

# IMPACT OF INVASIVE ALIEN SPECIES AND GENDER



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## ABSTRACT

Invasive Alien Species (IAS) is considered the second major cause of biodiversity loss and habitat degradation. They pose a serious threat to different ecosystems of Nepal such as agriculture, forestry, fisheries and natural systems. Invasive alien species affect people's livelihoods and human well-being.

Some species are important sources of fuel wood, fodder, timber and food products for local households and communities. Similarly, some species hold cultural, spiritual and recreational significance. In contrast, they also harm livelihoods and increase vulnerability via land encroachment and reduction in mobility or access. In some cases, they also diminish the abundance of natural resources used by households and reduce agricultural production. This results in a loss of their income and increases vulnerability. Furthermore, some invasive species have also negative implications on human health and safety. Likewise, they are responsible for reducing the cultural value of landscapes.

Invasive Alien Species are well-recognized drivers of social-ecological change. Extensive research on invasive species in Nepal has yet to be done. Therefore, the impact of invasive species on livelihoods and human well-being is a lesser-known concept. The effect of benefits and costs analysis of invasive species on livelihoods and human well-being remains pivotal for policy-making and management. This article is based on the development of a comprehensive national strategy and plan of action to control and manage IAS in Nepal. It discusses the broader aspect and status of IAS in Nepal.

## 1. INTRODUCTION

Invasive Alien Species (IAS) is foreign species in any ecosystem that pose a threat to its natural order. It changes natural or semi-natural ecosystems or habitats threatening their native biological diversity. Globally, it is known to lead to fragmentation, destruction, alteration and even complete replacement of habitats. It results in functional collapses of the native ecosystem. They are recognized as the 2<sup>nd</sup> greatest threat to the biodiversity resulting in enormous economic losses (Mack et al., 2000; MEA, 2005). They are not only threatening biodiversity & ecosystem but also development processes & yield of agricultural products affecting trade & commerce. They are affecting human and livestock health, development plans, infrastructure, recreation & tourism. (Mack et al., 2000; Thomas, 2003).

Alien Species (AS) refers to non-native, non-indigenous, foreign and exotic species, subspecies, or lower tax on that occurs outside its natural range. It occupies naturally or may be introduced directly or indirectly by humans. This includes any part, gametes or propagates of species that might survive and subsequently reproduce. Many such species also support farming and forestry system for economic & ornamental values for medicine, food for animals, recreation and industries (IUCN, 2000). It is said that wise use of IAS promotes industrial and economic growth. IAS spread through seeds, vegetative growth (producing new plants from rhizomes, shoots, tubers etc.) or both. Wind, water and wildlife help their dispersion. Human activity is also equally responsible for the dissemination. IAS has very distinguished adaptive features. It can easily spread and has a dominating nature (Miththapala, 2007; McGeoch et al., 2010).

Nepal has recognized that IAS is damaging ecosystems and biodiversity. Major areas such as forests, wetlands and agricultural land are facing serious socio-ecological problems due to IAS. However, the extent of economic damage in Nepal from IAS is not yet known. 219 species of naturalized alien plant species have already been observed. Out of them, 25 species are threatening the native biodiversity in different ecosystems (Siwakoti et al., 2014; Siwakoti and Shrestha, 2014, Shrestha 2016). IUCN Nepal has also identified the 21 most problematic alien plant species (Tiwari et al., 2005). For example, *Mikania micarantha*, a climber infested in the Terai and Siwaliks spreads fast over forest canopy subsequently blocking sunlight. It also kills all native plants or stunts their growth (MoFSC, 2014). Biological invasions are now recognized as the cause of significant ecological and economic damage. *Mikania* weed reproduces rapidly in forest trees, grassland and wetland areas of the Koshi Tappu Wildlife Reserve (Siwakoti, 2007). They have been spotted in Chitwan valley and even further in the west. *Mikania* in Chitwan National Park significantly reduced biomass production of rhino's food plants (Subedi, 2013). This disturbs local ecosystems' structure and function. Entry routes for IAS into Nepal are the inland borders of India, roads networks, and air corridors for international trade. IAS has been spreading through increased travel, trade, and tourism associated with globalization (Keam et al., 2009).

