



STUDIES ON ANIMAL GRAZING PREFERENCE AND SOCIO-ECONOMIC IMPACTS OF ANIMALS ON HUMAN POPULATION

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ABSTRACT

Various animal species have their own preference to graze the variety of plant species. A study was reported first time about grazing behavior of different animals in the regions of Thal and Cholistan deserts of Punjab, Pakistan. Survey and information regarding animal grazing preference were collected from inhabitants of the area. 300 people were interviewed, who had the different herds of animals such as cows, buffaloes, goats and sheep. From the knowledge of informants, 39 species of wild plants were frequently grazed in the area. The level of grazing pressure was found in the order of, herbs and grasses > shrubs and under shrubs > trees by the different categories of animals. Most dominant family was poaceae comprising of nine (9) grass species in both the localities and almost highly palatable for animals. In addition, there were also observed the socio-economic impacts of animals on human population of the study area.

Keywords: animals, grazing preferences, social behavior, biodiversity, palatability, socio-economic impact, human population.

INTRODUCTION

The vegetation of Cholistan desert is characteristic of arid regions and represents xerophytic species; however Thal desert contains a mixture of both xerophytic and mesophytic type of vegetation. The plant species growing in these regions are adapted to extremes of environmental factors such as temperature, moisture fluctuations, strong wind and wide variety of endemic factors. A large variety of nutritious and multiple stress tolerant species of trees, shrubs and grasses grow there. These plant species, though slow growing, respond very well to the favourable climatic conditions particularly, the timely rains fall and produce abundant fodder (Arshad and Akber, 2002), for different types of herbivores. The effect of large herbivore grazing preference on plant species diversity has been investigated in various terrestrial ecosystems (Keblawy *et al.*, 2009), but a few have dealt with the UAE desert ecosystem (e.g., El-Keblawy, 2003; Gallacher and Hill, 2006). Biodiversity plays a crucial role in ecosystem stability and productivity (Alhamad, 2006). Massive increase in the population followed by land encroachment for agriculture and urban utilization was reflected on natural resources, particularly species biodiversity (Al-Eisawi *et al.*, 2000 and Abou auda, 2010).

Grazing animals can affect an ecosystem through defoliation, treading and leaving excreta (Warda and Rogalski 2004, Duncan 2005, Wasilewski 2006). The transport of seeds is another significant way in which grazers can influence plant diversity (Olf and Ritchie 1998). Natural fertilization and transport of nutrients in animals' excreta is also important for grassland and adjacent biocenoses which may be used by herbivores for feeding and resting. It may be assumed that wild plants are adapted to herbivores since they have evolved together. However, the intensity of defoliation, treading and natural fertilization in farming landscapes may exceed the levels

occurring in natural systems, thus adversely affecting grassland biocenoses. Defoliation is the main way in which herbivores affect plant communities. Periodic defoliation is vital for controlling succession of plants (Rook *et al.*, 2004). They concluded that the main mechanism through which grazing animals influence pastures is their dietary selection, which in consequence creates and maintains the structural heterogeneity of pasture swards.

Bartoszuk *et al.* (2001) suggested that the size of grazing animals is an advantage of pasture conservation, as heavy animals prevent the growth of weeds by trampling and disturbing the soil with their hoofs. According to Vavra (2005), grazing animals can protect specific plant seeds by churning the soil and creating mulches which cover them. On the other hand, trampling may reduce stream bank stability and increase soil erosion (Kauffman *et al.*, 1983; Vavra, 2005). The risk of erosion increases when a soil is wet, when animals cut the canopy very short (less than 20 mm) or when stocking rate is too high (Russell *et al.*, 2001). However, intensive grazing can also cause over-fertilization of pastures, disturbing organic matter and the nutrient circulation balance, thus negatively influencing the biodiversity of a whole ecosystem. For example, a decrease in wader populations on mown and grazed peat grassland is observed when the farmland is drained and heavily manured (Dyrzc *et al.*, 1985; Kleijn *et al.*, 2001).

