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CHAPTER 10

Dimensions of human-wildlife conflict in Peninsular Malaysia

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Abstract: Human-wildlife conflict (HWC) is an increasing challenge globally, driven largely by habitat loss and degradation, human encroachment into animal habitats, and spatial and dietary overlap between humans and wildlife in shared spaces. Negative interactions affect both humans and animals through loss of resources, injuries and fatalities, and psychological stress, thereby threatening biodiversity conservation and human well-being. In this chapter, we review the major dimensions of HWC, including drivers of conflict and its negative impact in Peninsular Malaysia, and highlight the most reported interactions involving macaques, tigers, elephants, wild boars, snakes, and civets. These case studies demonstrate that conflicts are highly context-specific and are influenced by ecological factors, land-use change, resource availability, and human behaviour. We further examine the consequences of these interactions for rural livelihoods, public health, community perceptions, and conservation outcomes. Current and emerging mitigation approaches are discussed, including behaviour-based interventions, public awareness programmes, habitat connectivity measures, compensation schemes, and long-term monitoring and research. Effective management of HWC requires interdisciplinary and evidence-based approaches that address both ecological and socio-economic drivers, while promoting responsible human actions to maintain or enhance opportunities for coexistence. Strengthening species-specific conflict management, improving spatial planning, enhancing inter-agency collaboration, and empowering local communities will be essential to ensuring the long-term persistence of Malaysia's wildlife and the well-being of people living alongside it.

INTRODUCTION

Human–wildlife conflict (HWC) occurs when human needs and activities overlap with those of wild animals, leading to negative outcomes for one or both parties (Abrahms 2021). The IUCN Species Survival Commission Human-Wildlife Conflict and Coexistence Specialist Group further defined HWC as situations when the presence or behaviour of wildlife poses "actual or perceived direct and recurring threat" to human safety or livelihoods for some parties. Differences in perspective, interests, and proximity to conflict zones can lead to disagreements between different groups of people about the occurrence, importance, and intensity of conflict (IUCN SSC HWCTF 2020). Negative impact on people (including tangible and intangible costs) and wildlife (retaliation and persecution) can emerge if

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reconciliation and conflict mitigation are not implemented. As human populations expand into natural habitats, and wildlife are displaced and have adapted to human settlements, conflict may become more frequent, severe, and widespread (IUCN SSC HWCTF 2020).

Conflict can happen when humans and wildlife use the same space or resources and when that overlap results in harm, loss, or stress for either or both species. In Malaysia, conflict involves various species and types of interactions, e.g., elephants feeding on crops, macaques and civets entering residential areas, tigers preying on livestock, snakes biting farm workers or hikers, or villagers feeling unsafe due to wildlife presence (Xin *et al.* 2024).

In this chapter, HWC refers to "any negative interaction between humans and wildlife". These interactions can involve tangible (i.e., crop loss, property damage, reduction in income) and intangible costs (i.e., negative emotions, avoidance of high-conflict spaces, social strain). For humans, conflict can range from mild discomfort to severe stress, which may be intermittent or persistent, depending on the situation on the ground (Zimmerman *et al.* 2020). Conflict may be experienced differently by local communities versus large corporations, or non-governmental organisations versus governmental agencies, due to differences in past experiences, objectives, beliefs, and values among stakeholders (Zimmerman *et al.* 2020). Sometimes it may be difficult to find common ground, especially regarding ethical and responsible actions for conflict-prone wildlife. As forests are cleared for farming, infrastructure, and settlements, surviving wildlife must remain in the area or move elsewhere, inevitably increasing their chances of contact with humans.

