

Effects of tourism pressure on herd composition in the Sherpa villages of Sagarmatha National Park (Everest, Nepal)

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Key words: Ecological effects of tourism, human ecology, herd composition, yak (*Bos grunniensis*)

SUMMARY

Tourism represents an increasingly important resource for many countries. We estimated the impact of tourism on local herd composition in Sagarmatha National Park (Nepal). We collected field data (interviews in villages) and searched bibliographic and historical sources. Village structure (lodge building) and animal husbandry (herd composition, male/female ratio) were also examined. We found that economic pressure (tourism income) has led to a change in village structure and livestock composition. Statistical analysis (χ^2 and Spearman correlation coefficient) confirmed this hypothesis. We suggest that traditional settlements have a positive effect on biodiversity because they increase landscape heterogeneity, while changes in villages due to tourism pressure may exceed the natural limiting factors of the park.

INTRODUCTION

Tourism is an important economic resource for many countries (Fennell 1999), especially for developing countries where GDP and household budget may be determined mainly by tourism (Weaver 1998). Therefore, all the elements that attract tourists (i.e. natural attractions or historical monuments) have an intrinsic economic value and need to be carefully preserved. However, tourism may have a strong impact on the environment, especially if it implies non-optimal exploitation of natural cycles, and may lead to overexploitation of natural resources (see Farrell and Runyan 1991).

This could result in problems with waste management (rarely recyclable, burned or stockpiled in suitable waste disposal sites; Cole and Sinclair 2002), sanitary problems (due to organic pollution of water sources; Boselli *et al.* 1998), hydrogeological instability and landscape degradation (loss of biodiversity, deforestation; Laiolo 2003; Stevens 2003; Chettri *et al.* 2005). Furthermore, tourism may also cause cultural changes (Byers 2005).

Mountain areas are particularly fragile ecosystems and many problems caused by increased tourism may be exacerbated (Nepal 2002). Nepal

represents a good example of the current situation: it is a less developed country where economic revenues mainly come from tourism (Adams 1992; Stevens 1993a; Boselli *et al.* 1997). Nepal is mainly mountainous and contains the highest mountains in the world. A national park was established around Everest in 1972 (Sherpa 1988): the Sagarmatha National Park (SNP, Sagarmatha is the Nepalese name for Everest). The high mountains of Nepal are the main tourist attraction and, during the last 20 years, an increasing number of tourists have visited the SNP. However, tourism has had contrasting effects: it has created a higher level of prosperity for the local people, but also led to decay in natural resources and a change in the traditional life-style of the local Sherpa people (Fisher 1997). The aim of this study was to investigate if tourism has led to changes in traditional settlements and life-styles of the Sherpa people.

MATERIAL AND METHODS

Study area

The Sagarmatha National Park (literally, Mother of the universe) is located in the Solu-Khumbu district, in the northeast of Nepal, and covers an area of 114800 ha (Inskipp and Inskipp 1998), between 27°45'–28°07'N and 86°28'–87°07'E. The protected area includes the upper part of the Dudh Kosi (one of the three major rivers in Nepal) drainage basin, and is encircled by high mountains.

The Khumbu Valley is inhabited by the Sherpas, a people who originally came from Tibet and settled in this part of Nepal around 600 years ago. The main means of subsistence for these people is yak breeding. Since 1953, with the first ascent of Everest, tourism has become more and more important to their economy. For hundreds of years, Sherpa life was dominated by the natural passing of the seasons, with an ancient cycle of agriculture, animal breeding, trade and harvesting. The economic benefits of tourism have given the Sherpas new jobs during the spring and autumn, such as porters and guides for alpine and trekking expeditions. However, until recently, this change did not decrease the value of their traditional activities, which are still deeply ingrained (Brower 1991; Stevens 1993b; Fisher 1997).

Data collection

Our data were collected in April 2002 (apart from the data for Periche, which were collected in 2003), during a 2-week expedition. The intention was to collect data that might verify the effective transformation of traditional Sherpa life.

