Topic 5: Resolution of Human–Macaque Conflicts: Changing from Top-Down to Community-Based Damage Management

Katsuya Suzuki and Yasuyuki Muroyama

17.1 Introduction

Human–wildlife conflicts have become a major concern in many countries. These conflicts range from wildlife being a nuisance in daily life and crop-raiding, to wildlife being a threat to human life. Such conflicts have been observed in Japan, where the activities of wild mammals such as sika deer (*Cervus nippon*), wild boar (*Sus scrofa*), Japanese black bears (*Ursus thibetanus japonicus*), and Japanese macaques (*Macaca fuscata*) have caused serious damage to agricultural and forestry products, and their activities around human settlements have impacted human life in a variety of ways. The Ministry of Agriculture, Forestry and Fisheries, Japan, reported that total agricultural damage caused by wild mammals was 13.2 billion yen in 2007 (Ministry of Agriculture, Forestry and Fisheries, Japan 2008a). To alleviate these conflicts, researchers have developed theories and techniques of wildlife damage management.

Japanese macaques are one of the major agricultural pests in Japan. Crop damage by macaques occurs in all prefectures of Japan, other than Hokkaido, Okinawa, and Ibaraki where macaques do not occur. Over the past 5 years (2003–2007), macaques have caused approximately 1.5 billion yen of agricultural damage each year, which is the third highest damage level caused by wild mammals in Japan (Ministry of Agriculture, Forestry and Fisheries, Japan 2008b). Japanese macaques are highly social, intelligent animals, and their excellent agility and learning capacity, combined with dietary and behavioral flexibility, appears to make them adaptable and efficient crop-raiders. Consequently, macaques are recognized as the most troublesome crop-raiders by most Japanese farmers.

In addition to the economic damage of commercial harvests, farmers have also suffered social and psychological damage caused by crop loss and the macaques' activities around human settlements. Damage to small-scale farming, for household

K. Suzuki (✉) and Y. Muroyama
Institute of Nature and Environmental Sciences, University of Hyogo, and Wildlife Management Research Center, 940 Sawano, Aogaki, Tanba, Hyogo 669-3842, Japan
e-mail: k_suzuki@wmi-hyogo.jp

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consumption, by macaques could result in a decreased motivation to continue farming in mountainous areas, where the human population has been declining and aging since the 1960s. As macaques habituate to the local people and environment surrounding human settlements, they lose their fear and cautiousness around humans, and often escalate their behavior into threatening people and intruding into houses (Fig. 17.1; see Chap. 7).

To alleviate conflicts between humans and macaques, two different approaches have been adopted in Japan. One is the traditional top-down damage management approach conducted by local government, such as population control and construction of fences. This approach has dominated, but many problems have been experienced with this approach, as described here. The other is the community-based damage management approach, which entails involvement of and positive action by local people, that is, guarding, chasing, fencing, and eliminating attractive foods in and around human settlements. This approach has been gradually spreading in Japan.

In this topic, we describe the top-down damage management approach applied Shimokita Peninsula, Aomori Prefecture, and discuss the problems of this approach, focusing on the involvement of local people in damage management. The community-

Fig. 17.1 Macaques raiding rice crops

based damage management approach for macaques is then described and its effectiveness, applicability, and prospects discussed. This topic is a summary of several articles published in Japanese (Suzuki 2002, 2005, 2007, 2008).

17.2 Crop-Raiding by Japanese Macaques Living in Shimokita

Shimokita Peninsula is located in the north of Honshu Island, the northernmost habitat of nonhuman primates (Fig. 17.2). Macaques have been recorded crop-raiding since the 1960s at Wakinosawa village in the south of the peninsula. Nevertheless, macaques inhabiting the peninsula have been protected by law as a Natural Monument

