct and indirect benefits while negatively correlated with the disservices. This "Dr. Jekyll and Mr. Hyde" paradox (Morales reyes et al. 2018) can be understood by socio economic characteristics of the respondents who are involved in poultry management cites raptor predation of chickens as a loss to their livelihood and livestock owners view raptors as a threat to the newborn cattle and a carrier of disease while fruit growing and seed growing farmers and those practicing organic agriculture perceive raptors as beneficial in their effect of controlling rodents and pest. Strength of correlation was slightly more for the male respondents. It may be explained by the fact that in this region male respondents are more involved in farming, poultry management, nature guides and transhumance and their interaction with raptors is more as compared to female respondents.

Were there follow up questions to those listed in the supplement? How did you get this level of detail?

Implementing long term conservation plans needs taking socio perspective in consideration, wrong perception of a species can be detrimental for its survival (Ceríaco 2012).To change farmers' behaviours toward more sustainable conservation of farmland biodiversity, instruments should aim to influence individual farmer's motivation and behaviour. However, a lack of knowledge of farmers' opinions toward wildlife can lead to poor integration of conservation measures (Katuwal et al. 2021, Kross et al. 2018). We should aim to place farmland biodiversity "in the hands and

minds" of farmers (Ahnström 2009).Without an appreciation of the human dimension to problems of conflict, sustaining species outside protected areas may be difficult (Lee and Priston 2005).

Conclusion

For the conservation of raptors, it required landscape-based approach beyond the protected areas. Very few resources and funding are allocated for the conservation of the raptors residing outside protected areas. Arid region of Rajasthan is home of many species of raptors but the overall conservation planning for raptors needs to include a socio-ecological perspective. Designing education and awareness programs along with community participation can reduce conflict with raptor in rural regions and will be beneficial for implementation of long-term conservation programs.

Additional references you might consider adding (some are harder to get access to, feel free to email me if you need help getting a PDF):

- Bourbour, R. P., Martinico, B. L., Phillips, E. M., Schlarbaum, J. N., Hawkins, M. G., Hull, J. M., & Kross, S. M. (n.d.). Banding records of nestling barn owls reveal optimal timing for nest box maintenance in California. The Journal of Wildlife Management, 10. https://doi.org/10.1002/jwmg.22278

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*Note a few of the above are papers I have co-authored. No pressure to include them all!

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Figure legends

Figure 1. Flowchart explaining connection between ecosystem services and human perception (Zoeller et al. 2020)

Figure 2: Location map of (a) study area and (b) sampling location in arid region Rajasthan during July 2020 to February 2022

Figure 3. Flowchart explaining steps followed for regression analysis (Morales reyes et al. 2018).

Figure 4. Perception of male and female respondents towards raptors in arid region Rajasthan (**A Indirect Benefits:** (A1 Increases crop quality, A2 Increases yield, A3 Essential for crop production**),** **B Negative/Disservice:** (B1 Causes damage to pollinators, B2 Causes damage to poultry, B3. Causes damage to livestock), **C Direct Benefits:** (C1 Controls Insects, C2 Controls Rodents, C3 Alternative to Pesticides)

Figure 5. Perception of respondents practicing conventional and organic agriculture towards raptors in arid region Rajasthan.

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Figure 6. Regression plot showing perception of population of raptors/vultures vs. perception of ecosystem services by raptors/vultures in arid region Rajasthan.

545 Figure 7. Pairwise correlation between cultural ecosystem services as perceived by respondents in arid
546 region Rajasthan.

547 **Table legends**

548

549 Table 1: Categorization of perception of farmers on ecosystem services in major categories (Echeverri et
550 al. 2019, Zoeller et al. 2020).

551

552 Table 2. GLM analysis of Socio-Demographic variables and their effect on raptor perception in arid region
553 Rajasthan.

554

555

Table 1(on next page)

Categorization of perception of farmers on ecosystem services in major categories (Echeverri et al. 2019, Zoeller et al. 2020).

Table 1: Categorization of perception of farmers on ecosystem services in major categories (Echeverri et al. 2019, Zoeller et al. 2020)

Name these 3 columns

Serial Code	Construct	Benefit and loss of raptors	Factor Loading		
A	Indirect Benefits (Cronbach's alpha=0.913)	A1. Increases crop quality A2. Increases yield A3. Essential for Crop Production	0.787 0.810 0.904	0.150 0.215 0.209	0.252 0.212 0.192
B	Negative/Disservice (Cronbach's alpha=0.769)	B1. Causes damage to pollinators B2. Causes damage to poultry B3. Causes damage to livestock	0.307 0.217 0.127	 0.332 0.353	0.587 0.735 0.662
C	Direct Benefits (Cronbach's alpha=0.813)	C1. Controls Insects C2. Controls Rodents C3. Alternative to Pesticides	0.137 0.197 0.175	0.769 0.734 0.669	0.132 0.237 0.264

6

Table 2(on next page)

GLM analysis of Socio-Demographic variables and their effect on raptor perception in arid region Rajasthan.