Data on tourist presence were collected at the entrance to the park, where every tourist is registered. As far as Sherpa tradition and culture are concerned, we used interviews with the local population to collect information on the structure of villages (number of houses, number of lodges – housing for tourists –, presence of other structures such as schools and hospitals) and about their herd composition. Interviews were performed using specific questionnaires and a Sherpa guide (Nawang Khunga Sherpa) who helped to translate questions into the local language. We analysed 10 villages: four (Periche, Pangboche, Dingboche, Khumjung) on the main tourist routes, four (Thame, Thengboche, Deboche, Phortse) on the tourist secondary routes, and two (Yillajung, Thamo) far from tourism routes. Because of the critical political situation (civil war and curfew) it was not possible to carry out interviews in Namche Bazaar.

Statistical analysis

Statistical analysis used Excel and SPSS (version 14 for Windows) packages. We used a χ^2 test (*sensu* Fowler and Cohen 1993) to verify differences between percentages of lodges in tourist and non-tourist villages and in herd composition. A Spearman non-parametric correlation was applied to see if there was a significant relationship between village altitude and percentage of yak and nak in the herds.

RESULTS

Around 1950, tourist flow began into the Khumbu region, with the arrival of the first climbers, intent on ascent of the Himalayan peaks, but only in 1964 was there a real increase in tourist numbers when the Nepalese government allowed more and more foreign tourists to enter the country. Tourists visit the park in spring and autumn, the short and most favourable seasons, outside the monsoon season.

The main tourist routes go from Lukla airport towards the Everest base camp and the Gokyo valley (in the eastern and central parts of the park, respectively), while the western part (Nangpa Tsangpu valley) receives few visitors. During the 1990s there was a steady increase in visitors (Figure 1); but a break occurred in 2001 and 2002 because of the combined effects of the Nepalese civil war and a general decrease in tourism after 9/11. Since tourism represents a fundamental economic resource for Nepal, the government decided (at the end of 2002) to abolish some restrictions on trekking activity in remote areas (e.g. to the Nangpa Tsangpu valley) and the ascent of smaller peaks (e.g. to the Island Peak of 6100 m, over Dimboche).

The important and significant data on villages are those concerning the relationship between the number of houses and the number of lodges (Table 1). In this way it is possible to divide villages into three classes: tourist villages, less-tourist villages and traditional villages. The ratio of the number of houses to the number of lodges is a good indicator for this classification. A detailed analysis reveals that, in tourist villages, there are more lodges than statistically expected, whereas in non-tourist villages there are less lodges than expected. A χ^2 test (*sensu* Fowler and Cohen 1993) shows a statistically significant difference between village typology and building typology; $\chi^2 = 58.24, P < 0.01$.