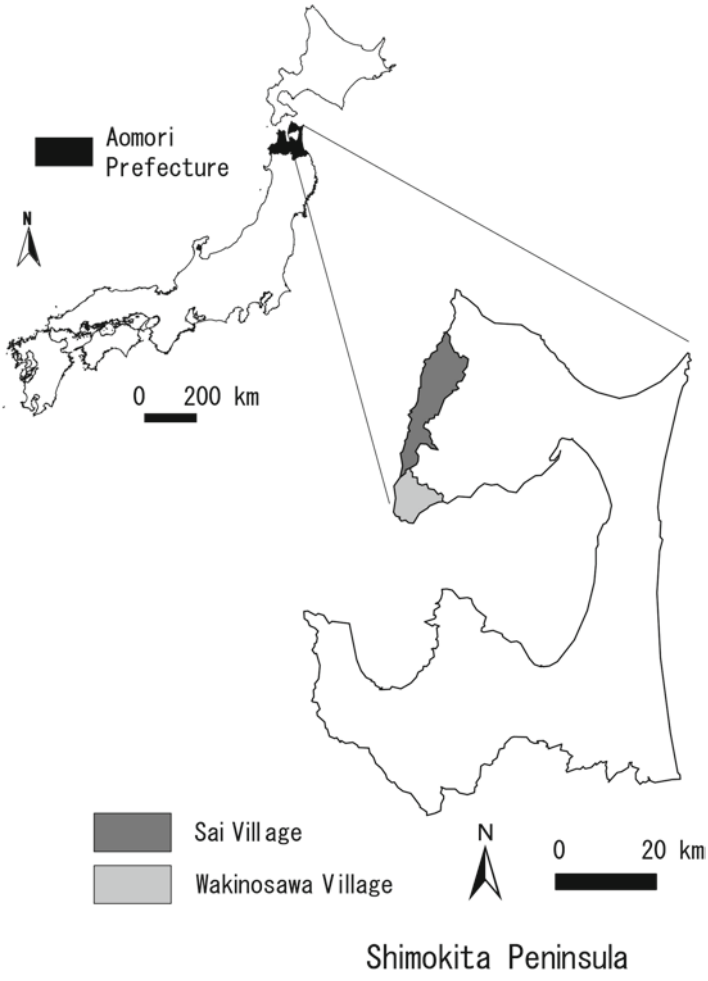

Fig. 17.2 Sai village is in the northwest of Shimokita Peninsula, Aomori Prefecture, located in the northernmost of Honshu Island

since 1970. In Sai village, located in the north of Shimokita Peninsula, macaques started to cause crop damage in 1991. In 1994, as a main countermeasure against crop-raiding by macaques, local government started a management project to construct electric fences around farmlands using subsidies (Table 17.1). Two types of electric fences, a vertical electric net fence and a wire electric fence, were constructed, and both were expected to be effective against macaques given adequate maintenance. All material and construction costs for the electric fences were paid for by the local government, while farmers were obliged to maintain the fences encircling their farmlands appropriately. However, Suzuki (2002) reported that in 2001 only 23% of these fences had been maintained adequately (Fig. 17.3a–c). Consequently, most of the fences no longer have any effectiveness against macaques.

Table 17.1 Construction cost and length of electric fences constructed in Sai village each year (Suzuki 2005)

Year	Project cost (in million yen)	Total length (m)
1995	2.9	460
1996	2.9	429
1997	9.1	1,340
1998	18.0	2,250
1999	18.0	2,284
2000	12.0	1,240
2001	12.0	1,046
2002	12.0	1,086
2003	13.1	944

The local government has spent 1.0 billion yen over 9 years from 1995 to 2003 on construction of electric fences around crop fields, using subsidies

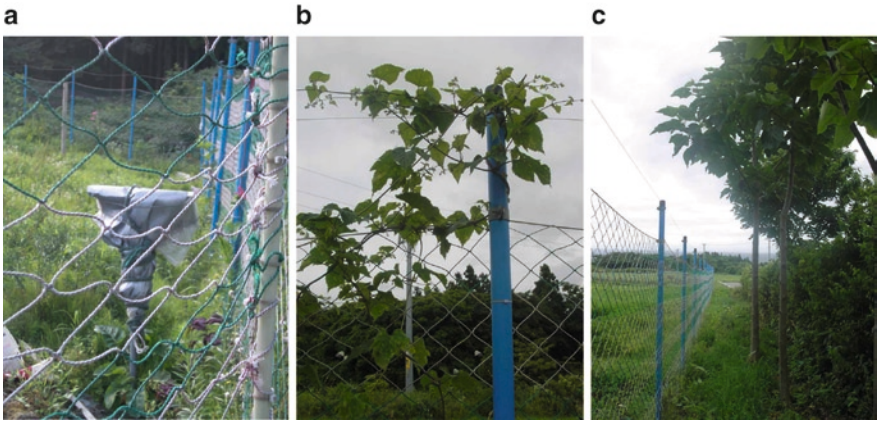

Fig. 17.3 Examples of poorly maintained electric fences. (**a**) A covered solar panel that does not supply adequate voltage. (**b**) An electric net fence short-circuited by vines winding around the pole and positive electric lines. (**c**) Trees standing close to an electric fence are used as an access route to the cropland

This case illustrates some typical problems relating to human involvement in the top-down damage management approach employed in Japan. In the case of Sai village, various social factors may hamper farmers from engaging cooperative maintenance of the fences.