Table 1: Categorization of perception of farmers on ecosystem services in major categories (Echeverri et al. 2019, Zoeller et al. 2020)

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More information is needed in this table header. What family of errors was used for the GLM? Was the response variable a composite score for overall perception? Or based on a specific question? Many of the coefficients are categorical, so should be presented with the category- I added some points below- (plus the intercept should be interpreted in the table legend).

Table 2. GLM analysis of Socio-Demographic variables and their effect on Raptor perception

Coefficient	Estimate	Std. Error	Z value	Pr(>z)
(Intercept)	-16.99807	624.19538	-0.027	0.978275
Gender This is likely gender:male?	0.08132	0.36984	0.220	0.825974
Fruit Crops Is this fruit crops/know?	-0.76781	0.33034	-2.324	0.020111 *
Farming.method Is this organic?	1.08905	1.12765	0.966	0.334162
Education	14.83957	624.19389	0.024	0.981033
Seed Crops	-1.67898	0.43777	-3.835	0.000125 ***
Forage Crops	1.55572	0.40745	3.818	0.0546
Vegetable	0.55477	0.50588	1.097	0.272792
Livestock	0.83013	0.76202	1.089	0.275983
Null deviance: 501.08 on 372 degrees of freedom				
Residual deviance: 422.16 on 360 degrees of freedom				
AIC: 448.16, Number of Fisher Scoring iterations: 13				

Figure 1

Flowchart explaining connection between ecosystem services and human perception (Zoeller et al. 2020)

Flowchart explaining connection between ecosystem services and human perception (Zoeller et al. 2020)

I don't think Figure 1 is necessarily. You also need permission to reprint this if it's directly from the Zoeller paper.

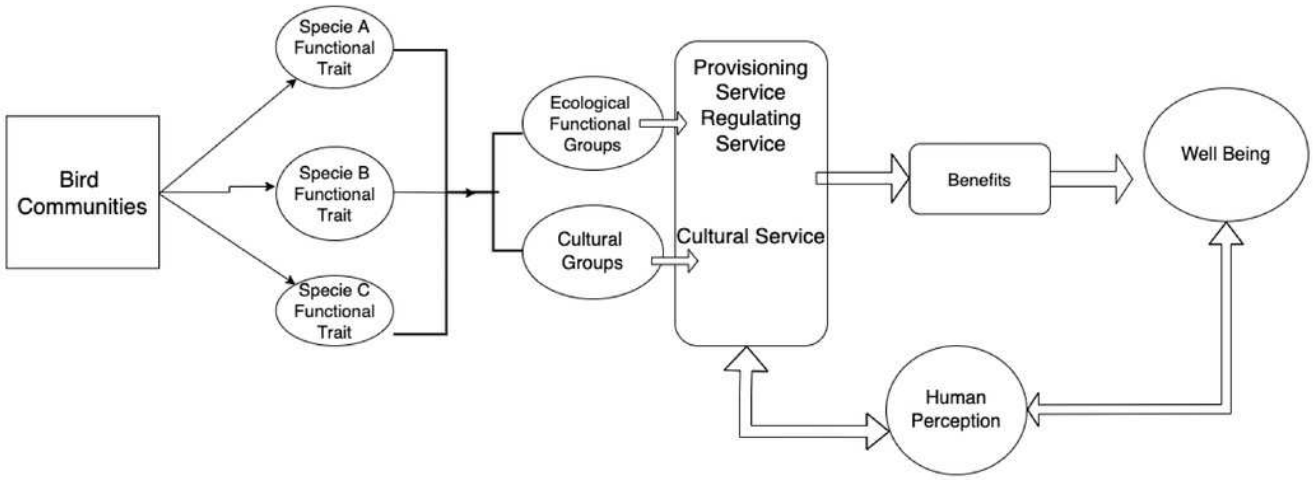

Figure 1. Flowchart explaining connection between ecosystem services and human perception (Zoeller et al. 2020)

Figure 2

Location map of (a) study area and (b) sampling location in arid region Rajasthan during July 2020 to February 2022

Location map of (a) study area and (b) sampling location in arid region Rajasthan during July 2020 to February 2022

a and b aren't shown on the maps. I don't think the 2 insets of India on the left are needed (just keep the bottom one). Explain what the different maps are showing. Is the bottom right brown map needed? Why are the points on the blue map so smudgy? Are they towns?

