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Community-engaged research and conservation of Himalayan salamanders in eastern Nepal

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Foundation for the Conservation of Salamanders

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Background

The Himalayan salamander is believed to be rarer and exposed to higher levels of threats in Nepal compared to other countries mainly due to its existence completely outside of protected areas (IUCN, 2021). In Nepal, documented threats include habitat modification driven by tourism, pollution from agricultural and tourism activities, the introduction of exotic species, and harvesting for use as fish bait (IUCN, 2021). However, most of these threats remain anecdotal, with a significant lack of comprehensive data on the species' habitat, distribution, and threats.

This project was designed to fill critical knowledge gaps related to the Himalayan salamander in Ilam district, eastern Nepal, an area that serves as a type locality for the species and likely represents a national stronghold. Despite its importance, Ilam lacks even baseline information on the species' habitat and threats. Furthermore, local communities often remain unaware of the salamander's conservation significance. This is reflected in practices such as converting natural ponds into concrete pools for tourism or altering water bodies for agricultural use, which can harm salamander populations.

The project involved a baseline habitat assessment to identify key habitat characteristics, document threats, and evaluate their relative impacts on salamander populations. A baseline distribution map was also produced. Community engagement formed a core part of the project, with local collaboration during fieldwork and awareness activities through educational campaigns.

Ultimately, the project was aimed to provide a scientific foundation for targeted conservation interventions and to foster an informed and empowered local community committed to Himalayan salamander conservation.

Natural History and Habitat Characteristics of the Himalayan Salamander

We began our survey from July 2024. The survey was conducted across different locations based on information obtained from local communities and our prior knowledge of the species' distribution.

A total of 41 sites were surveyed and salamanders were recorded in 28 of them (Figure 1). The survey was mostly focused in and around water bodies but covered various habitat types, including forest area, agricultural area, natural wetlands, man-made ponds and puddles. There were 16 sites in forest area out of which salamanders were recorded from 10 sites. The forests sites mostly contained trees dominated by *Castanopsis tribuloides, Alnus nepalensis, Saurauia napaulensis.* There were 15 sites located within agricultural area that contained both natural and man-made water bodies, especially ponds. Agricultural area was mostly dominated by cardamom farming and tea farming. Among the surveyed sites in agricultural area, eight were man-made ponds and salamanders were found in six of them (Figure 3). This highlighted the importance of artificial yet natural-looking habitats in the conservation of salamanders in our study area. Natural wetland area where we recorded the Himalayan salamander was mostly dominated by *Acorus calamus* and *Polygonum sps*. Notably, salamander numbers were found to be lower in ponds where fish farming occurred, suggesting that fish farming could pose a threat to their populations. Specifically, various species of carp and goldfish were introduced into these ponds. Studies by Hecnar & M'Closkey (1997) and Kloskowski (2010) have shown that the presence of such fish can significantly reduce amphibian numbers.

We documented 187 individuals of the Himalayan Salamander, observing various life stages throughout the study. Most individuals were recorded from natural wetland habitats followed by water bodies in forests area and then in man-made ponds and puddles (Figure 2). We recorded male vocalizations at five different sites, while courtship behavior and amplexus were observed at a single site. Additionally, based on (Bedi et al., 2021) description we identified characteristics associated with females and documented females preparing to lay eggs at four sites. Similarly, eggs were documented at three sites that were attached to submerged vegetation at the edges of ponds. Salamanders feeding on insects were observed at two sites. Tail fanning behavior was also observed in some individuals, this kind of behavior was also observed in *Tylototriton yangi* (Wang et al., 2017).