They are social herbivores that can switch between the grazing and browsing strategy (Hofmann 1989). Abaye *et al.*, (1994) and Bailey, (1999) focused on the role of grazers, as the majority of grazing farm animals belong to this category. Animal species differ in their preference for taking various plants, in the order of selection of species taken and in height of the cut made (Due to the diverse feeding behavior and feed preferences,



the impact on the area grazed differs between species. Bartoszuk *et al.* (2001) pointed out that cattle prefer taller grasses and other plants, whereas horses (Polish Konik) select the shorter sward. Cattle prefer the reproductive parts of plants whereas sheep show preference for vegetative parts. Compared to cattle, horses are more inclined to take fibrous grasses. Furthermore, they can bite closer to the ground because of their teeth structure (Dumont *et al.*, 2007). Cattle often utilize grassland selectively by grazing some areas more intensively than the other, resulting in local overgrazing (Coughenour 1991). Goats are less selective than other farm ruminants in the species of plant eaten (Bartoszuk *et al.*, 2001). Sheep and goats generally need more energy in relation to their gut capacity than cattle, and they have, therefore, to select plant parts with higher nutritive value (flowers, pods, shoots) Rook *et al.* (2004). The degree of selectivity of animals to the plants eaten depends also on sward composition and quality (Rook *et al.*, 2004, Dumont *et al.*, 2007). When the sward is rich in diverse species of flora, animals tend to choose plants which meet best their nutritional requirements. When the sward diversity is smaller, animals start to graze less selectively. Interactions between herbivores and ecosystems are especially complex in the case of free-ranging animals, as abiotic zones and successive stages of biocenoses are of different attractiveness for foraging vs. resting animals. For example, floodplains with short grass swards are preferred foraging habitats by grazers, whereas woodland on nutrient-poor fens and bogs are not attractive. Short vegetation in minerotrophic, base-rich fens occupies an intermediate position. Woodlands on uplands are a second choice foraging habitat but they may be preferred for resting. This different use of habitats generates nutrient transport between ecosystems (Van Braeckel and Bokdam, 2002). The ability of herbivores to move between different ecosystems is especially important when they are used in order to protect or conserve natural landscapes. Rogalski *et al.* (2001) quoted several examples of the way in which species of grazing animals affect the botanical composition of pasture swards. Due to selective biting, valuable grass species such as perennial ryegrass (*Lolium perenne* L.) were found to disappear from pastures grazed by cattle. This grass species also decreased in abundance on pastures grazed by sheep. *Lolium perenne* L. and smooth meadow grass (*Poa pratensis* L.) decreased in abundance on horse grazed pastures. The declining grass species were replaced mainly by orchard grass (*Dactylis glomerata* L.). When goats grazed, meadow fescue (*Festuca pratensis* L.) gradually declined and was replaced by *Dactylis glomerata* L. and *Lolium perenne* L., which became dominant in the sward. Sheep, and especially horse grazing, reduced the abundance of white clover (*Trifolium repens* L.) the abundance of which was positively affected by goat grazing. Generally, grazing animals increased the abundance of herb species in the sward.

Grant *et al.* (1985) compared grazing sheep and cattle and found that the two species were differed

significantly in all major aspects of their diet. Sheep diets contained more forbs and less grass flower stems than those of cattle. The differences between sheep and cattle diets were explained by a difference in the height at which the animals bit the sward, related to the distribution of plant species within the sward canopy. Other important differences included the greater ability of sheep to select from fine-scale mixtures; and the greater readiness of cattle to graze on tall, more fibrous components.

Although grazing behavior/ preference of single population of animals in various literatures in the world as well as Pakistan are available but grazing pressure/ preference of animal community and their effects on biodiversity are rare. For Pakistan and particularly the study area, it is the first rational approach to investigate the grazing preference of animal's community; therefore the main objectives of the present contribution were to evaluate:

- a) Determination of grazing preference of animal's community
- b) The socio-economic impact of animals on human population