17.3 Insufficient Cooperative Management of Electric Fences by Local People

17.3.1 Small-Scale Agriculture in Sai Village and Complex Ownership Patterns for Farmlands

Agriculture in Sai village is small-scale farming for household consumption involving mostly vegetables. Average farm acreage per farmer was recorded as 37 a in 2005 (Ministry of Agriculture, Forestry and Fisheries, Japan 2008c). Most of the farmers are elderly people. Of 26 electric fences constructed in 2001, only 6 of the fences encircled a single farm and were thus managed by one farmer (Suzuki 2002). The other 20 fences enclosed more than one farm and thus each was managed by two or more farmers. In addition, ownership of farmlands is complicated: some farmers used only their own croplands, but others also used part of another owners' croplands. Relationships between farmers and landowners may also be complex; some farmers are related to landowners, and others are friends or acquaintances. As rent for the cropland, farmers pay something as a token of gratitude, such as a small part of the harvest crop, a year-end gift, or some money, but not a fair rent based on an agreement with the owners. Such complex social relationships among residents in the village characterized by vague relationships between farmers and landowners, as well as small-scale agriculture for home consumption, underlie insufficient cooperative maintenance of the fences.

17.3.2 Insufficient Cooperative Maintenance of Electric Fences

As already described, farmers are obliged to maintain the fences encircling their farmlands appropriately. If a fence encloses more than one farm cultivated by more than one farmer, they must maintain it cooperatively. For electric fences to remain functional, it is necessary to maintain a suitable voltage at all times and to block any openings that could possibly be used by animals. In the case shown in Fig. 17.4, all seven farmers were requested to maintain the fence cooperatively. However, this task ended in failure as it was not done effectively.

There were two reasons why farmers were unable to cooperatively maintain their fences: first, there were individual differences among farmers in knowledge of electric fences, and second there were differences in the willingness and motivation

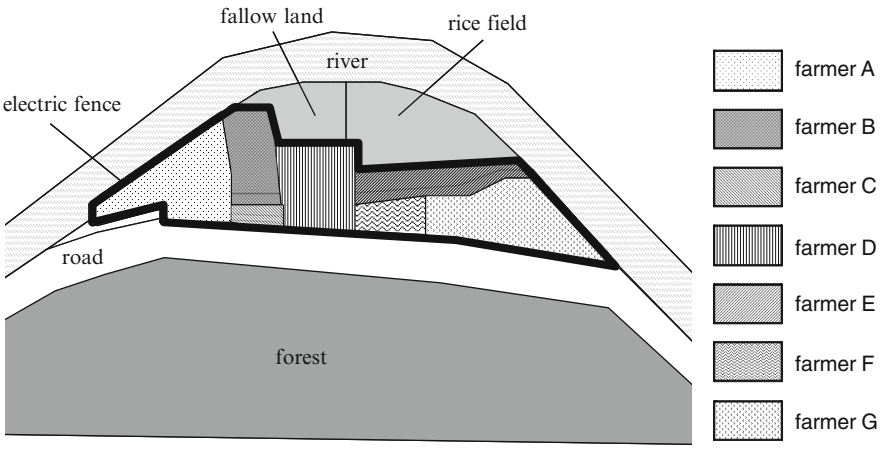

Fig. 17.4 An example of an electric fence surrounding several croplands. The length of the fence is 463 m, and it encircles seven croplands, cultivated by seven farmers (A–G), whose total area is 4,846 m^2. All these croplands adjoin the fence, and each of the seven farmers is obliged to maintain the fence cooperatively

to carry out the maintenance. Maintenance of electric fences needs a certain level of knowledge of the properties of electricity. However, it appears that it is very difficult for all the farmers engaging maintenance to have such knowledge. Willingness or motivation to carry out maintenance of the fences may be facilitated by the actual experience of crop damage by macaques and/or the placement of a high value on harvests. Both these factors may differ significantly among farmers. Farmers cultivating croplands far from forest edges sustain a lower risk of crop damage and may thus feel relatively less incentive to carry out maintenance.

Such individual differences among farmers, in particular the behavior of unmotivated farmers, are recognized as a critical issue by the motivated farmers. Nonetheless, frequently, overt requests for cooperative management of the fences do not occur, as farmers want to avoid destroying or souring their relationships with neighbors and others in the same village. When such a situation continues for a while, then crop-raiding by macaques continues or even escalates. The motivated farmers then start to see their own activity in trying to maintain the fence as useless and insignificant. In this way, originally motivated farmers may become unmotivated and the whole cooperative maintenance system for the fences becomes trapped in a vicious circle.