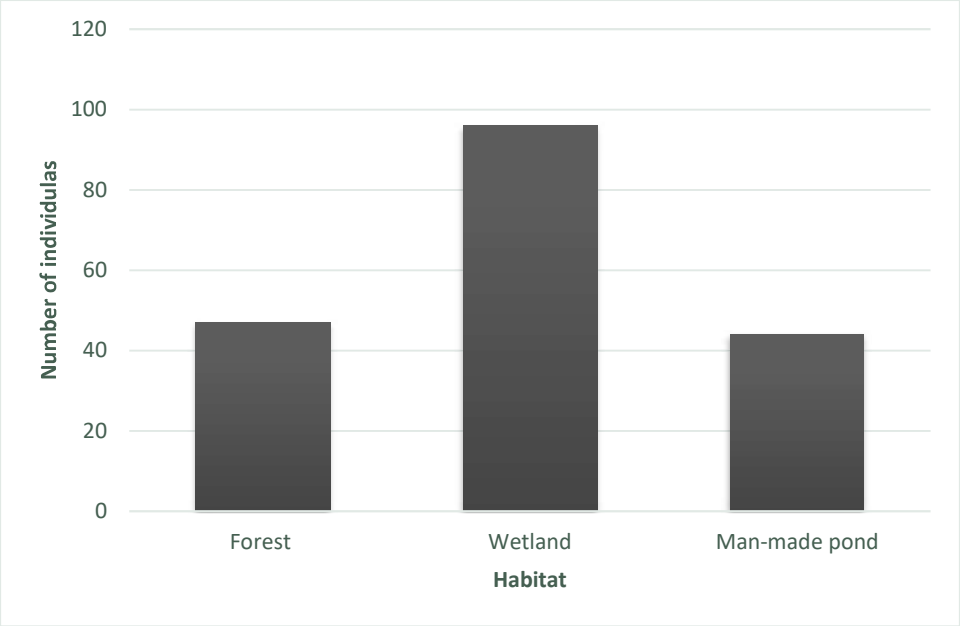

Figure 2: Total number of salamander individuals recorded according to habitat type

Figure 3: Man-made ponds serving as a habitat for the Himalayan salamander in the study area.

We also encountered the Himalayan Salamander along roadsides where water had pooled from rainfall (Figure 4). This observation suggests that temporary vernal pools also play a crucial role in the breeding of Himalayan Salamanders.

Figure 4: Roadside puddles serving as a temporary habitat for the Himalayan salamander

Threats to Himalayan salamander

We identified various threats degrading the habitat and causing a potential decline in the Himalayan salamander population. Among the surveyed sites, field observations revealed that habitats farther from urban areas experienced less impact, whereas those near urban centers faced significant habitat degradation.

During the survey, we recorded unmanaged plastic waste at three sites, ongoing deforestation at five sites, invasive plant species at five sites, a cheese factory waste at one site, and pig farms waste at three sites. Additionally, we found fish farming at six sites. In terms of habitat alteration of natural wetlands, two sites had natural ponds converted into concrete ponds, and two sites had undergone complete transformation from their original state (Figure 5).

Figure 5: Loss of salamander habitat in the study area. Left: wetlands being converted into hotels; Right: recreational spaces, playground

We recorded different types of plastic waste, including noodle wrappers, plastic water bottles, and poly bags. Invasive plant species such as *Eupatorium adenophorum* and *Digitaria sp.* were found to be present in salamander habitat. In one site located nearby cheese factory, one of the largest cheese productions from Ilam district, we found unmanaged disposal particularly cheese whey into the salamander habitat. This kind of waste product from cheese factory contains high levels of salinity, nutrients, organic matter, solids, oils, and fats (Guerreiro et al., 2020) ,which can directly impact the Himalayan salamander. According to local residents, it also produces a strong, unpleasant smell.

We also observed pig farm from where waste was directly discharged into the salamander's habitat through a connected pipeline (Figure 6). Among the eight surveyed man-made ponds, salamander populations were lower in those where fish farming was practiced. This suggests that non-native fish farming poses a threat to salamanders.

Figure 6: Waste discharge from a pig farm directly being disposed in the habitat of the Himalayan salamander through a pipeline

Additionally, many natural ponds were converted into concrete ponds for tourism and infrastructure development. This has created problems for salamanders and other amphibians by obstructing their movement and dispersion. Similarly, these artificially designed concrete ponds disrupt the natural flow of water, leading to stagnation, increased pollution, and a decline in aquatic biodiversity. During our survey, we observed dead frogs trapped inside these concrete ponds, indicating their detrimental impact on amphibian survival (Figure 7).

Figure 7: Dead frogs observed in the ponds that were converted from their natural state to being surrounded by concrete

Furthermore, rapid urban expansion and land-use changes in the study area have led to the conversion of vital wetland ecosystems into residential areas, hotels, and other commercial establishments (Figure 5). This habitat destruction not only reduces available space for salamanders but also fragments their populations, making them more vulnerable to further decline (Noël et al., 2007).