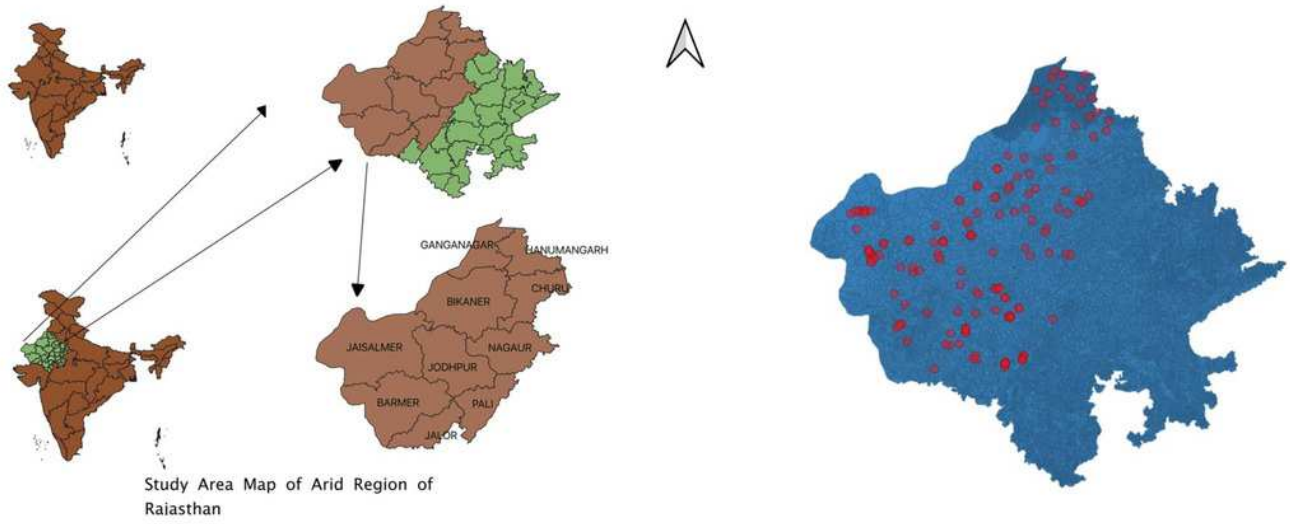

Figure 2: Location map of (a) study area and (b) sampling location in arid region Rajasthan during July 2020 to February 2022

Figure 3

Flowchart explaining steps followed for regression analysis (Morales reyes et al. 2018).

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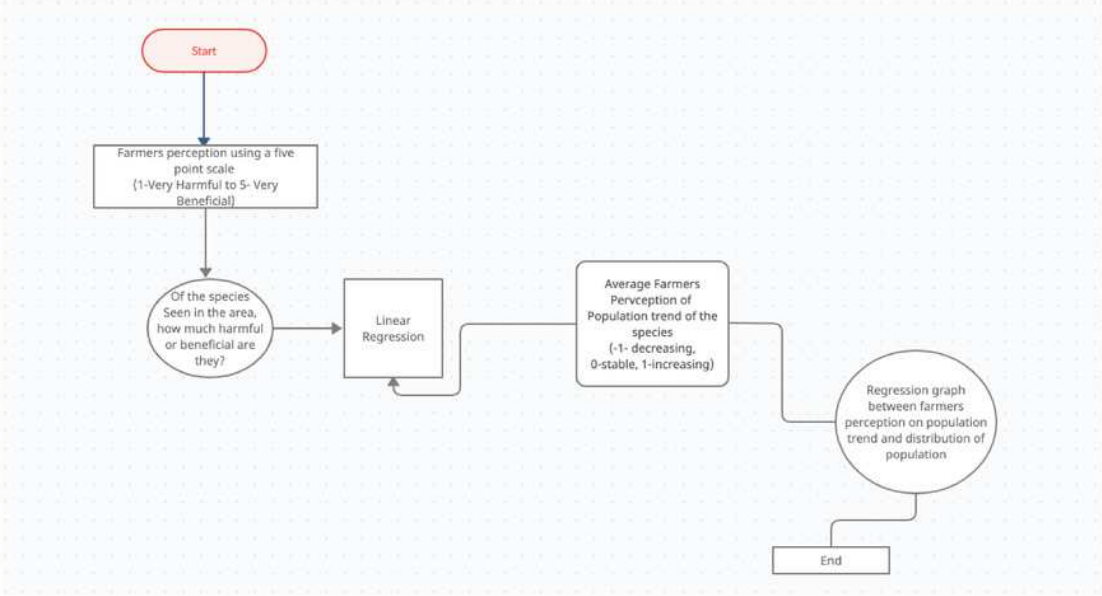

Fig 3. Flowchart explaining steps followed for regression analysis (Morales reyes et al.2018).