Peninsular Malaysia is one of the world's biodiversity hotspots, home to tropical rainforests that support diverse flora and fauna, including primates, megafauna, birds, and reptiles. The government of Malaysia has prepared a spatial planning policy known as the Central Forest Spine Masterplan (Kementerian Perumahan dan Kerjaan Tempatan 2022) to reconnect patches of forest across the main ranges of Peninsular Malaysia that constitute the country's ecological backbone and maintain water catchments, carbon storage, and wildlife corridors. However, rapid land-use changes over the past decades have significantly reduced and fragmented these natural habitats. Expansion of oil palm and rubber plantations, logging, infrastructure projects, and urbanisation have reduced natural habitat and led wildlife into closer contact with people (DWNP 2023). Wildlife may enter farmland and villages in search of food and space, leading to more frequent encounters with people. At the same time, rural communities living near forest edges may depend on agriculture for income and food security. Crop damage or livestock loss can harm smallholders and may affect the livelihoods of rural communities (Chung *et al*. 2000; Saaban *et al.* 2011, but see Holzner *et al.* 2019). In both rural and urban areas, negative interactions between humans and wildlife constitute a pressing conservation and community issue, with potential impacts for both people and wildlife including loss of resources, injury or even death. For example, between 2008–2019, 3,797 incidents of crop and property damage were reported by elephants and 33,198 by macaques in Malaysia (Xin *et al.* 2024). During that same period, there were 1,846 cases of human injuries caused by wildlife of which 62 were fatalities, largely from snakebites (Xin *et al*. 2024). Impacts of HWC on wildlife can range from individual-level, such as behavioural changes or individual mortality, to population-level effects such as local extinctions, range restrictions or changes in demography or disease epidemiology (Civitello *et al.* 2018). People affected by negative interactions may also escalate into retaliatory killings and deliberate persecution of wildlife, such as spray-painting macaques (Mohd Fadzli 2025). Direct interactions or fear and resentment of conflict-prone species can also reduce support for conservation and hinder sustainable long-term mitigation efforts. Overall, the needs of communities are often put in opposition to the conservation of wildlife and ecosystems, making it a complex socio-economic challenge to reconcile.

Efforts to address HWC must therefore consider both human and wildlife dimensions involving ecological, behavioural, psychological and political realities, which include human livelihoods, safety, and sentiments towards wildlife. This chapter provides case studies of some commonly reported species involved in HWC in Malaysia, and subsequently explores common drivers of conflict, their consequences, and potential mitigation measures.

CASE STUDIES

Macaques

In many areas bordering forests, large social groups of macaques are commonly encountered. Long-tailed macaques (*Macaca fascicularis*) and Southern pig-tailed macaque (*M. nemestrina*) are widely distributed across Southeast Asia (Hansen *et al.* 2025, Ruppert *et al.* 2023), but despite their increased visibility, their populations are declining, and both species are currently classified as Endangered on the IUCN Red List (Hansen *et al*. 2025; Ruppert *et al.* 2023). As highly synanthropic primates (Holzner *et al*. 2025), *M. fascicularis* readily adjust to human-modified landscapes, using remnant forest patches and carrying out daily activities in anthropogenic spaces, where behaviours such as foraging in rubbish bins, entering houses or orchards, and using human structures (Entezami *et al.* 2025). Additionally, habitat fragmentation and the loss of forest buffers increase the use of human-dominated landscapes by both *M. fascicularis* and *M. nemestrina*, which further increased the likelihood of aggressive behaviours that results in bites and scratches (Xin *et al.* 2024). Deliberate and indirect provisioning through unsecured garbage and other anthropogenic food sources can further reinforce associations between humans and food, creating a feedback loop that increases problematic interactions (Abdul-Nasir *et al*. 2021, Entezami *et al.* 2024; Hambali *et al.* 2012). Conflict management driven largely by complaints of *M. fascicularis* to The Department of Wildlife and National Parks (locally known as PERHILITAN) involves mainly culling (Xin *et al*. 2024).

Despite being perceived as pests, these animals also play an ecological role. Field studies in Peninsular Malaysia found *M. nemestrina* to be an important biological control by preying on rats in oil palm plantations and reduced rodent-related crop losses by approximately USD 100 per hectare per year (Holzner *et al.* 2019).

Tigers

The Malayan tiger (*Panthera tigris jacksoni*), a subspecies restricted to Peninsular Malaysia and southern Thailand (Luo *et al*. 2004), plays an important ecological role as an apex predator in tropical forests. Malayan tigers are Critically Endangered (CR), with current populations estimated as <100 individuals (Goodrich *et al*. 2022). Populations have declined due to agricultural expansion, urbanisation, road development, and depletion of prey populations (Kawanishi *et al.* 2013; Rayan and Linkie 2015; Ten *et al.* 2021; Goodrich *et al.* 2022). Poachers have also killed dozens of Malayan tigers in recent decades (Ten *et al*. 2021; Goodrich *et al*. 2022) while highways have increased the risk of both road mortality and poaching by providing access to key habitats (Clements *et al.* 2010; Ten *et al*. 2021; Goodrich *et al*. 2022).