MATERIALS AND METHODS

Study area

Cholistan is an extensive desert that begins from Bahawalpur, Punjab to end Thar Desert, Sind and covers an area of 26,330 Km. It lies within the southeast quadrant of Punjab province between 27° 42' and 29° 45' North latitude and 69° 52' and 73° 05' East longitude. The Cholistan desert has extreme summer temperatures (50°C plus) and prolonged droughts rearing is the only age-old profession of the nomadic pastoralists of this desert. Pastoral system is characterized by mass migrations of animals and people throughout the year in search of water and forage. The onset of monsoon and the distribution of rainfall mainly dictate the pattern of movement of nomadic herders. Livestock are the main source of their survival and a number of cultural norms are linked with the animals. The major constraint to the nomadic system is very poor quality of drinking water and inadequate feed, both of which are acute during summer. The Thal desert is a dry desert with scarce vegetation mostly thorny bushes over a breadth of 70 miles and is situated between the Jhelum River and Indus River south of the Pothohar Plateau. It covers an area of about 190 miles long from north to south and 70 miles (110km) wide from east to west. It resembles the Cholistan and the Thar deserts geographically. But in Thal the people are very poor because the whole land is arid and depends upon the weather condition. They cultivate grains only. Thal desert is basically a triangle between the districts of Khushab, Bhakkar, Mianwali, Jhang, Leyiha and Muzzafargarh. Thal has very hot days with pleasant nights.



Data collection

This investigation covered the area about 150 km of Thal in between the Muzzaffar Garh and Choubara district Layyah; secondly 140km from Cholistan started Ahmad pur Sharqia to Khanpur district Rahim Yar Khan. The data on the grazing behavior and knowledge about grazed/ browsed floristic species was conducted during the year 2010. The knowledge about animal- plant interaction was collected through interview from inhabitants of the study area. The age of interviewing person was about 45-55 years old. The choice of informant's age was according to fundamental importance to the reliability of the gathered information. Total three hundred inhabitants were selected from Thal and Cholistan deserts based on one of the following criteria that have been living in the region for more than twenty years and they have been grazing different animal's community such as camel, cow, buffalo, sheep and goats. The selection of interviewers was performed which based on questionnaire, which consists in a number of questions about personal experience on the preference of grazed/ browsed different plant species by the different animals. The questionnaire was addressed to each interviewed informants and included several aspects such as, how old are you, what is your occupation, how much number of different domestic animals nurture, how much experience about the grazing of animals, what is the local name of grazed or browsed plant species, What types and numbers of plant species found in your area, Which one group of plants species was under the grazing pressure, what is the social or economic role of domestic animals in your life, which one plant species was near to threatening due to overgrazing and did the animals play the role in biodiversity? The study areas were thoroughly surveyed and collected the data through out the year in different intervals of time.

RESULTS

Animal grazing preference and their effects on biodiversity

The information regarding the different aspects of this study was collected through the interviewed informants. According to local inhabitant's questionnaires, total 39 plant species were grazed more or less in the area. Out of 39 species, 8 were trees, 6 were shrubs and under shrubs and 25 species belonging to different families of herbs and grasses (Table-1a). The selected age and experienced of informants in the Table-1 was more suitable and reliable for collection of data about the knowledge of plants species and grazing practice of various animals species. The different animal categories have their own preference to graze different types of plant species. In trees there are two xerophytic genera e.g. Acacia and Zizphus were frequently grazed by goats and sheep and camel browsed the leaves of Salvadora genus happily. The leaves of Dalbergia and Albezia genus were more or less palatable by all categories of animals (Table-

1b). All shrubs and under shrubs were grazed by goats and sheep but rarely eaten by cattle (Table-1c). Herbs and grasses were under the grazing pressure and mostly used by the animals community. From the informative data it was analyzed that maximum grazing percentage of herbs and shrubs were 476.00%. The animals of the study area mostly depend on their feed on the herbs and grasses (Tables 1d and 2). So there were found certain herbs and grasses near the status of threatening due to over grazing activity of the animals. From the regional investigation of this study we observed that the occupation of the people of Thal and Cholistan is mostly agriculture and animal husbandry but in Cholistan agriculture was rare. In Cholistan the greater number of herds of different animals was found in each and every family. So the competition develops between the animals and plant species for their survival in the area. In one side the survival of plant species depends on the mercy of rainfall, on the other hand more grazing pressure increased due to increase of domestic animals. So we observed interesting interaction between plant and animals in the desert of study area. From the analysis of variant numbers of domestic animals were increased along the locality gradient e.g. Thal to Cholistan (Tables 3a and 3b $P < 0.000^{***}$) and the grazing pressure also significantly increased towards gradient. In addition to this some times animals play a significant role in biodiversity. Seeds of number of palatable plant species were eaten by the animals. These seeds are indigestible and easily passed on through excreta of the animals. During favourable condition seeds in the excreta were proliferated and played a significant role in biodiversity.