### **1.1. INVASIVE ALIEN SPECIES AS A GLOBAL ISSUE**

Invasive Alien Species (IAS) is globally known for the fragmentation, destruction, alteration and even the complete replacement of habitats. It leads to functional collapses of the native ecosystem. They are recognized as the 2nd greatest threat to the biodiversity and homogenizing the world's flora & fauna. That is widely known as one of the major agents of changing native biodiversity (Mack et al., 2000; MEA, 2005) and resulting in enormous economic losses (Czech and Krausman, 1997; Wilcove and Chen, 1998; Mooney and Hobbs, 2000; GISP, 2004). They not only threaten biodiversity & ecosystem but also affect development processes & products from agriculture yield, trade & commerce. It also directly impacts human and livestock health, development plans, infrastructure and recreation & tourism (Mack et al., 2000; Thomas, 2003). One of the key messages under the Millennium Ecosystem Assessment (MEA) is that invasive species continue to be major drivers of change in biodiversity. They are a major cause of extinction of freshwater native species and introduction of non-native invasive species (MEA, 2005).

### **1.2. SOCIO-ECONOMIC DIMENSION OF IAS**

Economic damage from IAS is estimated at 1.4 trillion dollars globally (Boy & Witt, 2013). IAS affects local economies by changing market prices and ecosystem services (Ciruna et al., 2004). Water hyacinth in wetland affects the production of fisheries and other products by depriving life-supporting elements (light, air) and reducing water. Water hyacinth dropped the annual income of local people from US\$ 1,984 to US\$ 607 in Benin. In many countries, overall loss due to IAS is over 1% of the GDP (Sankaran et al., 2014). IAS causes a huge economic loss, about US\$ 138 billion a year in the USA (Boy and Witt, 2013). It is estimated that about 60 million USD is spent annually to control water hyacinth (*Eichhornia crassipes*) and water lettuce (*Pistia* sp.) in African nations. IAS also cause harm to human health and safety as they are known to cause asthma and serious skin allergies (IUCN, 2000).

### **1.3. NEPALESE CONTEXT OF IAS**

Alien invasive species are considered the second major cause of biodiversity loss next to habitat degradation. The introduction and colonization of invasive alien plant species, mostly of neo-tropical origin, is one of the serious

threats to different ecosystems of Nepal. The interruption on agriculture, forestry, fisheries and natural systems impacts the livelihood of the people of Nepal. It could intensify poverty and threaten development. It is one of the serious threats to different ecosystems of Nepal (Siwakoti et. al. 2016).

Mikania weed has proliferated rapidly in forest trees, grassland and wetland areas of the Koshi Tappu Wildlife Reserve (Siwakoti, 2007), its single mother plant can release as many as 40,000 viable seeds in moist areas (Tiwari et al., 2005). Mikania has reduced availability of food for *Rhinoceros unicornis* in Chitwan National Park (Subedi, 2013). Data on economic losses in monetary value from IAS in Nepal is not available.

Recently, researches have evidence that some species of butterflies; mollusks; migratory birds and plants have been expanding their range outside their territories. Phenology of some plants is also altered. All these phenomenal changes will continue to happen and may impose challenges to prevent and eradicate IAS. IAS is already problematic in areas that have been disturbed (anthropogenic) such as forest clearing, grazing and infrastructure development, floods, landslides, etc. However, there is no concrete evidence yet in Nepal on how climate change and disaster can alter substratum favorable for invading species.

## **2. MATERIAL AND METHODS**

The objectives of the research are as follows:

- To assess the status of IAS in Nepal.
- To identify impacts and vulnerabilities of Invasive Alien Species in ecosystems of biodiversity and livelihoods.
- To develop a comprehensive national strategy and plan of action to control and manage IAS in Nepal.

The study was done based on reviews of published and unpublished journals, reports, consultative meeting, workshops, IAS experts meeting, field stakeholder, field observation and assessment of Regions and Central level. Primary and secondary data were collected for the study. Direct observation, field survey Key informant interviews (KIIs), stakeholder consultation, regional and central level workshops were done. Issues were linked to 'Impact Chain' and major impact on environment & economics and adaptive measures from published and unpublished documents and reports.

### **2.1. LITERATURE REVIEW**

Desktop review of relevant policies, strategies, action plans, literature and other available information together with lessons from different countries on IAS plan preparation and implementation was done. Published and unpublished literature, reports and documents were studied.

### **2.2. CONSULTATION**

Extensive consultations were done with Department of Forest Research and Survey (DFRS), Department of Forest (DoF), Department of National Parks and Wildlife Conservation (DNPWC), Ministry of Agriculture (MoA), Central Department of Botany TU, WWF Hariyo Ban Program, ICIMOD, IUCN and NTNC.