17.3.3 Unsuccessful Elimination of Access Routes Used by Macaques

Even if farmers maintain the fences adequately, crop-raiding by macaques still occurs if the farmers are unable to effectively eliminate footholds (i.e., trees or

buildings close to fences) or to block openings (holes, ditches, etc.) used by animals. Such footholds and openings may remain left as they are, whenever local people base decisions on social, economic, psychological, and institutional factors but not on scientific findings or theories.

The social relationship between a tenant farmer and landowner is one of the most typical factors to hinder the blockage of such access routes. A tree or building close to an electric fence may be used by macaques as a route to cropland (Fig. 17.5), and thus eliminating such a foothold is an important task for the management of the electric fence. However, if the tree or building is owned by the landowner, then the fence management efforts of the tenant farmer may be hindered because the landowner will not remove the tree or building for various reasons.

Figure 17.6 illustrates such a case where macaques frequently use Japanese cedars (*Cryptomeria japonica*) adjoining croplands as access routes to cropland encircled by an electric fence. In this case these trees are planted in the land owned by X. All the farmers Y and Z, and landowner X, recognize the risk that macaques may raid crops by using the trees. Farmer Y appears to have a higher risk of crop-raiding, but is unable to request X to cut down the trees, possibly because he rents a cropland from X for nothing. Landowner X himself has also a risk of raiding of his own crops, but he will not cut down the trees because the following incoherent logic.

"I realize that I should cut down the tree, but I don't do it because I planted the tree as a gift for children and grandchildren. I also hesitate to do it solely for my farming since I don't know how long I can continue farming."

Other landowners may have other reasons to not cut down the tree. For example: that the tree is an owner's memory of childhood, that is, "the tree was planted when I was a child." Another reason is that the tree is a landmark of the border between neighbors. Alternatively, a landowner may wish to let a tree grow until the treetop reaches a high-voltage cable so that the power company will pay compensation for cutting the tree down, even if he realizes that macaques use the tree as a route for raiding.

Fig. 17.5 A macaque jumping into a cropland from a hut standing close to an electric fence

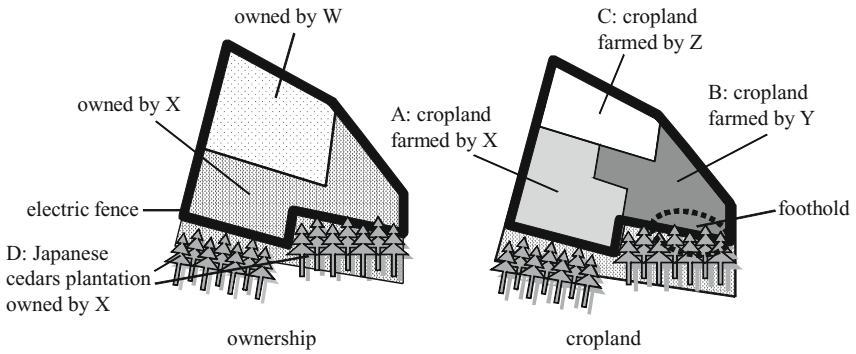

Fig. 17.6 A case study where macaques frequently use trees (Japanese cedars) adjoining croplands as access routes for crop raiding. Croplands encircled by the electric fence are owned by either W or X, and are farmed by X, Y, and Z. Area A, cropland owned by X and W and farmed by X; area B, cropland owned by X and W and farmed by Y; area C, cropland owned by W and farmed by Z; area D, Japanese cedar plantation, owned by X

As seen in these cases, even if landowners perceive a risk of raiding by macaques to their own crops, they may still not eliminate access routes as a countermeasure. This observation would suggest that farmers will experience many more problems in negotiating such issues with landowners who do not farm. Consequently, footholds and openings used by macaques frequently remain as they are, and many farmers feel discouraged from engaging in appropriate maintenance of the electric fences.

17.3.4 Farmers' Perception of Agriculture

In Sai village, farming is conducted as a low-profit, multipurpose activity. Harvests are used for household consumptions, gifts for relatives and neighbors, and for a small extra income (Figs. 17.7a, 17.8a,b). The purposes of farming are varied and include a means of livelihood, maintaining good health, as a habit or a hobby, and for socializing with neighbors, but do not include large commercial activities (Suzuki 2007; Fig. 17.7b). In such farming, some farmers appear to have relatively little incentive to protect their agricultural products because they value the activity of farming itself rather than the products of farming as important in their daily life. This idea suggests that their perception of farming significantly affects whether or not fences are maintained appropriately (Suzuki 2007).