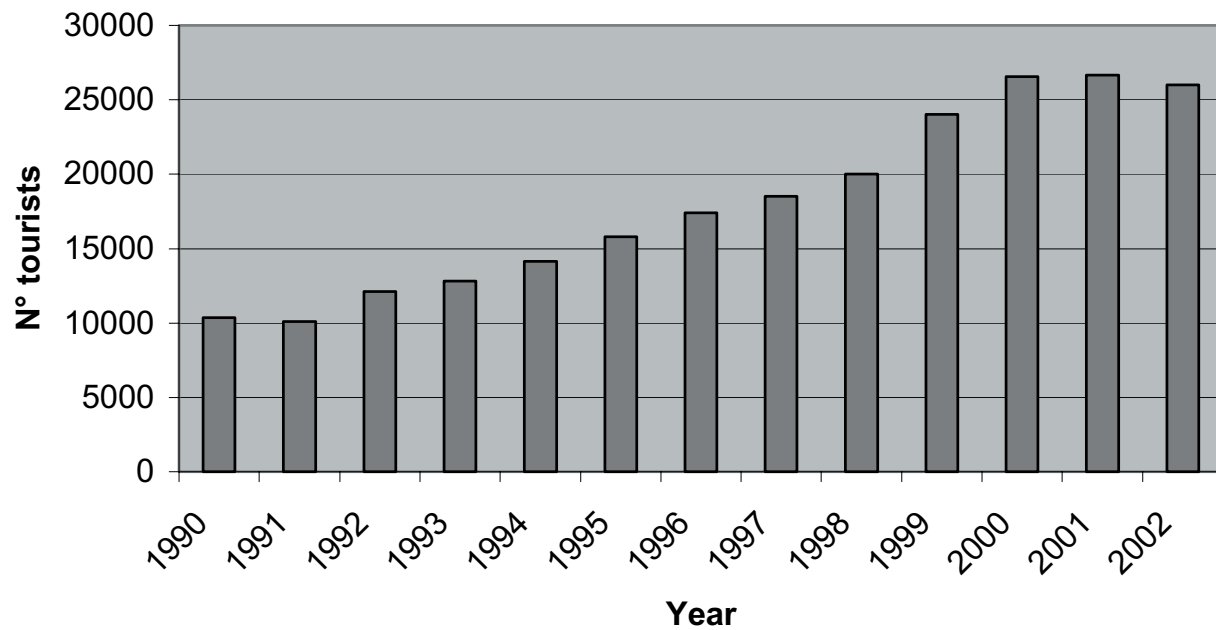


Figure 1 Number of tourists in Sagarmatha National Park

Table 1 Survey of houses and lodges in villages of Sagarmatha National Park

Village	Date of survey	Height (m asl)	No. of houses	No. of lodges	% lodges
Yillajung	08/04/2002	3800	60	0	0
Thamo	06/04/2002	3443	50	2	3.85
Thame	08/04/2002	3753	52	6	10.34
Phortse	15/04/2002	3800	70	8	10.26
Deboche	11/04/2002	3676	25	3	10.71
Thengboche	11/04/2002	3867	47	5	9.62
Khumjung	09/04/2002	3790	87	16	15.53
Dingboche	13/04/2002	4350	52	13	20.00
Pangboche	13/04/2002	3900	85	45	34.62
Periche	11/04/2003	4270	10	10	50.00

The main issue in this paper is differences in herd composition. The Sherpa people traditionally breed yak (*Bos grunniensis*), and the Khumbu people distinguish yak and nak based on sex (male and female, respectively). Apart from yak, Sherpas breed cows and cross-breed cows and yaks to produce Dzoo and Dzoone. The higher the altitude, the more relevant the percentage of yak and nak (Table 2) because yaks are more resistant to cold and hard work at high altitudes, while at low altitudes, yaks are less effective and Sherpas prefer the hybrids. A Spearman correlation coefficient shows a positive, highly significant relationship between the altitude of villages and the percentage of yak and nak (r_s 0.881; $P=0.004$). Sherpas engage in dairy activities, using naks for milk, butter and cheese, and therefore there are more females (naks) to males (yaks) (Table 2). There is also a

clear difference in yak gender between tourist and non-tourist villages: for four villages it was possible to compare our current data with that of Brower (1991) (Figure 2: number of males per 100 females), showing that the number of males has increased, particularly in the two tourist villages.

A contingency table was prepared to evaluate the variations over time of herd structure in tourist and less tourist villages. First, in both village typologies the livestock sex ratio has changed, leading to a statistically significant difference between time thresholds and sex ratio ($\chi^2 = 504.77$, $P < 0.01$ for tourist villages and $\chi^2 = 292.15$, $P < 0.01$ for the less tourist villages). The lower χ^2 in the less tourist villages implies less relationship between the dynamics of these two elements. Comparing the tourist and the less tourist villages at the various time thresholds (Figure 3), we observed that, in 1957

Table 2 Herd data in villages of Sagarmatha National Park

Village	Height (m asl)	Yak	Nak	Dzoo	Dzoone	Bull	Cow
		♂	♀	♂	♀	♂	♀
Thamo	3443	50	105	70	140	10	37
Thame	3753	180	267	37	16	8	11
Yillajung	3800	210	340	60	47	4	8
Khumjung	3790	88	110	97	33	37	11
Deboche	3676	11	17	2	7	17	–
Dingboche	4350	400	175	5	–	–	2
Pangboche	3950	450	300	60	30	5	17
Phortse	3750	75	110	11	16	4	26