Community Engagement

From the very beginning of this project, we actively connected with local people through phone calls, chats, and in-person conversations. They provided valuable information on potential salamander survey sites, status of salamander populations, threats and their perception about salamanders. As part of our commitment to community involvement, we engaged five local individuals: two males and three females from different survey sites for salamander habitat surveys. During the field time they worked with excitement and curiosity. Before the surveys, they were taught on survey protocols, noting GPS coordinates and filling out data collection forms.

Some of the community members are still sending pictures of salamanders when they encounter them adding to their enhanced awareness and observation of the species. Through community engagement, it was found that salamanders are not viewed as an important species by the majority of local people. Most of them had little knowledge about salamander ecology and conservation status. People also attributed the loss of traditional knowledge among younger generation for this lack of information about salamanders, especially among young populations. It was found essential to dive deeper into documenting the traditional knowledge of local people about salamanders in this area, which might also help in their conservation awareness.

Conservation Outreach programs

We conducted three community-level outreach programs, directly engaging with local people to raise awareness about salamander conservation. These sessions were designed to provide information on the ecological importance of salamanders, including their contribution to pest control and soil health. We also discussed the various threats endangering salamander populations, such as habitat destruction caused by deforestation and land-use changes, pollution from agricultural runoff and waste disposal, and the impacts of climate change on their breeding and survival. A total of 50 community members from Teenkhutte, Bunge, and Aahaletar villages actively participated, engaging in discussions, sharing their observations, and expressing a willingness to contribute to salamander conservation.

Similarly, we organized three school-level conservation programs: two formal sessions at Shree Fhikkal Higher Secondary School and Shree Shyambal Secondary School, where we gave conservation presentations, and one informal session at Shree Budhanilkantha Basic School, where we met with the head of school, talked about salamanders and shared our posters. In total, we reached 90 students. These interactive sessions included presentations and discussions to help students understand the importance of salamanders and their role in maintaining ecosystem balance. We also used the maps to show the survey sites during the presentation, making it easier for students to see where salamanders are found in their own area. To reinforce our message, we distributed informative conservation posters to various local stakeholders, including community leaders, teachers, and forest user groups, ensuring that key information reaches a broader audience.

Additionally, during the Nepal Owl Festival 2025, held in Dhanusa district, we took the opportunity to further promote salamander conservation. We distributed our salamander posters and actively engaged with festival attendees by explaining their ecological significance and the urgent threats they face. To enhance visibility and accessibility, we also displayed our posters on large flex prints, ensuring that even passersby could learn about this often-overlooked species.

Next Steps and Future Directions

According to the project's objectives and allocated budget, we have successfully completed our planned activities. However, I believe our efforts are just the beginning, and there is still much more to be done. Conservation is an ongoing process, and to make a lasting impact, we need to expand our efforts. It is important to extend these activities to other districts where salamanders are found, ensuring wider conservation and awareness.

Based on our study, we found the need to do habitat restoration activities in different sites where natural wetlands are being degraded. Proper waste management is essential to prevent further

habitat degradation. During the field time when we interact with young people, we felt the gap in information sharing about Himalayan salamanders. Hence, documentation of traditional knowledge seems an important part. Furthermore, the designation of specific salamander conservation areas should be a priority in certain identified areas.

In terms of limitations, we were unable to measure various habitat characteristics such as canopy cover and ground cover due to technical issues with the mobile application we intended to use. Unfortunately, the app did not function properly during the fieldwork, so we were not able to collect those specific data that hindered our ability to connect salamander distribution and populations with the habitat characteristics.

Budget Description

Budget Category	Amount granted	Amount spent
Travel (Lalitpur to/from project site) x 2 persons x 3 roundtrips @ $40/roundtrip/person	240	230
Travel (within field site) x 40 days @ $7/day	280	250
Lodging x 2 persons x 40 days @ $7/day/person	560	400
Food x 2 persons x 40 days @ $6/day/person	480	500
Stipends for community members in field surveys x 5 person @ $80/person	240	400
Snacks for participants in education programs x 140 participants @ $2/person	225	180
Posters printing cost x 500 pieces @ $0.5/piece	150	250
Stationery items cost (data collection forms, pens, pencils, maps, notebooks)	80	50
Field gears (4 pieces of raincoats, 4 pairs of plastic boots, 4 pieces of rechargeable	200	200

headlamp, 2 packet of non-powered vinyl gloves, 1 piece of 50m long measuring tape, 1 piece of 1m x 1m wooden quadrat)		
Total	**$2455**	**$2460**

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