The traditional top-down approach has provided materials and costs for damage management, but it has paid little attention to the importance of social factors, particularly the issues related to effective damage management, as just described, which encompass a human dimension. The many unsuccessful cases of damage management found all over Japan are a testament to this difficulty.

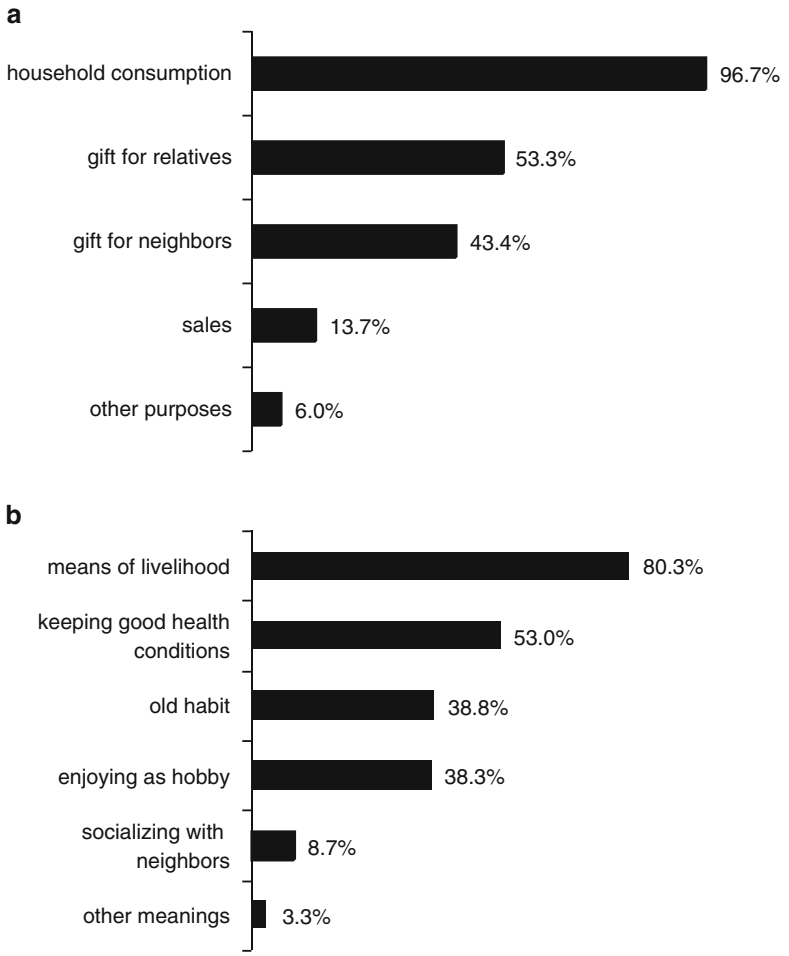

Fig. 17.7 Questionnaires investigating the farming practices of local people. (**a**) Use of agricultural products ($n = 182$). (**b**) Purpose of farming (Suzuki 2005)

17.4 A Community-Based Damage Management Approach

17.4.1 What is the Community-Based Damage Management Approach?

The major countermeasures to wildlife crop-raiding adopted to date have been top-down damage management approaches of population control and construction of fences, based on biological findings. These traditional top-down approaches have

Fig. 17.8 (**a**) A farmer, pleased with the harvest for household consumption. (**b**) A farmer carrying harvested potatoes as gifts for relatives living far away. Most farmers recognize farming itself as an important activity in their daily life

not considered issues that have a human dimension and thus have not been developed as appropriate damage management projects encompassing a wide variety of social conditions in different regions.

However, a new methodology for damage management for monkeys that takes into account the human dimension has recently been developed in Japan (Inoue 2002; Muroyama 2003). This approach proposes that it is crucial to manage the behavior and environment of both wildlife and humans to alleviate and control the damage caused by wildlife. That human behavior and perception may unconsciously facilitate crop-raiding by wildlife has been emphasized. In this methodology, damage management explicitly targets local people and farmers, as well as the wildlife and their habitat. In comparison the traditional top-down management approach only targeted the wildlife and habitat. In other words, this approach, called community-based, requires individual involvement of and positive actions by local people for damage management.