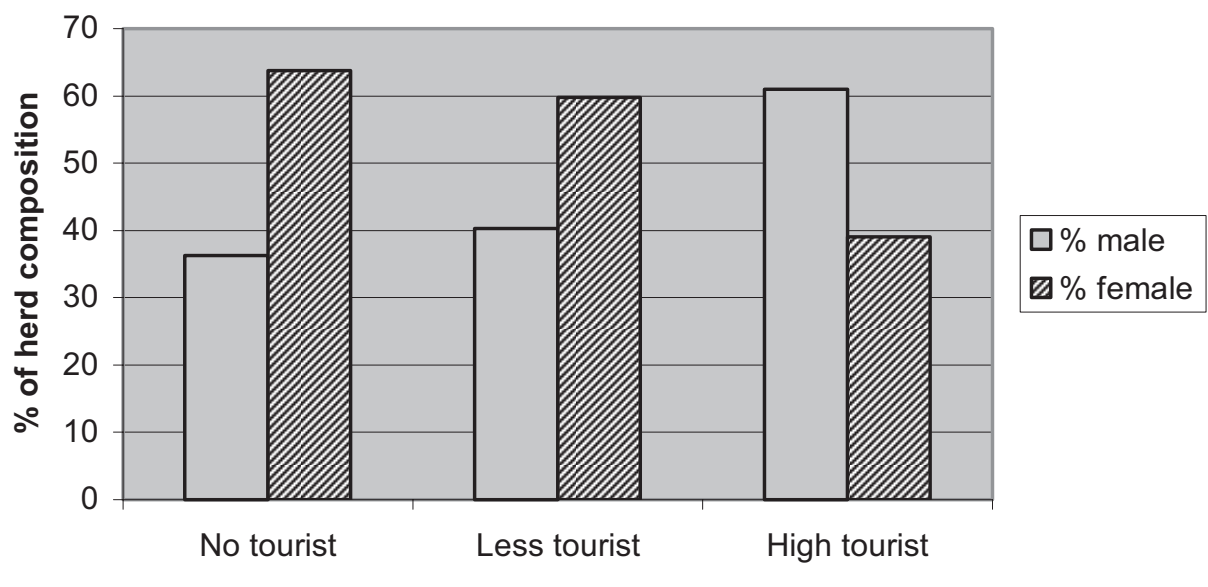


Figure 2 Percentages of male and female animals in highly, less and non-tourist villages

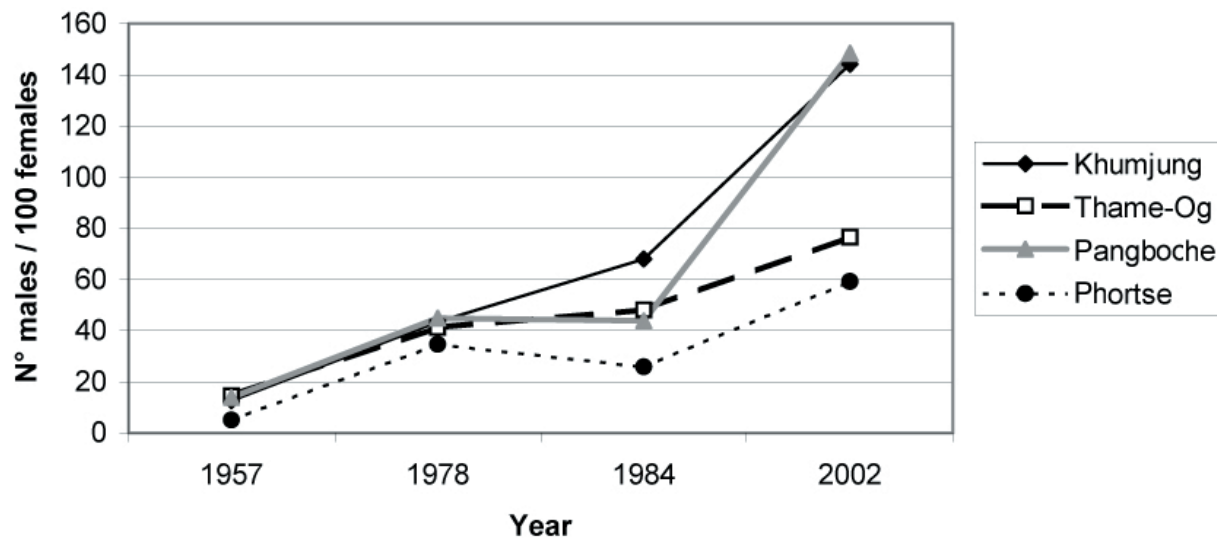


Figure 3 Historic relationship between male and female animals in the herds of four villages

and 1978, there was no evidence of a difference in yak sex ratio (χ^2 1.91 = $P > 0.05$ for 1957 χ^2 1.41 = $P > 0.05$ for 1978), while in 1984 and 2002 the differences are statistically significant (especially in 2002) (χ^2 9.59 = $P < 0.01$ in 1984 χ^2 62.19 = $P < 0.01$ in 2002). In Khumjung this variation in herd composition began earlier than in Pangboche. This is probably related to the building of tourism infrastructure, which began first in Khumjung and later reached Pangboche. There is, however, also a small variation in herd structure in the less tourist villages that can be explained by the fact that many Sherpas, even if they do not live in the main tourist areas, work for the tourism industry and therefore need male animals.