Conflict by tigers involved attacks on humans or livestock, or the perceived risk of such encounters (Abas *et al.* 2026). Although conflict with tigers accounts for only 4% of reported HWC cases, Malaysians are less tolerant of tigers than elephants and tapirs (Tan *et al*. 2020) and incidents are often prioritised because of concerns for human safety (Abas *et al*. 2026). Livestock depredation represents about 24% of tiger conflict reports and has caused economic losses of RM 124,000 and above (DWNP 2008) between 2005 and 2006. Between 2008 and 2019, tigers injured three people, with no deaths (Ten *et al.* 2021), but since 2020, several fatal attacks have occurred (White 2022; Sharma 2023; Azmi 2024).

Conflict management commonly involves tiger removal or translocation, resulting in the loss of four individuals between 2008 and 2019 (Ten *et al.* 2021), with additional losses in subsequent years (White 2022; Azmi 2024). Consequently, despite low numbers of conflict reports, conflict has become a major threat to the persistence of Malaysia's remaining tigers (Ten *et al.* 2021).

Elephants

Asian elephants (*Elephas maximus*) favour palms, other monocots (i.e. grasses and bamboo), and pioneer plants, and will target young oil palms and occasionally push down older palms in plantations, resulting in crop damage. Modelling of elephant movement behaviour based on GPS satellite collar tracking data revealed that agricultural areas, particularly those near forests, are prime habitat for elephants (de la Torre *et al.* 2021, 2022). Habitat loss, fragmentation, and reduced connectivity have further increased elephant reliance on shared landscapes, where crops provide abundant and predictable food resources. Public attitudes towards large and conflict-prone wildlife such as elephants and tigers are often negative (Tan *et al.* 2020), raising concerns about people's willingness to coexist with elephants (de la Torre 2021). Greater efforts are therefore needed to overcome biases and promote coexistence between people and elephants.

Wild boars

Wild boars (*Sus scrofa*) are among the species most frequently associated with HWC in Peninsular Malaysia. Their rooting, trampling, and feeding behaviours damage crops, seedlings, and plantation infrastructure, resulting in economic losses for smallholders and commercial plantations (Muhammad Idrus and Cik Mohd Ridzuan 2019). Oil palm plantations provide abundant and predictable food resources that support high boar densities and encourage movement into surrounding forests and agricultural areas (Fujinuma and Harrison 2012; Luskin *et al.* 2017). Beyond direct crop damage, boar activities can alter soil properties, seedling recruitment, and forest regeneration, potentially changing habitat conditions and exacerbating conflict (Luskin *et al*. 2019; Brearley *et al.* 2024). They can also mediate large-scale edge effects in lowland tropical rainforest in Peninsular Malaysia (Fujinuma and Harrison 2012). Wild boars also occasionally injure people. Local attitudes towards boars are shaped by economic losses, safety concerns, and cultural or religious sensitivities, which influence the acceptability of lethal control and other management options (Xin *et al*. 2024).

Snakes

Human-snake conflict and bite risk in Peninsular Malaysia are driven largely by landscape change and increased contact at forest-agriculture interfaces. Agricultural expansion, deforestation, and expanding forest edges bring people and snakes into closer contact, with most bites occurring in rural and plantation settings during farming activities (Lee *et al.* 2025, Mhd Nizar *et al.* 2022). Risk is heightened by inadequate protective measures and attempts to capture or kill snakes, which account for many severe incidents (Renault *et al.* 2024). Forest-edge species such as cobras (*Naja* spp.), pit vipers, and kraits are frequently involved (Ismail *et al*. 2023). In human-dominated environments, snakes may also exploit drains and other sheltered microhabitats. Risks are further exacerbated by gaps in species-level surveillance, snake misidentification, inconsistent first-aid practices, and limited public awareness that trained emergency responders can safely remove snakes from residential areas (The Sun 2026). Many snakebite incidents are therefore preventable and strongly influenced by human behaviour.