This community-based approach involves manipulating the human factors related to the occurrence of crop damage. This concept includes changing people's incentives for damage management, and thus this method may have a wider application for a variety of social situations. One of the most important principles of this approach is to reduce the food resources available to wildlife, such as crops, fruit, garbage, disposed vegetables, unharvested fruit, etc., in and around human settlements (Inoue 2002; Muroyama 2003, 2005). These types of food resources around human settlements are likely to attract wildlife, resulting in increasing crop damage

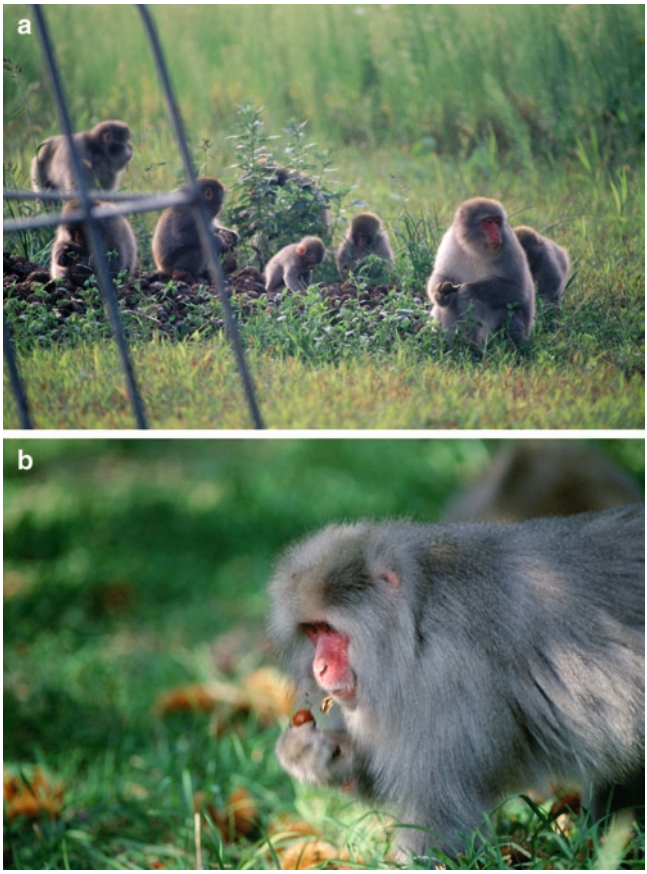

Fig. 17.9 Macaques feeding on abandoned potatoes in the postharvest season (**a**) and on unharvested chestnuts (**b**)

(Fig. 17.9). Another important principle is to invoke fear and cautiousness of humans and the human-related environment within wildlife by using activities such as chasing or scaring wildlife, such that wildlife feel uncomfortable in and around human settlements (Fig. 17.10).

17.4.2 Promotion of Damage Management Practices by Local People

To promote community-based damage management effectively, it is crucial that the entire village tackles this issue as a whole and that each farmer manages their cropland appropriately against wildlife. This form of management has been initiated in

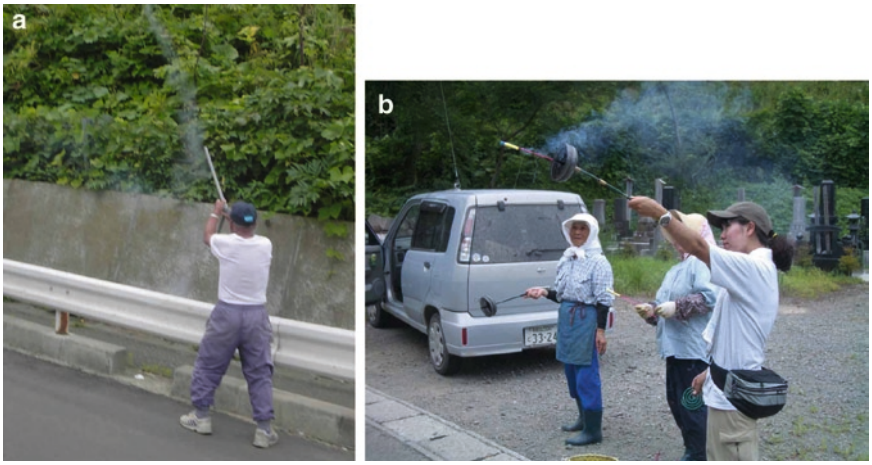

Fig. 17.10 Residents driving macaques away using fireworks under the guidance of the local government

some prefectures, particularly in prefectures where official agricultural divisions and/or institutions have actively participated in projects, with slogans such as "planning for villages to be undefeated by wildlife damage" or "wildlife damage management by all the villages."