DISCUSSION AND CONCLUSIONS

The data obtained represent the first step in a project that aims at verifying the effects of changes in the Sherpas' environment and culture due to increases in tourism inside Sagarmatha National Park. Apart from the well-known problems of an increase in waste and organic pollution of watercourses, there is evidence of changes in the life-style of the Sherpa population and especially in the management of their herds. The herd plays an important role in biodiversity conservation, especially for large carnivores that are attracted by livestock (Fox *et al.* 1994; Mishra 2000; Bagchi *et al.* 2004; Namgail *et al.* 2007). Therefore, in order to provide guidelines for future research on the impact of tourism, it is necessary to draw some

conclusions on the traditional Sherpa way of life and on their role in the ecology of the area.

Traditionally, the Sherpa people depended on local natural environmental resources, undertaking small-scale activities that have little impact on the ecological systems, and contribute to maintain landscape variety. For example, during summer the potato fields attract wild animals (e.g. *Hemitragus jemlahicus*) or birds that eat some seeds of the cereal crops (buckwheat and barley). Sherpas also harvest some trees, which represents a local modification to the landscape that increases forest diversity by allowing shrubs and herbs to flourish and, as a consequence, provides a habitat for more and varied fauna. The traditional impact of humans on the landscape can be seen as a structural disturbance element that provides a source of heterogeneity, but only where it is spatially limited and controlled. In landscape ecology, such disturbances are described as moderate events that modify the structure of the ecological system, creating changes in resource availability. These events can be structuring, if they happen at small scales, but at larger scales they become harmful to the ecological systems, causing de-structuring (White and Pickett 1985; Farina 1998). Colinvaux (1990) applied this structural theory to the Amazonian forest in order to explain how an apparently uniform and climatically steady state area could be a world hotspot for biodiversity (*sensu* Wilson 1992). Colinvaux (1990) asserted that small disturbances in normal ecosystem dynamics (tree falls, water invading portions of a forest) cause small environment modifications

that consequently increase the variety and number of ecological niches. In the Sagarmatha National Park, the small spatial scale of human intervention is related to mountain morphology, the Buddhist religion of the Sherpas and the relatively low population density. The topography of the area reduces arable land availability to small sunny areas on less steep slopes. This prevents the original landscape from being totally transforming, as opposed to what happens on the plains, and also allows wild fauna to reach and settle in the open areas. The Buddhist religion forbids hunting, therefore the fauna of the park are under less pressure (Mishra *et al.* 2003). After the park was established, the presence of Nepali non-Sherpa military groups (who are not Buddhist) involved in intense hunting led to a drastic decrease in the wild fauna (particularly Phasianidae). However the condition of the fauna is now improving.

Because the Sherpa population is not large (approximately 3000 persons), pressure on environment is fairly limited. As a consequence of the increase in tourist flow in the last 30 years, a potentially dangerous situation for the ecological balance

of Sagarmatha Park has developed. In the 1970s, there were only 5000 tourists and these did not significantly affect the area and its people; however, 25,000 mountain climbers, trekkers, and visitors entered the park in 2000 and 2001. Western tourism provides income to local people but, unfortunately, can lead to exploitation of local natural resources. The increasing anthropogenic pressures affect more and wider areas. The disturbing phenomena that once occurred on a limited scale, are now widely dispersed, and are affecting the ecological dynamics of the whole area. Controlling access to the park would allow appropriate management of the area, together with respect for traditional Sherpa habits and values, and would decrease anthropogenic pressure on the fragile ecology and traditions of this mountainous area.

ACKNOWLEDGEMENTS

This research was supported by the program Ev-K2 CNR of the Italian National Research Council, from the Italian Ministry of Foreign Affairs and the ONOSTAMPI srl.