### **2.3. KEY INFORMANT INFORMATION (KII)**

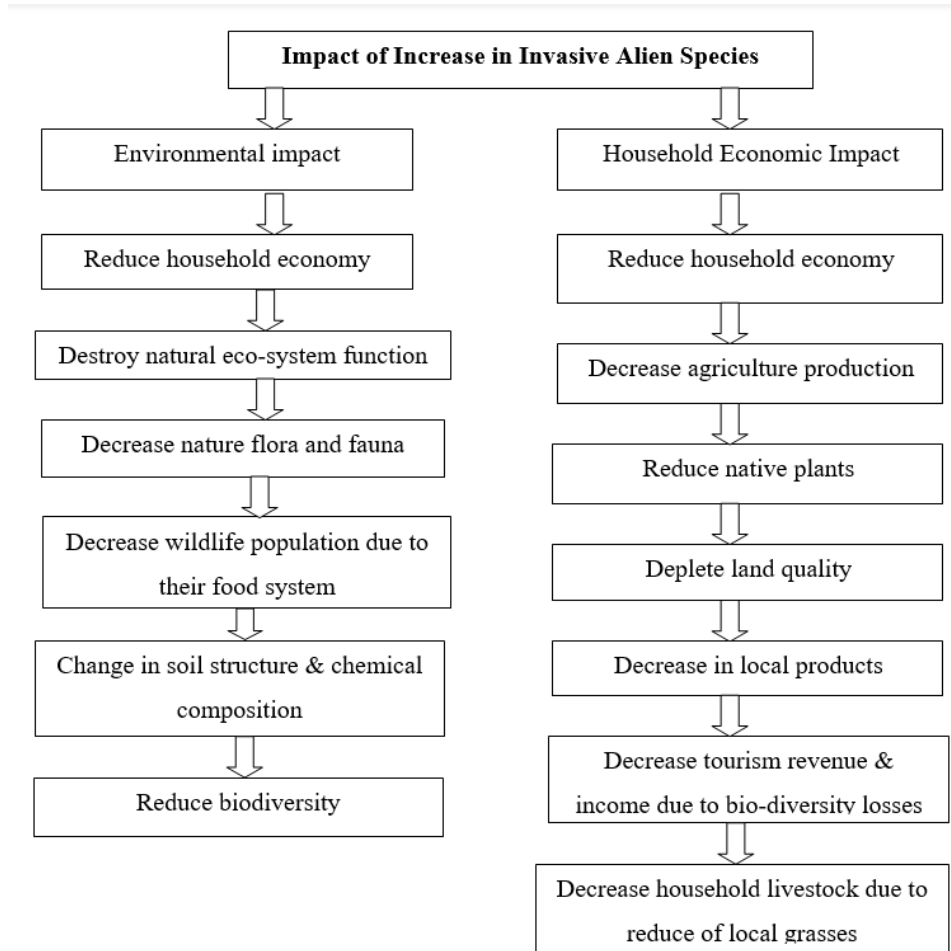
Key Informant Information (KII) and regional meetings were conducted with Forest Office (DFO), national park authorities, Soil Conservation Office (SCO), Livestock Service Office (LSO), Women Development Office (WDO) and local communities. The discussions were also focused on opportunities and constraints of invasive species and its adaptation and mitigation measures.

## 2.4. WORKSHOP

A central level national workshop was organized at Kathmandu to share and receive feedback on the draft of reports. Key stakeholders were the Ministry of Forest and Soil Conservation (MoFSC), DFRS, DoF, DNPWC, DPR, MoA, CDBTU, WWF, IUCN, BCN and NTNC.

## 3. RESULT AND DISCUSSION

Issues related to Invasive Alien Species were directly linked with impact chain in Nepal. Major impacts were as follows:



**Figure1:** Impact of Increase in Invasive Alien Species

### 3.1. GENDER AND INVASIVE ALIEN SPECIES (IAS)

The major impact of Invasive Alien species on the environment & economics was most significant and important in the gender perspective. Most of the women are involved in livestock and agriculture farming. Increase in Invasive Alien Species impacts has been found in these sectors which are relevant in the Nepalese context. IAS results in decreased water levels which compels women to walk long distances for water collection. Household chores such as nurturing children, farming livestock have always belonged to women. Smaller children become more vulnerable to dangerous alien species. So, women have to be careful in each of these sectors. They have travel further to collect fodder for livestock and water which may cause uterus prolepses in pregnant women (Gurung & Bisht, 2014).

Most of the community forests are being handled by women. Reduced forest productivity due to invasive alien species has become extra burden women (Acharya et al., 2008). Forest User Groups (FUGs) are formed to regulate

over-extraction, which stops forest degradation, and so the alternative scenario is likely to cause degradation of the forest and reduce resource heavily (Dev and et.al 2003). There is also a critical time-based element in this analysis. Furthermore, FUGs have their own pace of institutional development and it may take many years before they are sufficiently cohesive to manage the forest effectively.