Civets

Civets in Peninsular Malaysia, particularly the common palm civet (*Paradoxurus hermaphroditus*), increasingly exploit human-modified landscapes, resulting in crop losses, damage to buildings and poultry houses, and occasional public health concerns. Human-civet

conflict is driven primarily by habitat fragmentation, expanding agricultural and residential areas, and the availability of anthropogenic food, including fruit trees, unsecured waste, and poultry (Hasan and Csányi 2023b). Their behavioural flexibility enables civets to thrive in disturbed and semi-urban habitats, while poor waste management, inadequate poultry housing, and intentional feeding further promote habituation and increase the likelihood of conflict (Chong and Hashimi 2021; Hasan and Csányi 2023a). These factors contribute to frequent incursions into human spaces and heightened negative perceptions towards civets.

DISCUSSION

Drivers of HWC in Peninsular Malaysia

Human-wildlife conflicts in Peninsular Malaysia is shaped by interacting ecological and anthropogenic drivers that often operate simultaneously. Habitat loss and fragmentation, agricultural expansion, urbanisation, illegal wildlife exploitation, anthropogenic food resources, human behaviour during wildlife encounters, and climate change all contribute to increasing overlap between humans and wildlife (IUCN SSC HWCTF 2020; König *et al.* 2020; Gayo 2025). As natural habitats become fragmented and ecological connectivity is disrupted, wildlife is increasingly persisting within shared landscapes. Species with high ecological and behavioural flexibility, such as macaques, civets, wild boars, and some snakes, are particularly capable of adapting to anthropogenic environments when food and shelter are available (Holzner *et al.* 2025, Kulkarni and Radhakrishna 2026).

Changes in resource availability further intensify conflict. Human activities often reduce natural food availability while simultaneously providing attractive alternatives through crops, fruit trees, livestock, and unsecured waste. Wildlife may also access food from deliberate provisioning or feeding by residents or visitors (Hambali *et al.* 2012; Abdul-Nasir *et al.* 2021; Fehlmann *et al.* 2021; Entezami et al. 2024). As illustrated by macaques and civets, access to human food sources can promote habituation and increase the frequency of problematic interactions. Similarly, agricultural landscapes have taken over and modified natural habitats, and provide predictable resources that attract elephants and wild boars that could result in crop damage and economic losses if mitigations are not taken, and presence of livestock provides an alternative food source as abundance of wild tiger prey declines.

Human behaviour strongly influences the occurrence and severity of conflict. Feeding, approaching, photographing, harassing, or attempting to capture wildlife can increase risks to both humans and animals (Beisner *et al.* 2014; Weiler *et al.* 2021). Many snake bites occur when people attempt to capture or kill animals, suggesting that a considerable proportion of incidents are preventable (Renault *et al.* 2024). Once animals' associate humans with food, behavioural changes can create a positive feedback loop that further reinforces conflict (Entezami *et al.* 2024).

To manage HWC well, it is important to first understand the drivers contributing to a negative interaction which must be prioritised prior to developing a mitigation strategy. Additionally, it is important to consider the human dimension of the conflict and to explore mitigation approaches, positive interactions, and other ways to increase resilience of the community to tolerate or even thrive in the presence of the wildlife (IUCN 2023).

Mitigation strategies

Because conflict situations vary among species, landscapes, and stakeholders, mitigation measures should address underlying drivers rather than simply treating symptoms (Eklund *et al*. 2018). Effective strategies require a holistic understanding of ecological, social, cultural, and economic contexts and must be adapted for different species and landscapes.

Public awareness and behaviour change are therefore fundamental components of conflict mitigation (Basak *et al.* 2023). Over the years, PERHILITAN together with academic institutions and non-governmental organisations, has implemented numerous education and outreach programmes focusing on safe conduct around wildlife and the ecological importance of native species. For rural communities living near forests, these initiatives are particularly important in promoting coexistence and encouraging safe, non-lethal mitigation practices that minimise economic losses and improve safety without endangering wildlife (Esponisa and Jacobson 2011; Wong *et al.* 2021). Such programmes often emphasise community-based resource protection, non-lethal deterrence, and maintaining ecological balance for long-term livelihood security (Kansky *et al*. 2024). However, behavioural intentions are also influenced by personal values, social norms, and trust in institutions (IUCN 2023; Zahirudin 2025). Despite continuing efforts, understanding of wildlife behaviour and safe mitigation practices remains limited (Hasan and Csányi 2023a; Xin *et al.* 2024), highlighting the need for evidence-based approaches that promote tolerance and behavioural change (Baruch-Mordo *et al.* 2011; Tan *et al*. 2020).