REFERENCES

- Adams V. Tourism and Sherpas, Nepal – Reconstruction of reciprocity. *Annals of Tourism Research* 1992; 19(3):534–54
- Bagchi S, Mishra C and Bhatnagar YV. Conflicts between traditional pastoralism and conservation of Himalayan ibex (*Capra sibirica*) in the Trans-Himalayan mountains. *Animal Conservation* 2004; 7:121–8
- Boselli AM, Caravello G, Scipioni A and Baroni A. Sustainable tourism development in Nepal: evaluation and perspectives. *Journal of Human Ecology* 1997;8(1):1–12
- Boselli AM, Caravello GU, Baroni A and Scipioni A. Nepal: Water, Health, Culture and Environmental Quality Index. In Hens L, Bordens RJ, Suzuki S and Caravello GU (eds), *Research in Human Ecology: an Interdisciplinary Overview*. Brussels: VUB Press; 1998: 217–38
- Brower B. *Sherpa of Kumbu – People, Livestock and Landscape*. Oxford: Oxford University Press; 1991
- Byers A. Contemporary human impacts on alpine ecosystems in the Sagarmatha (Mt. Everest) National Park, Khumbu, Nepal. *Annals of the Association of American Geographers* 2005;95(1):112–40
- Chettri N, Chandra DD, Sharma E and Jackson R. The Relationship Between Bird Communities and Habitat: A Study Along a Trekking Corridor in the Sikkim Himalaya. *Mountain Research and Development* 2005;25(3):235–43
- Cole V and Sinclair AJ. Measuring the Ecological Footprint of a Himalayan Tourist Center. *Mountain Research and Development* 2002;22(2):132–41
- Colinvaux P. The past and the future of the Amazon. *Scientific American* 1990;260:68–75
- Farina A. *Principles and Methods in Landscape Ecology*. London: Chapman & Hall; 1998
- Farrell B and Runyan D. Ecology and tourism. *Annals of Tourism Research* 1991;18(1):26–40
- Fennell D. *Ecotourism*. London: Routledge; 1999
- Fisher JF. *Sherpas*. New Delhi: Oxford India Paperbacks; 1997
- Fowler J and Cohen L. *Statistics for ornithologists*. Second edition. London: BTO Guide; 1993
- Fox JL, Nurbu C, Bhatt S and Chandola A. Wildlife conservation and land-use changes in the trans-Himalayan region of Ladakh, India. *Mountain Research and Development* 1994;14:39–60

- Inskipp C and Inskipp T. Birds of Sagarmatha National Park. *Ibisbill – Journal of Himalayan Ornithology* 1998;1:3–34
- Laiolo P. Diversity and structure of the bird community overwintering in the Himalayan subalpine zone: is conservation compatible with tourism? *Biological Conservation* 2003;115:251–62
- Mishra C. Socio-economic transition and wildlife conservation in the Indian Trans-Himalaya. *Journal of the Bombay Natural History Society* 2000;97(1):25–32
- Mishra C, Prins HHT and Van Wieren SE. Diversity, Risk Mediation, and Change in a Trans-Himalayan Agropastoral System. *Human Ecology* 2003;31(4):595–609
- Namgail T, Fox JL and Bhatnagar YV. Carnivore-caused livestock mortality in Trans-Himalaya. *Environmental Management* 2007;39(4):490–6
- Nepal SK. Mountain Ecotourism and Sustainable Development: Ecology, Economics, and Ethics. *Mountain Research and Development* 2002;22(2):104–9
- Sherpa LN. Conserving and managing biological resources in Sagarmatha (Mt. Everest) National Park. Nepal Working paper 1988; no. 8
- Stevens SF. Tourism, Change, and Continuity in Mount Everest Region, Nepal. *Geographical Review* 1993a;83(4):410–27
- Stevens SF. Claiming the high ground: Sherpas, subsistence and environmental change in the Highest Himalaya. Berkeley: University of California Press; 1993b.
- Stevens SF. Tourism and deforestation in the Mt. Everest, region of Nepal. *The Geographical Journal* 2003;169(3):255–77
- Weaver DB. Ecotourism in less developed world. Wallingford, UK: CAB International; 1998
- White PS and Pickett TA. Natural disturbance and patch dynamics: an introduction. In Pickett TA and White PS (eds), *The ecology of natural disturbance and patch dynamics.* Orlando FL: Academic Press; 1985
- Wilson EO. The diversity of life. Harvard: Belknap Press; 1992