This is helpful, but I'm not sure it's necessary. Check for typos and also make sure the arrows are going in the correct direction.

Figure 4

Perception of male and female respondents towards raptors in arid region Rajasthan

A Indirect Benefits: (A1 Increases crop quality, A2 Increases yield, A3 Essential for crop production**), B Negative/Disservice:** (B1 Causes damage to pollinators, B2 Causes damage to poultry, B3. Causes damage to livestock), **C Direct Benefits:** (C1 Controls Insects, C2 Controls Rodents, C3 Alternative to Pesticides)

If possible, it would be good to offset (dodge) the male/female bars so they aren't overlapping. Point out that this is showing the mean (+/- what?)
It would be better to include the category names on the figure itself instead of the legend- you can use coord_flip( ) in your ggplot code to give you more space for the cat names.

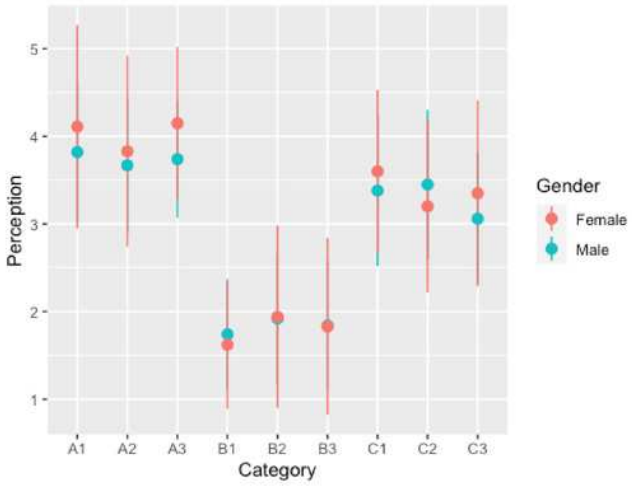

Figure 4. Perception of male and female respondents towards raptors in arid region Rajasthan

A Indirect Benefits: (A1 Increases crop quality, A2 Increases yield, A3 Essential for crop production)**, B Negative/Disservice:** (B1 Causes damage to pollinators, B2 Causes damage to poultry, B3. Causes damage to livestock), **C Direct Benefits:** (C1 Controls Insects, C2 Controls Rodents, C3 Alternative to Pesticides)

Figure 5

Perception of respondents practicing conventional and organic agriculture towards raptors in arid region Rajasthan.

Perception of respondents practicing conventional and organic agriculture towards raptors in arid region Rajasthan.

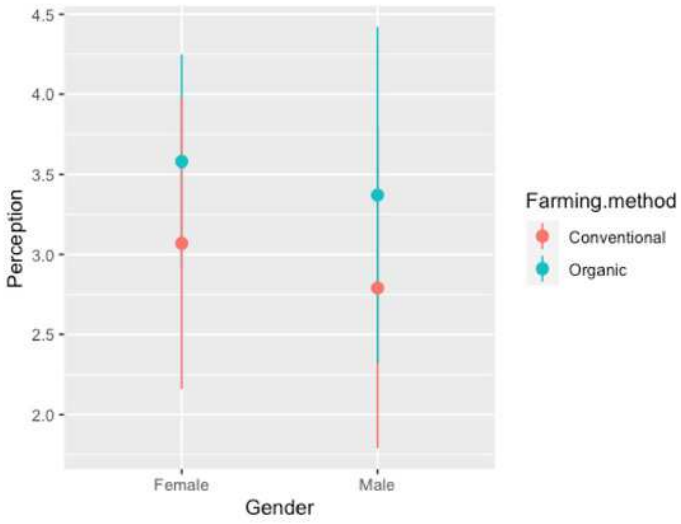

Figure 5. Perception of respondents practicing conventional and organic agriculture towards raptors in arid region Rajasthan

Figure 6

Regression plot showing perception of population of raptors/vultures vs. perception of ecosystem services by raptors/vultures in arid region Rajasthan.

Regression plot showing perception of population of raptors/vultures vs. perception of ecosystem services by raptors/vultures in arid region Rajasthan.