Socio-economic roles of animals on human population

Domestic animals have been a greater importance in the life of human population since many centuries. In this investigation the people of study area were also enjoying various benefits of their domestic animals. Camel carriage and bull cart is frequently used in beast of burden and transportation. The wedding ceremonies like Barat (People of bridegroom side coming towards the bridal home) of Thal and Cholistani people arranged on the camels and bull cart. The camels and bull cart were decorated with artificial colorful flowers and beats. The females of this area fully enjoyed camel cart during wedding ceremony. In addition, the people obtained meat and milk from various animals and enjoyed different types of dairy products. Bull is commonly used in this area for ploughing in the fields. Fur of sheep and goat is often used in local garment and limited sacs (Table-4). Moreover the economics of Cholistani people depends on the domestic animals. They often bought and sold the animals to fulfill their other necessities of life. The people of Cholistan who have more herds of animals and they were more sound in economics. Due to improvement of their economic situation, the living standard and life style of the people of study area was upgraded.

**Table-1a.** Informative knowledge about animal-plant interaction by interviewed inhabitants of Thal and Cholistan regions.

Questions	Regarding answers
How old are you?	45-55 years old
What is your occupation?	Agriculture and Animal husbandry
How much number of different domestic animals nurture?	Number of animals nurture by the people available in Table-3a
How much experience about the grazing of animals?	15-20 years experience about animal grazing
What is the local name of grazed or browsed plant species?	All the local names of plant species are available in Tables 1b, 1c, 1d.
What types and numbers of plant species found in your area	Trees, shrubs under shrubs, herbs and grasses
Which one group of plants species under the grazing pressure	Herbs and grasses frequently grazed by the animals
What is the social or economical role of domestic animals on your life?	Socio-economic impacts of domestic animals are available in Table-4
Which one the plant species was near to threatening due to overgrazing?	Mostly herbs and grasses due to over grazing
Did the animals play in the role of biodiversity?	Yes, indigestible seeds of various plant species remove with the animal excreta and play a role in biodiversity

Table-1b. Trees.

Scientific name	Family name	Local name	Localities		Palatability	Preferred by				
			Thal	Cholistan		Camel	Cow	Buffalo	Goat	Sheep
<i>Acacia nilotica</i> (L.) Willd.	Mimosaceae	Desi Kikar	*	*	HP	+	-	-	+	+
<i>Acacia senegal</i> (L.) Willd.	Mimosaceae	Kanda	*	*	HP	+	-	-	+	+
<i>Acacia modesta</i> Wall.	Mimosaceae	Phulai	*	*	HP	+	-	-	+	+
<i>Prosopis cineraria</i> Linn.	Mimosaceae	Maskeet	*	*	LP	-	-	-	+	+
<i>Dalbergia sisso</i> Roxb.	Fabaceae	Tali or Shesham	*	o	P	+	+	+	+	+
<i>Albezia labbeck</i> (L.) Benth.	Fabaceae	Sharin or Sars	*	o	HP	+	+	+	+	+
<i>Ziziphus jujuba</i> Mill.	Rhamnaceae	Bair	*	*	P	-	-	-	+	+
<i>Salvadora oleoides</i> Linn.	Salvadoraceae	Jal	*	*	P	+	-	-	-	-

P = Palatable, Hp = High palatable, LP = Low palatable, * = Species found in locality
 o = Not found, + = Preference of eaten, - = Not eaten



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Table-1c. Shrubs and under shrubs.

Scientific name	Family name	Local name	Localities		Palatability	Preferred by				
			Thal	Cholistan		Camel	Cow	Buffalo	Goat	Sheep
<i>Abutilon indicum</i> (Linn.) Sweet.	Malvaceae	Giddar War	*	o	P	-	+	+	+	+
<i>Aerva persica</i> (Burm. f.) Juss.	Amaranthaceae	Bui	*	*	P	-	-	-	+	+
<i>Alhagi maurorum</i> Medic.	Fabaceae	Jawansa	*	*	P	-	+	+	+	+
<i>Calotropis procera</i> (Willd.); R.Br.	Asclepiadaceae	Ak	*	*	HP	+	-	-	+	+
<i>Suaeda fruticosa</i> (Linn.) Forssk	Chenopodiaceae	Lana	o	*	P	+	+	-	+	+
<i>Withania somnifera</i> (Linn.) Dunal.	Solanaceae	Paneer	*	*	P	-	+	-	+	+

Table-1d. Herbs and grasses.