For example, in Totsukawa village, Nara Prefecture, the adequate information and technical support provided by prefectural workers from agricultural divisions has promoted local damage management practices and has successfully reduced crop damage by macaques (Inoue et al. 2004). However, another case suggests that whether the provision of knowledge and techniques for damage management results in more active participation by local people may depend on the social conditions (Suzuki 2002, 2007). Suzuki (2007) stated that it is important to carefully examine what social factors are more likely to increase or decrease the incentive for local people to engage in damage management practices on a case-by-case basis.

Currently, we have limited knowledge of ways in which to encourage damage management activities in local people because of the short history of research in this field. Inoue et al. (2004) suggested that inexpensive and convenient management techniques should be developed according to farming system, farmers' capacity, and social conditions, and then local communities should be familiarized with techniques according to these factors. Other possible factors relating to the farmers' incentive to participate may be the level of knowledge of theory and techniques, the presence of an administrative system or organization to provide support to farmers, the relationships between the administration and farmers, and so on. Introducing a special value to agricultural products may also be an effective way to encourage farmers' participation. In Shiga Prefecture, crops unpalatable to wildlife have been promoted as special indigenous agricultural products (Yamanaka 2009).

17.4.3 Complementary Collaboration by Local Government and Local People

To promote damage management by local people, local government must collaborate with local communities in a complementary manner in management practices. Furthermore, local government and local people must recognize a shared aim to reduce damage caused by wildlife. They must also recognize that to achieve this purpose efficiently each of them must play their role in the damage management process appropriately (Muroyama 2003). For example, population control or the construction of fences in a wide area should be conducted mainly by a local government, while management practices such as fencing croplands, reduction of available foods for wildlife in the village, and chasing wildlife should be undertaken only by the local people. Joint management projects including all these practices are needed to alleviate damage effectively and efficiently.

Within such community-based management, local government still has an important role in providing various supports for the damage management activities of local communities (Fig. 17.10). In locations where local government previously provided top-down damage management, such as population control and the construction of fences over a long time period, the local communities are less likely to take on management activities by themselves and depend on the intervention of local government initiatives for damage management (Nakamura et al. 2007; Suzuki 2008). In such cases, local people have very little knowledge of management techniques to counter crop-raiding by wildlife, and thus provision of information regarding and knowledge of theory and techniques for damage management by holding workshops for villagers and by distributing brochures on damage management are crucial to the effective implementation of such methods. In addition, local government needs to facilitate consensus among villagers on damage management activities.

17.5 The Future of Community-Based Management in Japan

In recent years, in Western countries, where wildlife management has a longer history, the concept of wildlife management has turned from biologically based management, conventionally designed by an expert, into community-based management tackling various human–wildlife conflicts in modern society with complex value systems (Decker and Chase 1997). As part of this shift, stakeholder involvement has become a central element of contemporary wildlife management (Chase et al. 2001). Furthermore, co-management, requiring stakeholder involvement at multiple stages of the management process, from the setting of broad policy goals through to evaluation, not just in decision making, is seen as the next step (Chase et al. 2000). These Western community-based management projects focus on stakeholder involvement in the management process.

Community-based damage management in Japan has developed independently of that found in Western communities. In the Japanese approach, the basis of the management method is farming and giving local people adequate knowledge of theory and techniques for damage management in the course of their daily life. Thus, sufficient and effective communication between farmers and authorities to facilitate community-based management should be encouraged.

To develop and extend community-based wildlife management in the future in Japan, it is not only necessary to promote damage management by local people, but also to consider the long-term conservation of local macaque populations as a part of the management project. To achieve this, a wide variety of stakeholders, including researchers, need to be involved in the management process. Continuous effort must be made to build consensus between stakeholders, with the aim of constructing a support system for community-based management within local government.

Although human–wildlife conflicts start with actual damage caused by wildlife such as crop damage, human relationships within the management process may result in more serious social conflicts (Suzuki 2008). For example, relationships between stakeholders with different concepts of value may be a social factor making conflicts more serious. During the process of community-based damage management, an integrative approach to reduce wildlife–human conflicts, not only adjusting interactions among wildlife, habitats and humans, but also mitigating conflicted interactions among humans where wildlife is the reason for the interactions, is necessary (Riley et al. 2003). Whether or not community-based management as described here becomes firmly established in Japan may depend on the development of the human dimension of wildlife management.