In urban and peri-urban areas, awareness programmes are particularly relevant for adaptable species like macaques whose interactions with people are often shaped by daily experiences (Mohamad Muslim *et al.* 2018). Campaigns that discourage wildlife feeding and encourage proper waste management can reduce habituation and dependence on anthropogenic food sources, while coordinated measures such as "monkey guarding" have been successfully used to reduce macaque presence in both urban and rural settings (Hambali *et al.* 2019; Langur Project Penang 2022; Animal Neighbours Project 2025). Increased public awareness is also important for reducing snakebite incidents by encouraging people to seek assistance from trained emergency responders such as Bomba, Pertahanan Awam or PERHILITAN, rather than attempting to handle snakes themselves.

Maintaining habitat connectivity and identifying areas where interactions between people and wildlife are most likely to occur are important for conflict mitigation. Roads, highways, plantation access routes, agricultural frontiers, and forest edges frequently overlap with wildlife movement paths, creating hotspots of human-wildlife interactions (Clements 2014). Identifying these areas through conflict records, roadkill data, field surveys, spatial modelling, and community-based reporting allows management agencies and conservation groups to prioritise interventions and integrate wildlife considerations into land-use planning (Galea *et al.* 2024; Zanuari *et al.* 2024).

Once high-risk areas are identified, site-specific measures can reduce encounters while maintaining ecological connectivity. Buffer zones around forest edges, settlements, and protected areas can serve as transitional habitats, providing cover and directing animal movements away from roads, farms, and residential areas (Ahmad *et al.* 2018). Maintaining habitat corridors and safeguarding traditional movement routes are particularly important for wide-ranging species such as elephants, while also facilitating dispersal among smaller species.

Linear infrastructure can contribute to wildlife mortality and habitat fragmentation, particularly through wildlife-vehicle collisions. Measures such as fencing, warning signage, speed reduction zones, and, where necessary, wildlife crossings can reduce collisions and facilitate safe movement between fragmented habitats (Soanes *et al*. 2024; Balčiauskas *et al.* 2025). Public awareness campaigns promoting safe driving near wildlife crossing zones can provide additional benefits for both humans and wildlife (Wong *et al.* 2018a, 2018b; Borza *et al.* 2023). Long-term mitigation success depends on integrating wildlife movement and conflict data into transport and land-use planning, supported by regular monitoring and citizen-based reporting to enable adaptive management (Newell *et al*. 2025).

Several species-specific management interventions have been implemented in Peninsular Malaysia. For example, elephant conflict mitigation includes translocation programmes and the use of electric fencing systems in high-conflict areas (Ahmad Zafir and Magintan 2016; Hii *et al.* 2016; Ponnusamy *et al.* 2016). Similarly, macaques in high-conflict areas have been culled, translocated or sterilised, and tigers have been captured, translocated, or killed (Ten *et al.* 2021; Azmi 2024). However, the long-term effectiveness of such approaches depends on the ecological drivers of conflict and integrating mitigation into broader landscape planning.

Compensation mechanisms represent another important tool for maintaining local tolerance towards wildlife. The Wildlife Attack Aid Fund (*Tabung Bantuan Serangan Hidupan Liar*), launched in 2024 by the Ministry of Natural Resources and Environmental Sustainability (NRES), provides financial assistance to individuals and families affected by wildlife-related incidents, including crop losses, property damage, injuries, and fatalities (DWNP 2025). Similar schemes have been implemented elsewhere with varying success (Karanth *et al.* 2018, Wang *et al.* 2024, Dahal *et al.* 2025). Their effectiveness depends largely on accessibility, timeliness, and perceived fairness (Gloriose 2019). In Peninsular Malaysia, challenges remain, including limited awareness, delays in claim verification, and bureaucratic procedures that may discourage reporting of smaller but recurring losses.