Scientific name	Family name	Local name	Localities		Palatability	Preferred by				
			Thal	Cholistan		Camel	Cow	Buffalo	Goat	Sheep
<i>Avena fatua</i> Linn.	Poaceae	Jangli jai or jodal	*	*	HP	+	+	+	+	+
<i>Boerhaavia coccinea</i> Mill.	Nyctaginaceae	It Sit	*	o	P	-	+	+	+	+
<i>Brachiaria ramosa</i> (Linn.) Stapfin	Poaceae	Makhan Grass	*	*	HP	+	+	+	+	+
<i>Brassica campestris</i> Linn.	Brassicaceae	Sarsoon or Saag	*	o	HP	+	+	+	+	+
<i>Cenchrus ciliaris</i> Linn.	Poaceae	Dhaman Grass	*	*	HP	+	+	+	+	+
<i>Chenopodium album</i> Linn.	Chenopodiaceae	Bathu	*	o	HP	+	+	+	+	+
<i>Citrullus colocynthis</i> (Linn.) Schrad.	Cucurbitaceae	Buramba	*	*	P	-	+	+	+	+
<i>Convolvulus arvensis</i> Linn.	Convolvulaceae	Wanveeri	*	*	HP	+	+	+	+	+
<i>Cynodon dactylon</i> (Linn.) Pers.	Poaceae	Tula Grass or lawn grass	*	*	HP	+	+	+	+	+
<i>Cyperus rotundus</i> Linn.	Cyperaceae	Sedge	*	o	P	-	+	+	+	+
<i>Dactyloctenium scandium</i> Boiss.	Poaceae	Grass	*	*	HP	+	+	+	+	+
<i>Desmostachya bipinnata</i> (Linn.) Stafin thiselt.	Poaceae	Drab	*	*	P	+	+	+	-	-
<i>Diplachne fusca</i> (Linn.) P. Beauv.	Poaceae	Kaller grass	*	o	HP	+	+	+	+	+
<i>Echinochloa crus-galli</i> (Linn.) P. Beauv.	Poaceae	Cheena	*	o	HP	+	+	+	+	+
<i>Eruca sativa</i> Mill.	Brassicaceae	Tara Mera	*	o	HP	+	+	+	+	+
<i>Malva neglecta</i> Wallr.	Malvaceae	Mehrine	*	o	HP	+	+	+	+	+
<i>Melilous indicus</i>	Fabaceae	Sinji	*	o	HP	+	+	+	+	+



(Linn.) All.										
<i>Medicago denticulata</i> Willd	Fabaceae	Mehna	*	o	HP	+	+	+	+	+
<i>Panicum turgidum</i> Forssk.	Poaceae	Grass	*	*	HP	+	+	+	+	+
<i>Phalaris minor</i> Retz.	Poaceae	Dumbi Sitti	*	*	HP	+	+	+	+	+
<i>Sorgham halepense</i> (Linn.) Pers.	Poaceae	Grass	*	*	HP	+	+	+	+	+
<i>Rumex dentatus</i> Linn.	Polygonaceae	Jangli Palak	*	*	HP	+	+	+	+	+
<i>Solanum nigrum</i> Linn.	Solanaceae	Mako	*	*	P	-	+	+	+	+
<i>Trifolium elaxandrianum</i> Linn.	Fabaceae	Barseem	*	o	HP	+	+	+	+	+
<i>Trifolium resupinatum</i> Linn.	Fabaceae	Saftal	*	o	HP	+	+	+	+	+

Table-2. Grazing percentage of plant species by the different animals in Thal and Cholistan with the reference to Table-1.

Name of Animal category	Trees 8 species		Shrubs and under shrubs 6 species		Herbs and grasses 25 species	
	Grazed species	% age	Grazed species	% age	Grazed species	% age
Camel	06	75 %	02	33.33 %	21	84 %
Buffalo	02	25 %	02	33.33 %	25	100 %
Cow	02	25 %	04	66.66 %	25	100 %
Sheep	07	87.5 %	06	100 %	24	96 %
Goat	07	87.5 %	06	100 %	24	96 %
Total grazing pressure %	300.00 %		333.23 %		476.00 %	

Table-3a. Number of animals nurture by inhabitants of Thal and Cholistan regions.