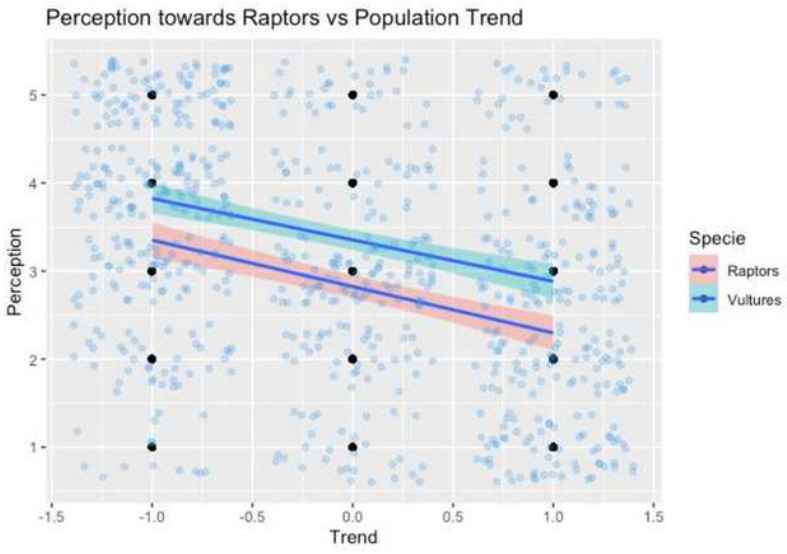

Figure 6. Regression plot showing Perception of population of Raptors/Vultures vs. Perception of Ecosystem services by Raptors/Vultures in arid region of Rajasthan

Figure 7

Pairwise correlation between cultural ecosystem services as perceived by respondents in arid region Rajasthan.

Pairwise correlation between cultural ecosystem services as perceived by respondents in arid region Rajasthan.

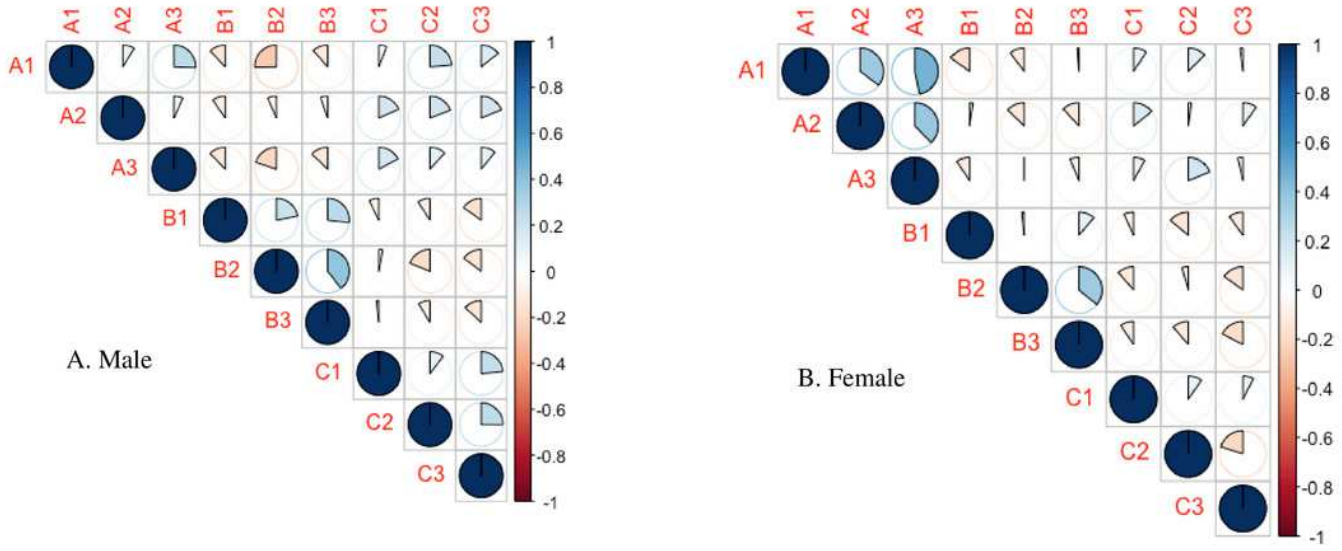

Fig 7: Pairwise correlation between cultural ecosystem services as perceived by respondents in arid region of Rajasthan

A Indirect Benefits: (A1 Increases crop quality, A2 Increases yield, A3 Essential for crop production)**, B Negative/Disservice:** (B1 Causes damage to pollinators, B2 Causes damage to poultry, B3. Causes damage to livestock), **C Direct Benefits:** (C1 Controls Insects, C2 Controls Rodents, C3 Alternative to Pesticides)