References

Chase LC, Schulsler TM, Decker DJ (2000) Innovations in stakeholder involvement: what's the next step? Wildl Soc Bull 28:208–217

Chase LC, Lauber TB, Decker DJ (2001) Citizen participation in wildlife management decisions. In: Decker DJ, Brown TL, Siemer WF (eds) Human dimensions of wildlife management in North America 2001. The Wildlife Society, Washington, DC, pp 153–170

Decker DJ, Chase LC (1997) Human dimensions of living with wildlife – a management challenge for the 21st century. Wildl Soc Bull 25:788–795

Inoue M (2002) Protection of crop fields in mountainous villages against crop raiding by monkeys: interesting ecology and clever countermeasures [Yama no Hatake wo Saru kara Mamoru – Omoshiro Seitai to Kashikoi Fusegikata]. Nosansonbunkakyokai, Tokyo (in Japanese)

Inoue M, Komeda J, Maegawa H, Kakuyama M, Iwamoto K, Hideta A, Muroyama Y, Ura M (2004) A countermeasure against monkeys damage to crops in Nara Prefecture. (2) Support for farmer. Wildl Forum 9:19–31 (in Japanese)

Ministry of Agriculture, Forestry and Fisheries, Japan (2008a) Crop damage by wildlife in Japan, 2007 [Zenkoku no Yaseityozyu ni yoru Nousakumotsu Higai Zyokyo, 2007]. http://www.maff.go.jp/j/seisan/tyozyu/higai/h_zyokyo/h19/pdf/report.pdf. Accessed 25 November 2009 (in Japanese)

Ministry of Agriculture, Forestry and Fisheries, Japan (2008b) Changes in crop damage by wildlife [Yaseityozyu ni yoru Nousakumotsu Higai Zyokyo no Suii]. http://www.maff.go.jp/j/

seisan/tyozyu/higai/h_zyokyo/h19/pdf/ref_data03.pdf. Accessed 25 November 2009 (in Japanese)

Ministry of Agriculture, Forestry and Fisheries, Japan (2008c) Census of agriculture and forestry 2005 (1) Result for prefecture [2005 Nogyo Census (1) Todofuken Betsu Toukeishiryo]. http://www.maff.go.jp/j/tokei/census/afc/2005/report_archives_01.html. Accessed 25 November 2009 (in Japanese)

Muroyama Y (2003) Getting along with monkeys around the village [Sato no Saru to Tsukiau niwa]. Kyoto University Press, Kyoto (in Japanese)

Muroyama Y (2005) Damage management of Japanese macaques: from the viewpoint of feeding ecology. Mammalian Science [Honyurui Kagaku] 45:99–103 (in Japanese)

Nakamura D, Yoshida Y, Matsumoto Y, Hayashi S (2007) Resident's consensus of countermeasures to the damage by wild Japanese macaque – case of coexistence of urban-rural village. J Rural Plan Assoc [Nouson keikaku Gakkaishi] 26:317–322 (in Japanese with English summary)

Riley SJ, Siemer WF, Decker DJ, Carpenter LE, Organ JF, Berchielli LT (2003) Adaptive impact management: an integrative approach to wildlife management. Hum Dimens Wildl 8:81–95

Suzuki K (2002) Human dimensions of the human–monkey conflict in Shimokita Peninsula [Shimokita Hanto ni okeru Engai Mondai no Shakaitekisokumen]. Hokkaido University Graduate School of Letters Kenkyu-ronshu 2:141–162 (in Japanese)

Suzuki K (2005) Regional-ecological study on human–Japanese macaques conflict – through practical study for diffusion of damage management [Yasei Nihonzaru Higai Mondai no Chiiki Seitai Gakuteki Kenkyu – Higai Kanri no Fukyu wo Mezashita Jissen Kenkyu wo Tsuujite]. Unpublished Doctoral thesis, Hokkaido University (in Japanese)

Suzuki K (2007) Farmers' complex cognition and its variability of damages caused by monkeys in human–monkey conflicts in the Shimokita Peninsula: a dilemma of damage management in agricultures with various purposes. Environ Sociol Study [Kankyo Syakaigaku Kenkyu] 13:184–193 (in Japanese)

Suzuki K (2008) How can we resolve human-wildlife conflicts? Analyses on developing processes of wildlife problems focusing on local people's cognitive structure. Environ Sociol Study [Kankyo syakaigaku kenkyu] 14:55–69 (in Japanese with English summary)

Yamanaka S (2009) Agricultural management not to attract wildlife – for essential resolution of wildlife problems [Yaseiju wo Yosetsukenai Einokanri wo – Zyugai Taisaku no Konponteki na Kaiketsu no Tameni]. Think of Japan in the 21st century [21 Seiki no Nihon wo Kangaeru] 44:36–44 (in Japanese)