Finally, long-term monitoring and research remain essential for adaptive HWC management. Continuous collection of ecological and social data allows managers to identify emerging conflict hotspots, evaluate mitigation measures, and respond to changing environmental and socio-economic conditions. Integrating scientific research with local knowledge and citizen-based reporting can further improve management effectiveness and support evidence-based decision-making (Newell *et al.* 2025). Ultimately, action to address both the ecological drivers of conflict and the human behaviours that influence its intensity is needed to promote long-term coexistence between people and wildlife.

BRIEF POLICY RECOMMENDATIONS

Species-specific management plans

- Develop evidence-based management strategies tailored to conflict-prone species.
- Incorporate species ecology (including food/prey species), movement behaviour, and local socio-economic contexts into mitigation planning.
- Incorporate an educational plan to increase stakeholder awareness and behaviour change.
- Prioritise non-lethal and coexistence-based approaches, with regular evaluation of management effectiveness.
- Establish long-term monitoring programmes to assess population trends and conflict hotspots.

Land use and habitat management

- Maintain and restore ecological connectivity through the establishment of evidence -based and realistic buffer zones around protected areas and forest edges.
- Identify and safeguard wildlife corridors and crossing hotspots during infrastructure and land-use planning.
- Incorporate wildlife-friendly infrastructure designs, including underpasses, overpasses, and road fencing where appropriate.
- Encourage sustainable agricultural practices that minimise habitat degradation and reduce opportunities for conflict.

Inter-agency collaboration

- Strengthen coordination among local authorities, plantation sectors, academic institutions, and non-governmental organisations.
- Develop standardised data-sharing platforms and joint response protocols for rapid conflict management.
- Integrate conflict considerations into broader land-use, transportation, and development policies.
- Promote cross-sector partnerships to support research, monitoring, and public outreach initiatives.

Community engagement and education

- Provide training and capacity building for local communities on safe coexistence strategies and non-lethal mitigation measures.
- Increase public awareness regarding wildlife ecology, responsible behaviour, and the importance of biodiversity conservation.
- Establish citizen reporting systems and community-based rapid response teams to improve early detection and incident management.
- Empower communities to participate in monitoring programmes and coexistence strategies including habitat restoration initiatives.
- Promote behavioural change campaigns aimed at reducing wildlife feeding and improving waste management practices.
- Funding and incentives:
- Expand and strengthen conservation-based funds and other financial mechanisms supporting conflict mitigation.
- Improve compensation and assistance schemes for affected farmers and communities to maintain tolerance towards wildlife.
- Provide incentives for wildlife-friendly agricultural practices and habitat conservation on private and plantation lands.
- Support community-based livelihood diversification and value-added products that reduce dependence on conflict-prone activities.
- Increase investment in long-term research, monitoring, and innovative technologies for conflict prevention and adaptive management.

CONCLUSION

Human-wildlife conflict in Peninsular Malaysia is a complex and multidimensional issue arising from overlap between human and wildlife in rapidly changing landscapes. Habitat fragmentation, agricultural expansion, anthropogenic food resources, and human behaviours have intensified interactions involving a wide range of species, with consequences that extend beyond immediate economic losses to include human injuries, psychological stress, and significant impacts on wildlife populations and ecosystem integrity. The examples of macaques, tigers, elephants, wild boars, snakes, and civets demonstrate that no single mitigation measure can effectively address all situations, as conflicts differ among species, landscapes, and stakeholders. Moving forward, management efforts should shift from reactive responses towards proactive coexistence strategies that address the underlying drivers of conflict. Such approaches require integrating ecological knowledge with social, cultural, and economic considerations, while recognising that sustainable solutions depend as much on changing human behaviour and perceptions as on modifying wildlife behaviour. Strengthening habitat connectivity, maintaining buffer zones, improving waste management, promoting biodiversity or wildlife-friendly agricultural practices, and reducing opportunities for conflict are essential components of long-term prevention. Equally important are public awareness, community participation, compensation mechanisms, and effective collaboration among government agencies, researchers, non-governmental organisations, industry, and

local communities. Continued monitoring and research are necessary to evaluate the effectiveness of mitigation measures and to enable adaptive management under changing environmental and socio-economic conditions. Ultimately, coexistence between people and wildlife will require balancing human safety and livelihoods with the conservation of biodiversity, ensuring that both communities and wildlife can persist within shared landscapes.

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