Alien species affect socio-economic factors by adversely impacting ecosystem services like regulating services, provisioning services, and cultural services, which directly or indirectly affect the local economics by changing market prices and ecosystem services (Tiwari and et.al 2005). The impact of alien species in anthropogenic landscape mainly includes the economic losses due to decline in agriculture production, increase labor to remove the weeds, suppression of useful species, and health hazards to human and livestock (Rai, 2012). It simply results in additional workload among women in Nepal.

Alien Species are also considered an important source for human health hazard. A number of health-related problems have been identified due to Alien Species. Alien species rapidly grow in human-disturbed areas than other lands affecting the day-to-day activities of human beings. People have to walk longer routes to grazing their livestock, collect water, collect herbals plants and fodder which in turn consumes more time and money. Alien species decrease the beauty of natural resources. This decreases the flow of eco-tourism which directly or indirectly harms the economy. All impacts affect both male and female members of society but its impact on women are far greater. Women are victims of alien species.

These problems have been outlined based on review works, consultative reports, field observation, and assessment and consultative meeting with experts. The major socio-economic and environmental problems were mentioned as follows:

### **Socio-economic problem of Invasive Alien species**

- 1) Reduce household economy
- 2) Reduce agriculture production
- 3) Decrease livelihood assets
- 4) Increase the time for resource collection
- 5) Quality of resource decrease
- 6) Decrease local product sales
- 7) Decrease the production of renewable resources
- 8) Deplete land quality
- 9) Increase erosion along stream and banks & roadsides
- 10) Decrease the number of tourists
- 11) Decrease tourism revenue and income

### **Environment and Economic loss of Invasive Alien Species**

- 1) Destroy natural ecosystem function
- 2) Depletion of native flora and fauna
- 3) Change natural ecological processes
- 4) Compete with and replace rare and endangered species
- 5) Change characteristics of soil structure and chemistry
- 6) Decrease plant resources
- 7) Loss of food source of wildlife
- 8) Competition for food and space
- 9) Decrease agricultural productivity
- 10) Reduce biodiversity
- 11) Prevent establishment of native flora

## **4. RECOMMENDATION**

The number of IAS reported in Nepal stands at 219 species. Once IAS is well accommodated, it is extremely difficult to eradicate them or prevent their expansion. However, early intervention may cost less and result better.

Therefore, it is necessary to prevent it by increasing awareness about the importance of 'Prevention Approach' to control the introduction of IAS. Following recommendations are necessary to prevent IAS.

- Coordinating the activities of government agencies relevant to Invasive Alien Species.
- Encouraging multi-disciplinary approaches that contribute to addressing Invasive Species problems.
- Applying experiences to combating IAS in natural systems.
- Involving environmental and developmental non-governmental organizations as means to address IAS issues.
- Identifying priority IAS and high-risk habitats for mitigation and control measures with eradication programs.
- Provide support for the individuals & HHs for product development as resource IAS for briquette, biogas, and fertilizers.
- Prioritize research about the uses of IAS for energy and fertilize as collaborative research projects.
- Emphasize socio-ecological research about the most problematic IAS with joint collaboration with research centers.
- Provide access to information about IAS for sectors and interest groups.
- Prepare action plans to minimize the risks for specific pathways for high-risk IAS.
- Prepare mitigation, eradication and control plans using biological or chemical or mechanical methods based on priority base of IAS.

## 5. CONCLUSION

Proper management of IAS is contributing to the socio-economic well-being in Nepal. They provide both benefits and costs efficient in different agriculture and livestock. Some species have positive impacts on local livelihood by forage and fodder plants. They are highly economic impacts on livelihoods and very dependent on the social-ecological contexts.

Some species have negative impacts. These negative implications can reduce resilience and adaptive capacity of households and communities to reduce their vulnerability to change. This decreases the flow of eco-tourism which directly or indirectly harm women because most of the women are involved in small tourism business in their economic activities. Similarly, women are actively involved in agriculture and livestock for their livelihood too.

Based on case studies, it highlights the efforts for managing Invasive Alien Species in order to safeguard livelihood benefits and mitigate negative impacts. In conclusion, it highlights future research and policy needs on the topic of Invasive Alien Species, livelihoods and human well-being. Understanding the effects of costs and benefits of Invasive Alien Species on livelihoods and human well-being is important for guiding policy formulation and management.

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## CONFLICT OF INTEREST

The author have declared that no competing interests exist.