Regions	Study sites	Total no. of inhabitants interviewed in each sites	No. of animals nurture by the people				
			Camel	Buffalo	Cow	Sheep	Goat
Thal	1	50	8	30	35	60	45
	2	50	15	40	30	45	65
	3	50	20	25	40	70	60
Cholistan	4	50	26	8	25	600	450
	5	50	22	10	38	650	480
	6	50	40	6	32	580	610
Total	6	300	131	119	200	2005	1710

Table-3b. One-way analysis of variance between locality and number of animal species.

Source	DF	MS	F-Value	P-Value
Locality	1	297804	7.71	0.010***
Error	28	38637		
Total	29			

P < 0.000***

**Table-4.** Animals and their socio-economic impacts on human population.

S. No.	Animals	Cholistan	Thal	Economic uses
1	Camel	A	R	Camel carriage is used in transportation, beast of burdon, meat and milk
2	Buffalo/ Bullock	R	A	Bullock cart is used in transportation and ploughing in fields. Female for meat and milk
3	Cow/ Bull	A	A	Bull cart is used in transportation and ploughing in fields. Female for meat and milk
4	Sheep	A	A	meat and milk and fur is used in local garments
5	Goat	A	A	meat and milk and fur is used in local garments as well as local sac

A = Abundant, R = Rare

DISCUSSIONS AND CONCLUSIONS

Animal graze the most palatable parts of plant species and the continuous grazing puts more pressure on grasses and legumes and less palatable plants such as weeds and bushes, eventually exhausting the root reserves of the desirable species. To increase pasture production, adopt a controlled grazing system that limits cattle access to smaller parts of the pasture at one time. This allows you to control the amount of grazing pressure your grasses and legumes receive, giving plants sufficient time to regrow and restore root reserves for a more sustainable plants community, biodiversity is our natural wealth, its conservation is important both economically and ethically.

A lot of literature on the grazing behaviour across the globe is available. Here some are discussed in the supporting of our study. Camel grazing affects over 90% of the area of the Arabian Peninsula, of which 44% is severely or very severely degraded (Ferguson *et al.*, 1998). In the inland desert ecosystems of the UAE, excessive grazing by camels has been recognized as the single greatest threat (Hellyer *et al.*, 2001; Gallacher and Hill, 2006). Camels are allowed to wander freely throughout the UAE desert to graze, while other livestock, such as goats, sheep must be kept permanently in pens (Gallacher and Hill, 2006). The increase in grazing pressures, due to the sharp increase in the number of livestock in many Gulf countries, including the UAE (Oatham *et al.*, 1995; Gallacher and Hill, 2006), has resulted in significant deterioration of desert rangelands (Assaeed, 1997; Brown *et al.*, 2003). Batanouny (1990) indicated that over 30% of the grazing land in the Arab Gulf countries is in a depleted condition due to large numbers of livestock, unrestricted grazing and destructive gathering of wood and dry farming. Camels generally brows on a broad spectrum of fodder plants, including thorny bushes, halophytes and aromatic species, usually avoided by other domestic herbivores (Iqbal and Khan, 2001).

It is concluded that animal grazing preference/palatability can be a tool to maintain or restore biodiversity of open landscape and contribute to the aesthetic and leisure importance of grassland. The successful use of grazing for environment protection and

biodiversity enhancement requires careful planning and should be adapted to local conditions. A deep understanding of the relationship between herbivores, plant, and small animal communities and the abiotic environment is essential. Therefore, there is a need for comprehensive research programmes in the area of extensive grazing, combining expertise from ecology, botany, agronomy, animal production and rural economics. The research should include both field experiments and development of appropriate models, allowing for the design of agro-environmental schemes aimed at the protection of grassland biocenoses.

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Competing interests

The author(s) declare that we have no competing interests financially or non-financially with any person or any Institute.

Author's contributions

ABG and AHD designed the study, ABG and AHD prepared the manuscript, ABG and AHD conducted the surveys.

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