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## REFERENCES

- [1] Boy, G., Witt, A. Invasive Alien Plants and Their Management in Africa. Synthesis report of the UNEP/GEF Project. Removing Barriers to Invasive Plant Management in Africa, CABI, Africa, 2013.
- [2] Czech, B. and Krausman, P. R. Distribution and causation of species endangerment in the United States. *Science* 277: 1997, 1116-1117.
- [3] GISP. Tropical Asian invaded the growing danger of invasive alien species. The Global Invasive species programme, 2004, 64.
- [4] Thapa, G. J., Subedi, N., Pandey, M. R., Thapa, S. K., Chapagain, N. R. and Rana A. (eds.), Proceedings of the International Conference on Invasive Alien Species Management. National Trust for Nature Conservation, Nepal. 112-122.
- [5] IUCN. IUCN guidelines for the prevention of biodiversity loss caused by alien invasive species. IUCN, Switzerland. 2000, 24.
- [6] Mack, R. N., Simberloff, D., Lonsdale, W. M., Clout, M. and Bazzaz, E.A. Biotic Invasion: Causes, Epidemiology, Global Consequences and Control. *Ecological Applications*, 2000, 10: 689.
- [7] Mack, R. N., Simberloff, D., Lonsdale, W.M., Evans, H., Clout, M. and Bazzaz, F.A. Biotic invasions: Causes, epidemiology, global consequences, and control. *Ecological Applications*, 2000, 10: 689-710.
- [8] MEA. Ecosystems and Human Well-Being: Global Assessment Reports Current State and Trends., 2 Washington DC: Island Press. 005, MFSC, 2014, 553-586.
- [9] Nepal Fifth National Report to Convention on Biological Diversity. Government of Nepal, Ministry of Forests and Soil Conservation, Kathmandu.
- [10] MFSC. Nepal National Biodiversity Strategy and Action Plan 2014-2020. Government of Nepal, Ministry of Forests and Soil Conservation, Kathmandu, 2014b.
- [11] Miththapala, S. ed A Strategy for Addressing Issues of Aquatic Invasive Alien species in the Lower Mekong Basin: Mekong Wetland Biodiversity Program and Regional Species Conservation Program. IUCN Asia, Sri Lanka., 2007.
- [12] S. Shrestha. Climate Change and Food Security from Gender Perspective, 2016.
- [13] S., Shrestha J. K. C., Shrestha B. B. and Adkins S. W. Genetic Diversity Assessment of the Alien Invasive Weed *Parthenium hysterophorus* L. in Nepal. In Thapa, G. J., Subedi, N., Pandey, M. R., Thapa, S. K., Chapagain, N. R. and Rana A. (eds.), Proceedings of the International Conference on Invasive Alien Species Management. National Trust for Nature Conservation, Nepal. 2014, 30-38.
- [14] Siwakoti M., Siwakoty M., Chaudhary R. N. and Thapamagar H. Status of Invasive Alien Plant Species in the Protected Areas of Nepal with special reference to the Parsa Wildlife Reserve, Central Nepal. A report submitted to University Grants Commission, Nepal. 2014.
- [15] Siwakoti, M. Mikania Weed: A challenge for Conservation. *Our Nature* 5: 2007, 70-74.
- [16] Siwakoti, M. and Shrestha, B. An Overview of Legal Instruments to Manage Invasive Alien Species in Nepal. In Proceedings of the International Conference on Invasive Alien Species Management, NTNC, Chitwan, Nepal 2014, 101-111.
- [17] Siwakoti, M., Chaudhary, R., Thapa Magar, H. Status of Invasive Alien Plant Species in the Protected Areas of Nepal with Reference to Parsa Wildlife Reserve, Nepal. A Report Submitted to the University Grants Commission, Sanothimi, Nepal, 2014.
- [18] Subedi, N. Effects of Mikania micrantha on the Demography, Habitat Use and Nutrition of Greater One Horned Rhinoceros in Chitwan National Park, Nepal. Ph.D. thesis, Forest Research Institute University, Deharadun., 2013.
- [19] Thomas, D. F. Invasive species in the United States of America. Country Report. Proceeding of the Asian-Pacific Forest Invasive Species Conference. Kunming, China., 2003.
- [20] Tiwari, S., Adhikari, B., Siwakoti, M. and Subedi, K. An Inventory and Assessment of Invasive Alien Plant Species of Nepal. IUCN-The World Conservation Union, Nepal. Viii+, 2005, 116.

**Website:** [www.adrc.asia/countryreport/NPL/2011/FY2011B\\_NPL\\_CR.pdf](http://www.adrc.asia/countryreport/NPL/2011/FY2011B_NPL_CR.pdf), Dangle, R. (2011). Disaster Risk Management: Policies and Practices in Nepal.